

NOTES FOR PILOT SPECIFICATION FOR CALCINED BAUXITE

1. SCOPE

These notes are a guide to be read in conjunction with the P25 Performance Based Pilot Specification for Calcined Bauxite applied with a non-bituminous binder (calcined bauxite).

The specification assumes the calcined bauxite is applied to an appropriate substrate. The expectation is that the surfacing (including the substrate) will have a life of 6 to 8 years with zero or minimal maintenance. The Defects Liability Period can only be specified as 2 years under current contract practices. The specification can be used when the substrate is provided by the client or the Contractor.

Where naturally-occurring aggregates or manufactured aggregates other than calcined bauxite may meet the performance requirements within the P25 Specification, these may be used at the Contractor's risk and would be assessed as an alternative tender.

Calcined bauxite is a very expensive surfacing and before laying the Client should be confident funding will be available to maintain it indefinitely.

N.B. the P25 Specification does not apply to the installation of Coloured Surfacing. Those installations are determined by a specific colour with a minimum PSV of 55, and must comply with the P33 – "Performance Based Specification for Coloured Surfaces."

2. DEFINITIONS

2.1 Calcined Bauxite

In the context of these Notes, calcined bauxite is defined as durable binder and aggregate-based surfacing systems that provide high skid resistance, generally higher than natural aggregates.

Calcined bauxite systems provide higher skid-resistance than all other asphaltic and cementitious substrates (wearing courses) and typically help reduce breaking distances.

Calcined bauxite system components:

- **Binders**

Historically the binders used in New Zealand have been two-component resin-based polyurethane or epoxy which has to be thoroughly mixed together by mechanical means to create the correct chemical reaction for successful curing. Other binders (such as rosinester thermoplastic and methyl methacrylate) may be considered for use by the client.

The binders' period of workability or "pot life" are typically in the order of between 15 and 30 minutes, depending on the ambient temperature and humidity.

Hot applied thermoplastic binders are generally able to be maintained at constant workable heat for up to 8 hours.

- **Aggregates**

Traditionally, proprietary calcined bauxite systems have included the use of calcined bauxite aggregate (naturally occurring or pigmented) of either Chinese or Guyanan origin providing a buff or grey colour respectively. Buff Chinese Bauxite has been preferred where a bright, highly visible surfacing is required, and Grey Guyanan Bauxite has been preferred where the local authority does not wish to 'advertise' to the motorists that a highly skid-resistant or 'grippy' material has been laid (e.g. on dangerous bends) or where the site is in an environmentally sensitive area.

The reason for their extensive use is that calcined bauxite aggregates have been the only aggregates available which have an extremely high resistance to abrasion and polishing, while providing consistently high skid-resistance properties through their micro-texture.

The PSV of an aggregate is determined in accordance with BS/EN 1097-8. The specific requirements for aggregate sizes used in the test are greater than those typically used on site.

To show that the aggregate proposed for calcined bauxite roading applications has the desired PSV, suppliers should obtain a coarse grade of chip (typically 14mm) for testing. A modified PSV test for use on smaller aggregate sizes has been conducted overseas but little information is available at this stage.

Calcined bauxite aggregates typically have a grading of 1-3mm however the next grading size of 2-5mm may be requested.

Recently, research has been done both in Australia and New Zealand on the use of artificially manufactured grey steel melter slag (a waste product from the steel making process) in place of calcined bauxite to provide high skid resistance installations. These appear to be performing satisfactorily.

It may be that other internationally-sourced natural or artificially-enhanced aggregates have similar potential, and these may be considered for use if their high skid-resistance properties are proven to be sufficient.

To attain long-standing texture depth, a strong and flexible binder with good adhesion properties is paramount, to adhere to the

underlying surface and hold each aggregate chip firmly in place. The chips may be one or two layers deep.

- **Compatible Primers (when appropriate)**

For applications on cementitious surfaces an appropriate primer (approved by the manufacturer of the binder) must be used. This provides several benefits:

- To stabilise any remaining surface laitance prior to application of the binder
- To create a seal preventing any moisture within the concrete from “sweating” to the surface when the binder is applied, consequently causing an adverse chemical reaction with the binder.
- To aid adhesion of the binder to a cementitious surface as these tend to have a fairly poor macro texture.

Other primers may be used at the manufacturer’s recommendation.

- **Catalysts (when appropriate)**

Catalysts are used to accelerate the curing process of the binder during colder months. Catalysts are normally available from the manufacturer of the binder however strict adherence to their advice on its use and how to manage its consequential significant reduction in the workable pot life of the binder is vital. Also catalysts have traditionally been quite toxic in their chemical composition (although some manufacturers are developing a non-toxic version). Installation staff should have the relevant Dangerous Goods Qualifications for their handling.

Catalysts are not required with hot applied thermoplastic binders as the temperature range is between 180 and 200° C.

- **Substrate surface preparation**

The substrate receiving the calcined bauxite should be in a visually sound condition and should be prepared as per the recommendations of the binder manufacturer’s recommendations e.g. totally dry, clean, etc.

Typically it is necessary to waterblast or watercut the existing surface to remove bitumen and other contamination. Wheel rutting is a sign of sub base or basecourse failure which will need to be rectified prior to installation.

Before application, the aggregate from the substrate should be visible, and free of contaminants and oil.

Scabbling is recommended for mature substrates that may have polished surfaces.

- **Installation equipment**
All tools used for the application of calcined bauxite must be clean, dry and in good condition. Worn or poor performing equipment should be replaced as and when necessary.
- **Installation**
Comprehensive installation training of all operatives is critical to the success of any calcined bauxite installation. Training records should be provided.
- **Health & Safety Plan**
Much information to compile a Health & Safety Plan is often provided by the binder manufacturer.

2.2 10m Section

No additional notes.

2.3 Defects

No additional notes.

2.4 Other Definitions

Use the NZS 3910 Definitions for Principal, Site, Contractor, Defects Liability Period etc.

3. PERFORMANCE REQUIREMENTS

Where the contractor is required to lay the substrate, the surface shape and tolerances shall be specified. Note that ponding of water can cause high skid resistant surfacings to fail.

3.1 Defects Liability Period

A Defects Liability Period of two years shall apply to all Contract Works, except that the final ESC measurement shall be taken at the next appropriate NZTA High Speed Data Contract (HSDC), which may be up to 30 months after application. The SCRIM+ survey is undertaken annually within the NZTA High Speed Data Contract (HSDC) and the final survey should be as close as possible to following two years after the application of the calcined bauxite.

In addition to the requirements of the specification, for good asset management, it is important that the client complete an assessment of the on-road performance of the calcined bauxite two years after application. This is best done through a database assessment of the high speed data to assess the asset's performance relevant to the performance requirements of ESC and macrotexture.

Once the contract is finished, the Client is advised to programme annual reviews and inspections.

See also Section 8 Tender Documentation, below

3.2 Skid Resistance

3.2.1 Equilibrium SCRIM Coefficient

It is expected that upon installation, the calcined bauxite should have 0.65 ESC which may gradually reduce towards 0.60 ESC during its performance life.

Where doubt exists surrounding the ESC of the surface, interim checks may be made by one of the following:

Interim testing may be undertaken once the new calcined bauxite has been in-situ for at least one month. Ideally, interim testing uses a British Pendulum Tester (BPT). Other proposed testing equipment, of similar accuracy, may be agreed to by the engineer (e.g. Griptest).

The two measurement methods (ESC from HSDC and BPT) will not provide the same skid resistance, and contractually the Contractor must comply with 0.65 or 0.6mm MPD from the HSDC. However, as the HSDC only measures once per year, as an interim measure, to show that the Contractor is likely to have complied with P25's performance requirements, they may use BPT or Griptest to show that the Contractor is likely to have complied with P25's performance requirements. If they pass BPT, but fail ESC, they have failed to comply.

When the British Pendulum Test Method is used, the initial skid resistance shall meet or exceed 87 BPN across at least 95% of all tested points, and shall meet or exceed 80 BPN across all tested points. Should BPN values be close to those above, the Engineer may agree to await ESC from the HSDC.

Testing shall be performed in sections as defined in Section 2.2. At least one test shall be performed per section, in a wheel path. A visual inspection of the ten metre length shall be undertaken to determine what is likely to be the area of lowest skid resistance, and the test shall be undertaken at that point. All test results shall be recorded and the results reported to the Client.

3.2.2 Macrotexture

Acceptance of the calcined bauxite macrotexture shall be by SCRIM+ methodology as employed within the NZTA High Speed Data Contract (HSDC).

Where doubt exists surrounding the macrotexture of the surface, interim checks may be made as follows:

Interim testing may be undertaken once the new calcined bauxite has been in-situ for at least one month.

The preferred test method for the interim measuring of macrotexture is the Sand Circle Method (NZTA T3: 1981). Other proposed testing equipment, of similar accuracy, may be agreed to by the engineer.

The two measurement methods (MPD from HSDC and sand circle texture depth) will not provide the same texture depth, and contractually the Contractor must comply with 0.9 mm MPD from the HSDC. However, as the HSDC only measures once per year, as an interim measure, to show that the Contractor is likely to have complied with P25's performance requirements, they may use sand circle. If they pass sand circle texture depth, but fail HSDC texture depth, they have failed to comply.

When the Sand Circle Method is used, the initial macrotexture shall meet or exceed 0.9mm across all tested points.

Testing shall be performed in sections as defined in Section 2.2. At least one test shall be performed per section, in a wheel path.

A visual inspection of the ten metre length shall be undertaken to determine what is likely to be the area of lowest macrotexture, and the test shall be undertaken at that point. All test results shall be recorded and the results reported to the Client.

3.3 Binder and Aggregate Retention/Loss

Binder and aggregate loss are usually caused by an inadequate depth of resin being applied to the substrate, incorrect mixing of the binder or the broadcasting of damp aggregate. Also a wet substrate or contamination of the surface of the substrate will lead to binder and/or aggregate loss.

The two sections below cover the two main calcined bauxite failure mechanisms.

(a) Failure of Aggregate to Adhere to Binder

The Engineer may interpret this requirement generously, as any excessive areas of aggregate loss will cause macrotexture and SCRIM measurements to be out of specification. Any large areas of aggregate loss will fail the requirements of section (b) below.

(b) Failure of Binder to Adhere to Substrate or Substrate Failure

- A failure over both wheelpaths is counted twice
- In a 3.5m wide lane, no more than a square 21 x 25cm shall be missing binder. It is assumed this is small

- enough not to significantly impact skid resistance available to a breaking vehicle
- Only two or three of the 21 x 25cm squares are allowed on a 100m site with 3.5 lane width.

Please note that damp aggregate will not properly adhere to any binder.

Adhesion of calcined bauxite to the substrate is critical to reduce risk of failure and achieve the requirements of the P25 Specification.

Please note that perimeter cracking around the calcined bauxite may not be considered a defect of the calcined bauxite or its installation.

3.4 Visual Appearance

The following are suggested headings and descriptions for Visual Condition Rating of calcined bauxite:

- **Binder and Aggregate Retention/Loss**

Usually caused by an inadequate depth of resin applied to the substrate, or an incorrect mixing ratio of two-part binder or the broadcasting of damp aggregate.

Also, significant varying shades of aggregate is caused by the use of different aggregate batches or aggregate supply sources. This may also result in varying aggregate grading and PSV.

- **Cracking**

Longitudinal, transverse and/or alligator cracking due to stresses within the underlying substrate, or within the calcined bauxite.

- **Joint cracking**

Joint cracking can be caused by poorly installed reinstatement patches (may be prevented by the proper use of an appropriate joint sealing material to 'knit' the new and existing asphalt substrates together) or poorly joint-sealed adjacent asphalt passes. Both these scenarios are caused by the ingress of water.

3.5 Loose aggregate

To meet the requirements of the specification, the newly-installed calcined bauxite must be swept after full curing of the binder and immediately prior to the opening of the site to traffic. Additionally, subsequent "after-sweep(s)" will most likely need to be conducted. In this case, sweeping should be staged, once on completion, again no more than three to five days from completion and a final sweep one to three months after if required.

To measure loose aggregate efficiently, you need a “calibrated eye”. To achieve this, broom a 1 m² area and weigh the aggregate. Repeat a few times until you get used to what compliant and non-compliant look like, then just use your eyes. This aggregate is dangerous, even though smaller than chipsealing aggregate, and can cause instability of two-wheeled vehicles. If the calcined bauxite system is constructed correctly, there should be very little loose aggregate after the contractor has finished at the site and completed one sweeping.

3.6 Application Guide

All new calcined bauxite installations should look ‘brand new’ from Day One, that is to say, no deformities or evidence of poor quality of workmanship.

- **Binder and aggregate overspill/underspill**
Binder and aggregate applied outside the area of treatment is caused by accidentally spreading the binder over and beyond the perimeter masking tape, and accidentally broadcasting aggregate onto this binder. The use of narrow 50mm-wide masking tape increases the risk of this event. Wider tape is now available in the New Zealand market.
- **Edge finishing**
Unstraight edges around the perimeter or between two different coloured surfacings are caused by incorrect tension applied to the masking tape when placing it on the road surface. This should always be a two-man job. Also, binder should not touch adjacent calcined bauxite or white line markings. This is caused by inaccurate use of the binder application tool (e.g. squeegee).
- **Ridges and join marks**
Ridges and join marks on the final surface should be avoided. For binder applied systems ridges usually occur if:
 - the binder has been applied too thickly and not evened out properly, to provide uniform coverage, prior to the broadcasting of the aggregate.
 - aggregate has been broadcasted over the edge of the binder (inside the masked area) during installation
 - installation operatives have stepped in the uncured calcined bauxite installation, leaving footprints
 - vehicles’ tyres have left tread mark impressions in not fully cured or softened calcined bauxite installation, especially when exposed to high climatic temperatures.

Hot applied systems will leave a join line with an initial ridge depending on the size of each screeded section. Ridges will disappear once the material has had time to settle. Lines should become almost too faint to recognise after approximately six to eight weeks.

Join marks may occur if the calcined bauxite is installed in more than one visit (due to inclement weather or running out of materials during installation).

Note that the application of resin epoxy in the calcined bauxite system can be undertaken in large treatments, with aggregate applied after the binder is applied. This allows for a more constant and aesthetically pleasing appearance. The application of a hot applied thermoplastic calcined bauxite system requires the aggregate and binder to be mixed before application, and then applied by hand-screeding the mix onto the pavement. As the system requires a more delicate application utilising a screed box of 500mm, the application leaves minor visible joint marks between each run. Are we setting a level of joint mark acceptance for the treatment, or are we dismissing the use of the treatment totally?

- **Aggregate shading**
Varying shades of aggregate from different batches broadcasted onto the binder. These variances are most typically prominent in 'buff (shaft kiln)' calcined bauxite where the minor proportion of grey chips can vary. It is recommended that the amount of aggregate needed per job is pre-calculated and if more than one batch is needed, these should be mixed together at base prior to transporting to site.

Note that hot applied systems have the aggregate premixed therefore will not have any variance of aggregate shading.

4. MONITORING AND REMEDIAL ACTION

4.1 Monitoring

No additional notes.

4.2 Defects and Repairs

The Engineer is to be informed of the repair method but it is not envisaged they would approve it. Any inferior repair methods will lead to non-compliance with the requirements of Section 3 and the Contractor would have to remedy the defective repair.

Unsuitable weather for binder curing is one reason the Engineer may agree to delay repairs for longer than 4 weeks. Options including heaters and tents over the repaired area while curing should be considered, in accordance with the resin manufacturer's recommendations (over-heating resins could impair their properties, potentially make their curing times longer, or causing brittleness and early failure).

The repair period may need to be extended pending application within ideal installation conditions (not winter). Repairs may be extended to the substrate therefore would require appropriate approvals (e.g. RON applications) prior to

commencing. Repair period should be appropriate to the location and type of repair.

5. SUPPORTING DOCUMENTATION

(a) Internationally-Recognised Certification

Internationally-recognised certification, if available (e.g. Roads and Bridges Agrément Certificate under the British Board of Agrément's Highway Authorities Product Approval Scheme, classified as Type 1).

Each certified calcined bauxite system must accompany confirmation that it can support up to 2500 commercial vehicles per lane per day.

If available this certificate must be current, and provided with the permission of the certified product's owner (manufacturer).

(b) Written references from local authorities or NZTA are required where certification in accordance with (a) above is not available.

(c) Evidence that the resin binder manufacturer, or their New Zealand agent, has agreed to the Contractor's use of their product, and any conditions attached to this.

A copy of an authorised 'supply and apply' Partnership Agreement between the Contractor and its resin binder manufacturer, or their New Zealand agent is expected. This should confirm the manufacturer/agent's confidence in the Contractor's knowledge, skills and abilities to competently install the calcined bauxite to the expected standard.

If any other organisations are involved in the installing of the calcined bauxite, e.g. sub-contractors, these must also be identified via certification from the Contractor.

(d) Test Results from at least one calcined bauxite site within New Zealand

Skid Test Results from at least one calcined bauxite site in New Zealand or overseas, which is more than three months old, and comprises the same calcined bauxite system and all its components.

If HSD is not available, the most cost-effective NZTA-approved skid-testing method for Contractors is the British Pendulum. For testing in New Zealand, the testing organisation must be IANZ-accredited.

(e) Quality Assurance Documentation

The Quality Assurance Plan shall include the manufacturer's material quality control requirements including comprehensive materials testing documentation, as outlined below:

Binder

The binder proposed for use within the calcined bauxite system shall be supported by relevant documentation, including but not limited to overseas nationally-accredited or/and IANZ-Accredited laboratory test results for the following; Tensile Strength (N/mm³), % Elongation at Break, etc. Example test results of these and any other tests which may become part of the calcined bauxite's QA system shall be provided with the application, as well as a statement regarding the expected variation in test results.

Aggregate

The aggregate proposed for use within the calcined bauxite system shall be supported by relevant documentation, including but not limited to internationally-recognised test results for Polished Stone Value (PSV), Aggregate Abrasion (A.A.V.) and internationally-recognised test results or IANZ-accredited test results for Crushing Resistance* (NZS4407:1991, Test 3.10), Moisture/Water Content** (NZS4407:1991, Test 3.1), Grading/Wet Sieving (NZS4407:1991, Test 3.8.1), and UV Stability*** (for pigmented aggregates only).

- * When tested in accordance with NZS 4407 Test 3.10, The Crushing Resistance of Coarse Aggregate Under a Specified Load, less than 10% fines shall be produced under a load of 230kN. The Crushing Resistance Test shall use aggregate passing a 3.35 mm sieve and retained on a 2.36mm sieve, or aggregate passing a 13.2 mm sieve and retained on a 9.5 mm sieve, or other representative size, and the test report shall state the aggregate size used.
- ** Moisture/Water Content Test shall be reported to 0.01% and shall be expected to show a result of <0.5%.
- *** UV Stability Testing is available at specialist labs, and an industry standard is currently being developed for this).

All test results submitted shall form part of the calcined bauxite system's Quality Assurance system.

Example test results of these and any other tests which may become part of the calcined bauxite's QA system shall be provided with the application, as well as a statement regarding the expected variation in test results.

Compatible Primer

The primer proposed for use within the calcined bauxite system shall be either manufactured specifically for the binder, or at least acknowledged as compatible with the binder, by the binder manufacturer.

Catalyst

Any catalyst proposed for use within the calcined bauxite shall be that developed specifically for the binder, or provided by the manufacturer as an optional additive.

This quality assurance documentation should include comprehensive training records and daily work records for any sites throughout New Zealand where their approved calcined bauxite has been laid.

Training Records must show the names of staff assigned within an experienced installation crew, the training received, trainer's details, dates and duration of training, confirmation of the Method Statement utilised for training and corresponding signatures.

(f) Health, Safety and Environmental Plan and Materials Safety Data Sheets (MSDS)

All the above products shall be stored and applied in accordance with the Contractor's Health, Safety and Environmental Plan.

This may be provided by the manufacturers of the system's components. All chemicals for use in calcined bauxite system shall:

- (i) Be approved under the Hazardous Substances and New Organisms (HSNO) Act as required.
- (ii) Be the chemical that poses least risk to humans, animals and the environment, yet deals effectively with the identified need, in compliance with NZS 8409.
- (iii) Be stored and used in accordance with the manufacturer's requirements and SDS.

The Health & Safety Plan should be onsite and available on request.

Original Safety Data Sheets written by the manufacturers of the calcined bauxite system's chemical-based components must be submitted, as they contain specific information about the chemicals used in the materials, and advice on the safe handling of them.

Additionally, the Contractor must submit equivalent NZ-compliant (HSNO) Safety Data Sheets for the calcined bauxite system's chemical-based components.

(g) Contractor's Installation Method Statement

See also clause 6 for client's pre-installation checklist.

A copy of the original Installation Method Statement from the resin binder manufacturer must be submitted as it contains information about installation parameters and techniques.

Additionally, the Contractor must submit its own company Installation Method Statement outlining its adopted methodology for the installation of its calcined bauxite system (in line with the resin binder manufacturer's expectations) and quality assurance promise to the Client.

This should include specific information on storage practices, environmental limitations such as air and substrate temperature and humidity tolerances, appropriate/inappropriate substrates, substrate preparation requirements, application techniques of all material components, and aftercare.

This “NZ version” may cover variances such as local climatic conditions and asphalt types, and this document must be checked, approved and certified by the resin binder manufacturer.

The Contractor must submit its own Installation Job Sheet which must demonstrate how it will record specific details of the contracted job (e.g. Client name, staff operatives and responsibilities etc), hazards identification (including visitors to site during installation), weather and site conditions (including air and substrate temperature and humidity, prep work, material batch numbers and quantities used (to ensure spread-rate conformity) and follow-up loose aggregate removal confirmation.

Pre-installation substrate condition and preparation requirements information will be expected to include advice such as;

- The calcined bauxite is placed on structurally sound and competent surfaces, which are adequate to support the traffic without undue cracking or deformation for the expected life of the system.
- All surfaces to be treated must be clean. Any bituminous deposits, loose road stone, fines, oil, grease, road salt and other foreign matter must be removed. The typical methods for this are air-compressing, waterblasting and/or watercutting. If any of these methods are utilised for a specific calcined bauxite installation these must be clearly stated in the contract.
- All surfaces to be treated must be dry. NB: Any waterblasting or watercutting works must be conducted at least 24 hours prior to the installation of the calcined bauxite, and may need the use of an air compressor to blow out standing water in the surface’s voids, to assist the drying process. Using the heater in a paver to warm and dry the surface is also an option.
- The application of calcined bauxite is carried out when the temperatures of the surface to be treated are in the range specified by the manufacturer (e.g. between 5 and 30 degrees Celsius). NB: Ambient and surface temperatures are normally recorded at the start and, if the weather is variable, during the installation process.
- The calcined bauxite should be laid on a suitable asphalt. Adequate pavement strength is important. The pavement needs to be able to withstand the vehicle loadings and stresses applied to it for the life of the surface. However, different pavement strengths may be required for different situations e.g. consider the pavement strength

requirements of a long straight where queuing vehicles brake suddenly from time to time (SH1 outside the Terrace Tunnel in Wellington) versus a high stress high speed curve (SH 1 at the top of Ngauranga Gorge in Wellington). Likewise an understanding of pavement deflection and its effect on calcined bauxite binder performance is essential.

- New bituminous and cementitious surfaces should generally be left to 'cure' for an appropriate period before overlaying with a calcined bauxite system.
- It is not recommended to apply calcined bauxite to Open Graded Porous Asphalt (OGPA).
- Resin binder based calcined bauxite should not be laid on any chip seal surfaces. Hot applied thermoplastic binders may be applied to more flexible pavements.

Recommended application techniques may include: dew, temperature and moisture recommendations, health & safety and environmental considerations, binder pot life, primer application, aggregate application rates and excess removal procedures and curing methods,

Environmental limitations of the system should include details on moisture tolerance.

6. TREATMENT SELECTION

This section includes the Client's pre-installation checklist.

See also section 5 (h) for Contractor's Installation Method Statement.

When selecting appropriate treatments for skid-resistance, naturally-occurring aggregates should be considered first using the principles in T10. Where standard chipseal or asphaltic concrete surfacings have not provided the desired ESC, the advice outlined in Specification T10 should be followed which may indicate the need for the use of calcined bauxite. It is important to note that calcined bauxite is an extremely expensive option for NZTA.

To continuously maintain the desired level of SCRIM Co-efficient:

- Economic analysis may indicate it is better to use a natural aggregate and replace the surface every two years. Full costs of the strategy must include the chipseal and earlier pavement rehabilitation due to build up of multiple seal layers.
- The next most cost-effective option may be a melter slag two-coat chipseal with a bitumen binder, then
- If either of the above does not provide an economic solution to continuously maintain the desired level of SCRIM Co-efficient, then calcined bauxite should be considered.

Important decisions which need to be made by the surfacing engineer include assessment of underlying substrate and identification of sources of water on site (which can cause stripping). Never lay calcined bauxite on an existing pavement or surface which may fail within 8 years. Both the pavement and surfacing must be strong. Where possible existing asphalt surfaces should be used however if the substrate is old or thin (less than 40mm) considerations should be given to the laying of a new replacement asphaltic concrete substrate, at least 50mm thick. Pavement integrity is absolutely essential for the life of the calcined bauxite.

Scabbling is recommended preparation for mature substrates that may have polished surfaces.

Where the installation of calcined bauxite is proposed, water and drainage considerations are important. Any water present during the installation of calcined bauxite can cause an adverse chemical reaction with the curing process of the binder. Water-affected binder foams, and cures in a weakened form, leading to binder and aggregate loss (scabbing and delamination).

Best practice is to not install calcined bauxite on roundabouts. In addition, calcined bauxite should not be installed on part of a lane to assist cyclists on out of context curves. This would produce uneven braking for motorists.

The recommended minimum length for approaches to "Site Category 1" sites is 50 metres and full width treatment of the traffic lanes should be used.

Due to the high differential skid resistance between calcined bauxite and adjacent asphaltic concrete and chipseal surfaces, the start and end points of a treatment section should be located on a straight section of carriageway, beyond the tangent points on a curve, and should be at right angles to the direction of travel (usually perpendicular to the kerb edge).

As part of the Client's pre-installation checklist and prep work plan, the site should be inspected and the following actions taken before preparing the request for tender (RFT) or advertising the contract:

- inspect for drainage defects and programme these for repair
- assess the integrity of the current surface, and if a new substrate is to be laid consider a membrane seal under the substrate for waterproofing
- If using the existing surfacing as the calcined bauxite's underlying substrate, measure its macro texture and deflection. Advise these findings to tenderers.

7. ADDITIONAL SUPPORTING INFORMATION

All prominent defects within an existing substrate should be identified and recorded by the Engineer and the Contractor for the purpose of reaching an agreement on the substrate's condition prior to the installation of calcined bauxite.

Please note that perimeter cracking around the calcined bauxite will not be considered a defect of the calcined bauxite or its installation.

8. TENDER DOCUMENTATION

It is advisable to let P25 contracts as stand-alone specialised contracts. Price and methodology, as a minimum, should be requested as part of the assessment criteria.

In Conditions of Contract clause 11.1.1 The Period of Defects Liability, change the default 52 weeks to “130” weeks.

The Contractor’s installation method statement should be submitted to the Engineer for approval before installation. It is advisable to add a hold point in the contract documents for this purpose.

Whichever option is chosen, it is important to acknowledge the need for more supervision on site during the application of these specialised surfacings and the importance of having the right expert on site at the time of installation.

Option 1

A P25 contract can be let as a direct appointment where the contract value is less than the limit specified for expedited procedures.

Option 2

Prices can be obtained from a minimum of 3 suppliers where the contract value is less than the limit specified for closed contest prices.

Option 3

A variation order may be used to give the P25 job to an existing contractor (e.g. maintenance or surfacing contractor) providing the contract variation falls within the project manager’s delegated authority.

In this option the Principal retains the right to go to the market if they are not satisfied with the P25 proposal provided by their existing contractor.

Option 4

Go to the market using PQM Simple method.