TNZ P/3 NOTES: 1989

NOTES FOR FIRST COAT SEALING

These notes are for the guidance of supervising officers and must not be included in the contract documents.

The numbers assigned to the paragraphs in these notes correspond with the clauses in the specification to which the notes refer.

1. SCOPE

The first coat seal is most suitable for the initial sealing of unbound or stabilised granular basecourses. However, the value of adopting the prime and seal technique should not be overlooked, particularly for low traffic density roads or where, because of the character of the basecourse, a high proportion of clay type fines in the surface layer prevents the production of the target surface texture required for first coat sealing.

2. EDGE DEFINITION AND TOLERANCE

Accurate definition of the first coat seal is essential because subsequent seal costs will follow the same definition.

As payment is based on the area sealed, it is essential that the tolerances are not exceeded and no payment is made for excess sprayed area.

3. SEALING PERIOD

The sealing period is unchanged since, although better results are obtainable in the normal sealing season, it is not always possible to complete basecourse construction to suit that limited period. Furthermore, the costs of maintaining the completed basecourse under traffic for any length of time would be excessive.

4. WORKING HOURS

The working hours are restricted to ensure satisfaction of the construction unless the Engineer decides, because of the traffic volume and patter or for other reasons, that different working hours should be adopted.

5. USE OF PRIVATE LAND

The use of private land, particularly for stockpiling sealing chips, is becoming more prevalent. If the Contractor elects to adopt that method, it is essential to ensure that a clearance is received from the landowner before the final payment is made to the Contractor.

6. CONSTRUCTION PLANT

Whilst the mechanical condition of plant is the responsibility of the Contractor it must be ensured that reduction of spray "run" lengths are made if a chip truck or roller suffer mechanical breakdown. Regular checking is necessary to prevent the adverse effects of oil, water or fuel from plant and vehicle leakages on the new or prepared surface.

Chip spreading equipment is required to satisfy the specification and must be checked before the work commences.

Rollers may be pneumatic tyred for which the weight is required to be checked in advance and the Contractor is required to provide means of checking tyre pressures. An approved steel wheeled roller may be used for the first two passes of the initial rolling requirement.

Rubber coated vibrating drum rollers may be used, providing the Contractor produces evidence of the approval of the Director of Roading. Approved roller models are equivalent to specified pneumatic tyred rollers unless the conditions of the approval state otherwise.

Before work commences, it is essential to check that the certificate of compliance for the distributor to be used is current, that the attached spray chart is being used, and that the bar height and nozzle angles are correct. Also, check the lap width on the certificate.

7. CONDITION OF SURFACE FOR SEALING

Initially it must be appreciated that a basecourse pavement course is not normally in a suitable condition for sealing on completion of the shaping and compaction. Study of section 10 of the notes of TNZ B/2 (the purposes of the running course aggregate with the effects of normal road traffic) will provide a background. Thus, when the surface is ready to prepared for sealing, removal of the loose aggregate from the road surface should produce a relatively clean surface of significant texture not unlike a grade 2 seal coat, although with some larger particles, on which an emulsified asphalt/grade 6 chip locking or void filling seal coat has been applied. In effect a very small pattern cobblestone surface with a matrix of finer particles is the aim. Sealing of a basecourse pavement having a glazed surface must be avoided.

8. ASPHALT CEMENT

180/200 penetration bitumen is to be used for all first coat seals unless a proprietary product is specified.

9. ADHESION AGENT

The use of an adhesion agent to satisfy the requirements of TNZ M/13 is mandatory. Its value in first coat seal is twofold, because it ensures the binder adheres to both the chip and the basecourse particles.

10. FLUXING

The quantity of automotive gas oil required in the first coat seal binder is related to the ambient temperatures experienced in the area of the work. In the southern sector of the South Island, and more particularly where freezing occurs in the winter, four parts per hundred parts of asphalt cement are necessary, whereas in the extreme north, in areas where frosts are rare, there should be no need for fluxing. Thus the quantity to be defined in schedule A should be that which is considered best suited in your area.

11. CUTTING BACK

The quantity of kerosene to be added is entirely dependent on the share air temperature at the time of application of the binder with a tolerance of ± 3^{o}C. It must be noted that table 1 of the specification sets out the parts of total diluents per hundred parts (by volume at 15^{o}C) required for the nominated shade air temperatures. It must therefore be ascertained in advance the parts of AGO and adhesion agent which have been added in order to establish the quantity of kerosene to be added. The total diluent content relative to shade air temperature is significantly reduced from the previous specification, but is greater than for resealing. The reason is that, although not yet quantified accurately, it is recognised that a lower viscosity is necessary to obtain bonding to the basecourse surface and that reduction in viscosity must be limited to ensure adequate strength of adhesion to the chips.

Alternatively, a proprietary first coat sealing binder may be directed or approved by the Engineer. it is recognised that Shell SRO (Special Road Oil) can be a better binder for use on lime stabilised pavements unless that pavement is dray. The reasons is that Shell SRO contains a different form of adhesion agent from the current types, which requires a slaked lime and water to energise it. Therefore, for the sealing of moist or wet lime stabilised surfaces, Shell SRO can be expected to produce a sound bond with the stabilised material, whereas the currently available adhesion agents are of no value because they are not compatible with lime.

12. BLENDING THE SEALING BINDER

Accuracy of the quantity calculation and measurement is essential in the blending of asphaltic binders. The contractor's calculations should be checked independently and the diluent quantity measuring devices are required to be certified, so those certificates should be checked.

Both site and central blending plant blending are acceptable, and where central blending plant facilities are available without increased costs then that method is generally preferred.

For site blending, the mixing is generally obtained by pump circulation of the binder. For an acceptable degree of mixing not less than 20 minutes of circulation with at least 80% of maximum pump speed is necessary.

Central blending plants may employ a wide range of mixing methods. When an unknown plant is being used, sufficient samples should be taken during delivery to the distributor or transfer tanker to check the acceptability of the blend. Further mixing by circulation in the distributor may be expected to occur but the product from the blending plant must satisfy the blending specification.

Every load of blended binder from a central blending plant is to have a certificate containing the specified data. The certificates must be collected and checked on-site for conformity with the contract requirements. Faulty certificates or apparently complying certificates for binder, which laboratory tests prove to be outside the specified tolerance, should result in client supervision of subsequent blending in that central plant until dependable accuracy is ensured. The payment for diluents may also be affected.

13. SAMPLING AND TESTING OF BINDERS FROM DISTRIBUTOR TRUCKS

13.1 Sampling

Samples of asphaltic materials shall be taken from bitumen distributors in accordance with TNZ M/1.

A minimum of two samples per bitumen distributor load shall be taken. The first of these samples shall be taken at the end of the initial spray run and the other immediately before the final spray run.

13.2 Asphaltic Binders

When the fluxing, cutting and adhesion agents are added and blended to the asphaltic binder in the presence of the Engineer or the engineer's representative whether to test the binder for the type, quantity or presence of these agents shall be at the Engineer's discretion.

If the Engineer or engineer's representative was not present during the addition of the fluxing and/or cutting agents, at least one sample per bitumen distributor load shall be tested for diluent content using the method described in the Ministry of Works and Development Central Laboratory Report N^{o} 6-83/3.

If the Engineer or the engineer's representative was not present during the addition of the adhesion agent at least one sample per bitumen distributor load shall be tested for the presence of an adhesion agent at least one of these samples shall be forwarded to the Bitumen Section of the Works and Development Services Corporation, Central Laboratories to be tested for the quantity and type of adhesion agent present.

All samples taken which are not for immediate testing shall be stored for a period of at least three months, along with the binder remaining in the sampling container after the test portions have been taken.

14. TEMPERATURES OF SEALING BINDER MATERIAL

The binder, dependent on the contained total diluent, is to be sprayed at temperatures within 10^{o}C of those nominated in table 2.

The purpose is to ensure that when the binder passes through the spray nozzles it is of suitable viscosity to produce the required fan of spray to provide the uniform coating which is essential.

Storage of bitumen and bituminous binders is normally at elevated temperatures, but excessive temperatures dependent on the storage term can change the characteristics of the material.

15. SAFETY PRECAUTIONS

Every sealing contractor and site supervisor should have thorough knowledge and a copy of A Guide to Safe Practices for the Handling, Transportation and Storage of Bitumen because they have responsibility for the safety of the workmen and the worksite to protect the travelling public.

16. QUANTITY OF ASPHALTIC BINDER

The appropriate application rate for first coat sealing binder must be related to the ALD of the chip to be used for the cover coat, and the texture of the underlying surface as for reseals.

Additionally, it is recognised that some binder is adsorbed into the basecourse layer.

With the adoption of the type of surface texture to be expected from basecourse construction in terms of TNZ B/2, it is possible to assess the binder rate with a greater degree of accuracy.

Initially, as for reseals, it is essential to know the ALD of the chips to be used. Then, without awaiting the preparatory brooming of the surface for sealing, several representative small areas of the trafficked surface are to be hand broomed to produce the surface for sealing. Sand circle tests on these areas, meaned or evaluated in terms of spray runs together with the chip ALD, will then give application rates from the spray rate RD 286 algorithm.

To complete the assessment of application it is necessary to assess the rate of adsorption of binder into the basecourse surface. This assessment is based on the percentage of basecourse aggregate passing the 75µm sieve. If that percentage is less than 3% then the spray rate chart application rate should be increased by 20%. If the percentage is more than 5% the spray rate chart application rate should be increased by 10%. Thus, the increase for 3% of 75µm is 17.5%, for 4% it is 15% and for 5% it is 12.5%.

It is important to appreciate that with the basecourse surface texture now being required for sealing, current methods of assessing binder rates, particularly on glazed surfaces are no longer applicable.

17. SEALING CHIPS

In all state highways works the sealed chips shall be grade 4. The reason for this change is that it is now recognised that first coat seals have a very limited impermeable service life so that the application of the second coat seal is to be generally after one year and always within two years. Because of this factor the use of larger (grade 3) chip can be expected, after only one year of service, to contain a surface texture too coarse for use of a grade 2 or 3 chip in the second coat seal. Conversely the use of smaller chips than grade 4 should not be contemplated because the thickness of binder film will be inadequate for waterproofing of the surface.

18. APPLICATION OF THE SEALING BINDER

It is essential to ensure that before any binder is sprayed, the signing and traffic control is fully established, that sufficient chip trucks are in train to apply the cover coat and that rolling equipment is ready to operate.

The tank of the distributor must be dipped at the beginning and end of the spray run, and it must be ensured that the non-porous paper (heavy duty bituminous paper) or fabric strips are placed across the start and stop positions. The length of each spray run is limited by the number and size of chip trucks available (refer section 21).

After checking that the spray bar is heated by circulation through the bar, spraying can commence. During all spraying a close watch on the spray bar is heated by circulation through the bar, spraying can commence. During all spraying a close watch on the spray from the nozzles is necessary in order to stop the spraying if nozzle blockage occurs or if the regular fan pattern changes.

19. PATTERN OF SEALING OPERATIONS

The proposed pattern of spray runs must be prepared by the Contractor and checked by the supervisor, and it must be ensured that no longitudinal joints are patterned to be in a wheel track.

20. PROTECTION OF ROAD FURNITURE

Insufficient attention is given to this subject so that kerbs and furnishings become affected by spray. it is a matter to be watched and guarded against.

21. SPREADING OF CHIPS

Spray run lengths may be measured out before sealing commences in liaison with the contractor as the number and size of chip trucks need to be determined. A check should be made so that sufficient loaded chip trucks are in train to complete the cover coat to the length to be sprayed. The spread must be uniform to cover the full sprayed width, except for any overlap strip. Do not expect an initial shoulder to shoulder coating but ensure that there are no unchipped areas. hand brooming is generally sufficient to correct these.

If the chip application is not uniform over large areas then sheeting or drag brooming is necessary before compaction is carried out.

A rule for calculating the maximum spray run length from the loose volume of chips is:

$$(1) = Run\ length = \frac{loose\ volume\ of\ chips\ (m^3)\ x\ spread\ rate}{effective\ spray\ width}$$

where effective spray width = Number of nozzles operating x nozzle spacing (m)

$$Spread\ rate = \frac{1000}{1.5\ ALD + 0.6}\ m^2\ \ per\ m^3$$

By solving for volume in (1) this equation may also be used to check that stockpile volume is adequate thus:

$$Volume = \frac{seal\ area}{spread\ rate}$$

This equation assumes very accurate chip spreading control is used, only 2% whip-off for grade 2 and approximately 10% for a small grade 4.

22. ROLLING

The formula $T = \frac{V_t}{450 \ x \ S \ x \ n}$ relates to the total specified rolling requirement when asphaltic binder is used, half of which is classified as initial rolling, required to be completed within 30 minutes of the chip application. Therefore further binder spraying may need to be delayed until rollers are available for the next spray run. Thus in effect the number and speed of available rollers controls both the length of spray runs and the period between successive spray runs.

The remainder of the rolling, classified as the finish rolling, is to be obtained within the day of the sealing and by sunset on that day to satisfy clause 4 "Working Hours".

The formula $T = \frac{V_t}{450 \ x \ S \ x \ n}$ is used to ensure that the new seal receives sufficient rolling. The speed (S) has therefore been inserted in the formula. It is important to realise that this formula does not recommend any particular speed of rolling. The speed element (S) is solely introduced to ensure that the new seal still gets sufficient rolling. At 8 kph or greater it is considered that the new seal will get sufficient passes of the roller. Below 8 kph the formula allows for the total rolling time to be increased to compensate for this slower speed. As an example, a contractor is spraying 36,000 litres (hot measure) on a reseal and using two rollers at an average speed slightly greater than 8 kph, therefore total rolling time

$$T = \frac{36{,}000}{450 \ x \ 8 \ x \ 2} = 5 \ hours$$

That is two rollers working together would each require five hours of uninterrupted rolling time on the reseal.

If the average rolling speed was instead 5 kph,

$$T = \frac{36{,}000}{450 \ x \ 8 \ x \ 2} = 8 \ hours$$

That is in this second example the two rollers together would require eight hours of uninterrupted rolling.

In sealing of reasonable flat and straight roads, it is not expected that rollers will have any trouble in achieving an average speed of 8 kph. However, it is important to ensure that extra rolling is carried out on steep grades and curves where the average speed of rolling drops below 8 kph.

It is important to ensure that greater emphasis is placed on the rolling of areas outside normal traffic wheel tracks. On a normal highway this means that greater rolling effort should be applied to the shoulders and centreline.

In all seal coats the compaction of chips is obtained effectively in two stages. The initial rolling presses the chips firmly into the binder with only a minority generally being ALD vertical. Some chips which are not initially in contact with binder may be moved to a gap where they can be pressed down into binder but here may be many windows or small gaps in the cover coat at the end of this stage. The second stage, for which normal road traffic is essential, occurs during and after the finish rolling and is produced by the kneading action of vehicle tyres at controlled speed. This action, along with the finish rolling, runs the chips into the ALD vertical position, causing lateral movement to develop chip interlock with shoulder to shoulder contact, thus closing up the windows. During this process the surface texture is ironed out, losing its initial excessive toothiness. This occurs relatively quickly in the normal traffic lanes but the channelling of traffic by cones, together where necessary with the provision of pilot vehicles, may be warranted to achieve this standard across the entire sealed width.

23. NO FOULING OF THE SEALED SURFACE

Leaking sumps and particularly hydraulic rams and fittings can readily promote bald patches in the seal coat whilst the carriage of soil, mud and other unwanted substances by the tyres of vehicles working from stockpiles can readily cause slick patches in the seal coat. Action must be taken when necessary to avoid these effects.

24. INTERSECTING PUBLIC ROADS AND PRIVATE WAYS

Too frequently the sealing of intersecting unsealed roads to the reserve boundary of the road being sealed or the private ways to kerb line or surface water channel line is overlooked. It is the policy of Transit New Zealand for the very sound reason that it prevents loose aggregate (windscreen ammunition) and mud from being brought on to the sealed road. There should be no exceptions to the need for this treatment.

25. REMOVAL OF SURPLUS AND WASTER MATERIAL

Whilst forgotten remnants of chip stockpiles are often taken and used for maintenance, other materials, if overlooked, become a maintenance responsibility. The contractor is being paid for the cleaning up, therefore it must be ensured that it is completed satisfactorily.

26. TRAFFIC CONTROL

As stated in TNZ G/1, traffic control, including the correct establishment of satisfactory signs, normally two traffic controllers suitably clad with R-53 STOP/GO paddles (which are more effective if the sign sizes are greater than the specified minimum dimensions), and radio intercommunication when necessary, must be checked to be established before sealing commences. This is essential and sealing operations should be allowed to commence only after the establishment has been checked to be complete. In the case of considerable seal coat length it should be ensured that the single lane traffic length is limited by obtaining the adjoining spray run as soon as practicable to achieve the full width of sealing. This does not apply to multi-lane situations.

It is necessary to confirm that there is no power with the contractor or the supervisor to enforce traffic speed in the restricted speed area. However, to assist in controlling traffic speed two vehicles with rear facing warning type signs marked “Pilot Vehicles Do Not Pass” can be employed to lead the alternate traffic streams in single lane sections and along the coned lanes on the newly sealed surface.

When there is evidence of a significant excessive speed problem, the MOT or Police should be consulted. Only they have the power to control the speed restriction.

Adverse weather, combined with traffic and excessive speed can completely ruin a seal coat so that it may cost considerably more than the initial seal coat to correct.

Reduced speed limits, enforcement, coned lanes and the use of pilot vehicles in the traffic stream can all assist to prevent damage. However, the use of clean chip, correct binder formulation with suitable adhesion agent and early total compaction, including that for which we depend on road traffic, are generally sufficient to avoid such problems.

27. REMOVAL OF SURPLUS CHIPS

The removal of surplus chips was once considered unnecessary but the need is now well recognised to prevent windscreen damage.

Generally, once the final interlocked shoulder to shoulder chip contact is obtained, chip removal can be achieved without loss of adhering chips. Brooming of surplus chips should be carried out sufficiently lightly and carefully to avoid dislodging adhering chips. In kerbed urban and particularly commercial areas, the use of suction after brooming may be necessary and may be specified in the job or contract specification. On no account should suction alone be used for surplus chip removal but only to remove swept chips.

28. PROTECTION AND REPAIR OF THE SEAL COAT

28.1 The contractor is responsible for the protection of the seal coat from the completion of the contractual rolling of each section of construction carried out within the day for a period of 48 hours, until the removal of temporary speed restrictions. The standard to be achieved at the end of the 48 hours is primarily that the “take” of chips is satisfactory so that there is no evidence of remaining windows or of chip loss and that surplus chips have been removed. The inspection and testing are to be carried out at the end of the protection period after the removal of surplus chips and immediately prior to the removal of the temporary speed restriction.

Providing the standard complies, the contractor is to be released from maintenance responsibility for the new surfacing. Thereafter any damage to the seal coat is to be deemed to be fair wear and tear.

Areas of any spray runs for which the binder application rates was significantly lower than the specified tolerance limits may be excluded from the maintenance release and consideration may be warranted to a requirement that the contractor apply a dry grit or emulsion and grit locking coat as a prerequisite for that release.

If the removal of surplus chips does not satisfy the requirements of clause 25, then that requirement must be satisfied to enable the surface to be inspected fully.

28.2 If the newly sealed surface does not satisfy the "take" of chip requirement at the inspection time, suitable repair methods must be approved by the Engineer. The maintenance of the work remains the responsibility of the contractor until the repairs are completed and the Engineer is satisfied that the surfacing is in a stable satisfactory condition.

28.3 The standard of remedial work is in compliance with the specification relative to the "take" of chips. As a guide to determine the period within which the repair of chip loss should be obtained, section 4.2 of the *Standard Levels of Maintenance Service for State Highways* should be adopted.

28.4 Where the chip loss comprises isolated chips (pockmarking) a dry grit locking coat may be sufficient, but if bald areas have developed then repair is liable to be relatively difficult. During a hot period of a day a light spray of kerosene or turpentine can soften the binder sufficiently to enable rolling in of replacement chips of the same size. If some time has elapsed since the surfacing was completed, one grade smaller chip should be used.

If additional binder is necessary a light coat (almost a tack coat) of heavily diluted binder should be sufficient providing the replacement chips are applied and rolled immediately. Excessive additional binder is liable to promote a slick surface in a relatively short time.

29. PAYMENT

The payment procedures and calculation methods are described in the course notes for TNZ P/4 which should be thoroughly understood.

The payment should not be processed until test results of binder samples have been checked since those results are to be used for payment purposes when they prove that the binder formulation is outside tolerance limits are also to be reduced to the tolerance limit for payment purposes.

The payment method provides for the payment of the asphalt cement, AGO and kerosene individually.

Payment for the adhesion agent is made on the basis of the total number of litres of asphalt cement approved for payment. For this reason more rigid control of the addition of adhesion agent is specified.

There is provision for payment for preparation of the surface, for the supply of chips or for client's supply, for precoating of chips when specified in the job or contract specification if required, and for the payment of a lump sum for traffic control.