NZTA P04 Notes: 2025

Notes to the Specification for Resealing

1 Scope

NZTA P04 is a Principal-led, or method-based, procedure for the design and construction of a chip seal over an existing sealed or asphalt pavement. It describes the materials, design criteria and construction process for the chip seal.

2 Treatment Selection

As P04 is a Principal-led method specification, the treatment is nominated by the Principal. Treatment options, in order of preference are:

(a) A single coat seal.
(b) A racked-in seal.
(c) A two-coat seal. Two coat seals are considered to be less waterproof than single coat seals and hence should only be used where necessary.

Other chip combinations may also be used at the discretion of the Principal.

The treatment selection will be provided to the Contractor no less than three months prior to the expected construction date. This will allow the Contactor sufficient time to procure the specified sealing chip and arrange for the site stockpiles to be constructed.

3 Materials

3.1 Base Bitumen

The bitumen grade will be nominated by the Principal based on the Winter climate conditions experienced at the job site.

For sites with very cold or cold Winters the base bitumen should be NZTA M01 180/200 or 130/150 grade. For sites with cool Winters the base bitumen can be either NZTA M01 130/150 or 80/100 grades. The concept is that a binder should be chosen that will not embrittle in the cold and crack, or shed chip.

Historical precedent, job site microclimate, materials availability and local experience should all be considered when choosing the base bitumen grade.

3.2 Fluxing

The base bitumen can be further softened by the addition of a flux oil. Up to 4pph of flux oil should be added for very cold or high-altitude job sites. The Principal will nominate the quantity of flux oil to be used.

The purpose of adding flux oil is to further minimise binder embrittlement during Winter conditions. Consequently the use and quantity of flux oil in the binder should be based on the severity of Winter pavement temperature and frequency and degree of frosts. The use of flux oil is independent of the binder delivery medium.

Very cold Winter temperatures are experienced in locations where frosts are frequent and lengthy, and Winter icing is common.

Cold Winter temperatures are for locations where frosts are experienced but generally thaw during the day. Icing rare.

Cool Winter pavement temperatures are experienced in locations where frosts are minimal and there is no risk of icing.

3.3 Cutting Back

The addition of cutter oil is required for all sites where cutback bitumen is the delivery medium. NZTA P18 Table 5 (2025 version) gives default recommendations for the cutter oil dosage, but these can be adjusted depending on site conditions, local practice and Contractor recommendations.

Bitumen emulsions are believed to have better wetting and adhesion performance than cutback bitumen, so the use of cutter oil not mandated but is at the Contractor’s discretion. Cutter oil can be added to the binder

prior to emulsification, or “post-blended” by injection into the emulsion stream exiting the production plant. Both processes are used by industry.

3.4 Adhesion Agent

All cutback bitumen must have adhesion agent added as specified by NZTA P18. The use of adhesion agents is not required where bitumen emulsion is the binder delivery medium.

3.5 Bitumen Emulsions

It is expected that bitumen emulsions will be the predominant binder delivery mechanism for chip seals in New Zealand. The binder must conform to the specified bitumen grade and flux oil content irrespective of the delivery medium, but for emulsions, the Contractor may choose the quantity of cutter oil used, as its function is for droplet coalescence, aggregate wetting and other workability aids.

Research has shown that, for cutback bitumen containing Jet A-1 as the cutter oil up to one third portion of the cutter can be lost during the spraying process prior to application of the sealing chip. Hence if the use of cutter oils in the emulsified binder is being considered, a lesser dosage is needed for equivalency with sprayed cutback bitumen.

3.6 Sealing Chip

The dryness of chips should be checked during the initial chip spreading. Effectively chips as supplied can be surface moist but should be dry within five minutes of spreading. If there is free water apparent, or should water flow from a load when the tray is raised for spreading, then the chips should be rejected.

Chip stockpile sites should be as close to the midpoint of the works as is practicable and when warranted, the temporary use of private land should be considered.

Frequently used chip stockpile sites should be considered for sealing to avoid contamination of the chips.

4 Design

It is the responsibility of the Principal or their delegate to carry out the chip seal design and determine the basic residual binder application rate. NZTA P18 is used for the design of the chip seal.

5 Construction

5.1 Timing

P04 mandates the construction of chip seals between 1 September and 31 March.

Daylight hours are recommended where possible for sealing for reasons of dryness and heat from sunshine. This can be a particular issue when bitumen emulsions are used as the binder delivery medium, as evaporation of the water from the emulsion and the consequent “set-up” of the seal can be delayed during cool, humid conditions, or if sealing during the night.

Nonetheless emulsions offer advantages with out of season sealing as wetting, chip embedment and adhesion can be superior to cutback bitumen seals, with a consequent reduction in the risk of early failure by stripping.

It is recognised that in some circumstances sealing outside of the mandated time and dates may be unavoidable. Where these circumstances arise, the prescribed departure process must be followed, and a plan developed to mitigate the effect of the departure from the specified requirements. Such a plan should consider, but not be limited to, items such as:

- Adjustments to the binder composition, including diluent content.
- Limits on climatic conditions, such as air temperature, weather, humidity.
- Changes to the traffic management plan to keep speeds low and distribute the traffic across the full width of the seal.
- The use of dried or precoated chip.
- Additional rolling.

The construction of the chip seal can not take place until the pre-seal repairs have been completed within the prescribed time period.

It is a requirement for the Principal or their delegate to be present on site for the construction of the seal. As the performance risk passes to the Principal shortly after removal of the traffic management, it is important for the Principal to witness the construction and be a party to any on-site decisions that may be needed.

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

5.2 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 recommended 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.

5.3 Pattern of Sealing Operations

A pattern of sealing spray runs, defining lengths, widths and application rates, should be prepared to the satisfaction of both the Contractor and the Principal to satisfy the specified longitudinal joint requirements and to define any essential hand spray areas.

Longitudinal joints should always be of the lapped type, the lap width being as indicated in the certificate of compliance. All laps must be completed within the day's work and laps within traffic lanes are to be completed within 30 minutes in the interests of normal road traffic. Longitudinal joints should never be in normal wheel track areas and should generally be along lane limits or junctions, or as close to those as is practicable. Otherwise those joints may be along the centre of lanes to avoid wheel track flushing. For outer edges of seal coats it must be ensured that a "cut-off" type nozzle is used at that end of the spray bar.

5.4 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:

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

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

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

By solving for volume the 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.

Figure 1: Typical chip application for a first coat seal.

there must be uncovered “windows” between chips following application. There must be sufficient room for the individual chips to be oriented such that the ALD axis is vertical following rolling and trafficking. Over-chipping will prevent this occurring and potentially reduce the life of the seal coat.

Experience and judgement is needed to assess the correct chip application rate during construction.

Figure 2: Typical chip application rate for the first layer of a racked-in seal.

Ensure that sufficient loaded spreading trucks are on site to provide cover before any spray run is commenced, and that spreading is completed within five minutes of the binder being sprayed.

The rate of spreading is the responsibility of the Contractor. The spread rate is measured for compliance at the end of the protection period defined in clause 6.

Although the spread rate cannot be directed to be changed during the spreading, the Contractor can, when necessary, be advised that the spread rate is considered to be sufficiently inadequate or excessive so that acceptance in accordance with clause 6 may be prejudiced.

Windows of significant area may be expected after initial spreading and also after contractual rolling, but normal road traffic provides the final setting up, as lateral chip movement enables the final shoulder to shoulder interlocked chip placement to be obtained as specified. Where the chip spread has been uneven hand brooming, sheeting or light drag brooming may be necessary.

5.5 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.

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

$$T = \frac{36000}{450\ x\ 8\ x\ 2} = 5\ hours$$

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,

$$T = \frac{36000}{450\ x\ 5\ x\ 2} = 8\ hours$$

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.

5.6 Protection of Road Furniture

Insufficient attention is often given to this matter so that kerbs and furnishings become affected by spray and service covers can become buried. The site supervisor should record all service covers in advance to ensure that none are overlooked. Special care is necessary for the rails at level crossings and for bridge expansion joints.

5.7 Dry Grit Locking Coat

Provision is made for the application of a dry grit locking coat to any specified measure or where directed by the Principal.

The purpose of the dry grit locking coat is to provide an additional locking effect to prevent chip overturn or loss until the volatile material in the binder has evaporated sufficiently. This is achieved by the light uniform application of grade 6 chips over the newly constructed sealcoat. It has proved to be very useful over grades 2 to 4 chips in areas of turning traffic, on small radius curves and at intersections or where frequent stopping and starting of vehicles are necessary as at traffic signals.

The dry grit locking coat should also be considered where, by error, the binder application rate on a section has been low and outside the specified tolerance. It has also proved to be successful in preventing extension of chip loss caused by wet conditions.

The time of application is important. The application must be after the completion of rolling and after as much traffic compaction of the chips as is practicable. However, to ensure some adhesion to the binder it should be applied within 24 hours of the completion of the rolling. However, considerable value may be expected even if the application is a short time later.

5.8 No Fouling of Sealed Surface

Fouling caused by oil, fuel or water can result in chip loss and must be avoided by checking that construction vehicles and plant with leakages are removed from the site. Topsoil, clay or silt carried by the wheels of chip trucks can cause permanent flush areas in the newly sealed surfaces and this must be avoided.

5.9 Intersecting Public Roads and Private Ways

Too frequently the sealing of intersecting unsealed roads to the road reserve boundary of the sealed road and the sealing of private ways to the kerb line or the line of the surface water channel line is neglected. This should be carried out with first coat sealing works but when resealing is being considered, shaping and first coat sealing of those areas should be carried out so that the second coat seal can be included with the resealing. Those areas for which second coat seal or reseal is warranted should be defined in by the contract for inclusion in the work.

5.10 Removal of Surplus and Waste Material

Whilst forgotten remnants of chip stockpiles may be taken and used for maintenance purposes, these and other materials, if overlooked, can become a maintenance responsibility. The removal of all surplus and waste materials must be ensured before a certificate of completion is issued.

5.11 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.

6 Protection and Repair of the Seal Coat

The Contractor is responsible for the protection of the sealcoat, 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 sealcoat is to be deemed to be fair wear and tear.

Areas of any spray runs for which the binder application rate 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 grit locking coat as a prerequisite for that release.

If the removal of surplus chips does not satisfy the requirements of clause 5.11, then that requirement must be satisfied to enable the surface to be inspected fully.

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 Principal. The maintenance of the work remains the responsibility of the Contractor until the repairs are completed and the Principal is satisfied that the surfacing is in a stable satisfactory condition.

Where the chip loss comprises single 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 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.