



**99% less  
kerosene  
emissions**



**Increased  
safety**



**Consume  
less energy**



**Superior  
adhesion**



**Non-  
hazardous**



**Carbon  
credits  
saving** NZ\$64  
per  
tonne



## **FAQs** Emulsion for chip seals

Bitumen emulsions have been used successfully in New Zealand roadworks since early 1900's, offering a safer, more sustainable alternative to hot cutback bitumen. Their warm application reduces health and environmental risks, eliminates hazardous solvents, and significantly lowers emissions. With proven durability, better workability, and strong industry backing, including from Waka Kotahi NZ Transport Agency, the shift to emulsions is no longer just innovative — it's essential for modern, responsible road maintenance.

Road Science has been advocates for this transition for years based on robust technical evidence and industry-wide support. This document provides an overview of all frequently asked questions in relation to Road Science emulsion products used for chip seal projects.

## 1. What is bitumen emulsion

Bitumen emulsion is a mixture where bitumen droplets are finely dispersed in water with the help of emulsifying agents. This formulation significantly reduces the viscosity of bitumen, allowing it to be sprayed at much lower temperatures compared to traditional hot bitumen applications.

In chip sealing, reduced viscosity is essential for effective spraying. Traditionally, this is achieved by heating bitumen to approximately 170°C. However, emulsifying the bitumen offers a safer and more environmentally friendly alternative. Once applied, the water in the emulsion evaporates, leaving behind a cohesive bitumen layer that binds the aggregate (chip) to the road surface.

## 2. How is Road Science emulsion manufactured?

Road Science emulsions are produced using advanced milling technology that breaks bitumen into microscopic droplets. These droplets are stabilised in water through the precise addition of emulsifiers and chemical agents. Key parameters such as droplet size, bitumen concentration, and chemical composition are tightly controlled to ensure consistent performance.

This process allows the emulsion to maintain a low viscosity suitable for spraying without the need for high temperatures. Due to the water content, emulsions are typically not heated beyond 90°C, making them safer to handle and apply.

## 3. Is bitumen emulsion a new technology?

Bitumen emulsions have been in use in New Zealand as a replacement for hot cutback since the early 2000s and have become increasingly popular for various chip seal applications. While the concept is not new, recent advancements in emulsion chemistry and manufacturing technology have significantly enhanced their performance.

Modern emulsions now offer superior adhesion, faster curing times, and improved stability, making them suitable for all chip seal types. These improvements position bitumen emulsion as a viable and often preferable alternative to traditional hot cutback bitumen.

## 4. Where can Road Science emulsion be used?

Road Science emulsions are engineered for use across all chip seal applications. Thanks to technological advancements, Road Science emulsions can:

- Be applied on steep slopes without runoff
- Achieve high application rates
- Maintain stability during storage
- Cure rapidly for quicker traffic return

Moreover, emulsions eliminate the significant health and safety risks associated with handling hot cutback bitumen. As a result, their use in chip sealing is increasingly recognised as industry best practice.

## 5. What are the advantages of Road Science emulsion over cutback bitumen?

Road Science emulsions offer a range of safety, environmental, and performance benefits compared to traditional hot cutback bitumen:

- **Enhanced Safety:** Emulsions eliminate the risk of explosions, fires, and serious burns associated with handling and applying hot bitumen.
- **Environmental Responsibility:** Emissions from kerosene are reduced by up to 99%, significantly lowering environmental impact.
- **Optimised Application:** Lower viscosity allows for reduced application rates without compromising performance.
- **Superior Adhesion:** Improved bonding to aggregates reduces chip loss, minimising the need for rework and maintenance.
- **Non-Hazardous Composition:** Emulsions are free from carcinogenic substances and classified as non-hazardous.
- **Durability and Performance:** Better resistance to stripping and enhanced bonding contribute to longer-lasting seals.

## 6. Why should customers switch to Road Science emulsion?

Switching to Road Science emulsion is a strategic move toward safer, cleaner, and more technically advanced chip sealing solutions. Compared to hot cutback bitumen, emulsions offer:

- **Improved Adhesion:** Reduces initial chip loss and enhances seal integrity.
- **Reduced Flushing:** Minimises surface bleeding and improves long-term performance.
- **Extended Seal Life:** Emulsions contribute to longer-lasting road surfaces.
- **Elimination of Kerosene:** Removes the need for volatile and harmful additives.
- **Environmental and Safety Benefits:** Lower emissions and reduced risk to workers make emulsions the responsible choice.

While conservative estimates suggest emulsions perform at least as well as hot cutback bitumen, field data and experience show that in many cases, they outperform traditional methods. The most compelling reasons to switch are the significant reduction in health and safety risks and the dramatic decrease in environmental emissions.

## 7. What grade of bitumen is used in Road Science emulsion?

Road Science emulsions are formulated using the same bitumen base grades traditionally used in hot cutback applications. Any commonly used bitumen grade can be emulsified without compromising performance.

If a specific bitumen grade has proven effective in a region as a cutback, it can be seamlessly transitioned into an emulsion-based product — ensuring continuity and reliability in chip seal performance.

## 8. How long do emulsions take to cure?

Road Science emulsions are considered fully cured once all water content has evaporated. Cure time depends on several environmental and application factors, including:

- Application rate
- Ambient temperature
- Wind speed
- Humidity levels

To support accurate planning and execution, Road Science has developed a proprietary performance forecasting tool called Zeus. This system uses real-time weather data and field-tested algorithms to predict cure times with high precision, enabling teams to optimise scheduling and ensure quality outcomes.

## 9. What happens if it rains during chip sealing?

Chip sealing — whether using hot cutback bitumen or emulsion — should never be performed in rainy conditions. Moisture interferes with the bonding process and compromises seal integrity.

While Road Science emulsions are more resilient than hot cutbacks in wet conditions and typically retain chip, rain can still cause unsightly wash-off. To mitigate this, Road Science has engineered faster-curing emulsions and developed a real-time performance forecasting tool (Zeus) to help teams assess weather-related risks and make informed decisions.

It's important to note that although hot cutbacks have historically been sprayed in light rain, chip adhesion is poor and stripping is a significant risk, making this practice unreliable and potentially costly.

## 10. What product can help accelerate chip seal curing?

Slow curing and unpredictable weather can delay chip seal performance. WeatherBarrier by Road Science is designed to speed up the curing process, improve efficiency, and minimise project risks. This advanced solution helps ensure consistent results and keeps your roadworks on schedule.

## 11. How storage stable is Road Science emulsion?

Road Science emulsions are highly storage stable, maintaining stability over extended periods — often outperforming hot cutback bitumen in terms of shelf life and consistency. When stored under recommended conditions and handled using best practices, Road Science emulsions remain ready for use without the need for frequent agitation or reprocessing.

## 12. Does Road Science emulsion require kerosene?

Road Science emulsions significantly reduce or eliminate the need for kerosene.

In hot cutback bitumen, kerosene is added to:

- Improve initial adhesion
- Soften the binder during early seal life

However, research shows that up to 50% of kerosene in cutback is lost to the atmosphere — 20% during spraying and another 30% within hours. Emulsions, by contrast, do not require kerosene for adhesion. If softening is needed, only half the amount used in cutback is necessary, and all of it remains in the binder.

During warmer months, most Road Science emulsions can be sprayed without any kerosene. Looking ahead, Road Science is developing emulsions with bio-based softening agents, aiming to eliminate kerosene entirely — further enhancing environmental sustainability.

Importantly, Road Science emulsion seals are engineered to match or exceed the lifespan of equivalent hot cutback seals.

## 13. Do emulsions reduce pick-up + tracking?

Yes, Road Science emulsions are specifically formulated to minimise pick-up and tracking, especially under high-temperature conditions.

Because emulsions typically do not require kerosene in the base binder, the cured binder is firmer and more stable. This results in:

- Reduced risk of chip roll-over
- Less binder pick-up on vehicle tyres
- Minimal tracking on hot summer days

This makes emulsions particularly effective in maintaining clean, durable surfaces during and after sealing operations.

## 14. How long do Road Science emulsion seals last?

Road Science emulsion seals are engineered to deliver equal or superior durability compared to traditional hot cutback bitumen seals.

## 15. Can you use Road Science emulsion for first coat seals?

Yes, Road Science emulsion is highly suitable for first coat seals.

Its superior adhesive properties and proven performance in damp or variable conditions make it an ideal choice for sealing freshly prepared surfaces. Emulsions bond effectively to the base layer, ensuring strong chip retention and minimising early-life failures.

## 16. Can application rates be lower than hot cutback bitumen?

Yes, Road Science emulsion allows for reduced application rates compared to hot cutback bitumen.

Thanks to its enhanced adhesive properties, less residual binder may be required to achieve the same sealing performance. While careful design and field validation are essential, experienced practitioners have successfully reduced application rates without compromising seal quality. As familiarity with emulsion systems grows, optimised designs can lead to material savings and improved efficiency.

## 17. Can Road Science emulsion be used for single coat seals with high application rates?

Absolutely. High application rates are not a limitation for Road Science emulsions. The formulations have eliminated the risk of runoff, even at rates exceeding 3 litres/m<sup>2</sup>. This enables effective sealing in demanding conditions and supports the use of single coat seals where thicker binder layers are required. Road Science emulsions maintain stability and adhesion, even at elevated application volumes.

## 18. Do Road Science emulsions help reduce flushing?

Yes, Road Science emulsions can contribute to reduced flushing over time.

Improved adhesion allows for lower binder application rates, which in turn can reduce the likelihood of binder migration and surface bleeding. However, it's important to note that most flushing is caused by water-induced venting, and while emulsions may mitigate this effect due to reduced binder volume, the impact may be modest. Nonetheless, emulsions offer a more controlled and predictable sealing process that supports long-term surface performance.

## 19. Do Road Science emulsions penetrate the surface effectively?

Yes, Road Science emulsions penetrate and adhere well to both dry and damp surfaces, thanks to their water-based formulation.

While direct measurement of penetration depth is not feasible for either emulsions or hot cutback bitumen, field performance shows that emulsions bond effectively to base layers. In damp conditions, emulsions may offer better penetration than hot cutback, enhancing adhesion and seal integrity. The belief that cutback bitumen penetrates base course layers more effectively is not supported by measurable data — emulsions perform equally well in this regard.

## 20. How are Road Science emulsions sprayed?

Road Science emulsions are compatible with conventional bitumen spraying equipment. In most cases, only minor modifications — such as adjustments to spray nozzles — are needed to accommodate more advanced emulsion formulations.

Emulsions can be:

- Stored and transported using standard bitumen tanks and tankers
- Sprayed using existing fleets, minimising the need for new capital investment

As the industry transitions away from hot cutback bitumen, there is growing potential to develop purpose-built emulsion spray and transport equipment, which could further improve efficiency and application precision.

## 21. Can Road Science emulsions be used for night sealing?

Yes, Road Science emulsions are suitable for night sealing operations.

With the support of the Zeus performance forecasting tool, teams can accurately assess curing times under varying environmental conditions. Road Science emulsions have been successfully applied at night in locations such as Auckland and on State Highway 2 during scheduled night closures, demonstrating their reliability and versatility in low-light, cooler conditions.

## 22. Can Road Science emulsions be used for membrane seals beneath hot mix asphalt?

Yes, Road Science emulsions are well-suited for use as membrane seals beneath hot mix asphalt.

Whether applied during the day or at night, any residual water in the emulsion is rapidly evaporated by the heat of the asphalt mix. Road Science emulsions have been successfully used as membrane layers for over seven years, providing a proven, safe, and effective alternative to hot cutback bitumen.

## 23. What initiated the shift from hot cutback bitumen to emulsion?

The transition to emulsions has been driven by safety, environmental, and technological advancements.

Historically, hot cutback bitumen was the standard for chip sealing in New Zealand. However, recent innovations in emulsion technology have made emulsions a viable and superior alternative. The introduction of stricter health and safety legislation has also played a key role, requiring all industry participants to eliminate hazards where reasonably practicable.

Emulsions eliminate the significant risks of fire, explosion, and burns associated with hot cutback, aligning with modern safety expectations and environmental standards.



## 24. What future developments can be expected in emulsion technology?

The future of emulsion technology is focused on performance enhancement and sustainability.

Ongoing research and development are targeting:

- Higher bitumen content emulsions (up to 76%) to reduce cure times and improve efficiency
- Bio-based softening agents to eliminate kerosene entirely
- Improved sprayability and storage stability
- Smarter application tools integrated with real-time data for optimal performance

As industry adoption grows, continued investment will drive innovation, making emulsions even more effective, sustainable, and user-friendly.

## 25. Are emissions reduced when using emulsions?

Yes, emissions — specifically kerosene emissions — are dramatically reduced when using Road Science emulsion compared to hot cutback bitumen.

An independently audited study conducted by Road Science found that kerosene emissions from emulsion sealing are reduced by up to 99%. This is because:

- Emulsions do not require kerosene for adhesion, unlike hot cutback bitumen
- Hot cutback bitumen typically loses up to 50% of its kerosene content through evaporation during and shortly after application
- Any kerosene added to emulsions remains longer in the binder, rather than evaporating into the atmosphere

This substantial reduction in kerosene emissions makes Road Science emulsions a safer and more environmentally responsible choice for chip sealing.

## MORE INFORMATION?

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