



# Road Science Emulsion for Chip Seals - Frequently asked questions

## What is Bitumen Emulsion?

A bitumen emulsion is a suspension of bitumen droplets in water which reduces viscosity to enable spraying at low temperatures.

For chip seals, the viscosity of the bitumen has to be reduced to enable it to be sprayed. There are two methods of reducing viscosity for spraying; one is to heat bitumen (usually to about 170°C) and the other is to emulsify the bitumen. After the emulsion is sprayed the water evaporates from the road surface and bitumen remains to hold chip in the chip seal.

## How is Road Science Emulsion made?

Emulsion manufacturing plants mill the bitumen into very small droplets and with the addition of emulsifiers and chemicals can suspend those droplets in the water. Droplet size, bitumen content and chemical addition are accurately controlled.

This reduces the viscosity of the bitumen enabling it to be sprayed without high temperatures. Due to the presence of water, emulsions cannot be heated past about 90°C.



**HAS LESS CARBON**  
than hot or cut back bitumen



**CONSUMES**  
Less energy



Contributes to  
**HIGHER**  
Productivity and  
**GREATER**  
Safety



### **Is Bitumen Emulsion new?**

Bitumen emulsions have been manufactured and used since the early 1900s. They have been widely used for some chip seal types since. In recent times improvements in technology and manufacturing plants have meant that the properties of emulsions have also dramatically improved. Emulsion is now able to be used for all chip sealing types and is a viable replacement for hot cut back bitumen.

### **Where can you use Road Science Emulsion?**

Road Science Emulsion can be used in all chip seals.

Advances in technology have meant the traditional limitations associated with older emulsion have been overcome. Road Science Emulsions are now able to be sprayed on steep slopes without run off, high application rates can be achieved, storage stability issues have been solved and cure times significantly improved. This means that emulsions can now be used for all chip seal types. Because emulsions eliminate the significant hazards associated with hot cut back bitumen the use of emulsion for chip seals should now be considered best practice.

### **What are the advantages of Road Science Emulsion over cut back?**

Road Science Emulsion is safer, produces less emissions and is now technically superior to hot cut back bitumen for chip seals.

Recent advances in technology mean that emulsions are now capable of being used in all chip seal types in New Zealand. The major advantages of emulsion are;

- Hazards are eliminated e.g. explosions, fires and serious burns. Emulsions are safer.
- Environmental, emissions are significantly reduced (almost 50% less).
- Application rates can be reduced.
- Improved adhesion means reduced chip loss and therefore reduced rework.



### **Why should customers make the change to Road Science Emulsion?**

Road Science Emulsion is safer, produces less emissions and is technically superior to hot cut back bitumen for chip seals.

There are many technical benefits associated with the use of emulsion which include;

Improved adhesion, less initial chip loss, reduced flushing, longer seal lives, and the elimination of kerosene. Some are more effective than others and a very conservative view would be that, emulsion seals perform at least as well as hot cut back seals and in many cases they perform better. Simply Road Science Emulsion is now a viable replacement for hot cut back in all chip seals.

However, the largest benefits of Road Science Emulsion over hot cut back bitumen seals are associated with the reduced risk of harm to people and reduced emissions to the environment.

### **What grade of bitumen is used in Road Science Emulsion?**

Road Science Emulsions are now made from the same grades used as hot cut back bitumen.

Recent advances in Road Science Emulsion technology means our products can be made for any of the commonly used bitumen base grades. If a bitumen base grade has been chosen for a region and used successfully as cut back, then that same base grade can be used for the emulsions.

### **How long does it take to cure?**

Road Science Emulsions are 100% cured when all the water has been evaporated. This means actual cure times are affected by factors such as; application rate, temperatures, wind, and humidity. Road Science has extensively tested and researched the curing time of their emulsions in various conditions. This testing and research means curing times can be calculated if the factors above are known. The result of this work is a product performance forecasting tool (known as Zeus) which provides cure time information to teams based on actual real time weather data.





### **What if it rains?**

Chipsealing, regardless of whether it is bitumen or emulsion should never be carried out in the rain.

While emulsion seals applied in rain usually do not lose chip they can create an unsightly wash off which should be avoided. Road Science has improved the cure time of emulsion to lessen the risk of wash off and have a product performance forecast tool to assist teams assess the risk of wash off. It should be noted that while hot cut backs have been sprayed in rain, chip will not adhere in wet conditions and stripping is a significant risk.

### **How storage stable is it?**

Road Science Emulsions are storage stable.

Recent advances in emulsion technology have eliminated storage stability issues of the past. Provided good practice is followed there are no storage stability issues with modern emulsion. A modern emulsion is now more storage stable than hot cut back bitumen.

### **Does it need kerosene?**

Road Science Emulsions significantly reduce the need to add kerosene.

Kerosene is added to hot cut back for two reasons, to improve adhesion and to soften the binder in the early stages of seal life. Research has shown that 20% of the kerosene in hot cut back is lost to atmosphere when spraying and another 30% within a few hours of spraying. Emulsion does not need kerosene to assist with adhesion. Therefore, any kerosene added to an emulsion should only be considered to soften the binder in the early stages of seal life. Because all the kerosene added remains in the binder, only half the amount used in cut back should be considered. During the summer months most emulsion should be sprayed with no kerosene added. In the future emulsions will contain a "greener bio" binder softening agent and kerosene will be eliminated altogether.

### **Do Bitumen Emulsions reduce pick up/tracking?**

Using Road Science Emulsion can reduce pick up and tracking.

In most situations emulsion does not require kerosene to be added to the base binder. This results in a cured binder that is more resistant to roll over, pick up and tracking on hot summer days.



### **How long do Road Science Emulsion seals last?**

Road Science Emulsion seals will last at least as long as the equivalent hot cut back seal.

### **Can you use Road Science Emulsion for first coat seals?**

Road Science Emulsion is suitable for first coat seals.

Because emulsions have superior adhesive properties and are successful in damp conditions they are especially suitable for first coat seals.

### **Can application rates be less than cut back?**

Application rates can be reduced when using Road Science Emulsion.

Because Road Science Emulsions have improved adhesion when compared to hot cut back bitumen it may be possible to spray less "residual" bitumen to achieve the same result. Care still needs to be taken and as experience grows some designers do successfully reduce application rates.

### **Can Road Science Emulsion be used for single coat seals with high application rates?**

High application rates are no longer a problem for Road Science Emulsion seals.

Recent advances in emulsion technology mean emulsions can be sprayed at high application rates without running off the road. There are no longer constraints of how much can be sprayed and rates in excess of 3 litres/m<sup>2</sup> are easily achieved without run off.

### **Do Road Science Emulsions reduce flushing?**

Using Road Science Emulsion can reduce flushing.

There is evidence which suggests that due to improved adhesion, application rates can be reduced when using Road Science Emulsion. This in turn can reduce flushing in the future. However, most flushing is due to water induced venting and while using emulsions can reduce the effect, because there is less binder on the road, the difference may not be significant.

### **Do Road Science Emulsions penetrate?**

Road Science Emulsions penetrate and adhere to both dry and damp surfaces because they are a water based system. When compared to cut back penetration of existing surfaces it is not possible to measure any difference between the two systems. It is worth noting however that while some believe cut back bitumen penetrates base course layers this cannot be measured. In damp conditions emulsion will penetrate more than hot cut back, but again is not able to be measured.





### **How are Road Science Emulsions sprayed?**

Road Science Emulsion is sprayed with conventional bitumen spraying equipment.

Some of the more advanced emulsions require only minor modification to spray nozzles on conventional spray equipment. Road Science Emulsion can be stored and transported in conventional bitumen tanks and tankers. As demand increases for emulsion and conventional equipment is retired, the opportunity presents itself to build specific emulsion spray and transport equipment. This could mean improved efficiencies over time.

### **Can you seal at night with Road Science Emulsions?**

Road Science Emulsion can be used at night. The use of the Road Science product performance forecast tool assists teams assess the cure time in differing environmental conditions. They are routinely sprayed at night in Auckland and recently on a section of State Highway 2 during night closures.

### **Can you use Road Science Emulsions for membrane seals beneath hot mix asphalt?**

There is no real difficulty using emulsions for membranes either at night or in the day. Any water remaining in the emulsion when the mix is applied is driven off by the heat of the mix.

Road Science Emulsions have been used successfully as membranes under hot mix for the last 7 years during the day and night.

### **What has brought on the change from hot cut back to emulsion?**

Road Science Emulsions are much safer to use than hot cut back bitumen.

Chip Sealing with hot cut back bitumen has been the method used in NZ for many decades. While emulsions have been used for a long time traditionally they have not been able to substitute for hot cut back. Recent advances in emulsion technology mean that emulsions have now become a viable replacement for hot cut backs. The new NZ Health and Safety legislation has increased the responsibility of all people involved in the industry, where reasonably practicable, to eliminate hazards. The use of emulsions eliminates the significant hazards associated with hot cut back bitumen.

### **What are the hazards associated with Hot Cut Back bitumen?**

Fires, burns and explosions are some of the hazards associated with hot cut back bitumen.

Because hot cut back is heated to reduce viscosity to temperatures in the order of 170°C and the kerosene added to the bitumen (cut back) has a flash point in the order of 38°C. This introduces significant health and safety hazards which include; Fires, Explosions, Burns (from contact with equipment and product), and Fumes. Because kerosene is emitted to atmosphere and energy is required for heating, environmental emissions are high and can be 50% more than emulsion sealing.



### **What future developments can be expected?**

Further development is already in progress to improve the performance of emulsions.

Significant advances in emulsion technology have occurred over the last few years. The performance of emulsions has improved to the extent that they are now a viable replacement to hot cut back for chip seals.

As the uptake of emulsion increases investment in further developments will follow. Already research and development projects have established what is required to manufacture and spray 76% bitumen emulsions. This next advance will shorten cure times and increase efficiencies.

### **Are emissions reduced?**

Emissions are significantly reduced by using emulsion instead of hot cut back.

Road Science conducted an independently audited study and found that for a final section of sealed road emissions from emulsion sealing are almost 50% less than hot cut back.

## **More information?**

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