



# Asphalt matters



News from the world of Asphalt

Fall 2021

**Nouryon**

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We are happy to publish  
Nouryon's 2021 Asphalt matters newsletter

It contains technical articles about interesting asphalt  
applications from various parts of the world as well  
as exciting products launched by Nouryon



Applications  
around  
the world

# Successful cold recycling project with Redicote E-7100 emulsion at Glen Elder, Kansas

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Innovations to enhance sustainability of asphalt pavements.

Successful commercial project at Glen Elder Kansas – Cold in place (CIR) field application of emulsion made with Redicote E-7100.

Article by Mike Jenkins and Sundaram Logaraj

The use of cold mix and cold recycling with emulsions is growing in many countries. In developed countries recycling is becoming more and more popular as there are restrictions on mining new aggregates and also there is savings if one uses recycled materials. Cold recycling with emulsions have a much higher impact on sustainability due to significant reduction in energy, reduction in emission and the use of recycled materials. The use of emulsions is also attractive as the oxidized and aged pavement does not undergo further oxidation by being subjected to higher temperatures as in hot-recycling. In certain countries the use of virgin cold mix is growing such as in India for secondary roads in remote regions where hot-mix plants are not accessible. Countries such as Sweden are promoting cold mix to reduce emissions and energy consumption associated with paving.

Cold in-place Recycling (CIR) as a pavement rehabilitation technique has several advantages. The use of existing or in-place materials instead of transporting mixes from a different site generates additional cost saving and provides environmental benefits. The use of emulsions as a binding or stabilizing agent reduces in

energy costs and emissions as the production and placement of mixes are done at ambient temperatures compared to a hot or warm mix application.

In cold-in-place recycling (CIR) there is a need for an emulsifier or emulsion systems that builds faster cohesion but still gives enough workability. Often a certain amount of cement is used in such mixes and the emulsifier system that is used needs to give enough workability in the presence of cement. The existing emulsifier systems are too slow and do not build strength quickly after placement and compaction. The systems that build quick cohesion quickly breaks in presence of cement and does not give enough workability. Nouryon introduced the Redicote E-7100 emulsifier that can be used to produce emulsions for CIR applications that builds faster cohesion development and reduce curing time compared to common CSS emulsifiers. It is also compatible with cement and so will give enough workability in mixes with or without cement. In addition, RedicoteE-7100 emulsions exhibit less settlement and better storage stability compared to other CSS emulsifiers.



Cold in-place recycling – Courtesy of Pavement Recycling Systems (PRS)

### University of Arkansas cold mix related research sponsored by us

We have been working with Universities such as University of Arkansas and industry leaders such as Ergon and Pavement Recycling systems in order to come up with better emulsifier and emulsion system to give optimum performance in cold mixes including CIR applications. The goal is to optimize emulsifier and emulsion formulations to balance workability and compactability with cohesion/strength gain and adhesion.

We sponsored a research program at the University of Arkansas with Dr. Braham and his group. The goal was to develop and optimize laboratory test methods to measure workability, compaction, and cohesion gain in cold mixes with emulsions starting with CIR applications. One of the main aspects of their study was also to develop correlation between lab results and field performance. Dr. Braham and his team were especially involved in monitoring and collecting data from this particular field trial.

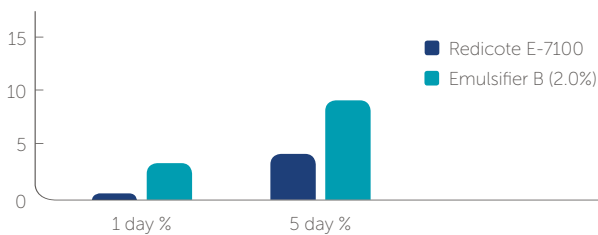
The first field trials with emulsions made from Redicote E-7100 was conducted in May 2020. The trial took place in a location called Glen Elder in Kansas. The emulsions formulations were developed and Optimized by Paragon Technical Services. The mix design for this particular CIR application was also developed by Paragon Technical Services. A CSS special grade of emulsion was produced for the trial with Redicote E-7100.

## Emulsifier and emulsion formulations

The typical dosage of Redicote E-7100 in the emulsions is 2.0%. The following are the advantages of using Redicote E-7100 in emulsions for CIR applications:

	Benefits	Comparison with other products
Faster cohesion development in CIR applications	Reduced curing time	Faster setting
Less sensitive to cement	Can be used in CIR mixes containing cement	Emulsion with certain emulsifiers are sensitive to cement
Good quality emulsions	Good storage stability	Better storage stability compared to emulsions made with certain products

Redicote E-7100 emulsions give good storage stability test results compared to other emulsion systems.



Storage stability test results, evaluations performed by AASHTO accredited laboratory

Redicote E-7100 emulsions are associated with a chemical break during CIR mix production and paving and so they tend to develop strength quickly unlike normal CSS emulsifiers. In spite of faster break compared to other CSS emulsifiers, Redicote E-7100 emulsion is also more stable with cement and so they will still provide necessary workability for placement and compaction of the mix in CIR applications. Emulsions made with Redicote E-7100 will pass cement mixing test.

## CIR mix design and lab test results

The CIR mix for this project was designed by Paragon Technical Services. The RAP material supplied as cores were crushed and evaluated. The CSS emulsion made with Redicote E-7100 with a binder content of about 65% was used. The mix was optimized to contain 4.6% total water and an emulsion content between 2.5-3.0% based on dry weigh of RAP. It was also recommended to use cement between 0.25-0.75% by the dry weight of RAP.

## Field trial

The CIR job site was on Glen Elder Road, just south of Glen Elder, Kansas. Various personnel were present including Dr. Braham from University of Arkansas, Donna Kwapis and Mike Jenkins from Nouryon. University of Arkansas was monitoring the trial and their main goal was to develop correlation between lab results and field performance. They were collecting field materials including RAP and emulsions and collecting field data using a device developed by University of Arkansas called the Stiffness Raveling Mechanism Test (SRMT).



## Stiffness Raveling Mechanism Test (SRMT)

According to the field observations conducted by the University of Arkansas, the air temperatures during construction were in the mid-60s to mid-70s (°F), while the pavement temperature was approximately 90-115°F and there was light wind during the entire project. The SRMT values in general should increase with increase in density during compaction but the collected data was not accurate enough as there was a high level of variability of rebound heights. In general, the SRMT data for this particular trial was similar to that of the results with normal CSS emulsion but the main difference that was observed was that the section using Redicote E-7100 section showed less segregation compared to normal CSS emulsion. This could be attributed to the increase in workability provided by Redicote E-7100 emulsion in this CIR application.

## After full compaction section (top) using Redicote E-7100 emulsion showed less segregation

The contractor constructing this section commented that they are pleased with the performance of the Redicote E-7100 emulsion as it was easy to place and the paving crew liked working with this emulsion. Ergon was pleased with results and commented that industry needs such new chemistry for CIR applications. One of the conclusions from the University of Arkansas trial report was that the section that used Redicote E-7100 emulsion showed noticeably less segregation compared to normal CSS emulsion used in this project.



# Unique Nouryon Surfactant package for Asphalt emulsion based water proofing formulations

Anionic asphalt emulsion based waterproofing paints has been one of hottest topics and market is witnessing a fast growth since this technology can find a number of uses such as, sealant for gapping filling (concrete ), non-cured primer for bitumen sheet, primer for bitumen sheet.

Article by Royan Xu

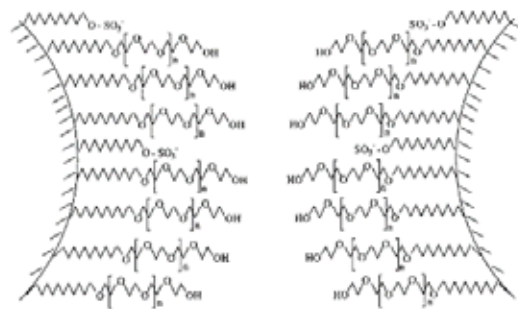
In addition anionic asphalt emulsion based waterproofing has a good compatibility with bitumen as they are composed of the same base material (asphalt/bitumen).

Anionic SBR, pure acrylic or Styrene/acrylic latex are used to modify the asphalt to improve many aspects, for example the flexibility under lower temperature, impermeability, resistance to temperature variation, ageing, ability to bridge cracks, stickiness of wet and dry state and water resistance.

The most critical part is to make an anionic asphalt emulsion with a good  $\text{Ca}^{2+}$  ion stability and mechanical stability, since the waterproofing formulation will contain  $\text{CaCO}_3$  filler which may leach out some  $\text{Ca}^{2+}$  ions. During paints manufacturing, it will undergo some mechanical shear /dispersion when the paints are applied on the substrate. Paints will also be subject to some shear due to roller, brush or spraying.

While formulating anionic emulsion, we follow some general rules regarding emulsifier.

We came up with a suitable surfactant package that give good shear stability and Calcium ion stability to the emulsion.



A mixed monolayer surfactant molecules stabilize emulsion droplets

Our China team have witnessed the market growth and invested a lot resource through a comprehensive study and launched our solution which consists of a unique surfactant package during Chinacoat 2020, Dec 8-10. Alongside this, we also recommend other products to formulate the paints, including Bermocoll, Alcosperse and Alcogum series.





The formulation of anionic emulsion will be composed of as below.

Asphalt: 60%

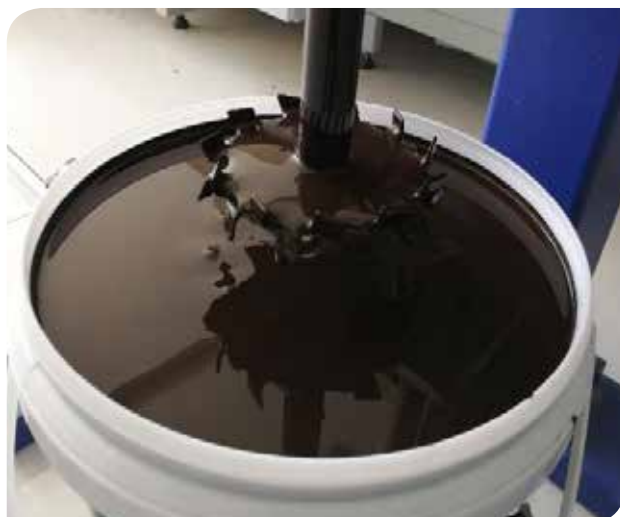
Nouryon surfactant package: ~3%

Adjust pH to approx 11.0

Add water up to 100%

Our solution show an excellent properties in  $Ca^{2+}$  stability, mechanical stability, finer particle size and anti-settlement, typical performance is listed as below:

Our solution unique surfactant package	
Solid content	60%
pH	~11.5
D50,um	1.4-1.6
Viscosity, 25°C	34-38
Mechanical stability	Good
$Ca^{2+}$ stability	Good



Courtesy of Skshu Paints

### Starting formulation for asphalt emulsion waterproofing paints

Furthermore, many customers show a great interest in this technology, Skshu Paints (the biggest local paints manufacture in China) has completed the trial production based on our solution ,with a good preliminary result ,customer is much satisfied with the performance and storage and application is still ongoing.

Composition	Weight /g
Bermocoll Prime 2500	2.0
AMP-95, pH adjustor	0.5
Latex acrylic emulsion from BATF (FS-670)	300
CaCO <sub>3</sub> , 400mesh	300
Alcosperse 602N, dispersant	2
Defoamer NXZ	2
Asphalt emulsion	300
Defoamer	2
Alcogum L-344	2.5-4.5
Water	17
Biocide	1
Water	up to 1000

# Growth in base stabilization with emulsions in India

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Cold mixes including base stabilization with emulsions is becoming popular in several countries. These stabilization techniques have several benefits and are used for structural layers including heavily trafficked pavement.

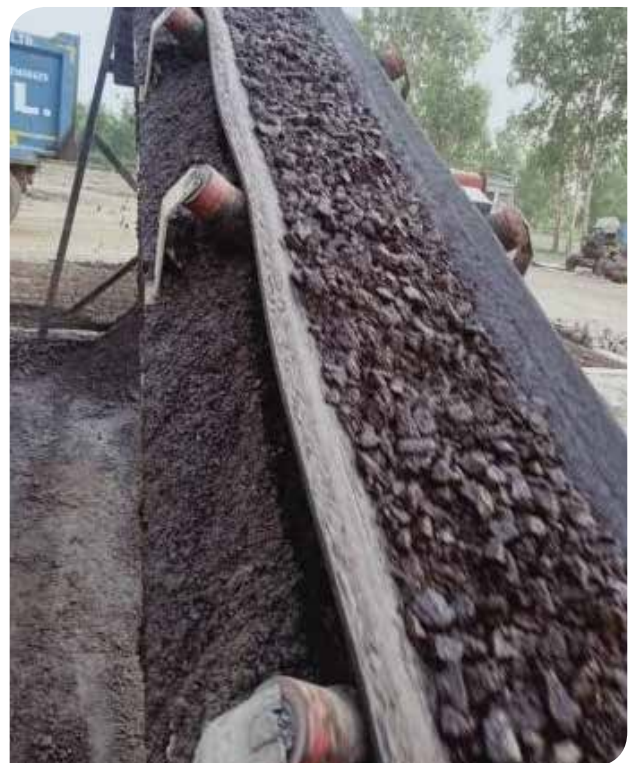
Article by Indrajeet Upadhyay

The purpose of stabilization is to enhance the properties of material which results in increased strength and load bearing properties. There are ample reasons for stabilization of RAP materials to eradicate the need to quarry non-renewable natural aggregates. However, the main reason for utilizing stabilized material with emulsions is improving performance of material by increasing its strength, stiffness, durability and cost savings.

To achieve stabilized RAP material cement is mixed as a stabilizer by 0.5-1.0% and SS2 grade emulsion 3.5% (formulated by using Redicote E-4875 NPF ) by weight of the total mix. In order to obtain proper coating, stability and better compaction, pre-wetting of mix is done with (1-3)% of water prior to addition of emulsion.

In the emulsion based cold mix technology, the process involving the addition of pre-wetting water to the aggregate, thereafter addition of emulsion, production of the mix, laying and compaction are all done at the room/ambient temperature (25-30°C). It was also shown through field trials that cold mix can be easily produced by using hot mix plants and laid using similar techniques.

The use of stabilized cement treated base enables lowering cost, reduces emissions and results in a worker friendly environment. For these reasons Base stabilization with emulsion is a Eco premium solution as they are paved at ambient temperature greatly reducing emission and energy use. This combined with recycled material greatly enhances the sustainability of asphalt pavement.





## Benefits of utilizing RAP and customized bitumen emulsion cold mix technology

- Environment friendly and energy efficient technology
- Construction feasible in all weathers except wet conditions which increases the productivity of the paving operation
- Reduction in pavement thickness when stabilized with emulsion compared to granular base by itself
- Low to medium traffic can easily be allowed on bitumen stabilized layer whereas – in cement stabilized layer only very low volume traffic can be allowed
- Quality control of bitumen stabilized layer is easier than cement stabilized layer
- Less manpower and machinery requirements
- Comparatively lower cost of construction as saving of aggregate, fuel and logistics cost
- Especially suited for paving in remote areas where hot-mix plants are not available due to the following reasons
  - Low capital investment for cold mix plants
  - Easier to transport mix plants
  - Easier to transport emulsion and mixes
  - Emulsion can be stored for longer periods of time
  - Well suited for on-site and in-place methods



# The Emulsion Asphalt Prime (EAP), prime coat application in Thailand

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The benefits of prime coat are to enhance aggregate's cohesion of road base course resulting in no surface damage prior to paving and to prevent water penetration through the base course prior to paving. The prime coat acts as a binder to enhance bonding between the base course layer and the subsequent paved surface layer. This technique is commonly used worldwide to provide a bond between the base course and asphalt layer.

Article by Naruesa Riwatong

## **Use of cutback asphalt and its limitations**

Cutback asphalts are often used for priming as they are able to penetrate through dust layer adhering to the base course, and also penetrate through small pores so as to enhance cohesion between aggregates. The use of cutbacks has several drawbacks. Cutback asphalts contain excessive amount of hydrocarbon solvent (approx 35-40%) resulting in slow curing (i.e. at least one week before paving the base course) but the main problem is that the evaporation of high amount of hydrocarbon solvent leads to environmental pollution. In addition, it is hazardous for the workers since the cutback asphalt is a flammable material which could catch fire and there have been several accidents during storage and use of cutback. Many countries have banned the use of cutback asphalts for these reasons. Moreover, use of solvent in the cutbacks adds to the total cost owing to high amount of hydrocarbon solvent used.

## **Current practice in using asphalt emulsions for prime coat**

The production of asphalt emulsion requires emulsifiers to disperse asphalt droplets in the water. The kind of emulsifier determines the type of asphalt emulsion such as cationic, anionic, or non-ionic grades. Cationic asphalt emulsions give better adhesion and faster break with commonly used aggregates compared to anionic and non-ionic asphalt emulsions. The cationic asphalt emulsion is most commonly used and mainly the slow setting cationic type asphalt emulsions (CSS-1) are used for prime coat application. However, all users are experiencing the same problem, where the asphalt layer easily peeling off (i.e. no adhesion to the base course) even if the emulsion complies to standards, e.g. ASTM D2397, BS 434, etc. This is because even the slow settling emulsion do not have enough chemical stability and they break on the surface without penetrating into the base.



When a few vehicles pass over the surfaces begin to peel. In order to minimize this problem the contractor usually spreads sand over the surface. Although, this is effective, it costs more, and diminishes a core function of prime coat (i.e. a binder between base course and road surface) because of sand blocking between the prime coat and pavement. Moreover, the used sand will absorb certain amount of asphalt resulting in lesser amount of asphalt functioning as a prime coat.

The DOH (Department of Highways) in Thailand specified the use of slow setting grades of asphalt emulsion excluding cutbacks. These asphalt emulsions do not penetrate through the surface even if it is an untreated base due to the reasons explained above. This resulted in the agencies not recommending the use of asphalt emulsions for treated base. It is an established fact that prime coat is essential and therefore, when the asphalt emulsions are used as prime coat, any or all together of the followings are done taking into account condition of the base course.

- Scarifying to a depth of 25 to 50 mm to break up the surface allowing the penetration of asphalt emulsions
- Mixing asphalt emulsion and water to dilute asphalt and reduce the viscosity of asphalt emulsion facilitating penetration
- Spreading sand over the surface to prevent the asphalt picked up by vehicle's tires

As explained before this is due to the fact that the asphalt emulsions typically do not penetrate. They cure on the surface, and stick to the wheels of the vehicles instead.

### **Penetrating prime coat emulsion formulations**

Use of EAP (Cationic Asphalt Emulsion Prime) with the following general formulation can address all above drawbacks.

Here's the typical EAP formulations with fuel oil or bio-solvent:

Asphalt content (PG 64-22): 35-45%

Fuel oil / bio-solvent: 5-15%

Redicote EM24: 2%

Add water up to 100%

pH of emulsion: 2.0

The emulsifiers chemistry is chosen so that it gives good chemical stability. The use of certain amount of solvents in the emulsion greatly helps with the penetration. If one uses a bio-solvent such as biodiesel or vegetable oils, they have high boiling point and so do not cause pollution problems.



# Products

**Our commitment to a sustainable future**  
We have a major emphasis on sustainability by setting ambitious safety targets, reducing carbon emissions by 25% in 2025, increase low carbon energy to 60%, growing share of revenue in sustainable solution and placing priority on people development. One of the key focus is in coming up with new sustainable solutions. Nouryon Asphalt Applications over the years have come up with several innovations to improve the sustainability of Asphalt pavements.

# Eco premium solutions for sustainable asphalt pavements

Our innovations enhances sustainability of asphalt pavements.

## Sustainability a key issue for the industry

More than 90% of roads in North America, Europe are paved with asphalt and asphalt pavements and it is the preferred choice for new roads and surfaces treatments for the rest of the world. Asphalt pavements have several advantages as the roads do not need to be closed for extended periods of time for construction, they are flexible pavements, can be recycled easily, provide a smoother and quieter ride. The asphalt industry has been working towards reduction of emissions by developing cleaner technologies including warm mix , cold mix asphalt and minimizing or eliminating the use of cutbacks by which contain volatile solvents with asphalt emulsion. In addition to using such cleaner technologies the greatest impact can be achieved by re-using and recycling reclaimed asphalt pavements to build and maintain new roads. Utilizing such applications and materials not only improve the sustainability in road construction but also provides a healthier environment for the workforce. The emphasis on sustainability has been growing and agencies including US Federal Highway administration (FHWA), major organizations such as National Asphalt Pavement Association (NAPA) and European Asphalt Pavement Association (EAPA) have currently placed a high emphasis in improving the sustainability of Asphalt pavements.

## Sustainable roads

Bahia and Miller<sup>1</sup> in their paper describe possible definition of sustainable pavements as '**Pavement that minimizes environmental impacts through the reduction of energy consumption, natural resources and associated emissions while meeting all performance conditions and standards**'. Use of warm-mix contributes toward reducing energy and emissions. Cold mixes with emulsions can have a much higher influence in reducing energy and emission as the mixes are produced and paved at ambient temperatures compared to typical mix productions temperatures of 135-160°C for warm and hot mixes. Recycling of existing pavement materials are becoming more attractive not only due to sustainability benefits but also in lowering the cost of asphalt mixes. For these reasons cold recycling with emulsions has a much higher impact in improving the sustainability of asphalt paving. In addition, certain amount of volatile solvents are used in asphalt paving in the form of cutbacks. Most of these volatile solvents eventually end of evaporating into the atmosphere causing pollution, the solvents cost money and also are hazardous as the solvents are flammable. Many countries and agencies are severely restricting or eliminating the use of cutbacks.

## Rediset LQ and Rediset WMX Warm-mix additives and compaction aids

The strength and durability of asphalt pavements depends on various factors including the composition of the mix or mix design. This also includes properties of the materials used and the interaction between asphalt binders with the aggregates. One of the key factors in determining the strength and durability of the asphalt pavements is the ability of the mix to be compacted to desired densities and air-voids. A mix that is not properly compacted will have poor strength and will be prone to various pavement distresses. The mixes are produced and paved at higher temperatures, especially the mixes that are harder to compact which substantially increases emissions and energy consumption. We introduced additives such as **Rediset WMX** and **Rediset LQ** which enable mixes to be produced and paved at about 15 to 30°C lower than conventional hot mixes. This is not only a warm-mix additive but also is a compaction aid which gives several advantage to the contractor including, achieving required densities with difficult to compact mixes, extending the paving season as the mixes can be paved at lower temperatures and increasing the hauling distances for the mixes. These additives are also high performance adhesion promoters and they extend the pavement life not only by helping in achieving higher densities but promote bonding of asphalt binder to aggregate surfaces and preventing moisture damage.



Use of Rediset LQ in a paving project at the Chicago O'Hare airport



Prime coat application with asphalt emulsion

## Redicote E11, Redicote E-7000 and Redicote E-47 NPF Solutions to substitute cutbacks with volatile solvent free emulsions

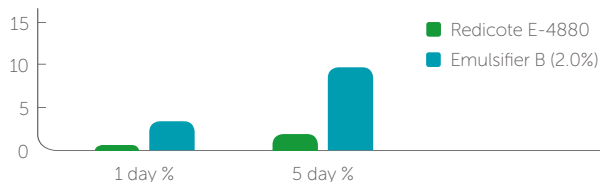
Significant amounts of cutbacks are used in paving which mainly goes into applications such as prime coat. The use of cutbacks is prevalent in developing countries for prime coat and tack coat. The use of cutbacks in tack coat can be more easily substituted with environmentally friendly emulsions but in the case of prime coat normal emulsions do not function as well as cutbacks. In prime coat applications cutbacks or emulsions are expected to penetrate the compacted base material to certain extent and then serve as a bond between the base material and asphalt pavement that will be placed on top. Most of the normal emulsions are chemically reactive and so they break on the surface and do not penetrate. We developed formulation by coming with a surfactant package that give chemically stability to the emulsion so that they do not break on the surface. In addition, the emulsions contain a certain amount of high boiling non-volatile bio-solvents such as biodiesel or vegetable oils which further help in improving the penetration into the base. The surfactant package includes our unique emulsifiers such as **Redicote E-11** (cationic) and **Redicote E-7000** (anionic) in combination with a non-ionic emulsifiers like **Redicote E-47 NPF**.



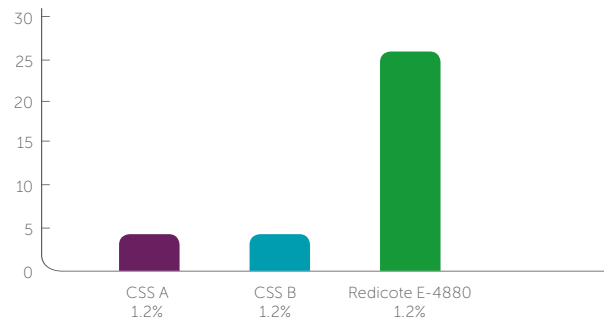
## Redicote E-7100 and Redicote E-4880 Innovations for cold mix and cold recycling

As mentioned earlier cold mix with emulsions are done at ambient temperatures and so they have much greater impact in reducing energy use and emissions compared to hot/warm mixes. Recycling of reclaimed asphalt pavement (RAP) minimizes mining of new aggregates and also reduces the amount of virgin asphalt binder in addition to lowering the cost of mixes. Combination of emulsion based cold mix with recycled materials greatly enhances sustainability.

There are several types of cold mix and cold recycling techniques which include Cold Central Plant Recycling (CCPR) and Cold In Place Recycling (CIR). These are mainly divided into plant produced mixes where the RAP material is taken to a central plant where it is crushed screened and then cold mix with emulsions is produced in a central cold mix plant. These types of mixes have to remain workable for longer periods as it may take hours to transport the mix to the job site besides being in the stockpile for some time. Some of the normal slow set emulsions and emulsifiers break faster and so do not provide long workability time. We introduced a slow emulsifier or emulsion system that gives extended workability. **Redicote E-4880** is the emulsifier launched for plant produced mixes.



Storage stability test results, evaluations performed by AASHTO accredited laboratory

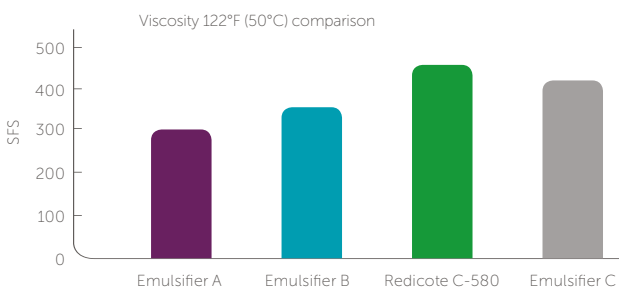


Simulated lab workability test without cement

In the case of in-place recycling (CIR) there is a recycling train which mills the existing pavement, transfers the material to a recycling unit where it is crushed, screened and mixed with emulsion to produce cold mix. In many cases certain amounts of cement is also used in this type of recycling application. This cold mix is immediately picked up and paved on the road surface followed by compaction. In this type of recycling extended workability is not needed and the focus is towards gaining strength quickly so that it can be opened to light traffic sooner. Relatively faster breaking emulsion/emulsifier systems are used for in-place recycling. In some of these systems it was found that when cement is added the emulsion starts to break quickly and does not give the necessary workability even for this in-place application. In order to address this issue Nouryon introduced a new emulsifier called **Redicote E-7100** which is faster breaking but have good stability in the presence of cement and so does not reduce workability when cement is used. **Redicote E-7100** also provides additional benefits such as better emulsion storage stability and improved adhesion in spite of being a slow set emulsifier.

## Redicote C-580 Chipseal/surface dressing

Chipseal or Surface dressing is one of the most prevalent surface treatment/preventive maintenance treatment using emulsions. The rapid set emulsions such as CRS-2 or the polymer modified version of CRS-2 need to have a certain higher viscosity to meet the specifications for this application. This viscosity specification is harder to meet with certain asphalt binders especially during recent times when properties of asphalt binder are changing. In order to meet this viscosity specification emulsion producer needs to use a higher binder content in the emulsion which adds significant cost. We over the years have introduced a few viscosity building CRS emulsifiers for this application but still there was a need for liquid easy to use product that builds viscosity. Nouryon recently launched **Redicote C-580** which is a cost effective, liquid easy to use CRS emulsifiers. This has very good solubility in acidified water and so soap solutions can be prepared even at ambient temperature water. It gives the highest viscosity compared to most of the CRS emulsifiers in the market which enables emulsion produced to use the minimum binder content to meet emulsion viscosity specification providing cost savings. In addition, **Redicote C-580** can give a faster-breaking system in chipseal/surface dressing applications.



CRS-2 emulsion viscosity comparison made with various emulsifiers

## Greener products

The use of NP ethoxylates is being restricted or eliminated by various agencies. We took a proactive step well ahead of time and substituted NP ethoxylates with environmentally friendly alternatives in our asphalt emulsifier formulations. Furthermore, introduced environmentally friendly phosphate ester based adhesion promoters such as **Wetfix G400** and constantly looking for opportunities to use raw materials from sustainable sources.

Sustainability is a major focus for Nouryon and Asphalt applications. We have come up with several innovations to enhance sustainability of asphalt paving. This includes unique emulsifiers for cold mixes and cold recycling with emulsions, viscosity building liquid emulsifier for chipseal/surface dressing, warm-mix additives/compaction aids, emulsifier systems, emulsion formulation to eliminate the use of cutbacks in prime and tack coat applications and greener products.

### References:

1. Bahia, H., Miller, T., Sustainable Asphalt Pavements: Technologies, knowledge Gaps and Opportunities, Prepared for the Modified Asphalt Research Center (MARC), 2009.
2. Kazmierowski, T., Ministry of Transportation Ontario Canada, Sustainable Benefits of Emulsion-Based Pavement Preservation Treatments: Ontario's Experience, AEMA, 2010.
3. Eckmann, B., Delfosse, F., Chevalier E., Reducing emissions and consumption of virgin aggregates through cold in-place recycling, Euraspalt & Eurobitume, 2012

# Successful field application with Redicote C-580 emulsion at Mt Pleasant

We launched Redicote C-580 in April this year which is a viscosity building, cost effective, liquid and easy to use CRS emulsifiers. This has very good solubility in acidified water and so soap solutions can be prepared even at ambient temperatures.

Article by Joe Brandenburg

On August 18th, a Midwestern emulsion manufacturer trialed the **Redicote C-580** in a CRS-2M chip seal emulsion. CRS-2M is a Michigan Department of Transportation cationic polymer (SBS or SBR latex) modified chip seal emulsion. This particular emulsion had SBR latex for its polymer. The test section for this project was located in Mt Pleasant, Michigan on E Airport Road and S Summerton Rd. These are two-lane county roads with a standard width of 22 feet used for daily traffic and to reach the Mt Pleasant Municipal Airport. The test section on E Airport Road was approximately 1.8 miles long and the test section on S Summerton Road was approximately 2.0 miles long.



The aggregate used in this trial was MDOT's 34 CS-M slag



The shot rate was approximately 0.33 to 0.35 gals/sqyd. The CRS-2M temperature was approximately 160°F (71°C). The air temperature was 81°F (27°C) with a relative humidity of 56%. Skies were sunny with few clouds and there was no perceivable breeze. The manufacturer made the CRS-2M emulsion the previous day and their lab results are as follows:

- Off the mill: Viscosity of 330 seconds with a residue of 68.30%, demulsibility between 65-80% (visual check)
- Halfway check in tank: 251 seconds viscosity with a 68.17% residue
- Final check: 196 seconds viscosity, 68.04% residue, 0.012% sieve, 69.87% demulsibility (0.25% C-580), 101 dmm penetration, 8.99 and 7.74 for toughness and tenacity, and 67.5% elastic recovery

The application of CRS-2M by a Midwestern chip seal contractor went very well. The crew was experienced and paid close attention to details. The application of CRS-2M began on the far east side of Airport Road, which was approximately 1.8 miles. From there they moved to S Summerton Road which was approximately 2.0 miles. They were able to shoot full width on Airport Rd.



As observed, all spray nozzles were properly aligned and not clogged.

The chip spreader followed the distributor closely, never allowing too much distance between them and applying a single layer or cover aggregate.



The aggregate appeared to have proper embedment into the emulsion between 50% to 70% of its width.



There were two pneumatic tire rollers present on this job. Approximately 5 minutes after application of the cover aggregate, they began compaction.



The chip seal developed enough strength so that it was drivable for car traffic within 15 minutes, but out of caution and safety of the crew the traffic controllers waited for the distributor and chip spreader to be off the road before cars were allowed back on.



The overall application of CRS-2M manufactured with **Redicote C-580** went extremely well. The emulsion's field viscosity and film thickness allowed for proper aggregate chip embedment. The spray bar was at the correct height and pressure to allow for double coverage, which allowed for proper coverage without streaking during application keeping the emulsion from running off the side of the road. After the cover aggregate was applied, within 10 to 15 minutes you could take the bottom of your heel and twist it and notice the strength of the chip seal, which gave a good indication there was proper adhesion. As reported above the manufacturer's lab tested the emulsion's demulsibility at 69.8%. This demulsibility seemed low considering the dosage of 0.25% **Redicote C-580** and the use of latex which will lower the demulsibility value. However, the chip seal was curing as if the demulsibility value was closer to the high 80's. The contractor's superintendent said that they are going to apply a cationic quick setting fog seal in the next day or two and finish up with striping the following week. All preliminary indications are showing that both the manufacturer and contractor were very satisfied with how the CRS-2M chip seal emulsion performed and they are looking forward to seeing how it withstands a Midwestern winter.

**Redicote C-580**, which is now available globally gives the highest emulsion viscosity compared to most of the CRS emulsifiers in the market which enables emulsion producers to use the minimum binder content to meet emulsion viscosity specification resulting in cost savings. In addition, **Redicote C-580** can give a faster-breaking system in chipseal/surface dressing applications.

# Use of adhesion promoters to extend the life of asphalt pavements in Vietnam

Moisture damage to asphalt pavements is a major issue since bitumen do not have a natural affinity to siliceous aggregates and most of the aggregates used for paving contain significant about silica as a main component.

Article by Naruesa Riwtong

If the mixes are not treated properly, in wet conditions the pavement will experience early failure within a year or two which is costly. This is due the fact that the roads have to repaved often as the pavement do not last for the full service life they were designed for.

Vietnam is promoting the use of adhesion promoters in asphalt mixes, to maintain adhesion, to prevent stripping thereby extend the lifespan of asphalt pavements., Edstachem team representing Nouryon worked closely with customers providing technical support and formulation guidance during the testing process. They also worked with end users in coming with proper storage conditions for the adhesion promoters. Edstachem did extensive amount of work to promote the use of adhesion promoter in spite of Covid-19 related issues.

Extensive testing was done by independent laboratories to establish the efficiency of various adhesion promoters. They are happy to announce that our product **Wetfix BE**, a heat-stable adhesion promoter for bituminous binders was chosen after testing with products from several suppliers.

The mixes were evaluated with and without **Wetfix BE** by static immersion test and boiling water tests according to Vietnam standards. For the static immersion tests 50 grams of unwashed aggregates were coated with 3.5-4.0 grams of hot bitumen and the mixes were subjected to the static immersion tests at 60°C and observed over a period of 3 days. Bitumen was treated with various dosage of **Wetfix BE** ranging from 0.3% to 07% by the weight of the bitumen.



## Summary of static immersion test results

Wetfix BE dosage %	% retained coating
Control	20
0.3	75
0.5	90
0.7	100

The mixes at a **Wetfix BE** dosage of 0.3% was evaluated after 5<sup>th</sup> day by the static immersion tests. It still maintained a retained coating of 70% after the 5<sup>th</sup> day.

In the boiling water test the mixes were subjected to boiling for 15 minutes according to Vietnam standards.

**Summary of boiling water test results**

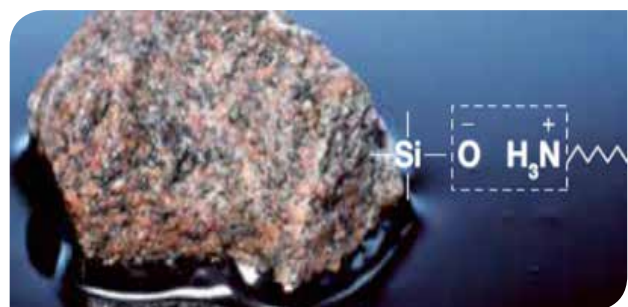
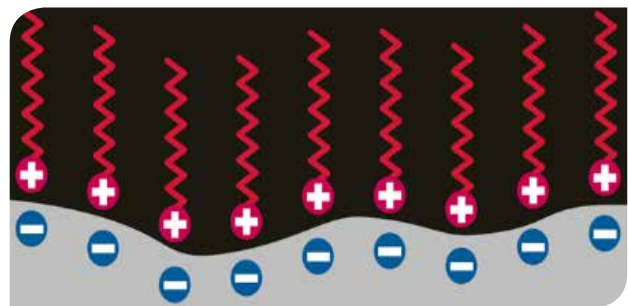
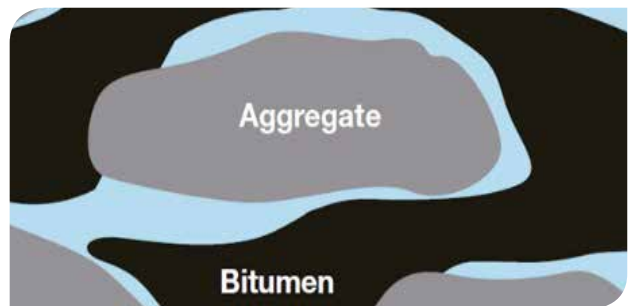
Wetfix BE dosage %	% retained coating
Control	20-30
0.3	75-80

The static immersion test and the boiling water test showed that a small dosage such as 0.3% of **Wetfix BE** by the weight of the bitumen greatly improves the retained coating and without the use of **Wetfix BE** very little retained coating is left. This clearly shows that without **Wetfix BE** treatment the mixes will have severe stripping or moisture damage problems in the field resulting in early pavement failures.



As one of the fastest growing economy in ASEAN, the rising population in Vietnam’s major cities has strained the existing road network and far exceeded maximum capacity of the existing roadways. Vietnam with only 20 per cent of the country’s national roads paved and has approved \$14bn plan to build a 1372km highway by 2030. Vietnam does has have a huge growth in the infrastructure construction sector.

This big win with Edstachem is the first step which allow us to supply adhesion promoter that will ensure long lasting asphalt pavements in Vietnam. Edstachem Group is a joint venture established in August 2006 between Malaysian and Vietnamese partners. They mainly focus on distribution of industrial chemicals and additives to Coating, Plastics, Rubber, Performance Chemicals, Food and Feed industry.



A long, straight asphalt road stretches towards a bright sun on the horizon under a dramatic, cloudy sky. The road is flanked by dry grass and leads the eye towards the sun, which is partially obscured by clouds, creating a lens flare effect. The sky is filled with dark, heavy clouds, with some lighter patches near the horizon. The overall mood is one of hope and forward movement.

# Conferences and Asphalt schools



# High turnout for the first ever Nouryon virtual Asphalt school webinar

We held the first Asphalt applications virtual school for our customers from March 2-4. This was a three-day 3 hour event each day and was mainly meant for customers from the Americas, but significant number of customers participated from other regions in spite of the time difference. There were 309 registrants and 237 actual participants which is record participation compared with our in-person events with a maximum attendance of 90 personnel.

The Asphalt school has been a tradition that brings together our customers from around the world for a few days to learn everything about our asphalt applications and products as well as hot topics in the asphalt industry. Over the years several thousand personnel across the world have benefited from our trainings and seminars.

## Keeping the tradition alive

This year, we chose to hold our North American Asphalt school as a virtual event due to Covid-19 restrictions. We have experienced this as one of the most effective ways to be in touch with several of our customers in a matter of a few days. We not only educate our customers about various aspects of asphalt applications and new developments but also learn from our customers about their needs and priorities. During the in-person event for North America we have two half days of lab demonstrations which was replaced with suitable videos. In fact, the videos provided close-up views of the demos for the participants. During the school, we focused on several aspects of various asphalt applications with an emphasis on emulsion applications. This year, customer engagement was at an all-time high which was evident based on the number of participants from various regions and number of questions asked during the panel discussion sessions.



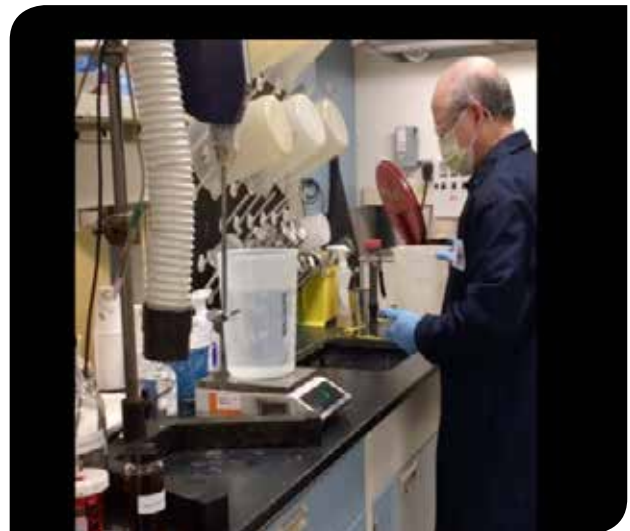
## Connecting with our customers

Apart from interaction with customers during the panel discussion we have offered interested customers virtual meetings with our technical and sales team. The feedback from our customers was very encouraging with many positive comments. We conducted a survey after the event in which over 95% of all participants that responded, rated the course as overall positive. In addition, over 95% of the participants of the survey reverted that they would recommend this course to others and commented that the right topics were discussed during the school.

This event has generated a lot of customers' interest and due to ease of participation we are considering the virtual School/Webinar as one of the important avenues to be in touch with our customers also in the future apart from our in-person events. We are now planning for similar events for the other regions as well.

The presenters included not only several members of the Asphalt Applications team but also Dr. Codrin Daranga who was the special guest speaker from Paragon Technical Services. Linda Bergermo, our Marketing Communications Manager was instrumental in organizing and conducting the virtual event

## Virtual video demonstration of active adhesion tests and soap solution preparation



**A Nouryon virtual Asphalt school webinar is scheduled for South East Asia, October 26-28, 10AM-1PM Bangkok time, based on the reception and positive feedback that we received from our customers.**

# Asphalt SEA participated in the Academic seminar 2020 Dept of Highway, Thailand

The seminar was organized by the Department of Highway's as a part of their Strategic Plan 2017-2021. The focus is on the development of highway systems to achieve complete connectivity, accessibility and mobility of the country, develop Standards for good quality of service and also to develop an organization management system.

In 2020 we set up a booth to promote our company and products during the conference. The main products highlighted include adhesion promoter such as Wetfix BE and our emulsifiers. This was presented to the Ministry of Transportation and to the DOH staff which consists of about 350 persons across Thailand.

During the conference we also interacted with many customers including Tipco asphalt, Shell Bitumen, Zolar asphalt and United Asphalt. We had several discussions with them to develop new asphalt emulsion formulations working jointly together.

In 2021 the academic seminar was held at the end of August, and from us Naruesa Riwtong was one speaker presenting the the benefit of Wetfix BE. The title of the presentations is "The adhesion enhancer between the aggregate and asphalt binder to increase the efficiency of the pavement and help prevent damage of asphalt roads".

We have sent samples of Wetfix BE to the DOH Center Lab for their evaluation and trials. DOH

is considering specifying the use of adhesion promoter mandatory in asphalt concrete (hot mix) in Thailand.





# Inside Asphalt applications

# Meet our Asia technical specialists



## Royan Xu

Royan has vast experience and technical knowledge in paint and coatings additives, with more than 15 years of experience serving the architectural paint and construction Chemicals industry. He is currently the Technical Service Lead for Paints and Coating in China.



## Anju Gidwani

Anju has 15 years of experience in R&D and Technical Services. She has worked in Paints & coating, Adhesive and Asphalt Industries. She has a B.Tech in Surface coating Technology. She is currently the Technical Service Manager for Paint and Coatings including Asphalt Applications for Indian Sub-continent region.



## Fanny Siregar

Fanny has 7 years of experiences in the asphalt industry working in the quality control laboratory. Her background is in Civil Engineering. She is the Technical Asphalt specialist serving customers in South East Asia.



## Jinjun Ni

Jinjun has 7 years of experiences in the asphalt industry as technical service specialist serving customers in China. His background is in Chemical technology and manufacturing.

# The Periodic Table

1  
IA  
11A

1 1.00794 <b>H</b> Hydrogen 1312.0    2.20	2 9.012182 <b>He</b> Helium 790.0    2.20										
3 6.941 <b>Li</b> Lithium 520.2    0.98	4 9.012182 <b>Be</b> Beryllium 899.5    1.57										
11 22.98976 <b>Na</b> Sodium 495.8    0.93	12 24.3050 <b>Mg</b> Magnesium 737.7    1.31	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 8			
19 39.0983 <b>K</b> Potassium 418.8    0.82	20 40.078 <b>Ca</b> Calcium 589.8    1.00	21 44.95591 <b>Sc</b> Scandium 633.1    1.36	22 47.867 <b>Ti</b> Titanium 658.8    1.54	23 50.9415 <b>V</b> Vanadium 650.9    1.63	24 51.9962 <b>Cr</b> Chromium 652.9    1.66	25 54.93804 <b>Mn</b> Manganese 717.3    1.55	26 55.845 <b>Fe</b> Iron 762.5    1.83	27 58.93319 <b>Co</b> Cobalt 700.4    1.91			
37 85.4678 <b>Rb</b> Rubidium 403    0.82	38 87.62 <b>Sr</b> Strontium 549.5    0.95	39 88.90585 <b>Y</b> Yttrium 600    1.22	40 91.224 <b>Zr</b> Zirconium 640.1    1.33	41 92.90638 <b>Nb</b> Niobium 652.1    1.60	42 95.96 <b>Mo</b> Molybdenum 694.3    2.16	43 (98) <b>Tc</b> Technetium 702    1.90	44 101.07 <b>Ru</b> Ruthenium 710.2    2.20	45 102.9055 <b>Rh</b> Rhodium 719.7    2.28			
55 132.9054 <b>Cs</b> Caesium 375.7    0.79	56 137.327 <b>Ba</b> Barium 502.9    0.89	71 174.9668 <b>Lu</b> Lutetium 523.5    1.27	72 178.49 <b>Hf</b> Hafnium 658.5    1.30	73 180.9478 <b>Ta</b> Tantalum 761    1.50	74 183.84 <b>W</b> Tungsten 770    2.36	75 186.207 <b>Re</b> Rhenium 700    1.90	76 190.23 <b>Os</b> Osmium 840.0    2.20	77 192.217 <b>Ir</b> Iridium 880    2.20			
(223) <b>Fr</b> Francium 380.0    0.7	(226) <b>Ra</b> Radium 509.3    0.90	(262) <b>Lr</b> Lawrencium 470	(261) <b>Rf</b> Rutherfordium 580	(262) <b>Db</b> Dubnium	(266) <b>Sg</b> Seaborgium	(264) <b>Bh</b> Bohrium	(277) <b>Hs</b> Hassium	(268) <b>Mt</b> Meitnerium			

Atomic mass

1.00794    1

Atomic number

Chemical symbol: **H**

Name: Hydrogen

1312.0    2.20

Electronegativity

First ionization energy

57 138.9054 <b>La</b> Lanthanum 539.1    1.10	58 140.116 <b>Ce</b> Cerium 534.4    1.12	59 140.9076 <b>Pr</b> Praseodymium 527    1.13	60 144.242 <b>Nd</b> Neodymium 533.1    1.14	61 (145) <b>Pm</b> Promethium 540
(227) <b>Ac</b> Actinium 499    1.10	90 232.0380 <b>Th</b> Thorium 597    1.30	91 231.0358 <b>Pa</b> Protactinium 508    1.50	92 238.0289 <b>U</b> Uranium 597.6    1.38	93 (237) <b>Np</b> Neptunium 604.5    1.36



Contact us directly for detailed product information and sample request  
website | [nouryon.com/markets/asphalt](https://nouryon.com/markets/asphalt)  
email | [asphalt@nouryon.com](mailto:asphalt@nouryon.com)

# Nouryon

Nouryon is a global, specialty chemicals leader. Markets and consumers worldwide rely on our essential solutions to manufacture everyday products, such as personal care, cleaning goods, paints and coatings, agriculture and food, pharmaceuticals, and building products. Furthermore, the dedication of more than 7,900 employees with a shared commitment to our customers, business growth, safety, sustainability and innovation has resulted in a consistently strong financial performance. We operate in over 80 countries around the world with a portfolio of industry-leading brands. Visit our website and follow us @Nouryon and on LinkedIn.

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