

WORKSHOP ON BITUMEN EMULSION TECHNOLOGY

10TH JUNE 2026
VIENNA, AUSTRIA

BITUMEN EMULSIONS

Paving the way for
Sustainable Infrastructure

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IBEF, Vienna, Austria

Who We Are

A Joint Venture

between Indian-Oil Corporation Limited and TotalEnergies

Delivering High-quality

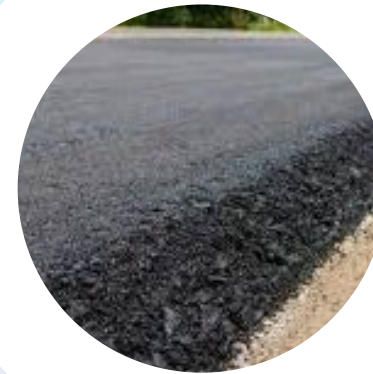
bitumen solutions, advanced binders, and sustainable pavement materials

Backed By Global Innovation

strength and national technical leadership

Importance of sustainable road construction in global context

Reduces environmental impact and carbon emissions while enabling durable, resource-efficient infrastructure for growing mobility needs.



Why bitumen emulsions are relevant today.

Enable low-energy, eco-friendly road construction with reduced emissions and cost-effective performance

Bitumen Emulsion

Classification of Emulsions on surface charge

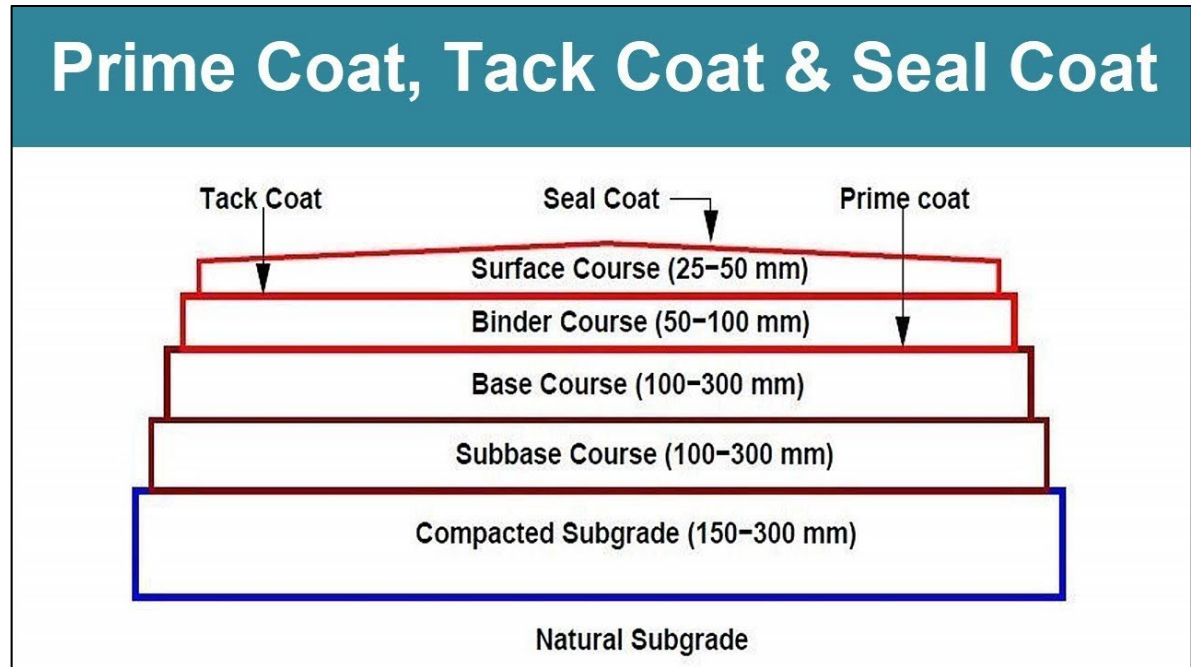
1. Anionic Bitumen Emulsion
2. Cationic Bitumen Emulsion

Classification of Emulsions on Setting Time:

1. Rapid Setting Emulsion(RS)
2. Medium Setting Emulsion (MS)
3. Slow Setting Emulsion(SS)

Uses of Bitumen Emulsion:

1. Acts as bond between pavements layers which prevents slippage of pavement.
2. To Increase structural strength of the pavement.
3. Helps the loose mineral aggregate on the surface to stay intact.
4. Fills the voids on the surface therefore preventing water seepage.



- A tack coat is a thin bituminous liquid asphalt applied between the existing road surface and an overlay.
- Emulsion plays an important role for pavement structure to behave as a single unit and provide adequate strength.
- Rapid Setting type of emulsion is used as tack coat



Figure 1. Good tack coat coverage.



Figure 2. Poor tack coat coverage.

Quantity of Bitumen Emulsion as primer for various surface types:

S.no	Type of Surface	Application Rate(Kg/10 m ²)
1	Bituminous Surface	2-3
2	Granular surface treated with primer	2.5-3
3	Cement concrete pavement	3-3.5



- Prime Coat is applied to base course, designed to penetrate, bond and stabilize the existing surface and to promote adhesion with the construction course that follows.
- Prime coat also serves the purpose to blocking capillary action in base course, so than water may not arise up to the asphalt layers.
- After 24hrs of applying prime coat, base course surface behave like asphalt base course.



Quantity of Bitumen Emulsion as primer for various surface types:

S.no	Type of Surface	Application Rate(Kg/10 m ²)
1	WMM/WBM	7-10
2	Mechanically stabilized soil base, lime/cement stabilized soil and lime cement base	9-12
3	Gravel base, Crusher run macadam and Crushed rock base	12-15



Checking difference between SS1(Oil Based) and SS1(Water Based)

- Oil Based SS1emulsion floats and forms a layer on the top when poured in to beaker of water.
- When water based emulsion is poured then it mixes with water and forms an homogenous mixture.
- All other grades of emulsions except oil based emulsion forms an homogenous mixture.



Application of Emulsion- Do's and Dont's

Cleaning of surface and making it free from dust, dirt and any extraneous material

Using fully automatic distributor/ Sprayer for uniform spreading and correct dosage.

Spraying temperature should be 20°C to 70°C



DO's

Usage in rainy, foggy, windy or temperature less than 10°C

Heating of Bitumen Emulsion.
Mixing of water.

Allowing Traffic



DON'ts

Storage in Bulk:

- Emulsion should not be allowed to free fall from higher heights.
- Bottom loading must be done to emulsion sprayer from tank.
- Circulate material for every 15 days.

Storage in Drums

- Rotate stock to ensure that older drums are used first.
- Generally, drums and packs in storage should be re-homogenised by rolling / inverting periodically to minimize any gradual separation of the bitumen phase.
- Drums and packs should be protected from frost and high temperatures, which could cause pressurization of the drum.
- Rolling must be done before every usage.

- **Residue by Evaporation:** Minimum **60–67%**
- **Viscosity (Saybolt Furol):** Must be controlled to ensure it sprays evenly but doesn't "run off" the road.
- **Storage Stability:** Should not settle more than **1–2%** in 24 hours.

The Sustainability Edge (Performance Data)

- One of the strongest technology in India is the "**Cold Mix**" advantage.
- Unlike Hot Mix Asphalt (HMA) which requires heating to 160°C, emulsions work at ambient temperatures.
- **Fuel Saving:** Cold Mix saves ~**1,500 liters of diesel per km** of single-lane road.
- **Carbon Footprint:** Reduced by over **80%** compared to traditional hot bitumen.
- **Safety:** Zero risk of burn injuries to labourer's and no toxic fumes.

Indian Case Studies

A. PMGSY (Pradhan Mantri Gram Sadak Yojana)

Context: Connecting remote villages where bringing heavy "Hot Mix" plants is logistically impossible.

Outcome: Over **47,000 km** of rural roads have been constructed using Bitumen Emulsions. It allowed construction in "difficult" areas (like the Northeast) where rain often halts hot-mix work.

B. North-East India (High Rainfall Zones)

Challenge: Roads in Meghalaya and Assam often fail because hot bitumen doesn't stick to wet aggregates.

Solution: Cationic emulsions are "hydrophilic"—they actually displace water from the aggregate surface to create a stronger bond.

Result: Significantly longer pavement life in high-monsoon regions compared to traditional methods.

- Full Depth Reclamation (FDR) using bitumen emulsion is a high-performance, sustainable recycling technique that pulverizes the entire distressed pavement layer and stabilizes it with a binder (like **SS-2**) and often a small percentage of cement.
- In Uttar Pradesh and across India, **SS-2 (Slow Setting)** emulsion is preferred for FDR because its extended setting time (breaking time) allows the specialized recycling machinery (Reclaimer) to thoroughly mix the binder with the pulverized material before it hardens.
- The use of **SS-2 (Slow Setting)** cationic bitumen emulsion in Uttar Pradesh (UP) has been a cornerstone of the state's push for "Green Highways" and high-speed maintenance.

Case Study 1: The UP-PWD "Green Highway" Initiative

Location: Major District Roads (MDR) in the Bundelkhand and Lucknow Regions.

Technology: FDR with Cationic Bitumen Emulsion (SS-2) and 2% Cement.

The Challenge: Traditional rehabilitation involved "crust thickening," which required hauling thousands of trucks of fresh stone aggregate. In the Bundelkhand region, stone transport costs were prohibitive, and the carbon footprint was massive.

The Implementation: The existing damaged road was pulverized to a depth of **250mm–300mm**.

- **SS-2 Emulsion** was injected directly into the mixing chamber of the reclaimer at a rate of 2.5% to 3.5% by weight.
- A small amount of **Ordinary Portland Cement (OPC)** was added to provide initial "early-age" stiffness.

Result: Aggregate Saving: Reused 100% of the existing road material, eliminating the need for new stone quarries.

Structural Gain: The resulting "Bitumen Stabilized Base" was found to be more flexible than pure cement-treated bases, significantly reducing the "shrinkage cracking" common in UP's extreme summer heat.

Case Study 2: Rural Road Sustainability (UP-RRDA)

Location: PMGSY Roads in Sitapur and Barabanki Districts.

Technology: Cold-in-Place Recycling (CIR) / FDR using SS-2.

Context: Rural roads often have weak subgrades. Adding a thick, heavy hot-mix layer often causes the subgrade to fail due to the sudden increase in load.

The Solution: Using SS-2 FDR to create a semi-flexible base.

Performance Data:

Curing: SS-2 provided the "extended workability" needed to ensure the pulverized RAP (Reclaimed Asphalt Pavement) was perfectly coated.

Deflection: Post-construction **Falling Weight Deflectometer (FWD)** tests showed a **40% improvement** in the structural number of the pavement compared to traditional WMM (Wet Mix Macadam) roads.

Cost: While the machinery is expensive, the total project cost was **15% lower** due to savings on bitumen and aggregate transport.

In the FDR process, the "Breaking Chemistry" is critical. Here is why SS-2 is the technical choice over RS or MS grades:

1. **Workability Window:**

- FDR machines move at a specific speed.
- **SS-2** stays liquid for a longer duration (>60 mins), ensuring that as the reclaimer moves forward, the material is fully homogenized before compaction begins.

2. **Fine Particle Coating:**

- FDR involves pulverizing the road into many "fines" (dust).
- RS emulsions would "break" instantly upon touching the dust, creating clumps. SS-2 is designed to coat these tiny particles evenly.

3. **Moisture Displacement:**

- UP's clayey soils often hold moisture.
- The cationic nature of SS-2 chemically displaces the water film from the stones, ensuring the bitumen sticks to the rock, not the water.

GSTIN NO. 09AHTPA3827H1Z5



M/s. R.L.A. Constructions

Engineers & 'A' Class Govt. Approved Contractor

Ref. No.

Date

To,
Shri Gaurav Gogne
North Sales & Technical Head
Indian Oil Total Pvt. Ltd. (ITPL)
Mathura Chatta

Subject: Appreciation letter for Supplying Good Quality SS2 ETA Bitumen Emulsion

Dear Sir,

We are writing this letter to express our Gratitude and Appreciation for the exceptional services provided by Indian Oil Total Pvt. Ltd. (ITPL) from their Mathura - Chatta & Kosi Plants in Supplying **Durapave Emulsis Bitumen Emulsions SS2 Stab** Quantity: - 1440 mt for our Company Projects

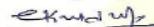
1. Sadabad Jalesar in District Hathras
2. Etmadpur Barhan in District Agra
3. Hasayan Kannau in District Hathras

The quality of the materials supplied by your esteemed organisation has significantly contributed to the successful completion of work. The product met all our quality requirements, effectively withstanding the challenging conditions and delivering outstanding performance in mixing / laying / Compaction and Ultimate Strengths.

We at RLA Mathura UP commend your team for their prompt delivery, technical support, and guidance throughout. We sincerely thank you for your unwavering commitment and support.

We look forward to collaborating with ITPL on future projects and wish your organisation continued success in all your endeavours.

Warm Regards,


Kuldeep Agarwal
Proprietor
RLA Constructions

H.O.: C-7, Govind Nagar, Mathura | Contact : 9997800000 | E-mail : contractorrla@gmail.com



Economical: reduced fuel usage, faster construction.



Eco-friendly: lower energy consumption, reduced emissions.



Versatility: suitable for surface dressing, slurry seal, tack coat, recycling.



Cold Application: no need for heating → safer & cost-effective.



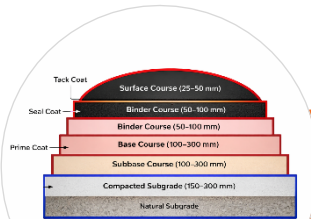
Surface Dressing For Highways.

Spraying rapid-setting bitumen emulsion followed by aggregate chips at ambient temperature; a cost-effective, eco-friendly method to seal pavements, protect surfaces, and restore skid resistance



Prime Coat & Tack Coat For Pavement Layers

Prime coat penetrates and binds granular base surfaces while sealing them; tack coat ensures strong bonding between asphalt layers and prevents slippage



Micro-surfacing For Urban Roads

A thin layer of polymer-modified emulsion and aggregates applied to restore surface quality, improve skid resistance, and extend pavement life with minimal traffic disruption



Cold Recycling Of Old Pavements

A sustainable method where existing pavement is milled, reprocessed, and mixed with binders on-site to create a durable new base layer without heat

Austria: cold mix technology adoption.



India: rural connectivity projects using emulsions.



France : advanced bitumen emulsion technologies driving decarbonization of asphalt pavements.



Africa: cost-effective road surfacing with emulsions.



UK : sustainable road maintenance with low-energy, low-waste emulsion solutions supporting carbon reduction goals.



Storage Stability

Weather Sensitivity

Skilled Workforce

CHALLENGES



SOLUTIONS

Advanced Emulsifiers

Training Programs

Improved Logistics



Aligns with global
sustainability goals.

Bitumen emulsions

=

sustainable, economical,
versatile.

committed to innovation
& greener infrastructure.

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THANK YOU