Markolines

Cold In Place Recycling - CIPR

About Us

Markolines was founded in 2002. We started out as a road marking company. Over the years, we have transformed this single product company into a leading Highway O&M service provider.

Today, we have a complete gamut of products under four verticals. We have established a well-equipped Technology Centre that steers the Company's goal of enhancing the on-ground performance of the technology.

We place our customer at the heart of everything we do and in all our projects, we adopt a customer-focused approach, committed to delivering a service that directly addresses the needs of our clients and the society we work in.

Our Offerings

Highway Operations	Highway Maintenance	Consultancy Services	Equipment Marketing
•Toll Operations •Route Patrolling •Incident Mgmt	•Routine Maintenance •Preventive Maintenance •Microsurfacing / CIPR •Mill & Fill	•Toll Services •Pavement Assessment & Solutions •Micro-surfacing	•Bergkamp Micro-surfacing Paver •Spruce Up – Jatayu, A litter picking machine

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What is CIPR

Cold-in-Place (CIR) recycling is a method of removing and reusing the existing asphalt surface. It involves grinding off the top layer (upto 200mm) of the existing asphalt surface and mixing the crushed asphalt with foamed bitumen and placing it back down with a recycler and allied machinery.

As described in the ARRA (Asphalt Recycling and reclaiming Association) *Basic Asphalt Recycling Manual,* CIR "consists of recycling asphalt pavement without the application of heat during the recycling process to produce a rehabilitated pavement"

The cold-in-place process is typically performed using a "train" of equipment which includes a water tanker, bitumen tanker, recycler, rollers and graders

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Where CIPR can be used

Urban Roads

Rural Roads

Runways

Highways

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When CIPR can be used

Alligator Cracks

Rutting (ideal candidate for CIPR)

Patched

Dry Ravelled

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Advantages of CIPR

 **SAVINGS**	• Aggregates from the existing pavement is re-used • Since the plant is at site, there is reduction in transportation and fuel costs • Time-saving technique, as transportation of MIX from plant to site is eliminated
 **GREEN TECHNOLOGY**	• Conservation of natural resources – as existing pavement is used, and less energy is consumed in the overall process • Environment friendly as emission of gases is reduced
 **OTHER BENEFITS**	• CIR overlay lasts *10-15 years as compared to 5-8 years of traditional overlay • Shorter construction period, due to high production capacity of recycling machines • Minimum traffic disruption- process is carried on one half of the road, leaving the other half open to traffic **Subject to traffic and overloading*

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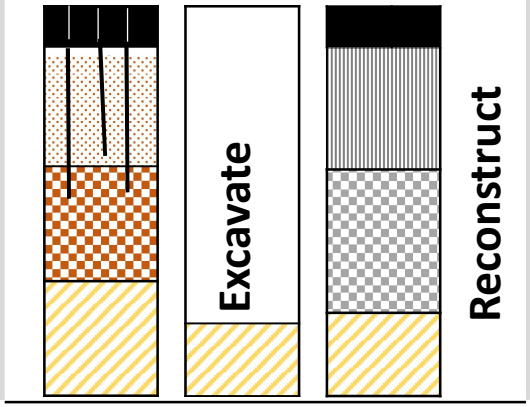
Structural Rehabilitation Methods

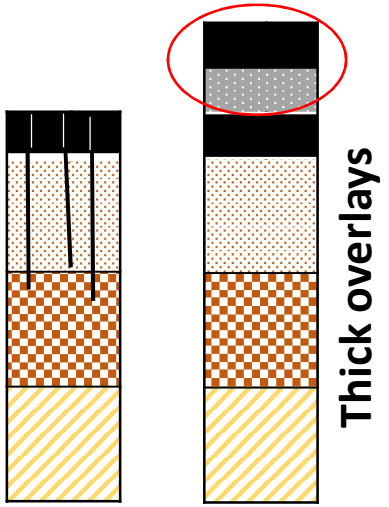
Total Reconstruction

Expensive, Long Construction time, Traffic management challenges



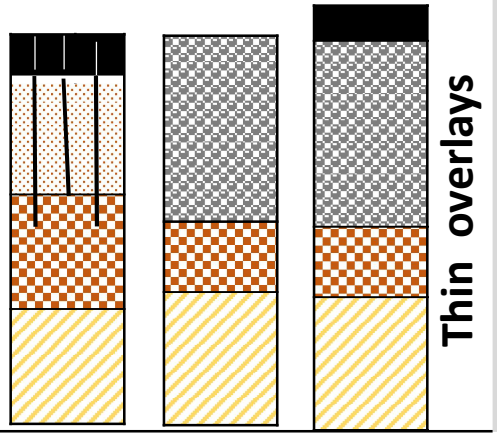
Thick Asphalt Overlays

Relatively quick method, elevation problems, reflection cracking



Deep cold recycling

Price effective, Environment friendly, Quick



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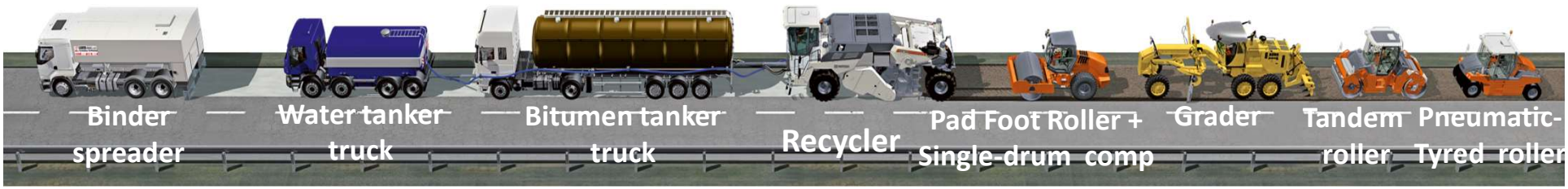
CIPR using Foamed Bitumen - Process

Recycling with pre-spread cement and bitumen



1. Cold in place recycling is carried out using specialised recycling machines, the heart of which is a milling drum equipped with a large number of hardened steel picks and the foaming attachment. The drum rotates upwards, milling the material in the existing road.
2. Based on the mix design Fresh/ virgin aggregates and Cement as a Binder is spread by Grader/ Paver on the surface. The Recycler then mills the damaged pavement wherein water from Water tanker is drawn in the Recycler by a flexible hose and is then sprayed in the mixing chamber., is mixed thoroughly with the milled material to bring it up to its optimum compaction moisture content and facilitates foaming of Bitumen, when it comes in contact with hot bitumen and compressed air. The addition of water is microprocessor based wherein exact quantity is added.
3. Recycling with foamed bitumen – it is produced onboard the recycling machine using a specialised process that adds a small percentage of water and compressed air, comes in contact with hot bitumen. Due to this the bitumen gets foamed up – expanding 20 times its original volume, which coats the aggregate.
4. The foaming process enables normal grades of bitumen to be mixed with cold, moist recycled material. In the case of granular materials, between 3% and 5% of foamed bitumen (by mass) is normally added and for recycling of old pavement it is approx. 2.5% depending on the job mix formula.
5. Behind the machine the recycled layer of material is compacted using a heavy-duty vibratory roller and profiled with a motor grader. Finally, a rubber - tyred roller is normally used to obtain a well-knitted surface finish.
6. Once compaction of the recycled layer has been completed it is cured for 2-3 days and primed before allowing traffic to ply over it to avoid damage to CIPR. An overlay is then laid as per Pavement design.

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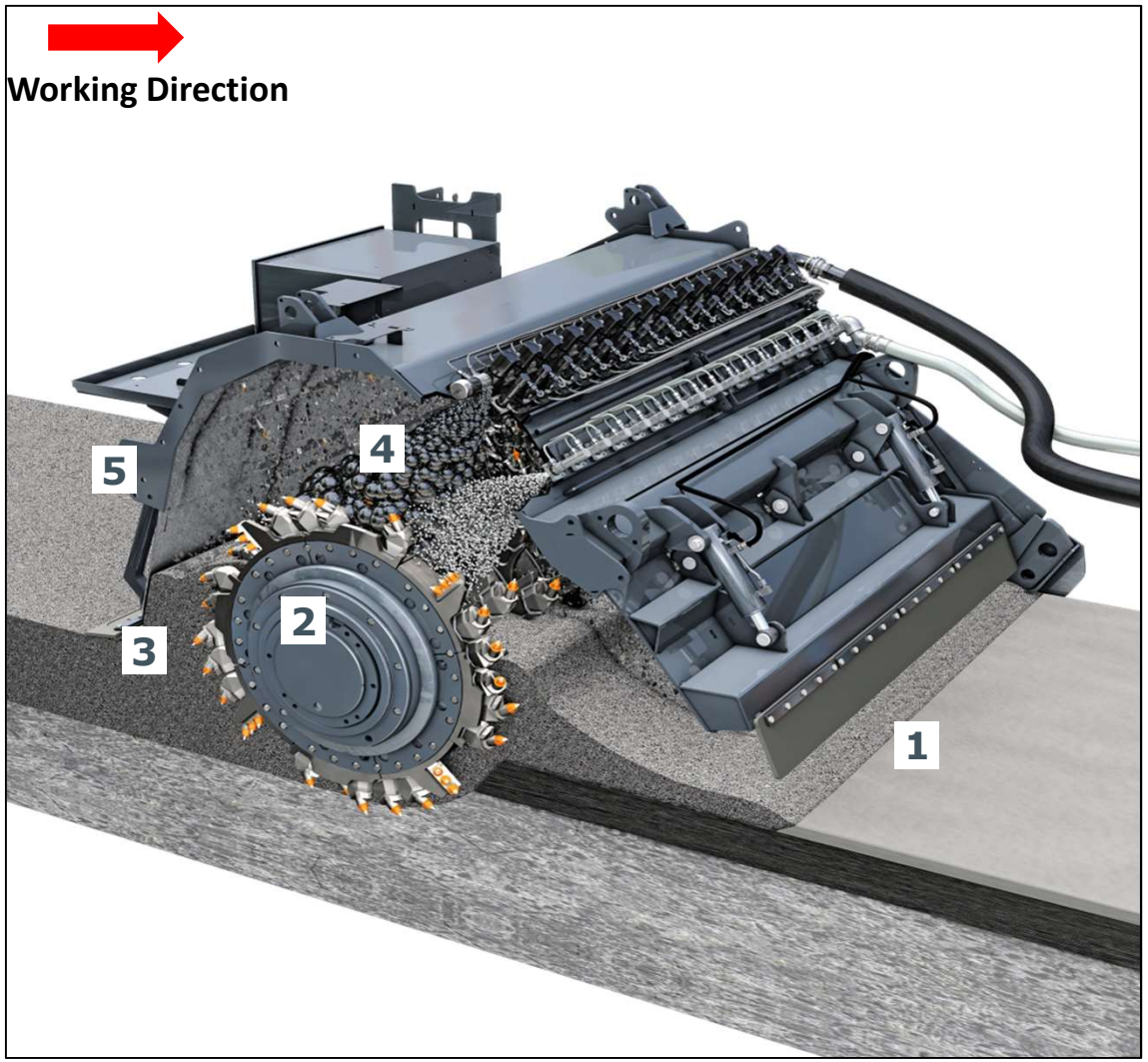
CIPR using Foamed Bitumen



Cold recycling

The milling and mixing rotor mills and granulates the asphalt layers. Binders and water are added via injection bars and mixed in to produce a homogeneous recycled material

1. Pre-spread Aggregate and Cement
2. Inject Water
3. Inject air resulting in Foaming of Bitumen
4. Milling and Mixing Rotor
5. Recycled, Homogeneous construction Material

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CIPR using Foamed Bitumen

- Hot Bitumen in contact with water and compressed air foams the bitumen
- 18-22 times its volume
- Increases flowability
- Reduced Viscosity.
- Binding of cold aggregates

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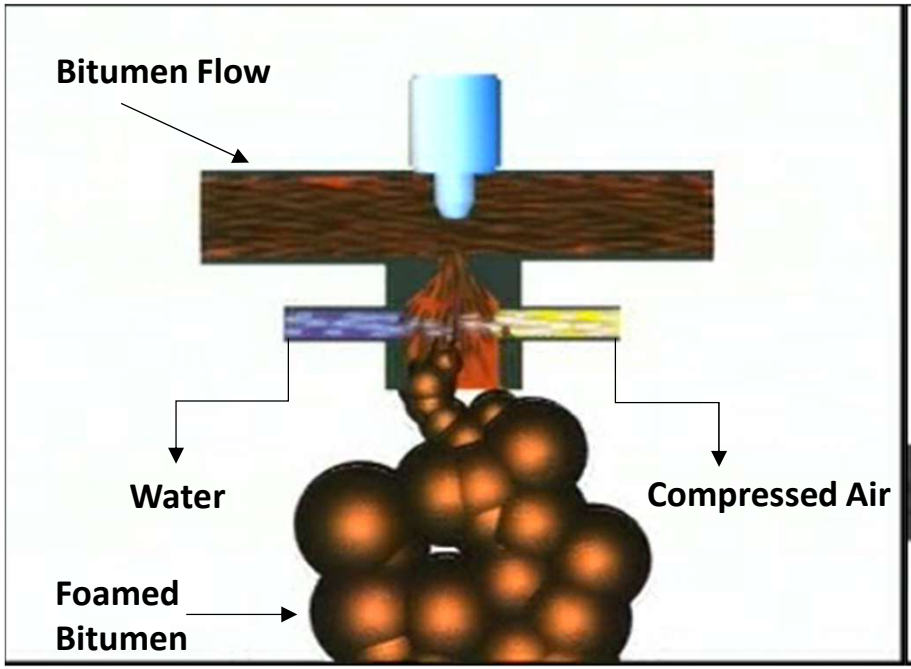
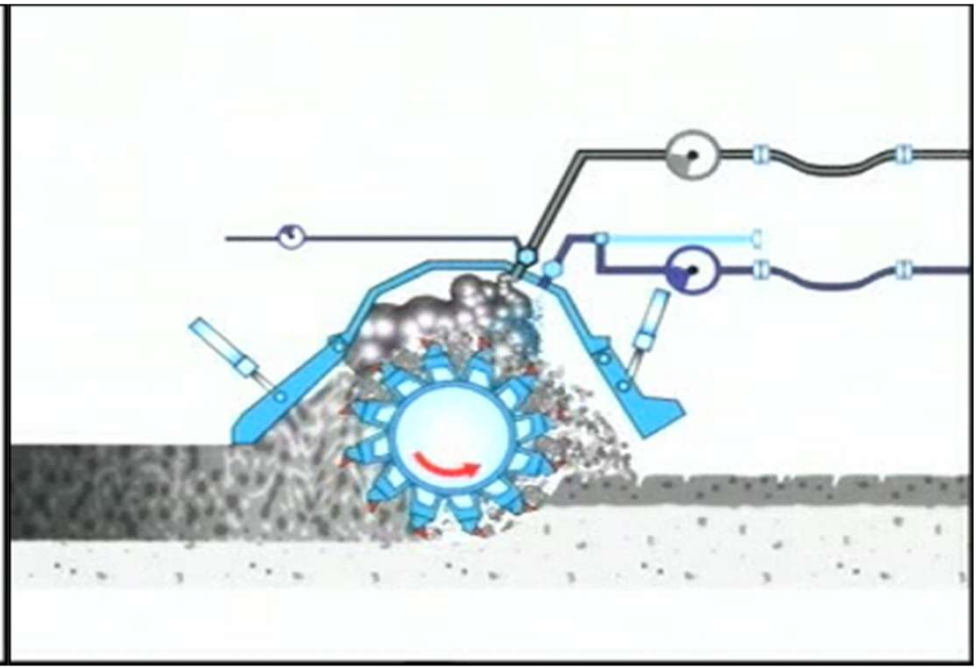
CIPR using Foamed Bitumen

What is Foaming



Inside the Drum



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CIPR using Foamed Bitumen

Foamed Bitumen is a Stabilising Process

- Bubbles of foam are thin films of bitumen (low viscosity) surrounding expanded water vapour (steam)
- These bubbles burst into small bitumen particles when mixed with aggregate
- Small bitumen particles can only adhere to the fine material
- The resulting mix is comprised of uncoated coarse granular particle with millions of sticky elastic “spots” in the mortar that hold it together (spot welding)

PERFORMANCE FACTORS

1. Stress dependent
2. Not temperature sensitive
3. Elastic properties
4. Not prone to cracking
5. Highly durable
   - No fines loss (pumping)
   - Slow oxidation of bitumen

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