Azadi Ka Amrit Mahotsav

National Rural Infrastructure Development Agency
Ministry of Rural Development
Government of India

Pradhan Mantri Gram Sadak Yojana

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Nanotechnology for Water Resistant FDR - Stabilized Bases & Bituminous Layers

International Conference on New Technologies and Innovations in Rural Roads, May 24-26, 2022

IRF GLOBAL

IRF Global Road Achievement Award

CII INDUSTRIAL INNOVATION AWARDS 2018

25 Most Innovative Companies of India

Globally Acclaimed

IRF, Washington D.C Global Road Achievement award

Marico Innovation Foundation's India's Best innovation Award

CII Innovation Award - Zydex Technology innovation

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Zydex Technology Impacts

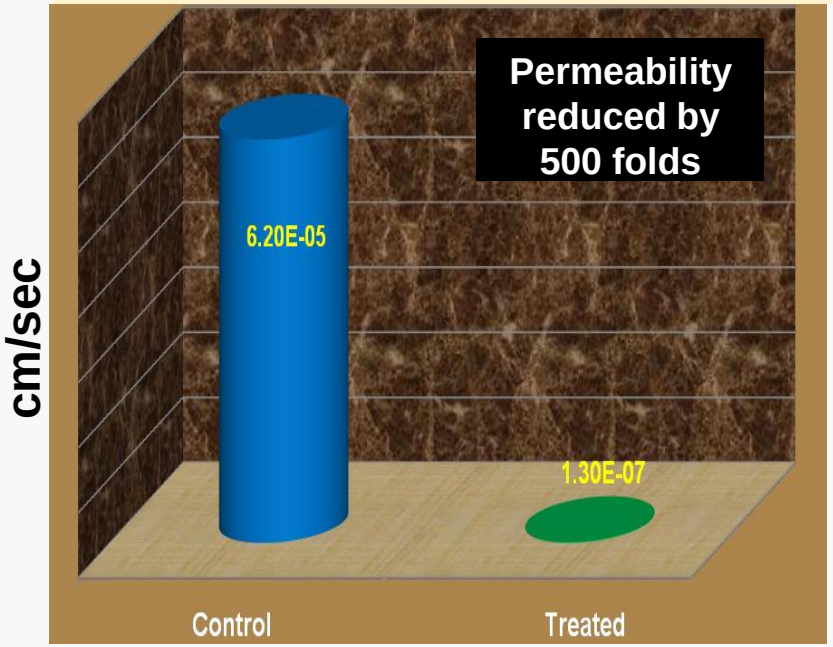
- Builds water resistant, high strength, nano flexible FDR / stabilized bases
- Reduces use of aggregates 50 - 70 %, enhances sustainability
- Superior design, allows higher drainage coefficient of 1.3 – 1.4
- Enhances durability of bituminous layers, reduces production temperatures and lowers maintenance costs
- Lower CAPEX, lower carbon footprint
- Technology validated over a time in different weather conditions since 2017

Water Resistant Nano Bonded Flexible Stabilized Bases

Improved Soil Compaction with Low Swell

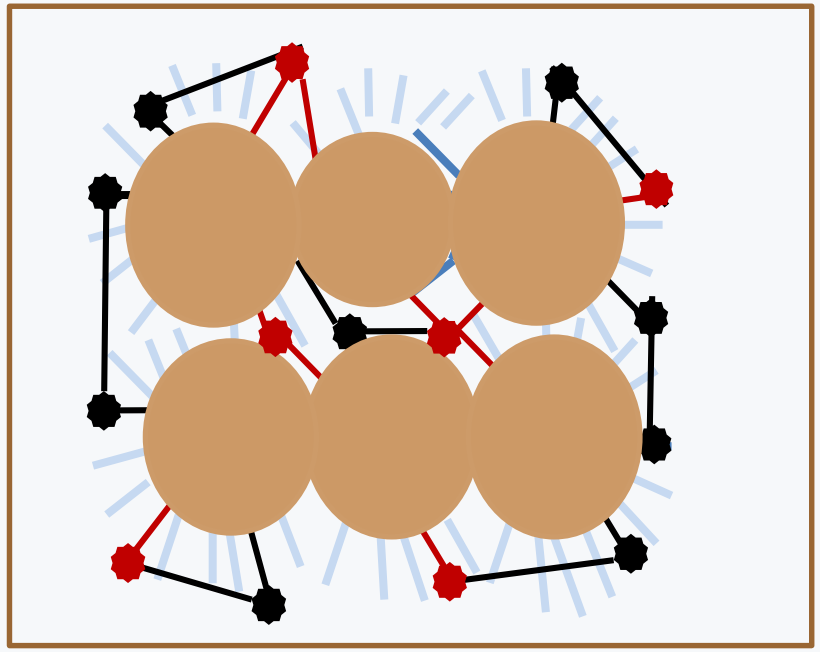
- Swelling reduces by 90 %
- Charge shielding and oil lubrication

Water Permeability Reduction



- Permeability 10^{-7} cm/s (100 days resistance) from 10^{-5} cm/s (1 day)

Nano Flexible Bonding



- Unaffected by wet and dry cycles

ZycoBond Particle Cement Particle

1. Shoulder Excavation & Material Removal

2. Scarification with Recycler

3. Grading and Mixing with Grader

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4. Solution Preparation : Terrasil + Zycobond + Water

5. Cement Spreading with Automatic Cement Spreader

6. Recycling and Additive Mixing

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7. Grading after Recycling of Mix

8. Compaction with Padfoot Roller

9. Grading for final finishing of Stabilized Surface

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10. Compaction with Vibratory Roller and PTR

11. Water Curing

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TerraPrime

Quick Priming in 1 - 2 hours, Faster Curing & Increased Bond Strength

Prime Coat @ 1 Kg/sqm with CSS1 & Terraprime
(CSS1 100 Kg + Terraprime 1 Kg + Water 100 Ltr)

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NanoTac

SAMI Layer

Fabric sandwiched in between CRS emulsion @ 1.8 Kg/sqm with 1% NanoTac by weight of emulsion

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ZycoTherm

Chemical Bonding - Complete Coating - Consistent Compaction

- ✓ Eliminates moisture & frost damages, prevents stripping in bitumen layers
- ✓ Enhanced Durability
- ✓ Odor Free
- ✓ Low Dosage
- ✓ Combined Warm Mix and Antistrip
- ✓ Enables lower mixing and compaction temperatures
- ✓ Allows paving at lower ambient temperatures

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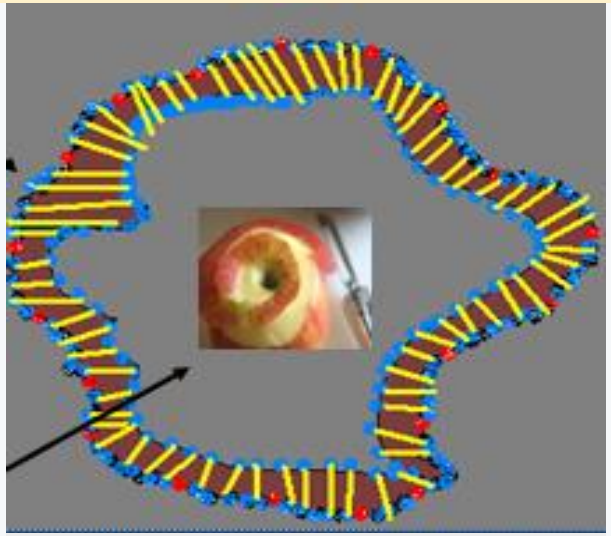
Silane Nanotechnology Bitumen Mixes

Higher Oxidation Resistance

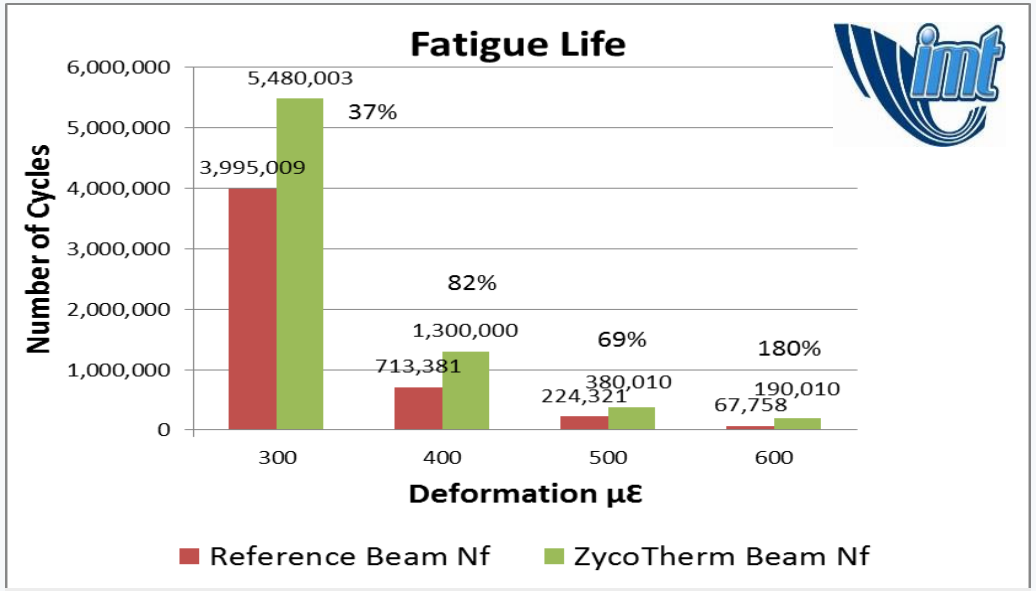
Faster Coating at Lower Temperatures

Higher Moisture Resistance



Chemical Modification
20 times Stronger Bonding

Higher Fatigue Resistance



Stronger and More Flexible Pavement

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Zero Stripping : NH 52 Haryana Kaithal – Rajasthan Border, IRB Infra

Wearing Course 40 mm with VG 40 , Sept 2015 – April 2016

<u>Performance after 3 years , CRRI</u>

1. **Bitumen Content: 5.6%**
2. **Bulk Density: 2.47**
3. **Bitumen Stripping: 0%**

Industrial Road, Gujarat, India

Wearing Course Performance after 7 years

Production: 145º C

Compaction Initial Temp: 135ºC

Mix Type: BC mix with VG 30

Aggregates: Basalt

ZycoTherm Dose: 0.1%

Air Temp: 23 ºC

Haul Length: 3 Km

BC Mix (VG 30, basalt aggregates) produced at 145º C and initial compaction at 135ºC

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Poland Warmian-Mazurian Voivod Road 511, PRDiM Lidzbark

Production: 155º C

Compaction Initial Temp: 135ºC

Mix Type: AC11 PMB 45/80-55

ZT EZ Dose: 0.1%

Air Temp: 2º C

Paving Time: Morning
Wind Speed: Weak
Haul Length: 25 Km
Haul Time: ½ Hour

Year: 2016

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THANK YOU