OrganoSilane Chemistry
Nano Technology
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Extending life increases sustainability. And so does conserving limited resources in pavement construction.

Organosilane nano technology benefits all three

Saving Aggregate
Saving Bitumen
Saving Fuel
Organosilane Nano Technology Enables

- Improved oxidation resistance
- Reduced water damage
- Higher densities at lower compaction temperatures
- Improved fatigue resistance
- Improved bleed resistance
Reactivity of Organosilane

Chemical bi-functional structure

Maltene loving group

“Silicon-functional” group

CHEMICAL BONDING
ORGNOSILANE HAS MANY FUNCTIONS—OUTSIDE OF SOIL STABILIZATION AND DUST CONTROL

Compaction Aid
Anti-Strip
Warm Mix
GTR
High RAP/RAS
Heavy Polymer

Only known product that is water soluble and used
1) Lime Replacement
2) Foaming Operations
- Extends half life better
- Excellent Anti-Strip

Control (dry) 122 (wet) 78 TSR--63
SP (dry) 131 (wet) 115 TSR--89
SOIL STABILIZATION PRODUCTS

Terra Prime – Waterproofing prime coat and soil stabilizer

TerraSil – Used in conjunction with cement

ZycoBond – Strengthens soil / Dust Suppression

4 Successful trials with ZycoBond at Quarry locations in US and Canada.
THE CHEMICAL ACTION

ZycoTherm creates molecular level hydrophobic zone (water repellent)

Aggregate / Soil / Clay / Sand surface silicate structure after ZycoTherm reaction

-OH groups make surface very hydrophilic (water loving)

Internal Siloxane bonds

Particle surface
TERRASIL + ZYCOBOND + CEMENT
SOIL STABILIZATION WITH WATER RESISTANCE

Water Resistant Stabilized Soil Layers & Waterproofed soil layers
Compacted Soil
Asphalt Layer

Replace GSB - Soil Stabilization
Sub Grade

Earthen Shoulder & Slope

Compacted Soil  Water Resistant Stabilized Soil Layers & Waterproofed soil layers
Terrasil – Nano-Organosilane
- Reduces plasticity in clayey soils – allows cement stabilization
- Reduces cement demand for similar strength
- Hydrophobized soils – eliminates water infiltration and degradation of cement over time
- Compaction aide
- Eliminates capillary rise
Note:
In case equipment are not available, agricultural implements like ploughs, rotavator etc. can be used.
TERRASIL / ZYCOBOND

ZycoBond – Reactive Acrylic Copolymer
- Nano-scale – 70 - 80 nm
- $10^{17}$ molecules ZycoBond per 0.5 kg
- $10^{17}$ particles in 1 m$^3$ typical soil
- 1 kg/ m$^3$ - Two bonding molecules per soil particle
- Decreases cement demand – reduces shrinkage and cracking
- Hydrophobizes soil
- Increases compressive strength/ R Value with flexibility
TERRASIL / ZYCOBOND

Typical Application
- Terrasil: 0.5 – 1.0 kg/m$^3$
- ZycoBond: 1.0 kg/m$^3$
- Determine OMC
- Add TS/ZB to make-up water used to reach OMC
- Add 3% Portland cement
- Scarify
DUST SUPPRESSION

Dust Palliatives - increase moisture content or bind particles together

- Water/ Water Absorbing (deliquescent salts)
  - calcium chloride, magnesium chloride
- Organic Nonpetroleum Products
  - lignosulfonate, tall oil emulsions,
    molasses/ sugar beet products, animal fats,
    vegetable oils & soy solutions
- Synthetic Polymers: ZycoBond, Soil-Sement,
- Synthetic Fluids       Envirokleen, EK-35, Earth Armor, Durasoil
Use of Calcium / Magnesium Chloride or blended brines or beet molasses or frequent water spray are conventional methods for dust control. These treatments are repetitive and expensive. They often require frequent applications and tend to get washed away during wet spells.

*ZycoBond, a UV and heat stable reactive bonder, is a nano Acrylic Co-polymer dispersion in water that gives water resistance and strong bonding to soil particles. It offers excellent dust control and erosion resistance for unpaved roads & shoulders.*
Prepare ZycoBond solution in water in the ratio 1 : 100 (for the first spray) and spray on Dust / Gravel surface @ 3 Ltr / m² (or till saturation).

A ratio of 1 : 200 and 1 : 300 are to be used for 2\textsuperscript{nd} spray (2\textsuperscript{nd} week from construction) and 3\textsuperscript{rd} spray (in 4\textsuperscript{th} week from construction) respectively to get best bonding and dust control. Allow the surface to dry after every spray.

Spray of solution prepared in the ratio 1 : 300 is recommended every quarter, in the initial two years, for maintenance. After two years, the maintenance spray should be need based.
ZYCOBOND RATIO 1:200

Zycobond distribution
EASTVALE SITE – 17 NOV

ZycoBond added once 2-3 months
THANK YOU

OrganoSilane Chemistry
good for Compaction Aid,
Anti-Strip, WMA, GTR,
RAP/RAS, High Polymer,
Tack Coats, Fog, Chip Seals
ETC............