

**Zydex<sup>®</sup>**



  
**TerraSil<sup>™</sup>**  
BREATHABLE - SOIL WATERPROOFING



**TerraSil nanotechnology is 100 % Organo Silane, water-soluble, UV and heat stable, reactive soil modifier to waterproof soil subgrade and stone bases.**

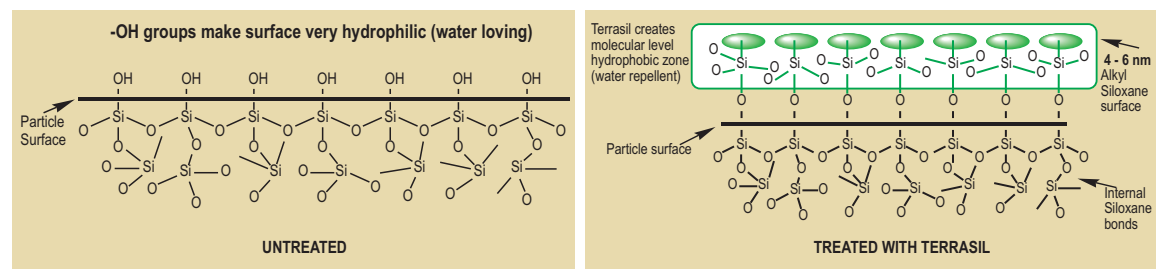
It reacts with water loving silanol groups of sand, silt, clay, aggregates to convert to highly stable water repellent alkyl siloxane bonds. It forms breathable in-situ membrane and resolves the critical sub-surface issues:

- CBR wet strength loss
- Cracks & undulations due to expansion-contraction during the wet & dry cycles
- Soil erosion in side slopes and shoulders
- Persistent potholes and cracks
- Cracks and large voids due to freeze-thaw cycles in wet spring season
- Inability to use expansive soils

### BENEFITS

- Reduces water permeability ( $10^{-7}$  cm/sec) of soil bases while maintaining 100% vapour permeability
- Forms breathable waterproofed soil subgrade and stone base layers
- Maintains frictional values between silt, sand, clay particles leading to retention of strength and resistance to deformation.

## TERRASIL CHEMICAL ACTION WITH SAND, SILT, CLAY & AGGREGATES



One Step Bonding & Waterproofing for Soils

**ZYCOBOND** is an acrylic co-polymer emulsion for bonding soil particles. It is mixed into TerraSil solution and sprayed on compacted soils to resist soil erosion.

### BENEFITS

- Enhances strength of soil layer
- Controls soil erosion
- Quick drying of soil layers/ dirt road after rains
- Mitigates dust on dirt roads
- Reduced undulations and low maintenance costs

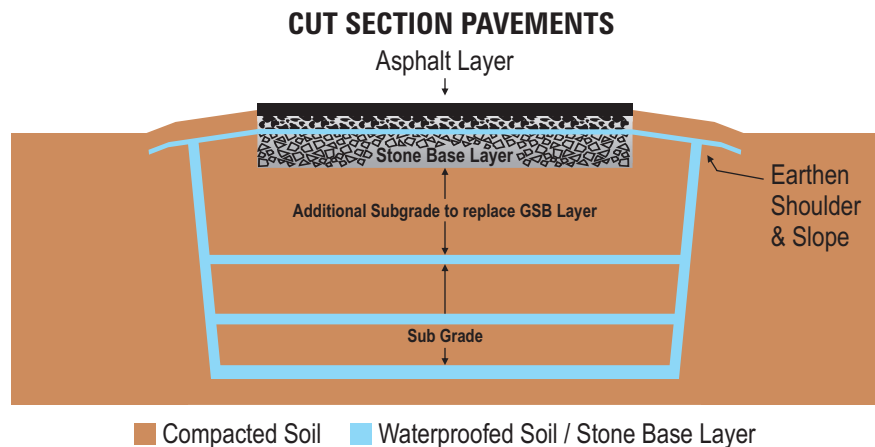
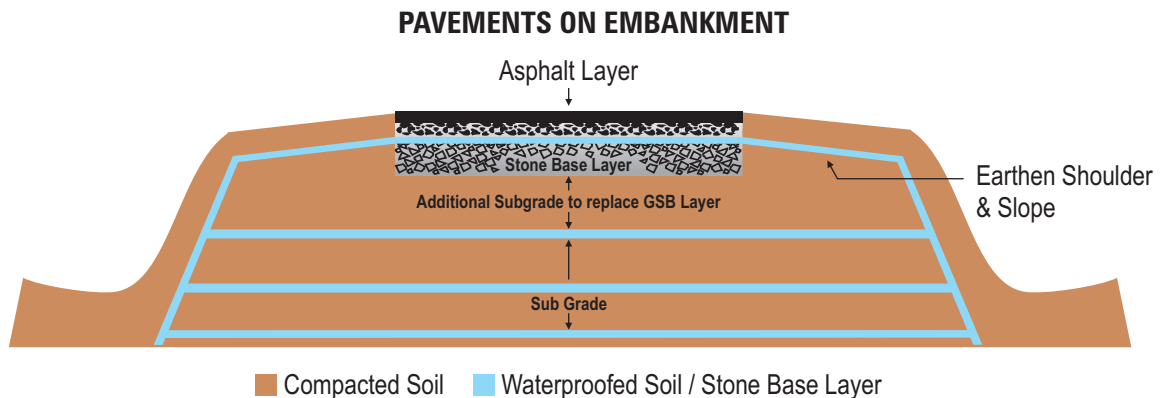
## SOIL SUBGRADE

### MULTILAYER ENVELOPE FOR PAVEMENTS ON EMBANKMENT / CUT AREAS

Apply Terrasil solution through two application cycles of Spray-Dry-Spray on compacted soil (Proctor Density above 95% at optimum moisture content).

First spray cycle waterproofs almost 90 - 95% of the soil surface.

Second spray cycle ensures 100% saturation of the soil surface, penetration and waterproofing of micro-cracks.



### BOTTOM LAYER

Spray Terrasil solution on the compacted bottom layer and dry for 1 to 3 hours. Compact the treated layer (if the expansive soil layer has shrinkage during drying) by compactor.

In case of cut area waterproofing, dig trench as per specifications (minimum 400 mm). Spray Terrasil solution on the compacted bottom layer and vertical side walls (from the top edge) and dry for 1 to 3 hours.

Do second spray application of Terrasil solution on the treated layer and dry. It is critical to dry the bottom layer completely to stop capillary rise especially in semi-wet areas.

Put drops of water on the dried surface. Drop retention for 20 minutes confirms that the surface is waterproofed.

Lack of repellency indicates incomplete drying. Ensure complete drying. Do the drop test again before laying the next layer.

### INTERMEDIATE AND TOP LAYERS

Waterproof all intermediate and top compacted layers and vertical side walls from top edge (in case of cut area) with the Spray-Dry-Spray technique. Dry the treated layers for 30-60 minutes before starting new earth work without waiting for complete drying of treated soil.

## SHOULDERS AND SIDE SLOPES

Spray Terrasil solution on compacted side slopes till saturation and dry.

Do the second spray application on the treated layer till saturation and dry.

Use regular soil to cover the treated slopes and build shoulders.

For extra binding of the side slopes mix 10 kgs of Zycobond with Terrasil solution.

Soil Layer	Soil Type (clays & silts)	Terrasil : Water (<1000 ppm TDS) Ratio	Dosage Liter / m <sup>2</sup> or up to saturation	No. of Applications
Bottom, Intermediate and Top	CH & CI	1 kg : 400 liters	1.5 - 3	2
	ML & CL	1 kg : 800 liters	1 - 2	2
Shoulders & Side Slopes	ML & CL	1 kg : 800 liters	2 - 3	2

## SIDE SLOPES WITH STONE PITCHING

Spray Zycobond mixed Terrasil solution on compacted side slopes till saturation and dry.

Do the second spray application of solution on the treated layer and dry.

Spray Zycobond mixed Terrasil solution over the stone pitched area with cement mortar or filled with soil and dry.

Soil Layer	Soil Type (clays & silts)/ Cement mortar	Terrasil : Water (<1000 ppm TDS) Ratio	Zycobond kg	Dosage Liter / m <sup>2</sup> or up to saturation	No. of Applications
Side Slope	ML & CL	1 kg : 800 liters	10	2 - 3	2
Stone Pitching	ML & CL	1 kg : 800 liters	10	1 - 2	1
	Cement mortar	1 kg : 40 liters	10	0.5	1

## STONE BASE WATERPROOFING

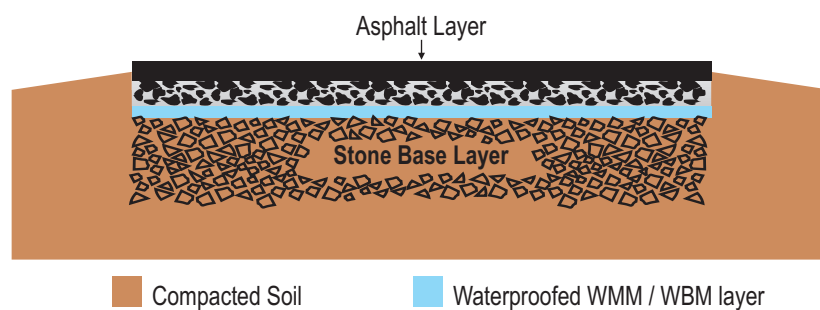
### WET MIX MACADAM (WMM) / WATER BOUND MACADAM (WBM)

Spray Terrasil solution till saturation on top surface of the compacted stone base and dry for 3 to 4 hours.

Do second spray application of Terrasil solution and dry to form a waterproofed breathable membrane.

### PRIME COAT ON WMM / WBM

Do penetrative waterproofed Prime Coat for bonding using Terrasil solution added to cationic bitumen emulsion.



WMM / WBM	Terrasil : Water (<1000 ppm TDS) Ratio	Cationic bitumen emulsion kg	Dosage Liter / m <sup>2</sup>	No. of Applications
Waterproofing	1 kg : 600 liters	-	2 - 4	2
Prime coat	1 kg : 600 liters	40	1	2

## NON DUSTY WATERPROOFED DIRT ROAD

Zycobond mixed with Terrasil solution is used to bind and waterproof the compacted soil particles to control soil erosion and mitigate dust.

Spray Terrasil solution mixed with Zycobond on compacted soil layer and dry for 1 to 3 hrs. Do the second spray application on treated layer and dry completely before opening traffic.

To get superior performance scarify the top 1 inch soil, spray the solution, compact the treated soil and dry for 1 to 3 hrs. Do the second spray application on treated layer and dry completely before opening traffic.

Layer	Soil type (clays & silts)	Terrasil : Water (<1000 ppm TDS) Ratio	Zycobond kg	Dosage Liter / m <sup>2</sup>	No. of Applications
Compacted Soil layer	CH & CI	1 kg : 400 liters	5	3	2
	ML & CL	1 kg : 800 liters	10	3	2

## TESTS OF WATERPROOFING

### BREATHABILITY TEST

Put any solvent like oil or thinner etc on the treated soil layer. Absorption of the solvent into the soil layer confirms its porosity and breathability.

### WATER DROP TEST

Put water drops on Terrasil treated surface. If the water drop stays on top for 20 minutes or more, it confirms the surface is waterproofed.

### CAPILLARY RISE TEST

Capillary rise test is done on Terrasil treated waterproofed surface. Create a 6 inch wide and 3 inch deep cut around the Terrasil treated compacted soil layer. Flood the cut area with water continuously for 3 - 4 hours. Dry surface confirms elimination of capillary rise.



## APPLICATIONS

- Road bases - Asphalt and Concrete Pavements
- Dirt Roads – Rural, Mining, Waste Sites
- Landfills/ Construction Sites, Ponds, Canals, Levees (Bunds) etc
- Solar Farms and Reclamations

## TECHNICAL SPECIFICATION AND PACKAGING

Particulars	Terrasil	Zycobond
Appearance	Pale yellow clear liquid	Milky white free flowing liquid
Solid content	72 ± 2%	35 ± 2%
Viscosity at 25 °C	20-100 cps	10-100 cps
Specific gravity	0.91	1.02
Solubility	Forms water clear solution	Dispersible in water
Flash Point	Flammable 12 °C	N.A
pH	6.5 - 7.5	6.5 - 8.0
Packing carboy	18 Kg	20 Kg

## STORAGE AND SHELF LIFE

Store in shade between 5 °C to 45 °C. Keep away from heat, ignition / sparks source and from rain / standing water.

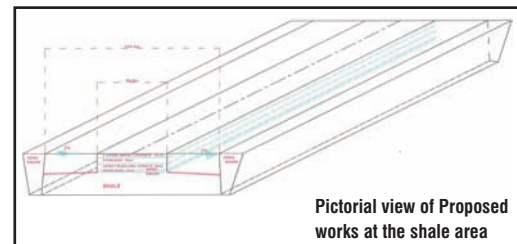
Keep the container tightly closed after the first withdrawal to prevent product from reacting with moisture when not in use.

Shelf life is 24 months when stored as recommended.

## WATERPROOFING OF AIRPORT RUNWAY SUBGRADE

### SUB-GRADE, AIRPORT RUNWAY EXTENSION ENUGU AIRPORT, NIGERIA

The runway extension subgrade had shale (CH type).  
Terrasil multi-layer system adopted to stop water  
ingress/capillary rise.



Pictorial view of Proposed works at the shale area



Soil surface levelling



Untreated compacted soil layer



Spraying



Waterproofing confirmation

The above spray-dry application technique was done for 4 layers to complete the multi-layer system over which stone base and asphalt concrete layer would be laid.

# WATERPROOFING OF RURAL ROAD

Waterproofing of New Connectivity Rural Road, Vadodara, India of CH expansive soil base, WBM Stone Base, Prime & Tack Coat and Asphalt Layers Waterproofing



**Spraying Terrasil solution on compacted bottom layer**



**Compacted WBM after two compacted soil layer**



**Prime coat - Terrasil with cationic bitumen emulsion**



**Waterproofing confirmation**



**Tack coat – Nanotac with cationic bitumen emulsion**



**Compaction of Zycosoil modified asphalt layer**

## POST MONSOON ROAD CONDITION



**Control - Stripped asphalt surface with cracks and depression**



**Treated with Terrasil & Zycosoil**

### Disclaimer

Whilst any information contained herein is true, accurate and represents our best knowledge and experience, no warranty is given or implied with any recommendations made by us, our representatives or distributors, as the conditions of use and the competence of any labor involved in the application are beyond our control.



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**Zydex<sup>®</sup>**

The Silane  
Nanotechnology  
for Penetrative  
and Reactive Bonding



**NANOTAC**

Ultimate Bonding, Without Tire "Pick Up"

# NANOTAC

Tack Coat is applied to ensure bonding between existing and incoming new asphalt layers. Tack coats eliminate slippage and debonding of pavements and allow the transfer of stresses in the monolithic structure.

However water based emulsion tack coats, suffer from typical issues of tire 'pick up' by construction vehicles, clogging of nozzles, non-uniform and inadequate coverage (poor wetting), water permeation and water sensitivity. This is due to inadequate cleaning of dust/ dirt and resultant bond failures.

## NANOTAC

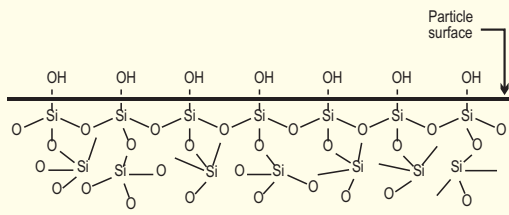
Nanotac is new generation reactive 100% organosilane nanotechnology. It has excellent wetting, sets quickly and eliminates tire pick up.

### FEATURES

- Makes tack coat water resistant and penetrative
- Converts water loving dust/ dirt/ aggregates to asphalt loving surfaces for excellent bonding
- Improves stability and lowers surface tension of cationic bitumen emulsion

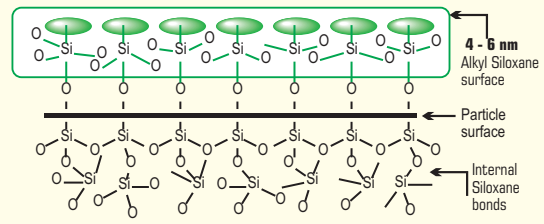
## THE CHEMICAL ACTION

-OH groups make surface very hydrophilic (water loving)



Untreated Stone / Dirt / Dust / Aggregate

Nanotac creates molecular level hydrophobic zone (water repellent)



Treated with Nanotac

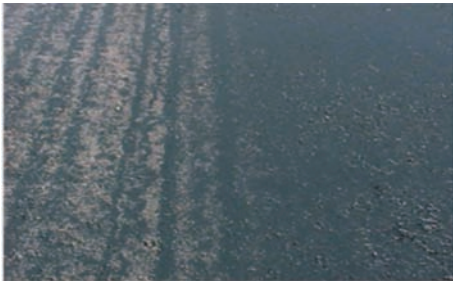
## BENEFITS

### WATER RESISTANCE

Nanotac converts water loving dust / dirt / aggregates to asphalt loving surfaces and ensures excellent bonding and water resistance

### WETTING, PENETRATION & SURFACE COVERAGE

Lowers surface tension of cationic bitumen emulsion, increases wetting and ensures complete coverage



Without Nanotac - Poor Wetting



With Nanotac - Excellent Wetting & Coverage

### CLEAN NOZZLES

Keeps nozzles clean by improving stability of cationic bitumen emulsions and ensures uniform spraying at room temperature. Saves time and energy since heating of the emulsion is not required



Without Nanotac - Result of Clogged Nozzles



With Nanotac - Clean Nozzles, Uniform Spray

## OPTIMIZES BITUMEN

Allows substantial reduction in asphalt thickness due to better wetting & spraying

## NO TIRE PICK UP

Wets, penetrates and sets quickly (5 – 10 minutes), reduces tackiness on the surface to eliminate tire pick up



Without Nanotac: Tire Pick Up



With Nanotac: No pick up just 15 minutes after application



With Nanotac: No pick up just 15 minutes after application

## MIXING PROCESS

- Start re-circulation of cationic bitumen emulsion
- Add water followed with Nanotac, continue re-circulation for 10-15 minutes
- Spray the mix

## DOSAGE

Bitumen Emulsion mix	Cationic Bitumen Emulsion (60%) (Kg)	Water (Liter)	Nanotac (Kg)	Total (Liter)	*Asphalt Content (%)
Conventional	3000	3000	0	6000	30
Nanotac	1500	4500	45	6000	15
Nanotac	1000	5000	50	6000	10

\* A 10 micron thickness requires only 2% residual asphalt content

## TECHNICAL SPECIFICATION

Particular	Nanotac
Appearance	Clear to Pale Yellow
Solid Content	41 +/- 2%
Solvent	Ethylene Glycol
Flash Point	80 °C
Viscosity (25 °C)	200 - 800 cps
Solubility	Soluble in cationic bitumen emulsion

## PACKAGING

Nanotac is available in 20 kg Carboy.

## STORAGE

Store under shaded area, away from direct sunlight. Recommended storage temperature is 10 °C to 45 °C. Keep away from heat, ignition / sparks source and from rain / standing water.

Even after freeze-thaw condition the product can be used with the same performance.

Keep the container tightly closed after the first withdrawal (product can start reacting with moisture in the ambient air) when not in use, in a dry and cool place.

## SHELF LIFE

24 months when stored as recommended.





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