ROMIX Industries

Product Presentation

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Building Better Roads

A REVOLUTIONARY NEW WAY OF BUILDING ROADS QUICKLY, COST EFFECTIVELY AND ENVIRONMENTALLY FRIENDLY

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History of Roads

The ancient Romans are credited for the first efficiently constructed roads which formed the basis for the development of road construction as we know it today….

Initially, the Romans built their roads for military purposes to spread their legions throughout the empire….

The road network also boosted their economy and led to cultural development and immense influence throughout the world ….

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History of Roads

During their reign, the Romans built in excess of 75,000 square kilometers of efficient roads, making access to Rome easy from all the corners of the empire. This led to the saying …….

“ALL ROADS LEAD TO ROME”

During the past 50 years, major infrastructure development took place worldwide.

Many of the roads in use today, are in excess of 20 years old, requiring increasing maintenance.

Increase in traffic volume leads to further deterioration, as roads were not designed to carry these loads.

More budget is used for maintenance – less available for new roads.

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Road Building Facts

A recent World Bank study concluded that a sound infrastructure is imperative for economic growth.

Funding for new road infrastructure is insufficient – too much spent on maintenance.

Therefore, innovation is the only way to address the backlog.

Find quicker, better and more cost effective, Environmentally sound methods to build roads.

Resulting in the delivery of more roads for the available budget.

Traditional Road Building Construction Methods

Bitumen / Asphalt roads with supporting layerworks:

- **Well established**
- **Romans started the layer-works concept in 318 B.C.**
- **Well developed and researched**
- **Proven and tested**
- **Durable (will last a long time if adequately maintained)**
- **Vast investments made by the industry in plant, machinery etc.**

B U T .....

Traditional Building, an Expensive Process

Only selected, graded materials can be used in the supporting layers.

Suitable materials must be imported from borrow pits or crushers – often far away from site.

For a highway, up to 6 layers must be imported and treated before applying the asphalt.

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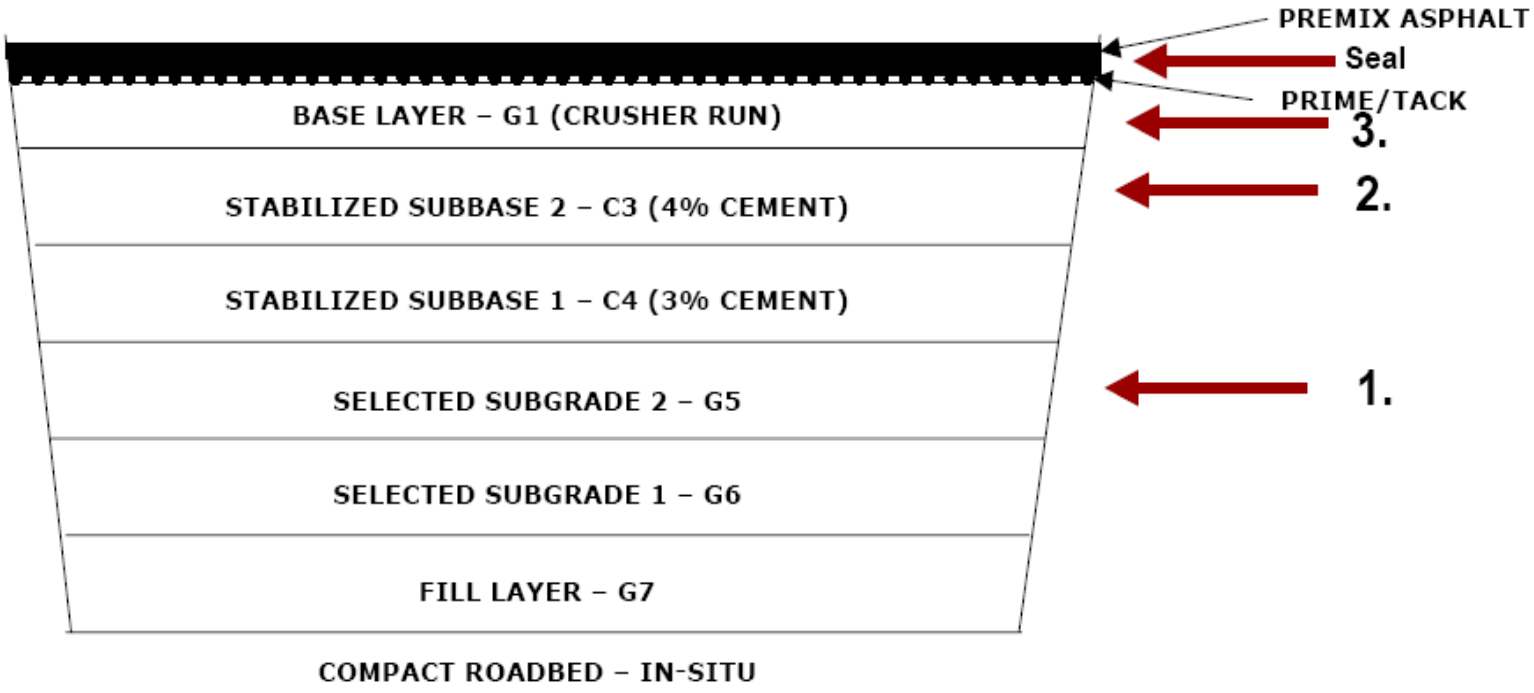
Typical Highway Design



Cement Stabilized road after 4 years

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The SoilFix SRB Polymer Blend

This unique polymer blend allows for binding of practically any soil particle regardless of the quality or grading of the material

Low and high PI (Plasticity Index) material will require modification :-

- **PI < 3 – Modify with higher clay content material**
- **PI > 18 – Modify with lime, or add non-plastic material**
- **Black Cotton soil – discard, import crushed rock, import G6/G7 material and stabilize**

This allows for the use of most in-situ materials rather than importing scarce, expensive special materials to site

Bearing Strengths (CBR) achieved with SRB Polymer far exceed minimum requirements.

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Benefits of SRB Polymer v.s. Traditional Stabilizer

SRB Polymer METHOD

- Concentrated – 10,000 litres per km (2km product on one Interlink Truck)
- Lower Transport Cost
- Road can be opened to traffic immediately after compaction
- No need for detours
- SRB Polymer will remain active for 7 days after mixing
- Mechanical bond – aided by compaction
- Cannot be over-compacted
- Will not crack – Flexibility of Polymers
- No cracking, no potholing

TRADITIONAL METHOD

- 72,000 Kg Cement required for one kilometer (3.6 Interlink Trucks per kilometer)
- Transport cost 6 - 8 times higher for cement
- Road must be kept closed for 7 days after stabilization
- Detours must be constructed to prevent damage
- Cement will remain active for up to 6 hours, thereafter – re-apply full amount
- Chemical reaction when water is added – crystal forming
- Will crack if over-compacted – 4 passes on full vibration
- Rigid substance – will crack under point-loads
- Cracking leads to potholing

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Benefits of SRB Polymer v.s. Traditional Stabilizer

SOILFIX METHOD

- Unlimited shelf life if stored correctly
- Liquid material – better even distribution in material
- Limited theft and pilferage
- Works on a wide variety of materials
- Improves marginal materials to usable materials
- Eco friendly – Limited CO2 emissions in production (1,200kg CO2 per km road built with SRB Polymer) (++)
- Ecologically sound – will not leach into the environment

TRADITIONAL METHOD

- 6 month shelf life for cement
- Dry powdery material – distribution difficult and uneven
- Cement is a popular building material
- Limited to certain graded materials – Cement PI<10, Lime PI >10
- Will only improve quality graded materials
- Massive Co2 emissions in production of cement – 50,5 tons per km built with cement (++)
- Health risks attached to use of cement and lime

(++) Source – Ergomax Carbon Footprint Assessment

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The Romix Alternative

From this… **To this!**

1 Kilometer completed in 5 days (including seal)

The Romix Method

A road construction method that is quick, easy, affordable and permanent

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The Romix Method – Stabilize with SoilFix

Rip the road surface to 150mm depth.

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The Romix Method – Stabilize with SoilFix

Load SRB Polymer into water bowser, 1.5 lit per m2 plus 3 parts water (for 150mm layer depth)

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The Romix Method – Stabilize with SoilFix

Spray the SRB Polymer / water mixture over the demarcated area

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The Romix Method – Stabilize with SoilFix

Mix the product into the soil with the grader blade

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The Romix Method – Stabilize with SoilFix

Adjust Moisture Content to Optimum (OMC)

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The Romix Method – Stabilize with SoilFix

If rocks are present, compact with padfoot roller to break rocks and "punch" stones into the mixed layer

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The Romix Method – Stabilize with SoilFix

Level the mixed material

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The Romix Method – Stabilize with SoilFix

Compact with smooth drum roller

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The Romix Method – Stabilize with SoilFix

Roll thoroughly with Pneumatic rollers (for chip & spray or PRS/PNS seal)

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Recycling Technology

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The Romix Method – Stabilize with SoilFix

Open the road to traffic

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The Romix Method – Stabilize with SoilFix

For Black Top - prime and seal on top of stabilized layer

No crusher run required

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Product Research and Development

SOILFIX SRB Polymer has been thoroughly researched and tested

Research started in 1998 –

- **CSIR tested SRB Polymer on several materials**
- **Reported major increase in strength (CBR)**
- **Compatible with all materials tested**

CSIR Report :-

“It was found that Romix SRB Polymer significantly increased the strength of the materials”

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Soil-lab UCS Test Results

Soil-lab tested SRB Polymer for Unconfined Compressive Strength UCS

- **G7 fill material from GJ Maritz quarries submitted**
- **Achieved UCS of 1290 kPa**

Minimum Specifications:

- **Urban Low trafficked roads – 750 kPa**
- **National Highways – 1200 kPa**

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DCP (Dynamic Cone Penetrometer) strength testing

Stopper

750mm steel rod

8Kg weight

Flange

1 m measuring stick

1 m Steel Rod

Penetrating cone

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Product Research and Development

Daveyton Field Trial

Latest DCP / CBR Results

	DN#1	DN#2	DN#3	CBR1	CBR2	CBR3
Control	8.4	41.0	78.0	14.4	3.6	1.6
SoilFix @ 0.4%	2.9	3.2	29.0	121.9	93.6	5.7
% CBR Improvement				536%		Average

FIELD TRIALS DONE ON COLLAPSIBLE SAND

TEST DATE – 29 MAY 2002

NOTE : DRY CBR VALUES
SOAKED CBR +/- 50%

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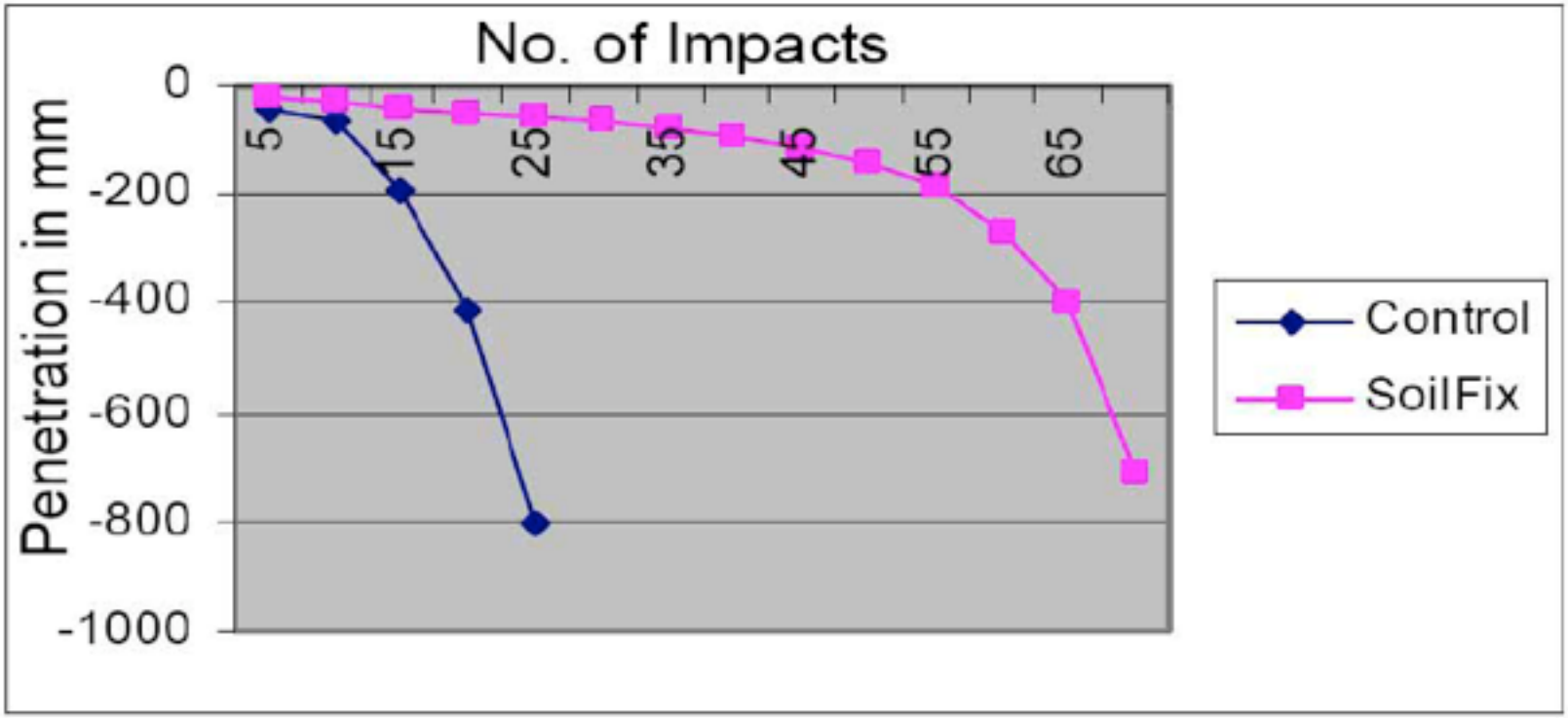
Field Testing - Daveyton Field Trial DCP/CBR Results



NOTE : DRY CBR VALUES
SOAKED CBR +/- 50%

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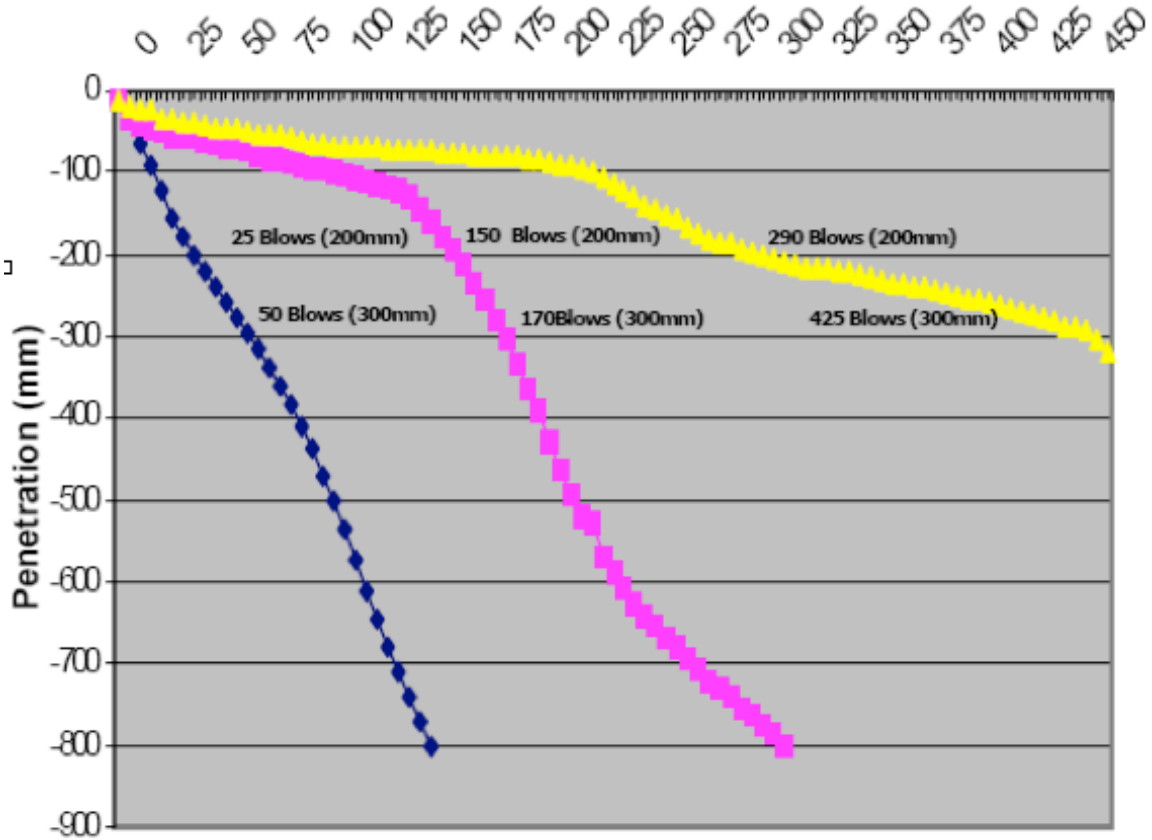
Field Testing - Kruger National Park Field Trial DCP/CBR Results



Control CBR

57.5 @150mm

SRB Polymer CBR

239 @ 150mm

3 Months

SRB Polymer CBR

350 @150mm

3 years

NOTE : DRY CBR VALUES

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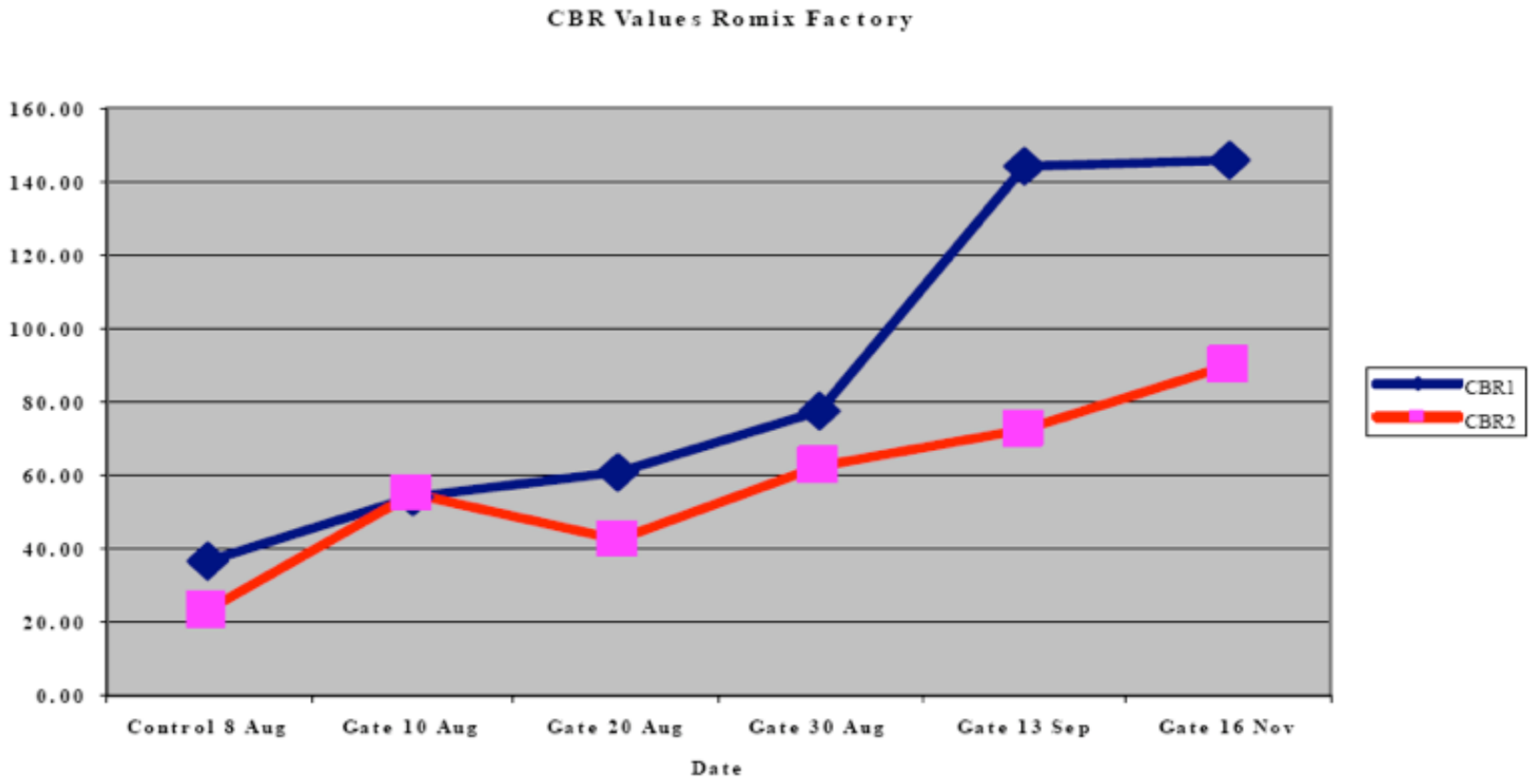
Strength Increase with Curing over Time



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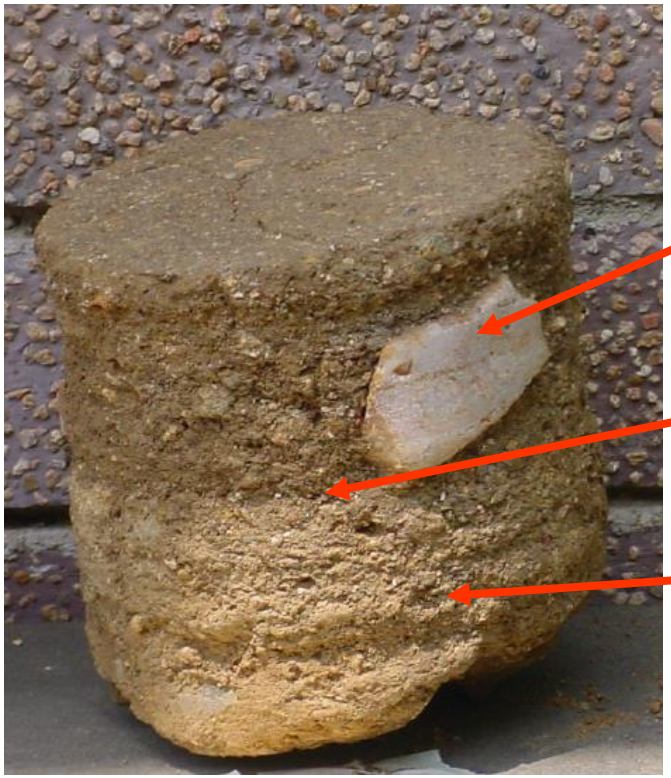
Core Drilled from Kruger National Park



Drilled through Quartzite stone without dislodging

Depth of SRB Polymer Stabilization – 100mm

Additional 100mm removed from core – SRB Polymer Migration – Double layer of strength.

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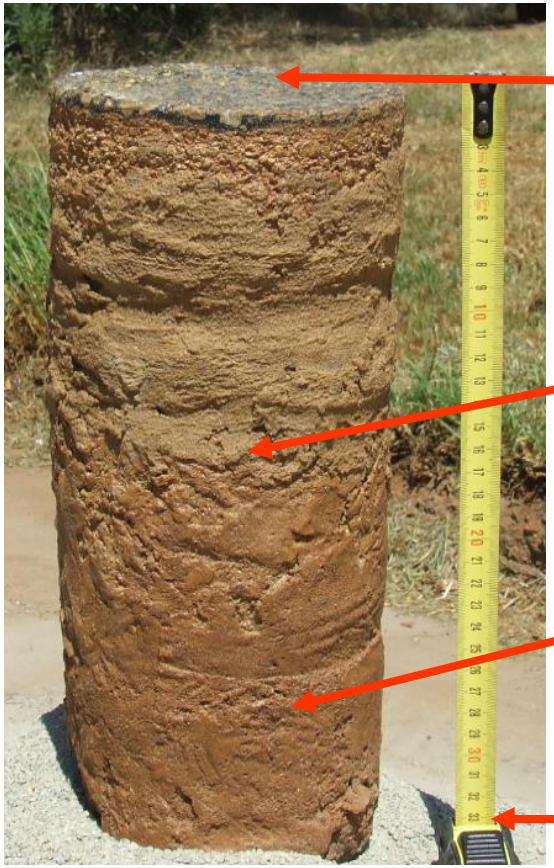
Core Drilled from Radiokop – 11 years after Construction



Single Seal Bitumen Chip ‘n Spray

SRB Polymer treated layer – 150mm

SRB Polymer migrated & strengthened another 170mm

Total depth of strength = 320mm

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Migration levels achieved in the Kruger National Park

Layer No.	Layer Depth	Control CBR	SRB Polymer CBR 90 Days	% Increase over Control	SRB Polymer CBR 360 Days	% Increase over Control
1	0-150mm	42	239	469%	350	733%
2	151-300mm	38	129	239%	284	647%
3	301-450mm	28	69	146%	205	632%

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Historical averages – All measured Projects

Downward Migration

Layer No.	Layer Depth	Control CBR	SRB Polymer CBR	% Increase over Control
1	0-150mm	35	117	234%
2	151-300mm	53	106	100%
3	301-450mm	44	94	113%

26 Control Tests – Various Projects

63 SRB Polymer Tests – Various Projects

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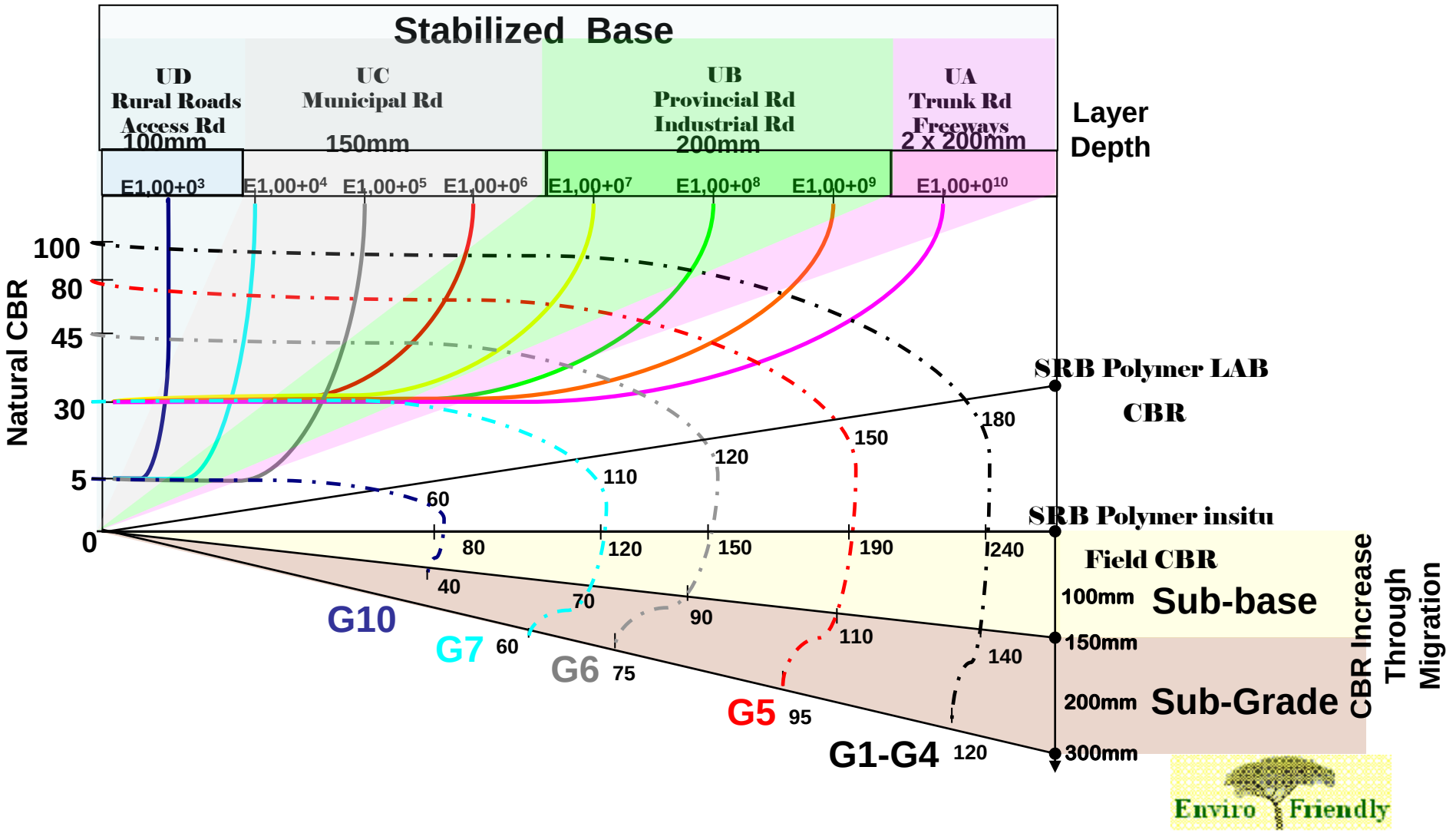
Road Design **with** Romix



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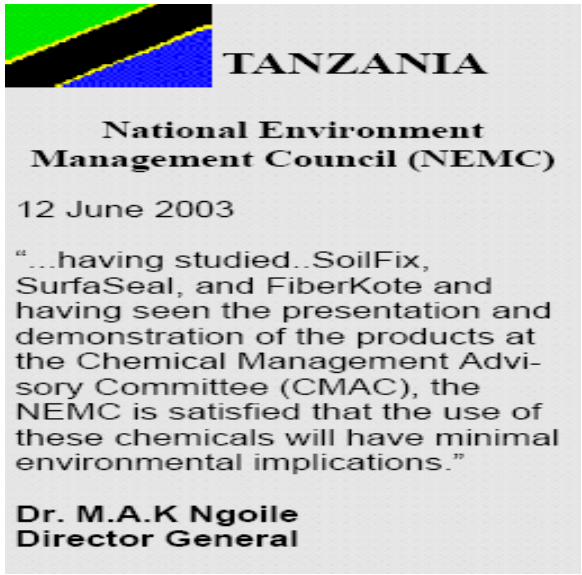
Environmentally safe

Romix Products have been certified Environmentally Safe by:

Australian Authorities

SABS (Potable Water)

Tanzanian Environment Management Council



SRB Polymer will not leach into the environment and damage plants or wildlife

SRB Polymer is safe to work with

Documentary proof available

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Will Work on a Wide Variety of Materials

SRB Polymer has been successfully used on:

- **Collapsible sand**
- **Modified beach sand / calcrete**
- **Laterite**
- **Desert sand modified with “Getsch”**
- **Decomposed Granite**
- **Basalt**
- **Chert**
- **Dolomite**
- **Shale**

Basic Rule :
Plasticity Index (PI) > 3 < 18
Non Plastic sand MUST be modified

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Will improve marginal materials to become usable materials

SRB Polymer improved CBR (California Bearing Ratio) significantly :-

- **Daveyton from 14 CBR to 123 CBR (Collapsible Sand)**
- **Kruger National Park from CBR 57 to CBR 350 (Decomposed Granite)**
- **Hluhluwe from CBR 20 to CBR 73 after 3 weeks *** (Beach Sand / Granite mix)**
- **Jleeb (Kuwait) from CBR 14 to CBR 111 (Desert Sand / Getsch mix)**

SRB Polymer increases in strength over time!

***** Full curing takes place within first 90 days,**

Extended migration up to 360 days

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Long Lasting with Minimal Maintenance

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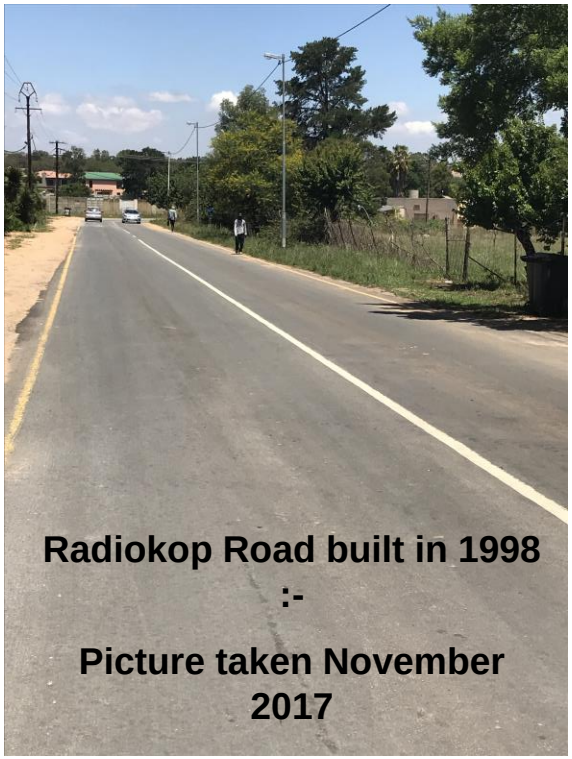
Radiokop Road built in 1998 :-

- **Single layer 150mm Stabilized with Soilfix**
- **Single seal Bitumen Chip and Spray**
- **Heavy quarry traffic (120 trucks per day)**
- **Zero maintenance over 17 years**
- **Picture taken 2006**

Radiokop Road built in 1998 :-

- **After 17 years of service, the first maintenance was done**
- **Applied slurry on top of Bitumen Chip & Spray**
- **Road is a good as new again**
- **Picture taken 2015**



Radiokop Road built in 1998 :-

Picture taken November 2017

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Thoroughly Tested in Global Conditions, Received Official Certification and Accreditation

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- First project done in May 1998 – Radiokop Roodepoort (CSIR supervised)
- Several Field trials done
  - +/- 40 trial sections in South Africa
  - Trials with Wirtgen recycler in Australia & elsewhere
  - Kuwait trials with US Military
  - Qatar
  - DRC – Lubumbashi, Kinshasha, Goma, Kolwezi
- Several successful commercial installations worldwide
  - Nigeria – Oyo Province
  - Zambia 10 km
  - Mpumalanga 16 km
  - Bafokeng 17.6 km
  - Port Elizabeth – 4 km trial
  - KZN – km with Wirtgen Recycler
  - Eastern Cape – 28 km
  - Angola – Porto Seco, Cabinda (Group 5)
  - India – 10km
  - China – 60 km
  - Trinidad, Grenada, St Kitts, Guyana
  - Botswana
- Tested and accredited by several laboratories worldwide, CSIR, Tanzania, Mocambique, Australia, China, Kuwait, US Military, India, DRC

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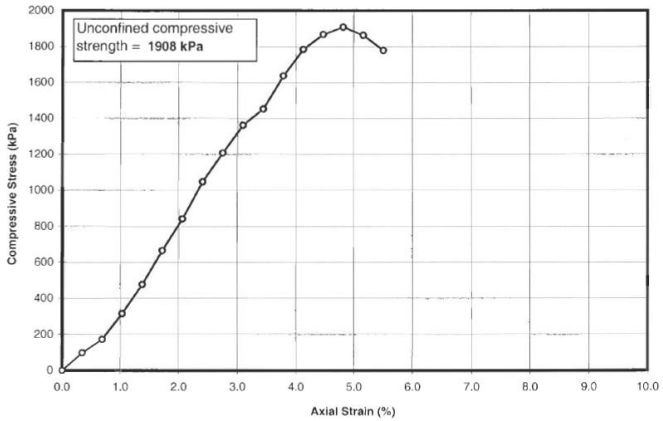

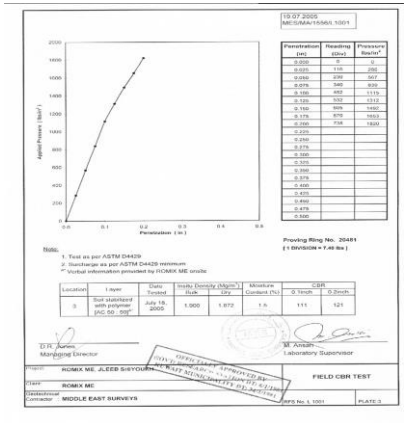

**** Test results available

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Exceeds minimum requirements – strength, bearing capacity and water resistance

SRB Polymer increased CBR Significantly :-

- **From Minimum 45 to up to 350 CBR (Kruger Park)**
- **CBR of at least 80 guaranteed after 90 days**

SRB Polymer increases densities (Troxler) to well above 100%

SRB Polymer increased UCS from minimum 750Kpa to almost 2,000 Kpa (Kuwait)

New testing criteria being developed by CSIR / Agrement

Traditional test criteria developed for cement

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Will bind materials well to minimise loss of precious resources

Erosion of unstabilised gravels is becoming an environmental disaster :-

- **Kruger National Park loses 140,000 cubic metres of material per year ! (154 Kilometers gravel road or 8% of total roads) – Source – CSIR Transportek**
- **Eroded materials silt up rivers and streams**
- **Replacement of lost materials no longer viable and also very costly**
- **Suitable re-graveling materials are scarce**
- **No new borrow pits may be created**

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Inhibits Dust and Prevents Dust Pollution

Dust Polution :-

- Health Risk for communities
- Damage to vehicles – filters, brake pads
- Loss of material
- Contamination of grazing
- Contamination of fresh produce when transported
- Safety compromised

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Single Layer vs Multi Layer

•Use of single layer in-situ material (where possible, instead of import of gravel).

•Where in-situ material is not suitable, import of soil to modify is limited

• Poorer quality materials can be used for modification

• Migration of SRB Polymer Polymer strengthens layer below

• Migration removes the need to treat sub-base layer

• Triple layer strength with single layer application

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ECONOMICAL ALTERNATIVE TO TRADITIONAL METHODS

Re-Gravelling

•Re-gravelling cycles removed if in-situ material is suitable

•Typical re-gravel estimate cost R700,000 (US$100,000) per km (unstabilized)

•Re-gravelling must be repeated at least once every 3 years under normal circumstances

•Ongoing grading and maintenance with re-gravelling

- Minimal maintenance with SRB Polymer
- Material import minimised
- Preserve scarce natural resources

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Designed, developed and produced in South Africa with a major international presence

Products designed and produced in South Africa :-

- **Research started 1996**
- **Factory in Alrode Johannesburg (SA)**
- **Toll manufacturing with Synthomer in Durban (SA)**

Marketing Presence in :-

- **Perth, Australia**
- **Beijing, China**
- **Harare – Zimbabwe**
- **Atlanta – Georgia USA**
- **Georgetown – Guyana**
- **Kampala – Uganda**
- **Kinshasa - DRC**

- **Telephonic Technical support**
- **Strict Supervision and On-site training done by Romix staff**

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Romix BTA

- **Romix BTA was designed as a wearing coarse seal to further improve the strength and durability of the stabilized layer, but still in a cost effective manner**

- **BTA has been successfully applied in the Eastern Cape and several other areas and has yielded phenomenal results**

4.7km at Bashee Bridge

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What is BTA?

- BTA is a polymer based product, that is produced at Romix Industries factory
- The product is mixed with Crusher Dust & Stone
- Mixing could be done on site or at the factory depending on the requirements
- The mix can be left in a stock pile for up to 7days covered with plastic sheets

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Application of BTA

The BTA can be applied by Labour

or

a Paver

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The Romix Roadsaver System of Pothole Repair

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Repair Potholes with Romix Roadsaver

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Pour the pre-mixed Romix Roadsaver into the pothole

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Repair Potholes with Romix Roadsaver

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Spread Romix Roadsaver with a shovel. Leave approx. 15mm above the level of the existing surface

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Repair Potholes with Romix Roadsaver

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Lightly compact the Roadsaver mixture into the pothole with the back of a shovel.

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Repair Potholes with Romix Roadsaver

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Open the pothole to traffic. Moving traffic will compact Roadsaver into the pothole without lifting any material.

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Repair Potholes with Romix Roadsaver

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Repair Potholes with Romix Roadsaver

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Pour Roadsaver into the flooded pothole.

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Repair Potholes with Romix Roadsaver

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Spread Roadsaver with a shovel, lightly pat down with the back of the shovel and open to traffic.

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Repair Potholes with Romix Roadsaver

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Roadsaver filled in flooded pothole after 2 days. Roadsaver bonded to the edges and bowl of the pothole, repelling water around it.

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Repair Potholes with Romix Roadsaver

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ROMIX Roadsaver

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Repair Potholes with Romix Roadsaver

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Romix Projects - China









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Romix Projects - Total Coal

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Thank You…

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