WAPA

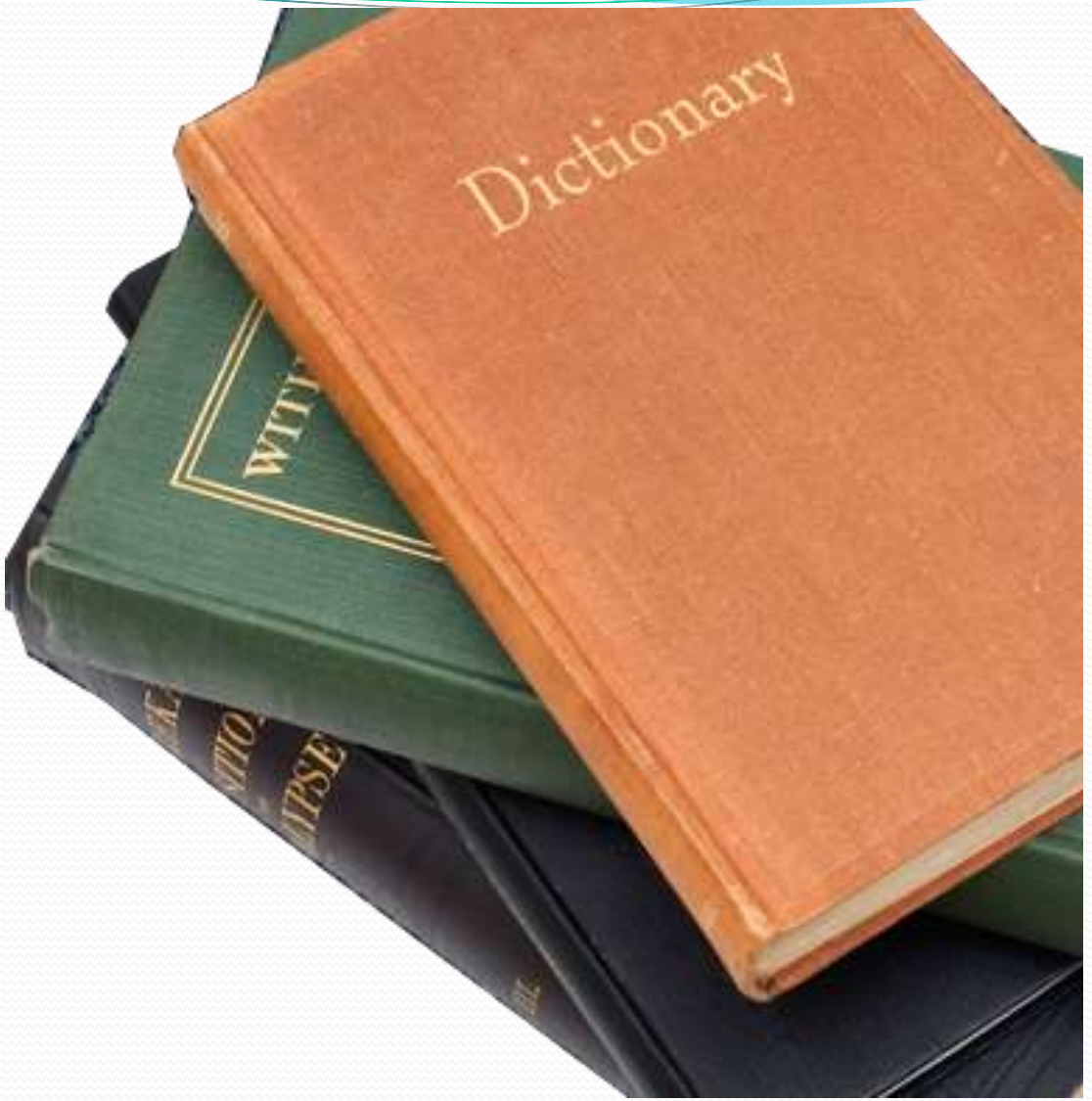
Geosynthetics Use In Asphalt Pavements

Wovens, Nonwovens & Grids Manufacturing, Properties & Capabilities

TenCate Mirafi University

Definitions

- Geosynthetics
- Geotextile
- Geogrid
- Interlayers



Geosynthetics

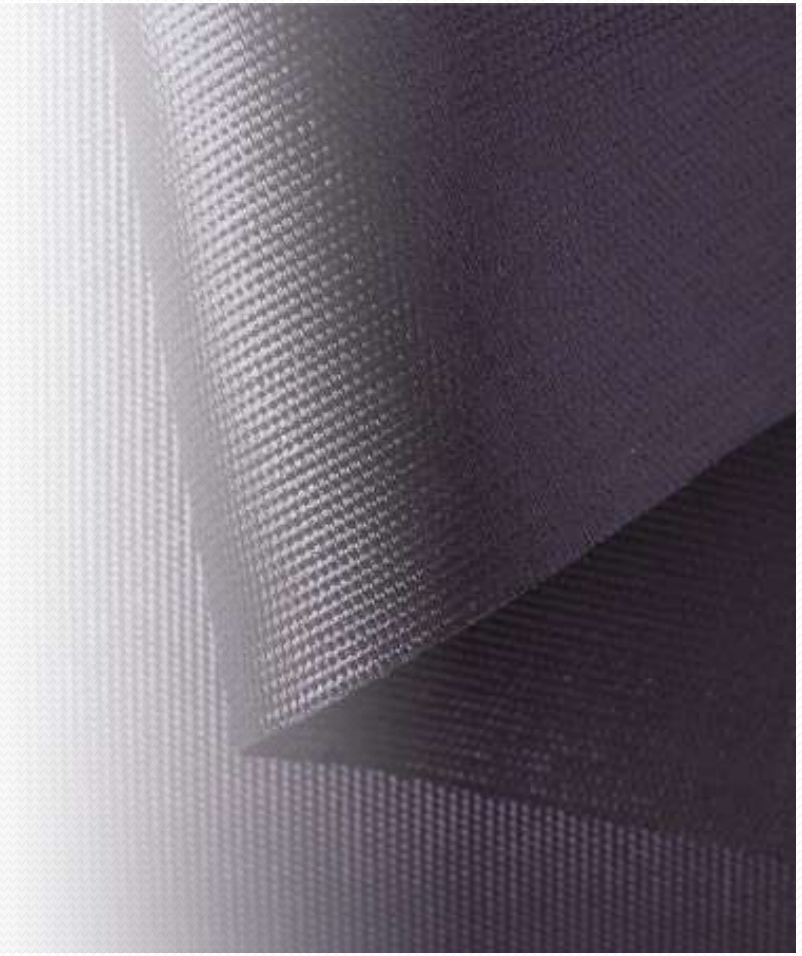
generic for all synthetic materials used in geotechnical engineering applications, including

textiles, grids, nets, membranes & composites

Geotextiles

any permeable textile used in any geotechnical engineered system

a.k.a.
Filter Fabric, Filter Cloth,
Filter Paper, Construction Paper



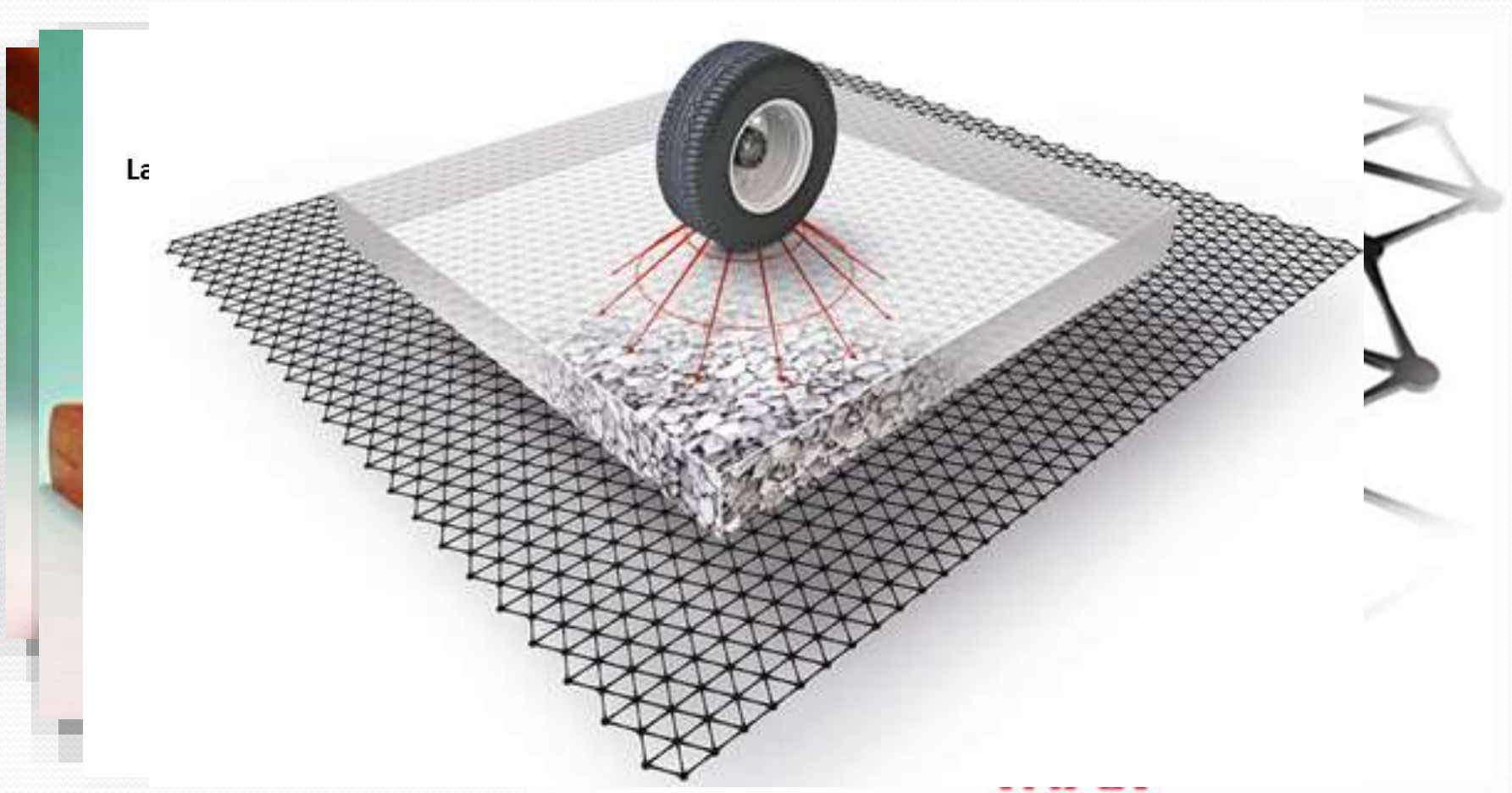
Geotextiles

- Nonwoven - textile structure produced by mechanical, chemical, thermal, or solvent bonding and/or interlocking of fibers
- Woven - textile structure produced by interlacing two or more yarns, fibers, or filaments
- Knit - textile structure produced by inter-looping ends of yarn

Geogrid

A gridlike polymeric material formed by intersecting ribs joined at the junctions used for reinforcement with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of a human-made project structure or system.

How does a geogrid work?



Profiles

Unreinforced

3,000 axle passes

BiAxial Geogrid

10,000 axle passes

TriAxial Geogrid

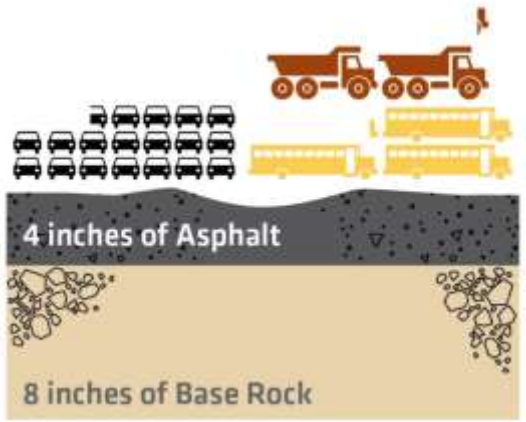
10,000 axle passes

Full-Scale Accelerated Testing of Multi-axial Geogrid Stabilized Flexible Pavements

Constructed over Very Stiff Soils

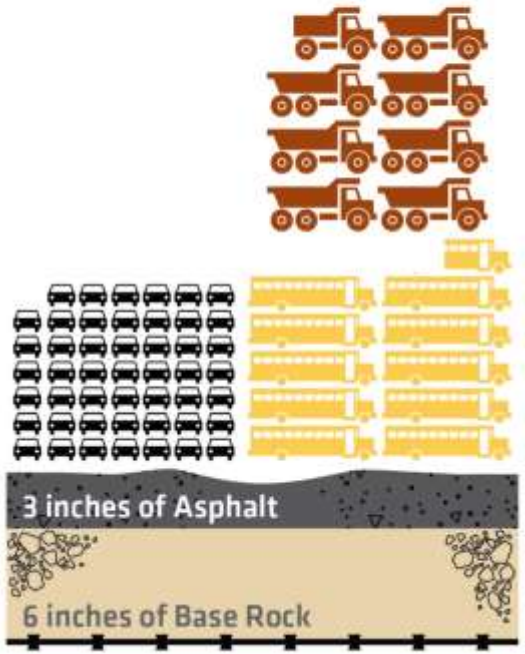
Based on 0.3 inches total surface deformation

220,000 ESALs
187,000,000 cars
36,048 buses
20,227 dump trucks



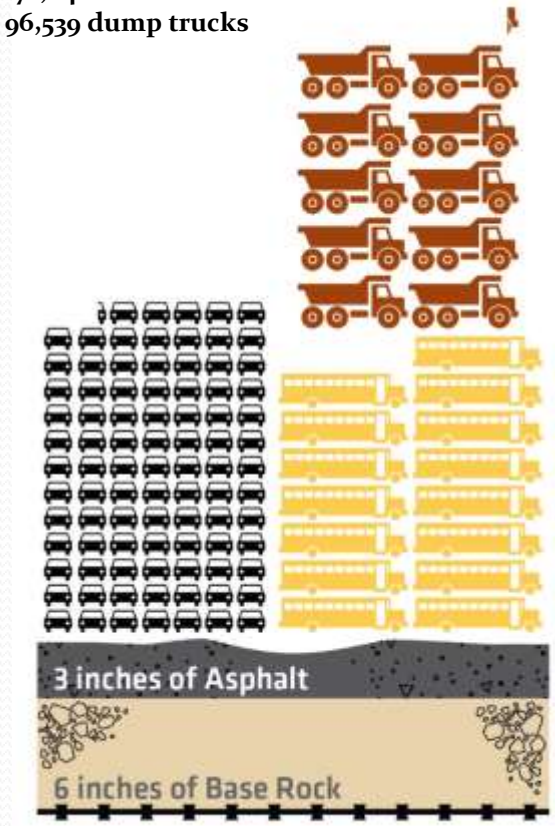
Control Section

811,200 ESALs
689,520,000 cars
132,920 buses
74,583 dump trucks



Tensar TriAx TX5 Geogrid

1,050,000 ESALs
892,500,000 cars
172,048 buses
96,539 dump trucks



Tensar TriAx TX8 Geogrid

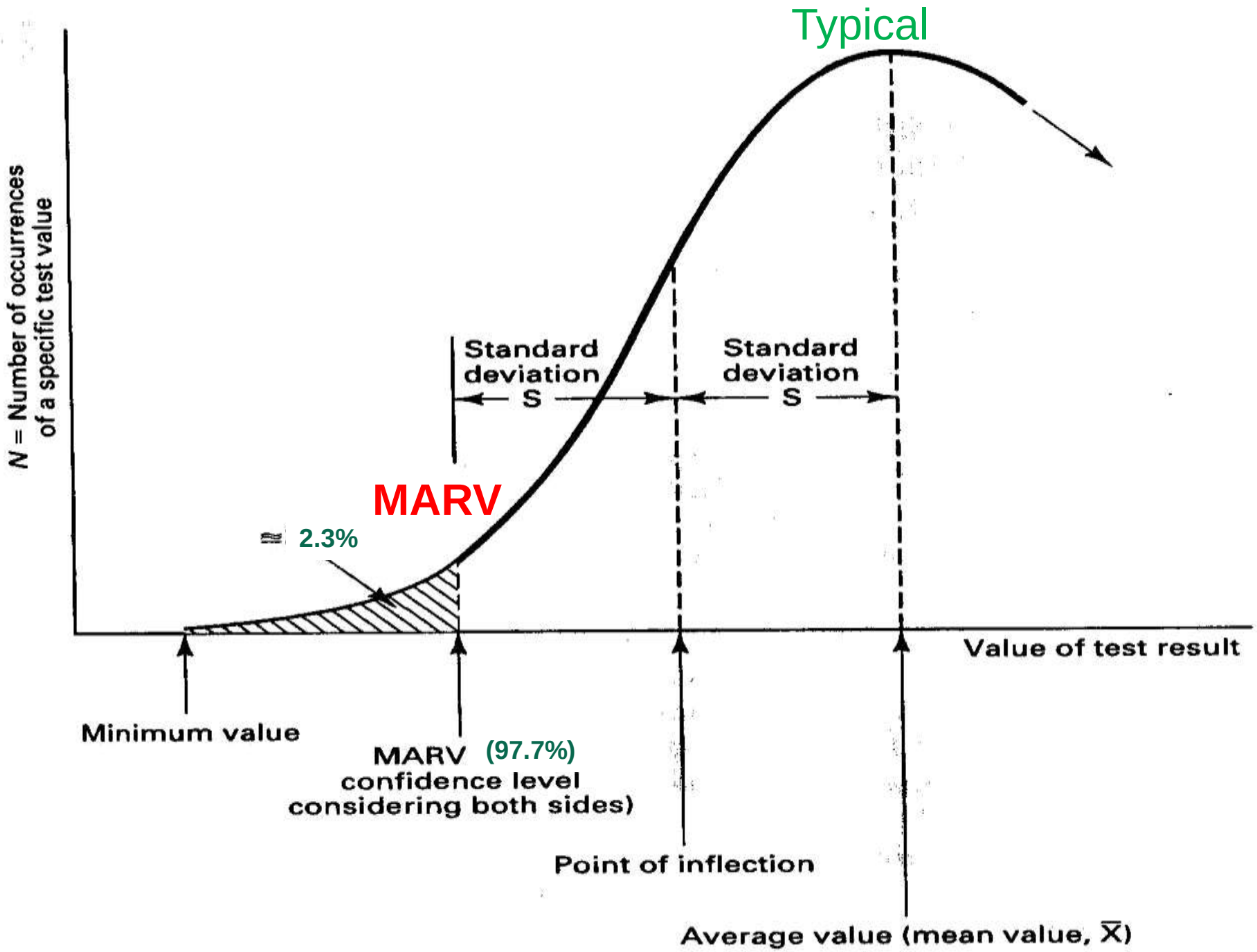
* Values Extrapolated. TX8 section never reached 0.31 inches total deformation

INTERLAYERS- Geotextile Fabrics and Grids Placed in between layers of Asphalt

Geosynthetic Product Properties

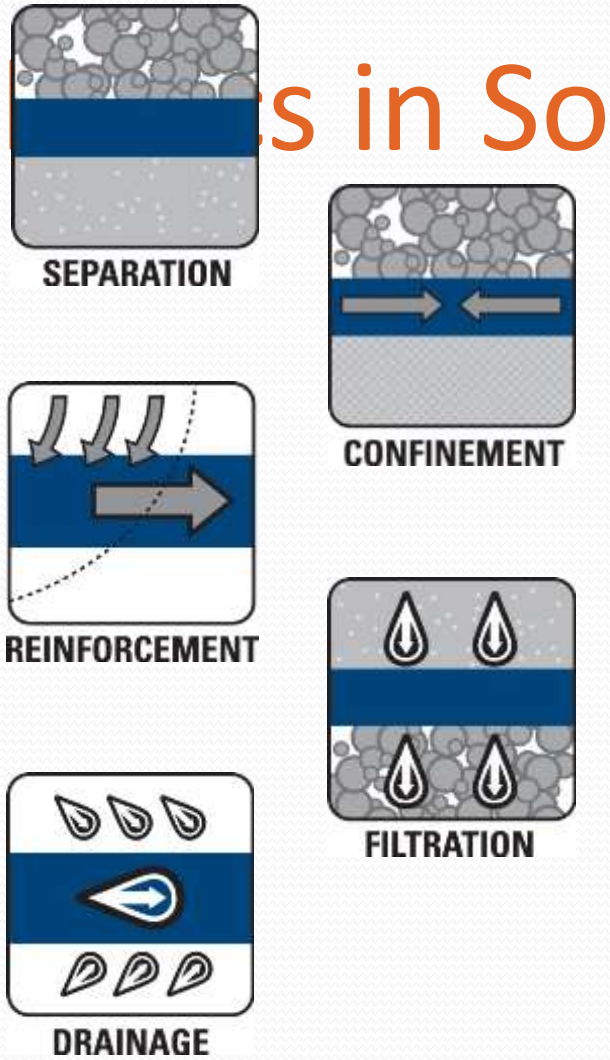
Geosynthetic Properties

- **Product test values are listed as "Typical" or "MARV"**
  - Typical value refers to the average or mean value
    - In general, 50% fall above and 50% fall below the published value
  - MARV is Minimum Average Roll Value
    - Statistically 97.5% of values fall **above** the published value


Typical
N = Number of occurrences of a specific test value
Standard deviation S
Standard deviation S
MARV
≈ 2.3%
Value of test result
Minimum value
MARV (97.7%) confidence level considering both sides)
Point of inflection
Average value (mean value, X̄)

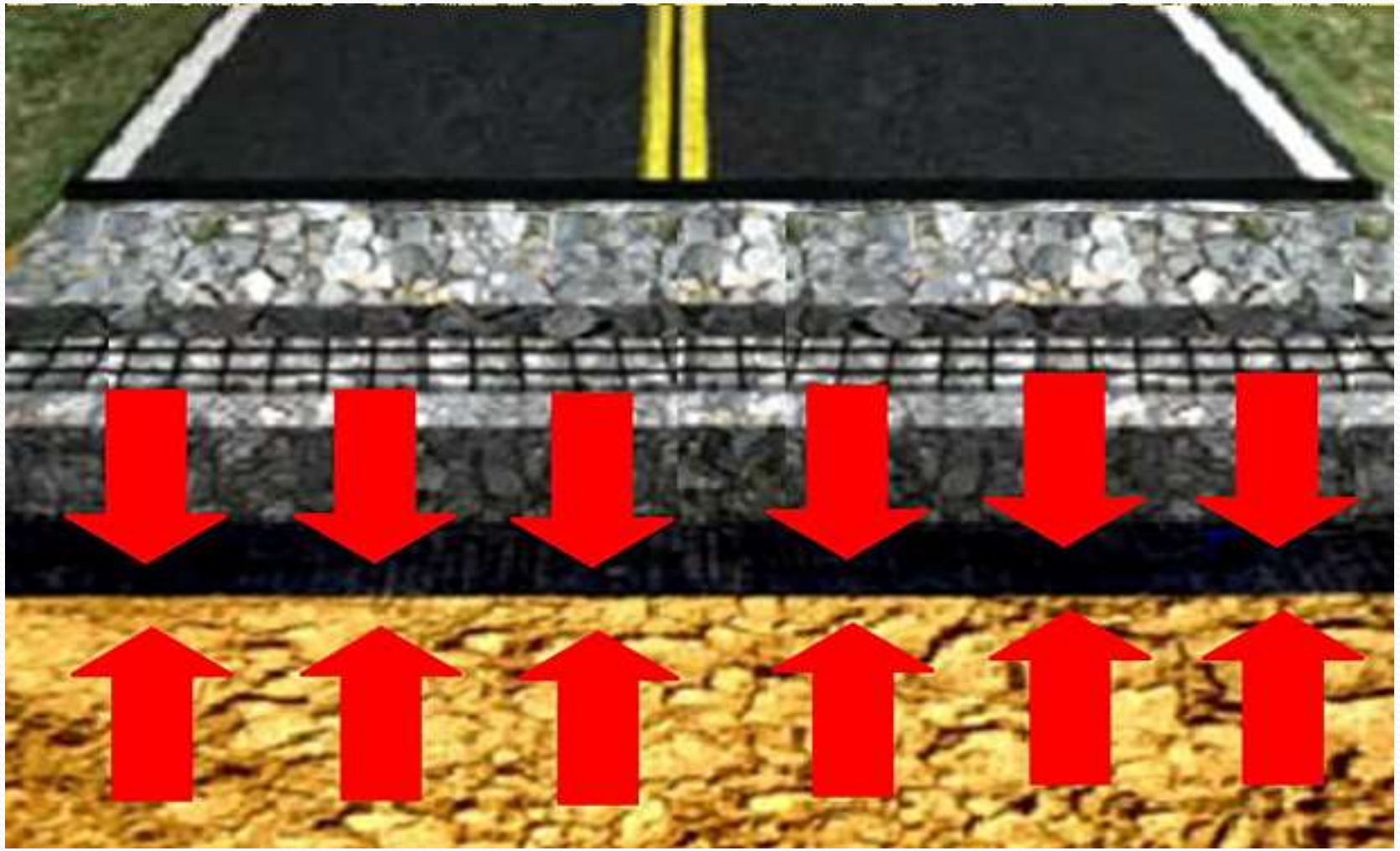
Functions of Geosynthetics in Soils

- **Separation**
- **Confinement**
- **Reinforcement**
- **Filtration**
- **Drainage**

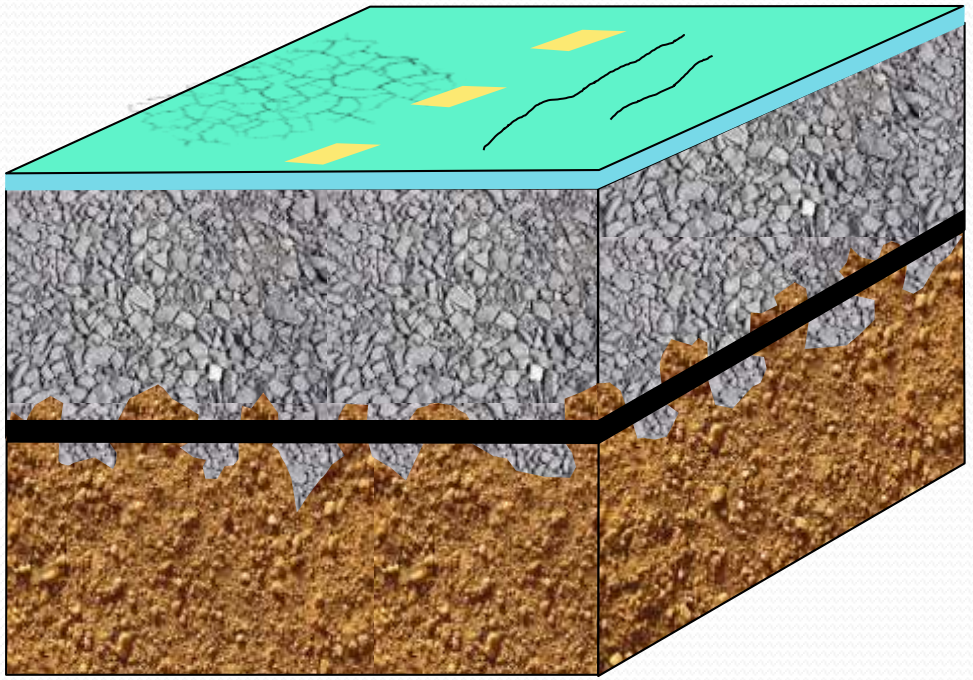


Separation

Geotextile placed between dissimilar materials so that the integrity of both can remain intact or be improved



Separation

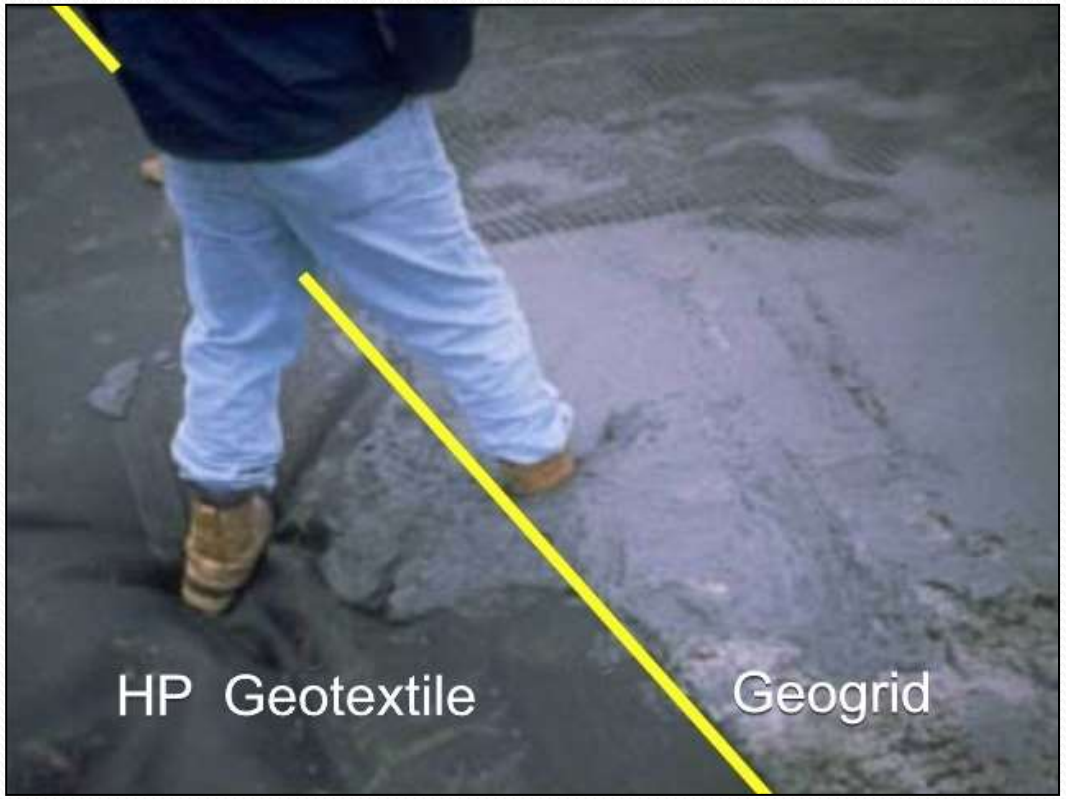


Maintains integrity & functioning of two dissimilar materials

"10 lbs of stone placed on 10 lbs of mud = 20 lbs of mud"

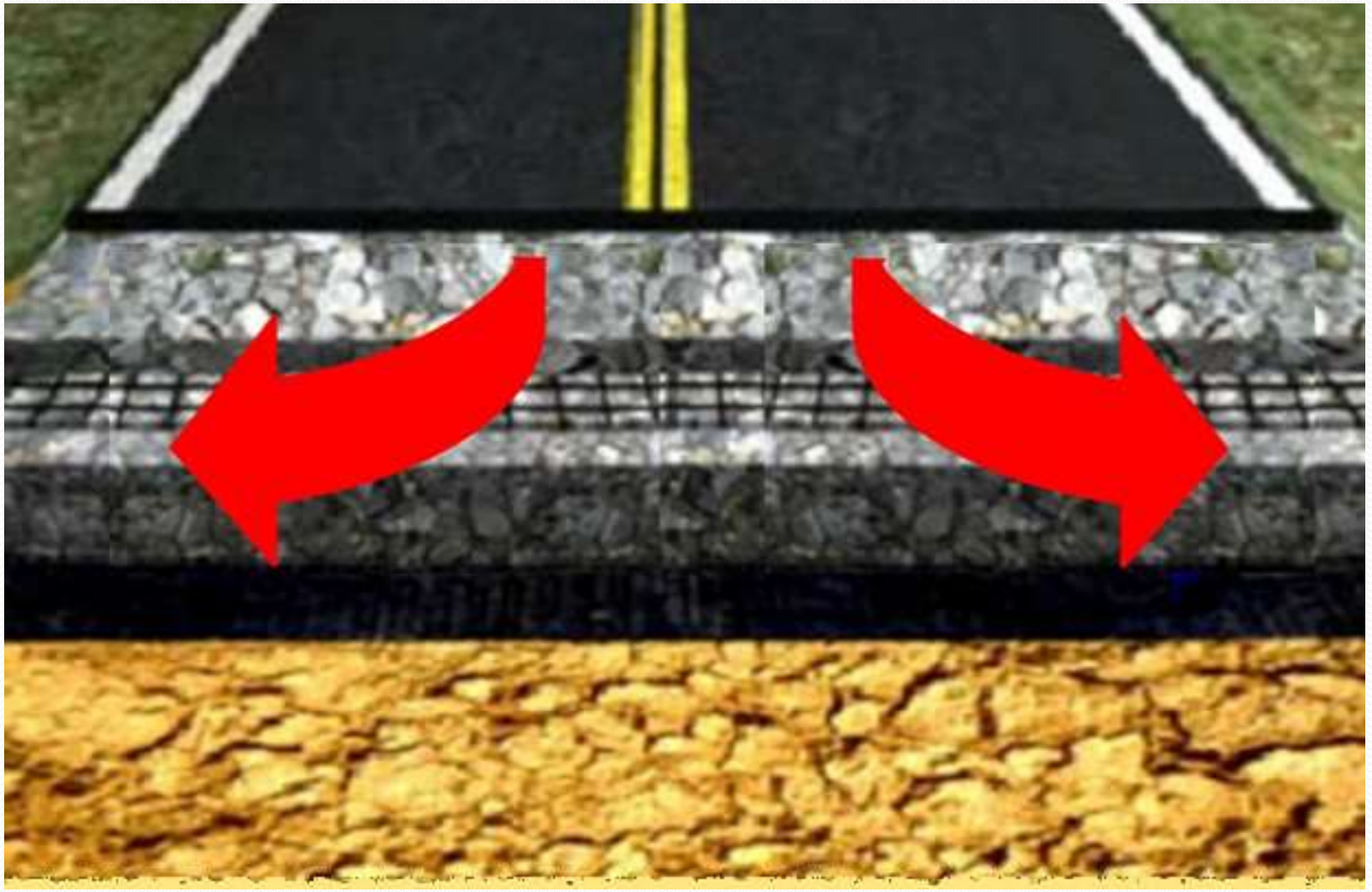
Separation

Prevents fine grained soil from contaminating the load bearing aggregate base course layer.

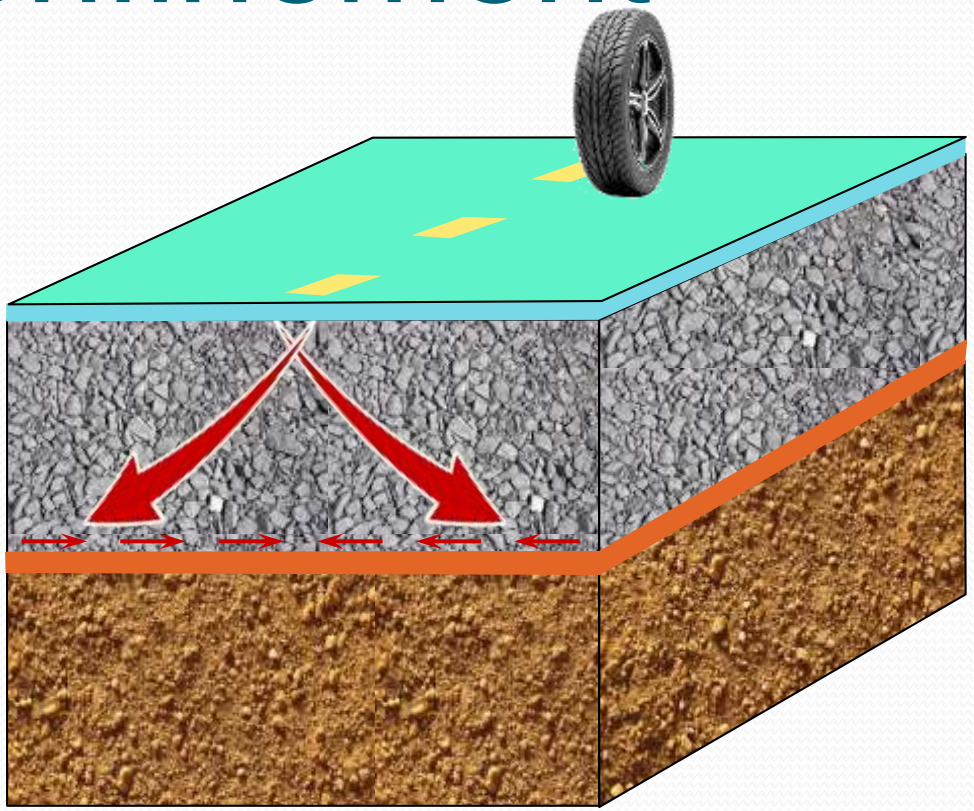


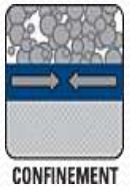
Confinement

Geosynthetic improvement of the ability to resist lateral movement of the aggregate



Confinement



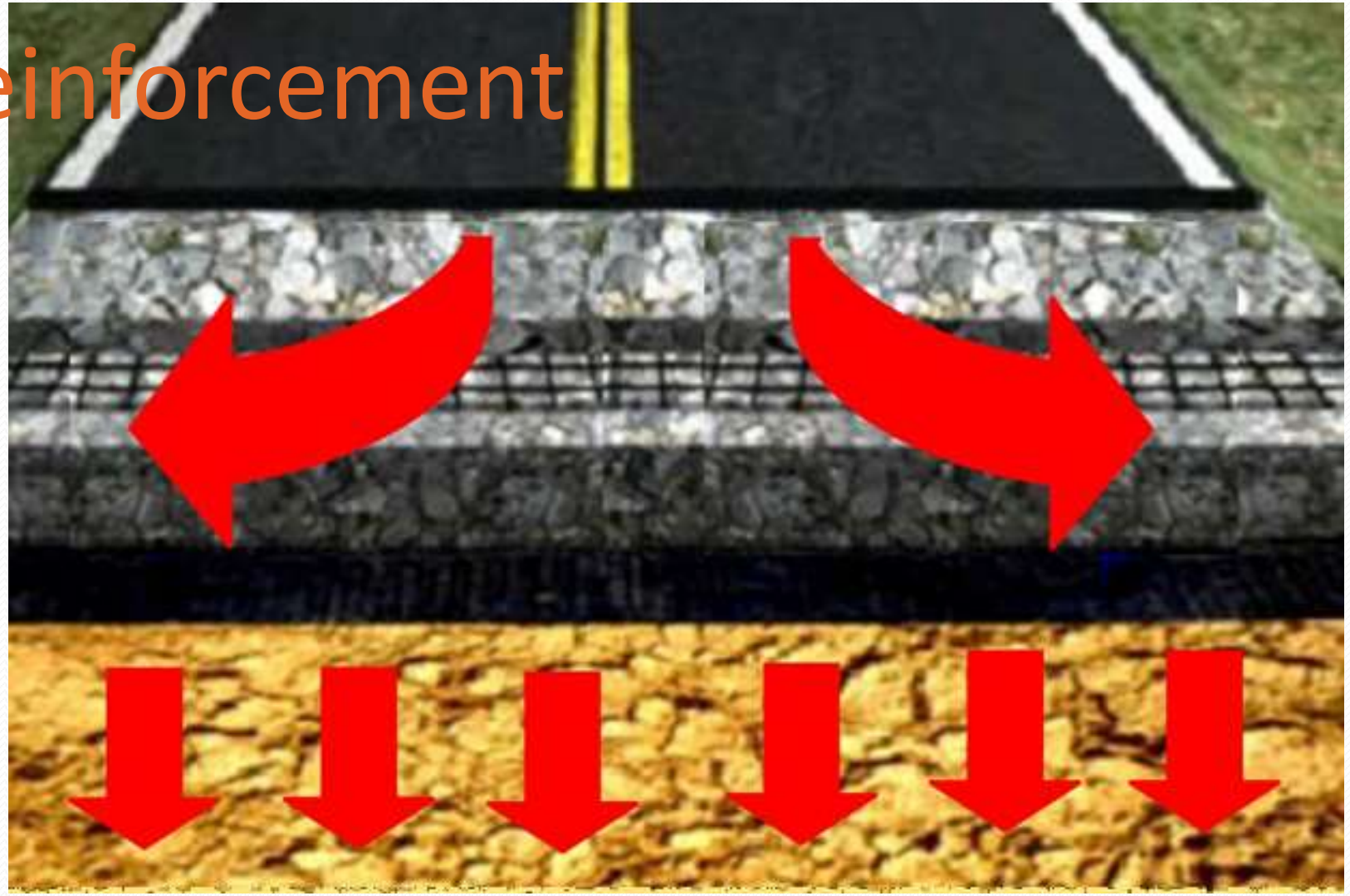


Prevents lateral movement of aggregate

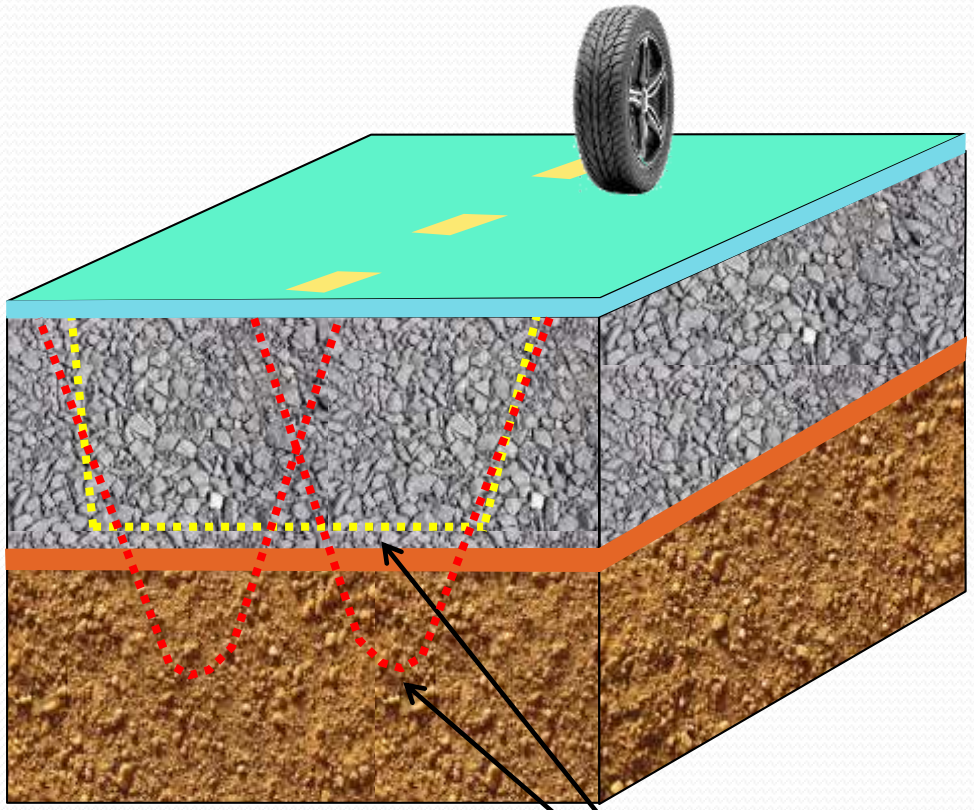
- Geotextile: Friction
- Geogrid: Interlock

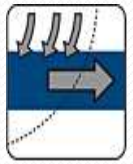
Improvement of the system strength created by the introduction of a geosynthetic into a soil/aggregate system

Reinforcement



Reinforcement



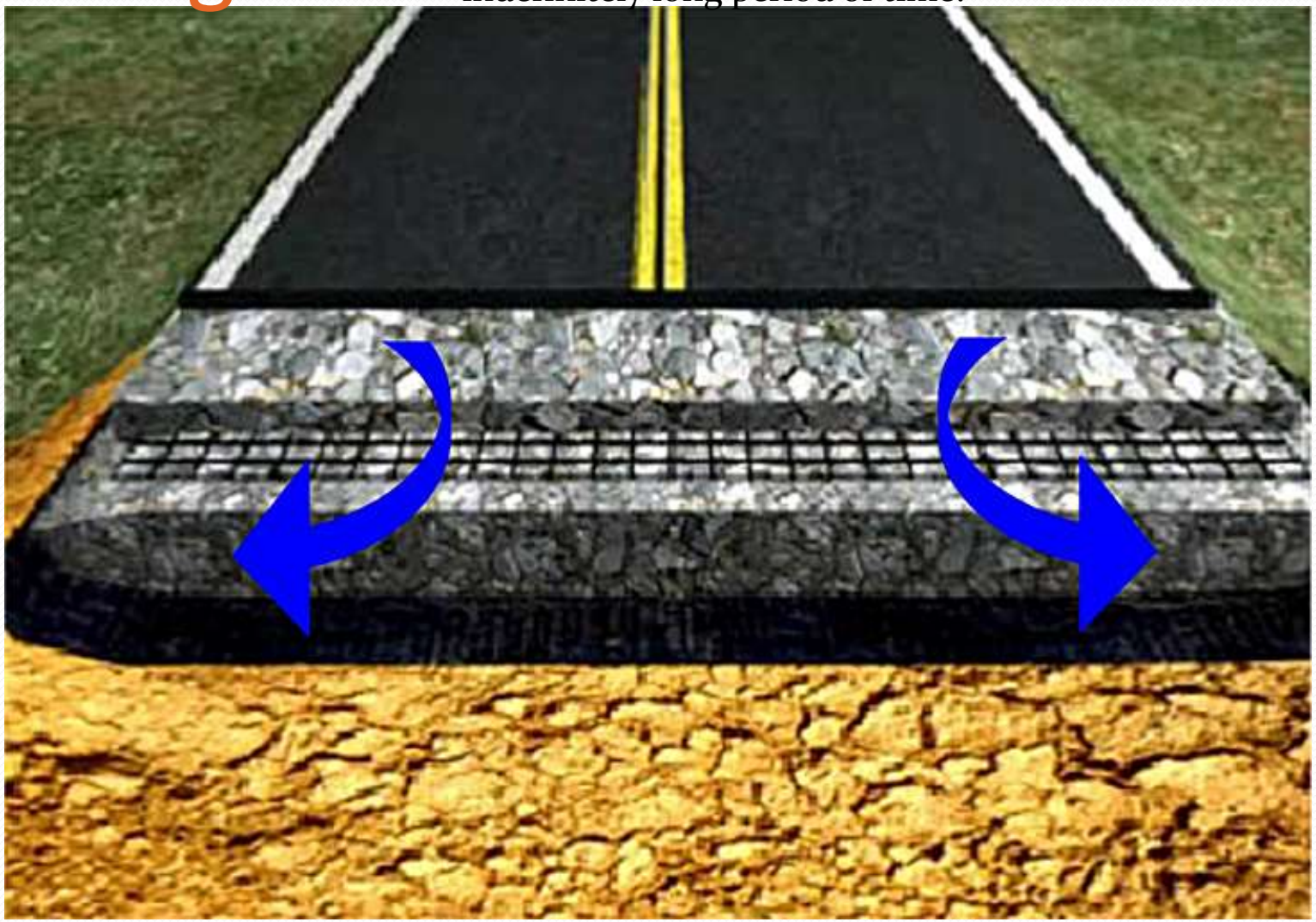


- Introduce a tensile element
- Improve bearing capacity
- Fine-grained silts & clays

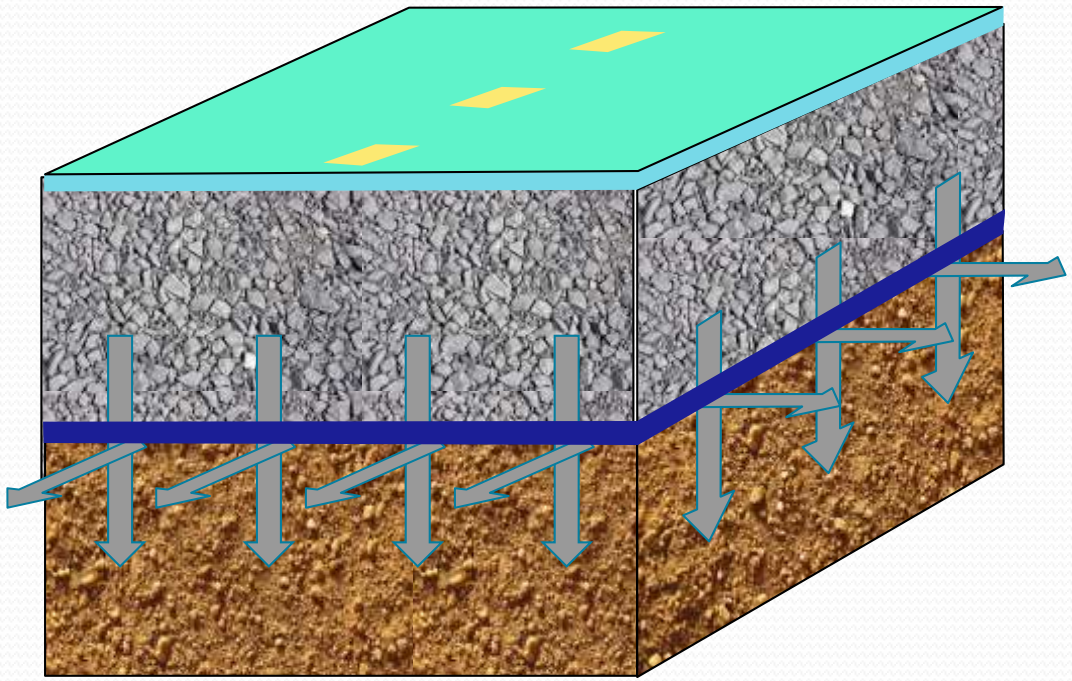
Unreinforced shear surface
Reinforced shear surface

Drainage

Fabric to soil system that allows for free liquid flow (but no soil loss) across or through the plane of the fabric over an indefinitely long period of time.



Filtration & Drainage

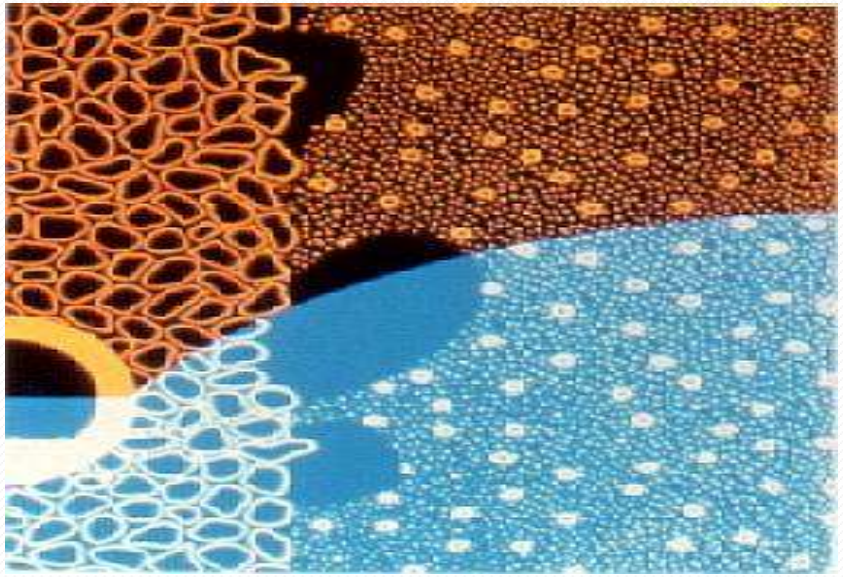


Filtration: Movement of liquid through the geosynthetic

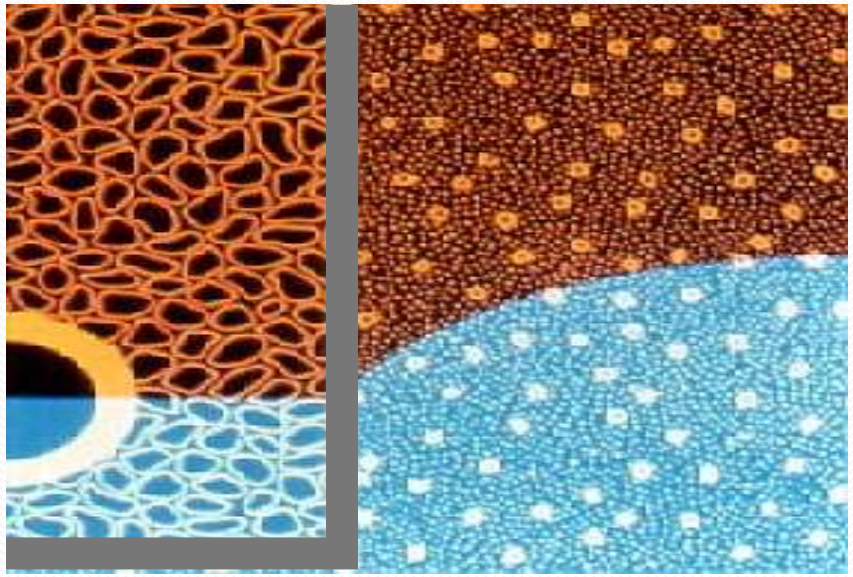
Drainage: Movement of liquid within the plane of the geosynthetic

Filtration

The ability of a geotextile to prevent excessive migration of soil particles, while maintaining the free flow of liquid through the filter layer.



No Geotextile



With Geotextile

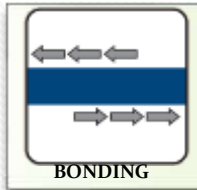
FUNCTIONS

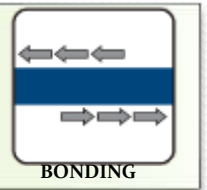
- 4 priorities

1. Moisture barrier

Slow down crack propagation

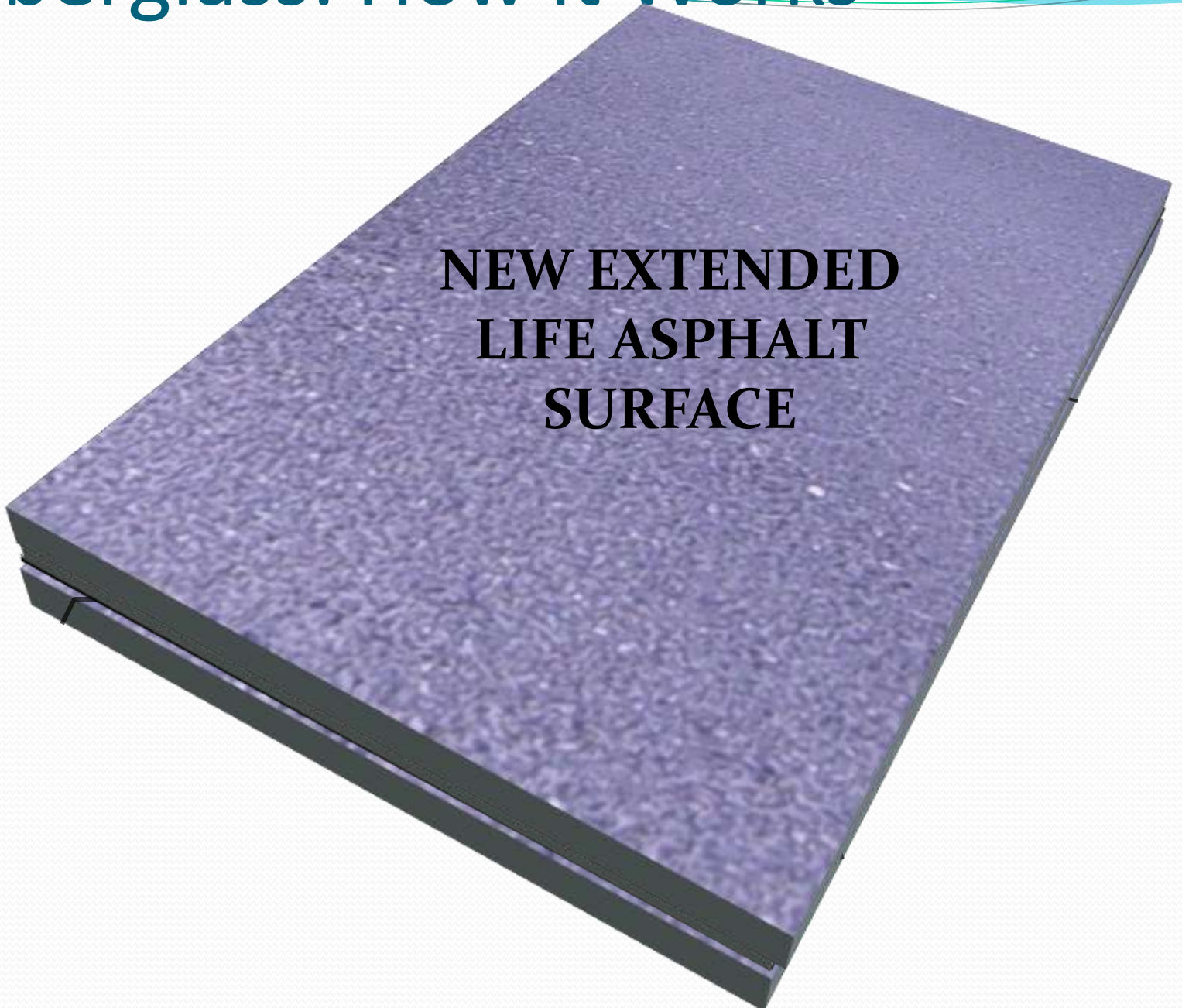
Provide bond





Maintain millability & recyclability

Fiberglass: How it Works



Effects of Water on Pavements

Interlayer Functionality

Loss of Base Load Bearing Capacity

- **Water intrusion through pavement into base:**

  33-67%

  Federal Highway Admin. (FHWA) RD 73-14, states; "between 33 and 67% of storm water infiltrates through the pavement"

  - **Asphalt** **from 33% - 50%**
  - **Concrete** **from 50% - 67%**

- **Pavement cracks increase base degradation:**
  Cracks significantly increase water penetration and base degradation, leading to loss of load bearing capacity.

Moisture Comparison

Mois


Street Paved with Engineered Paving Mat
Temperature 57°F, Humidity 82%
MAR 9 2006

Pavement Interlayers Work

Installed 2005

Innovative Geosynthetics for Roads


10439
Haslage
Trucking

Functions of Geosynthetics

- **Separation**
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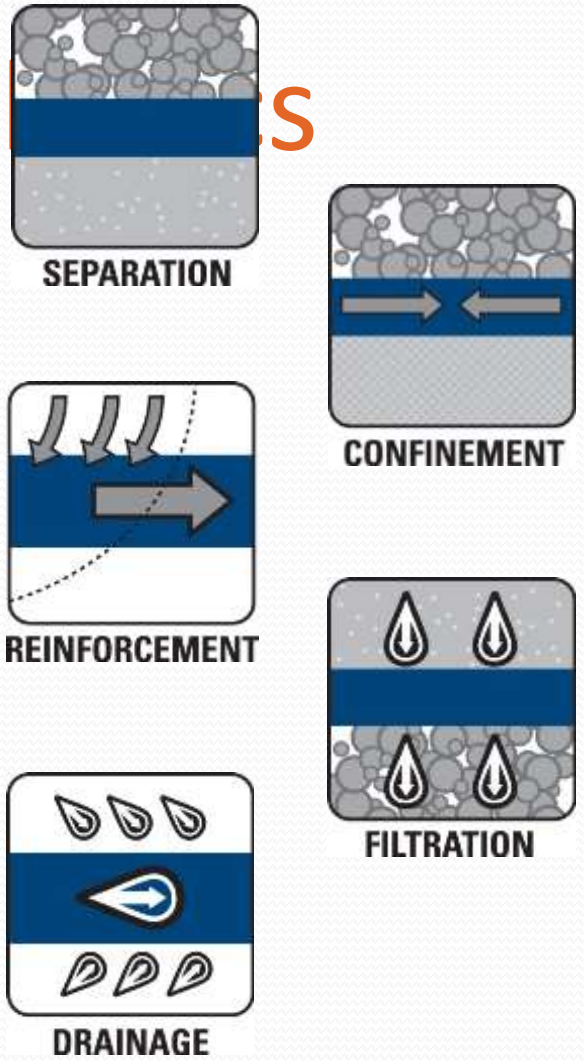
- **Reinforcement**
- **Filtration**
- **Drainage**

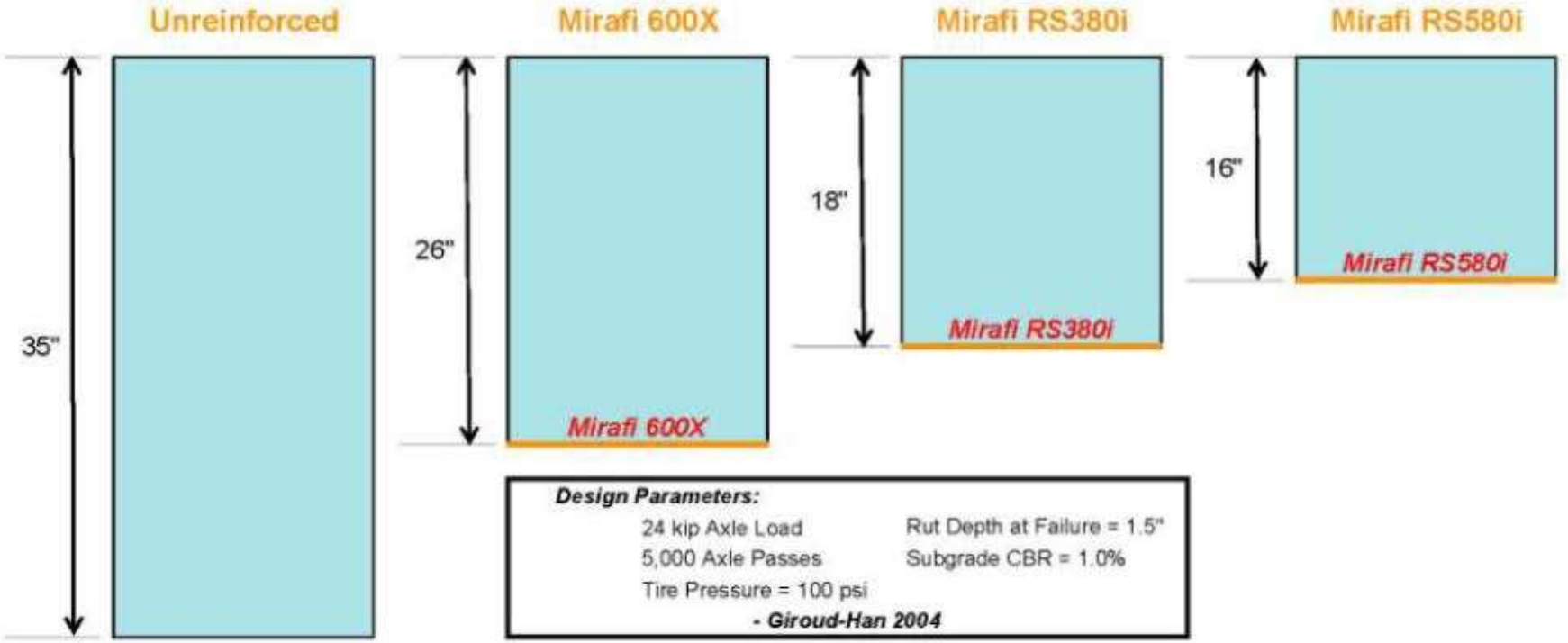


Functions Provided By Geosynthetics

Type	*Separation*	*Reinf.*	*Filter*	*Drainage*	*Conf.*
Non Woven	Yes	No	Yes	Yes	No
Woven	Yes	No	No	No	No
Monofilament	Yes	No	Yes	No	No
HP Series	Yes	Yes	Yes	Some	Some
Geogrid	No	Yes	No	No	Yes
RS*i*-Series	Yes	Yes	Yes	Yes	Yes

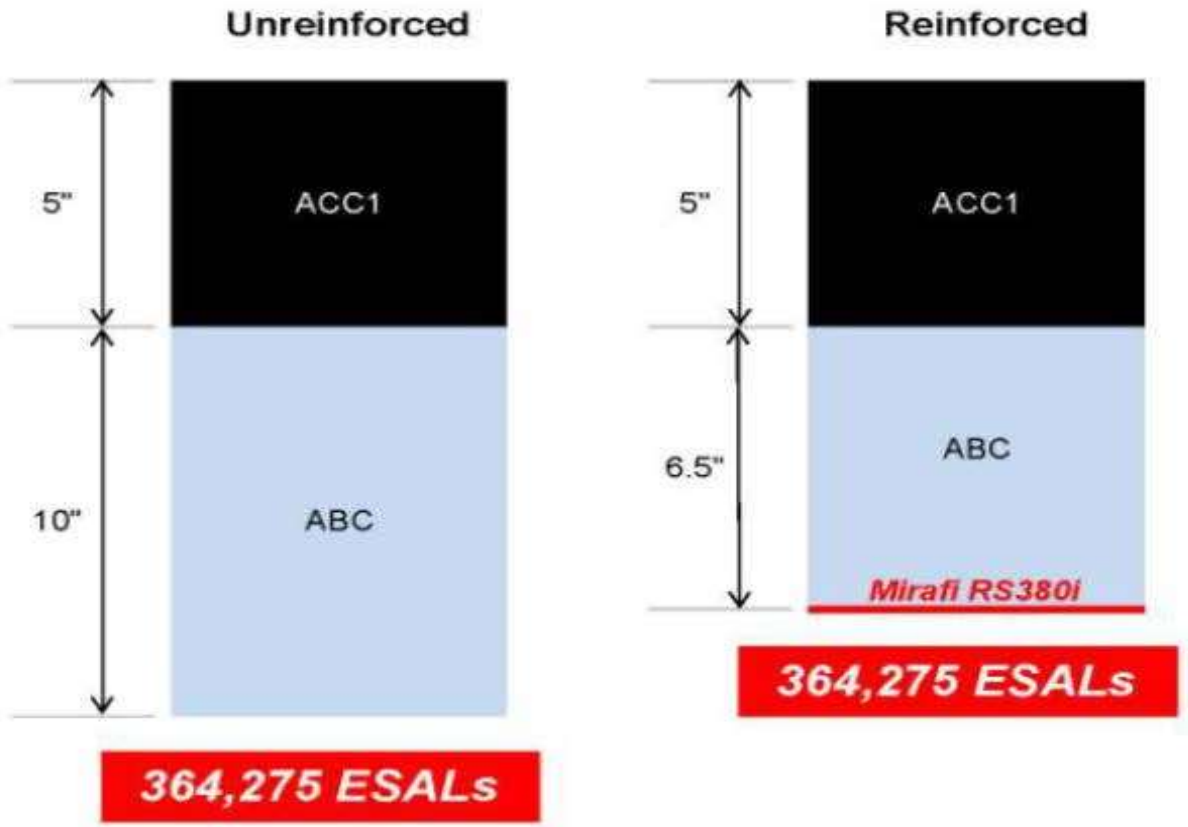

No Stabilization
Stabilized with RS580i

Example of Unpaved Application Comparison

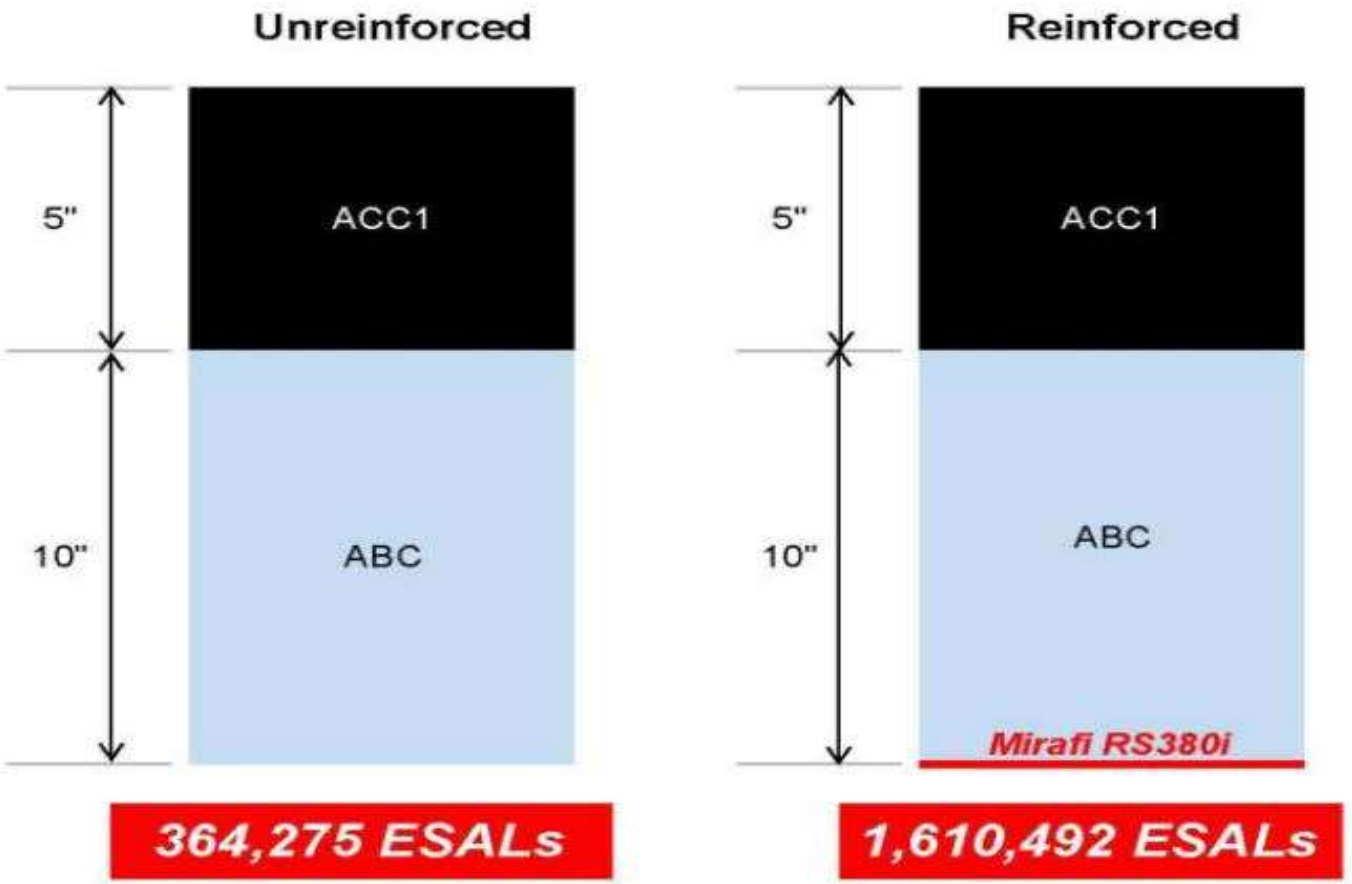


TENCATE
materials that make a difference

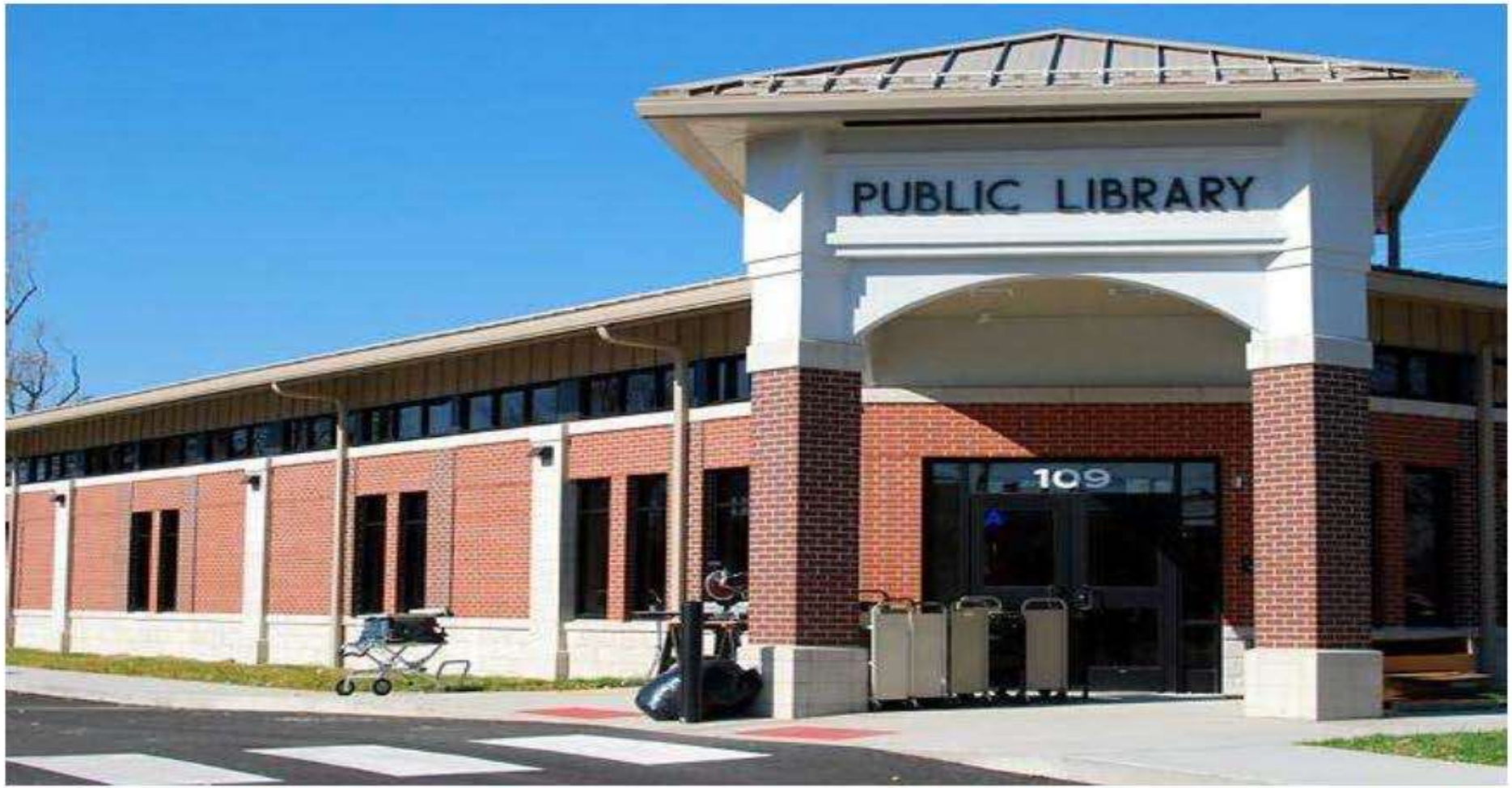
Comparing Option 1 - Unreinforced to Reinforced



Comparing Option 2 - Unreinforced to Reinforced



Mirafi® RS380i – Reduce Section Cost



TENCATE
materials that make a difference

Mirafi® RS380i – Reduce Section Cost

Original Section:

36" stone @ $15.00 / ton	= $ 27.00 / SY

Geosynthetic Reinforced Section:

RS380i @ $4.25 / SY (installed)	= $ 4.25 / SY
18" stone @ $15.00 / ton	= $ 13.50 / SY
Total Section	= $ 17.75 / SY
Savings	= $ 9.25 / SY (34%)

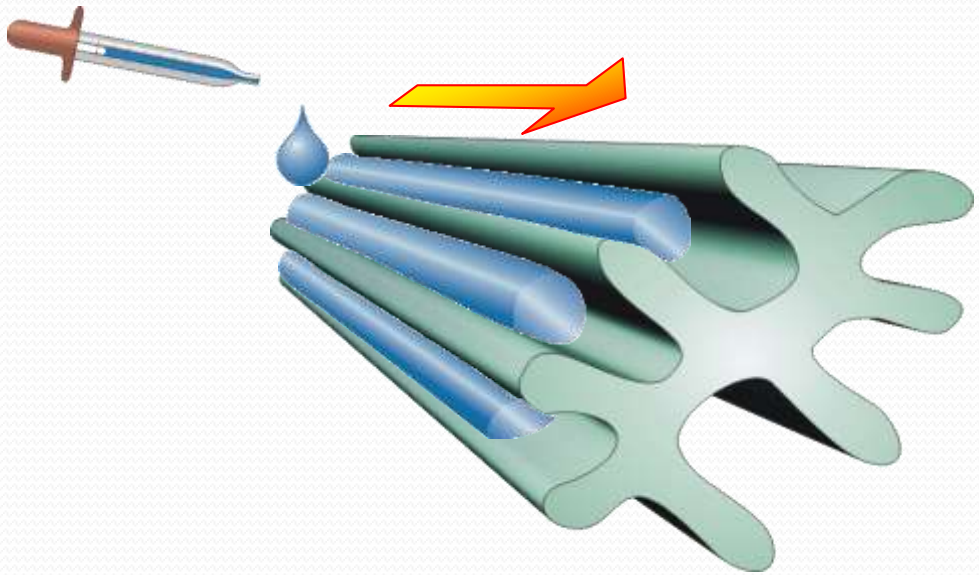
H_2Ri High Strength Wicking Geotextile

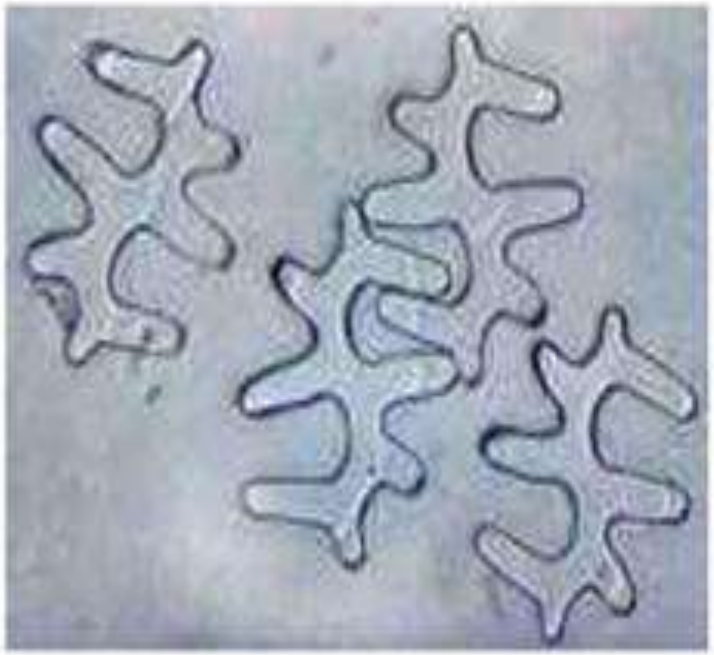
Nylon wicking fibers (blue) are:

Hygroscopic (pull water)

Hydrophilic (retain water)

Deep grooved fibers (4DG)





Dalton Highway without Mirafi® H_2Ri, May 2013

Dalton Highway with Mirafi® H_2Ri, May 2013

Questions?