Rain Smart

A Smarter Way to Manage Stormwater…

WELCOME TO RAINSMART SOLUTIONS

Environmentally Sustainable PRODUCTS & SOLUTIONS Presentation.

Current Situation:

Kerb inlets back in Roman Era

Kerb inlets of the 21st Century.

Very Surprisingly, BUT TRUE:

Our Current Stormwater Management System originated in the early Roman Era and has not changed much for well over a thousand years. Stormwater pits and pipe network discharging millions of litres of fresh precious resource into our waterways.

Due to modern techniques of Urbanisation and increased impermeable surface this resource also becomes a major source of contamination for our rivers, ocean and waterways.

Current Situation:

Impermeable Roads in Roman Era

Impermeable Roads in 21st Century

Current Situation:

Road Drainage in Ancient Greek Cities.

Roads in 21st Century

Current Situation:

Resource being wasted!

Results of Current Situation.

Flooding

Erosion

Contamination of our Waterways

Rainsmart Aim & Mission:

- To turn Stormwater Management a Major Environmental issue into a rejuvenated asset.
- Capturing and Recycle significant quantities of stormwater runoff from impervious surfaces and to reduce dependence on existing fresh water supply.
- Significantly reducing (or eliminating) stormwater runoff through existing pipe network, resulting in cleaner rivers, harbours, oceans and waterways.
- Recharge Groundwater aquifers without contamination.
- Reduce Impermeable Surfaces and create Eco-Friendly, Green Roofs for Greener, Cleaner, Healthier Cities.

A Smarter Solution:

2 Step Smarter Approach:

- Step 1:
  Reduce the Quantity of Storm Water Runoff:
  (Permeable Surfaces)

- Step 2:
  Capture Storm Water Runoff:
  (Retention, Detention, Infiltration, or Recycling)

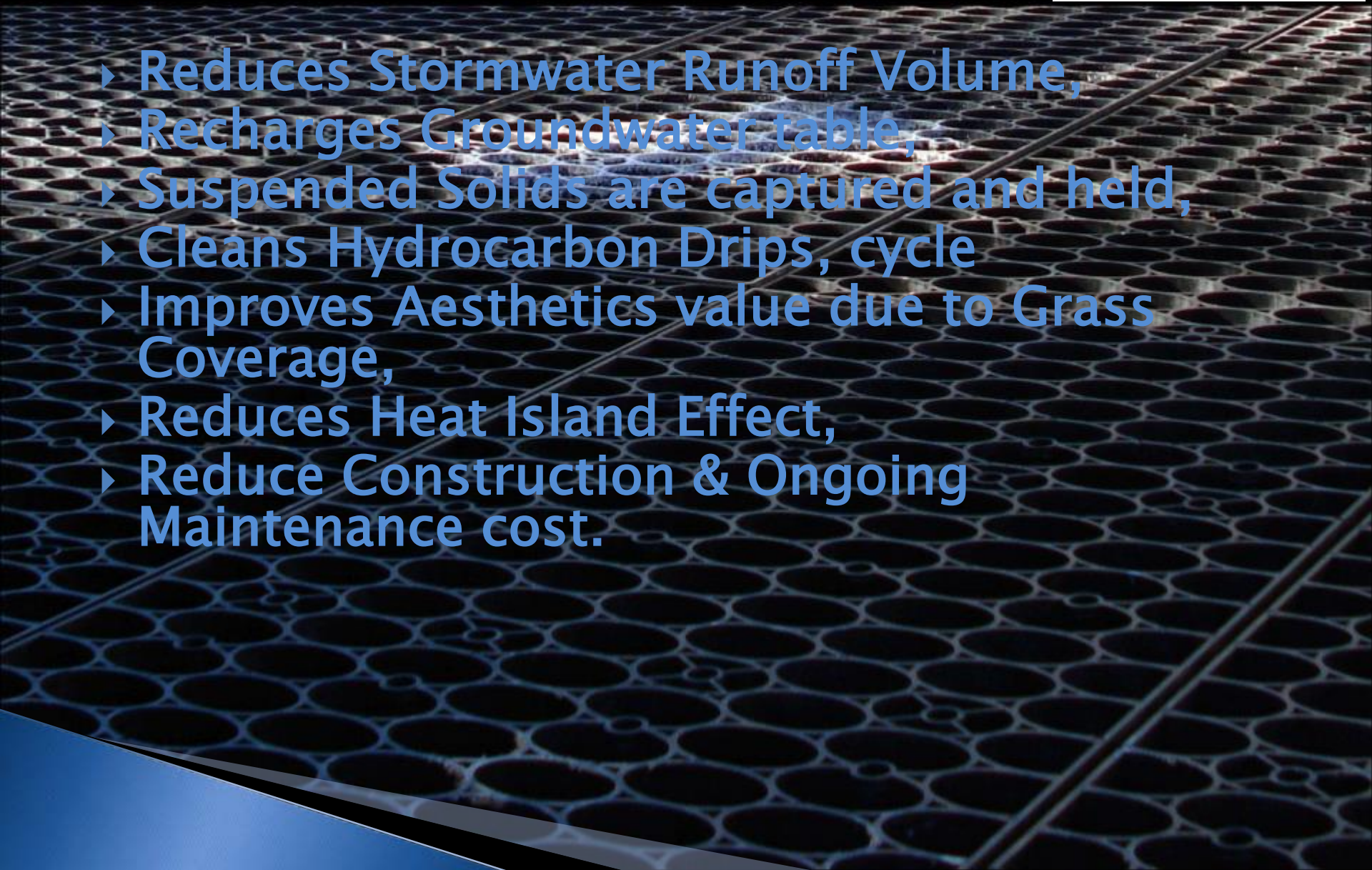
A Smarter Solution:

Step 1:

Reduce the Quantity of Stormwater Runoff:

(Increase Permeable Surfaces)

Benefits of Permeable Surface



- Reduces Stormwater Runoff Volume,
- Recharges Groundwater table,
- Suspended Solids are captured and held,
- Cleans Hydrocarbon Drips, cycle
- Improves Aesthetics value due to Grass Coverage,
- Reduces Heat Island Effect,
- Reduce Construction & Ongoing Maintenance cost.

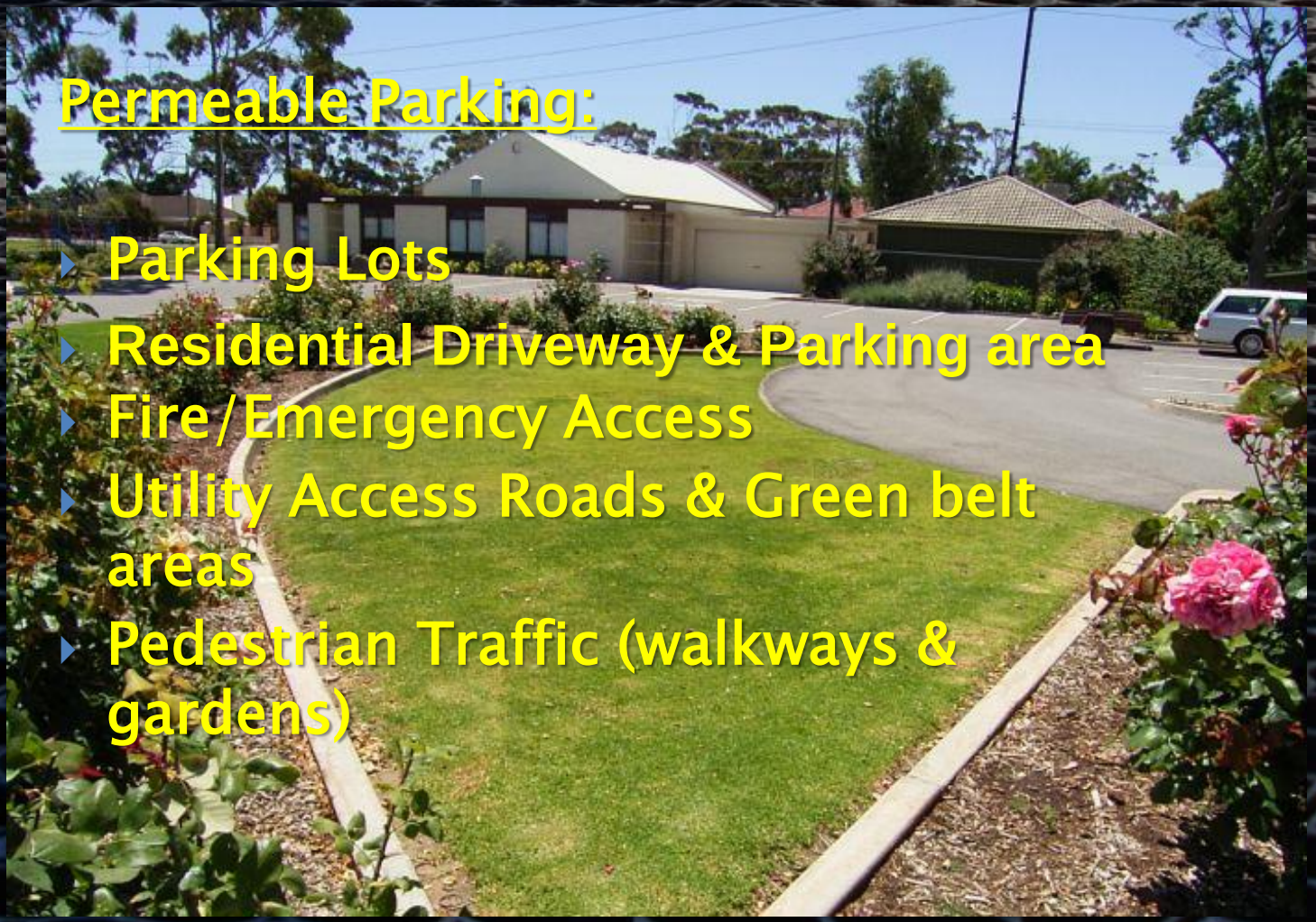
Reducing Stormwater Runoff Volume:

Rational Method:(Q = C i A)

- Modify C (Runoff Coefficient)
- Streets: C = .70 to .95
- Lawns: C = .05 to .35

Hence by having strategic permeable surfaces in New Developments we can reduce Stormwater Runoff volume by at least 35 to 80%

Primary Application:



Permeable Parking:

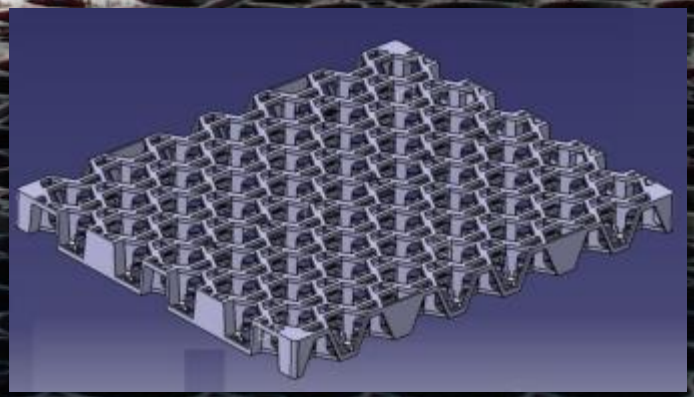
- Parking Lots
- Residential Driveway & Parking area
- Fire/Emergency Access
- Utility Access Roads & Green belt areas
- Pedestrian Traffic (walkways & gardens)

Porous Paving System:

- 3 Style of product:

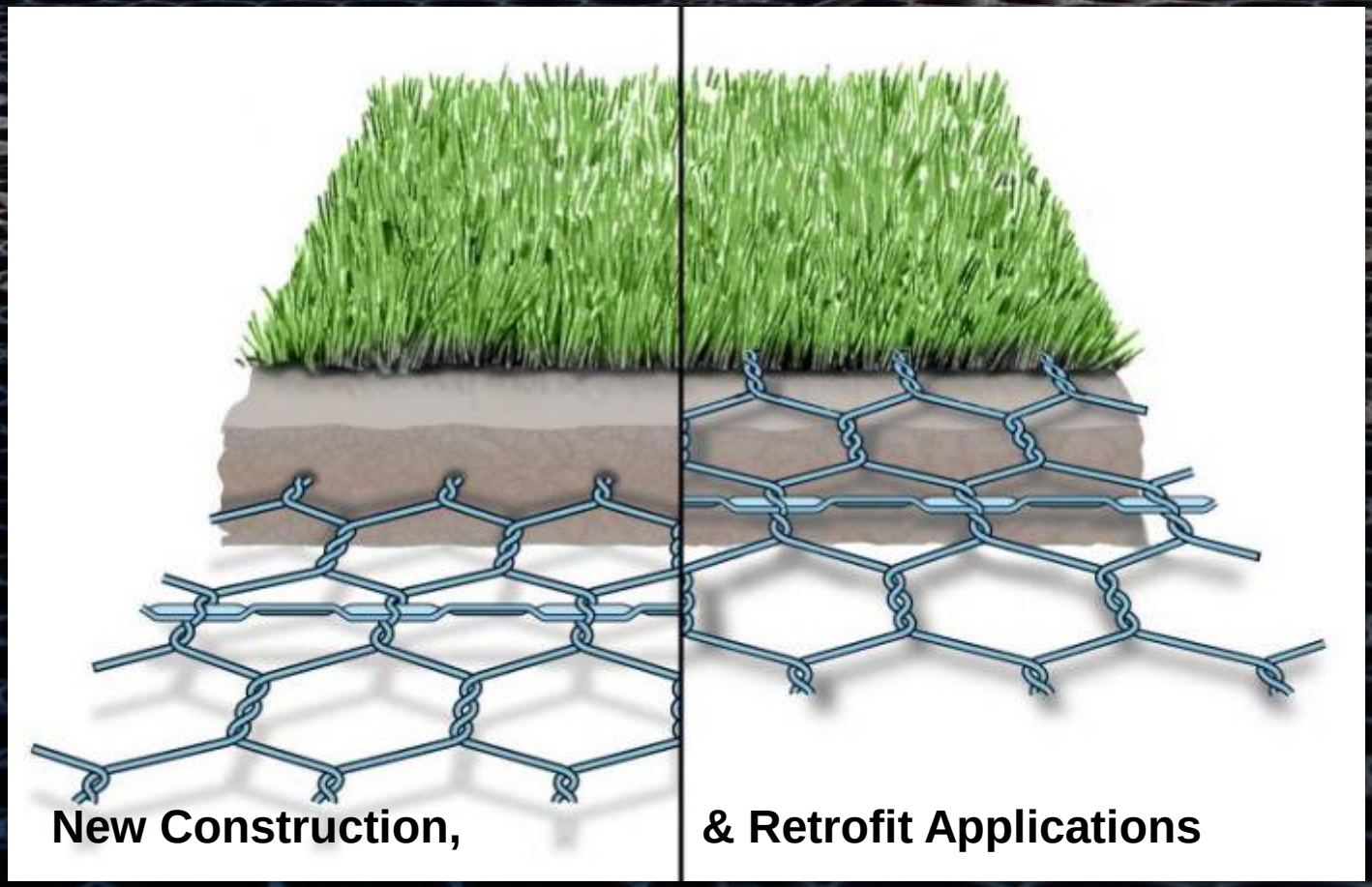
Reinforcing Only

Compaction Resistance Only



Reinforcing and Compaction Resistance

Porous Paving System:



New Construction, **& Retrofit Applications**

Strength of product typically reduces base requirements but only provides reinforcement.

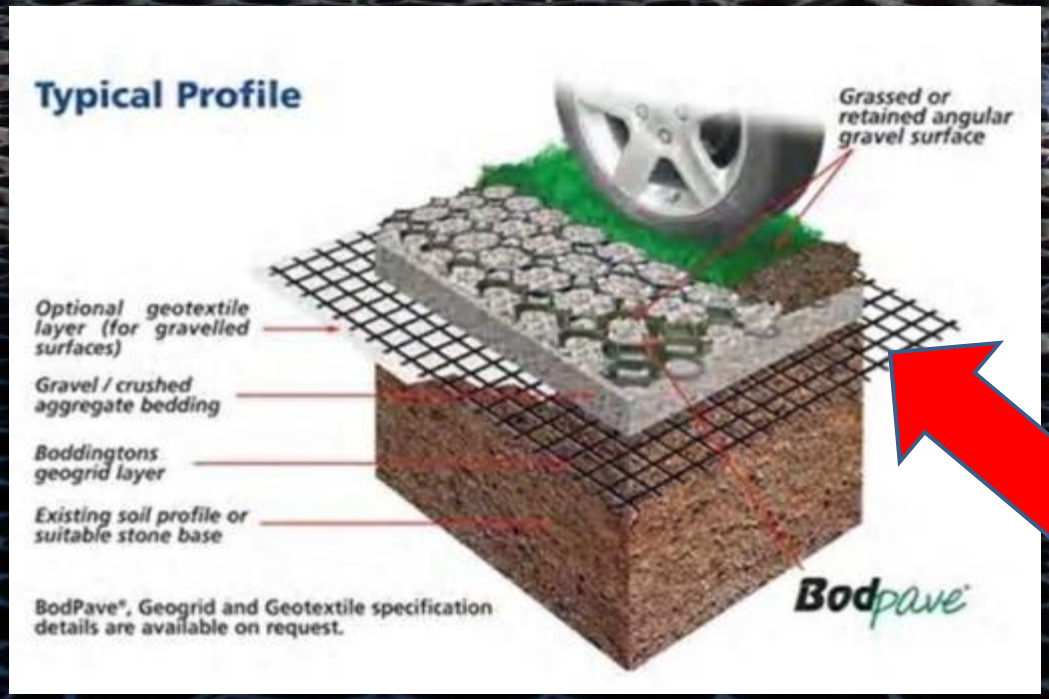
Porous Paving System:

High Compressive strength: 140 ton/m2 prior to filling 3800 ton/m2 when filled with sand

NO Horizontal Root growth.

Compaction Resistance Only

Porous Paving System:



- Designed only to prevent compaction of infill material
- No Horizontal root growth

Proper base preparation is very critical in such applications – base deflections WILL deform the surface!

Porous Paving System:

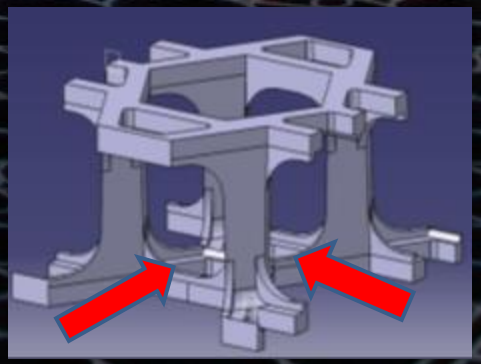
RAINSMART SOLUTIONS

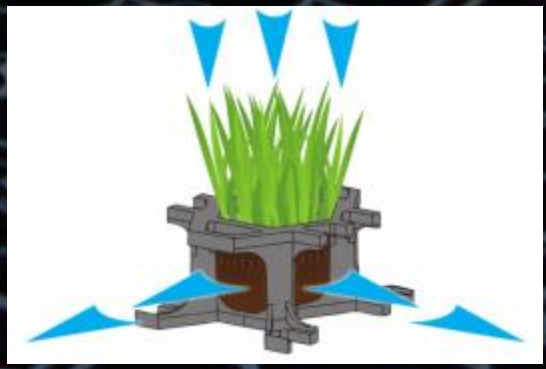
NEROPAVE PERMEABLE PAVING

>20 ton/m2

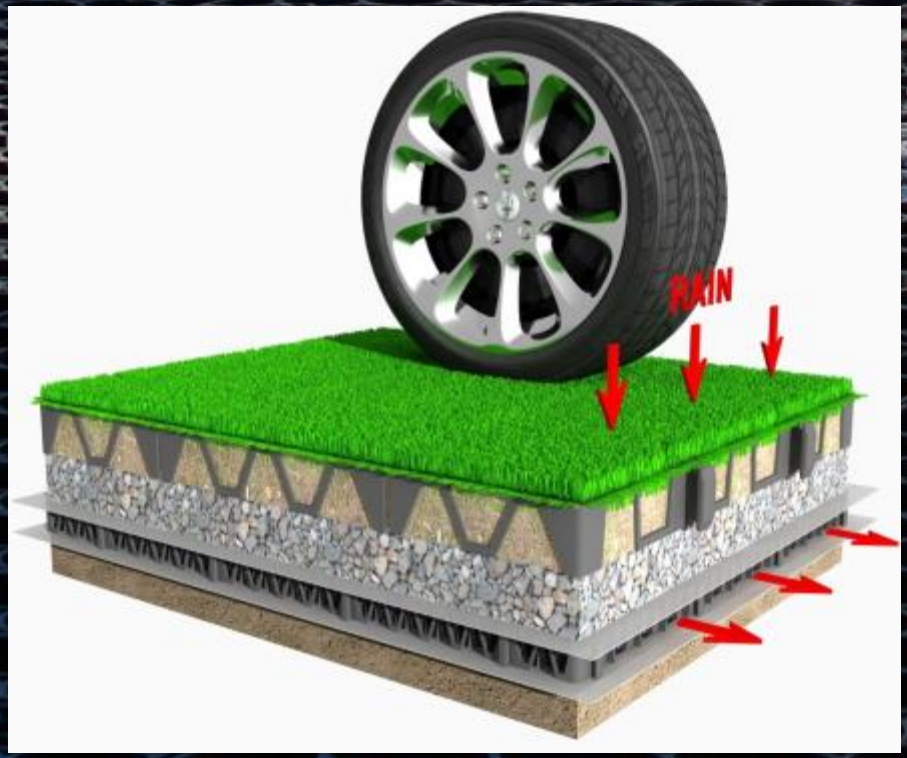
Designed for Reinforcing and Compaction Resistance.

Only system which promotes Horizontal as well as vertical root growth.

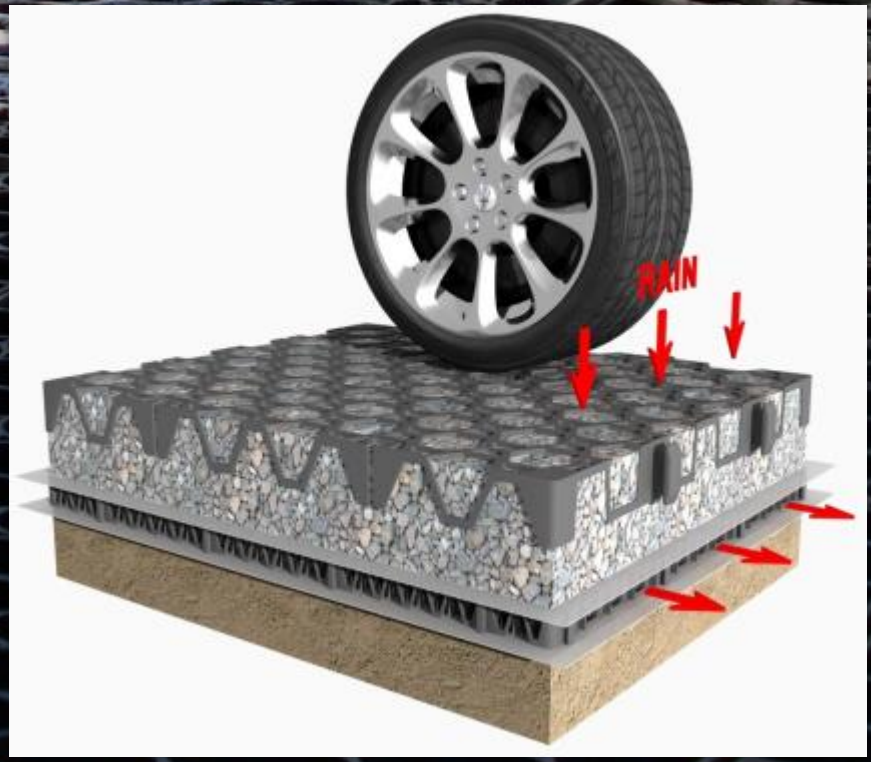




Porous Paving System:

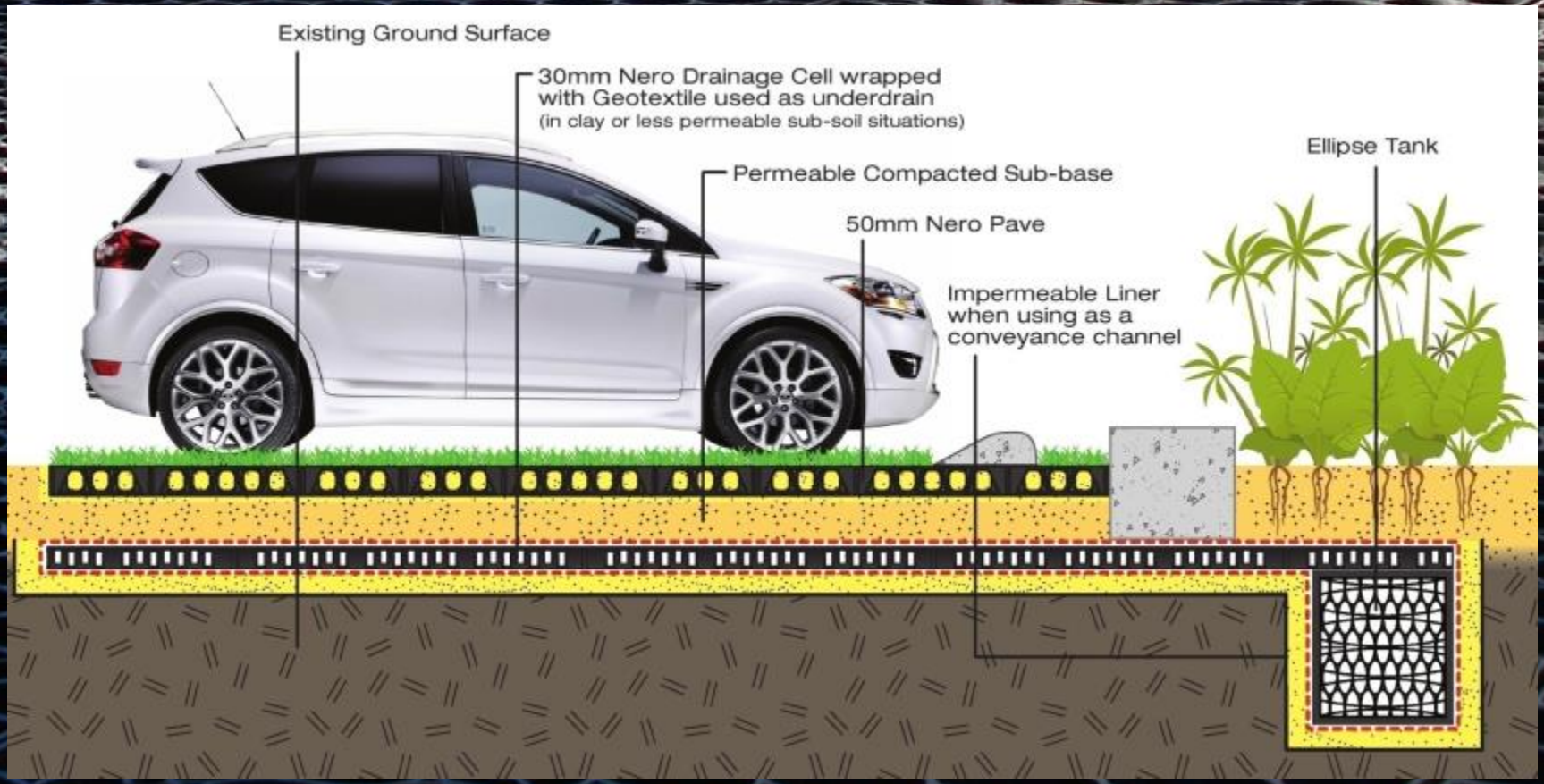


Grasspave Application



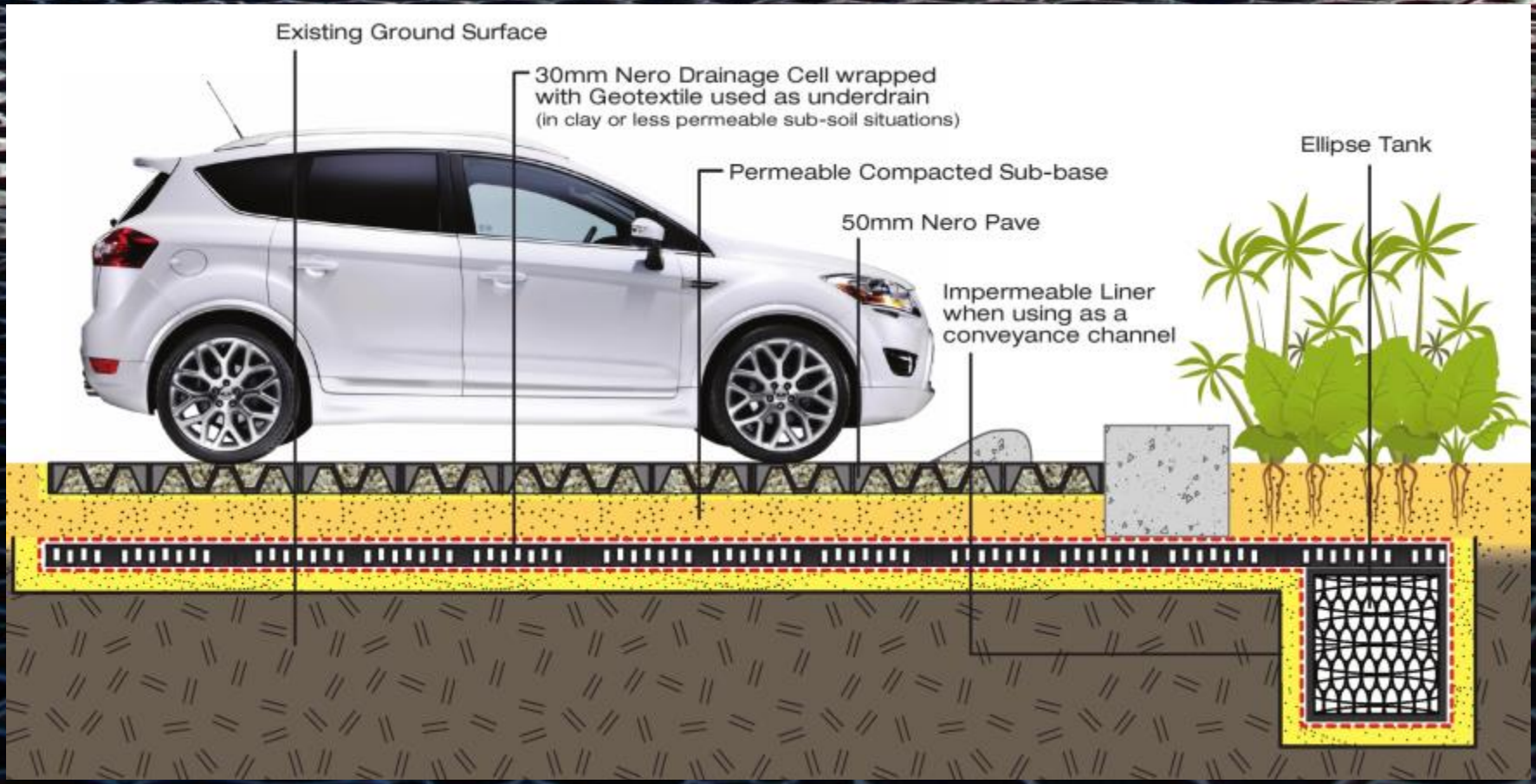
Gravelpave Application

Porous Paving System:



Grass Pave Application

Porous Paving System:



Gravelpave Application

Porous Paving System:

Example of Permeable Grass Pave for Boat Ramp and Car Parking Area.

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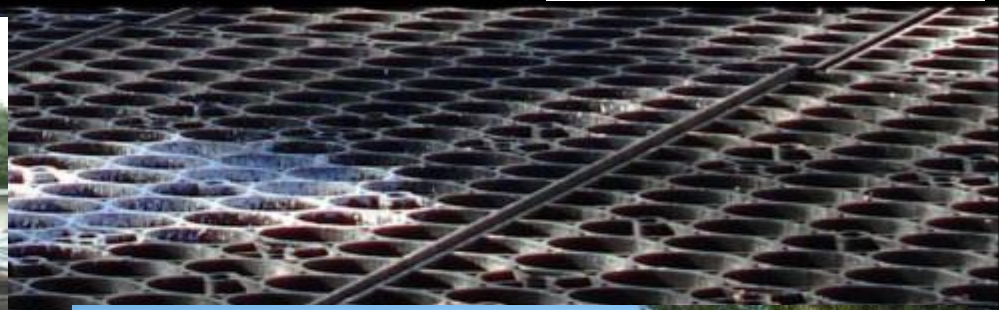

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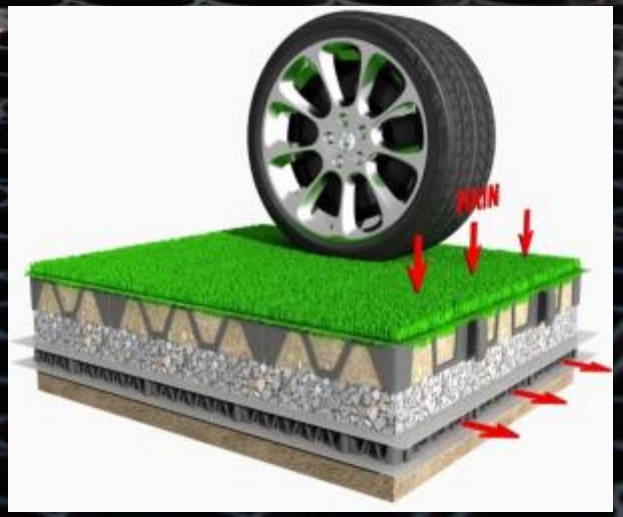
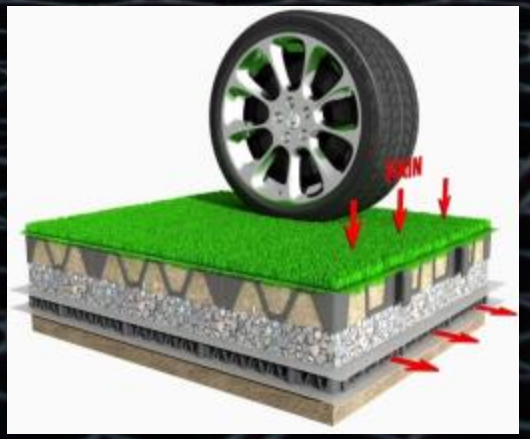


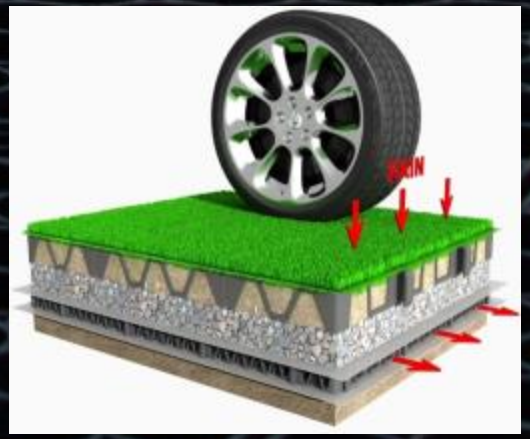
Fire Access Lane done using Grass paving system, reducing the impermeable surface in the development.

Porous Paving System:



Example of Permeable Green parking space using Grass Paving system and increasing the built-up area.

Porous Paving System:



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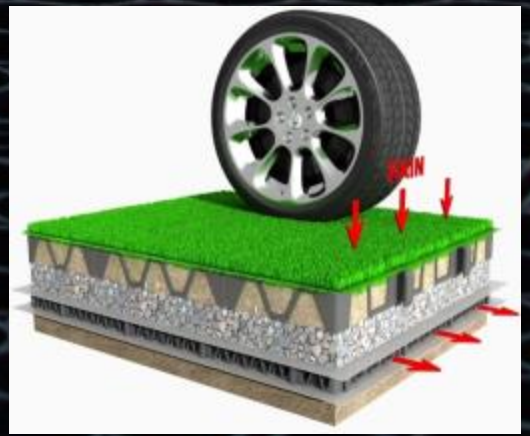

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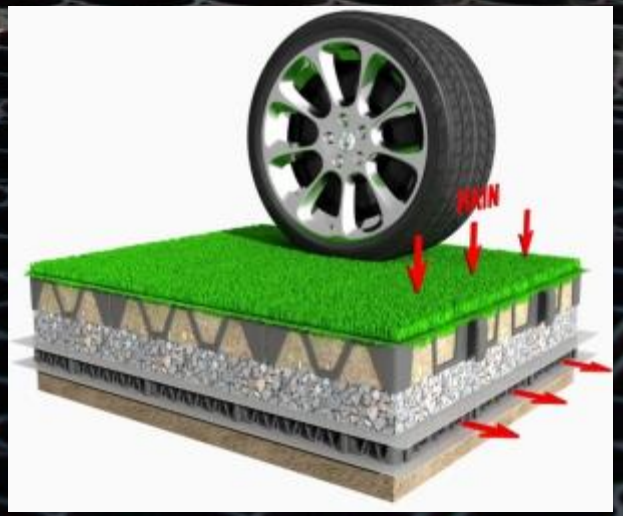

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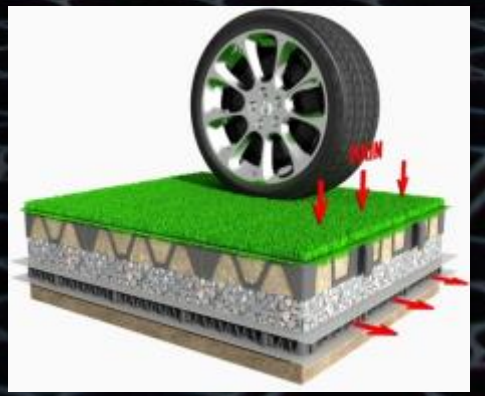
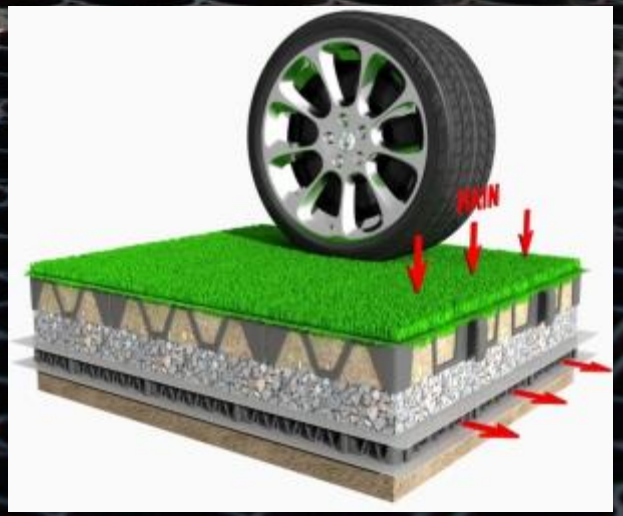


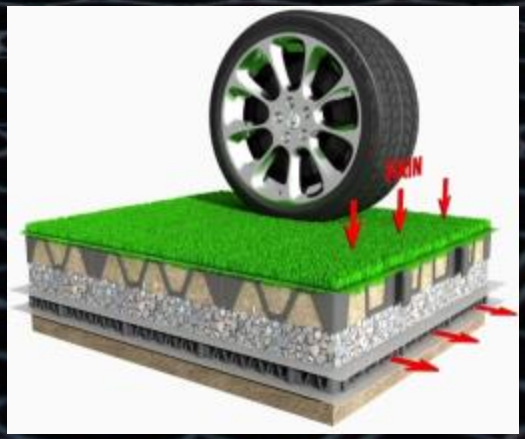
Car park done using Grass paving system, reducing the impermeable surface in the development.

Grass Paving System:



Overflow Car park done using Grass paving system, reducing the impermeable surface in the development.

Porous Paving System:

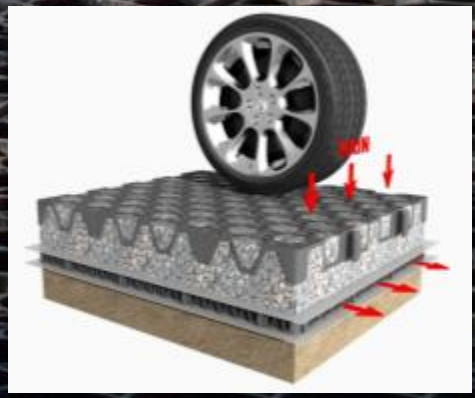


Example of Permeable Green parking space using Grass Paving system and increasing the built-up area.

Porous Paving System:

Example of Permeable Gravel Pave for Drive Way and Parking Area.

Porous Paving System:



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Example of Permeable Gravel Pave for Drive Way and Parking Area.

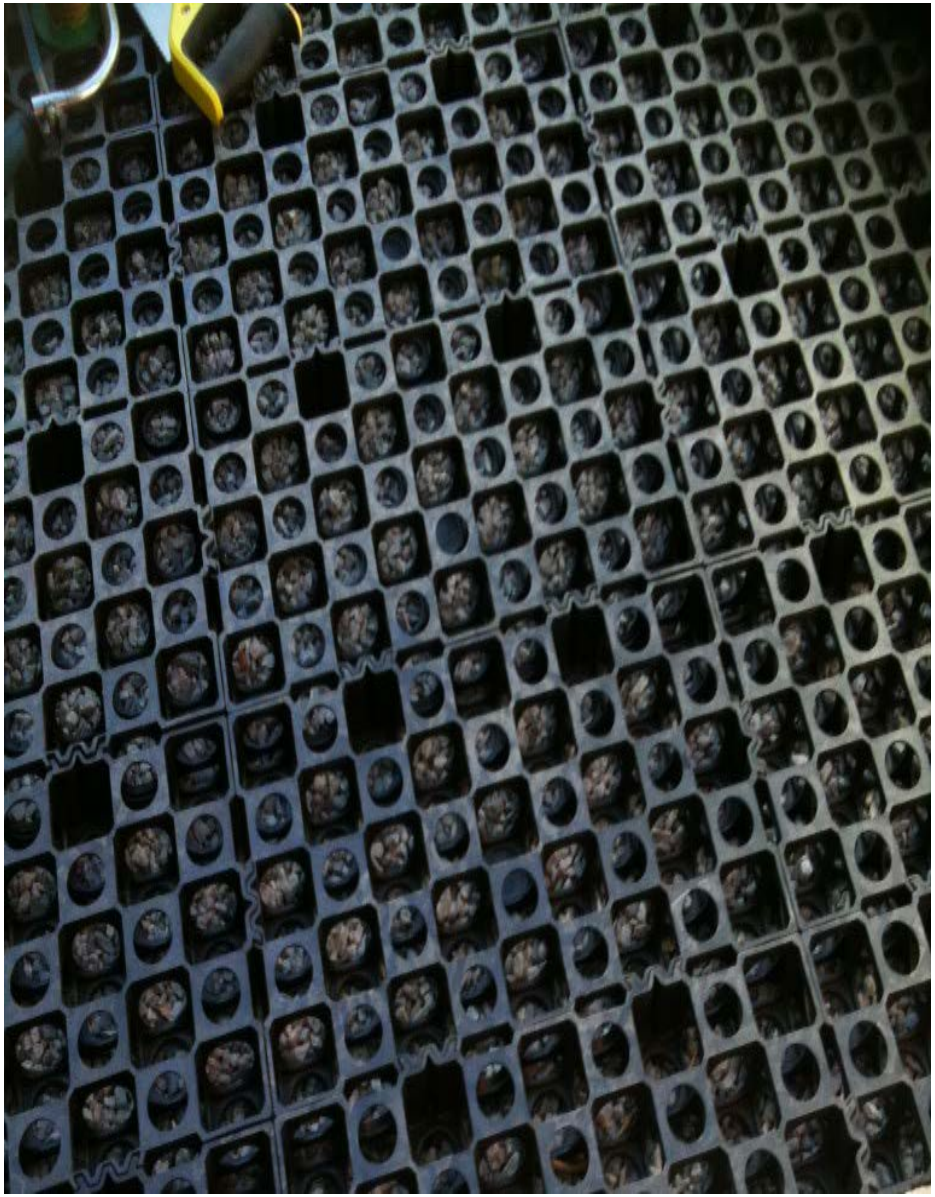
Porous Paving System:

Example of Permeable Grass /Gravel Pave for Drive Way and Parking Area.

RAINSMART SOLUTIONS LOCAL INSTALLS

RESIDENTIAL DRIVEWAY - YOKINE

RESIDENTIAL DRIVEWAY - YOKINE



CARAVAN PARK – SEASPRAY, DONGRA

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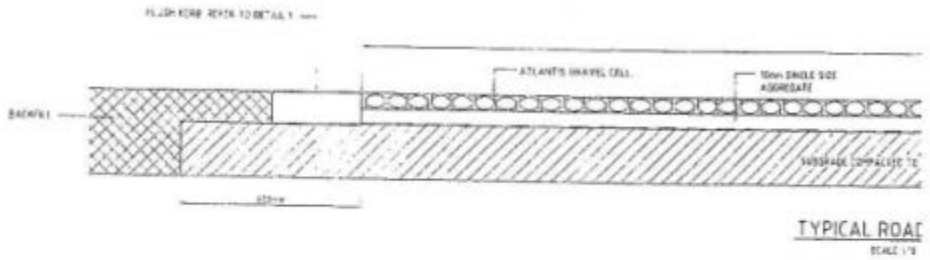
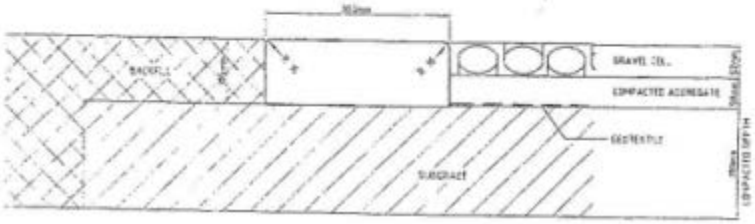
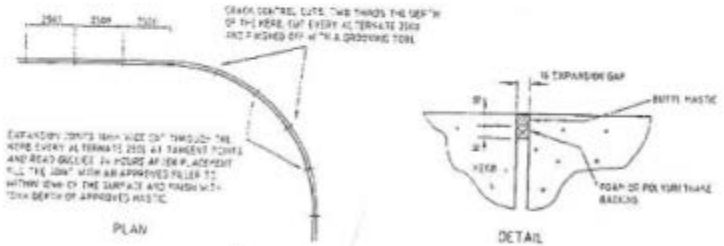


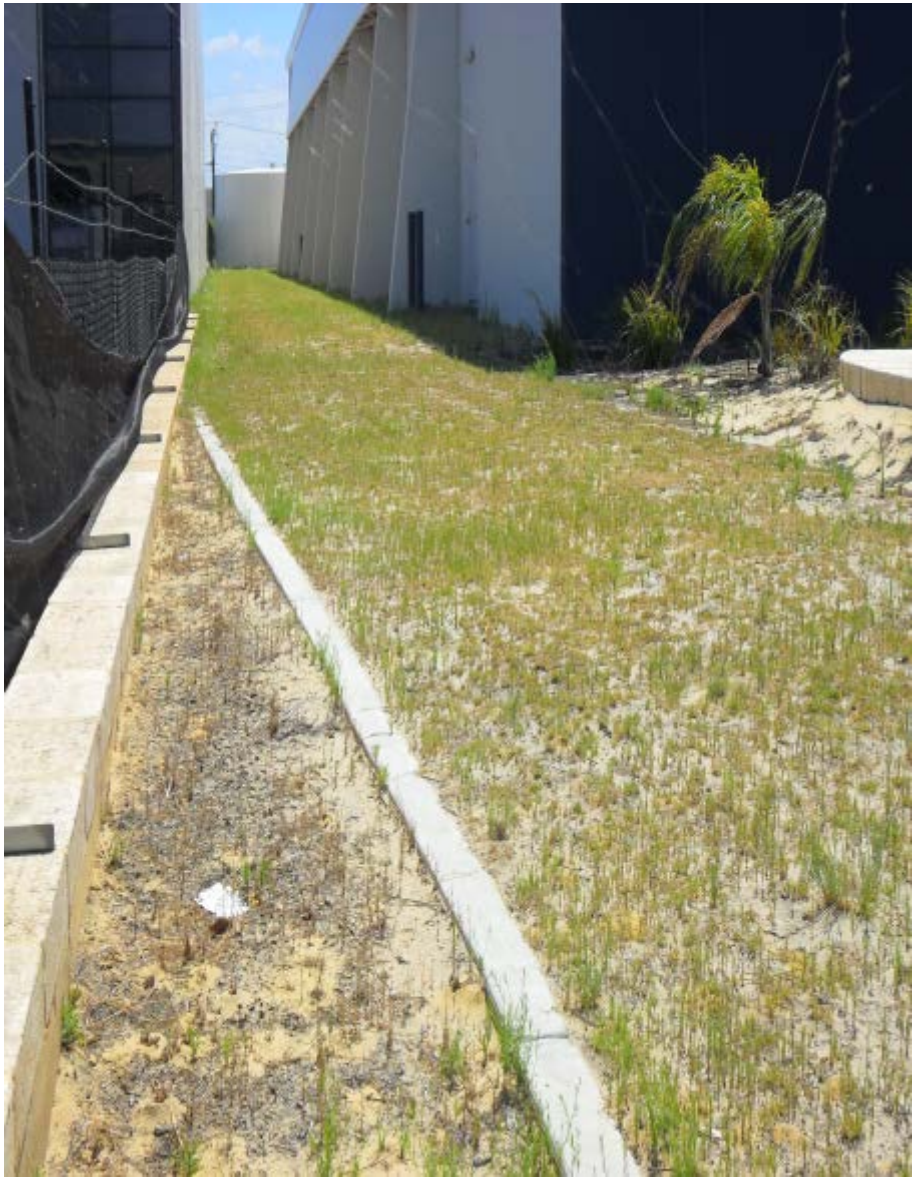
TYPICAL ROAD



DETAIL 1 – FLUSH KERBING (NOT TO BE CUT)

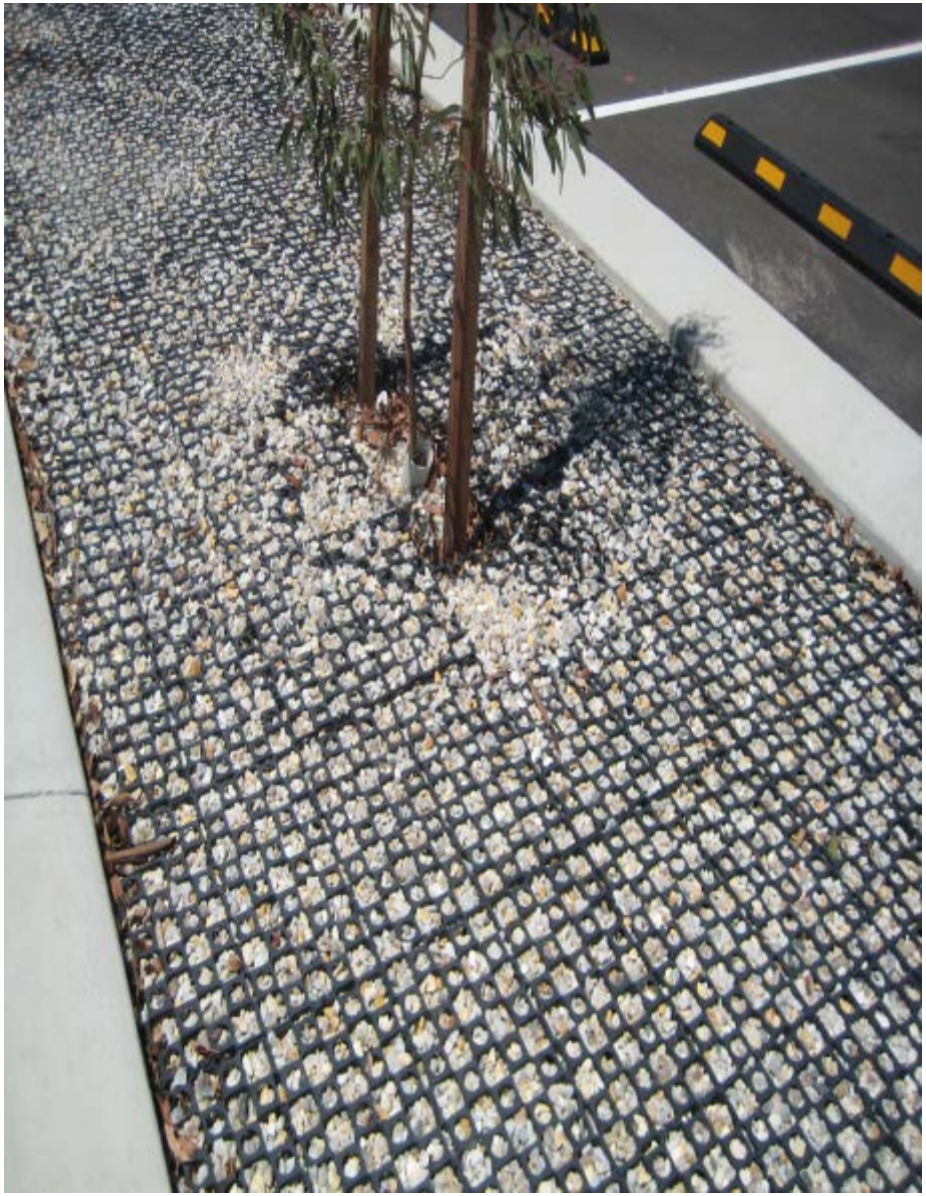


FIRE TRUCK ACCESS RD - MALAGA



LAUNCH RAMP – COOGEE BEACH RESCUE VEHICLE

CRICKET CLUB - GOSNELLS



Pervious Concrete Pavement
A new road construction paradigm

Eddy Wajon

Wajon and Associates

February 2015

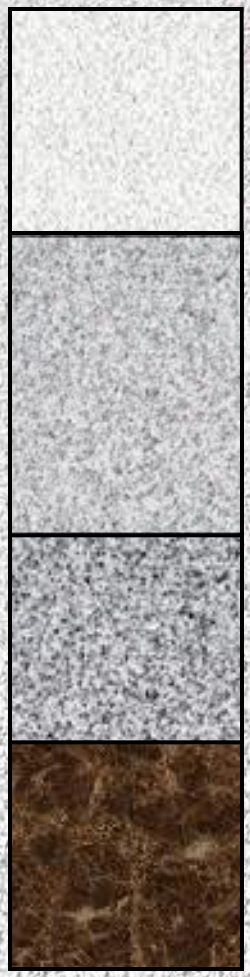
Pervious concrete pavement: what is it

Photo courtesy of John Harrison and TecEco

Pervious concrete pavement: what is it

Photo courtesy of Scott Erickson and Evolution Paving

Pervious concrete pavement design



200 mm concrete using mono-graded 6 mm aggregate

15 - 20% voids

250 mm base course using gap-graded 18 mm and 6 mm aggregate

15 - 50% voids with capacity for design storm

200-500 mm compacted graded sand or

200 mm sub-base using graded aggregate

Suitable subgrade

Graphic courtesy of John Harrison and TecEco

Pervious concrete pavements: The Vision

Roads which have less impact on the environment and the community, and contribute to sustainability

The potential for reduced impacts and increased benefits from pervious concrete pavements:

- **no interruption of natural drainage flow, either vertically (infiltration) or horizontally (crossflow)**
- **avoid or reduce the cost of drainage infrastructure**
- **reduced clearing footprint as a result of reduced drainage infrastructure**
- **reduced collisions with native animals and reduced death and serious injury to either humans or animals**
- **purify rainwater / road generated drainage which could be captured for direct use at low cost**
- **sequester carbon**
- **safer because they are drier, brighter and have more traction.**

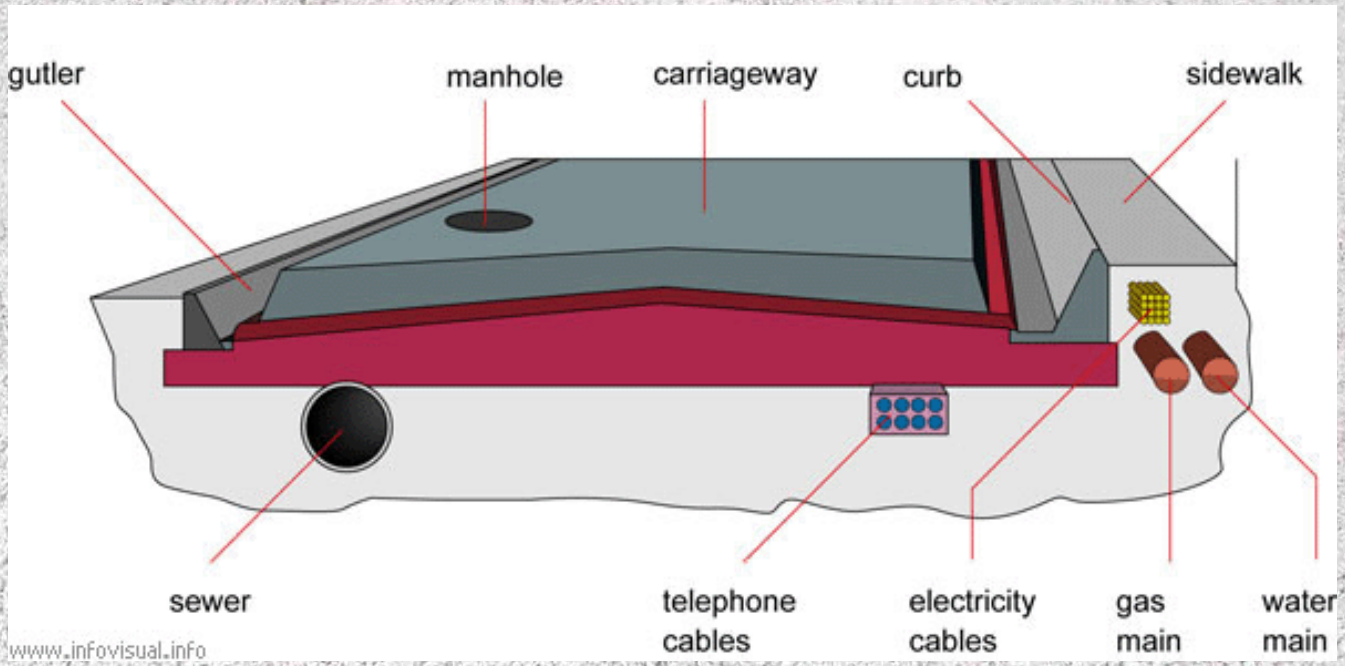
Permecocrete

Uses Eco-cements (15-95% MgO, 85-5% Portland cement)

- contains reactive magnesia
- can contain pozzolans to create greater durability
- carbonates form fibres and needles which tend to lock together giving very high strength over time
- reduced permeability and shrinkage
- can use of a wide range of aggregates (including recycled concrete)

Data courtesy of John Harrison and TecEco

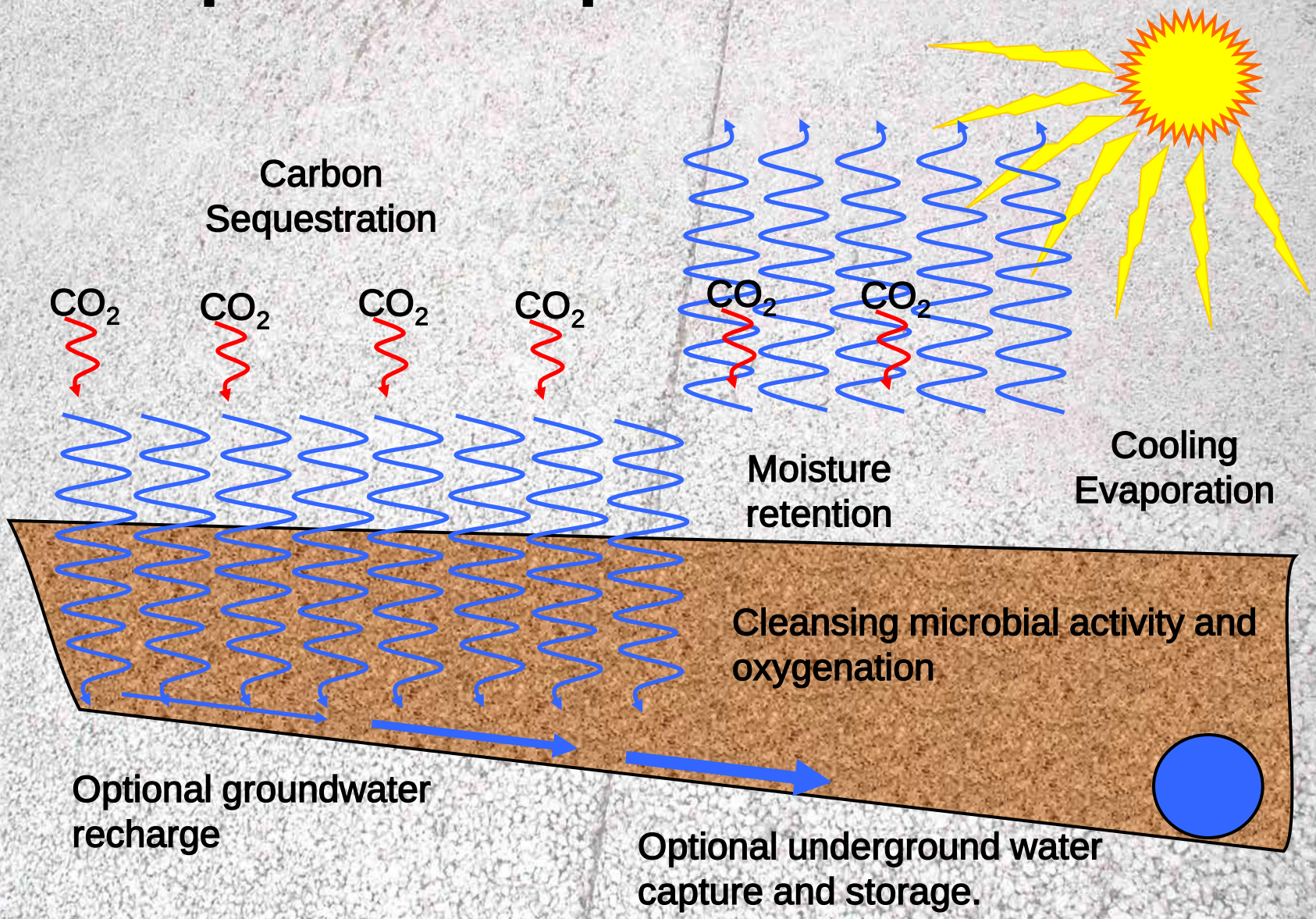
Typical current road design



- roads often seen as one-dimensional
- provides route for lots of services: water, sewerage, electricity, gas, telephone
- services located separately and apart
- water discharged to drain
- black surface generates heat

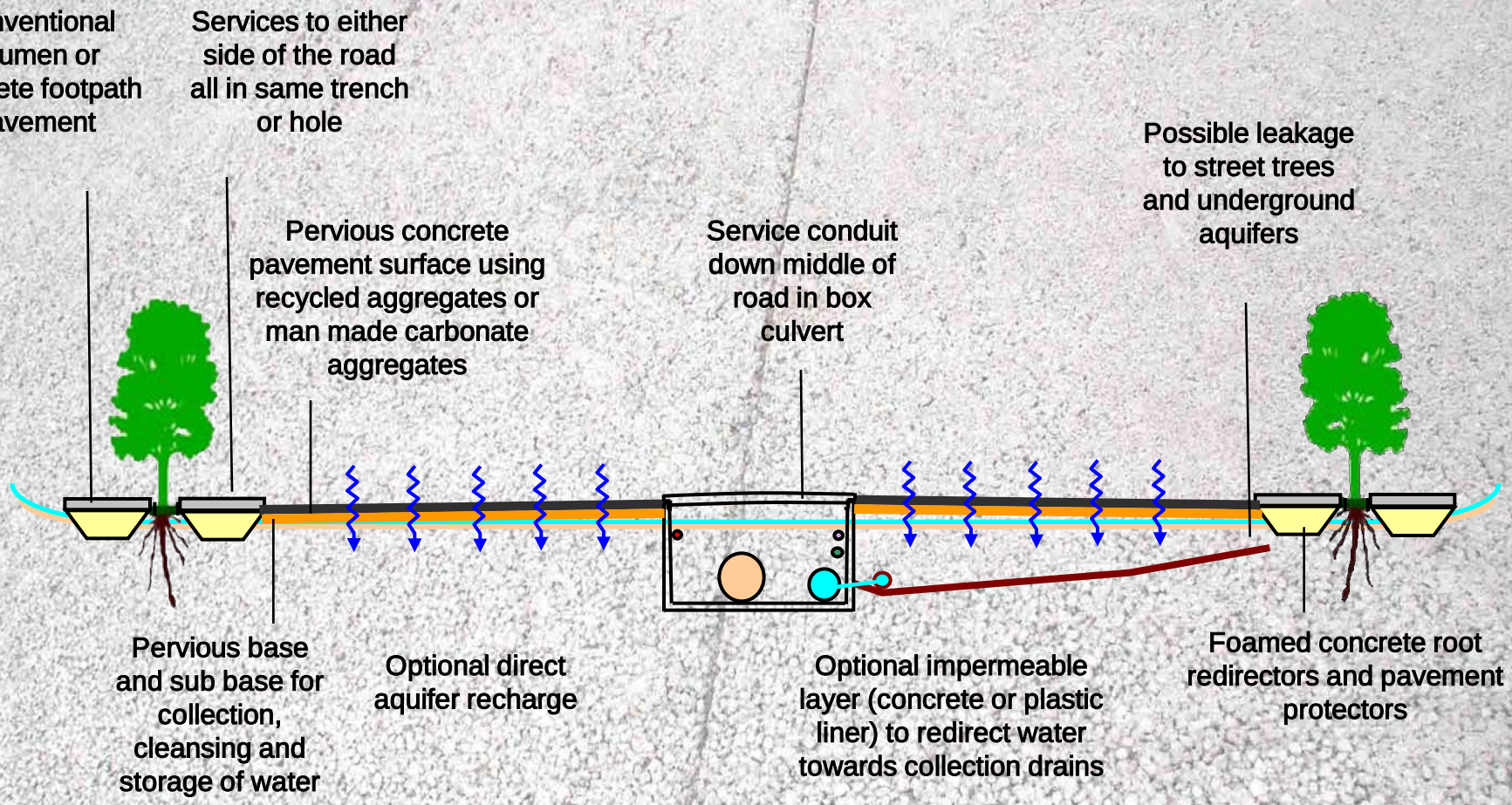
Graphic courtesy of John Harrison and TecEco

Conceptual multiple benefits of roads



Graphic courtesy of John Harrison and TecEco

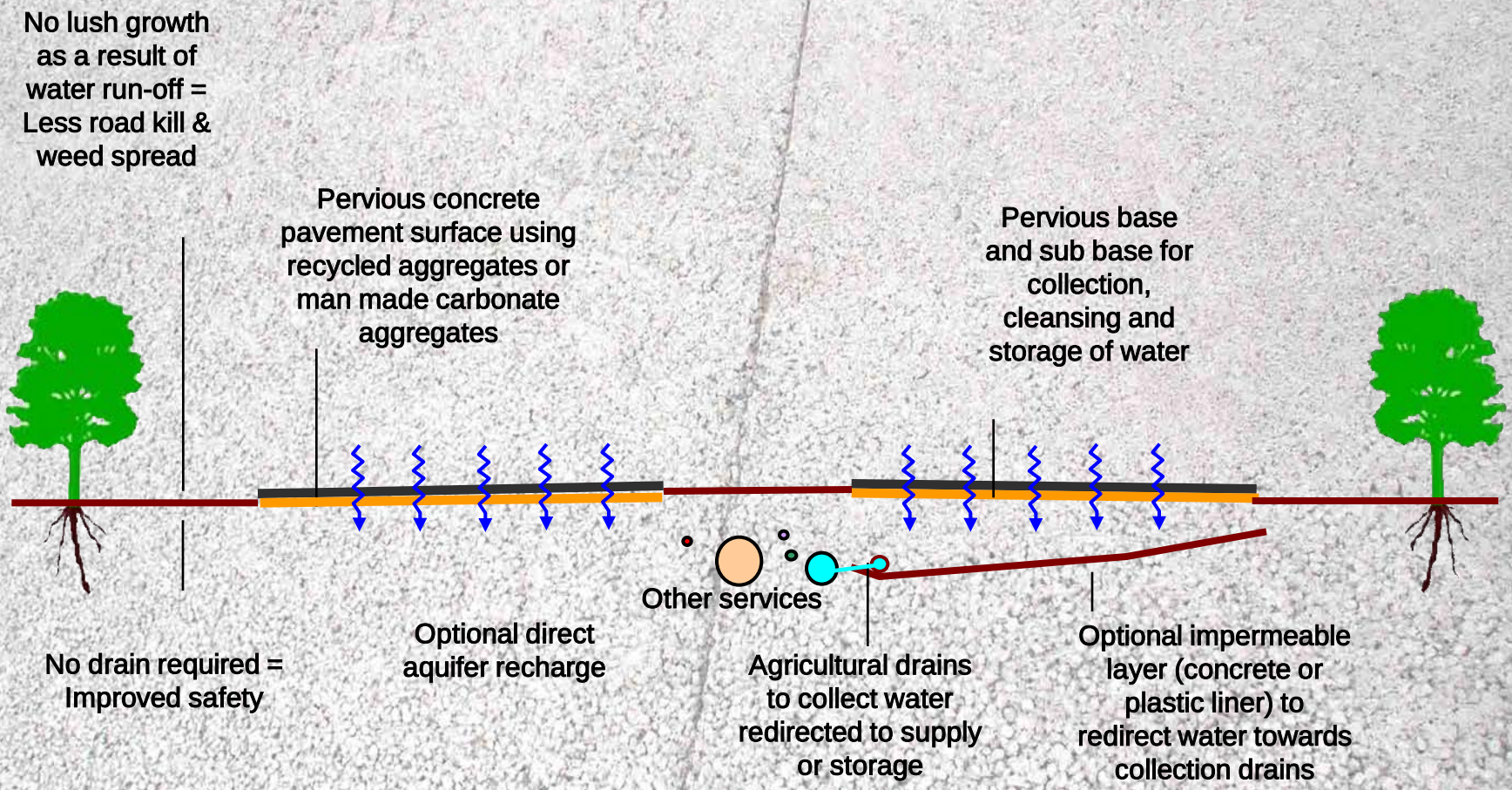
Potential conceptual urban road design



Carbon + Water Capture!

Graphic courtesy of John Harrison and TecEco

Potential conceptual rural road design



Carbon + Water Capture!

Graphic courtesy of John Harrison and TecEco

Safety benefits

	Permecocrete pavement	Pervious asphalt pavement	Normal asphalt pavement
Roadside drainage	Less or none	Less or none	Lots
Animal / human / vehicle trauma	Lower	Lower	High
Vehicle Hydroplaning	No	No	Yes
Traction	High	High	Low
Road visibility	High	Low	Low

Environmental benefits (1)

	Permecocrete pavement	Pervious asphalt pavement	Normal asphalt pavement
Footprint	Lower	Lower	High
Disturbance of natural hydrology	No	No	Yes
Tree deaths due to altered hydrology	No	No	Yes
Water consumption during construction	Low	Lower	High
Water purity	High	High	Low
Replenish aquifers	High	High	Moderate

Environmental benefits (2)

	Permecocrete pavement	Pervious asphalt pavement	Normal asphalt pavement
Carbon dioxide sequestration	High	Zero	Zero
Energy use during construction	Low	Moderate	High
Weed growth on verge	Low	Low	High
Albedo	High	Low	Low
Noise generation	Quieter (pores absorb sound)	Quieter (pores absorb sound)	Varying

Economic benefits (1)

	Permecocrete pavement	Pervious asphalt pavement	Normal asphalt pavement
Construction cost	Lower	High	High
Clearing	Low	Lower	High
Drainage infrastructure	Low	Lower	High
Capture and purify water for sale	Yes	Yes	No
Street tree watering requirements	Less	Less	More

Economic benefits (2)

	Permecocrete pavement	Pervious asphalt pavement	Normal asphalt pavement
Hot city syndrome	Alleviated most	Alleviated	Exacerbated
Evaporative cooling	High	Moderate	None
Lighting requirements	Lower	Normal	Normal
Vehicle fuel efficiency	Higher	Normal	Normal

Other comparisons

Permecocrete pervious pavement	Normal asphalt pavement
• can use recycled materials as long as they are hard and mono-graded • are more plastic than ordinary concrete • being carbonates tend to self heal • can be more easily made with non fossil fuels • are more thixotropic reducing placement problems • potential to adapt existing asphalting methods • need to be pressure cleaned • lane markings may be hard to see • potential for pervious shoulders only	• becoming more expensive as petroleum supplies dwindle • possibly carcinogenic • can be too plastic • higher unit embodied energy than concrete, especially so in relation to Permecocrete • pavement and base course are thinner

Data courtesy of John Harrison and TecEco

Cleaning pervious pavement

Like any other kind of surface, pervious pavements should be cleaned periodically to remove debris

- City of Portland vacuum sweeps 4 x year with regenerative air sweepers

Ocassionally need more vigorous cleaning

- water under pressure combined with suction is the most effective

Cleaning pervious pavement

Frimokar Australia high pressure jet and suction cleaning in action

Parker Pavement Cleaner

Typical annual maintenance costs of permeable paving in California were approximately AUD 9700/ha (Fletcher et al. (2004))

Photos courtesy of John Harrison and TecEco

Pervious concrete pavement (1)

Parking bays
Pringle
Community,
Salem, Oregon

Driveway
Alexis St, Keizer,
Oregon

Shared use path
Swan Island,
Portland, Oregon

Pervious concrete pavement (2)

Eco-Cement pervious pavement
Windsor Park, Glenorchy City, Tasmania
Photo courtesy of John Harrison and TecEco

Pervious concrete car park

Effingham County landfill, Guyton, Georgia

Photo courtesy of University of Central Florida

Pervious concrete road (1)

North Gay St, Portland, Oregon

Pervious concrete road (2)

Alexis St, Keizer, Oregon

Pervious concrete road (3)

Pervious Portland cement concrete on shoulders
North Gay St, Portland, Oregon

Pervious concrete road (4)

Quality Concrete quarry, Wheatland, Oregon

Pervious concrete road (5)

Pringle Creek, Salem, Oregon

Photo courtesy of Scott Erickson and Evolution Paving