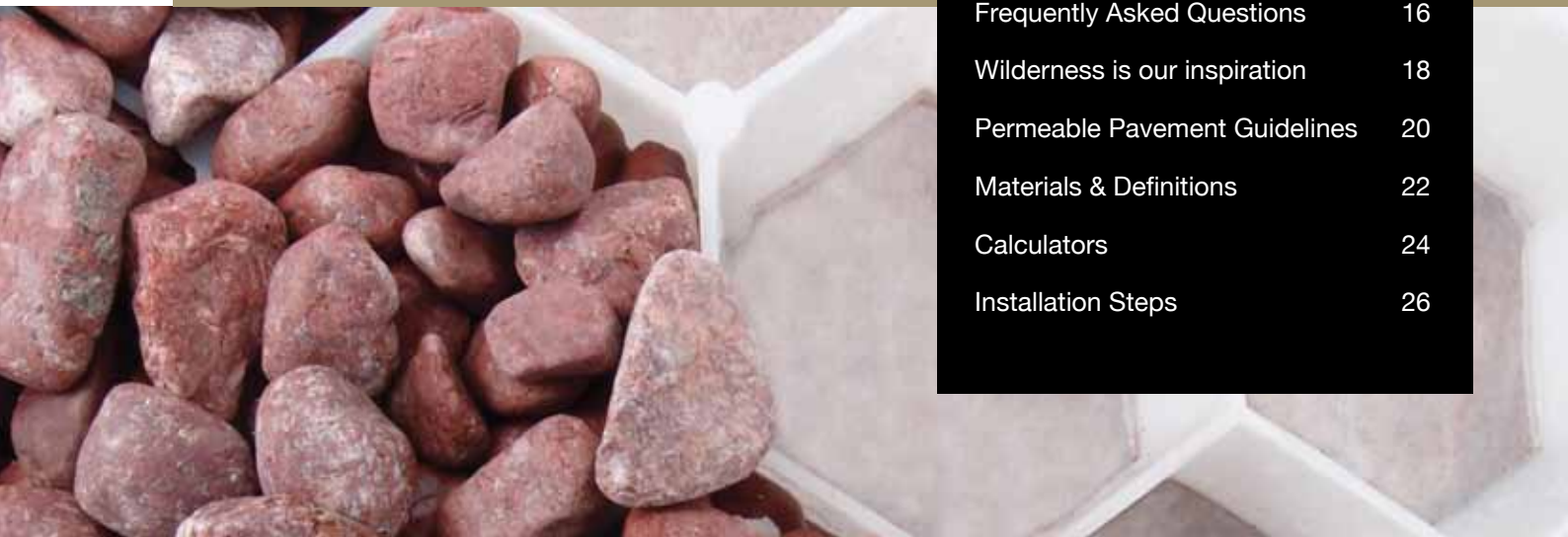
NATURAL PAVING

nature... locked in

www.naturalpaving.co.nz

Contents

Introduction	3
About Natural Paving	4
Natural Paving Advantages	6
Clutha-Garden Grade	8
Waiau-Car Grade	10
Rakaia-Truck Grade	12
Recent Projects	14
Frequently Asked Questions	16
Wilderness is our inspiration	18
Permeable Pavement Guidelines	20
Materials & Definitions	22
Calculators	24
Installation Steps	26



Introduction

Natural Paving is a landscaping product with a European heritage. Its name is derived from its characteristic to re-create a beautiful natural environment around your home. It has all the advantages of looking natural, without the disadvantages of loose stones. Imagine a beautiful South Island braided river sculpting its way out of the Southern Alps on a stunning day with a blue sky backdrop. Imagine you were right there, relaxed, with no deadlines, soaking up that scene and letting the peacefulness and beauty purge you of the pressures of life. Then you are on the way to understanding why Natural Paving is much more important than just another paving option.

Natural Paving aims to bring that peace and tranquillity to your home environment.

Pebbles forming your driveway, patio or paths mimic that braided riverbed. Natural Paving is a plastic honeycomb mat that stabilises those pebbles, stops weeds growing through, and allows free drainage of rain. It remains completely hidden and transforms what would be impractical loose and sloshy pebbles into safe and stable paving. It looks completely natural and brings the ambiance of nature into your home. As a pavement, it is as flat and hard as concrete, pavers or asphalt.

It is very forgiving when affected by tree roots or ground movement that damage hard surfaces.
Hard paving is utilitarian and a reminder of the rigid structure to our city lives.
Natural Paving exists to help you create a refuge where you can find nature's inspiration at home.

We invite you to explore with us the opportunities Natural Paving creates for you.

Company Profile

Natural Paving is a division of New Zealand Wheelbarrows Limited. It is a private family owned company with a heritage dating back four generations of New Zealanders. We are proud to be based in Thames on the Coromandel Peninsula; the town with the hills and sea and without traffic lights or pressure.

About Natural Paving

Natural Paving is a new, innovative and unique landscaping product.

It brings the ambiance and tranquillity of the natural environment to our world of tar and cement. Natural Paving is used to make stable pebble paths and driveways. Newly introduced to New Zealand, it incorporates the refinement of 20 years' experience in Europe.

In cities and towns, Natural Paving brings the feel of the natural environment to your homes. In lifestyle blocks and rural areas, Natural Paving can help maintain the environment that attracted you to the property, while delivering attractive low maintenance driveways, paths and parking areas.
Natural Paving is large honeycomb-cell plastic mats with a tough permeable and weed resistant geotextile welded to the base.
The mats are quick and easy to lay, large and light, and do not need to be clipped together.
It stays crack-free and stable indefinitely, even if tree roots grow, or ground movement occurs.
The mats are laid, and then covered in clean pebbles – graded 5 to 15mm, of any colour and texture.

There are three grades of mats:

1 Clutha-Garden grade
for pedestrians and bikes, 1.2m x 0.8m.

2 Waiau-Car grade
for cars and SUVs, 2.15m x 1.14m.

3 Rakaia-Truck grade
for trucks and busses, 2.15m x 1.14m.

It comes in two colours to match dark and light coloured pebbles. The natural beauty of stone paving stays looking fantastic forever.

Natural Paving pavements are flat, firm and safe like a hard paved surface.

Stiletto heels, bikes, walking sticks etc. do not sink in the pebbles.

All mats have a tough, weed stopping geotextile welded to the base. It is this essential element that makes Natural Paving a UNIQUE pebble stabilising product.

The mats stay permanently locked down and invisible under the pebbles thanks to the geotextile.

The pavement looks natural, and the job has a professional polish to it.

The paving is permeable, ensuring puddles don't form.

The pavement surface remains stable, even on relatively steep slopes.

Pebbles do not shift or rut, even in turning areas.

It is made from virgin plastic materials designed for optimum toughness, resilience and UV resistance. Like plastic pipes, Natural Paving can be expected to stabilise pebbles for it's entire life.

There is a wide range of innovative uses for Natural Paving, are as diverse as: surfaces for permeable pavements, floors for glasshouses, pedestrian surfaces under trees that allow aeration and water infiltration, etc.

Economy and simplicity is a common theme in the applications of Natural Paving. It is simple quick and rewarding work for Landscapers, and with a little toil, DIY'ers can create first-class paving too.

Natural Paving Advantages

- Natural Paving, as a feature of your garden, can evoke the tranquil sense of separating your home from the busy city. The natural ambiance of pebble paving enhances landscapes, while remaining practical.
- Natural Paving is large contiguous mats of tough, ductile plastic cells, with their base securely welded to a robust, permeable weed-stopping geotextile. This geotextile has an even more important job: it anchors the mat under the pebbles. The mat will never wriggle its way up through the stones and stays invisible, permanently locking the pebbles and leaving the surface looking completely natural. The loose looking pebbles on the surface are nested in locked stones below. This means Natural Paving resists migration of pebbles that form ruts or wheel tracks.
- Natural Paving pebble surfaces stay flat and firm, safe and stable.
- The beauty of Natural Paving is the ease of installation. In practical terms, Natural Paving has distinct advantages in being light, easily handled, and quick to lay. It is simple and easy to cut or trim to shape with a fine tooth hand saw, or even a bread knife. Alternatively you can use a power saw or a cut-off disc.
- You use fewer pebbles when they are locked in. Even standard pebbles can be enhanced with a little imagination. Sprinkling a few white pebbles on dark pebbles can make a stunning look.
- Natural Paving has none of the problems of pavers which can rock, crack and pump, or poke up causing tripping hazards, and lets weeds grow in the joints. Concrete paving cracks and is a mission to install.
- The Natural Paving honeycomb cells are the optimum size for gravel stabilisation.
- The geotextile flaps ensure continuity and prevents weeds from growing between mats.
- A life span of up to 40 years, or even more! Natural Paving will stabilise pebbles for an indefinite period of time. If it is laid on a sound foundation with good water control, never overloaded, kept tidy, and remains undisturbed, then Natural Paving will last indefinitely. See Q16 in the FAQs on page 17.

Natural paving tips and tricks

Natural Paving mats are laid on a base-course that is deep enough to carry the expected loads, and is appropriate for the foundation conditions. This is simple for pedestrian areas and lightly trafficked paths. For driveways, our installation section on page 26 recommends a base-course that can carry SUVs and occasional service trucks.

For Commercial applications using Rakaia-Truck grade, we recommend a specific design. Contact Natural Paving or a pavement engineer for more information.

Natural Paving's load capacity is increased by using thicker layers of crushed gravel in the base-course. This allows Natural Paving to be installed on relatively soft foundations. A description of these materials is in the installation section on page 26 and on our website.

Natural Paving may be approved as a trafficable surface close to scheduled and protected trees. Using a thick permeable base course under Natural Paving, the ground pressure, aeration and infiltration requirements may enable driveways to be constructed. Contact Natural Paving or you specialist arborist.

Permeable Paving

Natural paving can be used as an element of an approved permeable paving system. Foundation and drainage requirements are outlined in the "Permeable Pavement Guidelines" on page 20.

The pebbles or gravel that will form the surface MUST be clean. The recommended stone size for all grades is 5mm to 15mm. Larger sized pebbles will not nest properly. When the mats are filled, the top layer of pebbles will be seated in the pebbles below. Natural Paving is sourcing the right pebbles for the job, so look out for 'Natural Paving' pebbles in the future.

Any pebble or gravel can be used. Rounded stones are gentle on bare feet. Gravel with broken faces lock well so are appropriate for steeper slopes. Denser pebbles, those with more kg's per m^3, are stronger and better for commercial duty in Rakaia-Truck grade.

Spreading pebbles can cause segregation of the larger stones and the surface may not look uniform. To avoid this, place small piles often to minimise the amount of spreading.

Natural paving can be used on **slopes.** For maximum slopes refer to the specifications on each grades' introduction page, Clutha-Garden grade on page 8, Waiau-Car grade on page 10, and Rakaia-Truck grade on page 12. These are also on the Installation Steps.

Here is a **good tip** to help economise when using **expensive decorative pebbles.**

Using Natural Paving means less volume of pebbles to cover an area, and a cubic metre of pebbles covers up to $12m^2$. However, using the following **'Welly Way'** technique, you can make the same cubic metre of attractive expensive pebbles cover up to $50m^2$!

1. Spread an economical road chip of similar size to the decorative pebble.
2. Scrape the surface to remove any chips above the mats.
3. Use a stiff broom to flick out the top layer of chips, to form the 'nests' to carry the fancy pebble.
4. Spread the expensive decorative pebbles on top. The top layer will be approximately 20mm thick.

Clutha-Garden grade is ideal for patios, paths and gardens around your home and in parks and cycleways in your cities. It enables you to create enduring landscaping features with pebbles.

The mats are light, easily handled and installed. The tough geotextile welded to the base keeps weeds at bay, but water drains through, so there are no puddles after rain.

One very significant feature unique to Natural Paving is that the geotextile keeps the mats locked down under the pebbles, ensuring that the mats are never seen. The geotextile also protects special permeable bases from contamination.

At home, your mower or barbeque will glide across the paving as though it was on a hard surface. Clutha-Garden grade also gives vegie garden paths a completely natural look and feel.

In public areas, it can be used to stabilise pebbles for pathways in parks, gardens and golf courses. Clutha-Garden grade is also suitable for paving paths for cycles or light vehicles, such as mobility scooters and golf carts etc. Cycle-ways made from Clutha-Garden grade are stable, permeable and easy to ride on. It is also good for hard-stand areas for trailers and caravans (if a vehicular base-course is used). It's ideal for greenhouse floors enabling excess water to drain away, and providing a thermal mass to help regulate heat.

Pebbles need to be clean, and ideally, graded from 5 to 15mm. For more ideas on pebbles refer to the 'materials and definitions' on page 22

SPECIFICATIONS

Mat Size/weight:	0.8m x 1.2m (0.96m^2) / 1.7kg per mat
Cell Size:	42mm dia x 45mm depth (with pebbles)
Max Compression:	(empty) 40 tonnes per m^2
	(filled) 100+ tonnes per m^2
Geotextile:	(welded to mat) 80gsm non-woven
Pebble fill*	63 to 70kg per mat, or 65 to 72kg per m^2
	43.5 litres per mat or 45 litres per m^2
Colours:	Light cream and dark grey
Max slope with:	
round pebbles	1 in 5 or 11°
crushed gravel	1 in 4 or 14°

** pebbles vary in density from 1.45t/m^2 to 1.6t/m^2 depending on source.*

Clutha-Garden
• Grade •

It is safe to use on slopes of up to 1 in 5 (11° slope) with rounded aggregate, and 1 in 4 (a steep 14° slope) if using a crushed aggregate.

Edging is used around the perimeter. See the 'installation guidelines' for more details.

The foundation requirements are very simple. See Clutha-Garden grade Installation Steps at the back for details.

You may find answers to many of your questions in our "frequently asked questions" section on page 16

Waiau-Car grade is ideal for creating natural and inviting driveways, car parks and turning areas where traffic is generally cars, SUVs and the occasional heavy vehicle. It stays looking flat, uniform and professional. Pebbles do not migrate in areas subject to repeat wheel tracking or turning.

The mats are light, easily handled and installed very quickly and economically. There is a tough geotextile welded to the base.

The geotextile has five very important functions.

- The most important feature is that it keeps the mats invisibly buried under the pebbles. Without the geotextile, the plastic matrix would wriggle its way up through the pebbles and become exposed on the surface. That is the fate suffered by other cell products that have no geotextile, and that constitutes complete failure in the eyes of Natural Paving!
- It lets water drain away so puddles do not form.
- The geotextile stops weeds growing through, and
- It stops pebbles being pressed into the base.
- The geotextile protects also special permeable bases from contamination.

Waiau-Car grade Natural Paving can be used to stabilise pebbles in public car parking areas. A Waiau-Car grade pavement is stable and permeable. Pebbles stay flat and firm like a hard paved surface making it ideal for driving or walking on, even in silettos, or with walking sticks.
Cycle wheels won't sink in the pebbles. It is also good for hard-stand areas for trailers and caravans.

Pebbles need to be clean, and ideally, graded from 5 to 15mm. For more ideas on pebbles refer to the 'Materials and Definitions' page 22.

It is safe to use on slopes of up to 1 in 6 (9.5° slope) with rounded aggregate, and 1 in 5 (or 11 degrees) if using a crushed aggregate.

Edging is used around the perimeter. See the ‘Installation Steps’, page 26, for more details.

The foundation requirements are outlined in the ‘Installation Steps’ at the back of this booklet.

You may find answers to many of your questions in our ‘Frequently Asked Questions’ section on page 17

Waiau-Car

• Grade •

SPECIFICATIONS

Mat Size/weight:	1.14m x 2.15m (2.45m^2) / 5.4kg per mat
Cell Size:	42mm dia x 55mm depth (with pebbles)
Max Compression:	(empty) 60 tonnes per m^2
	(filled) 250 tonnes per m^2
Geotextile:	(welded to mat) 80gsm non-woven
Pebble fill*:	195 to 216kg per mat, or 80 to 88kg per m^2
	135 litres per mat or 55 litres per m^2
Colours:	Light cream and dark grey
Max slope with:	
round pebbles	1 in 6 or 9.5°
crushed gravel	1 in 5 or 11°

** pebbles vary in density from 1.45t/m^2 to 1.6t/m^2 depending on source.*

Rakaia-Truck

• Grade •

Rakaia-Truck grade is great for commercial applications, parking and driveways for trucks and buses. It is useful for highly stressed gravel areas such as public parking area entrances

SPECIFICATIONS

Mat Size/weight:	1.14m x 2.15m (2.45m^2) / 6.4kg per mat
Cell Size:	37mm dia x 55mm depth (with pebbles)
Max Compression:	(empty) 170 tonnes per m^2
	(filled) 300+ tonnes per m^2
Geotextile:	(welded to mat) 80gsm non-woven
Pebble fill*:	195 to 216kg per mat, or 80 to 88kg per m^2
	135 litres per mat or 55 litres per m^2
Colours	Light cream and dark grey
Max slope with:	
round pebbles	1 in 8 or 7°
crushed gravel	1 in 7 or 8°

** pebbles vary in density from 1.45t/m^2 to 1.6t/m^2 depending on source.*

The mats are light, easily handled, and installed quickly and economically.

The geotextile has five very important functions.

- The most important feature is that it keeps the mats invisibly buried under the pebbles. Without the geotextile, the plastic matrix would wriggle its way up through the pebbles and become exposed on the surface. That is the fate suffered by other cell products that have no geotextile, and that constitutes complete failure in the eyes of Natural Paving!
- It lets water drain away so puddles do not form.
- The geotextile stops weeds growing through, and
- It stops pebbles being pressed into the base.
- The geotextile protects also special permeable bases from contamination.

Pebbles need to be clean, and ideally, graded from 5 to 15mm. For more ideas on pebbles refer to the 'materials and definitions' on page 22

In commercial applications it is safe to use on slopes of up to 1 in 8 (7° slope) with rounded aggregate, and 1 in 7 (and 8° slope) if using a crushed aggregate.

Edging is required around the perimeter. It must be capable of supporting a wheel load if there is a possibility of it being driven on.

The foundation needs to be engineered for commercial applications for a long and trouble free life.

Ellerslie Flower Show 2012.

Even after the passage of 120,000 feet during the course of the Ellerslie Flower Show, the Natural Paving in the emerging designers' area did not scuff or move. Natural Paving stabilised pebbles stayed flat and firm.

Recent Projects

Dream Home 2012.

Pebbles are so beautiful. Natural Paving let me be creative and make the surface safe and sound
– Steven Remington

"Natural Paving let me use these amazing pebbles so my paths are safe to walk on and look fantastic"
– David Butterworth

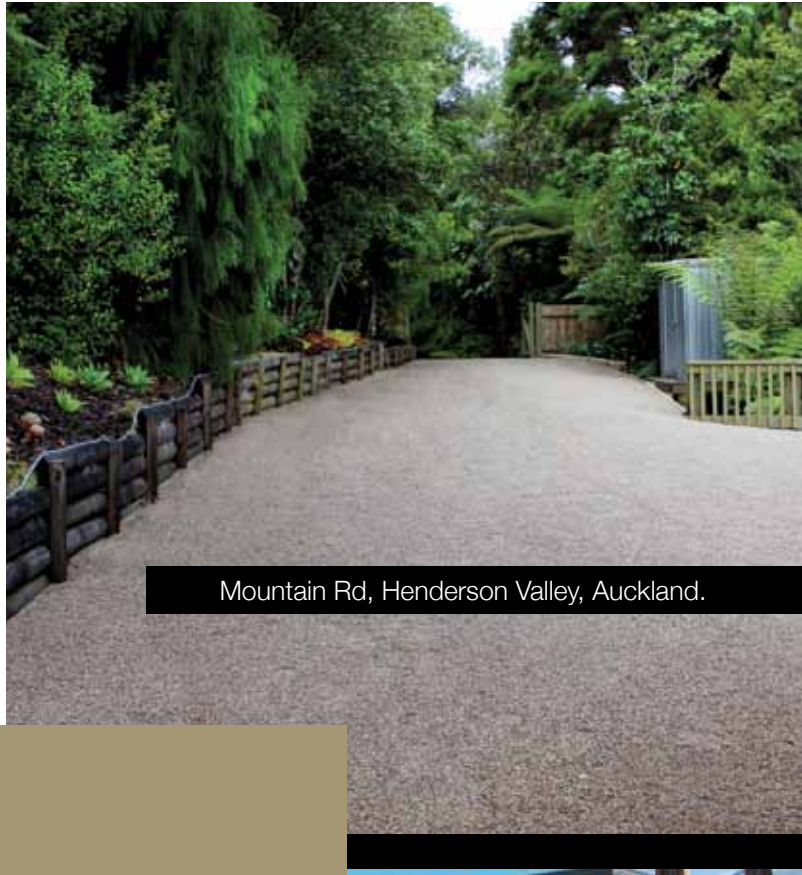
"You were right about it locking. I can even walk on it in my heels!"
– Melanie Cropper

"We chose Natural Paving because we wanted a stable, low maintenance, driveway that enhanced our natural environment"
– Martin Hall

Monteiths Brewery, Greymouth.

Site of original home of Monteiths Brewery, first built in 1896. It is now a museum, restaurant, and bar visited by over 40,000 people a year.
It is situated on Herbert Street in Greymouth, on the unique West Coast of New Zealand.

Papakura Patio, Auckland.



Mountain Rd, Henderson Valley, Auckland.

Sam Newsome's Gold Medal Award Landscape, Waikato, Home and Garden show 2011.

- Ocean View Mansion, Whangaparoa Peninsula.
- Cycle track trial, Queenstown.







FAQs





1. Will weeds grow through Natural Paving?
No. Natural Paving has a strong and dense non-woven geotextile welded to its base. This stops weeds growing through but allows rain to soak into the ground. If seeds drop into the pebbles they will wither and die because there is no water retained in the pebbles and the roots can't go through the geotextile.

2. I have a concrete driveway/pathway that is cracked; can I lay Natural Paving on top?
There are a number of reasons why concrete cracks.
a. New slabs shrink and the concrete may not have saw cuts. Saw cuts control the position and appearance of cracks.
b. The foundation was not strong enough to carry a heavier than expected load, maybe a heavy removal van or delivery truck caused a foundation failure.
c. It could be that the foundation design did not allow for the wet strength of the foundation (e.g. very low for clay) and the base is simply not adequate.
In (a), and (b) above, specific design to cope with water drainage may allow natural paving to be laid over cracked concrete. If the reason for the cracks is (c), the concrete has to be removed and the problems treated appropriately to provide a sound base for Natural Paving.

3. Is Natural Paving is better than concrete or pavers?
The defining reason for using pebbles in landscaping is to create a natural ambiance. Pavers set in Natural Paving are attractive and are a common theme in landscaping. There are other practical considerations that make Natural Paving very desirable, for example, permeability or economy. There are many beautiful pebbles you can use. Hard paving has its place, but comparatively it is more utilitarian and expensive. Natural Paving counters all the disadvantages of pebbles and transforms them into a stable flat pavement with a natural look and feel. With Natural Paving, pebbles are as practical as a hard paved surface for handling narrow wheels, stilettos, walking sticks, cars etc. In comparison concrete is unforgiving; it cracks when stressed or overloaded, it sheds water, and it puddles. Weeds can grow through cracks. They both have their pros and cons, but Natural Paving makes pebbles low maintenance so you can enjoy them.

4. What pebbles can I use with Natural Paving?
You can use any pebbles: river worn, rumbled or from crushed rock. There is a variety of colours and textures to form broad patterns. The main criteria is that the pebbles should be free of dust and graded between 5mm to 15mm. If the use is a driveway on a slope of more than 11° an irregular shaped pebble or chip should be used, like a crushed stone. If there will be a lot of bare feet on the pebbles a rounded chip is best.

5. Can I put it straight on the grass?
Not really. To build a great path you need to be careful and sensible by following our installation guide. You need to remove the vegetation and get to a firm surface at the right level, remove any soft spots and start from a good foundation. The installation guide gives helpful advice.

6. Is a Natural Paving driveway more expensive than a concrete driveway?
Both driveways need similar foundation work for long term reliability. This part of the cost is the same no matter what surface you use. Natural Paving is used primarily because it provides the environment you desire. You may find it less costly but you'll certainly find it much easier to install.

7. Can it be used on any type of surface?
All surfaces need some preparation, and every installation needs support at the perimeter. The foundation needs to be able to carry the expected loads, so truck carparks need a substantial foundation, driveways somewhat less, and garden paths are simplest base to prepare.

8. Is it easy to lay?
When the base-course is compacted and level, it is easy to lay Natural Paving.
If necessary, you can cut the sheets with a fine handsaw or even a bread knife, and use all the offcuts like a jig-saw puzzle. Refer to the Installation Steps, #5 on page 27.

9. Can I do it by myself?
It is very easy to lay Natural Paving and spread pebbles. The hardest part is preparing the base.

10. Where do we buy Natural Paving?
The Natural Paving website has a list of stockists, or contact Natural Paving directly if you need specialist advice. You can also purchase Natural Paving from your nearest Bunnings store.

11. What type of care is required?
Little maintenance is required. Leaves etc. can be raked or blown off. In shady areas the pebbles may need a moss and mildew spray and any settling of the stones or foundation can be smoothed by raking. After installation, give the pebbles a good wash down to remove any dust so you don't walk it into your home. Should disaster strike, for example if the pavement was flooded by silt, there is always the option of rejuvenation by lifting the mats and pebbles and cleaning them before relaying.

12. What will happen to the rainwater?
Rain will pass straight through the surface. Natural Paving is very permeable.

13. Can you grow grass in Natural Paving sheets?
No. The geotextile bonded to the base of the sheets prevents roots or shoots passing though and there is not enough soil in the sheets to sustain grass growth.

14. What is the steepest slope you can use it on?
Natural Paving can be laid on slopes as steep as 14 degrees. (1 vertical in 4 horizontal) for Clutha-Garden grade, and 11 degrees (1 vertical in 5 horizontal) for Waiau-Car grade. In this magazine the maximum slope for each grade is listed in the mat specifications.

15. So what is natural about Natural Paving?
For your home, Natural Paving can create the most natural looking pavement of any paving system. In terms of the materials used it is by far the paving system with the lowest carbon footprint. Apart from the 1.7kg of plastic per square metre of plastic mat matrix, all the rest of the paving is made up of natural materials. In comparison the manufacturing process for concrete produces voluminous quantities of carbon dioxide. Worldwide, cement manufacturing accounts for approximately 5% of CO_2 emissions. The binder in asphalt is a product of oil; and producing asphalt requires fuming, heating and drying aggregates, which requires high fuel consumption.

16. How long will it last?
Natural Paving is guaranteed to stabilise pebbles for an indefinite period of time.
If it is laid on a sound foundation with good water control, never overloaded, kept tidy, and remains undisturbed, then it will last indefinitely as you would expect.
In practice, a pavement is subject to such variable conditions and service during its life that it is not uncommon to find older pavements with distress. In concrete, unwanted cracking; pavers with weeds and rocking; and asphalt with cracks, weeds or pot-holes. Even in these testing conditions Natural Paving has distinct advantages. The simplicity and ease of any required restoration of Natural Paving after such an event means it outshines more rigid and complex to repair hard paving options.

North West Ridge and West Face, Mount Aspiring.

Sabine Valley, Nelson Lakes, New Zealand.

Park Pass, Fiordland National Park, New Zealand.

wilderness is our inspiration

Routeburn Track, Fiordland National Park, New Zealand.

Robert Ridge, Nelson Lakes National Park

Whitehorn Pass, Arthurs Pass National Park.

Travers Pass, Nelson Lakes.

Queenstown, from Single Cone, Remarkables.

Travers Valley, Nelson Lakes, New Zealand.

Beansburn, Aspiring National Park.

NATURAL PAVING

What are permeable pavements?

Permeable pavements are hard surface paving systems that reduce stormwater runoff flows and improve runoff water quality. The porous surface of permeable pavement allows stormwater to soak through to an underlying coarse gravel layer, before slowly draining away. They are used in low traffic areas such as carparks, driveways and footpaths.

Permeable Pavement Guidelines

Quick Checks

- ***Keep sediment and soil clear of permeable paving area during construction.***
- ***Inspect area after one year to check functioning as designed.***
- ***Block new and existing inlets and outlets from area during construction.***

9 key components of permeable pavements

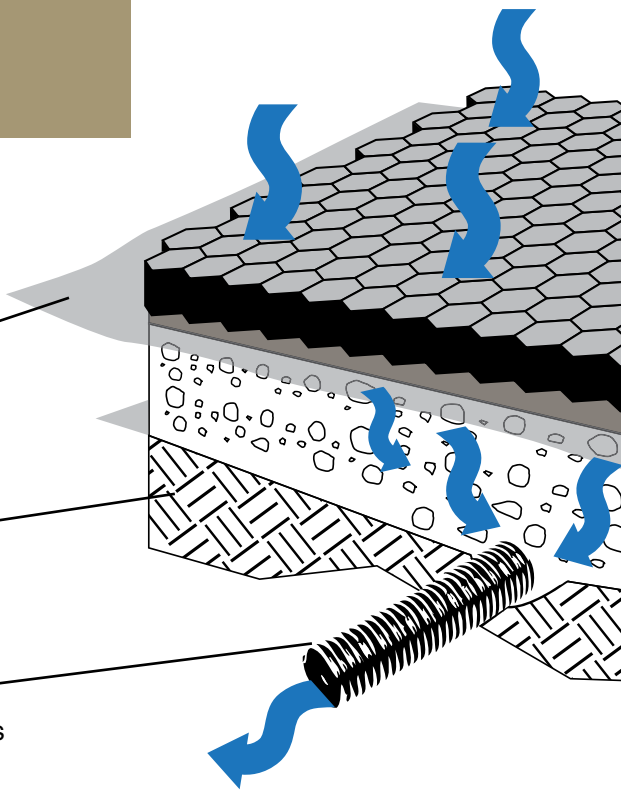
8. Edging
To fix paving in place, and retain pebbles.

9. Overflow
To take excess flows. Includes catchpits.

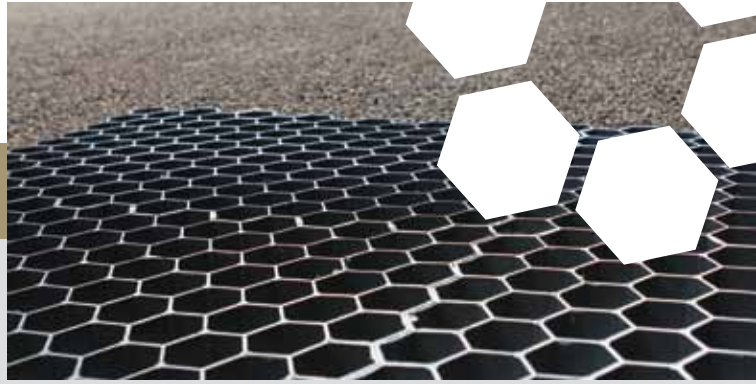
4. Geotextile
Already welded to base of mats.

1. Sub-grade material
Strong and durable material to withstand wetting and drying over time.

3. Underdrain (if present)
Directs flow draining through pavers. Perforated pipes connecting to local stormwater system.



Construction Sequence



The following is a general guide for permeable pavement construction. Refer to detailed plans and specifications for each site in consent plans.

1. Prepare site ground

Mark or peg out paving area. Put erosion and sediment control measures in place (catchpit protection, filter socks, silt fencing). Remove topsoil and, if specified, compact sub-grade. Grade to specified level. Place edge beams around perimeter.

2. Lay impermeable liner and underdrain, if included.

If specified, lay impermeable liner over entire area, checking seams are sealed and there are no stress points or tears.
If included, lay underdrain (with filter sock, if specified), on 300mm minimum depth gravel with 0.5% slope (50mm drop over 1m length). Connect to stormwater outlet with watertight fit. Backfill carefully over underdrain with 50mm base course.

3. Impermeable liner or mudstop.

Place impermeable liner and / or mudstop over sub-grade material. Place filter sock over underdrain to prevent clogging by fine sediment in runoff.

4. Place base course

Place gravel base course material to level and depth specified, and compact. Base course gravel to be washed crushed rock (not scoria) with 30% minimum voids. Winstone Aggregates WPP12 or equivalent.

5. Lay bedding material

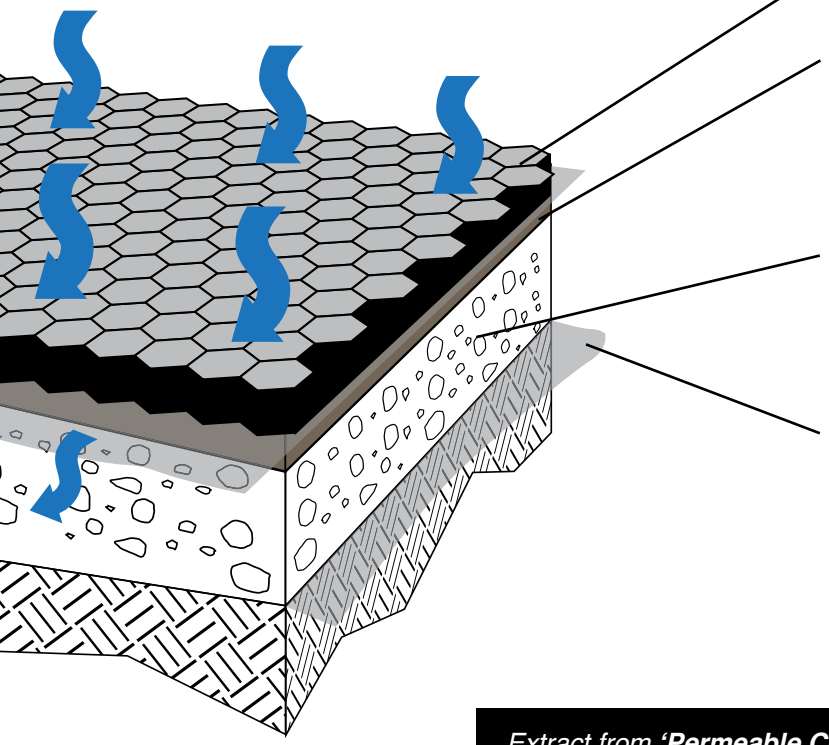
Lay clean, bedding material over base course. Level with rake or straight edge. Do not compact. Lay to 25mm minimum depth. Winstone Aggregates WPP7 or equivalent.

6. Lay Natural Paving

Follow manufacturer's specifications for grade of mat and fill with clean pebbles, 5 to 15mm dia. At edges lay strips of geotextile to make up any gaps to edging, overlaping under mats by 100mm.

7. Restore site

Remove construction materials and reinstate surrounding area, regrassing disturbed areas. Remove sediment and erosion controls. Check underdrain connections to stormwater systems are clear of blockages.



7. Natural Paving

6. Bedding material

Porous material. May be coarse sand or fine gravel (2-5mm), depending on paver type. Filters pollutants from runoff.
Winstone Aggregates WPP7 or equivalent.

5. Base course

Strong, durable high volume draining material (up to 30% voids). Provides temporary storage for runoff.
Winstone Aggregates WPP12 or equivalent.

2. Impermeable liner or mudstop (if required)

Prevents water draining through to sub-grade material. May be specified on sites with poor draining soils, in high groundwater areas or in structurally sensitive soils. On some sites, clay soils create a natural impermeable layer.

*Extract from **'Permeable Construction Guide'** published by Auckland Council: Stormwater device information series, customised for Natural Paving.*

Materials & Definitions

Natural Paving

Natural Paving is a plastic honeycomb cell mat used to stabilise pebbles. It has a strong, permeable, weed resistant non-woven geotextile fully welded to the bottom of the mat. The mat is available in three grades.

Specifications

	Clutha-Garden grade	Waiau-Car grade	Rakaia-Truck grade
Mat Size/Weight:	0.8m x 1.2m (0.96m^2) 1.7kg per mat	1.14m x 2.15m (2.45m^2) 5.4kg per mat	1.14m x 2.15m (2.45m^2) 6.4kg per mat
Cell Size:	42mm dia x 45mm depth (with pebbles)	42mm dia x 55mm depth (with pebbles)	37mm dia x 55mm depth (with pebbles)
Max Compression:	(empty) 40 tonnes per m^2 (filled) 100+ tonnes per m^2	(empty) 60 tonnes per m^2 (filled) 250 tonnes per m^2	(empty) 170 tonnes per m^2 (filled) 300 tonnes per m^2
Geotextile: (welded to mat)	80gsm non-woven	80gsm non-woven	80gsm non-woven
Pebble fill*: (kg)/mat & m^2 (Litres)	Clean, 5 to 15mm 63 to 70kg per mat, or 65 to 72kg per m^2 43.5 litres/mat or 45 litres/ m^2	Clean, 5 to 15mm 195 to 216kg per mat, or 80 to 88kg per m^2 135 litres/mat or 55 litres/ m^2	Clean, 5 to 15mm 195 to 216kg per mat, or 80 to 88kg per m^2 135 litres/mat or 55 litres/m^2
Colours:	Light cream and dark grey	Light cream and dark grey	Light cream and dark grey
Max slope with: **Round pebbles** **Crushed gravel**	 1 in 5 or 11° 1 in 4 or 14°	 1 in 6 or 9.5° 1 in 5 or 11°	 1 in 8 or 7° 1 in 7 or 8°

* pebbles vary in density from 1.45t/m^2 to 1.6t/m^2 depending on source.

Mats are large and easy to lay. Natural Paving is placed on a prepared base and pebbles spread to form beautiful and stable paved areas. Choose the appropriate grade and colour to match your stones.

There are three grades. Each grade is available in cream and dark grey colours.

- **Clutha-Garden grade** is used for garden paths, public walkways and cycle-ways. It is also fine for hard stand areas for boats, caravans and trailers providing a suitable base-course is installed.
- **Waiau-Car grade** is for residential driveways including SUVs and occasional concrete or delivery trucks.
- **Rakaia-Truck grade** is for trucks and busses and commercial car parks.

Pebbles

- Use pebbles or gravel to fill the cells to form your Natural Pavement. Pebbles can be river gravel, quarried pebbles, manufactured pebbles or crushed gravel.
- Use clean pebbles with a grading from 5mm to 15mm. (If the pebbles are a spherical shape, i.e. not elongated, you can use up to a 20mm max diameter pebble).
- Clean pebbles, all bigger than 5mm, means no dust or mess in your house.
- Rounded pebbles are kinder to bare feet.
- Use any pebbles on shallower slopes. Steeper slopes are better with an irregular pebble. Steepest slopes should use a crushed gravel. Crushed gravel is the most stable fill for in Natural Paving. Refer to specifications for each grade mat.
- Spreading pebbles can cause segregation of the larger stones and the surface may not look uniform. To avoid this, place small piles often to minimise the amount of spreading.

Pebble quantity calculator:

- Waiau-Car grade and Rakaia-Truck grade holds 80 to 88kg per m^2 or 55 litres of pebbles per square metre.
  (1 m^3 pebbles will cover 18m^2, or one tonne of pebbles will cover 12.5m^2 to 11.3m^2)
- Clutha–Garden grade holds 77kg or 45 litres of pebbles per square metre.
  (1 m^3 pebbles will cover 22m^2, or one tonne of pebbles will cover 13 square metres).

Edging

Use any edging that suits your job.
Edging is required to protect the edge of the pavement. Install the edging 20 to 25mm above the mat surface. This is required because you spread the pebbles 20mm thicker than the mat and in time they settle to be 10 to 15mm thicker.

Bedding sand, AP7 or Crusher Dust

The large stones in the base-course make it hard to smooth the surface, so a bedding material is used to contour the surface prior to laying Natural Paving mats. It can be either a bedding sand or a crushed gravel that all passes through a 7mm screen, called ‘AP7’.
AP7 is sometimes referred to as Crusher Dust.

Base-Course

Is a grade of gravel called AP40. This means that the gravel has been quarried or is from a rock crusher, and put through a grading plant. The gravel will all pass through a 40mm sieve. This material is commonly available from gravel merchants and landscape product suppliers. As a rule of thumb a 125mm deep layer of base-course is required for Waiau-Car grade. It needs to be compacted with a plate or roller compactor in layers less than 100mm thick to give a good foundation.

Mud stop

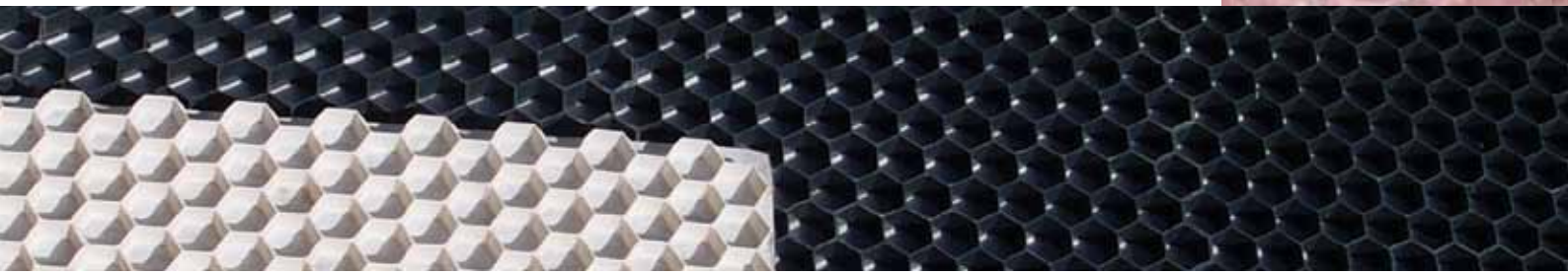
Mud stop is a geotextile that can be placed on the sub-grade to improve the strength of the pavement and stop slippery clay in the sub-grade mixing with, and reducing the load carrying capacity of, the base-course gravel.

Sub-Grade

The Sub-Grade is the foundation surface after you have finished excavating sufficient depth of soil to build your pavement.

Drainage coil

Drainage coil is a plastic pipe full of holes that can collect ground water. Wrapping the drainage coil in a filter fabric geotextile keeps the holes clear. If conditions require a drainage coil to collect water, dig a trench to carry the coil, install it lower than the sub-grade, and slope the sub-grade and the pipe so the water drains to a soakage area or a storm water connection. Lay mud stop or an impermeable liner under the drainage coil.



Calculators

Project:_____

Date:_____

Area Calculator

Edging Calculator

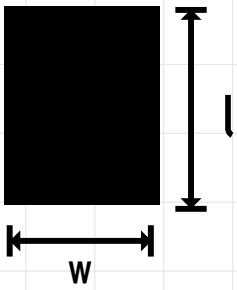
1

The area of a Rectangle shape
Area = Length in metres multiplied by the width.

length: l (m) = _____

width: w (m) = _____

Area 1: l x w = _____ m²



Edging for rectangles
(Measure the length for each side)

Length: l (m) = _____

Width: w (m) = _____

Length 1 l + l + w + w = _____ m

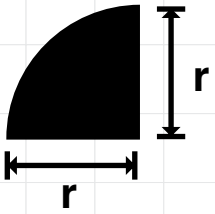
2

The area of a quarter circle shape
(For half circles or full circles add together the number of quarter circles)
Area = radius in metres multiplied by the radius again, multiplied by 0.79

Radius: r (m) = _____

Radius: r (m) = _____

Area 2: r x r x 0.79 = _____ m²



The Length of a quarter circle edge
(For half circles or full circles add together the number of quarter circle edges)

Length = radius in metres multiplied by 1.57

Radius: r (m) = _____

Length 2 r x 1.57 = _____ m

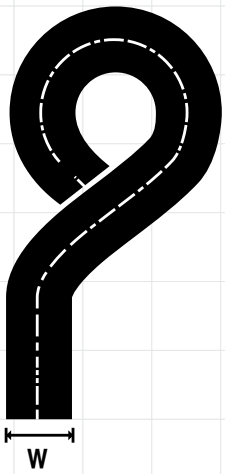
3

For a driveway or path that is straight or curvy, including drives that go in a circle, or part of a circle.
Area in square metres. Area =
Centre line Length in metres multiplied by
the average width in metres

Length: L (m) = - - - -

Width: W (m) =

Area 3: L x W = _____ m²



For a driveway or path that is straight or curvy or circles, or part of a circle.
Length of edging. L =
Centre line Length in metres multiplied by 2, plus the average width in metres for edging at the end(s)

Length: L (m) = - - - -

Width: W (m) =

Length 3 L+L+W+W = _____ m

4

Total area to be paved

Add together the area of rectangles, quarter circles and straights.

Area 1 + Area 2 + Area 3 =

A= _____ m²

Total Length of edging

Add together the length of rectangles, quarter circles and straights.

Length 1 + Length 2 + Length 3 =

L= _____ m

Area of mats including scrap and offcuts

The area of mats to buy is the calculated pavement area multiplied by 1.025 for straight paths, to allow 2.5% scrap as a result of trimming, or the calculated pavement area, multiplied by 1.05 to allow 5% scrap when there are curves or circles in the project.

Minimum Area of mats to buy:

For straight paths is: A **x 1.025 =** A m²

or

For curves or circles in the project is: A **x 1.05 =** A m²

Number of mats needed

Clutha-Garden Grade mats:
(each mat is 0.96 m2)

A

divided by 0.96

Number of mats required =

or

Waiau-Car or Rakaia-Truck Grade mats:
(each mat is 2.45m2)

A

divided by 2.45

Number of mats required =

Since you can't buy a part of a mat, the minimum number of mats to buy = whole number of mats required, (ie the number on the left side of the decimal point in the result of the 'number of mats' calculation) + 1

Diagrams, workings and notes

THINGS TO CONSIDER BEFORE STARTING YOUR NATURAL PAVING JOB.

For your paved area to look good for a long time, consider:

- How much traffic will the path or driveway carry? More, and heavier, traffic means making the base-course thicker. Occasional trucks and SUVs can drive on Waiau-car grade with no detriment if the base-course is constructed 50% thicker.
- If the sub-grade is soft or clay, and the pavement is for cars, use a mud-stop geotextile on the sub-grade to stop mud mixing with the base-course.
- If the area is boggy, the base-course should be thicker and the sub-grade should have a mud stop geotextile to stop soft wet sub-grade soil, or clay, mixing with the base-course. It may also be an advantage for the finished level of the path to be higher than boggy ground.
- Soft spots in the sub-grade need more excavation.
- Natural Paving is permeable. Water from rain and irrigation will soak straight through. Considering what happens to this water is important if your pavement is carrying vehicles. Water needs to soak away from under the pavement. This can use the natural fall of the land or the inherent permeability of the sub-grade. But . . . if your excavation is into clay, you need to design the excavation so it will not hold water like a bucket. You have to make an exit for the water. If the area is flat, slope the sub-grade to a shallow trench along one side of the paved area and lay a drainage coil wrapped in filter geotextile in this trench (on top of the mud-stop). Connect the outlet of the drainage coil into a storm-water drain, or a soakage trench away from under the pavement.
- If the area beside your paving is to be mowed, plan your edging to protect the pebbles from the blade.
- If the paved area is for trucks or buses, obtain a pavement design from a proficient pavement design professional, or contact Natural Paving for advice.

Installation Steps

(Items 4 to 7 are common to all grades)

do it yourself!

Clutha-Garden grade	Waiau-Car grade
1: EXCAVATION and PREPARATION	
Excavate to form sub-grade at a depth suitable for your pavement. Remove topsoil. Excavate 100mm, a sufficient depth for 50mm of bedding material and a further 50 to 55mm for Clutha-Garden grade mat and pebbles.	Excavate 210mm or more if required. The minimum recommended depth of base-course is 125mm. On the base-course lay 30mm AP7 and form this to the desired contour. The Natural Paving will be 60 to 65mm thick. For the driveway to carry SUVs and occasional trucks add 50% (65mm) to the depth of excavation for the base-course. If required for handling water, and the sub-grade is impermeable, contour the sub-grade so water will drain to a filter fabric wrapped drainage coil, and excavate trenches and runoff areas for the drainage coil, or pipe it to a storm water connection. If required because of soft, wet or clay foundation conditions, lay mud stop, or if drainage to a storm-water connection is provided use an impermeable liner on the sub-grade.
2: LAY THE BASE-COURSE / BEDDING	
Use AP7 to a depth of 65mm then compact or roll it to a compacted depth of 50mm. Screed the surface so it follows the contour you want to achieve for your path or paved area	Lay AP40 base-course and compact it with a plate compactor to a depth of 125mm or more if required. If a permeable pavement is being constructed, refer to the Permeable Pavement Construction guide on page 20.
3: LAY THE BEDDING	
	Spread a 35 to 40mm layer of bedding sand or AP7 over the bedding layer and compact. Screed the surface so it follows the contour you want to achieve for your driveway or paved area.

4: INSTALL THE EDGING. (All grades)

Edging is required all around your paved area. It protects the edge of the Natural Paving mat, retains the pebbles on the mat, and makes a suitable edge so mowers don't fling pebbles. You can use any material for edging, or butt the mat against walls or existing paved areas. If you use bricks or kerb stones, we recommend you haunch them with concrete so they are well seated. Concrete haunching should be 100mm deeper than the base of the brick.

For pathways, place the edging on the sub-grade, but for driveways you lay the base-course first.

5: LAY THE NATURAL PAVING MATS. (All grades)

Natural Paving mats are large and easy to lay. They have geotextile welded to the base which ensures the mat stays buried in pebbles and prevent weeds growing through it. The mats have a geotextile flap to maintain continuity. There is no clipping together, or meshing required, and the joints do not have to be precise. The mats can be cut with a fine tooth hand saw, circular saw or cut off disc. You can easily free form the mats to follow complex shapes. Overlap the geotextile, or fit strips of permeable weed resistant geotextile if there are gaps between Natural Paving and the edging, or at trimmed edges.

6: SPREAD THE PEBBLES. (All grades)

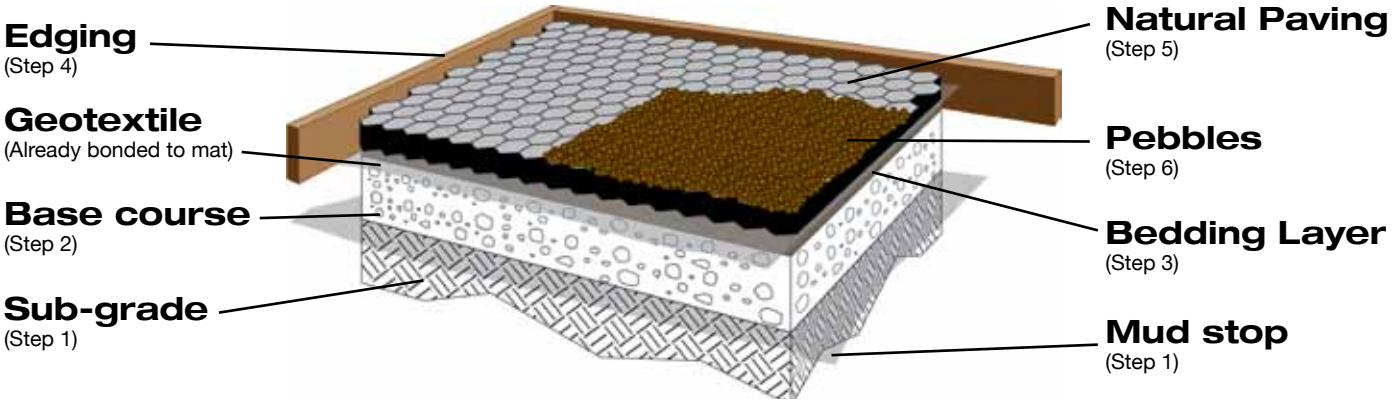
Pour your pebbles or gravel onto the mats and spread with rakes until the mats are covered. Refer to page 7 if using expensive pebbles and the economising strategy. Place the pebbles in regular small piles to minimise spreading work. Even more importantly, this minimises segregation. When pebbles are worked, the larger pebbles roll further, and this changes the visual texture in patches.
The pebbles will settle into the mats over time, so fill the mats 20mm deeper than the mat surface and it will settle to a long term thickness of about 10 to 15mm over the top of the mat. This should hide the mat so it is invisible and protected. If the pebbles are overfilled, stabilisation of the surface will be compromised.
Once the job is finished thoroughly water the surface to clean the pebbles.

7: CARE

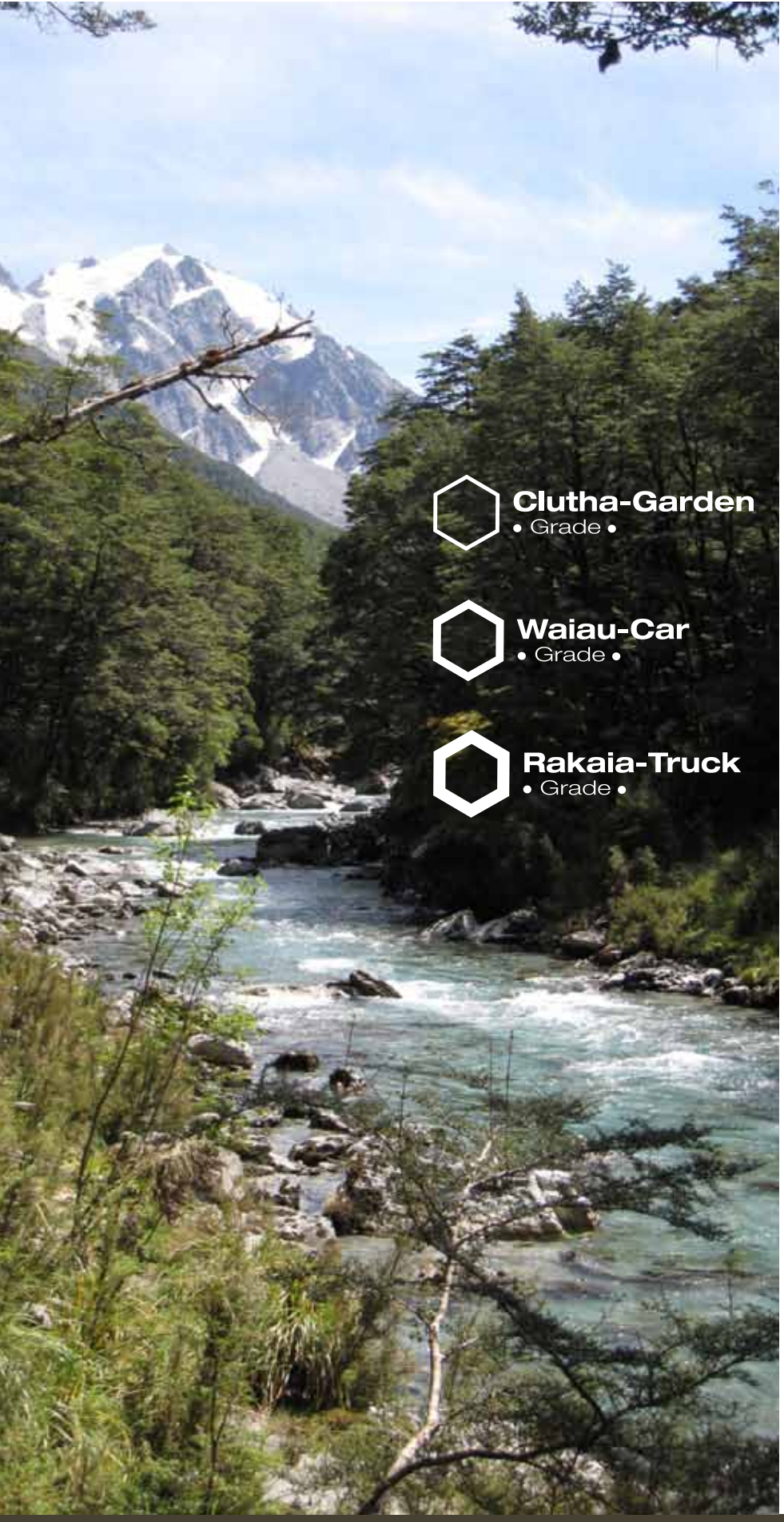
The pebbles on the surface can move; not a lot, but enough to keep them clean in trafficked areas. In other areas the surface can be maintained with any cleaners made for hard paved areas. Oil drips can be easily removed by scooping up the pebbles. If the pebbles settle, add sufficient pebbles to hide the Natural Paving mats by 10 to 15mm. Rake or blow leaves off.

Rakaia-Truck grade

For truck grade we recommend specific design in most instances. Truck and bus loads are much higher than cars and require a good understanding of the foundation conditions so a good trouble free pavement can be built.



and this is the begining!



NATURAL PAVING

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