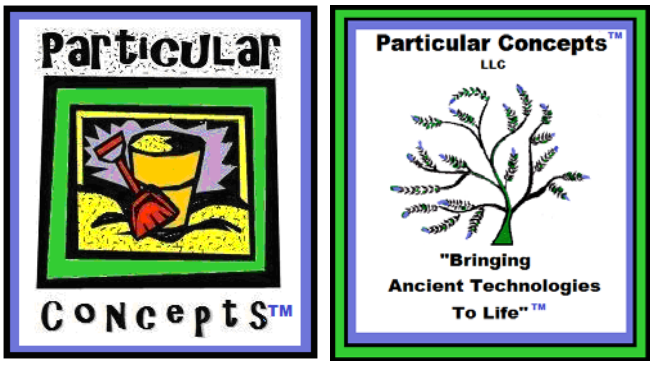

Particular Concepts™

By Elsie Spry

Education
Engineering
Licensing

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http://particularconcepts.org
http://particularconcepts.com

February 2013

Summary

The following are concept explanations of Particular Concepts™ technologies:

- **The Particular Valve™** -- **for precise particulate control**
- **The Particular Wall™** -- **for a stable and cost-effective retaining wall**
- **The Particular Blanket™** -- **for beach/bank/channel stabilization, maintenance, and buildup.**

The above listed patented technologies are cumulative. They also are a major shift from traditional approaches -- and eliminate some engineering concerns such as rotation. The Particular Technologies™ are:

- **Simpler**
- **More effective**
- **Less costly**

As the following explanations and illustrations show, the technology base is... a hill.

For a more complete explanation of all the Particular Concepts™ technologies, please go to http://particularconcepts.org**.**

For lesson plans/videos to help meet STEM (Science, Technology, Engineering and Math) goals using the new physics/engineering concepts, please go to http://particularconcepts.com**.**

Contents

Anatomy of a Hill

Don't be fooled by its familiar simplicity -- **A hill's structure is unique -- and powerful. Without the qualities of a hill, the natural world would be flat; interrupted only by solid rock formations. Earth particulates -- gravel, silt, loam, clay, sand, etc. -- make up most hills. Hills are made of individual solid *particles*. When the particles are all together in one place, we call them solid *particulate*. What is unique about particulate is that it flows like water -- but water does not pile. Dry sand and water both pour out of a pitcher. Only the sand makes a pile -- or hill.**

Why a hill? -- **The particles in a hill act against each other due to the friction between their surfaces. The more friction between the particles, the more they push each other, and the higher their hillside slopes. This slope is a particulate's *angle-of-repose* (angle of internal friction).**

Angles-of-Repose are unique -- **A piece of gravel is not as round as a grain of dry sand. Gravel does not roll/flow as much as dry sand. Pieces of gravel push/roll/flow against each other to form a steeper hillside -- a higher angle-of-repose. Grains of dry sand push/roll/flow against each other to form a gentler hillside -- a lower angle-of-repose.**

Pile of Gravel **Pile of Dry Sand**

Angles-of-Repose are constant -- **Particulate in a hill flows down the hillside when you add more to the hill. The particulate flows down to fill the hole when you scoop out part of the hillside. In both cases, the particulate piles -- or stops -- when it reaches its natural angle-of-repose -- again. Its "desire" to be at its natural angle-of-repose is unchanging. In some cases, water or other factors can change the particulate's angle of repose to a new "desire". This new "goal" is then an anticipated design constant.**

The proof is in the sandbox -- **When we add dry sand to our hill, the dry sand slides down the side of the pile. When we dig away or under our hill, the dry sand pile falls into the hole we made. We observe the same outcomes when we witness a landslide or the erosion of a riverbank.**

Particular Concepts™ -- **The Patented Particular Concepts™ use the unique power of a hill as powerful technology. Designing for angle-of-repose (angle of internal friction) controls when particulates flow (or "GO"), when particulates pile (or "STOP), and when they can move or retain other objects -- or other particulates.**

A Particular Valve™ Summary

US7341399 -- GB2441073 -- NZ563219

The Particular Valve™ is the basic building block of the Particular Wall™ and the Particular Blanket™.

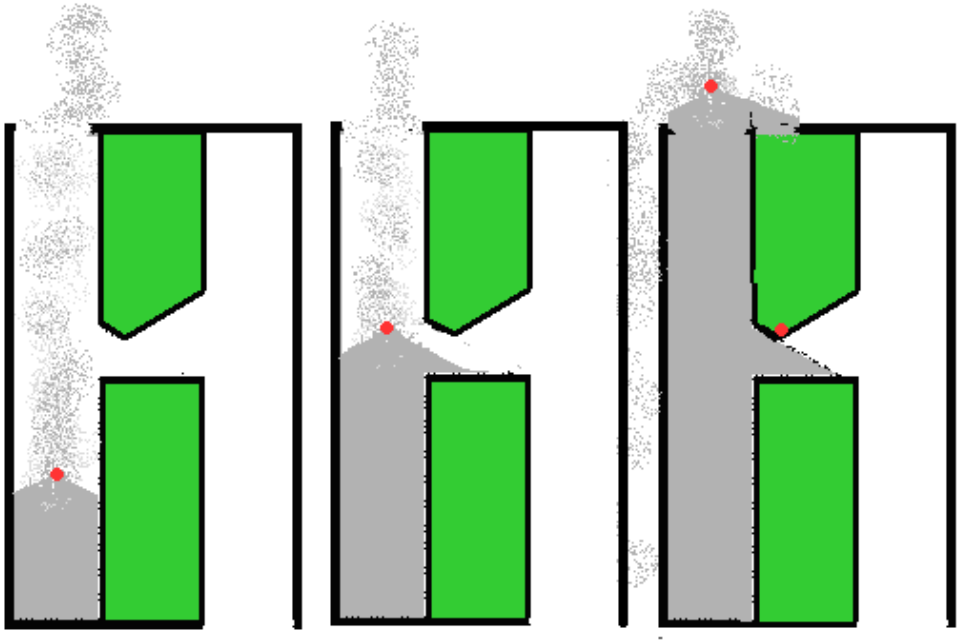
By measuring the angle-of-repose of the particulate you want to control, an engineer can design a permanent, stationary valve to either "Stop" or "Go" a particulate:

- **When designed NOT TO support the particulate's unique angle-of-repose, it is a "GO" valve.**
- **When designed TO support the particulate's angle-of-repose, it is a "STOP" valve.**

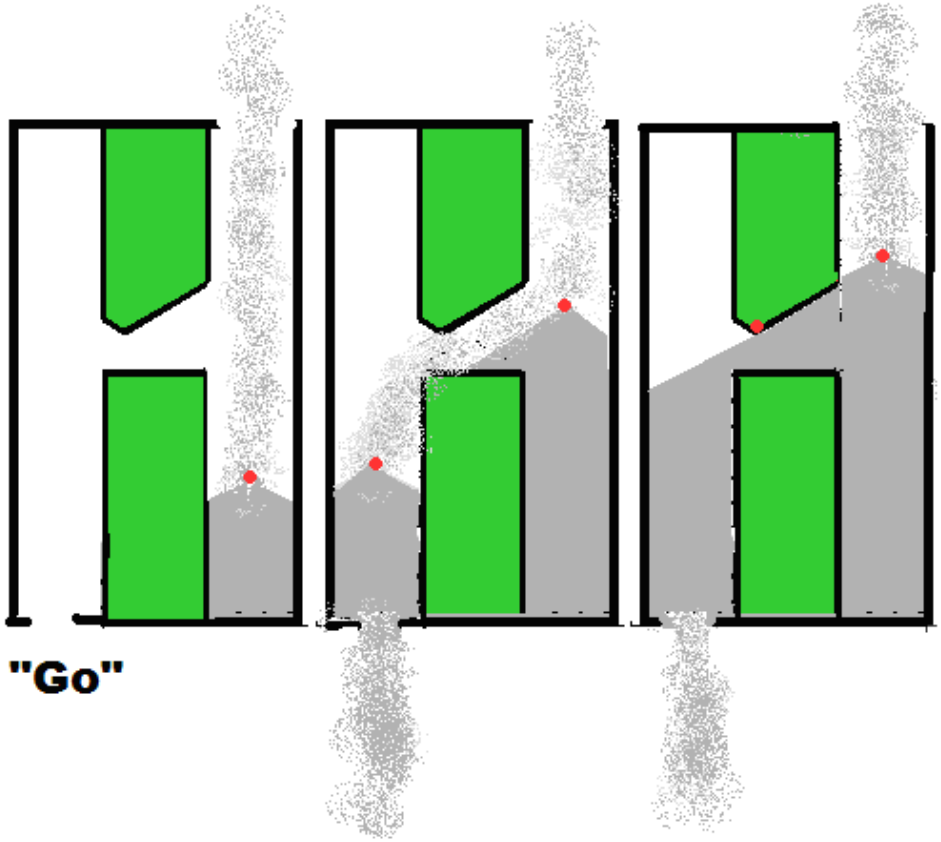
It can mix pharmaceutical powders, control grain storage, and contain road salt.

It also makes a nifty hourglass...

“STOP” and “GO” Diagram



"Stop"



"Go"

Note the red dots (●) for each application: where the angle of each hill starts!

Particular Wall™ technology is as powerful as a landslide -- without the ill effects.

The Particular Wall™ applies the inherent gravitational forces of particulate -- earth, gravel, shell, etc. -- against itself, through the properties of angle-of-repose. Civil Engineers familiar with the forces of particulates (first quantified by William McQuorn Rankine) will recognize the motive -- turned retentive -- applications:

- **Eliminating wall rotation**
- **Stabilizing slopes longer under more circumstances (including soil liquefaction).**

By choosing the particulate used -- either by trucking it in or designing the wall for the economically preferred on-site particulate -- the Particular Wall™ eliminates much of the guesswork when building a traditional retaining wall. There are two design parameters to consider:

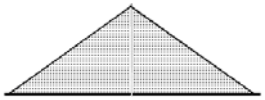
- **The chosen particulate's angle-of-repose (to size the Particular Valve™)**
- **The chosen particulate's density (it must be equal or greater than the slope retained)**

Without heavy mass or intensive earth conditioning, the Particular Wall™ reduces on- and off-site costs. Since the Particular Wall™ structure is more stable BECAUSE of the "holes" it has, it reduces both material and trucking costs (holes are low in material cost and fairly cheap to haul -- ;).

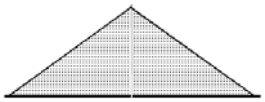
In addition, a Particular Wall™ can be engineered to have a "forever" steep slope (79 º degrees with a fill angle-of-repose/dfa of 30º), or small baffle (11º with a fill angle-of-repose/dfa of 30º).

Sandbox Piles

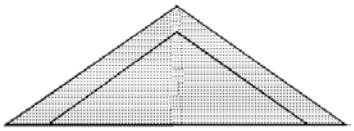
Regular



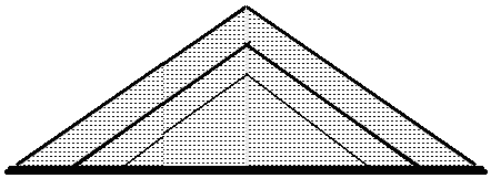
A Pile



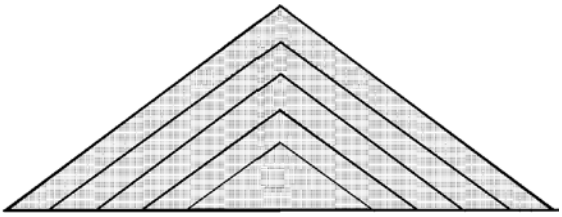
A Pile



Bigger Pile

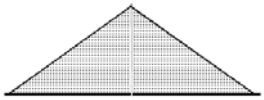


Bigger Bigger Pile

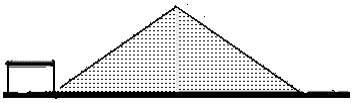


Bigger Bigger Bigger Bigger Pile

Particular Concepts™

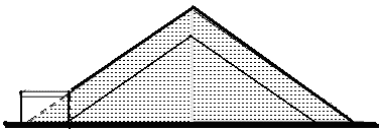


A Pile



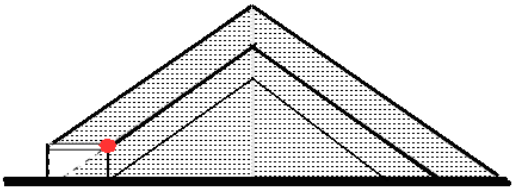
A Pile

With a “Step”



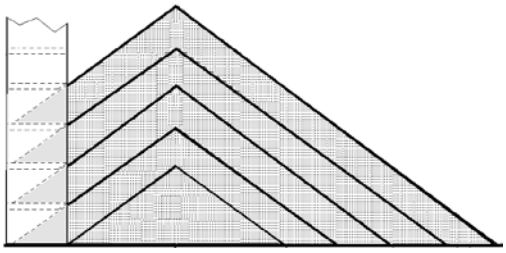
Bigger Pile

With a “Step”



Bigger Bigger Pile

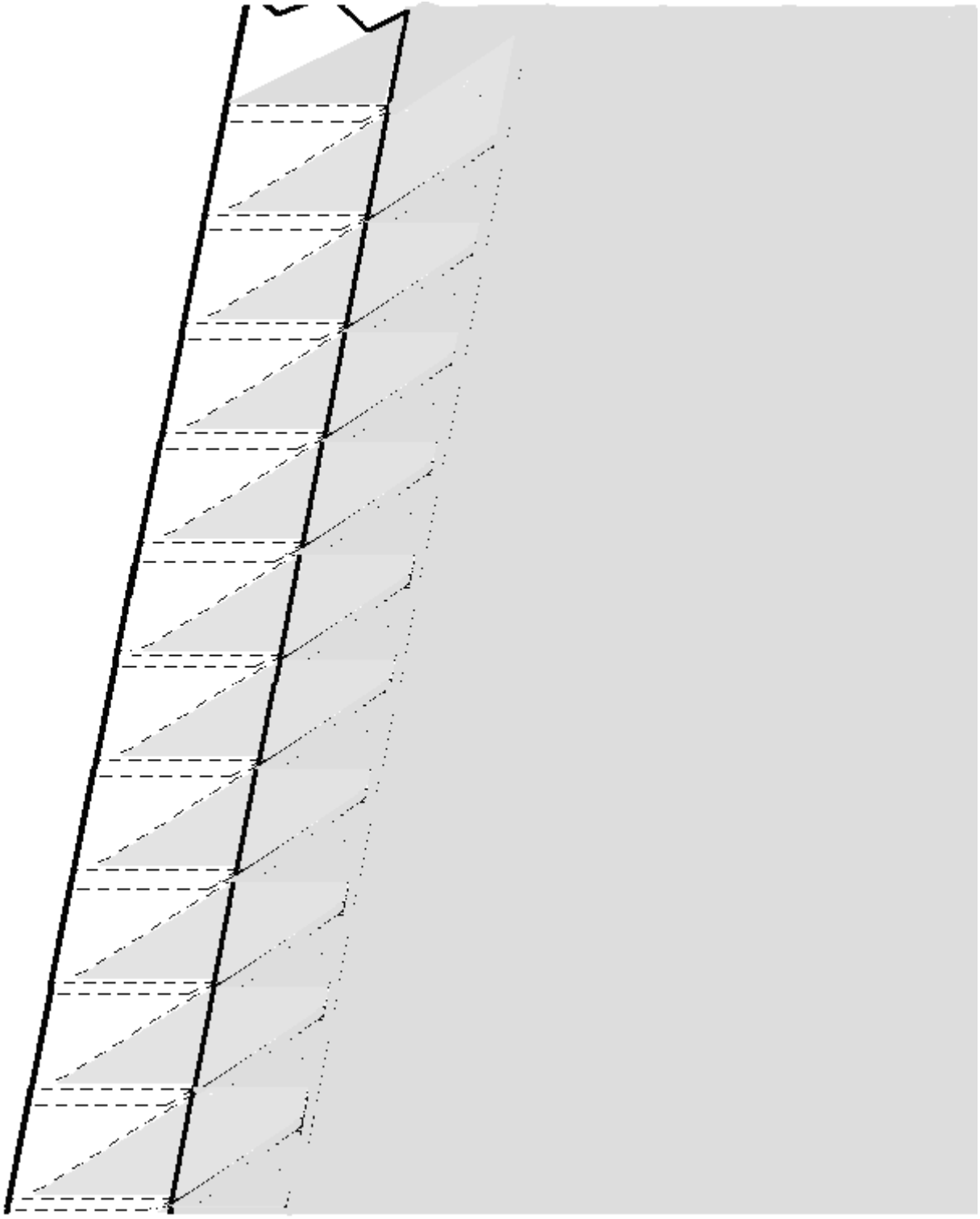
With a Particular Valve™*



Bigger Bigger Bigger Bigger Pile

With a Particular Wall™

REALLY BIG PILE -- (almost forever) Particular Wall™

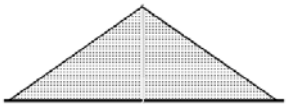


With the Particular Wall™ Slanted at 11º for dfa = 30º

Particular Wall™ (Short Engineering Explanation)

#1 -- A stable "Particular Pile" -- made up of flowable, loose particulate -- at rest at its natural angle of repose.

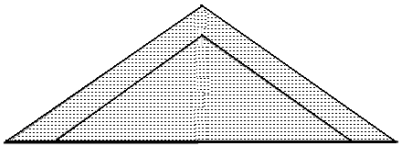
#1



A Pile

#2 -- The same pile, with an added layer of particulate. The new layer has the same angle of repose.

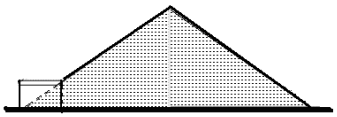
#2



A Bigger Pile (with new layer).

#3 -- Same pile, with a "step". The particulate is seen through the "step" supports --  -- at its angle of repose.

#3

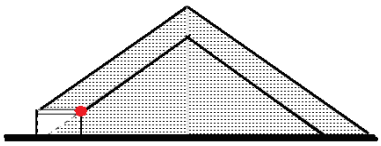


A Pile with a "Step"

#4 -- New layer is stable at its angle of repose. The "step" is the patented Particular Valve™*.

Note: The Right Upper Edge of the Particular Valve™ precisely sets the point where the angle of repose of the first layer starts* (●)

#4.

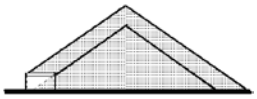


A Bigger Pile with Particular Valve™* (new layer held up)

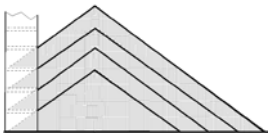
#5 -- The Particular Valve™* is one unit of the patented Particular Wall™**. The Particular Wall™** retains and controls all layers.

NOTE: The top Particular Valves™ -- when left open -- will "catch" and control any future additions (such as landslides).*

#5



The Particular Valve™ is one unit of the Particular Wall™



The Particular Wall™** Retains all layers at their angles of repose

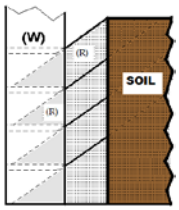
---

#6 -- The Particular Wall™** retains the particulate (R), and the soil behind it.

Density of (R) = or > Density of SOIL

NOTE: Force is even along the wall height, minimizing rotation. Center of gravity (cg) is right of center, due to the weight of particulate.

#6



Particular Wall ™** Retains the Particulate (R) and Soil.

#7 -- The Particular Valve™ Resultant Force Vector (dotted arrow) must fall within the base.

*Note: "Baffling" -- 11º for particulate with 30º angle of repose **("dfa")*** -- assures an infinitely high stable wall (with gravity).

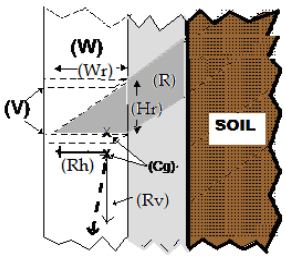
"Infinite" Baffle Angle Tangent =

((1-SIN(RADIANS(dfa)))/ (1+SIN(RADIANS(dfa))))

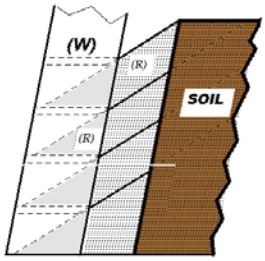
÷

(1/(TAN(RADIANS(dfa))))

#7



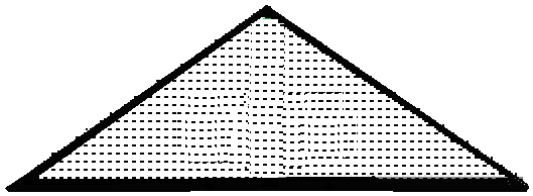
Particular Valve™* Force Diagram



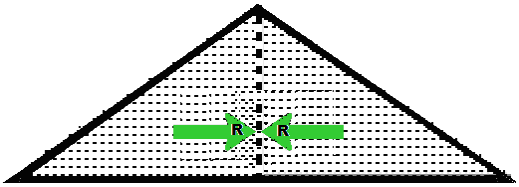
"Infinite" Baffle 11 º

Physics of a Hill

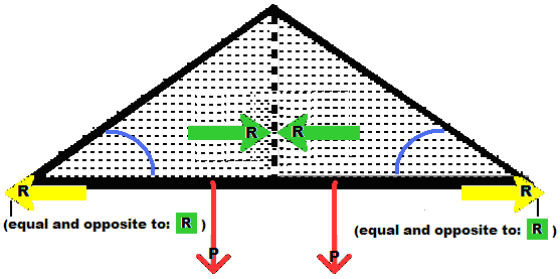
A Hill



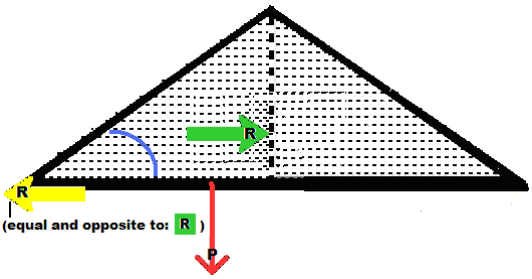
Forces Within a Hill



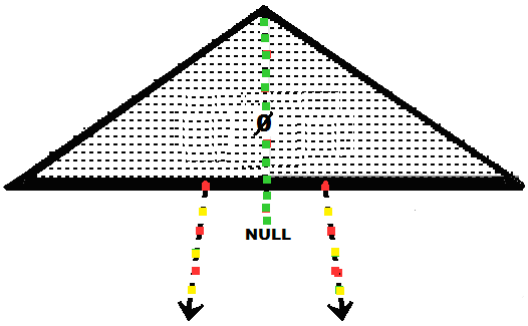
Within a Hill Entire



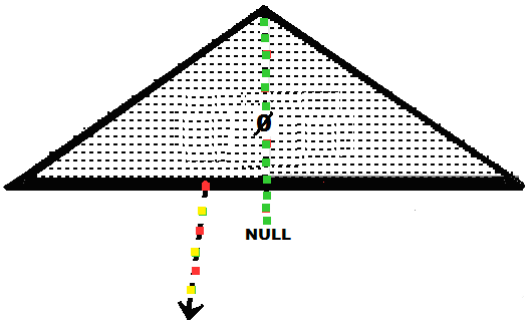
Within ONE Side of a Hill Entire



Resultant Vectors Within a Hill



Resultant Vectors Within ONE Side of a Hill



R = Rankine Force

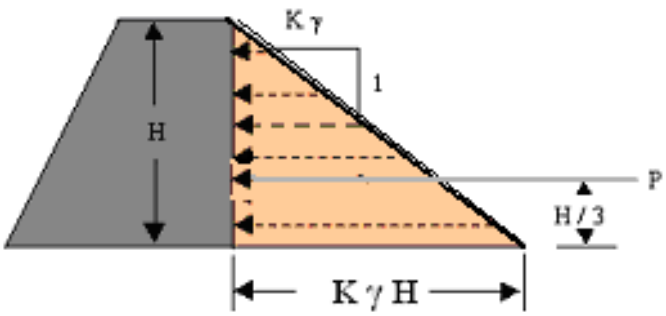
R = Equal and Opposite Rankine Force (Sir Isaac Newton)

P = Particulate Weight

Null / Ø = Balance of Rankine Forces

= Angle-of-Repose (angle of internal friction)

Rotation -- Traditional Wall vs. Particular Wall™

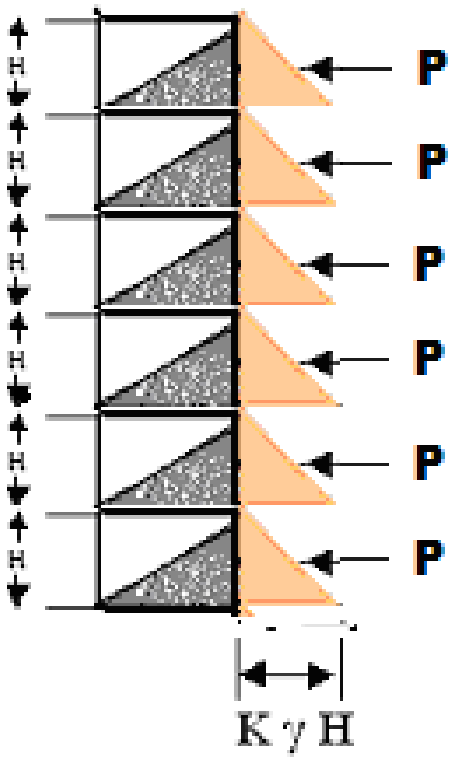


$$P = \frac{H * K\gamma H}{2}$$

$$P = \frac{K H^2 \gamma}{2}$$

$$K = \frac{2P}{H^2 \gamma}$$

Traditional Evaluation



$$P = \frac{H * K\gamma H}{2}$$

$$P = \frac{K H^2 \gamma}{2}$$

$$K = \frac{2P}{H^2 \gamma}$$

(P at H/3 for each valve)

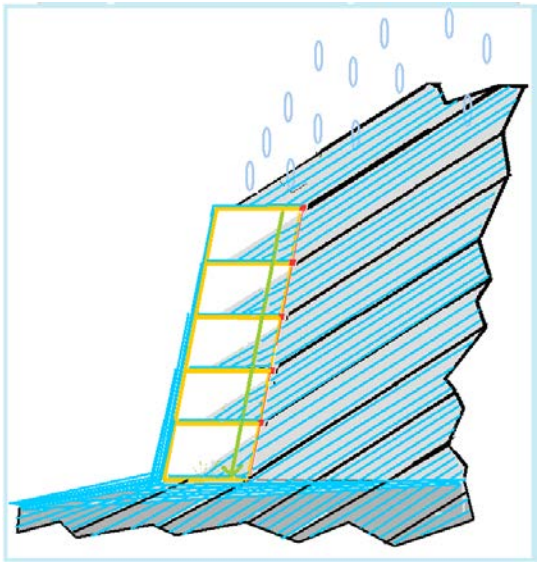
Particular Wall™ Evaluation

No increase of loads due to depth, so NO rotation.

Additional Benefits of a Particular Wall™

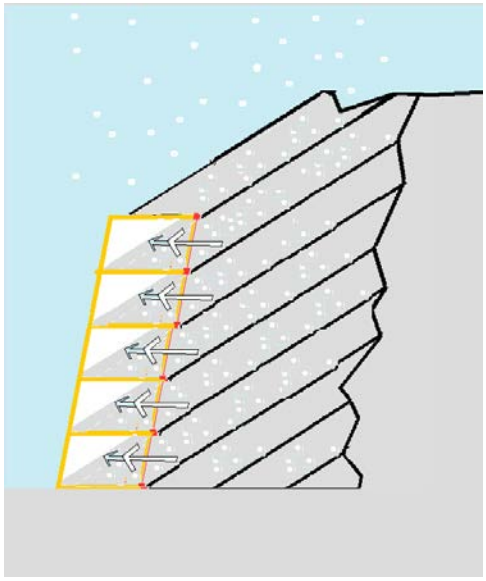
Water Drainage

(For runoff)



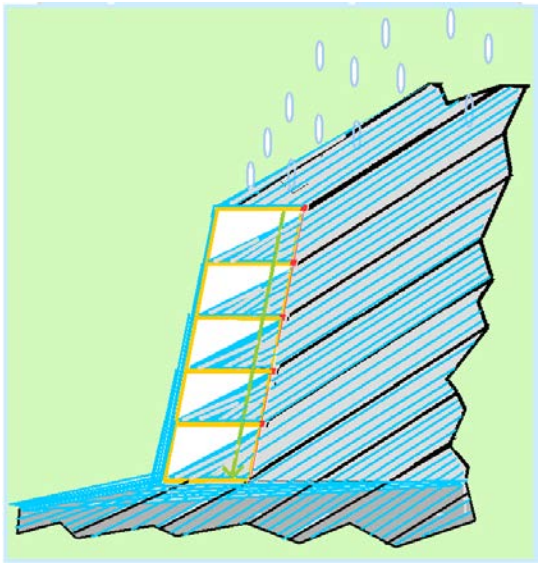
Freeze Hove Adjustment

(For gradual push-out forces)



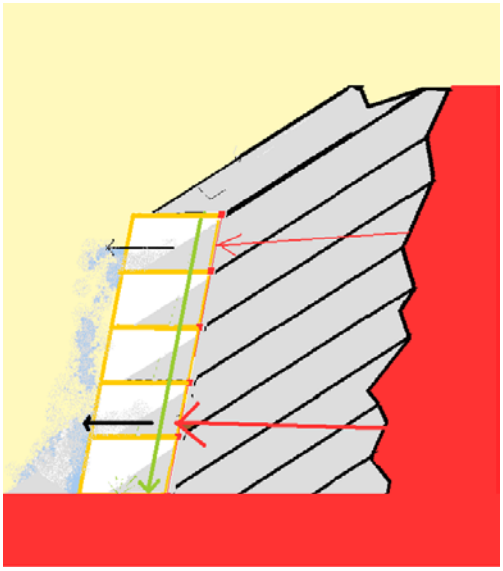
Liquefaction Safeguard

(For angle of repose change -- water or earthquake)



Uneven Lateral Force Relief

(For intense push-out forces)



Brick Window Well using a Particular Wall™

(State College, Pennsylvania)

A Particular Wall™ made with Matireal™

(Milwaukee, Wisconsin)

http://beintween.ning.com/forum/topics/matireal-retaining-wall

“ 

matireal™ retaining wall

- Posted by keith hayes on February 18, 2013 at 3:26pm
- View Discussions

thanks to elsie spry of particularconcepts.org, and the physics that govern the anatomy of a hill, matireal can be stood upright and has yet another civil engineering capability.

believe it or not, it can also serve as a retaining wall with no foundation!

using the rankine theory of particulates, the patented particular concept technology suggests that a retaining wall need not be solid. in fact the open cells are what negate the lateral forces common in most retaining walls.

"how a retaining wall with HOLES is better than one without! this patented design concept takes advantage of angle-of repose, a shift of center of gravity, as well

as proportionally reducing surcharge, shear and rotation forces (the more holes, the more surcharge, shear and rotation are reduced). also maximizes drainage both internally and externally."

see a great example here of this concept here:

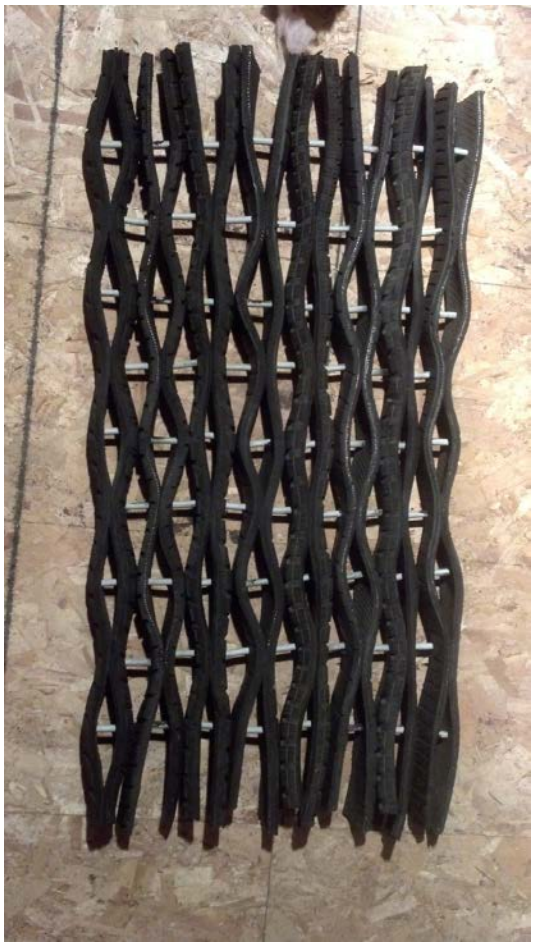
https://www.youtube.com/watch?v=nvOOgEsyXzM&feature=player_embedded

bewildered by this concept, and prompted by elsie to see if our matireal could also employ the technology of the particular wall, fellow beintweener jeff and i decided to put it to the test.

it worked! check it out:
https://www.youtube.com/watch?v=G1ktO1bAeNQ&feature=player_embedded

building models is a great way to test out how this actually works. as shown in the video of the particular wall, a bit of aggregate spills out as it is backfilled, but a surpisingly small amount.

here are pictures of the [Matireal™/Particular Wall™] to give some additional looks:



matireal™ as a doormat (thanks to thomas keeley, a gold level sponsor of our kickstarter, we were able to upcycle his backer reward to make this demonstration)

this master craftery of this matireal™ weave is owed to beintweener jacob bruni who was able to tame the inherent structure of the autombile tire. the smooth cuts are credit to willie fields.

right handed + left minded beintween treasurer jeff haneline took the lead on assembling this half scale model.

the model was backfilled with rock salt as scale appropriate aggregate. made visible are the miniature hills that naturally form on account of the friction of the aggregate and the angle of repose.

here's a closeup of the hill formed under each consecutive tread, which layer by layer secures the prior.

a straight on detail view in elevation of one of the open cells

each of the undulations and tread patterns are unique, but it works regardless, though it is essential to make sure each layer is paired either outside to outside or inside to inside.

this is the closest you want to get to tires or rock salt.

from the top down, all filled up. one can see a cross axial view of the angle of repose on the edge.

what's in this pitcher is all that spilled out after topping off the model with 60 lbs of rock salt!

if the retaining wall is above eye level, you don't see much other than the matireal™ weave.”

Particular Blanket™ Summary

GB2462742 / US7748929

With the power and physics of particulate (sand, gravel, soil, sewage sludge, runoff sediment, etc.), the Particular Blanket™ is a horizontal application of the Particular Valve™. It catches the particulate suspended in moving water. Particular Blanket ™ takes advantage of the suspended particulate's angle-of-repose to stabilize, maintain, and/or increases banks and beaches through accretion.

It minimizes costs since the majority of the stabilization RELIES on on-site particulate.

In addition, when pre-filled with gravel or activated charcoal, it stabilizes riverbanks AND filters water flowing through the valves. This application benefits the indigenous plants, wildlife, and humans that use the water.

Beach/Bank/Bed Stabilization

- Particular Blanket™ "**catches**" **some of the particulate in each wave action, maintaining the bank, beach, or channel.**

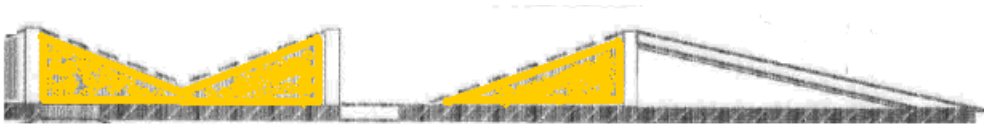
- Anchored **with spade attachments, it maintains a specific height/slope. This is useful in channel maintenance.**

- Constructed **with a wide variety of materials (reinforced fiberglass, concrete, treated wood, galvanized steel, etc.) and filled with a wide variety of particulate (sand, gravel, slag, coral, etc.) the Particular Blanket™ can be applied by professional engineers in many circumstances and within many budgets.**

Basic Particular Blanket™ Unit Diagrams

Custom Unit

Unit shown with deposited particulate --



WATER SIDE

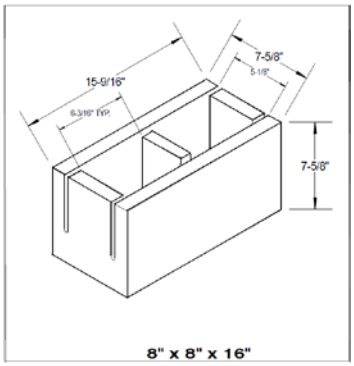
Concrete Block Variation Unit

"Knock Out" Bond Beam Blocks

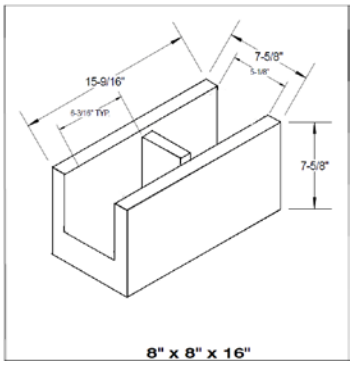
Facing blocks with one end filled with angled concrete --)

Unit shown with deposited particulate --

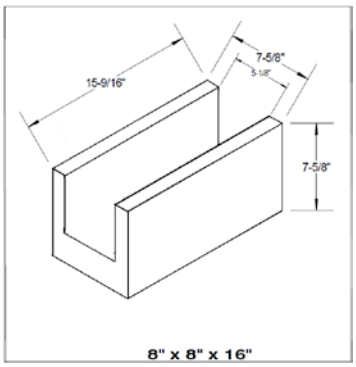
WATER SIDE



"Knock Out" Bond Beam Block



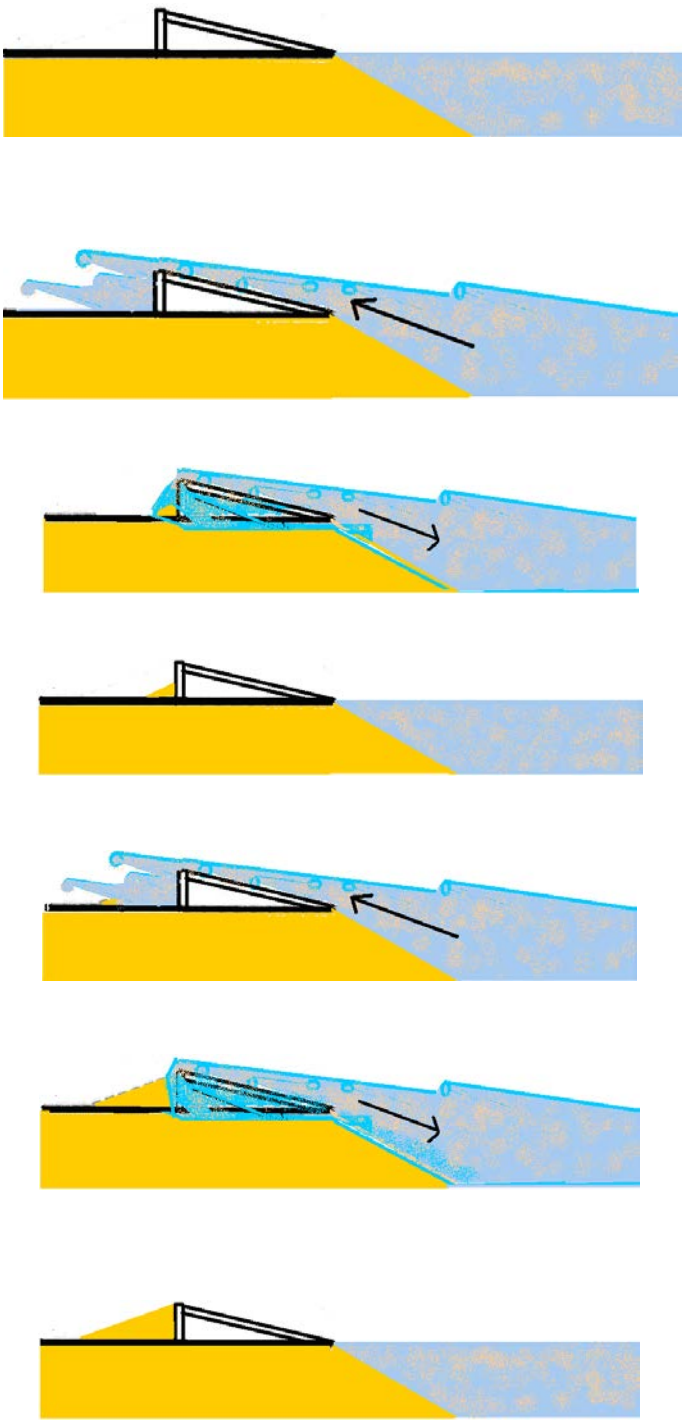
Ends Knocked Out
(Portrayed in diagrams)



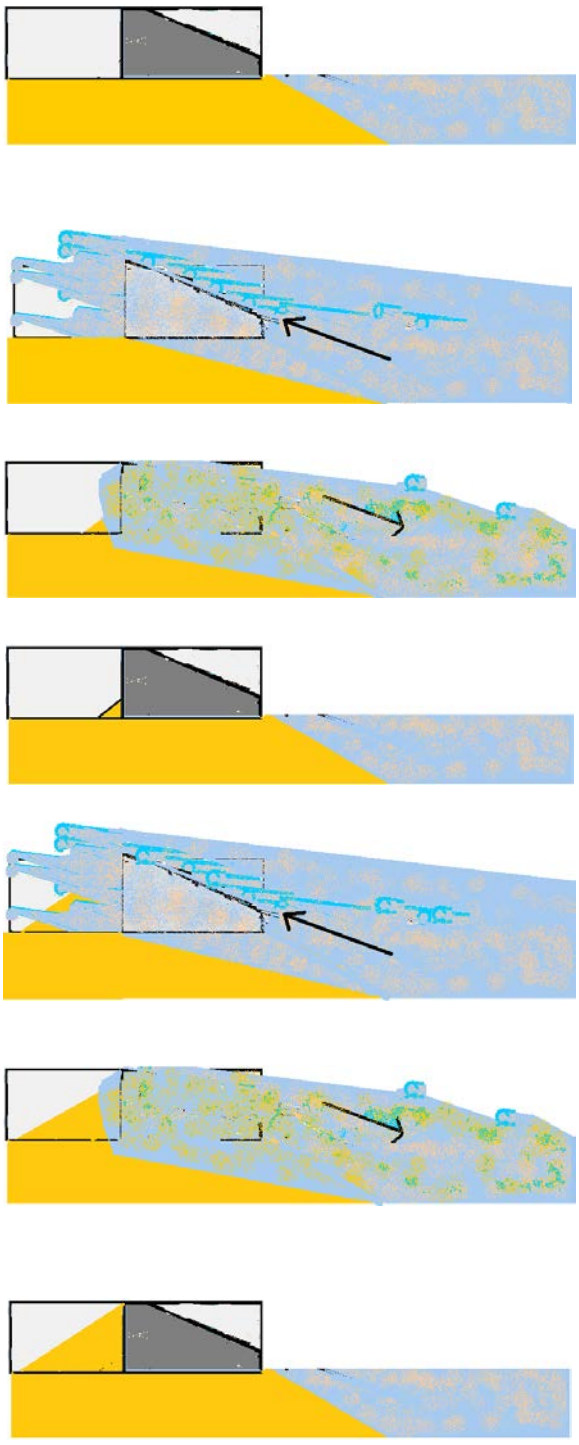
"Beam" Block Extension
(For lower angles-of-repose)

Particular Blanket™ Wave/Runoff Progressions

Custom Unit

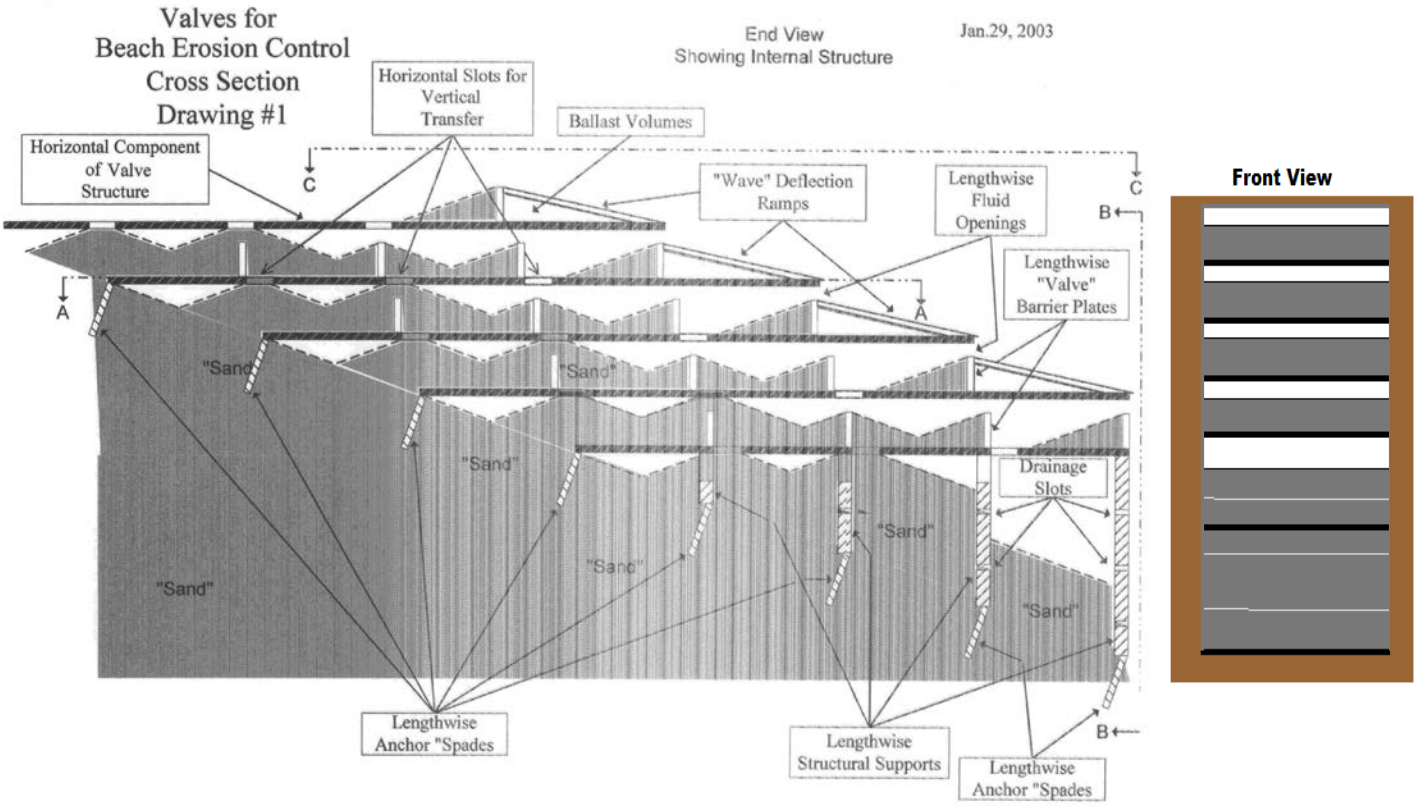


Concrete Block Variation Unit



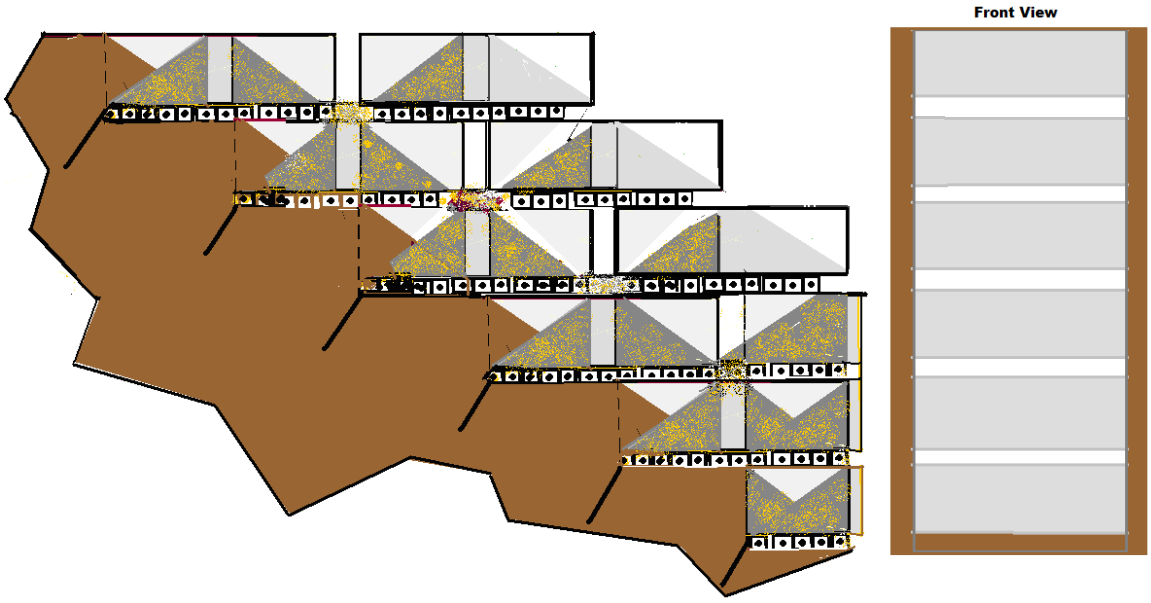
Anchored Particular Blanket™ Diagrams

Custom Unit System



Standard Concrete Block System

"Knock Out" Bond Beam Blocks



Conclusion

The patented Particular Concepts™ take advantage of the powerful simplicity of a hill:

- **The Particular Valve™ precisely controls the ebb and flow of powders, grains, and other commercial particulate.**

- **The Particular Wall™ turns traditionally threatening forces of particulates into stabilizing ones. Simplifying and improving the construction of retaining walls for various purposes, it performs longer and under more circumstances.**

- **The Particular Blanket™ maintains banks, safeguarding the navigation and clarity of our waterways. In addition -- when pre-filled with water-filtering gravel, sand, and/or activated charcoal -- it can improve water chemistry, meeting both environmental and commercial goals.**

To apply these technologies through licensing, please contact:

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Particular Concepts™

Non-Cohesive Particulate ▸ NO change with addition of water

Dry Gravel Wet Gravel VERY Wet Gravel

Cohesive Particulate ▸ changes with addition of water

Dry Sand Wet Sand VERY Wet Sand

http://www.douglasmanufacturing.com/engineering-info/matCharacteristics.php3
http://www.mi-ita.com/Portals/0/pdf%20files/Safety/angleofrepose.pdf

Various Measured Material Characteristics

Material	Avg. Wt. Lbs. Per Cubic Foot	Angle of Repose (Loose)
Ashes, Dry	35-45	45°
Ashes, Wet	45-50	45°
Cement, Clinker	75-95	35°
Charcoal	18-28	35°
Cinder, Coal	40-45	35°
Coke, Loose	23-32	30°- 44°
Earth, Dry	76	45
Earth, Saturated (Wet)	102-112	34 - 45
Earth, Super-Saturated (Very Wet)	?	26
Feldspar, Ground	65-70	35°- 40°
Gravel	90-100	30°- 44°
Sand, Bank, Dry	90-110	35°
Sand, Bank, Saturated (Wet)	110-130	45°
Sand, Bank, Super-Saturated (VERY Wet)	130	?
Slate, Crushed	80-90	28°
Slate, Ground	80	45°
Sugar Beet Pulp, Wet (similar to composting vegetable matter)	24-54	20°- 29°