

## Trail Materials Analysis and Comparison Matrix

For many years, agencies, trail consultants, land managers and trail stewards have sought the perfect trail surface for sustainable multi-use trails. The ongoing search has led to the development of new alternative surfacing products and the realization that there may be several suitable options depending on the unique characteristics of the area. The best trail materials are determined by trail use, local soils, hydrology, topography, vegetation, availability and local familiarity with the trail material.

Trail materials are compared based on a variety of factors. Relative to the Arana Gulch Master Plan criteria, the trail surfacing must meet a variety of requirements:

- Safe, in all types of conditions for public use
- All weather accessible for wheelchairs, per Americans with Disabilities Act (ADA)
- Protect water quality and subsurface drainage
- Permeable
- Context sensitive
- Low construction impacts and maintenance

The City of Santa Cruz is proposing to use integral colored Porous Concrete or Porous Asphalt for surfacing the multi-use trails in Arana Gulch. Features that the City considered in selecting porous concrete or asphalt include:

- Durable; does not rut, ravel or crack easily
- Strong; stays firm, level and safe
- Long life expectancy
- Low glare
- Integral color of native earth
- Low maintenance
- Good for wheelchairs, strollers etc.
- Less inviting for skateboards and fast traffic
- Accommodates light maintenance vehicles
- Rustic appearance
- Porous
- Cost effective

**Porous Concrete:** This material is durable and has free flowing drainage characteristics. Porous concrete pavement has a 15-25% void structure, allowing 3-8 gallons of water per minute to pass through each square foot. When it rains, porous concrete drains, putting water back in the ground. It is being used more frequently locally and in this type of environment. Porous concrete provides a safe, firm, level, nonskid surface; its ability to maintain this safe surface in all conditions including heavy rain; its durability and its low maintenance requirements meet the project requirements. Its appearance is more “rustic” than asphalt or conventional concrete due to the voids that allow water infiltration, i.e. a better visual fit for a natural setting. Colors are available similar to the color of the native soil and the adjacent environment in Arana Gulch. This material was reviewed by our

design team, and was deemed acceptable per the project's environmental documents, master plan and permit conditions.

**Porous Asphalt:** Asphalt is a time tested, low cost material to install and maintain. It is pervious to promote surface and subsurface drainage. It is readily available and can be colored to match the adjacent environment, though the color may have to be re-applied in future years.

**Natural Pave:** Natural Pave resin pavement binder is mixed with aggregate material to produce a durable and flexible surface, similar to asphalt, but without petroleum products. The foundation layer allows water to move laterally through the foundation, though the surface has limited permeability and unknown longevity. The aggregate color can be selected to match the surrounding environment.

**Filter-Pave:** This relatively new product is made from recycled crushed and rounded glass that is bound by flexible elastomeric glue. It has not been used in this area before. The color is made up of what recycled glass and granite chips are available locally which is typically mixed colors. It is a porous material allowing for drainage. Long term maintenance requirements are unknown.

**Gravel-Pave:** Gravel Pave is a system that uses a plastic grid to contain compacted sharp edged aggregate in place. It is a porous material allowing drainage. There is no binder to hold the materiel in place and so is not suitable for slopped areas and this application. The aggregate color can be selected to match the surrounding environment.

**Decomposed Granite:** Decomposed granite or DG is crushed granite particles, often a byproduct of granite quarries. DG provides an inexpensive paving option for pedestrian-friendly soft surface trails. It provides a surface texture similar to lightly compacted sand and is a nice material for footpaths. Unfortunately it has some deficiencies. It tends to rut, ravel and erode over time. Ruts and ravels at any time can create unsafe conditions for wheelchairs, the elderly and cyclists. In areas exposed to significant rainfall and /or flooding, puddling occurs and DG can deteriorate rapidly and become impassible.

DG paths on hillsides are prone to erosion. DG paths used for public access should have edging to keep the DG in place. Redwood header boards or steel are commonly used for edging. A DG path with steel edging will cost the same as a concrete path. Construction costs for DG paving include grading, vegetation clearing, edging, geo-textile fabric, aggregate base, and decomposed granite fines. A heavily used DG path will require low spots and washout areas filled-in and re-compacted each year and complete reconstruction every five to seven years which causes environmental impacts.



**Trail condition during winter and spring at Agnes Street entrance**

**Decomposed Granite with Binder:** This familiar product can be mixed with a binder, just as cement, to create a light weight resilient though not hard wearing surface. It does erode and rut with use and rain, and has to be re-graded and compacted often, causing greater disturbance. The surface has limited permeability, though the foundation allows for lateral drainage.

**Boardwalk:** This product is typically used over water or wet areas and the deck can be made of wood or recycled plastic. The substructure is made from wood and any in contact with soil or moisture will be pressure treated for improved longevity. The surface has limited permeability, though water can drain below the deck. It is not slip resistant and cannot be used in slopped areas. 4-1/2 foot high railings are required when it is built above the exiting ground level. Maintenance frequency and cost are high causing greater impacts to the environment.

**Paving vs. Decomposed Granite:** The goals of using DG as a trail material are to maintain a natural appearance to enhance the aesthetic appeal to users and to construct a hardened, low impact, permeable and accessible trail. Those are the same goals of a paved trail constructed with porous colored concrete. A concrete path can be constructed to look very similar to a DG path and provide a natural look through coloration and surface texture. Permeable concrete has stronger safety characteristics and ADA compliance when compared against DG for use as an all-weather surface and provides a trail surface that is safer, more accessible, and compliant with project requirements.

**Recommendation and Construction Method:** The City of Santa Cruz is proposing to use Porous Concrete or Porous Asphalt for surfacing the multi-use trails in Arana Gulch. We are proposing these materials for several reasons. There is local experience with these products and availability of experienced contractors. The installation and future maintenance can be completed from within the trails alignment as the work moves forward. The surface is all weather, fully accessible, context sensitive and the trail design will not impact surface or subsurface flows.

The 8 foot wide paths can be constructed within the current confines of the existing trail area. The City alignment is intentionally designed to match the existing terrain to achieve ADA compliance with the least impact to the open space area and in the most context sensitive manner. By placing the trail on this alignment the construction footprint is minimized, the amount of grading is reduced, and drainage is unaffected. The 2 foot wide shoulders will be native soil and planted appropriately according to the management plan.

## Trail Material Examples



Porous Asphalt



Porous Concrete



Filter-Pave ®



Natural-Pave ®



Gravel-Pave ®



Decomposed Granite  
with Binder



Boardwalk

## Trail Materials Comparison Matrix

The higher points in a category denote a beneficial rating. The first two categories have a maximum 20 points and the remainder 10 points.

	CONSTRUCTION & MAINTENANCE IMPACTS	PERMEABILITY	ADA COMPLIANT & SLIP RESISTANT SURFACE	CONTEXT SENSITIVE	CONSTRUCTION COST	MAINTENANCE COST		COMPARATIVE RATING (90 MAX)
<b>POROUS CONCRETE</b>	20	20	10	10	5	10		<b>75</b>
<b>POROUS ASPHALT</b>	20	20	10	5	10	5		<b>70</b>
<b>NATURAL-PAVE</b>	20	10	10	10	5	10		<b>65</b>
<b>FILTER-PAVE</b>	20	20	10	5	5	5		<b>65</b>
<b>GRAVEL-PAVE</b>	20	20	0	5	5	5		<b>55</b>
<b>DECOMPOSED GRANITE WITH BINDER</b>	10	10	5	10	10	0		<b>45</b>
<b>BOARDWALK</b>	10	10	0	5	5	5		<b>35</b>