



# TRAILS FOR ALL

EXPANDING THE  
ACCESSIBLE  
TRAILS NETWORK IN THE  
COMMONWEALTH  
2026



# APPENDIX B: TRAIL SURFACING MATRIX

The following matrix was compiled by the Trail Surfacing & Construction Subcommittee and informed by both professional experience and lived experience with disability. It attempts to present the considerations involved in selecting a material and the relative pros and cons of each.

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
UNBOUND	<p>3/8" Minus Crushed Stone</p> <p>Locally-quarried granite or trap rock, crushed and screened to achieve a mix of sizes in carefully specified proportions. Applied compacted, without binder.</p>	<p>Firmness: Firm when properly constructed and maintained to prevent loosening of material.<sup>1</sup></p> <p>Stability: Stable when properly constructed and maintained to prevent loosening of material.</p> <p>Slip Resistance: Inherently slip resistant when maintained to prevent loosening of material.</p>	<p>Low embodied carbon if sourced locally; easy to replace and recycle with little waste</p>	<p>Best for low speed, low impact trail use with focus on being in nature; less enjoyable for biking. Softer underfoot than hard pavement, and can provide a pleasing crunch; blends into the appearance of native soils on site; fits well with both natural and historic sites.</p>	<p>General use for longer trails and cost-sensitive projects; forgiving and adaptable, especially if ongoing maintenance is available.</p>	<p>Natural appearance; permeable; widely used; cost-effective; not subject to tree root damage; cooler temperature; self-sealing surface; low embodied carbon; with proper design, does not need to be installed at higher grade than adjacent surfaces</p>	<p>Dusty when dry; soft when saturated; requires proper base prep and good drainage; not all quarries can produce; quality varies considerably between quarries; on sloping sites typically requires controlled drainage with ditches and cross culverts to prevent washouts; rolling resistance is higher than pavement</p>
STABILIZERS	<p>Organic-Lock by Envirobond</p> <p>Patented, plant-based organic binder typically mixed with locally-sourced crushed stone</p>	<p>Firmness and Stability: Provides a firm and stable surface across its width with less softening and loss of material due to seasonal changes in moisture.</p> <p>Slip Resistance: Inherently slip resistant if sufficiently compacted.</p>	<p>Low embodied carbon, organic glue low in problematic chemicals (PFAS, petroleum byproducts). Permeable (comparable to loam).</p>	<p>A reasonably soft path that will hold up to traffic. Careful sourcing of material can help blend into the natural context. Color reflects the source material. After the surface has dried, the top most layer (maybe an 1/8") of stone dust loosens to provide a comparable look and feel to compacted stone dust paths.</p>	<p>In areas of high use or where reliable ADA access to important site feature or viewpoint is desired. Most successful where careful grading and drainage eliminates any concentrated water flow. Helpful for trails that will also require vehicular access for maintenance or safety, but subject to surface damage from vehicle turning or tire-spinning.</p>	<p>Provides more consistent accessibility; natural appearance with low dust and dirt-tracking; weather resistant; softer and more flexible/plastic when rewet with better ability to "self heal".</p>	<p>Higher upfront cost than unbound 3/8" crushed stone; Repairs difficult and need specialized contractors to complete (the same as install: material needs to be mixed in fairly large minimum quantities with specialized equipment [pug mill]); washouts are not infrequent; not performing well on slopes over 7%, does not perform significantly better than unbound 3/8" crushed stone, but repairs are more difficult</p>

<sup>1</sup> ADA regulations do not set standards for recreational trails, and adherence to ADA standards involves more than surface alone. Therefore this comparison focuses on key characteristics of ADA-compliant surfaces, including firmness, stability and slip resistance.

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
3/8" Minus Crushed Stone cont.	Can be moved and placed with common equipment. Requires thorough compaction with vibratory plate compactor or roller.	Can be very stable with good sub-base and drainage, but can erode quickly with a concentrated flow of water in strong storm events. Edges of path tend to become softer than center over time. Certain aggressive colonizing plants may present a weed issue. Chipmunks and other animals can make holes.	<p>3/8" minus can be compacted but to perform well it is important that the gradation (ratio of fine, medium coarse materials) is carefully engineered. Ideally, the specified gradation should have been used in the past successfully.</p> <p>It critical that an amount of water is used in the compaction process that is "just right" for the given mix. This is somewhat of an "art" and it is critical that specifications are written to require prior experience building compacted stone dust paving.</p> <p>Grading (slope of the finished surface) is also critical, because insufficient cross slopes, flat spots, and reversals will have a tendency to generate problematic erosion.</p> <p>Like all natural surface solutions, purpose designed and built trails will perform much better than trails being "converted" to accessible trails.</p>
Organic-Lock by Envirobond cont.	Organic-Lock has very specific requirements for installation and generally cannot be installed without expertise. Temperature and moisture also have to be within acceptable ranges or the product will fail.	Remains firm and stable across path width with little maintenance, but can fail quickly if subject to concentrated water flows.	<p>Special machinery and expertise is needed, and temperature and moisture conditions have to be met. The material fails if it is not installed properly.</p> <p>Grading (slope of trail surface) is critical to success. A cross slope of 1.8% to 2.0% for a running slope of 5% max has performed well at Shaw Elementary School, Upton Community Center, and Marion Bicentennial Park. Trail surface should be allowed to freely drain on the downhill side with no edging or plant beds restricting or channelizing flow. Ideally the finished surface should be 1/4" above adjacent surfaces. Problems have generally resulted from excessively concentrated stormwater flows. Washout at Upton Community Center was the result of unintended concentrated stormwater runoff uphill of the trail crossing the path in a low cross slope (1% or less) area, leading to water running longitudinally down the trail, with sheet flow restricted by adjacent plant beds. Washout at Shaw Elementary school appeared to similarly be the result of insufficient sheet flow off the path and possibly over-saturated soils uphill of the trail. Some crushed stone mixes from RCS seem to perform better than others.</p> <p>Color can be customized to match local conditions. Anecdotally, DCR staff have indicated that the RCS "Natural" color mix (which has recently been discontinued) seems to have performed less well than some alternative color stone dust mixes.</p>

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
STABILIZERS	<p>Stabilizer by Stabilizer Solutions</p> <p>Natural binder made from psyllium husks and typically mixed with local crushed stone</p>	<p>Firmness and Stability: Provides a firm and stable surface across its width with less softening and loss of material due to seasonal changes in moisture.</p> <p>Slip Resistance: Inherently slip resistant if sufficiently compacted.</p>	<p>Low embodied carbon, organic glue low in problematic chemicals (PFAS, petroleum byproducts). Permeable (comparable to loam).</p>	<p>A reasonably soft path that will hold up to traffic. Careful sourcing of material can help blend into the natural context.</p> <p>Color reflects the source material. After the surface has dried, the top most layer (maybe an 1/8") of stone dust loosens to provide a comparable look and feel to compacted stone dust paths.</p>	<p>Higher use areas and settings with steeper slopes where it may be advantageous to combine stabilizer paths with StaLok for spot areas. Helpful for trails that will also require vehicular access (occasional or regular—for example, DCR Ranger access for maintenance or safety). However even vehicular systems are susceptible to rutting where vehicle turning is required.</p>	<p>Natural appearance; stable and weather resistant</p>	<p>Higher upfront cost; repairs require specialized contractors</p>
	<p>StaLok, StaLok Concentrate by Stabilizer Solutions</p> <p>Waterless, Polymer-based Soil binder for crushed stone that creates an impermeable surface</p>	<p>Firmness and Stability: Provides a firm and stable surface across its width with less softening and loss of material due to seasonal changes in moisture.</p> <p>Slip Resistance: Inherently slip resistant if sufficiently compacted.</p>	<p>Impermeable</p>	<p>Somewhat stiffer underfoot; looks natural but feels more artificial. Careful sourcing of material can help blend into the natural context.</p>	<p>Slopes, higher-use areas</p>	<p>Accessible and natural-looking; weather resistant. Top surface is bound and impermeable so it can be helpful in areas where loose stone dust could be problematic. Also, similarly, does not look as similar to unbound crushed stone as organic lock or Stabilizer.</p>	<p>Creates a less "natural" looking surface as compared to Organic Lock, or even Stabilizer bound stone dust. Impermeable (which is why it also holds up better).</p>
	<p>Klingstone Paths or similar Polyurethanes</p> <p>Moisture-cured polyurethane resin binder</p>	<p>Firmness and Stability: Provides a firm and stable surface across its width with less softening and loss of material due to seasonal changes in moisture.</p> <p>Slip Resistance: Inherently slip resistant if sufficiently compacted.</p>				<p>Wet or high-traffic areas</p>	<p>Natural appearance; reduced washout; strong adhesion, water-resistant</p>

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
Stabilizer by Stabilizer Solutions cont.	Requires careful mixing and delivery to the site by provider. Can be installed with common equipment, but must be spread and compacted properly to meet specs	Remains firm and stable across path width with little maintenance, but can fail quickly if subject to concentrated water flows.	
StaLok, StaLok Concentrate by Stabilizer Solutions cont.	Requires careful mixing and delivery to the site by provider. Can be installed with common equipment, but must be spread and compacted properly to meet specs. StaLok Concentrate can be applied after installation to reduce permeability in high-erosion areas.	More resistant to erosive water flows, but less flexible after installation.	
Klingstone Paths or similar Polyurethanes cont.			

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
STABILIZERS	<p>Permazyme, TerraZyme</p> <p>Enzyme-based soil stabilizer derived from organic materials</p>	<p>Firmness and Stability: Provides a firm and stable surface across its width with less softening and loss of material due to seasonal changes in moisture.</p> <p>Slip Resistance: Inherently slip resistant if sufficiently compacted.</p>			Unpaved roads, low-impact trails	Environmentally friendly, improves compaction, dust control	Requires native soils with enough silt/clay; limited performance data on ADA trails
	<p>Soil Sement</p> <p>Latex polymer</p>	<p>Firmness and Stability: Provides a firm and stable surface across its width with less softening and loss of material due to seasonal changes in moisture.</p> <p>Slip Resistance: Inherently slip resistant if sufficiently compacted.</p>			High-traffic or dust prone areas	Strong binding, dust control	Industrial feel, less natural look

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
Permazyme, TerraZyme cont.			
Soil Sement cont.			

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
BOARDWALKS	<p>Pressure treated wood</p> <p>Typically pine treated with chemicals to resist rot and insect damage</p>	<p>Firm and Stable.</p> <p>Slip Resistance: Depeding on age and process employed, can be slippery when wet</p>	<p>Contamination risks, impact from anchoring/ footing</p>	<p>Typically neutral or unpleasant user experience.</p> <p>Tends to be dark and unnatural looking; can release odors.</p>	<p>Wetlands, raised trails</p>	<p>Raised above terrain; good for wetlands</p>	<p>Prone to rot; slippery if not treated; contamination risk if using pressure-treated wood</p>
	<p>Ipe, black locust, heat-treated lumber (Thermory, thermally modified ash, white, and red oak)</p> <p>Naturally dense and rot-resistant woods; new methods of thermal treatment help seal cells to resist moisture penetration</p>	<p>Firm and Stable</p> <p>Slip Resistance: Varies by wood species and other factors (i.e. stains and seal-ants). Important consideration in wetlands. Black locust is generally regarded as naturally slip resistant (see notes). There are approaches/products to increase slip resistant - for example, grooved thermally modified boards at Walden Pond visitor center.</p>	<p>Ipe is a tropical hardwood associated with unsustainable forestry practices damaging rainforests. Thermally modified, sustainably sourced hardwoods and naturally rot resistant hardwoods like black locust are a good alternative.</p>	<p>Natural and user-friendly. Tend to weather to an attractive natural finish</p>	<p>Decks, boardwalks, seating/furnishings.</p>	<p>Renewable resource with low embodied carbon. Rot resistant compared to other hardwoods. Ipe is a tropical hardwood that is associated with damaging forestry practices (though products vary and some purport to be harvested more sustainably than others).</p>	
BOARDWALKS	<p>Composite and Plastic Lumbers</p> <p>Manufactured lumber, in part of whole including recycled plastic</p>	<p>Firm and Stable</p> <p>Slip Resistance: Can be slippery under certain conditions.</p>	<p>Anchoring/ footings have environmental impact. Footings/structural components will need to be made of another material (e.g. pressure-treated or structural 100% plastic lumber)</p>	<p>Composite lumber can be very hot. Appearance varies widely; typically the more natural looking materials are more expensive</p>	<p>Wetlands, long-term durability</p>	<p>Raised above terrain; good for wetlands</p>	<p>Expensive; material warps/deforms easily (not recommended by DCR)</p>
	<p>Aluminum</p> <p>Cast or extruded aluminum parts, typically welded together into sections to create supporting frames and surface grids</p>	<p>Firm and Stable;</p> <p>Slip Resistance: Can be slippery under certain conditions (dew).</p>	<p>Can be recycled and reused</p>	<p>Feels and looks like metal</p>	<p>Best where safety, durability and predictable structural performance is paramount.</p>	<p>Prefabricated by marine dock supplier; quick installation; durable and weatherproof</p>	<p>More expensive than site built wooden bridges and boardwalks</p>

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
Pressure treated wood cont.	Can be installed with common carpentry techniques	Relatively stable but will weaken and fail over time from exposure to sun and moisture	
Ipe, black locust, heat-treated lumber (Thermory, thermally modified ash, white, and red oak) cont.	Harder woods require special construction methods (stainless steel screws, etc.)	Tend to be relatively rot resistant. However, all wood rots over time and requires replacement of boards, in most cases on a shorter time span than, for example, concrete pavement replacement.	Black Locust decking is promoted by many vendors as being naturally slip resistant and is used for this reason for boardwalks in NYC, for example. That being said, at Shaw Elementary school, one particular black locust boardwalk with east exposure has been problematically slippery from late fall to early spring. It was not clear the exact reason, though it seems that frost accumulation/drainage of boards may be part of it. D&F communicated with industry reps (RobiDecking) who were not able to determine a cause, and insisted this appeared to be a unique circumstance.  Harder woods require special construction methods (stainless steel screws, .ex)
Composite and Plastic Lumbers cont.	Can be worked like traditional lumber; various proprietary fasteners can ease installation	Typically requires little maintenance over the mid term; some materials will degrade over time with sun exposure and are subject to staining	Composite woods, since they contain wood fiber, are also subject to rotting issues, though they tend to have a longer lifespan than hardwoods/softwoods. An alternative that D&F has used successfully is recycled structural plastic (100% plastic) lumber. This is a sustainable material for framing and ground contact that will not rot. D&F has used this in combination with black locust for planters and seating features at Shaw Elementary School, Millbury, MA, and Jacobs Elementary School, Millbury, MA.
Aluminum cont.	Tend to be pre-engineered components assembled on site for decks and bridges.	Very stable over time	

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
PAVED	<p><b>Asphalt</b></p> <p>Also known as Bituminous Concrete, a mix of bitumen and crushed mineral aggregates, generally placed and rolled while hot, cooling into a solid matrix.</p>	Firm, stable and slip resistant.	Based on fossil fuels	Can be hot and odorous on warm days. Stiff underfoot and a dark, unnatural ribbon through the landscape	Helpful for trails that will also require vehicular access (occasional or regular—for example, DCR Ranger access for maintenance or safety)	Installation methods and equipment are widely available; provides vehicular access; ADA-compliant when properly installed	Petroleum-based material, retains heat and emits odors in warm weather, unnatural appearance, deterioration can lead to accessibility failures
	<p><b>Concrete</b></p> <p>A mix of crushed mineral aggregates, Portland cement and water, which hardens through hydration into a solid matrix</p>	Firm, stable and slip resistant	High embodied carbon. Mixes vary in environmental/climate impact, with innovative mix additions/ replacements that help to reduce the amount of embodied carbon. Under the right conditions, long-term durability can offset upfront environmental impacts.	Can get hot. Stiff underfoot and typically a bright, unnatural ribbon through the landscape. Surface can be colored or modified with exposed aggregate to create a more natural appearance.	Helpful for trails that will also require vehicular access (occasional or regular—for example, DCR Ranger access for maintenance or safety)	Allows tight control over grades, cross slopes, and transitions; durable in appropriate settings; helpful for vehicle access; ADA-compliant when properly installed	High embodied carbon, can feel hard underfoot, visually intrusive in the landscape, light-colored surfaces may increase heat and flare
	<p><b>Porous pavement</b></p> <p>Bituminous Concrete made with coarse aggregate, leaving spaces that allow water to drain through</p>	Firm, stable and slip resistant	Reduces runoff and improves on-site infiltration of stormwater	Can get hot and odorous on warm days. Looks like standard asphalt pavement, with a bit more texture	Helpful on sites where on site stormwater infiltration is important		Needs to be vacuumed out to maintain porosity

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
Asphalt cont.	Requires good drainage and subbase preparation for long-term success. Installation requires specialize paving equipment, but widely available.	<p>Requires more frequent renovation/replacement than concrete, including crack sealing and resurfacing. Generally more resistant to snow melt chemicals/salts than concrete. Once degraded, can be very inaccessible.</p> <p>Asphalt walkways/trails are superior to concrete in areas that will see regular snow removal (see notes on de-icing salts below). A decorative chip seal finish course (3/8" or smaller aggregate with asphalt emulsion) over an asphalt base may provide an alternative that combines the stability of asphalt with the appearance of crushed stone trails (case study: Blue Hill Observatory entrance trails)</p>	
Concrete cont.	Requires careful preparation and formwork, but allows finely tuned compliance with accessibility standards.	<p>Subject to spalling/degradation due to snow melt chemicals/salts. Requires sealing and regular re-sealing in order to withstand snow removal salts/chemicals. Once degraded, can be very inaccessible.</p> <p>A major question for concrete walkways in Massachusetts is "to seal or not to seal". Sealing concrete helps the pavement withstand de-icing salts that may be applied (even if the agency or institution has policies limiting this or encouraging alternatives). Unsealed concrete is subject to faster degradation and will need to be replaced faster. Sealed concrete requires regular re-sealing in order to provide a similar resistance to these chemicals.</p>	
Porous pavement cont.	Requires good drainage and subbase preparation for long-term success. Installation requires specialize paving equipment, but widely available.	Not as durable as standard asphalt and requires careful maintenance to remove any sand that is used in the winter so it doesn't block up the pores.	

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
OTHER	<p><b>Engineered Wood Fiber; WoodCarpet</b></p> <p>Processed natural wood shredded, chipped and screened to create a consistent material that can be spread and compacted to create a firm accessible surface.</p>	Firm, stable and slip resistant when properly installed and maintained	Can be considered a renewable resource with relatively low embodied carbon depending on wood sourcing	Soft underfoot. Looks natural, like wood chips; weathers over time.	Natural playground safety surfacing and adjacent trails and walkways with complimentary products (rubber access matting or binding) to address MAAB interpretation of ADA surfacing requirements.	Renewable resource, provides dependable and lab-tested fall attenuation for play areas. Can provide a wheelchair-accessible surface if properly maintained.	Requires maintenance to keep finish grade accessible.
	<p><b>Sand Rollout Matting (Mobi-mat and similar)</b></p> <p>Roll out mat made of recycled PET bottles made to look like natural woven matting.</p>	Firm, stable and slip resistant	Made of recycled bottles; after useful life likely headed for the landfill	Provides firm surface for access over sand			
	<p><b>GrassMat</b></p> <p>Roll out mat of green woven polyethylene, typically used for making temporary accessible paths across turf areas.</p>	Reasonably firm and stable; can be slippery when wet.	After useful life likely headed for the landfill	Provides firm surface over turf or soil areas.		Can be used on grass surfaces and mowed over	

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
Engineered Wood Fiber; WoodCarpet cont.	Can be placed and installed with common landscaping equipment	Needs to be compacted and maintained in order to be accessible. If the material is loose, it is not accessible.	
Sand Rollout Matting (Mobi-mat and similar) cont.	Simple to rollout on prepared surface.	Can be rolled up and stored for the winter	
GrassMat cont.	Simple to roll out	Can be rolled up and stored when not needed	

	MATERIAL	FIRMNESS, STABILITY, SLIP RESISTANCE	ENVIRONMENTAL IMPACT	USER EXPERIENCE & AESTHETICS	USE CASES	PROS	CONS
	<p>Flexible Porous Rubber/Aggregate Pavements (Flexipave, PerkEpave, and similar)</p> <p>3/8 minus ground recycled tires mixed with 3/8 minus gravel with a proprietary binder</p>	Firm, stable and slip resistant	Recycled materials are frequently part of the mix. Binders and rubbers used in this material may contain problematic chemicals and have higher embodied carbon than materials like wood or quarried crushed stone. After useful life likely headed for the landfill	Cushy under foot, though tends to be somewhat uneven surface unless carefully placed. Available in a variety of colors, including some that are comparable to stone/soil surfacing. Texture is spongy and obviously synthetic/rubber.	This is a great, flexible, permeable solution for spot areas in pavements that need to be firm/stable/slip resistant. Helpful for replacing sections of concrete pavement within tree root zones. Also a useful material for sections of asphalt or concrete walkways/trails over tree roots, for steep areas of trails subject to erosion, where a deep compacted base is not desirable. Also advertised for running/walking paths to reduce impact-related strain.	Flexible; can bend with tree roots. May not require full depth of compacted aggregate base like asphalt or concrete (because it is flexible and able to deform with frost heave). Permeable.	Must be installed well. Made of petroleum products (rubbers, binders/glues).

MATERIAL	INSTALLATION NOTES	MAINTENANCE NEEDS	CONSTRUCTION NOTES
<p>Flexible Porous Rubber/Aggregate Pavements (Flexipave, PerkEpave, and similar)</p> <p>3/8 minus ground recycled tires mixed with 3/8 minus gravel with a proprietary binder</p>	<p>Installed similar to concrete (formwork, pour, screed/float) but with less specialty techniques required for finishing, jointing, etc.</p>	<p>Has a tendency to crumble at edges over time, particularly if edging or adjacent pavement has wear/movement issues.</p>	<p>These products are distinct from other rubber surfacing (such as PIP rubber play safety surfacing) in that they contain both rubber (usually recycled) and aggregate content. They tend to have a higher permeability and are widely used for tree surrounds regionally. Notably specified in Washington DC for tree pits, full width sidewalk replacement near street trees, and for Safe Routes to School program (the latter per PerkEPave promotional materials). There are formulations/installation systems for vehicular paving applications as well.</p>

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