ALTERNATIVE INFILLS *for Synthetic* TURF FIELDS

By John M. Perry, P.E.

Since the installation of the first synthetic turf field in the 1970s, there have been concerns about the safety, health, and environmental impacts of installing and playing on artificial surfaces. Infill was introduced to turf fields in the 1990s, and consists of crumb rubber (SBR—styrene butadiene rubber) and sand. The sand and crumb rubber are added on top of the carpet and raked in between the fibers to provide footing and shock attenuation, and to hold the fibers upright, giving the carpet a realistic, grass-like appearance. This basic system has been used ever since for most types and brands of synthetic athletic fields, except for some field-hockey fields, which still use knitted nylon carpet.

In the fall of 2014, NBC television broadcasted a segment that proposed a link between the crumb rubber used in infilled synthetic turf fields and several soccer goalies who had contracted an uncommon type of lymphoma. Although the link is still unsubstantiated, many owners and players have questioned the safety of using recycled rubber crumb in synthetic turf and have requested alternative materials. Because of these concerns and the potential for community opposition to turf-field projects, many field owners no longer want to consider using the standard crumb rubber and sand infill, and look for alternatives.

WHY NOT USE NATURAL GRASS FIELDS?

Members of university communities often suggest simply using natural grass fields. There are pros and cons for both natural and synthetic turf options. A few drawbacks to natural grass fields include overused and overscheduled natural turf fields, which can turn them into a morass of divots and mud if played on only once in a saturated condition.

A properly scheduled and maintained natural turf field can typically be played on approximately 250 times per year without significant degradation of quality. A synthetic turf field (without lighting) can sustain approximately twice the amount of play of a natural turf field, without sacrificing playability or increasing maintenance costs.

With athletic lighting, a synthetic field can sustain approximately three times the amount of play as natural turf. This increased use can eliminate the need for municipalities and other owners to construct and maintain additional natural grass fields to accommodate the demand for more fields. Synthetic turf can also be used in almost any type of weather. As such, if frequency or density of use is the driving decision, synthetic turf provides the answer. If frequency of use is not a driving factor, natural turf remains an appropriate option.

WHAT ARE THE ALTERNATIVES TO CRUMB RUBBER?

There are other infill options for field owners, users, and parents to explore if they would rather not use SBR. Most alternative infill materials are considered "virgin" (as opposed to recycled) materials. These virgin materials do tend to cost more than the traditional recycled SBR and sand infills.

In addition to the direct premium costs of infill materials, most alternative infill manufacturers recommend using a shock pad, which adds an additional cost. The costs for a shock pad for a standard-sized turf field (85,000 sq. ft.) can range from $85,000 to $130,000, depending on the brand specified. Because of this, owners must consider the cost of the whole system when considering alternative turf-infill systems. It should be noted that shock pads have shown to increase player safety regardless of the infill material chosen, especially as it relates to head-impact attenuation, which many owners consider to be worth the added cost. Some of the more popular alternative infills, and their benefits and potential drawbacks, are summarized below.

Left: One of the first fields in the United States to use an infill material that consists of crushed walnut shells and sand, The Wheeler School of Seekonk, Massachusetts.

Organic Infills. Pictured left to right: Corkonut (cork and coconut hust), walnut shells, and cork.

ORGANIC/NATURAL INFILL

Organic infill materials are manufactured from naturally occurring materials, such as renewable cork, coconut fiber, rice husks, walnut shells, or some combination of these materials. Although they are not necessarily certified "organic," the industry has adopted the term "organic infill" for these natural materials. Organic-type turf infills are typically a mix of 30 percent organic material and 70 percent sand by weight. Organic infill colors are appropriate for an imitation grass surface, and at an appropriate depth, provide footing very similar to natural grass.

There are many installations in Europe, and organic-infill turf fields appear to be growing in popularity in the United States. Based on material safety data sheets, organic infill appears to be free from volatile organic compounds (VOCs) and hazardous materials. Manufacturers also claim that organic infill materials generate less heat than similar fields with SBR infill. Some of the organic infills are required to maintain a certain moisture content, and irrigation may be required, depending upon the typical ambient temperatures in the region the project is located. In areas such as New England, watering would most likely be unnecessary, unless there are drought conditions in the summer. However, because these fields hold moisture, they can be prone to freezing.

The use of a shock pad under synthetic turf is typically an industry recommendation for organic infills to maintain proper resiliency over the life of the turf. For a typical 85,000-sq.-ft. field, the costs for organic infill can add approximately $80,000–$130,000 to a project's initial cost for the infill material alone, assuming a combination of cork (10%) and coconut husk (90%). Other additional costs could include irrigation (about $15,000) and the shock pad (between $85,000– $130,000).

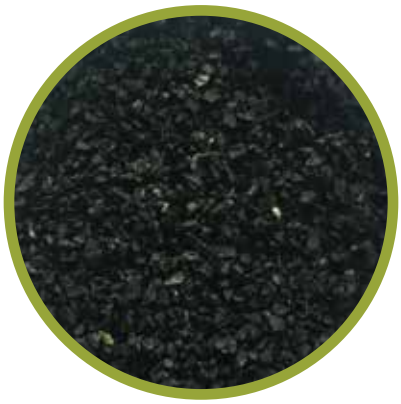
Some organic infill fields naturally degrade and need to be replenished every two to three years, costing approximately $10,000 per replenishment. Also, at the time of carpet replacement, organic infill currently available in the industry cannot be reused in the field, costing an additional $80,000–$130,000 for new infill. Standard maintenance requirements for this type of infill field would be similar to that for SBR; however, some manufacturers recommend that grooming be conducted more frequently, which increases the overall maintenance costs per life of the turf.

Organic infill can also experience weed growth, requiring additional maintenance. Newer versions of organic infills, such

as crushed walnut shells, have started to hit the market. They do not require an irrigation system and appear to be less susceptible to deterioration and the need for replenishment.

COATED SBR CRUMB RUBBER

Coated SBR is a product that applies a virgin EPDM (ethylene propylene diene monomer) rubber coating over traditional recycled SBR particles. Coated SBR is available under proprietary names in the industry. It is used the same way as SBR, has the same or similar traction qualities, and does not require irrigation.



Coated SBR crumb rubber

Although the use of a shock pad is recommended, it is not typically required to meet current industry standards for shock attenuation. However, a shock pad may be required to achieve desired head injury criterion (HIC) results. Coated rubber comes in various colors, which are advertised to significantly reduce the heat effect of synthetic fields. Manufacturers claim that coated SBR infill does not outgas or leach VOCs or hazardous materials into the environment.

For a typical 85,000-sq.-ft. field, the use of coated SBR can add approximately $125,000 in additional costs. Maintenance requirements and cost for this type of infill field would be similar to those for SBR.

VIRGIN EPDM RUBBER INFILL

EPDM is the generic name for virgin synthetic rubber crumb products. Its properties are very similar to SBR, and it is used in turf infills with sand in the same manner as SBR. It has the same or similar traction and resilience qualities as SBR. A shock pad is recommended, and the system does not require irrigation. EPDM rubber comes in a variety of colors that are appropriate for field use. Manufacturers claim that some colors of EPDM significantly reduce the heat effect of turf. EPDM is a generic name, and proprietary products with quality ingredients (e.g., ultraviolet (UV) stabilizers and pigments) and the right formulation must be specified and selected. EPDM uses the same manufacturing processes as SBR.

Virgin EPDM

For a typical 85,000-sq.-ft. field, the costs for virgin EPDM can add approximately $150,000 to initial costs for infill material, and approximately $85,000–$130,000 for the shock pad. Availability of EPDM material can be an issue in some locations in the United States. Maintenance requirements for this type of infill field are similar to those for SBR.

THERMO PLASTIC ELASTOMER INFILL

Thermoplastic Elastomer (TPE) is an extruded plastic product used as an alternative infill. TPE consists of small, extruded plastic rounded pellets or shredded crumbs that are uniformly sized and mixed with sand (similar to SBR). TPE is harder than rubber, but its rounded shape gives it resilient properties.

Similar to EPDM, TPE has a generic name and is a proprietary product with quality ingredients, and the right formulation must be specified and selected. It comes in a variety of colors and brand names for synthetic turf applications. TPE manufacturers claim that it is free of hazardous materials, and it is frequently used in medical devices, children's toys, and household appliances.

Thermoplastic elastomer (TPE)

Since TPE is a plastic, it has traditionally been produced with a petroleum base, although some companies have been manufacturing TPE with corn and soy oils. Used TPE can be melted down and recycled into new products. If the TPE is poor quality, there is a risk that it can clump or melt together over time.

For a typical 85,000-sq.-ft. field, the costs for quality TPE pellets can add approximately $200,000 to a project's initial costs for infill material, plus the cost for a shock pad ($85,000– $130,000). Availability of TPE can be an issue; historically it has been imported mainly from Europe, although it has recently become more available in the United States. Its maintenance requirements are similar to those for SBR.

COATED SAND

There are several products intended as synthetic turf infill on the market that are best described as rounded sand particles coated with acrylic, polyolefin, or other elastic coatings. The rounded, uniformly sized nature of the product provides its resilient properties. These products are intended to be used as 100 percent of the infill, without mixing it with silica sand. Because of their relative hardness, a shock pad is recommended under these infill systems to maintain proper resiliency and impact attenuation.

Coated sand is subject to the same quality issues as EPDM and TPE, and poor-quality coatings can clump over time. However,

Coated Sand

good-quality coatings resist degradation, and warranties up to 16 years are available from some manufacturers. Coated sand is available in tan or green. Although it is considered one of the most abrasive of infill options, most owners find that it is not significantly different from other choices.

For a typical 85,000-sq.-ft. field, coated sand adds approximately $150,000–$200,000 to a project's initial costs for infill material, plus the cost for a shock pad ($85,000– $130,000). Adjusting the relationships between resilient padding, pile height, and amount of infill can potentially offset some of the additional costs for this system. Coated sand is readily available, and its maintenance requirements are similar to those for SBR. However, as with all shallow-depth infill systems, additional attention is required to keep an even distribution of the infill on the field (as with SBR).

OTHER (SAND)

With few exceptions, sand is used with the majority of alternative infills. The sand used for turf infill is specialized for turf; not just any sand can be used. The sand used for turf is a rounded shape (as opposed to elongated or irregularly shaped) and is processed to be within a specific size range between 0.85 and 0.6 millimeters, and uniformly graded. The rounded shape and uniform sizing also tend to resist compaction and improve the resiliency of the finished turf.

Typically, this sand is obtained from gravel pits and processed to segregate out the desired particle size and washed to remove any smaller particle sizes or dust. The sand is selected not only for its round shape but also its resistance to fracture and chipping (hardness) that could cause dust. Rounded sand is valued as a component of the alternate infill options for turf because of its resistance to degradation, its drainage qualities, its resistance to compaction, and for the weight it provides to help hold the synthetic turf material in place.

CONCLUSION

There is no single "best" answer to the selection of an infill material for synthetic turf fields. The decision on which infill to use is subjective, and will depend on the values and priorities of the group making that decision as well as how the field will be used. Some groups may prefer the natural infills, because they are "organic," despite potential degradation issues. Other groups may prefer coated sand because longer warranties are available, allowing it to be reused when turf is replaced. Ultimately, the options vary with an owner's requirements for costs, quality, and playability.

RESOURCES

1. GreenPlay – Corkonut (Coconut fiber and cork infill)
https://www.greenplayusa.com/corkonut-infill/
2. Shaw Sports Turf, Geofill (organic infill)
http://www.shawsportsturf.com/geofill
3. Shaw Sports Turf Maintenance Manual
https://www.shawsportsturf.com/resources/downloads/maintenance-and-care/maintenance-manual
4. FieldTurf, PureFill (organic infill)
https://fieldturf.com/en/products/detail/infill-systems/
5. USGreentech, Envirofill
https://usgreentech.com/infills/envirofill

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