Synthetic field bases 101

SO YOU'VE MADE UP YOUR MIND that you are going synthetic. You were a bit panicked when the idea was first proposed, but now you have studied your current field use programming, maintenance levels and available space options. You have explored all of the known heat, recycling and sustainability issues. You have worked with a qualified design professional to determine the highest and best use of the land and budget available. You are fully versed in the latest materials, methods and manufacturers all the while paying attention to every detail imaginable. From ASTM test to insured warrantees, you have considered it all. Well, almost all. What about the field's base? You might ask, "Doesn't that come as part of the synthetic turf?"

Of course you do need a base under any synthetic turf field but no, fields do not typically come with a base or composite base materials as part of the system although a few offer it as an option. The base under any synthetic turf field serves two distinct functions, neither of which are typically considered in natural turf fields: a structurally sound base for field construction and a media for drainage of the field.

The structural component of any synthetic turf base is designed to ensure that once the field is in place, it never moves. Differential settlement, expansive soils, saturated subgrades or an inability to drain water are all disastrous to a new synthetic turf field. Unique to this type of project, it includes a 360'+ straight edge by which the quality of construction will be judged for life. While a ½-inch settlement on a natural turf field may go unnoticed, it will stick out like a sore thumb on synthetic turf. With that in mind, any synthetic turf field installation should begin with a geotechnical report.

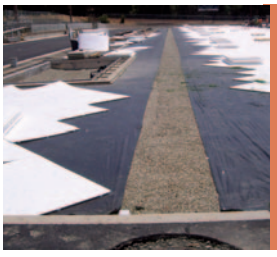
A good geotechnical report will contain information essential to providing a firm and unyielding base for the field. Existing soil conditions should be examined and recommendations for mitigation of existing sub grade conditions included. By requesting an expansion index as part of the report, you get an immediate idea of the potential for movement if the subgrade is exposed to moisture or freeze-thaw cycles.

Recommendations for treatment of the subgrade conditions typically range from removal of topsoil and compaction to lime or cement treatment and can greatly impact the overall cost. Achieving an initial value of 92%+ compaction at the sub grade level will typically ensure stability throughout the life of the field.

Based on the existing subgrade conditions, consideration for a geotechnical fabric should be included as part of the initial soil investigation. In highly expansive soils a woven geotechnical fabric can prevent penetration of water into the compacted sub grade to avoid expansion. In less severe conditions, a non-woven geotechnical fabric may help insure that the specified stone base does not migrate while still allowing some measure of water in to the sub grade. In the most severe conditions, a PVC or other impermeable material may be used as a liner to ensure that no surface water ever reaches the subgrade. These fabric options should be explored with the geotechnical engineer before design ever begins.

BUILDING THE FIELD

We are now ready to begin building the field section. Drainage is the second critical component. Based on



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the findings of the geotechnical report we may be able to allow some water to percolate in to the subgrade, but that is the exception and not the rule. If you have an existing sub grade that can be compacted, with a high percolation rate and a low expansion index, you are extremely fortunate. Typically, most if not all of the surface water that penetrates the synthetic turf will need to use the base as a transportation medium to the storm water drainage system.

Generally, there are at least two base options for consideration when building a synthetic turf field section: a stone base or drainage mats. Both are used today with a preference that is often based on regional availability of materials, native soil conditions and experience of the construction team. The first synthetic turf fields used a combination of aggregates to achieve the structural stability required while maintaining the drainage characteristics to keep the field playable in the worst conditions. This method is still often referred to as a "traditional" stone base.

The stone must be angular enough to allow pore space for drainage, the sieve size varied enough that it will interlock to form a stable surface without settlement, and the material strong enough that it will not turn to dust when compacted. A final layer of stone is often required with the same characteristics in a size that can be fine graded to meet strict tolerances for planarity.

Engineering of a good stone base is just the start. A perfect mix of aggregates can be ruined by a bad installation. Best practices require testing of materials at the source and upon delivery to the site. Continual testing for compaction and porosity should be scheduled regularly as the aggregate is being installed. An experienced contractor or subcontractor is key. A low-bid environment may not achieve the best results.

Drainage mat systems underlay the synthetic turf and come in a variety of materials. Cost of raw materials and petroleum, concerns for safety, and the occasional failed flood test have resulted in the design of multiple systems. The intent is for easier construction, predictable drainage and in some cases a tertiary benefit of increased or consistent shock attenuation.

It is worth taking a moment to talk about shock attenuation, i.e. Gmax. It is the most often used term when discussing the safety of synthetic turf fields. Drainage mat systems have been shown to influence the Gmax of a synthetic turf field, but few are sold as part of a synthetic turf system. The potential for future claims or disputes and the associated finger pointing, should the Gmax exceed safe limits during the warranty period, are real. For this reason, we strongly recommend that the Gmax performance of the synthetic turf alone be guaranteed to meet the specifications regardless of the base it is installed on. Any anticipated impact that a drainage mat may have on the Gmax of the field should be considered a bonus and closely coordinated between the drainage mat manufacturer and the synthetic turf manufacturer to avoid warranty conflicts.

The most significant difference between a traditional stone base and a drainage mat system may be in how they handle water. Concerns about over compaction and porosity of the stone are not a factor in most drainage mat systems. If a stone layer is installed, its function can be structural only. This makes the task of providing a firm and unyielding base much more comfortable to most grading contractors. An aggregate base can be installed and compacted to fulfill the core requirements of structural stability and planarity.

Drainage mats may require an additional layer of geotechnical fabric to ensure that the horizontal surface flow under the synthetic turf does not erode the aggregate base. The unit flow rate of some drainage mat systems has tested at 26 gal/min/ft2. Translated, that's more rain than any 100-year event in U.S. history and far exceeds the limits of the synthetic turf above it. A layer of woven geotextile fabric can help distribute the water evenly and guarantee that the aggregate and/or subgrade below it are protected against erosion.

In instances where an existing sand-based field is being replaced, some of the existing system may be able to remain. Sand-based fields typically have a minimal potential for expansion. The geotechnical engineer will give recommendations about the stability of the subgrade and if any treatment would be required to modify the remaining sand base. Modifications will still be necessary. Most sand based fields are designed with the rootzone as the structural component to stabilize the playing surface. In the absence of living turf, most sand based fields feel more like beaches and less like athletic fields. If the sand base material is deemed stable, the potential for removal of the synthetic turf and reuse of the field base for a natural turf field remains.

Regardless of the base option chosen, a storm drain outlet is required. Pipe sizes and materials will vary based on regional and engineer's preferences, but all serve

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similar purposes and share similar problems. Often times the open graded stone used as drain rock around pipes is rounded and struggles to compact to specified levels. If lime or cement treatment was used to stabilize the subgrade, care should be taken in areas where the depth of the pipe exceeds the depth of the treatment. Lining of the trench with the woven geotextile fabric used below the drainage mat is a common practice. Locating the trenches that contain the drainage piping beyond the field boundaries helps ensure that differential settlement over the life of the field will not impact the use.

SUSTAINABLE OPTIONS

Consider sustainable or "green" options. Many of the composite drainage products contain recycled materials or can be recycled themselves. The benefit of keeping the field section shallower with a drainage mat can minimize earthwork, off haul and equipment costs as well as the carbon footprint of the project. Most drainage mat systems can be delivered in a single load.

The potential for rainwater harvesting exists with any synthetic turf base option. In a traditional stone base, the storage capacity of the stone and the filtration of the water through the base and synthetic turf make an excellent start towards re-use of the rainwater for irrigation to cool the field or irrigate surrounding landscape areas. The same benefit is realized with any drainage mat option with the only limiting factors being storage capacity and required filtering of the water collected. Either system generates a water supply that is cleaner than most run off from natural turf fields. Compared to the potential contamination of silt, herbicides and pesticides commonly used to maintain natural turf fields at their peak the harvested rainwater is often cleaner than municipal recycled water sources.

Base systems are gaining their own importance in the life of a field. They now offer a warranty that meets or exceeds that of the synthetic turf manufacturers. One composite base provider has offered a 20-year warranty on their materials as standard. While no guarantee is iron-clad, that level of confidence in a system to perform provides a level of comfort that traditional stone base construction cannot match with a standard construction warranty of one year.

Once you have made the decision that synthetic turf is in your future, be sure that your selection of base materials provide the structural stability and drainage performance you need. Local landscape architects, geotechnical engineers and contractors with specific experience in this specialized field can help you with material selection, budgets, timelines, constructability and sustainability options. ■

Tony Wood, a landscape architect with Beals Alliance, Sacramento, CA has completed hundreds of facilities in the past 21 years with a broad range of scope, budget, and program needs.