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ANALYSIS OF GRANULAR-INFILL SYNTHETIC TURF AS A SPORTS FIELD SURFACE REPLACEMENT

The following analysis has been conducted for the review of the Entities who are considering the replacement of existing natural grass surfaces with Granular-Infill Synthetic Turf (GIS Turf). This report will attempt to establish the degree to which the benefits offered by GIS Turf offset the cost of constructing the new synthetic field. This analysis will investigate four major points of comparison: maintenance savings vs. construction costs; field usage; player safety; and economic impact as a result of increased stadium usage.

ITEM 1 – MAINTENANCE SAVINGS VS. GIS TURF CONSTRUCTION COSTS:

In order to determine the extent to which maintenance savings will offset the cost of constructing a GIS Turf field, key economic values must first be established. These values are (1) initial field construction costs; (2) costs for replacing field surfaces at the end of the original field surfaces useful life; and (3) average annual field maintenance costs. For this report, annual maintenance costs were estimated using data collected from records of clients for whom SET has provided budgeting services for. Field construction costs and field replacement costs were estimated using actual bidding data gathered from SET clients.

ESTIMATION CONSTRUCTION COSTS – GIS TURF

Initial construction cost for a typical stadium athletic field:

INITIAL CONSTRUCTION OF FIELD		
Construction	$	750,000.00
Engineering, Project Management & Inspection	$	60,000.00
Total Cost: Initial Investment on Field	**$**	**810,000.00**

It should be noted that the above construction cost does not include soil stabilization as the necessity for such is unknown at this time.

Construction cost of replacing the turf system with new turf after the initial turf system has reached the end of its useful life:

REPLACEMENT OF TURF @ END OF YEAR 12		
Construction	$	480,000.00
Engineering, Project Management & Inspection	$	20,000.00
Total Cost: Additional Investment on Field	**$**	**500,000.00**

ESTIMATION OF CONSTRUCTION COSTS - NATURAL GRASS

Construction cost of replacing old natural grass with new natural grass and new irrigation system:

INITIAL COST OF RE-GRADING AND RE-SODDING		
Construction	$	128,000.00
Engineering, Project Management & Inspection	$	15,000.00
Total Cost: Initial Investment on Field	$	143,000.00

Construction cost of replacing old natural grass with new natural grass without irrigation system:

COST OF REGRADING AND RESEEDING @ END OF YEAR 12		
Construction	$	90,000.00
Engineering, Project Management & Inspection	$	10,000.00
Total Cost: Initial Investment on Field	$	100,000.00

ESTIMATION OF ANNUAL MAINTENANCE COSTS – NATURAL GRASS

Annual costs of maintenance are taken as two separate parts. One, the out of pocket funds that the school currently spends as needed to upkeep the stadium field. These costs include water, chemicals, machinery, man hours, paint, top dressing, over seeding, aeration, etc. The second part is accounted as indirect saving that the school will realize as a result of having GIS Turf instead of natural grass. These savings include realizing longer life cycles form 400 meter track surfaces (in the case the field is surrounded by a track). These saving also include the reduced maintenance of other natural grass fields in the district as a result of the school being able to move more events to the stadium field.

For this report, the total maintenance savings used for calculations is $52,000.00 per year.

ESTIMATION OF ANNUAL MAINTENANCE COSTS – SYNTHETIC TURF

The cost of maintaining a synthetic field is approximately $4000 per year (cost of typical annual service contract).

ECONOMIC COMPARISON ANALYSIS

Using the above information and the assumption that the life cycle of both the synthetic turf and the natural grass field will be approximately the same (12 years), economic comparisons were made. The following chart depicts the comparison over the first 12 year life cycle.

Economic comparison over the first 12 year life cycle:

COMPARISON OF FIRST TURF LIFE CYCLE		
Cost of Natural Grass Over 12 Year Period	$	767,000.00
Cost of Synthetic Turf Over 12 Year Period	$	858,000.00
Percent PayBack After 12 Year Period		**89.39%**

As can be seen, the cost of Synthetic turf is offset by approximately 90% by the maintenance saving in the first life cycle. The following comparison shows that maintenance saving will pay for the turf systems in full after only two life cycles.

Economic comparison over the second 12 year life cycle:

COMPARISON OF SECOND TURF LIFE CYCLE		
Cost of Natural Grass Over 12 Year Period	$	724,000.00
Cost of Synthetic Turf Over 12 Year Period	$	548,000.00
Percent PayBack After 12 Year Period		**132.12%**

ITEM 2 – FIELD USAGE

The next topic this report will address is field usage and consequently the reliability of field condition for athletic play.

Natural grass fields are very difficult to maintain in good condition under heavy traffic conditions. Also, wet weather conditions, which cannot be controlled, make this situation even worse. Thus, in order to prevent the field from significant deterioration under existing conditions, the School must limit the amount of usage they allow on the stadium field or deal with a field in poor condition on a regular basis. On the other hand, GIS Turf has proven to be a very durable product that can handle considerable wear and tear without field deterioration independent of weather conditions. Because of this, the School could greatly expand how much they use their stadium field while at the same time being able to rely on the field always being in good condition. SET has found that amongst Owners that have already constructed a GIS Turf field, the smallest margin of increased field usage is about two times. However, most Owners realize a much larger factor usually between five and ten times. This is due to the fact that once GIS Turf is installed; the Owner can schedule stadium events at will without worry of weather or extent of use. Thus, by installing GIS Turf, the School would be able to consolidate events at the stadium location instead of using multiple sites to host events. The School would also be able to feel confident that the field would be in good condition for each event held, which leads to the next topic, safety.

ITEM 3 – PLAYER SAFETY

Natural grass fields that are properly watered and maintained in good condition (meaning complete ground cover exists) typically provide safe service. However, as was stated above, it is very difficult to maintain natural grass in a good condition when it is continually exposed to the intense traffic related to sporting events. For instance, most football fields experience significant deterioration towards the latter part of the season. The middle portion of the field experiences the worst deterioration since the majority of the traffic occurs there. Thus, the most heavily used areas of the field become the least safe for play. In

addition, wet weather can make this situation worse. Most football fans have witnessed how even one football game played when the field is saturated can cause the grass to simply disappear across much of the field leaving the field in poor condition until spring when new grass can be established. In the end, the typical natural grass field simply cannot be relied upon to be in safe condition at all times. On the other hand, GIS Turf has the ability to remain uniformly safe across the entire playing surface regardless of the amount of play or weather conditions it has experienced throughout the life of the turf. Thus, GIS Turf has the ability to better ensure a safe playing surface and in turn reduce turf related injuries.

Serious turf related injuries generally fall into two categories; rotation type injuries to the legs and head to ground impact injuries. Turf burn is the primary minor injury related to turf.

ROTATIONAL LEG INJURIES

Because of the granular nature of the infill used in GIS Turf, leg injuries due to a shoe or cleat binding in the turf during rotation are nearly eliminated. Granular rubber has a low degree of cohesiveness and therefore has little to no ability to lock or bind a shoe or cleat in place. As torsion is applied to the shoe or cleat, the rubber granules give way allowing the foot to release. The same is true for well-maintained natural grass but as the grass surface begins to deteriorate, so does the turfs ability to give and prevent injury as a cleat can become locked into the hard ground surface.

HEAD TO GROUND IMPACT INJURIES

The granular rubber infill used in GIS Turf will maintain a G-Max rating (measure of shock absorption) between 130 and 140, well below the allowable rating of 200. Natural grass when properly maintained also has a similar G-Max rating but areas of a field that are in poor condition can have G-Max ratings well above 200. Thus, the likelihood of head to ground impact injuries is greatly increased as the condition of the field deteriorates.

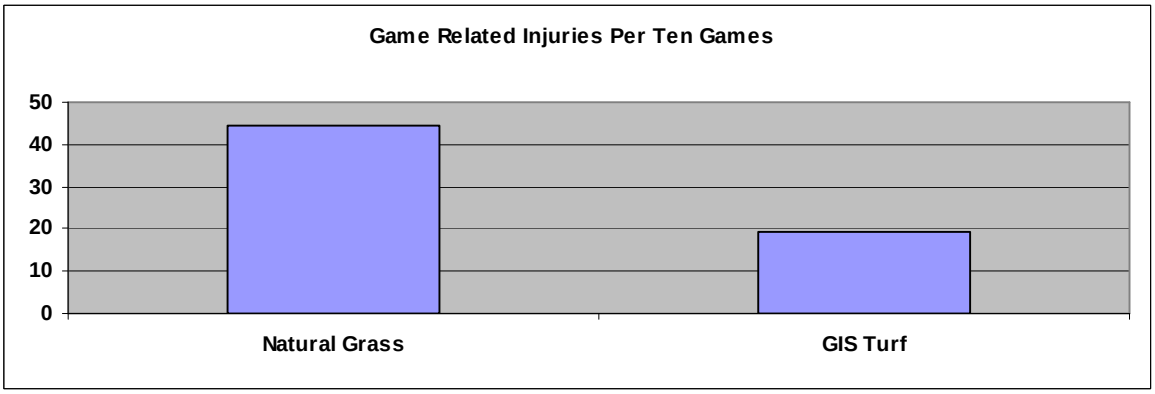
TURF BURN

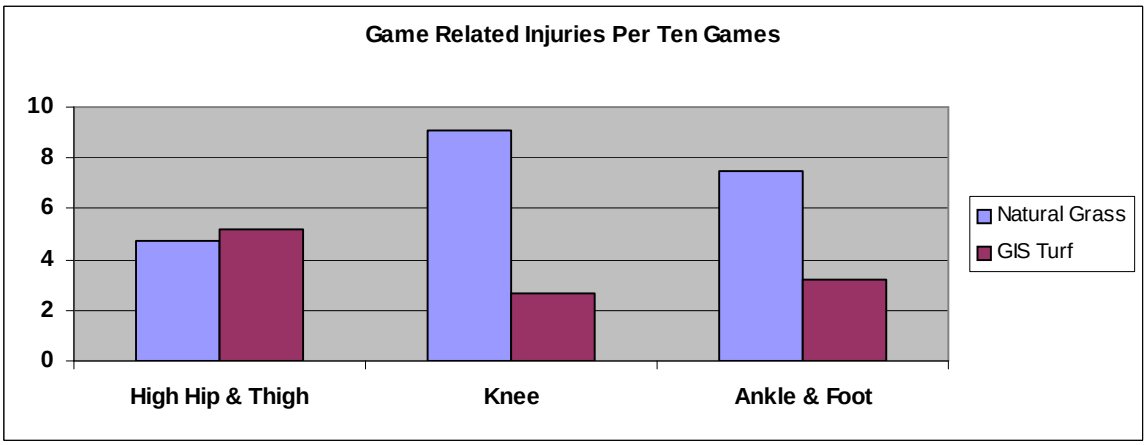
Unlike its synthetic turf predecessor, GIS turf is relatively nonabrasive to the skin. Natural grass is also relatively nonabrasive, but once again, as the field condition deteriorates; natural grass gives way to bare ground that is obviously much more abrasive.

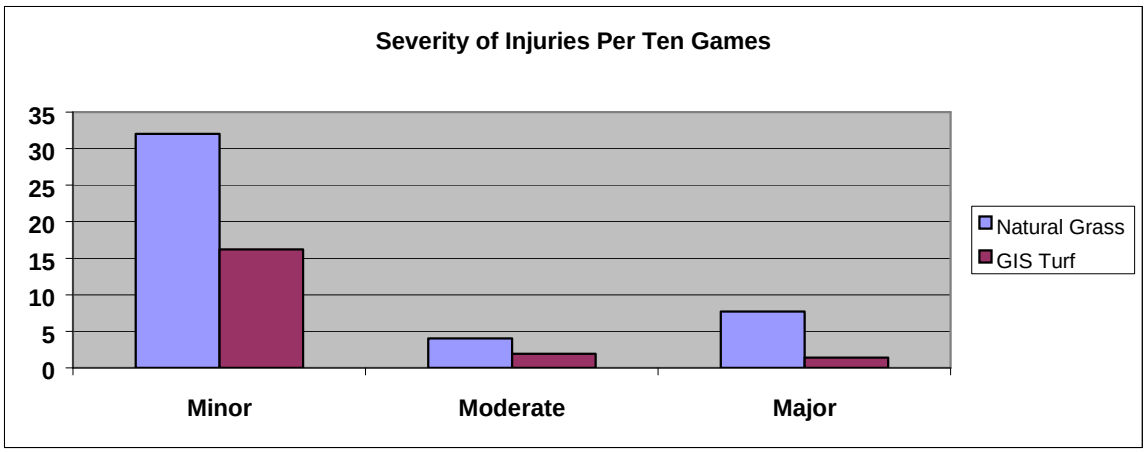
AMARILLO ISD - DICK BIVENS STADIUM STUDY

Dr. Bill Barnhill of Amarillo has generated a study that details the extent to which GIS Turf has reduced injuries at Dick Bivens Stadium. This field is the one of the oldest GIS Turf fields in the country and has provided over six years of data. This report will not attempt to cover to any degree Dr. Barnhill's report. However, the following graphs illustrate a summary of his report's findings:

BASED ON 50 GAMES PLAYED ON NATURAL GRASS PRIOR TO GIS TURF INSTALLATION & 71 GAMES PLAYED ON GIS TURF AFTER INSTALLATION.







As can be seen, GIS Turf has shown to significantly reduce turf related injuries. We find the data illustrated in chart 2 to be especially interesting in that when considering leg injuries, GIS Turf reduces these injuries at a rate of nearly ten per ten games or one injury per game.

ITEM 4 - ECONOMIC IMPACT

This report will deal only lightly with the economic impact that GIS Turf has on a community by drawing more events. SET will not attempt to estimate how many additional events, such as playoff games, might be attracted or what amount of additional revenue these events would equate to in the community. It is

simply noted that having a more durable field surface in place allows the Owner the option of hosting events without the worry of damaging the field and that many of those events, i.e. football playoff games and band competitions, attract many people to a community.

CONCLUSION

Sports Engineering Technologies does not seek to make any recommendations from this report. We find that GIS Turf is an excellent product that has a track record second to none in terms of customer satisfaction of the Owner's that have previously constructed a field. On the other hand, SET understands that the cost of such a field is significant and must be carefully considered in order to decide if the product is right for your Entity. We hope our services can be of help to you in this process.