

New York's Open Schoolyards Initiative: Will Artificial Turf Make it a Public Health Hazard?

By Tom Angotti, Paige Cowett, and Shira Siegel

Does the use of artificial turf in New York City's Schoolyards to Playgrounds Initiative compromise the city's goals of long-term sustainability as outlined in PlaNYC2030? In this paper we consider the pros and cons of artificial turf and conclude that without evidence to definitively confirm or deny the public health risks and cost effectiveness of artificial turf, the city could very well endanger the health of New Yorkers and pay more in the long run for school playgrounds. This case demonstrates the value of observing the *precautionary principle* when adopting new products and practices.

PlaNYC and the Schoolyards to Playgrounds Program

One of the major goals of Mayor Michael Bloomberg's Long-Term Sustainability Plan for New York City, PlaNYC2030, is to "ensure that all New Yorkers live within a ten-minute walk of a park." One of the programs aimed at achieving this goal is to "open schoolyards throughout the city as public playgrounds." The rationale for this program is that 97 neighborhoods in the city have many more than the standard of 1,250 children per playground. 81 percent of schoolyards are closed to the public after school hours. And many are bleak and uninviting expanses of asphalt, sometimes used for parking or storage. The need for playgrounds and parks is most acute in low-income, high-density neighborhoods where children have few recreational alternatives such as private gyms and health clubs. According to the Department of City Planning, in 16 of the 18 lowest income community districts, residents have less than the standard of 2.5 acres of open space per thousand residents.

PlaNYC designates 290 schools throughout New York City to be part of the Schoolyards to Playgrounds Initiative. 185 schoolyards are to be developed by the City Department of Parks (DOP). As of April 2008, 69 playgrounds requiring minimal work were ready for immediate opening. Construction was completed on the first three sites in need of renovation and designs were completed for 32 more. Many of them require new equipment, trees and landscaping, or pavement improvements; some also require capital improvements such as fences, repaving, or safety improvements. The Department of Education (DOE) and the School Construction Authority will retain control of the schoolyards, and will be responsible for capital construction, maintenance and security. This seeks to allay fears in the Department of Education that Parks involvement would mean relinquishing DOE control over school playgrounds. There are 269 Jointly Operated Parks (DOP and DOE) in the city, but that program is small and has not expanded.

PlaNYC proposes to include in the 2008-2017 capital budget \$117.2 million for the Schoolyards to Playgrounds initiative. \$3.5 million is designated for the fiscal year 2008 operating budget. Additional funding is expected to come from private donors, as many playgrounds would become public-private partnerships that include local community involvement.

Of the 185 new community playgrounds to be developed, 25 are to be part of a unique partnership between DOE, the School Construction Authority, and the non-profit Trust for Public Land (TPL). The average cost for renovations will be \$1 million for each playground. The City will commit \$2 for every \$1 raised by TPL, which seeks to raise \$8.3 million from individuals, corporations, and foundations to cover the overall cost of \$25 million.¹ As of May 1, 2008, TPL had helped revitalize 16 of the 25 school playgrounds. The TPL approach includes the design and programming of the space in collaboration with local non-profit and civic groups.

Artificial Turf in the Playgrounds

Many if not all of the schoolyards to be converted to playgrounds are expected to use artificial turf. Since 1997, the NYC Department of Parks has been installing artificial turf extensively throughout the parks system. As of 2007, 118 artificial turf installations were completed and an additional 91 under construction or planned. According to Micaela Birmingham of New Yorkers for Parks, New York City leads all other municipalities in the country in the use of artificial turf.² The city uses a newly developed variety of fake grass, most of it manufactured in Dalton, Ga.³ The two brands most commonly used are FieldTurf and AstroPlay. FieldTurf uses a crumb rubber base made from recycled rubber (usually from old tires) and mixed with sand. AstroPlay uses a base that consists only of rubber.

Only recently has the question of artificial turf come under scrutiny in New York.⁴ Many parents and users have welcomed the use of artificial turf because facilities are available for use more frequently. Administrators anxious to reduce operating budgets see it as a cost-saver. But many parents are now concerned about potential health and safety impacts, and the long-term costs for health care. And the long-term capital costs may outweigh short-term savings on maintenance. In response to concerns from civic and community groups, the New York City Council held its first oversight hearing about the safety of artificial turf on December 13, 2007.

Despite calls from the New York Public Advocate, New Yorkers for Parks, Natural Resources Defense Council, and the New York Lawyers for the Public Interest for an immediate moratorium on artificial turf installation, the Parks Department continues to

¹ <http://www.tpl.org>. TPL has three main initiatives in New York City: the City Spaces Playground Program; protection and support of community gardens; and the acquisition and preservation of public open space, particularly along the waterfront.

² Interview by Shira Siegel with Micaela Birmingham, October 3, 2007.

³ Joseph Berger, "A Softer, More Resilient Surface for Ball Fields in the City," *New York Times*. March 20, 2004.

⁴ "Toxic Turf Ban Fight in Albany," *NY Metro*, Feb. 7, 2008.

http://ny.metro.us/metro/local/article/Toxic_turf_ban_fight_in_Albany/11691.html

claim that there is no known danger and no reason for a moratorium. Public Advocate Betsy Gotbaum, a former New York City Parks Department Commissioner has said, “It’s appalling that the Parks Department continued to make plans to install more artificial turf fields even as evidence began to suggest that this type of turf may pose serious health risks. The truth is, no one yet knows for sure what the health implications are with artificial turf. The city should tread carefully.”

The New York City Department of Health and Mental Hygiene released a draft report in May 2008 claiming that there is no reason to believe artificial turf is harmful to health. However, this report was based on only a preliminary literature review, and advocates have called for more direct investigation including data collection. According to Geoffrey Croft of New York City Park Advocates, “In 10 years, they haven’t done a single independent study of the health effects due to the chemical nature of these fields. They’ve relied entirely on a few outside studies, some of which have been paid for by the tire recycling industry. They have conducted no heat tests; it’s really bad.”⁵

IS ARTIFICIAL TURF SUSTAINABLE?

The original fake grass, AstroTurf, was created in the 1960s and gained new popularity in the early 1990s with innovations in the manufacturing process. The basic manufacturing principle for artificial turf is the use of rubber or sand and rubber infill underneath a layer of synthetic fibers. These fibers are strips of synthetic material painted green to look like grass. The infill is usually made from recycled rubber tires called styrene butadiene rubber or butyl rubber (SBR), though some companies use the soles of old sneakers. The specific production methods vary. For example, Sportexe uses a 4-tiered padding system under the turf for stability, cushioning, and increased fiber life.⁶ Hummer Sports Field Design and Construction, makers of Sofsport, uses polyethylene fibers and a sand/rubber mix, and includes a porous recycled rubber pad as the base for its turf. Like most other artificial turfs, the product comes with an 8-year warranty; Hummer claims that regular sneakers can be used on the surface⁷

The used tires that make up the soft layer underneath the surface material are reprocessed using one of two different methods: cryogenic or ambient processing. Cryogenic processing refers to the use of liquid nitrogen or other materials to freeze and process tire chips or rubber particles prior to size reduction. The other method, ambient processing, also breaks down the rubber by freezing and cooling, but uses ambient and cool air rather than gases. Cryogenic freezing and cooling technologies using liquid nitrogen and carbon dioxide have been used in the food industry for decades.⁸ However, air quality studies of indoor artificial turf playing fields, cited below, show high levels of toxins due to the cryogenic freezing and cooling process.

The Pros and Cons of Artificial Turf

⁵ Interview by Paige Cowett with Geoffrey Croft, May 28, 2008.

⁶ <http://www.sportexe.com>

⁷ <http://www.usaturf.com/hummerturf/index.cfm>

⁸ <http://www.foodproductiondaily.com/news-by-product/news.asp?id=56247&k>

The apparent advantages of artificial turf are used in the arguments that manufacturers make to sell their products. They point to the fact that artificial turf has been used for decades throughout the world in place of natural grass in parks and playgrounds and by well-known professional and amateur teams. It is appealing to park users and athletes because it can be used at any time of day and under any weather conditions. Children who might otherwise have to wait for the natural grass fields to dry after a rainfall can use turf fields immediately. The cushion in the turf can reduce injuries. It also appeals to management because it saves on maintenance costs for mowing, replanting and recovery after rain and snow. It does not need to be regularly watered and does not require the use of pesticides, herbicides, or artificial fertilizers – which appeals to environmentalists.

In appearance the new generation of artificial turf is much closer to real grass than earlier products. Hans J. Kolitzus of IST Switzerland contends that a challenge faced in designing artificial turf is controlling the “various performance characteristics – ball roll behavior, ball rebound, resilience, sliding behavior, traction/foot safety, and abrasiveness – so that they correspond as much as possible with the structural model of natural turf surfaces.”⁹

The disadvantages of artificial turf are also significant. It can cause environmental health problems that affect users: extremely high temperatures during hot summer days; potentially hazardous chemicals released by the crumb rubber padding; and injuries from sliding on a synthetic surface. Short-term savings on maintenance may be illusory if the long-term costs of replacing turf every 8 years are greater. Most turf companies guarantee their product for 8 years, but some reports claim that this artificial turf has a much shorter life span in reality. Geoffrey Croft claims, “We’ve found some fields where within the first couple of years the fields had to be taken out because they had fallen apart. We really have no idea how long these things will last partly because the city doesn’t properly inspect them, and even when fields fail the minimal safety inspections, we’ve found instances where the Parks Department hasn’t taken them out.”

The claim that artificial turf is an environmentally-friendly substitute for natural fields that require artificial fertilizers and pesticides does not apply to New York City parks. Tupper Thomas, Park Administrator of Prospect Park, confirmed for us that Parks does not use any herbicide, pesticide or artificial fertilizers on any of their lawns. Also, artificial turf *does* require watering, not to keep it alive, but to cool it down as it can reach dangerously high temperatures on hot days. Environmentalists are concerned that artificial turf can increase storm water runoff, and disrupt the ecology of parks and recreational areas. Part of that ecology is human interaction with natural features of the environment, which is disrupted by artificial turf. Many experts in recreation question the value of play environments that are over-engineered to avoid injuries and deprive children and adults of direct contact with the natural environment.

While the artificial turf industry clearly has a stake in promoting its products and proving they are safe and cost-effective, other interests also have a stake in proving them wrong.

⁹ Hans J. Kolitzus, IST Switzerland, “Artificial Turf Surface Systems: Artificial Turf Surfaces for Soccer,” Study KR 6943, United States Sports Surfacing Laboratory USSS, June 8, 2007.

For example, the artificial turf industry claims that the natural grass industry, a \$40 billion a year business, is making false claims about artificial turf in order to protect their market share. Often lacking in the public discussion is a balanced analysis that approaches the question from the point of view of the public interest. In the following we will review the issue from this standpoint.

Health and Safety

Perhaps the most important issue in this discussion has to do with health and safety because it directly affects the people who use parks and playgrounds, particularly children, who are most vulnerable to toxic exposures. Workers who maintain these facilities and people who live and work nearby may also be affected. The industry claims that artificial turf does not pose dangers to human health are perhaps to be expected. Given the history of the tobacco, drug, food and chemical industry claims that have proven to be unfounded in the past, it would be best to rely on independent scientific research that does not depend on industry funding before making decisions that could place future generations at risk. The *precautionary principle*, widely used in European environmental and health policy, dictates that new products should not be introduced until there is definitive evidence that they do not have long-term negative health and environmental effects; however, this principle does not apply for the most part to U.S. public policy and instead the burden of proof that products are dangerous usually rests on the public.

Injuries

The International Association for Sports Surface Sciences, based in Switzerland, is an independent group of technical experts involved in the investigation, development, and testing of sports surfaces.¹⁰ The group claims that the newest generation of synthetic turf is more popular because the turf is resilient, soft, and reduces the extent of “carpet burns” when players fall.

The industry also claims that it is easier for athletes to run on the new versions of artificial turf, they are less likely to get “turf toe,” and the cushioning is easier on the joints. Researchers at Washington University School of Medicine in St. Louis have concluded that with regard to concussion risk, newer artificial turf fields are no safer than the old AstroTurf or natural grass fields; however, artificial turf fields with crumb rubber bases may become harder and therefore more dangerous over time.¹¹ Because the artificial grass fibers are taller and spread farther apart than the old AstroTurf, the newer surface also is thought to more accurately mimic natural grass, reducing the risk of leg injuries, burns, and joint strains. But the above-cited study suggests that artificial turf will not lower the risk of head injuries; in fact, as the surface becomes compacted in high traffic areas, those risks may increase due to the rigidity in those areas caused by usage.

¹⁰ <http://www.isss.de/>

¹¹ R. Naunheim, H. Parrott, and J. Standeven, “A Comparison of Artificial Turf,” *Journal of Trauma-Injury, Infection and Critical Care*. 57:6, Dec., 2004, 1311-1314.

According to the Oslo Sports Trauma Research Center at the Norwegian School of Sport Sciences, injury risk on artificial turf and natural grass did not differ significantly.¹² According to a study in the *British Journal of Sports Medicine*, there were no major differences in the incidence, severity, nature, or cause of match injuries or training injuries sustained on grass and new generation artificial turf by male and female soccer players.¹³ Rebecca Bridson, associate editor of *Grounds Maintenance* magazine, compared natural grass and artificial turf injuries reported by 28 Division I college baseball teams in 2003. She found that of 227,130 exposures to grass during practices, the number of injuries was 996, a rate of 4.4%. With regard to practices on artificial turf, she recorded 97,097 exposures during practices, with the number of injuries at 342, for a rate of 3.5%. Thus, artificial turf was marginally safer during practices. Of 17,973 exposures to grass during games, the number of injuries was 672, a rate of 37.5%. Of 9,673 exposures to artificial turf during games, the number of injuries was 333, for a rate of 34.4%.¹⁴ Therefore, there was no significant difference in the injury rate for grass and artificial turf, and the rate for artificial turf was marginally less.

Another commonly addressed concern is the potential for turf abrasions to expose users to the *Staphylococcus aureus* bacteria. Research conducted on professional football players in the United States has shown that drug-resistant bacterial infections have developed due to the scrapes and cuts obtained from rough play on artificial turf. According to an article in *Science News*, athletes who play on artificial turf are more prone to bacterial infections than those who play regularly on grass due to their exposure to “rug burn”-like skin abrasions.¹⁵

Heat Exposure

The evidence is clear that artificial turf is hotter than black asphalt, according to a study published in 2006 by Columbia University’s Center for Climate Systems Research.¹⁶ Researchers at Columbia found that artificial turf can become as hot as a tar roof because of the filaments used in making the turf. Satellite thermal images evaluated by the Center for Climate Systems Research indicated the turf temperature to be up to 60 degrees hotter than grass areas under the same ambient temperatures. Also, artificial turf cannot vaporize water and cool the air like regular grass does.

Stuart Gaffin, an associate research scientist at Columbia, told *The New York Times*: “I’ve been telling everybody that turf is among the hottest surfaces in the city....With the scale we are talking about here, I think they are going to be hazardous places to be during

¹² Jordana Bieze Foster, “Newer Artificial Turf Appears Safer for Soccer Players,” *BioMechanics*. 14:9, Sept., 2007, 9-10.

¹³ Colin W. Fuller, Randall W. Dick, Jill Corlette, and Rosemary Schmalz, “Comparison of the Incidence, Nature and Cause of Injuries Sustained on Grass and New Generation Artificial Turf by Male and Female Football Players.” *British Journal of Sports Medicine*. 41, Aug., 2007, i20-i26.

¹⁴ Rebecca Bridson, “Natural and Artificial Turf Injuries,” *Grounds Maintenance*. 2003.
http://grounds-mag.com/mag/grounds_maintenance_natural_artificial_turf/index.html

¹⁵ Nathan Seppa, *Science News*. 167:6, Feb. 5, 2005, 85-86.

¹⁶ www.epa.gov/heatisld/resources/pdf/NYC_UHI_Recon_Preliminary_Findings_Oct_25_Version.pdf

heat waves in the city. I know the public wants these spaces. My position is: Can we engineer a lower temperature?”¹⁷

Another problem is that because artificial turf is non-pervious, rainwater will not be absorbed and will run off into the city’s combined sewage overflow system. During periods of moderate to heavy rainfall, this runoff bypasses the city’s sewage treatment plants and discharges contaminated water into surface water bodies. Combined sewer overflows are already a serious problem in the city, and PlaNYC proposes to reduce the volume of these discharges. While some artificial turf fields do have a somewhat permeable layer under the “grass blades,” it would be necessary to install a water irrigation system underneath the field to ensure proper drainage of storm water.

Chemical Exposures

FieldTurf’s website claims its infill process utilizes only clean, washed silica sand and cryogenically processed rubber granules from recycled tires. They say that their recycling process eliminates all metallic and polyester residues from the rubber pellets. These claims come at the heels of a (FieldTurf funded) 2005 study by ALIAPUR, a public French company founded by the major tire manufacturers whose aim is to deal with the environmental risk of used tires in France,¹⁸ along with ADEME, the French Agency for Environment and Energy Management. The FieldTurf website, reacting to the study, claims that there is no cause for concern to human health or the environment.

A Health Risk Evaluation (HRE) of turf fields made with rubber granules was completed in 2007 by INERIS, the French National Institute for Industrial Environment and Risks. The study evaluated three different types of rubber granules used in the infill layer: from used tires, new material thermoplastic rubber granules, and new virgin material rubber granules. The results of the study indicate that the VOCs (Volatile Organic Compounds) and aldehyde emissions from the three different types of artificial grass fields should not be a cause of concern for human health, for the workers installing the surfaces, the general public, professional or amateur athletes, adults and children.¹⁹

There are studies, however, that show that the crumb rubber that makes up the base of artificial turf are 90% of the weight of the fields and contain VOCs with carcinogenic potential. As this artificial turf is composed of relatively new material, the long-term health effects on children, who are especially vulnerable, are unknown; some scientists and parents are concerned about the potential health hazards that may result from toxins being inhaled or absorbed via the skin.

¹⁷ David Gonzelez, “On Playing Fields, Grass Is an Endangered Species,” *New York Times*. August 13, 2007.

¹⁸ www.aliapur.fr/media/files/societe/PDF/english_brochure.pdf

¹⁹ <http://www.primenewswire.com/newsroom/news.html?d=125895>

A study of artificial turf was conducted in Italy in 2006 by Roberto Verna MD, PhD, the Chairman of the Committee for Artificial Turf Fields at the Italian Ministry of Health. His conclusions were that of 11 different artificial turfs of varying kinds, ten showed traces of zinc and other heavy metals; significant amounts of APH (Aromatic Polycyclic Hydrocarbons); and aromatic compounds – all of which are considered carcinogenic, mutagenic, and toxic. Further, the Norwegian Institute for Water Research produced evidence in 2005 of contamination of soil and underground water sources due to the chemicals emitted from the recycled tire rubber under artificial turf.²⁰

William Crain, a psychology professor at City College and an activist involved with preservation of Manhattan's Riverside Park, worked with Rutgers University to analyze the recycled rubber that is used as a base to provide cushioning for artificial turf. One of his biggest concerns was that the recycled rubber pellets in which the "grass blades" are embedded can often be found on the surface of the turf, and children and athletes frequently end up with these pellets in their hair, shoes, on their skin, or in their mouths. According to Dr. Crain, the artificial turf base contains "worrisome" levels of a known carcinogen, polycyclic aromatic hydrocarbon, or P.A.H. Because the turfs in question are relatively new, there is no research on long-term negative health effects.

The Norwegian Institute for Air Research concluded in a study of indoor artificial turf playing fields that if these locations are not ventilated there is a potential for large quantities of VOCs in the air. Even with ventilation, over time, the potential for VOCs to be prevalent in the air is still high.²¹ This has to do with the cryogenic freezing process utilized to break down the rubber tires or sneakers that make up the padding underneath the turf fabric. The liberation of gasses from liquid nitrogen and solid carbon dioxide, which is used in the cryogenic freezing and cooling processes, displaces oxygen in the air. This may cause asphyxiation in an inadequately ventilated space.

Cost Effectiveness

The evidence clearly shows that capital costs for artificial turf are greater than natural turf, but during the lifetime of the artificial field maintenance costs may be less. However, artificial turf appears to have a relatively short lifetime. Artificial turf manufacturers do not give an estimate for the average lifetime of turf but most do provide a warranty of at least eight years. This suggests that artificial turf may perhaps be utilized for nearly a decade without need for replacement, but after that a new capital cost will be incurred.

Current estimates of capital costs for artificial turf also do not take into account the additional costs for debt service over the lifetime of the field, which may well outweigh any savings in annual maintenance costs. Nor do they consider that natural fields, if properly maintained, do not require replacement as often as artificial turf. In addition,

²⁰ Torsten Källqvist, "Environmental Risk Assessment of Artificial Turf Systems." Norwegian Institute for Water Research. December 19, 2005.

²¹ C. Dye, A. Bjerke, N. Schmidbauer, and S. Manø, "Measure of Air Pollution in Indoor Artificial Turf Halls." Norwegian Institute for Air Research, August 31, 2007.

expenditures on maintenance are in large part payments to local labor, which get recycled in the local economy, whereas capital costs mostly benefit non-local industries and financial investors.

According to a report by New Yorkers for Parks in 2006 called “A New Turf War,” capital costs for installing artificial turf fields are \$675,000 more than for grass field installation. However, the annual maintenance costs for artificial turf fields can be \$14,000 less than they are for grass fields. The architecture and engineering firm David Evans and Associates even claims that some of their clients have seen a reduction in maintenance costs for artificial turf playing fields of as much as \$30,000 to \$60,000 per field per year.²²

Another comparative analysis completed in 2005 by the San Francisco Recreation and Parks Department outlines the costs of both artificial turf and natural turf, and their results are similar. They estimate that the large initial cost of installing a synthetic turf soccer field is about \$800,000 while the cost of installing a grass turf is about \$260,000. The annual maintenance for the synthetic turf field is about \$6,000 while the natural turf field is about \$42,000. So while it is over \$500,000 more to install, the synthetic turf saves, by their estimation about \$36,000 in operating expenses.²³

A New York analysis would have to take into consideration certain differences when estimating costs. First, the New York climate is less temperate than San Francisco’s and therefore might require water sprinklers to cool off artificial turf on hot days. Also, New York’s winter likely wreaks more havoc on natural turf fields than San Francisco’s winters. These analyses also assume that artificial turf is installed on vacant, non-grass fields. However, according to NYC Park Advocates, which has conducted field surveys of artificial turf installations in the city, synthetic turf often replaces natural grass fields, which means the previous investment in those fields is “lost.” Also, this cost analysis assumes that the life span of artificial turf fields is 10-15 years. The actual lifespan of synthetic turf may be significantly less, however. In order to seriously evaluate the economics, we need better data on synthetic turf life span, real maintenance costs of both natural and artificial fields, and better understanding of the health impacts in order to account for potential long-term health costs.

Artificial Nature?

The jury might still be out on whether artificial turf is unsafe or more expensive in the long-run, but there is a broader discussion that should take place among parents, health experts, and child psychologists about the inherent benefit of interactions with the natural environment. Some argue that in recent years childhood play is evaporating and that urban youth lack opportunities for interaction with the natural environment. With over-scheduled kids and the pervasive influence of indoor computer-mediated activities,

²² Erik Sweet, “Artificial Turf Has Come a Long Way,” *Seattle Daily Journal of Commerce*. August 20, 2002.

²³ Lemar Morrison, “Natural and Synthetic Turf: A Comparative Analysis.” San Francisco Recreation & Parks Department, December 20, 2005.

children are losing any real connection with the kind of unstructured play in nature that is so important to childhood development. According to the Michigan Public Media documentary *Where Do The Children Play?*²⁴ creativity, confidence, and socialization are at stake.

So even if artificial turf is found to be harmless to our health and turns out to be cheaper in the long-run, should we really be ripping out natural grass fields and replacing them with artificial materials? When kids are already moving further away from the natural environment, should we be placing them in yet another industrial cocoon? And maybe those grass stains, mud-caked sneakers and scraped knees are important reminders that we live on land that was not made in a factory, and that there are limits to the rule of the human species over the natural environment?

Tom Angotti, Ph.D. is Director of the Hunter College Center for Community Planning & Development. Paige Cowett has a Masters in Urban Planning and was a Fellow at the Center. Shira Siegel is graduate urban planning student at Hunter College. She loves the grass stains and scraped knees she gets from real grass.

PlaNYC References

City of New York. *PlaNYC: A Greener, Greater New York*, April 2007.
<http://www.nyc.gov/html/planyc2030/html/home/home.shtml>

City of New York. *PlaNYC: Progress Report 2008*, April 2008.

²⁴ “Where Do The Children Play?” co-produced by Michigan Television and Metrocom International, LLC. 2008.