

# Artificial turf

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Modern artificial turf



Side view of artificial turf



Artificial turf for home use for sale

**Artificial turf** is a surface of synthetic fibers made to look like natural grass. It is most often used in arenas for sports that were originally or are normally played on grass. However, it is now being used on residential lawns and commercial applications as well. The main reason is maintenance—artificial turf stands up to heavy use, such as in sports, and requires no irrigation or trimming. Domed, covered, and partially covered stadiums may require artificial turf because of the difficulty of getting grass enough sunlight to stay healthy. But artificial turf does have its downside: limited life, periodic cleaning requirements, petroleum use, toxic chemicals from infill, and heightened health and safety concerns.

Artificial turf first gained substantial attention in the 1960s, when it was used in the newly constructed Astrodome. The specific product used was developed by Monsanto and called *AstroTurf*; this term since then became a colloquialism for any artificial turf throughout the late 20th century. AstroTurf remains a registered trademark, but is no longer owned by Monsanto. The first generation turf systems (i.e., short-pile fibers without infill) of the 1960s have been largely replaced by the second generation and third generation turf systems. Second generation synthetic turf systems featured sand infills, and third generation 3G pitch systems, which are most widely used today, offer infills that are mixtures of sand and recycled rubber.

## **History**

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David Chaney – who moved to Raleigh, North Carolina, in 1960 and later served as Dean of the North Carolina State University College of Textiles – headed the team of Research Triangle Park researchers who created the first notable artificial turf. That accomplishment led *Sports Illustrated* to declare Chaney as the man "responsible for indoor major league baseball and millions of welcome mats."

Artificial turf first came to prominence in 1966, when AstroTurf was installed in the Astrodome in Houston, Texas. The state-of-the-art indoor stadium had attempted to use natural grass during its initial

season in 1960, but this failed miserably and the field conditions were grossly inadequate during the second half of the season, with the dead grass painted green. Due to a limited supply of the new artificial grass, only the infield was installed before the Houston Astros' home opener in April 1966, the outfield was installed in early summer during an extended Astros road trip and first used after the All-Star Break in July.

The use of AstroTurf and similar surfaces became widespread in the U.S. and Canada in the early 1970s, installed in both indoor and outdoor stadiums used for baseball and football.

Maintaining a grass playing surface indoors, while technically possible, is prohibitively expensive. Teams who chose to play on artificial surfaces outdoors did so because of the reduced maintenance cost, especially in colder climates with urban multi-purpose "cookie cutter" stadiums such as Cincinnati's Riverfront Stadium, Pittsburgh's Three Rivers Stadium and Philadelphia's Veterans Stadium.

## Applications



Tropicana Field equipped with artificial turf. In many artificial turf baseball installations, a full dirt infield is not provided, only the pitcher's mound and "sliding boxes" around each base.

## Baseball

Artificial turf was first used in Major League Baseball in the Houston Astrodome in 1966, replacing the grass field used when the

**stadium opened a year earlier. Even though the grass was specifically bred for indoor use, the dome's semi-transparent Lucite ceiling panels, which had been painted white to cut down on glare which bothered the players, did not pass enough sunlight to support the grass. For most of the 1960 season, the Astros played on green-painted dirt and dead grass.**

**The solution was to install a new type of artificial grass on the field, ChemGrass, which became known as AstroTurf. Because the supply of AstroTurf was still low, only a limited amount was available for the first home game. There wasn't enough for the entire outfield, but there was enough to cover the traditional grass portion of the infield. The outfield remained painted dirt until after the All-Star Break. The team was sent on an extended road trip before the break, and on 19 July 1966, the installation of the outfield portion of AstroTurf was completed.**

**Artificial turf was later installed in other new "cookie-cutter" stadiums such as Pittsburgh's Three Rivers Stadium, Philadelphia's Veterans Stadium, and Cincinnati's Riverfront Stadium. Early AstroTurf baseball fields used the traditional all-dirt path, but in the early 1970s, teams began using the "base cutout" layout on the diamond, with the only dirt being on the pitcher's mound, batter's circle, and in a "sliding box" around each base. With this layout, a painted arc would indicate where the edge of the outfield grass would normally be, to assist fielders in positioning themselves properly.**

**The biggest difference in play on artificial turf was that the ball bounced higher than on real grass, and also travelled faster, causing infielders to play farther back than they would normally, so that they would have sufficient time to react. The ball also had a truer bounce than on grass, so that on long throws fielders could deliberately bounce the ball in front of the player they were throwing to, with the certainty that it would travel in a straight line and not be deflected to the right or left. However, the biggest impact on the game of "turf", as it came to be called, was on the bodies of the players. The artificial surface, which was generally placed over a**

concrete base, had much less give to it than a traditional dirt and grass field did, which caused more wear-and-tear on knees, ankles, feet and the lower back, possibly even shortening the careers of those players who played a significant portion of their games on artificial surfaces. Players also complained that the turf was much hotter than grass, sometimes causing the metal spikes to burn their feet, or plastic ones to melt. These factors eventually provoked a number of stadiums, such as Kauffman Stadium in Kansas City, Missouri, to switch from artificial turf back to natural grass.

In 2000, St. Petersburg's Tropicana Field became the first MLB field to use a softer artificial surface, FieldTurf. All other remaining artificial turf stadiums were either converted to FieldTurf or were replaced entirely by new natural grass stadiums. In just 13 years, between 1992 and 2005, the National League went from having half of its teams using artificial turf to all of them playing on natural grass. With the replacement of Minneapolis's Hubert H. Humphrey Metrodome by Target Field in 2010, only two MLB stadiums, both in the American League East, are still using artificial turf: Tropicana Field and Toronto's Rogers Centre, which converted to a next generation AstroTurf in 2010 and will convert to natural grass by 2018.

## American football

The first professional American football team to play on artificial turf was the then-Houston Oilers (now the Tennessee Titans), at the time part of the American Football League, who moved into the Astrodome in 1968 which had installed AstroTurf two years prior. In 1969, Franklin Field, the stadium of the University of Pennsylvania, Philadelphia, Pennsylvania, switched from grass to artificial turf. Also home of the Philadelphia Eagles, it was the first National Football League stadium to use artificial turf.

In 2002, CenturyLink Field, originally planned to have a natural grass field, was instead surfaced with FieldTurf upon positive reaction from the Seattle Seahawks when they played on the surface at their temporary home, Husky Stadium during the 2000 and 2001 seasons.

**In 2006, Gillette Stadium, the football stadium of the New England Patriots and the New England Revolution, switched from grass to FieldTurf due to the conflict of poor weather and hosting many sporting and musical events at the stadium. It is one of 13 National Football League stadiums that have artificial turf instead of grass fields; the Giants and Jets (who share a stadium) and Bengals actually switched from AstroTurf to natural grass before reverting to a next-generation artificial surface.**

**All nine stadiums in the Canadian Football League currently use artificial turf.**

**The XFL, in its short life, outlawed the use of artificial turf, requiring all of its teams to play in stadiums with natural grass surfaces. The move, made in part to reduce injuries, was also a ploy to give the league a more authentic, "smash-mouth" appeal. The league also scheduled all of its games, however, in the winter, when grass does not typically grow as well in the northern United States; the New York/New Jersey Hitmen and Chicago Enforcers' home fields were visibly damaged with heavy bare spots by the end of the league's lone 2001 season.**

**NFL players overwhelmingly prefer natural grass over synthetic surfaces, according to a league survey conducted in 2010. When asked, "Which surface do you think is more likely to shorten your career?", 90% chose artificial in filled.**

## **Field hockey**

**The introduction of synthetic surfaces has significantly changed the sport of field hockey. Since being introduced in the 1970s, competitions in western countries are now mostly played on artificial surfaces. This has increased the speed of the game considerably, and changed the shape of hockey sticks to allow for different techniques, such as reverse stick trapping and hitting.**

**Field hockey artificial turf differs from artificial turf for football (any of them) in that it does not try to reproduce a grass 'feel', being made of shorter fibres. This shorter fiber structure allows the improvement in speed brought by earlier artificial turfs to be retained. This development in the game is however problematic for many local communities who often cannot afford to build two artificial fields: one for field hockey and one for other sports. The International Hockey Federation and manufacturers are driving research in order to produce new fields that will be suitable for a variety of sports.**

**The introduction of this playing surface coincided with the end of the dominance of field hockey by India and Pakistan, which had endured for many decades. The subsequent decline of the sport in these countries is often blamed on the switch from natural to artificial turf, with many in the region seeing the high cost of artificial turf, and the relative lack of such facilities outside the most developed nations, as the key reason for India and Pakistan being at a competitive disadvantage. However, there are alternative explanations which contradict this popular narrative. It has been suggested that Indian hockey had already begun to lose dominance prior to the adoption of artificial turf, and that outdated coaching methods, alongside failures in administration, have been the primary causes of the current malaise. Indian hockey player Balbir Singh Sr. has praised the speed of the modern game played on artificial turf and has stated that the superior ball control and potential for dribbling skills offered should be turned to the advantage of teams from the sub-continent, rather than using the change of surface as an excuse for poor performance.**

**The use of astro turf in conjunction with changes in the game's rules (e.g. the removal of offside, introduction of rolling substitutes and the self-pass, as well as changes to the interpretation of obstruction) have contributed significantly to changing the nature of the game, greatly increasing the speed and intensity of play, as well as placing far greater demands on the conditioning of the players.**





Aspmyra, Norway: home of the football club FK Bodø/Glimt

## Association football

**Some football clubs in Europe installed synthetic surfaces in the 1980s, which were called "plastic pitches" (often derisively) in countries such as England. There, several professional club venues had adopted them; QPR's Loftus Road, Luton Town's Kenilworth Road, Oldham Athletic's Boundary Park and Preston's Deepdale. QPR had been the first team to install an artificial pitch at their stadium in 1981, but were the first to remove it when they did so in 1988. The last team to have an artificial pitch in England was Preston North End, who removed their pitch in 1994 after eight years in use.**

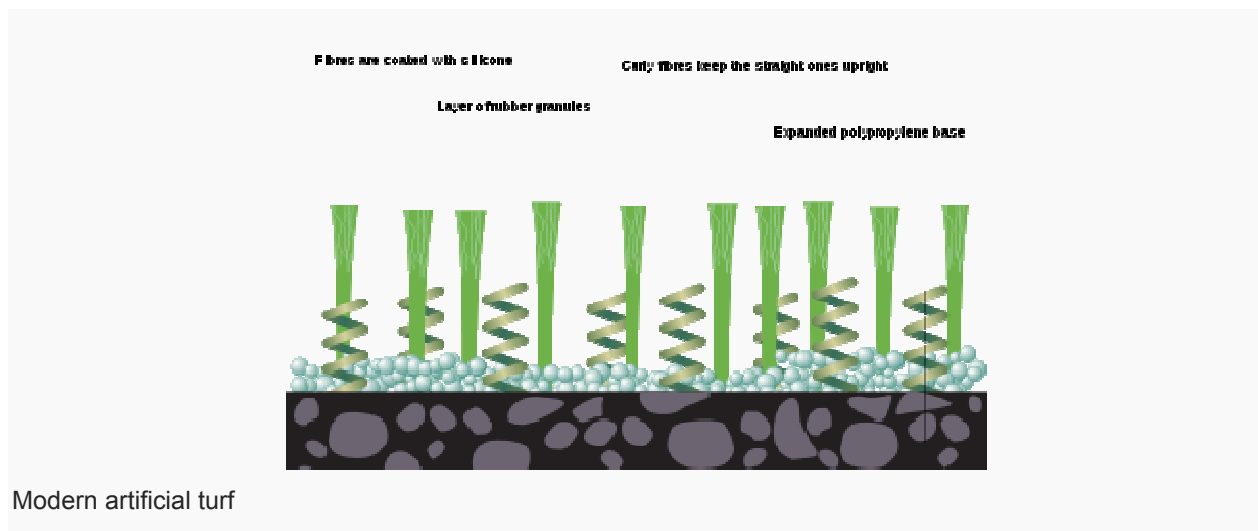
**Turf gained a bad reputation on both sides of the Atlantic with fans and especially with players. The first Astro turfs were a far harder surface than grass, and soon became known as an unforgiving playing surface which was prone to cause more injuries, and in particular, more serious joint injuries, than would comparatively be suffered on a grass surface. This turf was also regarded as aesthetically unappealing to many fans.**

**In 1981, London football club Queens Park Rangers dug up its grass pitch and installed an artificial one. Others followed, and by the mid-1980s there were four artificial surfaces in operation in the English league. They soon became a national joke: the ball pinged round like it was made of rubber, the players kept losing their footing, and anyone who fell over risked carpet burns. Unsurprisingly, fans**



**complained that the football was awful to watch and, one by one, the clubs returned to natural grass.**

**In the 1990s many North American soccer clubs also removed their artificial surfaces and re-installed grass, while others moved to new stadiums with state-of-the-art grass surfaces that were designed to withstand cold temperatures where the climate demanded it. The use of artificial turf was later banned by FIFA, UEFA and by many domestic football associations, though, in recent years, both governing bodies have expressed resurrected interest in the use of artificial surfaces in competition, provided that they are FIFA Recommended. UEFA has now been heavily involved in programs to test artificial turf, with tests made in several grounds meeting with FIFA approval. A team of UEFA, FIFA and German company Polytan conducted tests in the Stadion Salzburg Wals-Siezenheim in Salzburg, Austria which had matches played on it in UEFA Euro 2008. It is the second FIFA 3 Star approved artificial turf in a European domestic top flight, after Dutch club Heracles Almelo received the FIFA certificate in August 2000. The tests were approved.**



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**FIFA originally launched its FIFA Quality Concept in February 2001. UEFA announced that starting from the 2000-01 season, approved artificial surfaces were to be permitted in their competitions.**

**Regardless of the views of the governing bodies, criticism of artificial surfaces in soccer continues, notably in reference to the FieldTurf surface at Toronto F.C.'s BMO Field (replaced with**

grass in 2010) and Giants Stadium, former home of the New York Red Bulls. Current and former players have recently criticised the surface, expressing concerns that, among other things, it may exacerbate injuries.

A full international fixture for the 2008 European Championships was played on 17 October 2007 between England and Russia on an artificial surface, which was installed to counteract adverse weather conditions, at the Luzhniki Stadium in Moscow. It was one of the first full international games to be played on such a surface approved by both FIFA and UEFA. However UEFA ordered that the 2008 European Champions League final hosted in the same stadium in May 2008 must take place on grass, so a temporary natural grass field was installed just for the final.

UEFA stressed that artificial turf should only be considered an option where climatic conditions necessitate. One Desso "hybrid grass" product incorporates both natural grass and artificial elements.

In June 2009, following a match played at Estadio Ricardo Saprissa in Costa Rica, American national team manager Bob Bradley called on FIFA to "have some courage" and ban artificial surfaces.

FIFA designated a star system for artificial turf fields that have undergone a series of tests that examine quality and performance based on a two star system. Recommended 2-Star fields may be used for FIFA Final Round Competitions as well as for UEFA Europa League and Champions League matches. There are currently 130 FIFA Recommended 2-Star installations in the world.

In 2009, FIFA launched the Preferred Producer Initiative to improve the quality of artificial football turf at each stage of the life cycle (manufacturing, installation and maintenance). Currently, there are five manufacturers that were selected by FIFA: Act Global, Limonta, Desso, GreenFields and Edel Grass. These firms have made quality guarantees directly to FIFA and have agreed to increased research and development.

**In November 2011, it was reported that a number of English football clubs are interested in using artificial pitches again on economic grounds.**

**In February 2010 Arsenal F.C. ordered 1,400 m<sup>2</sup> of artificial grass from the Swiss company called Tisca Tiara for their training pitch at the Arsenal Training Centre.**

## **2010 Women's World Cup**

**The 2010 Women's World Cup is taking place entirely on artificial surfaces, as the event is to be played in Canada, where almost all of the country's stadiums use artificial turf due to climate issues. This plan has garnered criticism from players and fans, some believing the artificial surfaces make players more susceptible to injuries. Over fifty of the female athletes are protesting against the use of artificial turf on the basis of gender discrimination.**

**However Australia women's national soccer team winger Caitlin Foord said that after playing 90 minutes there was no difference to her post-match recovery – a view shared by the rest of the squad. The squad spent much time preparing on the surface and had no problems with its use in Winnipeg.**

**"We've been training on [artificial] turf pretty much all year so I think we're kind of used to it in that way ... I think grass or turf you can still pull up sore after a game so it's definitely about getting the recovery in and getting it right," Foord said.**

**The 2012 Women's World Player of the Year, Abby Wambach noted "The men would strike, playing on artificial turf.**

**The controversial issue of gender equality and an equal playing field for all has sparked debate in many countries around the world. A lawsuit was filed on 1 October 2014 in an Ontario tribunal court by a group of women's international soccer players against FIFA and the Canadian Soccer Association and specifically points out that in 1994 FIFA spent \$2 million to plant natural grass over artificial turf in New Jersey and Detroit.**

**Various celebrities are showing their support for the women soccer players in defence of their lawsuit, including actor Tom Hanks, NBA player Kobe Bryant and U.S. men's soccer team keeper Tim Howard. Even with the possibility of boycotts, FIFA's head of women's competitions, Tatjana Haenni, has made it clear "We play on artificial turf and there's no Plan B."**

## **Ski and snowboard**

**Some skiing and snowboarding clubs and resorts in Europe installed artificial surfaces in the 1960s and 1970s. Often called pistadel sol, after its ability to be used in warm, sunny conditions, these installations have become increasingly common.**

## **Tennis**

### **Main article: Tennis court**

**Carpet has been used as a surface for indoor tennis courts for decades, though these originally was more similar to home carpets than a synthetic grass. After the introduction of artificial turf, it came to be used for tennis courts, both indoor and outdoor, though only a small minority of courts use the surface. Both infill and non-infill versions are used, and are typically considered medium-fast to fast surfaces under the International Tennis Federation's classification scheme. A distinct form found in tennis is an "artificial clay" surface, which seeks to simulate a clay court by using a very short pile carpet with an infill of the same loose aggregate used for clay courts that rises above the carpet fibres**

## **Golf**

**Synthetic turf can also be used in the golf industry, such as on golf ranges, putting greens and even in some circumstances tee boxes.**

**Because of the vast areas of golf courses and the damage from clubs during shots, it is not feasible to surface fairways with artificial grass.**

## **Landscaping**



A home's yard with artificial grass.

**Since the early 1990s, the use of synthetic grass in the more arid Western states of the United States has moved rapidly beyond athletic fields to residential and commercial landscaping**

## **Airports**

**Artificial turf has been used at airports. Some artificial turf systems allow for the integration of fiber-optic fibers into the turf. This would allow for lighting or advertisements to be directly embedded in a playing surface, or runway lighting to be embedded in artificial landing surfaces for aircraft.**

## **Health and safety**

**There is evidence showing higher player injury on artificial turf. In a study performed by the National Football League Injury and Safety Panel, published in the October 2012 issue of the American Journal of Sports Medicine, Elliott B. Hershman et al. reviewed injury data from NFL games played between 2000 and 2009. "...the injury rate of knee sprains as a whole was 22% higher on FieldTurf than on natural grass. While MCL sprains did not occur at a rate significantly higher than on grass, rates of ACL sprains were 67% higher on FieldTurf." There is some evidence that periodic disinfection of artificial turf is required as pathogens are not broken down by natural processes in the same manner as natural grass. Despite this, a 2006 study suggests**

**certain microbial life is less active in artificial turf Metatarsophalangeal jointsprain, known as "turf toe" when the big toe is involved, is named from the injury being associated with playing sports on rigid surfaces such as artificial turf and is a fairly common injury among professional American football players. Artificial turf is a harder surface than grass and does not have much "give" when forces are placed on it.**

**There is also significant concern regarding a plausible link between artificial turf and cancer. The following Major League Baseball players and/or managers had prolonged tenure with teams that played on artificial turf, and subsequently were diagnosed with brain cancer: Darren Daulton, Ken Brett, Johnny Oates, Tug McGraw, John Vukovich, Gary Carter, Dan Quisenberry, and Dick Howser. In addition, New York Yankees outfielder Bobby Murcer had participated in the 1980 MLB playoffs, with at least five of the aforementioned victims, and also died of brain cancer. Some artificial turf requires infill such as silicon sand and/or granulated rubber. Some granulated rubber is made from recycled car tires and may carry heavy metals which can leach into the water table. Alternative sources of infill may provide a safer solution. Friction between skin and older generations of artificial turf can cause abrasions and/or burns to a much greater extent than natural grass. Artificial turf tends to retain heat from the sun and can be much hotter than natural grass with prolonged exposure to the sun.**

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**With best regards**

**Muhammed Ahmed Hasan**

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**Iraq-Sulaimany**