

# Avon High School Synthetic Turf Field Project Design Development Phase Town of Avon, CT



Synthetic Field Project Subcommittee – Turf Materials Meeting

May 23, 2016



# Athletic Field Materials - Agenda

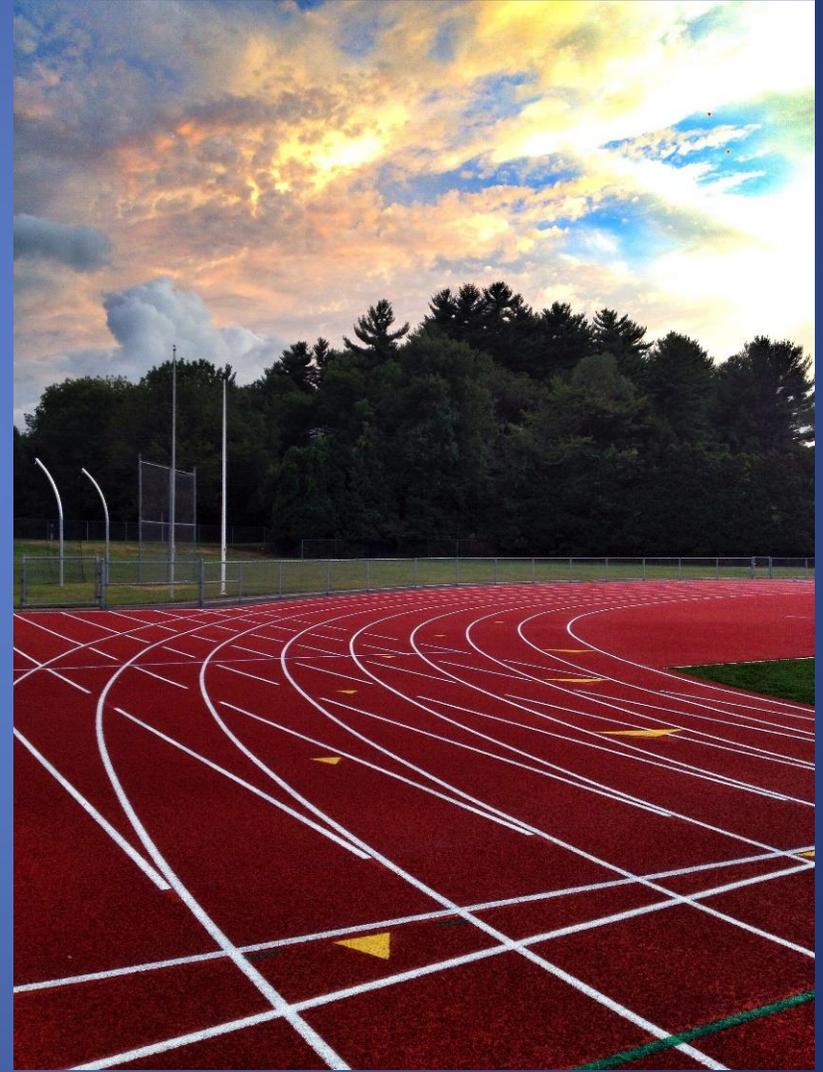
## Running Track Surfacing

1. Porous Systems
2. Impermeable Systems

## Synthetic Turf

1. History & Planning Considerations
2. Maintenance & Lifecycle
3. Industry Trends
4. Synthetic Turf Qualities
  - Turf Carpet
  - Turf Infill
5. Health, Environment & Safety
6. Current issues & Resulting Trends

# All-Weather Track Surfacing



Simsbury High School - Simsbury, CT

# All-Weather Track Surfacing - General

## Common Surfacing Considerations

- TUNED VS. NON-TUNED SYSTEMS
- PERMEABLE SYSTEMS
- IMPERMEABLE SYSTEMS
- LIFE CYCLE & REGULAR MAINTENANCE
- WARRANTIES – 5 YEAR TYPICAL
- CONSTRUCTION
  - WEATHER DEPENDENCE
    - Mid-May to Mid October
  - BASE CURING
  - CONSTRUCTION PERIOD
    - PROTECTION
- RECOATING



Rubberized Surfacing = Generic Term  
Permeable = passes vapor & liquids  
Impermeable = blocks vapor & liquids  
Latex vs. Urethane  
SBR rubber = recycled rubber crumb

# All-Weather Track Surfacing

## Surfacing Systems

### ■ Latex Systems (Permeable)

- Least Expensive
- Crumb and Spray
- Temperature Sensitive
- Life Cycle

### ■ Polyurethane Base Mat Systems

(Permeable)

- Mid Range
- 'Paved' Mat + Color surface spray
- Less Temperature Sensitive
- Most Popular Municipal Material.

### ■ Polyurethane Systems (Impermeable)

- Sealed Base Mat Structural Spray System
- Base Mat Sandwich System
- Full-Pour Surface

### ■ Pre-manufactured Rubber Systems (Permeable or Impermeable)

- Rubber Mats (Mondo)
- Vulcanized Rubber Mats



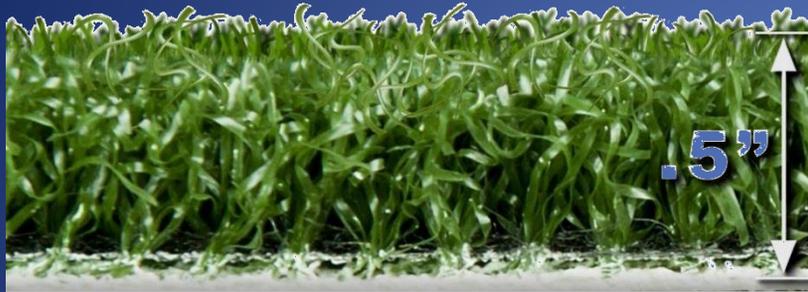
# All-Weather Track - Costs

## Track Surfacing Coatings

- Latex (Polyresin) Bound EPDM
  - Colored
  - 8 lane track Approx \$200,000
- Polyurethane Bound – SBR Pave Mat
  - Black (no color coat)
  - 8 Lane Track Approx \$220,000
- Polyurethane Bound – SBR Pave Mat
  - Red
  - 8 Lane Track Approx. \$250,000
- Polyurethane Bound – SBR Pave Mat
  - Green, Blue, etc.
  - 8 lane track Approx \$275,000
- Polyurethane Bound –EPDM Base Mat
  - Black or Red, Green, Blue, Grey
  - Market driven (Turf Demand)
- Polyurethane Bound EPDM Base Mat
  - Green, Blue, etc.
  - Market (Turf Demand)
- Polyurethane Impermeable Structural Spray
  - Black or Red
  - \$43 per SY
- Polyurethane Impermeable Structural Spray
  - Green, Blue, etc.
  - \$47 per SY
- Polyurethane Impermeable Sandwich System
  - Red
  - \$56 per SY
- Polyurethane Impermeable Sandwich System
  - Green, Blue, etc.
  - \$60 per SY
- Polyurethane Full-Pour with SBR Base Rubber
  - Red
  - \$65 per SY
- Polyurethane Full-Pour with SBR Base Rubber
  - Green, Blue, etc.
  - \$70 per SY

Typical 8 lane track = 5,777SY  
(?D-Areas, Field Events?)

# Synthetic Turf



1965-1998 1<sup>st</sup> Generation – Turf Carpet ‘AstroTurf’

1998 2<sup>nd</sup> Generation  
– Sand & Rubber Infill



3<sup>rd</sup> Generation  
– Alternative Infills & Pads

# Synthetic Turf – Planning

## Why is Synthetic Turf so popular if it costs so much?

- Increased Usage:
- **Natural turf roughly 200 uses per year**  
Specialty Maintenance
- **Synthetic turf Unlit roughly 550 uses per year**  
**Lit: Up to 750 uses per year (UMass Lowell)**
- **More consistent play compared to natural turf**
- **Early and late season play (wet and frozen conditions)**  
‘All weather’ surfacing

# Synthetic Turf – Planning

## Why is Synthetic Turf so popular if it costs so much?

- **Lower maintenance costs / No special maintenance skills**
- **Added sports programming & participation**  
(Youth Soccer, Mens Lacrosse, Womens Lacrosse)
- **Takes best advantage / Cost per use of related infrastructure (e.g. bleachers, lights, parking)**
- **Avoids having to purchase and develop additional land to accommodate current demand for fields**

# Synthetic Turf – Rough Life Cycle Cost

**Natural Turf Field \$350,000 construction + 20,000/yr maint + \$40,000 renovation every 5 years OVER 15 YEARS with 250 uses per year.**

**= \$770,000 = cost/use =  $$(770,000/250)/15 = \$205.33/\text{use}$**

**Synthetic Field \$812,000 construction + 5,000/yr maint. + \$450,000 recarpet at year 15 with 650 uses per year**

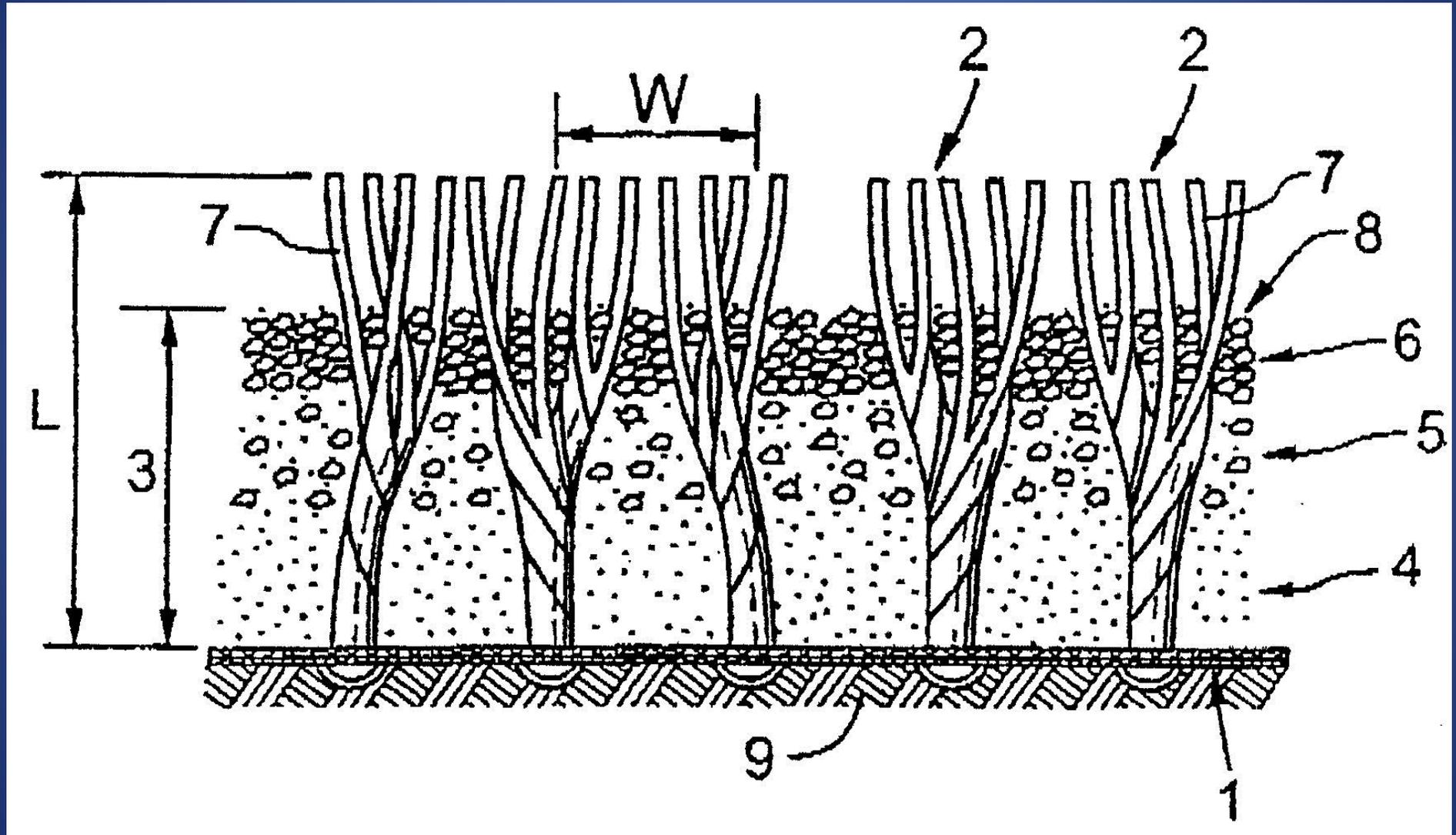
**=  $$(1,337,000/650)/15 = \$ 137.13.64/\text{use}$**

\*Initial costs  $\approx$  2x as much

\*Cost per use favors synthetic, Almost 1.5 : 1 (better in 2<sup>nd</sup> 15yrs)

\*Other savings (safety, pay to play, all weather, and community value are not considered and favor synthetic)

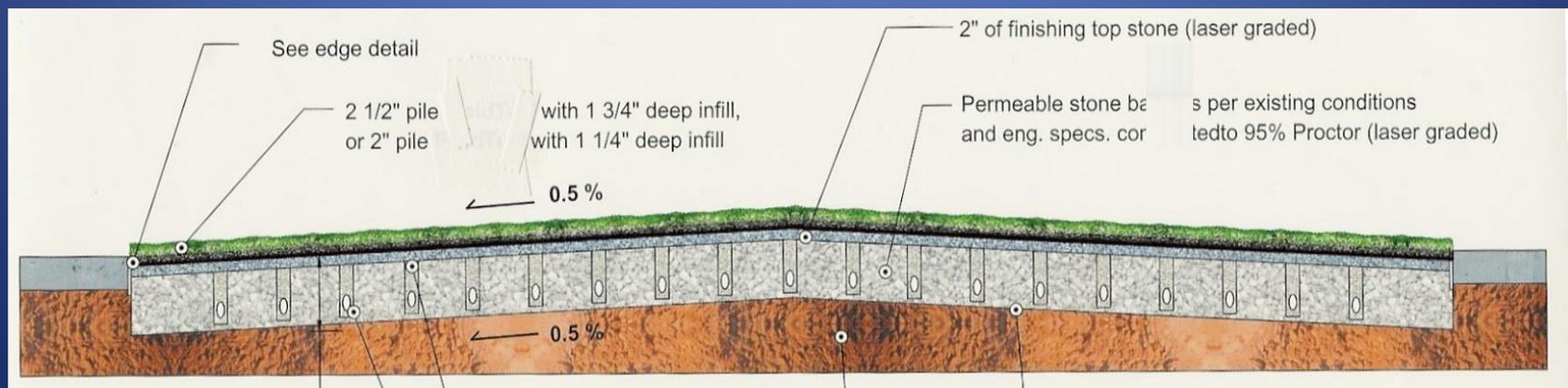
# Synthetic Turf – Engineering Considerations



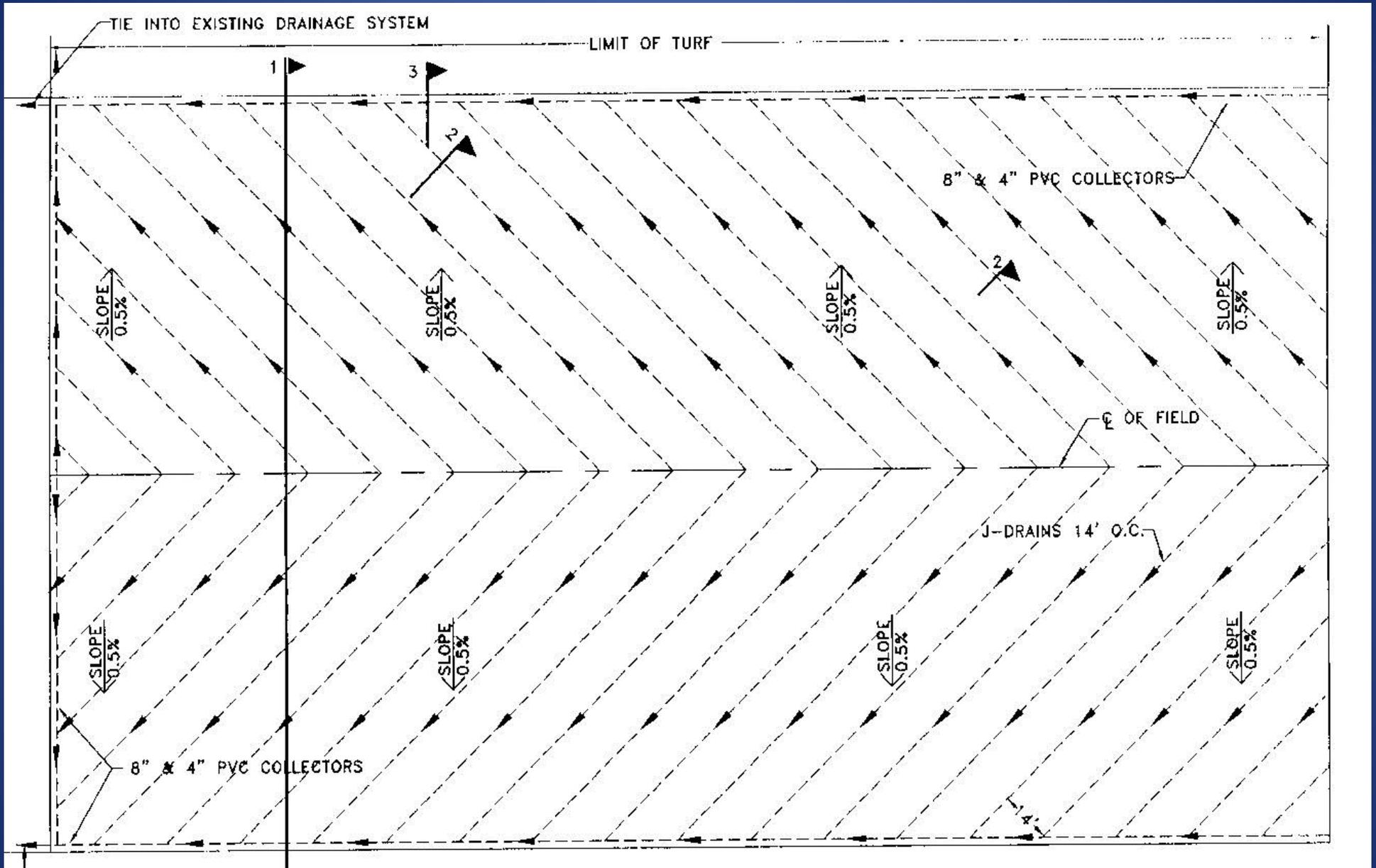
Field Turf – Patent Diagram

# How will the field be constructed?

- Top soil and subsoil is removed depth of around 15 inches
- ‘Crown’ of natural field is reduced (typically from 18” to 7”)
- Concrete anchor curb constructed around the field perimeter
- Flat panel drains (flat pipe) installed every 15-20 feet
- Open, fast draining stone base installed and laser graded
- New field crown of 0.5% to 0.8% is constructed on field centerline
- If a turf pad is required the pad is installed as turf is being placed
- Turf carpet is rolled out and seams sewn/glued on top of the stone or pad
- Field markings are permanently installed
- Infill material is spread over carpet with a broadcast hopper.
- Carpet and infilled are repeatedly brushed to work infill into fibers and make turf fibers ‘stand up in infill material.



# Synthetic Field – Drainage Layout

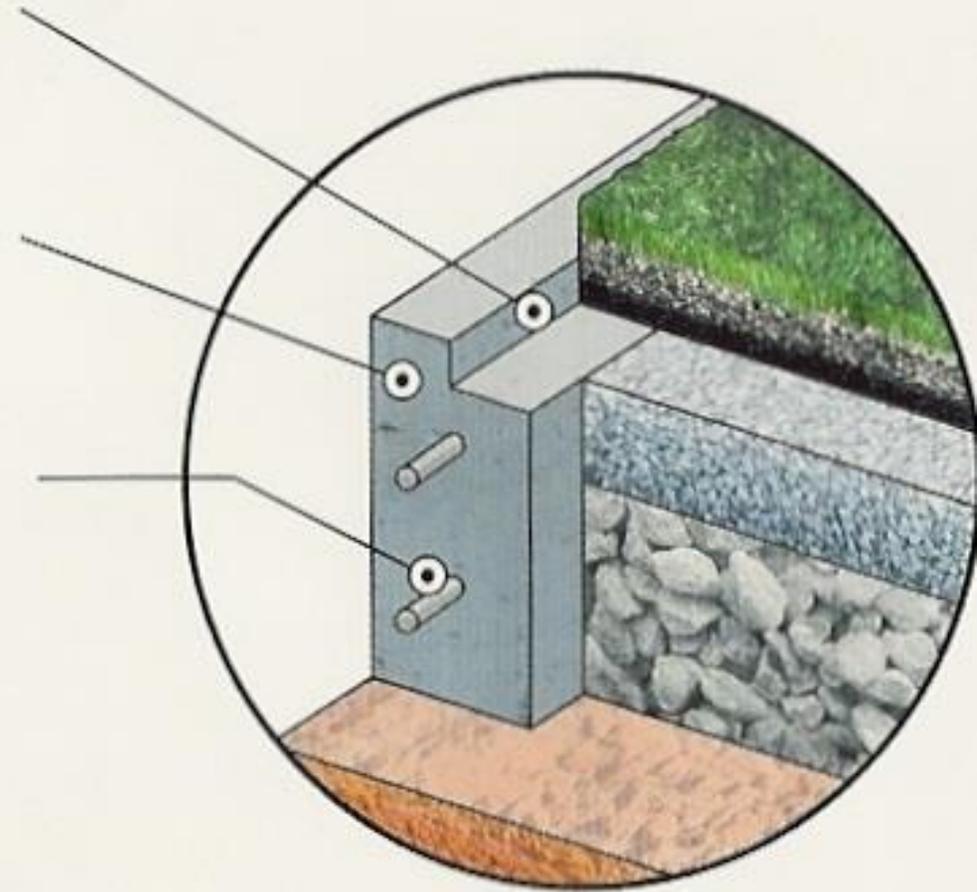


# Synthetic Field – Curb Edge Detail

2" wide recess same depth as infill

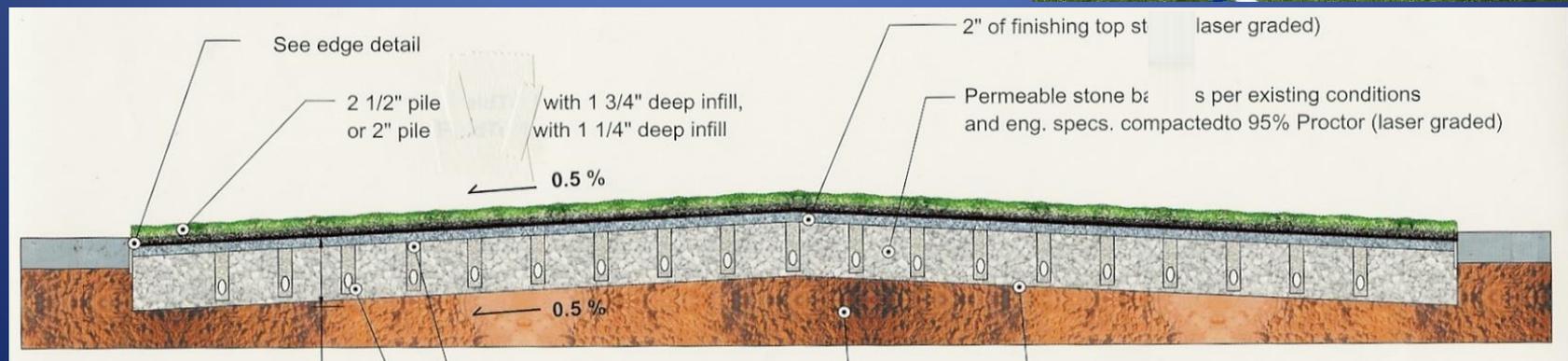
Concrete curb (supplied by others)

Rebars



# Construction Considerations

- Topsoil removal typically involves removal about 3000cy of material.
- Stone is imported for drainage
  - Truck Traffic - Typically around 300 truck trips over 2 weeks.
- Field Drainage typically is a benefit to surrounding site
  - Stone can be used for storage
  - Large infiltration area
- Turf fabrication time 3-4 weeks for delivery
- Installation time (carpet and infill only) 18 days
- Static Electricity: Initially Causes puddling & tracking of infill
- Field Testing
  - Stone
  - Turf Materials (pre delivery)
  - Turf Materials (post installation)
- End of Life Recycling



# Construction Considerations

## How do Fields Fail?

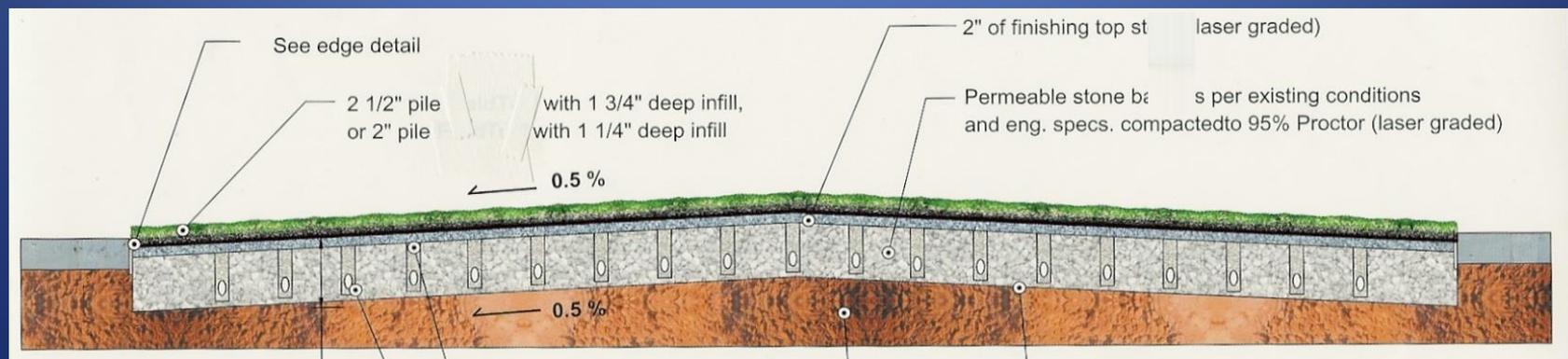
- Drainage - stone or turf backing failures
- Seams fail due to gluing or sewing failures
- Manufacturing Failures
  - Yarn Failures
  - Backing Failures
- Plowing or vehicle traffic
- Age / UV exposure
- Proper, intensive usage of a properly installed field is not a avenue of failure



## How to prevent failures:

Testing at installation, warranties

Enforced field usage rules and maintenance guidelines



# Field Maintenance Considerations

## How Long will my field last?

Fields prior to 2012 generation 10-12 years

Current fields 12-15 years (per manufacturers) (excluding organic)

## What is the warranty period? Industry standard 8 years

All seam and turf failures covered for that period.

## How I maintain my field?

- ‘Drag brush’ (tow behind brush) field once for every 100 hours of use.  
(typically 3 times per year) (figure \$5,000/yr)
- Deep Cleaning (usually vendor provided) as needed (every 5 years?)
- UV treatments? Not required
- Sanitation/bacteria treatments? Not required for outdoor fields (UV exp)
- Excludes Organic infill fields - require significantly more maintenance

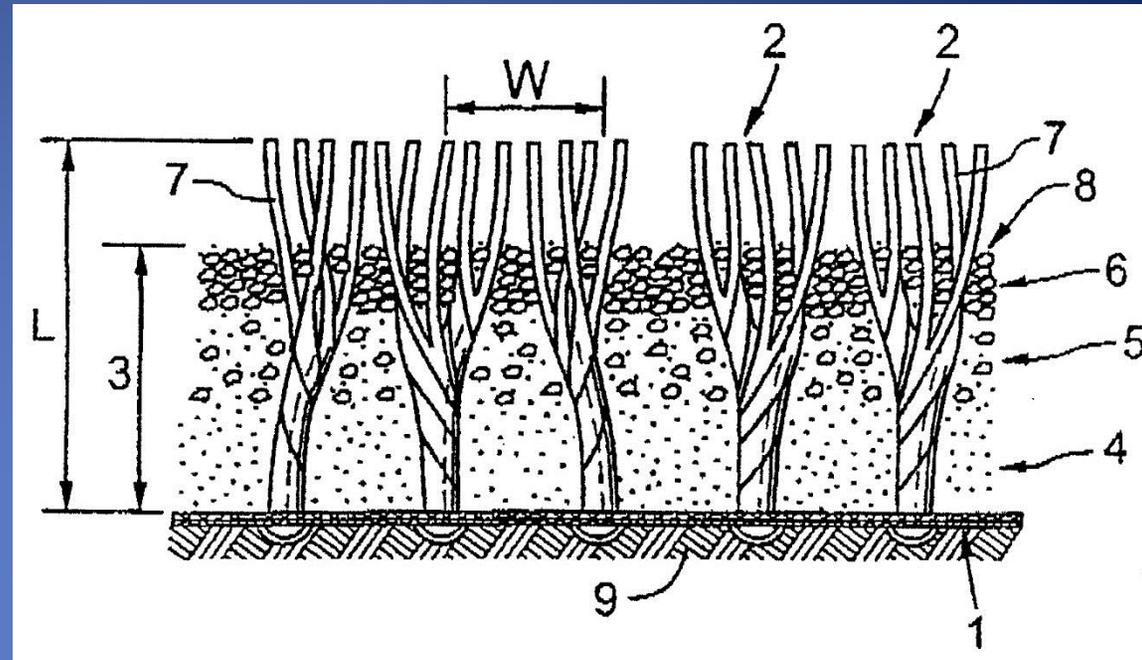
# Synthetic Turf – The LINGO

Turf Fiber = 7 & 2

Fiber Height = L

Infill Depth = 3

Stitch Gage = W



## Slit Film Fibers

Older style

Lays over/contains infill  
shiny/slippery

## Monofilament Fibers

Newer Style

Stands up /more natural look  
Wears longer

## Nylon Fibers

Original style  
Abrasive  
Curly

## Hybrid Turf – Slit and Mono Fibers

Carpet weight / backing weight

## Turf Pad

Gmax & Critical Fall Height

Planarity

# Turf fibers

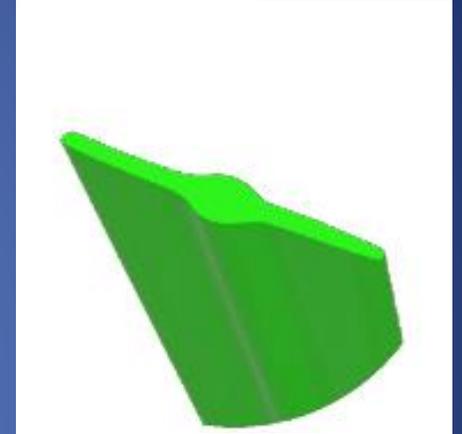
## Monofilament/Monoribbon Fibers



Quarter Moon/ 'C' Shape



Combination/Blend



Wing/Blade Shape



Oval/Rectangle Shape



Diamond Shape

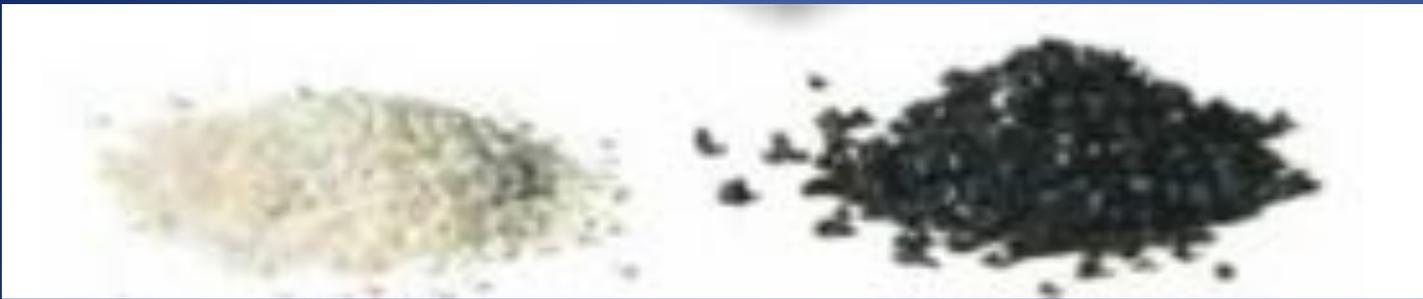
# Turf Fibers

## Parallel Slit-Film Fibers



Flat/Helix Shape

# Synthetic Turf – In-Fill Materials



## Traditional Infill Materials

- Silica Sand & SBR Crumb Rubber
- Crumb Rubber = SBR Rubber = Recycled Tire Crumb = Styrene Butylene Rubber
  - Recycled Tire crumb with fabric and steel removed
  - Highly processed (new advanced processing)
  - Excellent resiliency and longevity qualities
  - Low maintenance
  - Highly studied for health, performance & environment
  - Poor public perception



The mix of sand and rubber is manipulated to adjust field resiliency and ball handling. More rubber = softer. More sand = harder, faster field.

Deeper infill profile. No pad required to maintain GMAX (coated SBR rubber falls in this category also).



# Synthetic Turf – In-Fill Materials

## Alternate Infill Systems

- TPE (thermos Plastic Elastomer)
  - can be unstable/low melting point
  - Earthtone colors
  - Requires Pad to achieve resiliency
- EPDM (virgin rubber)
  - Many different colors
  - Very costly, requires pad to offset cost
- Acrylic Coated Sand
  - Earthtone colors
  - requires pad to achieve resiliency
  - Kills LAX ball play
- 100% Sand
  - Abrasive
  - requires pad to achieve resiliency
  - Kills LAX ball play off of turf



## Organic Infill Systems

- Earth Colors
- Moisture retention cools turf
- Increased maintenance – Herbicides?, Moisture retention?
- Requires pad to maintain resiliency
- Lifecycle unproven in New England
- Warranty/performance unproven in New England (freezing)

# Synthetic Turf – Alternative In-Fill Materials

## Costs Over Traditional Sand And Rubber Systems

- Coated SBR Rubber (+\$57,000) (New Milford)  
“encapsulates” Recycled Rubber  
Pad Not required same infill depth  
Cooler turf
- TPE (thermo Plastic Elastomer) (+400,000?)  
Add Turf Pad, Reduced infill depth
- EPDM (virgin rubber) (+530,000?)  
Add Turf Pad, Reduced infill depth/section  
Market driven
- Acrylic Coated Sand (+\$350,000) (Manchester)  
Add Turf pad  
Shorter knap turf
- 100% Sand (+\$300,000?)  
Add turf Pad  
Shorter knap turf
- Organic Infill (+500,000?)  
Add Turf Pad  
Add Irrigation (warranty)



# Synthetic Turf – Alternative In-Fill Materials

## Failsafe Turf Consideration:

### SBR or Coated SBR rubber and sand infill with a turf pad (+170,000)

- Provides Pad system incase SBR rubber should be deemed unsafe
- Would not require removal of turf – only infill
- Same proven qualities of SBR rubber systems
- Coated SBR rubber provides a ‘cooler’ field

# Synthetic Turf – Alternative In-Fill Materials

## Alternative infill materials:

Few Studies exist on Alternatives that:

Evaluate player performance or safety

Evaluate environmental Impact

**Or that suggest human health impact is any better or worse than  
Recycled SBR rubber**

Few Alternative infill fields have been installed:

to represent potential performance and longevity

to form a record of warranty performance

# Why Alternative Infill Systems?

NBC NEWS.com



October 8, 2014

**NBC News aired an story entitled:**

‘How Safe is the Artificial Turf on Your Child’s Sports Field?’

In which NBC Proposed a direct link between crumb rubber infill and cancer cases of youth soccer goalies in Washington State.

# Why Alternative Infill Systems?

Health affects of Synthetic Turf not a new concern....

2008 report by Environment & Human Health, Inc. (Cheshire)

Effective moratorium in Connecticut

Many resulting independent studies (esp. 2008 to 2012) on  
Synthetic Turf and Turf Infill Materials

Implied links to Yale research

There have been more than 50 independent technical studies and reports issued between 2000 and 2015 that review the health effects of crumb rubber. In the U.S. and Europe.

- 34 concerning inhalation toxicity
- 31 concerning ingestion toxicity
- 16 concerning dermal toxicity
- 5 concerning cancer

As NBC factually reported; *"there is no research directly linking crumb rubber exposure to cancer."*

# Why Alternative Infill Systems?

## Recent Reports by

*Connecticut Department of Health*

*Massachusetts Department of Health*

*State of California*

*State of New York*

*All of which effectively state that the current research does not indicate any reason why synthetic turf fields should not be installed.*

## ***Since the NBC REPORT:***

- New federal EPA study has been commissioned*
- The State of CT is considering a ban of SBR rubber in playgrounds*
- City of Hartford has banned the use of SBR rubber in fields.*
  
- Many municipalities, after performing their due diligence, have elected to proceed with installation of SBR rubber infill.*

# Are Infilled Turf Fields Safe?

**A 5-year study comparing Infilled Turf to natural grass, concluded:**

- **A 66% reduction in neural injuries**
- **50% reduction in cranial/cervical injuries**
- **A 33% reduction in third degree injuries**

**A 3-year study that assessed 704 Div. 1 NCAA football games comparing FieldTurf to natural grass concluded:**

- **7% fewer total injuries**
- **3% fewer minor injuries**
- **19% fewer substantial injuries**
- **22% fewer severe injuries**
- **12% fewer concussions**
- **64% fewer rotator cuff tears**
- **42% lower anterior cruciate ligament trauma**
- **16% lower ACL and associated tissue trauma**
- **10% fewer AC separations**
- **46% lower incidence of shoulder lesions**

# Environmental Health and Safety Topics:

- **Lead content**
- **Leachate potential**
- **Polycyclic aromatic hydrocarbons (PAHs)**
- **Volatile organic compounds (VOCs)**
- **Mold and staph infections**
- **Latex allergies**
- **Excess heat**
- **Sports injuries**

# Infilled Turf vs. Natural Turf?

- Water savings of 160,000 gallons per year per field
- No application of pesticides
- No application of herbicides / fungicides
- No application of fertilizer
  - (reduced nitrogen & phosphorous)
- NO pH adjustment
- Improved groundwater recharge
- No mowing,
- No striping
- No aeration or topdressing



# Can Industry Studies be Trusted?

## Is Artificial Turf Toxic?

THE FACTS CLEARLY SHOW IT IS **NOT**.

According to recent news reports, the most common chemicals of concern are

**ARSENIC, BENZENE, CADMIUM AND NICKEL**



### HOW DO HEAVY METALS IN CRUMB RUBBER COMPARE TO SOME COMMON FOOD ITEMS?

Rubber has Less  
**ARSENIC**  
than



ITEM	ARSENIC (PPM)
Crumb Rubber <sup>1</sup>	n.d
Uncle Ben's Original Rice <sup>2</sup>	0.25
Gerber Rice Baby Cereal <sup>2</sup>	0.26

Rubber has Less  
**CADMIUM**  
than



ITEM	CADMIUM (PPM)
Crumb Rubber <sup>1</sup>	0.53
Lobster	0.50
Rice	0.20

Rubber has Less  
**NICKEL**  
than



ITEM	Nickel (ppm)
Crumb Rubber <sup>1</sup>	n.d
Cashews	5.1
Cocoa/Chocolate	9.8

Rubber has Less  
**BENZENE**  
than



ITEM	BENZENE (PPB)
Crumb Rubber <sup>1</sup>	n.d
Soda	Between 2-20
Jam	<5

# Similar Recent Projects

## All-Weather Turf Fields

### Partial Listing

Uxbridge High School	A-Turf	48 oz., Blend
Southington High School	ProGrass/Act Global	48 oz., Blend
Bellingham High School	FieldTurf	55 oz., Slit-film
Tolland High School	ProGrass/Act Global	55 oz., Slit-film
Western CT State University	Hellas	55 oz., Slit-film
O'Brien Stadium	GreenFields	55 oz., Slit-film
Loomis Chaffee School	Shaw Sports Turf	50 oz., Slit-film
Old Saybrook High School	GreenFields	55 oz., Slit-film
Bloomfield High School	SprinTurf	50 oz., Slit-film
Lyman Hall High School	Shaw Sports Turf	55 oz., Slit-film
Plainville High School	SprinTurf	50 oz., Blend
Fairfield Ludlowe High School	Shaw Sports Turf	55 oz., Slit-film
West Middle School	FieldTurf/pad	50 oz., Slit-film
Miracle League Field	A-Turf/pad	72 oz., Slit-film
New Milford High School	SprinTurf	55 oz., Blend coated SBR
Manchester High School	Sprinturf/pad	55 oz., Blend coated SBR
Simsbury High School	Sprinturf/pad	55 ox., blend, coated SBR
Milford Orange Ave	Sprinturf/pad	55 oz, blend,



# More Information

## Suggested Reading:

Studies on all aspects of turf can be found on the PENN State Turf Research Website (which serves as a clearing house for turf research articles) at:

<http://plantscience.psu.edu/research/centers/ssrc/research/synthetic-turf-health>

# QUESTIONS



SAND

CRUMB RUBBER

# Avon High School – Existing Site



Existing Conditions

