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Sustainable Design With Recycled Rubber Surfaces

Sustainable Design With Recycled Rubber Surfaces

Presented By: Dinoflex Group LP
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Description: Provides an overview of interior and exterior recycled rubber surfacing products in terms of their sustainable design benefits and applications, and includes discussions on rubber manufacturing, post-consumer tires, and green building certification programs.

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Learning Objectives

At the end of this program, participants will be able to:

- compare natural rubber to synthetic rubber in terms of their components and manufacturing processes, and defend the argument that using recycled rubber is a more sustainable choice than manufacturing new rubber
- describe the environmental hazards posed by the dumping of post-consumer tires, and describe two methods used to recycle these tires
- describe two types of indoor rubber flooring, their benefits and installation methods, and explain how these products meet the criteria for four principles of sustainable design
- compare three types of exterior rubber products, their benefits and drawbacks, and how they contribute to sustainable landscape design projects, and
- explain two green building certification programs, and relate them to case studies where certification was achieved.

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Rubber

Where Does Rubber Come From?

There are two types of rubber: natural and synthetic (or man-made).

Natural rubber is an elastomer derived from the latex of the “rubber tree.” Latex is the white, milky substance drawn from the bark of the tree by tapping into it. If the tree is drilled too deeply, it wounds the tree and the latex becomes tainted and isn’t useful. However, if tapped correctly, the tree reacts as if it were “bleeding” and produces large amounts of the latex. After the tree has matured to seven years, it can then be used for the latex. The life span for collecting latex from one tree is 25 years. Rubber trees are found throughout the world in warmer climates but originated in South America.

History of Natural Rubber

Natural rubber is also called “gum rubber.” It was believed that Christopher Columbus first discovered rubber, but it had been around centuries before he ever arrived in South America. The Olmec people, indigenous to North America, were the first people to use rubber. They turned the hardened latex into ball shapes and used it as part of their religious ritual game called Tlachtli. The Olmec people passed down their knowledge to the Mayans, who continued to use the hardened latex. Then, as the European explorers started to arrive, the value of this hardened latex began to be realized.

Charles Marie de La Condamine introduced the first samples of the hardened latex to the scientific world in 1736. However, it was 15 years later before the properties of it were presented. La Condamine worked with Francois Fresneau, who wrote the paper outlining the properties. It wasn’t until 1770 that the coagulated latex was named “rubber” by Joseph Priestly of England. He named it after noticing that the hardened latex “rubbed off” pencil markings.

Vulcanization

The uses for rubber began to increase. Seeds were harvested from the trees and taken to England, where it was discovered the climate was not suitable. The seeds were ultimately planted in Sri Lanka, Singapore, and other countries with warmer, humid climates. Malaysia became the largest producer of latex.

Rubber was found to be useful for many products; however, its properties changed depending on the weather. It was Charles Goodyear who first discovered the concept of vulcanization, which created consistency in the product. It could now be produced without worrying about the rubber becoming brittle in the cold or sticky in the sun. This process proved to be important in the manufacturing of products using rubber, like tires. The end result was a product that was not affected by weather and was resistant to water and chemical interactions. Today, a form of vulcanization is still a widely used manufacturing method.

History of Synthetic Rubber

In 1926, a German chemist created synthetic rubber by combining styrene and butadiene, known today as SBR. It was used by the U.S. in WWII to replace the loss of natural rubber imports; it continued to gain in popularity throughout the world and continues to be used today.

The creation of styrene-butadiene (SBR) changed the rubber industry by allowing countries to create their own rubber without having to rely on the import of natural rubber.

SBR rubber, also known as man-made rubber, is the most widely used type of synthetic rubber and has excellent abrasion resistance and good aging stability. Synthetic rubber competes with natural rubber and can be found in shoe heels, soles, gaskets, and even chewing gum.

In general, synthetic rubber has the following advantages over natural rubber: better aging and weathering; more resistance to oil, solvents, oxygen, ozone, and certain chemicals; and resilience over a wider temperature range.

How Synthetic Rubber Is Made

SBR or styrene-butadiene is the most common type of synthetic rubber.

Styrene is a compound which is drawn from the sap of Styrax trees. It is a colorless, oily liquid which evaporates easily and has a sweet smell. Fifteen billion pounds of styrene are produced annually in the world today.

Butadiene, on the other hand, is an industrial chemical created as a byproduct of petroleum refining.

SBR is made by combining 25% styrene and 75% butadiene in a reactor containing soap suds. The result is a milky-looking liquid which coagulates and results in rubber “crumbs” that are purchased by manufacturers and melted into numerous products.

The largest issue with manufacturing synthetic rubber is the amount of petroleum product it requires. Crude oil is used in the manufacturing; to make one car tire requires approximately seven gallons of crude oil. Continued and increasing use of oil is dramatically impacting our ability to decrease dangerous levels of pollution from our environment and to reduce the devastating effects of a warming earth.

This in itself is one reason why using **recycled rubber vs. making new rubber** makes sustainable sense.

Natural and Synthetic Rubber: Uses

Natural and synthetic rubber compete with each other for a multitude of products. However, natural rubber is stronger, and the aircraft industry stipulates that all components that are made of rubber be made from natural and not synthetic.

In 2005, 42% of the 21 million tons of rubber used was natural rubber, and the remaining 58% of rubber products were made of synthetic rubber.

Of all natural and synthetic rubber products manufactured, 56% are tires and tubes, with tires being the largest user of rubber in the world. The other 44% consists of door and window profiles, hoses, belts, matting, flooring and dampeners (anti-vibration mounts for the automotive industry), gloves, toy balloons, erasers and rubber bands. Tons of rubber is used as adhesives in manufacturing industries—mostly paper and carpet.

Natural and Synthetic Rubber: Uses

There is only one chemical type of natural rubber. However, there are approximately 20 different chemical types of synthetic rubber, and within, many distinguishable grades.

Some tires are made of all natural rubber, as found in the aircraft industry. Most radial tires are made with natural rubber, some tires are a combination of natural and synthetic rubber, and some tires are all synthetic.

Large tires used on mining vehicles and heavy trucks have a higher percentage of natural rubber than synthetic. And car/light truck tires tend to have a higher percentage of synthetic rubber.

> *The U.S. Environmental Protection Agency states:* "At the end of 2003, the U.S. generated approximately 290 million scrap tires. Historically, these scrap tires took up space in landfills or provided breeding grounds for mosquitoes and rodents when stockpiled or illegally dumped. Fortunately, markets now exist for 80.4% of these scrap tires—up from 17% in 1990."

These markets—both recycling and beneficial use—continue to grow.

EPDM Rubber

EPDM (ethylene propylene diene monomer) rubber is an organic synthetic elastomer. The “M” refers to its classification in ASTM standard D-1418. The “M” class includes rubbers having a saturated chain of the polymethylene type.

When cured, EPDM has many properties equivalent to those of natural virgin rubber. The main properties of EPDM are its outstanding heat, ozone, and weather resistance. It is resistant to polar substances and steam and has excellent electrical insulating properties. It is widely used for industrial hoses, belts, gaskets, roof membranes, and sheathing for electrical cables.

Not all EPDM rubber is created equal. Different curing processes can be used, some resulting in strong residual odors. Environmentally conscious manufacturers choose only the lowest odor EPDM.

EPDM can be a combination of synthetic and natural rubber, and in its liquid state, is colored using pigment. Once hardened, the new rubber compound can be cut into varying sized granules, frequently used in combination with SBR rubber to create colorful flooring products.

Tires

Post-Consumer

A tire has a lifespan of use, and once the tread on the tire has worn down, it no longer becomes useful and is discarded. The problem that exists is how to dispose of the tire.

Approximately one tire is discarded per person per year in the world today.

In the past, tires were put into landfills and were often buried. The ground tended to "churn up" the tire after time, and the tire was spit out of the earth.

Tire piles were often burned, causing huge amounts of air pollution. The tires would burn for months, causing dangerous situations for landfill workers as well.

The burning of scrap tires releases benzene and heavy metals and produces dioxins. These toxins are associated with a wide range of serious health problems.

Post-Consumer

Tires don’t lose their shape, decompose or deteriorate.

When allowed into landfills, they pile up, creating large voids under the surface which trap methane gases. This causes the tires to become buoyant and bubble to the surface. This movement can damage landfill liners, allowing contaminants to leach into surface and groundwater.

Discarded tires collect rainwater and become breeding grounds for insects.

Illegal dumping of tires pollutes ravines, woods, rivers, deserts, and private property, causing many states and municipalities to pass scrap tire regulations.

Facts

Used tires are the most visible of the waste products made from rubber; it is estimated that North America alone generates approximately 300 million waste tires annually, with over half being added to existing stockpiles. It is also estimated that less than 10% of waste rubber is reused in any kind of new product.

The United States, European Union, Eastern Europe, Latin America, Japan and the Middle East collectively produce about one billion tires annually, with estimated stockpiles reaching three billion in Europe and six billion in North America.

It takes approximately 55,000 BTU to produce a pound of rubber. Tires burned for fuel have an energy value of approximately 14,000 BTU per pound.

It takes less than 1,000 BTU to convert a pound of waste tire rubber into good quality granulated or crumb rubber.

Did you know that it takes 2072 gallons of water to make four new tires?

Recycling

As stated, there is approximately one tire per person per year being discarded. A huge number of post-consumer tires can be recycled and the rubber used for other purposes. This is one answer to the tire disposal crisis.

REUSE – REDUCE – RECYCLE!

California's Department of Resources Recycling and Recovery has developed the CalRecycle's "Green Roads" program, which promotes waste tires as a valuable resource and environmentally sound solution to solve engineering problems. Scrap tires are ground and mixed with asphalt to pave roads, or shredded for use in landslide repair and embankments. These uses keep thousands of tires out of landfills; additionally, using tire-derived products frequently results in significant economic and energy savings and is the first step in helping the state reach its goal to recycle 90% of its unneeded tires.

Recycling helps the environment in several ways:

1. Recycling saves energy.
2. Recycling reduces pollution and preserves the environmental condition.
3. Recycling preserves natural resources.
4. Recycling saves the space that is used for waste disposal.

Recycling

The scrap tire industry is driven by regulation. The industry was created as a result of government regulations to address the environmental concerns about illegally dumped or stockpiled tires. Governments are also trying to improve the viability of the industry by providing incentives to end-markets that use scrap tire derived products. The United States and Japan were the first two countries to address the environmental hazards of scrap tires and put the laws in place. As a result, they are currently the leaders in recycling rates and market size. Europe has been a laggard in this aspect, but with the deadline for implementing EU directives fast approaching, the European industry is expected to register strong growth.

Tires are recycled primarily using two different processes:

- Ambient, and
- Cryogenic.

Source: Irevna. “Tire Recycling Industry: A Global View.” http://www.irevna.com/pdf/Industry%20report.pdf. Accessed January 2012.

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Ambient Recycling Process

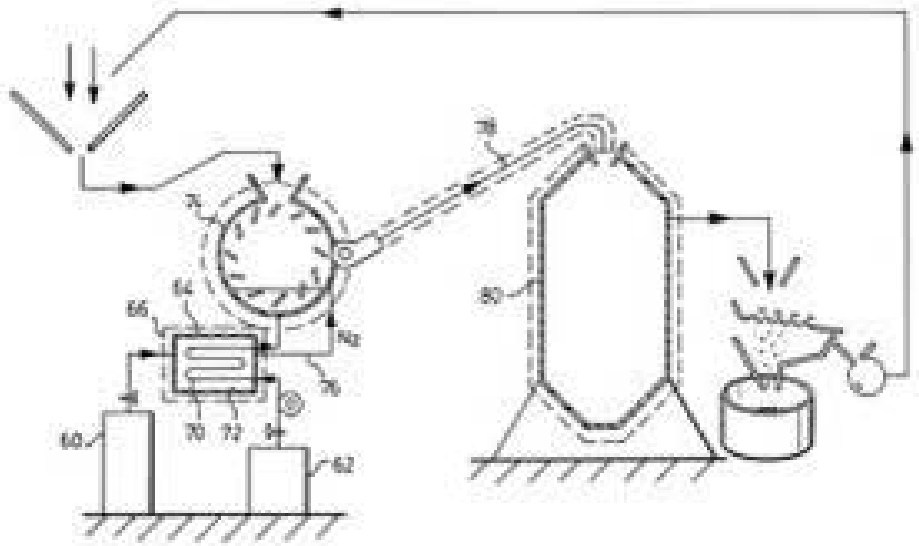
The ambient process consists of whole tires being shredded into strips using heavy cutting machines. The shredded material is then ground into smaller shreds, removing most of the steel fibers from the tires. Once the bulk of the steel is removed, the smaller strips are placed into granulators and milled into assorted sizes of granules. The result is ground rubber of varying size specifications with a yield of approximately 70% ground rubber and 30% steel and fiber.

The rubber is then put onto conveyor belts where large magnets draw out the steel and fiber from the tire. Vibration density separators cause the steel to part from the rubber shreds and be easily withdrawn by the magnets.

To control the smaller particles from polluting the air, spray or mist is used to keep the dust to a minimum. Air pollution devices are also used to recirculate any particles back into production.

Cryogenic Recycling Process

In the cryogenic recycling method, liquid nitrogen is used to cool the whole tire to a temperature below -112˚F. At this temperature, the rubber becomes brittle like glass. The tire is then shattered, the metal is separated from the rubber, and the chips are brought back to a normal temperature.



Recycled Rubber

Once the tires have been broken down, the steel can be used for other applications, and the rubber is further processed into different sized “crumb” for re-manufacturing into other products.

Recycled tire rubber is used for a variety of purposes: gaskets for the auto industry, turf for fields and equine, rubberized asphalt, industrial products, consumer products, indoor flooring and outdoor surfaces.

Benefits of Using Recycled Rubber

Consider the environmental impact of tires left in landfills. Tires are among the largest and most problematic sources of waste, due to the large volume produced and their durability. Those same characteristics which make waste tires such a problem, also make them one of the most reused waste materials, as the rubber is very resilient and can be reused in other products.

By recycling post-consumer tires, manufacturers help:

- save on crude oil
- save valuable landfill space
- reduce environmental impact
- facilitate waste management
- reduce inappropriate disposal, and
- encourage development of recycled products.

Recycled Rubber for Sustainable Building Design

Recycled Rubber Flooring

For decades, recycled rubber surfacing has been popular throughout the world as a preferred surfacing product for the sports industry. Now, commercial designers and building owners are realizing that its proven success in these tough environments makes it an easy product to support in the world of sustainable building products.

Because of its resilient properties, rubber flooring is now found in a wide range of applications, including: home gyms; fitness centers; multi-purpose recreation facilities; pro shops; libraries and museums; retail stores; schools and universities; play areas and daycare centers. Recycled rubber flooring now comes in a variety of shapes and sizes to meet a multitude of indoor applications, and can be made to match nearly any need or décor. Rubber is one of the most popular alternative flooring products for customers who require a more durable, yet functional solution for high-use, high-wear areas.

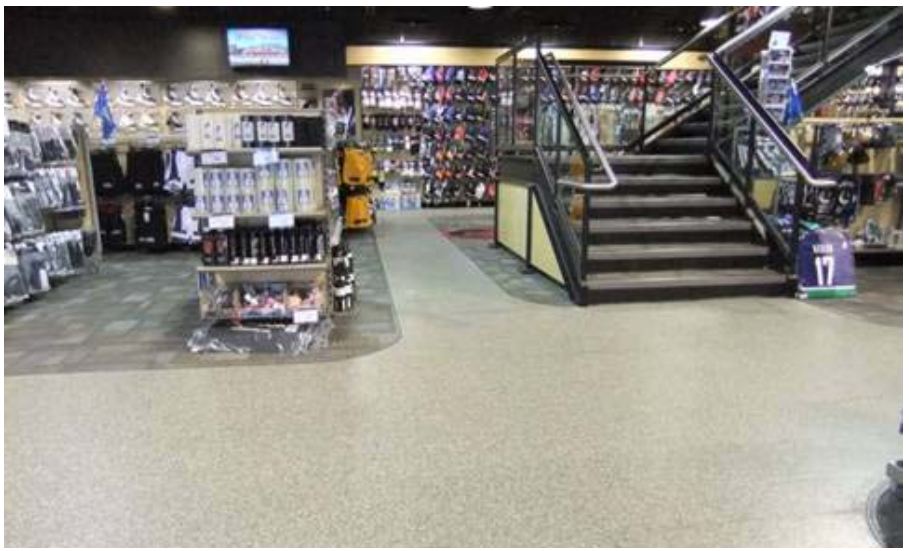
The focus here will be on polymer-bonded recycled rubber flooring. Other types of recycled rubber flooring include fully vulcanized products and laminated, dual-durometer products.

Benefits of Interior Recycled Rubber Products

Over time, recycled rubber flooring offers greater resource efficiency than many other flooring materials. It's a truly sustainable product that offers a long life, low life cycle costs, improved air quality, and increased energy savings.

Some rubber floor types are naturally hypoallergenic, discouraging common household allergens such as dust and mites from taking root. As well, no harsh chemicals are required for cleaning.

Rubber tile flooring is durable and resilient, resistant to scuffs, scratches and indentations, and easy to install and maintain; and the surface finish provides remarkable slip and stain resistance.



Benefits of Interior Recycled Rubber Products

Commercial builders and property developers choose recycled rubber as an ideal flooring material because it is durable, and provides a cost-effective option that can help ensure the safety of staff and customers. Added benefits of rubber flooring include its sound- and impact-absorbing qualities.

Rubber tile flooring is one of the most versatile flooring materials available today. It provides uniform color, non-laminated surfaces, and long-lasting wear qualities, and is rated as sustainable and environmentally friendly.

Most recycled rubber surfacing designed for indoor applications meets four key principles for sustainable design.

Principles for Sustainable Design

1. **Use Low-Impact Materials**: *Choose non-toxic, sustainably produced or recycled materials which require little energy to produce.*

- Through recycled rubber tile manufacturing, one manufacturer has kept over 2 million tires out of landfills since 1998. One tire produces about 10 sq. ft. of rubber flooring.
- Water-cured polymers are used in recycled rubber flooring to allow for the highest recycled content possible. During the processing of the recycled mix, only minimal heat is used, resulting in little or no off-gassing during manufacturing.
- When choosing low-emitting materials, many recycled rubber products are FloorScore® certified and CHPS (Collaborative for High Performance Schools) compliant.

2. **Energy Efficiency**: *Use manufacturing processes and produce products which require less energy to maintain.*

- Recycled rubber flooring requires less maintenance than other types of flooring. Vacuuming then damp mopping is the preferred method of cleaning, with very little or no detergent necessary. There is no need for chlorinated or ozone-depleting solvents.
- No need to resurface or refinish over the life of the product, reducing maintenance costs. If required, simple-to-apply water-based sealers work well on recycled rubber flooring.

Principles for Sustainable Design

3. **Quality and Durability**: *Longer-lasting and better functioning products will have to be replaced less frequently, reducing the impact of producing replacements.*

- Life expectancy in high-traffic areas is far greater than most carpet/carpet tile products. Rubber can withstand rolling load and heavy foot traffic with little or no visible wear.
- Life expectancy of rubber flooring can be up to 20 years in commercial applications depending on type of traffic.
- Polymer-bonded recycled rubber products have homogenous color, resulting in a product that will not exhibit color wear patterns, which may be found in laminated rubber products.

4. **Design for Reuse and Recycle:** *Products, processes, and systems should be designed for performance in a commercial "afterlife."*

- Recycling programs at many rubber flooring manufacturing facilities grind old products and post-production waste for use in new products.
- Many types of interlocking rubber tile products can be flipped over, doubling the life of the floor. As well, tiles are easily removed and transported to other locations.

Types of Recycled Rubber Flooring

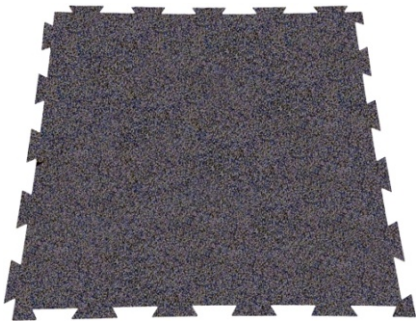
Rubber Tiles
Tile rubber flooring is the easiest type to install, as they require little or no cutting and are easier to handle than heavier rolls of rubber. A variety of tile sizes are available, but larger tiles are popular as fewer seams are created. Many interlocking versions of rubber tiles are fully reversible, doubling the life of the floor.

Rubber Rolls
Rubber flooring also comes in solid rolls. Lengths can vary depending on thickness required and can be cut on site to suit the installation. Caution should be used as long rolls may be heavy and require special equipment to handle on site.

Rubber tiles and rolls range in colors, textures, patterns, and surfaces, each of which carries certain advantages and disadvantages. Knowing project needs in terms of color choices, surface options, etc. will help save time and money. Installation options are also important to consider, depending on the particular flooring application required.

Rubber Flooring Installation Methods

Interlocking Rubber Tiles



Glue-Down – Rubber Tiles

Glue-Down – Rubber Rolls

Dowel-Secured Rubber Tiles

Rubber Flooring Installation Methods

Interlocking rubber tiles do not require adhesive and are easy to install due to their puzzle-piece, precision-cut sides that lock together. They can be installed over many existing surfaces and are effortlessly removed. Interlocking tiles are perfect for small retail areas such as kiosks, as no adhesive is required. Interlocking tiles are suitable for dry, indoor, temperature-controlled environments only. Popular applications include fitness facilities and over-access flooring systems. Interlocking tiles may not stand up to heavy rolling loads.

Dowel-secured rubber tiles do not require adhesive and are fit together and secured with dowels, to form a sturdier loose-lay floor. However, perimeter containment is always required with this type of interlock system.

Rubber Flooring Installation Methods

Glue-down rubber tiles are recommended in areas with heavy traffic or constant rolling loads. As well, glue-down installations are required for areas with fluctuating temperature or humidity, such as ice rinks or ski resorts. Tiles are acclimated to room temperature, then adhesive is trowelled onto the subfloor; tiles are laid into wet adhesive, then rolled to ensure good contact with the adhesive. Tiles are easily cut to fit small areas with little or no waste. Patterns and designs are easily achieved with square-edge tiles. Rubber tiles can be easily adhered to stairs for improved slip resistance.

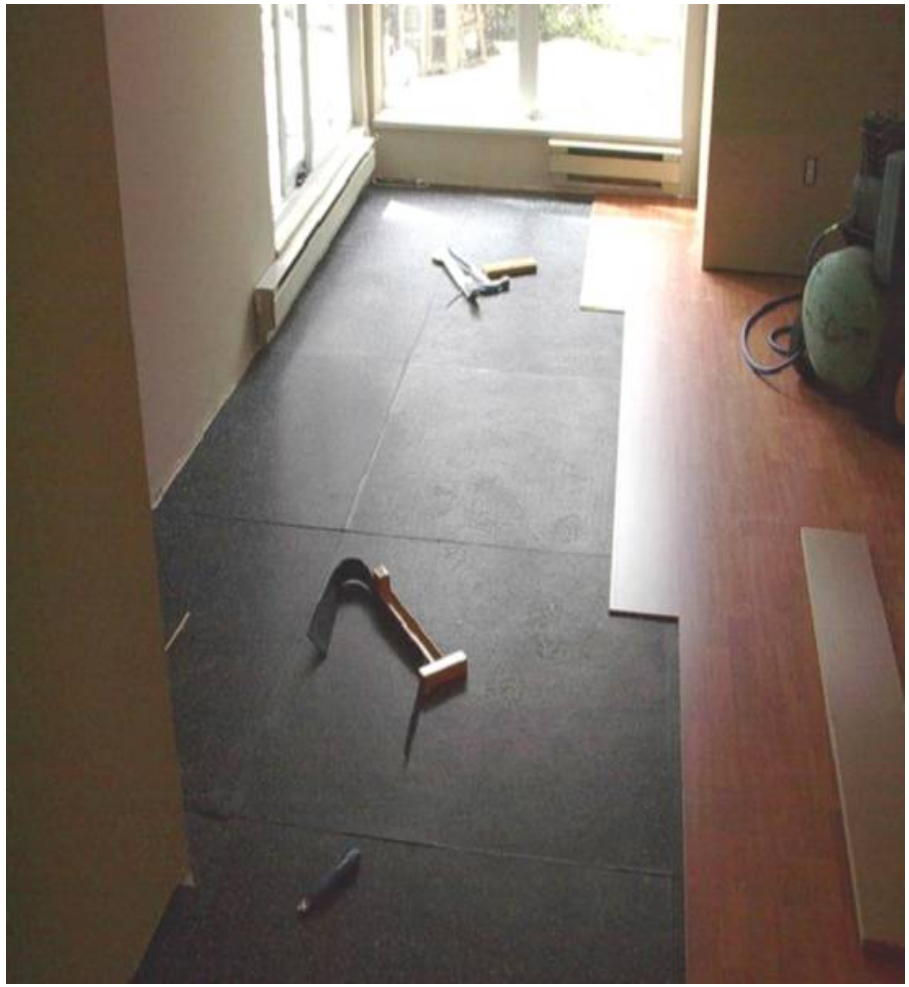
Glue-down rubber rolls are sometimes chosen for larger projects as more square feet can be covered with a single sheet. After acclimation to room temperature, rolls are laid out, then folded in half. Adhesive is trowelled onto the subfloor, and the roll is folded down into the adhesive. This process is repeated with the second half, then the entire piece is rolled to ensure good contact with the glue. Rolled rubber products may be available in wider rolls, making them suitable for corridor applications. Glue-down rubber rolls can be used in areas where temperature and humidity may fluctuate.

Recycled Rubber Underlay

Polyurethane-bonded recycled rubber is a reliable and eco-friendly source of underlayment material. The average recycled rubber underlayment contains approximately 90% recycled content, usually from used tires.

Rubber underlayment is available in many thicknesses to suit a wide variety of sound reduction and overlay product requirements. Products are available in both roll and tile formats.

This type of underlay material produces excellent sound reduction with IIC ratings typically in the range of 48 to 54. Rubber underlay is suitable for use under most rigid flooring such as hardwood, engineered wood, and laminate flooring.



Recycled Rubber for Sustainable Landscape Design

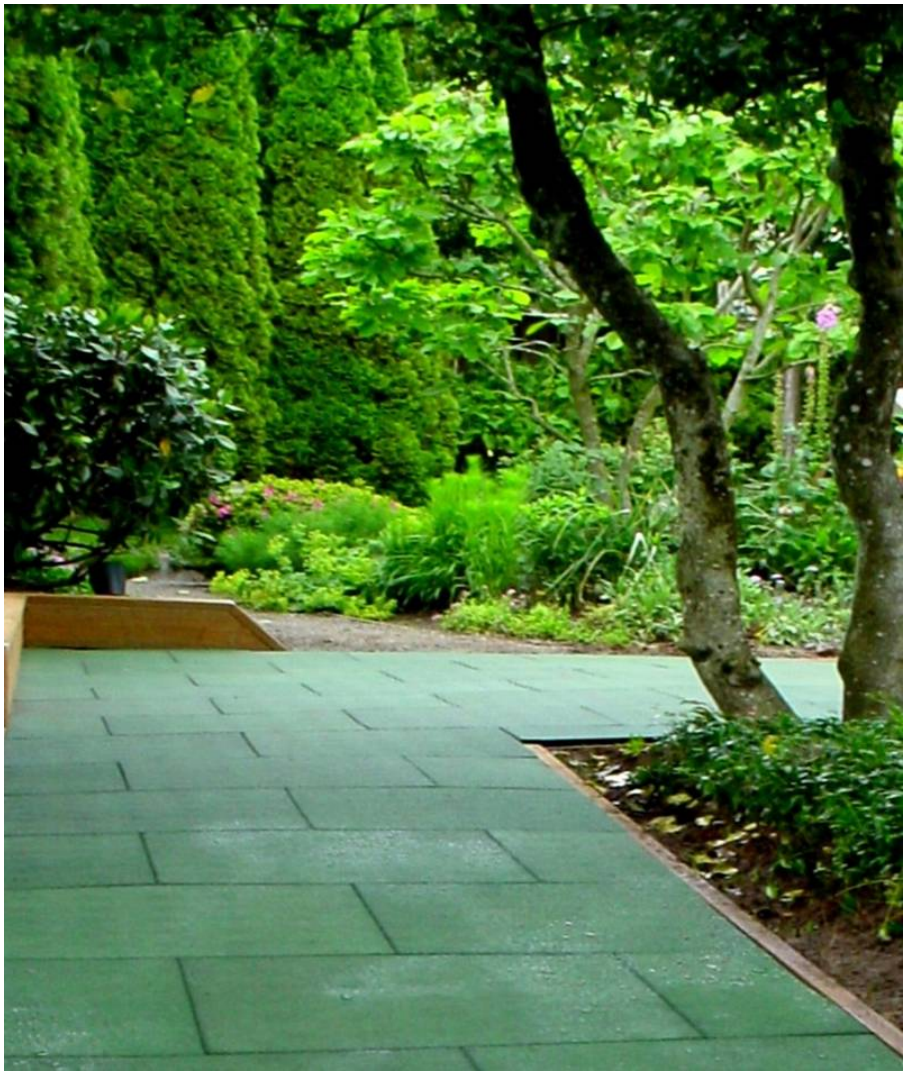
Benefits of Exterior Recycled Rubber Products

The benefits of using recycled rubber products in sustainable landscaped sites extend far beyond the most obvious—high recycled content.

The long-term life expectancy of exterior rubber products extends the life cycle cost over many years.

The durability and resistance to damage from freeze/thaw cycles make it a preferred choice when compared to other more typical products such as concrete.

Permeable rubber products can be used to reduce storm water run-off and allow rain water to infiltrate into the ground and replenish groundwater, rather than run into surface water.



Benefits of Exterior Recycled Rubber Products

Exterior rubber tiles are easily installed on compacted soft ground or solid surfaces. Accessible surfaces can be prepared including impact-attenuating recycled rubber tiles that meet the ASTM requirements for accessibility and safety. The right surface can increase safety and reduce injury.

The rubber tiles will provide a slip-resistant walkway over existing roof surfaces. Made from 100% recycled rubber, tiles will resist tearing, cutting, and freezing and are easy to install.

They provide superior shock-absorbing and slip resistance qualities and offer an excellent alternative surfacing for patios, decks, walkways and pathways, thereby contributing to the reduction of accidents.

Benefits of Exterior Recycled Rubber Products

Rubber tile pavers can be installed on concrete, asphalt or a compacted granular base; the interlocking and self-aligning systems provide ease of installation, thus allowing easy access to the subsurface for maintenance and repairs.

The porous nature of the design allows water to flow through and around the tiles, creating a secure setting.

Inadequate playground surfacing material is the leading cause of playground injury. Recycled rubber tiles provide a safe choice. The shock-absorbing and slip-resistant qualities of rubber tiles provide safety and comfort, while allowing for a wide range of colorful and fun possibilities.

Recycled rubber tiles are naturally hypoallergenic and antimicrobial. Rubber also slows the growth of mold and bacteria, providing a clean, kid-friendly play area.

Typical Uses in Sustainable Sites

At-grade installations:

- children's play areas – schools, parks, daycares
- walkways – over concrete or on soft ground
- patio areas – commercial, health care, residential
- outdoor entrances – retail, commercial
- general landscape applications

Elevated installations:

- commercial, multi-family residential, healthcare
- children's play areas
- balconies
- rooftop patios, decks, walkways
- green roof applications

Exterior Products

Three main types of rubber products available:

- Rubber mulch
- Poured-in-place rubber surfacing
- Rubber tile products

Rubber Mulch

Rubber mulch is typically made from recycled tires, reground into a variety of forms. It may be the original black color, or colored with pigments or paint. The depth of the mulch can be varied based on application and project needs. A retention border is required to confine material.

Benefits of rubber mulch:

- Easy to install
- Relatively inexpensive
- Feels soft underfoot

Drawbacks of rubber mulch:

- Must be regularly raked to fill in voids caused by use
- Can “bleed” outside containment field
- Unsavory objects can be buried, causing health risks

Poured Rubber Surfaces

The basic composition is SBR as a base, covered with an EPDM colored rubber topping, bonded together with a urethane adhesive. Raw materials are shipped to the site, mixed and poured in place as per specifications. It can be shaped to suit the location; designs and patterns are common with this product.

Benefits of poured rubber surfaces:

- Excellent design opportunities
- Bright colors are great for play areas
- Can be applied to uneven terrains

Drawbacks of poured rubber surfaces:

- Expensive to repair—patching required
- No access to sub-surface after installation
- Trained installers required
- Weather conditions can affect the success of the installation
- Testing (if required) must be done on site after the installation is complete

Rubber Tiles

The basic composition is SBR as a base, topped with either pigmented SBR rubber granules or a mixture of SBR and EPDM colored rubber, bonded using water-cured polymers. The components are mixed at the factory and molded into tiles of various shapes and sizes. Different surface textures may be available.

Benefits of rubber tiles:

- Quality controlled at factory
- Very little maintenance required
- Simple to install, in any weather, no special training required
- Easily removed for access to drains if necessary
- Low cost repairs, simply remove tile and replace with new
- Logo designs can be created at factory

Drawbacks of rubber tiles:

- Only simple patterns and designs can be achieved
- Manufacturing process can result in shade variation between tiles
- May be most expensive option in some locations

Rubber vs. Traditional Exterior Surfaces

Concrete Slabs or Pads	Rubber Surface
Crack/break easily	Will not crack
Slippery when wet	Superior slip resistance
Transmit noise on elevated decks	Excellent sound reduction
Little or no recycled content	High recycled content
High water run off	Permeability slows flow to drains
Carbon dioxide emissions in mfg	No carbon dioxide from mfg
Wood Decks or Walkways	**Rubber Surface**
Slippery when wet	Superior slip resistance
Transmit noise on elevated decks	Excellent sound reduction
Little or no recycled content	High recycled content
Will rot in humid/wet environments	Will not deteriorate
Difficult to remove to access drains	Rubber tiles provide easy access to roof drains
Loose Fill Gravel or Wood Chips	**Rubber Surface (loose or solid)**
Must be “topped up” regularly	Poured or tiled surfaces maintain consistent surface
Hard clumps form when frozen	Will not freeze or clump
Unhealthy items easily imbedded	Items cannot be hidden below surface
Difficult to remove to access drains	Rubber tiles provide easy access to roof drains with tiled or poured surfaces
Can flow onto surrounding areas	Poured or tiled surfaces stay in place
Hard to control weed growth	Little or no weed growth under tiles

Applications

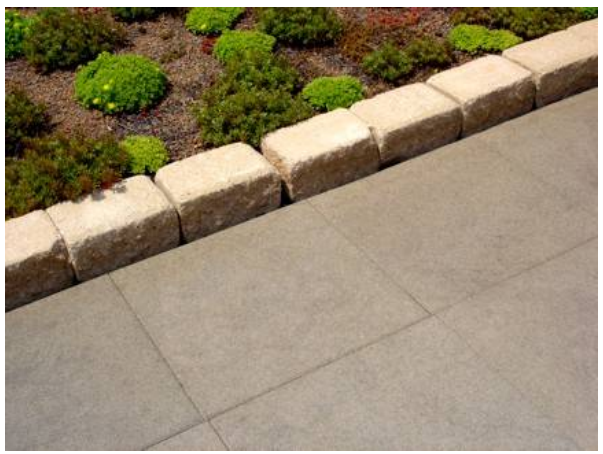
Elevated concrete walkway

Wood decking used in green roof system

Traditional gravel pathway

Elevated walkway with rubber tiles

Rubber tiles used in green roof system



Recycled rubber tile pathway

Green Building Programs / Case Studies

World Green Building Council

The World GBC is a coalition of national Green Building Councils, making it the largest international organization influencing the green building marketplace.

Their mission is to facilitate the global transformation of the building industry towards sustainability through market driven mechanisms.

There are over 20 established Green Building Councils world wide, with many more countries working to develop Councils to support sustainable building practices.

The U.S. Green Building Council (USGBC) is the nation's foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work.

Overview: LEED® Certification

The U.S. Green Building Council (USGBC) is a 501(c)(3) non-profit organization composed of leaders from every sector of the building industry working to promote buildings and communities that are environmentally responsible, profitable and healthy places to live and work. USGBC developed the LEED (Leadership in Energy and Environmental Design) green building certification program, the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings.

LEED credit requirements cover the performance of materials in aggregate, not the performance of individual products or brands. Therefore, products that meet the LEED performance criteria can only contribute toward earning points needed for LEED certification; they cannot earn points individually toward LEED certification.

For detailed information about the council, their principles and programs, please visit www.usgbc.org.

Living Building Challenge

The Living Building Challenge is an advocacy tool and certification program. Unlike LEED, each criterion must be met before full certification can be achieved. The Living Building Challenge defines the most advanced measure of sustainability in the built environment possible today and acts to diminish the gap between current limits and ideal solutions. The project must be operational for a minimum of 12 months and have records of proof that each imperative has been met before certification can be awarded. There are seven performance categories (called Petals) that have a total of twenty mandatory imperatives categorized within these petals.

1. Site: Limits to Growth, Urban Agriculture, Habitat Exchange, Car Free Living
2. Water: Net Zero Water, Ecological Water Flow
3. Energy: Net Zero Energy
4. Health: Civilized Environment, Healthy Air, Biophilia
5. Materials: Red List, Embodied Carbon Footprint, Responsible Industry, Appropriate Sourcing, Conservation & Reuse
6. Equity: Human Scale & Humane Places, Democracy & Social Justice, Rights to Nature
7. Beauty: Beauty & Spirit, Inspiration & Education

BC Hydro - Horne Payne Building

Building Type: Commercial Industrial
Location: Burnaby, BC
Architect: Omicron
Size: 25,000 Sq. Ft.
Installation Year: 2011
Type of Flooring: Recycled Rubber Tile
LEED Rating: Minimum LEED Gold

BC Hydro, the provider of hydro electric power for the majority of British Columbia, is “walking the talk” with their newly constructed Horne Payne Building, located in Burnaby, British Columbia. As the producer of clean energy, BC Hydro continues to focus on the environment and sustainability, important values within this Provincial Crown Corporation.

BC Hydro - Horne Payne Building

This 84,000-square-foot building is a combination of both commercial office space and industrial use areas. Designed for long-term efficiency and flexibility, the Horne Payne Building incorporates many green attributes, including the installation of both solar hot water and photovoltaic panels. A vegetative roof was designed to collect rainwater for the building's non-potable water use—a further contribution to water conservation. Every decision was focused on creating an energy efficient, low-maintenance and durable design, resulting in a building that could span over seventy-five years. The building was designed to Post Disaster Standards, ensuring in the event of a major emergency, BC Hydro would be able to reliably and safely continue to provide power to the community.

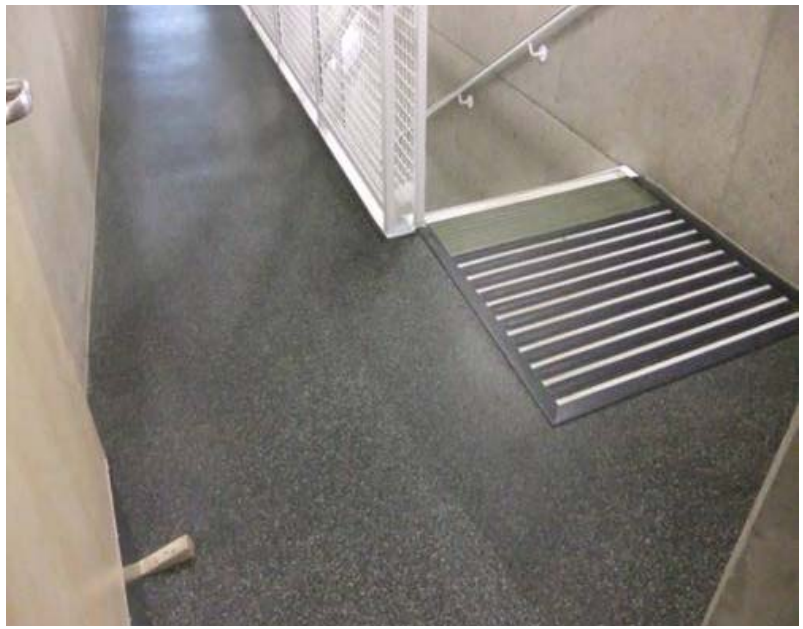
BC Hydro - Horne Payne Building

In the list of sustainable building products found within the Horne Payne Building is recycled rubber tile flooring. In total, approximately 25,000 sq. ft. of the recycled rubber tile was installed in various areas throughout the building. Stephen Chua, Project Manager with BC Hydro, was familiar with recycled rubber flooring, having worked with the product in previous projects. He knew that the durability and ease of maintenance of the product made it perfectly suited to this high-traffic facility. In addition to contributing to the building's LEED qualification, the rubber tile is aesthetically pleasing and sound absorbing, which creates a more comfortable working environment for the 100+ employees at this facility.

BC Hydro - Horne Payne Building

The recycled rubber flooring is slip-resistant, stain-resistant and a low-VOC-emitting product, which means the employees will have a beautiful and safe floor for years to come.

“This building will hopefully have an impact on the whole industry, showing that an industrial building can be comfortable, functional, energy efficient and durable,” says Stephen Chua.



The Centre of Excellence in Sustainable Building Technologies and Renewable Energy Conservation

Building Type: Education

Location: Penticton, BC

Architect: CEI Architecture Planning Interiors

Size: 76,262 Sq. Ft.

Installation Year: 2011

LEED Rating: Minimum LEED Platinum

Recycled rubber flooring can be found in one of Canada's most environmentally responsible and sustainable facilities.[1] This building was designed and built to target the strict guidelines of the Living Building Challenge, and is considered a step up from a LEED Platinum designation.

[1]Source: *SAB Magazine*. October, 2011.

The Centre of Excellence in Sustainable Building Technologies and Renewable Energy Conservation

Under the direction of CEI Architecture, the design team targeted the tough goals of the Living Building Challenge, but not without some difficulties, especially when choosing appropriate flooring. One of the most important goals was to use materials that are deemed “sustainable”: do not contain any ingredients that fall in the “Red List Materials” and are appropriately sourced, as laid out by the Living Building Challenge. The most significant criterion for flooring is that it does not contain PVC.

By using a combination of polished concrete flooring, epoxy and recycled rubber products, this challenge was met head on. Most of the surfacing throughout the building incorporates in-floor radiant heating to maximize heating efficiency. However, the concrete was considered too hard for teachers to stand on all day, and didn’t have the desired acoustic results for the classrooms. Instead, CEI created a custom color rubber mix to be installed in select classrooms and offices, and a thicker tile for use in the Human Kinetics suite.

Please remember the **exam password SURFACING.** You will be required to enter it in order to proceed with the online examination.

The Centre of Excellence in Sustainable Building Technologies and Renewable Energy Conservation

This project is a highlight for the CEI team, as it is to be used as a teaching institute to educate upcoming builders and trades professionals on the most advanced sustainable products and processes available. The installation of the product, the maintenance of the tiles and the tough, durable aspects of the recycled rubber floor make it easy for CEI's project manager, Robert Parlane, to recommend this type of product again.

York Hospital - York, PA

Building Type: Hospital
Location: York, PA
Type of Installation: Playground
Product Used: Playground Tile
Color: Terracotta Red

Anticipating the arrival of spring and the children that would follow, the Engineering Department at York Hospital in Pennsylvania prepared to replace the rotting wood chips in the hospital's playground. Fred Way, Head of Engineering, decided it was a good opportunity to consider alternative surface materials to address the costly annual maintenance, as well as the safety issues they had been experiencing.

Children were eating the wood chips, which evidently are difficult and painful to digest, and the wood chips were pushed around the playground causing low spots, removing the protection in those areas.

York Hospital - York, PA

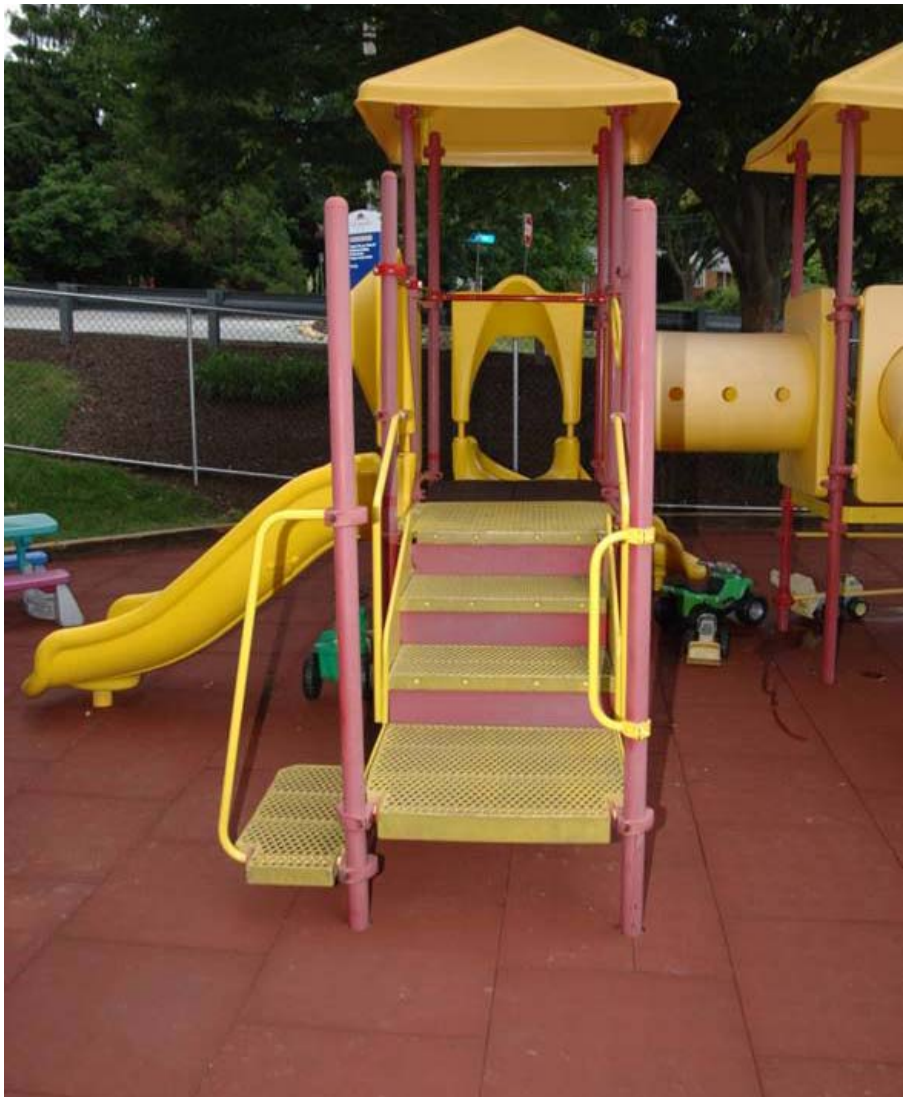
The team evaluated a number of surface options including rubber mulch and various types of outdoor tiles.

The rubber mulch would last longer than the wood, but it was small enough that it could be eaten, and it would still move around, allowing low spots and exposed ground. To reduce the potential for injury and skinned knees, they tested the density and texture of a variety of outdoor tiles for both impact absorption and abrasiveness. At last, the engineering team concluded that recycled rubber playground tiles would be the solution to solve all of their safety and maintenance concerns.

York Hospital - York, PA

Working with playground tiles for the first time, the installation team from Worden and Shewell put tiles in place in only a day and a half. “It was a really nice product to use, and the ease of the installation was key,” stated installer Brian Mummert.

In less than two days, Fred Way was able to re-open the playground that was now safe and more attractive, and would not have to be replaced for many years to come.



Summary and Resources

Summary

By recycling post-consumer tires, manufacturers help: save on crude oil; save valuable landfill space; reduce environmental impact; facilitate waste management; reduce inappropriate disposal; and encourage the development of recycled products.

Tires are recycled primarily using two different processes: ambient, and cryogenic.

Most recycled rubber surfacing designed for indoor applications meets four key principles for sustainable design: they use low-impact materials, are energy efficient, are durable, and can be reused and recycled.

Exterior recycled rubber products are durable, resistant to freeze/thaw cycles, slip-resistant, and shock-absorbing, and help to control the flow of storm water run-off.

When designers and consumers are considering sustainable building materials, recycled rubber products are growing in popularity. As more and more manufacturers find ways to utilize recycled tire rubber for indoor and outdoor surfacing products, the choices available to architects, designers, and building owners are growing.

By utilizing these products, not only can consumers feel good about helping keep tires from landfill sites, they also know that they are purchasing products with extreme durability and greatly extended life expectancy.

Resources: Websites

All sites were accessed on March 2012.

CalRecycle – CA Gov - http://www.calrecycle.ca.gov/Tires/GreenRoads/

Canada Green Building Council - http://www.cagbc.org/

NoToxicBurning.org - http://www.notoxicburning.org/recycling.html

Orange County Water District - http://www.ocwd.com/ca-182.aspx

People for Less Pollution - http://www.lesspollution.org

Rubber Manufacturers Association - www.rma.org/about_rma/rubber_faqs/

The World Green Building Council - http://www.worldgbc.org/site2/index.php?cID=83

U.S. Green Building Council - http://www.usgbc.org/

U.S. Environmental Protection Agency - http://www.epa.gov

Wikipedia – Tire Recycling - http://en.wikipedia.org/wiki/Tire_recycling

Wikipedia – Vulcanization - http://en.wikipedia.org/wiki/Vulcanization

Resources: Books

Alliger, G., and Sjothun, I.J. *Vulcanization of Elastomers.* New York: Reinhold, 1964.

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Resources: Periodicals

Laforest, S., Robitaille, Y., Lesage, D., and Dorval, D. “Surface characteristics, equipment height, and the occurrence and severity of playground injuries.” *Injury Prevention*. 2001.

McMahon, Vikki. “Ideas for a Children’s Outdoor Playground Floor.” May 20, 2011. http://www.ehow.com/info_8456975_ideas-childrens-outdoor-playground-floor.html.

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“Scrap Tires: Basic Information.” *U.S. Environmental Protection Agency*. July 16, 2011.

Skulksi, Jennifer. “A Longitudinal Study of Playground Surfaces to Evaluate Accessibility: Year One Findings.” Executive Summary. May 2011.

“Tire Recycling Industry: A Global View.” *Irevna.* http://www.irevna.com/pdf/Industry%20report.pdf.

“U.S. Environmental Protection Agency: Crumb Rubber Not a Health Risk.” *Scrap Tire News*. March 2012.

Resources for Statistics

Malaysian Rubber Bureau. *Natural Rubber News*. Washington, DC.

Recycling Research Institute. *Scrap Tire News*. Leesburg, VA.

Rubber Manufacturers Association Industry Rubber Report. Washington, DC.

Conclusion

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