FROM YOUR CAR TO YOUR PATIO: USING RECYCLED TIRE PRODUCTS IN BUILDING PROJECTS

Brett Eckstein[1]

INTRODUCTION

Canada has dealt with many of the same challenges managing scrap tires as found in other countries; however, with the world's second largest land mass and one of the lowest population densities, the challenges of recycling tires in Canada can be even more daunting.

Over 350,000 tons of tires are discarded each year in Canada. That is the equivalent of 35 million passenger car tires—or one tire per Canadian—generated as waste annually. Of this total, the province of Manitoba is responsible for generating 1.3 million scrap tires annually, requiring an in-province environmental management solution. Tire Stewardship Manitoba's role is to ensure that every tire from every corner of the province is collected and processed, as well as finding markets for its recycled tire rubber products.

The purpose of this article is to provide the practicing professional some insight into tire recycling in Canada and Tire Stewardship Manitoba's role. It also serves as an introduction to creating more sustainable buildings and landscapes using recycled tire materials and products in new building, road, or landscape projects.

Paving stone made from recycled tire rubber.

KEYWORDS

tire collection, processing, recycling, geo-technical, shred (TDA), fuel (TDF), crumb rubber, manufactured product, safe surfaces, playgrounds, landscape, roofing material, product stewardship, extended producer responsibility (EPR)

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WHY RECYCLE?

It has been 22 years since over 12 million tires in Hagersville, Ontario, caught fire and burned for 17 days, contaminating water wells and forcing 1,700 people to evacuate the toxic fumes. At the time, I was working as a legislative intern at Manitoba's provincial legislature and in the process of writing my Master's thesis on remote sensing and Canadian arctic sovereignty. I took note of the Hagersville tire fire as it was reported in both the press and on television—likely wondering if the smoke plumes could be seen from outer space—and then carried on following more important Canadian political developments of the day such as *The Meech Lake Accord*.

Fortunately, as it so happened, dedicated citizens, politicians, civil servants, and members of the tire industry across the country decided that preventing tire fires and the potential for a similar or even worse disaster in their own communities was well worth the effort and began to act in favour of stronger measures, implementing programs and regulations where needed to better manage scrap tires given the potential costs of not acting.

Fires were not the only concern facing policymakers. Landfills were becoming more difficult to site. The dumping of scrap tires among other wastes took up valuable space and the tire's uniform doughnut shape, inherent buoyancy, and resistance to compression created voids in the compacted material. A tire compressed in a landfill will rebound, and like a sliver under your skin, eventually find its way to the surface, causing damage to the engineered cap. Tires can also store water if left unmanaged and be a prime breeding ground for rodents and other vectors such as the mosquito, which supports the spread of West Nile virus.

What policymakers would ultimately discover years hence from the Hagersville fire was that the threat and potential for a Canada-wide environmental disaster would give rise to one of the top—yet little known—environmental success stories of the past quarter-century.

Tires are designed to be tough, rugged, durable, and as much as possible, indestructible throughout their service life. They must bend and conform, adhere firmly to the road under all-weather conditions yet reduce friction and rolling resistance, as well as hold the proper air inflation to provide stability and safely support the weight of your vehicle on the road. They are designed using many natural and synthetic rubber compounds that contain oil, sulfur, silica, phenolic resin, zinc oxide and titanium dioxide pigments, carbon black, as well as fiber and steel, among other materials. Tire manufacturers recruit and employ some of the top chemistry and engineering professionals and graduates to further refine and perfect the long list of compounds and materials in a tire to continually improve performance and safety capabilities.

It is sad to think that at one time, once a tire had reached the end of its noble service life, all the hard work and effort that these professionals devoted to building it, and the roughly 10 kilograms of our Earth's resources that go into each passenger vehicle tire, went to waste in a landfill site. It made rational sense back then, without the aid of hindsight, for site operators to burn discarded tires in the open or toss them into a landfill with other solid wastes; or in many instances leave unmanaged in stockpiles across the country to grow into the millions of scrap tires, given cheap disposal and no economical use for recycled tire rubber. Fortunately, policymakers began to search for a solution through notions of producer responsibility and stewardship.

Over the past two decades, environmental policymakers in Canada have given rise to both "extended producer responsibility" (EPR) and "product stewardship" programs to manage products at their end-of-life through improved product design and manufacturing.

Academics and government policy analysts generally define these program types as follows: an EPR program places the responsibility for the end-of-life management of designated products on producers, namely brand owners, first importers, or manufacturers; while a product stewardship program places this responsibility on provincial or municipal governments.

Producers provide the funding for EPR programs. The end-of-life management of a product can be internalized into the design and production or it may be passed on to consumers as a fee. Either way, the end-of-life costs of the designated product are identified and the product can be designed to mitigate or lessen these costs. For reasons to be identified shortly, this approach doesn't necessarily apply to all products, specifically tires. Under a product stewardship program, the costs are covered through legislated environmental fees and/or public funds and the producer is free of any direct financial responsibility. In theory, the producer is a spectator, or at best, a passive player in managing its product's end-of-life costs.

Industry, including myself, will dispute the nuances between the two concepts in provinces like Manitoba where there are no tire manufacturers. In this example, the responsible industry stewardship program determines the costs of managing scrap tires and sets the fee, but places the stewardship onus at the point of retail sale by the tire dealer. This creates a level playing field for the seller and consumer and helps avoid the complexities of identifying stewards that may arise through the cross-border distribution of new tires.

In any event, whether tires are managed through a product stewardship or EPR model, tire manufacturers do not consider end-of-life costs in the design of their products. The fact that tires are not "designed for the environment" is one point that needs to be clearly made before we go too far down the policy trail for those who apply theoretical rigor to product stewardship and extended producer responsibility concepts.

Shunning the concept of "design for the environment" as a means to advance a tire's end-of-life management should not be interpreted as a condemnation of the tire industry and their role in EPR. Tire manufacturers work endlessly to improve their tire manufacturing processes to manage costs and address environmental impacts of production. Manufacturers also understand the concept of "zero waste production" and what it can mean to the bottom line. Many manufacturers are looking to replace or lower the amount of refined oil and synthetic rubber used in tires through natural products such as orange oil or organic rubber produced from the Russian dandelion. Some manufacturers have even set a long-term goal to design and produce a completely green tire from "cradle to cradle," but this is decades from becoming reality. Even with the environment as a priority and the growing potential for an ecological breakthrough in tire design, manufacturers do not generally make it their mission to produce tires to satisfy the needs of tire recyclers.

For the time being we are stuck with the status quo, and for good reason. Tires that easily come apart are bad for consumer confidence and would fail to fulfill their *a priori* function of safely moving your vehicle from point A to B through time and space. Therefore, it should come as no surprise that a tire is built to last well beyond the end of its service life. This makes recycling a tire a challenge for each province's recycling program and tire recyclers.

Part of my job is visiting out-of-province tire recyclers that do business with Manitoba recyclers. Recently I toured Liberty Tire Recycling's facility in St. Martin, Minnesota, (formerly Monitor Tire Disposal) that takes a small amount of residual tire material from Manitoba annually for sale to U.S. markets. Liberty's St. Martin plant is capable of reducing large off-the-road (OTR) tires down to virtually wire and fiber-free rubber nuggets used as ballistics

material. The St. Martin plant also produces Tire Derived Fuel (TDF) and tire sidewalls for holding down grain silage tarp covers. In my conversation with Mike Overmann, who manages the plant with years of experience as a tire recycler, one thing was clear: the challenge of managing scrap tires is no different in Minnesota than in Manitoba, and likely anywhere else on the planet. Mike was able to sum up the universal relationship of tire manufacturer to tire recycler in these words, "They [the manufacturers] try to make them [tires] as indestructible as possible. It's our [the recyclers] job to try to destroy them [scrap tires]."

The good news for all of us is that tires, no matter how difficult to take apart, are a resource being recycled into new valued-added products through a partnership of government, industry, consumers, and innovative entrepreneurs creating both environmental and economic benefits. Although we still have some distance to go in Manitoba, some jurisdictions have, from time to time, seen demand for scrap tires as a resource exceeding supply.

TIRE RECYCLING PROGRAMS IN CANADA

Today, all provincial jurisdictions and the Yukon Territory have government-mandated tire recycling programs. All provincial and territorial programs in Canada are affiliated through the Canadian Association of Tire Recycling Agencies (CATRA). CATRA acts as a reference authority for scrap tire management in Canada. The Association's mission is to "enhance the effectiveness of scrap tire diversion and recycling across Canada through sharing of information, expertise, and resources."

CATRA is a voluntary non-accredited body. In some ways its legal standing is similar to your list of regular dinner guests or a neighbourhood book club, but with a practical mission to enhance and promote tire recycling throughout Canada. The association does not generate revenue or disburse any funding. The association is managed by all programs on a rotating chair basis and costs of communications, hosting annual meetings, and conducting research are generally shared by all provincial programs. CATRA activities include the exchange of information among members, research regarding markets, industry issues and trends, and managing the CATRA website (www.catraonline.ca). CATRA brings together all provincial jurisdictions for the common purpose of enhancing tire recycling, whether they are managed through government, industry, or multi-stakeholder boards. In view of this, CATRA's most significant accomplishment to date is its longevity as a voluntary organization recognized as the authoritative network for tire recycling programs in Canada.

Manitoba's program, once government-run, is now operated by Tire Stewardship Manitoba (TSM), a not-for-profit industry association formed to manage the program on behalf of tire retailers. The regulatory basis of the provincially mandated program in Manitoba is simple: it is unlawful to supply a tire unless the product steward (seller or importer) has, or belongs to, an approved tire stewardship program. Most stewardship programs in Canada follow this basic premise. The revenue to collect and recycle scrap tires is generated through either a government levy or an industry fee associated with the sale of each tire. In Manitoba, tire retailers, as well as motor and equipment dealers, remit an industry eco-fee to TSM that varies by tire type. It is applied on the sale of all new tires in the province and generates sufficient revenue to operate an effective, efficient, and sustainable program. Although retailers in Manitoba are free to decide whether to show the fee apart from, or included in, the sale price of the tire, most consumers will see the eco-fee applied separately to their bill of sale.

It was no small feat that industry took responsibility for the program in Manitoba. The move to industry-led tire recycling programs in Canada hasn't been a particularly easy road. As Glenn Maidment, President of the Rubber Association of Canada, and not by coincidence, the Chair of TSM, has suggested in the *Autosphere: Automotive Environmental Annual, 2012 Edition*, "*the real story* [behind the headlines for developing industry recycling programs in Canada] *is often never spoken because there is often great pain and consternation."* Despite both the reluctance and the impulse to act working simultaneously, change does occur and the move to an industry-operated program in Manitoba has been beneficial to industry, consumers, government, and ultimately the economy and environment.

TIRE RECYCLING IN MANITOBA

TSM is responsible for the management of all tires and tubes sold in Manitoba, in accordance with the government's *Tire Stewardship Regulation 2006*. TSM's responsibilities for managing scrap tires vary from the smallest riding lawn mower to the largest mining equipment tire. In between, some 1 million passenger and light truck tires are sold annually in the province. Ultimately, TSM is responsible for all of them, whether they are found at the local auto repair shop in Winnipeg Beach or the Vale mine in Thompson.

Through a network of tire, motor and equipment dealers, landfill operators, and other generators, the equivalent weight of 1.3 million passenger tires (13,000 tons) is collected and diverted from landfills, an amount equivalent to one passenger tire for every Manitoban. Just as important as the environmental considerations of this achievement is the adherence to the province's sustainable development principles that equally promotes economic development through tire recycling and the growth of an industry that has created over 50 permanent full-time jobs in the province.

These tires are recycled or repurposed into tire derived aggregate (TDA) and fuel (TDF), crumb rubber, blasting mats, and both fabricated and molded or manufactured products. Recycled rubber products and material find their way into geo-technical projects such as TDA

Tire shredding equipment and shred pile, with whole tires in foreground awaiting their fate.

for road construction and even landfills, but this time as part of leachate collection and daily cover and capping systems; crumb rubber for sports fields and playgrounds; landscape mulch for residential and commercial properties; rubber asphalt, resin mix or molded products for municipal sidewalks, road and pathway surfaces, and yes even your backyard patio!

BEFORE YOU RECYCLE, REDUCE!

Before tires are recycled, stewardship programs promote reducing the amount of tires that become available for recycling. This is done in a number of ways, but the easiest way to reduce waste is to *Be Tire Smart*. The Rubber Association of Canada (RAC) which represents the world's major tire and rubber manufacturers in Canada has a program—*Be Tire Smart*—dedicated to ensuring that those who own or drive a vehicle can safely maximize their tires' service life by following the four basic rules of proper air pressure, wheel alignment, rotation frequency and tread depth.

TSM promotes *Be Tire Smart* as part of its waste reduction efforts through an educational display hosted at a number of community events throughout the province. For further information on how you can reduce the amount of scrap tires generated and safely maximize tire life, visit the RAC's *Be Tire Smart* website at www.betiresmart.ca.

"Phillip-the-Tire" greets visitors to TSM's *Be Tire Smart* educational display booth.

WHERE DO THE TIRES GO?

Once a tire is considered unsuitable to continue serving its intended purpose, it can be repurposed. Many of us have enjoyed the back yard tire swing as kids. As adults we've likely tied a few tires onto our boat dock at the cottage. You may have even negotiated a grid of tires laid out like stepping stones in a high school football practice drill. Most tires, however, are not suitable or required for re-use and get dropped off and collected at no charge from the tire retailer or municipal storage yard (landfill/waste transfer station) for recycling. In Manitoba, landfills are provided an incentive payment of 50-cents per tire to accept and appropriately store each tire before it is collected.

Tires are generally sorted according to their potential for recycling into specific products. The main tire recycler in Manitoba, Reliable Tire Recycling (RTR), will process 100,000 tires monthly through its Winnipeg plant that are collected from every corner of the province, although in Manitoba half of the province's tires are situated in Winnipeg. RTR collects and processes all passenger/light truck (PLT) tires, medium or commercial truck (MT) tires, and some off-the-road tires (OTR), while most of the Large OTR tires are managed by another processor, OTR Recycling of Ashern, located in Manitoba's Interlake region and two hours closer to the mines of northern Manitoba that generate the largest and heaviest tires.

About 30% of tires in Canada are destined for geotechnical projects or used as fuel, but most PLT and MT tires will go through the first level of recycling which requires separating

the sidewall from the tread, although many PLT tires may skip this stage and go directly for primary shredding. RTR is one of the few recyclers in Canada that make blasting mats. This involves punching holes and stringing MT tire treads together with steel cable to form a heavy rugged mat for use in the mining and road construction industries to control rock blast spray and debris. Sidewalls can then be shredded or used in agricultural applications such as silage tarp cover weights or road barrel bases. Larger OTR tires are used as water troughs for livestock.

Road barrel base mats made by RTR are shown here. Tire sidewalls can also be used for this purpose.

Tire Shred

Shredding tires is generally seen as the primary product for most recyclers. Before any further refinement of a tire into a product is undertaken, tires are shredded into manageable sized pieces. The tire bead wire is either left in place or removed prior to shredding depending on the requirements of the material to be used as feedstock (usually 1" to 3") for further refining through grinders for making crumb rubber. Metal and fiber can be removed through grinding and milling and processed further through the use of magnets and dust collection units if a fiber and wire-free product is required.

Depending on the application, a 2", 4", or larger-sized shred is usually processed as TDA used in geo-technical applications or road-bed construction. TDA applications are becoming more prevalent in Manitoba and throughout Canada. Design or construction guidelines and an ASTM standard for TDA applications are available in many jurisdictions throughout North America. In Manitoba, TDA is used most often in road construction as lightweight fill to add stability and insulation to limit frost penetration. The material is used in the base of leachate collection systems, generally displacing granite. Although the push to producing higher-value-added products and fuel will ultimately reduce the availability of shred for geo-technical use,

4" plus TDA used as a lightweight fill in road base, R.M. of Siglunes, Manitoba, Canada.

much of the 2" plus material is currently used in Manitoba for landfill applications, primarily as daily cover in place of straw or clay. Given the harsh winter months in Manitoba, TDA is easier to spread at –40° C than using frozen clay as cover material and is also used in landfill capping or leachate collection systems.

Tires as Fuel

Although not a common use in Manitoba, whole tires or shredded tires may be used as a fuel supplement (TDF) at large industrial operations such as power-generation, cement kilns, industrial boilers, and pulp and paper mills. Shredded TDF is generally chipped into one to two inches in size and is classified into several grades. As tires contain about 30% metal and fabric, a wire-free TDF is a considerably higher grade material. The value of TDF is its ability to be blended with other material or displace it entirely. In Manitoba, TDF would displace coal or be used with hog fuel, displacing oil. To avoid the pitfalls of market fluctuation for recycled tire products, Manitoba processors are looking to diversify their approach to tire recycling through the balanced use of TDA, TDF, crumb rubber, and manufactured products.

Beyond energy recovery through TDF, resource commodities such as oil, carbon black, syngas, and steel can be extracted and recovered from scrap tires by way of a process called *pyrolysis* to be sold on the open market. The carbon black produced from pyrolysis can be re-introduced into the manufacture of new tires where it meets the manufacturer's specifications. As an emerging technology, the commercial viability of pyrolysis may not be suited to every provincial market just yet, but it is gaining traction in some North American, Asian, and European settings.

Fabricated Products

Recycling tires can also take the form of less-sophisticated methods by repurposing the rubber into cut or punched products from sidewalls, tread, or casings. About 10% of tire material in Canada is repurposed this way. Fabricated products generally do not garner high praise in the tire recycling business as they are formed through rudimentary processing and considered lower-value goods.

OTR Recycling of Ashern, who broke into the recycling business fabricating cattle feeders and water troughs from industrial and mining tires, is changing this perception. They have,

Rubber edge fabricated from mining tires installed on metal snow plow blade.

Rubber sheets for snow plow blades cut by OTR Recycling, Ashern, Manitoba, Canada.

with the support of TSM, recently expanded their operation to include the production of commercial snow plow cutting edge blades made from repurposed mining tire rubber that are longer lasting and reduce damage to infrastructure.

The rubber sheets cut by OTR Recycling from mining tires through an innovative process exceed industry standards for tear strength, elongation, and hardness. You can find these high quality plow blade cutting edges at www.resoluterubber.com.

Crumb Rubber for Feedstock or End Use

RTR is the sole producer of crumb rubber products in Manitoba. You can find crumb and other products RTR manufactures at www.reliabletirerecycling.ca. Manitoba crumb is made through ambient grinding using a series of granulators and cracker mills. The ambient process is conducted at room temperature using granulators with both stationary and fly knives rotating at speeds up to 200 RPM. The size of the product depends on the size of screens used within the machine, which are changed to meet the required product specifications. A cracker mill operates at lower speeds using two large serrated rollers that grind or "crack" the product down to size depending on the separation between rollers. Various sized mills will reduce the rubber and remove fiber and steel, at which point magnets and dust/fiber control equipment are introduced to remove these materials.

Once a tire has been reduced to crumb with the steel and fiber removed, the markets and uses for the material begin to multiply. Crumb ¼" in size is used in safe playground surfaces, pathways, horse arenas, or landscape mulch, while fine powder is mostly used for manufacturing molded products. Many recyclers or paving companies are using binding agents or resins to mix or "pour-in-place" rubber products such as walkways, playgrounds, and athletic tracks. Roadways use a mix of paving-grade asphalt and crumb rubber, subject to a formula that accounts for time and temperature. This changes the properties of the mix to produce less cracking, longer wear, and reduced road noise. Asphalt rubber is used extensively in the United States in places such as Arizona and California. In Canada, Saskatchewan has found success using hot mix asphalt rubber in roads that can withstand the temperature variation between summer and winter. Other provinces have attempted to use the material and have found mixed results through the trial-and-error required for new product testing. In Manitoba, the City of Winnipeg has completed two pilot projects on a roadway and bicycle path. TSM has funded the use of asphalt rubber to construct two high school athletic tracks and is pursuing the further use of the material in larger provincial infrastructure projects.

Processing of recycled tire crumb rubber by RTR, Winnipeg, Manitoba, Canada.

More than half of all recycled tires in Canada are turned into processed crumb that is used as an end product or feedstock for manufactured products. The vast majority of this material is produced in larger provinces with greater volumes of material that provide sufficient economies of scale and access to markets. Here on the prairies and in Atlantic Canada, smaller tire recycling operations (with one or two exceptions) tend to produce more aggregate than higher-value added products, although all programs from New Brunswick west tend to have more diversified processing capacity and are able to produce a wide range of products.

Manufacturing Higher-Value Products

The most commonly known use for recycled tire rubber is the manufacture of mats and paving stones. With heat and pressure, RTR uses a mix of crumb rubber and binder resin that is molded into a variety of shapes to make flooring and landscape products. RTR is also able to customize products to meet customer specifications. Patio blocks and pavers in a variety of colours are the most common items produced. Rubber mats molded through the same process provide a comfortable slip resistant surface (to which you can add colour) in residential and commercial applications. These mats are commonly used in gyms for flooring or placing equipment on and ice rinks for protecting dressing room floors and walkways. I have found them to work wonderfully over the concrete floor in my mud/laundry room at my home in Gimli, Manitoba.

Molding rubber allows for many innovative products to come to market. Clearline Technologies, a Winnipeg-based company, is an industrial leader in innovation for commercial rooftop equipment support applications. Clearline holds the patent on a rooftop support system manufactured from recycled tire rubber for HVAC units, cable trays, walkways, and solar panel mounts.

A number of other products or their variants are available from other recyclers across Canada. These can range from rubber roofing

Assorted recycled rubber landscape products made by Reliable Tire Recycling, Winnipeg, Manitoba, Canada.

tiles, shingles, or spray-on coatings and liners, to many automotive products such as truck bed liners, weather-stripping and gaskets, rubber hoses, lawnmower wheels, speed bumps and curbs, retail/commercial space flooring, carpet/wood floor underlay, basement subfloors, and dairy cow mats.

Ontario, which generates over 12 million scrap tires annually, was the last province in Canada to have a tire-recycling program. Given its size, Canada's largest province has developed an abundant crumb and product manufacturing capacity. In support of this industry, Ontario Tire Stewardship (OTS) has developed a very helpful resource for consumers and green builders to learn more about products available for the home and commercial buildings or infrastructure. You can visit the *Interactive Home and City Builder* on their website at www.ontariots.ca.

BACK TO THE FUTURE?

Related to the manufacturing of tire-derived products is a process called *de-vulcanization*. When un-vulcanized, the rubber from a tire—whether natural or synthetic—is a sticky material that easily loses its shape when warm and is easily broken when cold, due to its chemical structure. To a chemist, the *vulcanization* of rubber is considered irreversible. It is a process that cures the rubber and allows a tire to revert to its original shape when compressed. This makes vulcanized rubber ideal for producing tires but difficult—considered impossible by some—to revert back into the pliable *un-vulcanized* pre-tire state.

The market demand for new raw (natural or synthetic) rubber is growing primarily through the demands of the global automotive industry, but very little recycled rubber is used to make new tires due to the technical challenges of "un-baking the cake" that vulcanized rubber presents.

De-vulcanization, or the attempt to de-vulcanize, is a process that claims to delink sulfur molecules from the rubber molecules. Reclaiming rubber from tires in this form has yet to be proven entirely suitable for re-introducing into new tires. Nevertheless, attempts to do so continue to emerge as technologies and processes develop. Although not specifically suited to tire production as of yet, the attempts to de-vulcanize rubber for use in producing new products is growing and may prove to be a viable option for some manufacturers. Given oil pricing, green builders can look to a future where building and landscape material made from this type of reclaimed rubber is commonplace.

GREEN PRODUCTS MAKE BUILDINGS GREENER

When considering landscape, flooring, and other building materials, the benefits of recycled tire rubber products are many. Most apparent are improved accessibility and safety, lower maintenance, and environmental costs. The other benefit of rubber tire products is that most can be sourced through a recycler or manufacturer in most provinces. My colleagues at Tire Stewardship B.C. (TSBC), the industry program in British Columbia, have produced a list of reasons for sourcing tire-derived products locally.

These are:

- Reduces the carbon footprint by avoiding GHG emissions in transportation and new production
- Supports local recycling

- Creates jobs locally
- Aligns with government's green procurement policy
- May qualify for LEED® credits
- May qualify for a Community Grant from your provincial tire recycling program, or other government or industry funding.

There are many uses for recycled tire products in green building design and construction that can be found locally in Manitoba and across Canada. Here are the main uses and a few examples:

Infill for Synthetic Grass Sports Fields

Converting sports fields to synthetic turf provides an all-weather surface that can increase the use of the field and make the addition of lighting for night use more economical, as the surface does not require rest periods to lessen wear and regenerate growth. Using the recycled tire rubber in this manner can also lower maintenance costs and environmental impacts. Synthetic turf does not require watering, seeding, or fertilizing, and pesticide use is reduced.

Many communities across the country are switching from natural grass to synthetic turf. Synthetic turf surfaces use crumb rubber as infill to replace the traditional sand and grass turf. Recently TSM awarded a $5,000 matching Community Demonstration Grant to the Skylight Complex in East St. Paul, Manitoba, to use crumb rubber infill for an indoor synthetic turf field to benefit area youth and sports teams. More projects of its kind are on the way as many outdoor fields begin the conversion from natural to synthetic surfaces.

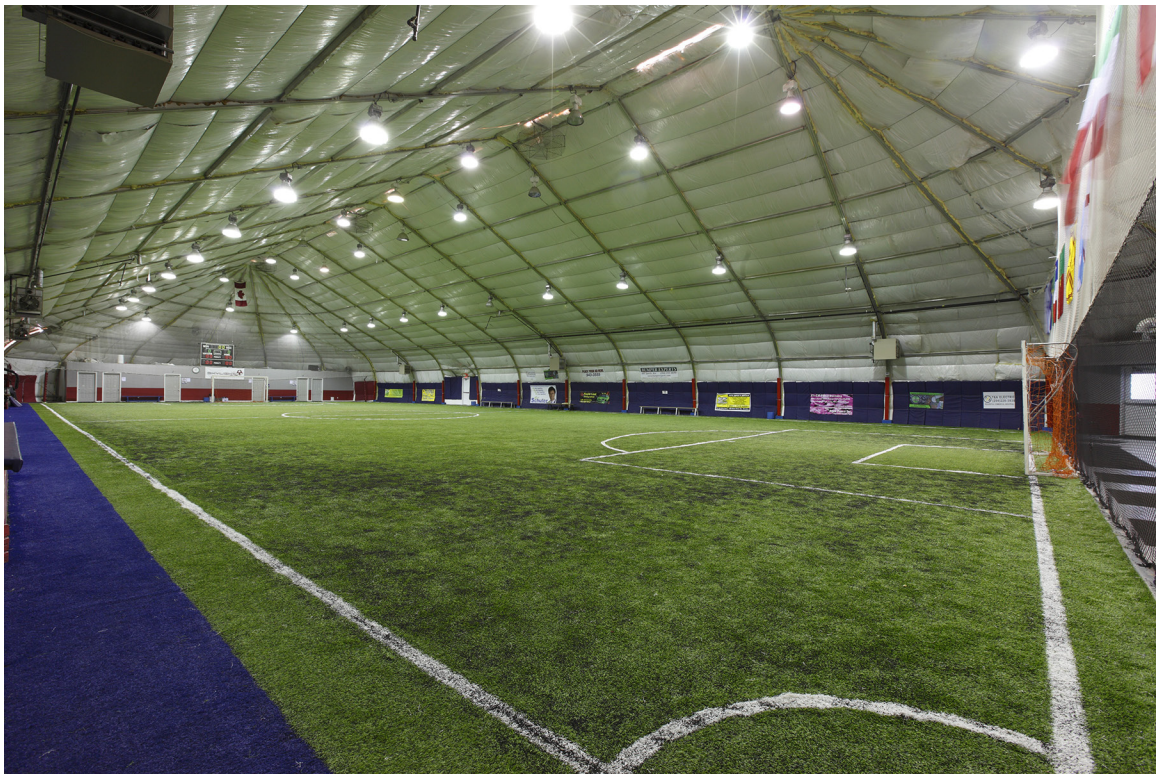
Safe Surfaces for Playgrounds

Improving accessibility and safety for playgrounds is the main feature of tire-derived surfacing products. Traditional surfacing such as wood chips or pea gravel can limit access for those with physical disabilities. By using recycled rubber pour-in-place or tiled surfaces, playgrounds can now be fully accessible for people of all ages and abilities. The fall-height standards for playground surfaces are set by CSA to reduce the risk of personal injury. Fall heights are measured from the highest point of the playground structure. Pour-in-place and tile surfaces that are made from recycled tire rubber are typically designed to meet or exceed CSA standards.

The move from the traditional pea gravel and wood chips to recycled rubber surfaces—either pour-in-place or tile applications—is accelerating across the country. Many schools,

Synthetic sports field using crumb rubber infill made from recycled tires, Central Park, Winnipeg, Manitoba, Canada.

Skylight Complex Indoor Synthetic Turf Field, East St. Paul, Manitoba, Canada.



community centres, and daycares across Manitoba are taking advantage of TSM's Community Demonstration Grant Program to fund pour-in-place rubber safety surfaces to ensure safer playgrounds for children under their care. The Campus Daycare at the University of Manitoba is a recent beneficiary of TSM's community grant program that supported the construction of a pour-in-place surface for their playground. Requests for funding community playground projects continue to grow. TSM's board of directors has recently centupled its community grant program budget and raised the matching fund limit to keep pace with demand to provide safer surfaces for our children.

Pour-in-place playground surface using tire rubber and polyurethane base with EPDM rubber wear layer.

What Makes Pour-in-Place So Appealing to Canada's Green Builders?

The Pour-in-Place surface is porous and typically used outdoors. Installations in Canada generally consist of two-layers that are poured and troweled on site and can be made in any design, configuration, and dimension. The cushioned base layer uses recycled tire rubber and a polyurethane binder while the top, or wear, layer of EPDM (Ethylene Propylene Diane Monomer) rubber, uses an aromatic binder that can be coloured to meet customer requirements. The thickness of the surface can vary from one to six inches. There are a number of standard colours and colour combinations available that include custom designs such as logos, shapes, or games. For playgrounds, the installed surface will conform to CSA requirements for critical fall heights and come with a product warranty. The recommended base of the surface is concrete, asphalt, or crushed stone. Typically the surface can be eligible for LEED® credits and federal, provincial, or tire recycling program grants.

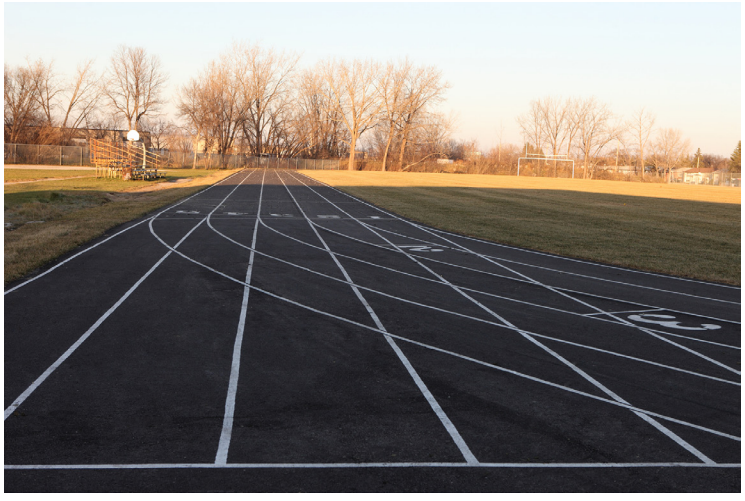
Recreational Flooring, Sidewalk, and Other Surfaces

The use of recycled tire rubber mat flooring can be found in ice skating arenas, fitness rooms, and high traffic areas in many facilities throughout Canada. Thicker and higher density mats, tiles, pads, or pour-in-place surfaces are also being installed to provide local residents safe durable walkways year-round.

One of the greatest advantages of recycled-rubber surfacing on sidewalks is that the product is permeable, allowing water to pass through and downward into the soil so trees may root properly. This is not the case with concrete slabs, which cause tree roots to seek moisture nearer the surface causing heaving and cracking sidewalks that become dangerous to the pedestrian. You may find many rubber sidewalks near schools or senior complexes for this very reason.

The Village of Dunnottar, Manitoba, replaced crumbling and broken concrete sidewalks with rubber panels because the concrete pads could not withstand the weight of septic trucks where they access holding tanks on a weekly basis. The rubber sidewalk panels provide an easy installation, repositioning, and maintenance alternative for the community located on the west shore of Lake Winnipeg.

Asphalt rubber has been used on two athletic sports tracks by Winnipeg High Schools. Elmwood High was the first to use the material some 30 years after the extension of the adja-



Asphalt rubber athletic track, Elmwood High School, Winnipeg, Manitoba, Canada.

cent street left the school's former track unusable and in disrepair. A new 5-lane 400-metre asphalt rubber-mix track was installed with the support of the TSM community grant program. Over one thousand Manitoba tires were recycled to produce the 7.28 tons of crumb rubber used in the track to offer a safe, accessible and durable surface for the school's track and field program and the community.

Landscape Materials

Coloured mulch for landscaping is being made by RTR in Manitoba and in many other provinces by their local recyclers. The material is becoming popular throughout the country as a replacement for wood mulch and chips. The product is currently featured on the grounds of the Manitoba Legislative Building

The benefit of rubber tire mulch for landscaping is that it reduces costs. Coloured rubber mulch—unlike wood chips—will not fade, decay, or blow away. Water consumption and pesticide use are also reduced.

Coloured splash pads for downspouts are also produced by RTR at just the right weight for easy lifting and are UV ray resistant, replacing the heavy and difficult to handle concrete slabs or similar products made from lightweight plastics that tend not to stay in place.

Coloured rubber mulch ground cover.

Rubber landscape mulch at Manitoba's Legislative Building.

Roadways

The tires on your car may also find their way underneath the roadway you drive on. One million tires were used in St. Stephen, New Brunswick, by the provincial highways department as a lightweight fill (TDA) material because the normal heavier aggregate sunk and was washed away in the low area. At the RAC's biennial 2008 Rubber Symposium, held in Vancouver, New Brunswick Department of Transportation (NBDOT) staff provided details of incorporating TDA into the reconstruction of a highway embankment producing an overall geotechnical, economic, and environmental benefit. TDA has a much lower unit weight than conventional earth fills and provides an economical solution to reducing the load of an embankment constructed over soft foundation soils. In order to keep to the original design dimensions of the embankment, the TDA lightweight fill was placed in layers about 3 metres thick. At first NBDOT staff had considered replacing the soft soil with granular fill, stone columns, or geofoam, but because the long embankment section—about the size of a Canadian football field—had failed during construction, TDA became the material of choice. According to NBDOT staff, the local availability of TDA, ease of handling and transport, and material performance compared to the next feasible option, resulted in a savings to the Department of about 30%.

Asphalt rubber bicycle path, Winnipeg, Manitoba, Canada.

Paving roads with a rubber asphalt mix also has sustainability advantages. Saskatchewan has undertaken paving approximately 500 kilometers of roadways with asphalt rubber in the province since 2005, using 550,000 scrap tires. Without the institutional resistance found in some other provincial jurisdictions, Saskatchewan set forth to openly test the product in the most conspicuous manner. Sections of the Trans-Canada Highway at the Alberta-Saskatchewan border and the road linking Regina and Saskatoon, both major roadways, have received asphalt rubber paving. The asphalt rubber paving process used in Saskatchewan requires blending crumb rubber produced from recycled scrap tires into liquid asphalt cement. This process produces an extremely resilient and high performance modified binder that is used to pave roadways. Industry experts see this hot mix asphalt, produced with Asphalt Rubber binder, creating a more durable, longer lasting, quieter, and safer roadway than roads paved with conventional asphalt. To date, test results on Saskatchewan roads using asphalt rubber have not shown this statement to be incorrect.

CONCLUSION

With one scrap tire per person generated as waste annually, Canada needed an all-encompassing environmental management solution that fit its vast geography and widely dispersed population. This was achieved through the development of provincial product stewardship programs tailored to the needs of each jurisdiction. In Manitoba, virtually every tire that comes available for recycling is recycled. Finding markets for the materials produced remains the biggest challenge.

In closing, if you are already planning to use, or are just beginning to think about using recycled tire material in a building, landscape, or infrastructure project, but you need to know more about a specific product and availability in your area, or have ideas and questions about using material in other applications, then your provincial tire recycling program is the best place to start. These CATRA member organizations can provide you with local recyclers, suppliers, and installers, or if none are available in your area they can put you in contact with other provinces' tire recycling programs that likely can provide insights into products or the applications you are considering.