Renewable Infrastructure Solutions, LLC

Creating a Circular Economy

For all your Renewable Infrastructure System needs

Presentation Flow

- RIS, what we started/why
- Theory and science behind using waste as an aggregate
- What is GreenDeck? Basics
- Development of Closed Loop Concept
- Mackinac Island Case Study
- How GreenDeck is a superior environmental choice

RIS Vision

It is with the ideals born of integrity, courage and respect that we embrace our responsibility to our communities and our planet to innovate solutions that not only solve our great infrastructure challenges with superior performing products but create real and sustainable markets for the recycled waste from the communities in which they are generated.

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Glass Recycling

- Glass bottles and jars are 100% recyclable and can be recycled endlessly without any loss in purity or quality.
- Recycled glass is substituted for up to 95% of raw materials.
- Over 1 Ton of natural resources are saved when substituted with 1 Ton of glass

Glass Recycling

- An estimated 80% of all glass containers recovered are used in the manufacture of new glass containers. Source, Strategic Materials, Inc.
- Other markets: Fiber Glass, Sand Blast Materials, Aggregate
- Require sorting by color and type
- Require additional processing such as extra cleaning and melting

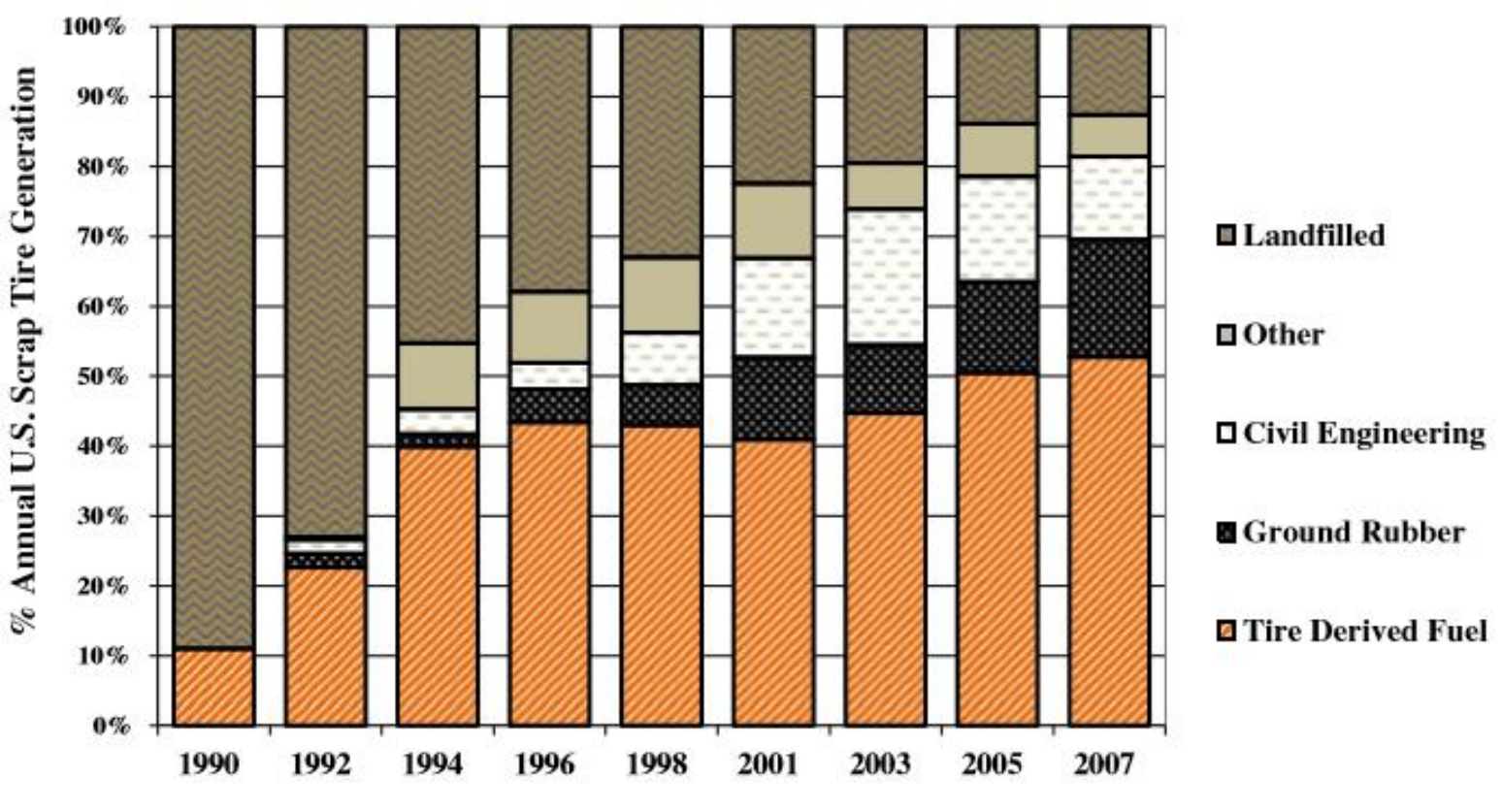
Economies of Recycling Glass

- Most brokers will pay only for clear or brown glass at an Avg Price of $20 ton or $.01 a lb.
- Cost to process glass is approx. $70 a ton or about $.04 a lb.
- Cost of glass as an aggregate is approx. $140/ton or $.07/lb.
- Shipping makes the commodity expensive.
- Shipping FTL (40klbs) is $80/ton or $.04/lb, doubles for LTL.
- Best to process and utilize the aggregate in the same area.

Crumb Rubber Recycling

	2013
Totals	**Tons**
Landfill Usage	3,085
TDF	107,904
Total	110,989
Reuse/Retread	15,541
Out of State	47,606
Total	63,147
Septic	13
Sidewall Rings	3,639
Other	117,971
Total	121,623

Crumb Rubber Recycling



RMA Scrap Tire Market Reports 1999-2007

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Crumb Rubber Recycling

Of the 130 million scrap tires used as fuel per/yr:

- Cement industry - 41%
- Pulp and paper mills - 20%
- Electric utilities - 18%
- Industrial/institutional boilers - 13%
- Dedicated tire-to-energy facilities - 8%

United States totals per year

Energy vs Material Recovery

Table 3 LCIA results for the baseline scenario of EOL treatment of 1 mt of mixed US scrap tires

		Attributional approach						Consequential approach	
		Short term			Long term			Short term	Long term
Impact category	Characterization factor	MR	ER	Delta	MR	ER	Delta	Shift to MR	Shift to MR
Global warming	kg CO_2 eq	−1,487	−501	−985	−1,480	−503	−978	−999	−1,004
Energy use	GJ	−56.6	−34.2	−22.5	−58.8	−35.5	−23.3	−22.3	−23.5
Iron ore	kg iron ore	−178	−143	−35.2	−178	−143	−35.2	−35.2	−35.2
Acidification	H^+ moles eq	−825	−277	−548	−822	−267	−555	−557	−568
Eutrophication	kg N eq	−0.20	−0.067	−0.13	−0.20	−0.056	−0.14	−0.14	−0.14
Smog	kg NO_x eq	−6.39	−1.52	−4.87	−6.4	−1.28	−5.11	−5.07	−5.22
Respiratory effects	kg PM_0 eq	−1.71	−1.04	−0.68	−1.7	−1.02	−0.67	−0.67	−0.71

Article in The International Journal of Life Cycle Assessment ·March 2012

Glass as Construction Aggregate

- No need to sort by type or color
- No melting required for reuse, reduces energy output
- Can be utilized from single stream collection
- Potential to utilize mobile processing for generation and storage within a community

Rubber as Construction Aggregate

- No need to apply heat, reducing issues with use of rubber in heated applications such as Asphalt.
- Provides added flexibility and bonding when blended with binder systems.
- Reduces weight

GREENDECK®

For all your Renewable Infrastructure System needs

Concrete and Asphalt–

Potholes, Spalling, Cracks







*For all your **Renewable Infrastructure System** needs*

Our Solution

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Applications









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Closed Loop Product Life Cycle

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Case Study – Mackinac Island

Glass Recycling on the Island

- 88,000 lbs of glass recycled sold and shipped to brokers
- Approx 18,000 lbs landfilled
- Has to be separated for brokers
- Shipping makes a net cost to the island to recycle the glass
- Looking to create processing on the Island to manage waste glass

Case Study – Mackinac Island

Logistics challenges for traditional repair options

- Cost to get construction materials to island is expensive
- Timing due to weather constraints around tourist season limited
- General aggregates for drainage and other construction very expensive

Case Study – Mackinac Island

Proving out of GreenDeck Solution

- Projects successful to test utilizing GreenDeck concrete repair product for unique infrastructure needs.
- Will work with RIS to process and blend with rubber to create specialized aggregate.
- Can utilize in GreenDeck for concrete repair as well as a general aggregate for fill and drainage.

Applications on Island

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GreenDeck Mixing Process

Step 1: Blend Epoxy

Step 2: Mix in Agg

Step 3: Screed onto surface or fill holes/cracks

Step 4: Cover with Agg

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GreenDeck – Environmental Solution

- Improved use for both scrap tires and mixed glass that typical traditional markets
- Close to carbon neutral in mfg process and installation
- No VOC's in application of GreenDeck
- Up to 70% recycled content per batch

How Much Waste is Diverted ?

Overlay: 80 sq/ft = 40lbs recycled aggregate

Mortar Repair: 1 c/ft = 80lbs recycled aggregate

- Example – avg pothole @ 2ft x 2ft x 6 in deep requires approx. 2 c/ft of GreenDeck repair product.

For every average pothole we divert 160lbs of waste!

Waste Diverted on the Island?

Mission Point Circle Drive – 4000 lbs waste

Market Street Project– approx. 32,000 lbs waste

- about 1/3 of the islands annual glass waste

Summary

- As shown in the studies and data cited the use of the waste products, poly crumb rubber and crushed mixed glass as aggregates in a concrete/asphalt repair product provides a viable end use market that can divert significant waste from landfills. It also provides a more effective solution than current end uses for rubber and glass.
- In addition GreenDeck is not only a green solution for a wide variety of infrastructure repair needs, it is a superior quality offering to many current products on the market.

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