Tire-Derived Product Applications in Building & Construction

Disclaimer: CalRecycle and its contractors make no warranty, expressed or implied, and assume no liability for the information contained in this presentation. Any mention of individual businesses, commercial products or processes shall not be construed as an endorsement of such products or processes.
Learning Objectives

1) The Beneficial Attributes of Recycled Tire Rubber
2) TDP Competitive Advantages and Customer Value
3) The Range of Tire-Derived Products (TDPs)
4) How TDPs Support Sustainability Goals and Certifications
5) Resources to Evaluate and Source TDPs
• Recycled Tire Rubber Beneficial Attributes
  • Competitive Advantages / Customer Value
  • Growing Range of TDPs
  • Support Sustainability Goals
  • Information Resources
ASTM D5603 & D5644
Recycled Tire Rubber Feedstock Standards

Ground Rubber
$\frac{1}{4}" - \frac{3}{4}"

Crumb Rubber
4 – 200+ Mesh

Buffings
Recycled Rubber Beneficial Attributes

**Inherent Material Attributes**
- High Surface Friction
- Softness
- Acoustic Insulation
- Temperature Insulation
- Range of Shapes
- High Contraction/Expansion
- Water Impermeability
- High Density
- Low UV Degradation Rate

**Manufacturing Flexibility**
- Diverse Feedstock Sizes & Shapes
- Use as Product Base or Filler
- Compound with Polymers
- Simple, Inexpensive Binders
- Diverse Production Processes
  - Compression or Extrusion Molding
  - Immersions
  - Assemble-in-Place
- Customized, Flexible Results
  - Design to Unique Project Dimensions
  - Permeable or Impermeable
  - Hard or Soft
Recycled Tire Rubber Beneficial Attributes

Competitive Advantages / Customer Value

Growing Range of TDPs

Support Sustainability Goals

Design Exercise

Information Resources
Recycled Rubber Beneficial Attributes
Enhance Product Performance

Tire Rubber Attributes
- High Surface Friction
- Material Softness
- Contraction/Expansion
- Low UV Degradation Rate
- Flexible Shape, Size and Manufacturing Processes

Performance Enhancements
- Slip Resistant
- Fall Height Safety
- Freeze/Thaw Resistance
- Extended Life Time
- Permeability
Recycled Rubber Beneficial Attributes
Enhance Product Performance

Tire Rubber Attributes
- Elongation
- Impermeability
- Temperature Insulation
- Material Softness
- Heat Resistance

Performance Enhancements
- Building Envelope
- Waterproofing
- Energy Performance
- Sound Dampening
- Occupant Safety

Buildings
Recycled Rubber Beneficial Attributes
Enhance Product Performance

**Tire Rubber Attributes**
- High Surface Friction
- Material Softness
- Low UV Degradation Rate
- Flexible Shape, Size and Manufacturing Processes

**Performance Enhancements**
- Slip Resistant
- Fall Height Safety
- Extended Life Time
- Rainwater Management

Playgrounds
## Recycled Tire Rubber Versus Some Competing Materials

<table>
<thead>
<tr>
<th>Tire Rubber</th>
<th>Concrete</th>
<th>Asphalt</th>
<th>DG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td>Heavy</td>
<td>Heavy</td>
<td>Heavy</td>
</tr>
<tr>
<td>Crack Resistant</td>
<td>Cracks</td>
<td>Low Cost</td>
<td>Erodes</td>
</tr>
<tr>
<td>Flexible</td>
<td>Corrodes</td>
<td>Installation</td>
<td>Mud/Moss</td>
</tr>
<tr>
<td>Permeable</td>
<td>Impervious</td>
<td>Poor Envelope</td>
<td>Permeable</td>
</tr>
<tr>
<td>Shock</td>
<td>Energy</td>
<td>Energy</td>
<td>Impact</td>
</tr>
<tr>
<td>Absorbing</td>
<td>Intensive</td>
<td>Intensive</td>
<td></td>
</tr>
<tr>
<td>Waterproof</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tire-Derived Products

Value to Customers

- Performance Enhancements
- Flexibility – Design to Project Dimensions/Needs
- Compliance Solutions
  - Accessibility / ADA
  - Permeable Surfaces / Storm Water Management
- Availability of EH&S Studies
- Initial Pricing Often Competitive
- Life-Cycle Costs Often Lower
  - Longer Life, Reduced Maintenance/Replacement

Check with Manufacturers for Product Pricing and Performance Documentation
- Recycled Tire Rubber Beneficial Attributes
- Competitive Advantages / Customer Value
- Growing Range of TDPs
- Support Sustainability Goals
- Information Resources
Tire Derived Product Categories

Building Construction

- Roofing
- Flooring
- Coatings & Sealants
- Accessibility Solutions
Tire Derived Product Categories

Outdoor Build Environment

Mats, Pavers, Tiles

Paths, Sidewalks, Bike Trails

Landscaping

Playgrounds
- Recycled Tire Rubber Beneficial Attributes
- Competitive Advantages / Customer Value
- Growing Range of TDPs
- Support Sustainability Goals
- Information Resources
How TDPs Support Sustainability Goals

- Recycled Content Product
  - Strengthens Recycling Markets and Infrastructure
  - Uses Local Resources that are Otherwise Wasted
  - Supports California Jobs and Businesses
- May Be Locally-Sourced in Most Areas of California
- May Contribute to Green Building Certifications
- May Help Comply with Sustainability-Related Regulations
- May Help Meet Green Procurement Policies
## TDPs Support Sustainability Goals

### CalGreen Building Code
- Regional materials
- Recycled content
- Enhanced durability and reduced maintenance
- Weather resistance and moisture management
- Heat island effect
  - Cool roof
  - Hardscape alternatives
- Potable water reduction

### LEED v4 Certification
- Rainwater management
- Heat island effect
- Outdoor Water Use
- Building life-cycle impact
- Green purchasing
- Local Sourcing of raw materials
- Low-emitting materials
- Acoustical performance
- Exterior noise control
- Design innovation
Benefits

- Reduces noise between units
- Superior impact sound isolation
- Resilient & Durable in comparison to other underlayment

Concerto Lofts, Los Angeles
Building Life-Cycle Impact Reduction
Accessibility Transition Ramps

Benefits

- Elegant solution to federal accessibility regulations
- Compliance with federal ADA access laws codified in local building requirements
- No load-weight limitations
- Easy installation, no jack-hammering or sawing

Liberty Station, San Diego
Rainwater Management
Permeable Walkways

Benefits

- Recharges groundwater, nontoxic, no leaching,
- Non-slip surface, reduced falls and liability
- Durable, 40k+ lb. load capacity
- Easy to install, poured-in-place
- Low-impact development
Rainwater Management
Pavers

Benefits

- Non-slip surface, reduced injury
- Shock-absorbing, comfortable
- Durable, freeze/thaw
- Flexible, no cracking/breaking

Contra Costa County Fairgrounds

Monterey County Fairgrounds
Optimize Energy Performance
Roofing Membrane

Cool Roof Rated
- 300 mm thickness
- Meets Title 24 and reduces energy consumption

Other Benefits
- Durable waterproof layer is flexible and can withstand hot temperatures
- Torch application creates strong bonds
Energy Efficiency

Low-emitting

Procurement Needs

Flooring & Surfacing

Safety

ADA

Insurance Needs

Raw Materials

Check with manufacturers for documentation on product testing and certification.
- Recycled Tire Rubber Beneficial Attributes
- Competitive Advantages / Customer Value
- Growing Range of TDPs
- Support Sustainability Goals
- Information Resources
Online Catalog for Architects

- Manufacturer Sales Sheets
- Product Videos
- Company Directories
- 26 TDP Case Studies
- Annual Market Report
- Links to Other TDP Resources

www.calrecycle.ca.gov/files/Tires/TDPCatalog/default.htm
Or Google “CalRecycle, TDP Catalog”
Suppliers & Manufacturers

Map – Tire-Derived Material Feedstock Suppliers
1. The Bakersfield Association for Retarded Citizens Inc (BARC)
2. BAS Recycling, Inc.
3. BJ’s Used Tire & Rubber Recycling, Inc.
4. CB Tyres Recycling Resources LLC
5. CRM Co. LLC
6. Lakin Tire West, Inc.
7. McClanahans Tire LLC
8. refRubber LLC
9. Rubber Recovery, Inc.
10. Shamrock Recycling of CA, Inc.
11. Tri-C Tire Recycling Division, Inc.
15. West Coast Rubber Recycling, Inc.

Map – Tire-Derived Product Manufacturers
1. Crossfield Products Corp.
2. Decofelt Corporation
3. Delano Manufacturing
4. Eco-Plex California LLC
5. Environmental Molding Concepts
6. International Mulch Company
7. K.B. Industries, Inc.
8. Kirkhill
9. MBTechnology
10. Millennium Molding, Inc.
11. Mission Rubber Company
12. Paragon Tactical
13. PDPlay, Inc.
14. PlayMax Surfacing, Inc.
15. refRubber LLC
16. Robertson Recreational Surfaces, Inc.
Thank You!

www.calrecycle.ca.gov/Tires/Products/
Or Google, “CalRecycle, TDPs”

- Product Installation Map
- Product Material Studies
- Health and Safety Studies
- Procurement Grants
- Technical Assistance

Randy Russell, CalRecycle
Technical Assistance Contractor
rrussell@louisberger.com
916-281-0471
AT THE INTERSECTION OF SOLUTIONS
USING TIRE – DERIVED MATERIAL & PRODUCTS

Greening the Golden State
Green California Summit 2018
Sacramento, California
Recycled Tire Markets

Developing Tire-Derived Products

Feedstock Conversion Projects

Opportunities
California Recycled Tire Markets
Trends by Market Segment

2016 California Tire Market

- Disposal: 32%
- Diversion: 68%
- Recycle: 34%
- Alternative Daily Cover: 4%
- Tire-Derived Fuel (TDF): 30%
- CA Statute – non recycle: 34%

- Disposal: 32%
- Diversion: 68%
- Recycle: 34%
- Alternative Daily Cover: 4%
- Tire-Derived Fuel (TDF): 30%
- CA Statute – non recycle: 34%
Products and End Use Applications

- Retreads
- Coatings, Sealants and Paints
- Automotive
- Flooring
- Ballistic Products
- Paving Materials & Products
- Landscape Surfaces
- Accessibility Products
- Building & Construction
- Mats, Pavers & Tiles
- Playground Surfaces
- Traffic Related Products
- Civil Engineering
- Cleaning Tools
- Paths, Walkways, Sidewalks & Bike Trails
- Synthetic Turf
Table of Contents

Table of Contents.................................................. 3
About The Catalog.................................................... 4
Tire-Derived Products by Category........................................ 6
Accessibility Products............................................. 18
Animal Care....................................................... 22
Automobile......................................................... 32
Ballistic Products.................................................. 40
Building & Construction.......................................... 46
Civil Engineering.................................................. 58
Cleaning Tools..................................................... 66
Coatings, Sealants & Paints........................................... 82
Floors................................................................. 94
Industrial Surfaces................................................ 112
Landscape Surfaces............................................... 128
Mats, Pavers & Tiles............................................... 138
Paths, Walkways, Sidewalks & Bike Trails......................... 166
Pavements.......................................................... 209
Playground Surfaces............................................. 196
Retreads.............................................................. 222
Roofing.............................................................. 224
Sports Surfaces.................................................... 234
Synthetic Turf....................................................... 252
Tire-Derived Material/Feedstock..................................... 262
Traffic Related Products.......................................... 280
Appendices.......................................................... 289
Appendix A - Company Directories................................ 301
Firms Listed in Catalog............................................. 301
Tire-Derived Product Manufacturers............................... 310
Tire-Derived Material/Feedstock Suppliers........................ 310
Tire-Derived Product Installers & Contractors...................... 310
Tire-Derived Pavement Suppliers................................ 310
Retreads.............................................................. 310
Appendix B - Certification Programs................................ 310
Appendix C - Case Studies........................................ 310
Appendix D - LEED Benefits & Contributions....................... 310
Appendix E - Resources........................................... 400
Appendix F - CA Market Report.................................. 400

http://www.calrecycle.ca.gov/tires/products/catalog/
Developing Tire-Derived Products
Best Management Practices (BMP)

- Customer
- Tire-Derived Material (TDM) Feedstock Supplier
- Consistent Qualified and Quantitative Material
- Tire-Derived Product (TDP) Manufacturer
- Compounder
- Specifier
- Equipment to Support Tire-Derived Product
- Testing Standards, Protocol, Testing Facility
- Expected Timeline for Return on Investment
Drivers in Developing Products

- Return on Investment
- Customer Demand
- Economic Value
- Lower Cost Material
- Performance Benefits
- High Quality
- Sustainable Material
Standards
Certification
Compliance Processes
Third-Party Testing

Add Value to the Product

Add Value to the Industry
ASTM D5603 – Standard Classification for Rubber Compounding Materials – Recycled Vulcanizate Particulate Rubber

ASTM D5644 – Standard Test Methods for Rubber Compounding Materials to Determine Particle Size Distribution of Recycled Vulcanizate Particulate Rubber
ASTM D5603 - Determine Particle Size Distribution

Parent Compound

- Grade 1: Whole Tires - Highway and Non Highway
- Grade 2: Whole Tires - Highway Tires
- Grade 3: Whole Tires – Non-Highway Tires
- Grade 4: Tread Only – Highway Tires
- Grade 5: Tread Only – Non Highway Tires
- Grade 6: Tread & Shoulder Only – Highway Tires
- Grade 7: Tread & Shoulder & Sidewall – Highway Tires
- Grade 8: Non-tire Devulcanizate Rubber

Table 1. Parent Compounds

<table>
<thead>
<tr>
<th>Grade</th>
<th>5.3.1 Classification of the Source of Rubber</th>
<th>Passenger Car Tires</th>
<th>Light Truck</th>
<th>Truck</th>
<th>Bus</th>
<th>Agriculture</th>
<th>OTR</th>
<th>Non-Tire Rubber</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3.1 Grade 1</td>
<td>Whole tire recycled vulcanizate particulate rubber is prepared from all highway and non-highway tires;</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5.3.1.1</td>
<td>Passenger car, light truck, truck, bus, agriculture, Off-the-road (OTR) tires;</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5.3.1.2</td>
<td>Truck, bus, and agriculture tires.</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.2 Grade 2</td>
<td>Whole tire recycled vulcanizate particulate rubber is prepared from all highway tires;</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.2.1</td>
<td>Passenger car, light truck, truck and bus tires;</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.2.2</td>
<td>Passenger car, light truck and truck tires;</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.2.3</td>
<td>Passenger car and light truck tires;</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.2.4</td>
<td>Truck tires and bus tires;</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5.3.2.5</td>
<td>Truck tires;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5.3.2.6</td>
<td>Bus tires;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5.3.3 Grade 3</td>
<td>Whole tire recycled vulcanizate particulate rubber is prepared from non-highway tires;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.3.1</td>
<td>Agriculture tires and OTR tires;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5.3.3.2</td>
<td>Agriculture tires;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5.3.3.3</td>
<td>Agriculture and OTR tires;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Third-Party Testing
Feedstock Conversion Projects
- Coating Line for self adhering building product membranes with adhesive coating containing crumb rubber

- Self adhering roofing membrane containing adhesive with crumb rubber

- Window and Door Flashing
- Below Grade Blind-Side Waterproof Membrane
- Ice Dam Isolating Roofing Underlayment
No Hub Plumbing Couplings
QuietSound RRC Underlayment
Crumb Rubber Intermixed Base Layer
Sidewalk Repair System
Safety Surface

Sierra Mat & Rubber Company
Opportunities to Add Value to Products and Industry

- Existing Tire-Derived Products and Uses
- Outside of the Box Thinkers
- California Manufacturers
- California Tire-Derived Material Feedstock Suppliers
- California Compounders
- CalRecycle Grants
  - Tire Incentive Program (TIP)
  - Tire-Derived Product (TDP)
  - Tire-Derived Aggregate (TDA)
  - Rubberized Asphalt Concrete (RAC)
Denise Kennedy, DK Enterprises
(916) 706-3869
denise@dkenterprises.us
www.dkenterprises.us
Civil Engineering Uses of Tire Rubber

Nate Gauff
CalRecycle
April 9, 2018
Overview

- Support of Tire-Derived Products (TDP)
- Tire-Derived Aggregate (TDA)
- Rubberized Asphalt Concrete (RAC)
TDP Support

- General Support
- Technical Support
- Financial - Grants
TDP - General Support

- Tire-Derived Business Assistance Program
  - TBAP 1
  - TBAP 2

- Tire Outreach and Market Analysis Contracts
  - TOMA 1
  - TOMA 2
TDP - Technical Support

- OEHHA Turf Study
- Feedstock Conversion Contract
TDP - Financial Support-Grants

- Have provided grants for over 25 years.

- Over $57M awarded + $15M (TBAP + TIP)

- Wide variety of TDPs supported (primarily tracks, playground cover, turf fields)
Tire-Derived Aggregate (TDA)
Tire-Derived Aggregate (TDA)

- Uses for Tire Derived Aggregate
  - Lightweight fill for Road Embankments
  - Lightweight fill for Road Slide Repair
  - Lightweight backfill for Retaining Walls
  - TDA used in Vibration Mitigation Applications
  - TDA in Landfill Applications
  - TDA in Low Impact Development (LID) Storm-Water infiltration galleries
Tire-Derived Aggregate (TDA)

- TDA has properties that civil engineers & contractors need
  - Lightweight
  - Free Draining/High Permeability
  - Low earth pressure
  - Good thermal insulation
  - Durable
  - Compressible
  - May be cheapest solution
  - Helps the environment when used in sustainable infrastructure
  - Conserve natural aggregate resources
Rubberized Asphalt Concrete (RAC) has been a tire diversion strategy used by the CalRecycle/CIWMB since the very beginning of the Tire Program.

The use of RAC by State and Local Government Agencies currently diverts over four million waste tires per year from landfill disposal.

Over the past 25 years of the Tire program RAC has diverted an estimated 80+ million waste tires.
Rubberized Asphalt Concrete

- Caltrans
- Local Government
  - Technology Transfer
  - Grants
- Research Contracts
Rubberized Asphalt Concrete

Why CalRecycle Will Continue to Support RAC

- Largest recycling use of waste tire rubber
- Demonstrated superior performance of RAC over conventional AC. Long-lasting durability; resists reflective cracking; lower maintenance.
- Shown to be a cost effective resurfacing option over conventional AC
That’s All Folks!