Repurpose Waste Tires For Rubberized Pavement and Pothole Repairs

There are 300 Million Waste Tires discarded in the US each year!

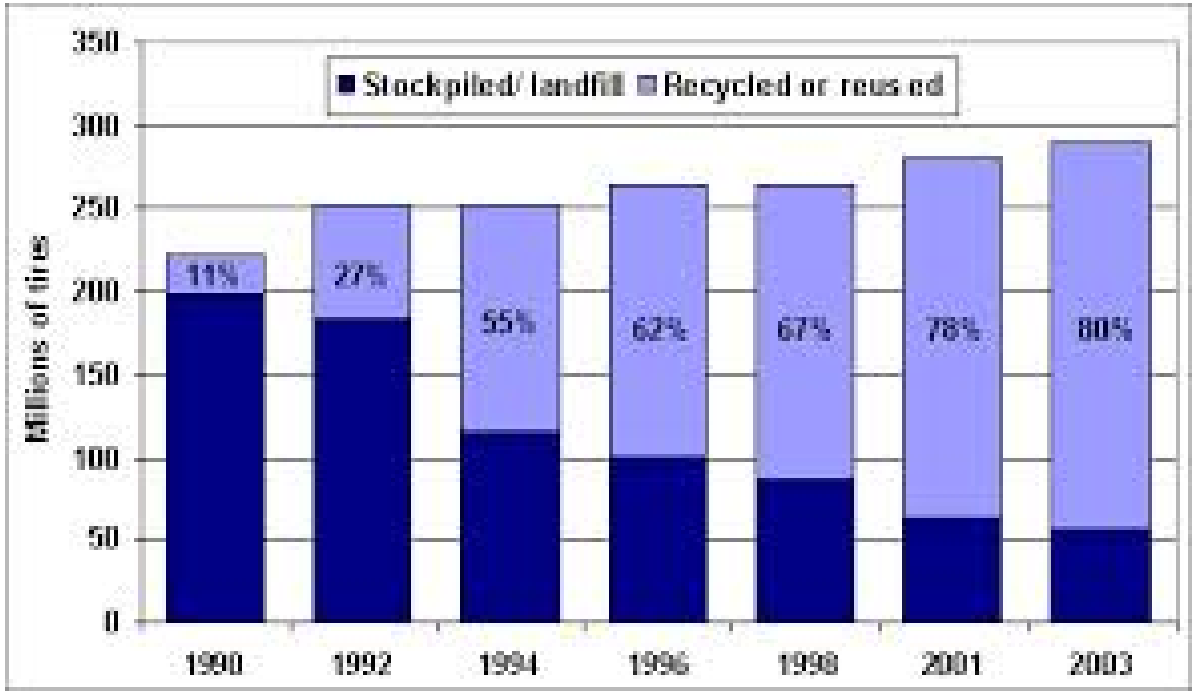
Industry Challenges – Waste Tires, Problems & Solutions

With the ever increasing health and environmental concerns, the disposal of waste tires is a growing problem all over the world. A waste tire processing plant recycles whole car and truck tires into a valuable product called crumb rubber. This crumb rubber can then used in numerous applications including sport fields, rubberized asphalt for paving and a wide variety of molded products. The steel and fiber removed during this process is also recycled into various products.

In addition, the waste tire rubber can be used as a waste to energy source.

Industry Challenges – Waste Tires, Problems & Solutions

Crumb rubber can not be considered a waste material. It is a valuable commodity with ongoing expansion and growth in diversified markets. Its use in asphalt is not making a highway into a linear landfill. Crumb rubber has proven to be one of the only additives to hot mix asphalt derived from a waste material that has a beneficial impact and actually improves performance.



Industry Challenges – Waste Tires, Problems & Solutions

Some conclusions include:

1. Crumb rubber production is an environmentally economical sound method of waste tire reduction,
2. Asphalt Rubber has proven long term performance, cost effectiveness, and sustainable market growth, and
3. Asphalt Rubber paving programs are key components to acceptable and successful waste tire management programs.

Industry Challenges – Political Obstacles

- Requirement by municipalities and State DOTs to approve specifications for materials to be included in road pavement
- Lab testing
- Elongated time to obtain approval
- Market demand for use of the materials in a proposed paving project
- Open bid process or sole source procurement
- Adoption by paving contractors

Asphalt containing rubber continues to stretch its way into more state Departments of Transportation.

By Tom Kuennen, Contributing Editor September, 2014
www.betterroads.com http://ow.ly/BaCZO

Use of rubber in asphalt pavements likely will get a boost as the Federal Highway Administration (FHWA) updates its 1992 State of the Practice: Design and Construction of Asphalt Paving Materials with Crumb Rubber Modifier (Search for FHWA-SA-92-022 in Google).

In May 2013, representatives from the Rubber Manufacturers Association, Tire Industry Association, Rubber Pavements Association, Rubberized Asphalt Foundation, National Asphalt Pavement Association and Liberty Tire Recycling met with FHWA's John Baxter, associate administrator for infrastructure.

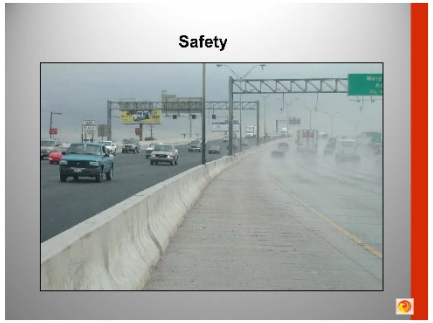
Their purpose was to encourage FHWA to update that document to reflect innovations and changes that have occurred in the rubberized asphalt industry since it was published 22 years ago.

Vision

Mitigate Waste Tires

Create Sustainable Jobs

Elongate Road's
Useful Life



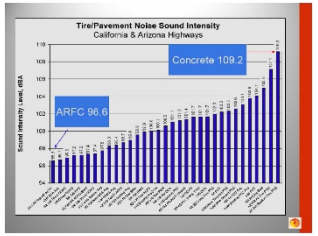
Increase Safety

USA
360° Tire
Reclamation
Program

Zero Emissions
Clean Environment

Sustainable pothole
repairs

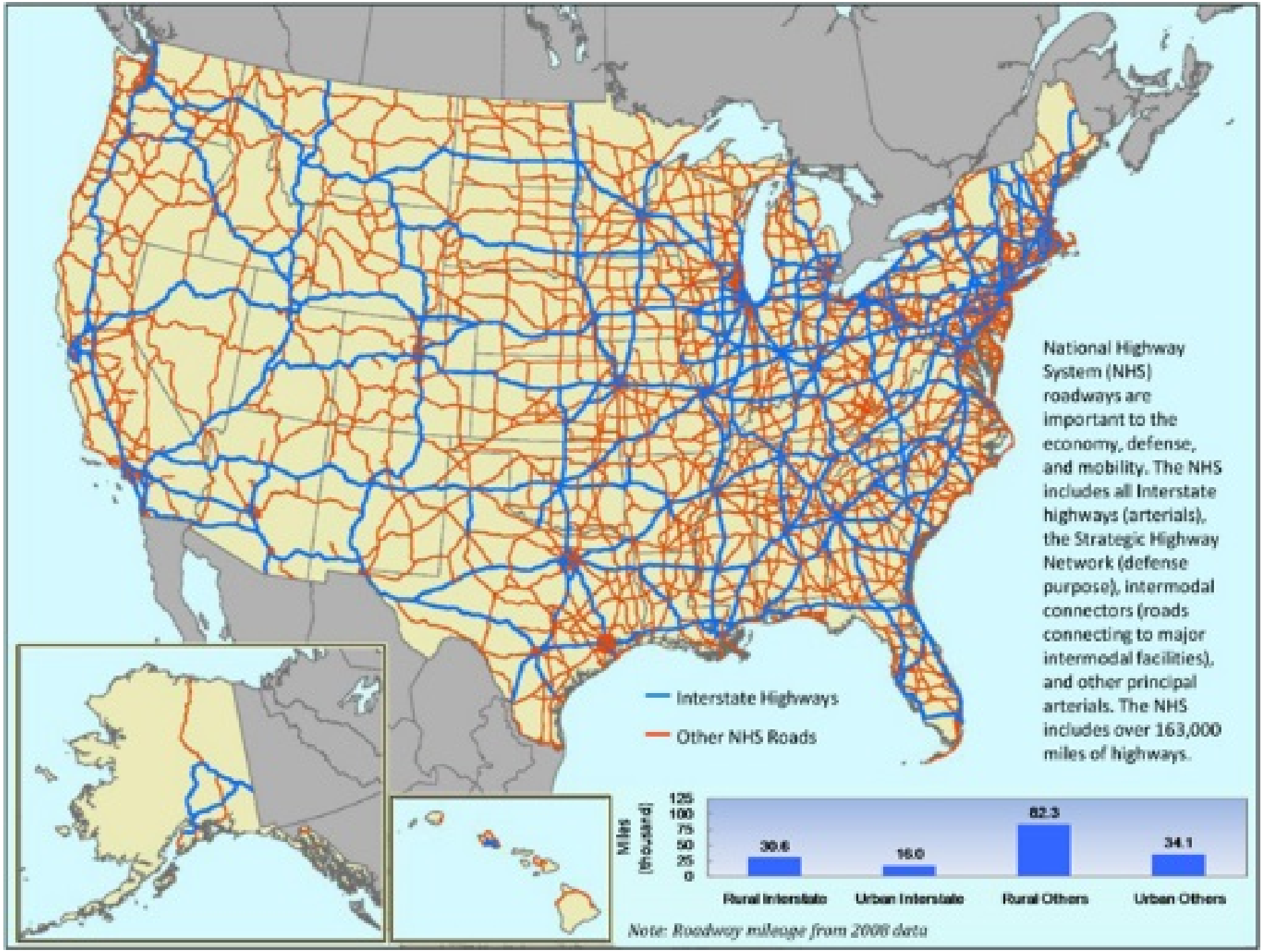
Create
National
Model



Reduce Noise

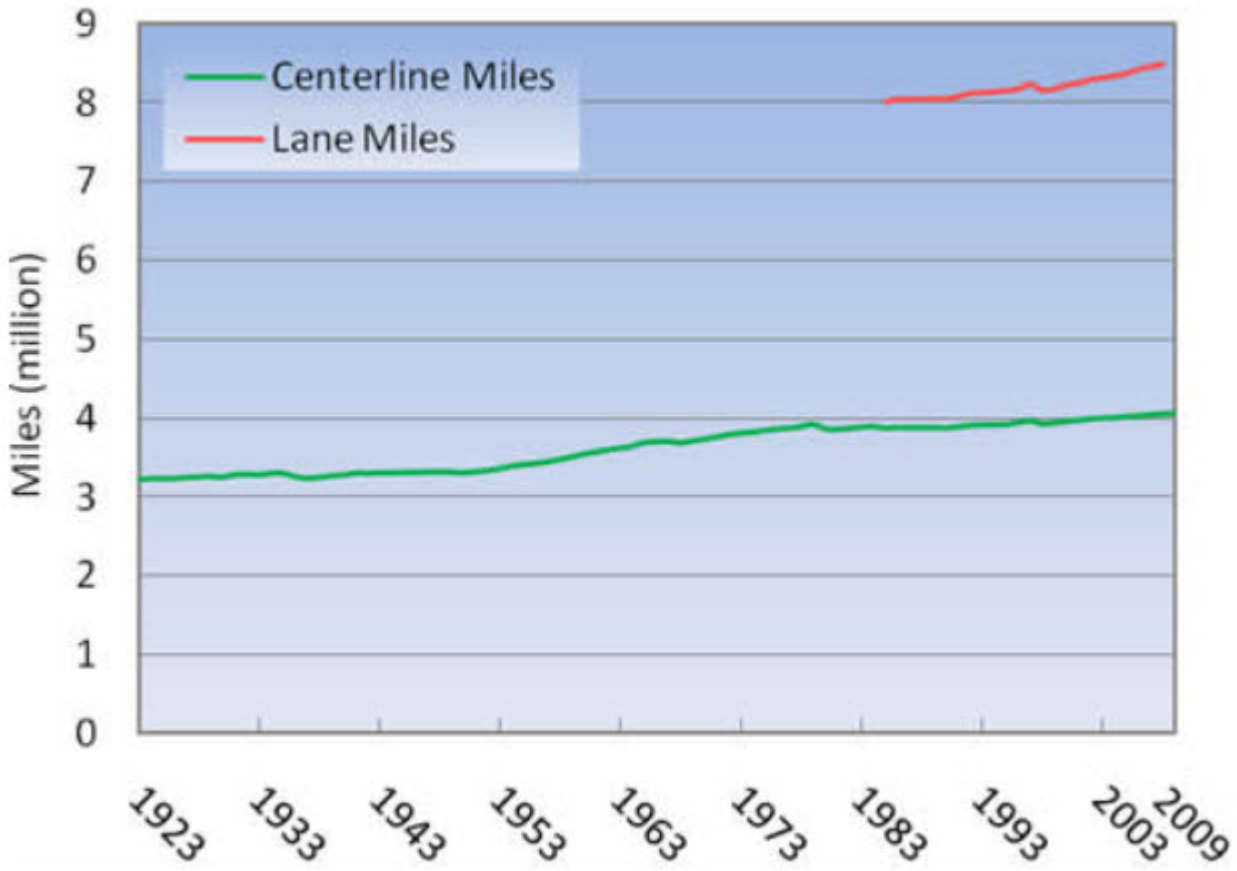
HOW MANY MILES OF ROADS ARE THERE IN THE U.S.?

- Currently, there are **4.09 million miles of road in the United States**, according to the Federal Highway Administration, including Alaska and Hawaii. The core of the nation's highway system is the 47,432 miles of Interstate Highways, which comprise just over one percent of highway mileage but carry one-quarter of all highway traffic. The Interstates plus another 175,514 miles of major roads comprise the National Highway System, which carries most of the highway freight and traffic in the U.S.
- Most of the roads in the U.S., **2.98 million miles, are located in rural areas**, with the remaining **1.11 million miles located in urban areas**. Local governments are responsible for maintaining and improving 3.17 million miles of road or 77.5 percent of the total. State highway agencies are responsible for 780 thousand miles of road, or 19.1 percent. The federal government is responsible for only 140 thousand miles of road or 3.4 percent, largely roads in national parks, military bases and Indian reservations.
- **Of the 4.09 million miles of road, about 2.65 million miles are paved**, which includes most roads in urban areas. However, 1.42 million miles or more than one-third of all road miles in the U.S. are still unpaved gravel or dirt roads. These are largely local roads or minor collectors in rural areas of the country. (Source: Highway Statistics 2012 Table HM-20, HM-10, HM-12, HM-15)


National Highway System (NHS) roadways are important to the economy, defense, and mobility. The NHS includes all Interstate highways (arterials), the Strategic Highway Network (defense purpose), intermodal connectors (roads connecting to major intermodal facilities), and other principal arterials. The NHS includes over 163,000 miles of highways.
Interstate Highways
Other NHS Roads
Miles (thousand)
125
100
75
50
25
0
30.6
16.0
82.3
34.1
Rural Interstate
Urban Interstate
Rural Others
Urban Others
Note: Roadway mileage from 2008 data

Approximately one percent of all public roads are part of the Interstate Highway System. Of these 47,000 miles of Interstates, 65 percent are in rural areas and 35 percent are in urban areas. Seventy-four percent of the remaining public roads are located in rural areas, with 26 percent in urban areas.

Figure 1-5: Public Road Centerline and Lane-Miles: 1923-2009[4]



Data Source: FHWA. Note: Lane-mile data not available before 1985.

State departments of transportation (DOTs) are spending more money building new roads than maintaining the ones they have—despite the fact that roads are crumbling, financial liabilities are mounting and conditions are not improving for America's drivers.

$45.2 billion!

The amount states would need to spend to bring roads in poor condition into a state of good repair while also maintaining their existing systems.

State leaders—including governors, legislators and DOT officials—have the ability to change these priorities for the better. Here are recommended actions that state officials can take to increase the portion of funds going to repair, such as

- raising the public profile of repair projects;
- using asset management practices;
- focusing repair investments on the most heavily used roads;
- setting aggressive targets for pavement conditions; and
- using cost-benefit analysis to prioritize road investments.

Average annual state expenditures on road expansion vs. repair 2009-2011

State	Road expansion and repair	Road expansion	Road expansion as percent of total	Road repair	Road repair as percent of total
Alabama	$566	$262	45%	$304	55%
Alaska	$256	$89	35%	$167	65%
Arizona	$745	$620	83%	$124	17%
Arkansas	$345	$235	68%	$110	32%
California	$2,379	$940	40%	$1,438	60%
Colorado	$404	$215	53%	$189	47%
Connecticut	$313	$176	56%	$137	44%
District of Columbia	$106	$0	0%	$106	100%
Delaware	$160	$113	70%	$48	30%
Florida	$2,535	$1,223	48%	$1,312	52%
Georgia	$1,055	$486	46%	$569	54%
Hawaii	$151	$88	59%	$63	41%
Idaho	$267	$115	43%	$152	57%
Illinois	$1,571	$543	35%	$1,028	65%
Indiana	$1,028	$736	71%	$293	29%
Iowa	$456	$238	52%	$217	48%
Kansas	$419	$194	46%	$225	54%
Kentucky	$870	$527	61%	$343	39%
Louisiana	$1,032	$645	62%	$388	38%
Maine	$256	$35	14%	$221	86%
Maryland	$381	$257	68%	$123	32%
Massachusetts	$293	$52	18%	$241	82%
Michigan	$757	$95	13%	$662	87%
Minnesota	$627	$377	60%	$250	40%

Average annual state expenditures on road expansion vs. repair 2009-2011

State	Road expansion and repair	Road expansion	Road expansion as percent of total	Road repair	Road repair as percent of total
Mississippi	$619	$603	97%	$16	3%
Missouri	$744	$461	62%	$283	38%
Montana	$293	$132	45%	$161	55%
Nebraska	$216	$20	9%	$196	91%
Nevada	$471	$392	83%	$79	17%
New Hampshire	$206	$76	37%	$130	63%
New Jersey	$1,361	$266	20%	$1,095	80%
New Mexico	$225	$53	23%	$172	77%
New York	$1,272	$297	23%	$976	77%
North Carolina	$1,388	$1,155	83%	$233	17%
North Dakota	$254	$14	6%	$240	94%
Ohio	$1,032	$404	39%	$628	61%
Oklahoma	$779	$500	64%	$279	36%
Oregon	$252	$94	37%	$159	63%
Pennsylvania	$2,298	$1,421	62%	$877	38%
Rhode Island	$25	$5	22%	$19	78%
South Carolina	$371	$158	43%	$213	57%
South Dakota	$245	$49	20%	$196	80%
Tennessee	$584	$421	72%	$163	28%
Texas	$3,377	$2,765	82%	$612	18%
Utah	$750	$700	93%	$50	7%
Vermont	$131	$30	23%	$101	77%
Virginia	$595	$402	68%	$192	32%
Washington	$1,015	$849	84%	$166	16%
West Virginia	$425	$312	73%	$113	27%
Wisconsin	$892	$544	61%	$349	39%
Wyoming	$270	$46	17%	$224	83%
Median	**$470**	**$257**	55%	**$213**	45%
Total	**$36,942**	**$20,417**	55%	**$16,525**	45%

Comparison of Rubberized Asphalt to Conventional (rigid) Asphalt

- Whenever the costs are compared, asphalt rubber strategies come out ahead of conventional materials over eighty percent of the time.
- Life Cycle Costs studied by Oregon State University in Arizona, California and Texas where Asphalt-Rubber is widely used, show **great savings over the life of the project, as much a $7.34 for every square yard of pavement**.

That's over $50,000 for every lane mile.

After ten years, Asphalt-Rubber pavements have only one third the maintenance costs. (Arizona Department of Transportation)

ROI TO GOVERNMENTAL AGENCIES

Comparative costs for current roadway paving

75% of current paving is with conventional asphalt at a cost of $60 per mixed ton

20% of current paving is with SBS polymers added to hot mix asphalt at a cost of $85 per mixed ton. Using Rubberized Pellets as a modified binder substitute reduces cost approx. $5 per mixed ton.

5% of current paving is with rubberized asphalt at a cost of $95 per mixed ton. Using Rubberized Pellets as a modified binder substitute reduces cost approx. $5 per mixed ton and also eliminates the use of the Asphalt Rubber Blending "wet process" unit equipment at the hot mix plant.

Advantages of AR to Conventional Asphalt

- In Summary, the use of Asphalt Rubber in highway pavement establishes that:
-
- **More cost effective by as much as $50,000 per lane mile**
- **Three times longer pavement life over conventional asphalt pavement**
- **Environmentally responsible by recycling scrap tire rubber**
- **Environmentally responsible by reducing atmospheric particulate matter**
- **Environmentally responsible by improving fuel efficiency**
- **Environmentally responsible by improving tire life**
- **Environmentally responsible by reducing noise pollution**
- **Environmentally responsible by lowering carbon footprint with extended repaving cycle**
- **Reduction in major wet weather accidents by 51%**
- **83% reduction in traffic accident fatalities**

Process Overview

Environmentally Friendly Pelleted Asphalt Rubber Binder

1 waste tire generated per person per year

Waste tires processed to crumb rubber

Crumb rubber is blended with A/C to produce asphalt rubber then hydrated lime is added in the pelleting process

Rubberized Pellet Process

The pellets are blended with the aggregate at the hot plant

The PelletPAVE mix is used in a typical paving procedure

2,000 waste tires used per lane mile in a 2 inch overlay

Equation of mitigating unsightly and unsafe piles of waste tires by repurposing the crumb rubber for inclusion in roadway pavement

Assume new asphalt pavement

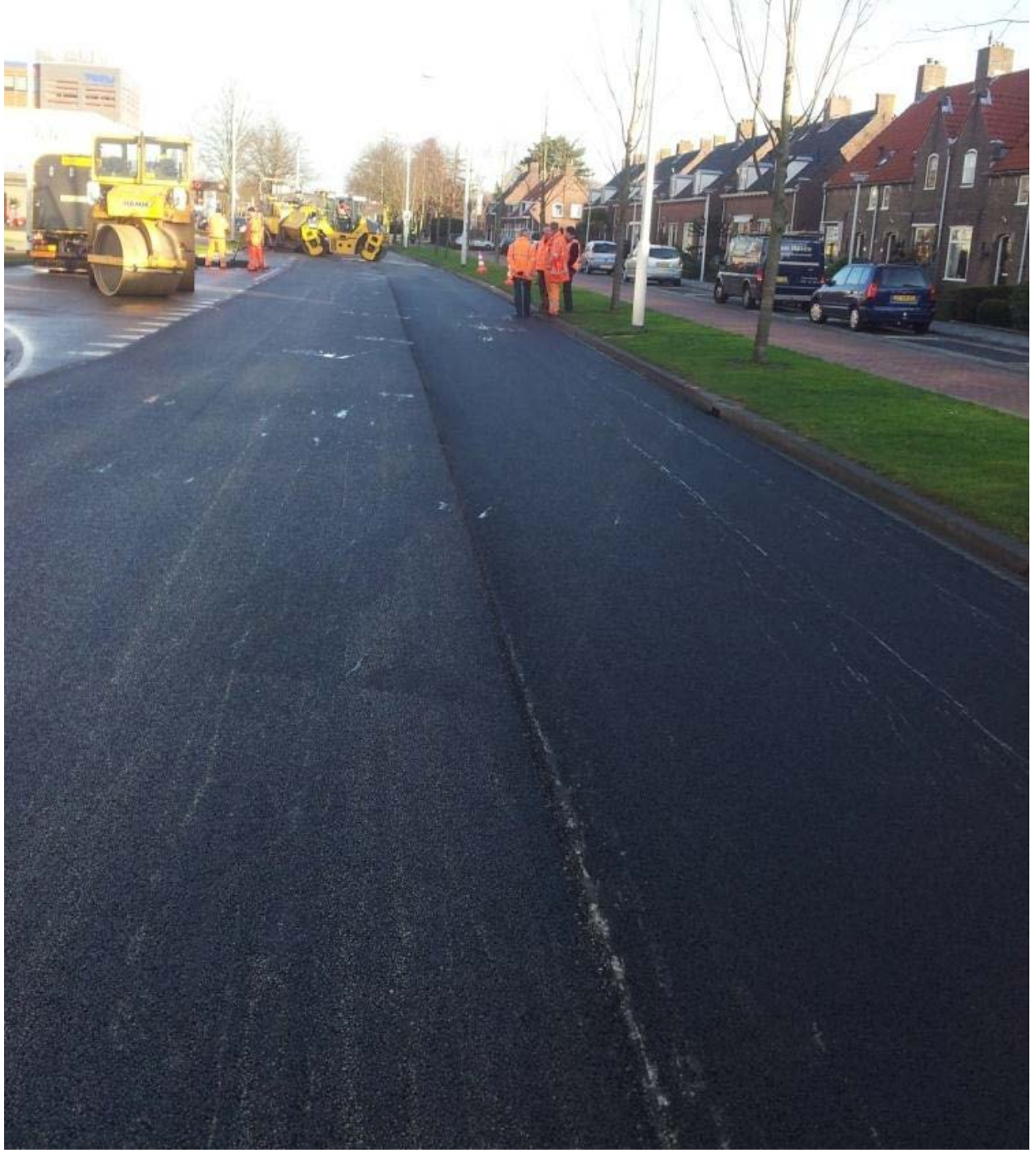
1 mile long, 1 lane, 12’ wide, 2.5” thick lift

- Requires approx. 800 tons of finished mix
- If the mix design requires 12% pellets this will use 96 tons
- **The result is that one lane mile would repurpose 2,000 tires**

2.65 Million linear miles are paved in the US

(this includes 2, 4, 6 & 8 lane roadways)

Roadway paved with rubberized pellets



Equation of mitigating unsightly and unsafe piles of waste tires by repurposing the crumb rubber for inclusion in pothole repairs

It is estimated that there are 30 million potholes per year across the US

- Assume that there are 12lbs of crumb rubber per tire
- The average pothole repair uses 200lb of material
- 30 Million potholes would require 6 Billion lbs of patch material

- **Every 600lbs of rubberized hot mix patch mitigates 1 waste tire**
- The result is that 10 Million waste tires could be mitigated just for repairs on an annual basis

CONVENTIONAL & HISTORICAL MATERIALS USED TO REPAIR POTHOLES

HOT MIX ASPHALT procured from an asphalt plant

- Requires purchase of minimum of 2 mixed tons
- Requires pickup at the plant resulting in wasted labor time
- Hot Mix plants are closed during cold weather so the patching is seasonal depending upon ambient temperature

COLD PATCH

- Temporary solution or short term
- Typically installed on “throw & go” basis; not properly compacted
- Debris from patch is dangerous to drivers resulting in property damage and potential liability
- Requires more than one application to keep the hole filled until the weather is conducive to apply Hot Mix

NEW TECHNOLOGY MARKET DISRUPTER

RUBBERIZED PELLETS (DRY MIX)

- **Patented Green Technology**
- **Uses Crumb Rubber derived from Waste Tires**
- **Rubberized Pellets facilitate easy transport to repair site**
- **Stored dry at ambient temperatures without special requirements**
- **No Wasted Material**
- **No Wasted Labor Time**
- **Provides Permanent, Rubberized & Durable Patch**
- **Can be applied even in cold weather**
- **Elongates the life of the road**
- **“One and Done!”**

RETURN ON INVESTMENT ANALYSIS

- *Assume labor costs to initially repair a pothole at the site are equal with all 3 methods*

HOT MIX

$60/mixed ton

(in season; higher priced during winter if available)

Add'l Labor Cost to pickup
1.5 Hours x 2 workers
Total 3 hrs @ $20/hr = $60

PELLETS (DRY) MIX

$40/mixed ton

Daily Cost for Trailer Mounted Unit
$40/day ($5/hour)

Limited 1 Year Material Warranty

COLD PATCH

$140/mixed ton

1 Repeat Trip
1 Hours x 2 workers
Total 2 hrs @ $20/hr = $40
Plus more material

Sustainability applying Rubberized pothole

Original Patch 1/2013
Revisited 4/2014

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