USTMA Full Corporate Members

BRIDGESTONE
Continental
The Future in Motion
COOPERTIRES
Giti
GOODYEAR
MORE DRIVEN
Hankook
driving emotion
KUMHO TIRE
Better. All-Ways
MICHELIN
A BETTER WAY FORWARD
nokian TYRES
Pirelli
SUMITOMO RUBBER INDUSTRIES
TOYO TIRES
driven to perform
YOKOHAMA
The functions of the tire

- Support weight of the vehicle
- Provide precise/effortless everyday steering
- Provide stable & effective emergency steering
- Grip to accelerate
- Grip to brake
- Perform in wet conditions
- Perform in winter conditions
- Provide a quiet ride
- Absorb vibrations and impacts
- Provide long wear life
- Resist heat, overload, speed, low inflation
- Comply with Federal Motor Vehicle Safety Standards
Why do tires produce particles?

- Tires are a vehicle’s only connection to the road.
- The grip between a tire and the road surface is essential to tire safety and performance.
- The tires’ critical grip on the road creates tire and road wear particles (TRWP) due to abrasion that occurs during accelerating, braking and cornering.
- TRWP are a mixture of tire tread and road surface.

Many factors impact the generation of particles from tires

- Road surface
- Vehicle characteristics
- Driving behavior and tire maintenance
- Tire design
- Weather
- Road topography
Tires today are lasting longer than ever before

Tire Shipments in the U.S. in thousands (blue)

USTMA estimate of total number of PLT and TB tires shipped from the manufacturer or importer to the customer in the U.S. market.

Vehicle Miles Traveled (yellow)

Dept. of Energy estimate reflecting light-, medium-, and heavy-duty vehicles.

https://www.afdenergy.gov/data/10315
Data gaps

• **Road pavement surface impact** (roughness and frictional characteristics)

• **Contribution of EV’s to increased TRWP generation**
  - Increased vehicle weight, torque
  - Trade-offs between exhaust and non-exhaust emissions

• **Airborne modeling improvements**
  - Improved input to EPA MOVES model
THANK YOU

Sarah Amick
samick@ustires.org
APPENDIX 1 – TIRE WEAR CALCULATION AND DATA INPUTS
## USTMA Tire Wear Rate Calculation – United States

### Wear Rate Calculation - U.S. Total

<table>
<thead>
<tr>
<th>Factor</th>
<th>Tire Type</th>
<th>Notes</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passenger Car</td>
<td>Light Truck</td>
<td>Truck/Bus</td>
</tr>
<tr>
<td>Average Weight of Tire (lbs)</td>
<td>26.00</td>
<td>50.60</td>
<td>117.19</td>
</tr>
<tr>
<td>Tread Weight (lbs)</td>
<td>8.35</td>
<td>16.70</td>
<td>29.64</td>
</tr>
<tr>
<td>Tread Depth (in)</td>
<td>0.31</td>
<td>0.47</td>
<td>0.56</td>
</tr>
<tr>
<td>Under Tread (in)</td>
<td>0.08</td>
<td>0.12</td>
<td>0.09</td>
</tr>
<tr>
<td>Total tread (in)</td>
<td>0.39</td>
<td>0.59</td>
<td>0.66</td>
</tr>
<tr>
<td>Wear to Depth (4/32 for passenger cars and light trucks; 6/32 for truck-bus) (in)</td>
<td>0.18</td>
<td>0.35</td>
<td>0.38</td>
</tr>
<tr>
<td>Percent tread worn (%)</td>
<td>0.46</td>
<td>0.59</td>
<td>0.57</td>
</tr>
<tr>
<td>Potential Worn tread weight (lbs)</td>
<td>3.87</td>
<td>9.78</td>
<td>16.94</td>
</tr>
<tr>
<td>Tread groove void factor (%)</td>
<td>0.30</td>
<td>0.34</td>
<td>0.15</td>
</tr>
<tr>
<td>Total Worn Tread weight per tire (lbs)</td>
<td>2.72</td>
<td>6.45</td>
<td>14.40</td>
</tr>
<tr>
<td>Tires shipped (millions)</td>
<td>256.41</td>
<td>36.93</td>
<td>51.32</td>
</tr>
<tr>
<td>Distance traveled (millions of vehicle miles)</td>
<td>2,478,921</td>
<td>395,805</td>
<td>314,077</td>
</tr>
<tr>
<td>Wear Rate (lb/100 vehicle miles)</td>
<td>0.028</td>
<td>0.06</td>
<td>0.235</td>
</tr>
<tr>
<td>Yearly Worn Tread Weight (tons)</td>
<td>348,588</td>
<td>119,136</td>
<td>369,394</td>
</tr>
<tr>
<td>Registered Vehicles (millions)</td>
<td>215.72</td>
<td>33.92</td>
<td>13.30</td>
</tr>
<tr>
<td>Yearly Miles per Vehicle</td>
<td>11,492</td>
<td>11,668</td>
<td>23,607</td>
</tr>
<tr>
<td>Total Vehicle Miles per Tire</td>
<td>9,668</td>
<td>10,719</td>
<td>6,120</td>
</tr>
</tbody>
</table>

* Numbers may not add due to rounding
Data inputs – USTMA Shipment data

**Passenger Car**
Shipment data included “Radial Industry OE” + “Total Industry Replacement” for 2016, 2017, and 2018. The average for the three years was used in the calculations.

**Light Truck**
Shipment data included “Radial Industry OE” + “Total Industry Replacement” for 2016, 2017, and 2018. The average for the three years was used in the calculations.

**Truck-Bus**
Shipment data included “Radial Industry OE” + “Total Industry Replacement” for 2016, 2017, and 2018. The average for the three years was used in the calculations.
Data inputs: Vehicle Miles – United States

• Data sources:
  o The data for the number of registered vehicles was found at: https://www.bts.gov/content/number-us-aircraft-vehicles-vessels-and-other-conveyances.
  o The data for the number of vehicle miles driven was found at: https://www.bts.gov/content/us-vehicle-miles.

• Data years:
  o Data was obtained for 2016, 2017, and 2018.
  o The average for the three years was used in the calculations.

• Annual “vehicle miles driven” data:
  o Source: U.S. Department of Transportation
  o The following categories under “Highway, Total” were used in the tire wear rate calculations:
    • Light Duty Vehicle, Short Wheel Base (all attributed to passenger car tires)
    • Light Duty Vehicle, Long Wheel Base (40% attributed to passenger car tires and 60% to LT tires)
    • Truck, Single Unit 2-axle 6 tires or more (all attributed to truck-bus tires)
    • Truck, Combination (all attributed to truck-bus tires)
    • Bus (all attributed to truck-bus tires)
  o The breakdown of the US miles driven was:
    • 77% passenger car, 12% light truck, 10% truck-bus
Data inputs: Vehicle (tire) segmentation

- Vehicle (tire) segmentation – passenger car, light truck, truck/bus
- Based USTMA shipment data, as found in the USTMA FACTBOOK, for 2016, 2017, and 2018.
- The average for the three years was used in the calculations.
Data inputs: Data collected from USTMA members

1. Average Total Tire Weight and Standard Deviation
2. Average Total Tread Weight and Standard Deviation
3. Average Tread Depth and Standard Deviation
4. Average Undertread Thickness and Standard Deviation
5. Average Tread Void Factor % and Standard Deviation
• Most tires are not completely worn down to 2/32” around the entire tire before they are removed from service.
  o USTMA and tire retailers recommend replacement when a tire reaches 2/32” in the fastest wearing groove
  o Tires are typically replaced before this point due to road hazard damage, uneven treadwear and customer needs for tire performance due vehicle type, driving needs, weather conditions, etc.
• USTMA member company engineers recommended using tread depth of 4/32” for passenger and LT tires and 6/32” for truck/bus tires as the average tread depth at removal due to the various factors affecting tire replacement