REDMOND CLARK, PhD
PRESIDENT, ASPHALT PLUS, LLC, BARRINGTON, IL
TESTIMONY REGARDING HOUSE BILL 781

My name is Redmond Clark. I am president of Asphalt Plus, a leading developer of markets for scrap tire rubber use in asphalt pavements. I have invested a 52-year career in developing functioning markets that change industrial and consumer waste products into valuable commodities while reducing the environmental footprint of global manufacturing processes.

Over the past 20 years, we have worked to develop the science, engineering and operational knowledge required to allow the use of modified ground scrap tires/chemically Engineered Crumb Rubber (ECR) in asphalt pavements. Those efforts have been successful. Since 2006, various state and federal agencies have successfully used scrap tires in their roads. More than half the US states now use ground tire rubber in their pavements, and many report a series of benefits on heavy traffic and lighter traffic roads:

- Heavy-duty traffic roads:
    - Meaningful reductions in cost
    - Higher levels of recyclables in pavement
    - Better traction for vehicles/safer, quieter roads
    - Significantly more sustainable road surfaces
- Lighter Duty Roads
    - Extension of road life
    - Potential reduction in pavement thickness
    - Higher levels of recyclables in pavement
    - Better traction for vehicles/safer, quieter roads
    - Significantly more sustainable road surfaces

Tire rubber represents an untapped engineering and environmental opportunity for public and private road owners. Advances in pavement technology make rubberized pavements an opportunity for Maryland.

At present, about half of US scrap tires are either burned for fuel or they are disposed in landfills. Maryland generates about 6.2 million scrap tires annually, and the state consumes about 6 million tons of asphalt mix annually. If the region's scrap tires currently going to incineration and disposal were used in asphalt mix designs, several benefits could accrue:

- A reduction in the life cycle cost of all pavements through lower up-front costs and/or extended pavement life.
- Safer, quieter roads and a reduction in vehicular accidents
- Environmental benefits, including:
    - Elimination of GHG emissions from burning 2 million tires/year and less disposal
    - Increased use of other recycled materials in pavements (like RAP)
    - Continued reuse of rubber when pavements are recycled.
    - Reduced repaving frequency (lower processing/use of materials)

We strongly support the goals of this legislation.

REDMOND CLARK, PhD
PRESIDENT, ASPHALT PLUS, LLC, BARRINGTON, IL
ENVIRONMENT AND TRANSPORTATION COMMITTEE WRITTEN TESTIMONY
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THE STATE PAVEMENT SYSTEM

The road construction industry is a vital portion of the US economy. Roads are central to economic function, but they also create a number of environmental impacts, both locally and globally. Road maintenance/construction agencies have a shared mission: construction of safe, efficient and durable roads while minimizing the environmental impacts of construction and maintenance activities. The traffic volumes on each road are important drivers of the construction and maintenance needs of each roadway. The vehicles that use these roads operate on vulcanized rubber tires, and the wear rate of those tires is directly impacted by the condition of the road surface. Roads and scrap tires are connected elements in our transportation system.

In order to make roads last longer, road agencies design roads based on the amount and type of traffic expected on each pavement. Heavy traffic roads with lots of truck traffic typically include concrete and asphalt surfaces that have been modified to withstand the extra stress. These heavy traffic roads include interstate highways and major arterials throughout the state. Modified asphalt pavements (heavy traffic roads) represent about 10-20% of the state's asphalt production.

When asphalt roads are designed for heavy traffic, they are typically modified with various kinds of rubber. Two kinds of rubber are most commonly used as strengthening agents: synthetic rubber polymers added to the liquid asphalt cement (un-vulcanized, manufactured synthetic rubber) and modified ground scrap tire rubber (vulcanized ground tire rubber or GTR) added to the binder ("wet process") or the asphalt mix ("dry process"). Although they adds cost to those roads, rubber additions to the pavement extend pavement life and promote smoother, quieter rides. At this time, heavy traffic modified asphalt roads in Maryland utilize rubber polymers, not scrap tire rubber.

Maryland has a second, larger population of asphalt roads that carry low to moderate traffic volumes. These would include state, county and city/town non-arterial roads. These pavements are typically not designed with modified asphalt. Although modification can increase road life, it is not commonly used in medium and light traffic roads because modification adds cost, and most road paving and maintenance budgets are limited.

BENEFITS OF SCRAP TIRE RUBBER USE IN MARYLAND PAVEMENTS

Heavy Traffic Roads

Decades of research and field testing indicates that the addition of scrap tire rubber in what is called "dry process" mix modification of asphalt pavements produces roads that behave like polymer pavements, but at a discount of approximately $3-5 per mix ton. That number will vary somewhat based on oil and polymer market prices. Maryland consumes about 6 million tons of

asphalt mix annually, although amounts will vary based on economic and Trust Fund conditions. Approximately 10-20% of those pavements are modified with polymers each year. At a savings of $3 per mix ton, changing from polymers to rubber in Maryland would save the state, counties, cities and towns an estimated $2-$4 million annually. Annual savings will vary somewhat based on market conditions for oil and petrochemicals.

Lighter Traffic Roads

Rubber asphalt research also indicates that the use of crumb rubber modification in medium and light-traffic roads can extend the life of the roads. Published data comparing rubber, polymer and unmodified pavements indicates that the addition of dry process Engineered Crumb Rubber (ECR) to the asphalt mix or polymers added to the asphalt binder can extend the mean life of those pavements from 35-50% and beyond. Net of the cost of modification, the net present value of extended pavement life savings can exceed $10 per mix ton. In addition, modification of hot mix can also allow for the reduction of pavement thickness. Although caution should be used in projecting performance improvements in all pavements, a conservative estimate of the savings from the use of scrap tire rubber in medium and light-duty roads could approach $50 Million annually if fully deployed in the state.

All Roads

The addition of GTR products to asphalt roads offers some important ancillary benefits:

- The addition of GTR to roadways improves wet weather skid resistance by up to 10-15%. Better skid resistance means fewer accidents.
- The addition of GTR in an asphalt pavement impedes crack formation. Since the addition of materials like recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS) tends to encourage cracking, GTR additions can permit elevated additions of recyclables without an increase in pavement cracking risk.
- GTR/asphalt roads are quiet pavements, usually much quieter than concrete pavements or old, worn pavements of any design.
- When GTR is used in asphalt pavements, each grain is coated with asphalt binder, thus all but eliminating any chemical or particulate releases from the tire rubber grains.
- Extension of road life is one of the key goals in the design of sustainable, low carbon roads. If the repair or reconstruction of a road can be delayed for years, it means less mining (quarried aggregate and oil), less material movement over time and less processing over time. All of those factors contribute to a greener economy.

MARYLAND SCRAP TIRE MANAGEMENT

Maryland generates over 6 million scrap tires per year that are collected by a number of in and out-of-state scrap tire recycling companies (MDE Annual Scrap Tire Report, 2023). Maryland reports a high recycling rate for tires managed inside Maryland, but a sizable fraction of Maryland tires get exported. In order to understand the environmental impacts of tire management in the region, it may be more enlightening to consider regional recycling numbers, especially since the environment does not recognize political borders.

Using national figures assembled by the US Tire Manufacturing Association (USTMA, Scrap Tire Report: 2021), about 34% of the US scrap tires are burned for energy recovery and at least 17% are disposed in landfills. Burning tires create roughly 2 lbs. of CO_2 per pound of rubber burned. If those metrics are applied to the MD scrap tire stream, approximately 1 million MD tires will end up in landfills annually and approximately 2.1 million MD tires will be burned for energy recovery (directly as fuel or indirectly in pyrolysis). Burning 2.1 million scrap tires each year would produce approximately 38,000 tons of CO_2 annually.

To the best of my knowledge, none of the scrap tires generated in Maryland are used directly in paving processes. If such a market could be created, it could divert tires that might otherwise be burned or discarded in landfills.

SPECIFICATION AND IMPLEMENTATION

If the proposed legislation is enacted, immediate adoption of rubber as an asphalt modifier is not workable unless attention is paid to the necessary phases of technology implementation. Those phases include:

1. Preparation of a specification with MDOT.
   MDOT is best equipped to provide a timeline for that process, which can occur during the evaluation of demonstration projects. It is my understanding that MDOT is already in the process of preparing a provisional specification for demonstration projects. In other states, specification preparation and approval is in the range of a six month process. Because the use of rubber in asphalt is a process that has been vetted by other states, much of the critical engineering information necessary for specification preparation is already assembled.
2. Demonstration pavements
   Since MDOT has not placed a material number of tire rubber-modified pavements in the last 25 years, MDOT will want to evaluate a few test/demonstration pavements before releasing a full specification. Through the use of a provisional specification and a value engineering process, MDOT can phase in the rate of early technology deployment while the agency accumulates the last information necessary for a full, state-wide specification.
3. Construction of a supply chain
   Individual asphalt plants will either have to obtain or repurpose equipment to feed ECR into their mix production process. Asphalt producers will be more likely to invest in repurposed or new equipment when they see evidence of opportunity (market demand and margin) and bid pricing advantages. There are creative financial and funding tools that can be applied to accelerate this process. These tools might include support from the State Used Tire Cleanup and Recycling Fund, but it will require time to move the producer market forward. As a stopgap measure, feeder machines are available for rent from various companies. This allows the producer an opportunity to work with ECR modification before making a commitment to purchase capital equipment.
4. Training of the engineering community

Training on new technology application and operation will be required for a number of different groups:

- Specifying and regulatory communities: on-line and in-person training is available to support this effort.
- Plant operations personnel: training is helpful during the first use of the technology, and ECR providers typically offer those services.
- Plant quality engineers: training is helpful during the first use of the technology, and ECR providers typically offer those services.
- Field regulatory personnel: on-line and in-person training is available to support this effort.

Once a full specification is put in place at the state level, most road owners in the state will adopt it by default, as most road owners rely on MDOT specifications for their road construction and maintenance needs.

SUMMARY ECONOMIC AND ENVIRONMENTAL BENEFITS WITH TIRE RUBBER IN MARYLAND ASPHALT PAVEMENTS

The use of rubber in asphalt pavements has become more common throughout the US, and as a result, earlier engineering uncertainties have been successfully addressed. Although (much) earlier additions of tire rubber to asphalt binders did not work well and were not economically competitive (Pre 1995), dry process rubber mix modification now offers both the performance and economics that permit the use of recycled tire rubber in asphalt a viable tool for the paving industry. If that technology is adopted in Maryland, the potential benefits should include:

- Economic Benefits
    - Heavy traffic roads: annual savings in several million dollars in modification costs when fully deployed.
    - Lighter traffic roads: multimillion dollar savings due to extended road life and/or reduced pavement thickness when fully deployed.
    - Increased recyclable materials in mix designs (lower cost mixes)
    - A 5-15% improvement in pavement skid resistance (fewer accidents)
- Environmental Benefits
    - Pavement life extension: less road reconstruction and mining/processing/transport of construction materials.
    - Increased use of other recycled materials (RAP)
    - Future use of recycled tire rubber/beneficiation from the recycling of asphalt rubber in recycled asphalt pavements.
    - Reduced road noise
    - Reduction of GHG emissions and a host of related environmental and impact reductions (See Table 1).

Impact category	Impact of Rubberized road with respect to Conventional road
Climate change (kg CO_2 eq)	-34%
Ozone depletion (kg CFC-11 eq)	-38%
Human toxicity (kg 1,4-DB eq)	-27%
Photochemical oxidant form. (kg NMVOC eq)	-34%
Terrestrial acidification (kg SO_2 eq)	-35%
Freshwater eutrophication (kg P eq)	-20%
Terrestrial ecotoxicity (kg 1,4-DB eq)	-37%
Freshwater ecotoxicity (kg 1,4-DB eq)	-26%
Water depletion (m^3)	-30%
Fossil depletion (kg oil eq)	-37%

Table 1: Ancillary Environmental Benefits Caused by Rubber Modification of Standard Asphalt Pavements

SUMMARY COMMENTS

The contract held between MDOT and the public is and has been straightforward, and it includes the construction and maintenance of safe and cost-effective state-owned roads throughout the state. By extension, the MDOT specifications passed down to the county, city and town level influence the same safe and cost-effective roads to every level of government. With the growing pressures on the regional and global environment, that contract is evolving. US FHWA, The US EPA and national paving organizations all recognize that the paving industry has to include sustainable, low-carbon roads as a key goal in future pavement designs and construction projects.

For asphalt production and asphalt roads, there will be a number of process adjustments that can have an important impact on environmental impacts:

- Keeping aggregate stockpiles dry,
- Reduced haul distances between the quarries and the plant,
- Use of more recyclable materials in mix designs,
- Reduced asphalt binder use, and
- Extension of pavement life

Taken together, these improvements can reduce the environmental footprint of asphalt by more than 60%. The single greatest environmental impact reduction will come from extensions in road life.

Inclusion of rubber modifiers in asphalt will materially extend pavement life. The use of recycled scrap tire crumb rubber as a modifier is more cost-effective than traditional methods of rubber polymer modification. As such, the addition of scrap tire rubber as an asphalt mix modifier should be an important tool available to contractors through MDOT specifications.