
The Impacts of Federal and State Policies on Asphalt Rubber in the United States

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ABSTRACT. *In the United States policies of both the federal government and state agencies can and do impact the use of asphalt rubber (AR). These results vary; some policies can expansion of the use of AR, while other can be counterproductive to the use of asphalt rubber. This paper provides a historical perspective of these policies and impacts based on the authors 27 years of work experience in the scrap tire industry. This paper will also provide information on current federal and state policies and offer conclusions on and recommendations for policy decisions that can expand the use of asphalt rubber in the United States*

KEYWORDS: *Asphalt rubber, scrap tires, Federal Highway administration United States Congress, and state department of transportation.*

1. History of Asphalt Rubber

1.1 The Beginning

The first use of scrap tire rubber in asphalt rubber (AR) was in 1966, took place in Arizona and was done to enhance the performance and characteristics of asphalt binders. Tire rubber in asphalt binders was not intended to be solution for scrap tires, which

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in 1966 was neither recognized as a problem nor had a market infrastructure. The initial use of tire rubber in AR preceded the ground rubber industry by 26 years. Intensions aside, however, the use of ground rubber in AR is a major market for scrap tires

1.2 Brief History of the Ground Rubber Marketplace

The initial source of ground tire rubber came from the tire retreading industry, which created 'buffing' when a retreadable tire had its remaining tread removed. These 'buffings' were collected, cleaned, packaged and sold to a series of end use markets. There are about 250 million pounds of tire buffings generated annually in the United States, which met the demand for ground tire rubber until 1992.

The scrap tire industry was created in 1986 when the state of Minnesota was first to enacted legislation and regulations specific to scrap tires. Up until those regulations were enacted it was legal to dispose of scrap tires in landfills or place scrap tire into stockpiles. By 1991 48 states has enacted legislation and regulations on scrap tires, most of which banned scrap tires from being disposed of in landfills and banned the stockpiling of scrap tires. If an entrepreneur wanted to collect and process scrap tires they needed to prove to the regulatory community that they had an end use market for whatever form of tire-derived product they manufactured.

In 1992 the demand for ground tire rubber exceeded the supply of tire buffings and other non-tire rubber materials available on the market. From 1992 through 1996 there was a dramatic increase in both the number of companies engaged in producing ground tire rubber and the amount of ground tire rubber available on the market. The main target market of the ground rubber market was AR, which was viewed by many as the solution to the scrap tire problem

The scrap tire marketplace is unique among all secondary (recyclable) materials because the supply of scrap tires is abundant and there is sufficient processing capacity for that supply. All other secondary materials (i.e., glass, plastics, paper, cardboard) are harder to collect than scrap tires and there was not sufficient processing capacity for these materials. The other and very significant difference between scrap tires and these other materials is that these other secondary materials all have end use markets to send their materials to. Consequently, supply-side economics and supply-side oriented policies were successful in increasing the collection,

processing and ultimately, the increasing the rate at which these other secondary materials were recycled.

That is not the case with scrap tires, which are a demand-pull material. During the formative stages of the scrap tire industry many state scrap tire development programs were focus on increasing the production capacity for scrap tires. This unfortunately caused a very serious over capacity situation, which resulted in a market correction for the ground rubber producers in 1996.

While AR was the predominant end use market for ground rubber in the 1990's, in 1998 other ground rubber markets were beginning to have a presence in the marketplace and began to use ground tire rubber. The use of processed tire rubber as a playground cover, as an infill in synthetic sport surfaces and as a component in non-dynamic automotive parts. Starting in 2000 scrap tire processing technology was able to make commercially available ultra-fine ground rubber, which is now used into paints and coatings. The use of larger-sized processed tire rubber is also finding a viable market as mulch, which is used in horticultural applications

2. Regulatory Framework in the United States

2.1 The Federal Government

The Federal government does not issue permits for the use of scrap tires nor do they provide any regulatory requirement for the management of scrap tires. That is the responsible of state regulatory agencies. The Federal government, through the Environmental Protection Agency (EPA) issues statutes which sets thresholds for air emissions from the combustion of fuels and waste materials, defines what solid waste is & what is defined as fuel, for the purpose of the Clean Air Act Amendment and sets water discharge standards for acceptable leaching limits.

The Federal Highway Administration (FHWA) has the responsibility for managing all federally funded roads. This is achieved through payment by FHWA to state department of transportations (DOTs) for the construction, care and maintenance of these federally funded roads. FHWA can set construction standards or performance requirements which the state DOTs must comply with in order to continue receiving these funds. The FHWA receives its funding from the United States Congress, which can place conditions onto the funding which it provides.

2.2The Federal Mandate

In December 1991 the United States Congress enacted the Intermodal Surface Transportation Efficiency Act (ISTEA) which included a mandate instructing all state DOTs to use a prescribed amount of AR in the federally funded road in their states. Beginning in 1993 all state DOTs were required to use AR in five percent of their federally funded road. The mandated level was to increase to 10 percent in 1994, 15 percent in 1995 and 20 percent in 1996 and was to be maintained at the 20 percent level in perpetuity.

The Federal mandate was not well received by the paving industry nor any of the state DOTs because of a series of factors. In 1991 there was not a sufficient amount of ground tire rubber available. The AR technology was still under patent protection, which precluded states from using the technology. Furthermore, the use of AR was limited to two states at that time, so the technology was not well understood and was viewed, mistakenly, as a paving technology that was limited only to hot climates.

The underlying reason for the Federal mandate had less to do with the benefits of AR than as an effort to stop the use of tires as a source of fuel. This author had direct discussion with the Senate staff responsible for the creation of the mandate, and found out that there was no discussion concerning the mandate or it's impacts with either the paving community or the state DOTs. Consequently the reaction from the paving community and DOTs was one of condemnation of the mandate and intense resentment of the mandate and the use of AR. The impact on AR was dire and long-term. While AR was being used in six states the other 44 states held and maintained an unfavorable bias against AR, which held back the expansion of this beneficial technology.

Although state DOTs harbored resentment against the mandate and AR many scrap tire entrepreneurs believed that the mandate would create immense demand for ground tire rubber, which was the prime cause for the dramatic increase in construction of ground rubber production facilities and the increased production of ground

tire rubber. In 1993 Congress repealed the section of ISTEA that contained the mandate, which ended the controversy about the mandate and the use of AR, although not the resentment against AR. The Federal mandate failed to increase the use of AR, although there were many studies undertaken to address the many concerns about AR. While the advancement in knowledge about AR did provide answers for some of the obstacles to increased AR use the impact of the mandate on the ground rubber industry was the prime cause of overproduction of ground rubber and the loss of many ground rubber companies in 1996.

3. Changing Market Conditions

The use of modifiers in asphalt binders was relatively uncommon until the late 1990's. Consequently when a cost-benefit analysis was done comparing AR to non-modified asphalts the price differential was significant. It was also uncommon at that time for any state or federal agency to be advocating for the use of recycled materials in road/highway construction. Most state DOTs shunned the use of recycled materials in any form of road/highway construction, whose use was considered as building "linear landfills".

In 2002 the EPA and FHWA began programs to encourage the use of industrial and recycled materials in road/highway construction. EPA created the Resource Conservation Challenge (RCC) and FHWA began their Green Highway Partnership. It was also at that time that FHWA changed its policy on how states were to construct and maintain federally funded roads. FHWA ended their program of dictating how roads were to be constructed and replaced that policy with one which simply stated that federally roads had to meet a series of performance criteria. How this was to be accomplished was now the responsibility of the state DOT. These new programs converged to create new operational procedures and opportunities to get recycled materials into more roads.

4. State Policies and Asphalt Rubber

4.1. Technology based use versus politically driven use

The use of AR at the state level has, in general, been a function of one of two driving forces: the state DOT or the state agency responsible for scrap tire market development. Both driving forces can cause AR to be used, however observations of the difference state experiences clearly indicates that when the state DOT is the driving force the use of AR is sustainable.

The reasons for this difference can be attributed to any of three factors. First, decision makers and design engineers at state DOTs do not generally like to be told which materials they have to use. Most DOTs prefer to conduct research on the materials to be used and use specific materials for specific applications. Consequently when a DOT is approached by a state agency which would like to have AR used because it's a good market for scrap tire rubber DOTs generally find ways to undermine that effort.

Secondly, in some cases state market development agencies provide financial incentives for the use of AR. These incentives can either be in the form of a subsidy that will pay for the use of AR or the cost differential between AR and the product for which AR is replacing. This was the case in South Carolina, which also provided technical support for the use of AR. Observations of this approach are that AR will be use used as long as the subsidy and technical support are available, and will revert back to whatever was being used when the subsidy and technical support ends: as was the case in South Carolina.

In California AR is being subsidized by the state market development agency. There is also a mandate that sets a minimum

level of AR usage by the DOT. Observations of the California experience yield an interesting conclusion. The use of AR would likely continue close to the current level of usage with or without the subsidy, which is completely different than the experience in South Carolina. Furthermore the DOT's level of AR usage is slightly more than the mandated level, suggesting that the level of AR usage by the DOT was significant before the mandate was issued. The conclusion of the California experience is that the high level of AR usage in the state is more a function of the performance benefits of AR than the financial incentives, although the financial incentives are appreciated by the recipients.

The third reason for the difference is that when a DOT undertakes their own AR development program there is both ownership of that program and the knowledge that the use of AR is being developed for a specific application, based on its technical merits. Consequently a DOT will continue to use AR without the need for financial incentives or policy goals. Table 1 provides a synopsis of various state experiences with AR.

Table 1. States Using AR

State	Driver	Program	Status of AR use
Arizona	DOT	AR invented by DOT engineer. Became widely used maintenance material. Now accepted construction practice	Ongoing & stable
California	DOT/state	DOT tested &	Largest user of

	agency	approved AR, use of AR is routine. State agency has grant program for AR. State issued mandate to DOT for AR use; use of AR slightly greater than mandated levels	AR; DOT. Mandate has had minimal impact on use since DOT uses AR regularly. Grants for AR use has expanded markets for AR; grants probably not necessary but counties enjoy financial assistance
Colorado	State agency	Early stages of market development: DOT has not expressed interest in AR	Unlikely to be major AR user
Florida	DOT	Early adaptor of AR. DOT has experimented with AR-polymer blends. Has settled on revised polymer blends	Constant use in defined applications
Georgia	DOT	Has begun to test and use	Likely to have gradual

		wide range of recycled materials: AR is one of many. DOT has been pleased with results	increase in AR use
Louisiana	University	State university has led effort to test AR for local conditions. Results favorable	Likely to have increased use of AR
Massachusetts	DOT	DOT began AR use on limited basis: found defined applications for AR	Limited but steady use of AR
Nebraska	DOT	DOT engineer started AR program; got AR specifications approved. Continues to use & champion AR	Gradual increase in AR use is expected
New Jersey	DOT	DOT ran tests on AR; results were favorable	AR use is increasing; expect continued increase

New York	State agency	State agency wanted DOT to use AR & provided grant for testing. Results were unfavorable	Use of AR unlikely
Rhode Island	DOT	DOT began AR use on limited basis: found defined applications for AR	Use of AR likely to continue
South Carolina	State agency	State provided cost difference for AR and technical assistance to counties. When grant & technical assistance ended so did the use of AR	Unlikely to have any significant use of AR
Texas	DOT	DOT began program to use recycled materials in road construction. AR one of several materials tested AR; results	Use of AR is significant and expected to increase.

		were favorable.	
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5. New Political Realities

5.1. Changing priorities

Twenty years ago the concept of using recyclable materials in road construction was an anathema for the road construction industry and state DOTs. Today there are a series of federal, state, county and industrial programs that are focused on using recycled materials in all forms of road construction.

The FHWA started this transformation when they introduced the Green Highway Partnership, an effort to encourage state DOTs to use recycled materials in road construction. FHWA is now developing their INVEST program which will further stimulate sustainable highway systems. The American Association of State Highway Transportation Officials (AASHTO), the association representing state DOTs has an active committee on sustainable construction. The Recycled Materials Resource Center (RMRC) is working with state DOTs to develop specifications for recycled, industrial materials in road construction, while the Industrial Resources Council, an association representing the six industrial materials that are priority materials for both FHWA and EPA is actively working with FHWA and state DOTs to provide technical information on these materials. Finally, the American Public Works Association, the association representing county departments of public works has a sustainable construction effort as well.

The efforts of these organizations are being driven by larger issues, such as the national effort to reduce road construction's carbon footprint and green house gases. Additionally state DOTs are moving towards increased use of recycled and industrial materials as a way to show their commitment to these concerns. While state

DOTs and county's are encouraged to use these materials, and receive awards for continued and expanded applications of these materials the underlying driving factor is cost related.

The costs and availability of many construction materials is causing states and counties to reassess their construction practices, national and state policies notwithstanding. In the case of AR the increasing cost of asphalt and certain asphalt modifiers is creating a window of opportunity that if taken advantage of could dramatically increase the amount of AR used in the United States.

6. Conclusions & Recommendations

6.1. Conclusions

Federal and state policies can and do have an impact on the use of asphalt rubber in the United States. In some cases these policies are specific to asphalt rubber, such as mandates, financial incentives or programs from state market development agencies. The history of these programs indicate that such policies generally do not create a self-sustaining AR market.

When a state DOT takes it upon themselves to study and use AR the level of AR use increases and becomes self-sustaining.

Federal and state policies which are directed at national issues, such as encouraging the use of recycled or industrial materials in road construction, reduction of green house gases and/or the carbon footprint, have an indirect but significant impact on the potential use of asphalt rubber. These policies tend to incentivize states and counties to research alternative construction practices, which presents opportunities for the use of asphalt rubber.

While these policies create opportunities for AR and other recycled content materials the most significant driving factor that can increase the use of AR is the cost of competing construction materials. With the increased cost of petroleum, and subsequently increased

cost of asphalt and petroleum-based modifiers, AR can be offered as a material with many benefits.

6.2 Recommendations

Efforts must be continued to further document AR's ability to reduce green house gases and a construction project's carbon footprint.

The AR industry, ground rubber industry and state market development agencies should be coordinating efforts to approach state DOTs and county departments of public works with information on AR's unique combination of cost savings, performance characteristics, recycled content and ability to reduce green house gases and the carbon footprint of the construction project.

Efforts by industry should be directed at getting AR specifications into the accepted construction practices of all states and coordinate efforts with the federal, state and county organizations which are encouraging the use of recycled and industrial materials in road construction. It will be through these coordinated efforts that AR can be presented as a product that can satisfy the policy driven ends, and will ultimately result in the realization that AR is also a material that can be used solely because it provides the performance characteristics needed to get the job done.

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