



From Roofs to Roads

The business of adding recycled asphalt shingles (RAS) to your hot-mix.

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Introduction

This past year has brought many challenges to our industry. It has forced us to rethink how we do business. But the good thing about challenges is they spark ideas. Ideas lead to innovation and innovation leads to new and better ways of doing things. No one would have thought two years ago you'd be fractionating your RAP into multiple bins, storing very large amounts of liquid asphalt at your facility, adding warm-mix additives to your mix or retro-fitting your HMA plant for warm-mix.

But here we are, and times have changed. And you as an industry have been key in driving these changes. The way we do business has changed to reflect the growing concerns of our economy as well as our environment. That's where recycling of asphalt shingles comes in as not only an economically viable addition to our hot-mix toolbox, but an environmentally conscientious change that can benefit everyone.

History

The practice of recycling asphalt shingles into HMA has had a slow and steady growth but has gained more momentum in recent years. Its beginnings date back to the mid 1980's in Florida but didn't arrive in Texas until 1997. Duinck Brothers placed two test sections on SH 31 just outside Corsicana, one with manufactured waste shingles and one with post consumer or tear-off shingles. The important facts here are: it was the first project built in Texas; the performance was very good compared to the control section and along with some previous research, it established some specification parameters that are still applicable today. Most importantly, states that do allow shingles will allow up to 5% in their HMA and require the material to be processed down to 1/2 inch or less.

Modern economics tells us there are only three ways to increase the value of a product; make it faster, build it cheaper or make it better. So where is the value? Well, asphalt shingles provide a significant source of liquid asphalt for HMA. Greater than 20% in most cases. So, what else is in a shingle? Besides a high quality asphalt binder, there is hard fine aggregate, mineral filler, polymers and fibers (either fiberglass or organic felt). With over 11 million tons of waste produced each year from asphalt roofing shingles and less than 5% of that being recycled, there's a lot of good material that's being buried in the ground each year.

Several benefits of recycling asphalt shingles include:

- an economic cost savings on the price of hot-mix,
- an increase in the strength and stiffness of HMA mixes from the fibers and polymers in RAS,
- conservation of raw materials required for mixes and
- a reduction in the consumption of landfill space.

Uses of recycled asphalt shingles include:

- hot-mix asphalt,
- cold mix and patching mix,
- dust control for unpaved roads and
- fuel for cement plants.

Regulatory Compliance

One of the hurdles in gaining acceptance to use recycled asphalt shingles is satisfying the regulatory agency requirements imposed on the process. The Texas Commission On Environmental Quality (TCEQ) has oversight and authority for allowing and regulating the use of recycled shingles. In fact, TCEQ did not allow recycled shingles to be used in HMA officially until 2006, almost 9 years after the Corsicana project was placed.

TCEQ issued a memorandum in March of 2006 to authorize the use of recycled asphalt shingles in HMA, but allowed manufactured waste shingles only. The memorandum allowed a maximum of 15% RAS in the mix, which based on research, was probably too much, but it opened the door to allow shingle manufacturers an opportunity to have their waste recycled instead of being landfilled.

In reference to post consumer shingles or “tear-offs,” TCEQ still had concerns of the possibility of shingles containing asbestos. The use of tear-offs has other challenges, as well. There is the increased cost and time of processing. They usually contain various contaminants; nails, wood, demolition debris, household refuse, and in very rare occasions, asbestos. Although the use of asbestos in the manufacturing of asphalt shingles was phased out in the late 1970’s, the possible presence of asbestos has still been the primary environmental concern and slow growth associated with recycling of asphalt shingles.

Working through many of those issues, TCEQ has now given the authority (pending final approval) to allow recycled shingles from both manufactured waste and tear-offs in hot-mix asphalt. So what will they expect?

- The memorandum will allow a maximum of 5% shingles in hot-mix, either manufactured waste or tear-offs. The tear-offs however, will only be allowed from residential structures, not commercial tear-offs. [There are many different materials that go into commercial roofs that cause environmental concerns for regulatory agencies.]
- The authorization to use RAS in a HMA plant does not include the processing and sizing of shingles. A specific air quality authorization for processing and sizing operations will be required. Please contact the TCEQ Air Permits Division to determine the type of authorization required.
- The use of RAS is limited to HMA plants using counter-flow drum dryers, which also includes double-barrel drums. This has to do with limiting the possibility of increased air emissions.
- Tear-off asphalt shingles have to be inspected by a certified asbestos inspector to ensure no asbestos is present.
- The amount of deleterious material in the RAS must be less than 1.5%. This includes anything that is not part of the shingle.

Statewide Special Provision

There is also a new TxDOT statewide special provision approved for Item 340 and 341. It allows a maximum of 5% processed shingle waste in HMA. It requires all material to be processed to a final size smaller than 1/2 inch. It limits the percentage of recycled binder to 35% for surface mixtures and 40% for non-surface mixtures. It also specifies the percentages of RAS combined with fractionated or un-fractionated RAP. More importantly with respect to proper processing, the amount of deleterious material in the RAS must be less than 1.5%. Sound familiar? Even state agencies can work together.

Shingle Type

Once the idea of adding recycled shingles into your hot-mix starts to sink in, the next decision is what type of shingle to use: manufactured waste or tear-offs. This will greatly influence most of the other decisions made downstream and define what that business model will look like. More than likely, that decision will be made for you, based on the location of your HMA plant and available sources for shingles. Shingle manufacturers in Texas are located primarily in the Dallas/Fort Worth area and the Houston area. Shingles are heavy; therefore, transportation costs are a key factor in the economic value of recycled shingles. Tear-off shingles are more readily available, but require more processing for use in hot-mix. This brings up the decision of processing: do you process the shingles or purchase them already processed?

Processing

A grinder, shredder or hammermill is normally used to process the shingles down to proper size. The RAS material can then be screened, and then blended with sand or RAP if needed to keep the material from sticking back together. Proper processing and sizing of shingle waste is critical to both the quality and consistency of the HMA product being produced. Know what you are getting and what you have. This applies if you're are processing your own shingles or getting them from a qualified recycler. If processing your own, check before and after processing to make sure the material meets all specifications and regulatory requirements. If you get processed shingles from a recycler, get all applicable paperwork to ensure the RAS meets the same specifications and regulatory requirements as above.

Design Considerations

Designing mixes with RAS is very similar to designing HMA with RAP. With RAS, it is a finer gradation, fibers and a lot more asphalt. Some tips for designing with RAS.

- Design volumetrics will drive the need to know what is in the shingles. Asphalt content varies with different shingle types, so be sure to check the AC content of your processed shingle stockpile.

- Gradation is also important because of the amount of fines in the RAS. Certain mixes are more conducive to RAS than others are. Mixes that incorporate a considerable amount of fines are more suited to incorporating RAS than those that do not.
- Consider starting with a softer binder. Recent studies have shown that adding 5% RAS is roughly equivalent to adding 20% RAP in terms of mix stiffness. Typically, both will result in one PG grade bump. Therefore, the mix will be stiffer. Granted, this may take some negotiating with the area engineer, but the results could lead to a better product long term and a cost savings as well.
- There have been some concerns with adding too much RAS to HMA may cause a mixture that is prone to pre-mature cracking. Ongoing research is still investigating the fatigue properties of these mixes.

Plant Production

Any time you put a new material through your hot-mix plant, it makes the plant operator a little nervous. There are adjustments to be made, such as temperature changes, gate adjustments, mixing time, etc. With RAS, it starts at the stockpile. A few tips about stockpiling.

- Do not build your stockpiles too big. Recycled shingles have a bad habit of sticking back together. This can happen quickly, especially in the summer heat. A good practice is to use what you process. If not, see the following bullet point.
- Pre-blend with other materials that will be used in the mix. Sand can help the processed shingles from sticking back together. RAP can also be used to keep the RAS from sticking back together.
- As with processing, a little water helps with dust control issues when moving material around. And it keeps the environmental folks happy too.

Paving Operations

“You can do what you want at the plant, but don’t mess with us out here on the road!” That seems to be the usual comment from the paving crew. Actually, things are not much different than normal for the crew on the road. However, it’s good to be aware that something different is going into the mix, so that when it doesn’t lay well or compact properly, you can give feedback to the quality control manager or plant operator.

- When the freshly laid mat looks as if it is in need of a shave, this isn't a good thing. It's usually an indication that the shingles aren't getting ground down to the proper size or there's a problem with the screening operations.
- If the crew notices an increase in mix stiffness behind the paver, a slight increase in mix temperature can help. A mix with a PG 64-22 binder will behave as if it has PG 70-22 or higher grade binder. Remember, the mix will be stiffer.

Final Thoughts

At TxDOT, we are not driving these changes. The HMA industry has been doing that for a while now. It is the same with TCEQ; environmental groups and construction materials recycling companies having been driving the recent change in their industry as well. But when several leaders in the HMA industry have been quoted as saying "Black; It's the new green," you know the two industries are about to merge on some common ground. And RAS is that common ground, a green technology that takes asphalt shingles out of the landfill and reuses them back into our pavements. The use of RAS conserves our resources and it is not only the smart thing to do; but it is the right thing to do.

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