



Asphalt Shingle Recycling In Massachusetts

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The following summarizes a study of the generation rates and markets for post-consumer asphalt shingles in Massachusetts. The project was undertaken as part of an ongoing effort to discover and develop markets for construction and demolition debris in service of greenGoat subscribers, who invest in evolutionary construction practices.

Each year, Massachusetts discards an estimated 210,344 tons of asphalt shingles¹. greenGoat found that the factors most influencing the rate of recycling are:

| Factor | Impact | Outcome |
|---------------------------------------|--|--|
| Performance of post-consumer material | Shingles generally last 20 years or more. Weather exposure decreases stone content and increases brittleness. Studies showed that the binding attribute of shingles was not diminished with time, although elasticity is (and is important for pavement). | Not significant in the usability of the resulting feedstock. "Recipe adjustments" have accommodated the effects of aging. |
| Purchasing practices | Making institutional buyers aware of post-consumer content products and its performance against competitors is a key factor in entering the market. Worth noting: Mass Highway has not seen post-industrial content being used in pavement, although the specification allows for it. The highway spec does not currently allow for post-consumer content in base or surface courses. | Highly significant. The next section focuses on the single largest buyer. |
| Predictable supply of feedstock | Established shingle recyclers have their own markets and are able to aggregate volume in order to supply companies with the needed volume. Many aggregate companies also produce pavement and have a contracting division, which allows them to leverage cost savings for state jobs. Longer term, shingle recycling becomes more the rule than the exception, and manufacturers will have the confidence to invest in post-consumer feedstock processing. | Less significant (but highly significant for shingle manufacturers). As long as the manufacturing process can adjust for volumes of post-consumer material in its 'recipe', this does not have to be a show stopper. |
| How material is de-installed | Unlike other types of renovation, this is largely a one-material (or two material) job. Source separation is relatively easy. If a laborer can tarp area to minimize yard waste, prevent trash from going into the load, all other contaminants (ice and water shield, shingle wrapping) are removed by MRF. The rest is ground into dust. | Significant. Source separation is easy, but this corner of the industry is veeery traditional, so change will come slowly. |
| The complexity of the material | Shingles are composed of asphalt, stone dust, an organic felt or fiberglass backing, and adhesive. Unfortunately, sorting shingles into product types so that they can be used as feedstock for new shingles is not cost effective. | Significant for manufacturers accepting the material. This is a longer-term consideration. |

¹ 10 million tons of *national* discards (<http://www.shinglerecycling.org/index.asp>) adjusted for Mass population of 6,218,770 compared to national population of 295,647,245, according to www.census.gov

| Factor | Impact | Outcome |
|---------------------------|---|---|
| Purity of product | <p>For a manufacturer, the enduring tick of the assembly line is everything. For a producer in any of the markets to accept post-consumer material, that material needs to meet certain specifications and be supplied in a predictable volume, which is difficult in a 'young' recycling loop.</p> <p>Most roofers interviewed think of greenGoat as a disposal option. Those who spend the time separating wood and flashing out of loads get a lower tip fee, and only asbestos-containing loads would be rejected² (or charged a higher rate). Most bids are based on known vendor relationships, and the incremental labor of source separation was not a known quantity.</p> | <p>Significant. Unless the load taken from the roofing job site meets the market specifications, it may be rejected (or accepted at a higher per ton rate).</p> <p>GreenGoat offered help in regard to roofers as an enticement to participate in the project and a way to train the crew so that recycling could become habit rather than anomaly.</p> |
| Availability of markets | <p>New England is a densely populated area, which attracts manufacturers, distributors, and vendors. The markets for shingles are: HMA (hot mix asphalt), aggregate road base, cold patch, erosion control, and fuel³. Currently, shingles are used only in private paving jobs locally. One shingle recycler, Rooftop Recycling (Boxborough, MA), has been in business since 2003, and Recycle America (Fitchburg, MA) went on line this year.</p> | <p>Highly significant. Recycling technology is ready, but only increased demand will provide the stimulus for competition and resulting cost efficiency.</p> |
| Price of virgin materials | <p>As petroleum prices rise, the prospect of post-consumer feedstock for a petroleum-based product becomes more attractive. And we see that in the last two years, two shingle recyclers have located in Massachusetts, which supports the theory.</p> | <p>Long term impact. Not only is the product itself petroleum-based, but transporting heavy virgin materials burns gasoline, which is increasingly expensive.</p> |
| Regulatory Incentives | <p>Mass DEP is preparing to ban asphalt shingles from landfills as soon as markets can 'handle' at least 75% of the current waste stream. Bans of certain materials go into effect this year. DEP runs task forces that encourage markets for materials that could be diverted at a higher rate in the future; asphalt shingles is one of those materials</p> | <p>Highly significant. The state is using both the carrot (see grant programs below) and the stick to drive waste diversion.</p> |
| Grant Programs | <p>State and federal funding, though competitive and underfunded, helps bring new ideas to the problem. Home Depot Foundation can be very proud to contribute in this area.</p> | <p>Moderately significant, but needs to be coupled with industry incentives affected to really take 'root'.</p> |

Markets

Although shingle manufacturers might provide a take back service, quality and dependability of the feedstock present obstacles. Most recent statistics indicate that annual production of shingles is about 13,000,000 tons⁴, of which 273,447 are probably sold in Massachusetts (if sales are weighted by population). If 10% feedstock was 'post-consumer', that would create a local market for 27,334 tons, not counted as a realistic near-term market (in our totals).

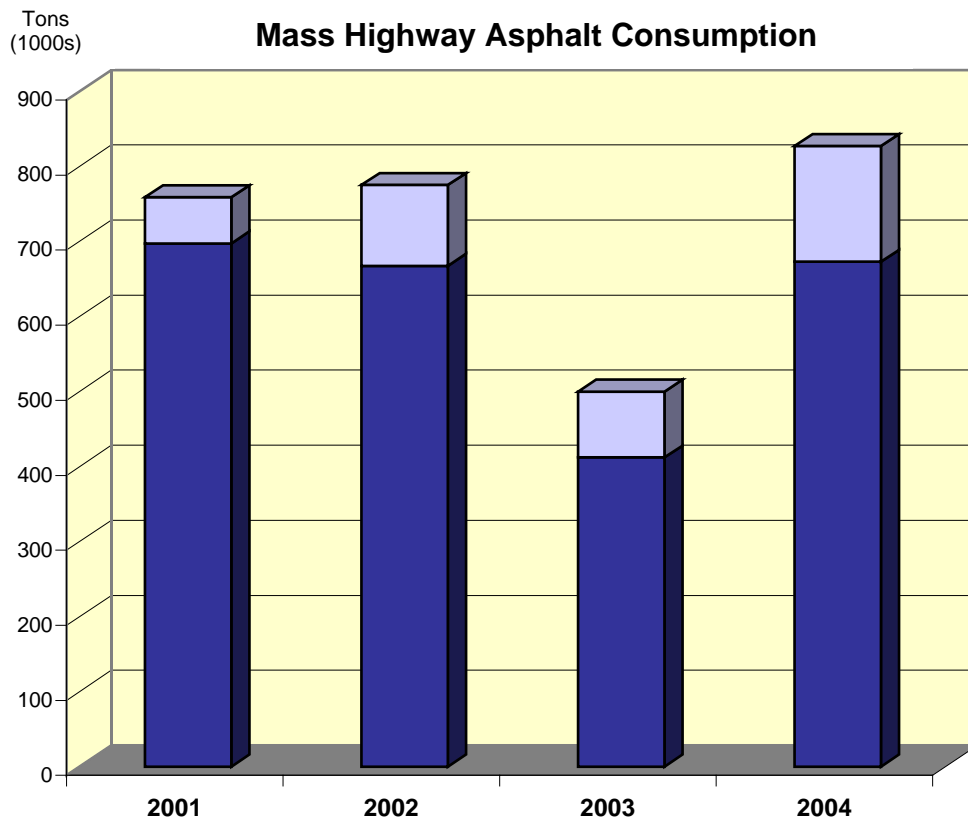
² Recyclers prefer roofers who do their own disposal, so that specifications can be reinforced upon delivery of the load

³ considered 'diversion' but not 'recycling' by the state of Massachusetts.

⁴ "Researching Debris Generation", *Recycling Today*, by Robert Brickner (8/29/01). [click to view article](#)

Of all markets studied, the most promising application was in road surface and base⁵. By far, the largest single buyer of asphalt is MassHighway. They resurface an average of 600 lane miles annually⁶, which translated into 826,530 tons of material last year. A cross-section of highway would reveal 8 inches of aggregate, 2 inches of base, and 2 inches of surface⁷. Shingles can be mixed into either the base or the surface (275,510 tons per year).

This means that MHD could potentially buy 27,551 tons of shingles per year, assuming the expansion of the current specification, which does allow for the inclusion of post-industrial shingle material in the base course. The following shows a four year trend in consumption:



MassHighway's specification is also used by municipalities, increasing its impact two-fold. Municipal roads are estimated to use twice as much asphalt mix per year⁸. That would expand the total market by 55,102, **bringing the total potential market to 82,653 tons.**

Waste Generation and Cost Savings

Department of Housing and Community Development (DHCD) approached greenGoat for an easy way to introduce resource management techniques to more their more extensive renovation projects. We began with roofing, because it suggests natural source separation. DHCD updated the specification for roofing jobs to list recyclers available to them.

⁵ "Researching Debris Generation", *Recycling Today*, by Robert Brickner (8/29/01). [click to view article](#)

⁶ Mass Highway FAQs [click here to view web page](#)

⁷ Minnesota DOT [view source](#), and "Massachusetts, Meet Superpave", by Jai Wallace. [view source](#)

⁸ "Cape Infrastructure is Old, Overburdened", Cape Cod Times, by Frederick Melo (07/05/03). [click to view article](#), which is supported by Chapter 90 spending (federal expenditures for municipal roadways) and the % of the budget that is spent on hot mix.

Although recycling was added to the specification as more of an option than a requirement, DHCD project management found that the incoming bids were clumped in two groups: recyclers and non-recyclers. Roofers that took the recycling option had decidedly lower disposal costs. It was easier for them to consider the project a disposal option, but in the end ... each roofer preferred to keep their disposal costs out of the study. As a result, we focused on the systemic supports (or obstacles) to further market development. The roofer reaction was indicative of the hiring agencies and protocol of working with the state.

In a study of the potential supply of shingles, greenGoat found that the vast majority of roofing companies have under 5 employees and under \$500,000 in annual sales. The following table shows the number of companies claiming SIC code 1761-09 (roofing contractors) in Massachusetts⁹, organized by annual sales:

| # EES | < \$500k | \$500k - \$1mm | \$1mm - \$2.5mm | \$2.5mm - \$5mm | \$5mm - \$10mm | \$10mm- \$20mm | \$20mm- \$50mm | \$50mm - \$100mm | \$100mm - \$500mm |
|---------|----------|----------------|-----------------|-----------------|----------------|----------------|----------------|------------------|-------------------|
| 1 - 4 | 764 | | | | | | | | |
| 5 - 9 | | 80 | 5 | | | | | | |
| 10-19 | | | 58 | | | | | | |
| 20 - 49 | | | 19 | 21 | | | 1 | | |
| 50 - 99 | | | | | 5 | | | | |
| 100-249 | | | | | | 1 | 1 | | |
| 250-499 | | | | | | | 1 | | |
| 1k - 5k | | | | | | | | | 1 |

Clearly, companies disposing of smaller volumes cannot negotiate volume disposal deals. As a result, most companies pay as much as \$115/ton in eastern Massachusetts. Recycling fees are about \$75/ton or \$85/ton *including transportation*. A big difference!

Do all savings roll uphill? Yes. Companies using the recycling option are able to submit lower bids, be more competitive, and ultimately save the state money on their roofing projects.

Material Analysis of Age and Weather¹⁰

Massachusetts rooftops see a variety of weather: very cold winters and very hot summers. The effects of age and weather can be seen in the table on below.

| Shingle type | 2002 Sales ¹¹ | Misc attributes | Weather | Aging |
|--|---|--|--|--|
| Organic felt backing (cellulose, wood fiber) | \$ 280,053 | Tear resistant | Less brittle in cold weather | Components break down, crack and curl. |
| Fiberglass felt backing | \$ 392,652 (225 lb) \$ 540,167 (other) \$ 932,819 (tot) | Lighter Cheaper (\$45-\$60/sq) | More cohesive in heat | Components break down, crack and curl. |
| Laminated Shingles | \$1,382,881 | Thicker More expensive (\$100/square) | More durable than traditional shingles | Slower break down |
| Roll roofing (organic) | \$ 387,561 | Similar to organic shingle | | → |
| Roll roofing (fiberglass) | \$ 182,728 | Similar to fiberglass-back shingle | | → |

⁹ Source: Reference USA Business Disc, Info USA Library Division, www.referenceusa.com

¹⁰ "Elements of Roof Repair", Canadian Home Workshop, by Martin Zibauer, [link to article](#)

¹¹ Asphalt Shingle and Coating Manufacturing: 2002 (issued January 2005), [link to report](#)

The material most suited to New England temperature swings needs to perform in both cold and hot weather. This is true for both shingles and pavement material. If the mixture contains too much binder, it softens in hot weather ... too little will become brittle and crack in extreme cold. For Mass Highway to accept shingles into pavement materials, additional testing of the 'recipes' used for surface and base courses would need to be done.

Reporting to State and Local Agencies

Most of the work needed to create markets for shingles is simple education and marketing. Most of the information shared in this report was readily available, but the very agencies that are charged with acting on the facts have little time (or funding) to compile them.

We interviewed various agencies to determine their piece of the statewide puzzle. The outcome of those conversations and what lies ahead follows:

| Agency | Impact | Interest | Next Step |
|---|---|--|--|
| Dept of Housing and Commun. Development | Manages state projects< \$20mm | <ul style="list-style-type: none"> Has a strong internal advocate Wants to build a protocol for C&D recycling, beginning with shingles Needs cost effective solution Cannot recommend vendors; can recommend methodology | Apply savings figures to estimated annual volumes. Present results to upper management. |
| Dept of Environmental Protection | Can recommend ban of certain materials from landfill | <ul style="list-style-type: none"> Needs to prove that there is a market for 75% of the waste stream Runs task force on asphalt shingles | Ongoing market development through Asphalt Shingle task force |
| Dept of Capital and Asset Mgmt | Manages state projects> \$20mm | <ul style="list-style-type: none"> Recently put construction reform through legislation, | Update roofing specifications for recycling option |
| Operational Services Division | Updates environmental alternatives to DCAM specs | <ul style="list-style-type: none"> Lists recycling alternatives in specification for roofing jobs | Update roofing specifications for recycling alternative to disposal |
| State Legislation | Legislative changes; approves budget | <ul style="list-style-type: none"> Certain legislators have a strong record on environmental issues Can navigate different agencies | Compile legislators' environmental records. Pat Jehlen to contact them. Also survey NCSL about past legislation. |
| Mass Highway | Designs pavement mixture for all state roads | <ul style="list-style-type: none"> Minimizing health risk due to foreign matter mixed in with pavement Needs cost effective solution | Phase II project to include tests of pavement with MHD test protocol |
| Mass Municipal Agency | Clearinghouse of info and activism for municipalities | <ul style="list-style-type: none"> Advocates for and administrates federal funding to the municipalities Collection point for Municipal-level data | Ongoing contact through state rep is planned |

Getting a commitment of resources for the next round of study is a critical next step. We broached the subject with simple objectives in mind: introduce the issue and raise awareness about the currently overlooked environmental potential of recycling shingles. The audience is still battling a perception that recycled content is riddled with quality issues¹², which we hope to dispel with more recent studies done in other states.

¹² "Roadworthy", Recycle Today, Bill Turley, 2/13/04. [view article](#)

Summary

Annual Market for Post-Consumer Shingles

- 82,653 tons, assuming 10% post-consumer shingles in road surface and base
- 27,334 tons, if shingles consumed in the state included 10% post-consumer content.
- A combined diversion of 47.5% of the estimated volume of shingles generated in the state.

State Shingle Recycling

- Dept of Housing and Community Development updated their roofing project specification to suggest recycling as a disposal option
- The specification listed greenGoat among the vendors offering recycling alternatives
- Ongoing analysis of cost impacts will be tabulated using DHCD numbers, and we will present findings to DHCD upper management on potential cost savings for the future

Effect of Age and Weather on Quality of Post-Consumer Shingles

- Added brittleness, loss of elasticity, and lower stone dust content as a result of exposure
- MN, MA and other states are using post-*industrial* (pre-consumer) shingles successfully
- Several other states are currently using or considering inclusion of post-consumer shingle
- Detailed survey of state usage practices will be pursued in Phase II of study.
- Economic report: "[What do the Cards Hold for the Asphalt Industry?](#)", by Nasreen Tasker.

Key Lessons

- Contractors have a practical view of recycling ... if it's cheaper than disposal, they'll do it.
- Never underestimate the 'domino effect' ... find someone who is doing what you want to do and figure out how they did it ... hence our growing file of other state approaches
- Who will benefit the most if the situation turns the way you want it to turn? In the end, the grant project work was market confirmation that the recyclers need to do anyway!
- Who are the other NGOs that may want to join forces for the study?

Acknowledgements

We'd like to thank the many organizations that shared their insights through extensive interviews:

The initial impetus for the study came from **Stan Kruszewski** of DHCD, who wanted to confirm the cost savings possible through recycling back to his team. Because the specification encourages roof bids to consider recycling, DHCD has seen a decrease in the disposal cost of roofing jobs as a result.

None of this would have been possible without the financial support of the **Home Depot Foundation**. We discovered that the roofing jobs done by the retail organization send a fair number of shingles to local recyclers, so Home Depot not only supports further study, but already practices what we preach.

Both shingle recyclers in Massachusetts had had critical input to this report. **Sean Anestis** of Rooftop Recycling shared war stories from his 18 months of experience, how they began, their testing protocol, their volume, and plans for expansion. **Ken Snow** of Recycle America shared experiences in starting up their operation, their capabilities, outlook, and markets.

We received great introductions from **Steve Long** at Massachusetts Department of Environmental Protection. **Pat Jehlen**, our state representative, was so willing to meet on a moment's notice and has given us great advice in our ongoing navigation of state agencies. **Leo Picard** at AAPA provided a 'sanity check' for the state-level numbers. **Phil Goddard** at The Towne of Bourne Landfill and **Greg Smith** of Cape Cod Commission helped get additional legislative support for the concept.

Plans for Phase II of the Study

The more Phase I revealed market, process, and potential ... the more Phase II ideas were generated. We are soliciting ideas from Phase I participants, and among those, greenGoat will:

- 1) Identify financial benefits of including post-consumer content in pavement under three scenarios: current levels of recycled material allowed by the Mass Highway specification, and comparable levels to other states currently using recycled material.
- 2) Identify other NGOs supporting analysis of including post-consumer content of road surface. Encourage them to join the team, either financially or in lobbying with other state agencies to support the study.
- 3) Identify Mass Highway's list of tests that need to be satisfied before post-consumer shingles will be considered for pavement feedstock. Identify the path to update the specification for post-consumer materials and take it (collaborating with Mass Highway)
- 4) Identify and secure a source of testing services for private paving jobs that have been done using post-consumer shingle pavement. Test the performance of material using the Mass Highway testing protocol.
- 5) Expand the scope of this local study nationwide, soliciting participation by the Federal Highway Administration. Compile a basic email distribution list of state-level pavement design engineers and distribute our Phase I findings.

greenGoat is soliciting philanthropic organizations for funding. If you or your organization would like to be a financial supporter of the study, contact us at thegoat@greengoat.org