Recycled Asphalt Shingles
Feasibility Report

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Clallam County Public Works

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Executive Summary

Diverting asphalt shingles from the landfill for recycling into hot mix asphalt has demonstrated benefits including the containment or reduction of paving costs and the advancement of sustainability directives. On the other hand, a recycled asphalt shingle (RAS) program may face challenges such as market fluctuations and organizational logistics. This analysis is intended to provide stakeholders with the background, resources, and a variety of scenarios that can be used to further discuss the merit of implementing a RAS program in Clallam County.

Introduction

Asphalt shingle waste is generated in Clallam County from roof installations and tear-offs from re-roofing. These asphalt shingles can be ground up and successfully recycled for road applications such as hot mix asphalt (HMA) pavement, cold patch and other uses. While national and regional markets are developing, enacting a RAS program in Clallam County holds opportunities and challenges both akin to the broader RAS industry, and characteristic of the local solid waste system.

Clallam County stakeholders have expressed continued interest in how a local RAS program might affect them and the Regional Solid Waste Export and Transfer system. A RAS program could help meet state and county solid waste targets, outlined in the Clallam County Comprehensive Solid Waste Management Plan (CSWMP) 2014 Update, to increase waste diversion and support local waste processing opportunities. Local roofing contractors are interested in seeing how asphalt shingle recycling could affect disposal costs for their businesses. Another important consideration is how a switch from disposal to recycling shingles would affect the operations budget at the Regional Transfer Station, which relies on tipping fees for a significant amount of funding.

Much research exists on RAS, particularly its use in HMA. The King County Solid Waste Division's Linkup Program (Linkup), dedicated to expanding markets for recycled materials, has compiled extensive research on its Asphalt Shingle Resources webpage including national and regional performance evaluations, best practices, study reports, and example specifications; experts are available through this program to assist counties with further research. Therefore, this report instead focuses on a brief assessment of local options regarding RAS, utilizing County-specific data where possible and interviews with relevant stakeholders.

Background

Recycling Asphalt Shingles: Use, Performance and Specifications

The cost of virgin asphalt binder has increased significantly compared to recycled asphalt binder, making recycled asphalt an increasingly valuable component in the production of Hot Mix Asphalt (HMA). Reclaimed asphalt pavement (RAP) is used at a higher percentage by weight due to differences in binder properties; RAP is often an abundant byproduct of HMA producers' activities, therefore competing with RAS. However, RAS contains much more asphalt binder which replaces the costly virgin binder, and so has more significant cost savings benefits by weight. RAP has been used effectively at 15-20 percent of the HMA by weight, though many states are developing specifications or procedures for the use of RAS ranging between 3-8 percent by weight.

Studies have demonstrated comparable or improved performance standards in pavement containing RAS. National and state studies have prompted the Washington State Department of Transportation's (WSDOT) 2014 Construction General Special Provisions (GSPs), in Division 5 Surface Treatments and Pavements to include specifications for RAS on state roadways. Other state agencies including King County Roads Division, Solid Waste Division and Metro Transit, and City of Bellevue are using RAS in paving projects; King County is developing an HMA specification which will likely include RAS at 3% and RAP at 15% and will not require the significant amount of material and mix testing that is required under the WSDOT GSP.

Markets

The RAS market is still developing, including collection and processing infrastructure, end use markets, and ease of regional specifications. As recycling of asphalt shingles moves forward, it is imperative to confirm that recyclers are both successfully processing and distributing their end-products in solid markets. Especially in new markets, infrastructure can shift, reducing options for recycling and requiring another approach.

To strengthen the end use market, jurisdictions can require RAS on one or more projects, and include RAS as permissible in bid requests. An alternative bid (Krivit 2002) for RAS-containing HMA could turn out to be the cheaper option.

There are a small number of shingle recyclers in the region. Evergreen Shingle Recycling (Evergreen) in Woodinville is currently the closest and least expensive shingle recycler for Clallam County. Evergreen accepts shingles with metal and felt attached at $65 per ton. Loads that are rejected due to contamination (excess wood, garbage or other material as defined by the recycler) would cost $125/ton. The closest HMA producer in Clallam County is Lakeside Industries, located in Port Angeles. Lakeside Industries' Clallam County plant doesn't currently recycle asphalt shingles or use RAS; but they do utilize RAP in their HMA mix. However, four of Lakeside Industries other plants in Western Washington does use RAS, demonstrating an investment in this material by one of the biggest HMA producers in the state.

Amount produced in Clallam

The amount of asphalt shingle waste produced in Clallam County ranges from 700 to 1261 tons per year, based on analysis of sources described below. Re-roofs producing shingle waste occurs most heavily from June to October; shingle waste could expected to be generated at about 140 to 250 tons per month during that time.

The City of Port Angeles Solid Waste Division staff, responsible for the Regional Transfer Station operations, tracked about 700 tons of asphalt shingles crossing the scales each year. The City of Port Angeles Department of Community and Economic Development estimates that for the average 1,814 square foot home re-roofed in Port Angeles, 4,450 lbs. (nearly 2.5 tons) of tear-off asphalt shingles are generated. An average of 123 roofs of all building types was re-roofed in Port Angeles since 2009, representing over 300 tons of shingle waste from Port Angeles every year.

Clallam County and Tribal Lands do not issue permits for re-roofs; so estimates of shingle waste generated in the rest of the county are not presented here. Table 1-1 shown on page 4, estimating

weights of RAS based on a building's square footage, could be used to derive estimates using data compiled by local roofing contractors.

Table 1-1: Weight Estimates of RAS Material per Square Footage of Home

Square Footage of Home	1000	1500	2000	2500
Asphalt bundles (75 lb ea.)	30	45	60	75
Felt rolls (40 lb/ea.)	10	15	20	25
Total weight	2650 lbs/ 1.325 tons	3975 lbs/ 2 tons	5300 lbs/ 2.65 tons	6625 lbs/ 3.312 tons

Source: Waste Connections, Inc. 2014.

The last waste characterization study at the Regional Transfer Station was the 2010 Waste Characterization Study by the Department of Ecology (Ecology) which tracked approximately 1,261 tons of asphalt shingles in the study area representing Clallam County (Ecology 2010). Common estimates put roof waste weight at 3-5 tons per roof; which supports the larger estimates tracked in the Ecology study.

Analysis

Recycling Options

Based on the information presented in the previous sections, four general options for recycling asphalt shingles that will be presented here. These options are: 1) purchasing a shingle grinding machine for the County or region; 2) public collection and hauling of shingles to a recycler; 3) private collection and hauling of shingles to a recycler; and 4) contracting with a mobile grinder to recycle shingles within the County or region. Temporary, undercover storage at a private or public site in the County would be a necessary consideration for all options. Regional partnerships could also be considered (for instance, with Jefferson County) to increase economies of scale. General costs, logistics, and other factors for consideration for each of these options will be presented in the following sections.

a) Shingle grinding machine

The average cost of a shingle grinding machine is $500,000, with installation bringing initial investment to $1 million. Preliminary research by the City of Port Angeles Department of Community and Economic Development suggests a minimum tonnage amount of 10-20,000 tons of shingles needed for a positive return on investment (ROI); 10-20 times the amount estimated to be disposed of in Clallam County in a year.

b) Public collection and hauling of shingles to a recycler

Only a few materials are currently recycled by public entities in Clallam County: metals, and tires. All other recyclables collected in the county are handled by private companies under contract through the Regional Solid Waste Export and Transfer System (System). The public sites operating under this System are the Regional and Blue Mountain Transfer Stations. A cost analysis of RAS recycling at the Regional Transfer Station is included below; other public sites were not identified in this analysis but could be a potential option for public collection of RAS.

Using the costs identified in the Markets section above, the comparison between disposal and recycling of shingles from an average roofing job (2.5 tons) are estimated below.

Disposal at regional transfer station at current tipping fee:	2.5 Tons @ $170 =		$425.00
Disposal of acceptable RAS at Evergreen:			
Transfer ops/fixed costs:	2.5 tons @ $35 =	$87.50	
Transportation Costs:	2.5 tons @ $32 =	$80.00	
Disposal Cost at Evergreen:	2.5 tons @ $65 =	$162.50	
Total Recycling Cost:			$330.00
Net Savings from recycling:			**$95.00**

Significant challenges to using the Regional Transfer Station have also been identified by various stakeholders. These include:

1) **Space.** Current operations utilize most of the covered space at the Transfer Station. Also, in the case of equipment breakdown, space availability becomes further hindered. Space limits could potentially be addressed with tighter scheduling of operations, and possibly depend on contract negotiations.
2) **Current solid waste contracts.** Negotiations may be necessary may impede collection of shingles to a recycler and
3) **Transportation costs.** Transportation costs may be extremely variable depending on load weight and fuel prices. The $32/ton estimate provided by Waste Connections, Inc. would be amended if negotiations were entered with them for RAS hauling.
4) **Contaminated loads.** Rejection of loads at the Evergreen facility raises the tipping fee from $65 to $125 ton. Evergreen's standards for acceptable RAS would have to be met by the party bringing the original load to the Transfer Station (e.g. roofer). Rejected loads would add $150 per roofing job to the cost, wiping out recycling savings; thus loads would have to be monitored by Transfer Station staff and be charged full tipping fee if contaminated.

c) Private collection and hauling of shingles to a recycler

Another scenario for recycling asphalt shingles is an organization or group such as regional roofers, make arrangements for private collection and hauling to a recycler. Private haulers such as Waste Connections, Inc., may be able to offer a lower operations and fixed costs (e.g. collections and storage) than those incurred under the System.

Some of the challenges identified above would also need to be addressed in this scenario. Transportation costs and the potential for rejected loads may affect the actual savings. Space for collection and storage and a hauler would need to be identified and could also impact the gain in savings for recycling.

d) Contracting with a mobile grinder to recycle shingles onsite

Maximizing the end use of RAS is a critical part of ensuring a continued demand for the asphalt shingles being recycled. Grinding shingles onsite for local HMA production is a viable alternative to purchasing a costly grinding machine; and could potentially lower transportation costs. A conversation with Dave Bell at Lakeside Industries, Inc., confirmed Lakeside's willingness to further

discuss options regarding the use of the mobile grinder for onsite processing of RAS. The local Lakeside manager had been previously contacted about also collecting and utilizing RAS at the Port Angeles facility, although those discussions have been stalled. As one of the County's more frequent paving bid winners, market support could again be buoyed through RAS requirements in County contracts.

Conclusion & Recommendations

The economic and environmental value of RAS is very promising, though collective effort is needed to move forward regional markets and processing of RAS. To carry out solid waste mandates and answer the interests of constituents, Clallam County can further investigate some of the potential actions discussed in this report. One action would be to include a RAS specification in one or more County contracts, stimulating regional and potentially local markets for RAS. As well, the options for asphalt shingle recycling presented for analysis can be used to engage stakeholders in discussions on the challenges and opportunities for recycling asphalt shingles in Clallam County.

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