LET ME SHINGLE YOUR ROADWAY

Interim Report
for
Iowa DOT
Research Project HR-2079

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DISCLAIMER

ABSTRACT

Approximately ten million tons of waste bituminous roofing are torn off annually in the United States. This volume is a major factor in the rapid filling of landfills. In 1995, Benton County, Iowa initiated a program to cost effectively recycle torn off waste shingles. Nine hundred tons of waste shingles were ground using a Maxigrind. A magnetic roller on the discharge conveyor removed most of the nails.

Three hundred tons of the ground waste shingles were blade mixed into 0.5 km (0.3 mi) of a crushed stone granular surfaced Benton County rural secondary roadway. A magnet attached to the motor grader removed another 1/3 kg (¾ lb) of nails during the spreading and mixing operation on the 0.5 km (0.3 mi.) section of roadway.

The bitumen of the waste shingles is very effective in providing a dust free granular surfaced roadway. It remains relatively dust free two years after treatment.

KEY WORDS: Waste materials
Recycling
Roof shingles
Dust control

INTRODUCTION

In recent years, there has been substantial emphasis on processes to utilize waste tires. Much of this emphasis is based on the 2.5 million tons of scrap tires discarded annually in the U.S. It is estimated that 10 million tons of "tear off" waste roofing material are generated annually in the U.S. (1). Based on volume, waste roofing material is a much bigger problem than scrap tires. It is estimated that 130,000 tons of waste shingles go into Iowa landfills annually.

Bituminous shingles contain approximately 30% asphalt cement binder. As is often the case, it has been suggested that waste shingles could be used in asphalt concrete. This may be a feasible way to utilize waste shingles, but often they contain foreign material that may reduce the quality of the pavement.

This paper explores another cost effective method of recycling waste shingles. In 1995, Gerald Petermeier, the Benton County Engineer, (also coauthor of this paper) decided to use waste shingles for dust control on rural granular surfaced roadways.

ENVIRONMENTAL CONCERNS

Bituminous shingles manufactured after 1973 pose no environmental problem. Unfortunately, asbestos fibers were used in a very small percentage of bituminous shingles produced between 1940 and 1973. The Iowa DOT is required to test all materials that possibly contain asbestos on properties obtained for right-of-way. Since 1994, we have conducted 368 tests of bituminous

shingles with three showing asbestos. This is 0.8%, so there is some, but it is relatively rare. Bituminous shingles containing asbestos have relatively low contents of this material present, usually less than 20% and typically two to three percent.

On roof openings the blackjack sealant material around pipes and chimneys quite often contains asbestos, but there is usually a very small amount of this.

Benton County is very concerned with protecting the health and well being of Benton County residents and will exercise care to avoid the risk of generating hazardous asbestos dust. As shown above, there is a very small amount of asbestos in bituminous shingles. What little asbestos is present is encapsulated in asphalt cement. We initially believed that if the roadway remained dust free, there would be no airborne asbestos. Environmental experts claim that asbestos is very buoyant in air and could be carried even if there is very little visible dust. This has now changed our approach.

The United States Environmental Protection Agency (EPA) of Region VII in Kansas City issued a letter in early 1996 in response to an inquiry from a Keosauqua, Iowa firm planning on recycling waste shingles. This letter noted that the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation identifies and controls asbestos-containing materials (ACM). In that letter, EPA stated that asphalt shingles coming from residential buildings having four or fewer units would be exempt from NESHAP and would not require asbestos analysis before being used

in roadway projects. This exception is for waste coming from the renovation or demolition of structures which do not constitute a facility (i.e., residential buildings having four or fewer dwelling units). EPA did state that asphalt shingles from a "facility" requires sampling and analysis for asbestos content. Any material containing greater than 1% asbestos cannot be used for roadways.

An April 1996 correspondence from the Iowa Department of Natural Resources (DNR) stated a guideline advisory for landfills. "Landfills are prohibited from accepting any shingle wastes that will be crushed, broken or ground on-site per federal NESHAP regulations....unless the generator or hauler provides lab certification that the shingle waste do not have asbestos-containing material in them." The correspondence goes on to state that if the shingle wastes are not certified (in regard to asbestos), they may be accepted for disposal in a separate working area of the landfill. This communication would, therefore, prohibit any recycling, productive use of the 600 tons of ground shingles remaining on the landfill from the 1995 grinding operation or the 300 tons of unground shingles that were to have been ground in the spring of 1996. In 1997, the Iowa Department of Natural Resources granted Benton County a permit to use both the 600 ton and 300 ton if tests of the ground material show that it did not contain asbestos. Subsequent testing showed both piles to be free of asbestos contamination and Benton County has used both for dust control.

Because of the remaining slight possibility of a health hazard due to asbestos, in July 1997 Benton County decided to have the shingles tested before grinding. They will be using a certification form (Figure 1) to ensure that the shingles are from roofs that are not NESHAP regulated. NESHAP regulated shingles will be disposed of in the landfill. NESHAP regulations require a sampling frequency by licensed personnel and other things that the Benton County plan would not conform to. Under NESHAP regulations sampling is to be done before the shingles are removed from the roof. It is the opinion of the authors that this would be very difficult to achieve.

Benton County has decided to pile all roofing material from one building (not NESHAP regulated) in one numbered pile. A core sample including all layers of material will be taken from the debris pile and submitted to an asbestos laboratory for testing. The numbered building pile will be kept separate until the results of asbestos testing have been obtained. Upon receipt of asbestos test results, any pile showing asbestos contamination will be buried in the landfill. Piles that are free of asbestos will be moved to a larger pile for future grinding.

WASTE SHINGLE PROCESSING

Benton County had accumulated 900 tons of "torn off" waste shingles (Figure 2) during 1994 and 1995. The disposal fee for accepting these shingles at the landfill was $40 per ton.

Processing of the shingles began in June 1995. A contractor that was willing to grind the shingles had told Benton County that additional wood would facilitate the grinding process. Old pallets

and other scrap wood were added to the pile of waste shingles. The first attempt to grind the shingles with a pan grinder yielded unsatisfactory results and its use was terminated.

A Rexworks Maxigrind Model 425 was brought in for the next grinding trial (Figure 3). It has a 3 m (120 in) long, 1.5 m (59 in) wide and 0.8 m (32 in) deep hopper that was charged with an end loader. A ram feeder forces the waste shingles into a shear bar grinder that reduces the size until it will pass a quick change sizing screen. The initial grinding with the Maxigrind used a 51 mm (2 in) screen and was very successful processing at 40 ton/hr. It demonstrated that it was capable of grinding bituminous shingles without wood. A water spray system provides effective dust control. Most of the nails were removed using a magnetic roller on the Maxigrind discharge conveyor.

A 25 mm (1 in) sizing screen was used for a while, but reduced the capacity to 15 tons per hour which was too slow. Approximately 300 tons of 25 mm (1 in) sized material was produced.

The 51 mm (2 in) screen was the most successful in grinding the waste shingles. The balance of the shingles were ground through a 51 mm (2 in) screen. An analysis of the ground product yielded a composition of 82% shingles and 18% wood on a dry weight basis. The ground shingles contained 6.6% moisture.

PROJECT LOCATION

The shingle treated roadway is located 11 km (7 mi.) south of US 30 on the Benton-Iowa County line (Figure 4). It is approximately 4.8 km (3 mi.) south and 2.4 km (1½ mi.) west of Blairstown. The roadway is approximately 3 km (2 mi.) from the landfill where the shingles were ground.

ADDING GROUND SHINGLES TO THE ROADWAY

The ground shingles were applied to the roadway on July 19, 1995. The intent was to add a volume of shingles equal to the volume of crushed limestone granular surfacing. Five hundred ton of shingles were transported by dump truck and spread on 0.5 km (0.3 mi) of roadway. The ground shingles were dumped on top of the crushed stone surface. A motor grader bladed the crushed stone and ground shingles back and forth to achieve a uniform mixture (Figure 5). Visually, this yielded a well mixed surfacing material that was still very friable. The shingle-granular surface mixture was approximately 65 mm (2½ in.) thick.

PERFORMANCE OF THE SHINGLED ROADWAY

A DOT sedan was driven over the shingled roadway at 80 kmh (50 mph) soon after the blade mixing was completed. There was substantial dust on the adjacent untreated crushed stone surface. There was no dust generated from the shingle treated section of the road. It was very impressive.

The roadway has remained workable and can be bladed very much like the untreated crushed stone surface. The traffic displaced much of the light wood particles to the edges of the roadway. In December 1995, the surface of the shingled roadway appeared somewhat "open." In an effort to seal the surface, a distributor was used to apply a light spray (fog seal) of a mixture of 2300 L (500 gal.) of CSS1 emulsiton diluted with 4500 L (1000 gal.) of water at a coverage rate of 1.3 L/sq. m (0.3 gal/sq. yd).

The shingled roadway remains workable but almost dust free one year after treatment. An Iowa DOT sedan driven at 80 kmh (50 mph) one year after treatment produces almost no dust (Figure 6). It is also relatively dust free two years after treatment. Its performance has been very impressive and supports the potential of this dust control program. There were a few flat tires due to nails that were not removed, but this problem has now been overcome.

FUTURE DUST CONTROL PLANS

Additional research into improving the processing and magnetic nail removal is currently being conducted by Benton County in July and August 1997.

Benton County intends to use ground shingles for dust control in front of rural residential houses on granular surfaced roadways. This will be an alternative to MC70 or lignunsulfanate dust control that is currently being used.

BENEFITS

This may be one of the most cost effective uses of waste materials to be identified to date. Benton County charges a $40 per ton disposal fee for waste shingles. The estimated cost for asbestos testing is $12 per ton plus another $18 per ton for grinding and processing for a profit of $10 per ton. It results in substantial reduction in the volume of garbage to be buried in the landfill which will extend the life of this landfill. It is becoming increasingly difficult to obtain land for landfills. A third benefit is very effective dust control. The bituminous shingles bind the crushed stone granular surfacing material together, thereby, reducing the loss of the granular surfacing into the ditches. The treatment also improves the lateral control of cars being driven on this section. It also yields a smoother and quieter roadway.

CONCLUSIONS

From this research on ground waste shingles, it can be concluded that:

1. The use of ground shingles on granular surfaced roadways is a very effective dust control system.
2. The use of ground shingles for dust control is a very cost effective method of recycling waste shingles.
3. The ground shingle treatment results in improved lateral control of the vehicle on a smoother, quieter roadway.

REFERENCES

1. Kandhal, Prithvi, "Roofing Shingles Reduce Cost of HMA," Roads and Bridges, May 1996.

FIGURE CAPTIONS

1. Certification for Bituminous Waste Shingles.
2. A Pile of Benton County "Torn Off" Bituminous Shingles.
3. The Benton County Endloader Dumping Bituminous Shingles into the Maxigrind.
4. The Shingle Treated Roadway Project Location.
5. Mixing the Bituminous Shingles into the Crushed Stone Granular Surfacing Material.
6. Almost No Dust Produced Behind a Car Driven at 80 kmh (50 mph) One Year After Treatment.

FIGURE 1 - **CERTIFICATION FOR BITUMINOUS WASTE SHINGLES**

The shingles were removed from a building at the following address:

_____
NAME

_____
STREET

_____
CITY

The building is ☐ Residential
☐ Commercial
☐ Industrial

The building contains _____ dwelling units.

Shingle - Color

Top layer - _____

2nd layer - _____

3rd layer - _____

4th layer - _____

Load	**Tonnage**	**Load**	**Tonnage**

I certify that the above information is correct.

_____
NAME OF TRANSPORTER

_____
STREET

_____
CITY

Figure 2
A Pile of Benton County "Torn Off" Bituminous Shingles

Figure 3
The Benton County End Loader Dumping Bituminous Shingles into the Maxigrind

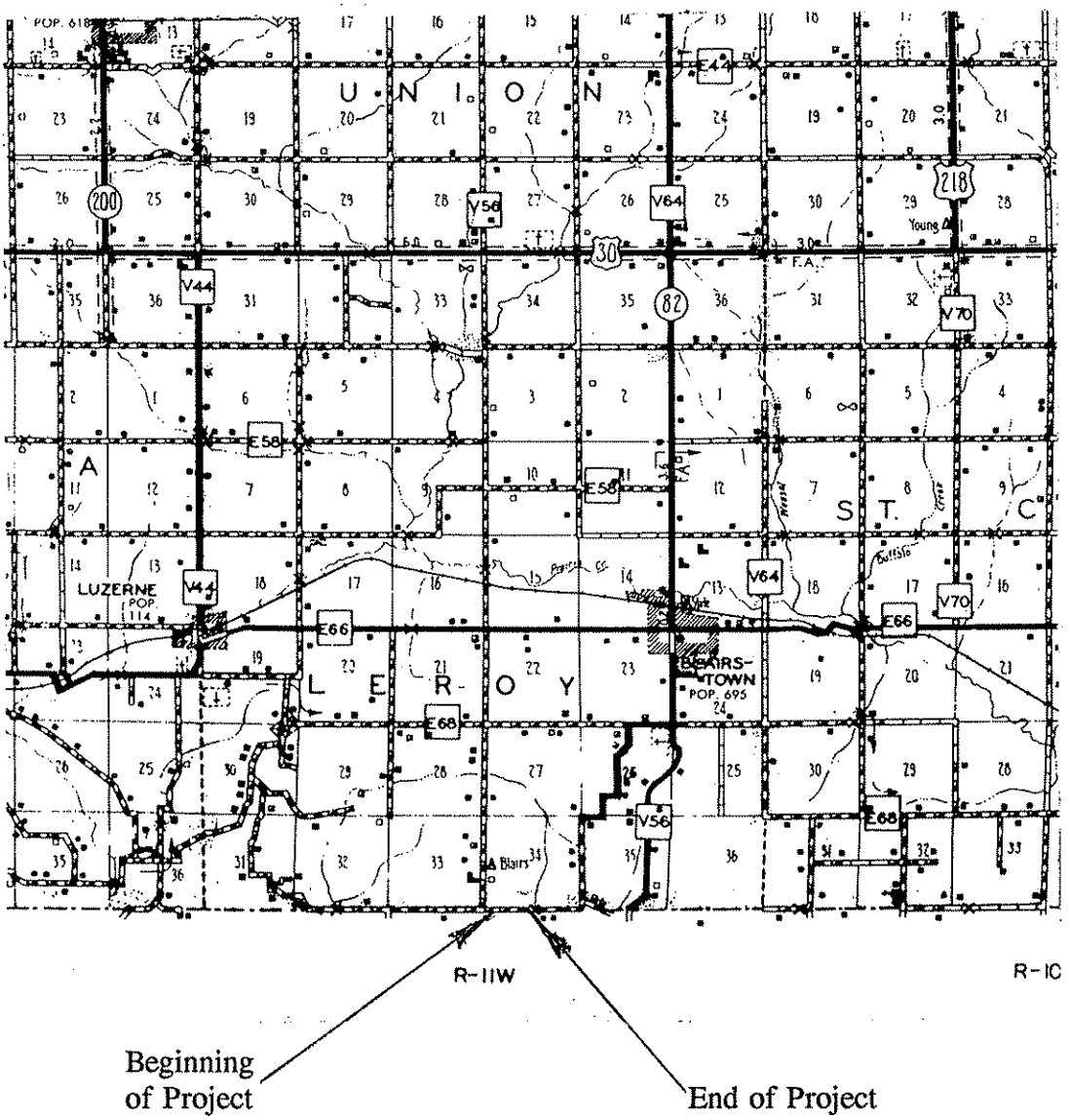

Figure 4
The Shingle Treated Roadway Project Location

Figure 5
Mixing the Bituminous Shingles into the Crushed Stone Granular Surfacing Material

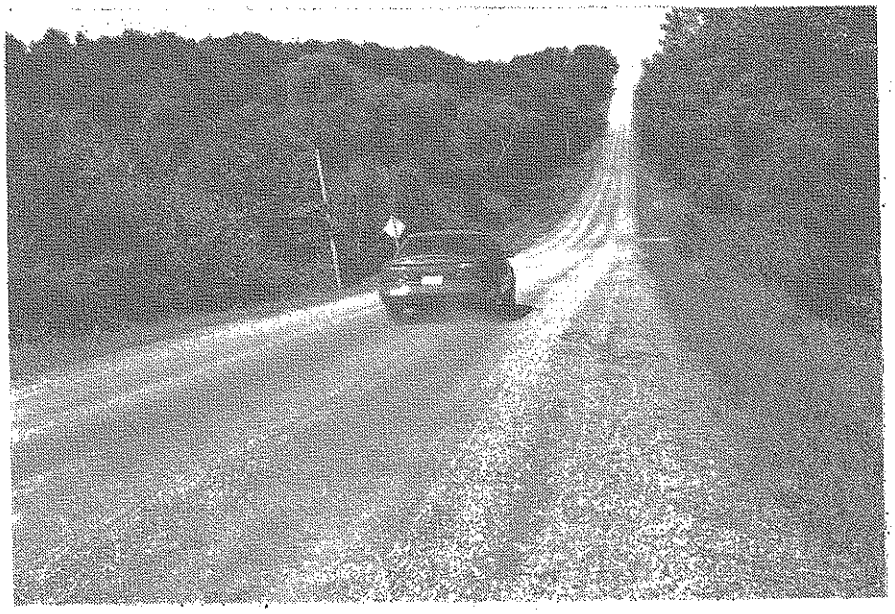

Figure 6
Almost No Dust Produced Behind a Car Driven
at 80 kmh (50 mph) One Year After Treatment