

NEWMOA FACT SHEET

Beneficial Use of Tire Shreds as Lightweight Fill

April 6, 2001

This fact sheet is intended to provide general information to potential users of tire shreds as lightweight embankment fill and lightweight retaining wall backfill. It is the responsibility of the design engineer to determine the appropriateness of using tire shreds in a particular application and to select applicable tests and specifications to facilitate construction and environmental protection. Potential users of tire shreds as lightweight fill should contact the appropriate state regulatory program to identify specific use conditions and permit requirements. A listing of state contacts is located at the end of this fact sheet.

MATERIAL DESCRIPTION¹

Tire shreds are irregularly shaped and vary in size, with most in the range of 4 to 8 inches long. The shredding process usually exposes the tire's internal steel belt or bead, particularly along the edges of the shreds. The average loose density of tire shreds typically ranges from 24 pounds per cubic foot (lb/ft^3) to $33 \text{ lb}/\text{ft}^3$. The average compacted density ranges from $40 \text{ lb}/\text{ft}^3$ to $52 \text{ lb}/\text{ft}^3$. Tire shred fill has the permeability of clean gravel, approximately 1.5 to 15 centimeters/second, depending on the void ratio.

BASIC DESCRIPTION OF USE

The value of tire shreds as lightweight fill stems from their low specific gravity, which is less than one-half of the value for common earthen coarse aggregate. Additionally, the compacted dry density of tire shreds is one-third to one-half of the compacted dry density of typical soil making shreds an attractive alternative for embankment fills on weak compressible soils. The low compacted dry density together with the free draining character of tire shreds can result in greatly increased stability for embankments built on weak soils, and reduced lateral pressures, as compared to soil, when used as retaining wall backfill. The use of tire shreds could result in reduced frost penetration due to their favorable thermal characteristics when compared to granular soils. The tire shreds need to be contained in-place and are typically fully enclosed in a geotextile wrap (nonwoven is recommended).

CONCERNS

¹ Source: *User Guidelines for Waste and By-Product Materials in Pavement Construction*, Federal Highway Administration, FHWA-RD-97-148, April 1998.

Tire shreds can produce leachate that exceeds the secondary drinking water standard for iron and manganese. When placed below the water table, field studies have shown that shreds release low levels of a limited number of organic compounds. However, the levels were below primary drinking water standards² and there was very limited downgradient migration of organic constituents. Field studies of tire shreds above the water table have shown negligible release of organics. Based on these results it is recommended that tire shreds be used above the water table, and that the acceptability of using shreds below the water table be evaluated on a project-by-project basis.

Tire shred fills have experienced spontaneous heating in the past. However, the following design changes have been successful in minimizing the potential for heating:

- limiting the thickness of tire shreds to 3 meters (10 feet)
- using larger size shreds
- limiting the presence of fine rubber particles, organic soil and exposed steel belts
- limiting access of the tire shred layer to air and water

Another concern is compaction because over time some consolidation will occur (typically 10-15 percent of the height of the tire shred layer). Some cracking of the roadway above a tire shred embankment could occur. A minimum of 3 feet of compacted soil should separate the tire shred embankment and the base or subbase layer of the roadway. Another mitigation measure is to mix the shreds with soil. Using 40 percent, by weight, of tire shreds might be appropriate.³

Lastly, another potential problem with using tire shreds in construction projects is that the exposed steel in the shreds can puncture the rubber tires on the construction vehicles. Magnetic separation can be used to minimize the number of shreds with protruding metal.

TECHNICAL/SCIENTIFIC STATUS

- 1) **Standards: ASTM Standard Practice for Use of Scrap Tires in Civil Engineering Applications, D 6270 – 98.**
- 2) **R&D: Five-Year Field Study of the Effect of Tire shreds Placed Above the Water Table on Groundwater Quality, Transportation Research Record No. 1619, Transportation Research Board, Washington, D.C.**
Water Quality Effects of Using Tire Chips Below the Groundwater Table, Final Technical Report 94-1, August, 1996.

APPLICATIONS/CASE STUDIES

² Levels of some compounds have been found above secondary drinking water standards.

³ Source for Paragraph: *User Guidelines for Waste and By-Product Materials in Pavement Construction*, Federal Highway Administration, FHWA-RD-97-148, April 1998.

- 1) Approximately 15 states have utilized tire shreds or chips as lightweight fill for the construction of embankments or backfills, and six states have prepared specifications or some provisions for this use: Maine, North Carolina, Oregon, Vermont, Virginia and Wisconsin.⁴
- 2) **Tire Chips for Lightweight Fill**, Maine Turnpike Authority Jetport Interchange, Contract 96.31.
- 3) **Tire Shreds as Lightweight Fill for Embankments and Retaining Walls**, Proceedings of the Conference on Recycled Materials in Geotechnical Applications, ASCE, pp. 51-65.

REGULATORY STATUS

- 1) **Connecticut:** Requires a General Permit pursuant to Section 22a-209f of the Connecticut General Statutes and adherence to technical guidance (document available from DEP).
- 2) **Maine:** Permit-by-rule notification to Maine DEP and adherence to standards published in Chapter 418 of Maine Solid Waste Management Regulations required prior use of tire shreds as lightweight fill.
- 3) **Massachusetts:** Beneficial use determination required pursuant to 310 CMR 19.60, Permit code BWPSW 13.
- 4) **New Hampshire:** Permit-by-rule in accordance with Env-Wm 3203.07.

⁴ Ibid.

- 5) **New York:** Case-by-case beneficial use determination by NYSDEC is required for the use of tire chips as lightweight fill.⁵
- 6) **Rhode Island:** Marketer/potential user of material must obtain DEM approval through the beneficial use determination process in order to obtain an exemption from the solid waste regulations (chapter 23-18.9).
- 7) **Vermont:** “Shredded tires, if used as a substitute for earthen material in roadway applications (base course, subbase, embankments) or drainage fill applications (foundation drains, drainage blankets, French drains) in accordance with the June 1990 draft Agency practice titled *Acceptable Uses of Shredded Tires*” is listed in the “Acceptable Uses of Solid Wastes,” and therefore the applicant does not have to obtain approval from the DEC.⁶

⁵ Note: The use of tire chips as an aggregate for road base materials or asphalt pavements in accordance with NYS Department of Transportation standard specifications, or the use of whole tires or tire chips for energy recovery are predetermined beneficial uses (6 NYCRR Part 360-1.15(b)(6)).

⁶ *Procedure Addressing Acceptable Uses of Solid Waste*, Solid Waste Management Program, Waste Management Division, Department of Environmental Conservation, Agency of Natural Resources, State of Vermont, July 2000.

For More Information Please Contact:

<p>In Connecticut: Oswald Inglese Department of Environmental Protection 79 Elm Street Hartford, CT 06106 (860) 424-3725</p>	<p>In Maine: James Glasgow Department of Environmental Protection 17 State House Station Augusta, ME 04333 (207) 287-7719</p>
<p>In Massachusetts: Sean Griffin Department of Environmental Protection One Winter Street Boston, MA 02108 (617) 292-5967</p>	<p>In New Hampshire: Mike Sills Department of Environmental Services 6 Hazen Drive Concord, NH 03301 (603) 271-2907</p>
<p>In New York: Jeff Schmitt Department of Environmental Conservation 50 Wolf Road Albany, NY 12233 (518) 457-6072</p>	<p>In Rhode Island: Chris Shafer Department of Environmental Management 235 Promenade Street Providence, RI 02908 (401) 222-2797</p>
<p>In Vermont: Bryan Harrington Department of Environmental Conservation 103 South Main Street Waterbury, VT 05671 (802) 241-3473</p>	<p>At NEWMOA: Jennifer Griffith NEWMOA 129 Portland Street, 6th Floor Boston, MA 02114 (617) 367-8558, ext. 303</p>

The Northeast Waste Management Officials' Association (NEWMOA) is a nonprofit, nonpartisan interstates organization that addresses regional waste and pollution prevention issues. The membership is composed of state environmental agency directors of the hazardous waste, solid waste, waste site cleanup, pollution prevention and underground storage tank programs in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. New Jersey recently rejoined NEWMOA (March 23, 2001) and therefore, did not participate in the development or review of this fact sheet. NEWMOA provides a forum for increased communication and

cooperation among the member states, a vehicle for the development of unified position on various issues and programs, and a source for research and training.