

## How Can I Learn More about Using Taconite Tailings as an Alternative Aggregate Source?

More information about using taconite tailings as an alternative source of aggregate material is available at Minnesota's LRRB Web site, [www.lrrb.org](http://www.lrrb.org)

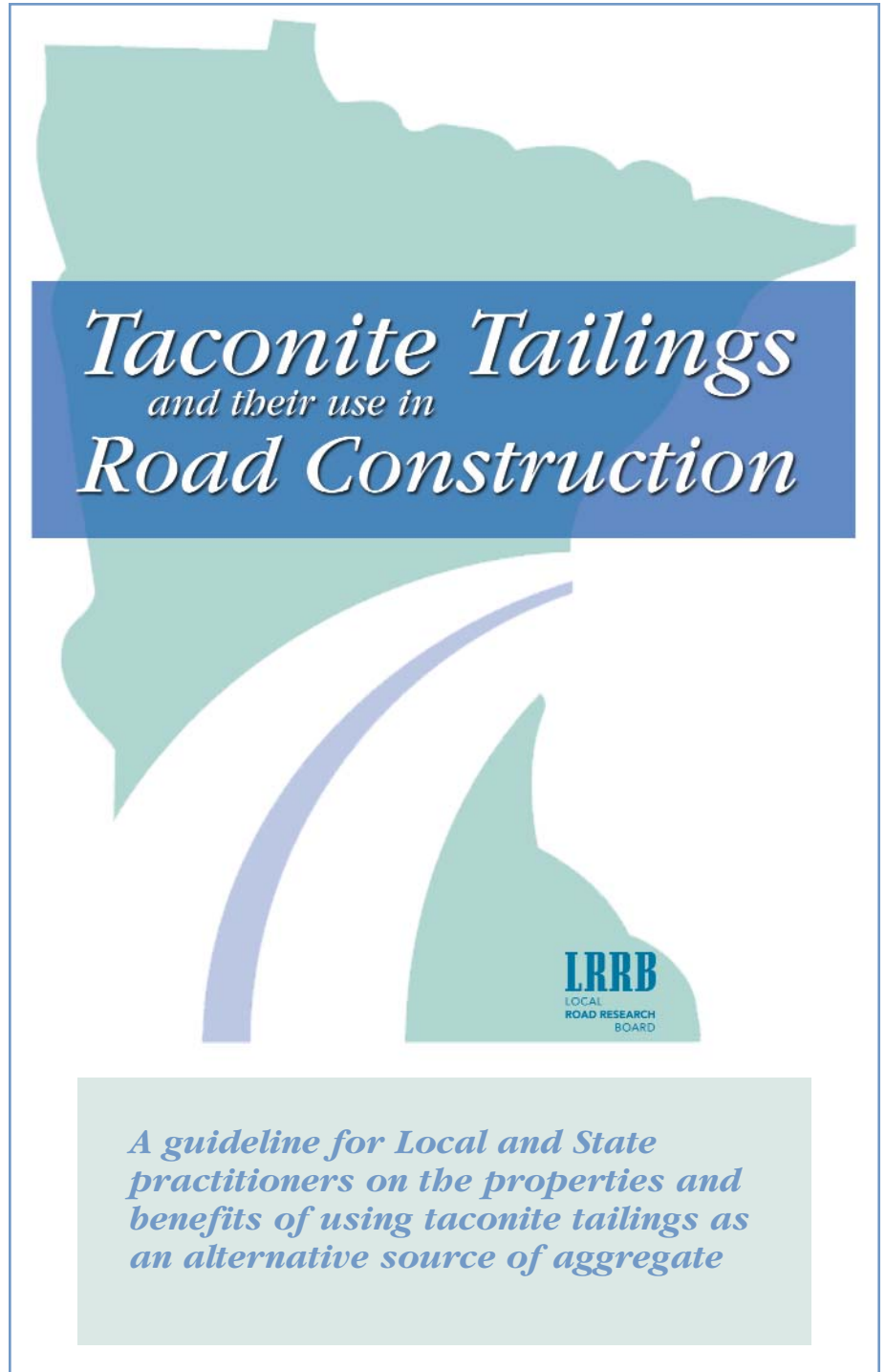
A research report on taconite tailings was published in 2004 and is also available on line at: [www.lrrb.org/pdf/200406.pdf](http://www.lrrb.org/pdf/200406.pdf)

## How Can I Purchase Taconite Tailings?

Information on purchasing coarse taconite tailings can be received directly from the taconite producers.

United States Steel	Ed Dorman	(218) 749-7329
	General Aggregate Sales	(218) 742-3590
Cleveland Cliffs, Inc.	Bruce Gerlach	(218) 222-3127 ext 4261
Ispat Inland Mining	Bill Bond	(218) 749-5910 ext 249

These contacts may also provide assistance with transportation.



*Taconite Tailings*  
*and their use in*  
*Road Construction*

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*A guideline for Local and State practitioners on the properties and benefits of using taconite tailings as an alternative source of aggregate*

## Where Do Taconite Tailings Come From?

Taconite is mined from the Mesabi Iron Range in Northern Minnesota. It is a very hard rock containing low-grade iron ore used to make iron and steel.

Using explosives, taconite is blasted into pieces that are then crushed into smaller pieces at a processing plant. After the iron ore is separated from the taconite, the tailings are the remaining by-product. Tailings are either placed in tailings basins or held in reserve for some other purpose.

One-half to two-thirds of all processed ore-bearing rock ends up as tailings. Other materials generated in the mining process include the “overburden” (material that covers the taconite, comprised primarily of rock, clay and gravel) and low-grade iron ore.

*One-half to two-thirds of all processed ore-bearing rock ends up as tailings.*



Ispat Inland Mining's Laurentian Pit

Source: Skillings



Unprocessed Taconite

Source: Michigan State University



Coarse Taconite Tailings

Source: NRRI

- The BEBO Arch-System Tunnel at Hibbing Taconite used coarse taconite tailings as granular base and backfill material.



BEBO Arch

Source: Lakehead Constructors

- Numerous other county and municipal roadway and airport construction projects have successfully used taconite tailings as an alternative for aggregate

## Why Isn't Everyone Using Taconite Tailings as an Aggregate Alternative?

Because taconite tailings are produced on the Iron Range, transportation to other areas of the state is an issue. One potential solution is to use the rail systems that are already connected to the mines. Rail transportation costs may be reduced by arranging for “back-haul” opportunities, such as:

- Carbonate rock from Rochester
- Biomass fuels from the Twin Cities
- Coal from North Dakota

*Transportation costs can be an issue*

Transportation of taconite tailings by barge is another potential solution.

Any potential means of transportation would need to take into account that taconite tailings have a higher specific gravity than traditional aggregates. The specific gravity of taconite tailings typically ranges from 2.9 to 3.0 while traditional aggregates have a specific gravity of 2.65 to 2.75. As taconite tailings are up to 10 percent “denser” they are at a disadvantage in terms of shipping weight per unit volume. However, other properties of taconite tailings, such as particle angularity, durability, friction and low moisture absorption, may partially offset this difference.

## Have Taconite Tailings Been Used Successfully in Minnesota?

Taconite tailings have been successfully used in road construction in Minnesota since the late 1960s. Over the past four years (2001-2004), Mn/DOT used approximately 2.3 million tons of taconite tailings in road construction projects.

Some examples include:

- On TH 169 from Virginia to Chisholm, taconite tailings were used as a 15 percent blend in the SuperPave™ Mix, as Fine Filter Aggregate and as granular borrow.
- On TH 135 from TH 53 to Aurora, taconite tailings were used as 100 percent of the aggregates in the wear course.
- On the TH 53 beltline around Virginia, taconite tailings were used as the granular backfill in the subgrade.
- The Brainerd Speedway was constructed with taconite tailings as 100 percent of aggregates in the wear course.

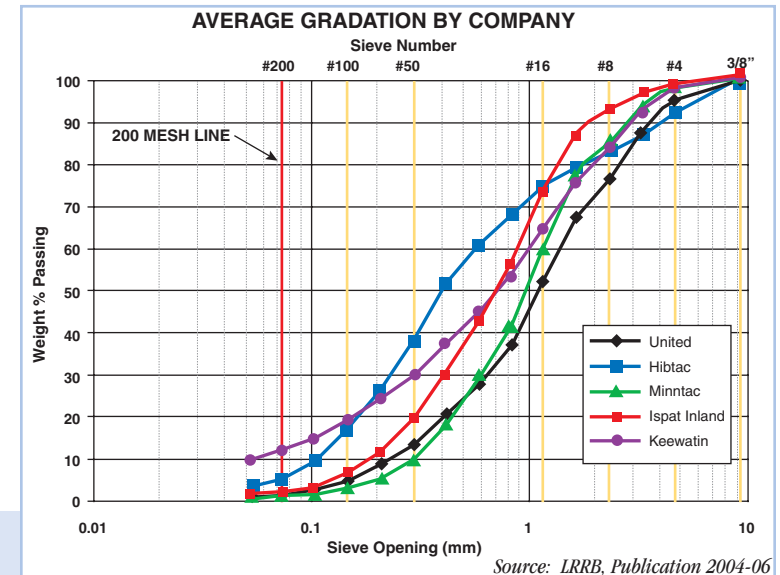


Construction on TH 53 North of Virginia

Source: Mn/DOT

## What Are the Properties of Taconite Tailings?

Gradations are similar to FA-1 fine aggregates for bituminous and concrete mixes and for sealcoats. The chart below provides average gradation values for coarse taconite tailings obtained from five Minnesota iron mining operations. When the term “coarse” is used in referring to taconite tailings, it can be confusing since coarse tailings are equivalent in size to “fine” aggregate (particles passing through a 3/8” sieve).



Property or Test	Taconite Tailings
Micro-Deval	8.4-15.8
Magnesium-Sulfate Soundness	2.8-12.1
Fine Aggregate Angularity	45.28-47.23
Sand Equivalent (SE)	73.5-93.0
Crushing	100% Fractured Faces
Specific Gravity	2.9 to 3.0
Absorption	≤1%

Taconite tailings are extremely hard and have high strength (meeting or exceeding Mn/DOT hardness specifications).

The high angularity of coarse taconite tailings is equivalent to manufactured fines.

Asphalt mixes using coarse taconite tailings have higher friction values. This property makes tailings an attractive addition to bituminous mixtures, providing higher skid resistance.

## How Can a City or County Use Taconite Tailings?

Wherever aggregate less than 3/8" is needed, taconite tailings can be substituted. They are especially suitable when high-angularity aggregate is desirable.

Taconite tailings can be used in road construction as part of a wear course:

- bituminous pavements (stand-alone aggregate for fine mixes or as fine aggregate supplement)
- thin overlay
- chip seal (seal coat)

or as a base material

- fill (granular borrow, select granular, Class 5 supplement),
- subgrade material,
- backfill in sub-cuts, and
- fine-filter aggregate material in edge drains.

## What Are the Benefits of Using Taconite Tailings?

### GOOD AGGREGATE IS BECOMING A SCARCE COMMODITY

In the seven-county metro area, demand for aggregate will exceed supply in the next 10 to 15 years.

Almost 33 million tons of taconite tailings were produced on the Iron Range in 2002, and mining companies have been stockpiling coarse taconite tailings for years.



Taconite Tailings Stockpile

Source: NRRI

### PRODUCTION COSTS ARE CHEAPER

Since taconite tailings are being produced as a by-product of another process (taconite mining), costs of production are much lower than for traditional aggregate mining.

### THEY HAVE EXCELLENT PROPERTIES

Taconite tailings have high strength and hardness, as measured by Micro-Deval and Magnesium Sulfate Soundness tests. Their inherent particle angularity (100 percent fractured faces) makes it easier to achieve superior performing asphalt pavements (SuperPave™).



Bituminous Road Paving Crew

Source: Mn/DOT

### USING TACONITE TAILINGS CAN BE A "GREEN" OPTION

By finding ways to use this by-product, cities and counties can avoid using energy to produce new sources of aggregate and reduce the pressure to expand existing (or develop new) "natural" aggregate sources.

## Can I Use All Taconite Tailings from the Iron Range?

Taconite tailings that can be used as an alternative source of aggregate for roadway/highway construction come from an area west of a north-south line located between Biwabik and Aurora (2360/2350 Combined Specifications, 2360.2A2g).

Processes and practices for using and handling taconite tailings are the same as for traditional aggregate sources. No special permits are required nor are any special environmental clearances needed.