MnROAD Update - Use of Taconite Materials  
January 2008

Background
The goal is to assess potentially suitable, available aggregate resources that could supply an abundant, high quality, low cost aggregate for roadway use. This effort will help pave the way to use this material in the near future, especially in areas that aggregates are becoming scarce. Currently this aggregate material from the Iron Range is considered “waste product” relating to their taconite production, but it has high potential for its use in our roadways which includes the use of fine to coarse taconite aggregate materials in hot mix asphalt, concrete mixes, and other pavement applications for both its constructability and field performance over time. This would help create a greater comfort level for the use of this aggregate and help promote its use in the state and the nation.

Research Partners
MnROAD (Mn/DOT), Minnesota DNR, Natural Resources Research Institute (NRRI), University of Minnesota Duluth (UMD), and the mining industries have developed a number of partnerships since 2004 to research the use of taconite materials in roadways. An initial partnership in 2004 helped construct two test cells at MnROAD. The most recent partnership uses federal funds from the Economic Development Administration (EDA) of the U.S. Department of Commerce for research on Iron Range aggregate materials in transportation applications.

2004 MnROAD Existing Pavement Condition
In 2004 the partnership constructed both a Hot Mix Asphalt (HMA) and Portland Cement Concrete (PCC) at MnROAD on its low volume road using various taconite aggregates. Today both pavements are performing as good as or better than similar pavement with traditional aggregates.

PCC Performance (Cell-54)
- No construction placement or mix design issues
- No aggregate material issues related to its use
- No Cracking or other distresses
- Friction – Greater than 60 (excellent)
- Ride – 1.7 m/km (good and steady over time)

HMA Performance (Cell-31)
- No construction placement issues
- Monitoring the effects of flat and elongated aggregate particles – no material issues so far
- Two transverse cracks caused by reflective cracking from the existing HMA shoulders that were initially built in 1993. This does not reflect the aggregate use.
- Rutting – Less than .25” (good)
- Friction – Greater than 60 (excellent)
- Ride – 1.5 m/km (good with a slight increase in roughness over time)
2008 MnROAD Construction/Research Efforts
This latest partnership with NRRI includes $125,000 federal funds from the Economic Development Administration (EDA) of the U.S. Department of Commerce to support the MnROAD-related work for the next three years. The work under this partnership includes:

- MnROAD continued performance monitoring for existing taconite test cells
- MnROAD future test cell construction support for 2008
- Pothole Taconite Patch Material Study
- Laboratory Testing of Taconite Materials

MnROAD is planning two test cells using Mesabi Hard Rock aggregates. This construction will also help demonstrate the use of RailMate Semi Trailer/Railroad cars to aid in the delivery of these materials to the MnROAD site. The 2008 test cells include:

Use of Mesabi Hard Rock Railroad Ballast
MnROAD will build one test cell on the interstate (I-94) mainline to demonstrate the use of permeable large stone base materials compared to our traditional finer non-permeable aggregate base materials. It will allow researchers to demonstrate/model the benefits of a higher quality stronger base layer and its effect on hot mix asphalt pavement performance and how we account for these materials in our designs. Simply stated, should we place more emphasis on the base layers than the pavement surface?

Use of Mesabi Hard Rock High Volume Hot Mix Asphalt Mixtures
MnROAD will build one test cell on the interstate (I-94) mainline to demonstrate the use of a 4.75-mm Superpave HMA pavement. This mixture, made with sand-size aggregate particles, should make a durable pavement surface as well as provide superior surface characteristics such as friction, noise abatement, texture, ride quality, and splash and spray reduction.

Mn/DOT is also conducting laboratory experiments aimed at designing Stone Matrix Asphalt mixtures using taconite aggregates. These mixtures provide a high quality pavement surface that is resistant to rutting, cracking, and other distresses. They provide longer-lasting pavements with less need for maintenance over time, reducing delays for the driving public.