Using Tire Chips for Roadway Embankment Fill

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MEN AND NATURE MUST WORK HAND IN HAND. THE THROWING OUT OF BALANCE OF THE RESOURCES OF NATURE THROWS OUT OF BALANCE ALSO THE LIVES OF MEN.
Step One: (too often forgotten)

• Define the problem
  – Freeze-thaw – expansive soils?
  – Moisture migration, saturation, etc.?
  – Slip surfaces – global instability?
  – Insufficient bearing capacity?

• Look for the causes

• Research the roadway history

• Obtain soil borings
March Roads in Minnesota
(a problem)
April Roads in Minnesota
(another problem)
Some April Road Conditions!
(more problems)
May Roads in Minnesota
(even more problems)
Frost protection in cold regions

• Thermal insulation
Building Rds. Over Swamps
Step Two:

• Design a solution to the problem
  – Look at all available tools, techniques, materials:
    • Deep foundations/structures
    • Excavation/removal
    • Ground improvement/reinforcements
    • Drainage features
    • Lightweight fill
      – Geofoam
      – Wood chips
      – Tire chips
How Full is Your Toolbox?

• Making tire chips an available ‘tool’ requires:
  – Approvals (State PCA, County Waste Boards, City permits, internal DOT and FHWA).
  – Legislation in some states.
  – A Champion*
  – Source of material.
  – Research, example projects, standards
History

• First Use 1903!
• Pre 1984 Undoc. Proj.
• 1984-92 Forest Rds.
• 1992 DOT Use
• 1995-2009 All Govt.
Sound Eng. + Envir. Friendly
Nature Has It’s Own Problems
(we don’t want to make more)
What’s an Engineer to Believe?

• Feb. 19, 1990 MN study scared off users.
• New mn study on environmental effects still not conclusive:
  http://www.research.dot.state.mn.us/detail.asp?productID=2290
• Many studies by others look promising.
Available Information

• MN roadway tire chip guidelines on line: http://www.mrr.dot.state.mn.us/geotechnical/foundations/SHREDDED_TIRE_STANDARD.doc

• ASTM spec. D 6270-08 (in vol. 11.04) = good guide – use it.
  http://www.astm.org/Standards/D6270.htm
Where to Use/Not Use Tire Chips?

- Grade increases
- Weight reduction – unstable slopes/swamps
- Urban sections (curb & gutter)
- As a cheap fill/get rid of tires
- Areas with utilities
- Below the water table?
- Mixed with sand
- Rockfall and crash barriers
- Near walls & utilities: compression to lateral load
Not all sites suitable for chips

• Excavation
• Bridge
• Change Alignment
Engineering With Tire Chips

• Unit Wt.: 40-50 pcf
• Friction angle: 17-35+ deg.
• Cohesion: ????
• Compaction: 30% +/-, Methods of,
• Creep over time (30 days)
• Surcharge
• Cover amount
Material Spec.

- Though to spec.
- Larger sizes often better
- Limit free metal (de-bead = premium)
- ASTM D 6270 spec.
- “Ordinary” compaction
- Start with Hydro compaction in cover mat.
Base Prep.
Construction placement:
Covering the Chips
Questions (from those awake)?