15 Years of Tire Shreds as Lightweight Fill

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Presented to:
North American Geosynthetic Society
February 11, 2003

Tire Shreds First Used as Lightweight fill in 1986

Why use tire shreds?

- Tire shreds have properties that civil engineers need
- Lightweight (0.8 Mg/m^3)
- Low earth pressure (1/2 soil)
- Good thermal insulation (8 times better)
- Good drainage (> 1 cm/s)
- Compressible

Why use tire shreds?

- Tire shreds are often cheapest alternative if you need their unique properties

Why use tire shreds?

- Can use lots of tires!!!
  - 100 tires per C.M. of tire shred fill
  - 1.2 million tires for highway embankment, Portland, Maine
  - 600,000 tires for highway embankment in Milpitas, CA
  - 400,000 tires for landslide stabilization, Topsham, Maine

Range of civil engineering applications

- Lightweight fill for highway embankments
- Retaining wall backfill
- Insulation to limit frost penetration
- Vibration damping layers for rail lines
- Drainage layers for landfills

Civil Engineering Applications in United States

- The fastest growing use for scrap tires
- Approximately 48 million tires per year are used in these applications

Specifications

- Type A – drainage and insulation
  - 100% passing 100-mm sieve
  - Minimum of 90% passing 75-mm sieve
  - Maximum of 5% passing 4.75-mm (no. 4) sieve
- Type B – lightweight fill
  - 100% smaller than 450 mm max. dimension
  - 90% smaller than 300 mm max. dimension
  - Maximum of 25% passing 37.5 mm
  - Maximum of 1% passing 4.75-mm (no. 4) sieve

Guidelines

- ASTM D6270 “Civil Engineering Applications of Scrap Tires”
- Guidelines to limit heating
- Water quality

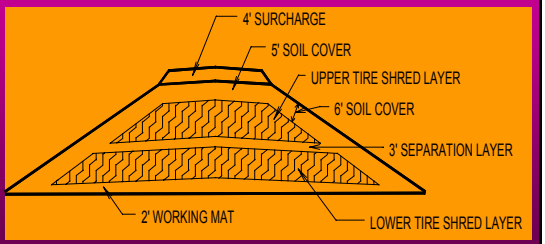
Tire Shreds as Lightweight Fill for Embankment Construction

- Weak foundation soils
  - –Increase slope stability
  - –Reduce settlement
- Landslide stabilization

Portland Jetport Interchange

- PROBLEM: Embankment Constructed on weak marine clay
- SOLUTION: Use tire shreds for the core of the embankment (1.2 million PTE)
- CHEAPEST SOLUTION: Maine Turnpike Authority saved $300,000

Typical Cross Section



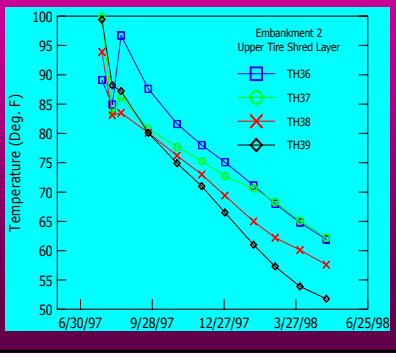
First load of shreds

Overview of construction

Spreading shreds with dozer

Completed embankment

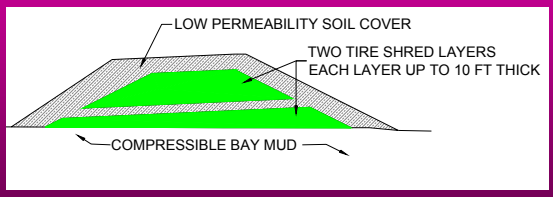
Temperature in upper layer



Dixon Landing Interchange

- PROBLEM: Embankment Constructed on Bay Mud
- SOLUTION: Use tire shreds for the core of the embankment
- CHEAPEST SOLUTION: Caltrans saved $470,000

Typical Cross Section



Overall layout

Unload tire shreds

Spread with bulldozer
(300 mm lift)

Compact with 10-ton roller
(6 passes)

Conventional Lightweight Fill

Unit Costs

- Cost for common borrow = $9.80/m^3
- Placement costs of shreds = $4.90/m^3
- Purchase & delivery costs of shreds (paid by CIWMB) = $31/m^3
- In-place cost for shreds = $36/m^3
- In-place cost for lightweight aggregate = $65/m^3

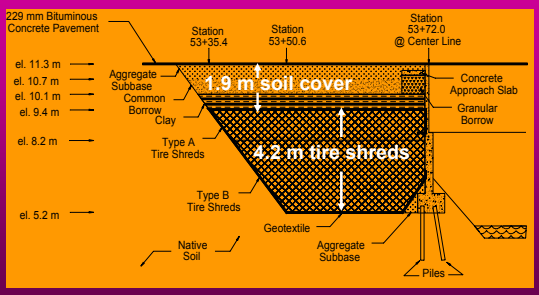
Cost Savings

- Cost savings to CALTRANS with shreds provided at no cost by CIWMB = $477,00
- Cost savings to state less purchase price of shreds = $230,000

North Abutment of Merrymeeting Bridge

- Bridge approach underlain by weak clay
- Existing factor of safety = 1.1
- Excavate upper portion of existing slope
- 14 ft of tire shred fill covered by 6 ft of soil
- Used 400,000 tires

Cross section of north abutment



Placing tire shreds behind north abutment

Ground Water Quality

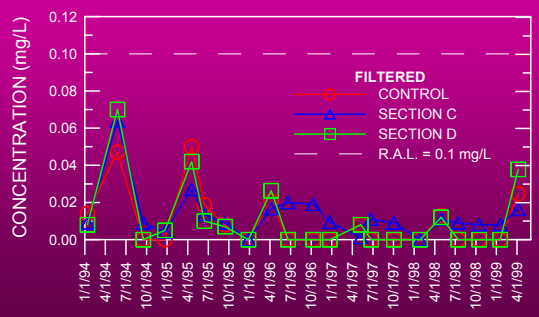
- Above groundwater table
  - Primary standards
  - Secondary standards
  - Organics
- Below groundwater table
  - Primary standards
  - Secondary standards
  - Organics

Tire shreds above water table

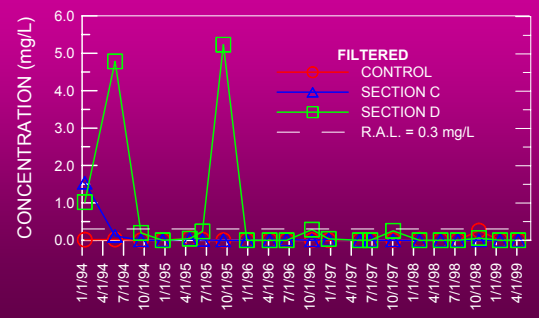
North Yarmouth Field Trial

Barium (Ba)	Chloride (Cl)
Cadmium (Cd)	Sulphate
Calcium (Ca)	pH
Chromium (Cr)	Alkalinity
Iron (Fe)	BOD
Lead (Pb)	COD
Magnesium (Mg)	Conductivity
Manganese (Mn)	Total dissolved solids
Sodium (Na)	Hardness
Zinc (Zn)	Organics

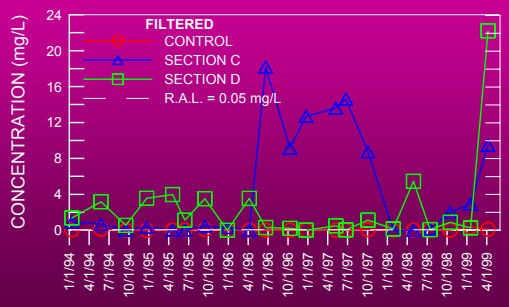
Chromium Concentration



Iron Concentration



Manganese Concentration



Tire shreds above water table

North Yarmouth Field Trial

- Primary drinking water standards
  - No effect
- Secondary drinking water standards
  - Manganese & iron
  - Not significant
- Organics
  - No effect

Conclusions

- Tire shreds are a cost effective lightweight fill
- In-place unit weight = 0.8 Mg/m^3
- Dozens of successful case histories
- Specifications and guidelines available
- Negligible environmental effects


QUESTIONS?