CIVIL ENGINEERING APPLICATIONS OF TIRE DERIVED AGGREGATE

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Outline

Why use TDA?

- Example projects
  - Boundary Road Project
  - Lightweight fill over reinforced concrete culvert

- Design parameters for TDA as retaining wall backfill

Why use TDA?

- TDA has properties that civil engineers need
  - Lightweight (1/3 soil)
  - Low earth pressure (1/2 soil)
  - Good thermal insulation (8 times better)
  - Good drainage (10 time better)
  - Compressible
  - Vibration damping

- Can use lots of tires!!!
  - 75 tires per yd$^3$ of TDA fill
  - 1.2 million tires for highway embankment, Portland, Maine
  - 75,000 for vibration damping layer in San Jose, CA
  - 390,000 tires for highway embankment in Cornwall, Ontario
Boundary Road Project

- Cornwall, Ontario
- Reconstructed highway overpass
- Owner: Ontario Ministry of Transportation
- TDA
  - 5000 cubic yards
  - 3400 tons
  - Supplier: Liberty Tire, Brantford, Ontario

TDA Production

TDA Loading

Type B TDA
Monitoring Program

- Settlement
- Temperature
- Water Quality

Post Placement Compression of TDA layer – South Embankment
TDA as Lightweight Fill Over Concrete Box Culvert

- U.S. 101 – Piercy, California (Confusion Hill) – 200 miles north of San Francisco
- New highway alignment to avoid landslide area
- Existing 6.1 m x 6.1 m reinforced concrete culvert covered by 25 m of fill
- Must add 2 m of fill for road realignment
- Problem: No load can be added to culvert
- Solution: Use TDA as lightweight fill

Confusion Hill Project

Longitudinal Cross Section

Confusion Hill – Initial Conditions
**Confusion Hill – TDA Delivery**

**Confusion Hill – During Construction**

**Confusion Hill – Completed Project**

**Design Parameters for TDA as Retaining Wall Backfill**

- Earth pressure coefficient
  \[ K = \frac{\sigma_h}{\sigma_v} \]
**Instrumented Walls**

- **At-Rest Conditions**
  - UMaine Test Wall
  - North Abutment Merrymeeting Bridge
  - Limestone Run Bridge, Tarrtown, PA
- **Active Conditions**
  - UMaine Test Wall
  - Wall 119 Riverside, CA
  - Wall 207 Riverside, CA

**Pressure cells**

**Wall 119 in Riverside, CA**

**Compacting TDA**
Placing soil cover

- Heavy equipment immediately behind wall!!!

Horizontal vs. Vertical Stress (Cells in Soil)

- Wall 119 - Soil Control Section
- Wall 207 - Soil Control Sections
- Wall 207 - TDA Test Sections (Cells in Soil)
- Tarrtown - TDA Test Abutments (Cells in Soil)
- Tarrtown - TDA Test Abutments (Cell in Rock Fill)*

K=0.3

*Rock Fill consists of ± 6-in. ripped angular bedrock fragments

Horizontal vs. Vertical Stress (Cells in TDA, At Rest Sections)

- Tarrtown - TDA Test Abutments (Cells in TDA)*
- Merrymeeting Bridge - TDA Test Abutment (Cells in TDA)
- Tweedie, At Rest Conditions (Cells in TDA)*
- Tweedie, At Rest Conditions (Cells in TDA)**

K=0.3

*No surcharge

Horizontal vs. Vertical Stress (Cells in TDA, Active Sections)

- Tarrtown - TDA Test Abutments (Cells in TDA)
- Tweedie, Active Conditions (Cells in TDA)*
- Tweedie, Active Conditions (Cells in TDA)**
Example of Potential Benefits

Conclusions

- TDA has properties that engineers need
- Civil engineering applications are critical to managing scrap tires
- Highway applications
  - Lightweight embankment fill
  - Lightweight fill over culverts
  - Retaining wall backfill
- Specifications and guidelines available
- Negligible environmental effects

QUESTIONS?