

CIVIL ENGINEERING APPLICATION USING TIRE DERIVED AGGREGATE (TDA)

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CalRecycle's Main Objective is to get TDA Accepted by the Civil Engineering Community

- Educate Local public works, CALTRANS, Private Consulting Civil Engineers and State and Local Environmental Agencies on the benefits of TDA
- Research – Develop Sustainable, Environmental Beneficial and Cost Effective Civil Engineering Reuses for Waste Tires
- Coordinate and Assist Waste Tire Processors to assure there is adequate TDA to meet future demand.

Services Available from CalRecycle to Promote TDA

TDA Technical Expertise –

- Provide TDA project design Assistance
- Provide education and training on the technical aspects and benefits of using TDA

TDA Project Management

- Provide construction management assistance
- Provide procurement and staging for TDA projects
- Provide performance and environmental monitoring for TDA projects

California TDA Projects

- 2001- First TDA Project, Dixon Landing Interchange Project
- 2003-2007 - Hwy 215 and Route 91 Retaining Wall research projects. Joint project with Caltrans
- 2004 - Valley Transit Authority - Vibration Mitigation Project
- 2007 – Marina Dr, Mendocino Co. Landslide Repair
- 2008 - Riverside County Landfill Gas Collection system, Pilot projects
- 2008 - Caltrans Confusion Hill, Lightweight fill Embankment
- 2008 - Sonoma Co. Geysers Rd. Landslide Repair Project
- 2009 - Sonoma Mtn. Road , Landslide Repair Project
- 2009 - Sacramento County Keifer Landfill, Landfill Leachate recirculation project
- 2010 - Santa Barbara County, Palomino Rd Slide Repair



Future TDA Projects in California

- BART Extension, TDA for Vibration Mitigation 5300 ft .of track. Warm Springs - SanJose
- MTA Goldline Extension TDA for Vibration Mitigation 9900 ft. of track, Pasadena-Azusa,
- Construction of Type 1T Retaining Wall Pilot project, Caltrans
- Septic system leach field research
- TDA in MSE applications

Beneficial Properties of Tire Derived Aggregate (TDA) in Civil Engineering Applications

Tire Derived Aggregate (TDA) has properties that civil engineers, public works directors & contractors need

- Lightweight
- Free Draining/High Permeability
- Low earth pressure
- Good thermal insulation
- Durable
- Compressible
- May be cheapest solution

Help solve significant environmental problems
Conserve natural aggregate resources



Type "B" TDA

Dixon Landing Road

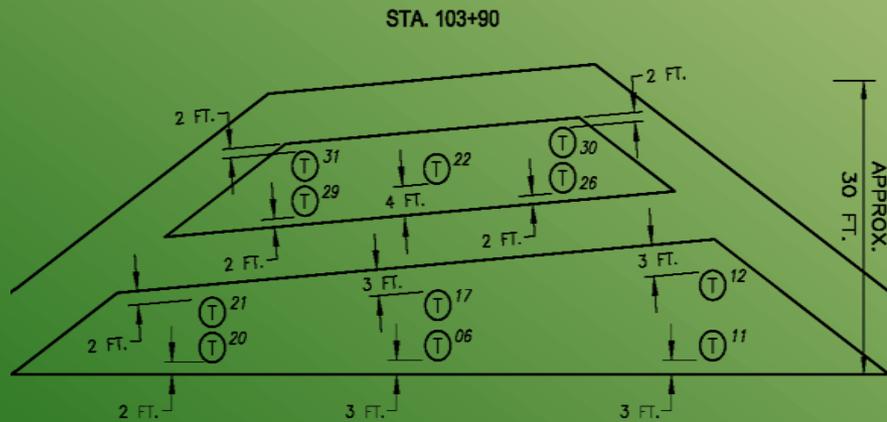
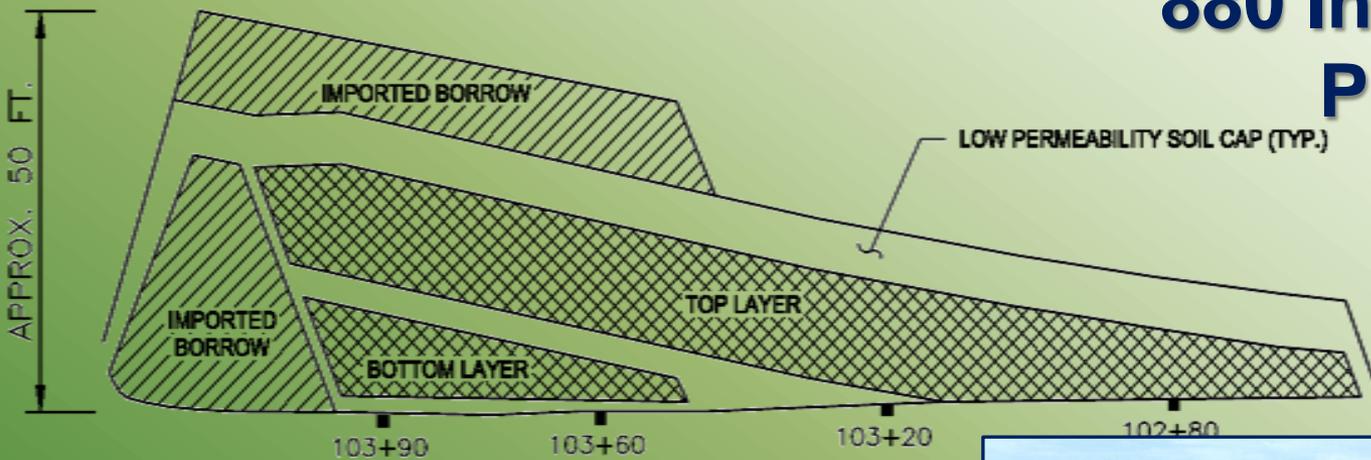
7/10/2001

Uses for Tire Derived Aggregate

- Lightweight fill for Embankments
- Lightweight fill for slide Repair
- Lightweight backfill for Retaining Walls
- TDA in Landfill Applications, replacement for conventional aggregate
- TDA used in Vibration Mitigation Applications



Dixon Landing/HWY 880 Interchange Project





**Dixon Landing/HWY 880 Interchange
Project**

Dixon Landing/HWY 880 Interchange Project



Dixon Landing Road

7/27/2001

660,000 Tires



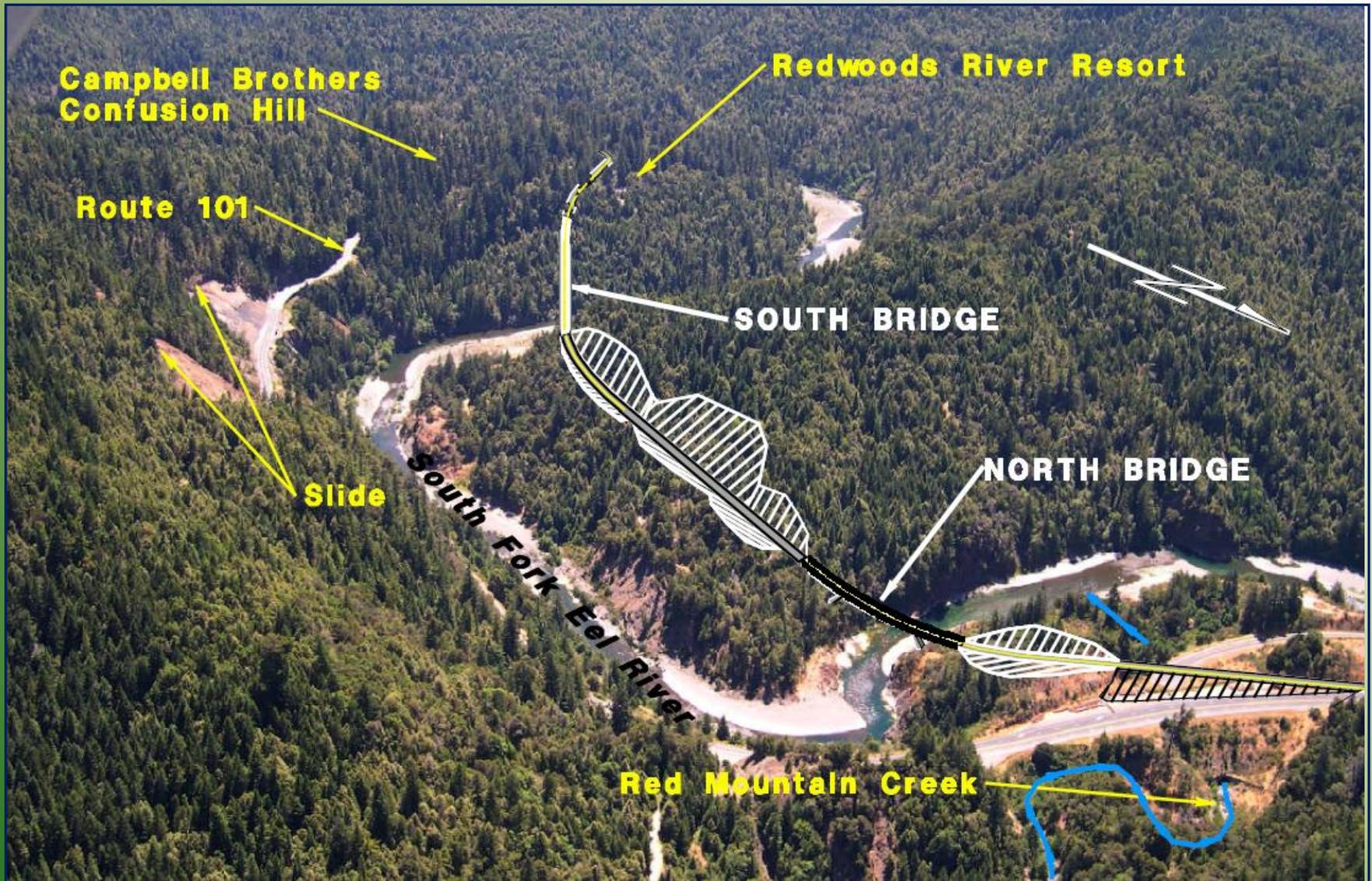
DIXON LANDING



Savings to the State \$240,000

Dixon Landing/HWY 880 Interchange
Project

Confusion Hill Embankment Project



Confusion Hill - Lightweight TDA Embankment Project 2008



Confusion Hill Lightweight Embankment Project



Confusion Hill - Lightweight Embankment

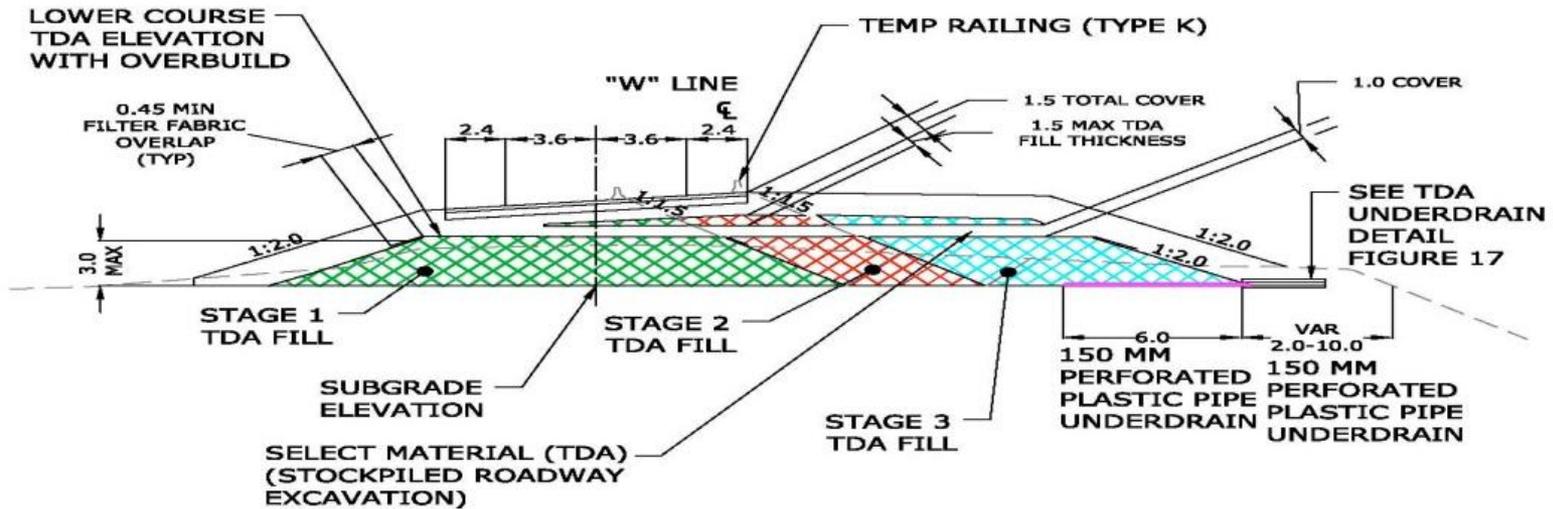


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Confusion Hill - Lightweight Embankment

LEGEND

-  STAGE 1 TDA FILL
-  STAGE 2 TDA FILL
-  STAGE 3 TDA FILL



**CONFUSION HILL TDA EMBANKMENT
HIGHWAY 101 - TIRE DERIVED
AGGREGATE LIGHTWEIGHT FILL**

Confusion Hill Final Project



Saving to State \$320,000

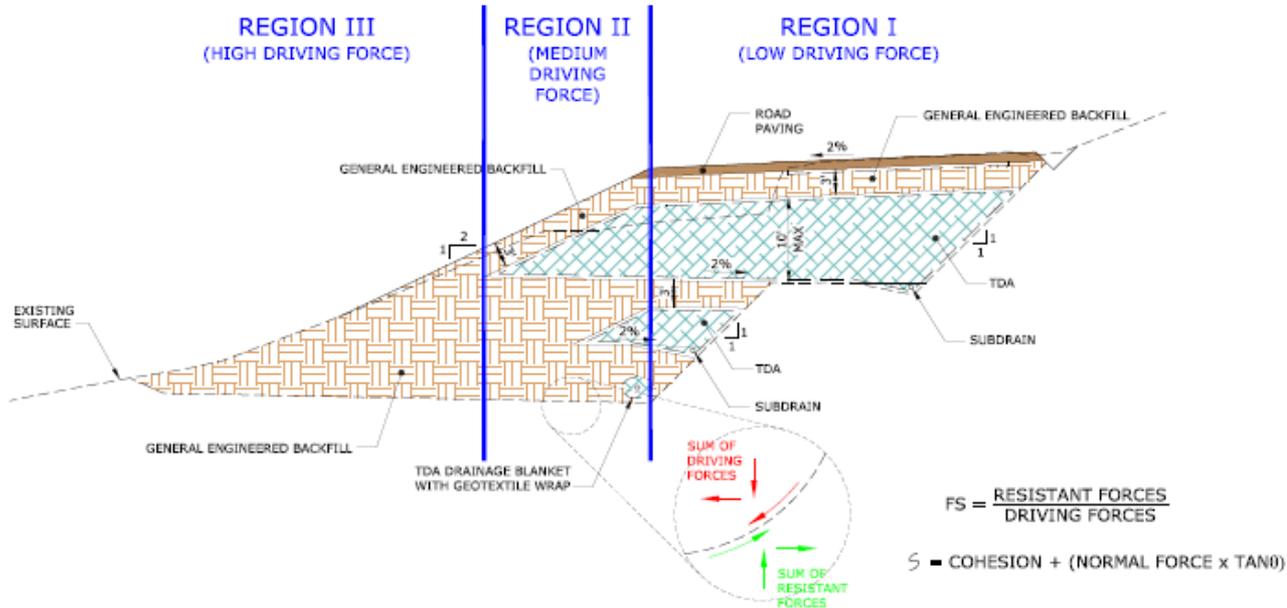
Light Weight TDA Fill for “Slip outs”

Lightweight Fill for “Slip Out”
Road Slide Repair
Mendocino and Sonoma
Counties



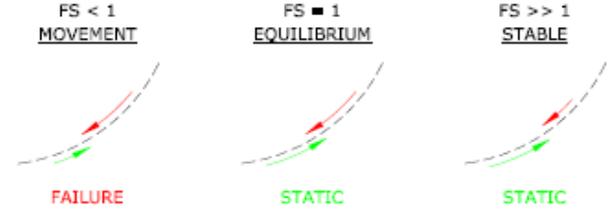
General View of TDA Slide Repair

GENERAL TDA SLIDE REPAIR SECTION



$FS = \frac{\text{RESISTANT FORCES}}{\text{DRIVING FORCES}}$
 $S = \text{COHESION} + (\text{NORMAL FORCE} \times \text{TAN} \phi)$

- LEGEND**
- FS = FACTOR OF SAFETY
 - δ = WEIGHT (DRIVING FORCE)
 - S = SHEAR STRENGTH OF MATERIAL



TDA CONDITIONS

	FS
δ_H	↓
δ_L	↑
S_H	↑
S_L	↓

Marina Drive Slide Repair



Mendocino County, Marina Dr.



133,000 Tires

09/04/2007

Marina Drive Slide Repair



Savings to the County \$ 90,000

Geysers Road Slide



Geysers Road Slide Repair



Geysers Road Slide Repair



Geysers Road



Before

Saving to County
\$128,000



After

Sonoma Mtn. Road, Sonoma County



Sonoma Mountain Road



Sonoma Mtn. Road, Sonoma County



Saving to County
\$590,000

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Palomino Road, Santa Barbara County

Slide Repair



Palomino Road, Santa Barbara County Slide Repair



Palomino Road, Slide Repair



Palomino Road, Slide Repair



Palomino Road, Slide Repair

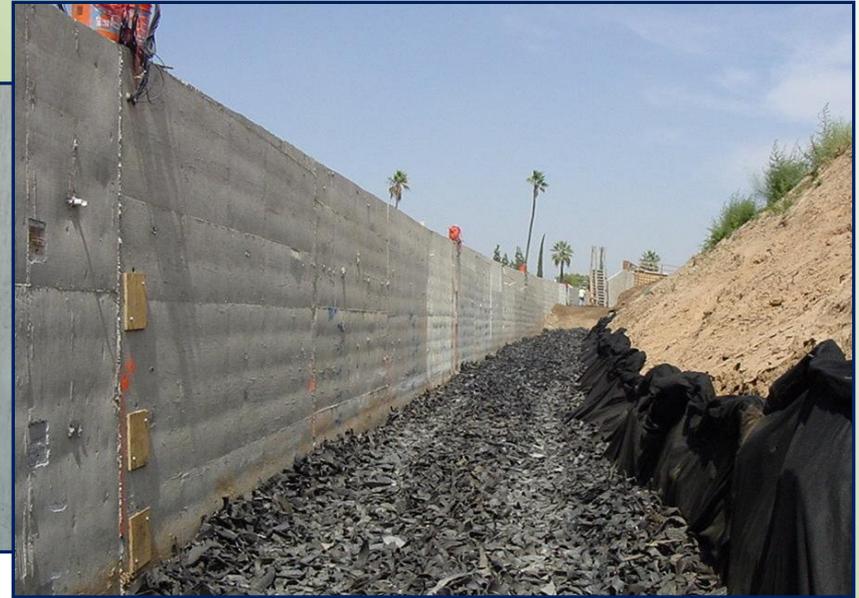


Palomino Road, Slide Repair



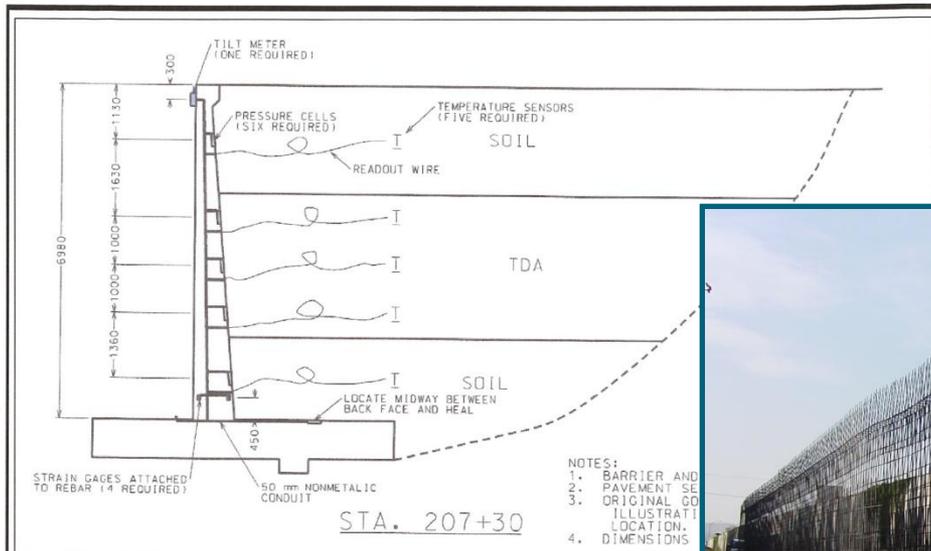
Savings to County - \$ 90,000

Light Weight Backfill Behind Retaining Walls



Light Weight Application Wall 119 and 207

Lightweight Backfill Behind Retaining
Walls
Riverside, Ca
Wall 119 and 207



- NOTES:
 1. BARRIER AND
 2. PAVEMENT SE
 3. ORIGINAL GO
 ILLUSTRATI
 LOCATION.
 4. DIMENSIONS

KENNEC

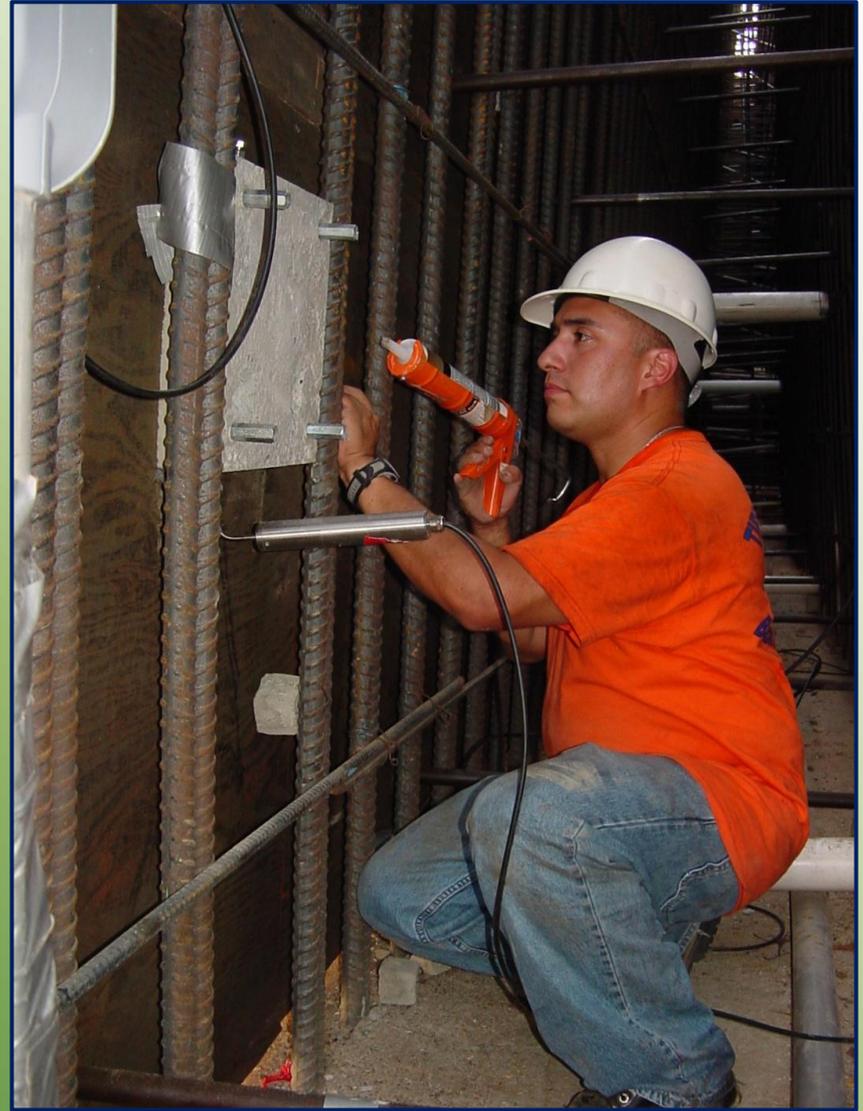
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CIWMB

CALTRANS WALL 207
RIVERSIDE, CALIFORNIA

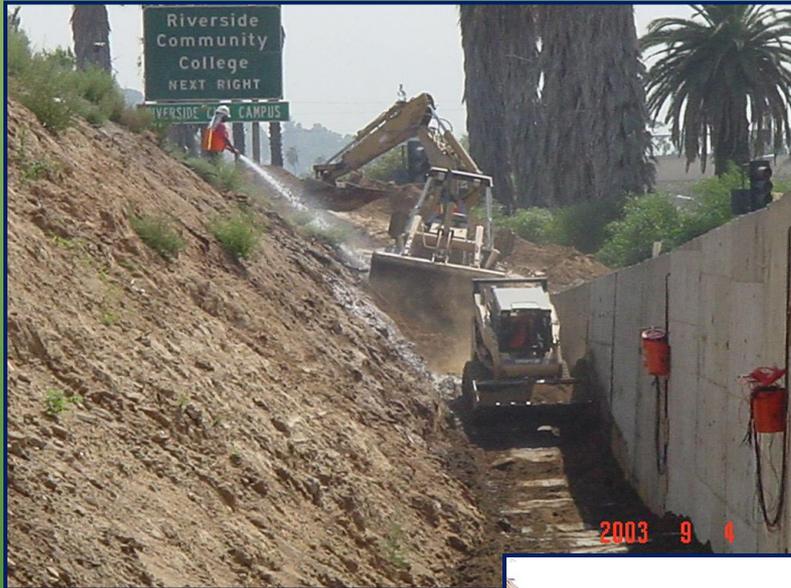
**STATION 207+30 SENSORS
TDA BACKFILL SECTION**

Wall 119 Riverside, CA



Wall 119 Riverside, Ca

Placement of foundation soil

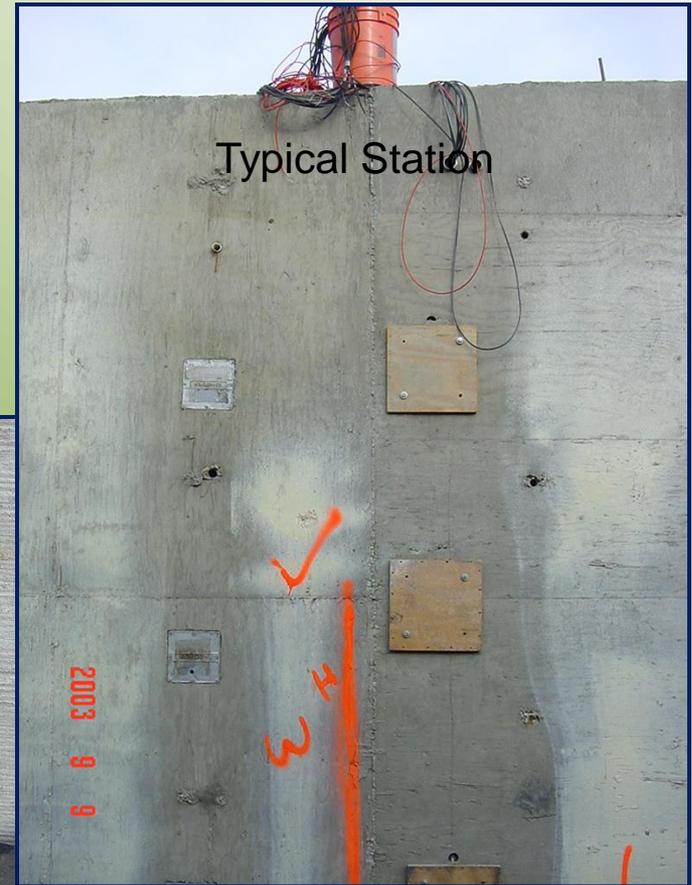


Compaction of foundation soil

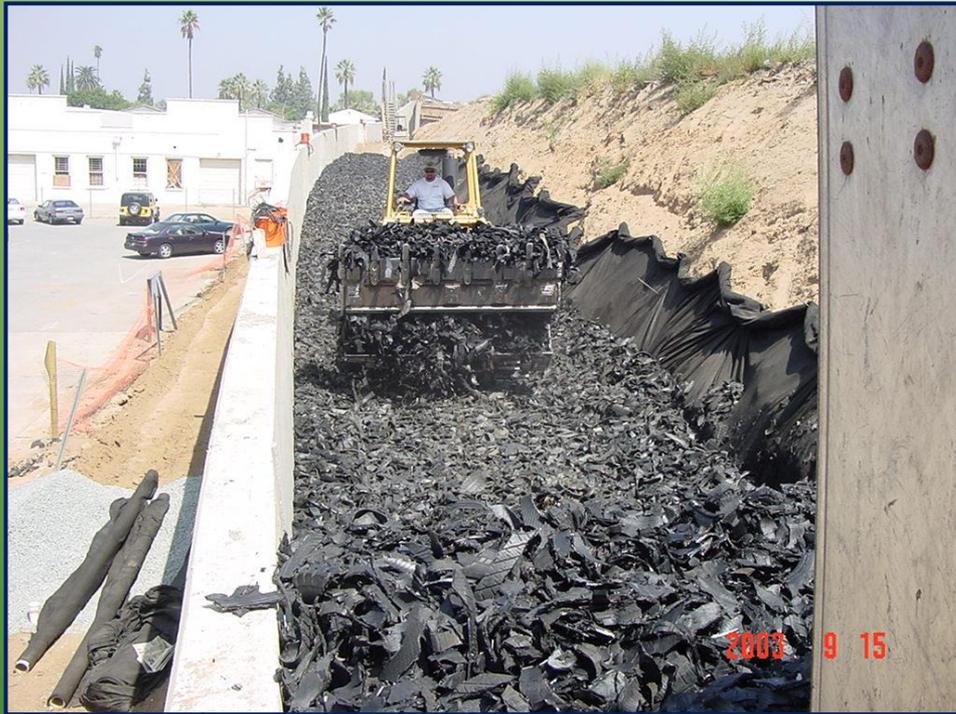


Unloading TDA

Wall 119 Riverside, CA



Wall 119 Riverside, CA



TDA placement

TDA placed and compacted



Wall 119 Riverside, CA

Final geo-textile wrap



Wall 119 Riverside, CA

Cover soil delivery, placement, and compaction



Wall 119 Riverside, Ca

Completed cover soil installation, 2 feet



Typical gravel/soil section



Wall 119 Riverside, Ca



86,000 TIRES

2003 9 19

Wall 207 Riverside, Ca



Type 1 T Retaining Walls



Estimated Savings on Future Walls - \$100/ lineal foot

TDA In Light Rail Vibration Mitigation



Vibration Mitigation



Conventional Vibration Mitigation Technology \$800+/ft



TDA Vibration Mitigation \$150/ft



VTA Vasona Line Light Rail



Saving to VTA \$1,000,000

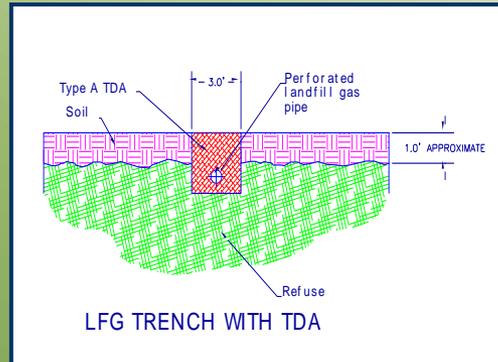
TDA in Landfills Applications

- Landfill Gas Pipe Protection
- Landfill Bio-Reactor System
- Drainage Layers in Landfill Covers
- Landfill Gas Extraction Trenches
- Daily and Intermediate Alternative Cover

Why use TDA in Landfill Systems

- High Permeability/Free Draining
- Compressible
- Lightweight
- Cost savings
- Recycling (100 Tires = 1.5 cy)

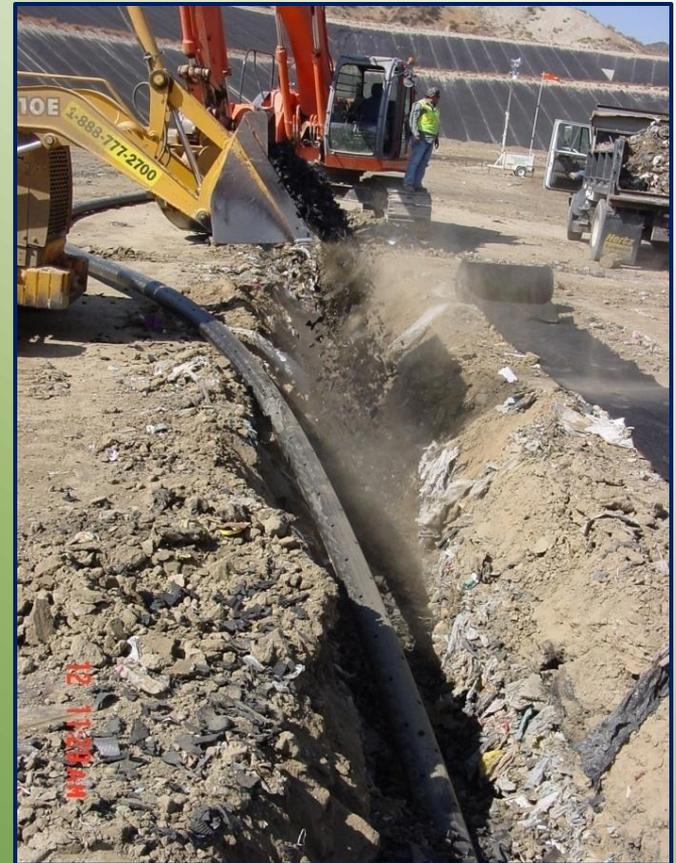
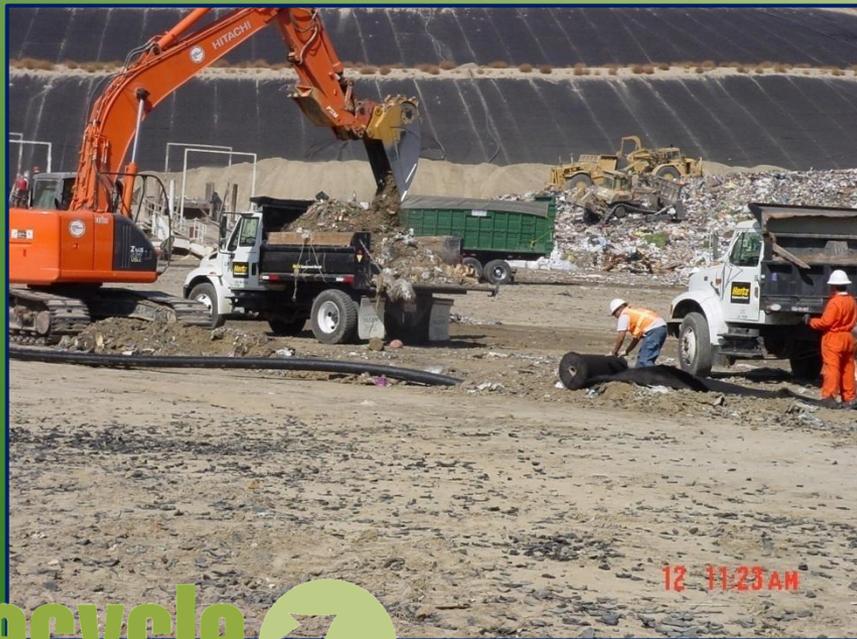
Landfill Gas Collection Trenches, Replace Gravel w/Type A TDA



- Type A for Gravel Replacement
- Oversize Auger for Vertical Wells
- Geo-textile separator between TDA and Soil or Fine Material

LFG TDA Trenches Typical Construction

- Typical excavation & relocation of refuse
- Typical equipment, End Dump, Excavator, Skip loader, Air monitor



LFG TDA Trenches

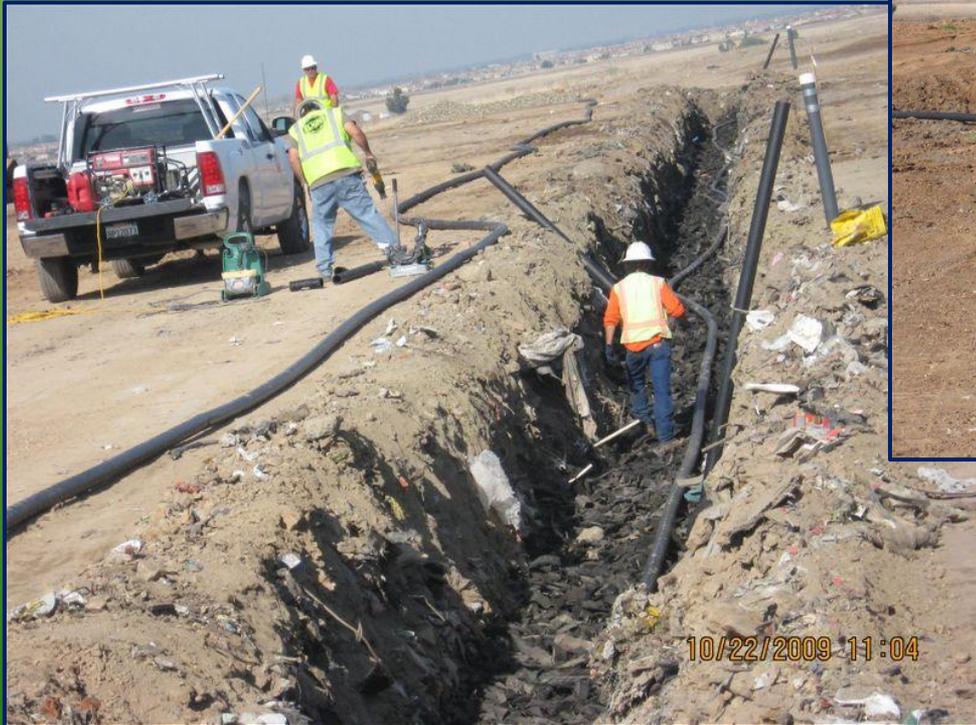


LFG TDA Trenches Typical Construction

- Geo-textile separator between TDA and Soil or Fine Material



LFG TDA Trenches Typical Construction



What is Type “A” TDA?

- Type “A” TDA – Typical, Three inch minus,
 - 1 Ton = 1.4 cubic yards
 - 1 Ton = 100 tires (PTE)
 - In Place Density = 45-58 lb/ft³
 - Permeability > 1 cm/sec for many applications
- **Uses** – Drainage material, septic leach fields, Vibrations dampening layers under light rail tracks. Gas collection media, Leachate collection material



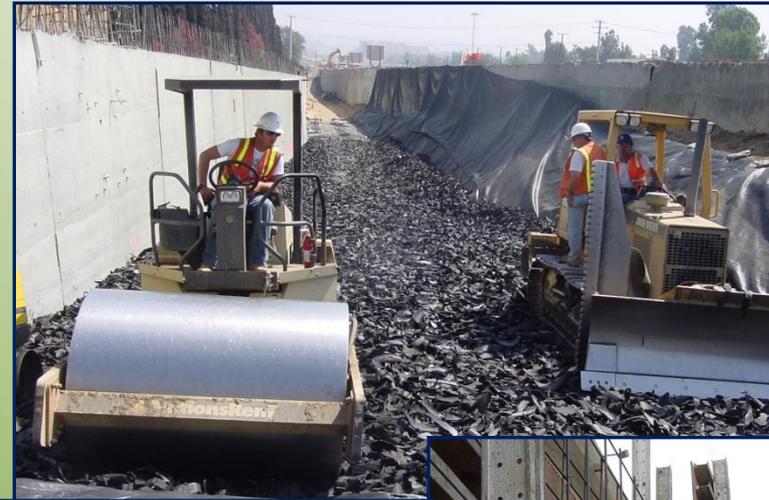
What is Type “B” TDA?

- Type “B” TDA – Typical, 12 inch minus,
 - 1 Ton = 1.5 cubic yards
 - 1 Ton = 100 tires (PTE)
 - In Place Density = 45-50 lb/ft³
 - Permeability > 1 cm/sec for many applications
- **Uses** – Lightweight fill for embankments, Slide repairs, Lightweight fill behind retaining walls, Gas collection and leachate recirculation media



CM Aspects for TDA Projects

- Pre-Construction
- Construction



Pre - Construction Activities

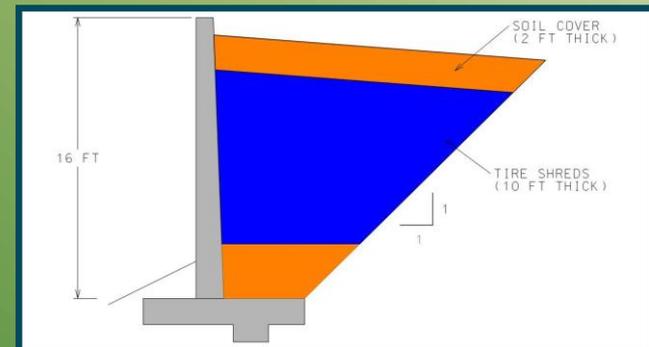
- Design and Overall Project Understanding
 - Develop Comprehensive Understanding
 - Communication with team for Design, Construction, and Construction Management expectations.
 - Delivery methods and rates
 - Material quality/verification
 - Stockpile location

- Regulatory Agency Outreach
 - Education and Communication
 - Local Water Board
 - Local Fire Department
 - Interagency Agreements



Construction Activities

- Construction Understanding
 - Communication with team at kick off meeting, TDA Construction, when, where and team expectations.
 - Placement techniques
 - Rates of Delivery, number of suppliers
 - q/a of material
 - Advantageous changes in techniques
 - Documentation of work
- As-builts
 - Documentation of changes
 - Data retrieval methods and verification
 - Drawings of TDA location, sensors etc



The Future of the CalRecycle's CEA Program

- Continue Assistance with Design and Construction Oversight Assistance
- Continue TDA – Research and Development of new Applications
- Continue TDA Education
- Continue TDA Project Construction Oversight and Material
- Procurement Assistance
- Develop and TDA Grants and Loans



Questions ?