Applications of Expanded Polystyrene Geofoam for Transportation Infrastructure

Overview of functions, applications, design considerations and guidelines

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Topics

- *Geofoam Functions*
- *Applications for Transportation Projects*
- *Design Considerations and Guidelines*

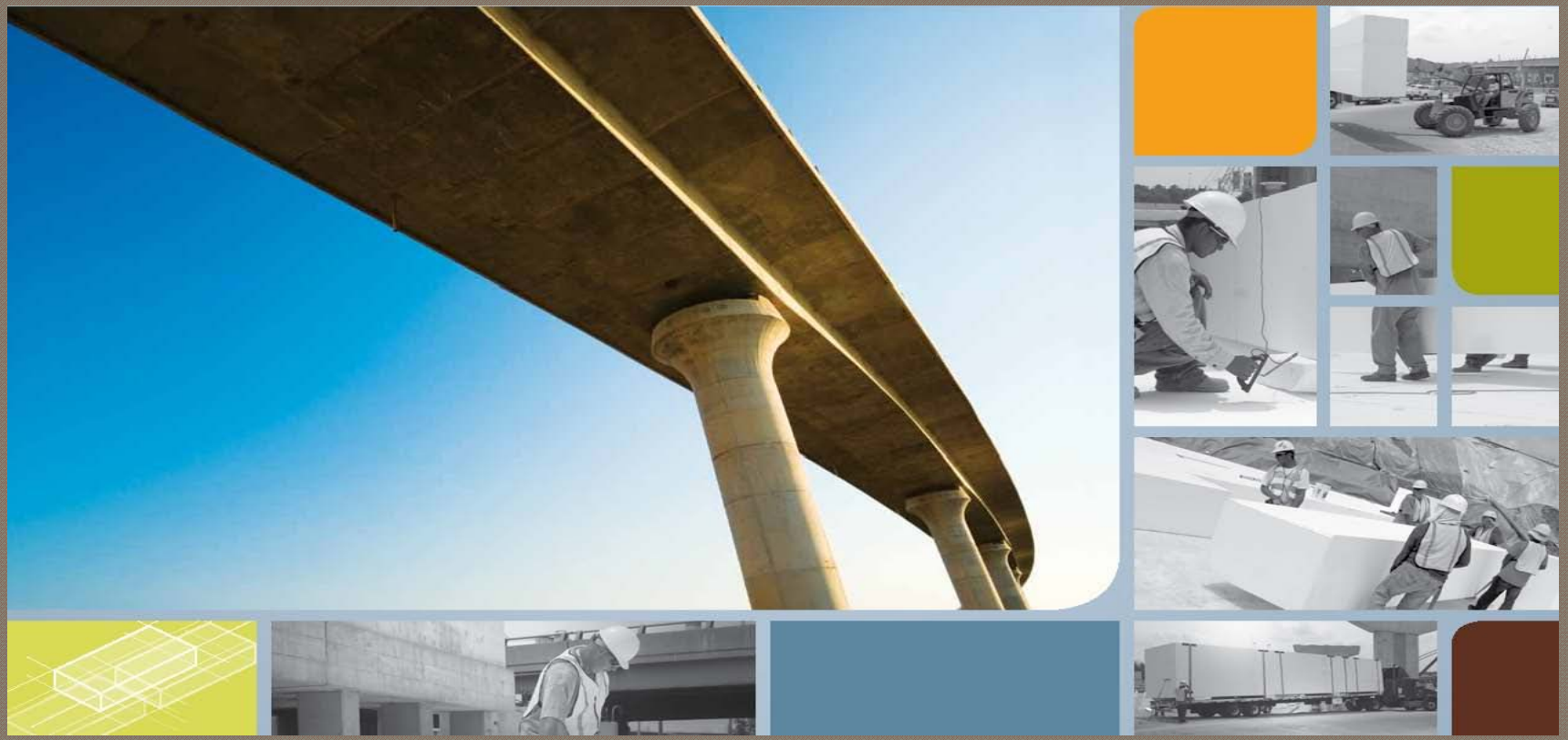
Functions

- *Lightweight Fill*
  - *Roadway*
  - *Embankment*
  - *Structures*
- *Compressible Inclusion*
  - *Earth pressure reduction*
  - *Damping*
- *Fluid Transmission & Drainage (not discussed)*
- *Thermal Insulation (not discussed)*

Topics

- Geofoam Functions
- Applications for Transportation Projects
- Design Considerations and Guidelines

Expanded Polystyrene (EPS) Geofoam Applications & Technical Data



Stark, Bartlett, Arellano

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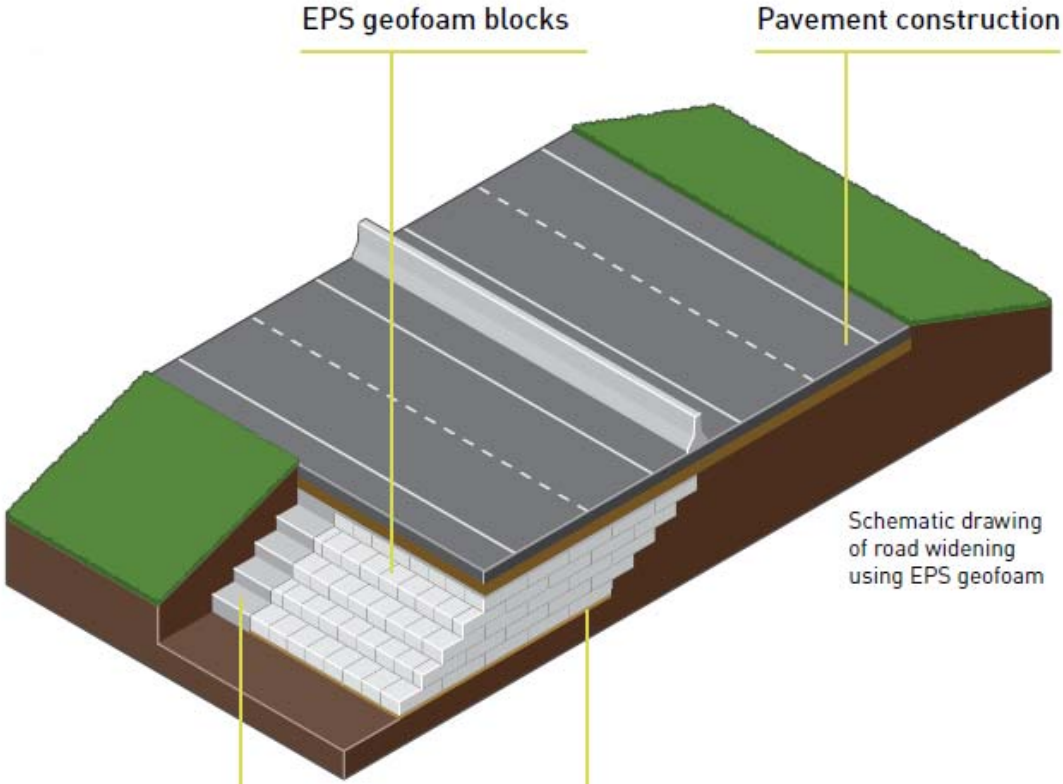
Geofoam Civil Engineering

Primary Uses For Transportation Projects

- *Roadway widening*
- *Road construction over poor soils*
- *Bridge abutments*
- *Bridge underfill*
- *Bridge support*
- *Culverts, pipelines and buried structures*
- *Light-weight backfill*
- *Railway embankment*
- *Slope stabilization*

Roadway Widening



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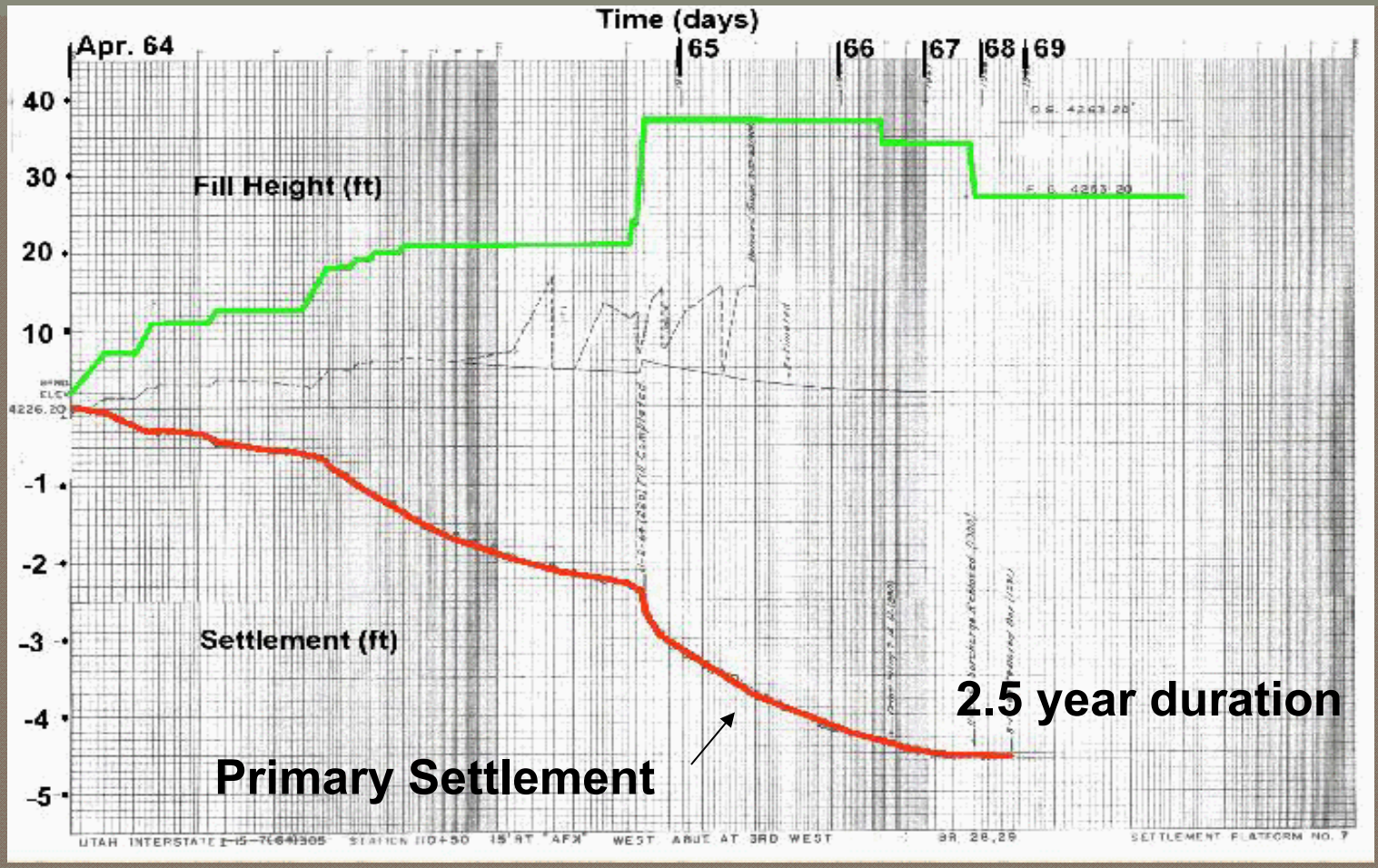
Road Widening



(I-15 Reconstruction Project – Settlement Record)

UDOT GOING THE EXTRA MILE

Roadway Widening

I-15 Reconstruction Project
Salt Lake City, Utah

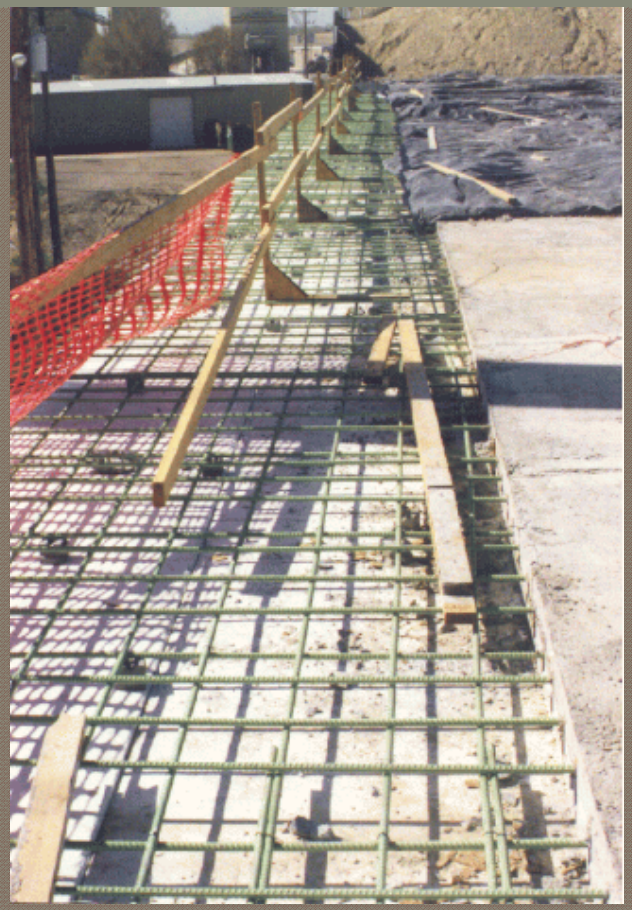
UDOT
GOING THE EXTRA MILE

Roadway Widening

I-15 Reconstruction Project
Salt Lake City, Utah

UDOT
GOING THE EXTRA MILE

Roadway Widening



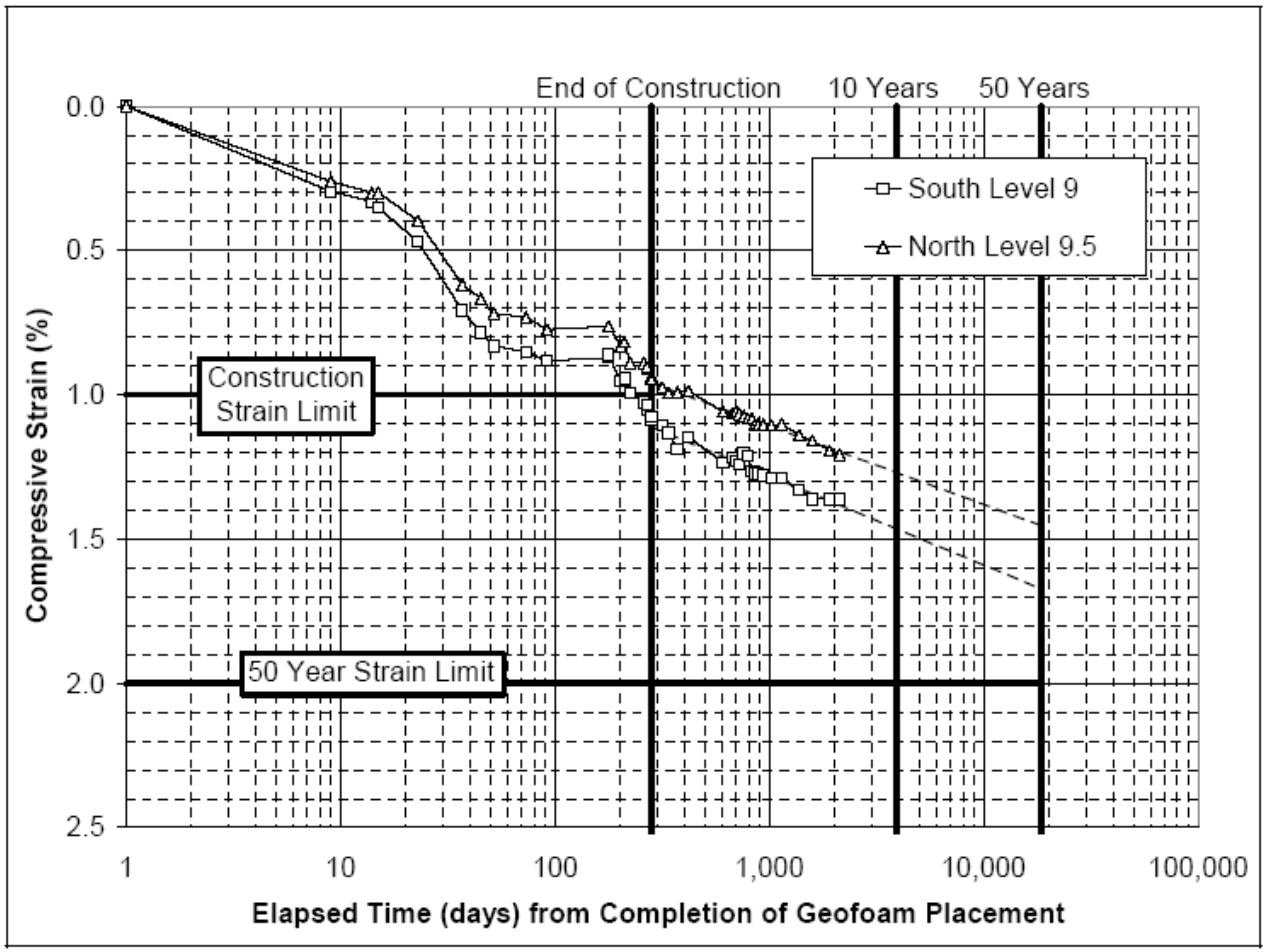
Reinforced Concrete Load Distribution Slab

Completed Load Distribution Slab

(I-15 Reconstruction Project)

UDOT GOING THE EXTRA MILE

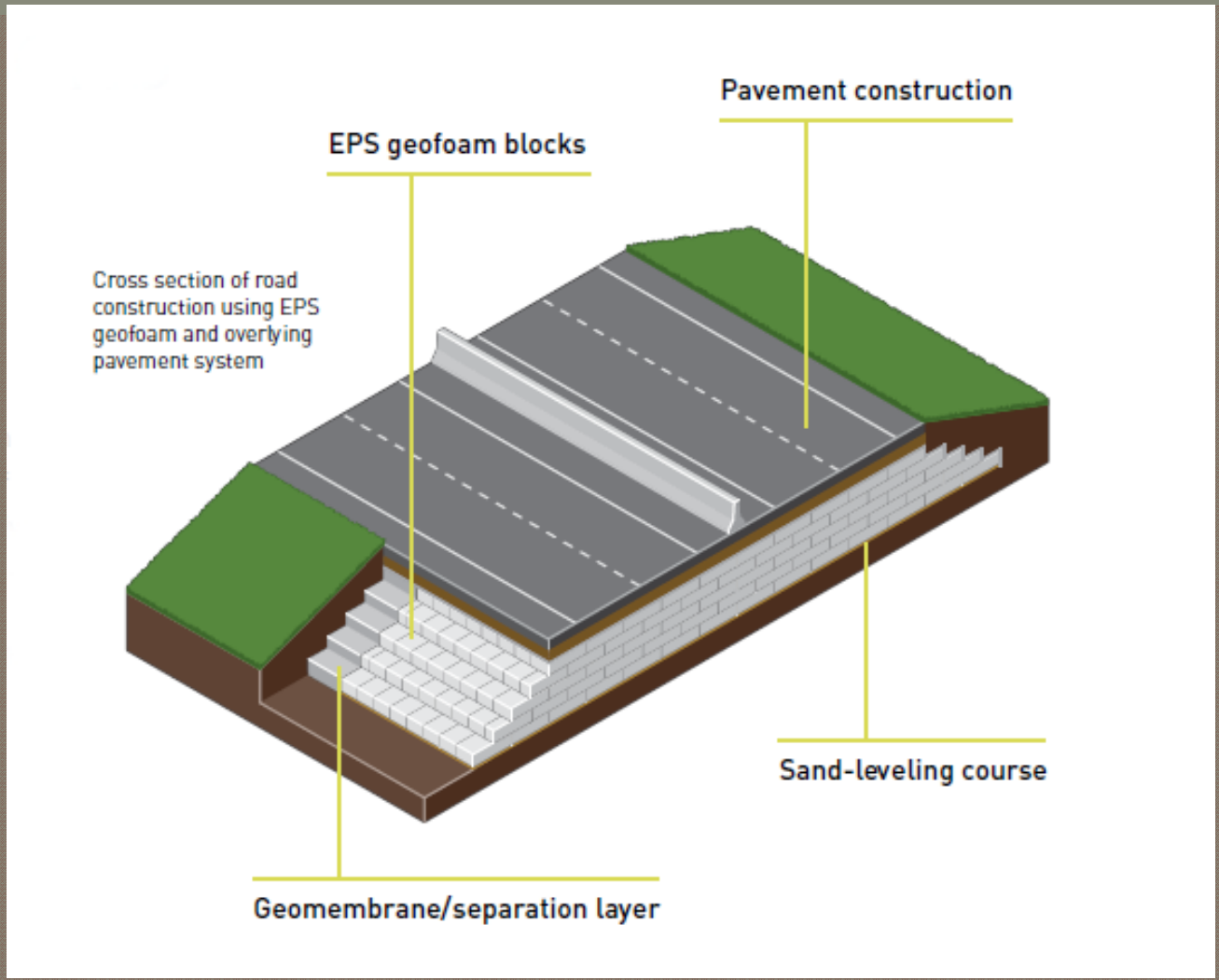
Roadway Widening



(I-15 Reconstruction Project)

UDOT GOING THE EXTRA MILE

Road Construction Over Poor Soils



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Road Construction Over Poor Soils

FIG A

Flom Bridge – 1972 – Lillestrom, Norway

Figure 3. Excavation of the first EPS embankment at Flom bridge (EPS and polyurethane as protective layer).

Statens vegvesen

Norwegian Public Roads Administration

Road Construction Over Poor Soils

St. Rosa Road

Private Road
Constructed Over
Rice Fields

St. Rosa, Philippines

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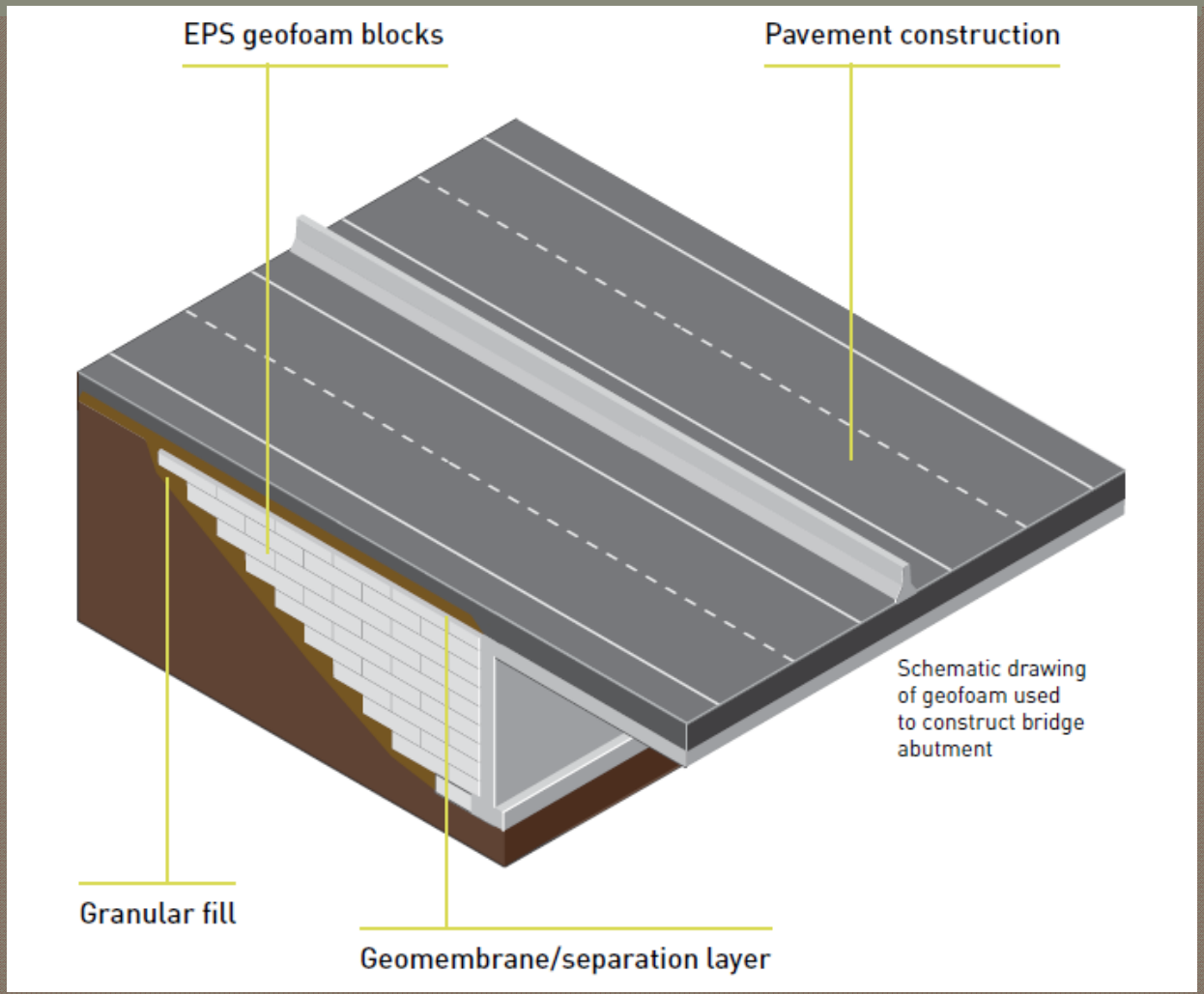
Bridge Abutments, Underfill and Support



Schematic drawing of geofoam used to construct bridge abutment

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Geofoam Civil Engineering

Bridge Abutment

I-15 Reconstruction,
Salt Lake City, Utah

Overpass, 5300 S. over UTA TRAX
Salt Lake City, Utah

UDOT GOING THE EXTRA MILE

UTA

Bridge Approaches

North Temple Viaduct – Salt Lake City, Utah

Bridge / Tunnel Underfill

I-215 at 3300 South,
Salt Lake City, Utah

UDOT
GOING THE EXTRA MILE

Temporary Bridge Supported on EPS

Lokkeberg Bridge, Norway

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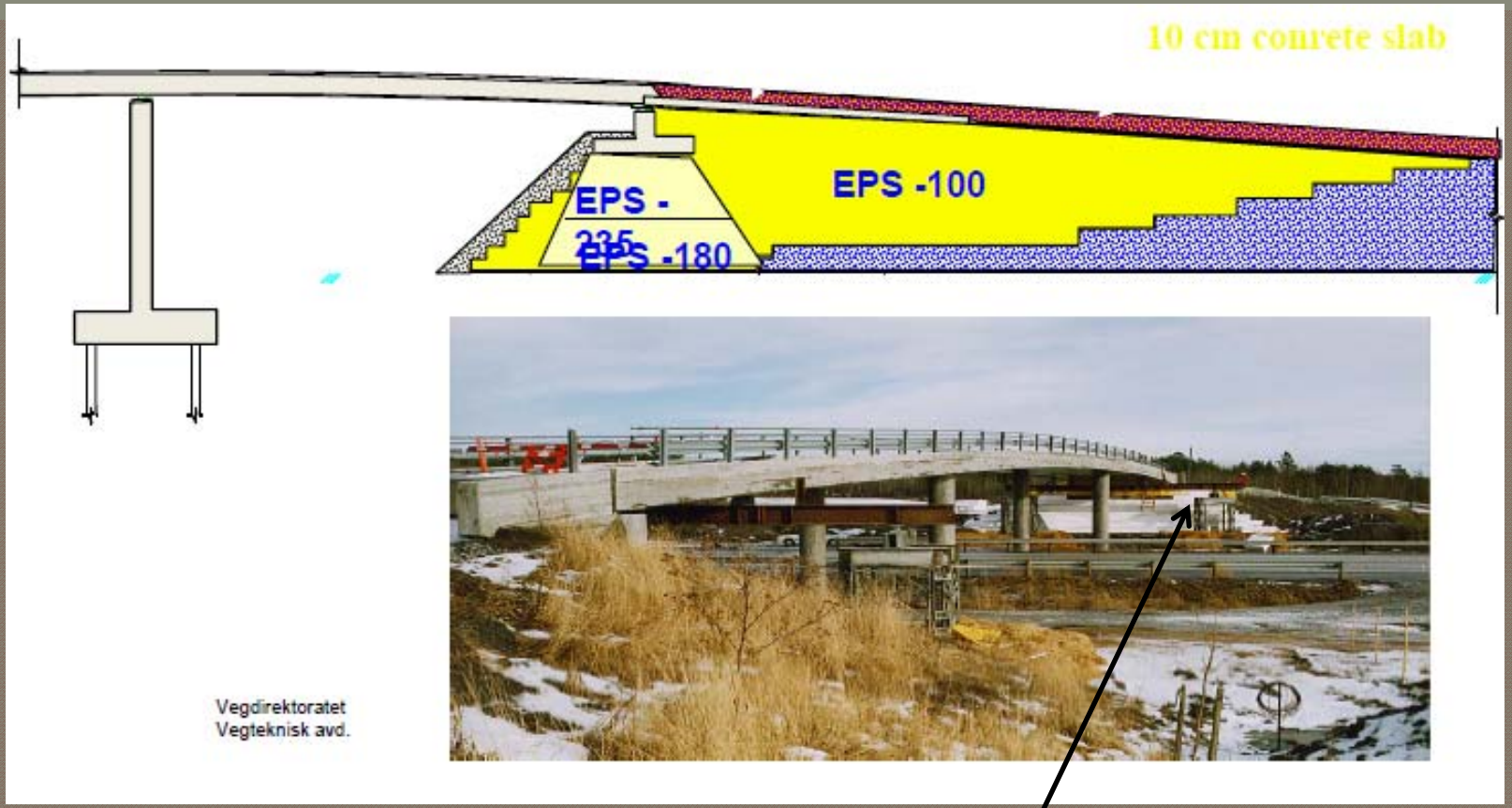
Norwegian Public Roads Administration

Permanent Bridge Supported on EPS



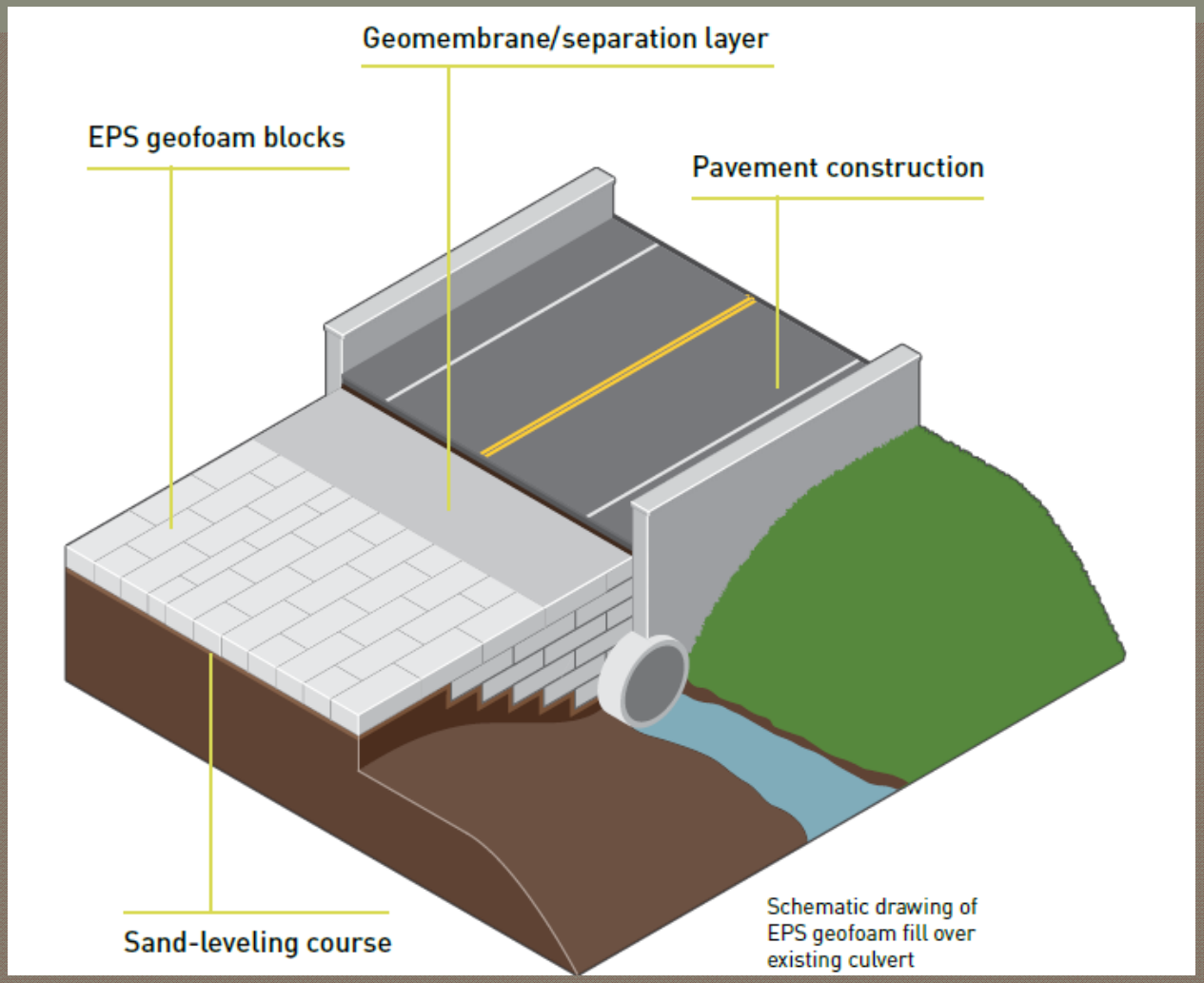
Hjelmungen bru, Norway

EPS block

Statens vegvesen

Norwegian Public Roads Administration

Culverts, Pipelines and Buried Structures



Schematic drawing of EPS geofoam fill over existing culvert

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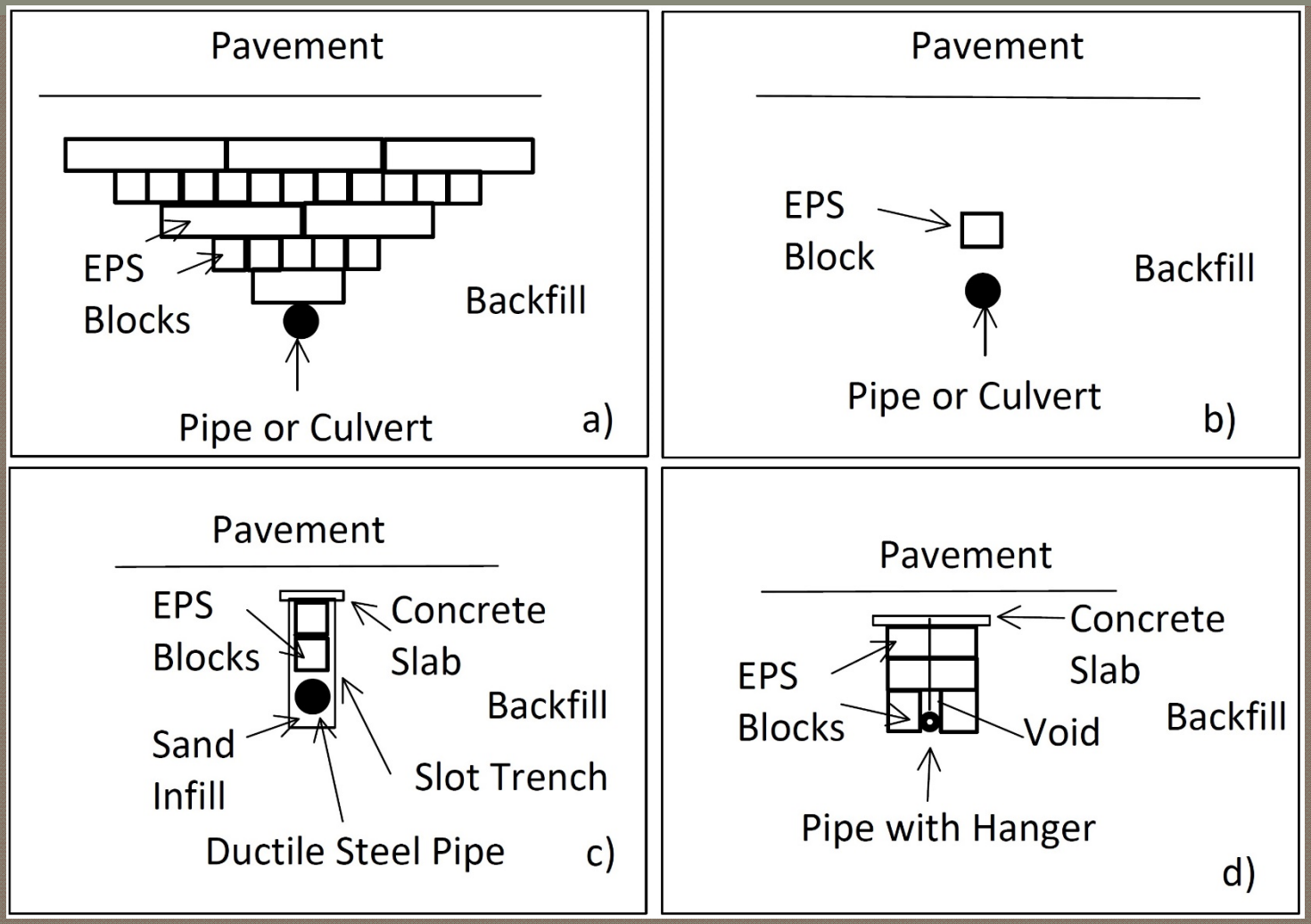
Geofoam Civil Engineering

Common EPS Protection Strategies



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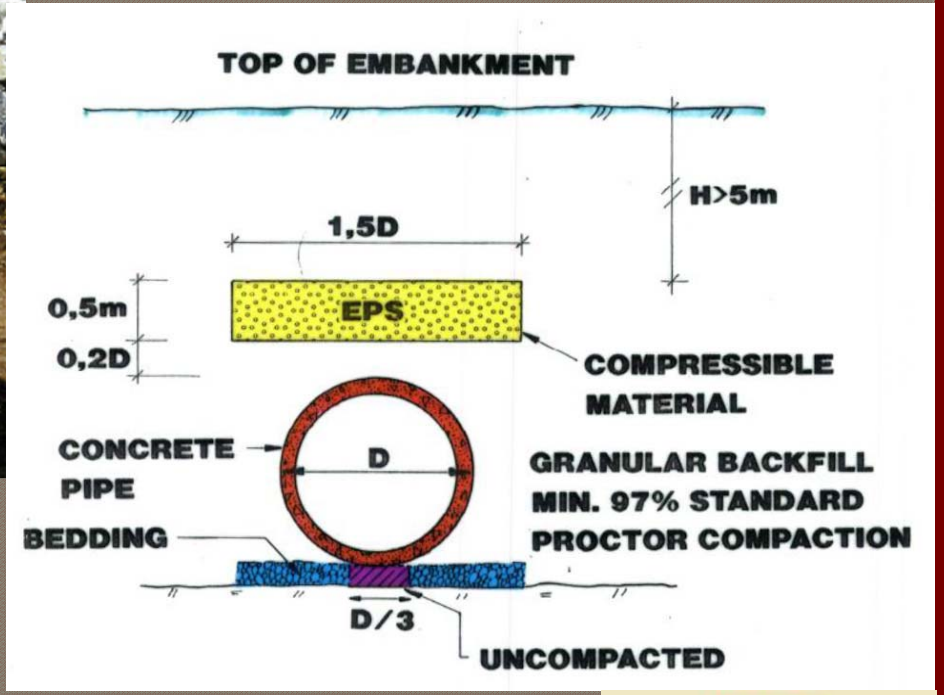
Culverts

UTA Commuter Rail Widening Over Existing Culvert,
Corner Canyon, Draper, Utah

Compressible Inclusion – Imperfect Trench Method

Eidanger, Norway 1988 (photo courtsey of Norwegian Public Roads Administation).



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Norwegian Public Roads Administration

Slot Trench Cover System

Salt Lake City, Utah

QUESTAR Gas

BECHTEL

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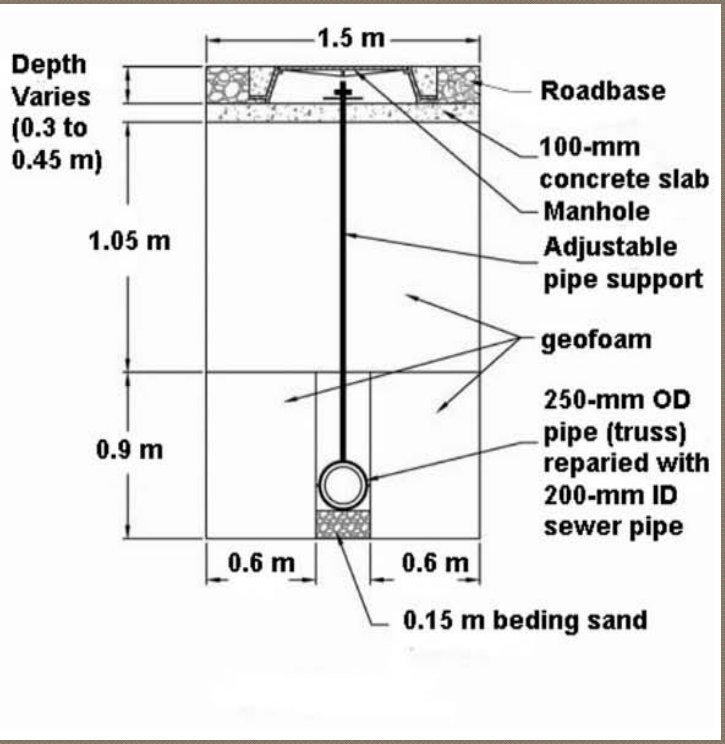
Post and Beam Cover System



Brian Head Ski Resort, Cedar City, Utah

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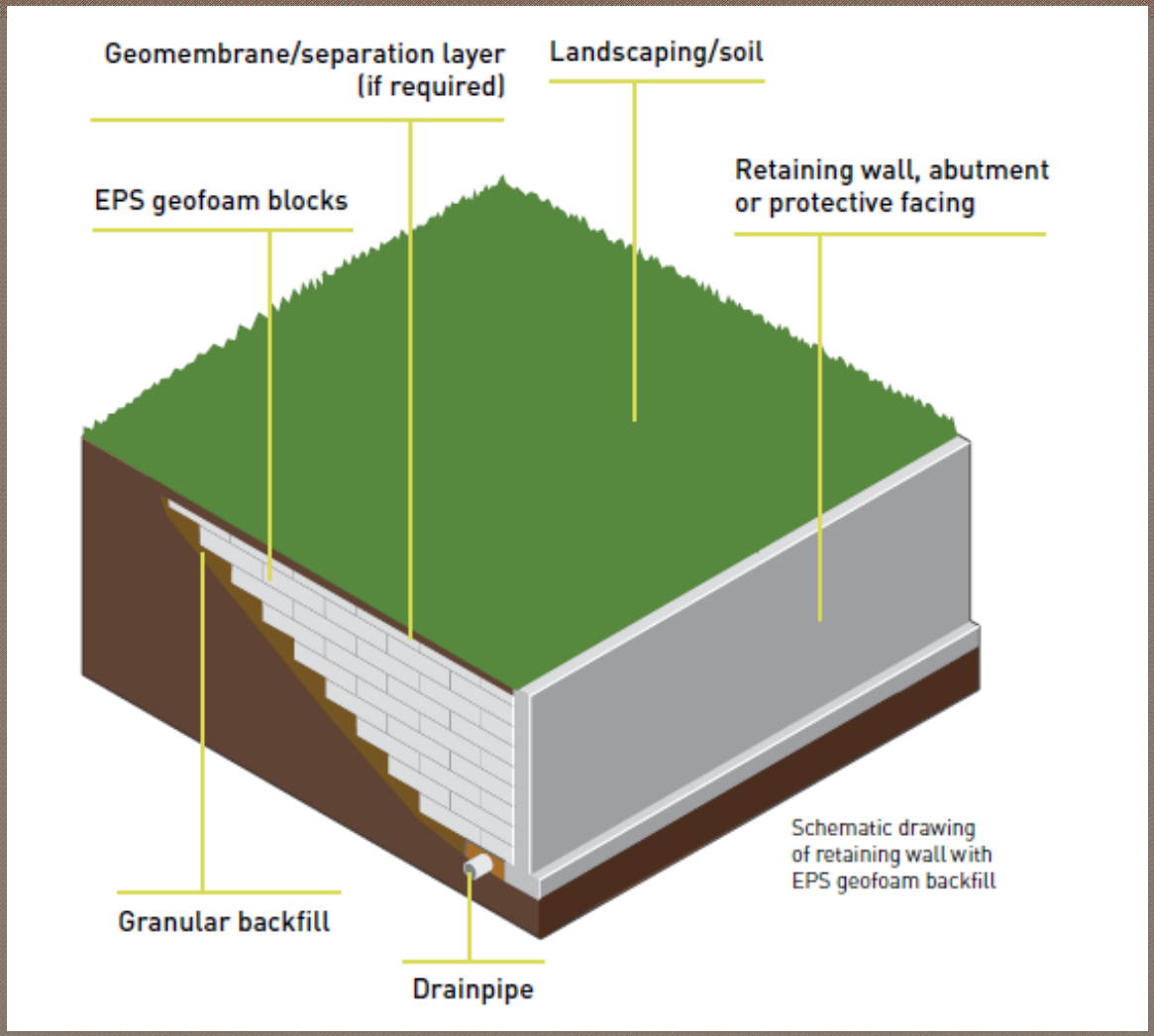
Light-Weight Backfill



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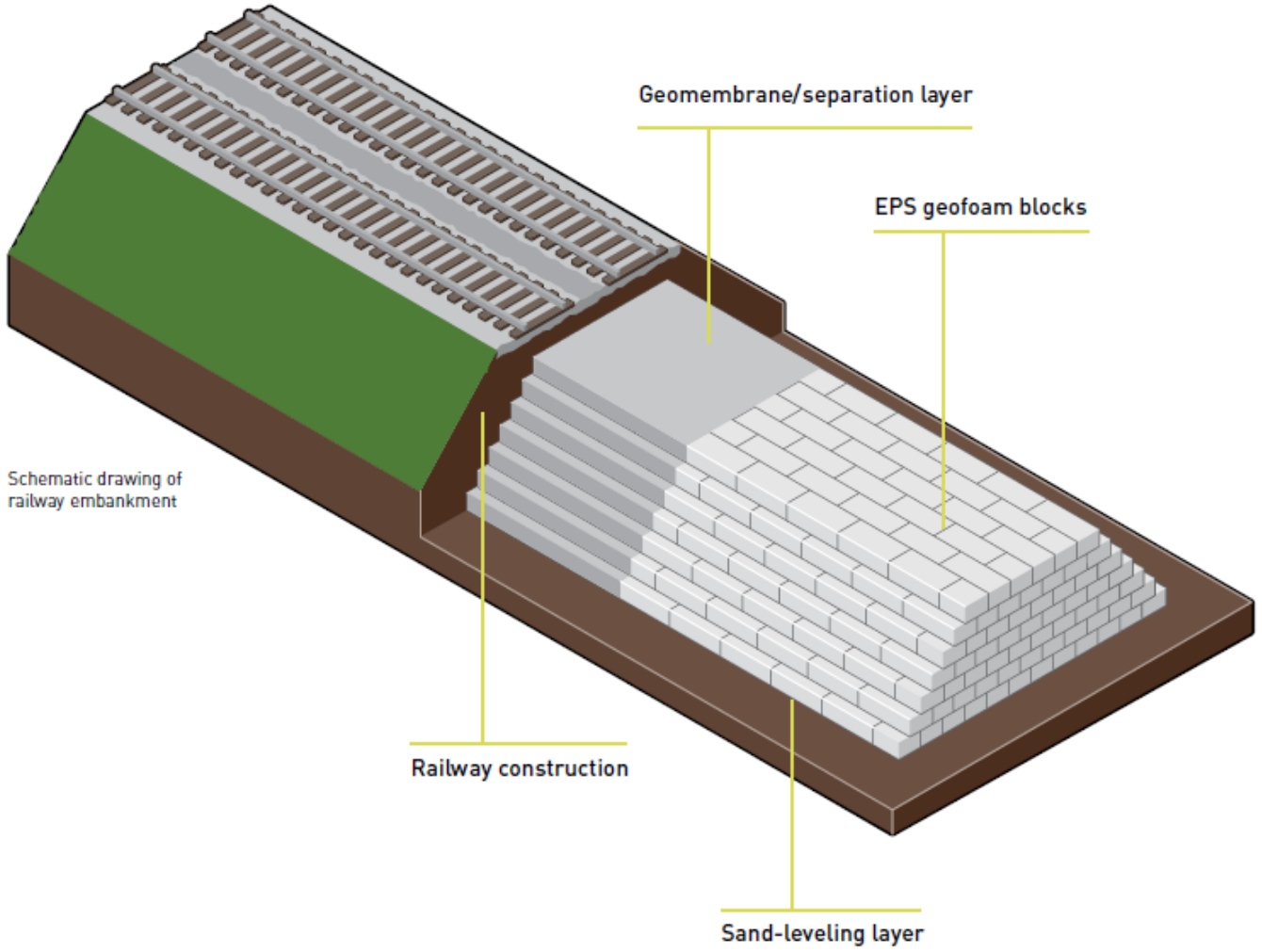
Geofoam Civil Engineering

(Light-Weight Backfill)

Tunnel Infill, Tucker Blvd.,
St. Louis, Missouri

Rail Embankments



Schematic drawing of railway embankment

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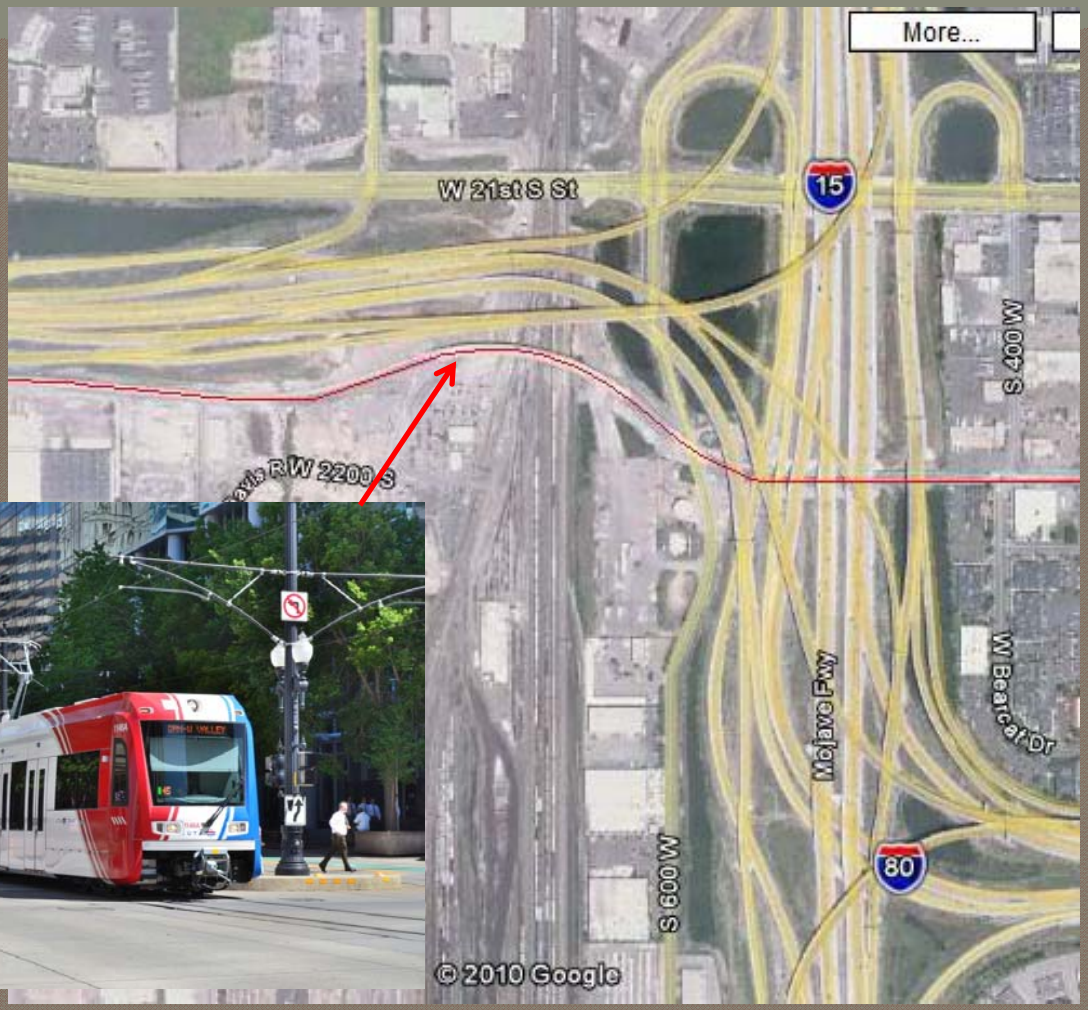
Geofoam Civil Engineering

Light Rail Embankments



UTA –Light Rail – Salt Lake City, Utah

Light Rail Embankments

UTA –Light Rail – Salt Lake City, Utah

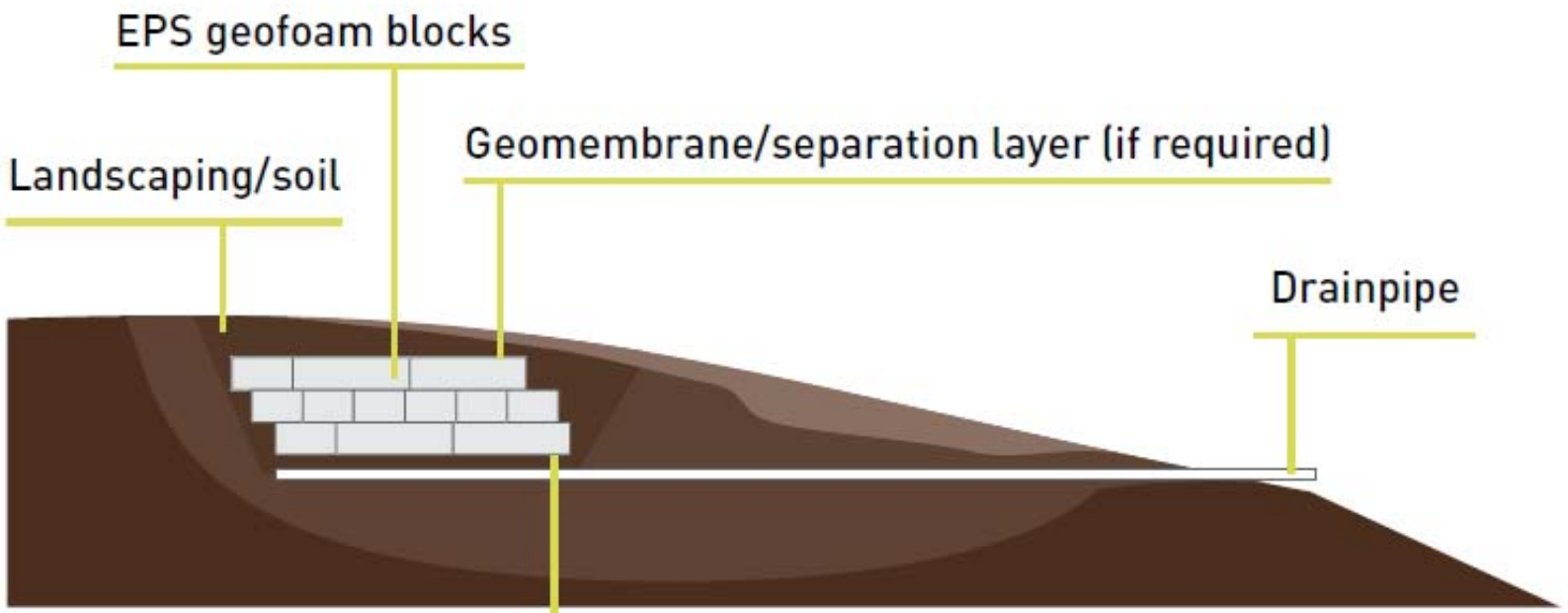
Light Rail Embankments

UTA –Light Rail – Salt Lake City, Utah

Commuter Rail Embankments

Front Runner – UTA – Corner Canyon – Draper Utah

Slope Stabilization



Schematic drawing of EPS geofoam placement in a slide area

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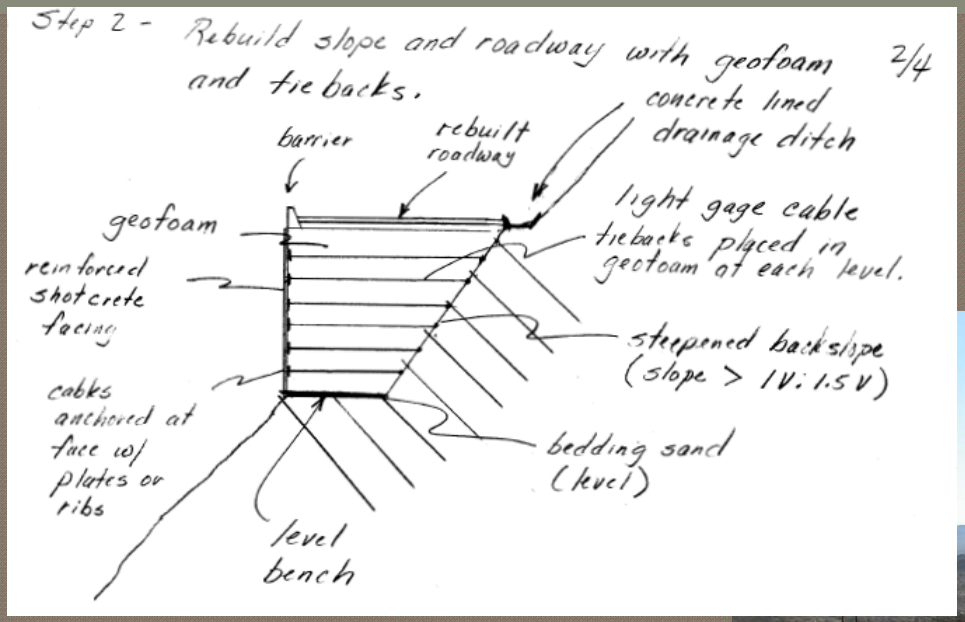
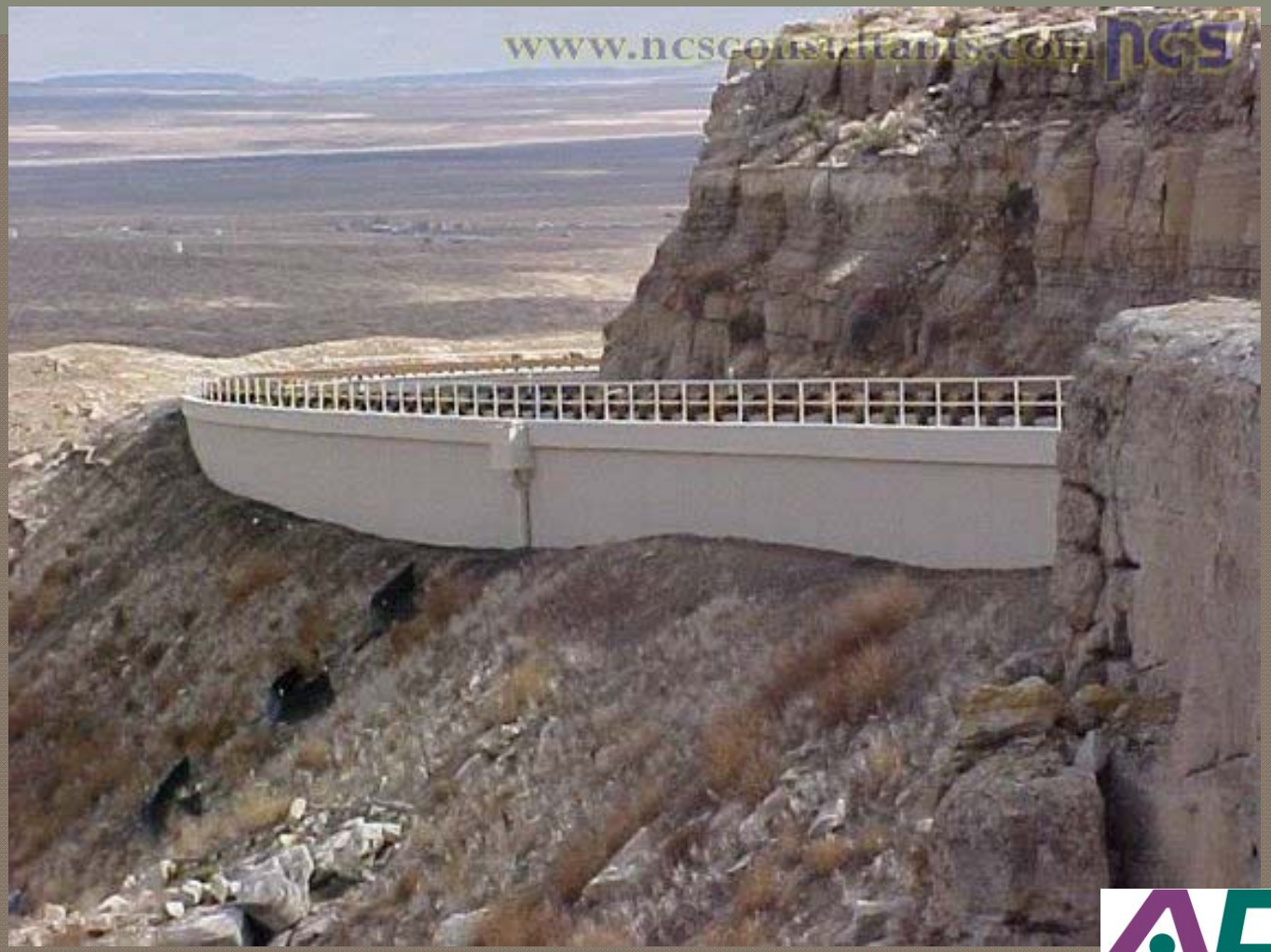
Geofoam Civil Engineering

Slope Stabilization



Slope Stabilization



ADOT

Topics

- *Geofoam Functions*
- *Applications for Transportation Projects*
- *Design Considerations and Guidelines*

Design and Construction Considerations

- Design
  - Roadway & Pavement Design
    - Situation and Layout
    - Geometrics
    - Protective Systems
      - UV degradation
      - Chemical adsorption
      - Concentrated Loads
    - Pavement Design
      - Dead & Traffic Loadings
  - Internal and External Stability
    - Settlement – Foundation Soils
    - Bearing Capacity
    - Global Stability
    - Extreme Loadings
      - Seismic
    - Drainage & Buoyancy
- Construction
  - Bedding Material
  - Compaction
  - Handling
  - Block Dimensions
  - Block Layout & Placement
  - Cover and UV protection
  - Quality Assurance/Control
    - Specifications / Provisions
    - Testing and Sampling
    - Inspection
    - Corrective Action

Design Guidance for EPS Geofoam

- *Current Design Methods / Guidance*
  - *Norwegian Public Roads Administration (1987, 1992)*
  - *Japanese – EDO (1996, 2001)*
  - *Draft European Design Code (1998)*
    - *I-15 Reconstruction Project (1998-2001)*
  - *NCHRP 529 and Web Document 65 (2004)*
  - *European EPS White Book (2011)*
  - *NCHRP Project 24-11(02) Phase I Study (slopes) (2011)*
  - *Various Research Reports*
  - *Technical Papers*

Questions

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Statens vegvesen
Norwegian Public Roads Administration