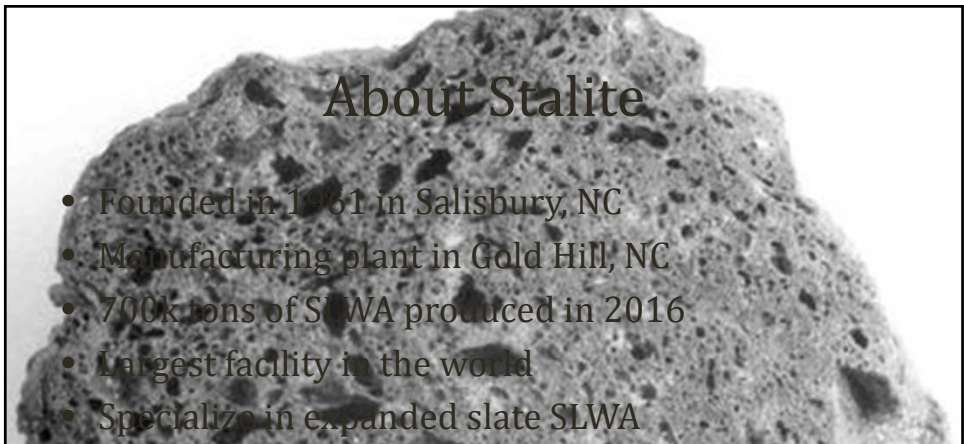




# Structural Lightweight Aggregate


All Rocks Are Not Created Equal:  
A Case Study of SLWA in Geotechnical  
Engineered Applications

Imani Brodie Surratt, E.I.  
Carolina Stalite Company



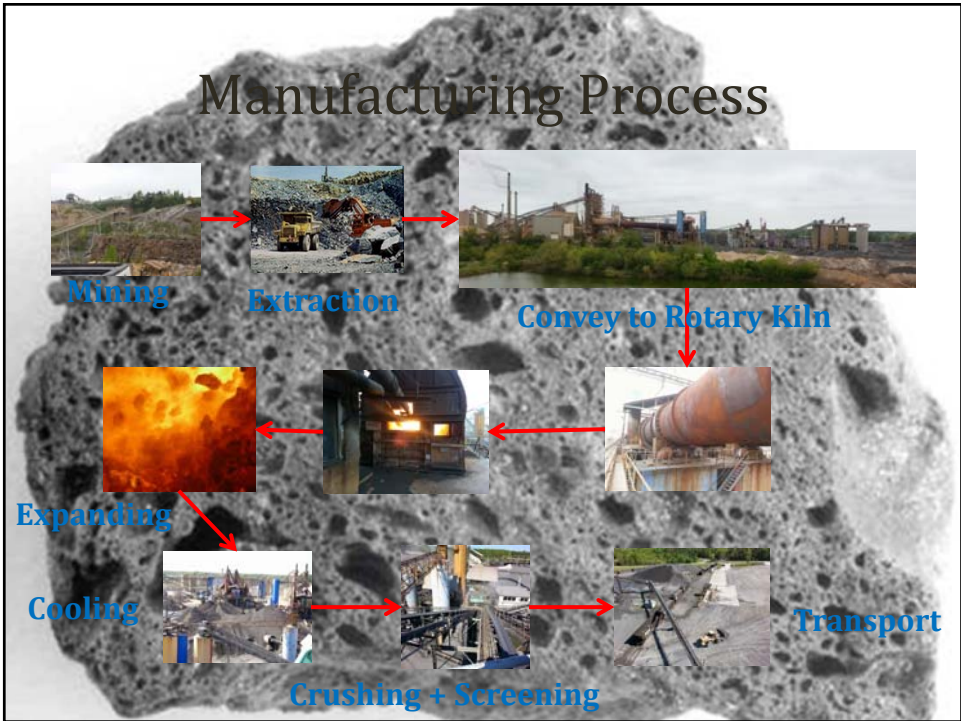
## About Stalite

- Founded in 1961 in Salisbury, NC
- Manufacturing plant in Gold Hill, NC
- 700k tons of SLWA produced in 2016
- Largest facility in the world
- Specialize in expanded slate SLWA

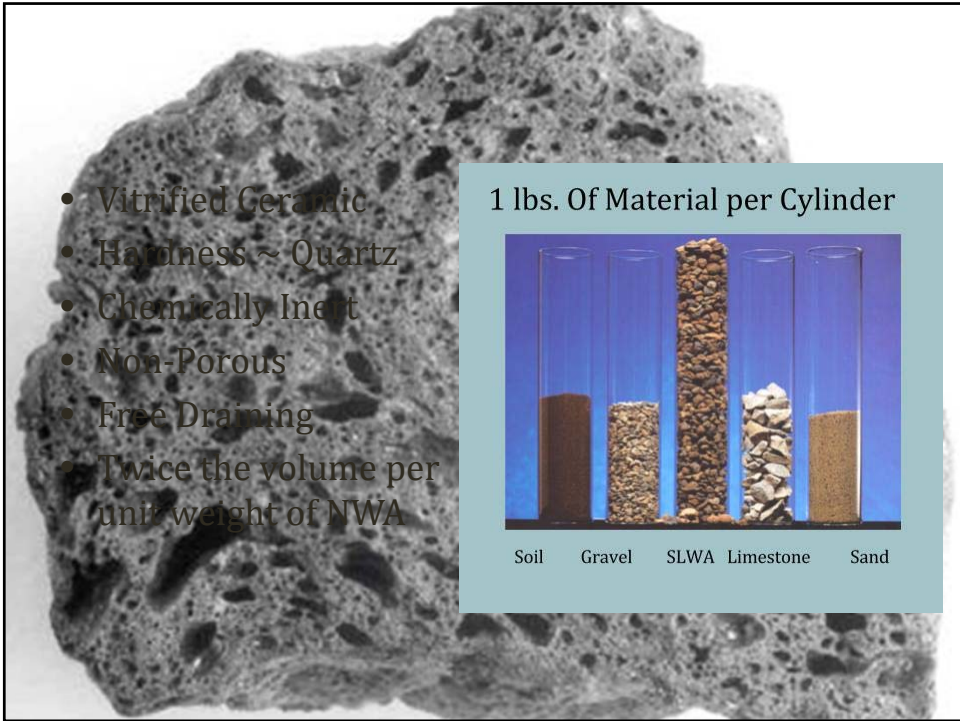


## Expanded Slate?

- Parent Material = Meta- Argillite
  - Grey striated rock with foliations that bear a resemblance to slate
  - Metamorphic rock
    - Volcanic ash → Sedimentary Clay Layer → Metamorphic Rock (Meta Argillite)
- Uwharrie Mountains in “Slate Belt”
- Meta- Argillite → Slate








- Vitrified Ceramic
- Hardness ~ Quartz
- Chemically Inert
- Non-Porous
- Free Draining
- Twice the volume per unit weight of NWA

1 lbs. Of Material per Cylinder



Soil    Gravel    SLWA    Limestone    Sand

## Physical & Electrochemical Properties of ¾" x #4

Property	
Density - Damp Loose	48 pcf
Density - Compacted In Place Moist	60 pcf
Specific Gravity (Dry)	1.45
Absorption	6 %
Angle of Internal Friction (Compacted)	40-42°
Organic Impurities	0 %
Electrical Resistance	30,000 - 40,000 ohm-cm
Sulfate Content	32 ppm
pH	7-9
LA Abrasion	25-30 %

## Property Comparisons

Property	SLWA ¾" X #4	Normal Weight Aggregate
Density - Damp Loose	48 pcf	89 - 105 pcf
Density - Compacted In Place Moist	60 pcf	110 - 130 pcf
Angle of Internal Friction ( $\Phi$ ) Compacted	40 - 42°	26 - 33°
pH	7 - 9	5 - 10
LA Abrasion	25 - 30 %	10 - 45 %

## Applications

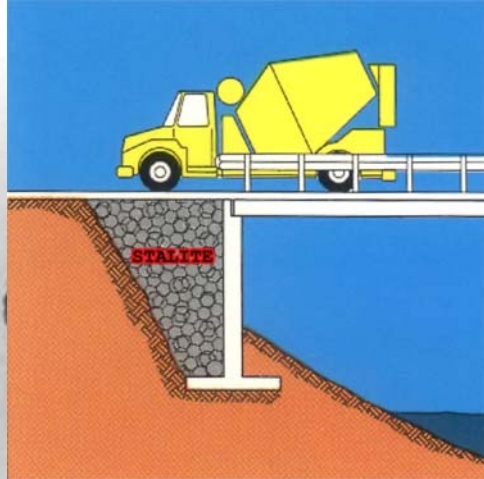
- Lightweight Concrete
- Lightweight Concrete Masonry Units
- Road Surfacing
- Structural & Load Bearing Soil
- Soil Amendment
- Filtration Media (Stormwater, Wastewater)
- Greenroof & Nursery Bed Material



### Landscape and Plaza Fills

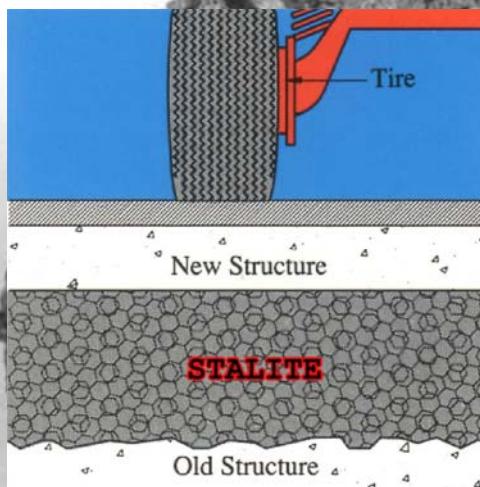
- Minimizes Dead Loads
- Free draining which helps minimize hydrostatic potential
- Due to reduced mass of fill more planters and levels can be added
- Stalite is easy to transport and install these applications

## Bulkheads and Retaining Walls



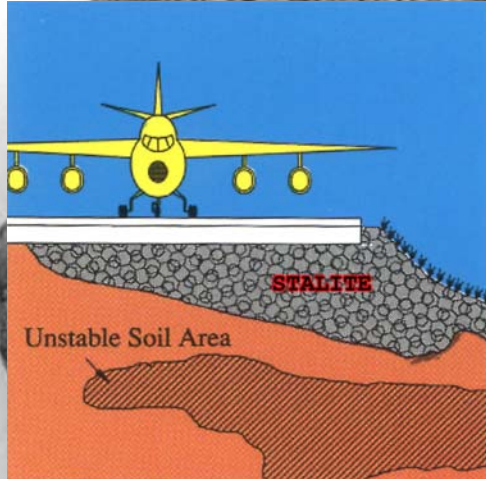
- Reduces soil thrust and bending moments
- Reduces pressures against both the abutment and the end slope
- Allows for free drainage
- Improves embankment stability

## Repair and Rehabilitation



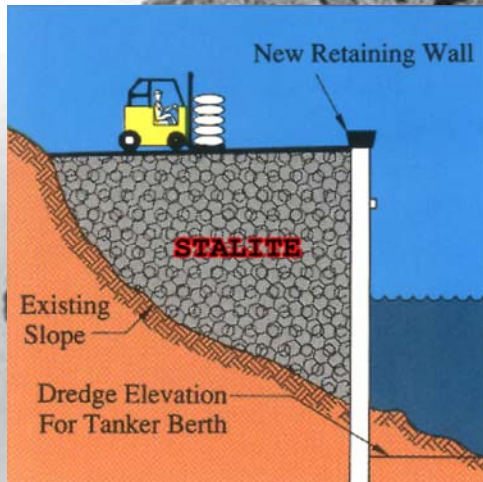
- Reduces dead load on existing structure
- Stalite is very durable with controlled gradations allowing for uniform in place density and load distribution

## Fill Over Poor Soils and Marsh Lands



- Poor construction sites can be reclaimed and developed
- Design elevations can be achieved with much lower fill weights than when using conventional fill
- Long term settlement is controlled and reduced
- Controlled fill allows uniform load distribution

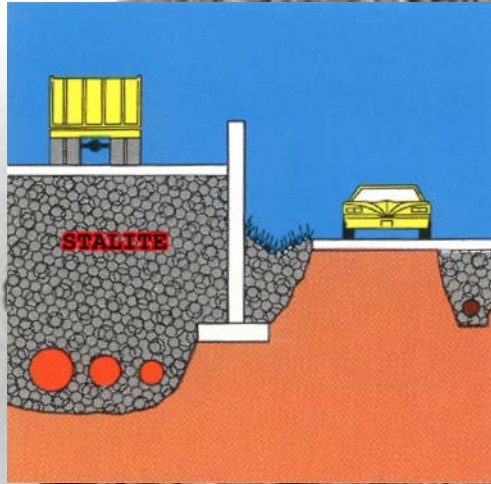
## Waterfront Structures



- Allows economical modification of marine terminals
- Allows increased dockside draft
- Reduces lateral thrust and bending moments
- Allows for free drainage and control of in-place density



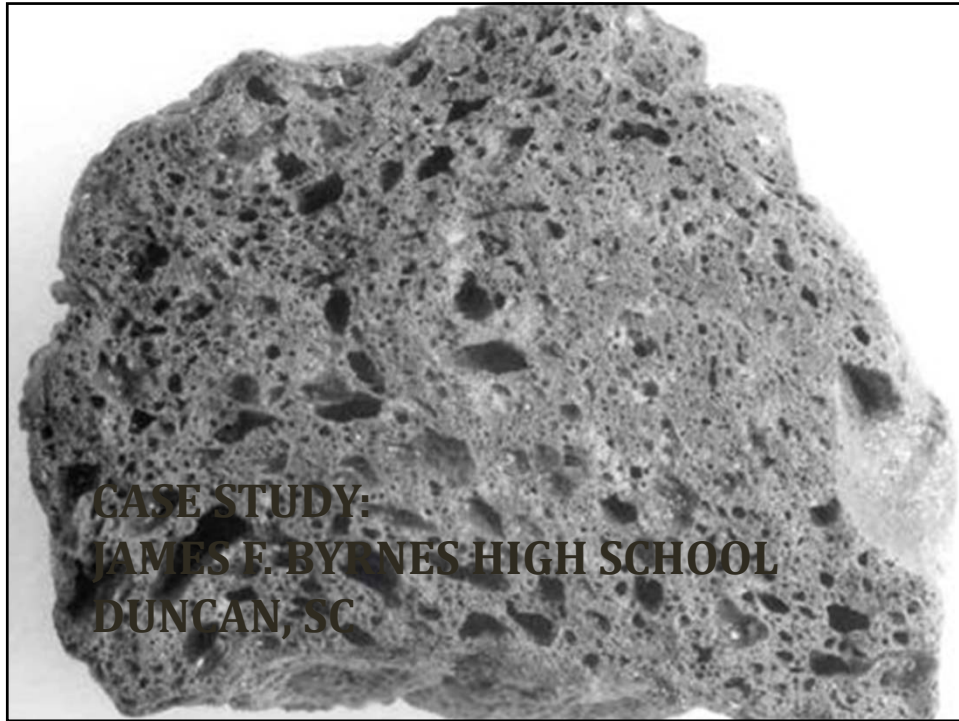
## Underground Conduit and Pipelines



- Reduces dead load on buried pipes and structures
- Allows for higher fill construction over buried pipes and structures
- Minimizes hydrostatic potential
- Provides thermal insulation to underground pipes and structures
- Economical alternative to flowable fill

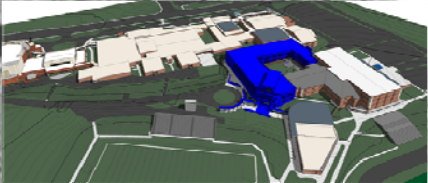
## Testing Standards for Geotechnical Applications

- ASTM
  - C330-14
  - C191
  - D2794
  - D3080
  - D4253
  - D4254
- AASHTO
  - T104
  - T288
  - T289
  - T290
  - T291



**James F. Byrnes High School**  
Phase I & II Construction

- Location: Duncan, SC
- 2015-2016 Academic School Year
- Engineer: Baily and Son Engineering, Inc.
- Site Civil Contractor: McKnight Construction

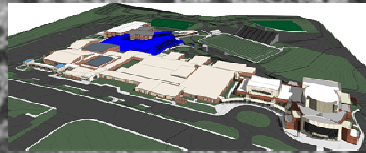
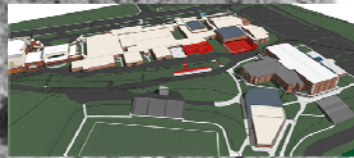


## Project Scope

- Demolish existing classroom building from original
- Construct a new multi-story classroom wing

## General Project Info

- Phase 1 of 4
- Construction Timeline
- September 2015 through May 2016
  - During the academic year!
  - Fully function, full capacity high school



## Geotechnical Scope of Work

- 7500 Tons of lightweight Estimated
- Blast into existing hillside (15+ feet vertically)
- Stabilize the exposed slope
- Construct a poured-in-place concrete retaining wall in 4 segments to further stabilize and support the slope
- Backfill these retaining walls with 7500 tons of Stalite 74'



## Geotechnical Design Constraints

- Main school buildings exist on 265' EL
- Construction Site Constraints:
  - School property elevation drops 20+ feet vertically within >500 linear feet
  - Phase 1 additions were to be constructed on a ~200 feet of that slope
  - A historic building was to be protected from construction.
- Basement for Unloading + Staging Area:
  - Driveway to existing Cafeteria on the existing campus (single car width) at elevation ~265'
  - Driveway to Fieldhouse and athletic facilities at elevation ~255'
  - Easement between the new classroom building and the Historic Building (old gymnasium):
    - Foundation and exterior masonry walls were constructed concurrent to the retaining wall construction.

## Why SLWA Was Specified?

- ✓ Expedite the construction timeline
- ✓ Ease of compaction
- ✓ High Angle of Internal Friction = Less Backfill Material
- ✓ Decreased loading on foundations of historic structures onsite
- ✓ Increased Slope Stability

## Construction Site





### CATS I-485 Light Rail Station – Charlotte, NC

- Contractor
  - Crowder Construction
- Geotechnical Engineer
  - C&R



## MSE Wall on I-40 Western Loop – Greensboro, NC

- Contractor  
– Archer Western
- Geotechnical Engineer  
– NCDOT + Foster Geotechnical



## Pentagon Secured Entrance from I-395 – Washington, D.C.

- Contractor  
– Pachina Construction
- Geotechnical Engineer  
– Mactec



## Historic Rock Wall Preservation on Saluda River – Columbia, SC

- Geotechnical Engineer  
– R&ME



## NC133 Bridge Approach – Wilmington, NC

- Contractor: A/CAC
- Geotechnical Engineer  
– NCDOT







## In Summary

All rocks are not created equal

SLWA = Multifaceted geotechnical design solution