- What is cellular concrete
- Uses and advantages
- Production methods
- Mix Designs
- Quality Control
- Projects
What is cellular concrete?

ACI 523.1 definition: Concrete made with hydraulic cement, water, and preformed foam to form a hardened material having an oven-dry density of 50lb/cubic foot or less.

Other specifications:
ASTM C869
ASTM 769
ASTM 495

(Section view of cellular concrete sample)
Geotechnical/Infrastructure Uses:
- Annular space grouting
- Utility pipe abandonment
- Soil stabilization
- Utility trench fill
- Bridge/Overpass abutment backfill
- Wall/Foundation backfill
- Void fills—sink holes, wells, tunnels, mine abatement, abandoned utilities
- Ideal for flowable fill (CLSM) replacement

Building Construction Uses:
- Roof decks
- Floor decks/Floor topping
- Precast blocks/walls
- Ballistic blocks/panels
- Energy absorbing crash barriers
Geotechnical/Infrastructure Uses:

- **Annular space fills**
  Reduces potential pipe flotation and pipe collapse, pumps and fills completely
Geotechnical/Infrastructure Uses:

- Pipe Abandonment/Underground Void Fill
  Pumps long distances at low pressures and fills small voids extremely well

Before

After
Geotechnical/Infrastructure Uses:

- General Backfill
- Soil stabilization/Subgrade Fill

Creates a strong, lightweight base in poor soils. Speeds construction. Reduces lateral loads on surrounding structures.
Building Construction Uses:

- Roof decks/Floor decks/Floor topping

  Creates a insulative weather resistant membrane/Decreases dead load
Building Construction Uses:

- Precast block and walls
  - Fireproof
  - Thermal and sound insulation
  - Economical and easy to handle
Production Methods - Batch Production

Any density possible
Requires external pump to place
~ 30yds/hour production
Production Methods - Continuous Production

Integrated pumping capability
Reduced logistics
~ 100yds/hour production
Mix Designs

- **Base Slurry Mix Design**
  
  Neat cement slurry --- typ. .40-.80 water/cement ratio  
  Fly Ash, Slag, other cementitious materials may be used  
  Coarse and fine aggregates not typically used  
  Batch weights for .5 W/C = 2000lbs Portland, 1000lbs water

- **Cellular Slurry Mix Design**
  
  Specified by density and compressive strength  
  As density decreases, so does strength  
  30PCF material = 1yd base slurry + 2.5yd foam  
  
  30PCF = 100-150 psi  
  60PCF = 700-1000 psi  
  80PCF = 1500-2000 psi
Mix Designs

### CRETEFOAMER

#### Cellular Concrete Calculator

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Metric</th>
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<tbody>
<tr>
<td>Dry Cellular Weight (PCF/ KG/M^3)</td>
<td>30.0</td>
<td>480.5</td>
</tr>
<tr>
<td>Wet Cellular Weight (PCF/ KG/M^3)</td>
<td>31.5</td>
<td>504.5</td>
</tr>
<tr>
<td>Cellular Concrete Required (YARD/METER)</td>
<td>0.4200</td>
<td>0.3211</td>
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<tr>
<td>Base Slurry Required (YARD/METER)</td>
<td>0.112</td>
<td>0.086</td>
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<tr>
<td>Base Slurry Density</td>
<td>118.0</td>
<td>1899.5</td>
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#### BASE SLURRY PROPORTIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>SPG</th>
<th>PORTLAND (LBS/Cu. Yd.)</th>
<th>LBS.</th>
<th>KG.</th>
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<tbody>
<tr>
<td>Portland</td>
<td>3.14</td>
<td>2194</td>
<td>134.5</td>
<td>61.0</td>
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<tr>
<td>Fly Ash</td>
<td>2.77</td>
<td>111.6</td>
<td>50.6</td>
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<tr>
<td>Pozzolan #2</td>
<td>2.75</td>
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#### AGGREGATE/CEMENTITIOUS RATIO

<table>
<thead>
<tr>
<th>Description</th>
<th>SPG</th>
<th>0.0</th>
<th>0.00</th>
<th>0.00</th>
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#### WATER/CEMENTITIOUS RATIO OF BASE SLURRY

<table>
<thead>
<tr>
<th>Description</th>
<th>SPG</th>
<th>0.45</th>
<th>110.7</th>
<th>50.2</th>
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#### WATER/CEMENTITIOUS RATIO OF CELLULAR SLURRY

<table>
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<th>Description</th>
<th>0.56</th>
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</thead>
</table>

#### SAND/CEMENTITIOUS RATIO

| Description | SPG | 2.65 | 0.00 | 0.4  | 0.2  |

#### CreteFoamer Setup

- **CreteFoamer output (CFM):** 9.0
- **Concentrate/Water Ratio:** 0.025
- **Desired Weight of Foam:** 3.00
- **Water Flow Required (GPM):** 3.24
- **Cost of Foam concentrate/gallon:** $40.00
- **Volume of foam needed:** 8.89 cubic feet
- **CreteFoamer Run Time:** 0.99 minutes
- **Amount of foam concentrate needed:** 0.08 gallons
- **Amount of water needed (for foam):** 3.20 gallons
- **Cost of Foam Needed:** $3.20
- **Base Design Cost Per Yard:** $120.00
- **Cellular Slurry Cost Per Yard:** $39.66
- **Cost Savings Per Yard:** $80.34

*Highway Industries assumes no responsibility and no liability from the use of this tool. Due to variances involved with all cellular concrete applications, including the inputs associated with this tool and the physical inputs used in the production of cellular concrete, it is the end user's responsibility to determine the usefulness of this tool for their application.*
Quality Control

● Three key components to quality cellular concrete
  I. Equipment designed for producing and placing cellular concrete
  II. Foam concentrate designed for producing cellular concrete and is ASTM C869 certified
  III. Well prepared slurry

● Density of cellular slurry
  Density is strongly correlated with strength
  Material density must be closely monitored at point of placement
Project: Dysart Rd Water Main Abandonment

Job Specs: 16” ø X 2100’ water main
Calc’d to require ~ 110yds³ of 40 PCF cellular concrete

Mix Design: Neat cement slurry -- .6 W/C ratio

Requirements: Needed to pump full distance from one port on the low end of the pipe
Project: Dysart Road Water Main Abandonment

CT-30D Cretefoamer

Density sampling test tee
Project: Dysart Road Water Main Abandonment

Results:

Calc’d volume meant that it would take nearly 4 hours to fill w/CT-30D

At 4 hours & 15 mins a calculated volume of 110 yds$^3$ had been placed, but pipe was not full

At this point another 5 yds of slurry was ordered to try finishing the project

Pumping resumed approximately 5 hours & 15 mins after first material was placed

Material was being pumped in, but no longer pushing the flow

After discussing situation with the inspector, he was satisfied with what had been placed and called the job complete
THANK YOU!

Q & A