ICRI National Convention **March 18, 2016**

EUCLID CHEMICAL

Repair and Protection of Concrete Subject to Harsh Abuse in Mines and Elsewhere

- Physical Abuse
- Thermal Shock
- Chemical Attack
- Dynamic Loading

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I recently did a Webinar about the physical abuse of slabs.

An engineer texted me.

“I am forming a non-profit organization whose mission is to put an end to slab abuse.”

Dave Flax

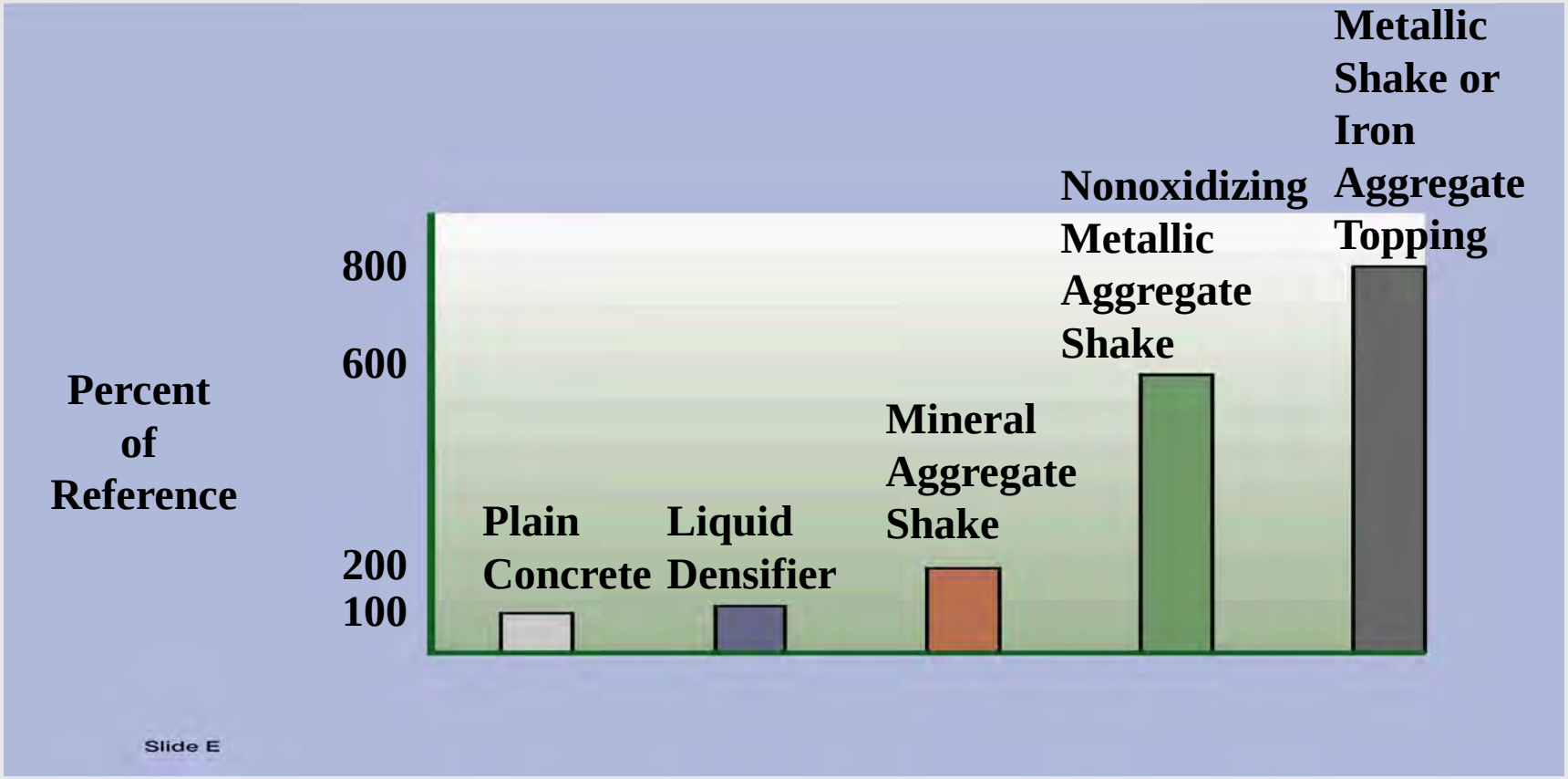
- Civil Engineering Degree from RPI
- Over 35 years experience with concrete
- Years as a Field Engineer
- Years with a contractor
- Years with the Corps of Engineers doing research
- Published dozens of articles
- Specialized in cement and concrete
- Earned CDT and CCPR from CSI
- On many ICRI Committees

ABRASION RESISTANCE


ASTM C 779

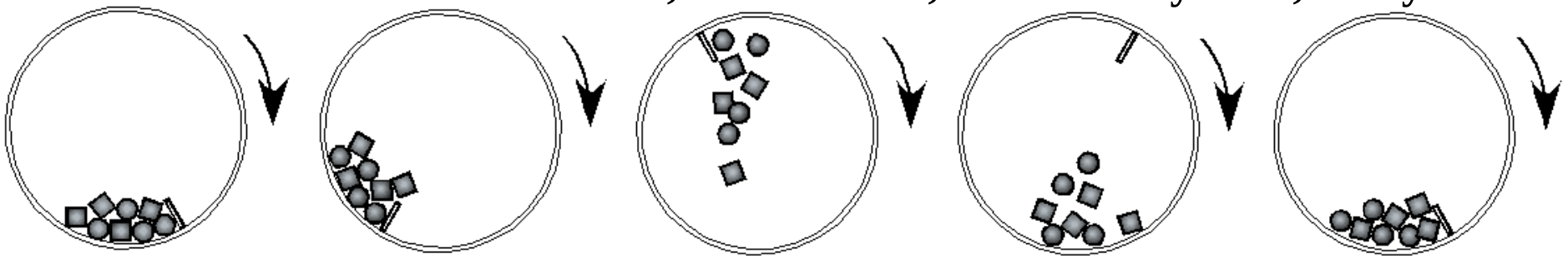
Relative Abrasion Resistance

ASTM C 779



IMPACT RESISTANCE

LA Rattler: 2” cubes of material, 2” steel balls, rotate slowly for 2,000 cycles



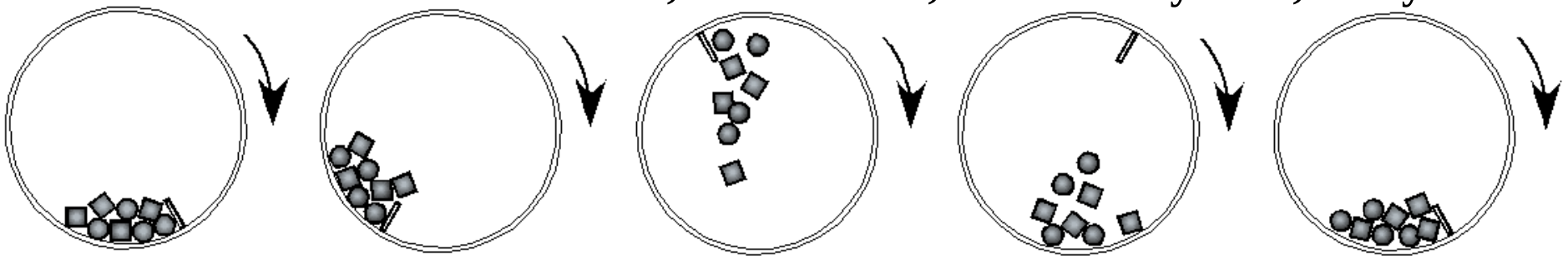
2” cube

4,000 psi concrete

10,000 psi concrete with emery

12,000 psi cementitious topping with iron aggregate

LA Rattler: 2” cubes of material, 2” steel balls, rotate slowly for 2,000 cycles



2” cube

4,000 psi concrete

10,000 psi concrete with emery

12,000 psi cementitious topping with iron aggregate

18,000 psi cementitious topping with iron and natural aggregate

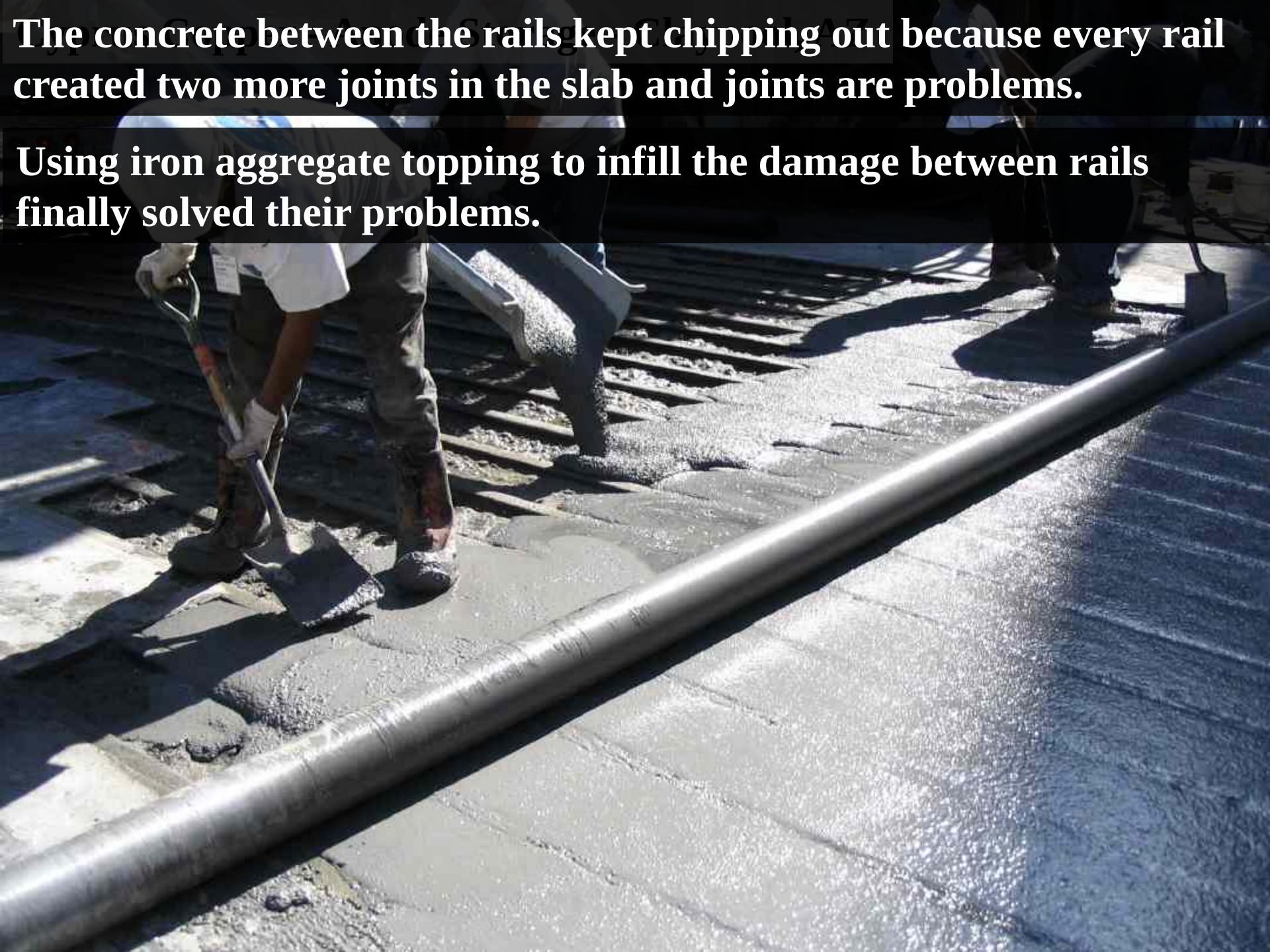
Used for one of the Toughest Abuses Known to Man


MAIN STREET TRANSPORTATION COMPANY


One of the Reasons
for Development was
Tipping Floors


CAT


24
CAT
CARON


The concrete between the rails kept chipping out because every rail created two more joints in the slab and joints are problems.
Using iron aggregate topping to infill the damage between rails finally solved their problems.

Wear between steel rails and around steel plates turned their yard into a washboard.

It was such a maintenance problem for them, they covered it all with iron aggregate topping.

Tracked Vehicle Maintenance Bays
Holt Caterpillar, Texas

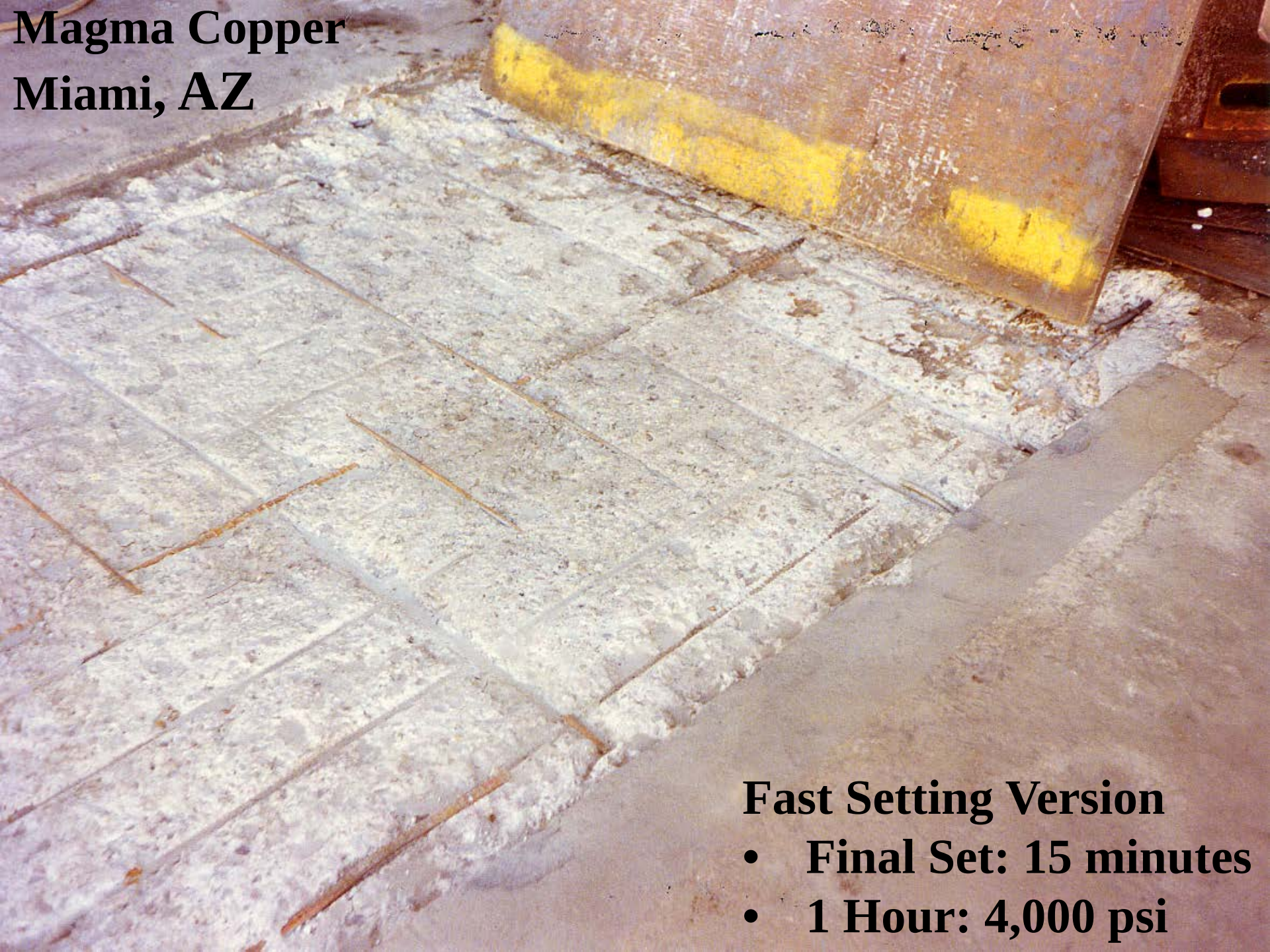
Nucor Steel

Asarco Copper Tracked Vehicle Maintenance Bays – Ray, AZ

Proper Surface Preparation
Keyed Edges
Bonding

SPEC NEEDS TO SAY:
“Backroll with short nap roller.”

This makes the coverage uniform.


Magma Copper
Miami, AZ
Fast Setting Version
• Final Set: 15 minutes
• 1 Hour: 4,000 psi

TYPICAL NON-MINING USES:

- Transfer stations
- Tracked vehicle maintenance shop floors
- Steel foundries
- Heavy manufacturing
- Dam spillways (corrosion is not an issue)
- Loading docks
- Scales
- Rolloff dumpsters
- Anything and everything that takes a beating


Roll off Dumpster
City of Tucson

Required:

- Pre-job meeting with minutes
- Thickness - minimum 1”
- Proper surface preparation
- Bonding agent
- Evaporation retarder
- Proper curing
- Contractor experience

COATINGS, LININGS, and TOPPINGS for CHEMICAL RESISTANCE

Flake Filled Epoxy Novolac
Coating, Broadcast, or Trowel-Down
for Severe Chemical Attack like Tankhouses

Acids				
Acetic	50%	4		
	10%	2		
Chromic	10%	1	50%	1
Citric	10%	1	50%	1
Formic	25%	4	98%	4
Hydrochloric	10%	1	37%	1
Hydrofluoric	25%	4		
Lactic	85%	2		
Nitric	10%	2	45%	4
Phosphoric	10%	1	85%	2
Sulfuric	10%	1	75%	1
			98%	2

Miscellaneous	
Brake Fluid	1
Ethylene Glycol	1
Formaldehyde 37%	2
Gasoline	1
Propylene Glycol	1
Skydrol	1
Vegetable Oil	1

Solvents		
Ethyl Alcohol	95%	2
Ethyl Acetate		4
Methanol		4
Methyl Ethyl Ketone		4
Methylene Chloride		NR
Mineral Spirits		1
Toluene		2
Tricholoroethane		1
Xylene		2

Alkalies / Salts		
Ammonia	29%	1
Ammonium Sulfate	50%	1
Calcium Chloride		1
Diethanolamine		1
Ferric Chloride	50%	2D
Hydrogen Peroxide	35%	1D
Potassium Hydroxide	50%	1
Sodium Hydroxide	50%	1
Sodium Hypochlorite	10%	1D

Rating Key

1 = Long Term Exposure (30 days)
2 = Extended Exposure (7 days)
3 = Splash / Spill (72 hours)
4 = Incidental Contact (8 hours)
D = Discoloration may occur
NR = Not Recommended

Asarco Copper
Hayden, AZ


Asarco

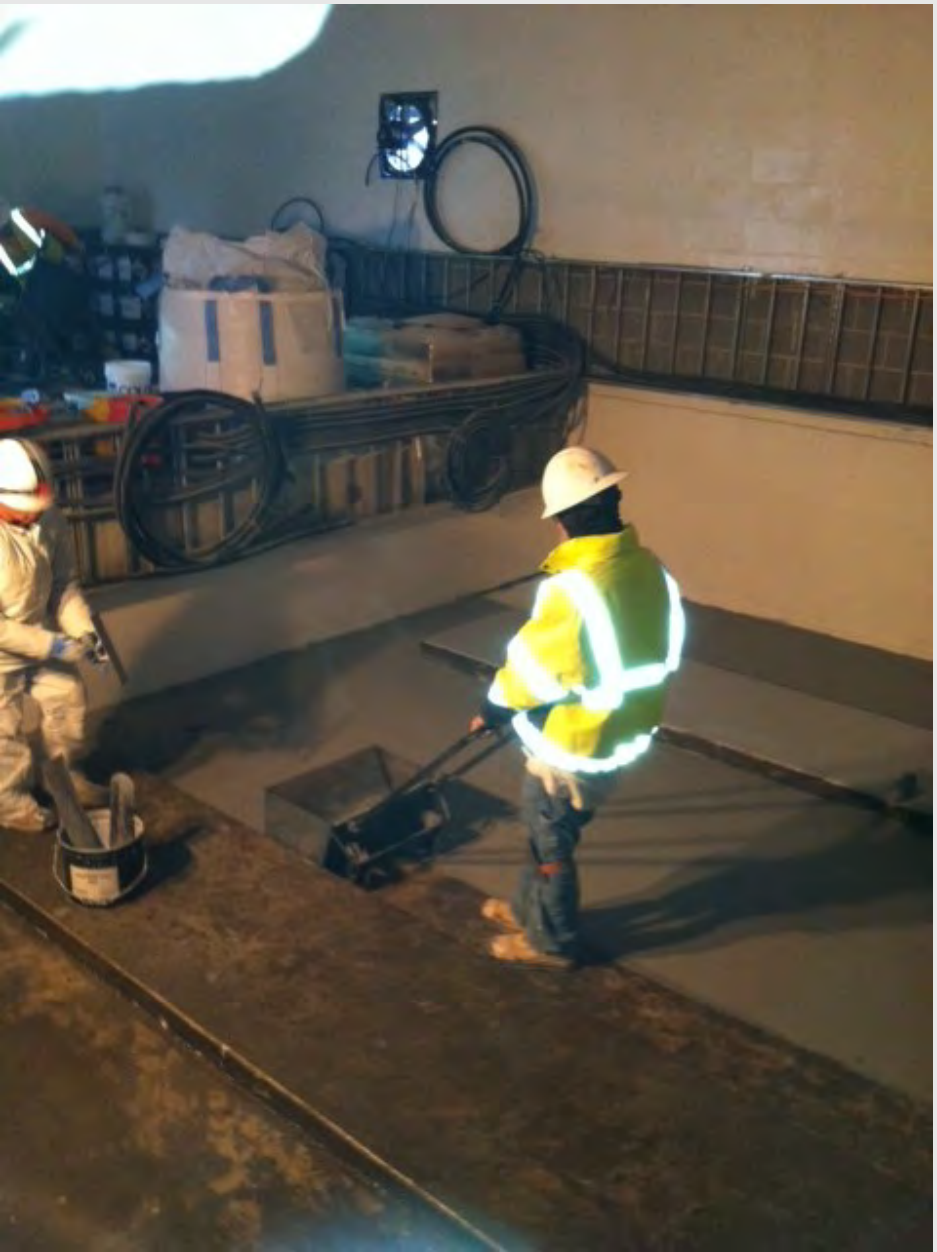

Phelps Dodge
Morenci

EPOXY TROWEL DOWN

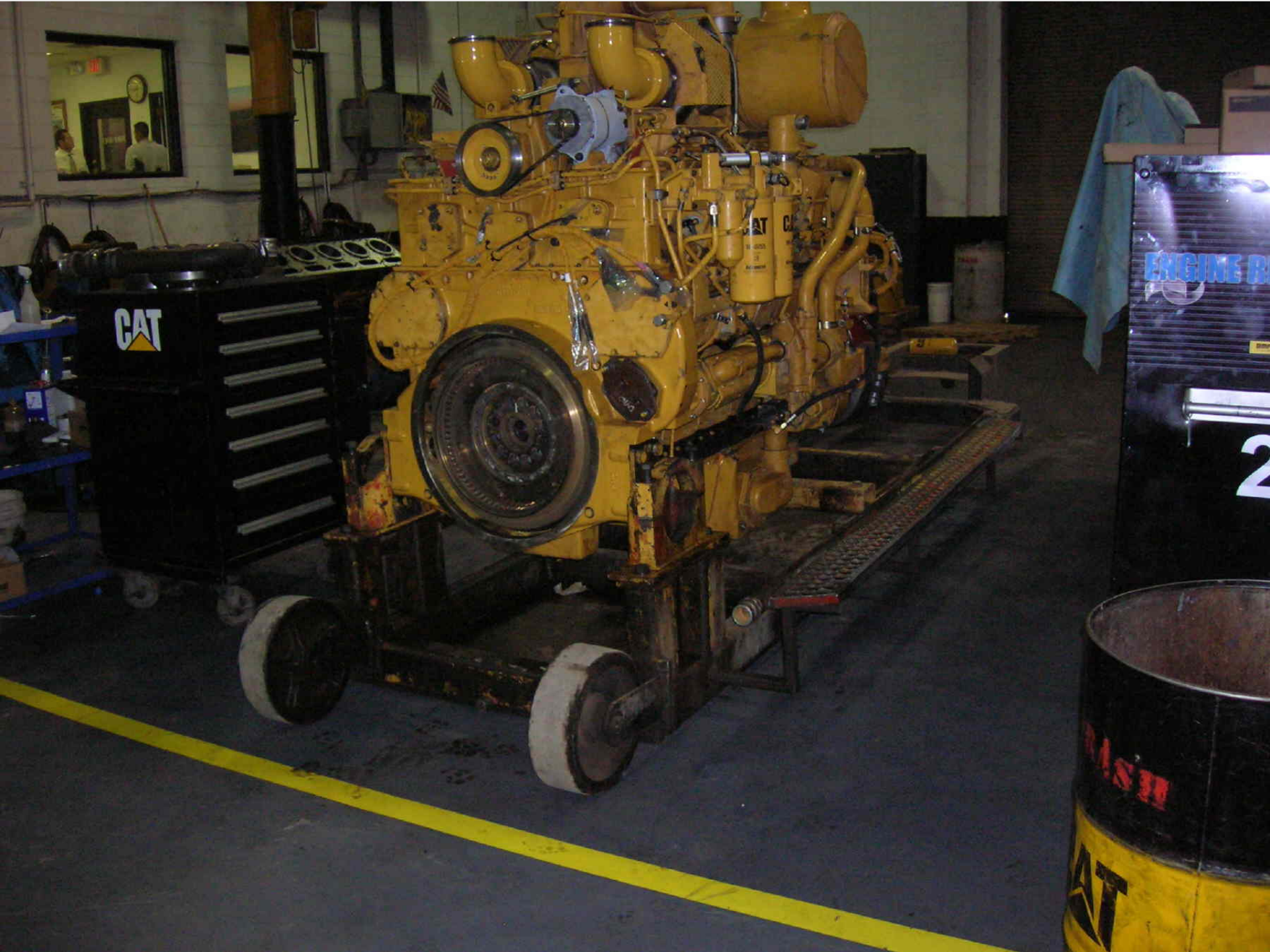
Advantages:

- **Abrasion Resistance**
- **Impact Resistance**
- **Chemical Resistant**
- **Easy to Clean**
- **Aesthetic**

Hycroft Gold Mine
Winnemucca, NV



¼” Trowel Down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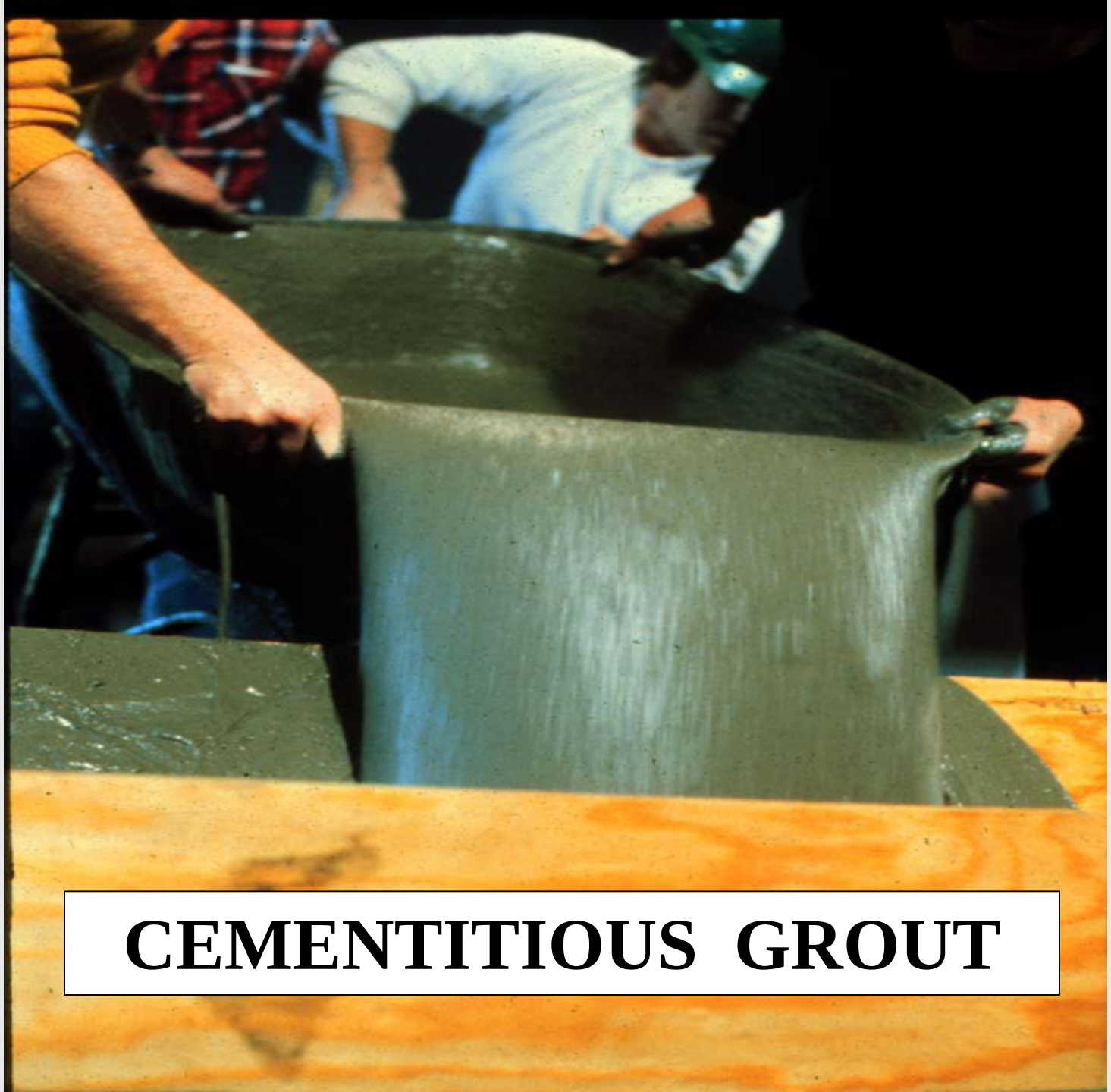

CEMENTITIOUS GROUT

Bagdad, AZ


Asarco Copper
Ray to Hayden


EPOXY GROUT


Magma Copper
San Manuel

DIFFERENCES BETWEEN CEMENTITIOUS AND EPOXY GROUTS

Consistency:

- **Cementitious Flows while Epoxy Oozes**

Sticks to Base Plate:

- **Cementitious Doesn’t while Epoxy Does**

Compressive Strength:

- **Epoxy has Higher Early and Ultimate**

Creep:

- **Epoxy Creeps More at High Temperatures**

Dynamic Loading:

- **Cementitious with Natural Aggregate is Good**
- **Cementitious with Iron Aggregate is Better**
- **Epoxy is Best**

When it comes to construction its:

- **The contractor's job to build it**
- **The Engineers' job to tell them how in the spec**
- **My job to help with product selection and the spec**
- **All this so that the Owner gets the results they need**

IF IT CANNOT BE GROWN,
IT MUST BE MINED

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QUESTIONS?

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