

Need For

**Self-Consolidating Concrete Mixtures
Appropriate for Accelerated Bridge
Construction**

& Repair

By **Charlie Goodspeed**

NHDOT

Graduate Students

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Self - Consolidating / Self - Compacting

- Low Yield Stress
- High Deformability
- Moderate Viscosity

Placed purely by means of its own weight

Placed by whatever it takes!

Yield Stress Spectrum



- High
 - Slow flow

Move a structured fluid with a paddle

- High spread
- Low internal friction

Viscosity Spectrum

- High



Molasses or Water

- Fast flow/spread
- Low spread
- Fast placement possible



Property Relationship: 4 Extremes

High Viscosity / High Yield Stress

- Very thick/stiff
- Very slow flow
- Moderate total spread
- May require vibration
- Key ingredients
 - AEA
 - HRWR
 - Fly ash
- Joint Grout

High Viscosity / Low Yield Stress

- Thick consistency
- Slow flow
- High total spread
- Key ingredients
 - Slag and/or Fly ash
 - HRWR
 - Hydration Stabilizer
 - Shrinkage Reducers
- Ideal SCC

Property Relationship: 4 Extremes

Low Viscosity / High Yield Stress

- Thin consistency
- Segregation
- High internal friction
 - Aggregate characteristics
- Fast flow
- Very low total spread
- Key ingredients
 - Silica fume
 - Hydration stabilizer
- Least usable

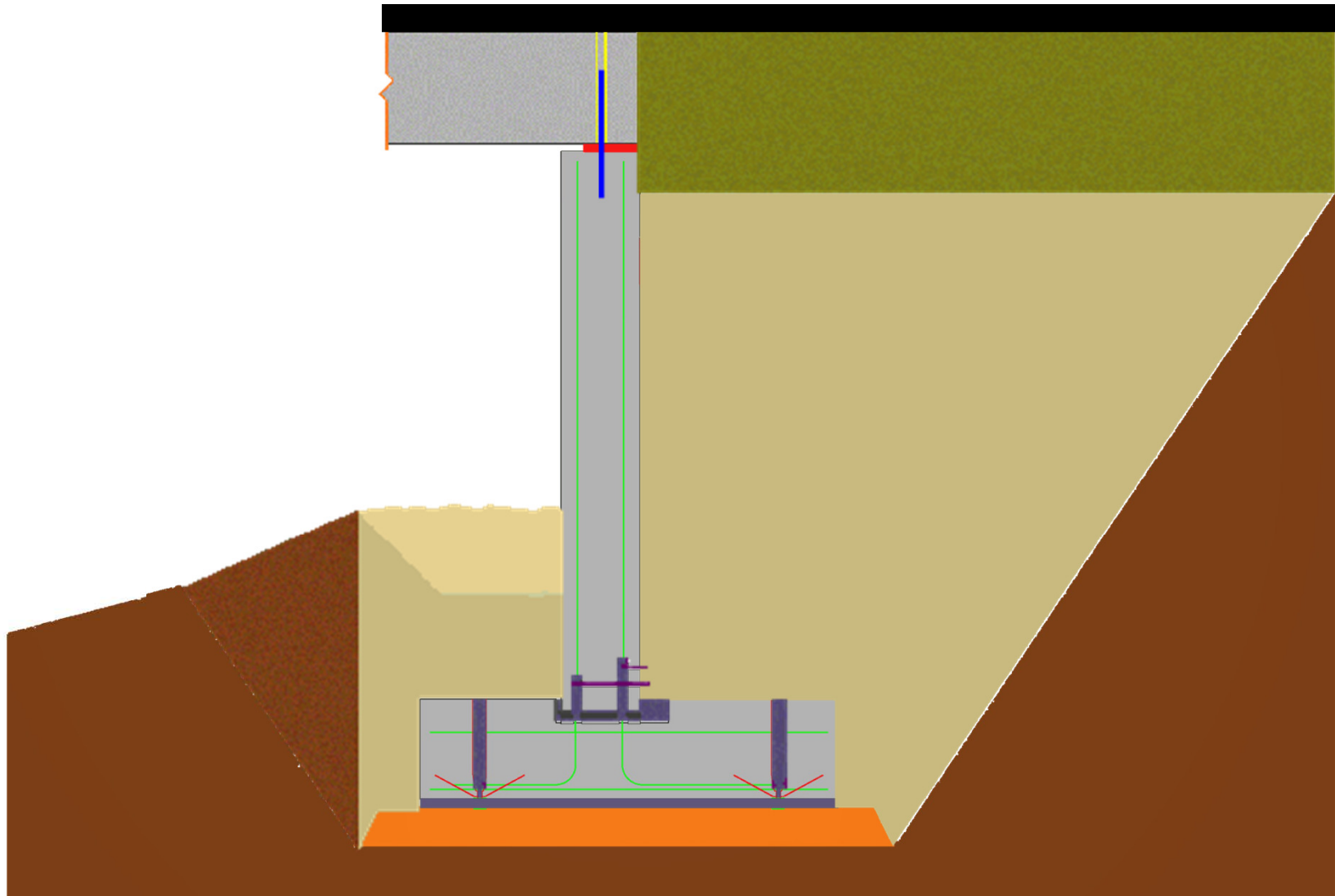
Low Viscosity / Low Yield Stress

- Liquid
- Low friction
- Very fast flow
- High total spread
- Key ingredients
 - Silica fume
 - Hydration stabilizer
 - Slump retainer
- Pressure Grouting ?

ABC – Full Bridge Replacement - SCC



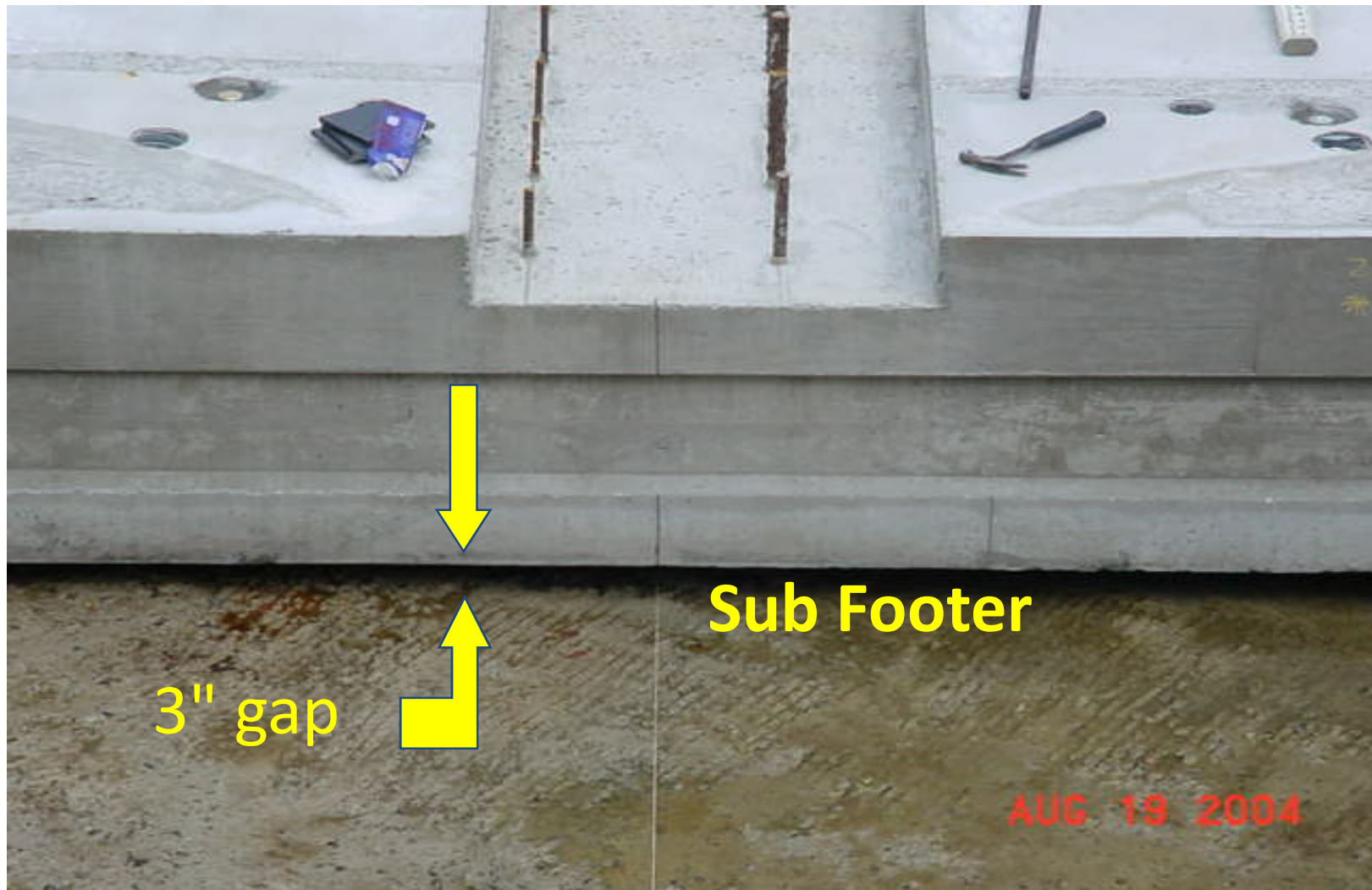
ABC Erection Sequence



Casting Footers



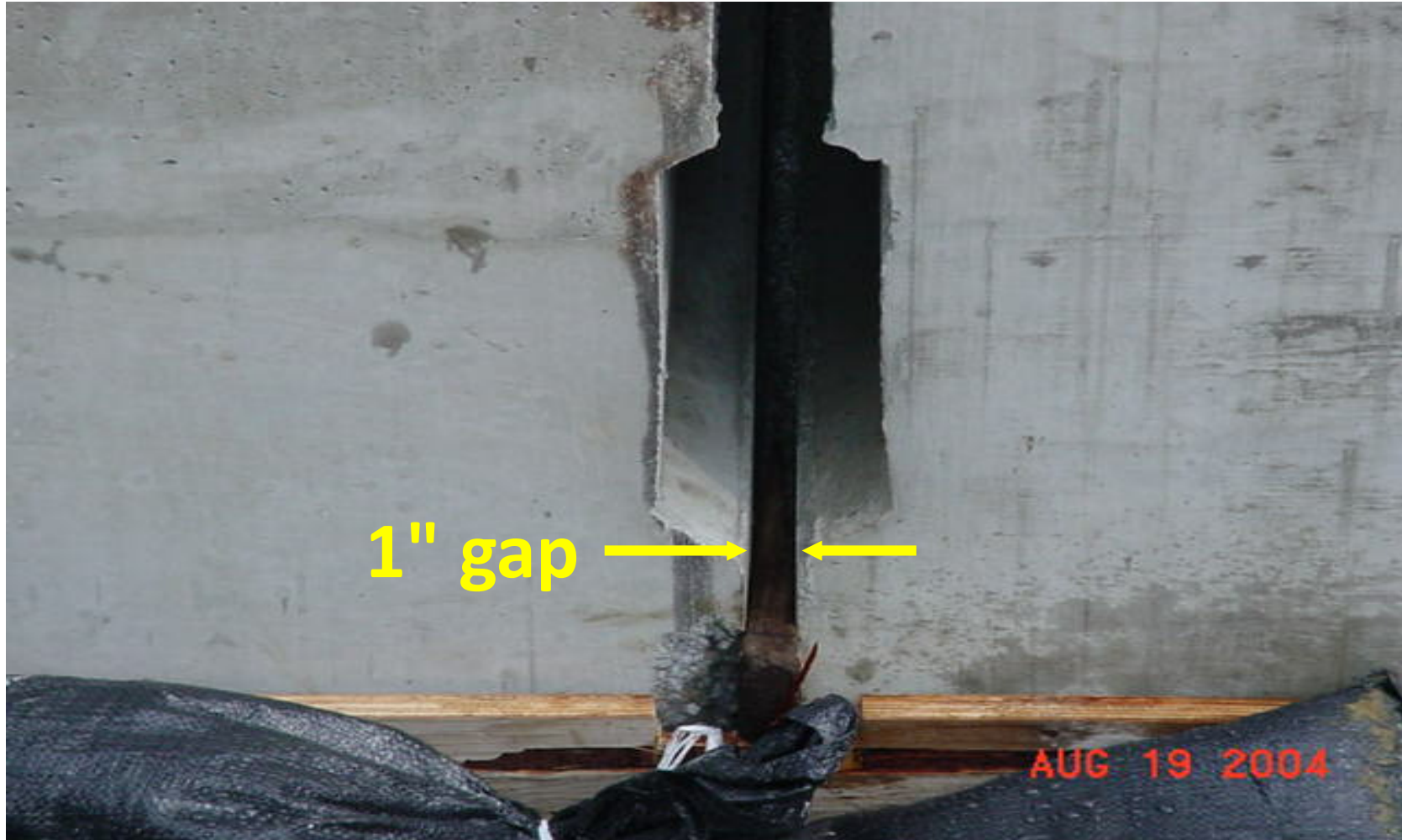
Installing Footers



2 Hours to Grout the Footings



Footing Key





Grouting Base of Abutments



Grouting Splice Sleeves



Vertical Abutment Joints



Abutment Joint



Post Tensioned Adjacent Box Girders



Grouting Full Depth Shear Key



7 Days, 23 hours 1 day Interruption - Flooding



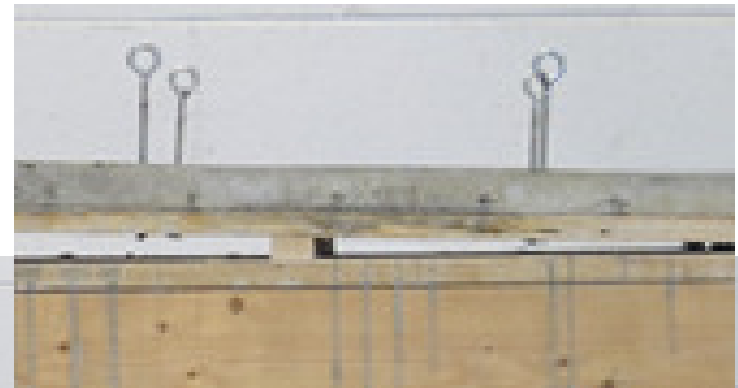
ABC - Deck Replacement – SCC

60 hrs



Full Width - 55 ft. 9 inch Depth

Lifting/Leveling



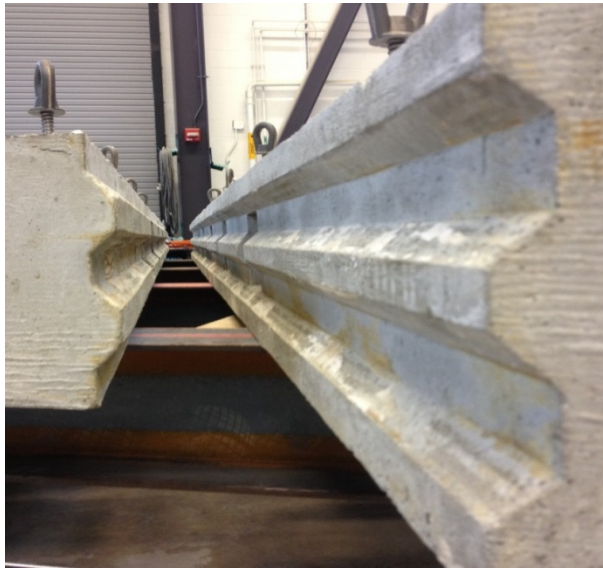
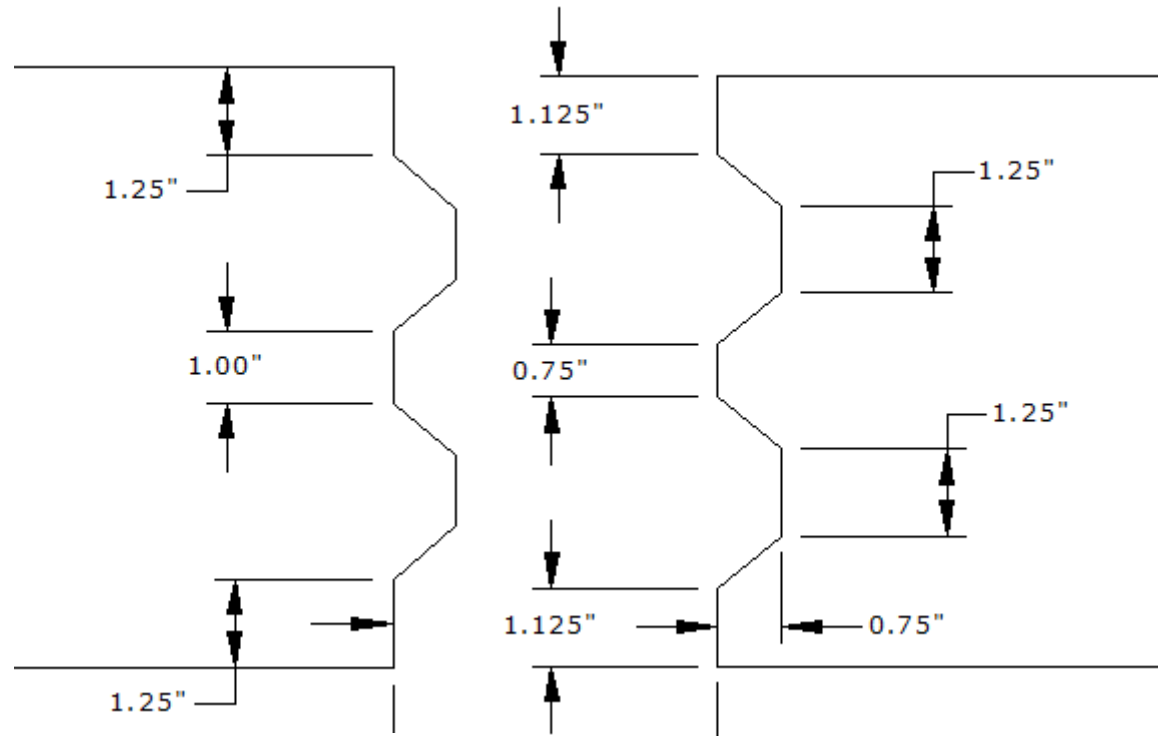
Bond Failure
< Service Load



Concrete Failure
> 3 X Service

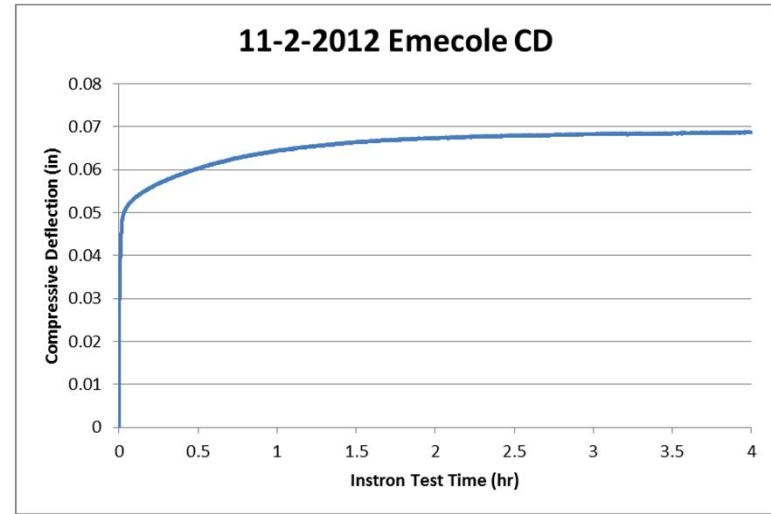


Tongue and Groove



Need SCC!

Thixotropic, 450psi in 1 hr



Need SCC Pressure Installation, 3 hr Cure, \$'s



Analysis and Construction



Hunch Form Work



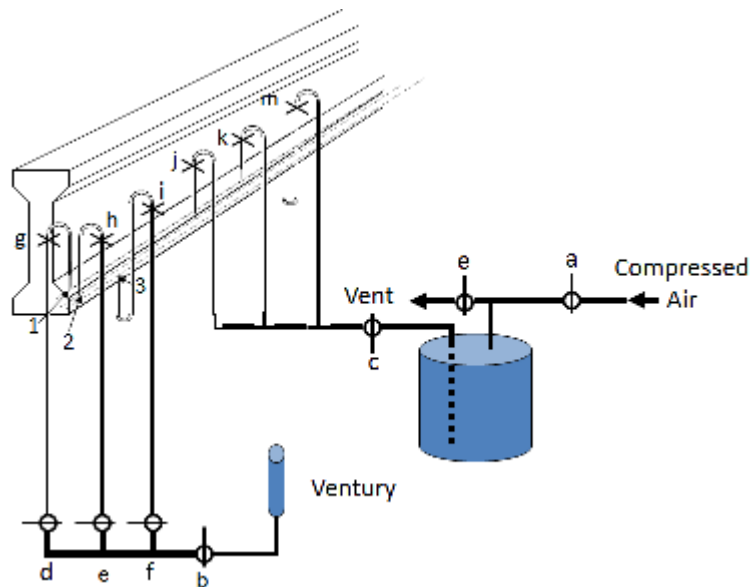
Need! SCC for Pressure Grouting

- 60 AASHTO Type IV Girders
- Submerged under 12' of salt water during Hurricane Katrina storm surge



Need! SCC

- Low Viscosity
- Few Hour Cure
- Low Permeability
- Pressure Installation



Columns 60' by 5' in Salt Water SCC Mixture Please



Type	Columns	Walls				Flatwork		Mass
Project	Ready Mix DOT deified shaft 5,000psi	Precast Wall 5,000 psi	Precast DOT median barrier 6,000psi	Precast manholes 4,000psi	Ready Mix WTC wall pumped 60 stones 14,000psi	Ready Mix pumped flatwork 10,000psi w/ steel fiber	Ready Mix FAST 14 flatwork 2,000psi	Ready Mix bridge counterweight 4,000psi
Viscosity	Low	Medium	High	Low	High	High	High	Medium
Spread	22"-24" (56 - 61cm)	25"-27" (64 - 69 cm)	26"-28" (66 - 71cm)	20"-23" (51 - 58cm)	28"-32" (71 - 81cm)	28"-32" (71 - 81cm)	28"-32" (71 - 81cm)	24"-26" (61 - 66cm)
Cement	590 (350)	566 (336)	490 (291)	522 (310)	375 (222)	460 (273)	291 (173)	720 (427)
Class F Fly Ash	160 (95)	142 (84)	210 (125)	115 (68)	86 (51)	76 (45)	180 (107)	150 (89)
Silica Fume	50 (30)				50 (30)			
Slag					470 (279)	333 (198)		225 (133)
#67 C Agg			1640 (973)	1100 (653)	1111 (659)		1513 (898)	1100 (653)
#8 C Agg	1350 (801)	1489 (883)		440 (261)	505 (300)	1152 (683)		400 (273)
Natural Sand	1432 (850)	1424 (845)	1350 (801)	1400 (831)	1170 (694)	1538 (912)	1289 (765)	1300 (771)
Steel Fiber						200 (119)		
AEA	1	1	1.3	1			1.5	
HRWR	6	7	10	7	14	10	9.3	10
Hydration Stabilizer	6				5	6	0.5	
Slump Retainer	6					2	8	
Corrosion Inhibitor			55					
Non-chloride accelerator							80	20
De-foamer					1.7			
Shrinkage reducing admixture							26	
Design Air %	6.5	6	7	6	1	2	7	2
Water, lb/yd ³ (kg/m ³)	292 (173)	283 (168)	240 (142)	260 (154)	233 (138)	292 (173)	250 (148)	275 (163)
Water, gallons/yd ³ (L/m ³)	35.1 (174)	34.0 (168)	28.8 (142)	31.2 (154)	28 (139)	35 (173)	30 (148)	33 (163)
Design Volume, ft ³ (m ³)	27.0 (0.765)	27.06 (0.766)	27.06 (0.766)	26.9 (0.763)	27 (0.765)	27.06 (0.766)	27 (0.765)	27.06 (0.766)
Design Density, lb/ft ³ (kg/m ³)	143.5 (2299)	144.3 (2311)	145.2 (2326)	140.1 (2244)	141.9 (2273)	145.7 (2334)	142 (2275)	143.7 (2302)
w/c ratio	0.365	0.4	0.343	0.452	0.29	0.3	0.29	0.37

Table 1 – SCC Mix Designs