

# Strength-on-Demand Concrete

## Interstate Lane Replacement in Sub-Zero Temperatures



Portions of Interstate 80 at the Highway 505 intersection were in need of repair. The California Department of Transportation specified the use of “Rapid Strength Concrete” to minimize lane closures and disruption to traffic for these applications. The challenge during this project was that the concrete needed to achieve the required flexural strength even though the overnight temperatures were expected to be below freezing.

**Project:**

Interstate 80 and Highway 505  
Lane Replacement

**Location:**

Vacaville, CA

**Owner/s:**

California Department of Transportation  
(Caltrans)

**Concrete Producer:**

Rinker Materials

**Concrete Contractor:**

C.C. Myers, Inc.

**Requirements:**

high-early strength, durable concrete  
400 psi (2.8 MPa) flexural strength  
@ 4 hours

**Products Used:**

MasterSet® DELVO  
extended set-controlling admixture  
MasterGlenium® 3030  
high-range water-reducing admixture  
MasterSet® AC 534  
accelerating admixture

**Market Sector:**

Paving

## Project Profile

Interstate Lane Replacement in Sub-Zero Temperatures



### The Solution

To meet the project requirements and minimize lane closure time, Rinker Materials along with Master Builders Solutions, developed a quality, high-early flexural strength concrete mixture using 4x4 Concrete technology. Even in record low overnight ambient temperatures of 26 °F (-3.3 °C), the 4x4 Concrete mixture achieved a flexural strength of 400 psi (2.8 MPa) in as little as 2.75 hours, 560 psi (3.9 MPa) in 5 hours, and an average 7 day flexural strength of 1,100 psi (7.6 MPa). During a 45-day period between December 2006 and January 2007, Rinker Materials and C.C. Myers, Inc. successfully placed over 4,000 yd<sup>3</sup> (3,060 m<sup>3</sup>) of 4x4 Concrete in challenging environmental conditions.

#### High-EarlyStrengthConcrete Mixture Proportions

|                        |                                                    |
|------------------------|----------------------------------------------------|
| Cement Type III        | 800 lb/yd <sup>3</sup> (475kg/m <sup>3</sup> )     |
| Water                  | 240 lb/yd <sup>3</sup> (142 kg/m <sup>3</sup> )    |
| w/cm                   | 0.30                                               |
| Coarse aggregate (#57) | 1,890 lb/yd <sup>3</sup> (1120 kg/m <sup>3</sup> ) |
| Fine aggregate         | 1,064 lb/yd <sup>3</sup> (630 kg/m <sup>3</sup> )  |
| s/a                    | 0.36                                               |

#### Plastic Properties

- Slump: 6 - 10 in. (150 - 250 mm)
- Concrete arrived at job site typically between 4 - 6 in. (100 - 150 mm) slump; after the accelerator was added, the slump increased to between 6 and 10 in. (150 - 250 mm)
- Air Content: 1.5%

#### About Master Builders Solutions

Master Builders Solutions is a leading global manufacturer of concrete admixtures, as well as other sustainable solutions for the construction industry, focussed on delivering its vision: **Inspiring people to build better.** Master Builders Solutions provides value-added technology and market-leading R&D capabilities to improve the performance of construction materials and to

### Project Facts and Benefits

- Lab and truck trials were evaluated in early December 2006
- Custom trailer was built to deliver and dose out of four, 275 gal (1040 L) totes of MasterSet AC 534 accelerator on the job site
- MasterGlenium 3030 was available on the job to adjust the slump if necessary
- Record low 26 °F (-3.3 °C) temperatures were experienced during the project
- No major problems or delays were encountered
- Flexural Strength achieved
  - @ 2.75 h: 400 psi (2.8 MPa)
  - @ 5 h: 560 psi (3.9 MPa)
  - @ 7 days: 1,100 psi (7.6 MPa)
- The minimized lane closure time resulted in early opening to traffic
- Over 4,000 yd<sup>3</sup> (3,060 m<sup>3</sup>) of concrete was delivered and placed successfully
- The owner was provided with what they desired in a timely manner while the contractor, ready-mix supplier and admixture supplier turned a good profit

enable the reduction of CO<sub>2</sub> emissions in the production of concrete. Founded in 1909, Master Builders Solutions has ca. 1600 employees operating 35 production sites globally, supporting their customers in mastering their building challenges of today – for a decarbonised future.

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