INTERNAL CURING OF CONCRETE BRIDGE DECKS IN UTAH: MOUNTAIN VIEW CORRIDOR PROJECT - 2012

Research by:

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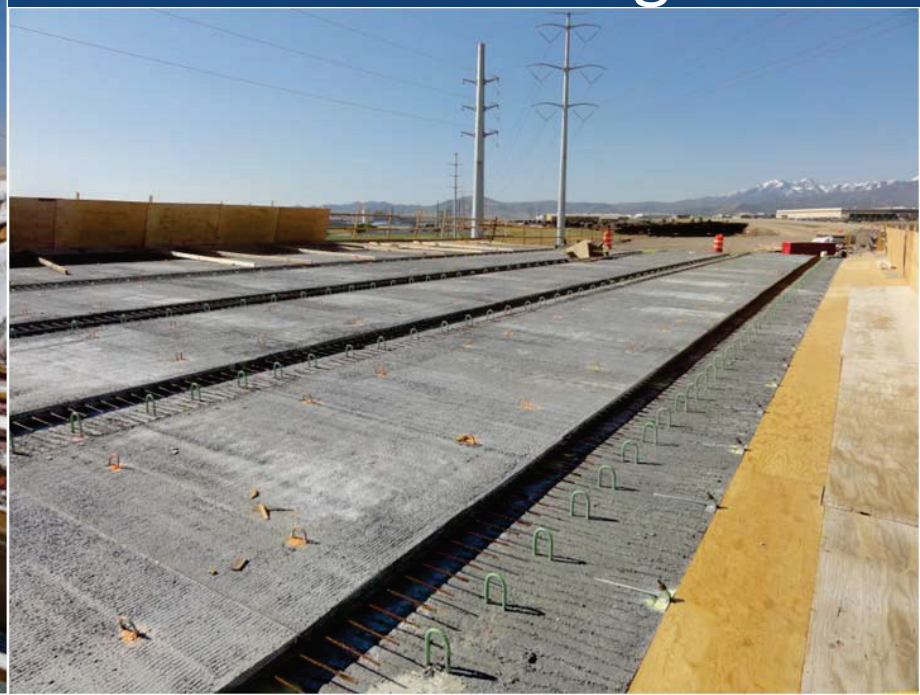
Project Location/Description
Mountain View Corridor – Western Salt Lake Valley

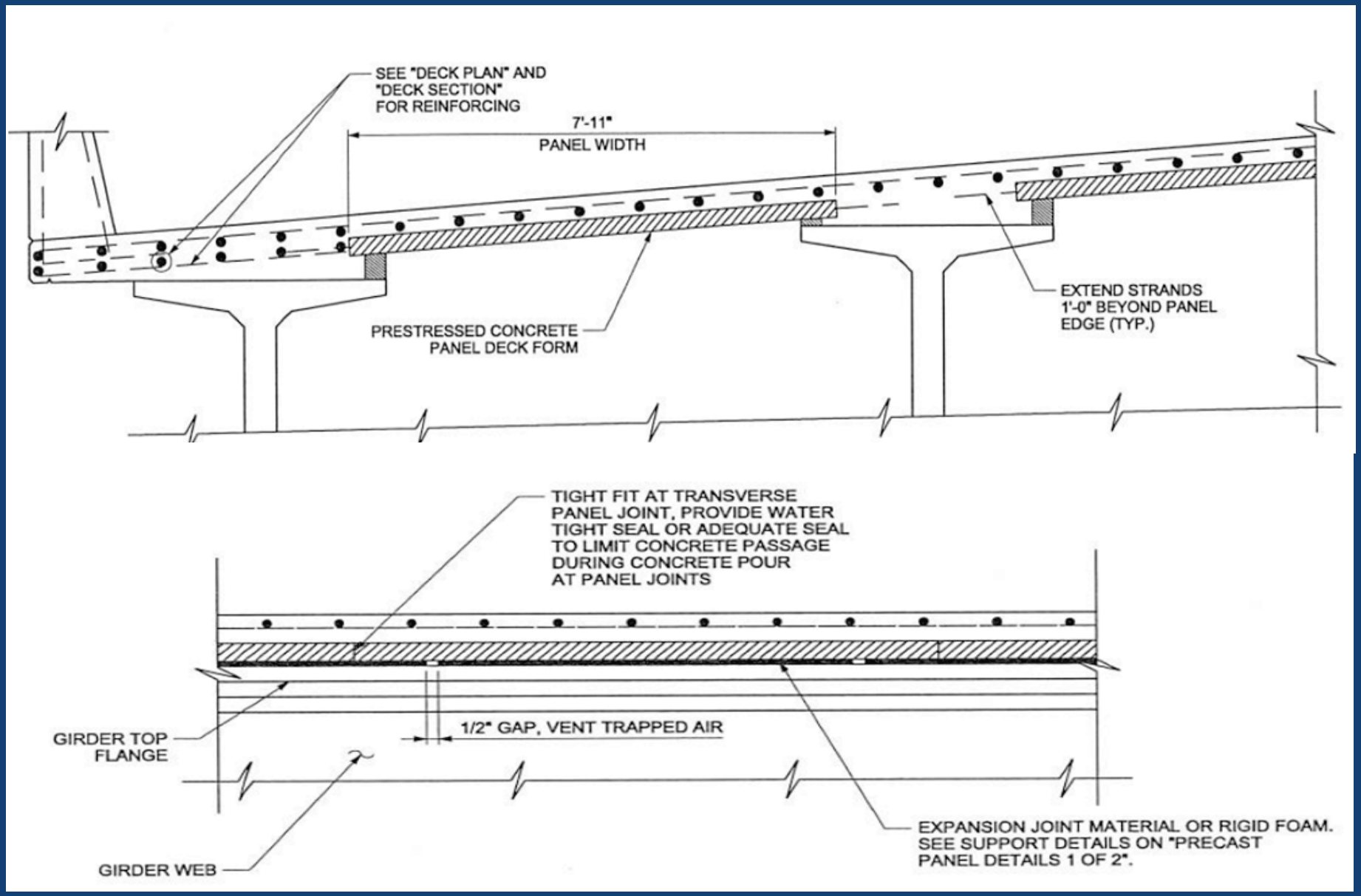
Bridge Design

- Spring 2012 Construction
- 5 Pre-stressed, Single Span Girders

- 7’11” x 8’ Pre-cast Panels between girders



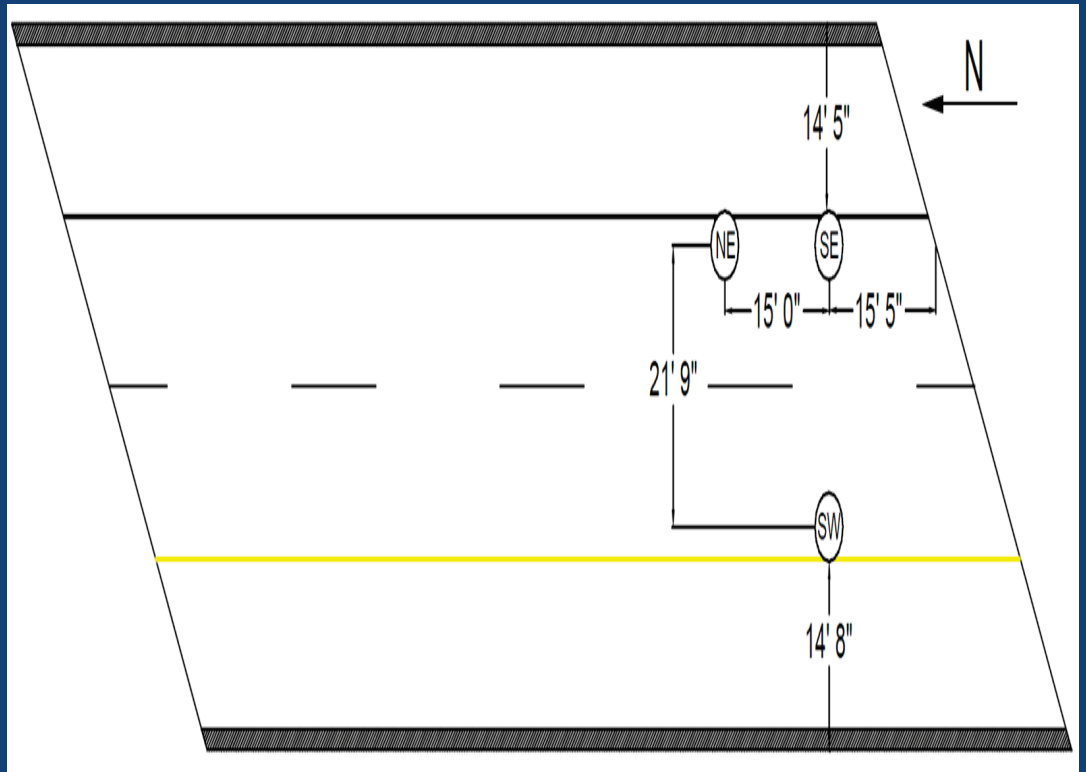
Panel Placement



Top Mat of # 5 rebar – 2.5” cover

Instrumentation

- 3 sensors each deck
  - Data logger connection, Cellular phone service
  - Measured:
    - Volumetric moisture content
    - Temperature
    - Electrical Conductivity



Instrumentation (continued)

Ambient Conditions:

- Air temperature gauges
- Relative Humidity
- Precipitation gauges

Deck Construction Mix Designs:

Ingredient	Conventional (lb/yd³)	IC (lb/yd³)
Cement Type II/V	.09	.09
Class F ASH	.03	.03
Water	.16	.16
CA (3/4”)	.39	.39
FA	.27	.16
LWFA	0	.11
Air	.06	.06

Parameters	Conventional	IC
Unit Wt (pcf)	137.3	132.3
W/CM	.44	.44
Target Slump (in)	3.5	3.5
LRWR (oz/cwt)	.03	.03
% FA absorption	1.20	1.20
% LWFA absorption	-	15

Pre-wetting of LWFA

- Pre-wetted for 2 days
- Minimum 15% moisture

Metal Shoring

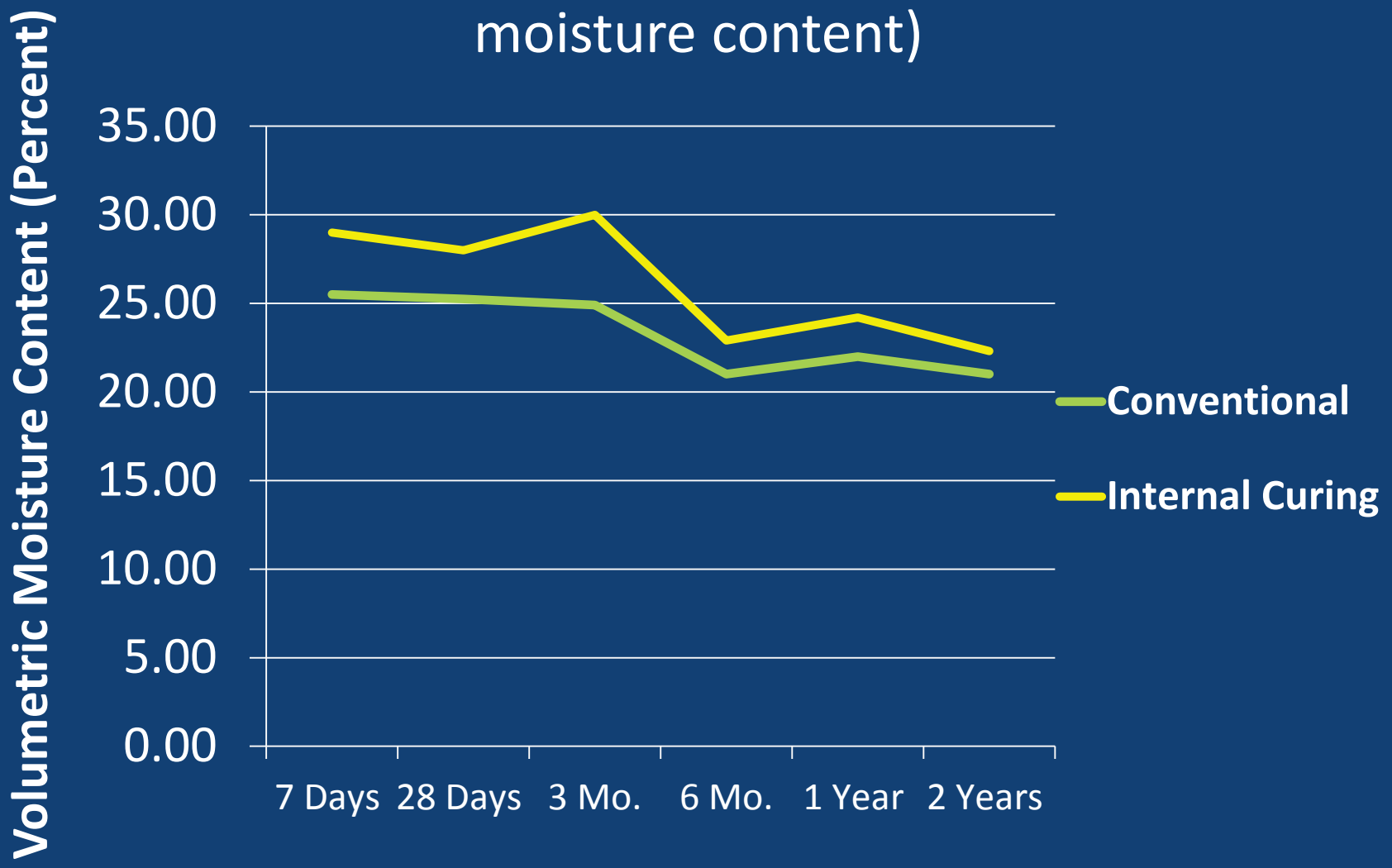
Curing compound and 14 day wet cure

Testing:

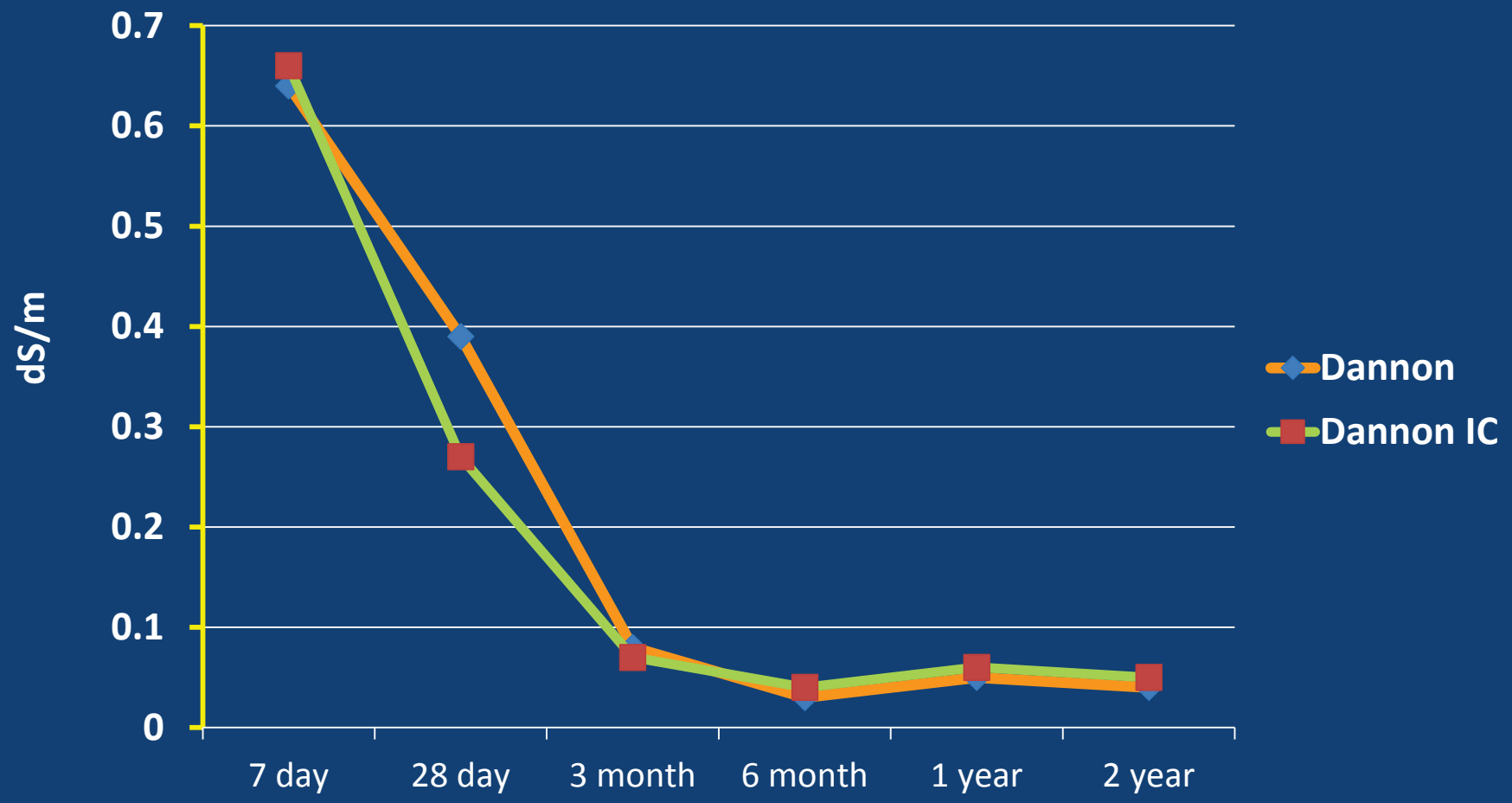
- Embedded Sensors
- Lab Testing on Cylinders
- Field Testing
  - Schmidt Hammer
  - Chloride Concentration
  - Distress Mapping

Test Results

(Sensor measurements – moisture content)



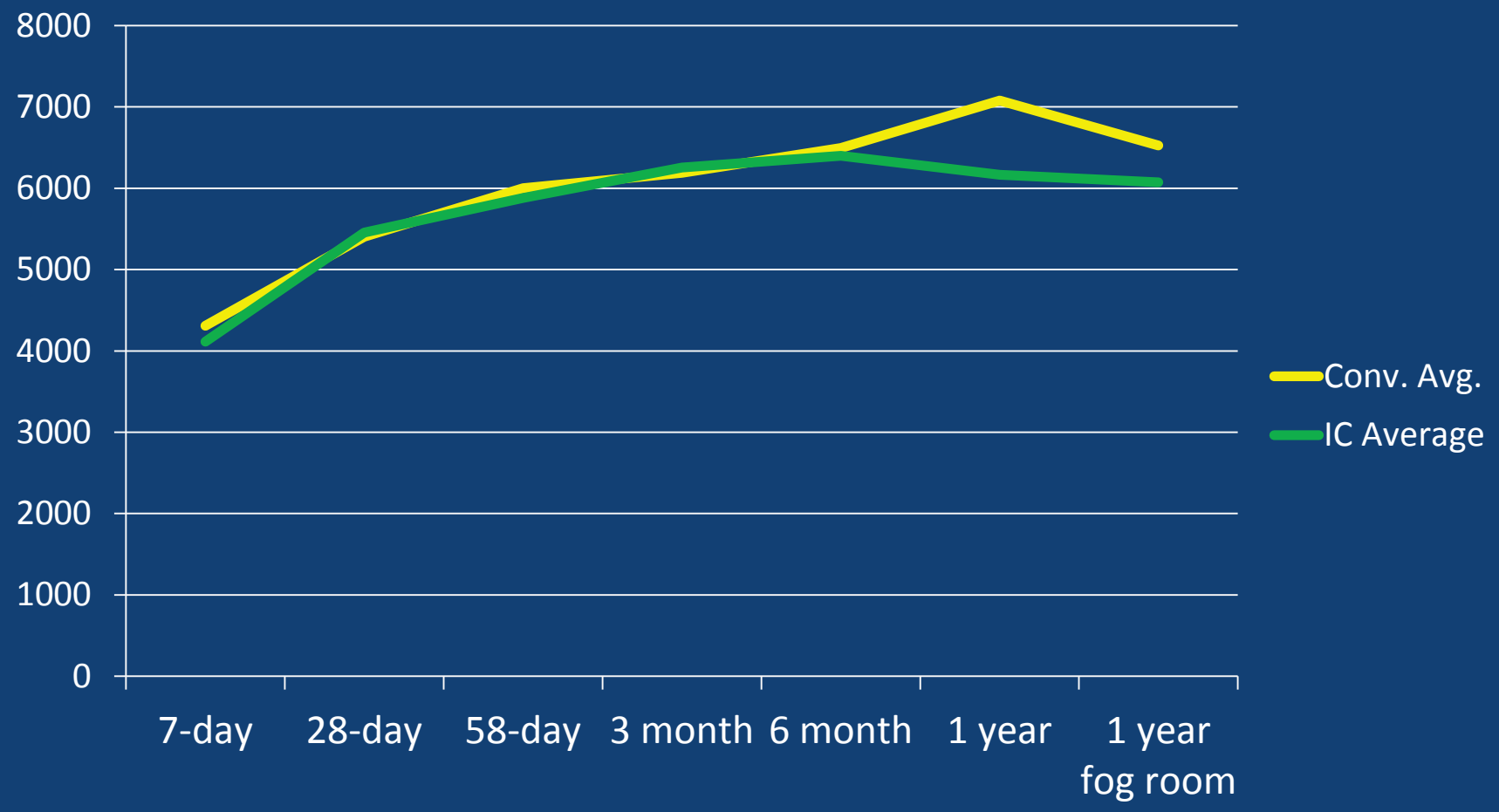
Sensor Measurements Electrical Conductivity



Laboratory Testing

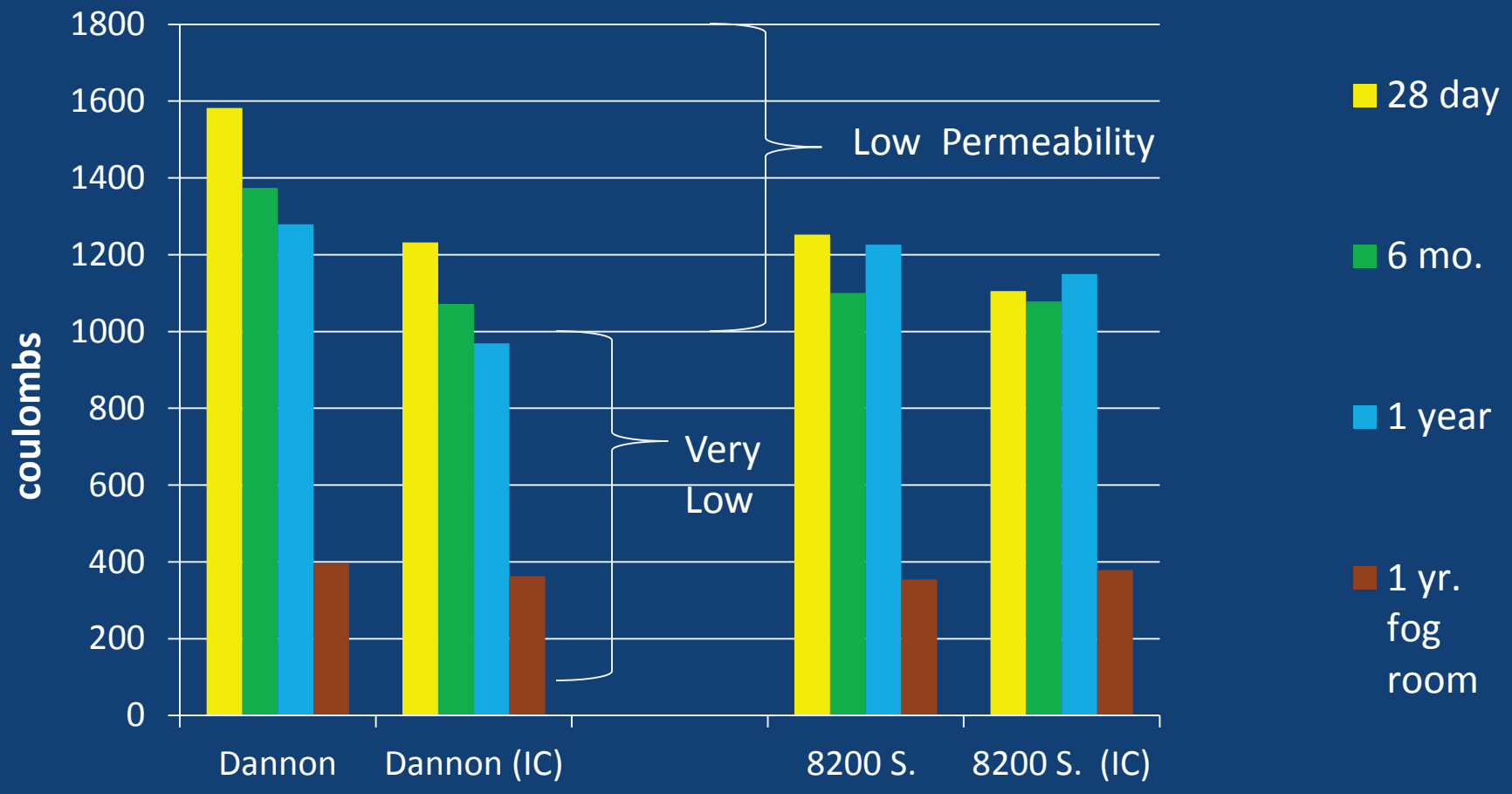
- Cylinder strength testing from each sensor location
  - 7, 28, 56 days, 3 months, 6 months, 1 year
- Rapid Chloride Permeability Testing (cylinders)
  - 28 days, 6 months, 1 year
- Moisture Content Testing
  - 1 year cylinders

Compressive Strength (cylinders)

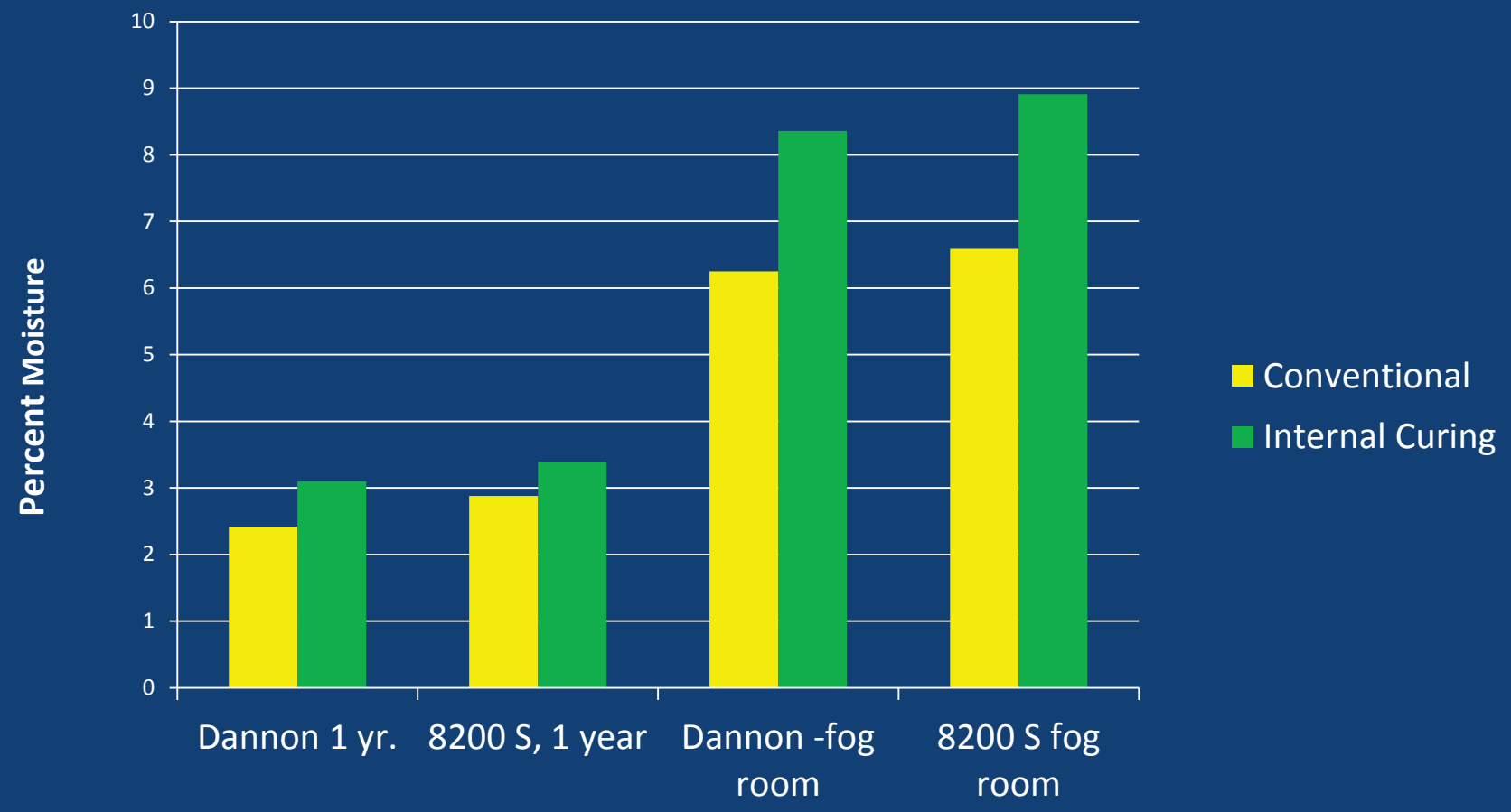


Rapid Chloride Permeability

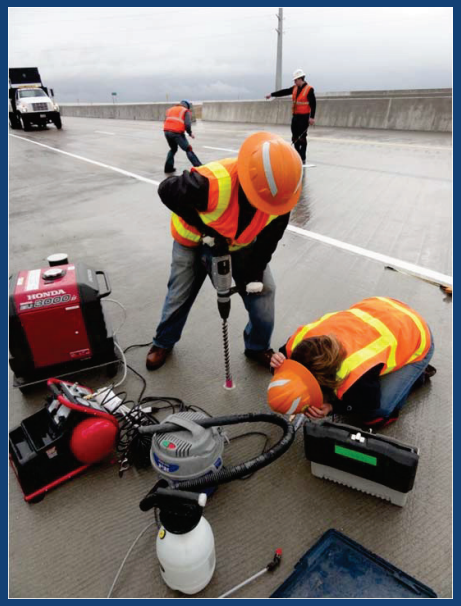
(C1202 lab testing- cylinders)



Moisture Content Lab Cylinders

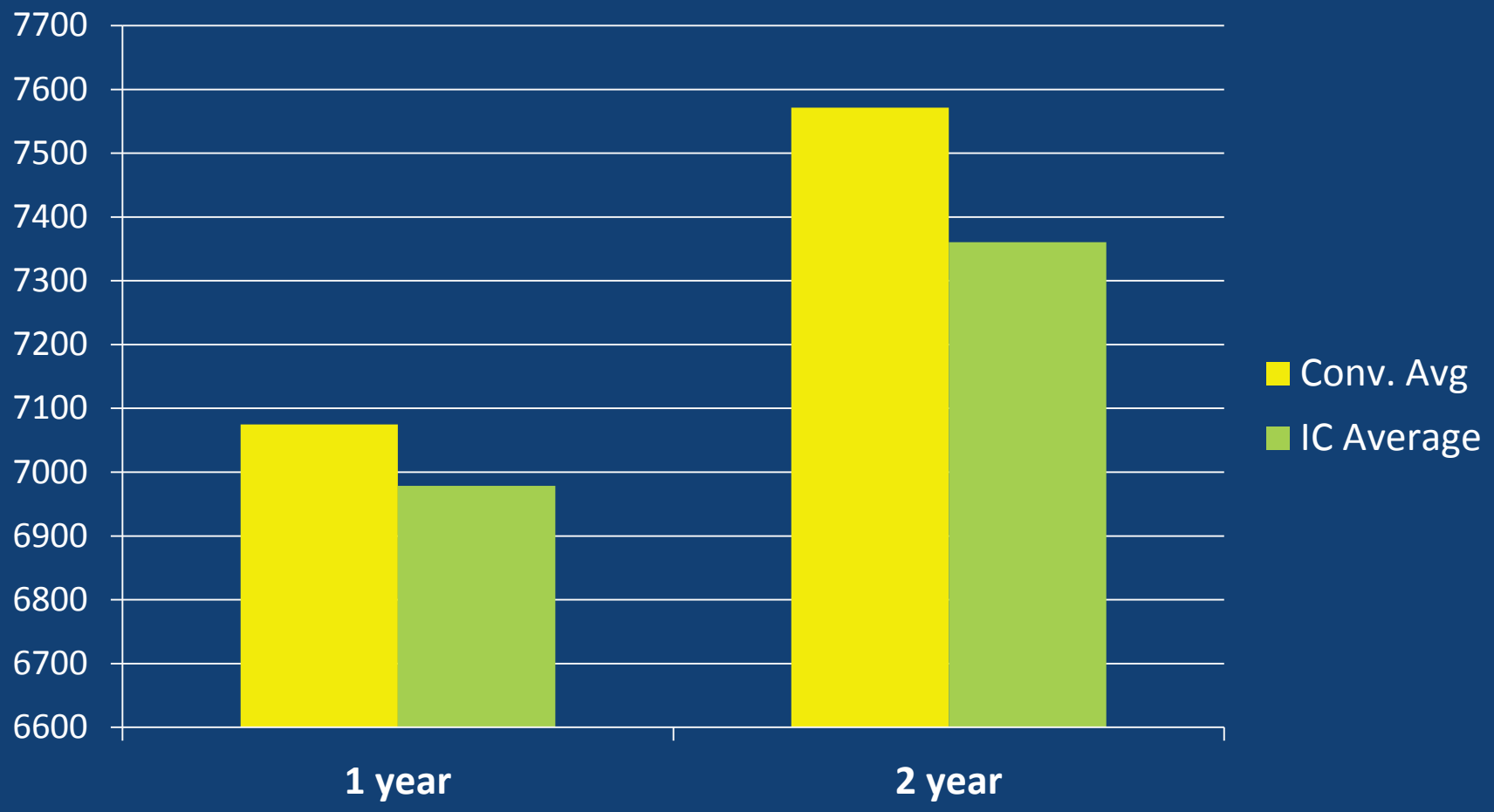


Field Testing

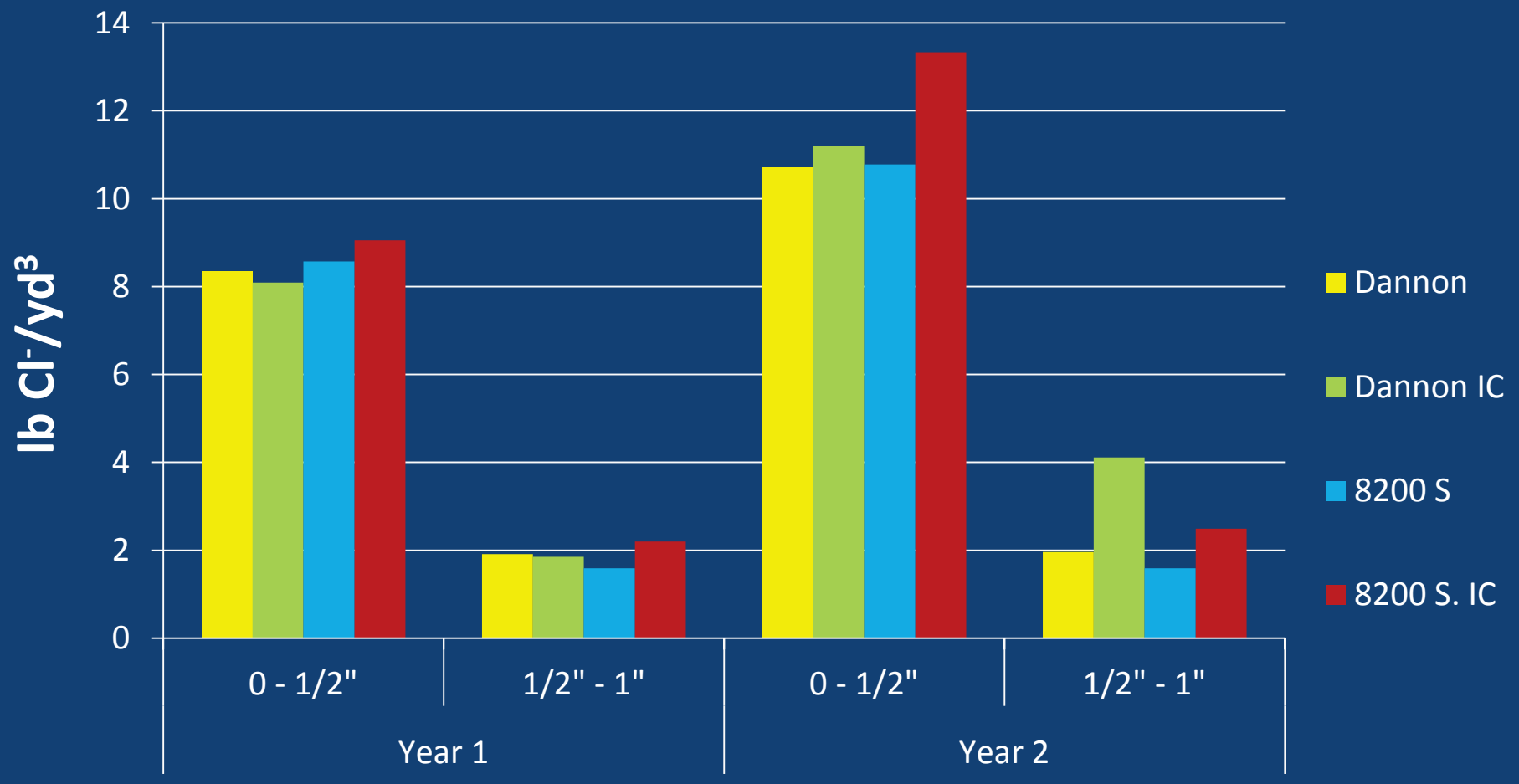


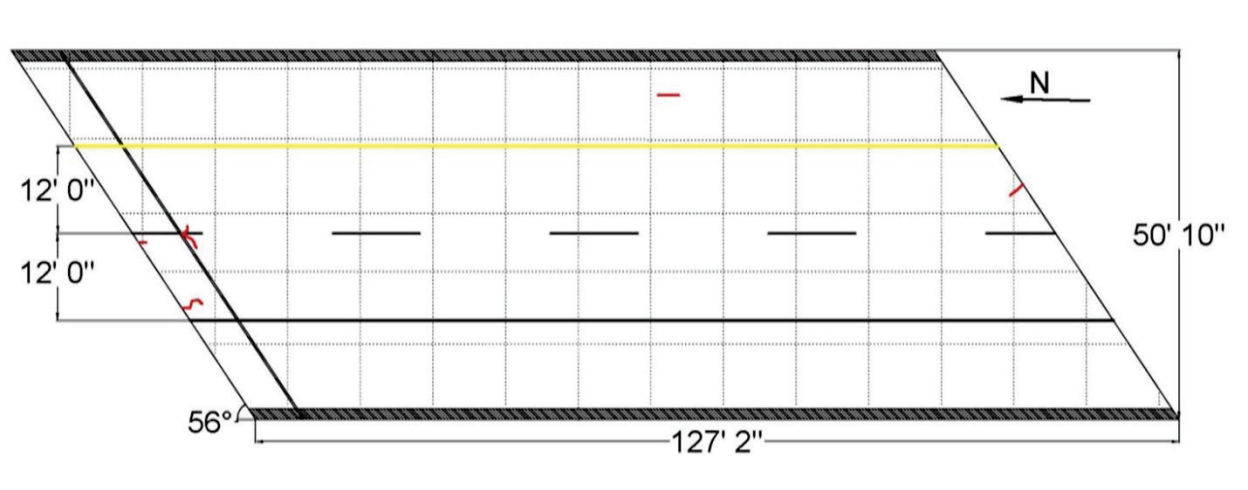
- Schmidt Hammer
- Chloride Concentration
- Distress Survey

Compressive Strength – Schmidt Rebound Hammer

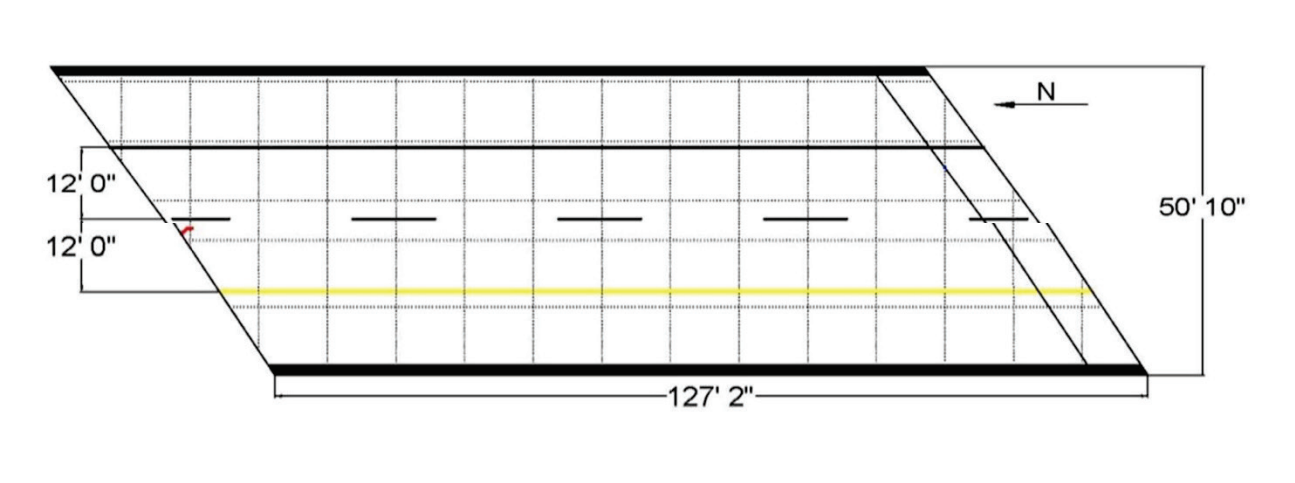


Chloride Concentration Testing (Field)

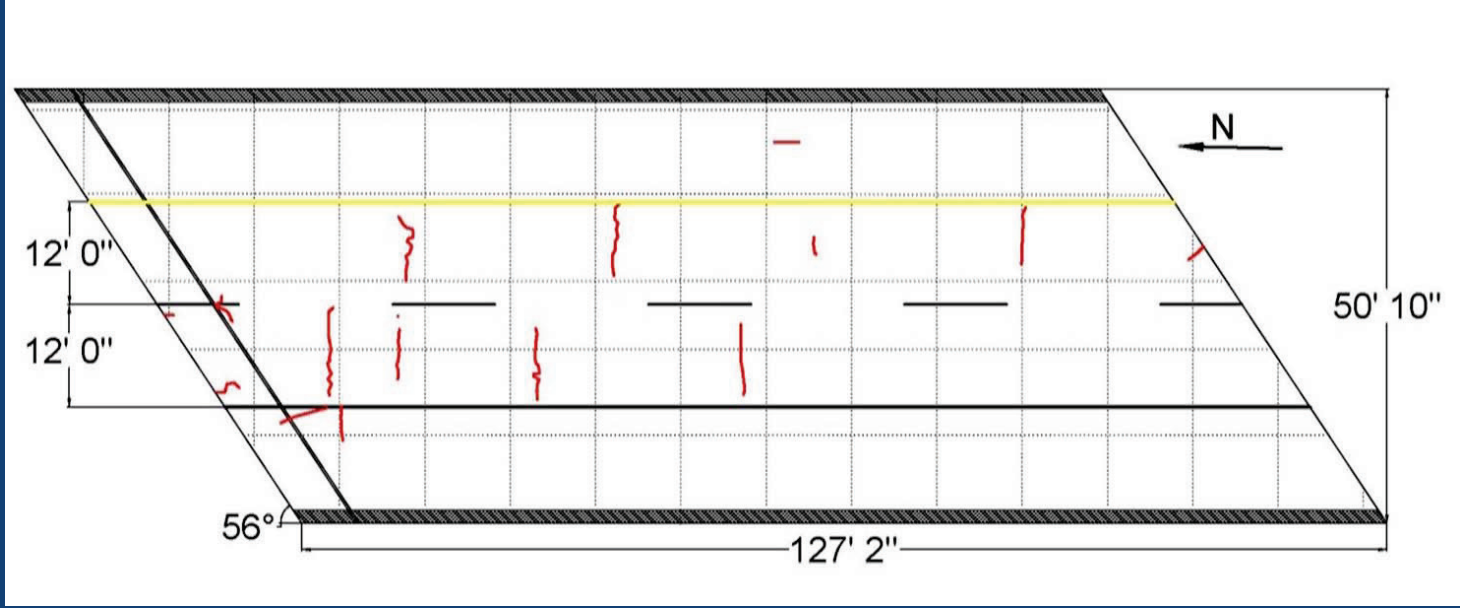




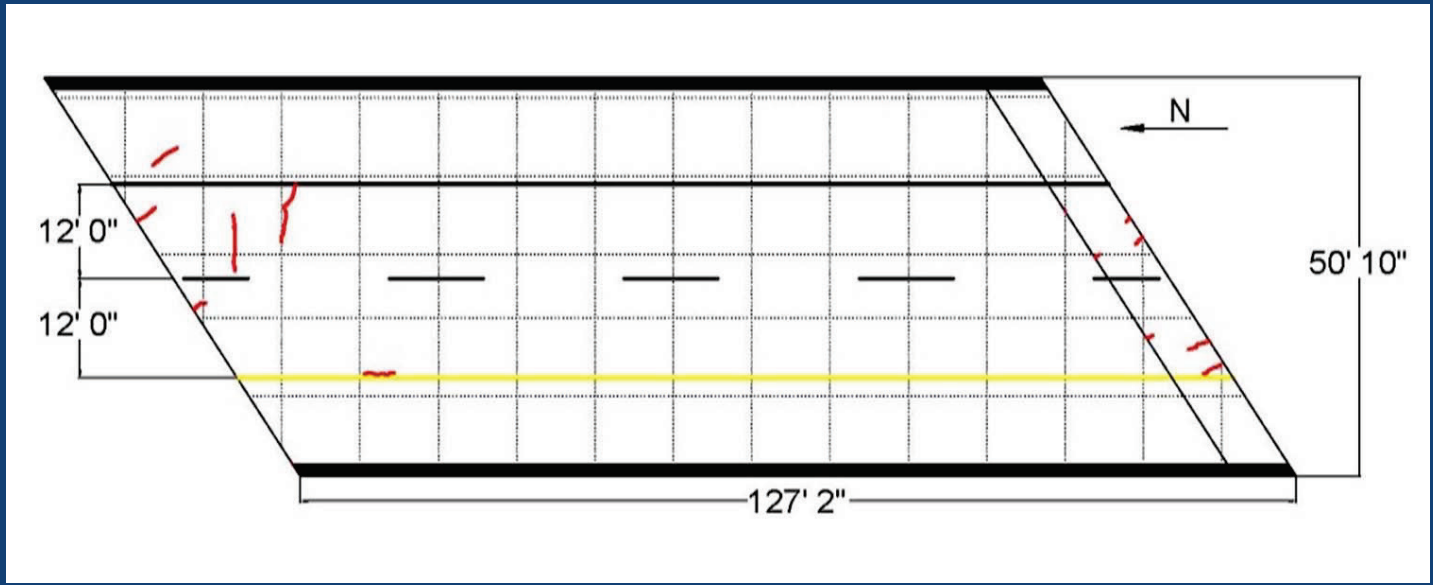
Distress map, Dannon Way Conventional Deck at 5 months



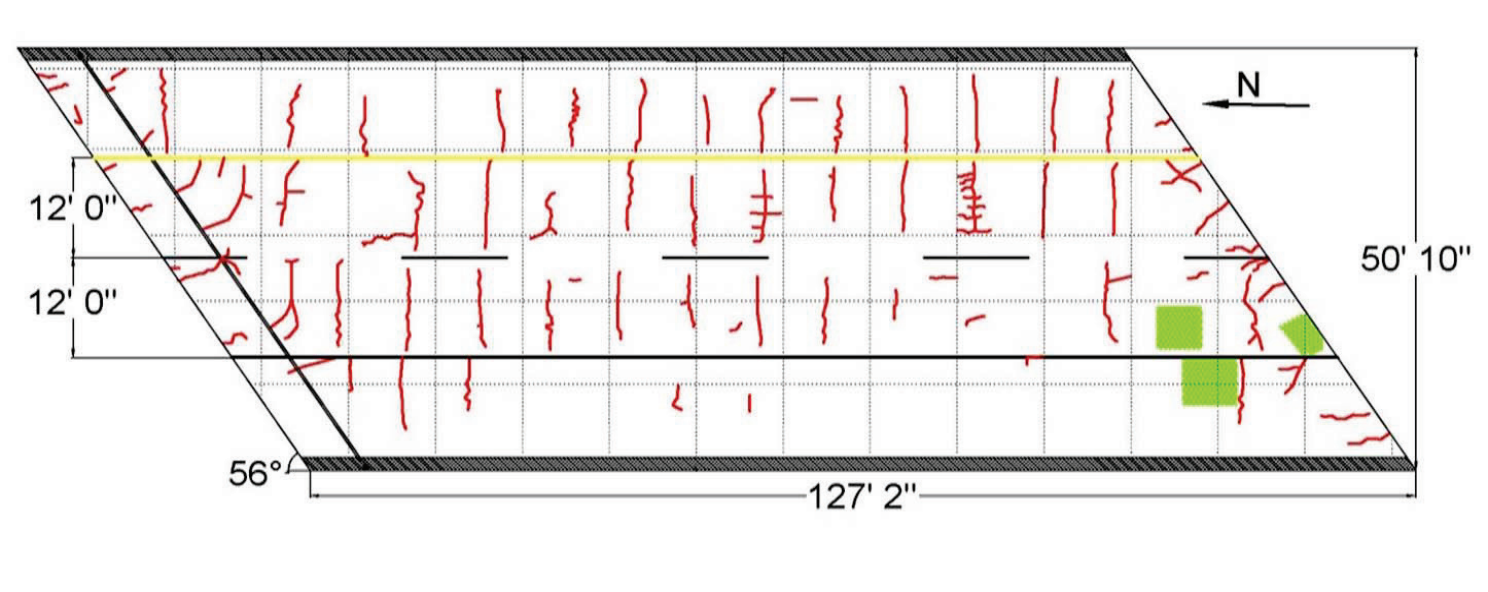
Distress map, Dannon Way Internal Curing Deck at 5 months



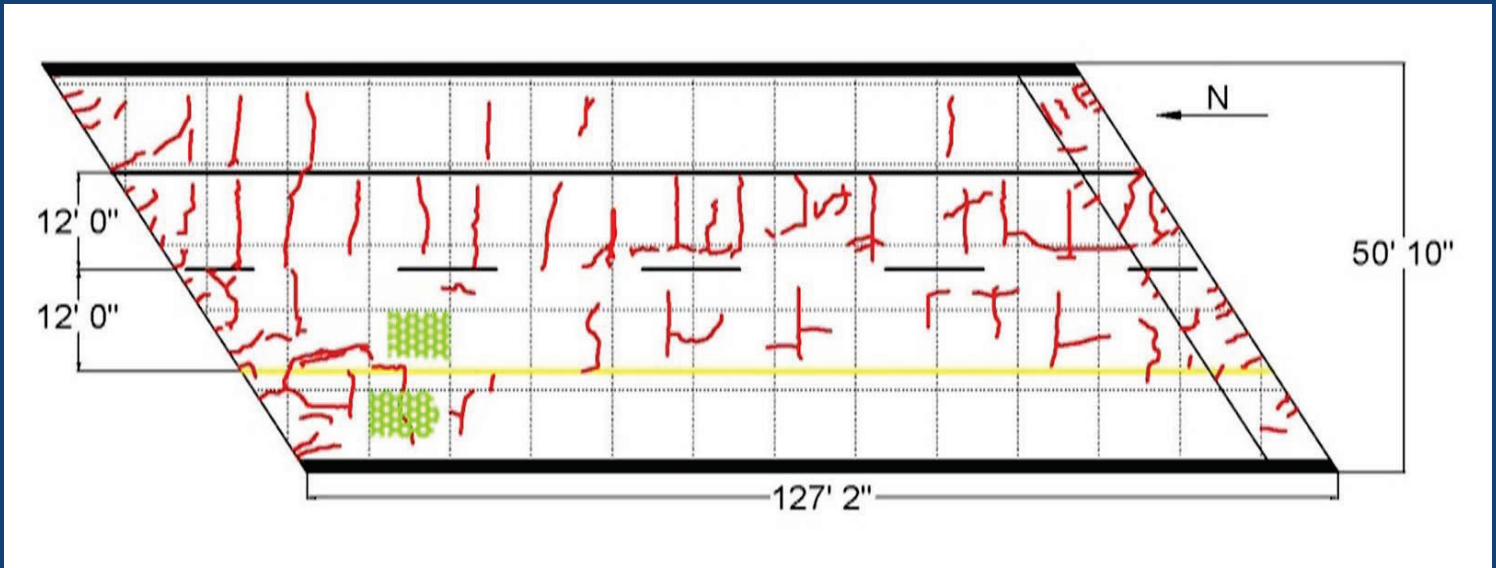
Distress map, Dannon Way Conventional Deck at 8 months



Distress map, Dannon Way Internal Curing Deck at 8 months

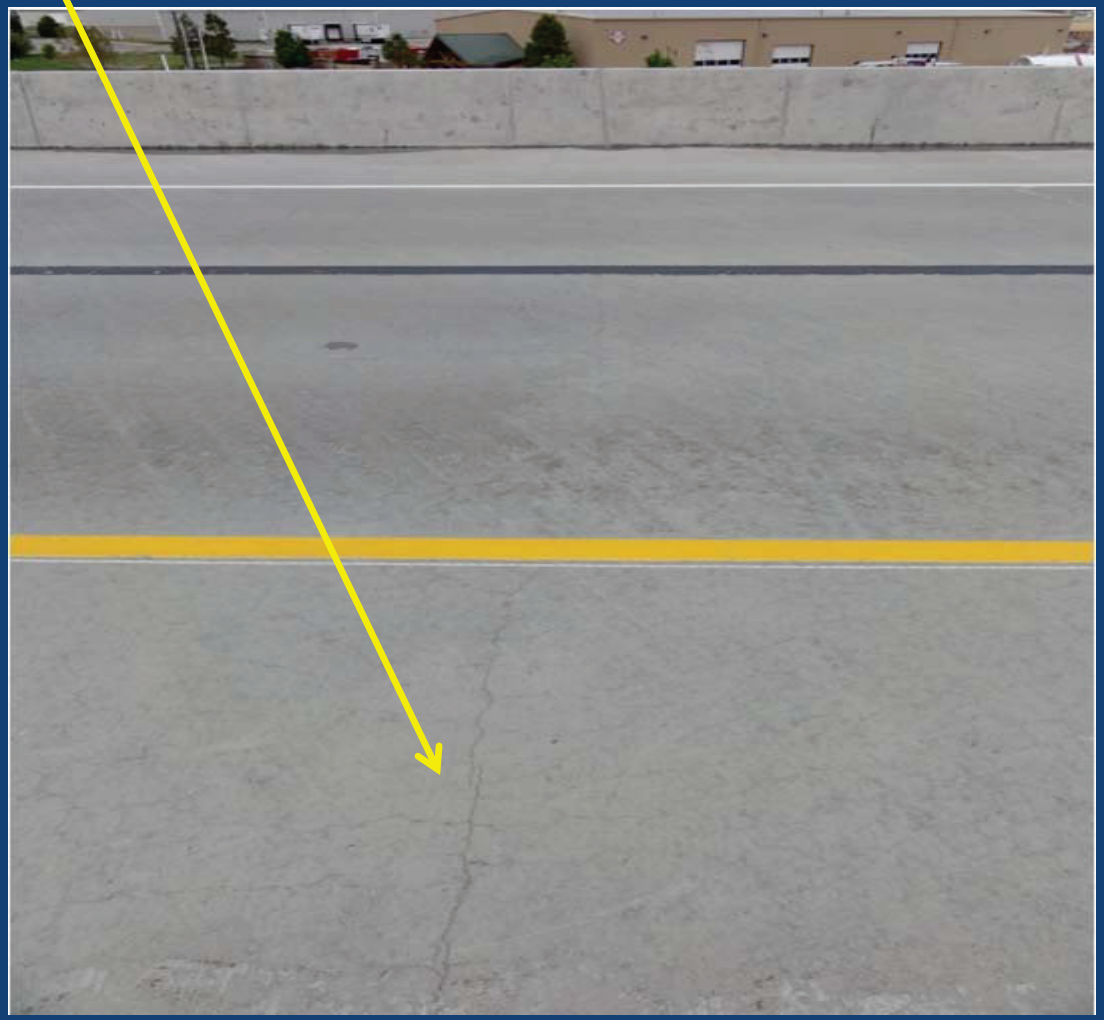


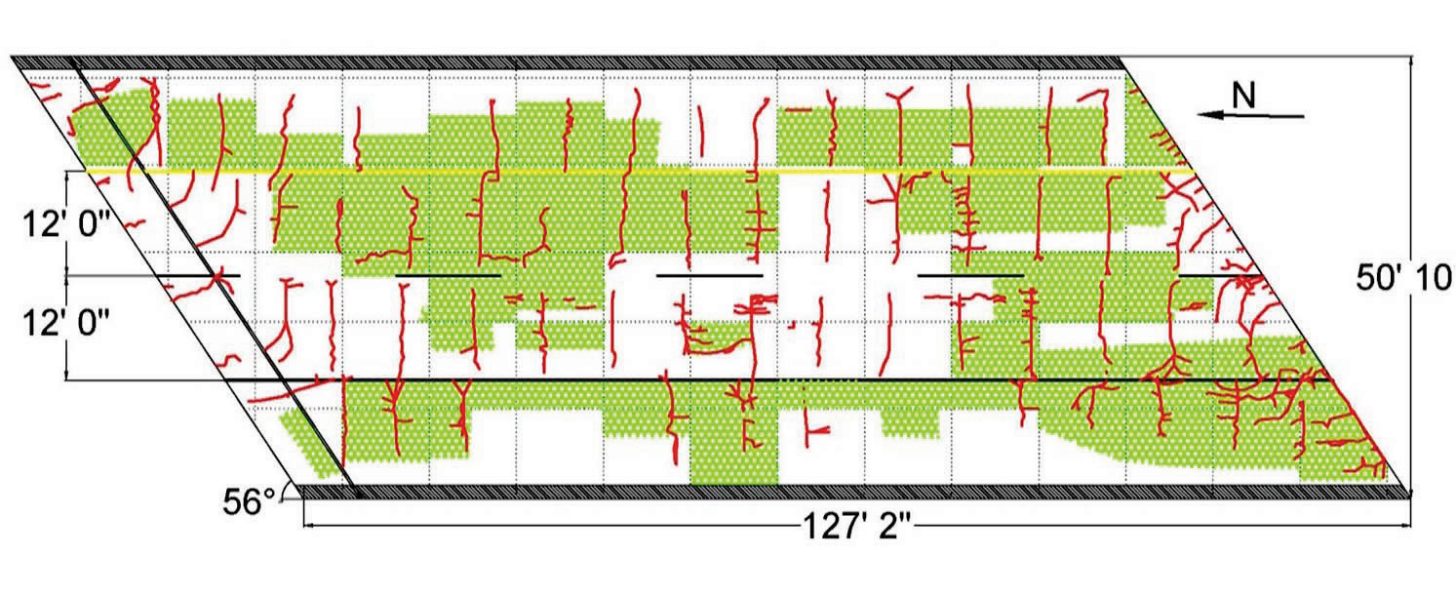
Conventional – 1 Year



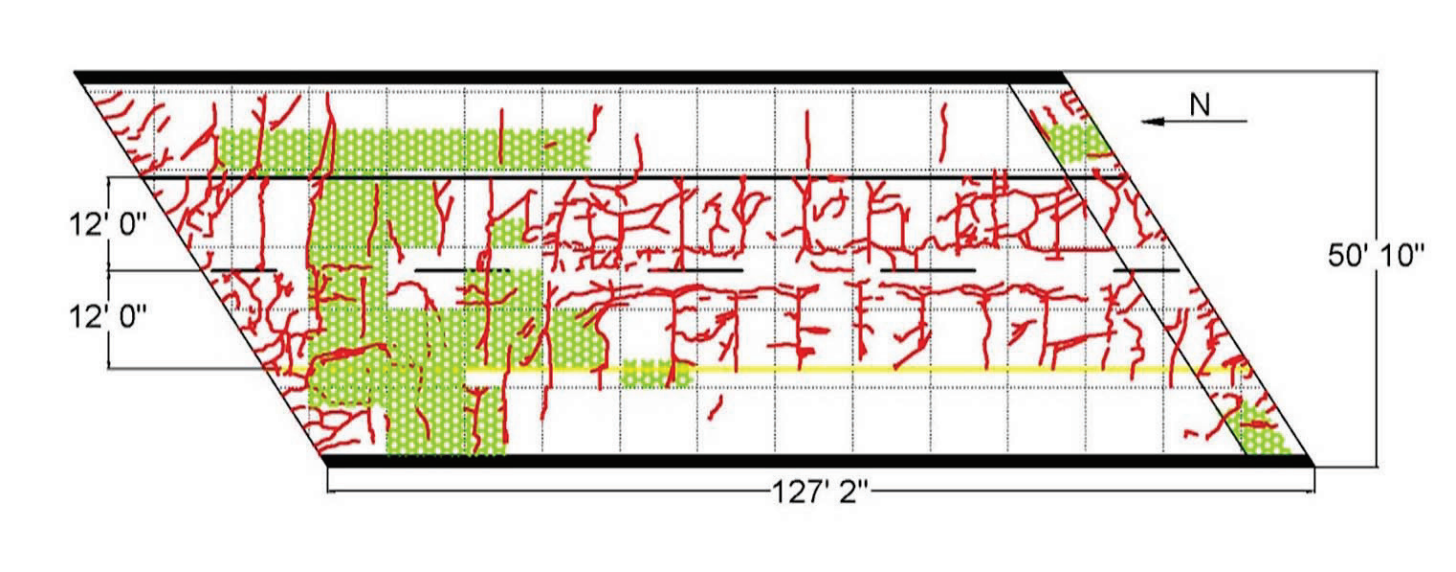
Internal Curing – 1 Year

Reflective Cracking from half deck precast panels – IC deck





Conventional – 2 Year



Internal Curing – 2 Year

Summary

- Sensor measured moisture –
  - IC 2-3% higher up to 1 year
  - Less than 2% difference at 2 years
- Sensor measured electric conductivity
  - No significant differences up to 6 months
  - At 1 to 2 years, IC decks averaged 46 % higher

Summary Continued:

- Lab tested cylinders
  - Little difference in strength testing at 7,28 days, 3 months and 6 months
  - At 1 year, average conventional was 900 lbs greater than internally cured
- Lab RCPT (C1202)
  - IC Decks passed average 15.4 % less current at 1 yr.
  - All decks exhibited “Low – Very Low” permeability

Lessons Learned

No Half Deck Pre-cast Panels

Future Use of Internal Curing

- Bridge Deck replacement by Salt Lake City, 1300 South Project – in progress
- Full Depth Replacement Panels on I-80 in 2013

Performing well but in early stages.

More Information:

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