

# A tribute to Calvin McCall an ACI Honorary Member

Originally Raleigh, NC USA ??  
October 26<sup>th</sup>, 2020 ACI Virtual Convention  
During the Pandemic year of 2020  
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Gallup, New Mexico, USA, Earth



# Initial Curing of Concrete Test Specimens

**Will discuss the initial curing of test specimens . Curing from the summer months into the winter and how to do it economically**

**Calvin and I discussed this often when doing Trouble shooting seminars the past 20 years, for ACI, using 35mm slides and then power points. Calvin was chair of ACI committee 517 Accelerated Curing of Concrete 33 years ago. When we met at ACI**

# ASTM C31/C31M-19a

## Making and **Curing** Concrete Test specimens in the field

- Most abused procedure in my opinion when it comes to testing concrete. Colorado has done a study and it is the most abused test in the field. Over 30% of the time. Colorado has developed a program to report when initial curing is not being done properly by others.

# ASTM C31/C31M 2020 Volume 04-02

- Parg. 10.1.2 initial curing is on page 10 of the 2020 vol 04.02
- Cylinders can be stored for a period up to 48 hours after molding to maintain the specimen's temperature and moisture condition
- Parg. 10.1.2.2 Store the specimens in an environment that controls the loss of Moisture
- **Note 13- Immersion in water maybe the easiest method to maintain require moisture and temperature conditions during initial curing. This is very simple as you will see.**

# Cont. ASTM C-31/C31 Parg,12 Report

- 12.1.1 Identification number ( whose cylinders are these)
- 12.1.2 Location of concrete represented by the samples
- 12.1.3 Date, time and name of individual molding specimens
- 12.1.4 Slump or flow, and air content, and concrete temperature, test result and results of other test on fresh concrete
- 12.1.5 Curing method . **For standard curing method report the initial curing method with maximum and minimum temperatures and final curing method, abused and not done by labs.**

# Laboratory notes from Concrete reports

- Concrete specimens molded and cured in the field in accordance with C31. (**Good**)
- Deviations:
- Specimens environment was not monitored by lab during initial cure. **They do not care what happens to the test specimens after they were cast**
- **. Things like this have been on reports.**
- Does CCRL review this when they do lab inspection?
- Designers and owners hire Testing labs assume they are doing all testing per the ASTM latest edition.

# Proper initial curing of test specimens

Proper curing of test specimens in water  
However they forgot the thermometer



Checking the water temperature.



# *Properly cured test specimens previous slide*

Mix time to sample 2.57 hours and 3.23 hours avg 3.0 hours

Air temp 85 F avg high 54 avg. low approximately

Concrete temp 63F when tested

Slump over 6" used Super plasticer.

Strength two sets 6110 and 6400 avg 6255 psi f'c was 4500 psi **40%higher**

Cement efficiency 6255 psi / 760 lb (8.1bag) of cem. 8.23 psi / pound of cementitious.

*improper initial curing will give*

**Cement efficiency of 3 to 4 psi / pound of cementitious**

# Summary of Proper initial curing

- If Concrete test specimens are properly cured, initially in water, and temperature maintained with moisture you will get the strength. The delivery time factor is secondary
- On the other hand if the test specimens are not initially cured properly and the strength is not made folks blame the 90 minutes that could be the problem for low strength.
- It is time to initially cure the concrete properly and if the mix time is over 2 hours and strength is made no problem on time .

# Improper Marking and initial curing of test specimen



10/15/2020

THE WORK



# Initial curing of cylinder No moisture or thermometer



**Improper curing per ASTM C-31**  
**You could loose 1000 psi in 28 days**

# Improper initial curing



# Proper Field Curing tank for first 24 to 48 hours



American Concrete Institute  
*Always advancing*



518-490-2330

sales@coninnco.com

THE WORLD'S

11/2/20



# New Thermocure box with water.



 Construction Innovations Co. Inc.

## Thermocure II Concrete Cylinder Curing Box

- 30 Years of Dependable In-Field Service
- Uses Water to Heat and Cool Cylinders.
  - Minimal temperature loss when lid is opened.
- Water Circulation Pump
  - Helps eliminate uneven temperature distribution. (Thermocure II standard)
- Holds 22 Standard 6" x 12" Test Cylinders. (320Qt Cooler)

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# Master Cure box and wireless sensors by RPX



RPX folks were the inventors of the intellrock loggers for Maturity and temperature sensors. 405-880-5129 or [insite.rpxtech.com](http://insite.rpxtech.com) For more information



# A curing box by Deslauriers

## CONCRETE CURING BOX/COOLER

### Cure Plus 2

The Cure Plus 2 concrete curing box is thermostatically controlled to ensure specified curing temperatures are maintained during initial field curing for up to 48 hours.

Designed to maintain the curing environment in the specified 60°F to 80°F degree range.

The Cure Plus 2 is designed, produced and distributed by Deslauriers right here in the USA.

It is ASTM C31 & AASHTO T-23 compliant.

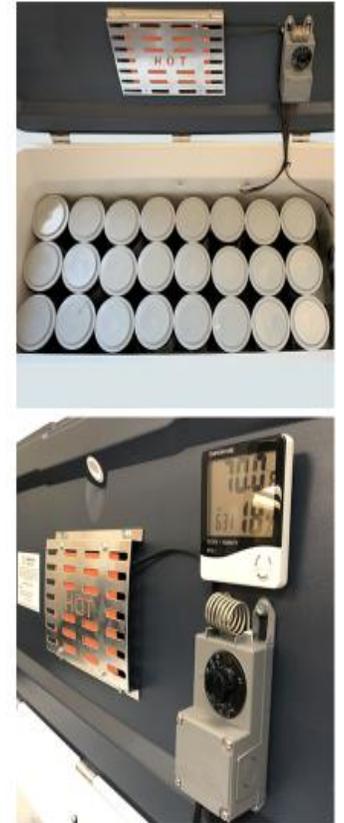


## CONCRETE CURING BOX/COOLER

### Cure Plus 2

#### Features

- Automatically switches from heat to cold when needed.
- Perfect for curing test specimens in all seasons.
- Adjustable thermostat.
- Accommodates (10) 6x12" cylinders or (24) 4x8" cylinders.
- Light-weight and portable.
- Includes MIN/MAX Thermometer (ASTM C1064).



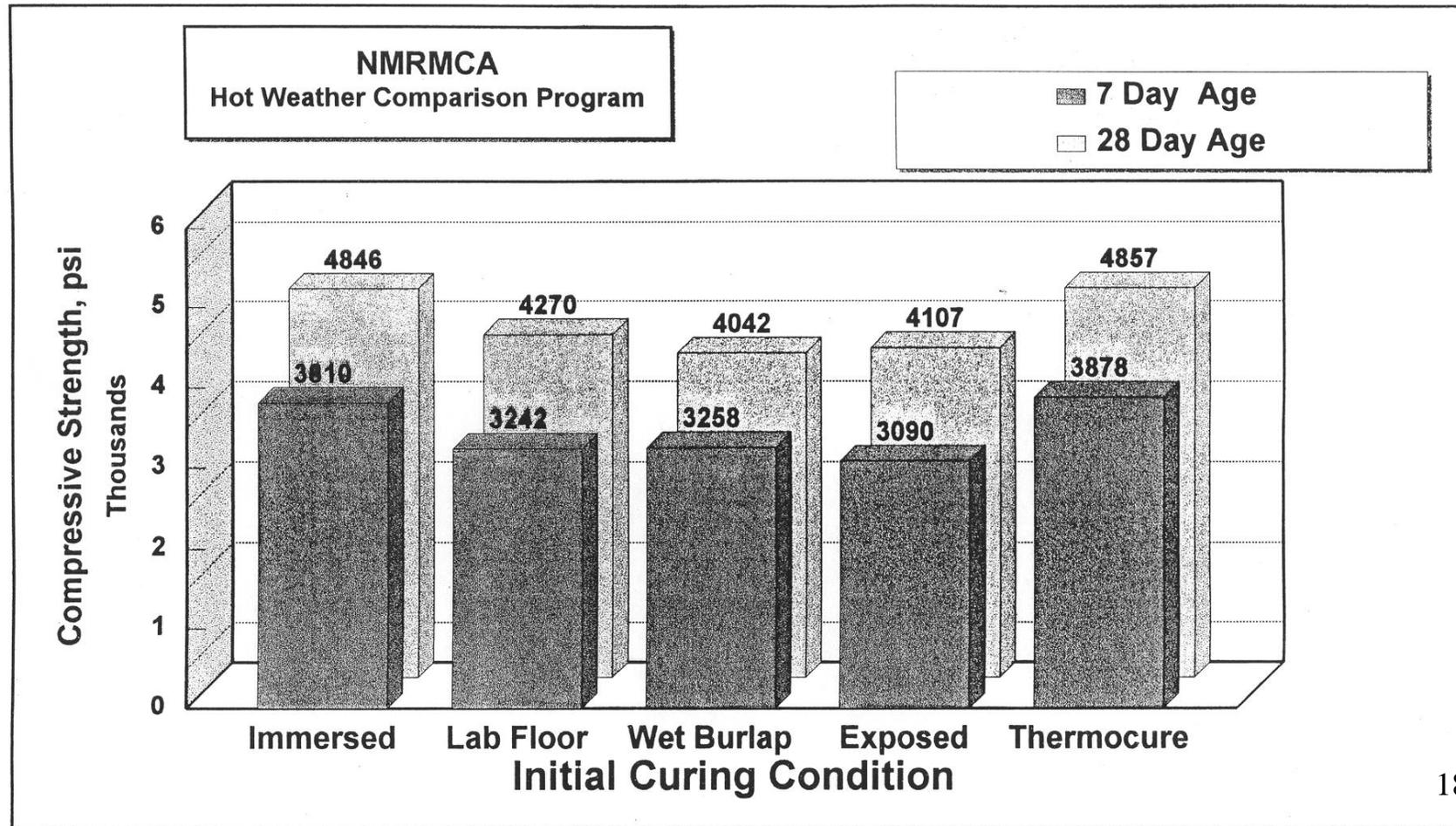
Deslauriers about \$1300

# Curing Concrete test Cylinders

Thermal curing	(7) 3878 psi	(28) <b>4857</b> psi
Immersed water	(7) 3818 psi	(28) 4846 psi
Exposed to air	(7) 3090 psi	(28) 4107 psi
Wet Burlap	(7) 3258 psi	(28) <b>4042</b> psi

**In summary you can loose 800 psi when testing cylinders at 28 days if not cured properly for the first 24 hours.**

# Comparison of Immersed vs exposed cylinder curing first 24 hrs. comparison of Immersed vs exposed



# Latest MasterSpec December 2018 Version

- Test lab provides curing container for acceptance testing and verify compliance with ASTM C31
- Test lab to report results to Owner, Architect, Contractor and concrete manufacturer **within 48 hours**. Test reports to include **curing method and maximum and minimum temperatures during initial curing period**.
- Testing Agency qualified in accordance with ASTM C1077, ASTM E329

# MasterSpec December 2018 Version cont.

- Field tests - ACI Concrete Field Testing Technician, Grade I.
- Laboratory tests - ACI Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Laboratory supervisor – ACI Concrete Laboratory Testing Technician, Grade II.
- Contractor provides daily access, secure space for storage, initial curing, and field curing of test samples, source of water and continuous electrical power at project site
- Pre-installation conference requires review of curing

Winter curing conditions (real weather)



# Keeping a 5 gal bucket with 4 cyl. warm

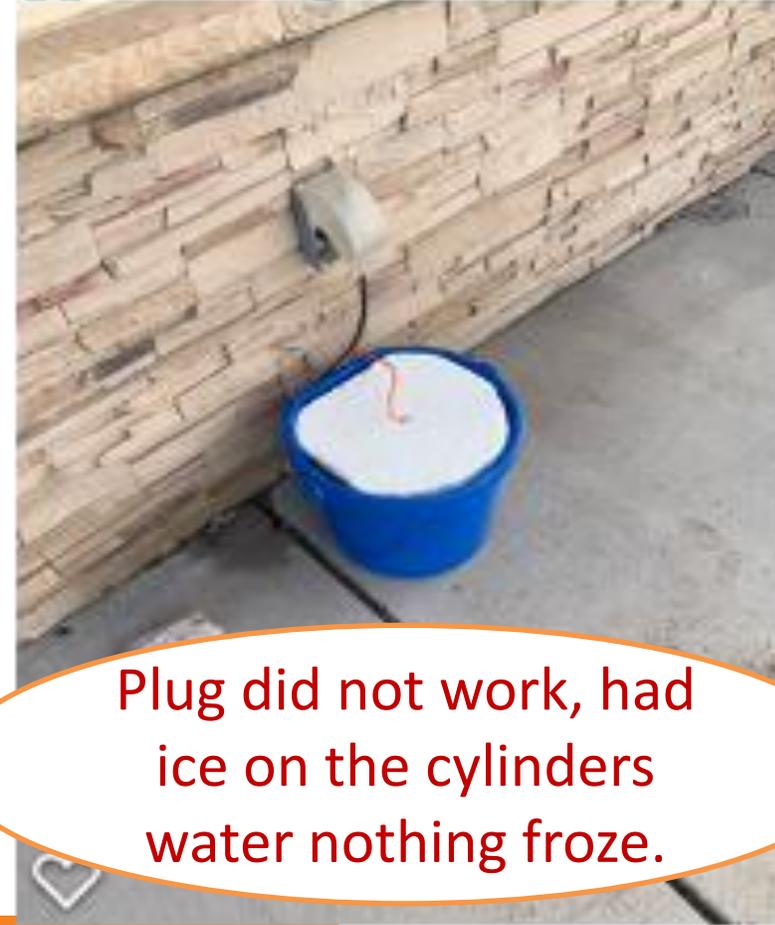


- [Powerblanket.com](https://www.powerblanket.com) was about \$100 +/- in 2019
- Will heat water over the 80F need a timer to turn it off and on to keep it in the 60 to 80F range.
- Please monitor the temperature with an hourly print out of the temp so you know what is happening.

# Proper initial curing very economical



**The blue containers had weight on the lid to seal the cooler + Heat of hydration**



**Plug did not work, had ice on the cylinders water nothing froze.**

# Check the power to be sure it works



Lights turn on if there is power



Cost about \$6.00

# Monitoring the initial curing temperatures

**Command  
Center  
Sensor  
reader  
Module**



# Winter curing of test specimen's tractor Supplied had the bucket

Manufacture is Allied Precision Industries Cost is about \$ 50.00 +/- up.

16 Gallon container. The have larger ones Can go up to 32 gal 20" diameter,



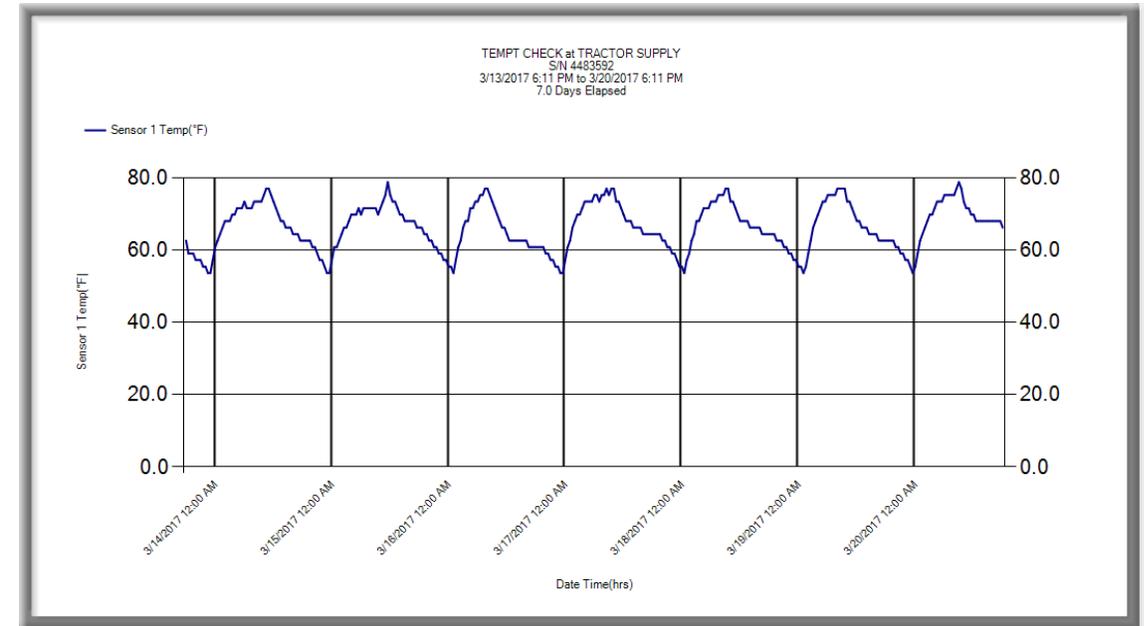
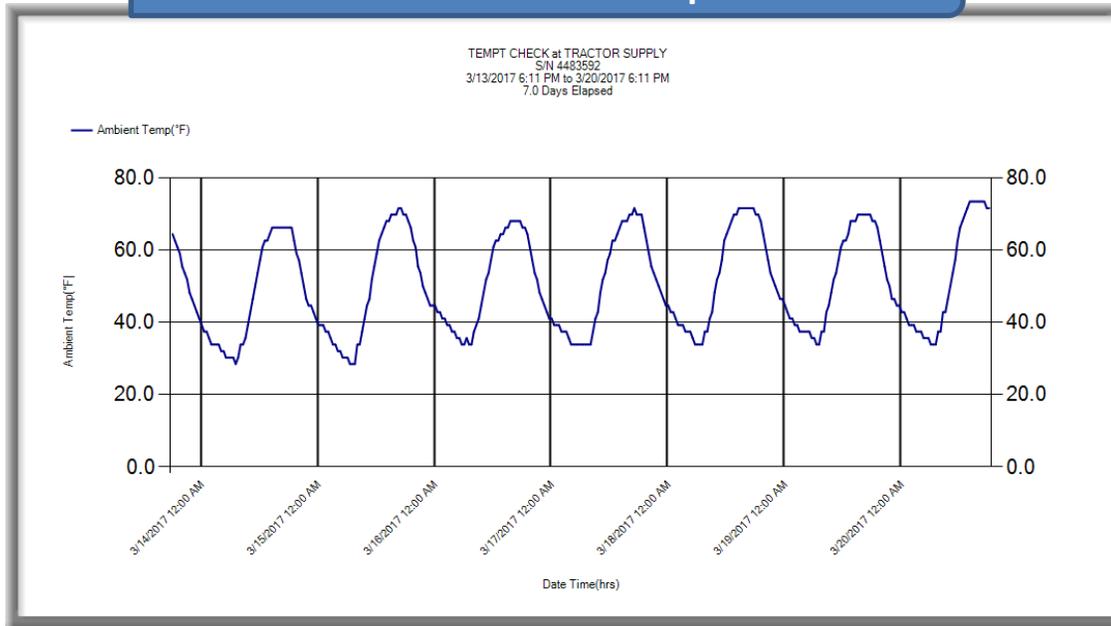
Command center and intellirock sensors use to record temperatures



New buckets turn on at 35F and off at 45F air temp.

# Tractor supply bucket

## Ambient temp



Giatic of Canada has temperature and Maturity sensors

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# Temperature monitoring of cylinders



This is a method of getting the temperature, & Relative Humidity of the curing box with the Iphone. Put this on top of the cylinder . Kestrel was at a recent ACI convention.



This is how we measured the high low temperature before electronics

An old fashion High –Low thermometer

# More new ideas for initial curing

Koz test for Smell ,  
Do you ever smell the cylinders?  
I had Ammonia smell one time



The plug turns on at 35F off 45F This is Air temperature, so nothing freezes (try it)  
\$19.00 tractor supply (found it last week)



New York City, I found a curing box. Somebody was doing it correct at least 6 years ago.



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# Proper curing on the left improper on the right



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**Concrete mixers are getting high tech.  
This measures the concrete temp. air content and yardage**



**Testing folks  
cannot do the  
initial curing  
properly  
something is  
wrong with  
the picture**



# The Data

Load Size	9.75
Slump	3.82
Temp	79.82
AIRtrac Temp	81.29
Air %	5.38
AIRtrac Air %	6.2

- 77 Data Points

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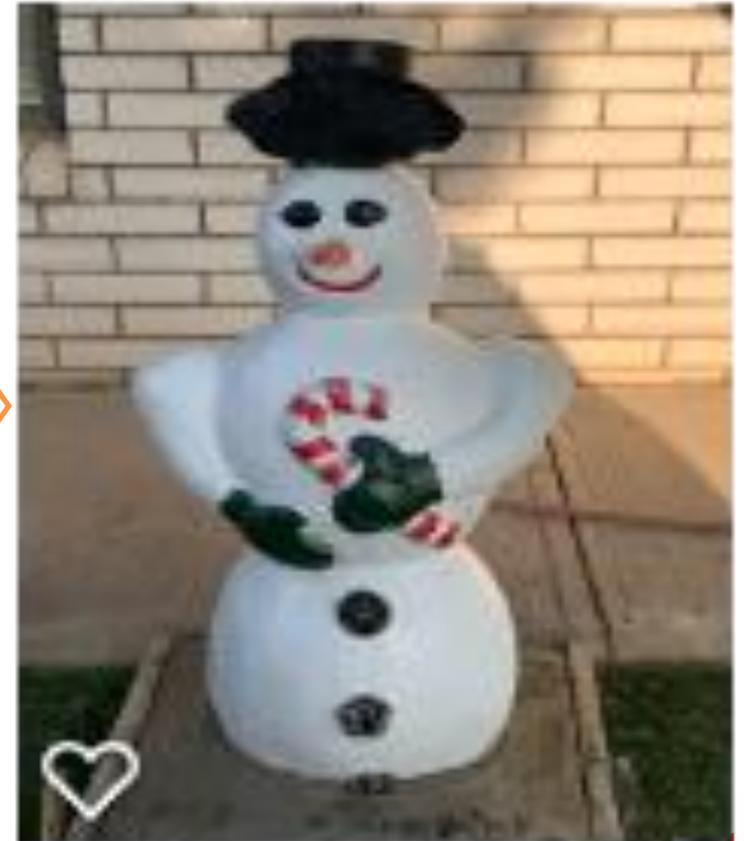
- In summary proper initial curing can be done if the folks testing the concrete want too do it properly. We are advancing computer batching, measuring the properties in transit so the concrete is as perfect as we can get when delivered to the project. Maybe the grade one certification can have the technician indicate how the initial curing was done. And the High-low thermometer will be part of the grade 1 test. This way we can get performance mix designs. Or let the ready-mix producer be in charge of Quality control. Some labs cannot handle the job of proper testing..

# Happy Halloween and Merry Christmas

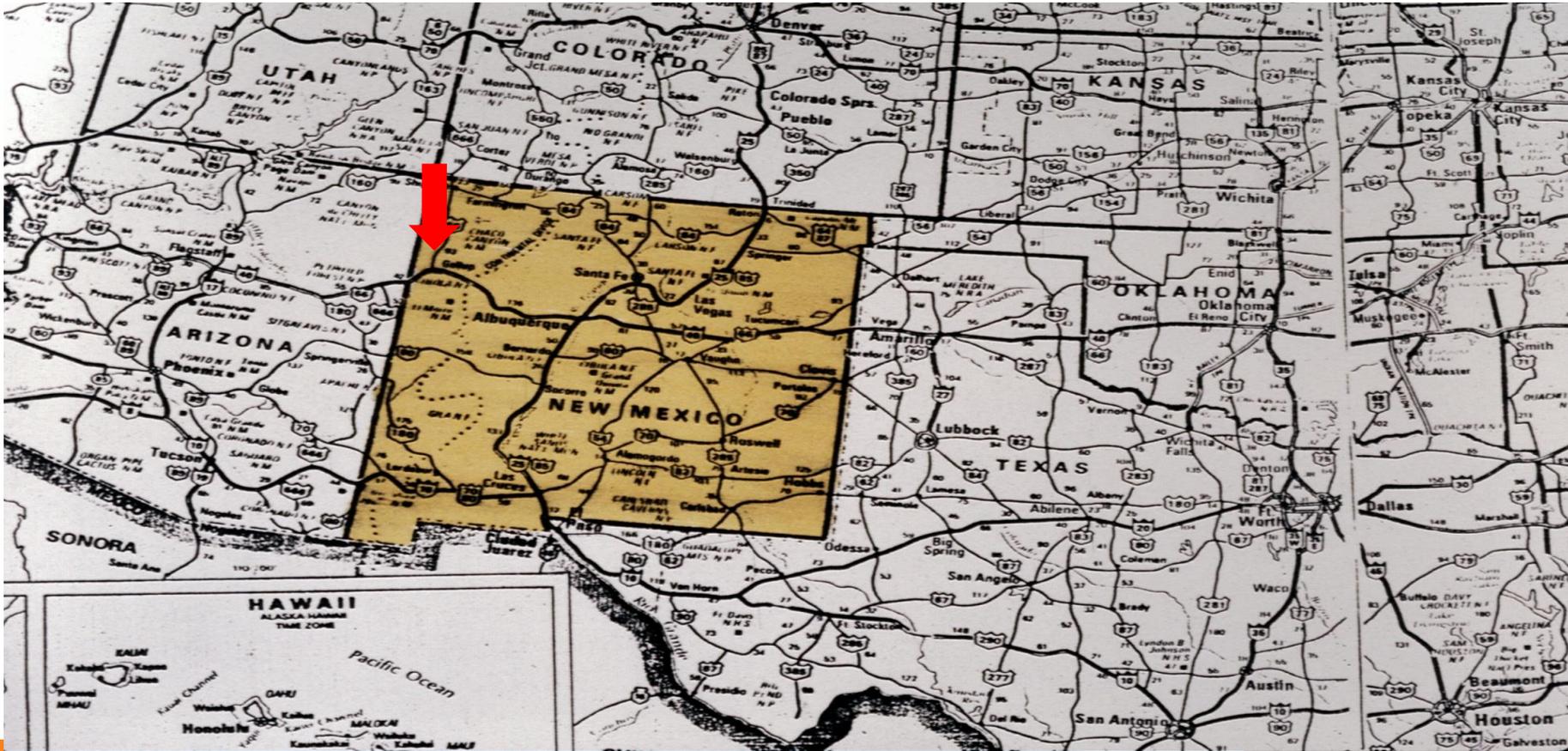


**Concrete  
snow man  
about 12  
years old**

Concrete does not  
melt in the summer  
It is at my Home in  
Gallup, NM



# This presentations came Gallup, NM



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11/2/2020



# Question's ???

Thank You

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**Pronounce “Cause-a-liskey”**

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