Mobile Mixers: History, Performance & Use

Spring 2019 National Concrete Consortium

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Concrete

Most widely used material in ~~construction~~ the world.

- 3000BC – Egyptian Pyramids

- 1824 – Portland Cement Invented

Concrete

- 1891 – First Concrete Street

- Bellefontaine, OH

- 1923 – Ready Mix

Ready Mix – Barrel Delivery

- Certified plant – keeps mix consistent
- Specifications written around ready mix
- Offload concrete quickly
- Simple operation

- Ready mix delivery model used for 100 years
- Is one tool a fit for all projects?

Project Needs

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- What if projects require:

✓ Multiple mix designs

✓ Specialty mixes such as latex, polymers or fast-setting

✓ Several pour locations

✓ Flexibility in the schedule

✓On demand concrete

✓ Night or weekend work with various amounts and/or mixes

✓ Remote work sites with limited access

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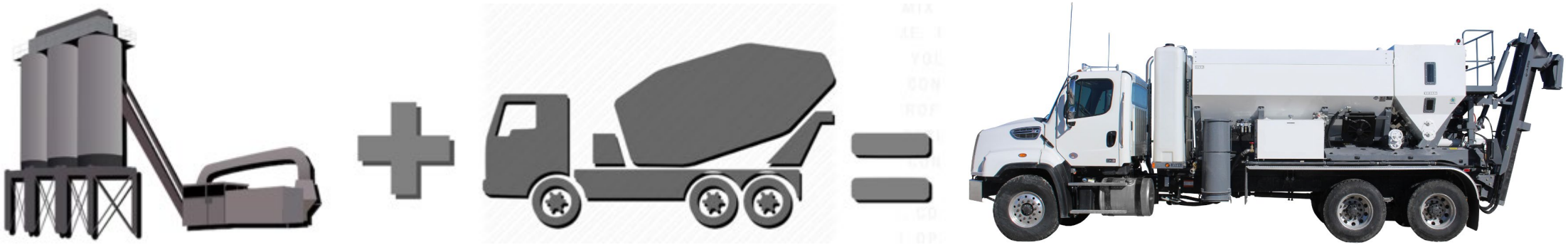

How it Works

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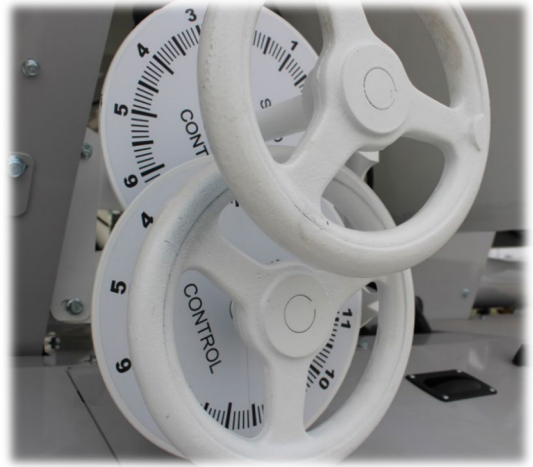
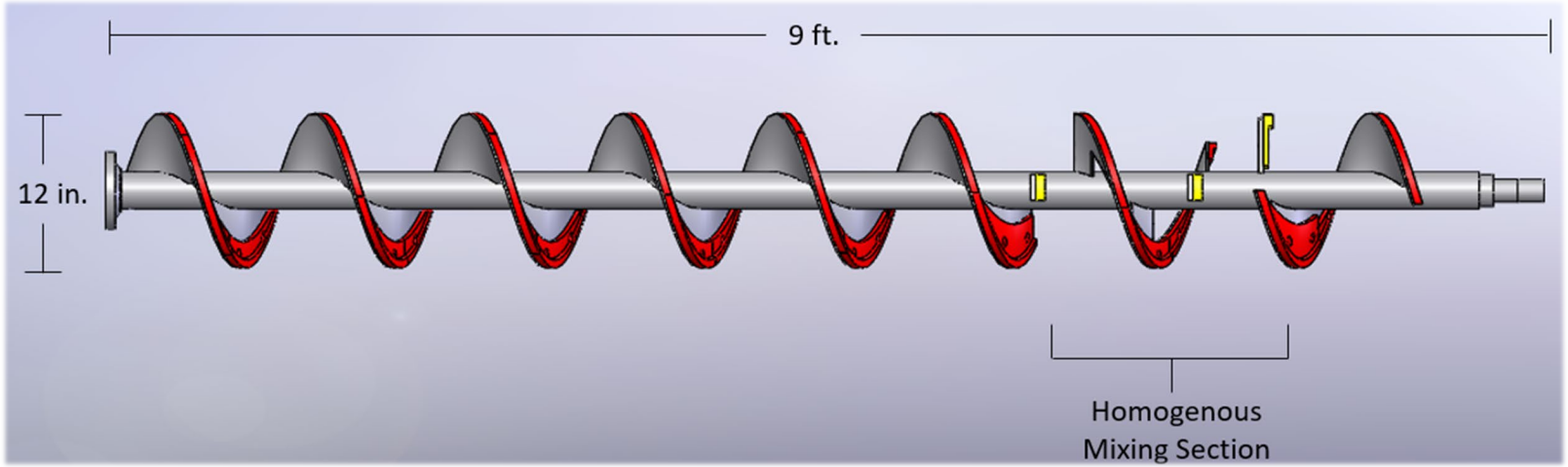
How it Works

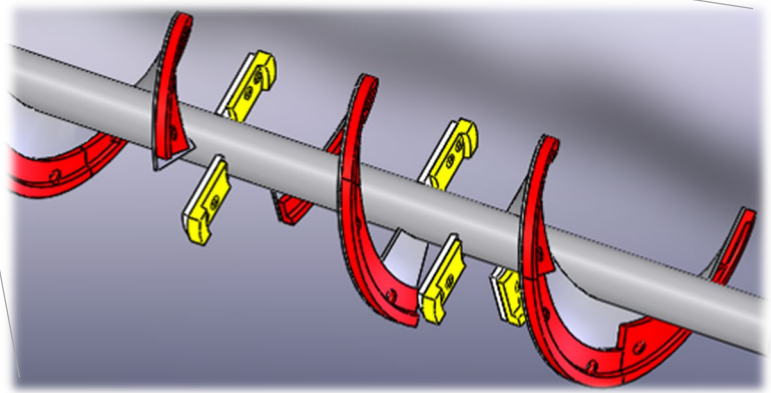
Sand and Stone Gate Dials



Pump Master Auger



- 278 - 280 RPM
- 10 - 15 seconds of mix time
- 30° Angle



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Weight vs Volume

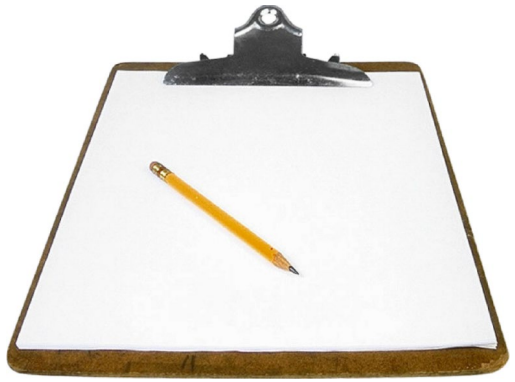
VS

ASTM C94

ASTM C685

Calibration Process - Tools

- Containers
- Scale
- Stop watch
- Clipboard



Calibration Process

Typical Order of Calibration:

1. Cement
2. Sand
3. Stone

- While the unit is empty of sand or stone, cement is discharged into the container, timed and weighed.

Calibration Process - Cement

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- 3-5 trials is recommended

Recorded Information:

1. Record Discharge Time - seconds
2. Counts - number
3. Weight of material - lbs

- The goal is to verify +/-1% accuracy between the 3-5 trials

Calibration Process - Sand

- Discharge a specified number of sand counts into the bin

Recorded information

1. Counts: number
2. Weight of material: lbs

- No need to time the sand or stone, timing is based off the cement discharge

Calibration Process – Stone

- 3-5 trials is recommended
- Empty sand & load rock
- Repeat process

Calibration Process – Mix Design

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Volumetric Concrete Dispenser Mix Design Worksheet

OWNER: Southeast Construction — Unit Serial #: 5512

YOUR MIX DESIGN (This sheet must be filled out for each mix design)

MIX DESIGN: 4000 PSI (max 8 characters) — Date:

Materials of one cubic yard:

Cement	564	LBS.	100%	Cement Discharge Speed (In Percent)	86 Counts per Bag of Cement
Cement	6.0	BAGS	1.07	Cubic Yard Discharge Time (Minute)	

Aggregate	Name	Aggregate # Desired (enter 1, 2, 3, or 4)	Aggregate Name	Pounds of Aggregate
1	SAND	Aggregate 1: 1	SAND	1425
2	STONE	Aggregate 2: 2	STONE	1625
3	0			
4	0			

Color: — OUNCES — Fiber Chopper: — Pounds per Yard

	Low, Mid, or High Sys	Dilution	Oz/bag
Admix # 1			
Admix # 2			
Admix # 3			

(Mid Range available on 130, 150, & 200 Series units only)

1. Determine the count per cubic yard.

6.0 bags/cubic yard x 86 counts per bag = 518 count per cubic yard.

2. AGGREGATE 1: Divide the lbs. of fine aggregate per cubic yard by the count per cubic yard.

1425 lbs. fine aggregate divided by 518 counts per cu. yd.= 2.75 lbs. per count.

GATE SETTING (from graph) 5.0

3. AGGREGATE 2: Divide the lbs. of coarse aggregate per cubic yard by the count per cubic yard.

1625 lbs. coarse aggregate divided by 518 counts per cu. yd.= 3.13 lbs. per count.

GATE SETTING (from graph) 6.5

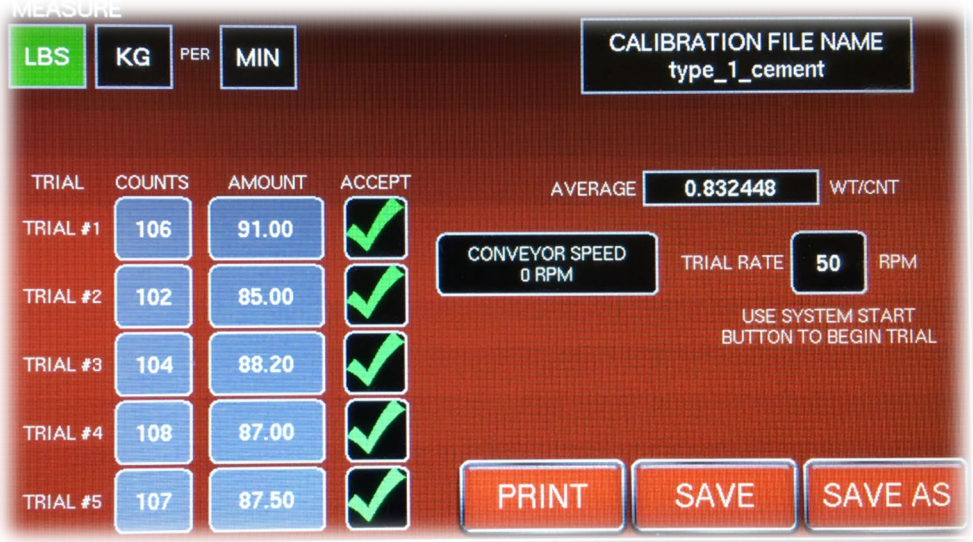
Description	4000 PSI				
Total	518	Counts / Cubic Yard			
Cement	1.09	lbs./ Count		Dial Setting	Oz/Min
Aggregate 1	2.75	lbs./ Count	Admix # 1	ERROR	0.0
Aggregate 2	3.13	lbs./ Count	Admix # 2	ERROR	0.0
*Water	0.00	lbs./ Count	Admix # 3	ERROR	0.0
Aggregate 1 Gate	5.0		Color	#DIV/0!	0.0
Aggregate 2 Gate	6.5		Fiber Chopper	#DIV/0!	0.0
Water Meter					

Calibration Process – Verify

- Verify the mix design by running yield tests
- Slump and air testing can also be used to verify the quality of the mix

Calibration Process – Digital

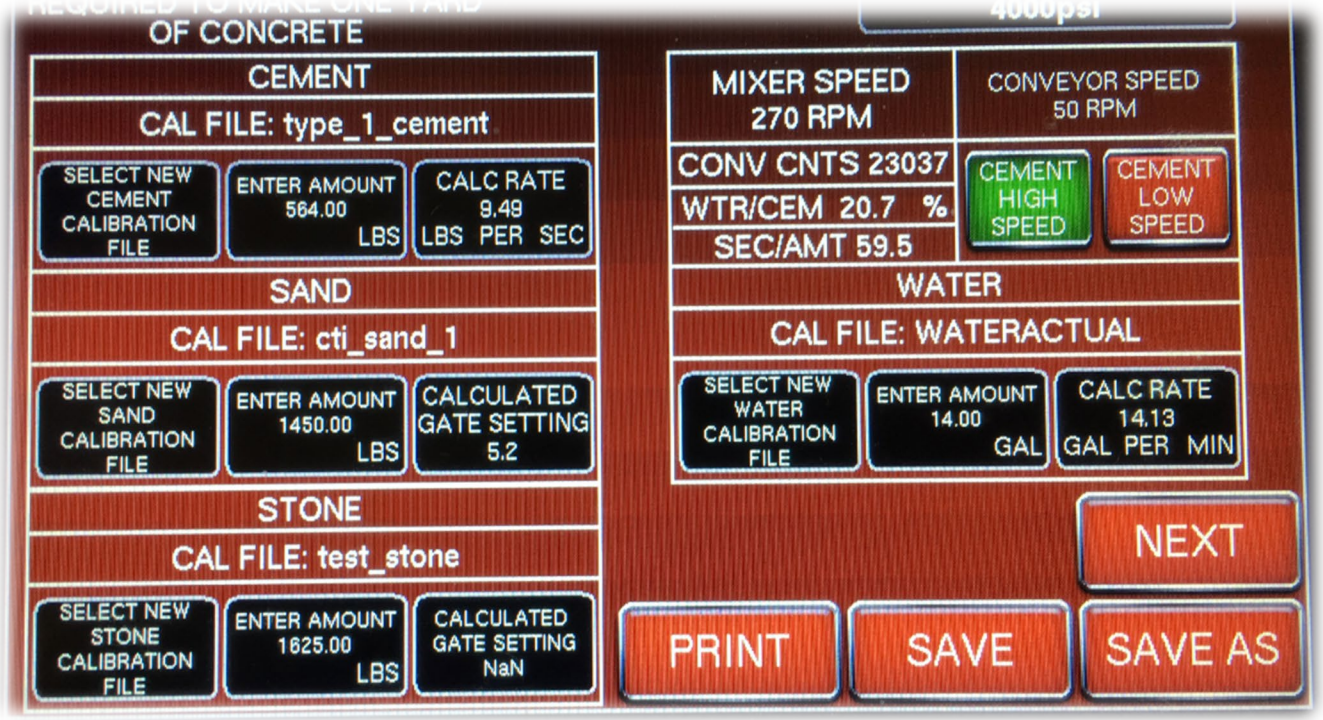
- Digital Calibration simplifies the process
- Eliminates stop watch and clip board



- Sand, stone, cement, admixtures, water, fiber and color calibrations are all stored

Calibration Process – Mix Design

- Digital mix designs are also stored on the computer
- Automated gates used during calibration and mix design process
  - Accurate to 1/16”
  - Less human error



Barrel vs Mobile Mixers

MYTHBUSTERS

Myth #1: Volumetric Concrete mixing is a new and unproven technology

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- 1965 – Patent granted for the Concrete-Mobile
- Over 2,500 Concrete-Mobiles were produced by 1980
- Over 10,000 Volumetric Mixers produced by 2000
- In use in every state in the United States and 60 countries
- Used by the U.S. Military, state DOT and cities
- City of Des Moines has been operating a mixer for 15 years

Myth #2: Volumetric mixers cannot match the accuracy and consistency of a batch plant

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- Specification ASTM C94 vs. ASTM C685
  - Same tolerances on all materials
  - More restrictions on ready mix as water-cement contact occurs at the plant, not at the job site
- ACI 304.6R “Guide for the Use of Volumetric-Measuring..”
  VMMB (NRMCA) approval and specification
- AASHTO M241

aci NRMCA ASTM INTERNATIONAL VMMB

3RD Party Test Results

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Terracon

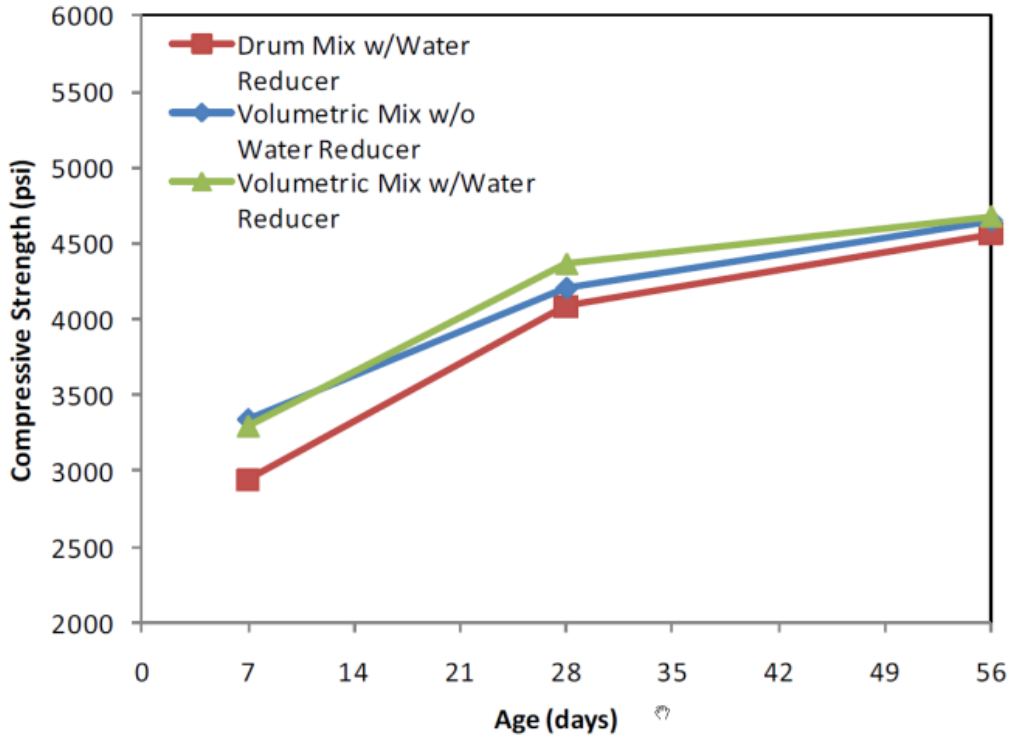
Concrete Comparative Testing – VMMB – 12/5/13

Table 4. Average* Concrete Compressive Strength (psi) Test Results, (ASTM C 39)

	Mixing/Production Method		
Age	Drum Mixed	Volumetric Mixed w/o WR	Volumetric Mixed w/ WR[1]
7 Day	2943	3338	3296
28 Day	4085**	4201**	4365
56 Day	4563	4647	4679

[1] *Additional Test*

**This is an average of the compressive strength test results of specimens of all the four batches at the respective test age.*



Air content, slump, unit weight testing

Myth #3: Volumetric mixers don't produce "good concrete" (e.g. not enough mix time)

BUSTING THE MYTHS

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Many examples of quality concrete:

- Bridge deck overlays – Virginia
- Street replacement/repair - Texas
- Airport runway repairs – Oregon, Australia
- Structural elements
- Pool builders, Soil retention - Florida
- Pervious concrete – California
- Light weight concrete by foam and lightweight aggregates

Myth #4: Volumetric mixers cannot handle large production pours or projects

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- A single piece of equipment can be reloaded at the jobsite – No time or fuel wasted in transit
- Volumetric equipment is capable of production rates in excess of 90 cubic yards per hour
- Many examples of large scale projects done with volumetrics
    - Fermi Labs – 28,000 CY of concrete in 1 month with 1 machine
    - Common volumetric model on the market today will produce 1 CY of concrete per minute

Myth #5: Volumetric mixers are too complex to operate and have too long a learning curve

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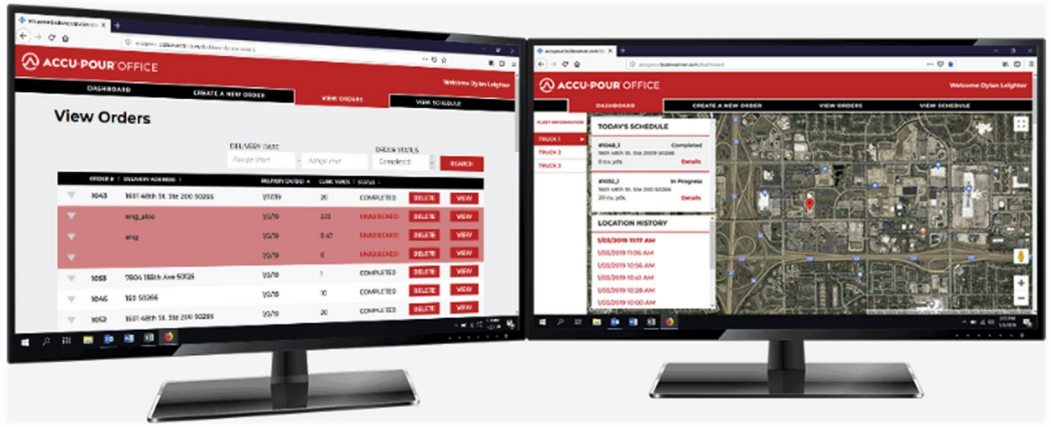
- Like other jobsite equipment, proper training of operators is a must
- An operator of a volumetric mixer must have more training than a typical barrel mixer operator – “batch plant on wheels”
- We offer extensive training in the operation, maintenance and calibration of their equipment
- Typical “day-to-day” operation is straight-forward and repeatable

Automated Units

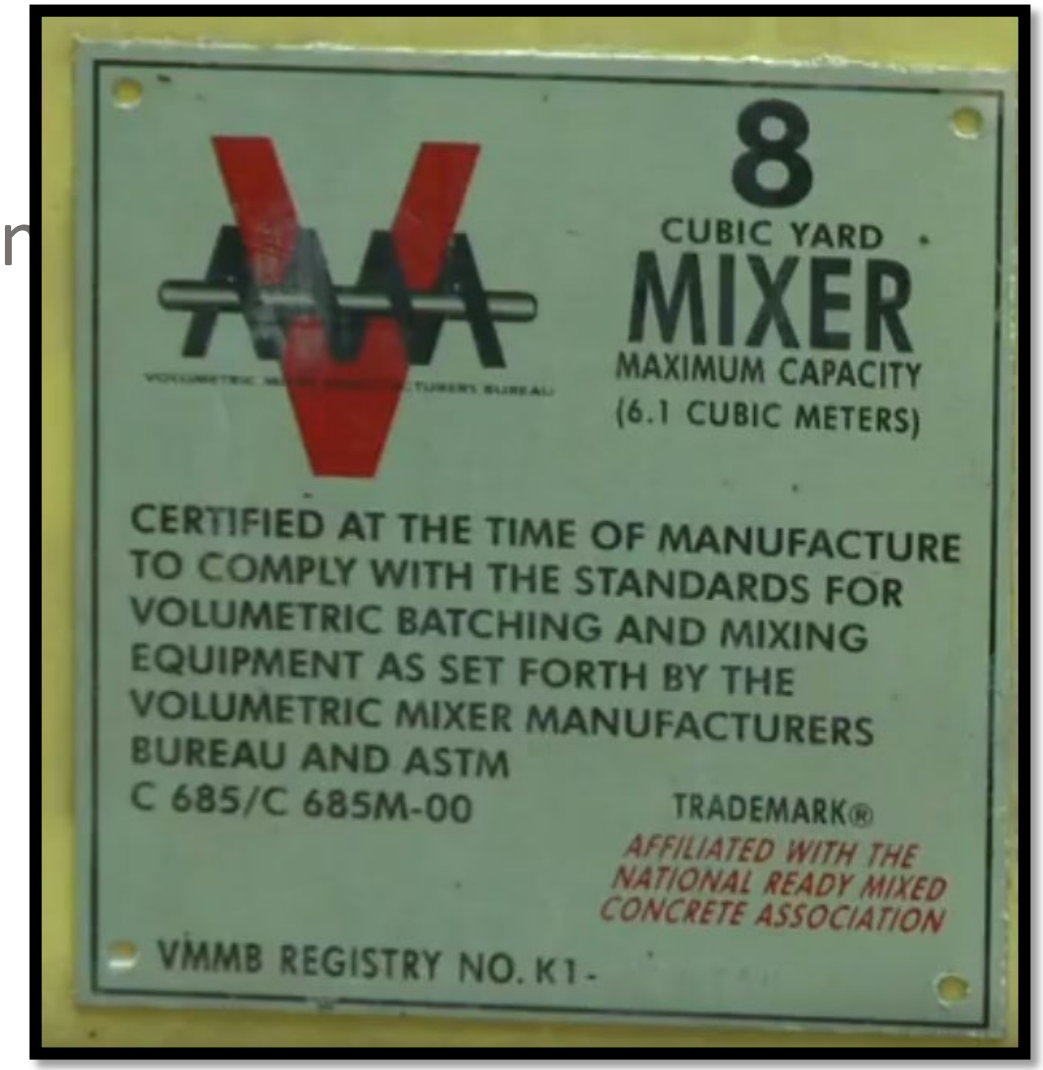
- Electronic controls
  - Simple Operation
  - CAN wiring – simplifying maintenance
  - Technology based infrastructure
- Pre-programmed mix designs
- Automated gate system
- Printable batch ticket with each pour



DOT Approved

DOT Approved

- Arizona
- California – CalTran
- Maryland
- North Carolina
- Illinois
- Iowa
- Louisiana
- Texas



- Florida
- Minnesota
- New Mexico
- Alabama
- Washington
- Oklahoma
- Georgia

Benefits

- Fresh, on-demand concrete
  - Stop and start as needed
- Multiple mix designs from a single load
- Not limited by travel time or distance
- Reduced clean out time, water, materials
- Specialty concrete – latex, fast-setting, etc.

Q&A

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