

# Mobile Mixers: History, Performance & Use

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Collin Robinson  
Product Manager  
[crobinson@cementech.com](mailto:crobinson@cementech.com)

# 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?





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# Project Needs

- 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



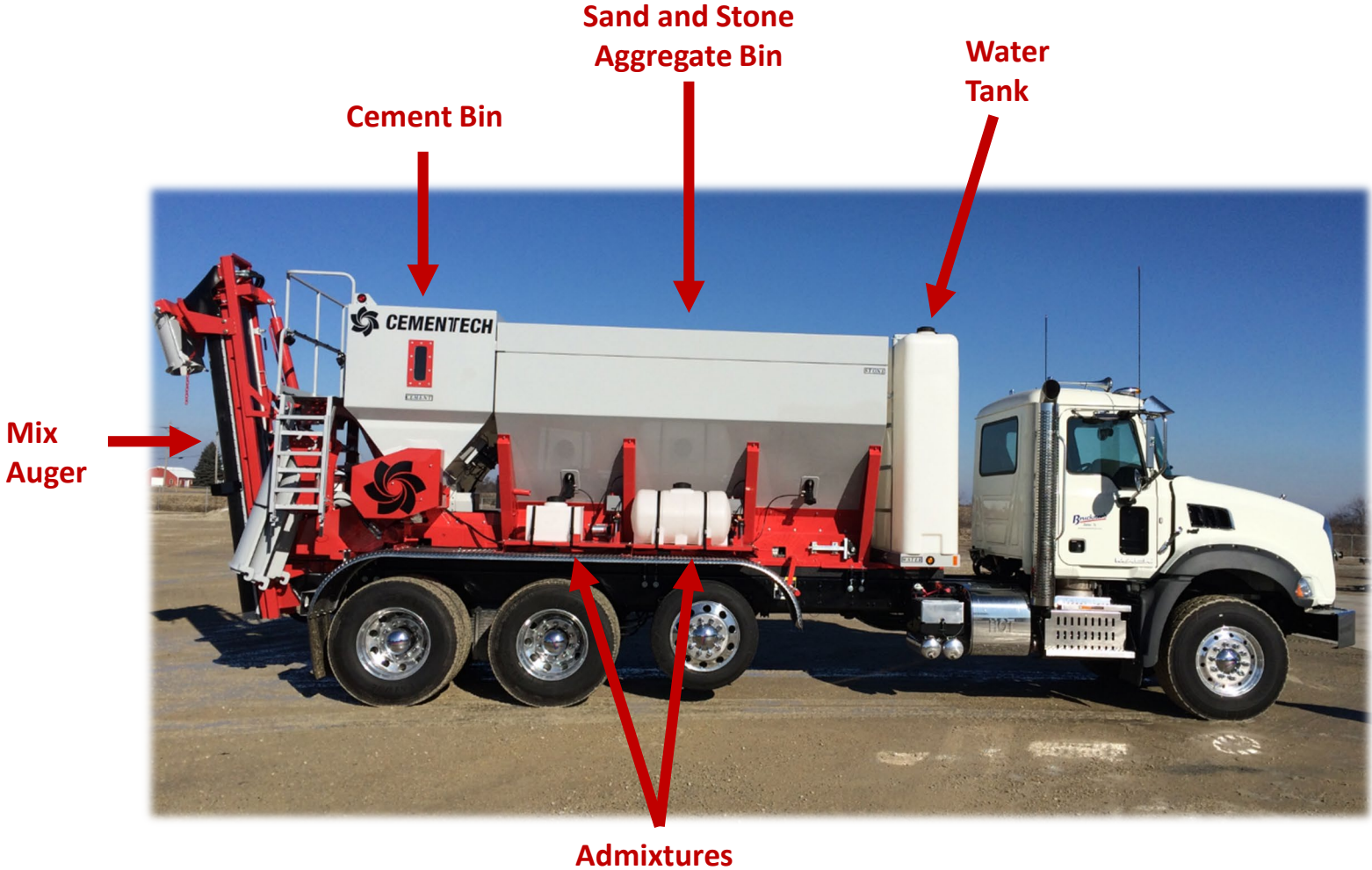
MIX  
JOB  
YOL  
CON  
ROF  
CO  
IDP



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# How it Works

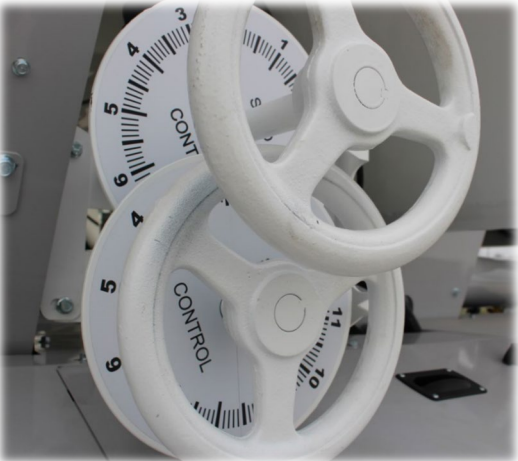




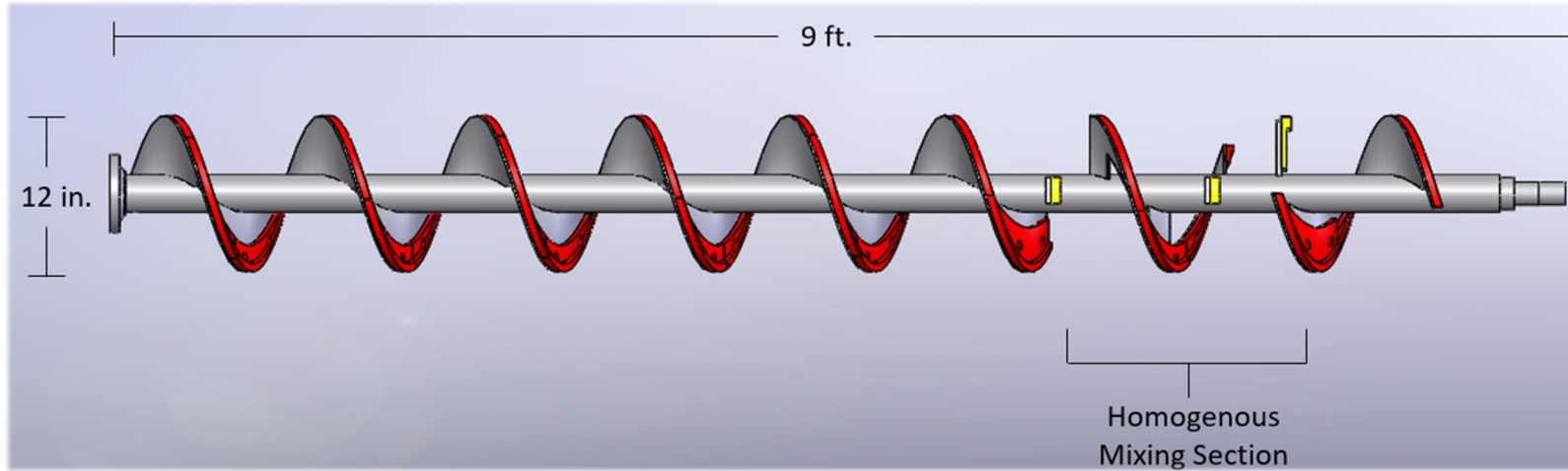
# How it Works



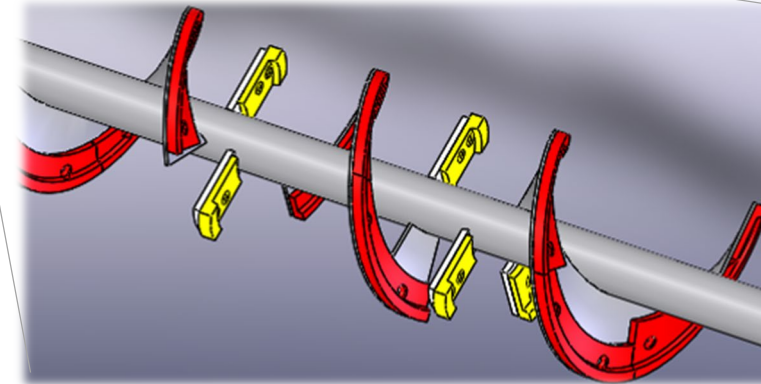
Sand and Stone Gate Dials



# Pump Master Auger



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







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# Weight vs Volume



ASTM C94

VS

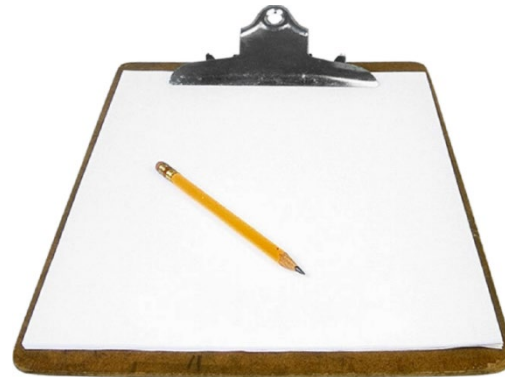


ASTM C685



# 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

- 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

Volumetric Concrete Dispenser Mix Design Worksheet										
OWNER	Southeast Construction			Unit Serial #	5512					
<b>YOUR MIX DESIGN</b> (This sheet must be filled out for each mix design)										
MIX DESIGN	4000 PSI			Date						
(max 8 characters)										
Materials of one cubic yard:										
Cement	564	LBS.	100%	Cement Discharge Speed	86	Counts per Bag of Cement				
(In Percent)										
Cement	6.0	BAGS	1.07	Cubic Yard Discharge Time (Minute)						
Aggregate	Name	Aggregate # Desired	Aggregate Name	Pounds of Aggregate						
(enter 1, 2, 3, or 4)										
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)										
<b>1. Determine the count per cubic yard.</b>										
6.0	bags/cubic yard	x	86	counts per bag	=	518	count per cubic yard.			
<b>2. AGGREGATE 1:</b> 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										
<b>3. AGGREGATE 2:</b> 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	
Aggregate 1	2.75	lbs./ Count		Setting	Oz/Min
Aggregate 2	3.13	lbs./ Count	Admix # 1	ERROR	0.0
*Water	0.00	lbs./ Count	Admix # 2	ERROR	0.0
Aggregate 1 Gate	5.0		Admix # 3	ERROR	0.0
Aggregate 2 Gate	6.5		Color	#DIV/0!	0.0
Water Meter			Fiber Chopper	#DIV/0!	0.0

# 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

MEASURE

**LBS** **KG** PER **MIN**

CALIBRATION FILE NAME  
type\_1\_cement

TRIAL	COUNTS	AMOUNT	ACCEPT
TRIAL #1	106	91.00	✓
TRIAL #2	102	85.00	✓
TRIAL #3	104	88.20	✓
TRIAL #4	108	87.00	✓
TRIAL #5	107	87.50	✓

AVERAGE **0.832448** WT/CNT

CONVEYOR SPEED 0 RPM TRIAL RATE **50** RPM

USE SYSTEM START BUTTON TO BEGIN TRIAL

PRINT SAVE SAVE AS

MEASURE

**LBS** **KG** PER **MIN**

CALIBRATION FILE NAME  
cti\_sand\_1

LOW GATE **3.0** ACTUAL **0.0**

TRIAL	COUNTS	AMOUNT	ACCEPT
TRIAL #1	4275	146.00	✓
TRIAL #2	4258	157.50	✓
TRIAL #3	4251	150.50	✓
TRIAL #4	4089	146.50	✓
TRIAL #5	4706	167.00	✓

LOW GATE AVERAGE **0.035567** WT/CNT

CONVEYOR SPEED 0 RPM TRIAL RATE **50** RPM

CURRENT SAND MOISTURE % **0.0** USE SYSTEM START BUTTON TO BEGIN TRIAL

PRINT SAVE SAVE AS NEXT



# 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

REQUIRED TO MAKE ONE YARD OF CONCRETE

4000psi

CEMENT		
CAL FILE: type_1_cement		
SELECT NEW CEMENT CALIBRATION FILE	ENTER AMOUNT 564.00 LBS	CALC RATE 9.48 LBS PER SEC
SAND		
CAL FILE: cti_sand_1		
SELECT NEW SAND CALIBRATION FILE	ENTER AMOUNT 1450.00 LBS	CALCULATED GATE SETTING 5.2
STONE		
CAL FILE: test_stone		
SELECT NEW STONE CALIBRATION FILE	ENTER AMOUNT 1625.00 LBS	CALCULATED GATE SETTING NaN

MIXER SPEED	CONVEYOR SPEED	
270 RPM	50 RPM	
CONV CNTS 23037	CEMENT HIGH SPEED	
WTR/CEM 20.7 %		CEMENT LOW SPEED
SEC/AMT 59.5		
WATER		
CAL FILE: WATERACTUAL		
SELECT NEW WATER CALIBRATION FILE	ENTER AMOUNT 14.00 GAL	CALC RATE 14.13 GAL PER MIN

PRINT    SAVE    SAVE AS    NEXT

# Barrel vs Mobile Mixers



MYTHBUSTERS

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



- 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



- 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



# 3<sup>RD</sup> Party Test Results

## Concrete Comparative Testing – VMMB – 12/5/13

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

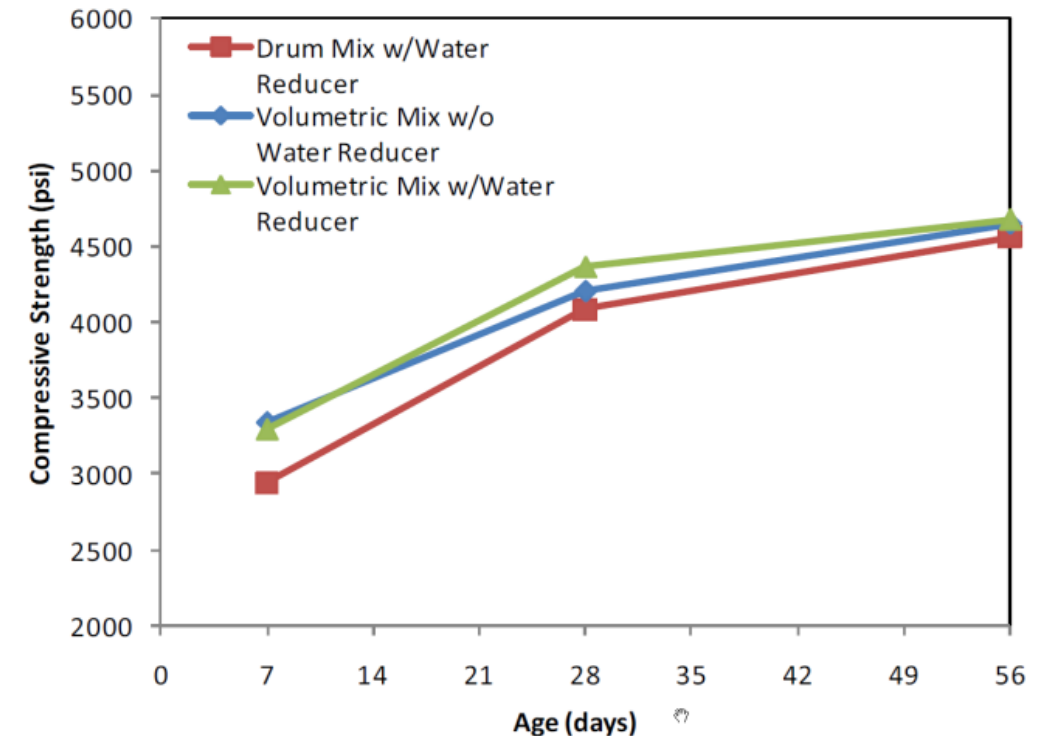
Age	Mixing/Production Method			
	Drum Mixed	Volumetric w/o WR	Mixed	Volumetric Mixed w/ WR <sup>1</sup>
7 Day	2943	3338		3296
28 Day	4085**	4201**		4365
56 Day	4563	4647		4679

<sup>1</sup> 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

# Terracon



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



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



- 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

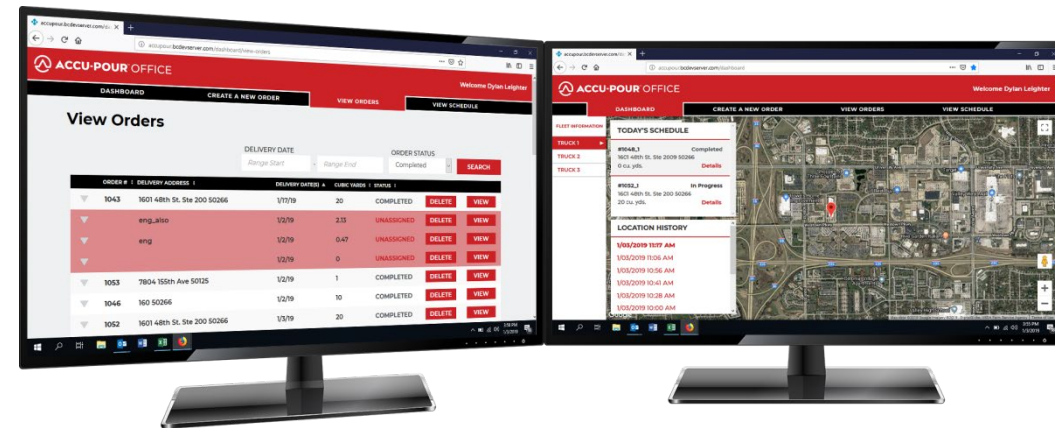
## Myth #5: Volumetric mixers are too complex to operate and have too long a learning curve



- 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

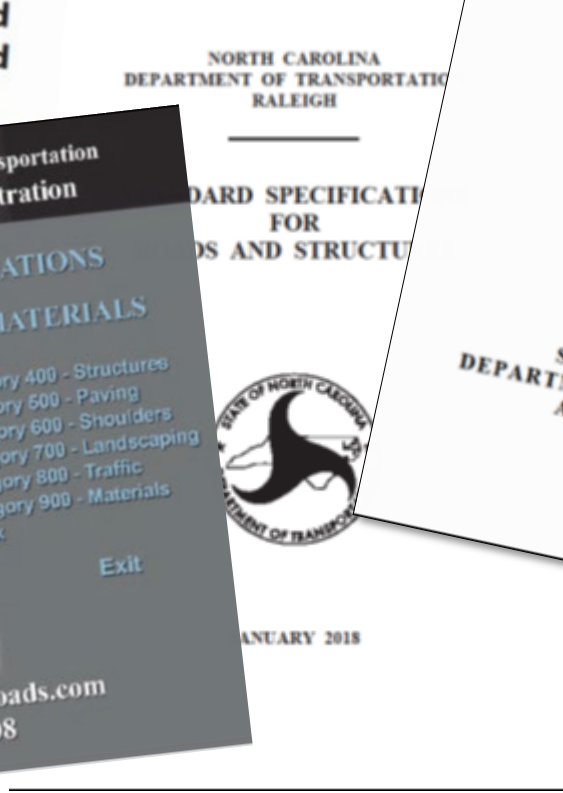
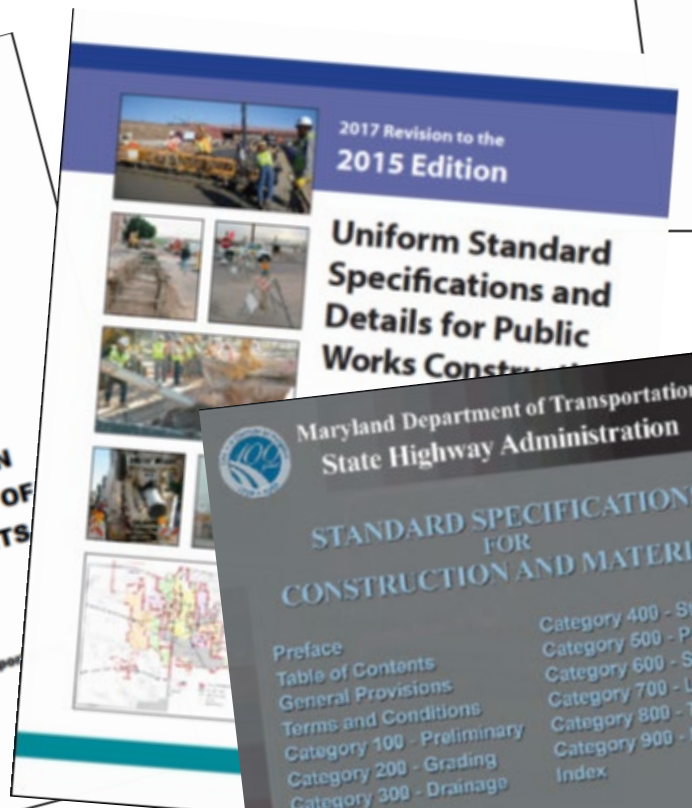


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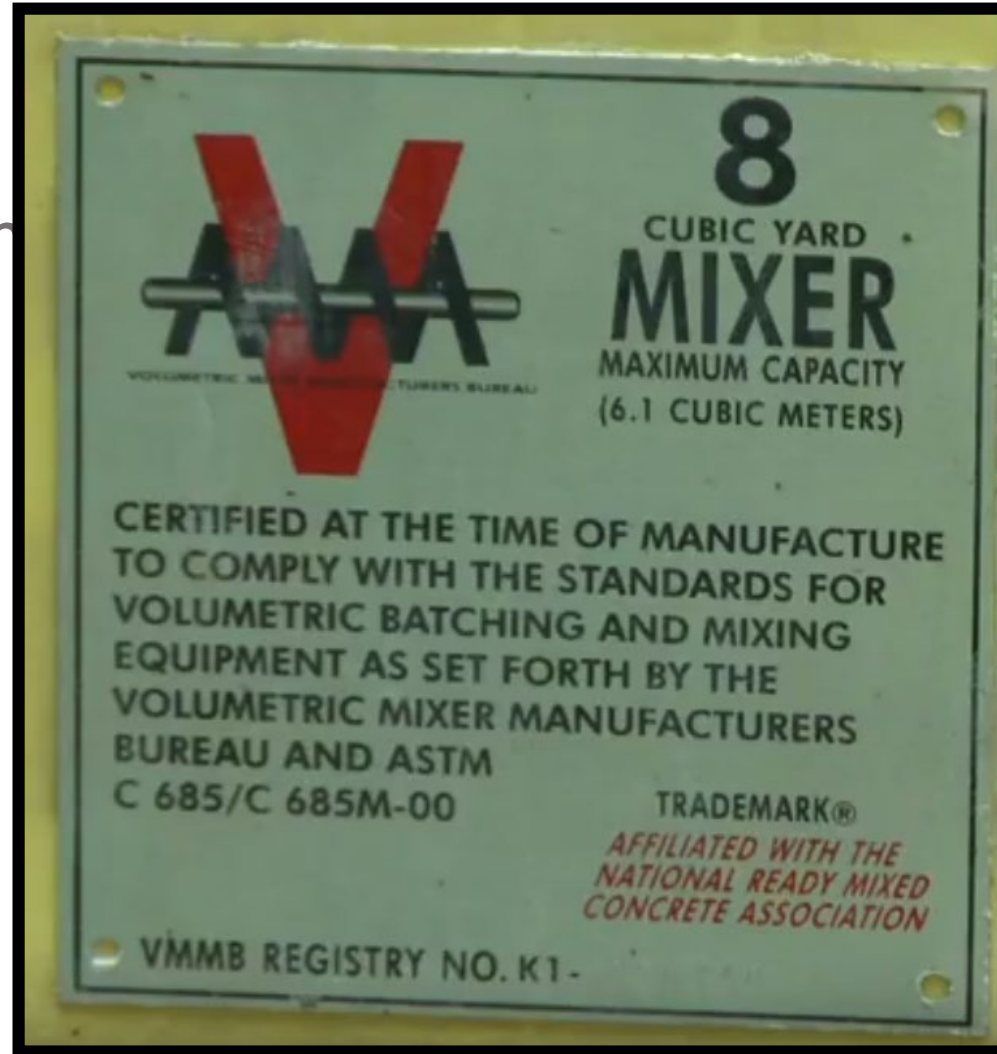


# DOT Approved



# DOT Approved

- Arizona
- California – CalTrans
- 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.





# Municipal Involvement



Cemen Tech has an awarded contract for “Roadway Maintenance Equipment with Related Accessories, Attachments, Materials, & Supplies” through solicitation #052417. Sourcewell contracts are solicited across North America and competitively awarded on behalf of Sourcewell current and potential government and education member agencies.

# Q&A



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