

# 2023 Construction Academy

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## Concrete and Structural Materials

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This conference has been prepared for you, construction project engineers, to facilitate better understanding of your role when dealing with ***concrete and structural materials*** in your projects.

If you want to know the specifics of each material beyond the scope of this presentation, please contact the presenters.



# Scope of the Presentation

## Concrete Fundamentals (1)



## Precast / Prestressed Concrete (2)



## Structural Materials (3)





# Part 1

## Concrete Fundamentals



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**Concrete Raw Materials**

**Concrete Classification**

**Concrete System Components**

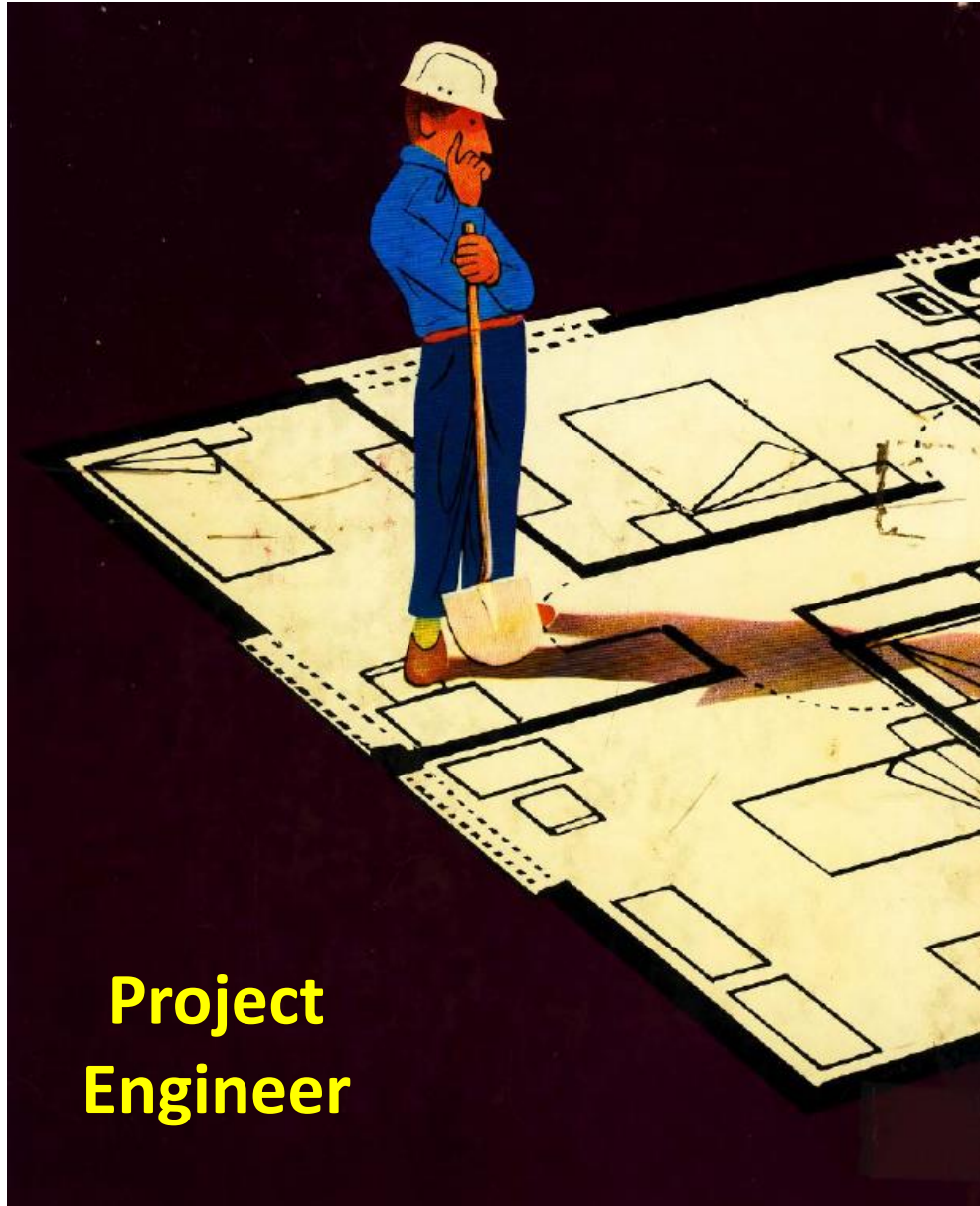
**Sampling and Testing**

**Special Types of Concrete**

**Concrete Acceptance based on Compressive Strength**

**Low Compressive Strength**

**Concrete Personnel Qualification Requirements**

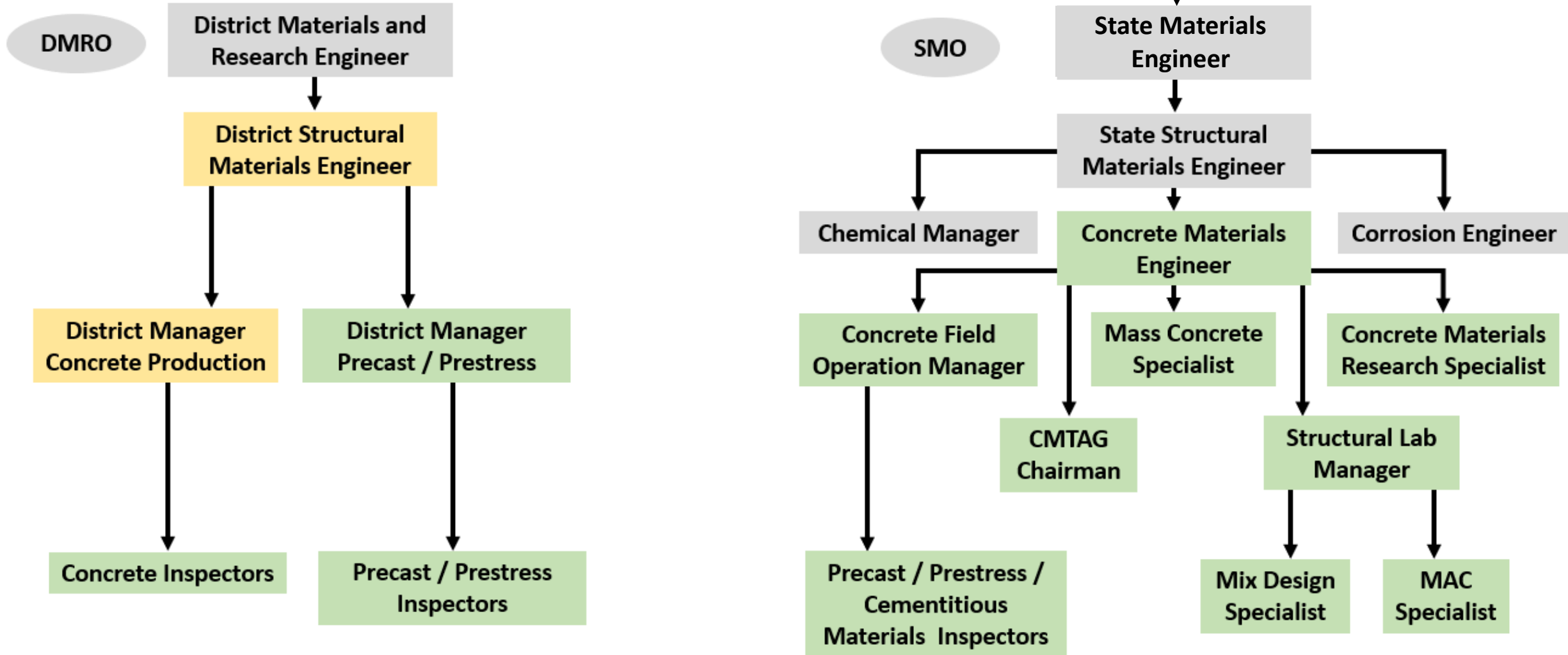


**Project  
Engineer**

**Who do I call if I have  
questions related to  
concrete or structural  
materials?**

**★CHAIN OF★  
COMMAND**  
★★★

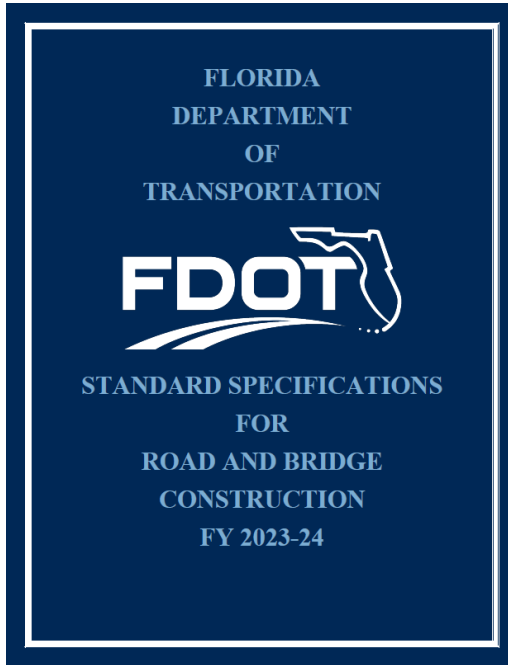
# FDOT Concrete Materials Structure



Contact your DMRO **first** and they may contact the SMO if needed.



# Concrete – Essential Documents



## Standard Specification (SS)

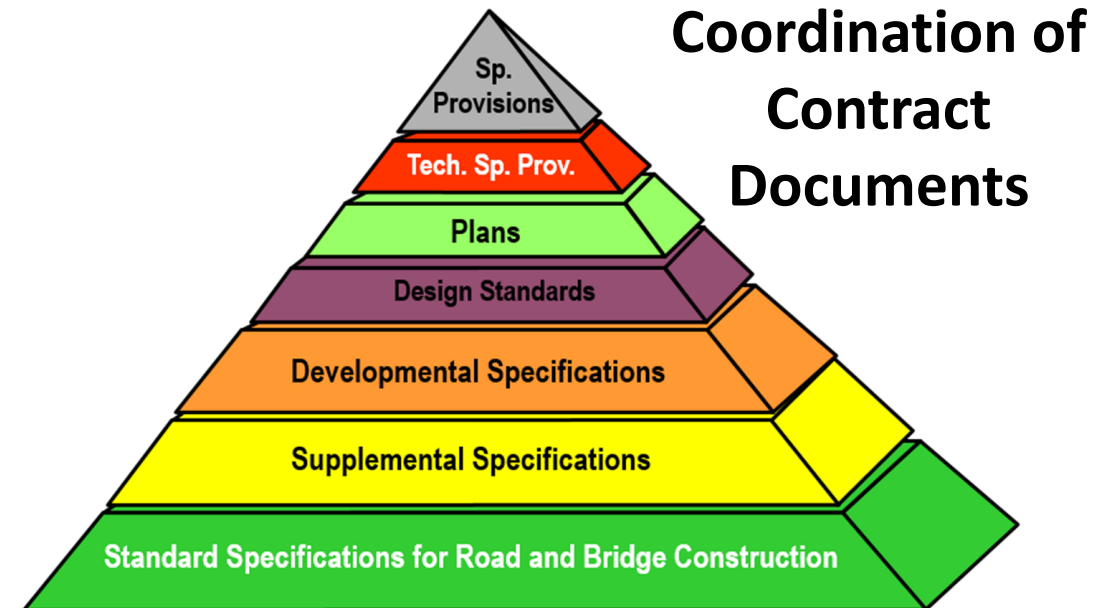
[https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/programmanagement/implemented/specbooks/fy-2023-24/fy2023-24ebook.pdf?sfvrsn=6b69416d\\_6](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/programmanagement/implemented/specbooks/fy-2023-24/fy2023-24ebook.pdf?sfvrsn=6b69416d_6)

## Materials Manual 8.4, 8.6, 9.2 and 9.3 (Vol I & II) (MM)

<https://www.fdot.gov/materials/administration/resources/library/publications/materialsmanual/default.shtm>

## CPAM (Chapter 10 Structures)

[Construction Project Administration Manual \(fdot.gov\)](https://www.fdot.gov/constructionprojectadministrationmanual/)



# Concrete Raw Materials


**Cementitious Materials**  
(SS 921 & 929)

**Portland Cement**  
(SS 921)

**Supplementary Cementitious Materials (SCMs)**  
(SS 929)

(1) Fly Ash (coal-fired power stations) 

(2) Slag (iron manufacturing process)

(3) Highly Reactive Pozzolans 

Silica Fume (Ferrosilicon Industry)

Metakaolin

Ultra Fine Fly Ash

(4) Other: Calcined Clay, Ground Glass, etc.

**Coarse Aggregate** (SS 901)

**Fine Aggregate** (SS 902)

**Chemical Admixtures** (SS 924)

**Water** (SS 923)



**Binary Mix = Portland Cement + 1 SCM**

**Ternary Mix = Portland Cement + 2 SCMs**

**Use of Supplementary Cementitious Materials (SCMs) is mandatory. Few exceptions apply (SS 346-2.3)**

$$\frac{\text{Water}}{\text{Cem}} \text{ Ratio} = \frac{\text{Total Water (lb)}}{\text{Total Cementitious Materials (lb)}}$$

# Concrete Classification according to FDOT Specifications

Conventional Concrete  
(SS 346 - 350)



Target Slump

3 in (general)

1.5 in (slip-formed pavement)

Tolerance  
 $\pm 1.5$  in

Increased Slump Concrete  
(SS 346)



Target Slump

7 in (maximum)

Tolerance  
 $\pm 1.5$  in

Flowing Concrete  
(MM 8.6)



Target Slump

9 in (general)

Tolerance  
 $\pm 1.5$  in

Self-Consolidating Concrete  
(MM 8.4)



Target Spread

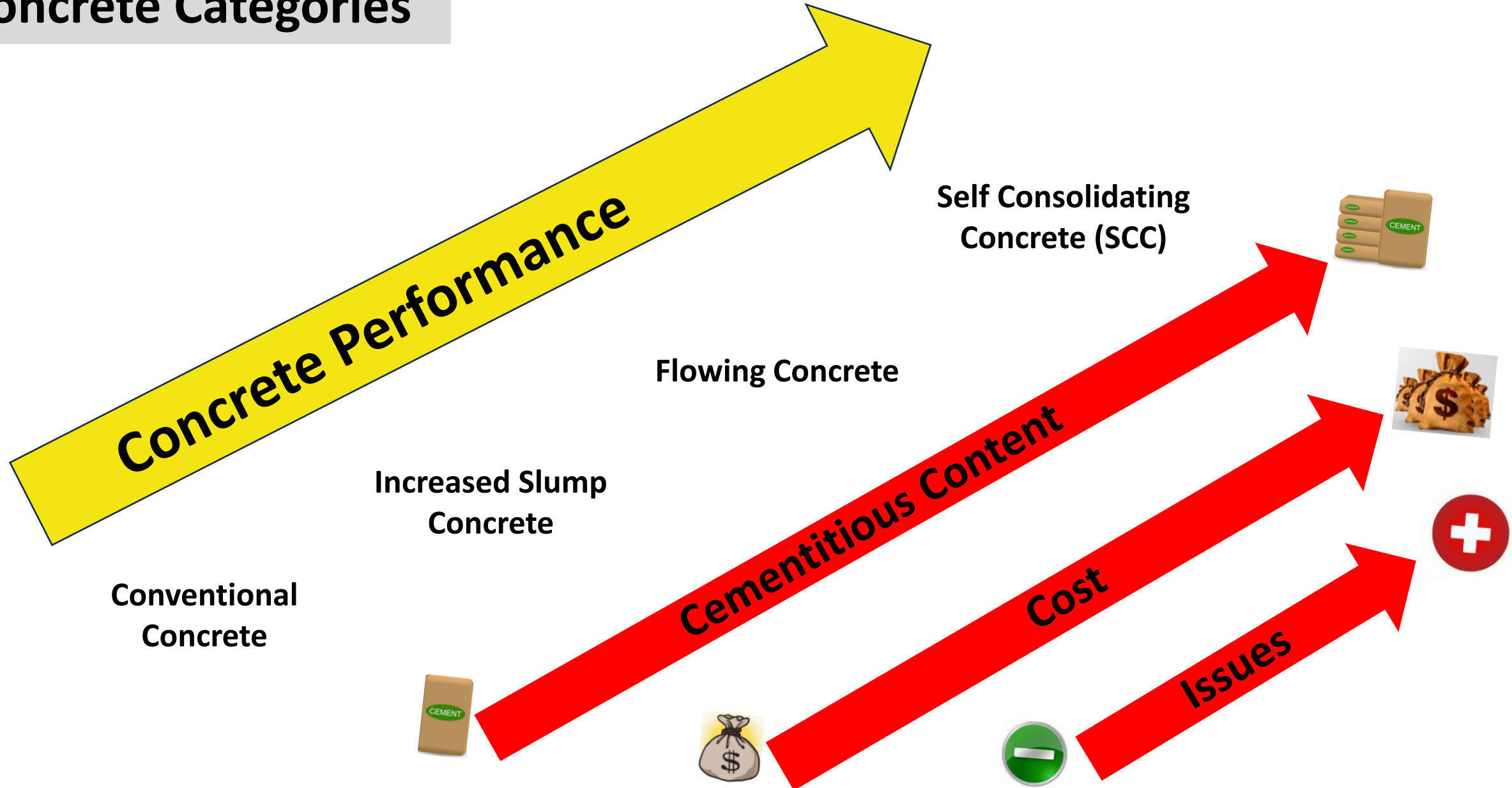
27.0 in (general)

22.5 in (Jan-2022)

Tolerance  
 $\pm 2.5$  in



# Concrete Categories



# Conventional Concrete Class I (Pavement)

$f'_c = 3,000$  psi (SS 350 – MM 9.3)



## Excessive Slump Issues

(Target 1.5 in  $\pm$  1.5 tolerance [0.0 in to 3.0 in])



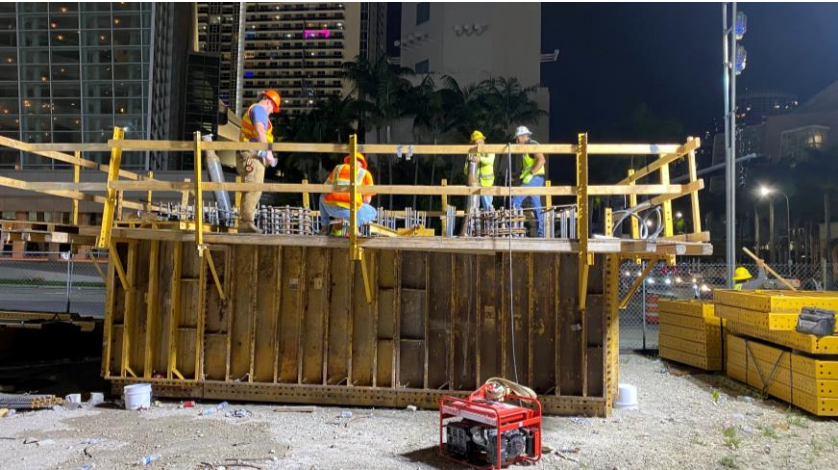
# Ex. Use of Flowing and SCC Concrete

## I-395 Signature Bridge in Miami (District 6)





# Flowing Concrete (MM 8.6), SCC (MM 8.4) require a Mock-Up Production and Evaluation





# Concrete System

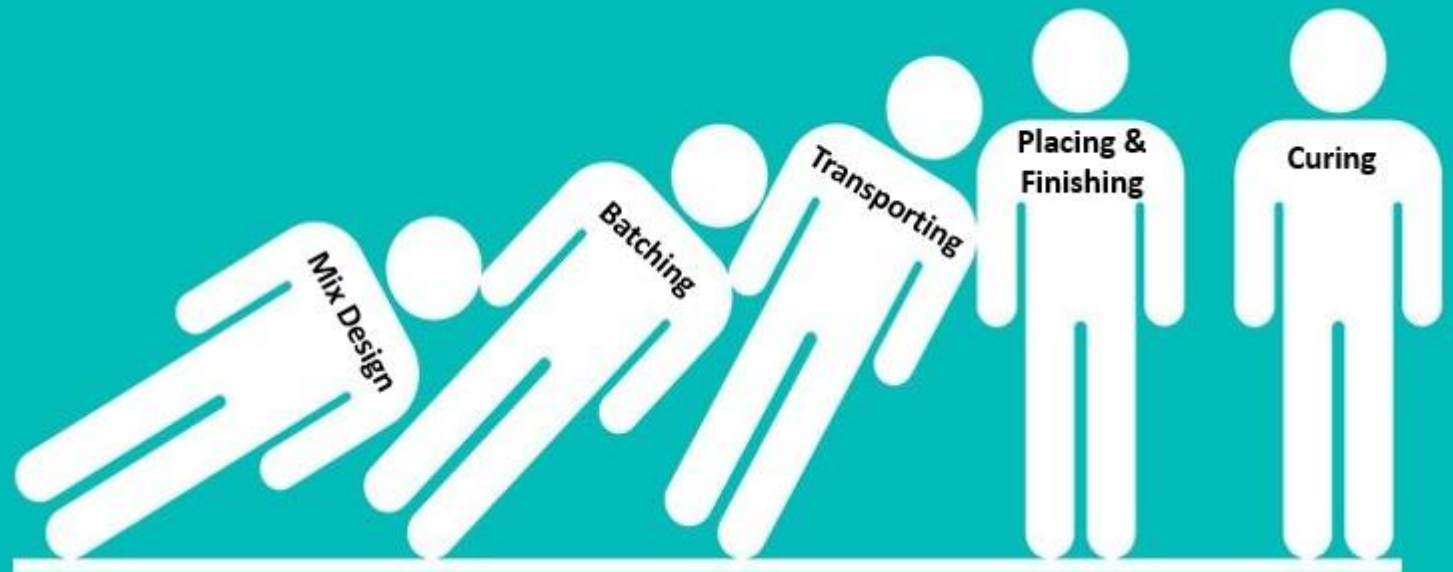
Mix Design (Proportioning)

Batching

Transporting

Placing & Finishing

Curing



# Sources of variability in concrete



SS 901, 902, 921,  
923, 924 & 929



SS 346, 350, 400, 450, MM 8.4, 8.6, 9.2 & 9.3



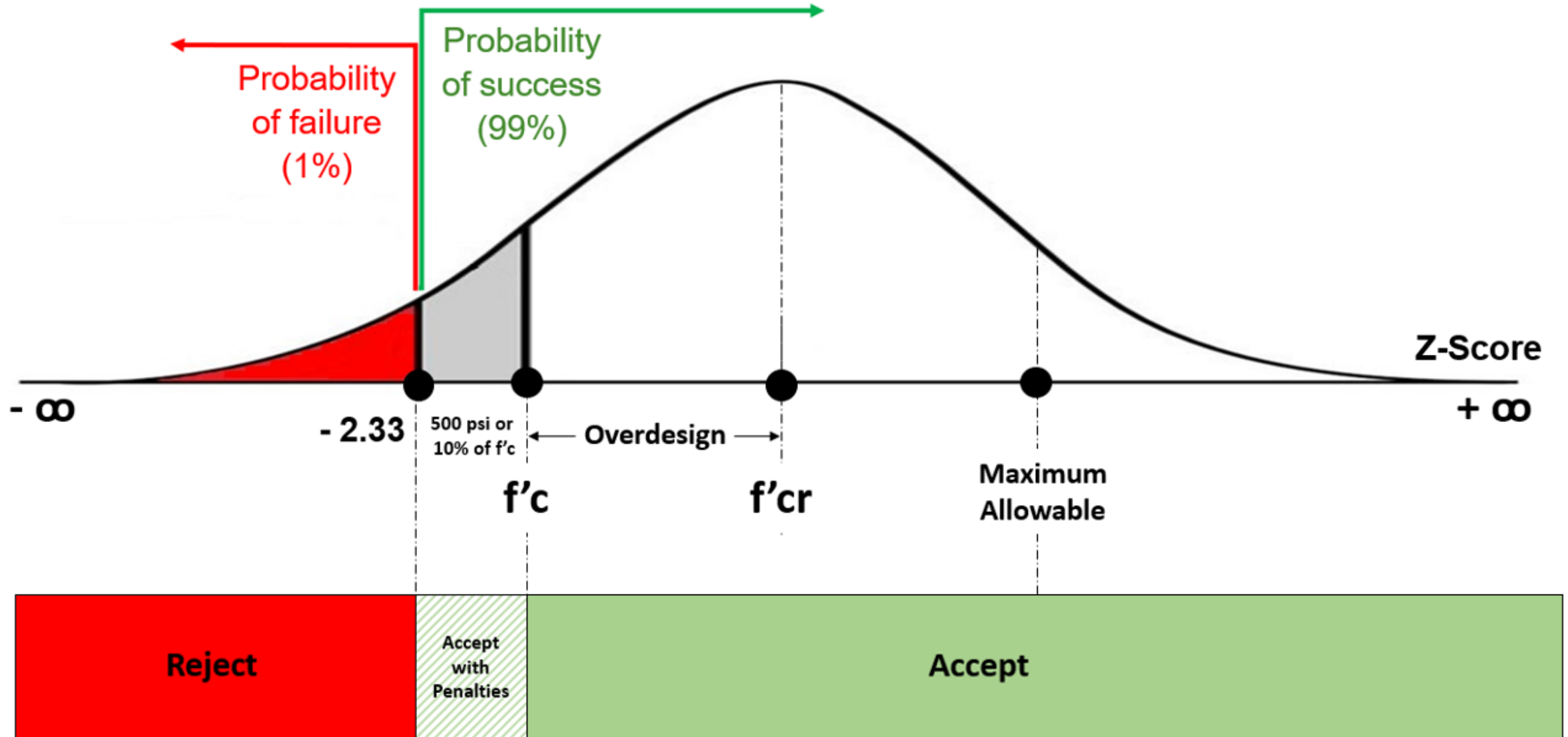
We overdesign the concrete **MM 9.2**  
 $f'_{cr} = f'_c + \text{Overdesign}$

TABLE 1 – Overdesign requirements for establishing  $f'_{cr}$  when data is not available at 28-day or 56-day whichever is applicable

Class of Concrete	$f'_c$ (psi)	Overdesign (psi)	$f'_{cr}$ (psi)	Maximum Allowable Compressive Strength (psi)
I Seal	3,000	1,200	4,200	5,200
I Pavement	3,000	1,200	4,200	5,200
II	3,400	1,200	4,600	5,700
II Bridge Deck	4,500	1,200	5,700	6,750
III	5,000	1,200	6,200	6,750
IV	5,500	1,250	6,750	7,850
IV Drilled Shaft	4,000	1,200	5,200	6,200
V	6,500	1,350	7,850	10,050
VI	8,500	1,550	10,050	11,700
VII	10,000	1,700	11,700	13,000



# Basis of Concrete Mix Design $\Rightarrow$ SS 346 & MM 9.2





## Mix Design (Proportioning)



A Concrete Mix Design is unique and proprietary (MAC – ID).

Concrete supplier proposes a mix design for approval.  
***DMRO reviews*** the mix. ***SMO approves*** the mix.

Each mix design approved meets the specified compressive strength plus an overdesign for the specified class of concrete **(MM 9.2)**

Raw materials substitutions may be considered (at the discretion of the SMO) to prevent concrete placement delays on ongoing construction projects **(MM 9.2)**

The Engineer may allow the substitution of a higher-class concrete in lieu of the specified class concrete. Acceptance is based on the requirements in Table 346-3 for the specified class concrete. **(SS 346-3.2)**



# Batching

Concrete Batch Plants follow the mixer manufacturer's design or recommendations.



Wet Mixers: Batch Plants equipped with a central mixer.



Dry Mixers: Batch Plants without a central mixer.

Plants weigh the materials, and ready-mix trucks are utilized to mix and transport the concrete.







# Movable Mixers: Proportion, mix and deliver the concrete.



## Developmental Specification 346 (Volumetric Mixers)

<https://www.fdot.gov/programmanagement/otherfdotlinks/developmental/default.shtm>

### **Volumetric Mixers**

*Allows the use of volumetric mixers with Structural Concrete Class I and II only.*

Materials Manual component	<a href="#">DevMM9.2VM</a>
Contractor Quality Control General Requirements component	<a href="#">Dev105VM</a>
Structural Portland Cement Concrete component	<a href="#">Dev346VM</a>

**Note: Must be used together**



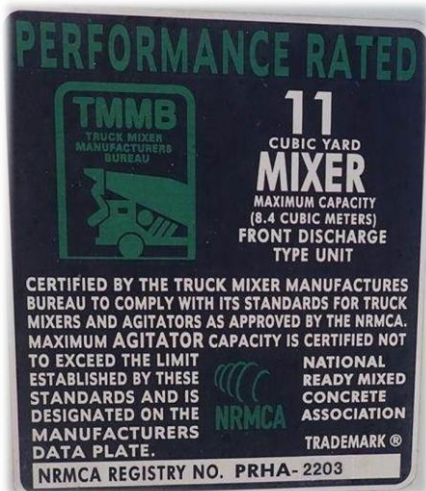


## Batch Plant Requirements are detailed in the Plant QC Plan.

Ensure that each truck has a rating plate and a valid mixer identification card issued by the Department.

Ensure that the revolution counter on the mixer is working properly, and calibration of the water dispenser has been performed within the last twelve months. **(SS 346-8 & MM 9.2)**

Operate all concrete mixers at speeds and volumes per the manufacturer's design or recommendation as stipulated on the mixer rating plate. **(SS 346-7.1)**



**DMRO performs  
quarterly Batch  
Plant inspections**



# Transporting (SS 346, 400, MM 9.2)

**346-7.2.1 Transit Time:** Ensure compliance with Table 346-8 between the initial introduction of water into the mix and completely discharging all the concrete from the truck. Reject concrete exceeding the maximum transit time. The Engineer may approve an extension of the transit time which will be identified on the approved mix design.

Table 346-8	
Maximum Allowable Transit Time	
Non-Agitator Trucks	Agitator Trucks
45 minutes	60 minutes
75 minutes <sup>(1)</sup>	90 minutes <sup>(1)</sup>

Note:  
(1) When a water-reducing and retarding admixture (Type D, Type G, or Type II) is used.

**346-7.2.2 Placement Time:** All the concrete in a load must be in its final placement position a maximum of 15 minutes after the transit time has expired unless a time extension is approved by the Engineer.

For Class IV (Drilled Shaft) mixes, placement time may be extended provided the slump loss time of the first concrete placed is not exceeded throughout the elapsed time.

Fresh concrete loses its workability with time. This phenomenon is called “slump loss”.



## Placing and Finishing (SS 400)



When concrete arrives to the job site and before placing it, check the delivery ticket information. **(MM 9.2)**

- The Contractor is responsible for ensuring that the truck has an FDOT issued mixer identification card.
- If the mixer card is not present, the Contractor must reject the load.

Reject concrete exceeding 100°F at the time of placement. **(SS 346-7.5)**

Do not mix or place concrete when the air temperature is below 40°F. **(SS 346-7.5)**

Protect the fresh concrete from freezing in accordance with Section 400.

Where conveyor belts, pumps, or chutes are used to transport concrete directly to the point of final placement, samples will be obtained at the point of discharge.

Avoid segregation of concrete during placement. **(SS 400-7.5)**



## Placing and Finishing

## Concrete Segregation (SS 400-7.5)

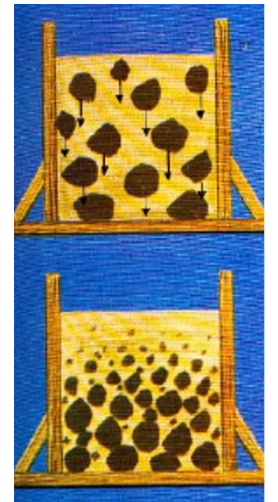
Segregation is the tendency for the coarse aggregate to separate from the mortar and is a measure of how cohesive the concrete mix is. Segregation can lead to non-uniform zones in the concrete, such as rock pockets or honeycombs.

Use a method and manner of placing concrete that avoids the possibility of segregation or separation of aggregates.

### Concrete Segregation - Causes



- Excessively wet mix.
- Over vibration.
- Excessive drop in placing (+5 ft).
- Gap graded aggregate.
- Low mix viscosity.







(SS 400-16)



Early covering with mats, kept water-soaked, protect concrete while it cures in hot weather (SS 400-16.2)



Curing compound application on Concrete Class I (Pavement) (SS 400-16.2)



# Sampling and Testing

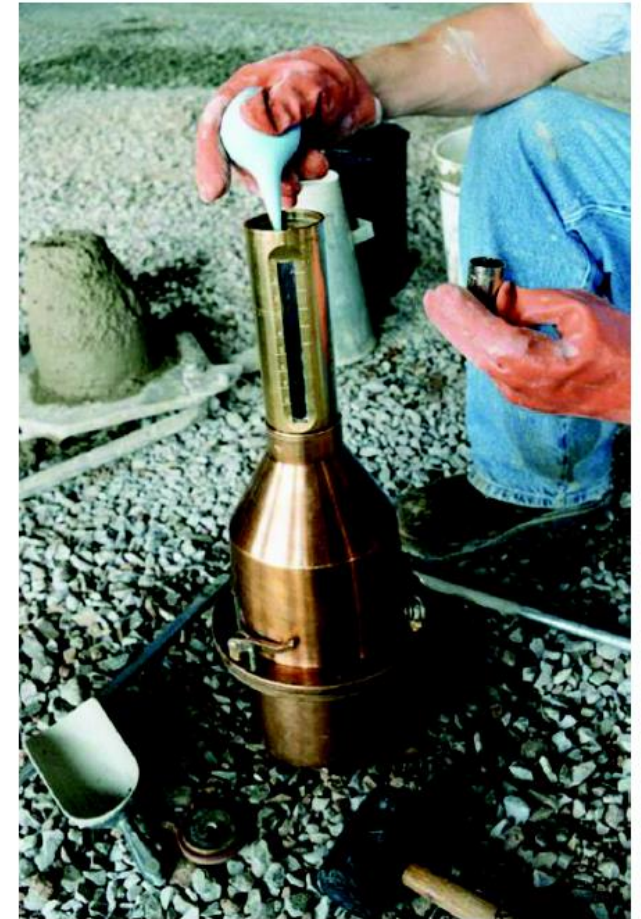
## Plastic Properties



**Slump**



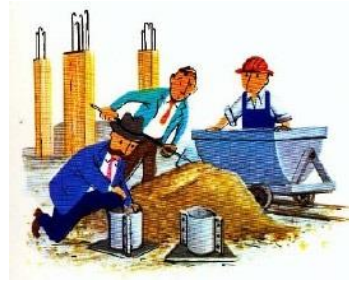
**Air Content  
(Pressure Meter)**



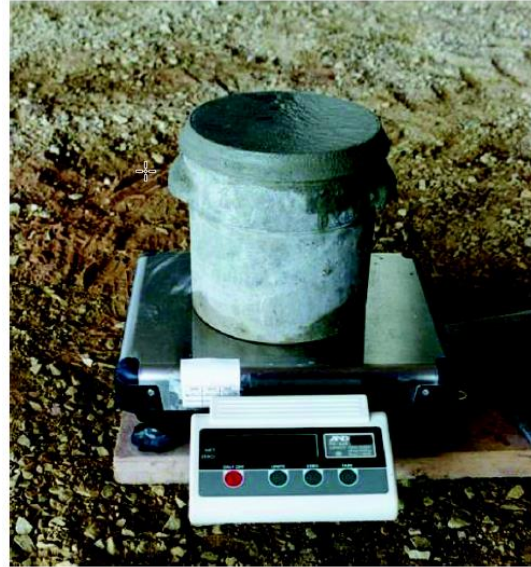
**Air Content  
(Roller Meter)**



# Plastic Properties



**Temperature**



**Unit Weight  
(Density)**



**Casting Cylinders**



# Do we reject concrete with slump out of the tolerance? (Y / N)

**YES, we do.**

There are opportunities to correct a low slump.

**346-6.4 Plastic Property Tolerances:** Reject concrete with slump or air content that does not fall within the specified tolerances, except as noted below, and immediately notify the concrete production facility that an adjustment of the concrete mixture is required. If a load does not fall within the tolerances, test each subsequent load and the first adjusted load. If failing concrete is not rejected or adjustments are not implemented, the Engineer may reject the concrete and terminate further production until the corrections are implemented.

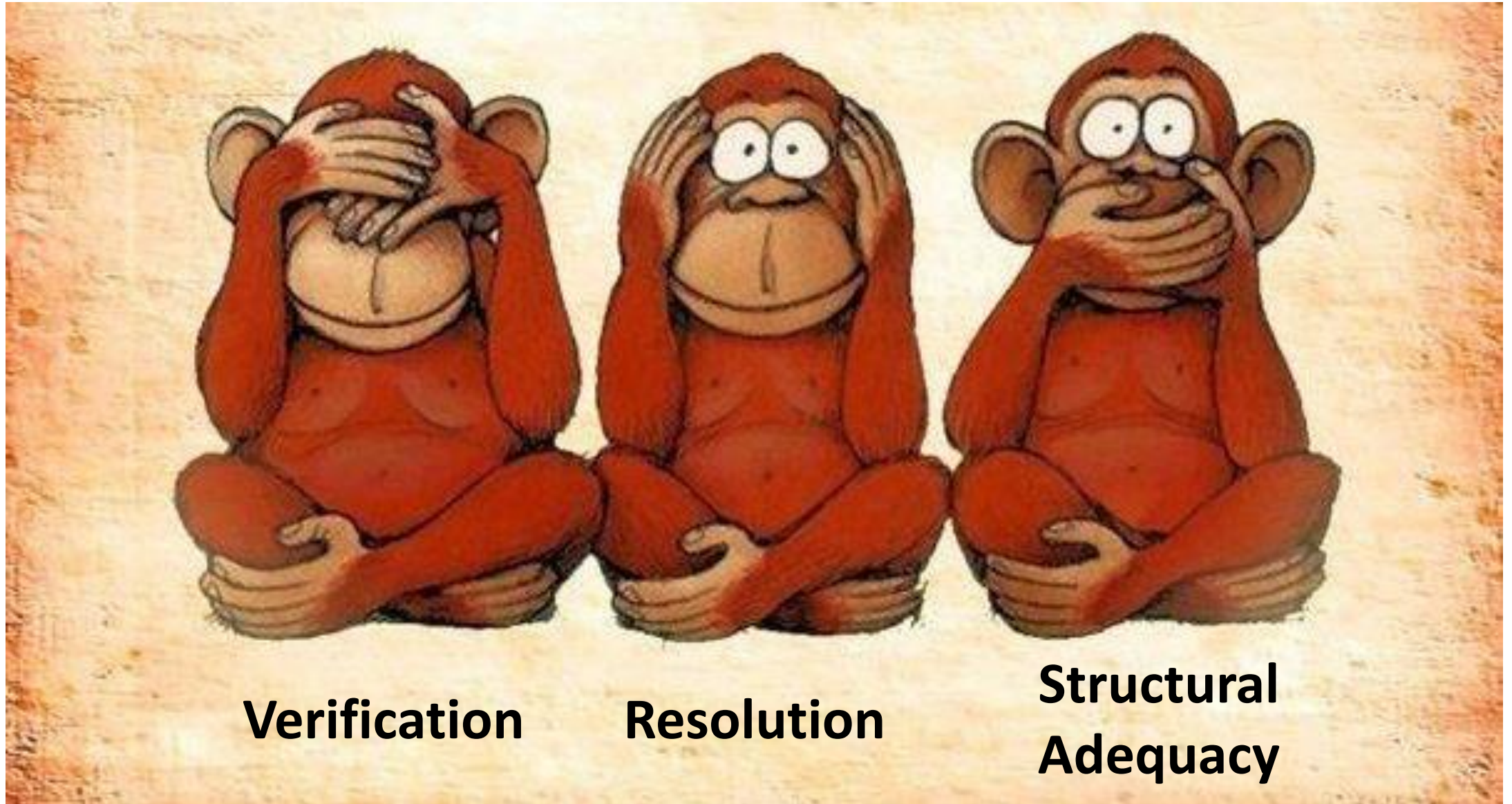
At the Contractor's risk, water may be added at the placement site immediately after completion of the initial slump test, either to correct a low slump or to increase the concrete workability, provided the addition of water does not exceed the water to cementitious materials ratio as defined by the mix design.

After adding water, perform an additional slump test to confirm the concrete is within the slump tolerance range. If the slump is outside the tolerance range, reject the load. If an adjustment is made at the concrete production facility, perform a slump test on the next load to ensure the concrete is within the slump tolerance range. Do not place concrete represented by slump test results outside of the tolerance range. Include water missing from the water storage tanks upon arrival at the project site in the jobsite water added.

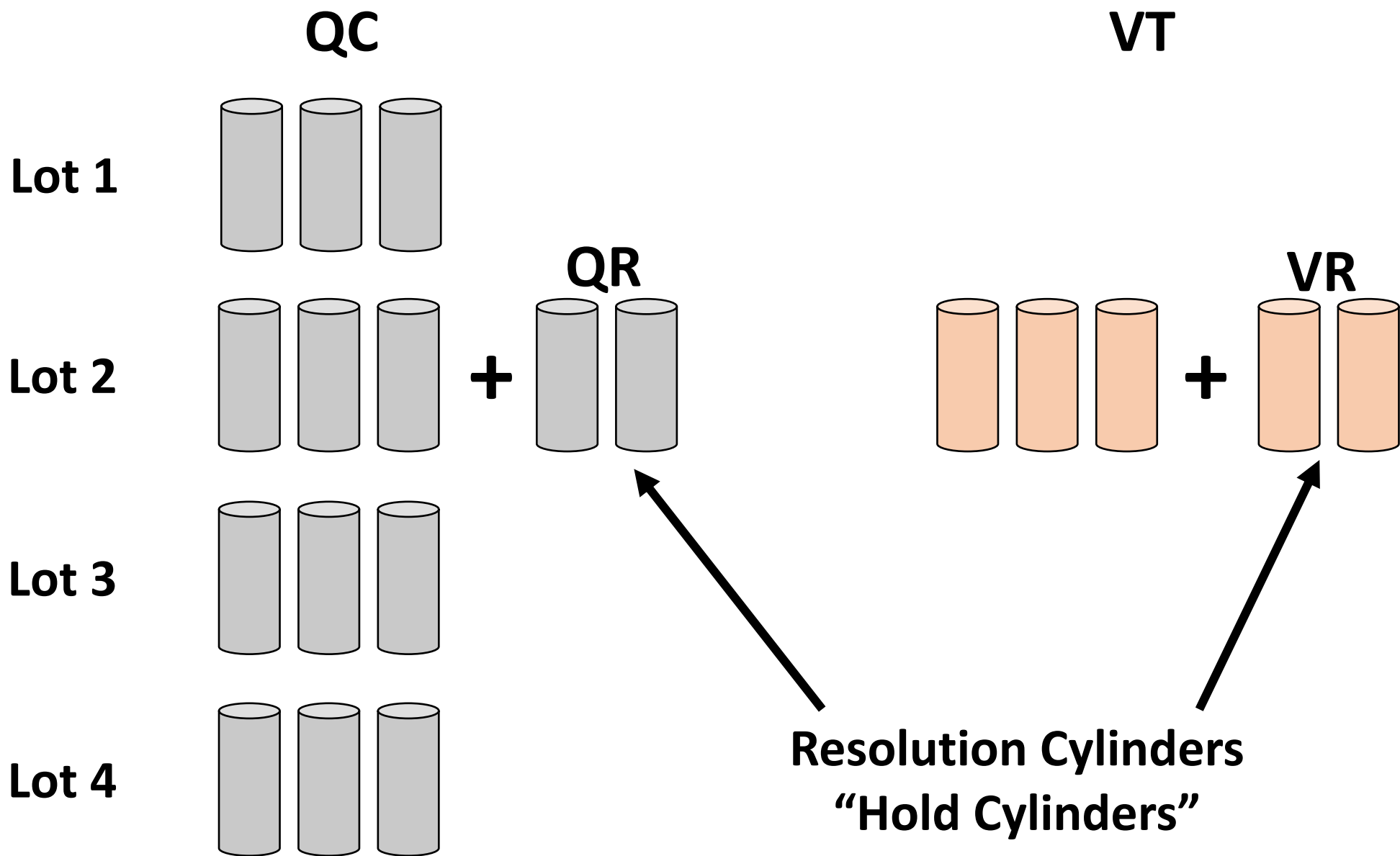
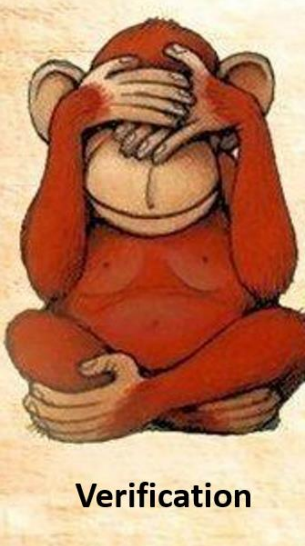
Do not allow concrete to remain in a transporting vehicle to reduce slump.

There is an exception for Self-Consolidating Concrete (SCC) based on additional plastic property tests (Precast/Prestressed). **(MM 8.4)**

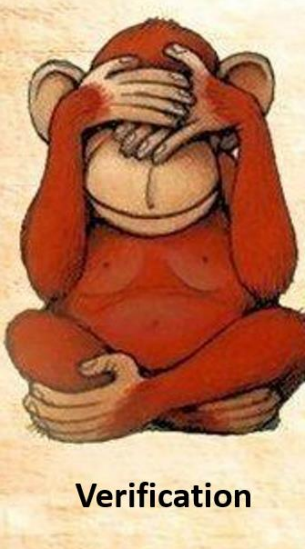
# Concrete Acceptance based on Compressive Strength at 28 days



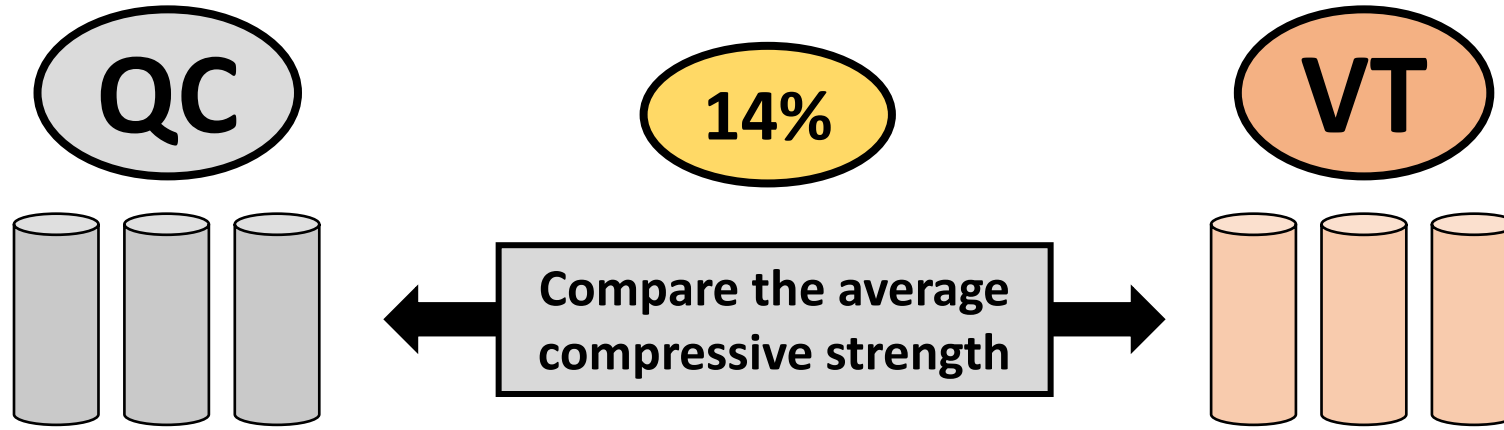
Verification of compressive strength by comparing **QC** and **VT** results.







Verification



$$\text{Difference (\%)} = \text{ABS} \left( \frac{\text{QC} - \text{VT}}{\text{QC}} \right) 100$$

**IF Difference (%) ≤ 14%**

**QC test results are verified**, the Engineer will accept the concrete based on QC test results.

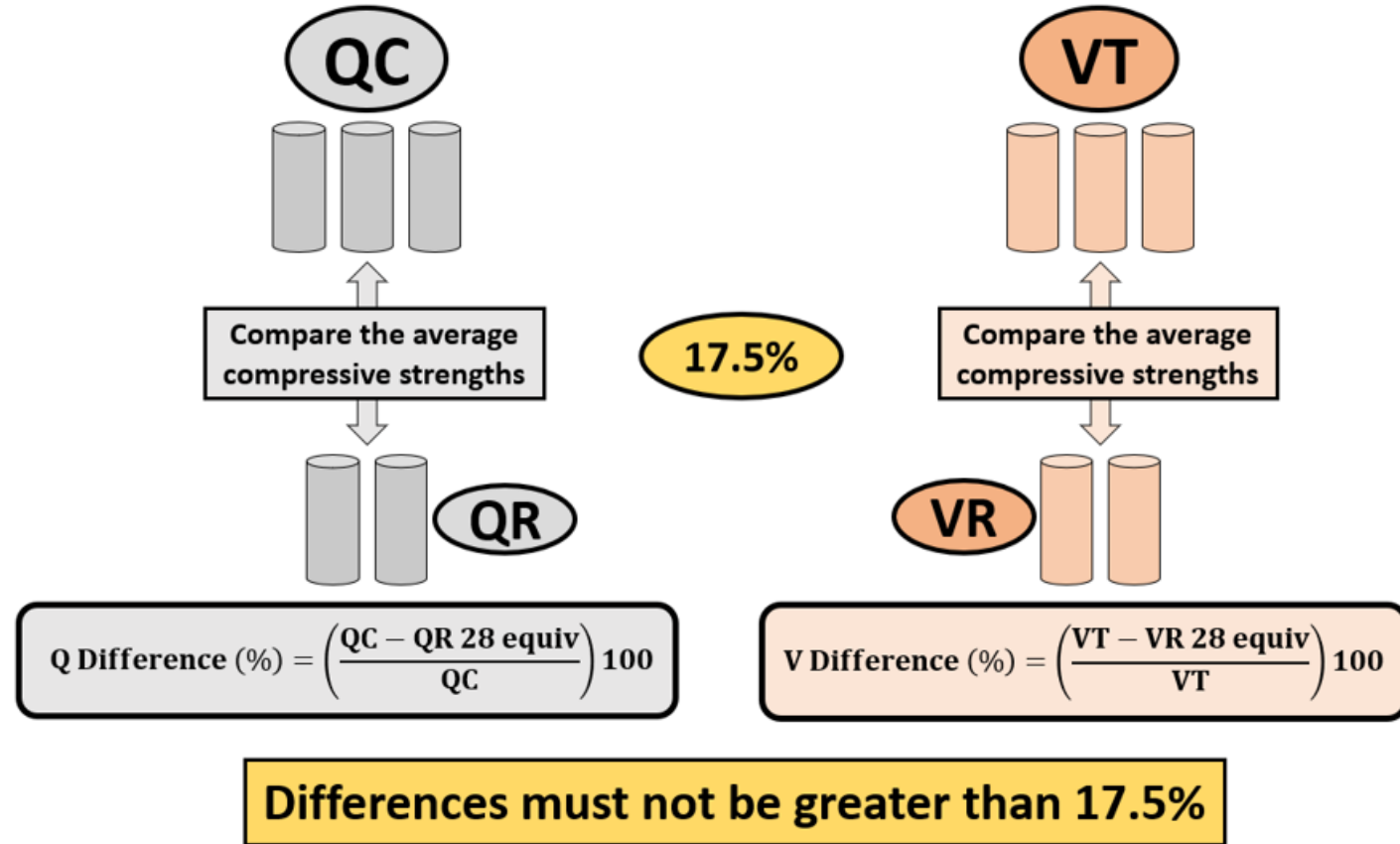
**IF Difference (%) > 14%**

**The QC data is not verified**, and the Engineer will initiate the **Resolution procedure**.



Resolution

Comparing (**QC** with **QR**) and (**VT** with **VR**) results.



Based on the **Resolution** process, the Engineer will determine the most accurate strength test result (**QC or VT**) to represent the four or fewer consecutive LOT(s).

When the Engineer cannot determine which strength test results are the most accurate, the concrete represented by the four consecutive LOTs will be evaluated based on the **QC** data.



The Engineer will determine the most accurate strength test result to represent the LOTs as follows:

When **both results meet** the established comparison criteria, both are deemed accurate, and the QC strength will represent the LOTs. The Department will pay for cost of the resolution testing.

When **only the QC result** is within the established comparison criteria, the **QC strength is deemed as most accurate** and will represent the LOTs. The Department will pay for the cost of the resolution testing.

When **only the VT result** is within the established comparison criteria, the **VT strength is deemed as most accurate** and will represent the LOTs. The Department will assess a \$1,000 pay reduction for the cost of the Resolution Investigation.

When **both results are outside** the established comparison criteria, the Engineer, with input from the District Materials Office, will determine if any Department **IA evaluations are required** and which test results are most accurate. The Department will pay for the cost of the resolution testing.

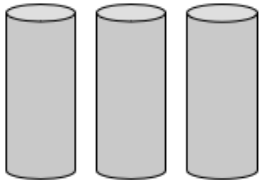
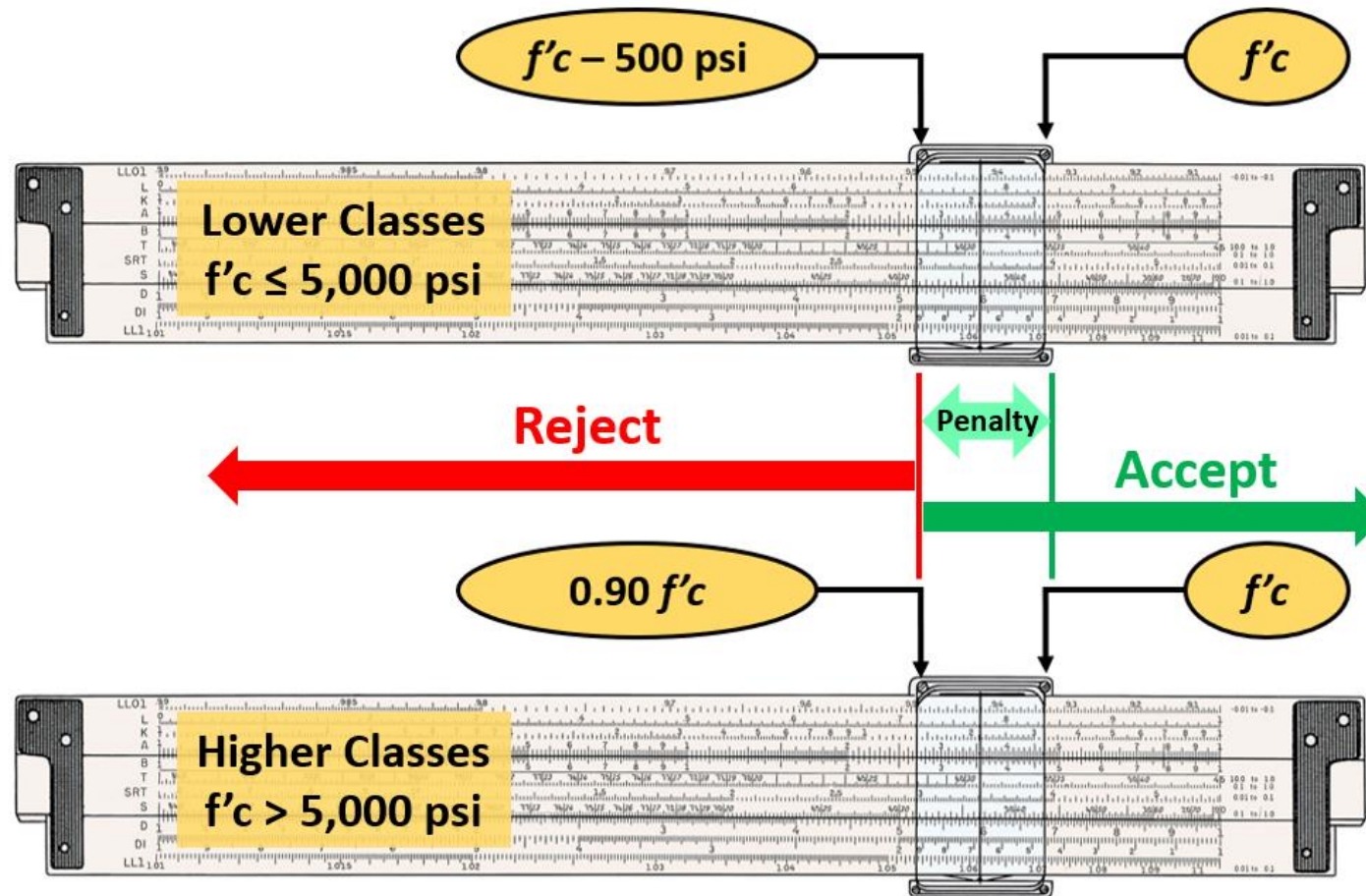






Structural Adequacy

The Engineer will accept the concrete of a given LOT when it meets the minimum specified compressive strength requirement ( $f'_c$ ) (SS 346-9.4)

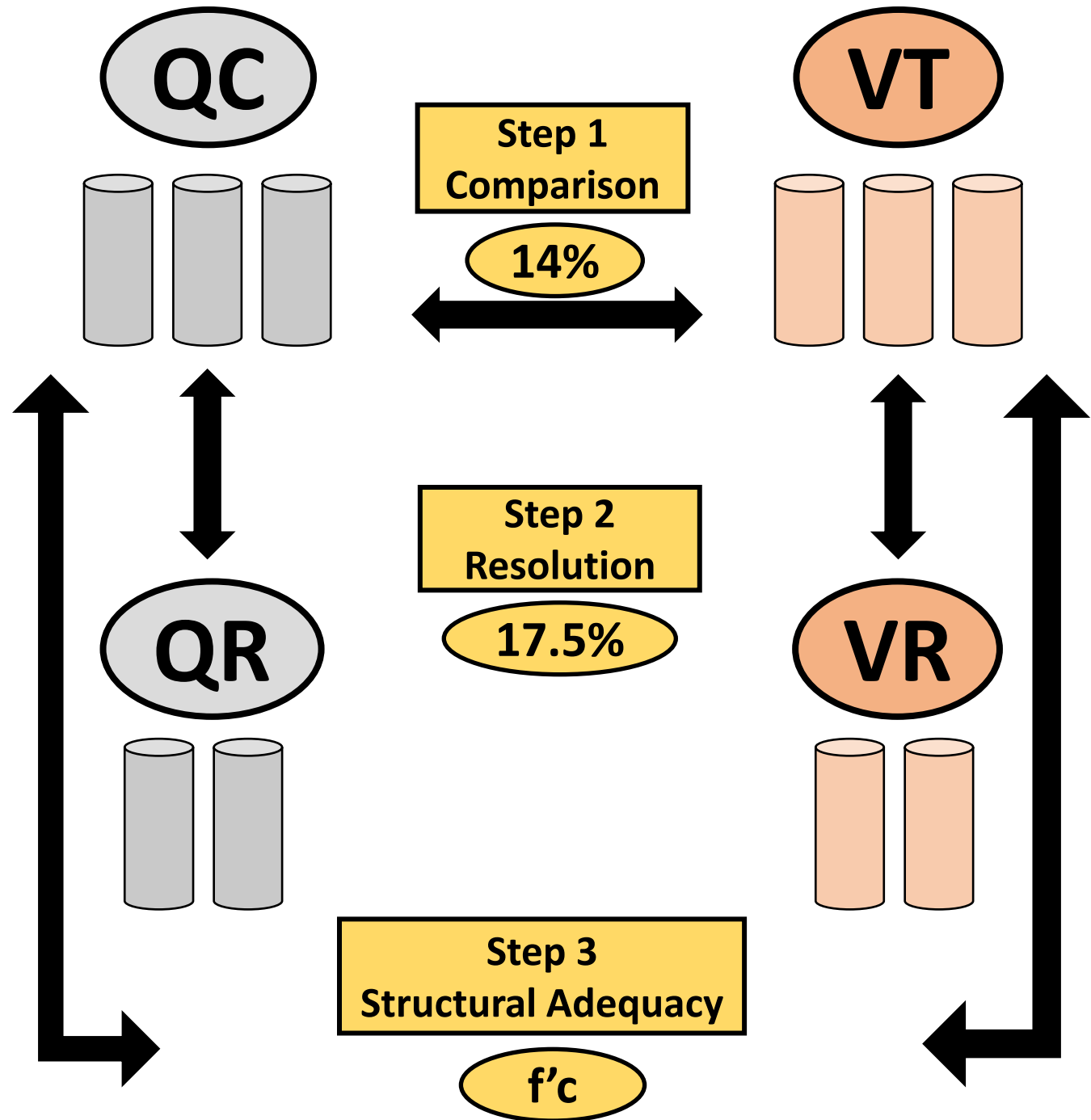
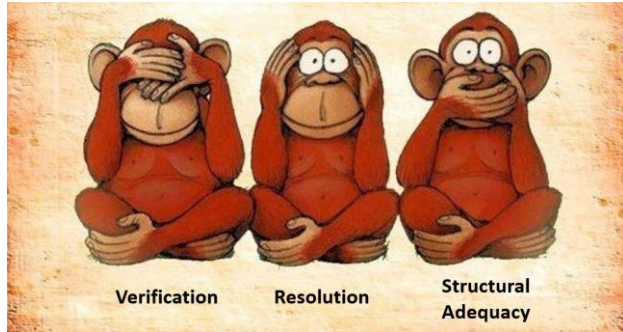


28-Day Average

Reduction in Pay is equal to the reduction in percentage of concrete compressive strength below the specified minimum strength:

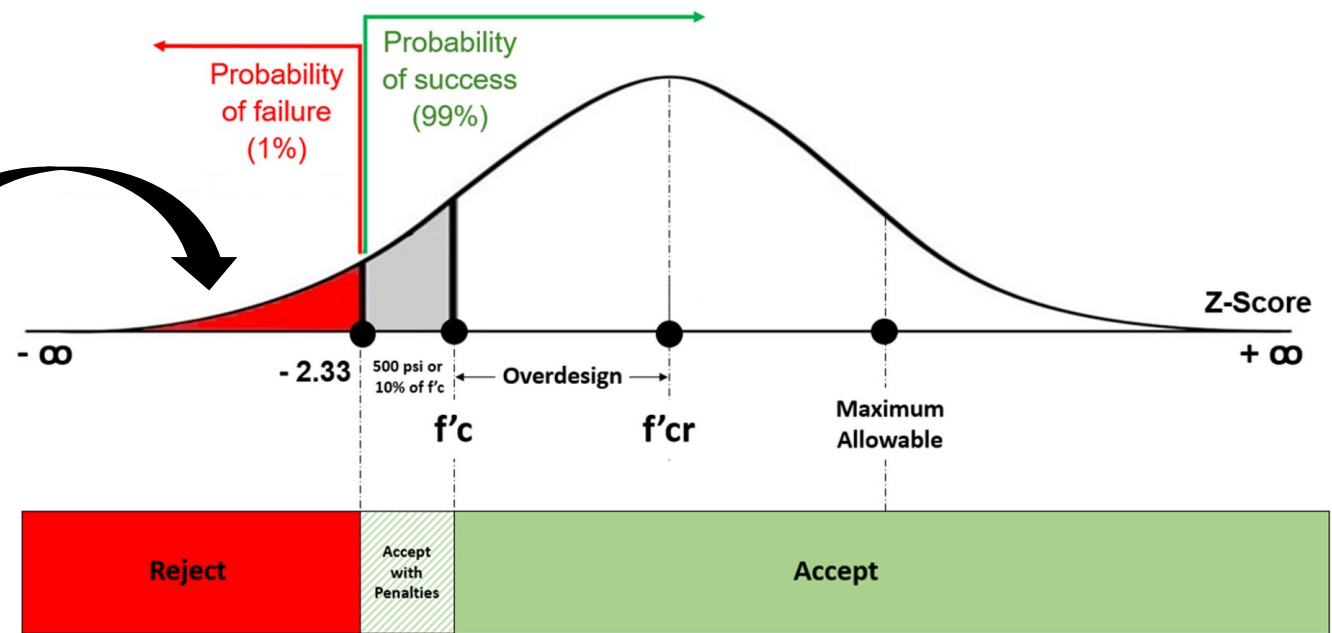
$$\text{Reduction in Pay (\%)} = \left( \frac{f'_c - 28 \text{ day Strength}}{f'_c} \right) 100$$

# Summary



# Low Compressive Strength

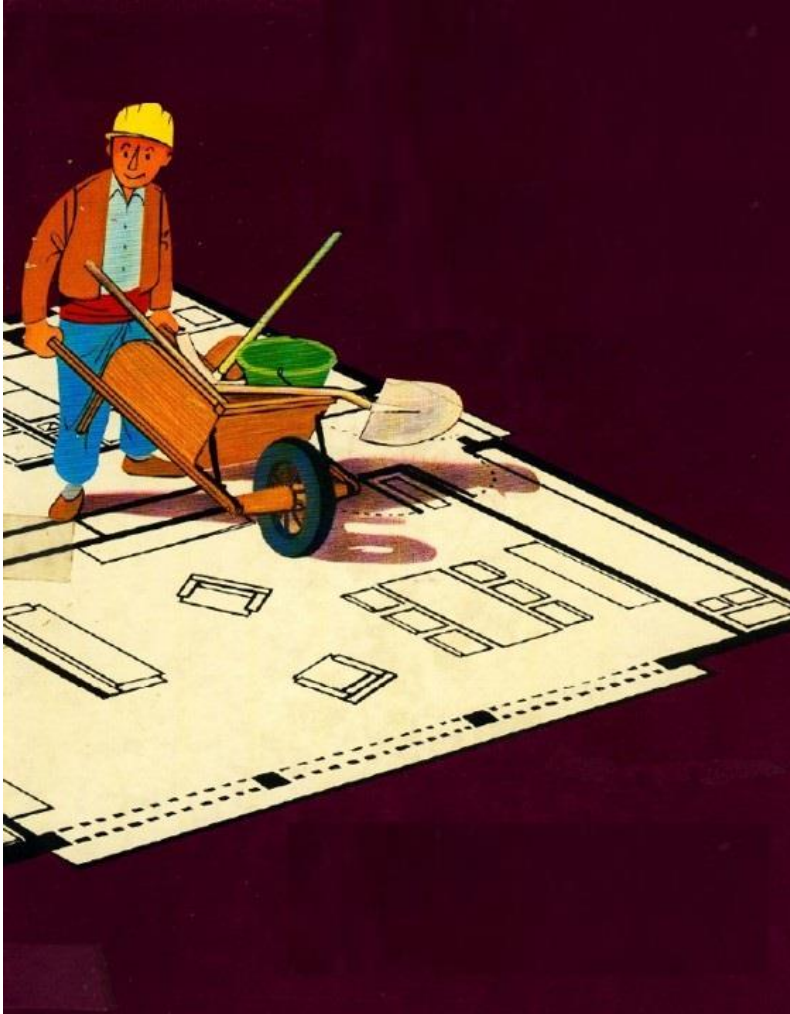
When the compressive strength of concrete does not meet the structural adequacy **(SS 346-10)**



1. Submit an Engineering Analysis Scope to establish structural and durability adequacy. If the results of the structural analysis indicate adequate strength to serve its intended purpose with adequate durability, and is approved by the Engineer, the Contractor may leave the concrete in place, otherwise, remove and replace the LOT of concrete in question at no additional expense to the Department.
2. At the Engineer's discretion, obtain drilled core samples to determine the in-place strength of the LOT of concrete in question, at no additional expense to the Department.



# Special Types of Concrete



**Drilled Shaft**

**Mass Concrete**

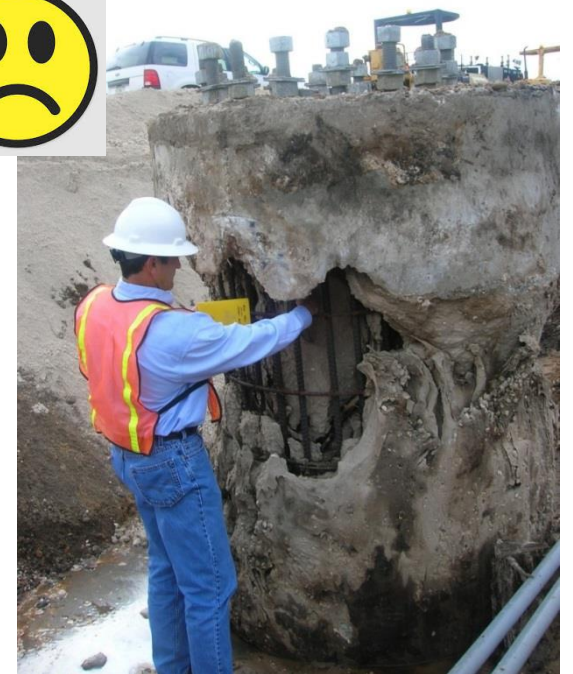
**Fiber Reinforced Concrete (FRC)**

**Ultra-High-Performance Concrete (UHPC)**

# Drilled Shaft

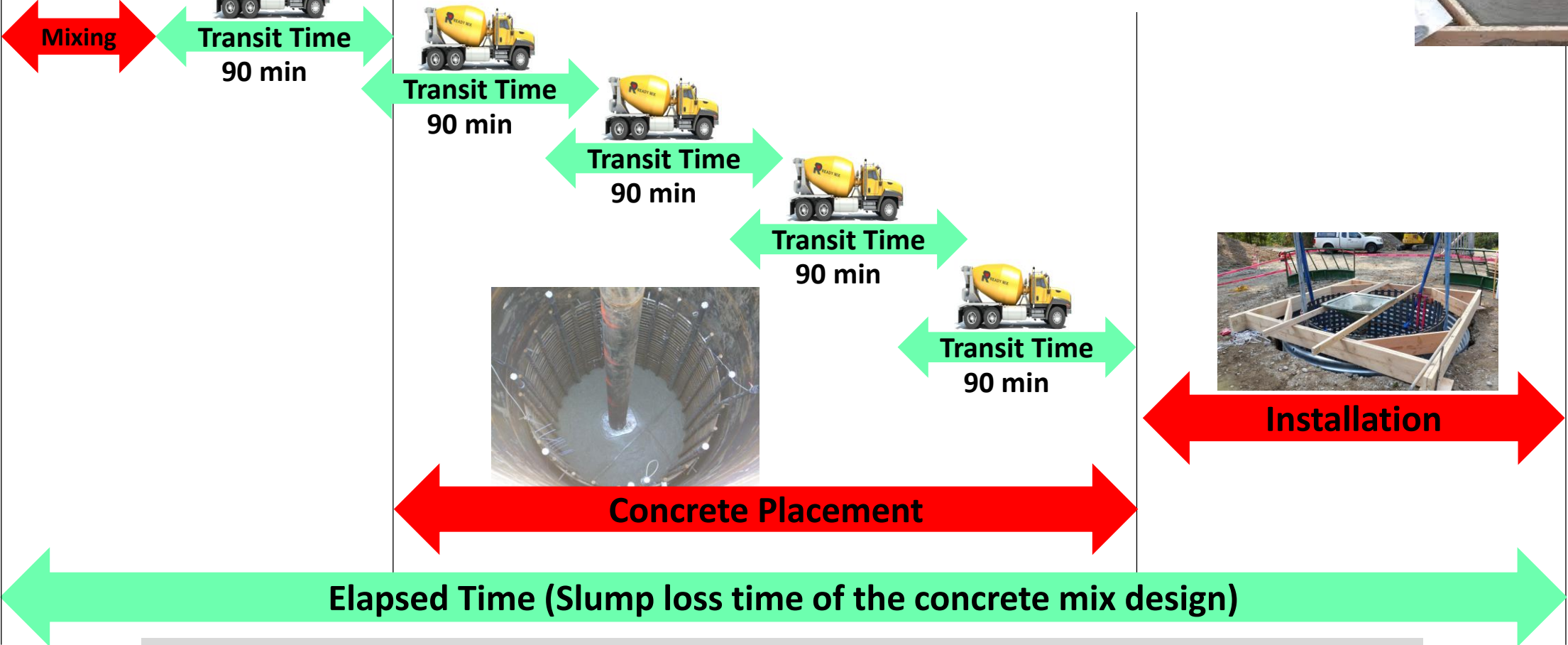
## SS 346-4.1

Obtain *slump loss* tests results demonstrating that the drilled shaft concrete maintains a slump of at least 5 inches throughout the concrete *elapsed time* before drilled shaft concrete operations begin.



If the *elapsed time* during placement exceeds the *slump loss* test data, submit an Engineering Analysis Scope in accordance with 6-4

# Drilled Shaft (Example)



**T= 0**

Maintain a minimum slump of 5 inches throughout the elapsed time **SS 455-17.2**

**T= 7.5 hrs**



# Drilled Shaft (Elapsed Time) SS 355-17.2

**455-17.2 Placement Time Requirements:** The elapsed time for placing drilled shaft concrete includes the concrete mixing and transit time, the concrete placement time, the time required to remove any temporary casing that causes or could cause the concrete to flow into the space previously occupied by the casing, and the time to insert any required column steel, bolts, weldments, etc. The elapsed time begins at the time the first truck load placed in the shaft is batched. Maintain a minimum slump of 5 inches throughout the elapsed time. Use materials to produce and maintain the required slump through the elapsed time that meets the class of concrete specified. Provide slump loss tests that demonstrate to the Engineer that the concrete will maintain a 5 inch or greater slump for the anticipated elapsed time before beginning drilled shaft construction.



T = 0

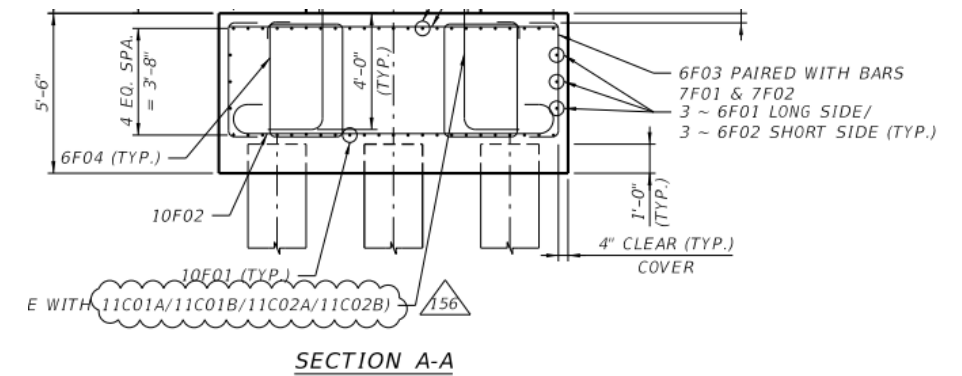
Elapsed Time (Slump loss time of the concrete mix design)

T = 7.5 hrs

# Mass Concrete SS 346-4.2

## Mass Concrete Designation

The designer includes the designation in plan sheets. (SDG)



## Mass Concrete Control Plan (MCCP)

The Contractor uses a Specialty Engineer. (SS 346 – Materials Manual 9.4)



# Mass Concrete. Placement and Surface Inspection

Temperature Sensors  
(SS 346-4.2 and MCCP)



Locations

→ Center

→ Surface



Insulation  
(SS 346-4.2 and MCCP)



Locations

→ Formed surfaces

→ Top and bottom

R-value ≥ 2.5

Pour and monitoring  
(SS 346-4.2 and MCCP)



Allowed Temperatures

Concrete at placement



Per MCCP

Core



$T \leq 180^{\circ}\text{F}$

Differential



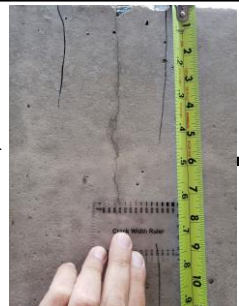
$T \leq 35^{\circ}\text{F}$

Insulation removal



$T_{\text{core}} - T_{\text{air}} \leq 50^{\circ}\text{F}$

Surface Inspection  
(SS 346-4.2, 400, and MCCP)



Significance

≤ 0.005%



Slightly Aggressive, Width ≤ 0.012 in

≤ 0.005%



Moderately Aggressive, Width ≤ 0.004 in

0.000%



Extremely Aggressive



# Mass Concrete

SS 346-4.2

## Installation

Pumps, Pipes, Fittings, Meters



## Operation

Pumps, Pipes



Cooling Pipes  
(active cooling)

## Monitoring

Temperature, Pressure (P), Flow Rate (F)



## Grouting

$f'_c$  grout  $\approx$   $f'_c$  concrete



# Fiber Reinforced Concrete (FPC)



## Developmental Specification 346 (FRC)

<https://www.fdot.gov/programmanagement/otherfdotlinks/developmental/default.shtm>

<b>Fiber Reinforced Concrete</b>	David Cerlanek	Dev346FRC
Fiber reinforced concrete bridge decks, to be used with precast deck slabs.		



# Ultra-High-Performance Concrete (UHPC)



## Developmental Specification 346 (UHPC)

<https://www.fdot.gov/programmanagement/otherfdotlinks/developmental/default.shtm>

<b>Ultra-High-Performance Concrete</b>	David Cerlanek	<a href="#">Dev349UHPC</a>
<b>Pre-Packaged Ultra-High-Performance Concrete</b> Provides the material requirements for UHPC, used with Dev349UHPC.	David Cerlanek	<a href="#">Dev927UHPC</a>



**UHPC (DevSpec 349/927)**

**Standard Concrete Products  
(Tampa)  
Field Demonstration**





# UHPC – Mockup Demonstration in District 3 – SR 8 Approach Slab Replacement





# UHPC – District 6 – Bridge Rehabilitation Project in Miami



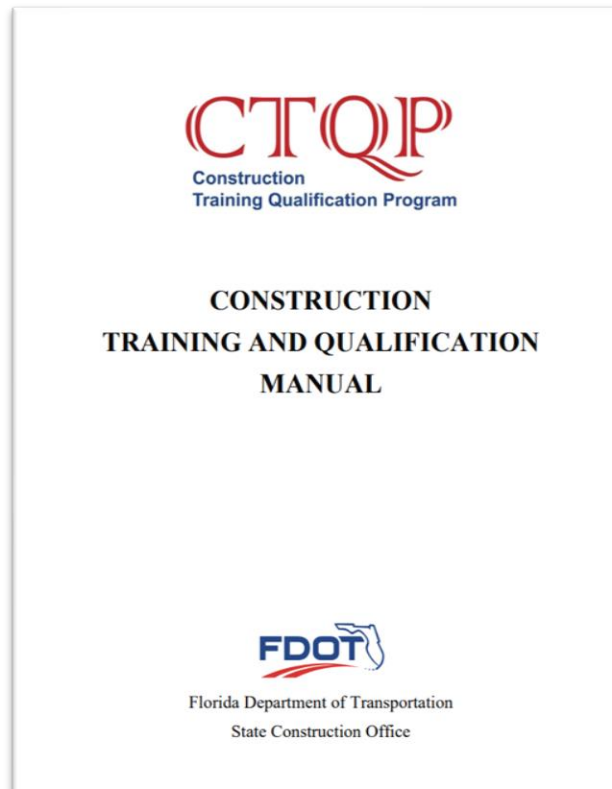
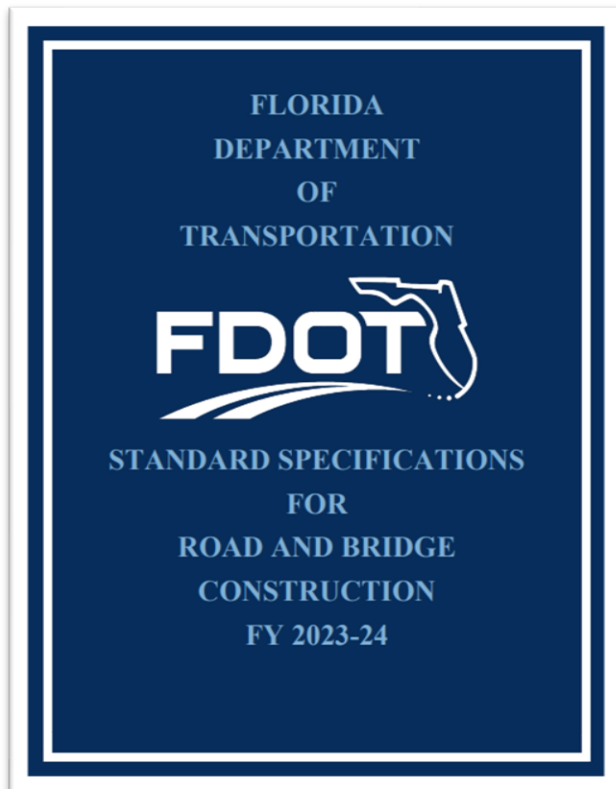


# Concrete Personnel Qualification Requirements

## Contractor

### Standard Specification Section 105

[fy2023-24ebook.pdf](#)



## Department

### CTQP Manual Chapter 4

[Construction Training Qualification Manual \(fdot.gov\)](#)

### Materials Manual Volume I (Training Articles)

Section 6.2 Precast Concrete Pipe

Section 6.3 Precast Concrete Drainage Structures and Box Culverts

Section 8.1 Precast Prestressed Concrete Products

Section 8.2 Incidental Precast Concrete Products

Section 9.2 Concrete Production

Section 9.3 Concrete Pavement Production Facility Guide

[SMO: Materials Manual \(state.fl.us\)](#)

# Part 2

## Precast / Prestressed Concrete



**Thomas Frank**  
**Concrete Field Operations Manager**  
[Thomas.Frank@dot.state.fl.us](mailto:Thomas.Frank@dot.state.fl.us)  
(352) 955-6683

## **FDOT Precast Concrete**

Precast concrete Producers are required to have a Quality Control (QC) manager, and a QC Plan/Program.

District Materials personnel have Quality Control (QC) Plan acceptance authority over four categories of precast concrete Producers.

Materials personnel perform periodic verification inspections at the plants.

The QC stamp must be applied to the products by the Producer's QC staff after final inspection and prior to shipment to the project.

The QC stamp includes the Plant's Department-assigned Facility ID and may contain a company logo.



# Precast Concrete Pipe (PI)

## MM 6.2



# Precast Concrete Drainage Structures and Box Culverts (PC)

## MM 6.3





# Incidental Precast Concrete Products (IPC)

## MM 8.2





# Precast Prestressed Concrete Products (PCP)

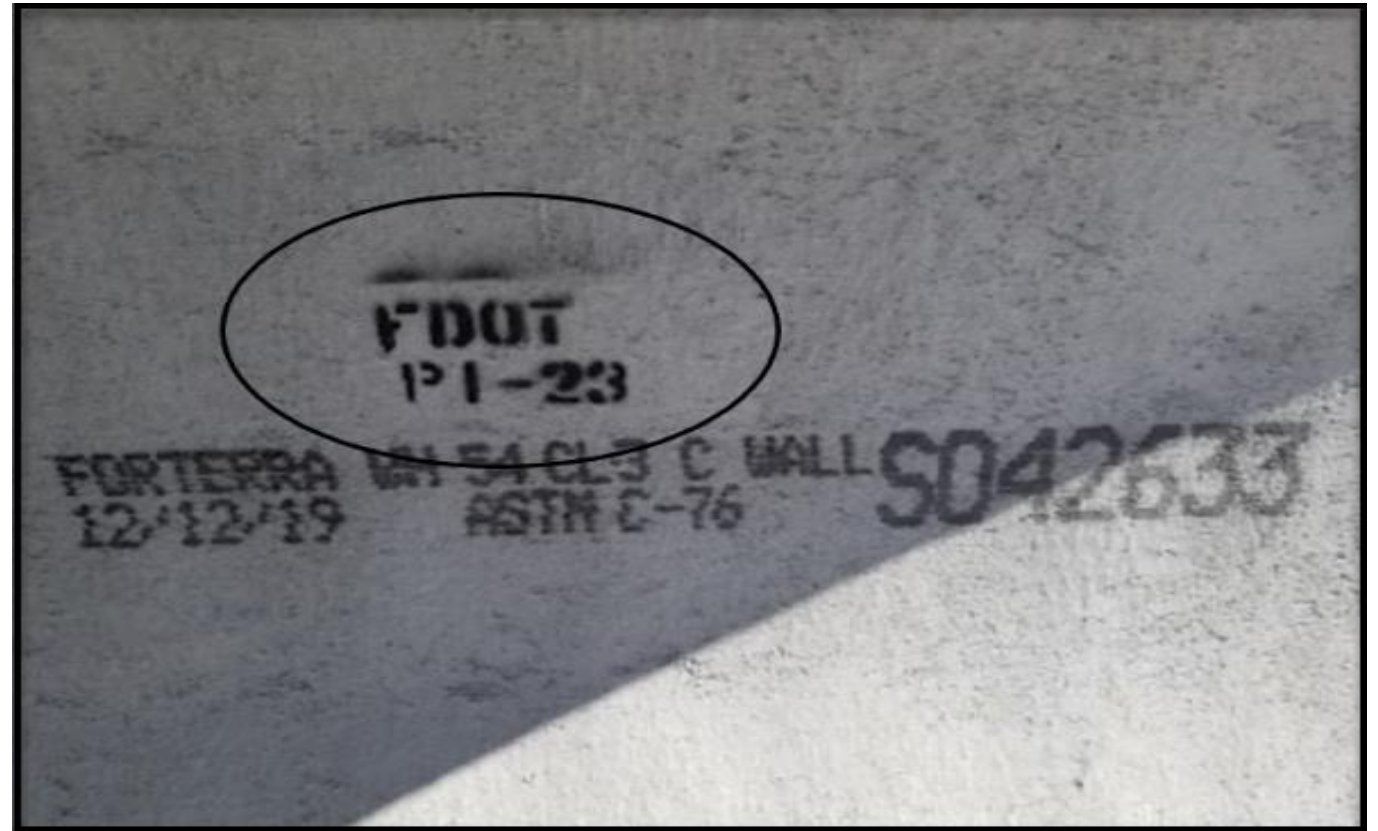
## MM 8.1



# Production Facility QC Stamp

At a minimum, the QC Stamp must contain the Department-issued Facility Identifier.

Example of QC Stamp on wall of concrete pipe.



# Verifying Precast Producer's QC Stamp

Can be viewed from the Precast Concrete Production Facility on the Contractor QC Plan in MAC.

E6J53: DESIGN-BUILD CONTRACTS [ARCHER WESTERN-DE MOYA JOINT VE] Go to

Precast Drainage Structures

Production Facilities [2]

Production Facility	City	Status	
<a href="#">PC-18 - UNITED CONCRETE PRODUCTS</a>	MEDLEY, FLORIDA	QC Plan Accepted for Precast Drainage Structures [1/23/2020]	<a href="#">QC Stamp</a>
<a href="#">PC-43 - All American Precast Manufacturing Corp.</a>	Homestead, FLORIDA	QC Plan Accepted for Precast Drainage Structures [2/25/2021]	<a href="#">QC Stamp</a>

Materials Acceptance and Certification System

<https://mac.fdot.gov/>



# Segmental Precast Concrete for Post-Tensioned Bridges

SS 452



These items are produced by Contractor (or sub) and verified by CEI personnel.

# Buy America requirements for Precast Concrete Products

There are two documents sent from the precast concrete producer to the project which contain Buy America / source of steel references:

- A. *Material Certification*** – this document is provided at the beginning of the project stating that the Producer will manufacture the products in accordance with their QC Plan and the Contract Documents.
  
- B. *Delivery Ticket(s)*** - must contain a Buy America compliance statement, and the dollar amount of any foreign steel used (Producer must put \$0 if none).

*"For Use on Producer's Letterhead"*

**MATERIAL CERTIFICATION**

**MANUFACTURED PRECAST PRESTRESSED CONCRETE PRODUCTS  
SPECIFICATION NUMBER \*(450)**

**FDOT Financial Identification Number (FIN):**

**FDOT Contract Number:**

**Project Location:**

---

**Description of Products:**

We certify that the described precast prestressed concrete products will be manufactured by our plant in accordance with the requirements set forth in the Florida Department of Transportation Contract Documents, the plant's approved quality control plan, and Section 6 (Source of Supply) of the Florida Department of Transportation Standard Specifications. The plant's quality control manager or the inspectors under his/her direct supervision will stamp the products prior to their shipment to the project site. The quality control manager's stamp is confirmation of the aforementioned certification. Each shipment of the precast prestressed concrete products to the project site will be accompanied with a signed or stamped delivery ticket, which will provide the description and list of the products.

**Manufacturer Officer or Designee:**

**Name (print):** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

*(Notarized)*

**Material Certification  
provided at beginning  
of project**

**SS 6-5.2**

**MM 6.2, 6.3, 8.1 & 8.2**



# Delivery Ticket provided with each shipment

SS 6-5.2

MM 6.2, 6.3, 8.1 & 8.2

The dollar amount of any foreign steel and iron used in the delivered precast products must be declared so those amounts can be included in the project total for compliance with Section 6-5.2 Source of Supply.

BOL/DOT-						N <sup>o</sup> 40754	
SOLD TO:				SHIP TO:			
_____				_____			
_____				_____			
PHONE: _____				PHONE: _____			
FAX: _____				FAX: _____			
DATE	DELIVERY	PICKUP	SHIP VIA	F.O.B.	TERMS	ORDER NO.	
QTY	DESCRIPTION				PRICE	AMOUNT	
<b>COMPLIANCE STATEMENT WITH BUY AMERICA PROVISION</b> <b>The dollar amount of Non-domestic steel or iron incorporated in the precast prestressed products listed above is \$0.00. Therefore, we hereby certify that the product(s) described above was (were) manufactured in accordance with the Buy America provisions of 23 CFR 635.410, as amended.</b>							
<i>All products described herein are in compliance with all Florida Department of Transportation standard specifications.</i>							
Q.C. Manager _____				DATE: _____			
Customer Signature: _____				DATE: _____			
Representative: _____				DATE: _____			
WHITE - FILE COPY		CANARY - STATEMENT COPY		PINK - CUSTOMER'S COPY		GOLDENROD - QUALITY CONTROL COPY	

# Buy America requirements for Precast Concrete Products

## SECTION 6 CONTROL OF MATERIALS

**6-5.2 Source of Supply:** Comply with Section 70914 of Public Law No. 117-58, §§ 70901-52, also known as the Infrastructure Investment and Jobs Act (IIJA), Public Law 117-58, which includes the Build America, Buy America Act (BABA). Domestic compliance for all affected products will be listed on the APL.

**6-5.2.1 Steel and Iron:** Use steel and iron manufactured in the United States, in accordance with the Buy America provisions of 23 CFR 635.410, as amended. Ensure that all manufacturing processes for this material occur in the United States. As used in this specification, a manufacturing process is any process that modifies the chemical content, physical shape or size, or final finish of a product, beginning with the initial melting and continuing through the final shaping and coating. If a steel or iron product is taken outside the United States for any manufacturing process, it becomes foreign source material. When using steel or iron materials as a component of any manufactured product (e.g., concrete pipe, prestressed beams, corrugated steel pipe, etc.), these same provisions apply. Foreign steel and iron may be used when the total actual cost of such foreign materials does not exceed 0.1% of the total Contract amount or \$2,500, whichever is greater. These requirements are applicable to all steel and iron materials incorporated into the finished work but are not applicable to steel and iron items that the Contractor uses but does not incorporate into the finished work. Submit a

Foreign steel and iron may be used when the total actual cost of such foreign materials does not exceed 0.1% of the total Contract amount or \$2,500, whichever is greater.

# Part 3

## Structural Materials



**Richard DeLorenzo**  
**Structural Lab Manager**  
[Richard.DeLorenzo@dot.state.fl.us](mailto:Richard.DeLorenzo@dot.state.fl.us)  
**(352) 955-6667**





## Metal Accessory Materials for Concrete Pavement and Concrete Structures (SS 931)

Reinforcing Steel  
Bars

Dowel Bars

Metal Dowel Bar  
Assemblies

Welded Wire  
Reinforcement

## Prestressing Strand and Bar (SS 933)

Strand for Prestressing  
(Post-Tensioning)

Steel Bars for Prestressing  
(Post-Tensioning)

## Structural Steel and Miscellaneous Metal Items (Other than Aluminum) (SS 962)

Structural Steel, Steel Castings, Steel Forgings, Iron Castings, Bolts  
Nuts, Washers and Direct-Tension-Indicator (DTI) Devices, Anchor  
Rods, Bridge Bearing Materials, and Miscellaneous Metal Items



## Components for Guardrail (SS 967)

Steel Posts

Steel Offset Blocks

Steel Panels

Bolts, nuts, washers,  
and other accessories

## Approved Products List (APL)

Curing Compound  
(SS 925)

Epoxy Bonding  
Compound (SS 926)

Materials for  
Concrete Repair  
(SS 930)

Non-Shrink Grout  
(SS 934)

Epoxy Anchor  
(SS 937)

Post-Tensioning  
Grout (SS 938)

# Metal Accessory Materials for Concrete Pavement and Concrete Structures (SS 931)

- Reinforcing Steel Bars
- Dowel Bars
- Metal Dowel Bar Assemblies
- Welded Wire Reinforcement





# Acceptance of Reinforcing Steel Bars



## Manufacturer's certified mill analysis

- Provided to the Engineer prior to use, for each heat, size, and grade per shipment.

## Samples taken by the Department

- The Engineer will select samples representing each LOT of reinforcing steel.  
(Lot is defined as 100 tons or less).
- Projects with less than two tons of bars do not require Department sampling.

## Manufacturer's compliance with the AASHTO Product Evaluation & Audit Solutions (formerly National Transportation Product Evaluation Program (NTPEP))

- Verified by SMO for samples taken.

# Acceptance of Reinforcing Steel Bars



## Project personnel to collect samples;

- Select 3 pieces, 7' long, randomly selected by Department.
- Sample the most frequently used bar size
- Mill Certificate, upload to MAC sample.
- Securely attach MAC ID to test samples.

## Send 1 bar, hold 2 (*as check samples if needed*)

- No preselected “test bars”, “splice bars”, or “FDOT test samples”.
- Don't wait until the end of the project to submit samples.



CMC STEEL FLORIDA  
16770 Rebar Road  
Baldwin FL 32234-4100

**CERTIFIED MILL TEST REPORT**  
For additional copies call  
904-266-1468

We hereby certify that the test results presented here are accurate and conform to the reported grade specification



Alex Renesto

Quality Assurance Manager

HEAT NO.:5004371

SECTION: REBAR 16MM (#5) 60"0" 420/60

GRADE: ASTM A615-18e1 Gr 420/60

ROLL DATE: 10/11/2019

MELT DATE: 10/11/2019

Cert. No.: / 004371K002

O  
L  
D  
  
T  
O

- Heat Number
- Bar Size
- Grade
- Specification

Delivery#:  
BOL#:  
CUST PO#:  
CUST P/N:  
DLVRY LBS / HEAT: 0.000 LB  
DLVRY PCS / HEAT:

Characteristic	Value	Characteristic	Value	Characteristic	Value
C	0.43%	Bend Test 1	Passed		
Mn	0.99%	Rebar Deformation Avg. Spaci	0.392IN		
P	0.015%	Rebar Deformation Avg. Heigh	0.041IN		
S	0.039%	Rebar Deformation Max. Gap	0.126IN		
Si	0.24%				
Cu	0.34%				
Cr	0.14%				
Ni	0.10%				
Mo	0.025%				
V	0.004%				
Cb	0.002%				
Sn	0.022%				
Yield Strength test 1	65.9ksi				
Yield Strength test 1 (metri	455MPa				
Tensile Strength test 1	106.1ksi				
Tensile Strength 1 (m					
Elongation test 1					
Elongation Gage Lgth					
Tensile to Yield rati					
Elongation Gage Lgth					

The Following is true of the material represented by this MTR:

- \*Material is fully killed
- \*100% melted and rolled in the USA
- \*EN10204:2004 3.1 compliant
- \*Contains no weld repair
- \*Contains no Mercury contamination
- \*Manufactured in accordance with the latest version of the plant quality manual
- \*Meets the "Buy America" requirements of 23 CFR635.410, 49 CFR 661
- \*Warning: This product can expose you to chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm. For more information go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

- Melted and Rolled in the USA
- Meets the "Buy America" requirements of 23 CFR 635.410, 49 CFR 661 and **SS 6-5.2**

REMARKS :



# Identification of Rebar



The Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice

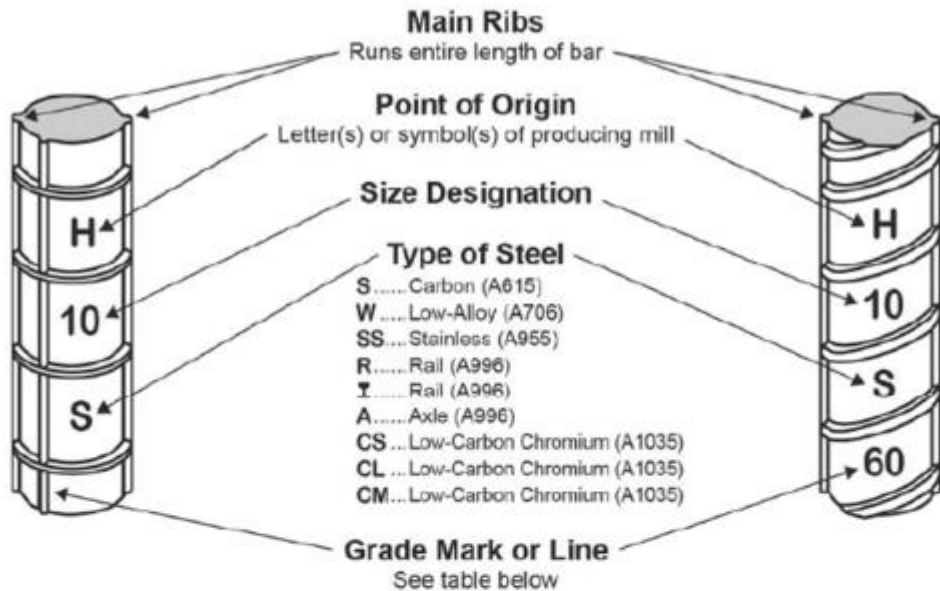
Acts as a guide to available reinforcing steel and accepted industry practices.

Identifies the U.S. Manufacturers of Concrete Reinforcing Steel Bars

[Manual of Standard Practice - CRSI Resource Materials](#)

<https://resources.crsi.org/resources/manual-of-standard-practice/>

# Identification of Rebar



Minimum Yield Designation		
Grade of Steel	Grade Mark*	Grade Line**
40	blank	no lines
50	blank	no lines
60	60	1 line
75	75	2 lines
80	80	3 lines
100	100 or C (A615)	4 lines (A615)
100	100 (A1035)	3 lines (A1035)
120	120	4 lines

\*For stainless-steel (A955) reinforcing bars: Gr 60 = "•", for Gr 75 = "••"

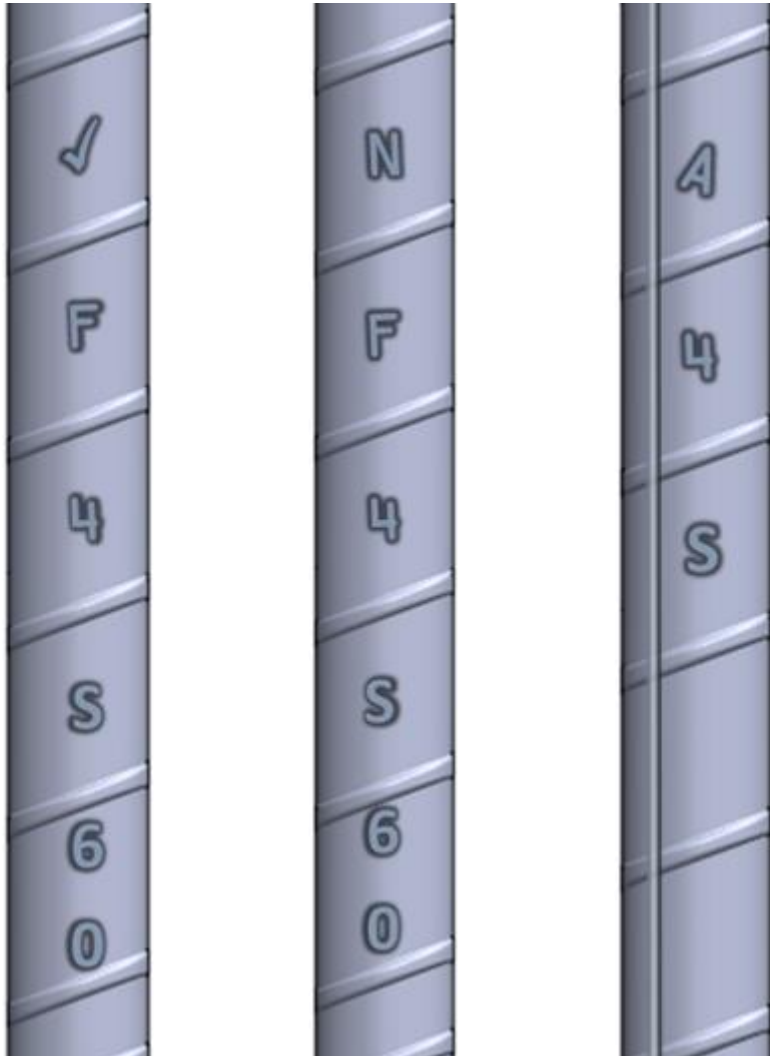
\*\*Grade lines must be at least 5 deformation spaces long

## ASTM Identification Marks

Bar Markings allows you to identify:

- Producing Mill
- Bar Size
- Type of Steel
- Grade

## Steel Mill Stamps



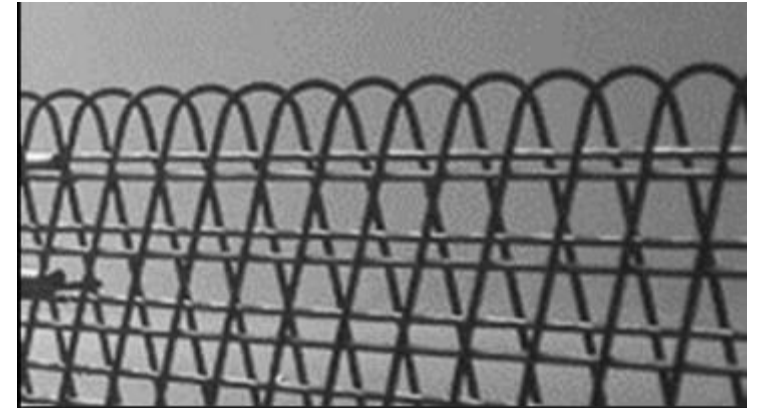
- **Examples of common mill stamps used in Florida.**
  - ✓F - CMC Steel Florida
  - NF - Nucor Steel Florida
  - A - Nucor Steel Alabama
- **Foreign Steel will identify the country of origin.**





## Acceptance of Dowel Bars and Welded Wire Reinforcement

- Manufacturer's certified mill analysis.
- Provided to the Engineer prior to use, for each heat and size per shipment.



## Dowel Bar Assemblies

- Product included on the Department's Approved Products List (APL).



# Prestressing Strand and Bar (SS 933)

- Strands for Prestressing (Post-Tensioning).
- Steel Bars for Prestressing (Post-Tensioning).



# Steel Pre-Stressing Strand (Post-Tensioning)

## Manufacturer's certified mill analysis.

- Provided to the Engineer prior to use, for each heat/ production lot, per shipment.

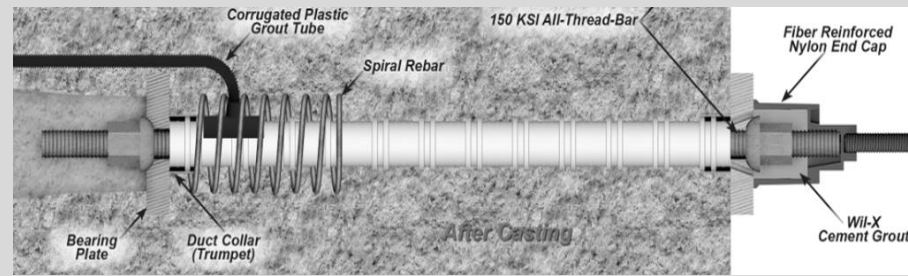
## Project personnel to collect samples.

- The Engineer will select one sample per producer, per size, per shipment.
- Select 3 pieces, 5' long, randomly selected by Department.
- Send 1 bar, hold 2 (*as check samples if needed*).
- Certified mill analysis, upload to MAC sample.
- Securely attach MAC ID to test samples.
- Don't wait until the end of the project to submit samples.





# Steel Stressing Bars (Post-Tensioning)



## Manufacturer's certified mill analysis

- Provided to the Engineer prior to use, for each heat/production lot, per shipment.

## Project personnel to collect samples;

- The Engineer will select one sample per heat or production lot producer, per size, per shipment.
- Select 3 pieces, 5' long, randomly selected by Department.
- Send 1 bar, hold 2 (as check samples if needed)
- Mill Certificate, upload to MAC sample.
- Securely attach MAC ID to test samples.
- Don't wait until the end of the project to submit samples.

# Structural Steel and Miscellaneous Metal Items (Other than Aluminum) (SS 962)

*Includes Structural Steel, Steel Castings, Steel Forgings, Iron Castings, Bolts Nuts, Washers and Direct-Tension-Indicator (DTI) Devices, Anchor Rods, Bridge Bearing Materials, and Miscellaneous Metal Items.*

## **Manufacturer's certified mill analysis.**

- Provided to the Engineer prior to use, for each heat/ production lot, per shipment.



## **When should you submit Certified Mill Analysis in MAC:**

**If the Certified Mill Analysis are reviewed through Commercial Inspection, *No MAC entry is needed.***

- The Commercial Inspection Report is retained in the construct file.

**When the Certified Mill Analysis is received directly from the Contractor.**

- MAC entry is required.
- Mill Analysis, upload to MAC sample.
- Do Not wait until the end of the project to submit.



# Commercial Inspection Report

- Project Information
- Fabricator
- Materials
- Description
- Inspection Status
- Signature on Inspector

**HRV** Quality Assured  
1800 River Street, Suite 100 • West Des Moines, IA 50396  
 Phone: 515.281.4242 | Fax: 515.281.4243 | www.hrv.com

**Weekly Narrative Report**

Client Name: Florida Department of Transportation	HRV Service Order: 2264-028
Project Description: SR 23 (FIRST COAST EXPRESSWAY) FROM EAST OF CROSS TO NORTH OF SR15	Report No.: 020 Final
Contract Number: 422958-S-62-011 T27247YWO #35	Inspector: William Finnan
Fabricator Proj. #: H0565	Inspection Period: 01/11/2021 thru 01/15/2021
Fabricator: Walpar	Location (city/state): Birmingham, AL

PAGE 1 OF 1

**FABRICATION INSPECTION STATUS**

<input type="checkbox"/> In Process	% Completed: 100%	Hours:	Sunday: 0	Monday: 0	Tuesday: 0	Wednesday: 0	Thursday: 0	Friday: 0	Saturday: 0
<input checked="" type="checkbox"/> Final									

Attachments: BOL 86703, 86705, 86706  
 CMTRIS for Hardware  
 Photos

**Narrative Description of Activities**

Monday, January 11, 2021

Shipping of approved structures for FDOT project 2565 continued.

Load # 05, Cantilever Post 2565-4C3, Cantilever Truss 2565-7T3  
 Load # 06, Walk Platform Assembly 2565-16P1 # 01, Cantilever Truss 2565-7T1  
 Load # 07, Walk Platform Assembly 2565-16P1 # 02, Cantilever Truss 2565-7T2



Inspector Signature: William Finnan Date: 01/16/2021

**HRV** Quality Assured

Report No: 020 Final	Project Manager: Miguel Diaz
FDI: 422958-S-62-01	Task Work Order: TWD #35
Contract: T2724	Inspector: William Finnan
Fabricator: Walpar	Inspector: Mike Molian
Draw: 01/11/2021 thru 01/15/2021	Location: Walpar, Birmingham, AL
CEI Contact: Kenny Genesdorff, P.E.	CEI Email: kgenesdorff@wal.com

**Participant Fabricator Facilities: (Insert Subcontractors by City & State as they are identified)**

Subcontractors (Fabricating & Coating)	City & State
Valmont Coatings	Swain, AL

**Structural Fabrication Status: (Identify in the box if an NCR or an RTI begins, and when it was completed)**

Designation	Description	MTR Review	Fabricated	Coated	Fit-Up & Bolted	Final Acceptance	Shipped
56W 715100	Cantilever	8/28/20	In Process	10/15/20	10/30/20	11/24/20	8T1, 10T1, 9C1 01/08/21
56W 715101	Cantilever	8/28/20	In Process	10/16/20	10/23/20	11/24/20	9T1, 11T1, 9C1 01/07/2021
56W 715102	Cantilever	8/28/20	In Process	10/16/20	10/21/20	11/24/20	8T1, 9C2 01/07/2021
56W 715103	Cantilever	8/28/20	In Process	10/16/20	10/29/20	11/24/20	9C2, 8T2, 10T2 01/08/2021
56W 715104	Cantilever	8/28/20	In Process	10/16/20	10/28/20	11/24/20	4C1, 01/08/2021 7T1 01/11/2021
56W 715105	Cantilever	8/28/20	In Process	10/16/20	10/28/20	11/24/20	4C2, 01/08/2021 7T2, 01/11/2021
56W 715106	Cantilever	8/28/20	In Process	10/16/20	10/27/20	11/24/20	4C3, 7T3 01/11/2021
ES	Walkway	8/3/20	In Process	11/12/20	11/16/20	11/18/20	16P1, 1 & 2 01/11/2021

**Action Item: (Discuss any NCR's or RTI's from above. (Add throughout project.) (Resolved, Insert Y/N or Date)**

Designation	Description	Resolved
3C1, 3C2, 4C1 4C2, 4C3 5C1, 5C2	Walpar submitted a revised drawing for leadlines fabricated from 4" plate. One piece. The original drawing has multiple pieces, full penetration welded.	Y 10/13/20

# Commercial Inspection Report

- Project Information
- Fabricator Approval
- Bill of Lading
- Certified Mill Test Reports

**WP walpar** Shipping Ticket - Inspector Copy

Waper, LLC  
1/11/2021 8:29:03AM  
Job Description: T2724422938-5-52-01

Job Location: FL, Clay  
Customer P.O. #: 10378-28390

Job: 2565  
3-CANT  
22368

Quantity: 1  
Mark: 14P1-2  
1 771-9

Sequence: 01

Shape: WALK  
TRUSS

Dimensions: WALK PLATFORM ASSY  
CANTILEVER TRUSS 4 3/4 x 4 3/4 x 29'7"

Structure: E1 No: 715101  
E5 No: 715104

Am't. Weight: 22368

---

**WP walpar** Bill of Lading - Cover Sheet

Page 1 of 2  
1/11/2021 8:29:03AM

Job #: 2565  
T2724422938-5-52-01  
Customer P.O. #: 10378-28390

Load #: 15  
BOL #: 86705  
Carrier: S&D

Shipped From: 44000 00#  
Capacity: 2235.74#

Weight Loaded: 2  
Assembly Quantity:

Date Shipped: 1/11/2021

Sold To:  
James D. Hinson Electrical  
11609 Columbia Park Drive, West  
Jacksonville, FL 32258  
Phone: (904) 262-3805

Ship To:  
James D. Hinson Electrical  
11609 Columbia Park Drive, West  
Jacksonville, FL 32258  
Phone: (904) 262-3805

Shipping Signature: *Thad Al...*  
Date: 1-11-2021

Received Signature: \_\_\_\_\_  
Date: \_\_\_\_\_

**WP APPROVED**

**NUCOR**  
Nucor Steel Abrasives

**Mill Certification**  
02/02/2017

3/304

MTFR 6286  
Lot # 10088529420  
2911 E NUCCOR ROAD  
PO BOX 309  
NORFOLK, NE 68701 US  
402-644-0200  
Fax: 402-644-0329

Sold To: NUCOR FASTENER  
PO BOX 6100  
6730 CR 60  
SAINT JOE, IN 46785 US

Ship To: NUCOR FASTENER  
6730 CR 60  
SAINT JOE, IN 46785 US

Customer P.O.	183622	Sales Order #	10020041 - 11 15
Product Group	Hot Roll - Engineered Bar	Product #	3099094
Grade	1037ML	Lot #	1000529420
Size	1 0126"	Heat #	100485294
BOL #	BCL 105945	Load #	8296
Description	HR-EB RD 1 0156" 1037ML COIL 5200 Ibs	Customer Part #	005018
Production Date	01/02/2017	Qty Shipped LBS	47130
Product Country	United States	City Shipped EA	9
Original Item Description		Original Item Number	

\*Indicates only that the source described herein has been manufactured in accordance with the specifications and standards listed above and that it conforms thereto.

Mill Country of Origin: United States  
Melting Date: 01/05/2017

C (%)	Mn (%)	P (%)	S (%)	Si (%)	Ni (%)	Cr (%)	Mo (%)	Cu (%)	Ti (%)	V (%)	B (%)
0.38	0.81	0.006	0.026	0.27	0.08	0.31	0.02	0.11	0.001	0.004	0.000
0.006	0.007	0.00	0.000	0.001							

Cu + Ni + Mo (%): 0.21

Reduction Ratio: 54.39: 1

**Comments:**  
Casting Grain Practice  
Selenium, Tellurium, Lead, Bismuth or Boron were not intentionally added to this heat.  
All manufacturing processes of the steel materials in this product, including melting, have been performed in the United States.  
Memory, in any form, has not been used in the production or testing of this material.  
Test conforms to ASTM A29-10, ASTM E415 and ASTM E1079 reheat-treated grades or applicable customer requirements.  
Strand Cast  
ISO 17025 LAB accreditation cert available upon request.  
Exporting Country: USA  
Sales@nucor.com

**Chemistry Verification Checks**

Part# 5016 Job# 31304

Checked By \_\_\_\_\_ Date 2-3-17

Receiving OK: 375

Certifications OK: 2-3-17

Signature: \_\_\_\_\_  
Jim Hill, Division Metallurgist

NBAG 10 January 1, 2012 Page 1 of 1

## Components for Guardrail (SS 967)

- Steel Posts.
- Steel Offset Blocks.
- Steel Panels.
- Bolts, nuts, washers, and other accessories.



### **536-4 Acceptance.**

Acceptance of materials and installation of guardrail will be based on conformance with the requirements of this Section and visual inspection by the Engineer.

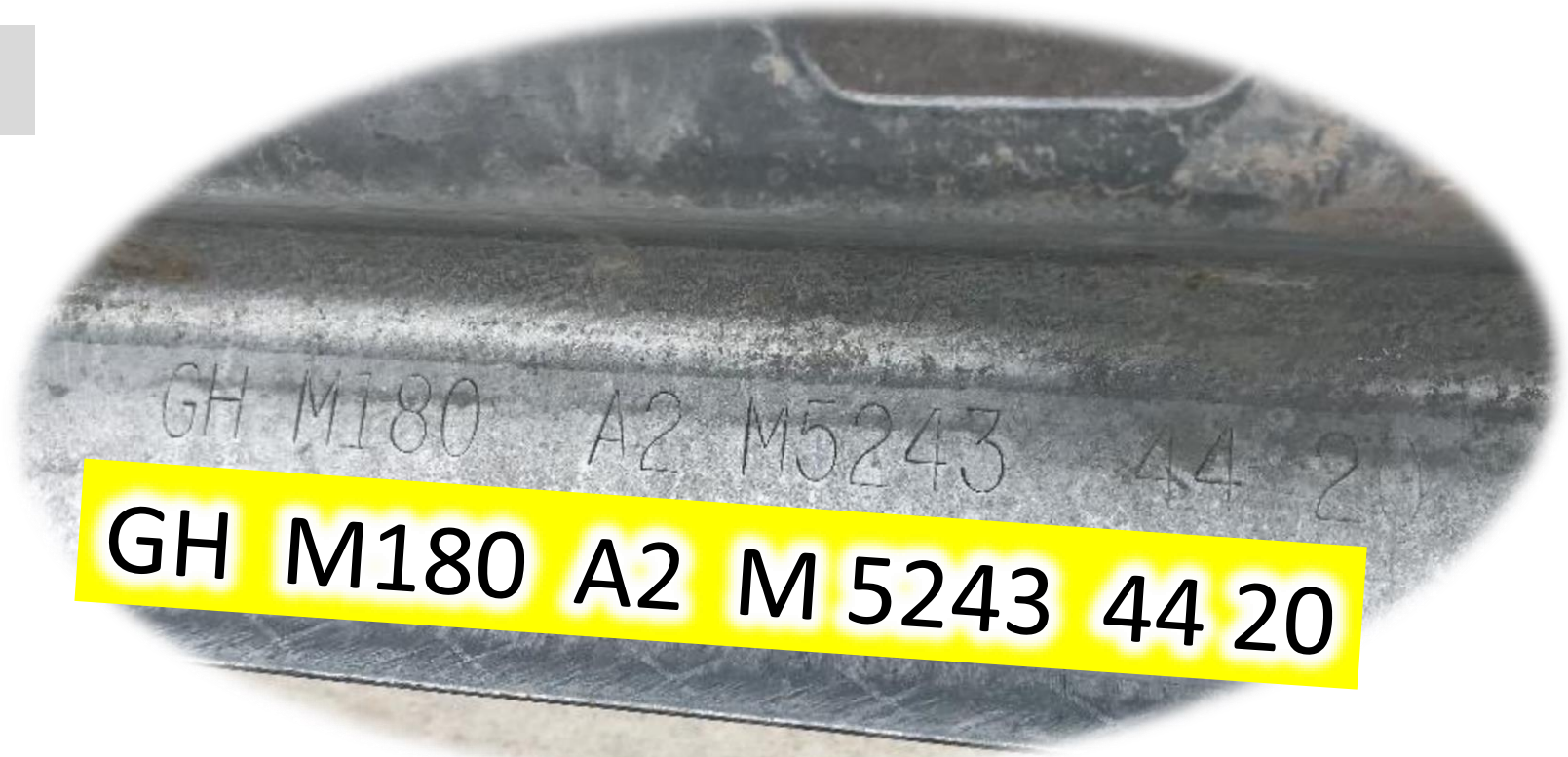


# Components for Guardrail

- Approved Metals Production Facility.
- Identify and record the manufacturer's mill stamp on panels.
- Randomly select 1 Stamp Number per 1000 feet of installed guardrail, up to a maximum of 10 Samples per Project.
- Create a sample in MAC for Steel Panel Stamp Number Review.
- Approved Products Listing (APL) for Approach Terminal Assemblies, Delineators, and Composite Offset Blocks.



# Guardrail Panel Stamp



<b>GH</b>	Manufacturer
<b>M180</b>	AASHTO Specification
<b>A2</b>	Class and Type
<b>M</b>	Operator ID
<b>5243</b>	Mill Heat Number
<b>44 20</b>	Week/ Year Galvanized Lot

# Approved Product List (APL)

**Curing Compound**  
**(SS 925)**



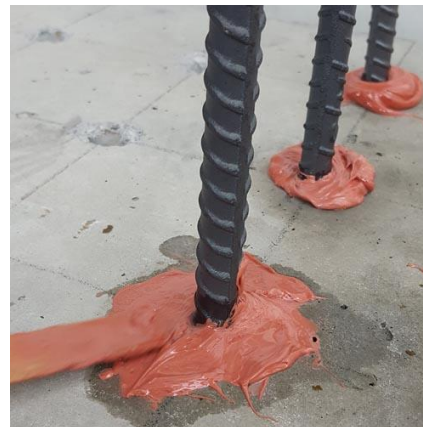
**Epoxy Bonding Compound (SS 926)**



**Materials for Concrete Repair (SS 930)**



**Non-Shrink Grout (SS 934)**



**Epoxy Anchor (SS 937)**



**Post-Tensioning Grout (SS 938)**



# 2023 Construction Academy

September 28, 2023

**David Cerlanek, P.E.**  
**Structural Materials Engineer**

**-Vacant**  
**Concrete Materials Engineer**

**Gonzalo Gallo**  
**Mass Concrete Specialist**

**Thomas Frank**  
**Concrete Field Operations Manager**

**Richard DeLorenzo**  
**Structural Materials Lab Manager**

# QUESTIONS

