



Developing and Deploying Performance Specifications

Mark Woolaver

Vermont AOT Construction Paving Engineer

March 14 -15, 2017



U.S. Department of Transportation
Federal Highway Administration

AMERICAN ASSOCIATION
OF STATE HIGHWAY AND
TRANSPORTATION OFFICIALS

AASHIO

Vermont Facts...




- Land Area = 9,248 Sq Miles (43)
- Population = 630k (49)
- Median Age = 42.8 yrs (2)
- Dairy Cows : People = 3.8 (1)



Putting Doves Inside the Freezer is Against the Law.



It's illegal to undress in public in Vermont, but if you leave your house naked, it's Totally Fine.



Clothing
Optional
Beach



At one point in time, it was illegal to tie a giraffe to a telephone pole in Vermont



**Billboards have been outlawed in
Vermont since 1968**





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Brief Vermont AOT History



**One Focus Area
Was / Is FDR**

**It Was Working
Fine Until.....**

We Added Cement....

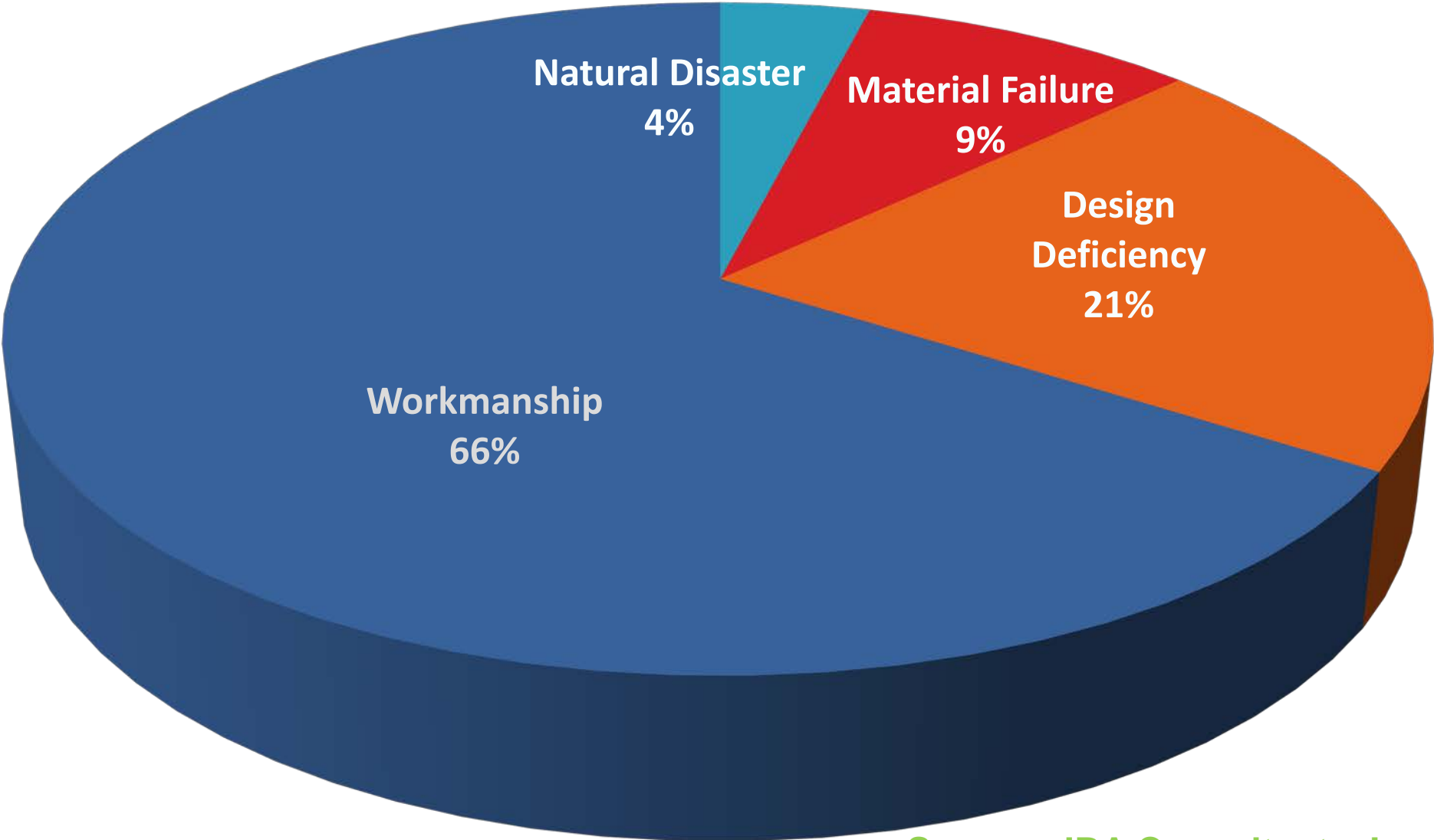


Some Brief Woolaver Thoughts



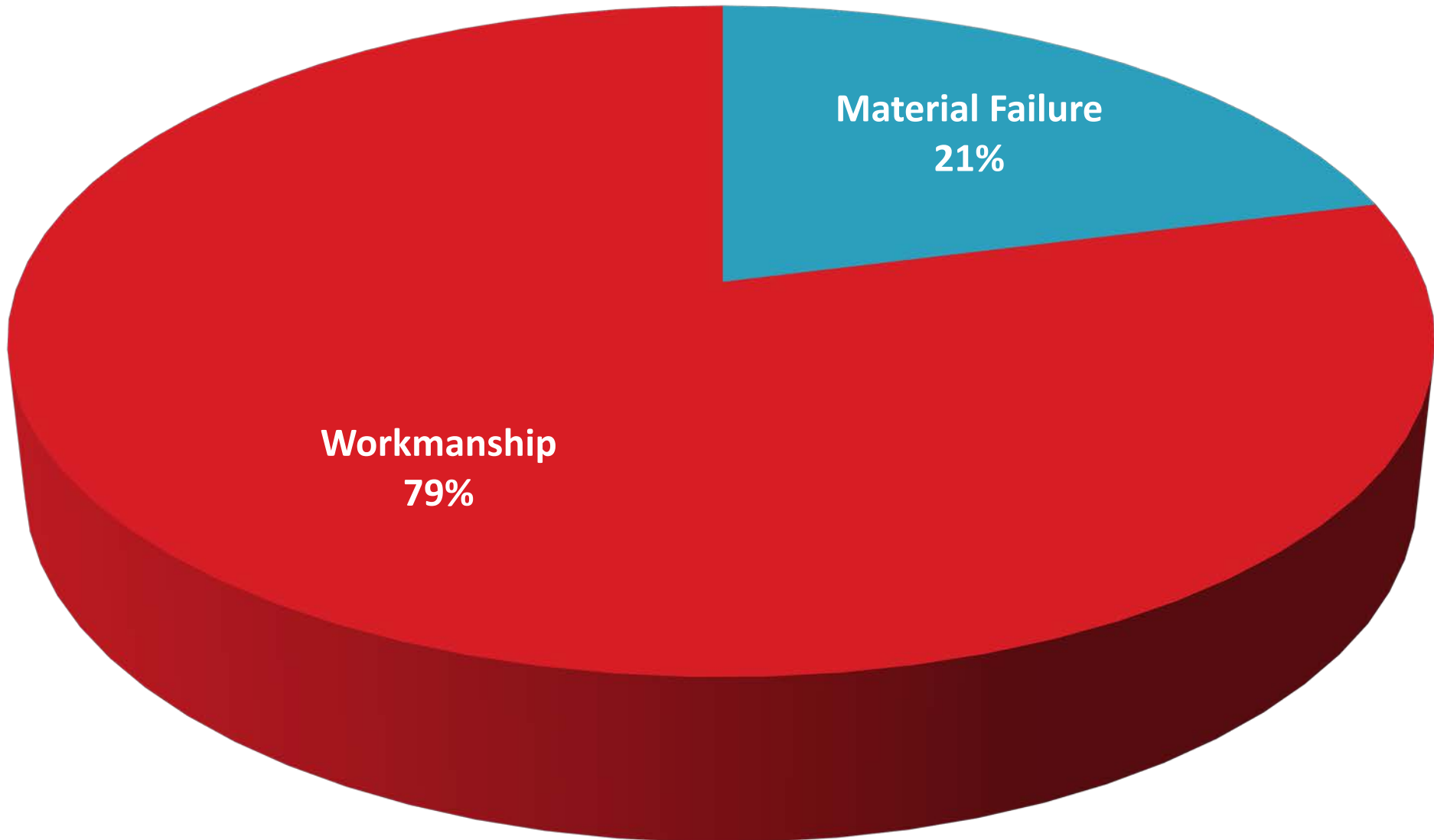
What is Construction?

Construction Causes of Failure



Source : IBA Consultants, Inc

Vermont Construction Causes of Failure

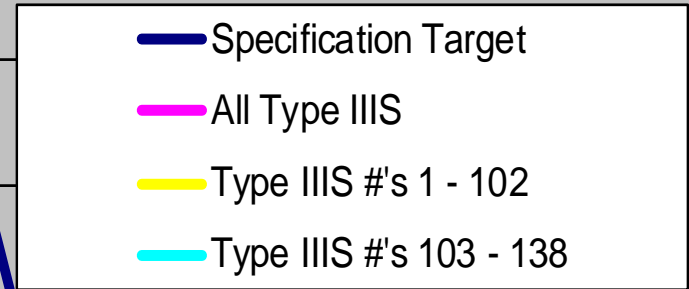


Material Failure?



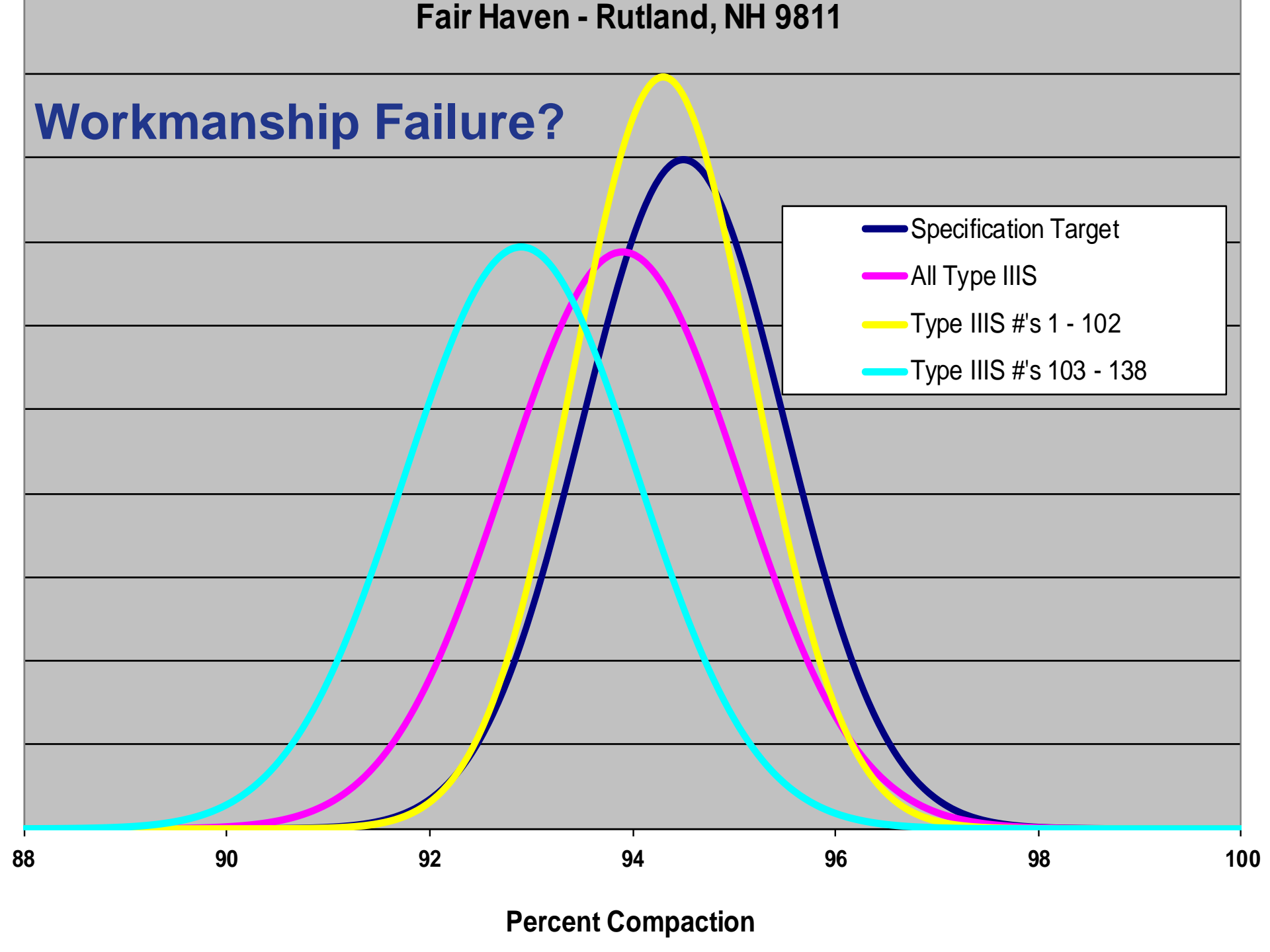
Fair Haven - Rutland, NH 9811

Workmanship Failure?



88 90 92 94 96 98 100

Percent Compaction



Ramifications: What Did We Do?

- ETG Scanning Tour / Formed
- Moratorium on Cement at Executive Level
- **Had to Regain Executive Trust** / Buy in with approach to Specifications
- **RSB Scanning Tour (Agency Cross Section)**
 - Recommended Spec Revisions / Improvements (Redline)
 - **Workmanship and Material**-Related revisions in an Effort to improve **Field Performance**
- Solicited **IAP** and Other Assistance
 - Further Specification Revisions / Improvements (Blueline)
 - Ghost Implementation 2015 / Shadow 2016

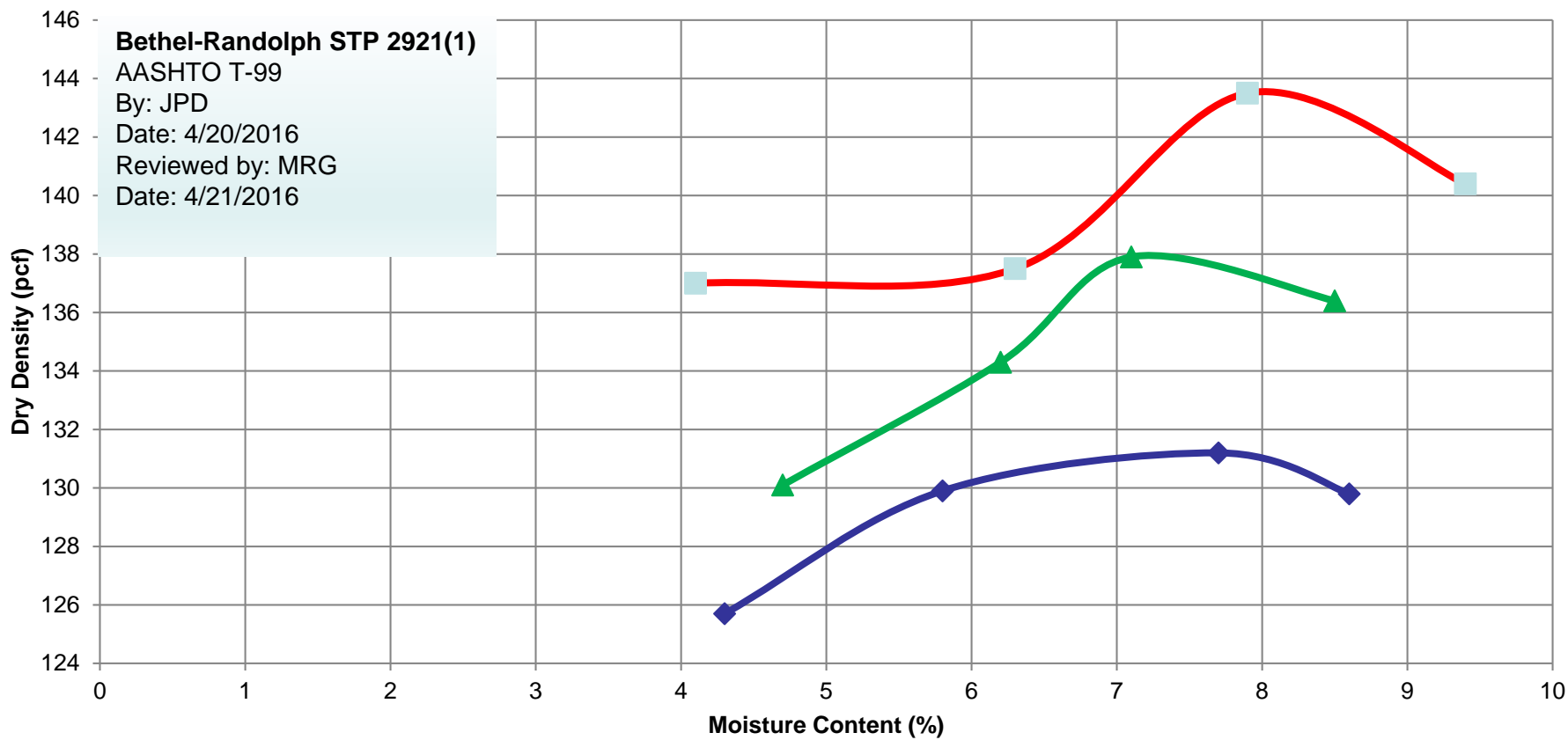
Ramifications: What Did That Do?



- Did we get results?
- Did we improve our specifications?
- The jury is still out but here are a few examples of where we went with FDR (Remembering Longitudinally Differing Material)

M-D Curves – Contractor QC

MD Curves For RSB



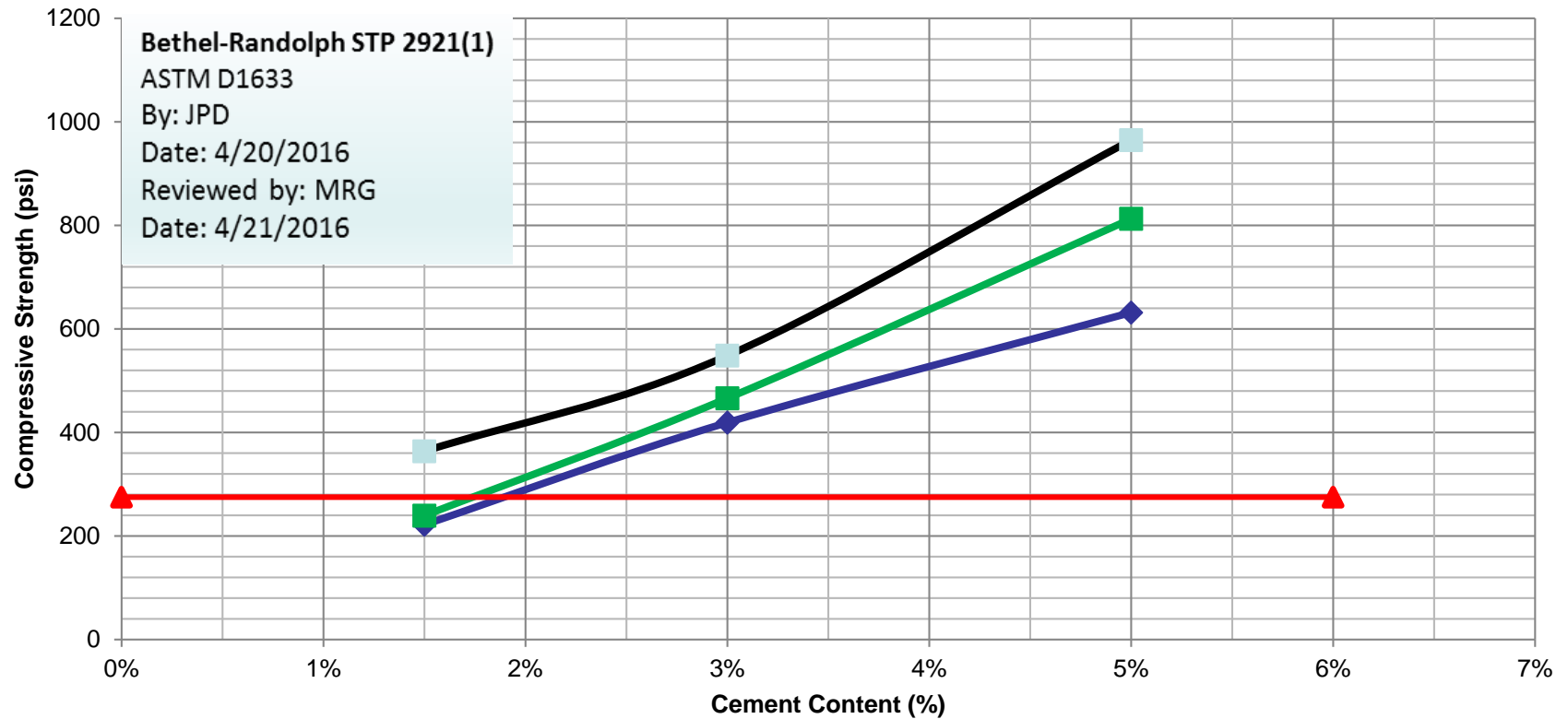
◆ Blend A: 100% Subbase

■ Blend B: 100% Aggregate

▲ Blend C: 50% Subbase, 50% Aggregate

PC Content – Contractor QC

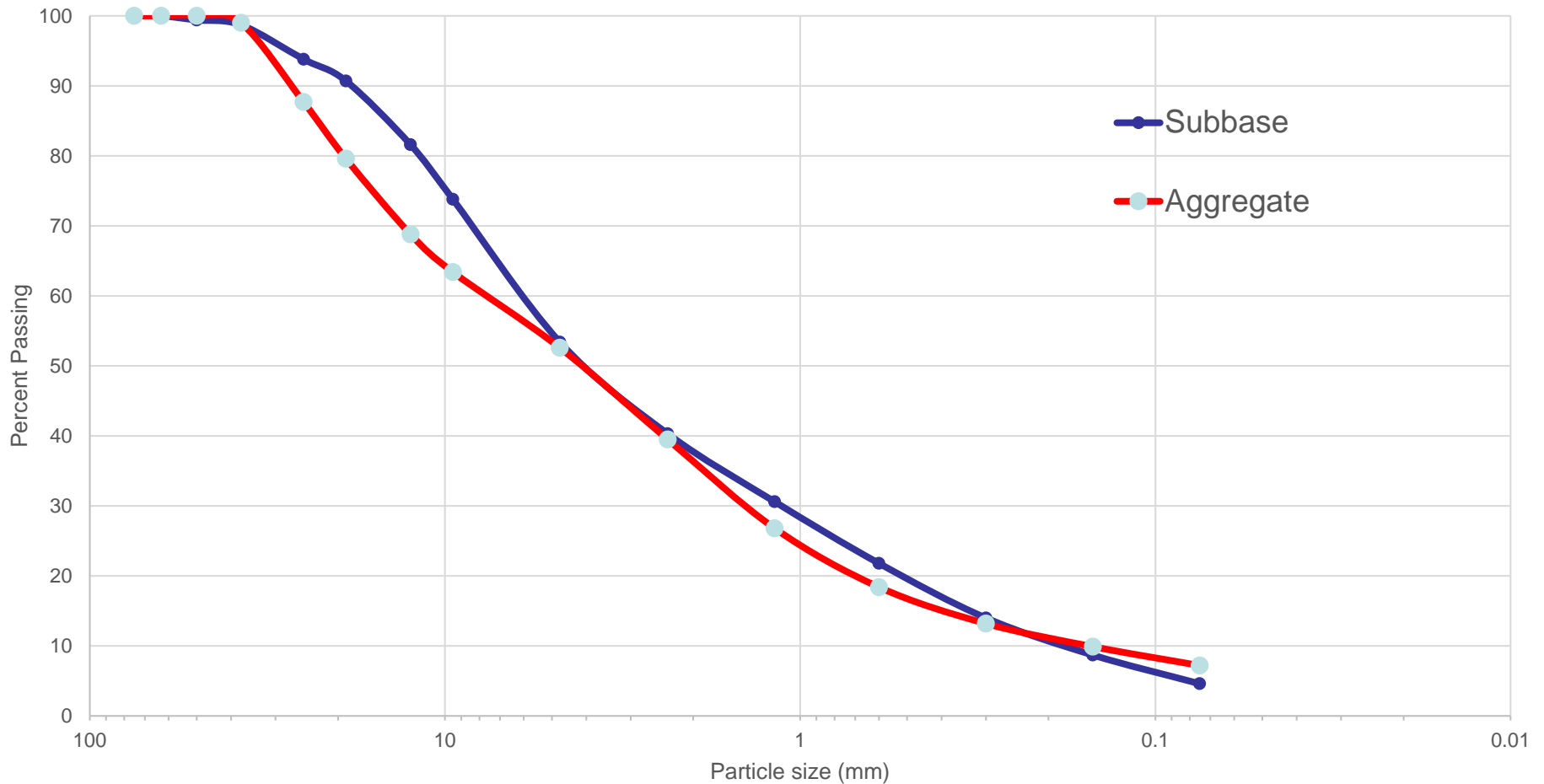
Blends A-C Compressive Strength with Trials Averaged



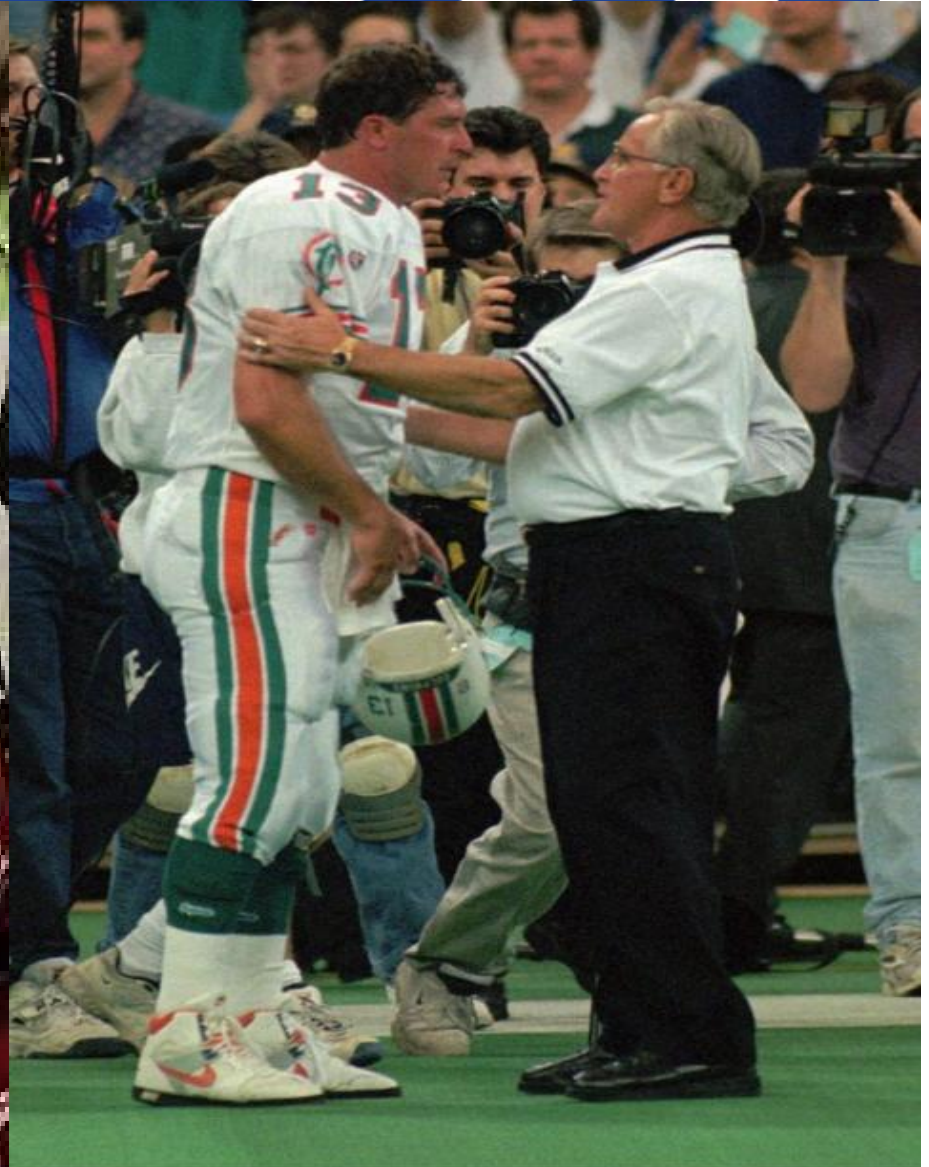
◆ Blend A: 100% Subbase ■ Blend B: 100% Aggregate ■ Blend C: 50% Aggregate, 50% Subbase ▲ Target Strength (275 psi)

“Supplemental Aggregate” – Contractor QC

T-27 Particle Size Analysis for Subbase and Supplemental Aggregate



Field Personnel Are Your Best Chance for Success (Or Failure)



Soil-Cement: Design and Molding 4"x4.6 Compressive Strength

Date/Time: 05/28/16					Bethel-Randolph Lab			Min	Max	
Weather: Sunny					Date Rec'd #:			Target 175PSI	350PSI	
Bethel-Project: Randolph					Lab Login #:			Lot #:	-	
AOT Contract #:					Cement Material ID: Reclaim			Sublot #:	-	
Contractor: Pike					Material #:	-		Sample Location:	Roadway	
Pay Item #:	-				Sample #:	-		Station:	0	
Source: Road way					Sample Type:	-		Offset:	0	
PII Job Number 315134.00					Mike Sampled Dunican By/Cert. #: #1451			#REF!		

Determination of Compressive Strength

	Compressive Strength, PSI 72 Hour									
Station Number	A74+00LT	A67+00LT	A76+00RT	A65+00RT	A42+00LT	A35+00RT				
Specimen Number	1	2	3	4	5	6	7	8	9	10
Specimen diameter, mm	101	101	101	101	101	101	101	101	101	101
Correction factor for Surface area	0.35	0.35	0.4	0.35	0.35	0.3				
Cement Content, %		1.25			1.25			1.25		
Total load, pounds	812.0	793.0	1,195.0	795.0	795.0	654.0				
Corrected surface area of specimen, inches² of	4.35	4.35	4.97	4.35	4.35	3.73	0.00	0.00	0.00	0.00
Avg. unit load, psi	186.8	182.4	240.6	182.9	182.9	175.5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cured days	3	3	3							

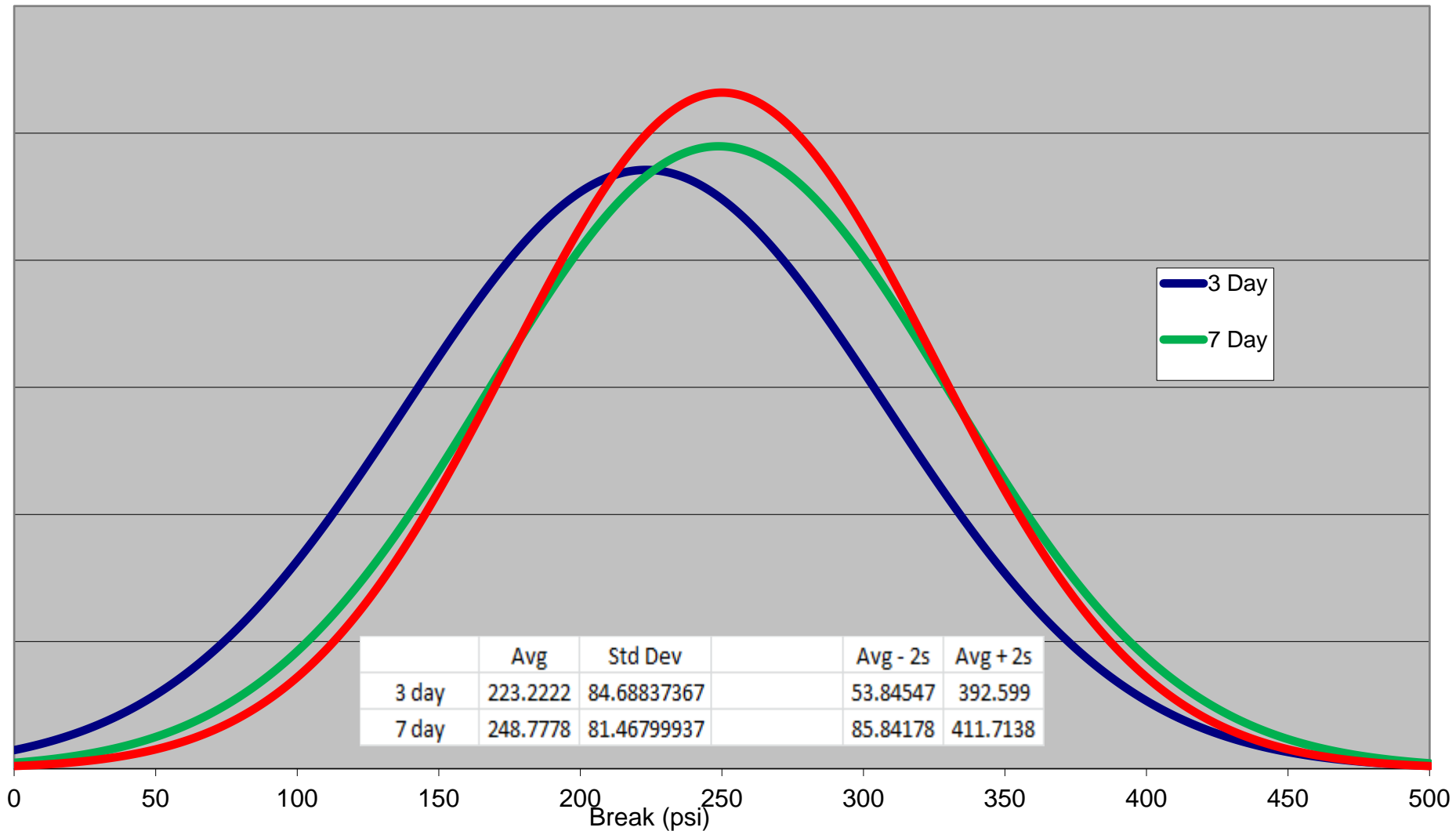
Specification Revisions



- Agency Mix Design Based on Contractor Sampling
- Required QC Plan
- Defined “Supplemental Aggregate”
- Equipment Requirements
- Tightened Moisture Requirements
- 3- and 7-Day Split Molds Allowing QC Feedback
- Cement Application / Monitoring
- Fog Seal Required
- Microcrack Emphasized
- Soils Trailer Required
- Field Staff Roundtables

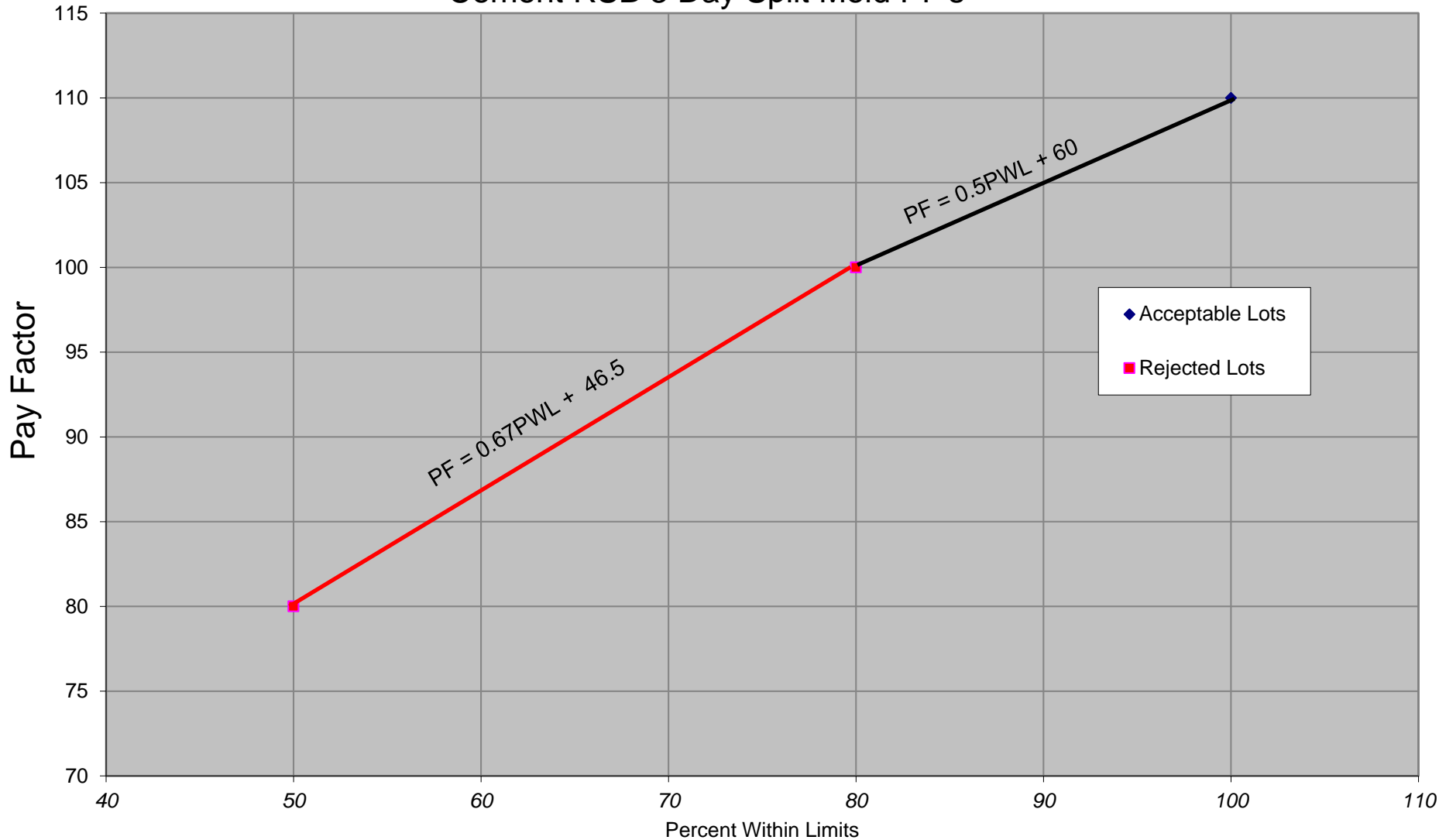
Did We Get What We Wanted?

Split Mold Break Normal Distributions



Vermont Shadow PWL / PF

Cement RSB 3 Day Split Mold PF's



PRS Order Of Importance in VT



- Get Rid of the “Us vs Them” Mindset
- Belay Complacency through “Years of Experience” or “That’s How We’ve Always Done It” While Respecting the Same
- Solicit and Gain (Or Regain in VT’s case) Executive Support
- Engage All Internal Parties
- Engage Available External Parties Through IAP or Other Efforts
- Improve Training / Communication
- Believe that a “Design” is Achievable and Above a “Recipe”
- Repeat

PRS, If Confident In Your Game, Should Lessen or Equalize the Risk for Both Parties



Thoughts?

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