



SHRP2 R07 Targeted Assistance Program

Furthering the Use of Performance Specifications

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U.S. Department of Transportation
Federal Highway Administration

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Project Partnership within FHWA

Brad Neitzke, Federal Lands Highway

Richard Duval, FHWA Turner Fairbank Highway Research Center



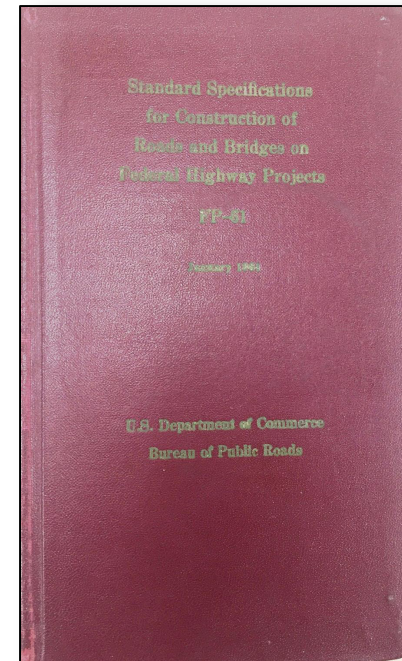
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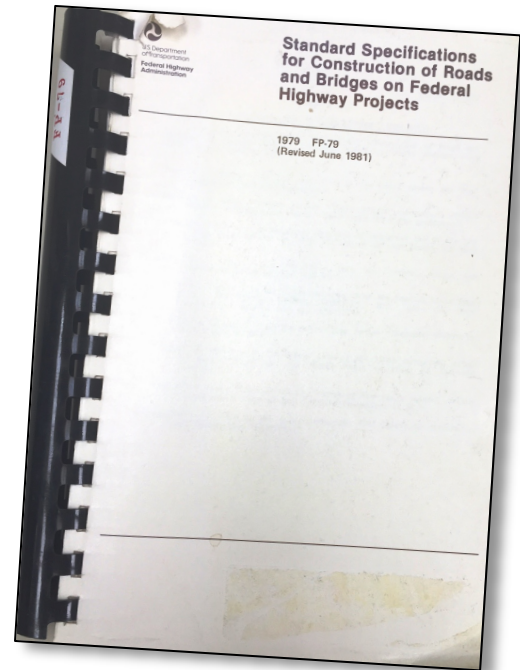
HMA Progression of Specifications

- **1960's Federal Specifications**
 - Broadband gradation requirements
 - Asphalt content by weight during mixing
 - Asphalt cement by certification
 - Methods of manufacture



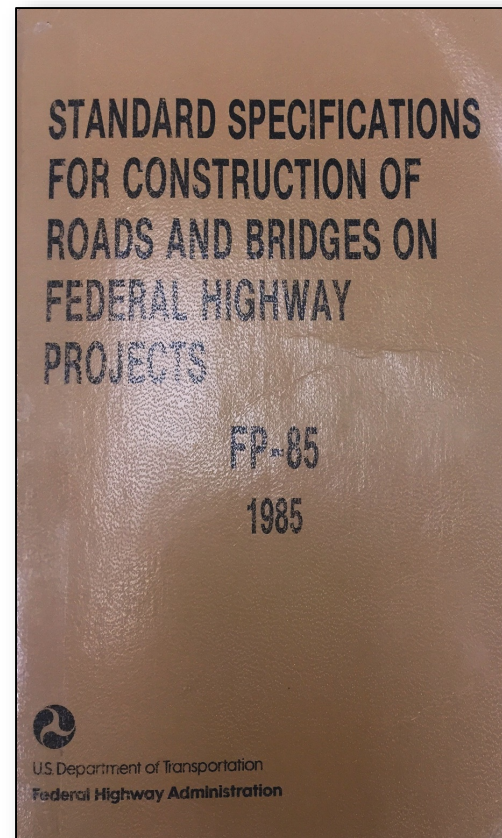
HMA Progression of Specifications

- **1970's Federal Specifications**
 - Gradation target values and tolerances
 - Asphalt content target and tolerance
 - Density
 - Limited asphalt cement testing
(primarily certification)



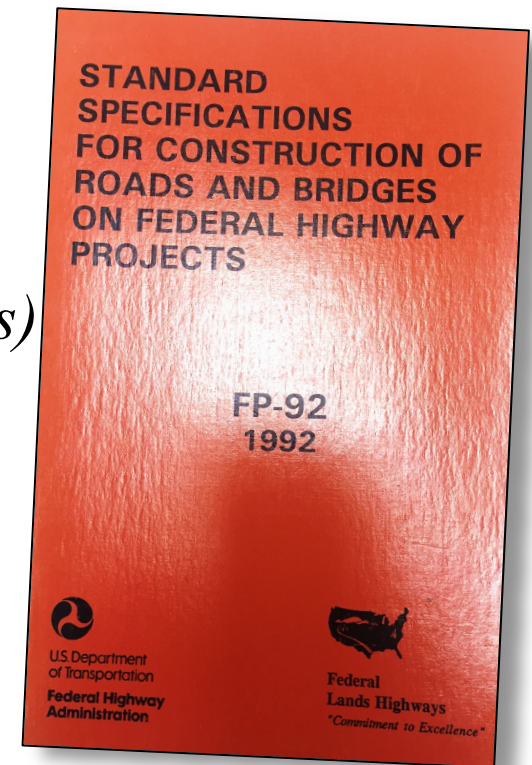
HMA Progression of Specifications

- **1980's Federal Specifications**
 - Gradation with target value and tolerance
 - Asphalt content with target value and tolerance
 - Density
 - Thickness
 - Asphalt cement testing – limited certification
 - Statistical acceptance
 - Pay lots and pay factors



HMA Progression of Specifications

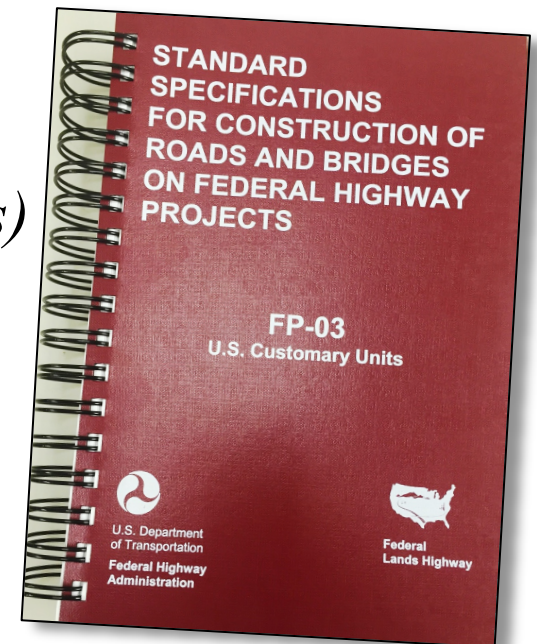
- **1990's Federal Specifications**
 - Gradation with target value and tolerance
 - Asphalt content with target value and tolerance
 - Density
 - Asphalt binder testing (*Performance Grades*)
 - Smoothness measurement with pay adjustments (*Profilograph*)
 - Contractor testing with agency verification
 - Statistical acceptance
 - Pay lots and pay factors



HMA Progression of Specifications

- **2000's Federal Specifications**

- Asphalt mixture volumetrics (*VMA, Air Voids, VFA*)
- Asphalt content with target value and tolerance
- Minimum VMA
- Density
- Asphalt binder testing (*Performance Grades*)
- Smoothness measurement with pay adjustments (*Inertial Profilers*)
- Contractor testing with agency verification
- Statistical acceptance
- Pay lots and pay factors



Additional Mixture Tests

- Immersion – Compression
- Tensile Strength Ratio
- Hamburg Wheel Track Testing
- Asphalt Pavement Analyzer
- TSRST

Empirical
Tests



Performance Specifications

- **Can we...**
 - Optimize and Improve Performance?
 - Determine how volumetrics relate to performance and pavement life?
 - Develop quality adjusted pay factors that reflect “as-constructed” pavement life?

These are the objectives for this project



Project Outline – Part 1

- **Perform desktop study**
 - Past projects
 - Collect test results from construction
 - Mix design information
 - Obtain field cores of existing pavement
 - Advanced laboratory testing
 - Traffic data
- **Compare predicted life vs. “as-constructed”**
- **Compare against pay factors for completed work**

Past Projects

Yellowstone National Park

- **East Entrance Road**
 - First WMA project constructed in 2007
 - Extensive testing (*FHWA mobile lab*)



East Entrance Road

Yellowstone National Park



Typical Data – Pay Factors

Quality Levels and Pay Factors

Quality Characteristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
12.5mm	85.00	+,- 5	87.18	2.738	85	0.96
9.5mm	71.00	+,- 6	70.13	3.365	92	1.00
4.75mm	46.00	+,- 7	43.97	2.985	95	1.03
2.36mm	30.00	+,- 5	28.06	1.903	95	1.03
425µm	12.00	+,- 3	11.15	1.092	98	1.00
75µm	6.00	+,- 2	5.15	0.557	98	1.04
AC-m	5.30	+,- .5	5.44	0.329	84	0.96
SE	45.00	min	65.37	3.137	100	1.00
% FRAC	90.00	min	99.80	0.267	100	1.05
% DEN	90.00	min	93.42	1.207	100	1.05

TESTING COMPLETED
FINAL PAY FACTOR: 0.96

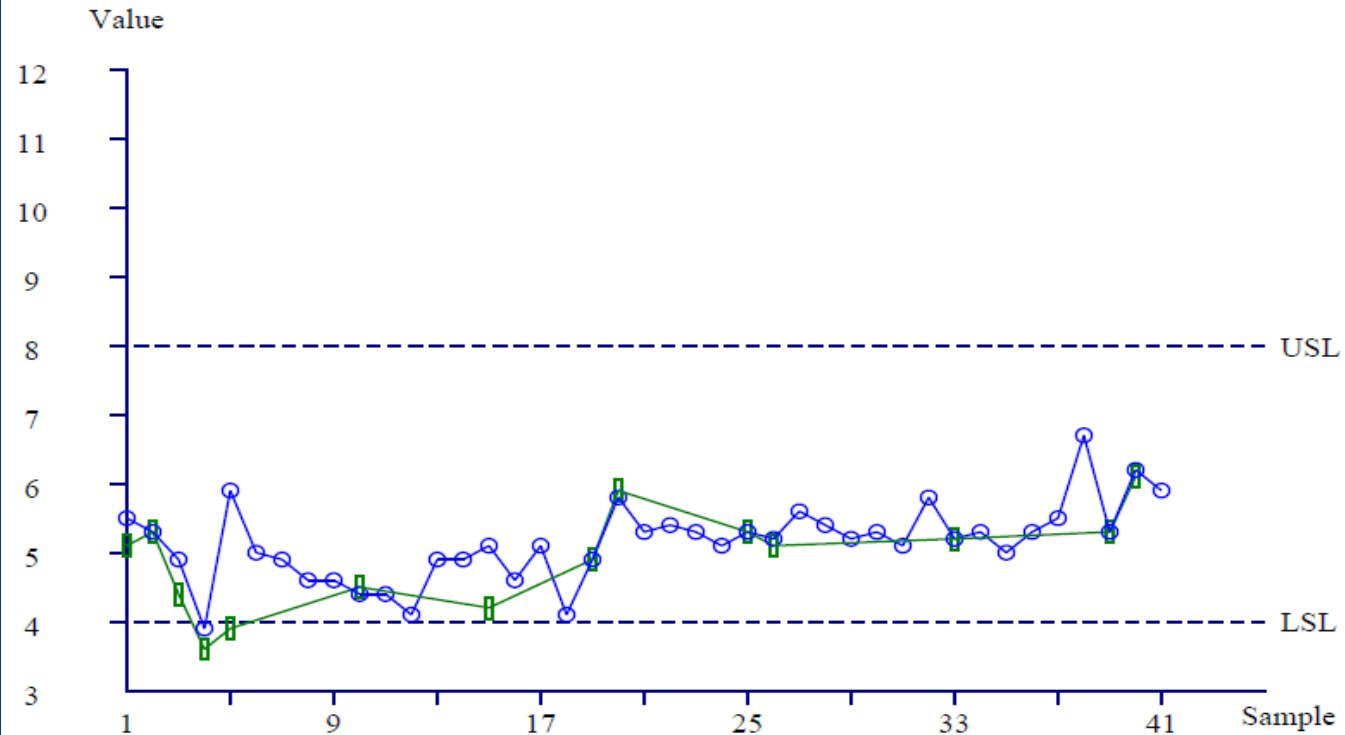
Verification Data

CONTROL CHART FOR 75 μ M SAMPLES

Project Name: East Entrance Road-Segment C
Project Number: DTFH70-04-C-00008
Project ID: WY- PRA-YELL 13(3)

Item Number: 40101
Lot Number: 1

○ Contractor's Lab
■ Central Lab



No of Samples 41, 14
Quality Level 98, 90

Mean 5.154, 4.914
Std Dev 0.557, 0.717

Target 6.000 +/- 2
Range 3.600 to 6.700

Past Projects

Grand Teton National Park

- **Eastside Highway**
 - Outside Highway Paving



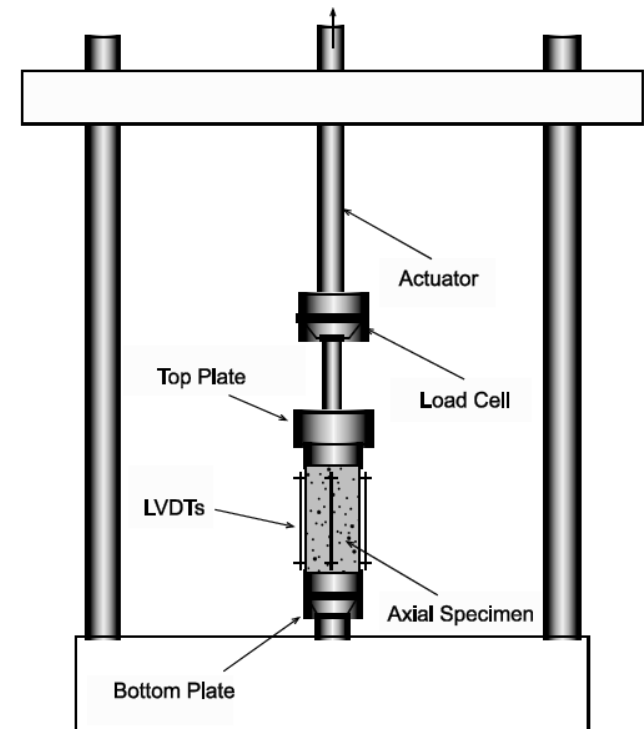
Performance Testing

- Obtain cores from existing pavement
- Advanced laboratory testing – fundamental AMPT
- In-service traffic data (*vehicle counts / traffic mix*)
- PMS / RIP data
- Performance relationships



Key Information for Desktop Study

- **Good traffic data**
- **Good “as-constructed” project data**
- **Obtain cores for AMPT testing**
 - Dynamic Modulus
 - Cyclic fatigue
 - Triaxial stress sweep



Project Outline – Part 2

- **Shadow Project**

- Skyliners Road near Bend, OR (*completed 2016*)



- Norris to Golden Gate, Yellowstone Nat'l Park (*currently under construction*)

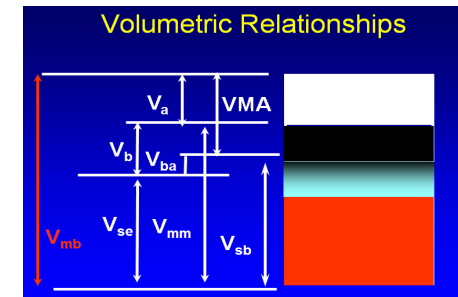
Shadow Project Data

- **Additional sampling of current project materials**
 - Performance testing
 - Use of calibrated performance models
 - Predicted pavement life vs. volumetric properties
 - “As constructed” pavement life vs. pay factors
 - AMPT and LVECD analysis

Shadow Project Data

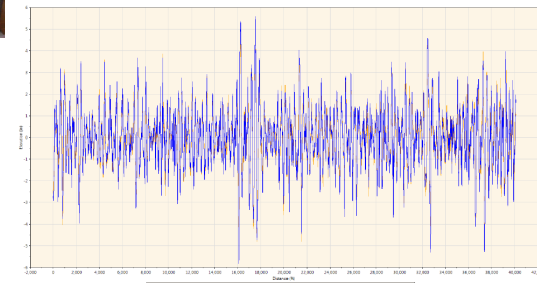
- **Asphalt concrete mix design information**

- Contractor mix design
- Agency verification
- TFHRC confirmation and comparison



- **Acceptance Quality Characteristics (AQC's)**

- Asphalt content
- VMA
- Density
- Asphalt binder
- Roughness (*IRI Evaluation*)



Project Construction Data

QUALITY LEVEL ANALYSIS & PAY FACTOR COMPUTATIONS

Project Name: Skyliners Road Improvements
 Project Number: OR PFH 247(1)
 Project ID: DTFH7015C00002

Item Number: 40101-5600
 Lot Number: 3
 Lab: Contractor Lab

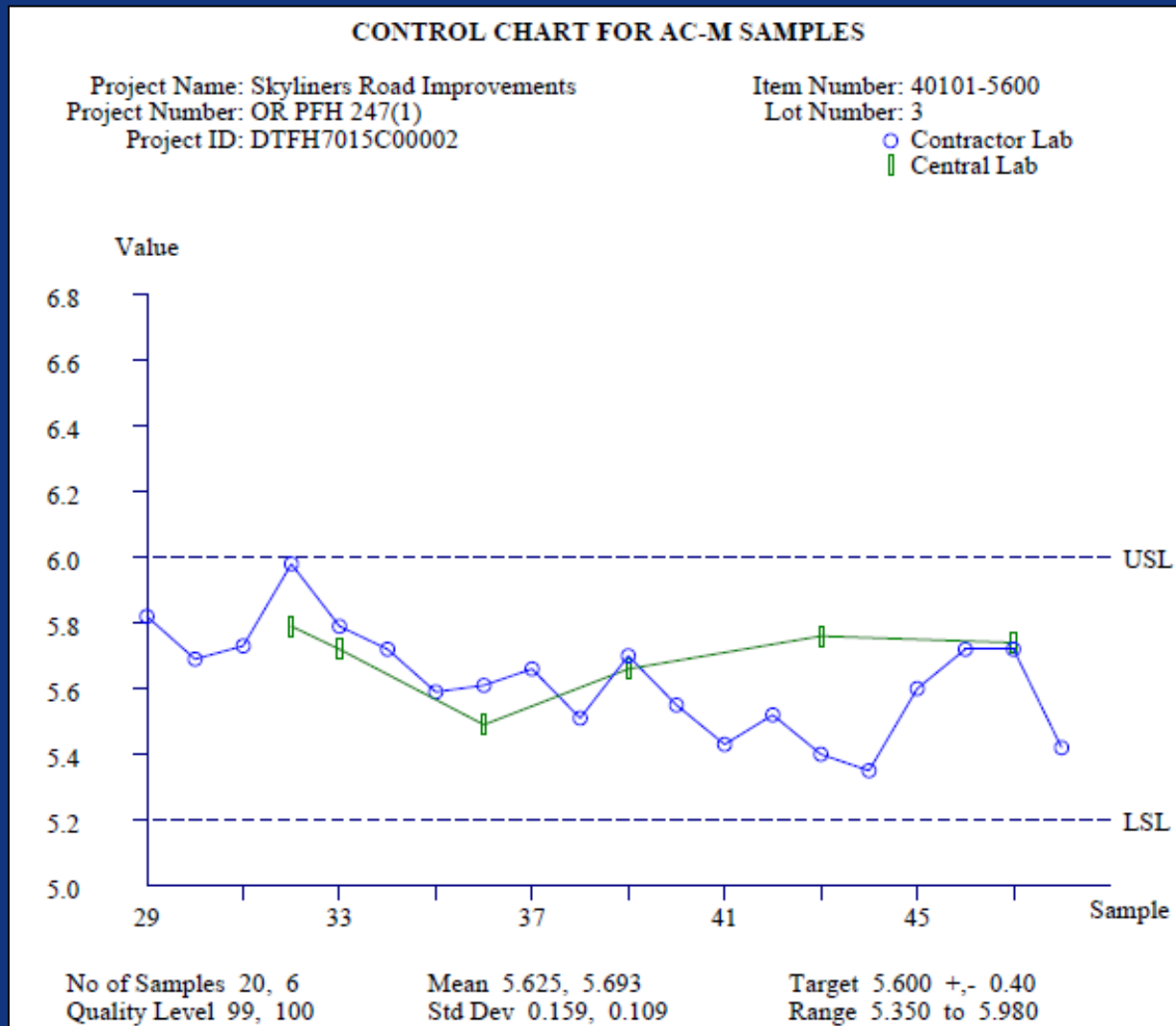
Quality Levels and Pay Factors

Quality Characteristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
AC-m	5.60	+,- 0.40	5.63	0.159	99	1.04
VMA	14.00	min	16.01	0.408	100	1.05
% DEN	91.00	min	92.90	0.877	99	1.04
VOIDS	info		4.34	0.696	---	---
VFA	info		72.97	3.809	---	---
Rice-SG	info		2.562	0.008	---	---
3/4"	info		100.00	0.000	---	---
1/2"	info		94.00	1.257	---	---
3/8"	info		86.35	1.899	---	---
#4	info		63.45	2.911	---	---
#8	info		39.65	3.407	---	---
#30	info		17.80	1.056	---	---
#50	info		12.90	0.912	---	---
#200	info		7.42	0.766	---	---

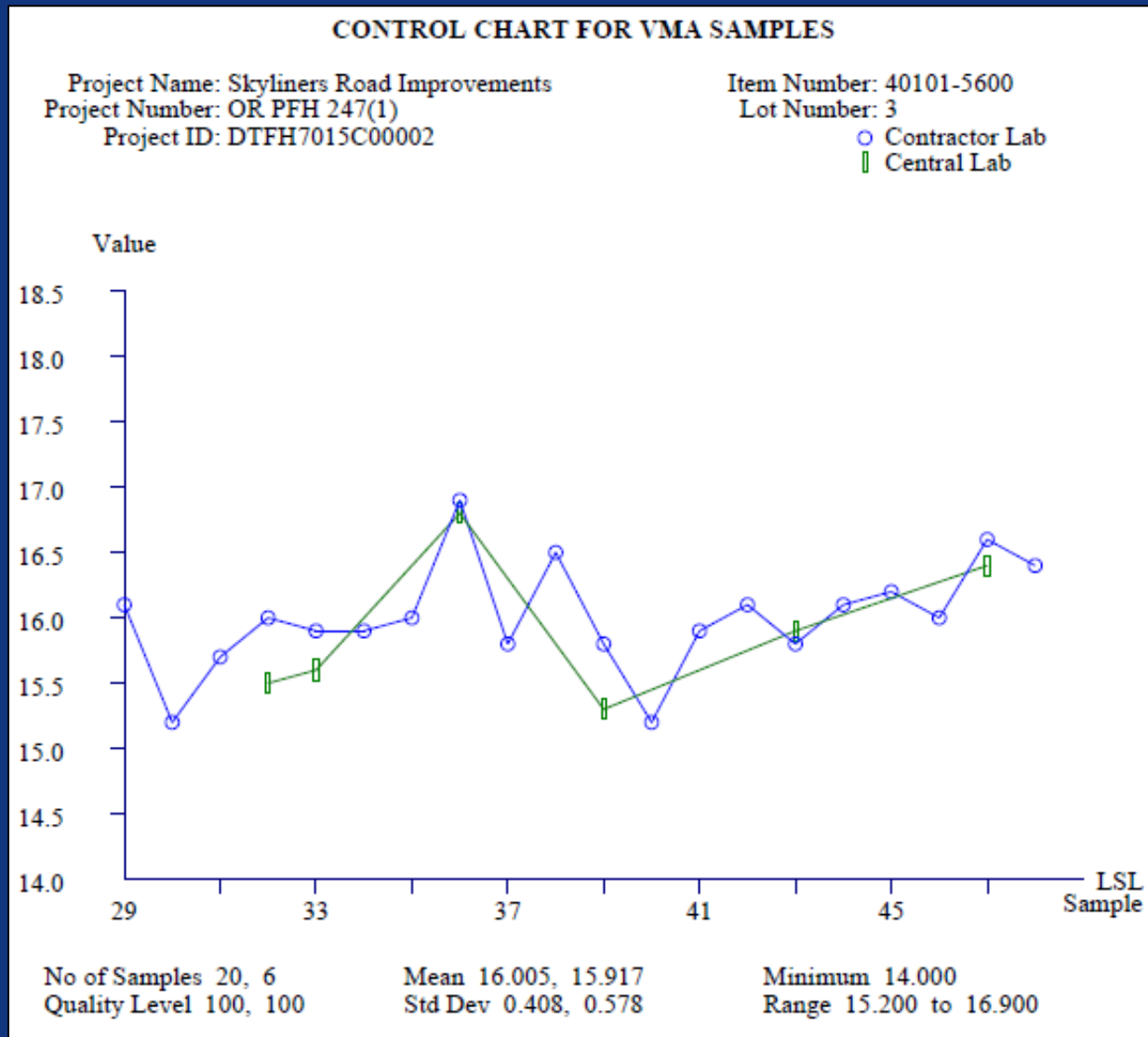
Project Construction Data

Sample	Binder Pay Factors						Pay Factor
	DSRorg	DSRres	DSRpav	BBR s	BBR m	DTstrn	
1	1.01	1.01	1.01	1.01	1.01	1.01	1.01
2	1.01	1.01	1.01	1.01	1.01	1.01	1.01
3	1.01	1.01	1.01	1.01	1.01	1.01	1.01
4	1.01	1.01	1.01	1.01	1.01	1.01	1.01
5	1.01	1.01	1.01	1.00	1.00	1.00	1.00
6	1.01	1.01	1.01	1.00	1.01	1.00	1.00
7	1.01	1.01	1.01	1.00	1.01	1.00	1.00

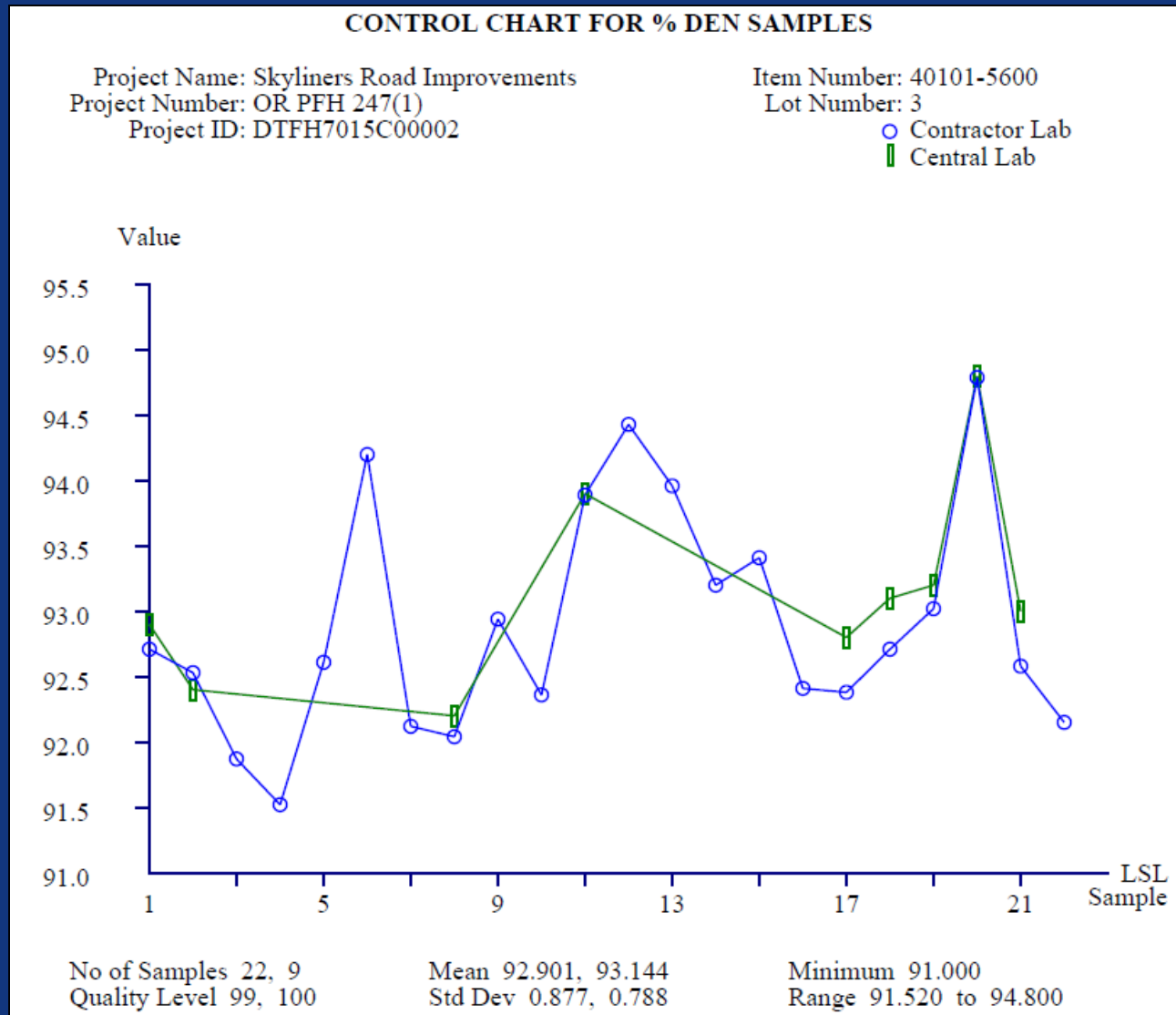
Project Construction Data



Project Construction Data



Project Construction Data



Deliverables

- Predicted pavement performance vs. Volumetrics
- Determine as-constructed pavement life compared against PWL pay factors
- Development of draft performance specification
- Superpave Volumetrics relation to performance testing



Questions?

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