CC5 HWD Data Analysis

Federal Aviation Administration

Airport Pavement Working Group Meeting

DATE : 04/16/2013

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Support Contractor for FAA

AC 150/5370-11B

Use of Nondestructive Testing in the Evaluation of Airport Pavements

U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: Use of Nondestructive Testing in the Evaluation of Airport Pavements	**Date:** 9/30/11 **Initiated by:** AAS-100	**AC No.:** 150/5370-11B **Change:**

1. Purpose. This advisory circular (AC) focuses on nondestructive testing (NDT) equipment that measures pavement surface deflections after applying a static or dynamic load to the pavement. It also briefly introduces other types of nondestructive measuring equipment to illustrate how supplementing NDT data with other test data may improve the quality and reliability of the pavement evaluation.

2. Application. The Federal Aviation Administration (FAA) recommends the guidelines and standards in this AC for data collection equipment and methods of data analysis used to conduct NDT. In general, use of this AC is not mandatory. However, use of this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assurance No. 34, "*Policies, Standards, and Specifications*," and PFC Assurance No. 9, "*Standard and Specifications*."

3. Cancellation. AC 150/5370-11A *Use of Nondestructive Testing Devices in the Evaluation of Airport Pavements*, dated December 29, 2004, is cancelled.

4. Principal Changes.

a. Since the previous revision, the FAA has developed and implemented the pavement design program FAARFIELD. Chapter 8 - NDT-BASED EVALUATION AND DESIGN INPUTS is updated to reflect the requirements of FAARFIELD rather than the previous design program LEDFAA.

Usage of NDT Data

- **Evaluate the load-carrying capacity of existing pavements.**
- **Provide material properties of in-situ pavement and subgrade layers for the design of pavement rehabilitation alternatives that include extensive maintenance and repair work (restoration), functional and structural overlays, partial reconstruction (for example, runway keel), and complete reconstruction.**
- **Compare parts of a pavement system to each other to gain relative strength and/or condition within that section. The results of the NDT can show which segments are the strongest and which are the weakest. These results can then be used to focus follow-on testing.**
- **Provide structural performance data to supplement pavement condition index (PCI) survey data in an Airport Pavement Management System (APMS).**

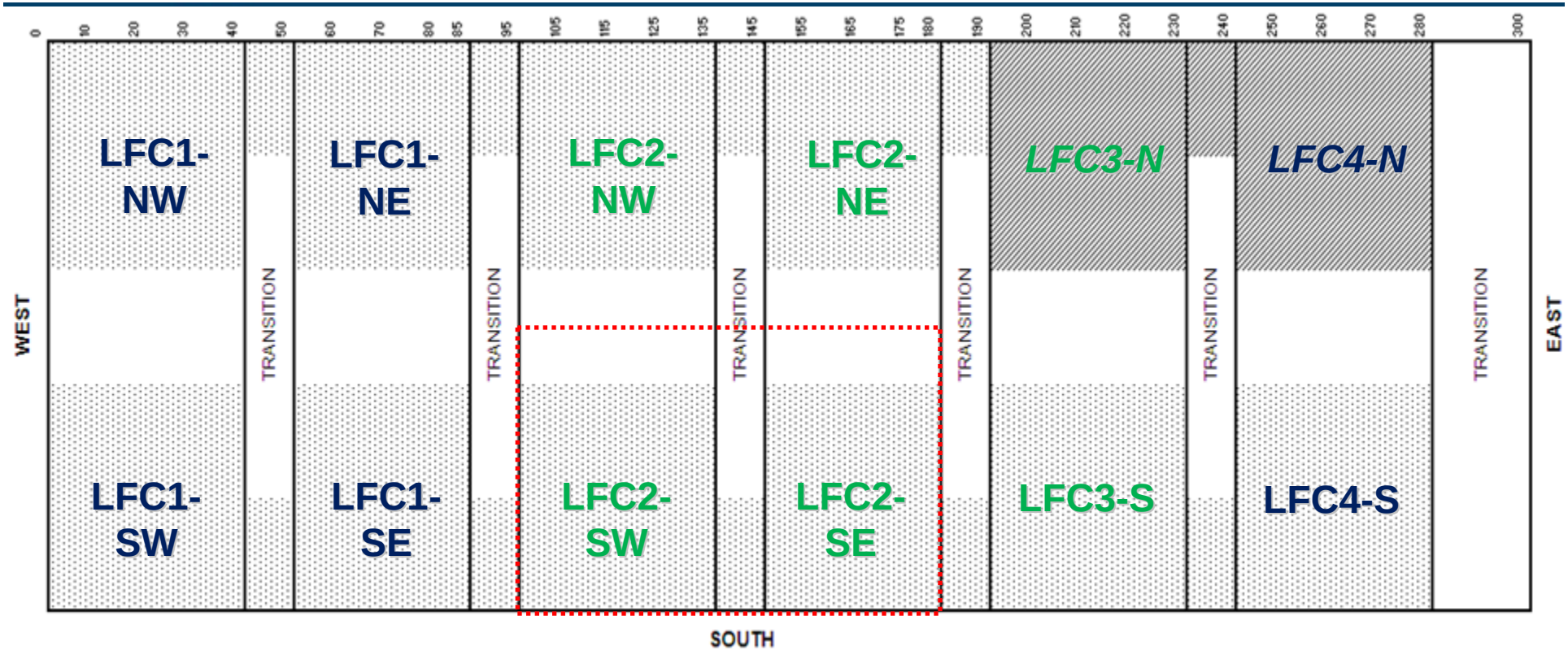
-AC150-5370/11E

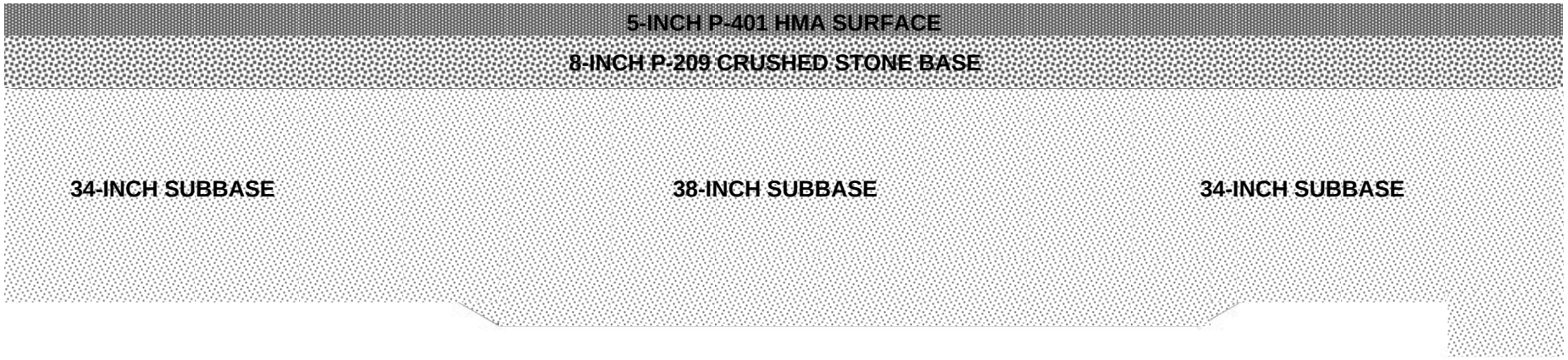
HWD Data Analysis

To obtain those *pavement characteristics* that are needed to identify the causes of pavement distresses, conduct a pavement evaluation, or perform a strengthening design:

- **ISM, DSM, and normalized deflections.**
- **Back-calculated elastic modulus of pavement layers and subgrade.**
- **Correlations to conventional characterizations (for example, California Bearing Ratio [CBR], k).**
- **Crack and joint load transfer efficiency.**
- **Void detection at PCC corners and joints.**

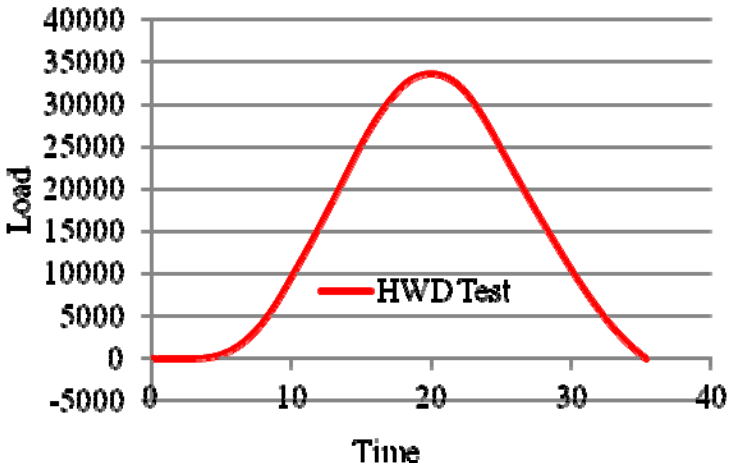
-AC150-5370-11B

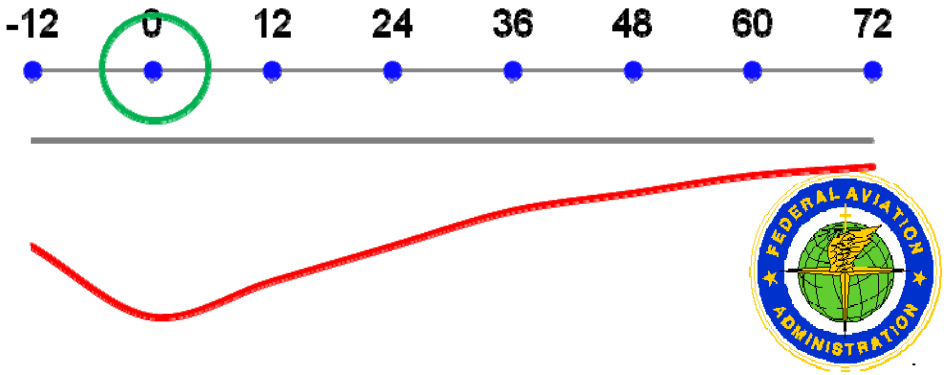




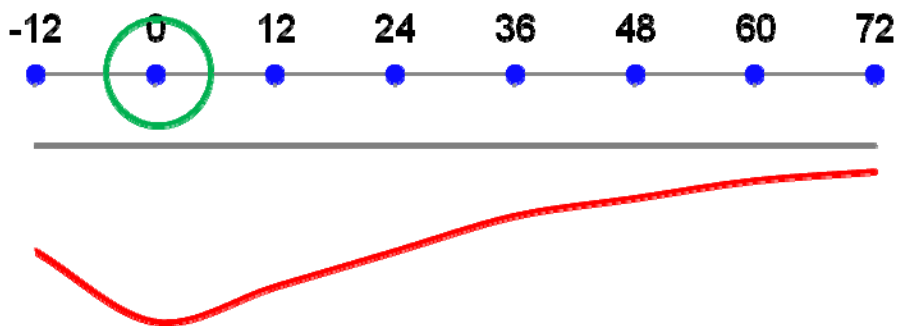
DuPONT CLAY SUBGRADE (TARGET CBR=3.4, FINAL CBR FOR LIFE PREDICTION=3.15)

Heavy Weight Deflectmeter (HWD)





Analysis 1: Impact Stiffness Modulus (ISM)



ISM_i=Load/Deflection at Sensor i

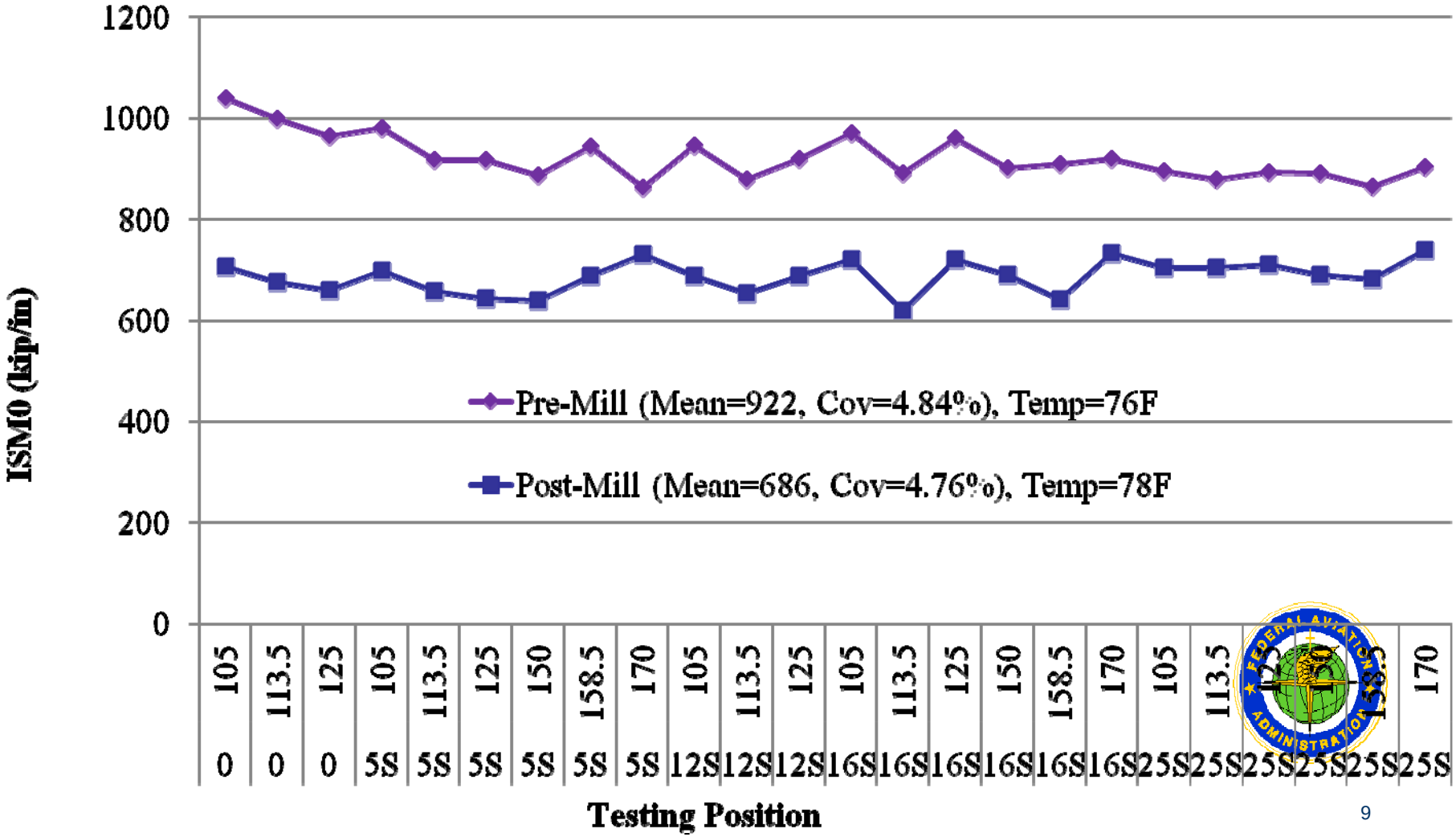
Usage:

check construction uniformity

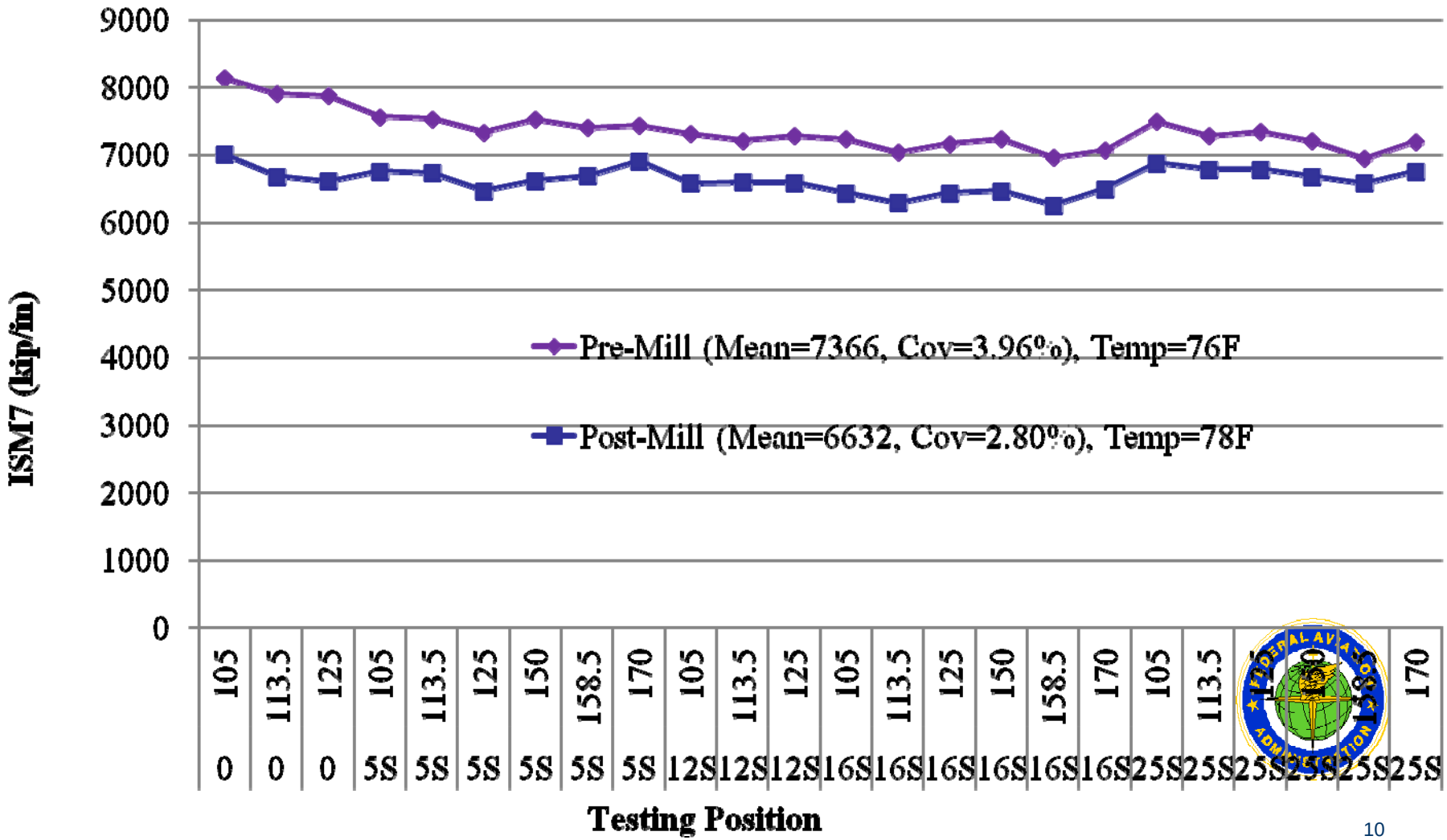
track pavement strength change

CC5-LFC2S Milling

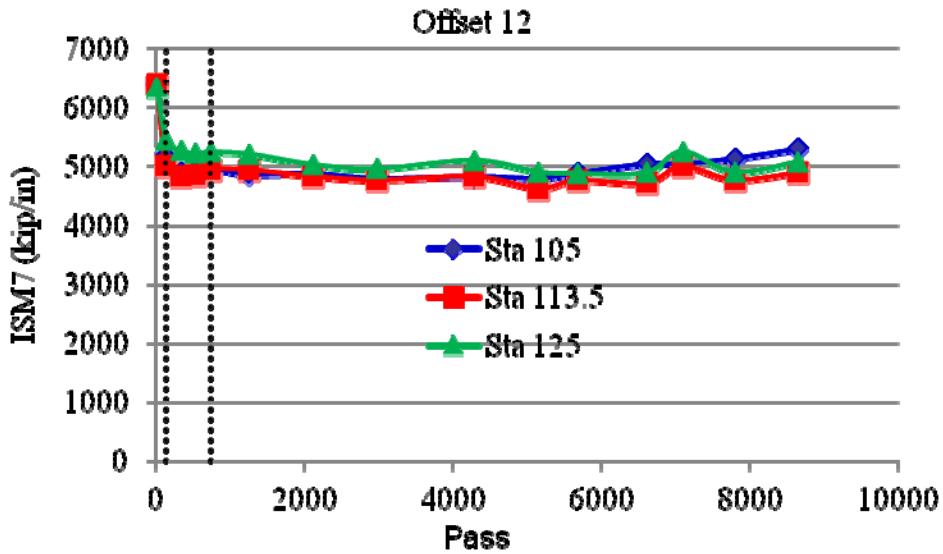
ISM: Milling Uniformity Check



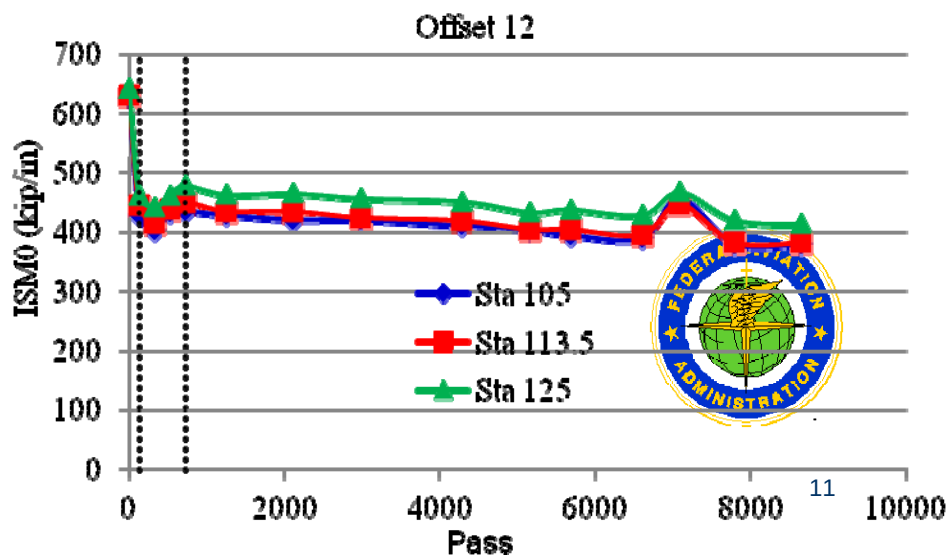
ISM: Milling Uniformity Check



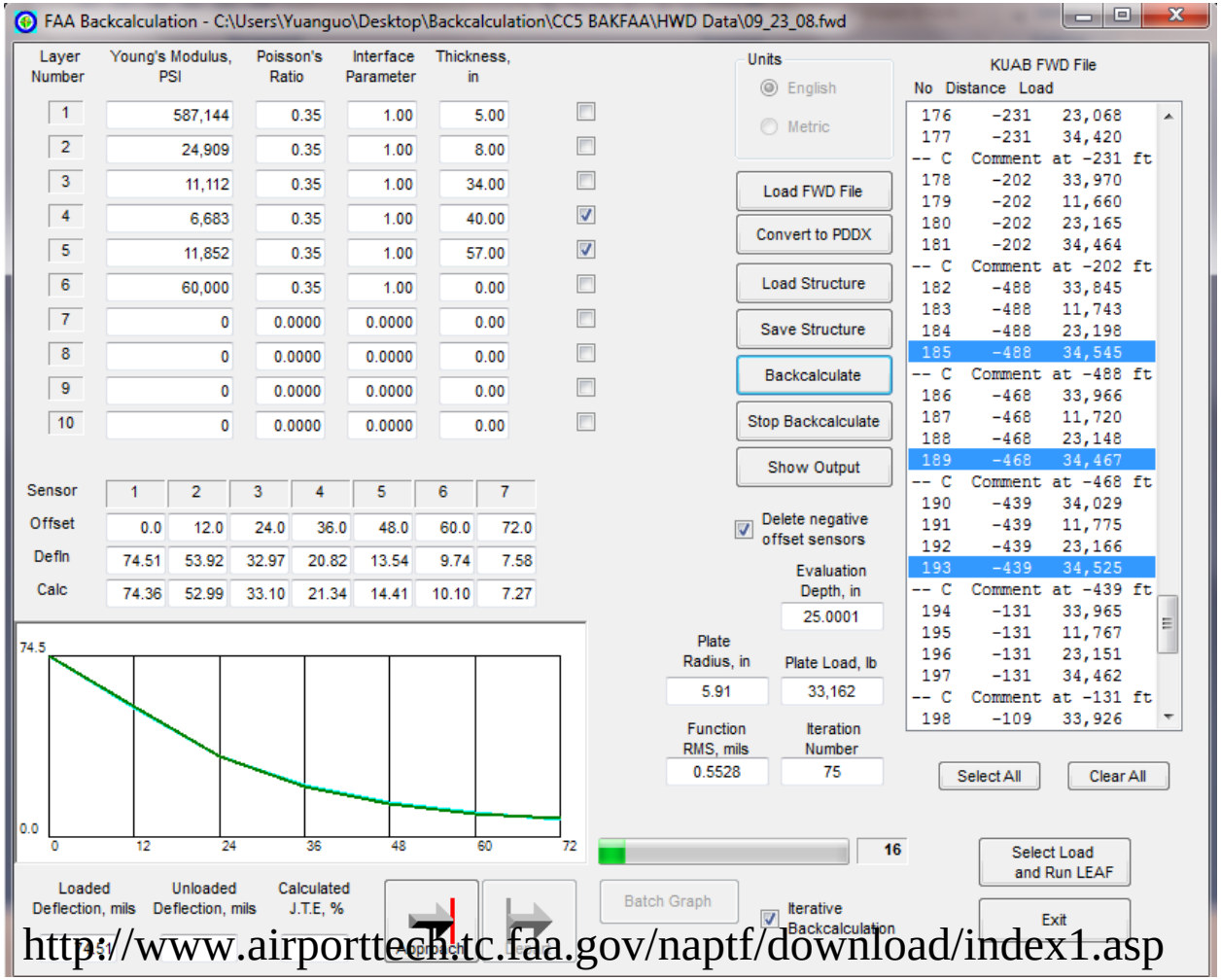
ISM: Pavement Strength Change



Increasing the interval for HWD testing is recommended



Analysis 2: Backcalculation

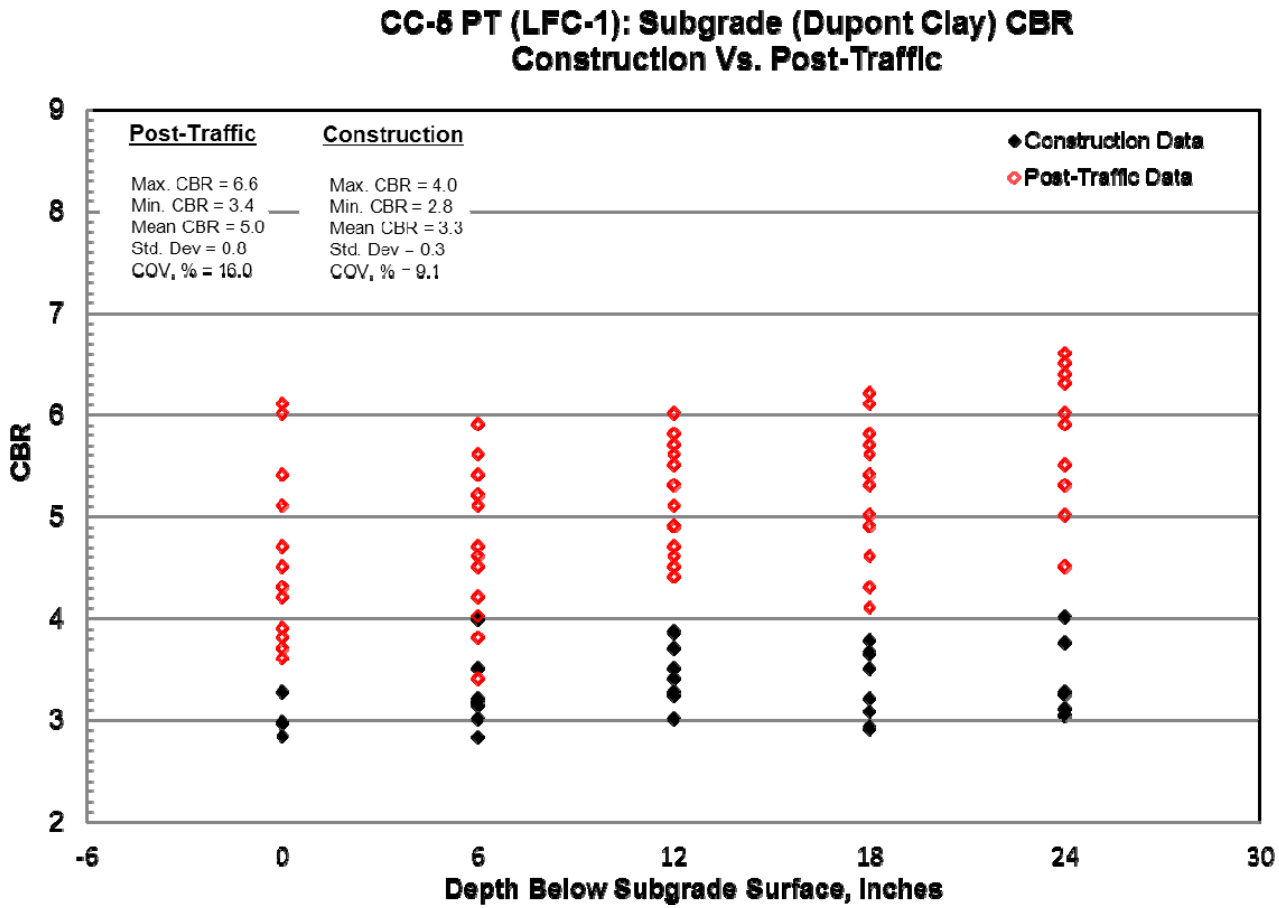


http://www.airporttech.tc.faa.gov/naptf/download/index1.asp

Usage:

Backcalculate elastic modulus of pavement layers and subgrade.

Subgrade Strengthing: CBR

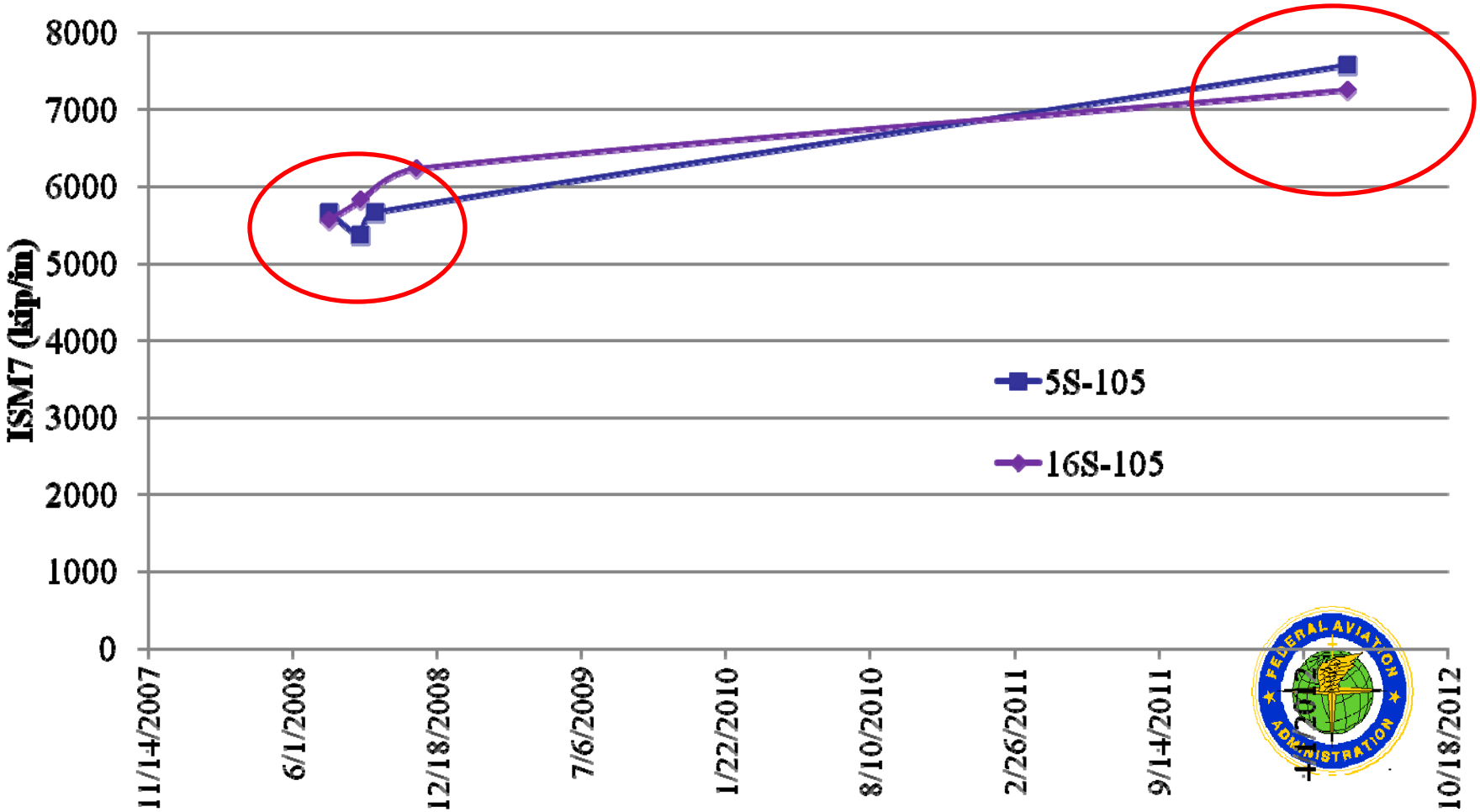


Construction Date: Summer 2008

Post-Traffic Date: Winter 2011

(Prepared by Harkanwal Brar)

Subgrade Strengthing: ISM



Backcalculated Subgrade Modulus

Construction Cycle	Testing Time	Backcalculated Subgrade Modulus (psi)	Pavement Thickness (in)
CC1	May., 1999 **(Post-Construction)**	6899 (LFS) 7325 (LFC)[1]	- 5/8/36
CC3	Aug., 2002 **(Post-Construction)**	6472 (LFC1) 7159(LFC2) 7632(LFC3) 7852(LFC4)	5/8/16 5/8/24 5/8/34 5/8/43
CC5	Jul., 2008 **(Post-Construction)**	9936(LFC1) 10427(LFC2)	5/8/34 5/8/38
	Oct.,2012 **(Post-Traffic)**	12956(LFC2S)	5/8/38

(Note 1: from McQueen e al. 2001)

Conclusions

1. ISM for the pre-mill and post-mill CC5-LFC2S has low Cov, indicating good uniformity;

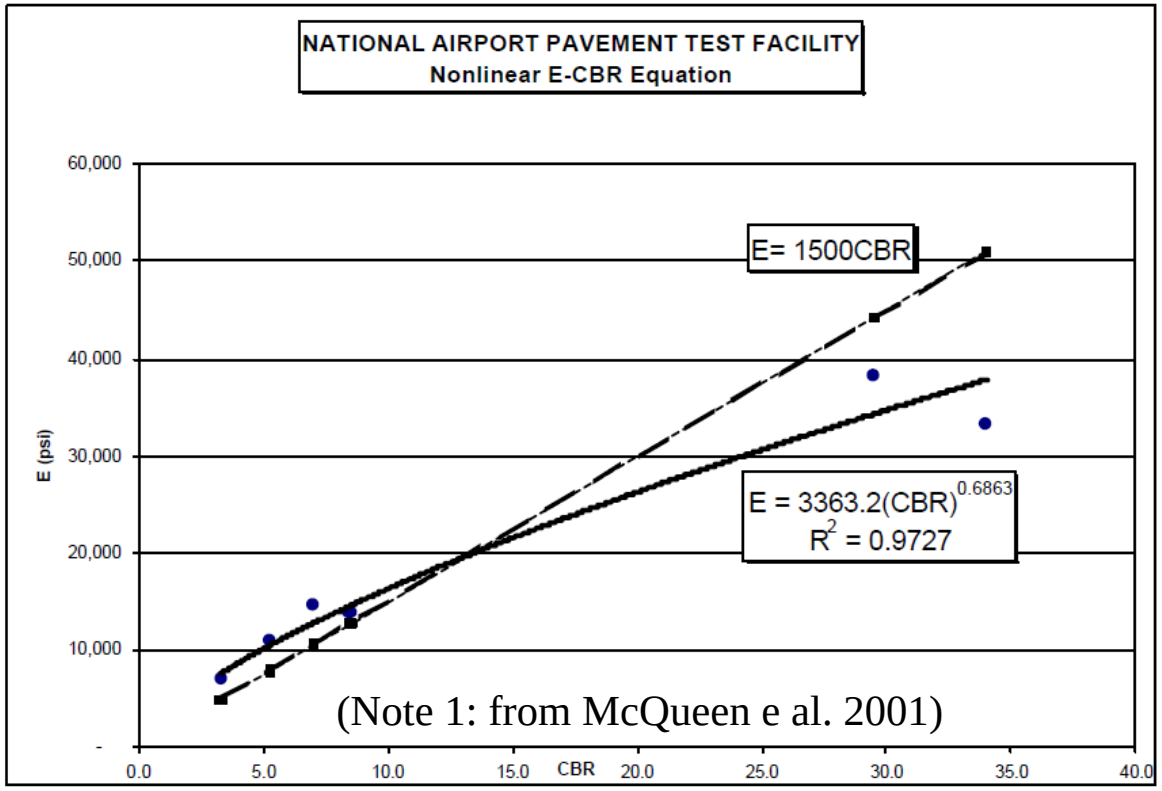
2. In trafficking, ISM first decrease dramatically, then redistributed till getting stable;

3. The backcalculated subgrade modulus increases with pavement thickness, and increases overtime from CC1 to CC5;

4. The backcalculated subgrade modulus increases from post-construction to post-traffic for CC5-LFC2S, agreeing with CBR test results.

Future Work

1. Correlation E~CBR



(Note 1: from McQueen e al. 2001)

2. Data Analysis in CC7

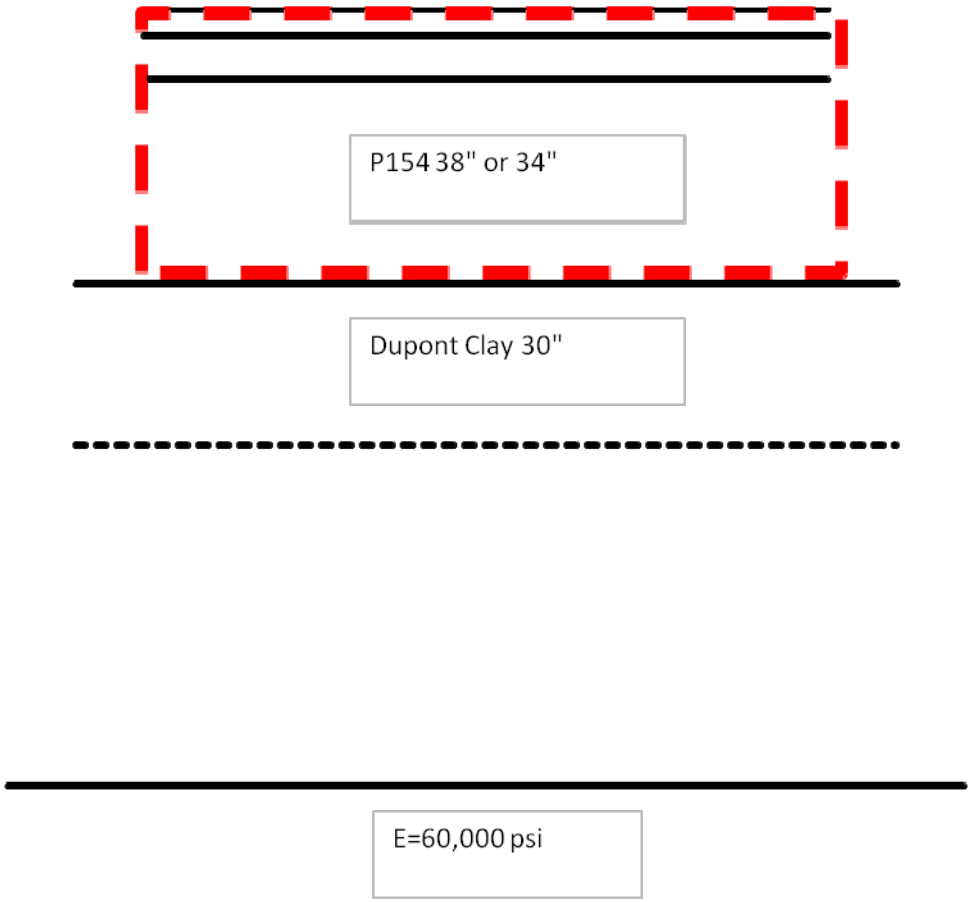
SRA HWD data collection:

Josh Davis

Henry Fermin

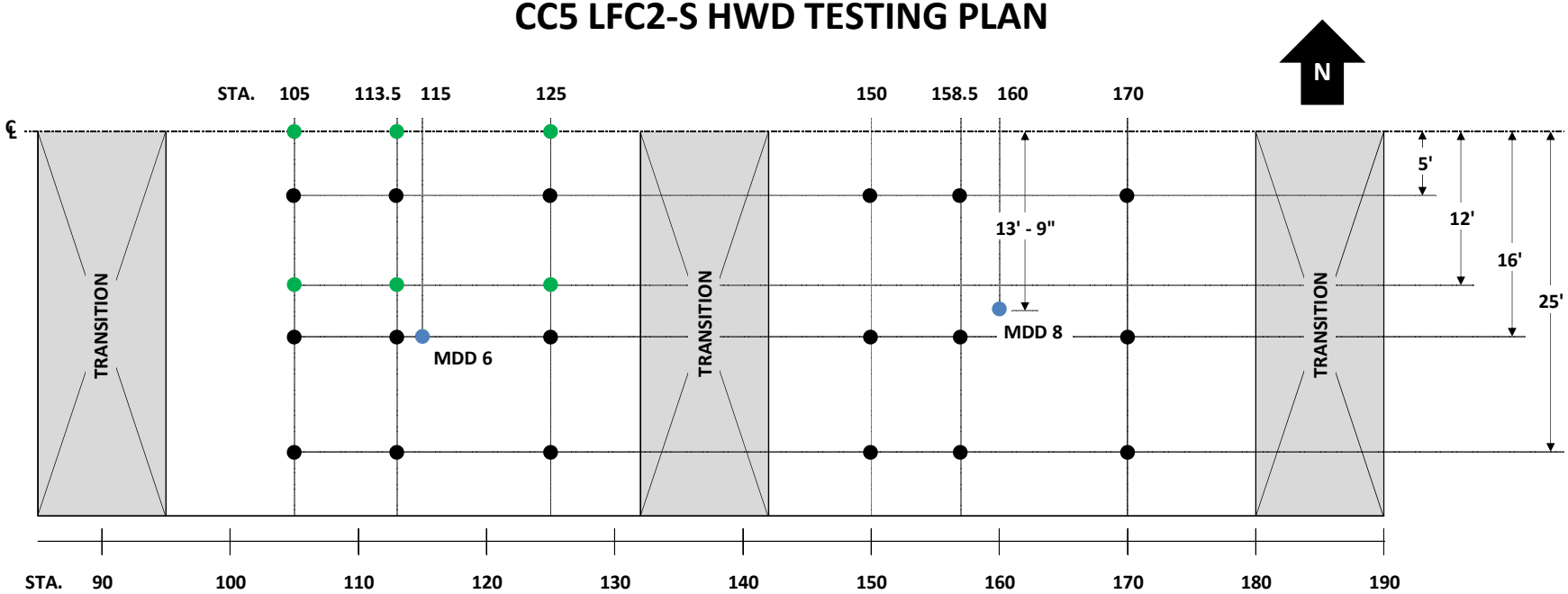
THANKS!

CC5 Structure



Testing Location

CC5 LFC2-S HWD TESTING PLAN



PLAN VIEW

- MDD HWD DROP LOCATION
  MDD DROP LOCATIONS ARE TO BE TESTED BEFORE AND AFTER MILLING PROCEDURES
  EMBEDDED MDD SENSOR DATA WILL BE COLLECTED FOR THESE HWD DROPS AT A MINIMUM SAMPLING RATE OF 400 HERTZ AND MAXIMUM RATE OF 1000 HERTZ
- PROFILE LINE HWD DROP LOCATIONS FOR COMPARISON
  PROFILE LINE DROP LOCATIONS ARE TO BE TEST BEFORE MILLING AND AFTER MILLING
  THE COMPARISON DROPS IN LFC2-SE WILL CONTINUE TO BE TESTED THROUGHOUT TRAFFICKING
- LFC2-SW CONTINUAL HWD DROPS
  AFTER THE COMPLETION OF COMPARISON DROPS IN LFC2-SW, THESE LOCATIONS WILL SERVE AS THE HWD DROP LOCATIONS THROUGH TRAFFICKING

(Prepared by Josh Davis)

Backcalculated Subgrade Modulus

Construction Cycle	Testing Time (Post-Construction)	Backcalculated Subgrade Modulus (psi)	Pavement Thickness (in)
CC1	May., 1999	6899 (LFS) 7325 (LFC)[1]	- 5/8/36
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(Note 1: from McQueen e al. 2001)

Construction Cycle	Testing Time		Backcalculated Subgrade Modulus (psi)
CC5-LFC2S	May.,2012	Pre-Mill	18598
	Jun.,2012	Post-Mill	17121
	Oct.,2012	Post-Traffic	12956