The Long Term Pavement Performance (LTPP) Program Warm Mix Asphalt Experiment and Arizona's Participation

November 19, 2014

Kevin Senn, NCE

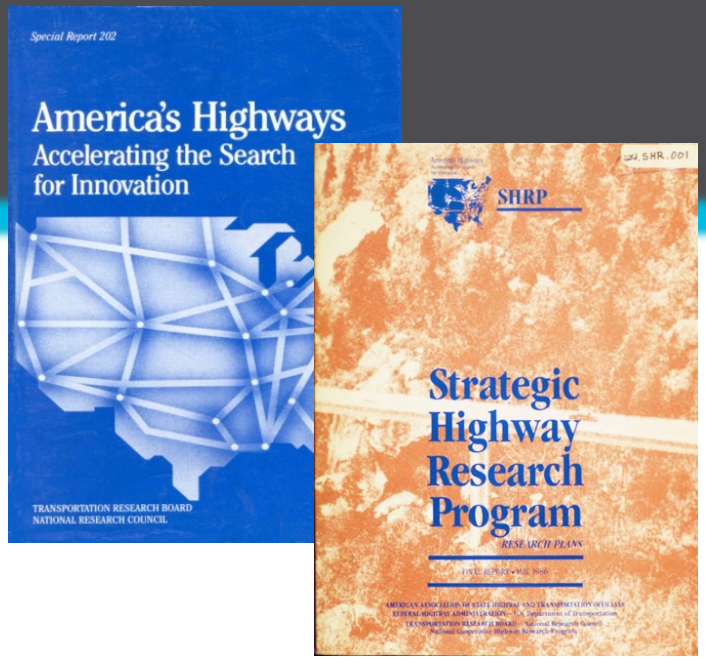
Presentation Outline

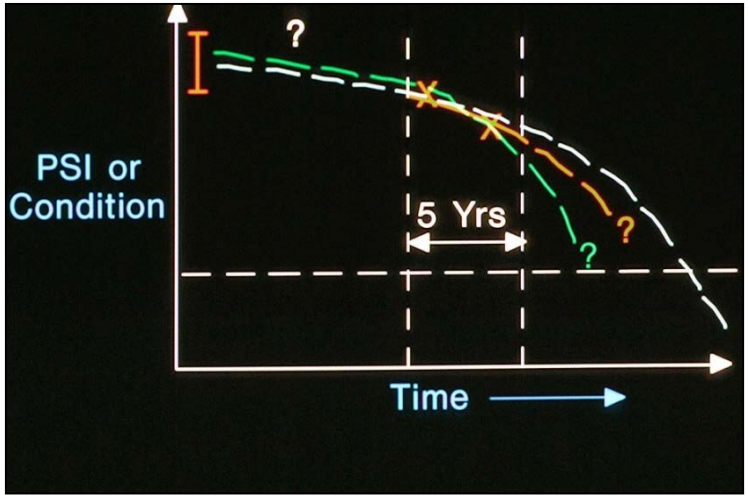
- Overview of LTPP
- LTPP Projects in Arizona
- LTPP Warm Mix Asphalt Experiment
- Arizona's Warm Mix Projects

Introduction

- The LTPP program began in 1987 as the Strategic Highway Research Program (SHRP)
- The longest running highway research program in history
- $200+ Million study
- Over 2,500 test sections—over 700 still active
- 16 data modules, 430 tables, 8,000 data elements

LTPP's GOAL is….





to provide answers to

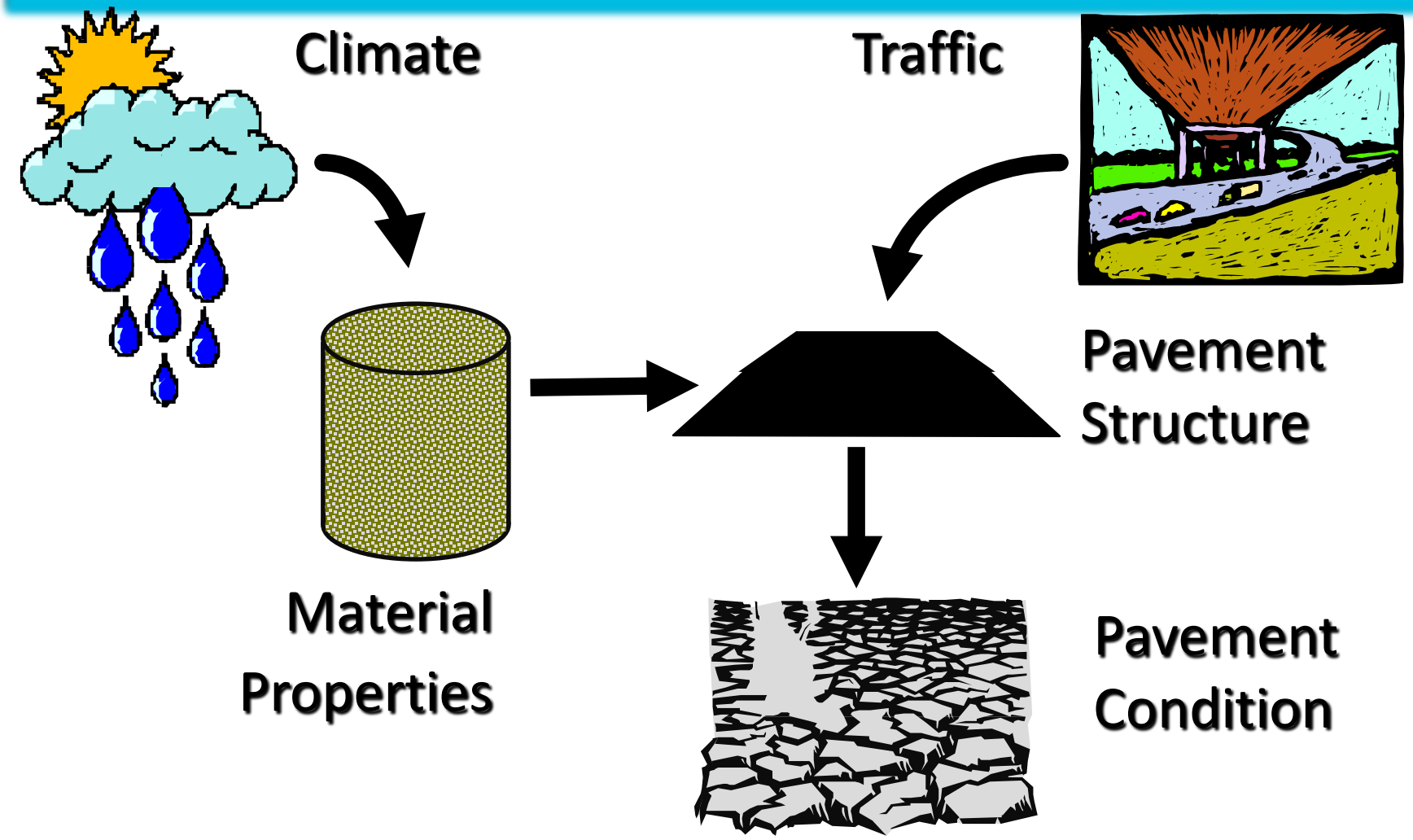
HOW and *WHY*

pavements perform as they do!

LTPP's CORE FUNCTIONS

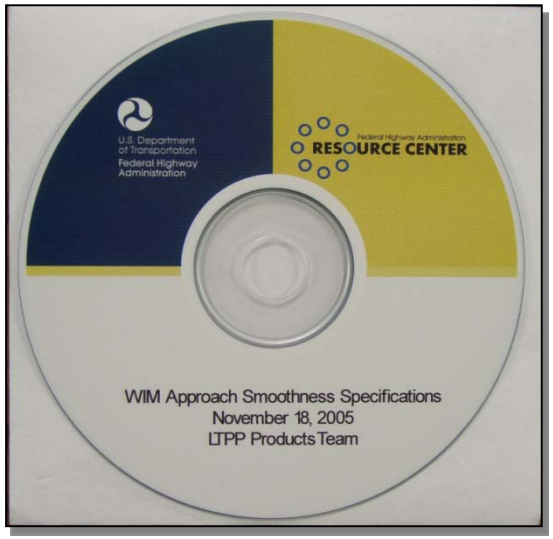
- Data Collection and Management
- Data Analysis
- Product Development

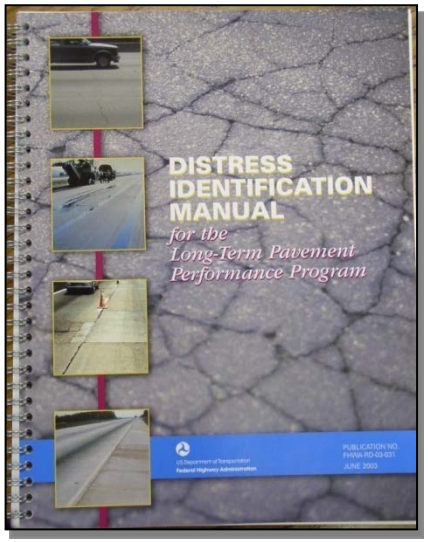
LTPP Data Collection

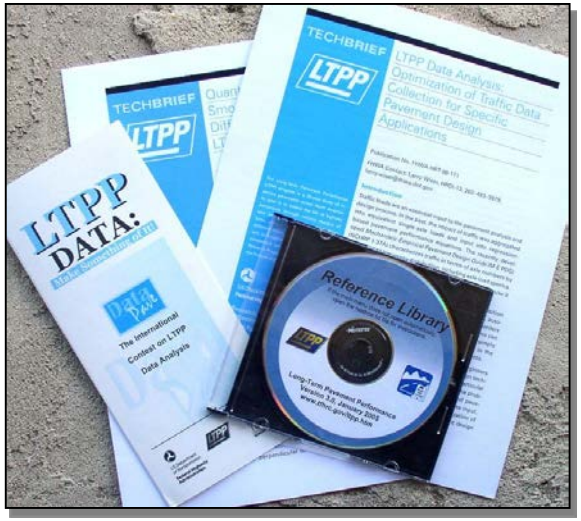


LTPP Benefits

The LTPP program has generated a wide range of benefits all across the pavement engineering and performance spectrum.







Return on Investment

LTPP by the Numbers

LTPP Resource	Statistics
Requests for Data	48,000 Requests
Registered LTPP Website Users	3,000 Users (in 75 Countries)
Published Documents Resulting from LTPP Data	500+ Publications
ASCE Paper Contest	60 Entries
Distress Manuals	20+ State Agencies
FWD Calibration Centers	500+ Calibrations
WIM Systems	550+ Installations
SPS Traffic Pooled Fund Study Installations	21 WIM Sites Installed
MRL Materials	2,000,000 Pounds Available
MRL Shipments	17,000 Pounds Delivered

The numerous innovations that have directly resulted from the LTPP program include procedures, tools, manuals, and research findings that have been implemented across the United States and abroad.

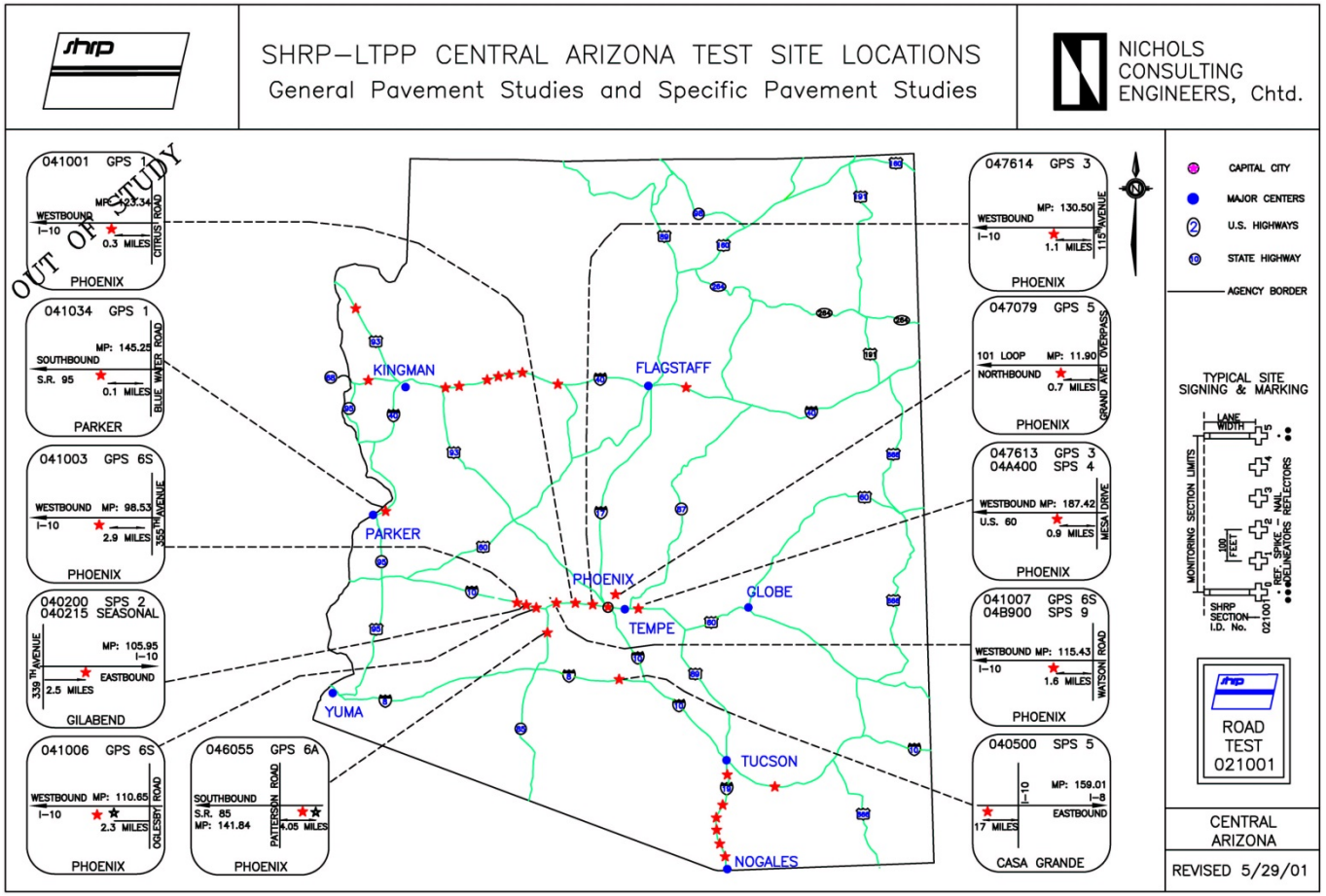
Return on Investment

Cost Savings

LTPP has already realized $2 Billion in savings, with the potential for even greater future savings.

Savings To Date	Projected Cumulative Future Savings (2015-2024)	
	No Additional Monitoring	Continued Monitoring
$2 Billion	$2.28 Billion	$4.56 Billion

LTPP Test Sections In Arizona



General Pavement Studies (GPS)

- Focus on most commonly used pavement designs
- Experimental design: full factorial
- One 500 foot section per location

Primary Factors

Subgrade: fine & course
Traffic: medium & heavy
Temp: freeze and non-freeze
Moistures: wet and dry

Secondary Factors

AC thickness
AC stiffness
SN of base and subgrade
PCC thickness
Joint spacing

GPS Projects in Arizona

A Total of 25 Projects*

GPS-1 → Asphalt Concrete (AC) on Granular Base (16)

GPS-2 → Asphalt Concrete on Bound Base (2)

GPS-3 → Jointed Plain Concrete (JPC) (2)

GPS-5 → Continuously Reinforced Concrete (CRC) (1)

GPS-6 → Asphalt Concrete Overlay on AC (17)

*Overlay projects can be in two experiments

ADOT LTPP NCE

Specific Pavement Studies (SPS)

- Focus on certain pavement engineering factors
- Experimental design: half factorial
- Multiple 500 foot sections per location

Primary Factors

Subgrade: fine & course
Traffic: medium & heavy
Temp: freeze and non-freeze
Moistures: wet and dry

Secondary Factors

AC drainage - yes, no
AC thickness
AC base type and thickness
PCCP drainage- yes, no
PCC strength and thickness
Lane width
Base type

SPS Projects in Arizona

A Total of 12 Projects (121 Test Sections)

SPS-1 → Strategic Study of Structural Factors for Flexible Pavements (1)

SPS-2 → Strategic Study of Structural Factors for Rigid Pavements (1)

SPS-3 → Preventative Maintenance Effectiveness for Flexible Pavements (4)

SPS-4 → Preventative Maintenance Effectiveness for Rigid Pavements (1)

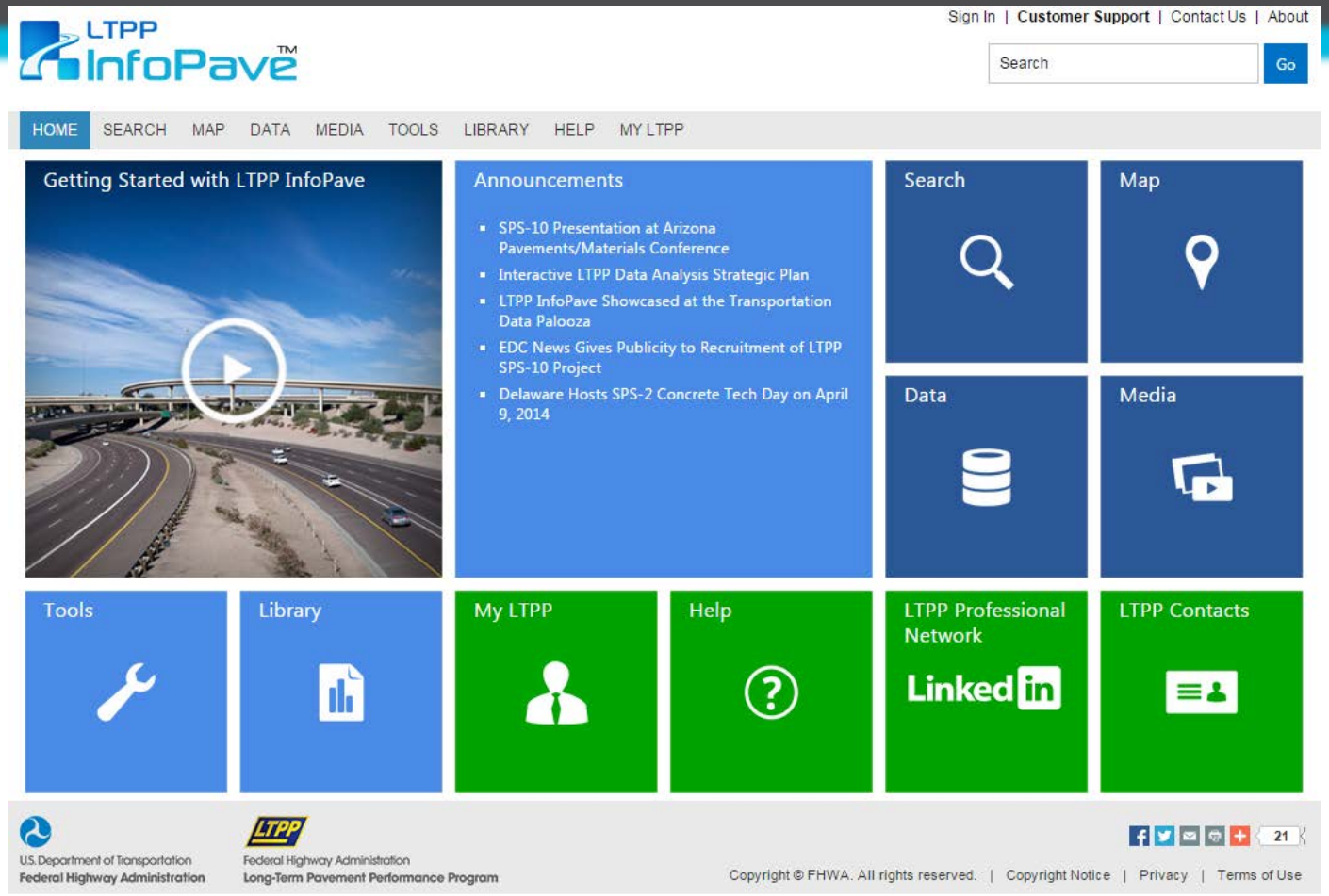
SPS-5 → Rehabilitation of Asphalt Concrete Pavements (1)

SPS-6 → Rehabilitation of Jointed Portland Cement Concrete Pavements (1)

SPS-9 → Superpave Asphalt Binder Study (3)

ADOT LTPP NCE

Accessing LTPP Data



www.infopave.com

LTPP Warm Mix Asphalt Experiment: Why WMA?

- 356 million tons of WMA produced in 2012
  - 24% of all plant mix produced in US was WMA
- 35 different WMA technologies
- WMA is a priority innovation under FHWA's Every Day Counts (EDC) Initiative

SPS-10 Objectives

- Long-term performance of WMA relative to HMA
- Capture data on WMA with RAP

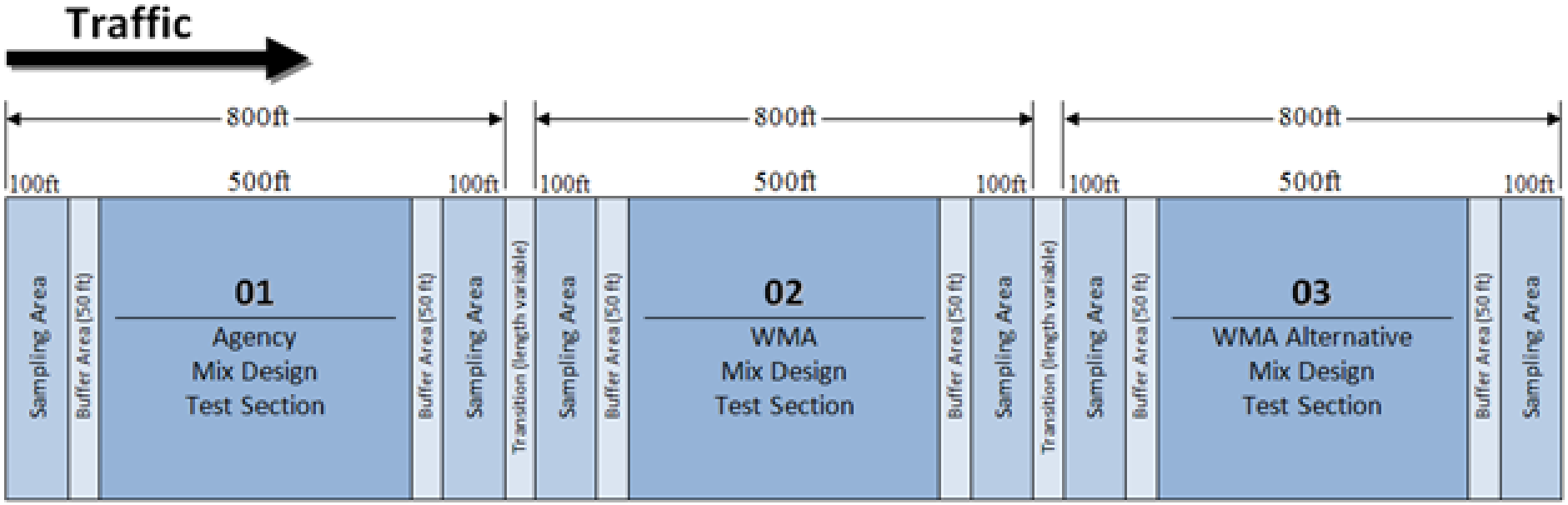
SPS-10 Benefits to Agencies

- Detailed construction information including a construction report
- Rigorous materials testing (over multiple intervals) using latest testing technology
- Ongoing FWD, distress, profile, and texture monitoring to study short and long term performance
- Ability to study Agency-specific issues related to WMA

SPS-10 Requirements

- Overview
  - AC overlay of existing AC pavements
  - 2” to 4” overlay thickness
  - Dense graded mix
  - RAP content 10-25% (binder replacement)
  - 1 HMA control test section
  - 2 WMA test sections
    - Foaming Process
    - Chemical Additive
  - Tack Coats between lifts

SPS-10 Site Layout Requirements



- WMA:
  - Production of ≤ 275°F or
  - Production at least 30°F less than HMA

SPS-10 Supplemental Sections

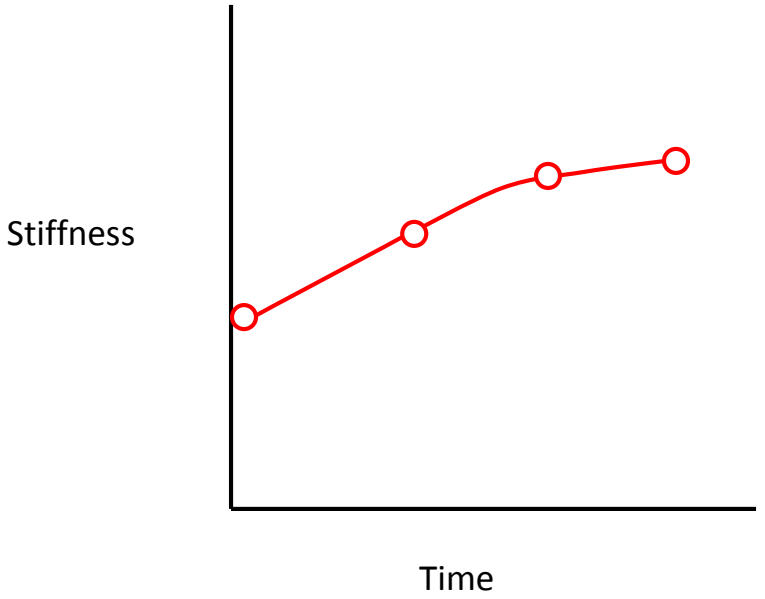
- Agencies can build additional test sections that will be monitored as part of the LTPP program
  - Varying levels of RAP
  - Additional WMA technologies
  - Layer thickness variation
  - Open or gap graded mixtures
  - Varying aggregate sources/absorption levels
  - Other variables of interest to Agency

SPS-10 MaterialsTesting Goals

- Investigate changes in WMA performance-related properties during initial aging period
  - What are these properties after initial aging
  - When do they stabilize
  - How can we predict them from initial state
- Provide inputs for MEPDG modeling
  - Must include existing pavement layers
- Provide data set for the development of future models

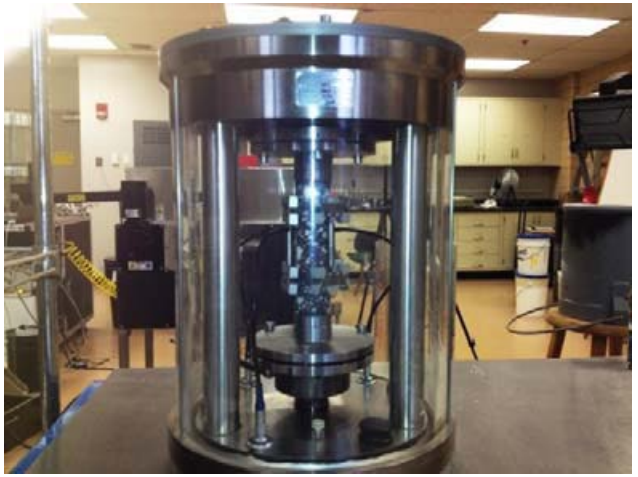
SPS-10 Focus on Cores

- Tracking changes in properties under field conditions requires field-aged specimens
- Potential bias between field specimens and laboratory-created specimens and test procedures means cores are required even for initial round of testing



SPS-10 Tests on Experiment Layer

- Dynamic Modulus – Small-scale AMPT (TP 79)
  - 0, 3-6, 12 and 18 months after construction
- 38 mm diameter x 110 mm height specimens
  - Re-cored horizontally from 6” diameter core
  - Otherwise in accordance with AASHTO TP79



SPS-10 Tests on Experiment Layer (cont.)

- Binder Testing – DSR, BBR, MSCR
  - Tank Binder
  - Extracted binder at 0, 3-6, 12, and 18 months
- Hamburg Wheel Tracker
  - Initial time period only
- Basic Mix Characterization
  - BSG, G_{mm}, P_b, G_{se}, G_b, aggregate gradation

SPS-10 Tests on Existing AC Layers

- Dynamic Modulus – Small-scale AMPT (TP 79)
- Binder Testing – DSR, BBR, MSCR
- Hamburg Wheel Tracker
- Basic Mix Characterization
  - BSG, G_{mm}, P_b, G_{se}, G_b, aggregate gradation

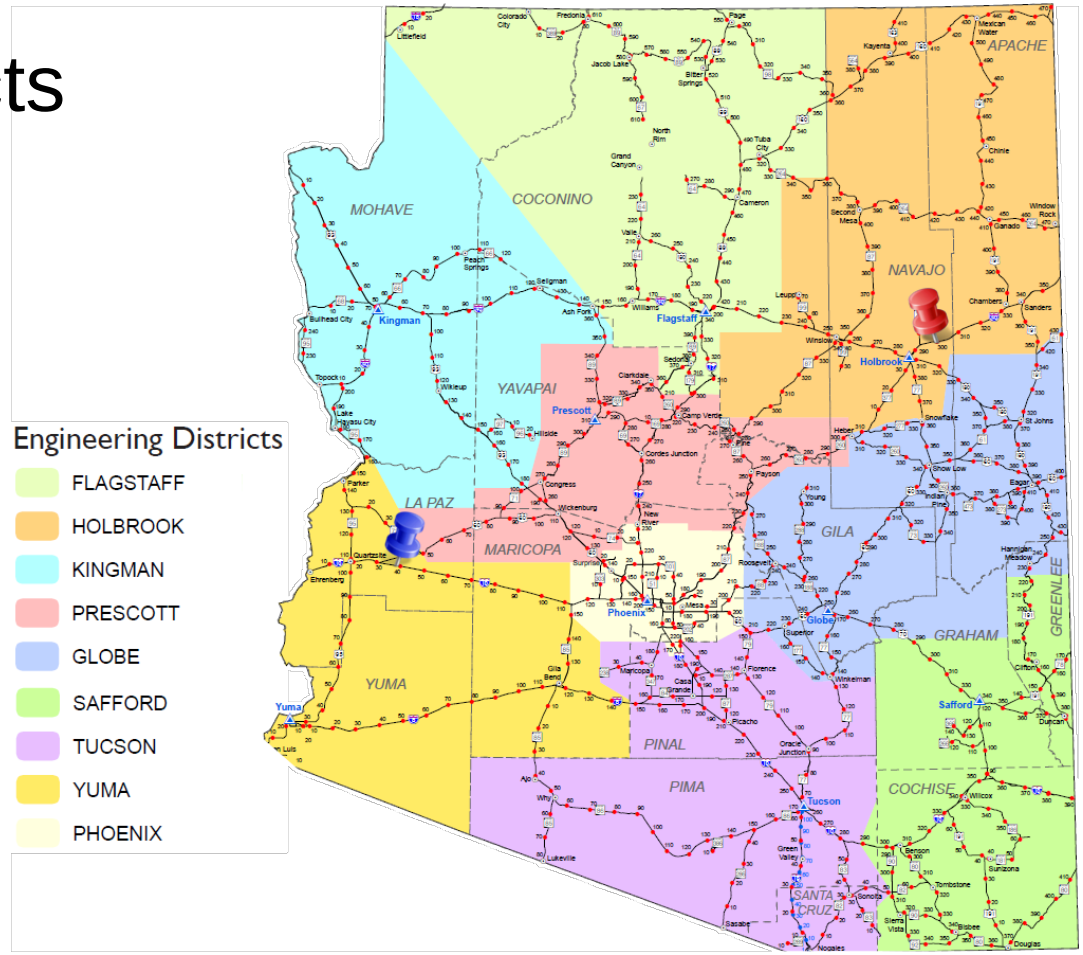
All tests performed at initial time period only

SPS-10 Tests on Unbound Layers

- Sieve Analysis
- Atterberg Limits
- Classification
- Natural Moisture Content
- Dynamic Cone Penetrometer

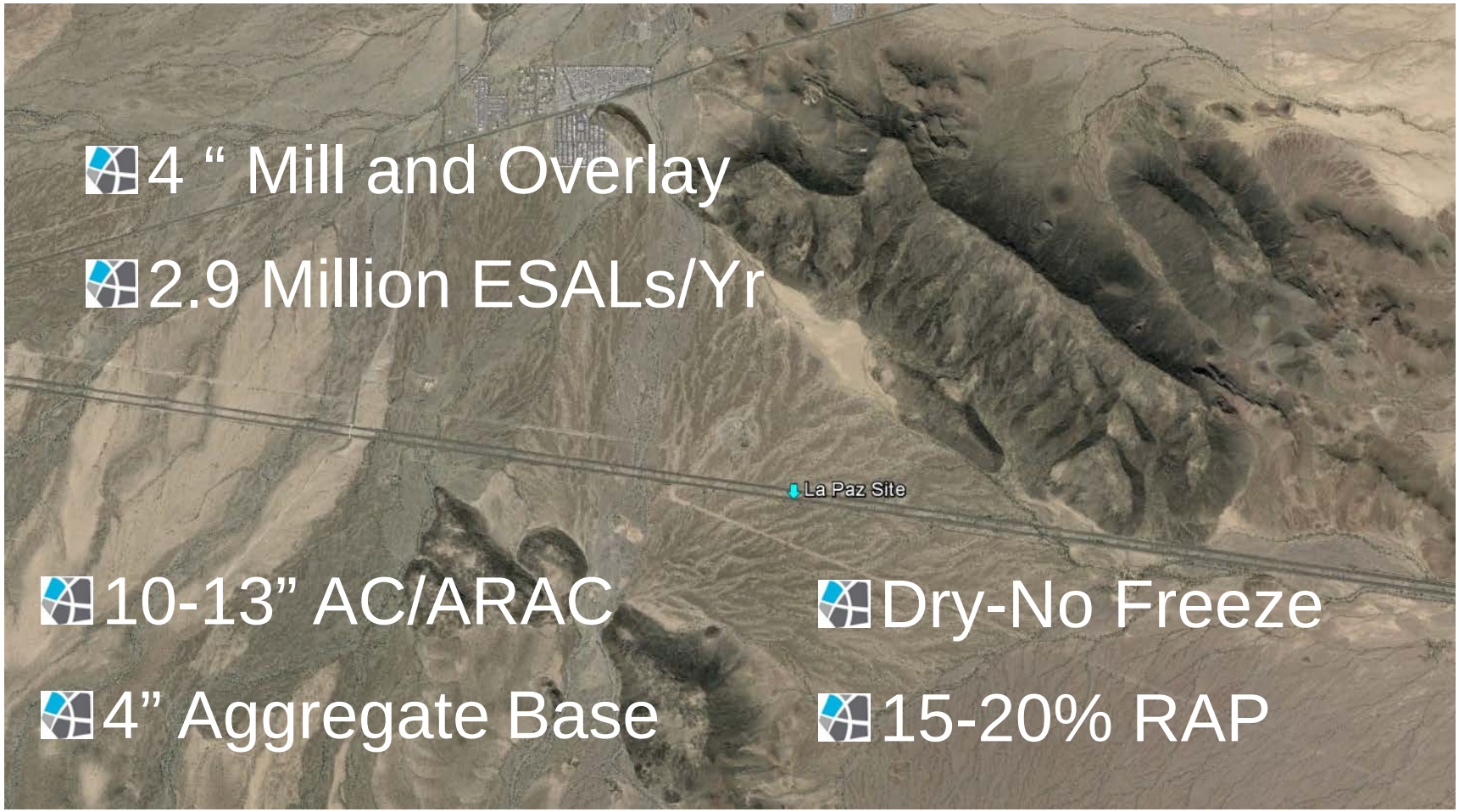
Arizona's SPS-10 Projects

- Two Projects
  - La Paz
  - Navajo



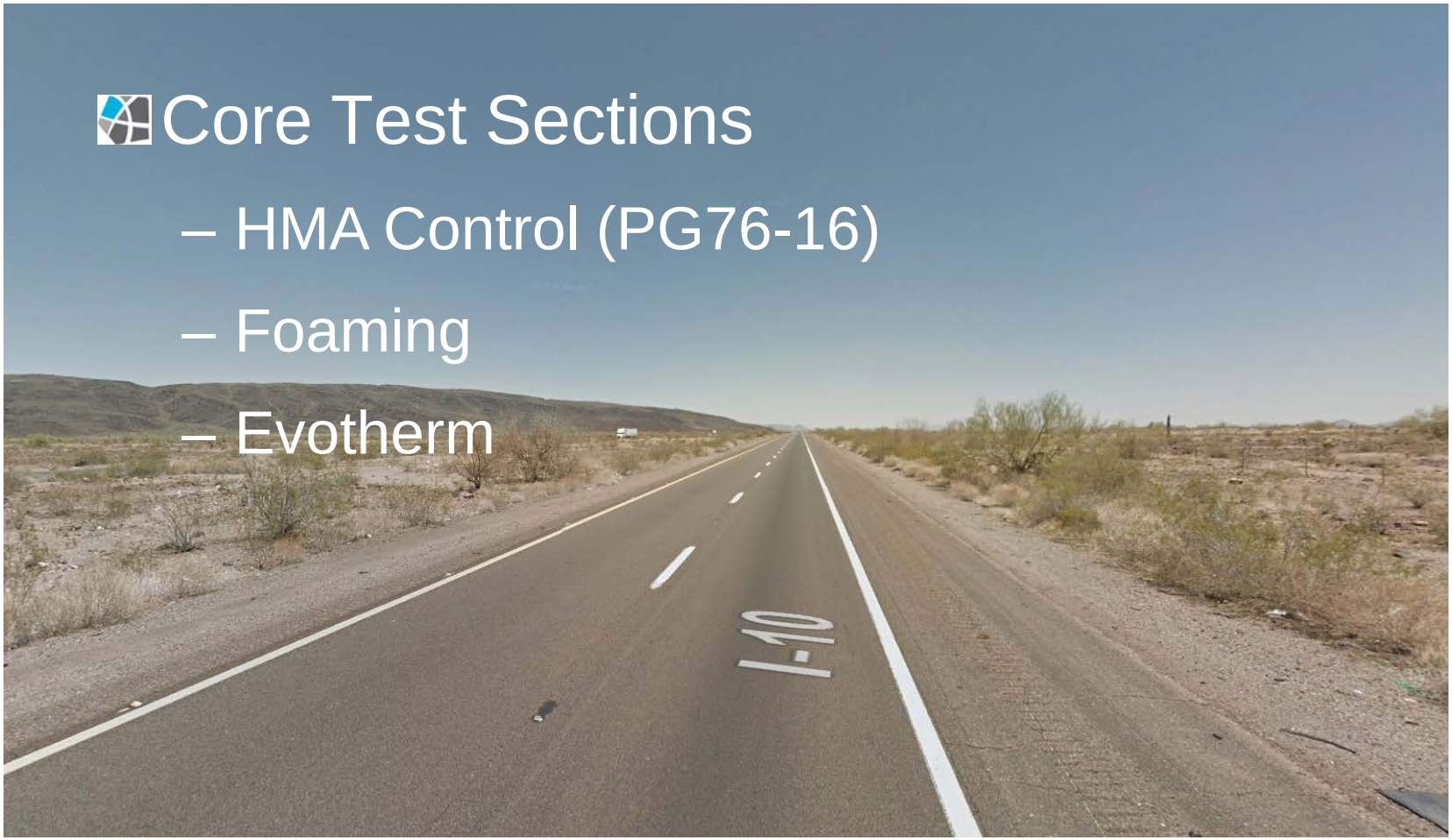
ADOT LTPP NCE

La Paz SPS-10



- 4 “ Mill and Overlay
- 2.9 Million ESALs/Yr
- 10-13” AC/ARAC
- 4” Aggregate Base
- Dry-No Freeze
- 15-20% RAP

La Paz SPS-10 (cont.)

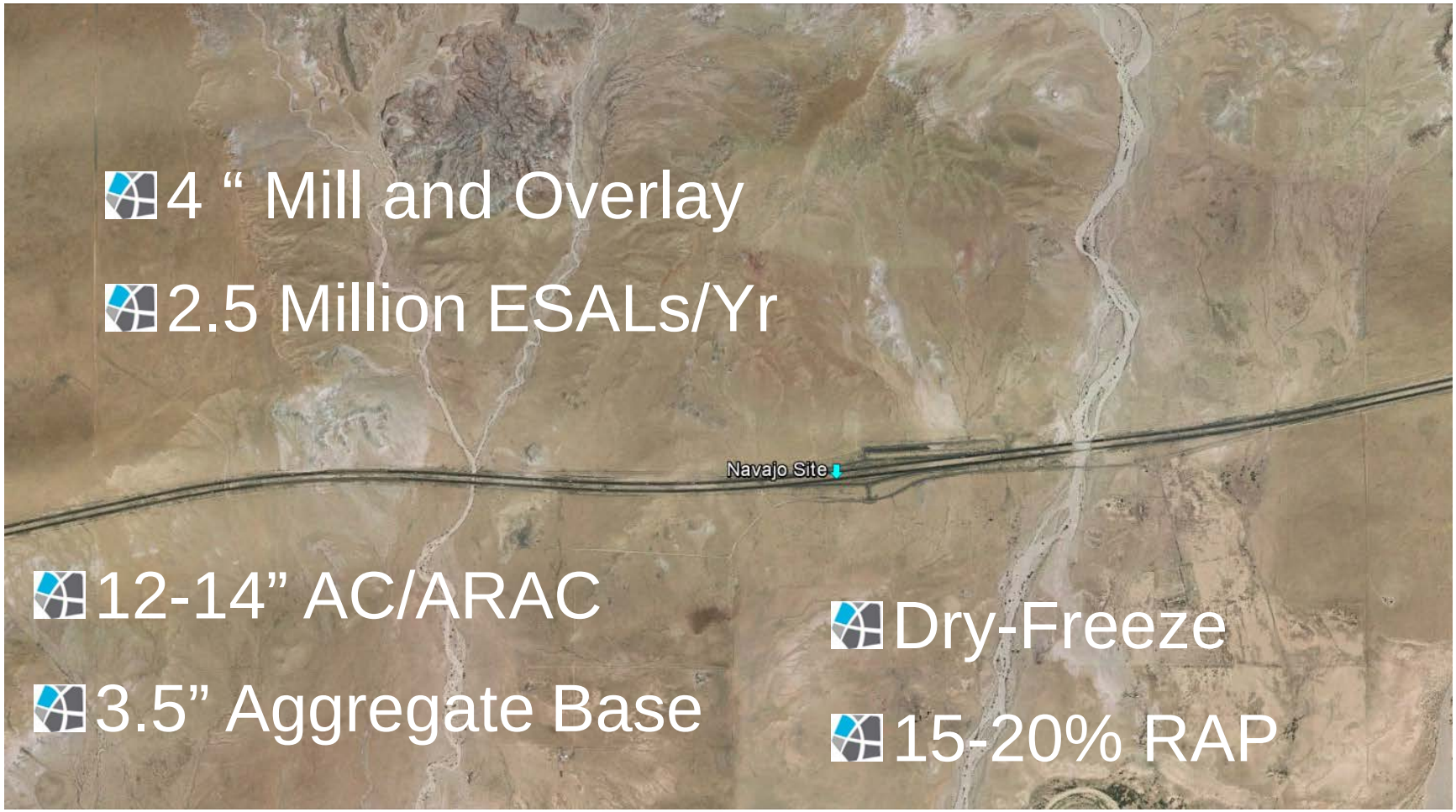


- Core Test Sections
  - HMA Control (PG76-16)
  - Foaming
  - Evotherm

La Paz SPS-10 (cont.)

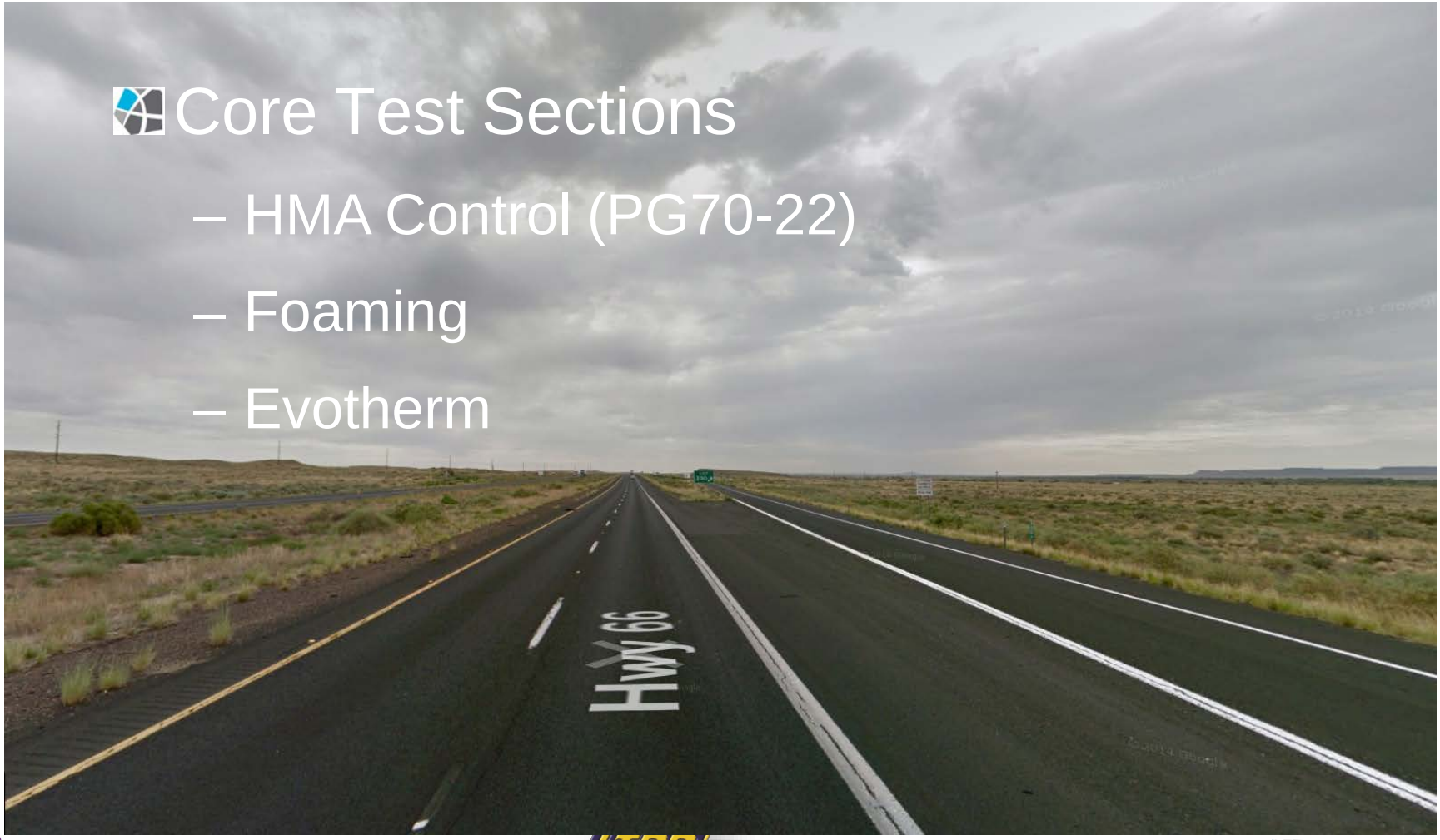
- Supplemental Test Sections
  - Wet Process ARAC, no RAP
  - Wet Process ARAC w/ Evotherm, no RAP
  - Conventional Fiber Modified (polyolefin, Aramid)
  - Evotherm Fiber Modified (polyolefin, Aramid)
  - Conventional w/ 30% RAP
  - Foaming w/ 30% RAP
  - Evotherm w/ 30% RAP

Navajo SPS-10



- 4 “ Mill and Overlay
- 2.5 Million ESALs/Yr
- 12-14” AC/ARAC
- 3.5” Aggregate Base
- Dry-Freeze
- 15-20% RAP

Navajo SPS-10 (cont.)



- Core Test Sections
  - HMA Control (PG70-22)
  - Foaming
  - Evotherm

Navajo SPS-10 (cont.)

- Supplemental Test Sections
  - Wet Process ARAC, no RAP
  - Wet Process ARAC w/ Evotherm, no RAP
  - Conventional Fiber Modified (polyolefin, Aramid)
  - Evotherm Fiber Modified (polyolefin, Aramid)
  - Conventional w/ 30% RAP
  - Foaming w/ 30% RAP
  - Evotherm w/ 30% RAP

Arizona's SPS-10's Looking Forward

- La Paz Timeline Estimate
  - Contract Letting: April 2015
  - Construction Start: July 2015
  - Construction Completion: November 2015
- Navajo Timeline Estimate
  - Contract Letting: April 2015
  - Construction Start: June 2015
  - Construction Completion: October 2015

Questions?

ksenn@ncenet.com

Thank You!