

# I-710 Revisited

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AMAP 5<sup>th</sup> Annual Meeting  
Feb. 9, 2004

# Longer Life Asphalt Pavement

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October 1996 - Caltrans Presented Longer Life Pavement Strategy to CTC

June 1997 - Formed Asphalt Advisory Group

March 1998 - Formed Joint Caltrans / Industry LLAPTG

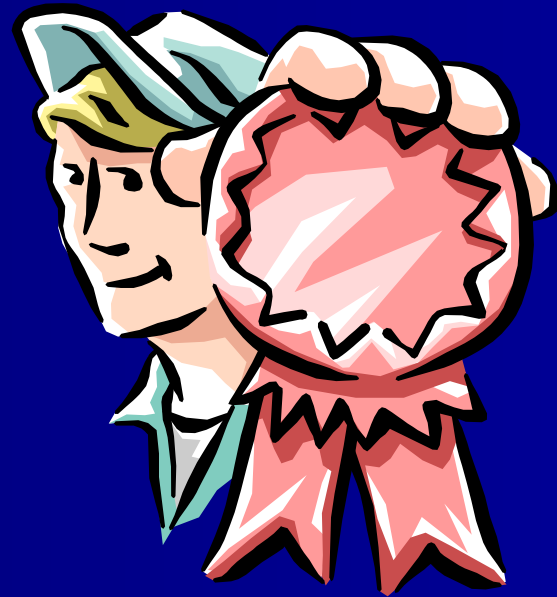
December 2000 - I-710 Project Bid

February 2001 - Construction Started

October 2003 - Construction Completed

# Longer Life Asphalt Pavement Task Group

- Partnered Effort
  - Caltrans
  - APA
  - U.C. Berkeley
  - NCAPA
  - Asphalt Institute
  - NAPA
  - FHWA



# Task Group Teams

- Mix Committee
  - Binder Subcommittee
  - Testing Subcommittee
- Structural Section Committee
- Constructability Committee

# High Performance Asphalt

- Using Quality Control (QC)/Quality Assurance (QA)
- Polymer modified binders
  - PBA-6A with a twist (additional elastomeric properties)
- Rich Bottom (0.5% more asphalt)
- Improved Aggregate Requirements:
  - Gradation Change (larger stone and less natural sand)
  - Aggregate Angularity (2 crushed faces mechanically)
- Modified Mix Design Method
  - Additional Testing Requirements
  - Performance Tests

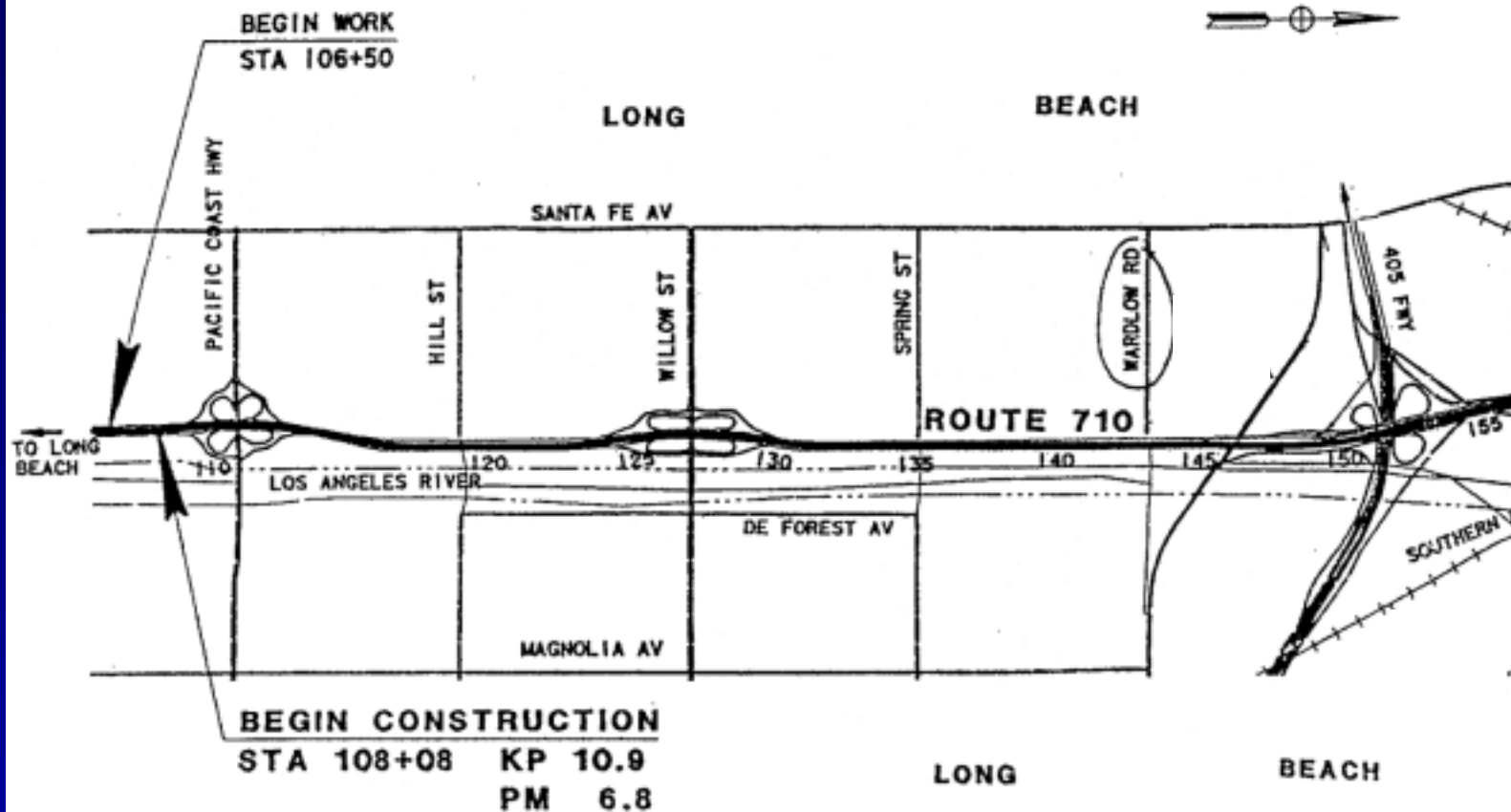
# High Performance Asphalt

- Mechanistic - Empirical Design for structural layers
- Layered Elastic Analysis by UC - Berkeley
  - Stiffness or elastic modulus
  - Thickness
  - Poisson ratio
- Models tempered with California's asphalt pavement experience & from CAL/APT Research Data

# I-710 Project Location



# Interstate 710





















St 3/4  
Coast Hwy 1 3/4

SEEK W  
SPEED  
65

ENTER W  
WEST 2  
CITY  
SOUTH 4





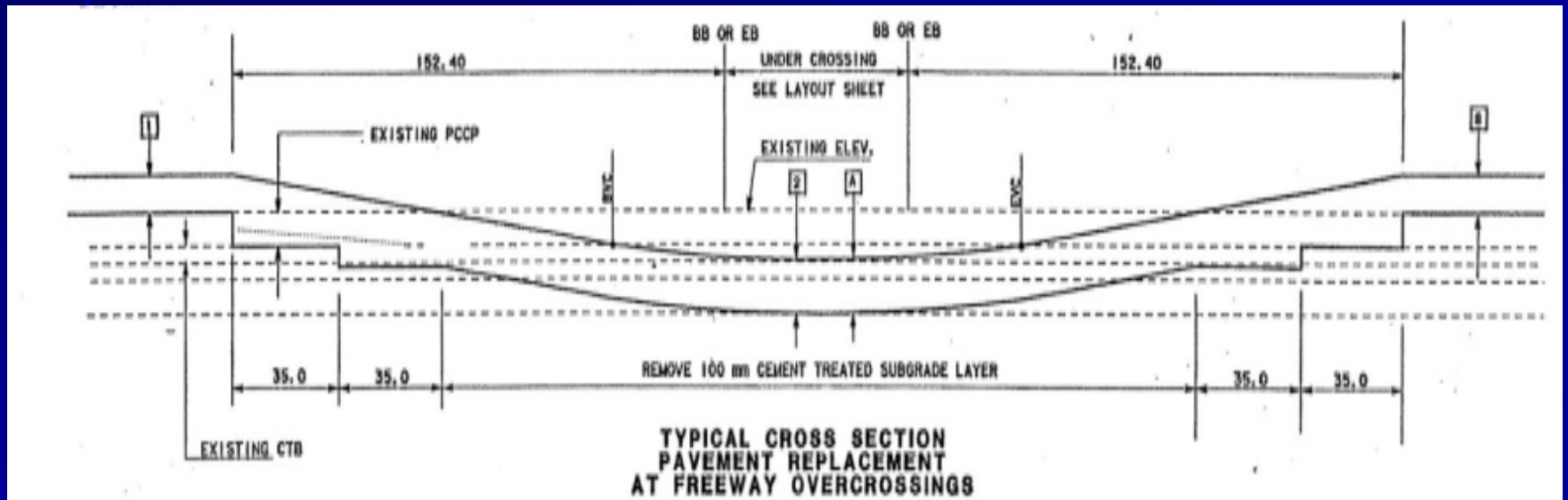
SPEED  
65

tex

81A



# Interstate 710



# Performance Criteria

(Defined by Caltrans)

- 30 to 35 years design period for the structural layer(s)
- Minimal maintenance during the service life
- Maintenance must be completed during the off-peak hours (night work in the future)
- Safety & Noise (District Office)

# Constructability Review

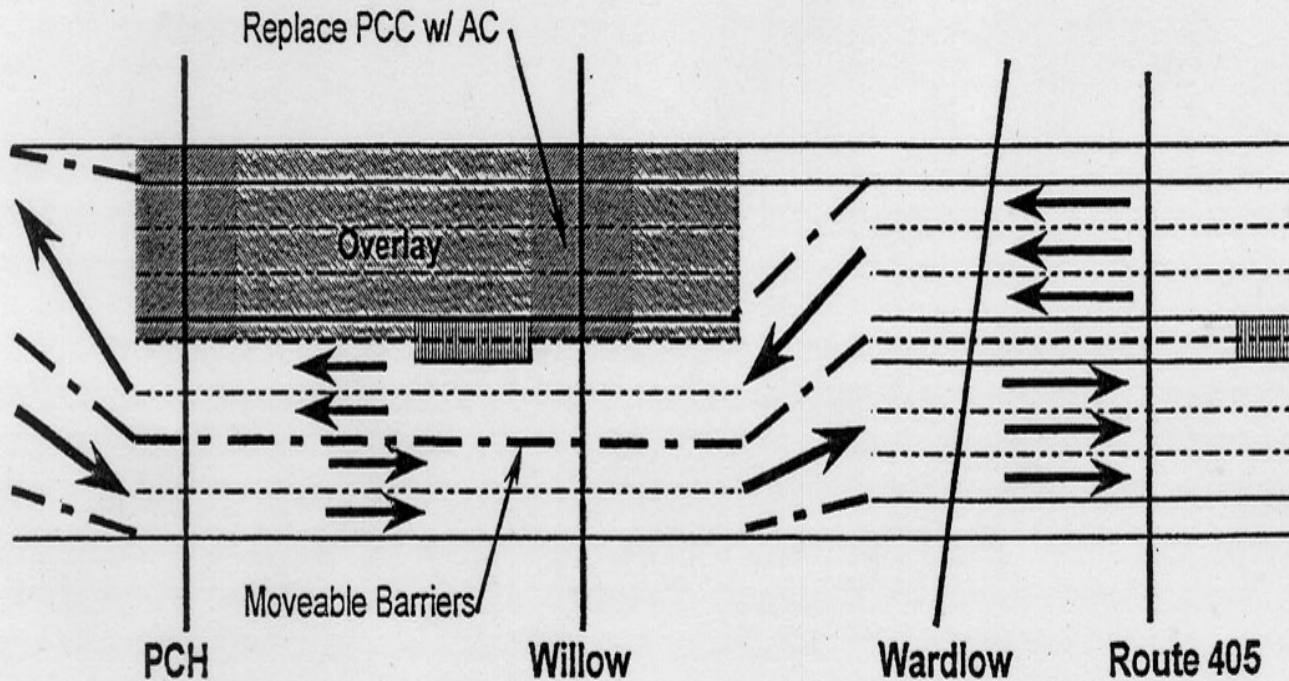
- Industry Part of Constructability team
- Traffic Operations Involved Early
- Construction Involved Early
- Use Experience from other Districts

# Construction Strategies

- Reversible Lanes
- Project Phasing
- Incentive/Disincentive Clauses
- Lane/Ramp Closures
- Moveable barriers
- Total Facility Closure



# Interstate 710



## STAGE 3: Overlay & Replacement Willow Through PCH S/B

STAGE 3 - Use Moveable Barriers. Reconstruct S/B Pavement at PCH and Willow OC and overlay portion closed to traffic.  
Lower profile at PCH and Willow to provide Standard Vertical Clearance.

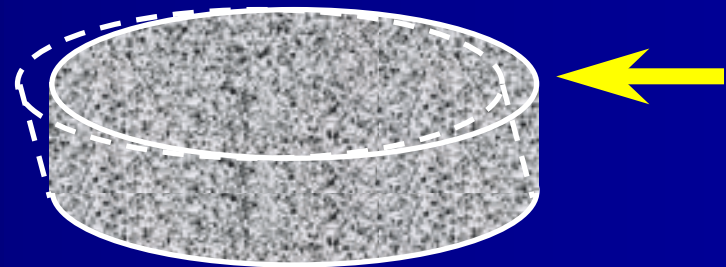
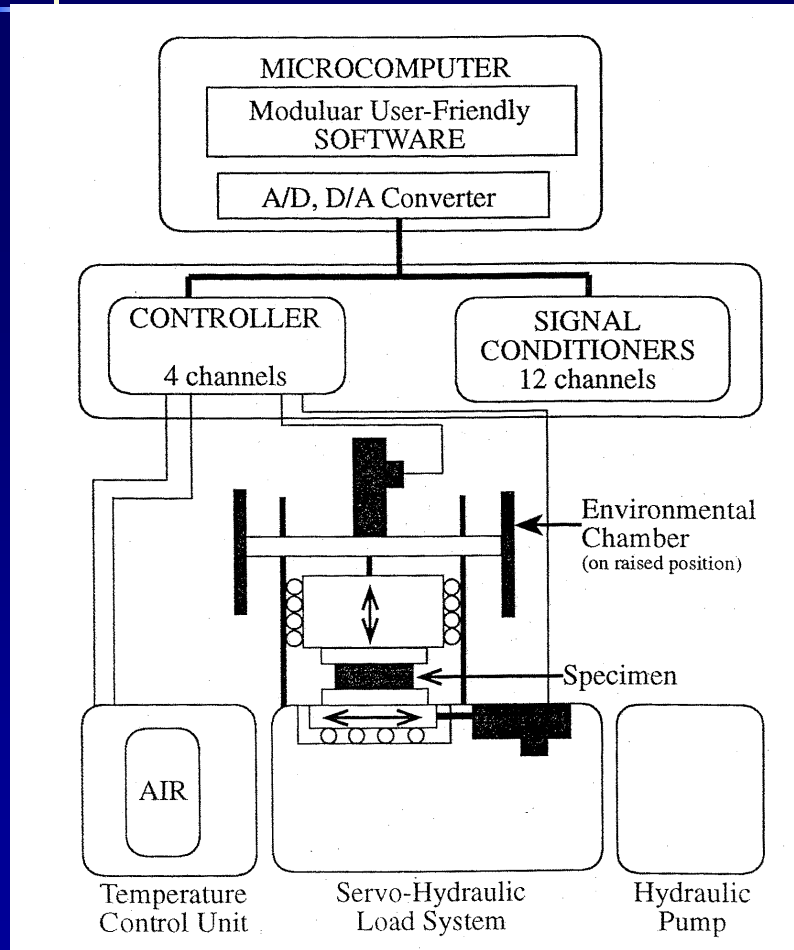
# Trial Mix Design

- San Gabriel aggregate
- Binders
  - Conventional: AR-8000  
(PG 64-16)
  - Polymer modified: PBA-6A\*  
(PG 64-40)
- Hveem - to establish range of binder contents

# Trial Mix Design

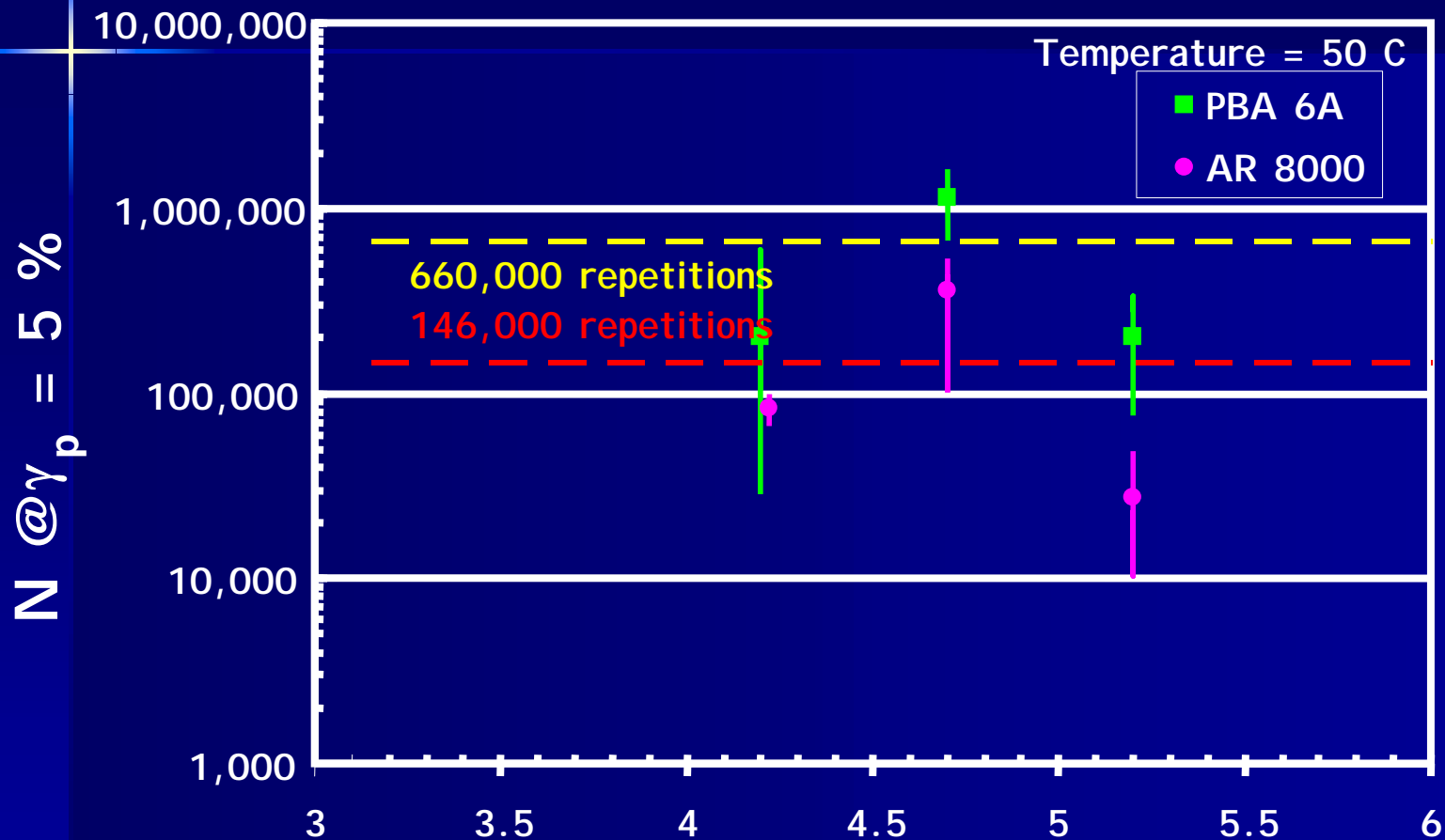
- Range of binder contents
  - 4.2 - 5.7% (by wt of aggregate)
- Conventional dense-graded mix per Caltrans
- All crushed materials

# Shear Test



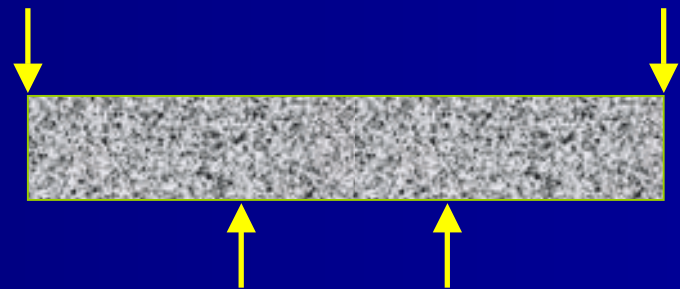
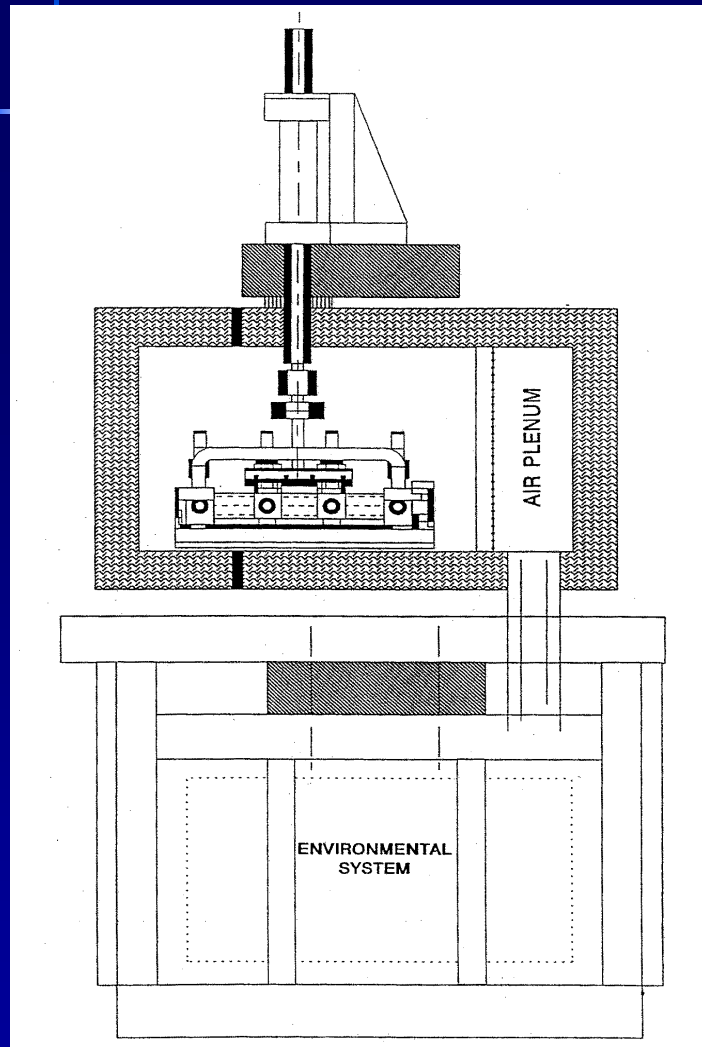


# Design Binder Content

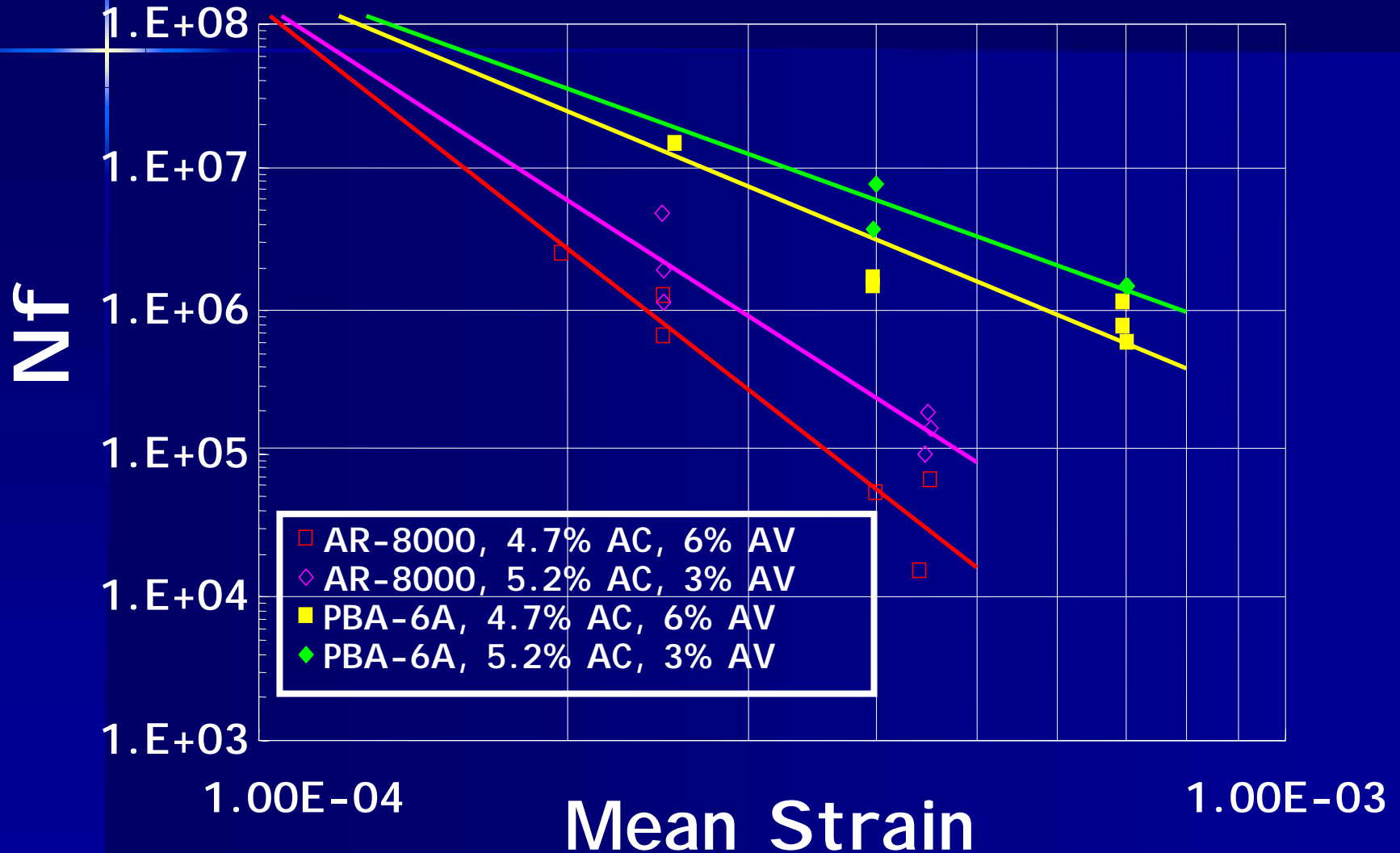


Asphalt content (percent by weight of aggregate)

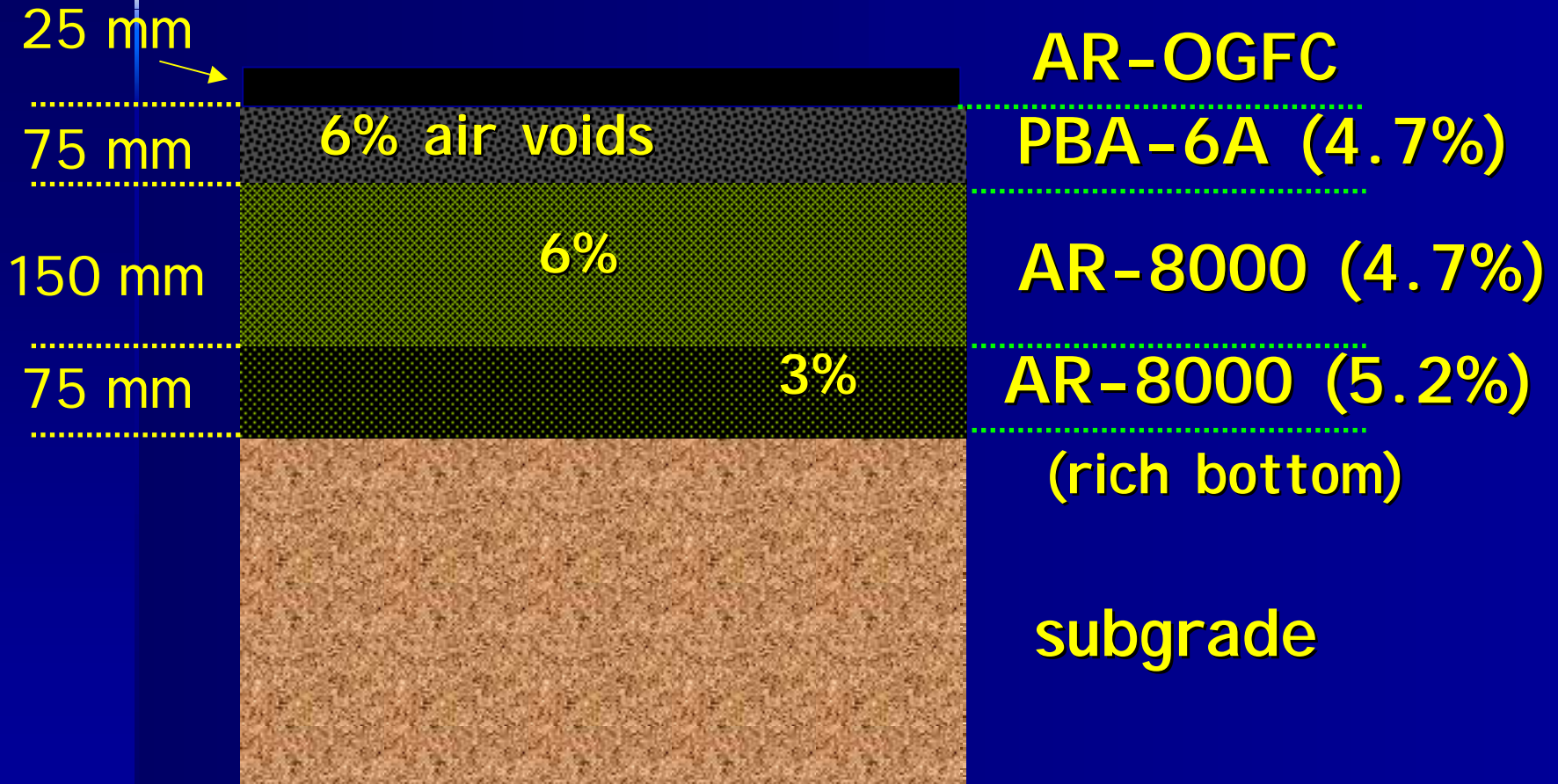
# Fatigue



# Fatigue Test Results



# Final Design (mechanistic)



# Final Design (Functional)

25 mm

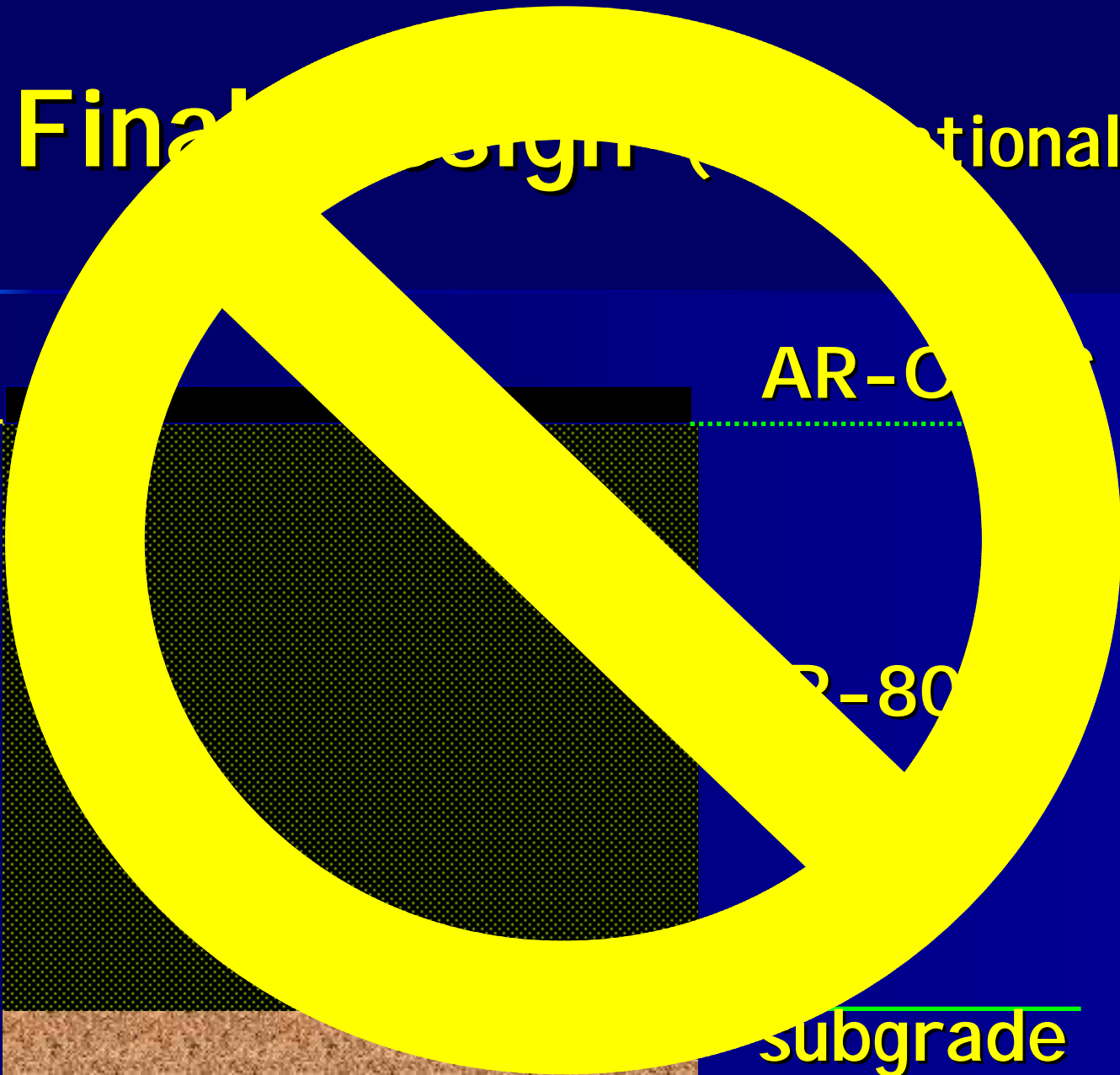


AR-0

575 mm

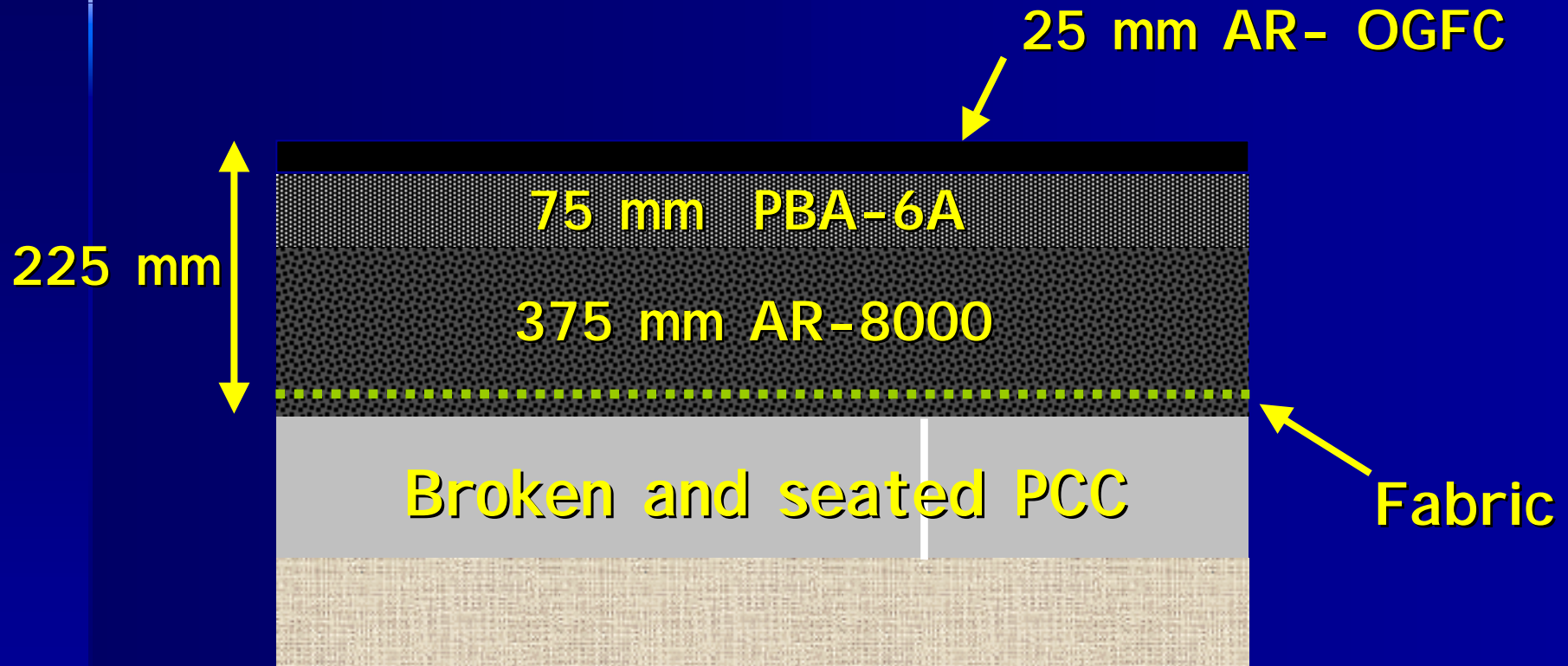
AR-80

subgrade



# Composite Overlay

Final overlay thickness

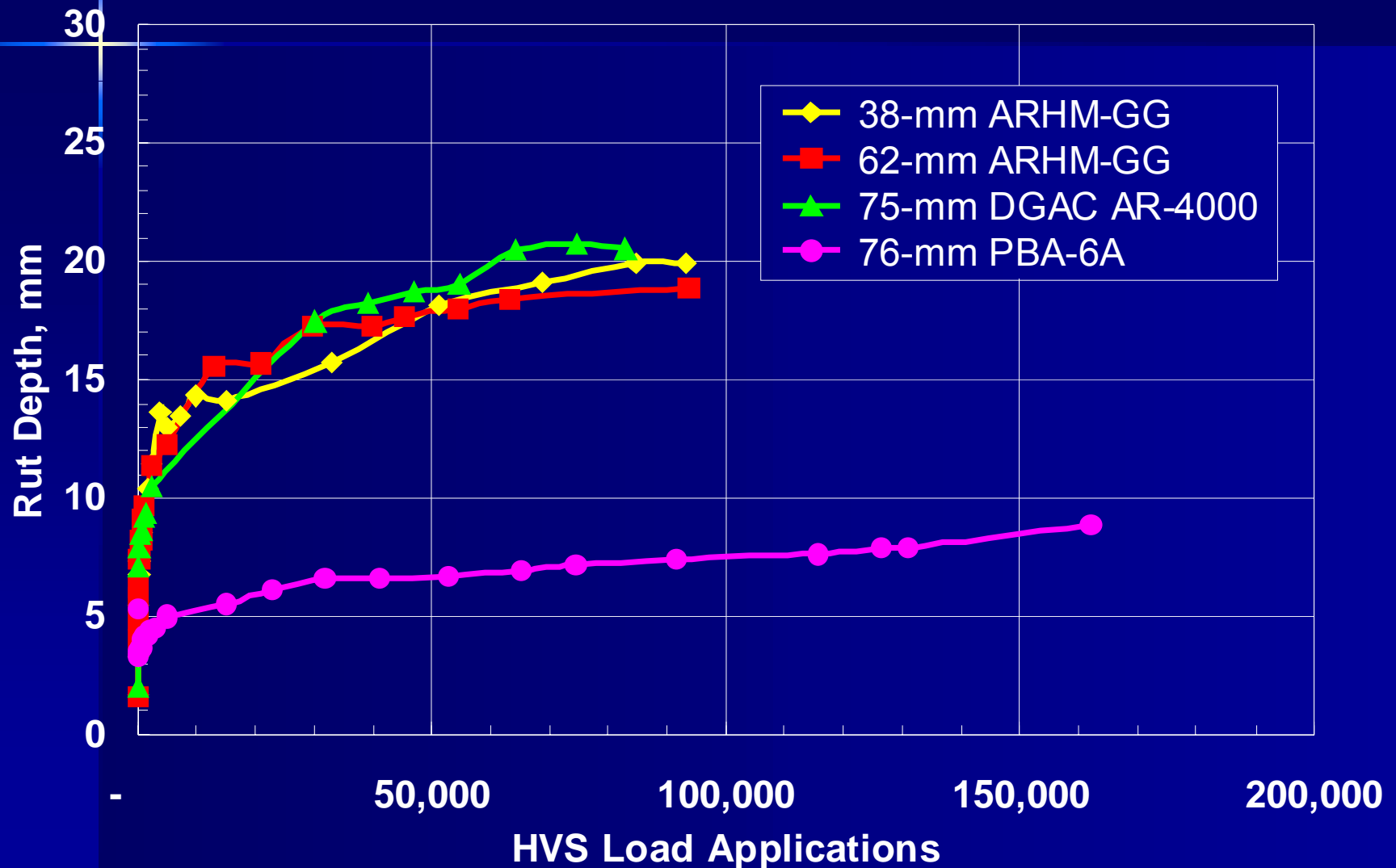




# HVS Rutting Study



# Rutting Study Results





# Specifications

- Gradation, binder and mix proportions recommended, *not* required
- Performance requirements for shear and fatigue testing included
  - Guidelines for performance testing are provided
- More stringent compaction requirements
  - ASTM D2041 (Rice)
- Tack coat between all lifts

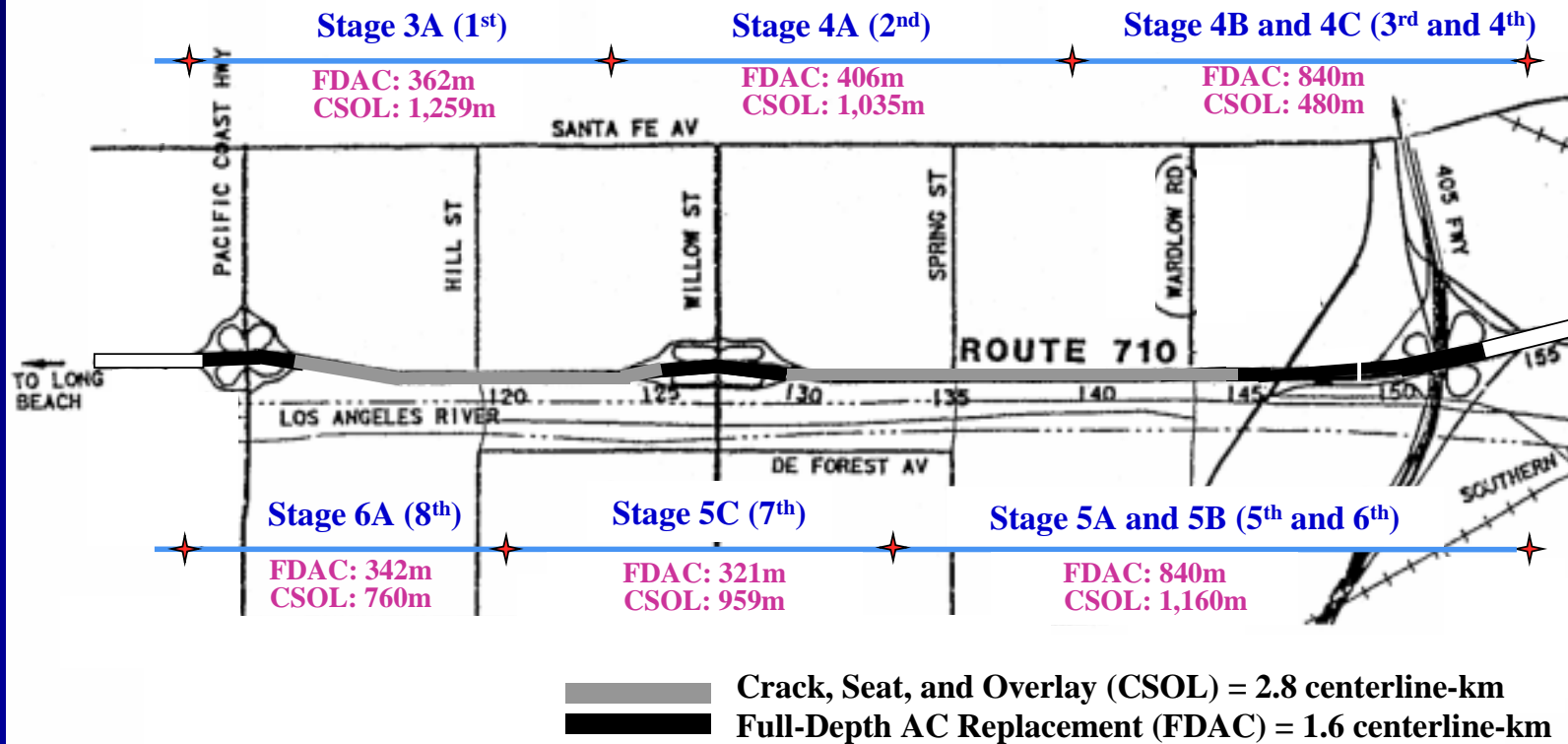
# Implementation

- Shear and fatigue laboratory tests and analyses
- Compaction
- Tack coat
- Rich bottom mix and structural design
- Partnering

# Interstate 710

- Asphalt Quantities
  - 28,000 tonnes PBA 6a
  - 91,000 tonnes AR8000

# Interstate 710



# Major Materials Quantities

## 55-H Weekend Closure

| Activities                      | Unit | Estimated Quantity |
|---------------------------------|------|--------------------|
| <b>CSOL Segment</b>             |      |                    |
| Crack & Seat PCC                | m2   | 13,826             |
| 45mm AR 8000 (Leveling Course)  | ton  | 2,462              |
| Paving Fabric                   | m2   | 19,065             |
| 85mm AR 8000                    | ton  | 4,120              |
| 75mm PBA-6A                     | ton  | 1,918              |
| <b>Full-Depth Segment</b>       |      |                    |
| PCC Removal                     | m3   | 1,489              |
| Roadway Excavation              | m3   | 1,489              |
| 50mm AR 8000 (Working Platform) | ton  | 261                |
| 75mm AR 8000 Rich Bottom        | ton  | 1,133              |
| 150mm AR 8000                   | ton  | 2,266              |
| 75mm PBA-6A                     | ton  | 1,133              |

# Screenshot of the CA4PRS Production Estimation

Constructability and Productivity Analysis

File Options Window Help

Full Depth Deterministic - 710\_Full Depth\_55-H Weekend

Project Identifier: 710\_Full Depth\_55-H Weekend

Project Details | Scheduling | Resource Profile | Analysis

Construction Window

- ☒ Weekend Closure
- ☐ Nighttime Closure
- ☐ Continuous Closure/Continuous Operation
- ☐ Continuous Closure/Shift Operation

Working Method

- ☒ Single Lane Paving (T1)
- ☐ Single Lane Paving (T2)
- ☐ Double Lane Paving (T1+T2)

Section Profile

Define... ☒ Profile A

Define... ☐ Profile B

☒ Additional Deviation Depth (mm): 165.0

Lane Width:

T1 Width (m): 5.4

T2 Width (m): 3.7

Save

ACP Layer Definition - Profile A

| Lift Number   | Lift Thickness (mm) | Lift Name   | Lift Cooling Time (hour) | Paver Speed (gph) |
|---------------|---------------------|-------------|--------------------------|-------------------|
| 4             | 76.20               | PBA-6a      | 3.00                     | 4.43              |
| 3             | 76.20               | AR-8000     | 3.00                     | 4.51              |
| 2             | 76.20               | AR-8000     | 2.00                     | 4.51              |
| 1             | 94.00               | Rich Bottom | 1.00                     | 3.36              |
| Total: 322.60 |                     |             | Average: 2.25            | Average: 4.20     |

Insert Delete Up Cancel

CA4PRS 3/13/2000 10:09 PM

start 2 Windows Ex... Constructability... Microsoft Powe... CA4PRS Cours... 10:09 PM

# Contractor's Construction Plan vs. CA4PRS Estimation vs. Actual Performance

- Estimated Production with CA4PRS
  - CSOL: 1.3 c-I-km
  - Full-depth AC: 0.37 c-I-km
- Contractor's Submitted Initial Construction Plan
  - CSOL: 1.3 c-I-km
  - Full-depth AC: TWO locations (0.76 c-I-km)
- *The Contractor Revised Construction Plan*
  - CSOL: 1.3 c-I-km
  - Full-depth AC: 0.37 c-I-km (PCH only)
- Actual Production/Progress
  - CSOL: 1.3 C.L. km, Full-depth: 0.37 c-I-km (no PBA-6a)
  - Unexpected poor sub-grade condition (4 hours delay)
- CA4PRS Estimates 8 x 55-H Weekends



# Mobilized Equipment on Shoulders





# Traffic Control













Installed Three RTMS (Remote Traffic Microwave Sensor) Surveillance Units: volume, speed, classification, occupancy



# CSOL Operation



# Existing PCC Cracking









Anshelm St 1/4  
Downtown 1/4  
Pine Ave/Flors 2-2 1/4

















SVEDALA

SVEDALA **DYNAPAC**



# Placement of Paving Fabric





26 13:02



# Paving 75mm PBA-6a\*



I-710 Long Beach  
UCB - ITS

Saturday, March 29, 2003 08:00





# Full Depth Operation

















2002.11.17



27 446





27 10:06













# What Went Well

- Full depth design utilized allowed construction completion within 55-hour closure
- Contingency plan worked well (except for 1st weekend closure)
- TMP worked well, no major accidents; very little congestion
- Different mixes presented no difficulties



# What Didn't Go Well

- Mix design verification by contractor using shear and fatigue tests
- Lack of exploratory testing in dig-out areas for FDAC sections prior to actual construction
- Difference between as-designed and as-constructed existing pavement sections in the dig-out areas
- QC/QA—dealing with large quantities of materials in short time frame
- Location of crossovers (contractor would have preferred to select these; believed that construction productivity could have been improved)
- Insufficient information on location of existing utilities, etc. under existing pavement in dig-out areas

# Lessons Learned

- Partnering a key at every level – especially technical
- Use of Productivity Program to set practical & achievable milestones
- Pre-bid conference S/B mandatory for all potential bidders
- For new test procedures included in Special Provisions insure that all involved groups perform tests and analyze resulting data the same way:
  - equipment calibration essential
  - preliminary testing of comparable specimens
- Improved specification requirements based on statistical considerations desirable

# What's Next?

- Follow-up Testing Program by Caltrans & UC Berkeley
- Continuation of AC Strategy on I-710
- Additional Long Life AC Projects in CA
- Continued Testing & Validation

# Acknowledgements

- California Department of Transportation (Caltrans – District 7)
- Asphalt Pavement Association (APA)
- Excel Paving Co.
- Vulcan Materials
- Valero Marketing & Supply
- UC Berkeley/UC Davis ITS & PRC



# Asphalt Pavement Association

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# Questions - ?

