California's Modified Binders – Past, Present & Future

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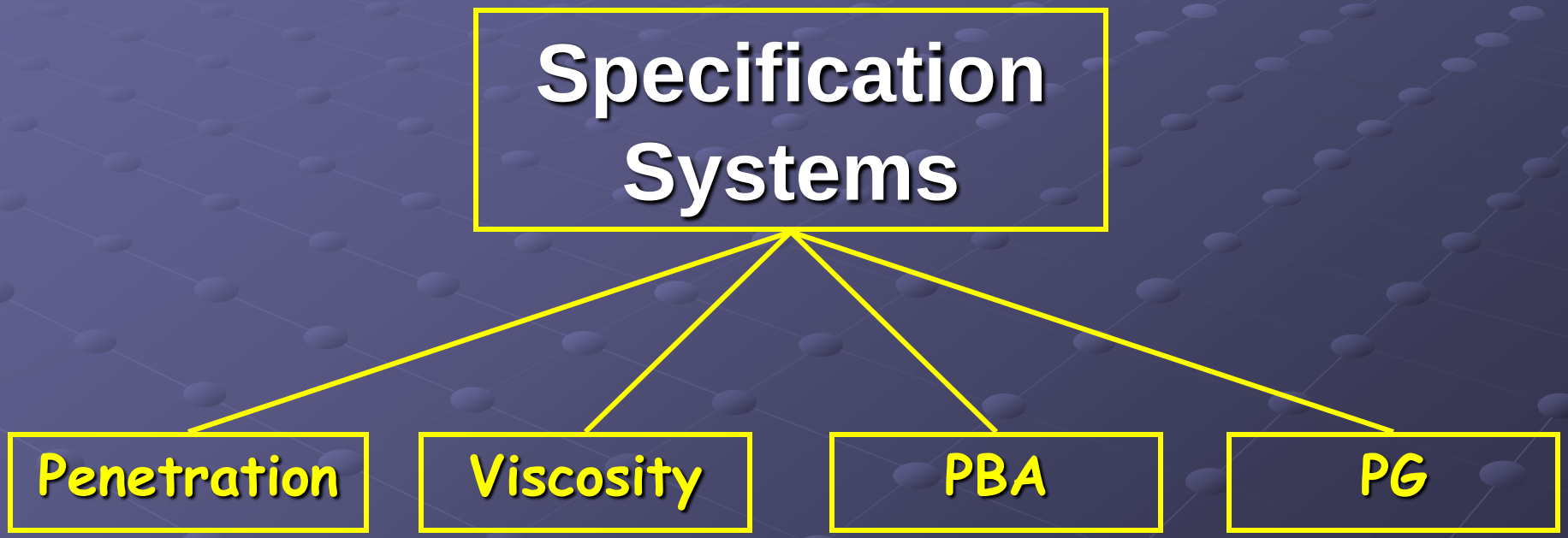
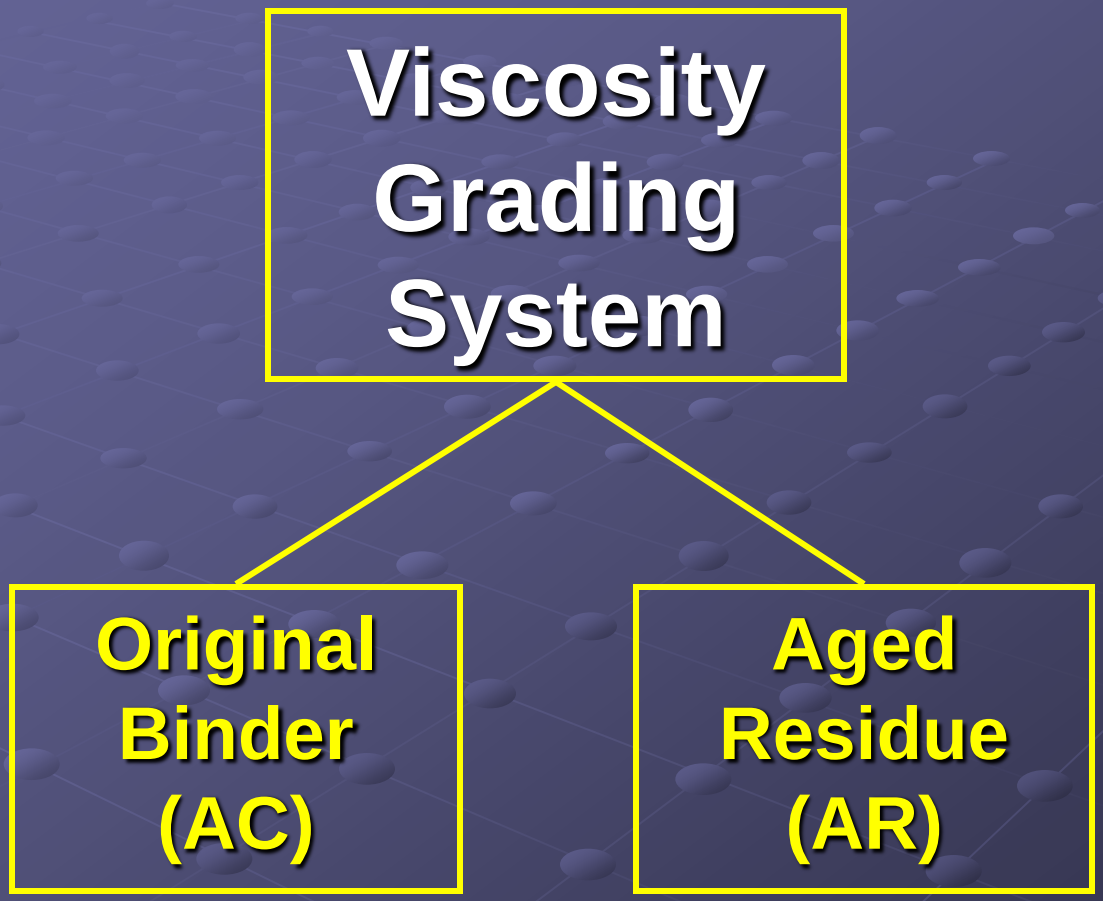
Historical Perspective




Viscosity Grading System
Original Binder (AC)
Aged Residue (AR)

PCCAS and the AR Grades

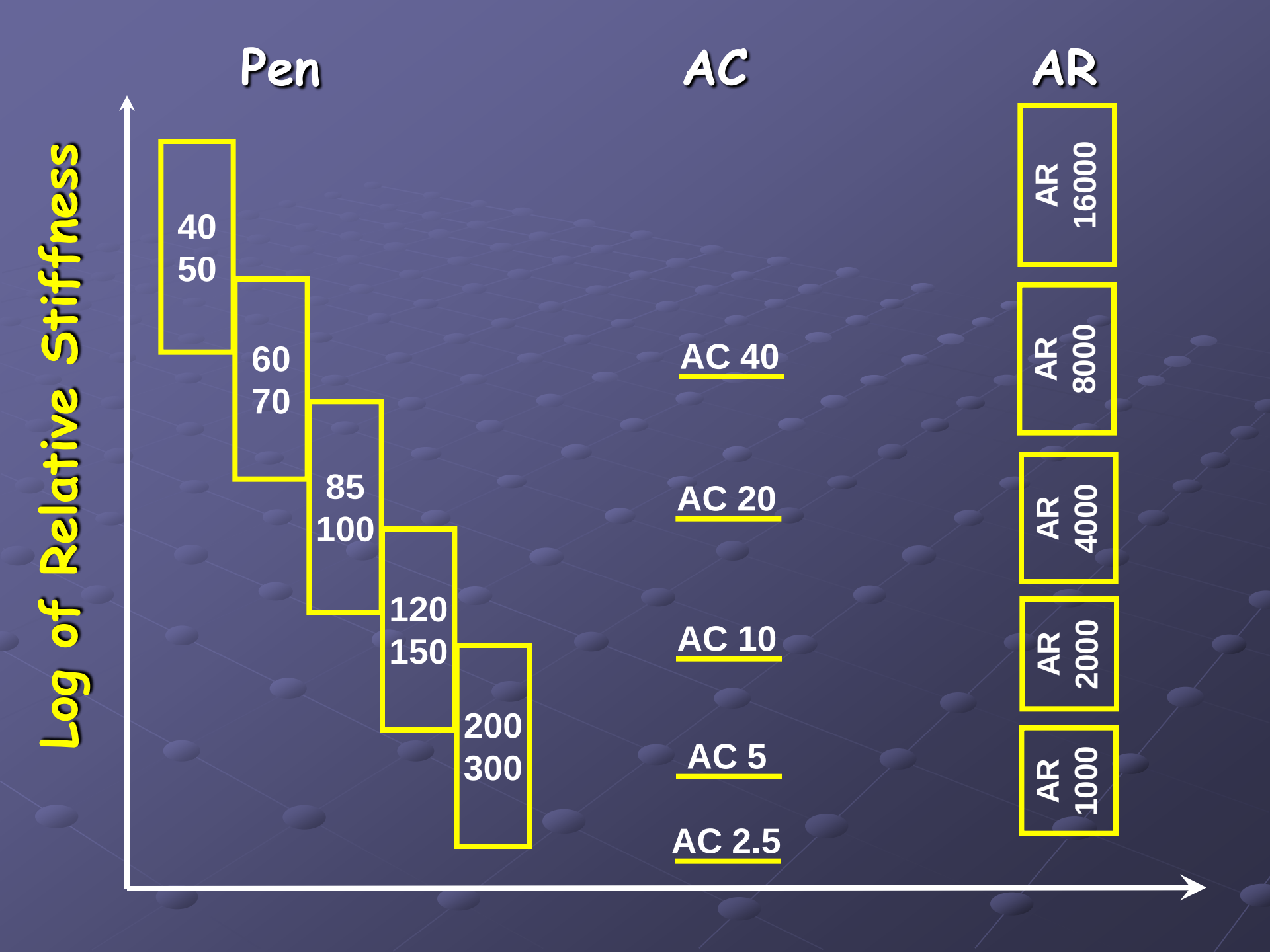
1967 1969 1972 1974

RTFOT adopted as alternative to TFOT

Use of RTFOT-conditioned asphalt began

Formally adopted

Implementation


Pen
AC
AR
Log of Relative Stiffness
40
50
60
70
85
100
120
150
200
300
AC 40
AC 20
AC 10
AC 5
AC 2.5
AR 16000
AR 8000
AR 4000
AR 2000
AR 1000

PCCAS to the Rescue

- 1987 – Paving Asphalt Committee charged to develop specs for modified asphalts
- Representatives from
  - Industry – Chevron & Golden Bear
  - ODOT
  - Caltrans

PBA Concept

Performance

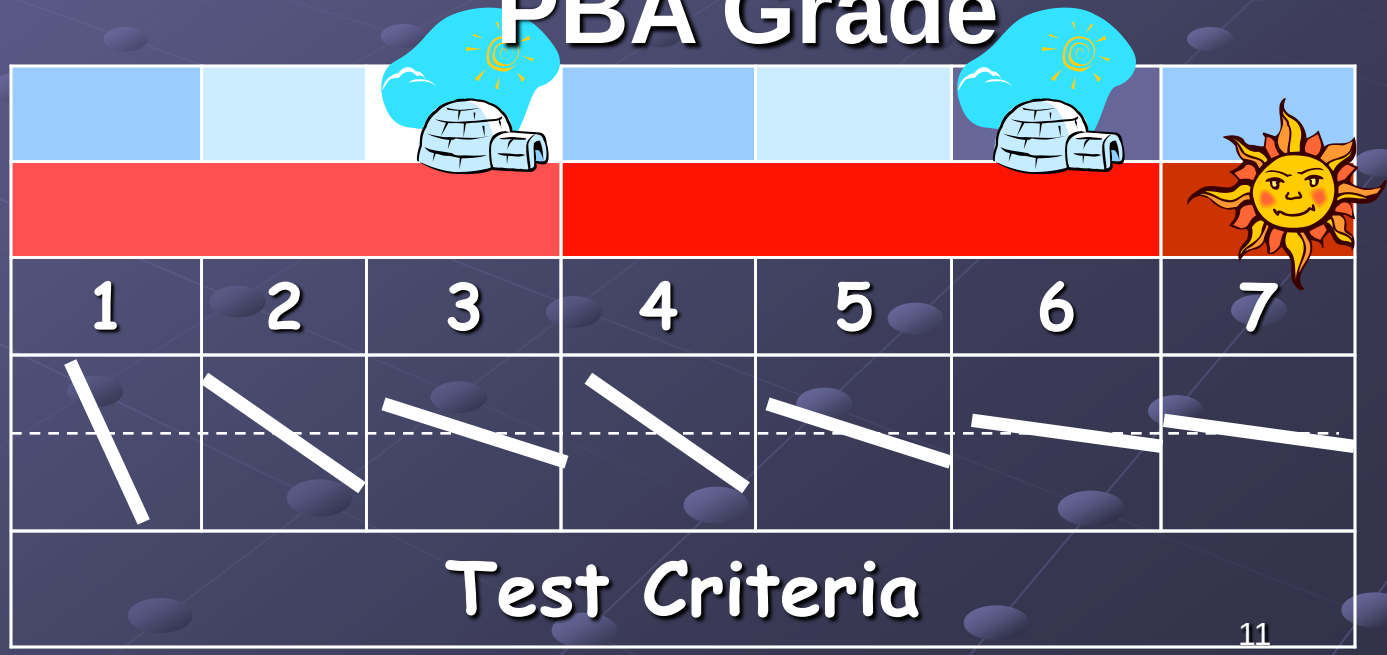
Rutting, Fatigue & Low Temp Cracking

Safety
Environment
Purity
Compatibility

Binder Tests

Climate

PBA Grade



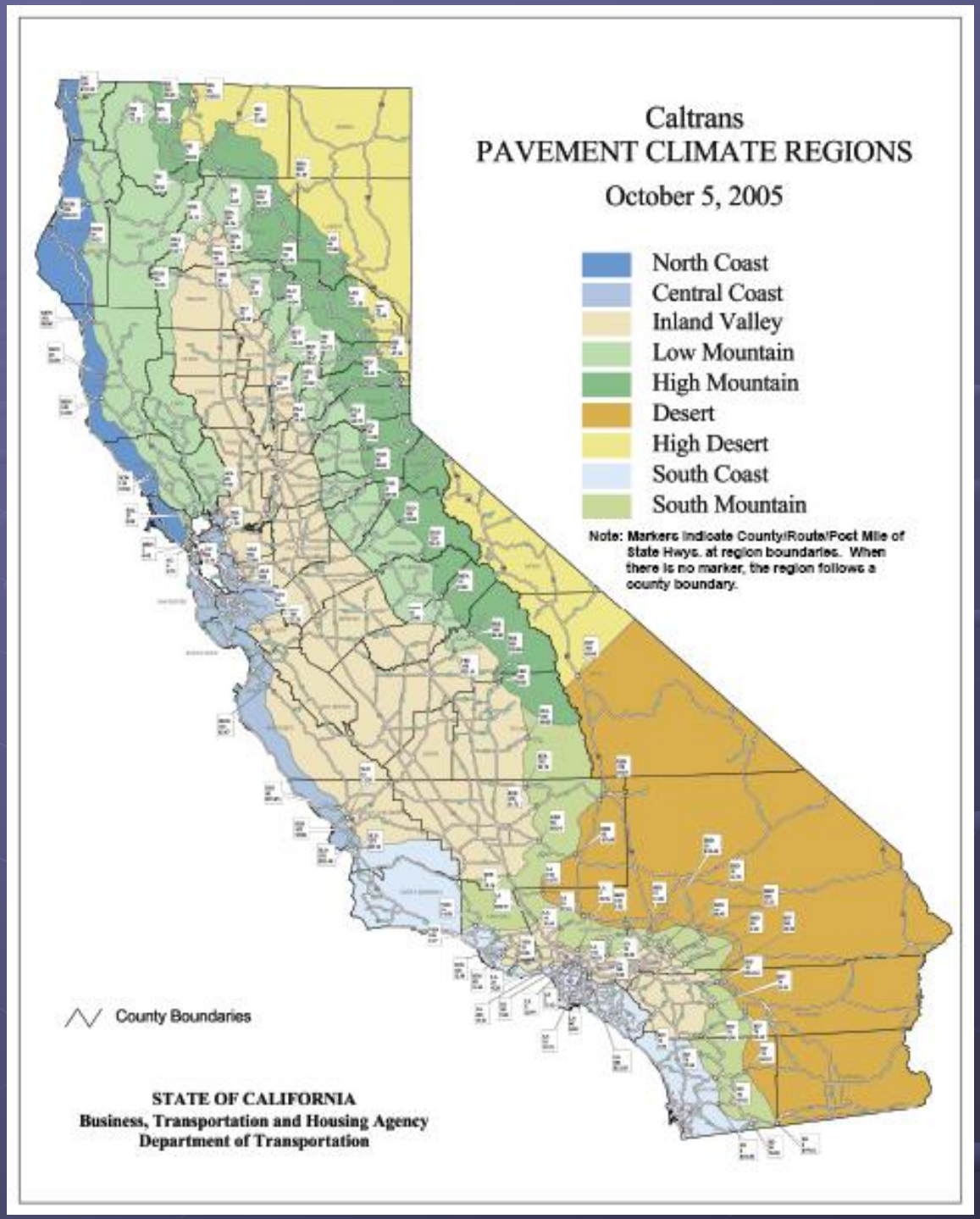
Polymer Modified Asphalts (PMA) – 1980s

- PBA 3, 6 and 7
- High Temp Properties
  - Absolute Vis on Original Binder and RTFOT
- Low Temp Properties
  - Pen (PBA 3 & 6)
  - SSD (PBA 7)

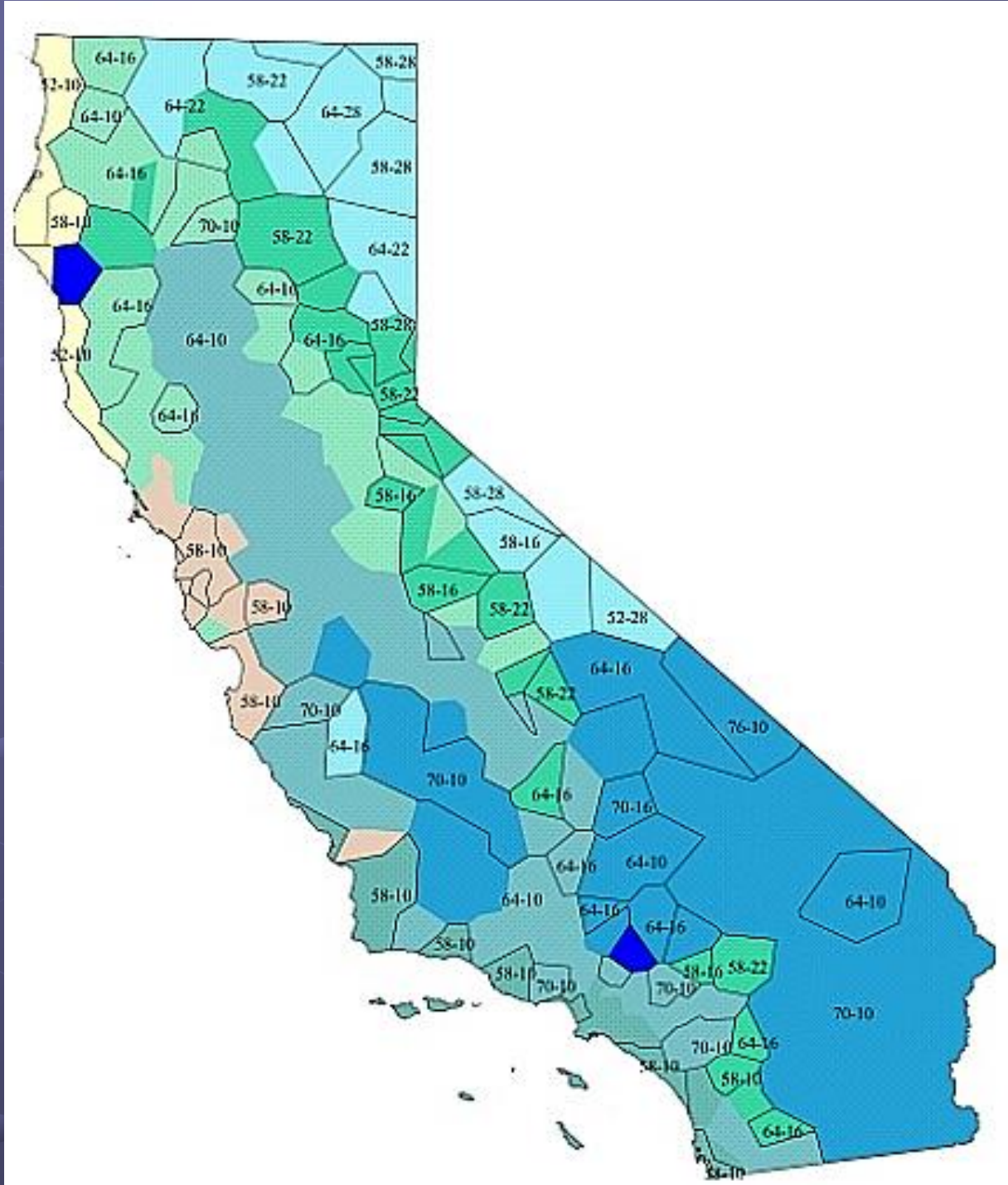
Polymer Modified Asphalts (PMA) – 1990s

- PBA 6A, 6A-mod, 6B, and 7
- High Temp Properties
  - Absolute Vis on Original Binder and RTFOT
- Low Temp Properties
    - BBR on PAV Residue
    - SSD on RTFOT or PAV Residue

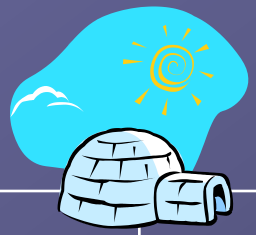
Present


Caltrans
PAVEMENT CLIMATE REGIONS
October 5, 2005
North Coast
Central Coast
Inland Valley
Low Mountain
High Mountain
Desert
High Desert
South Coast
South Mountain
Note: Markers indicate County/Route/Post Mile of State Hwys. at region boundaries. When there is no marker, the region follows a county boundary.
County Boundaries
STATE OF CALIFORNIA
Business, Transportation and Housing Agency
Department of Transportation

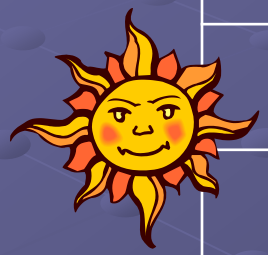
California Climate ➡ PG “Needs”



PG “Needs”

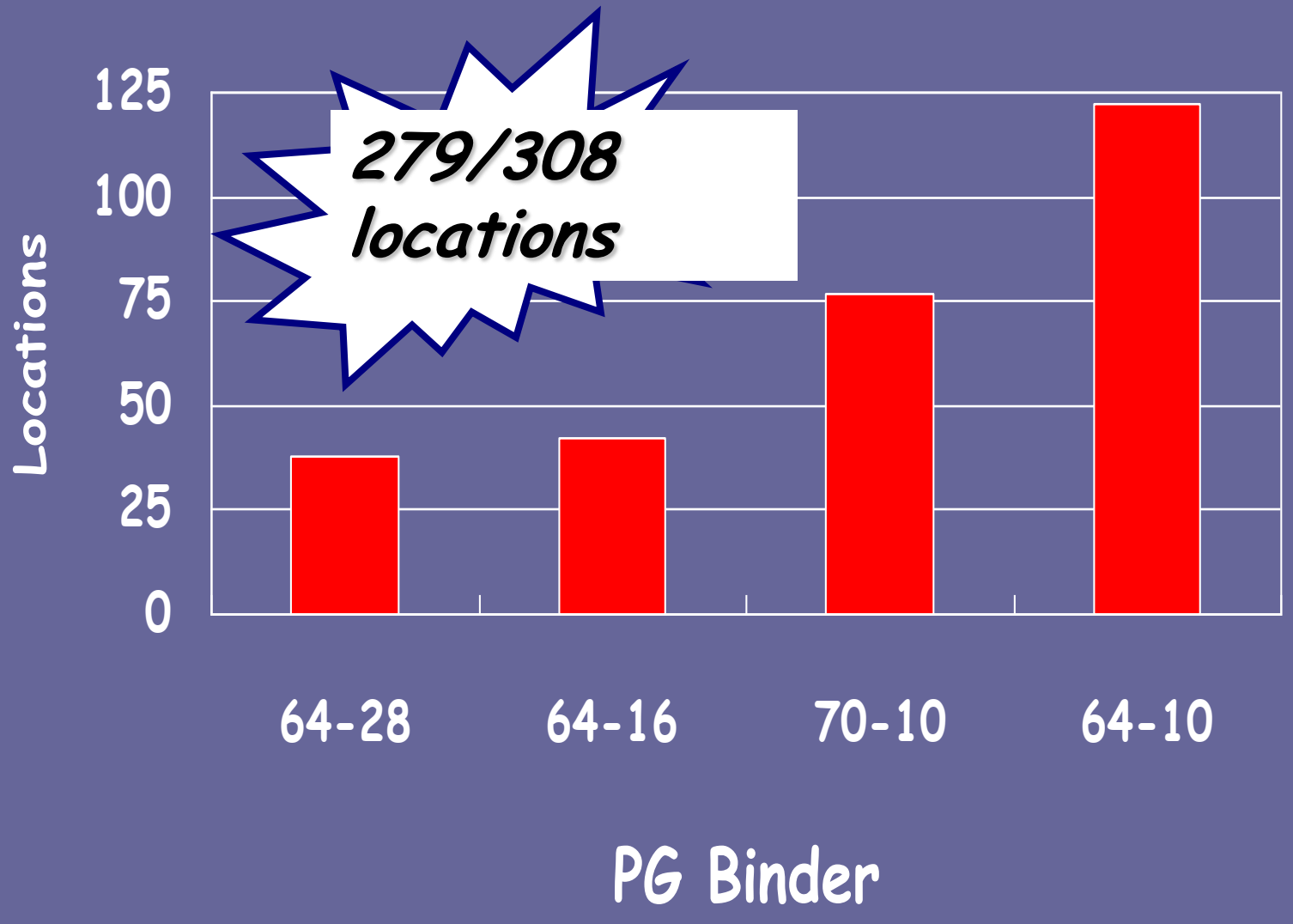


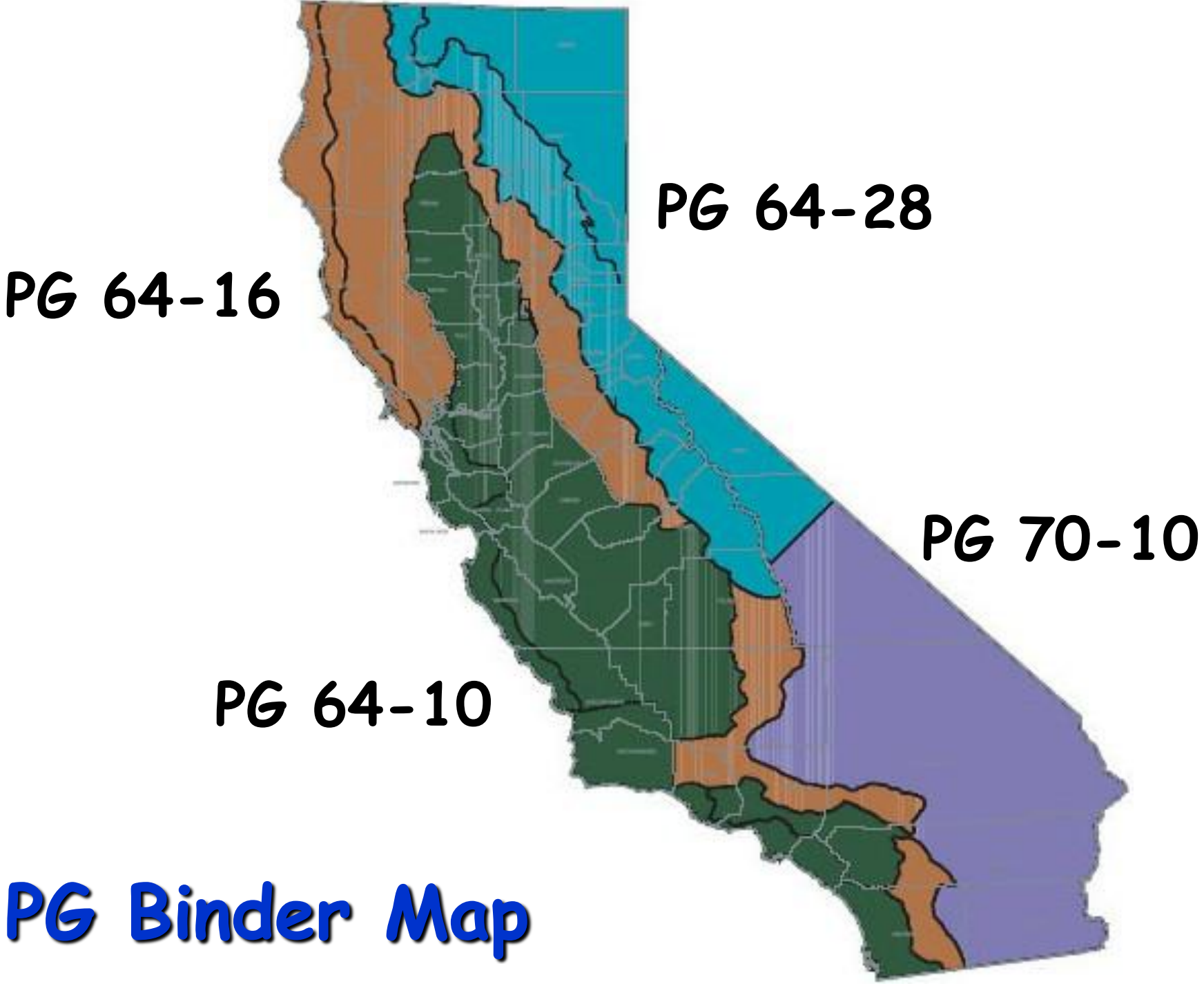
Low ▶ / High ▼	-34	-28	-22	-16	-10
40					1
46			2	3	8
52		4	5	3	23
58	1	9	10	13	24
64		1	7	23	66
70				10	77
76					18



20 PG Binders!

PG Binder Distribution





PG Binder Map

Caltrans Binder Selection – 2006

Binder / Climatic Region	Dense Graded		Open Graded	
	Typical	Special	Typical	Special
	PG	PBA	PG	PBA§
South Coast Central Coast Inland Valleys	64-10	6a(mod)	64-10	6a
North Coast	64-16	6a(mod)	64-16	6a
Low Mountain South Mountain	64-16	6a(mod)	64-16	6a
High Mountain High Desert	64-28	6a, 6b	64-28	6a
Desert	70-10	6a(mod), 7	70-10	6a(mod)

Caltrans Binder Selection – 2007

Binder / Climatic Region	Conventional Asphalt					Rubberized Asphalt
	Dense Graded			Open Graded		
	Typical	Special				PG
	PG	PG	PG (plus)	PG	PG (plus)§	
South Coast Central Coast Inland Valleys	64-10	70-10	64-28P	64-10	58-34P	64-16
North Coast	64-16	NA	64-28P	64-16		
Low Mtn South Mtn						
High Mtn High Desert	64-28		58-34P	64-28		58-22
Desert	70-10		64-28P	70-10		64-16

PG 76-22P for special location at DME discretion

§ low temp placement

Table 632.1

ASPHALT BINDER GRADE

Binder / Climatic Region	Conventional Hot Mixed Asphalt				Rubberized Asphalt
	Dense Graded HMA		Open Graded		Base Stock for Gap and Open Graded
	Typical	Special[1]	Placement Temperature		
			>70°F	<70°F	
South Coast Central Coast Inland Valleys	PG 64-10	PG 70-10 PG 64-28 PM	PG 64-10	PG 58-34 PM	PG 64-16
North Coast	PG 64-16	PG 64-28 PM	PG 64-16	PG 58-34 PM	PG 64-16
Low Mountain South Mountain	PG 64-16	PG 64-28 PM	PG 64-16	PG 58-34 PM	PG 64-16
High Mountain High Desert	PG 64-28	PG 58-34 PM[2]	PG 64-28	PG 58-34 PM	PG 58-22
Desert	PG 70-10	PG 64-28 PM	PG 70-10	PG 58-34 PM or PG 64-28PM[3]	PG 64-16

Notes:

1. PG 76-22PM may be specified for conventional dense graded hot mixed asphalt for special conditions in all climatic region when specifically requested by the District Materials Engineer.
2. PG 64-28 may be specified when specifically requested by the District Materials Engineer.
3. Consult the District Materials Engineer for which binder grade to use.

PMA Use by Caltrans

- Primarily SBR, SBS, Latex, Neoprene
- HMA (~ 15% PMA)
  - Open- and Gap-Graded
  - Elevation > 2700ft
  - Night time, coast
- Emulsions (Surface Treatments)
  - Slurry, Chip, Fog, Cape, Micro

- Original Use – Constructabilty, Eliminate Drain-Down
- Good Performance – Added Benefit!

PMA Suppliers in California

- Caltrans COC – 18 Refineries Participate
- 3 Produce PMA
  - Paramount
  - San Joaquin
  - Valero

Future PMA Use

- Attitude – Positive, Stay the Course
- Action – Uncertain
  - Global Volatility
  - Demand
  - Fuel vs Chemical
  - Competition – CRM?

Questions? Comments?