



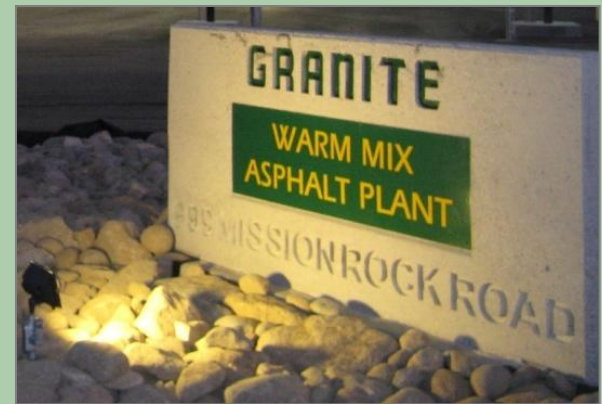
# *Staying a step ahead:* **A Contractor's Look at the Changing World of Asphalt Technology**



**2012 Arizona Pavement/Materials Conference**  
**Adam J.T. Hand, PhD, PE ♦ Granite Construction Incorporated**  
**October 30, 2012 ♦ Phoenix, AZ**

# Outline

- ❖ Industry Challenges
- ❖ Industry Opportunities and Role of New Technology
- ❖ Our Role



# Importance of Technology & Innovation

- Critical to Environmentally Responsible Supply
- Factor in Market Share
- Proven Track Record
  - Materials and Processes
- BUT, Pace of Implementation of New Technologies



# Industry Challenges

- Infrastructure Condition
- Economy / Funding
- Asphalt Binder Supply / Cost
- Competing Industry
- Slow Pace of Innovation and Implementation of New Technologies
- Societal Changes





# Infrastructure Condition\*

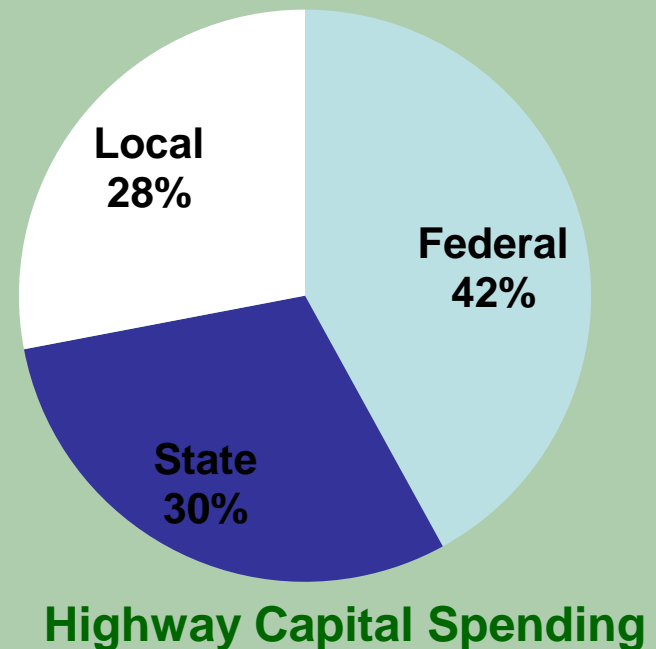
- Grade = D-
- $\approx 1/3$  of US Roads Poor or Mediocre Condition
- $\approx 1/2$  of Urban Highways Congested
- Lack of Investment through 2020 Will Cost:
  - $\approx 900,000$  jobs
  - Suppress GDP by  $\approx \$900B$
- System Backbone of US Economy



*\*ASCE 2009 and 2011 Report Card for Americas Infrastructure: Roads*

# Economy / Funding

- Asphalt Pavement Market:
  - Historically:  $\approx$  65% Publicly Funded Highways
    - Federal, State, Local Funding
  - Federal \$ = Highway Trust Fund
  - Highway Trust Fund = Gas Taxes
- Federal Transportation Bill
  - Finally
  - We Still Need More

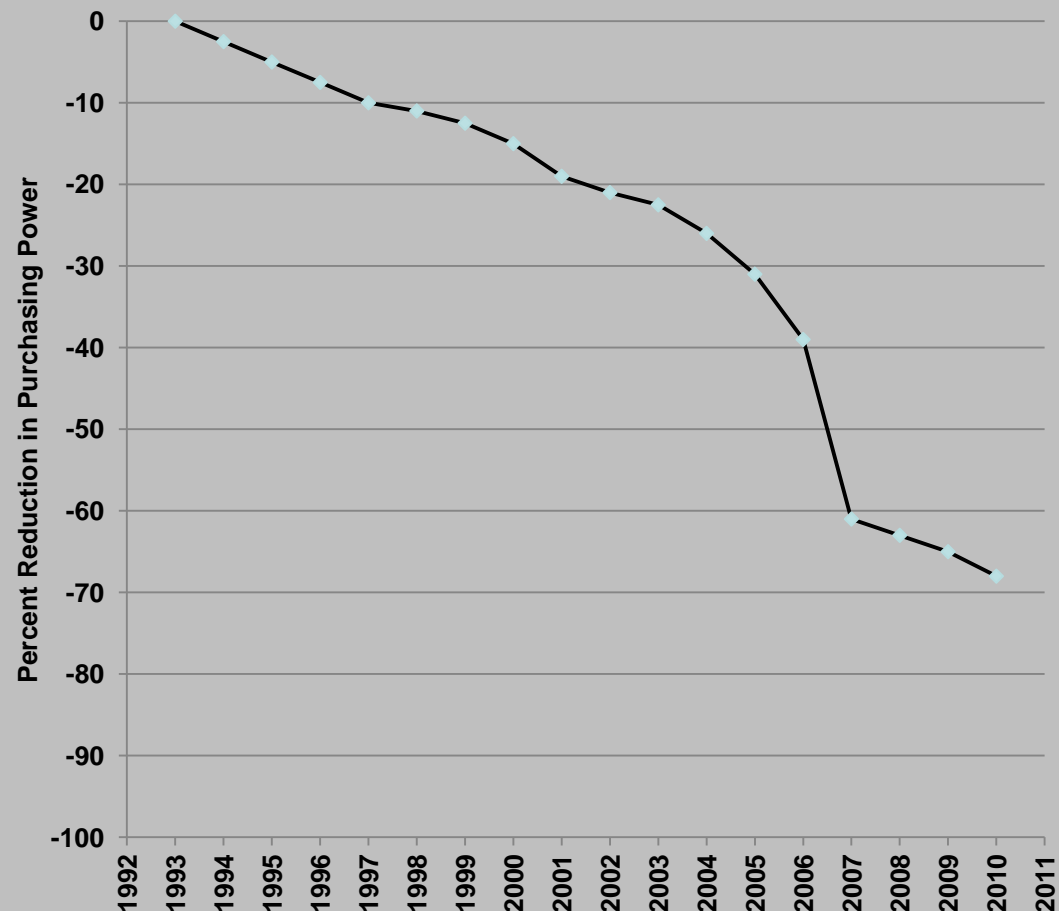


# Economy / Funding

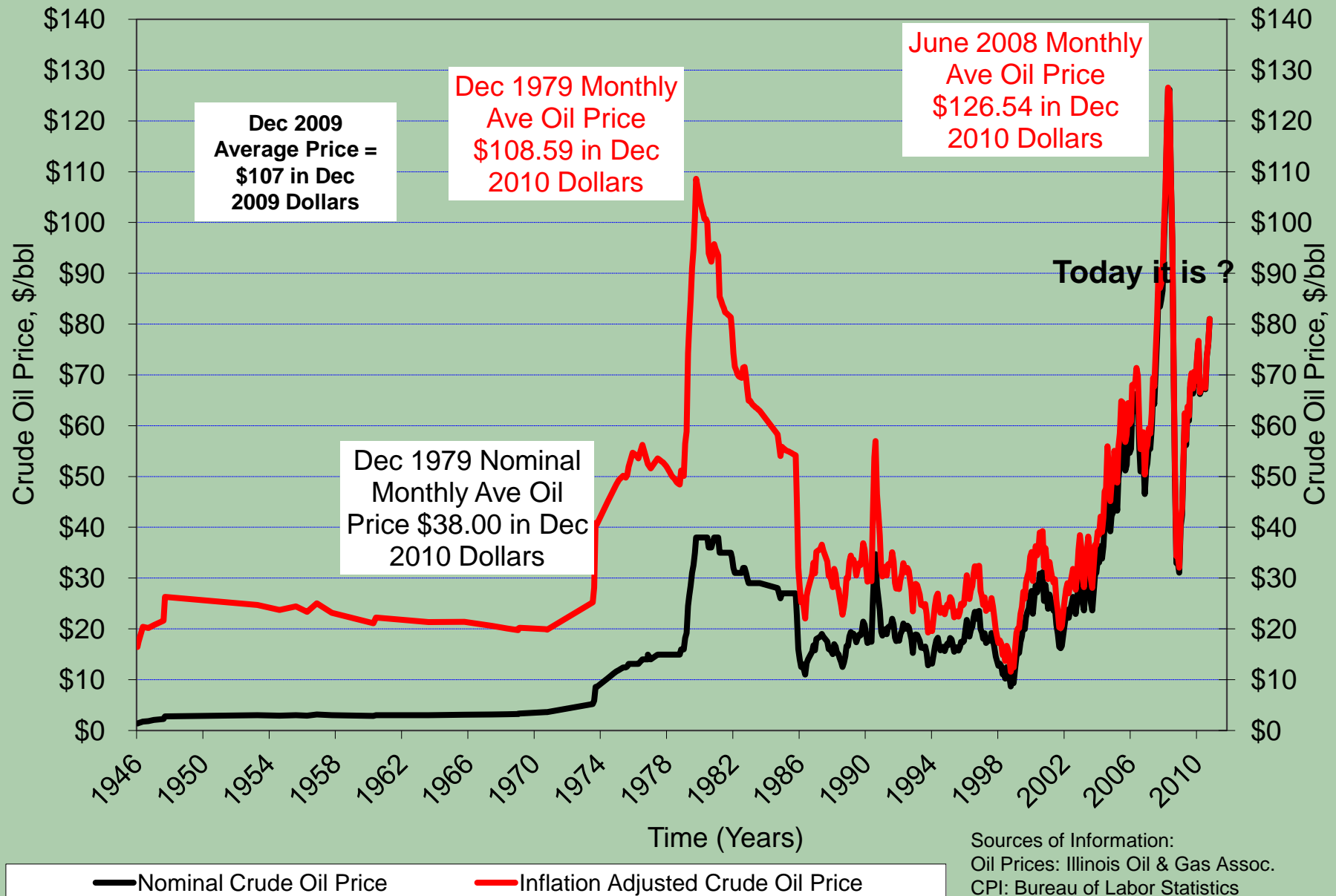
## ■ Gas Taxes Not Raised Since 1993

- Reduced Purchasing Power

- Inflation
- Raising Construction / Materials Costs
- Reduced Gas Consumption
  - Vehicle Miles Traveled
  - Improved Fuel Mileage



# Arizona Pavements/Asphalt Conference





# Asphalt Binder Supply / Cost

- 2011-2012
  - Availability of Supply
    - Crude + Modifiers + Chemicals = Paving Grade Binders
    - 21 Cokers On-line by 2014
  - Refinery Capacity and Inventory
    - Capacity Down (50-80%), but Available
    - Inventories Low, Peak Season Supply?
  - Cost = f (Raw Product Cost, Capacity, Supply and Demand)
  - Peak Season Supply and Cost
    - July 2012:  $\approx$  \$650/ton and \$800/ton
    - July 2013: \$650+/ton and \$800+/ton?



# Competing Industries

- Perception
- Economics
- Environmental Impacts
- Sustainability
- Fundamental Science Needed with LCA
  - Cradle to Grave



## ASPHALT: AGE 13

A recent survey of 50 state Departments of Transportation indicated that asphalt roads need major reconstruction after thirteen years compared to more than twenty-nine years for concrete. With initial and life-cycle costs for concrete now competitive with asphalt, concrete stretches your dollars and keeps drivers moving forward. For more information visit [www.think-harder.org](http://www.think-harder.org).

**PCA**  
Portland Cement Association

think  
harder.  
concrete™

# **Pace of Innovation and Implementation of New Technology**

- USA Built on Innovative/Technical Leadership
- Pace of New Technology Implementation is Slow
  - Many Barriers We Must Breakthrough
  - Must Wisely Manage Risk
  - Need to Accelerate the Time to Evaluate New Technology
    - Evaluation Time  $\neq$  Material Life

# Societal Change

- Global Economy
- Sustainability
- Environmental Stewardship
- Social Responsibility
- Long-term Economic Prosperity
- Industry's Role: Public and Private



# Outline

- ❖ Industry Challenges
- ❖ **Industry Opportunities and Role of New Technology**
- ❖ Our Role



# Industry Opportunities

- Infrastructure Condition
- Economy / Funding
- Asphalt Binder Supply / Cost
- Slow Pace of Innovation and Implementation of New Technologies





# Industry Opportunities

## (Infrastructure Condition)

- Capacity and Ability Exists to Build and Preserve Asphalt Infrastructure
- Maintenance / Preservation
  - Seals
  - Thin Overlays
- Rehabilitation
  - Overlays
  - Mill & Fill
- Reconstruction
  - Structural Section
  - Replacement



# Industry Opportunities

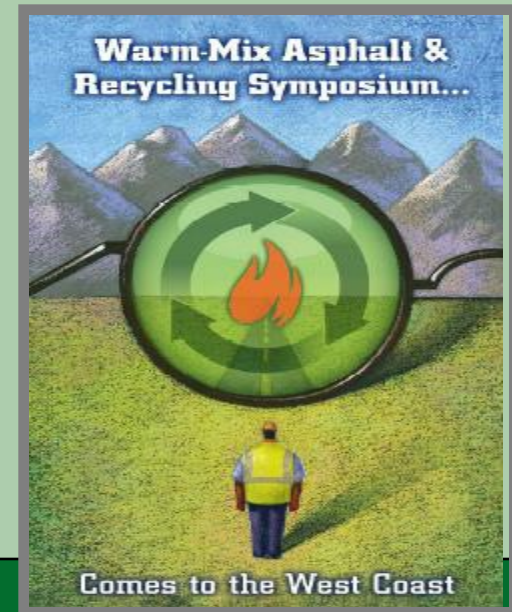
## (Economy)

- Potential Economic Impact
  - US Unemployment  $\approx$  8.5%
  - Construction Unemployment  $\approx$  20%
  - Highway Construction Investment Impacts
    - Every \$1 Billion Spent  $\approx$  35,000 Jobs
    - Every \$1 Invested  $\approx$  \$1.80 GDP
- AASHTO Report to Congress
  - 9,500 Projects “Ready to Go” (within 120 days)
  - \$69 Billion Value
  - Highway Investment Most Effective Economic Stimulator

# Industry Opportunities

## (Economy)

- 2010 On...
  - Economics and Sustainability No Longer Independent
  - Sustainability is Key
  - Green Construction Technologies are Available
    - Materials
    - Processes
    - We Need to Grow the List



# Industry Opportunities

## (Asphalt Binder/Supply)

- Bigger than Asphalt Binder/Supply: Green Construction Technologies
  - Technologies
    - Recycling
      - Materials
      - Processes
    - Warm Mix Asphalt (WMA)
    - Preventive Maintenance Treatments
  - Significant Sustainable Benefits through Green Technology



# Industry Opportunities

## ■ Recycled Materials

- HMA: Most Recycled Material in the World  $\approx$  100M tons/yr RAP
  - Conventional and High RAP HMA
- Tires
  - CRM (wet process) and Terminal Blend Binders
- Shingles (RAS)
  - Manufacture Byproduct and Tear Offs
- Aggregate Base





# States Use of Recycled Materials

- RAP
  - $\approx$  75% of States Allow 10+% RAP in Surface Course
  - $\approx$  30 States Increased Allowable % RAP Since 2007
- Shingles
  - $\approx$  20 States Allow 5% Shingles in HMA
- Tires - CRM
  - Primarily South(east & west)
- Aggregate Base
  - 0 to 100%





# Recycling Processes

- Recycle Processes
  - Cold In-place Recycling
    - Partial and Full Depth
  - Cold Foam In-place Recycling
  - Hot In-place Recycling
  - Aggregate Base Recycling



**CIPR**



**HIPR**



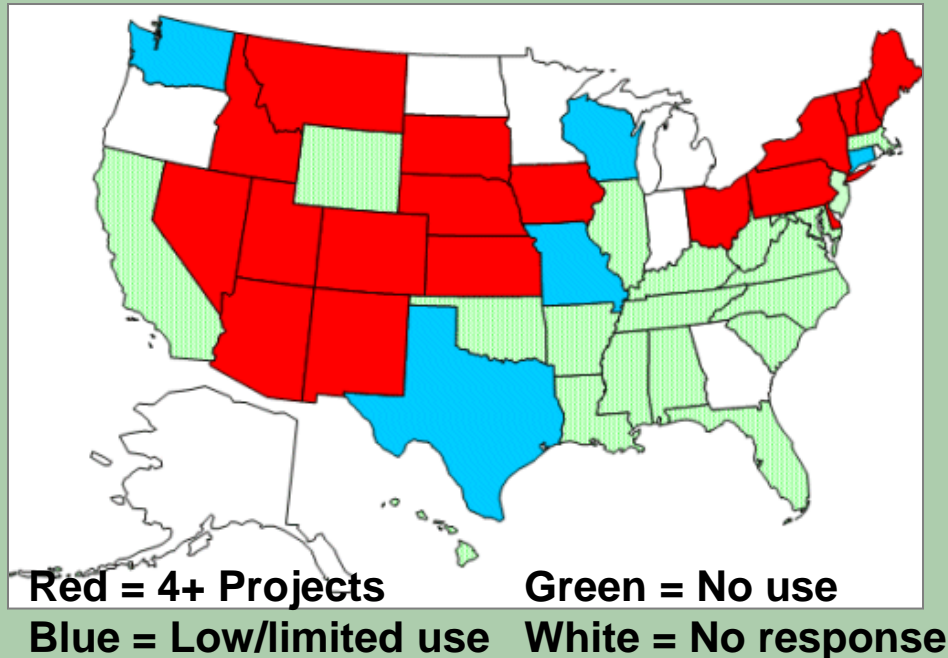
# State's Use of In-Place Recycling

## • CIPR

- ≈ 20 States Specify
- Most States have Experimented

## • HIPR

- ≈ 10 States Specify
- Over 30 States have Experimented



# Recycling Benefits

- Conservation
  - Materials (aggregate and asphalt binder)
  - Energy - burner fuel & trucking (in-place processing)
- Preservation of Environment
  - Landfill
  - Emissions / Green House Gases (global warming)
- Economics
  - Important to Look at Life Cycle Costs through Recycle Products & Processes
  - Complete Reconstruction vs. Alternative Methods
  - Recycling Benefits Often Overlooked in Economic Analysis

# Recycled Materials in HMA

## % Savings

Material / Process	Recycled Material Content, %	Recycled Asphalt Binder Content, %	Price	Energy	CO <sub>2eq</sub>	AC	Agg
Conventional HMA	0	0	-	-	-	-	-
RAP	15	4	5.7	6.1	4.7	11.5	15.2
	25	4	9.5	10.1	8.0	19.2	25.3
Post Industrial Shingles	5	18	6.6	7.6	4.5	17.3	4.3
Post Consumer Shingles	5	32	12.0	13.2	7.4	30.8	3.6
WMA	0	0	0.8	4.3	1.5	0.0	0.0



# RAP is Green!

	Annual Consumption/ Production	Estimated Annual Savings		
		15% RAP	25% RAP	50% RAP
Asphalt Binder, tons	23M	2.6M	4.3M	8.6M
Aggregate, tons	407M	59M	98M	196M
HMA Price, \$	34B	1.0B	1.7B	3.4B
		(\$2.40/ton)	(\$4.00/ton)	(\$8.00/ton)
Energy, 10 <sup>12</sup> Btu	234	12	19	37

# Another Opportunity: Warm Mix Asphalt

Warm Mix

Hot Mix



Many, Many Technology Options Available Today  
Many Discussed in Next 2 Days



# Benefits of WMA

## (NAPA QIS 125)

- Reduced Fuel Use
- Reduced Emissions
- Improved Working Conditions for Workers
- Paving Benefits
  - Compaction Aid
  - Cold-Weather Paving
  - Longer Haul Distances
  - Use of Higher %RAP
  - Beneficial in Non-Attainment Areas

Quality Improvement Series 125

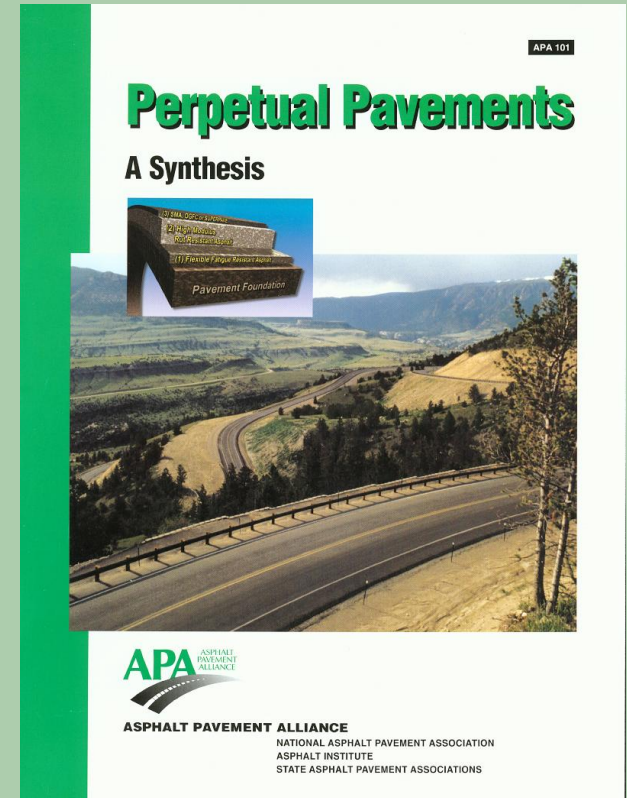


## Warm-Mix Asphalt: Best Practices



# Unique Design Considerations

- Specialty Materials
  - SMA
  - Porous Asphalt
  - Thin Overlays
- Design Procedures
  - Perpetual Pavements
  - Thin Overlays
- Performance Tests
  - NCHRP Ray Today



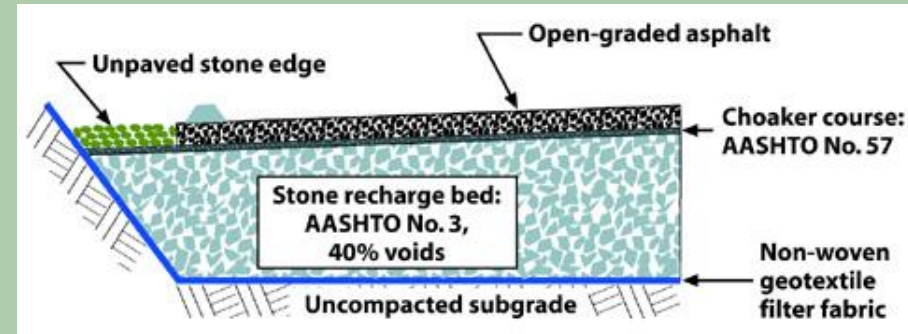
# Stone Matrix Asphalt (SMA) (NAPA IS 128)

- Surface Course Only
- Superior Rut Resistance
- Superior Durability
- Gap Graded
- Premium Cost
- Primary Use in East and So. East
- Perpetual Pavement Surface Course



## Porous Asphalts (NAPA IS)

- Dual Purpose Pavements
  - Parking Lots
  - Stormwater Management
    - Drains Recharge Bed
    - Infiltrates Soil
- Improve Water Quality
- Eliminate Detention Basins
- Cost-Effective
- UHI Tool





# Thin Overlays

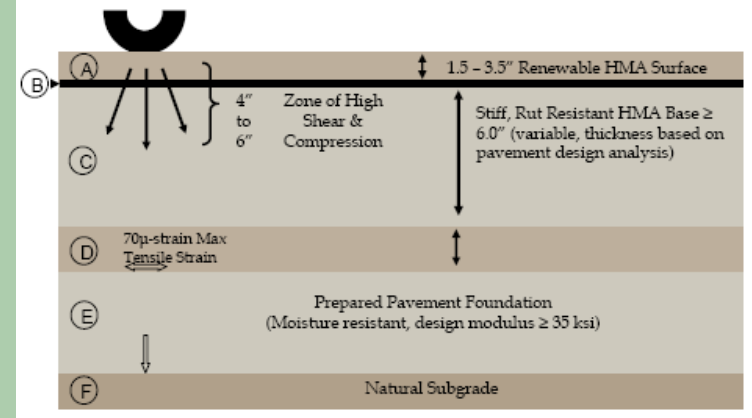
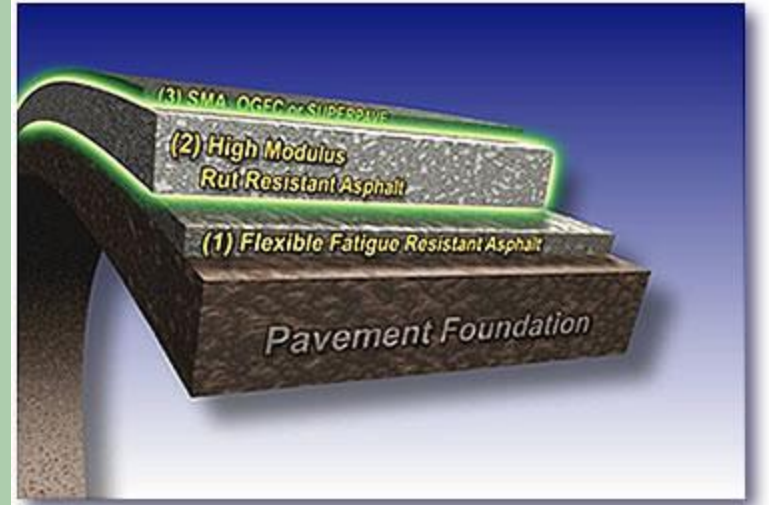
(NAPA IS 135)

- Improve Ride Quality
- Reduce Pavement Distresses
- Maintain Surface Geometrics
- Reduce Noise
- Reduce Life Cycle Costs
- Many Materials Can Be Used
  - HMA, WMA, RAP, RAS, PMB



## Perpetual Pavements (APA PerRoad Software)

- Long Life Multilayer Design with Routine Maintenance
- Benefits
  - Durability
  - Safety
  - Smoothness
  - Long Lasting
  - Cost Effective
  - No Expensive Time-Consuming Major Rehabilitation
- Limited Use





# Tools for Unique Design Considerations

- Equipment is Available
- Materials and Materials Selection
  - Numerous NAPA Publications
  - APA Publications
- Processes (Design and Economics)
  - Perpetual Pavement Design Software
    - APA PerRoad Software
  - Life Cycle Cost Analysis Software
    - APA LCCA and LCCAExpress
  - Must Go To LCA



# Outline

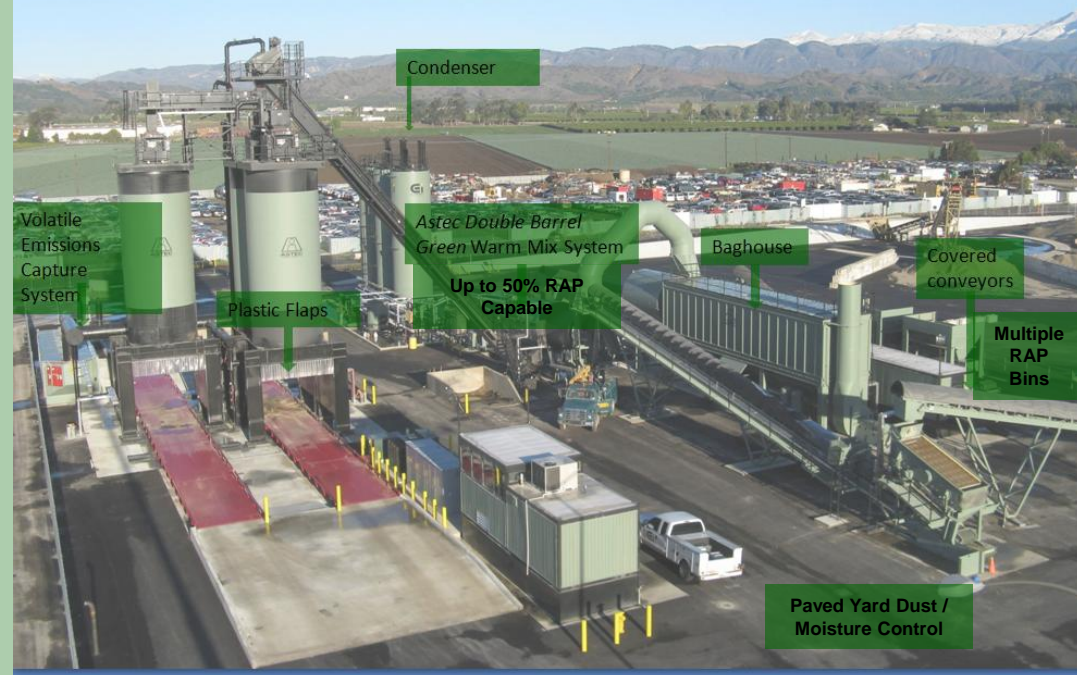
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# Putting Technologies Together

- RAP & RAS
- RAP & WMA
- RAP, RAS, & WMA
- CRM & RAP
- CRM, RAP, & RAS
- SMA, Thin Lifts
- Porous Pavements
- Perpetual Pavements
- Production/Equip. Capabilities in Place
- Design Tools Available

Ventura Plant Environmental Features



# We Have The Technology!

- We Have Implementable Technologies
- Why Aren't They More Rapidly Implemented?
  - High RAP                      WMA
  - Shingles                      CRM
  - CIPR                          HIPR
  - SMA                          Porous Asphalt
  - Perpetual Pavements
- Are You Satisfied with the Pace?
- What Can You Do?
- What is The Next New Technology?  
*(Could just be a combination of previously mentioned items...)*



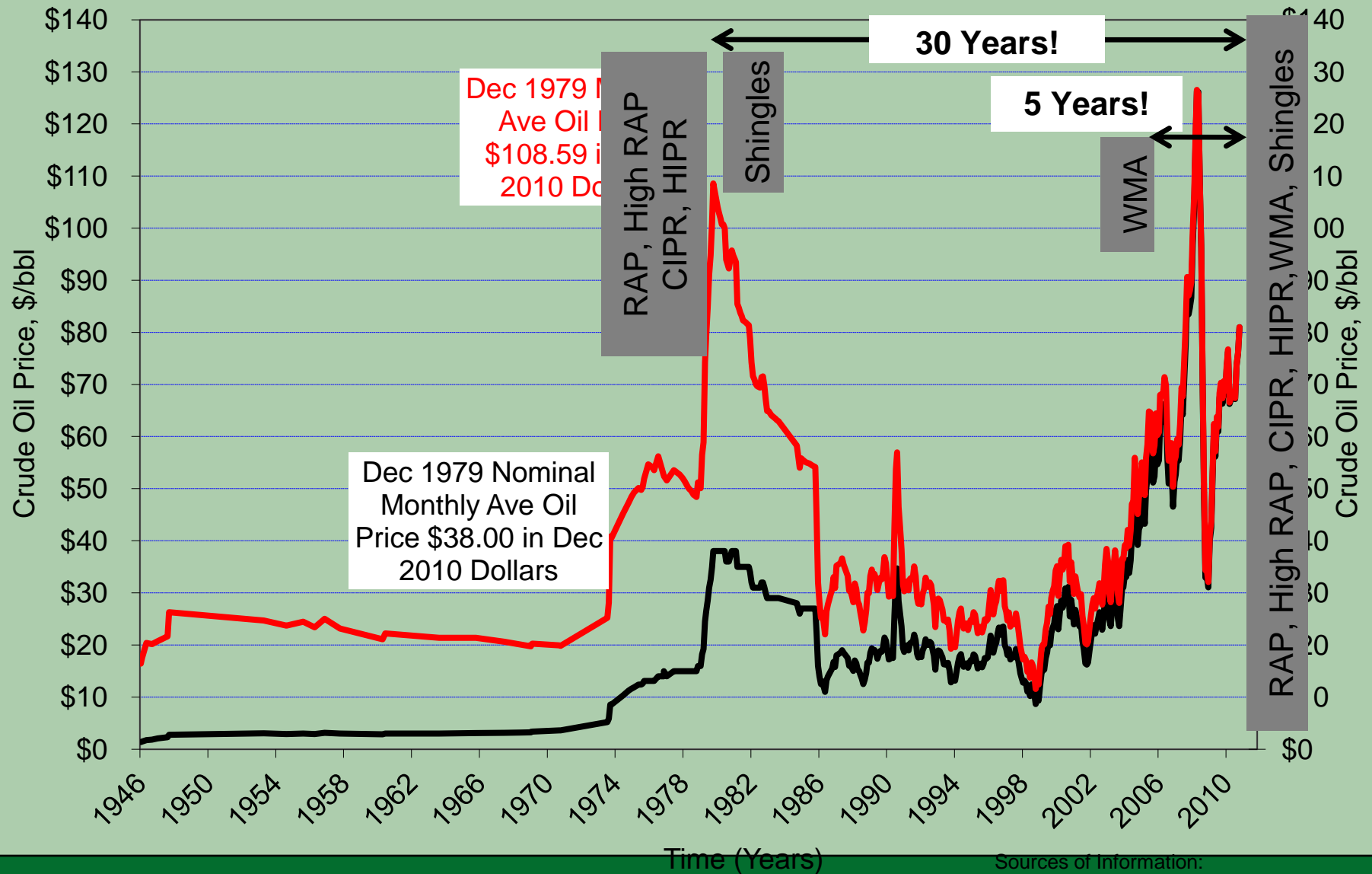
# Use Latest Resources

- APA
  - Software
  - Documents
    - *Carbon Footprint: How Does Asphalt Stack Up* Whitepaper
    - Asphalt in Livable Communities
    - Pavement Smoothness and Fuel Economy
    - Pavement Type Selection
- NAPA
  - Documents
  - Conference/Workshops



# Arizona Pavements/Asphalt Conference

## Why So Long?



Sources of Information:  
Oil Prices: Illinois Oil & Gas Assoc.  
CPI: Bureau of Labor Statistics

# Pace of Acceptance

- Technology Implementation is TOO Slow
- Over 30 Years Experience with Many
- Accelerate Evaluation Process / Time
  - Design Procedures
  - Lab and Test Tracks, Field
- Optimize Benefit, Cost, and Risk

# **We Should ALL Be Committed to...**

- Recognizing Infrastructure Condition / Forecast
- Maximizing Effectiveness of Declining Budget
- Using Technology / Innovation to Help
- Support Rapid Implementation of New Technology-materials and processes
- Adapting to Changing and Improving Society



Thank You!

