

CONCRETE PRESERVATION IN URBAN AREAS

LARRY SCOFIELD, P.E.

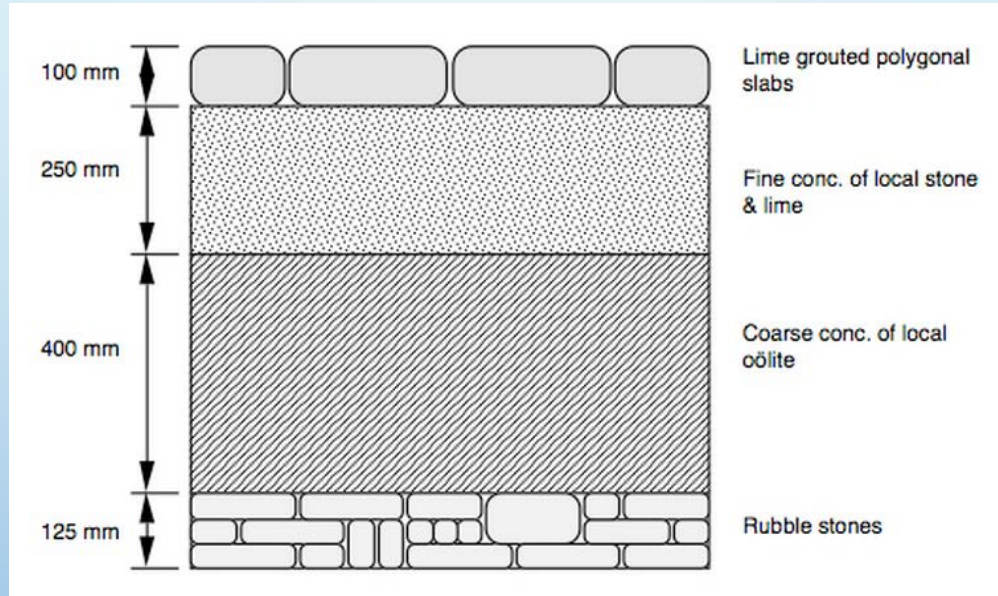
INTERNATIONAL GROOVING AND GRINDING ASSOCIATION



The background is a light blue gradient with several realistic water droplets of various sizes scattered across the top and bottom edges. The droplets have highlights and shadows, giving them a three-dimensional appearance.

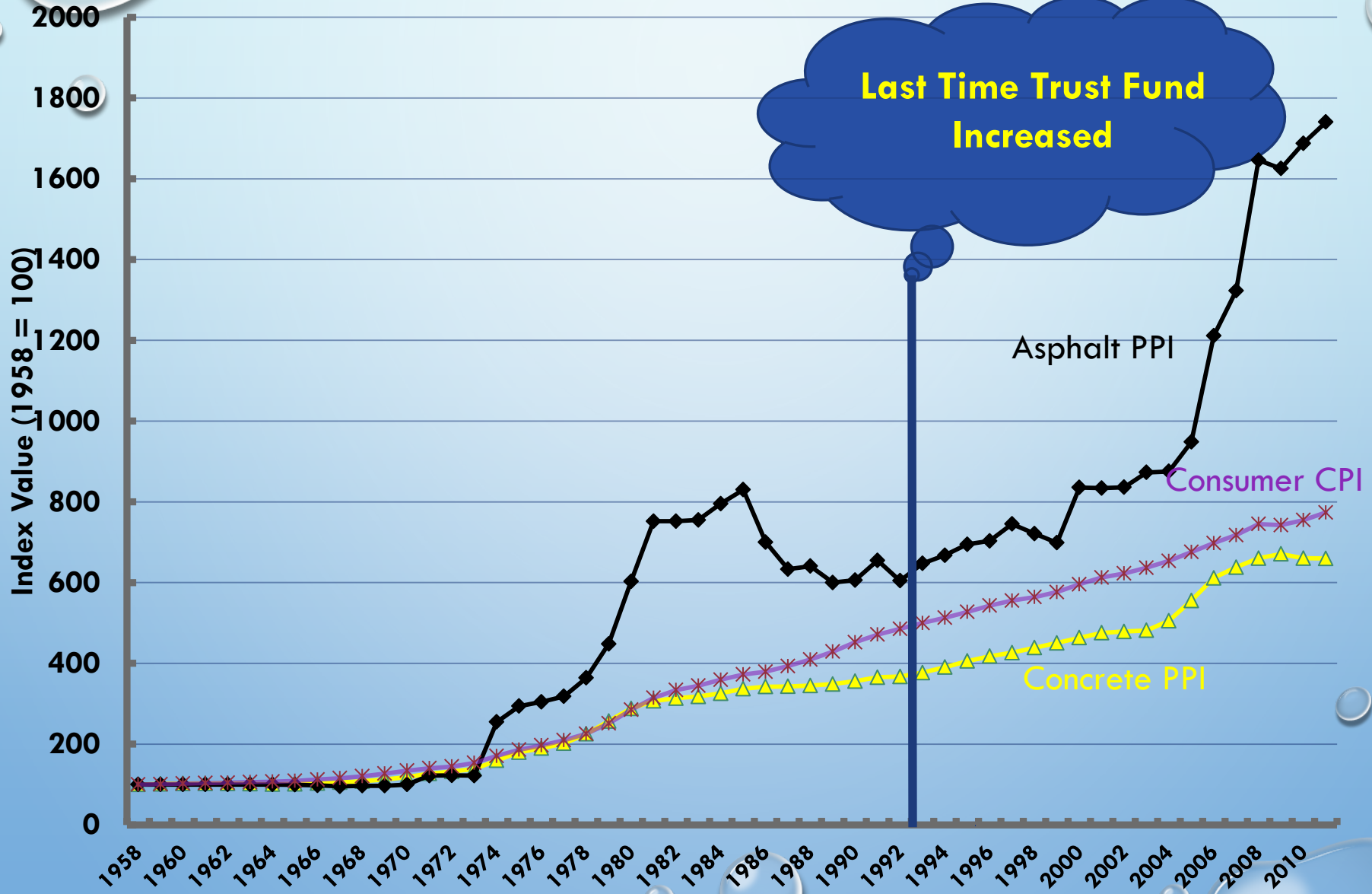
BIG PRESERVATION

EVERYBODY WINS WHEN IT IS FUNDED



**Roman Road – Network
Approximately Equal to
the US Interstate System--
Cost \$3.2 Million per Mile**

COMMODITY PRICE INCREASES



ROAD BUILDING/PRESERVATION 1993 AND 2014

Funding

- 1993 LETS BUILD 100 MILES
OF ROAD



- 2014 LETS BUILD 67 MILES
OF ROAD

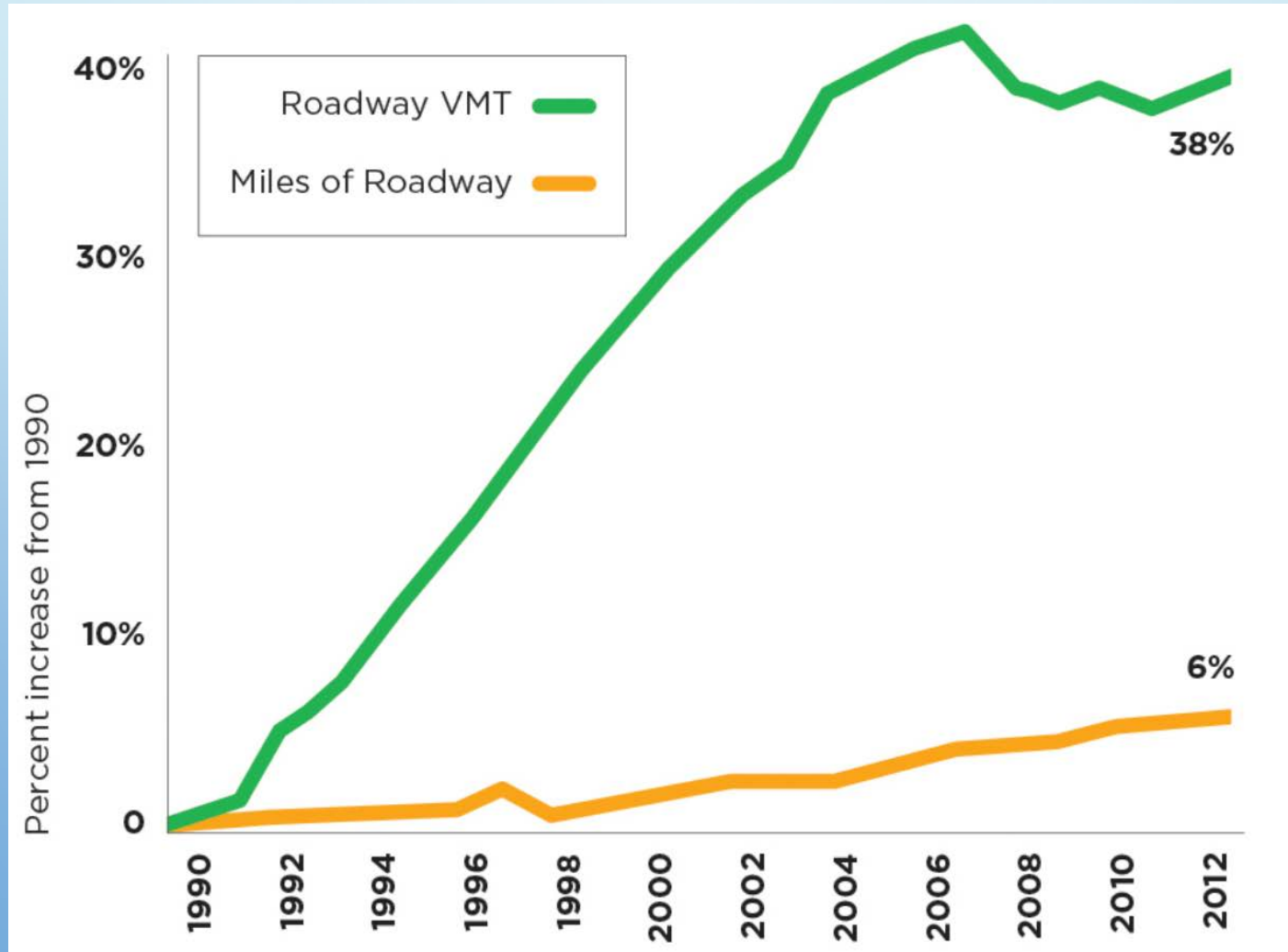


Arizona Consumption Rate

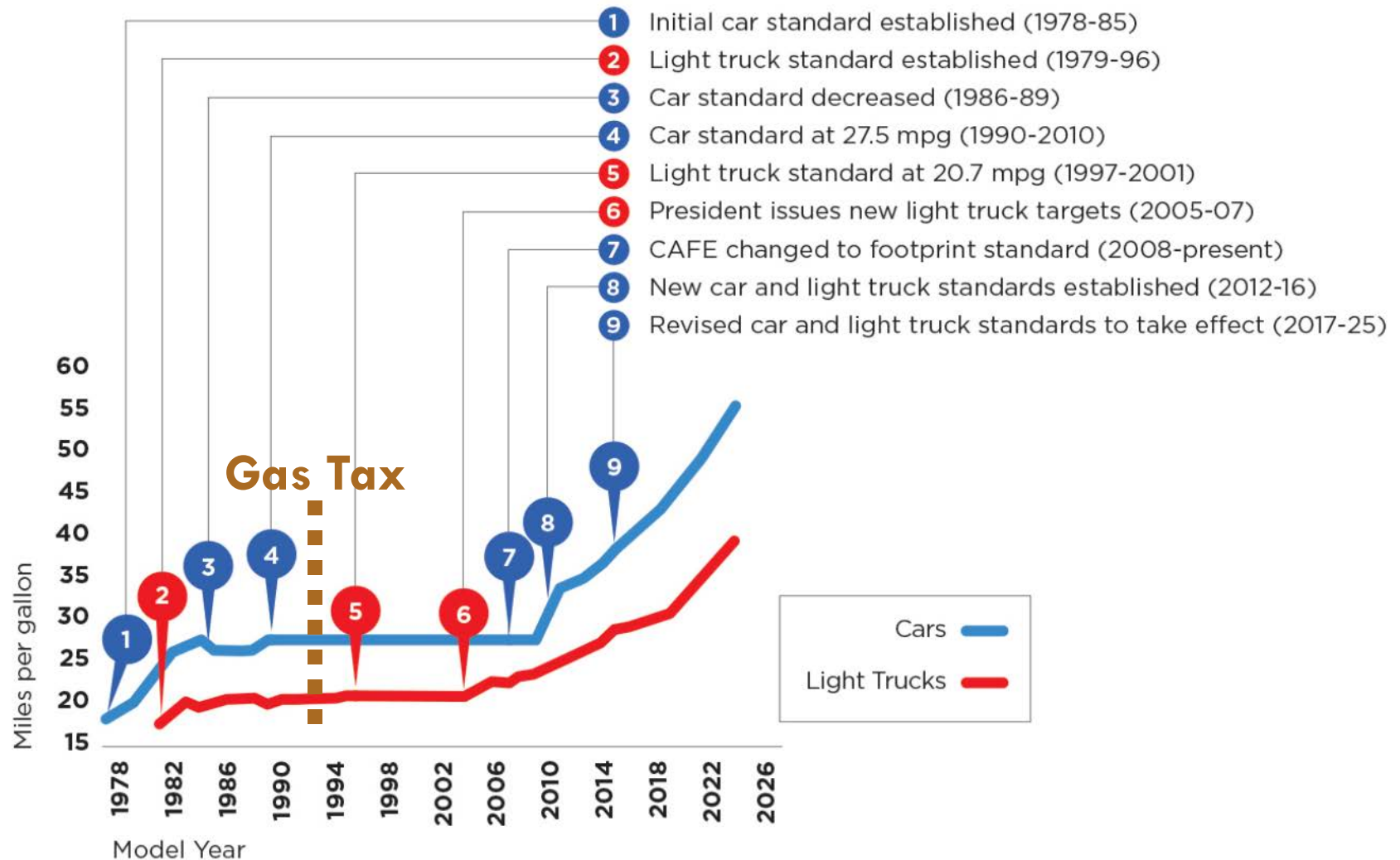
- 1995 Lets Drive 39.7
Billion VMT

- 2014 Lets Drive 59.6
Billion VMT (50%)

INCREASE IN VEHICLE MILES TRAVELED AND MILES OF ROADWAY (1990-2012)



STANDARDS IN VEHICLE FUEL EFFICIENCY



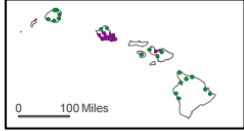
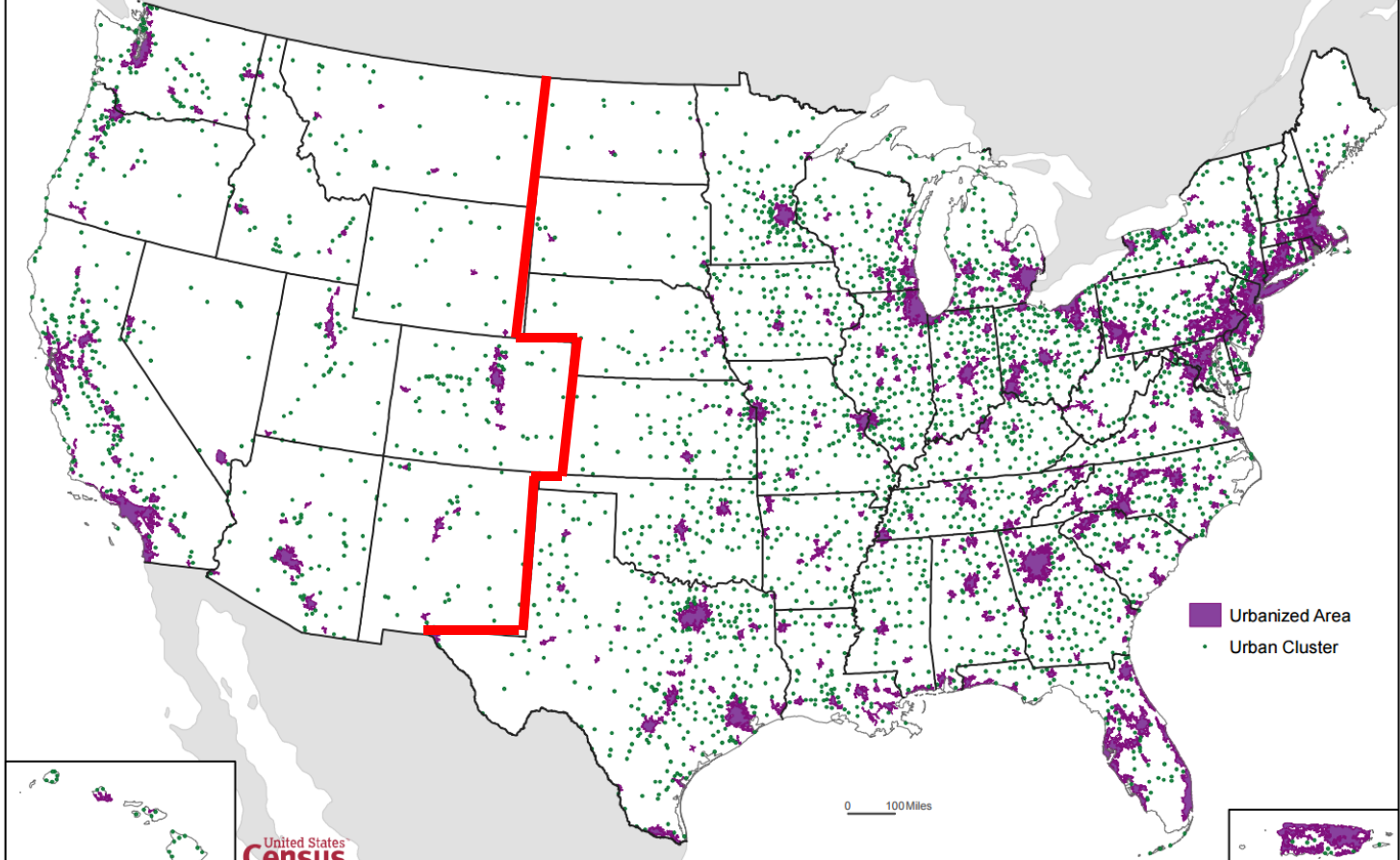
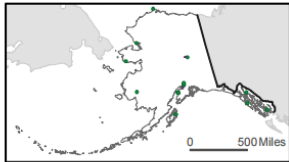
33 (34) ~~TRANSPORTATION~~ TRANSPORTATION FUNDING BILL EXTENSIONS AND COUNTING.....



2010 CENSUS DEFINITION OF URBAN

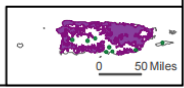
- **URBANIZED AREAS: 50,000 OR MORE PEOPLE**
- **URBAN CLUSTERS: AT LEAST 2,500 AND LESS THAN 50,000 PEOPLE**
- **RURAL IS EVERYTHING ELSE**

Urbanized Areas and Urban Clusters: 2010

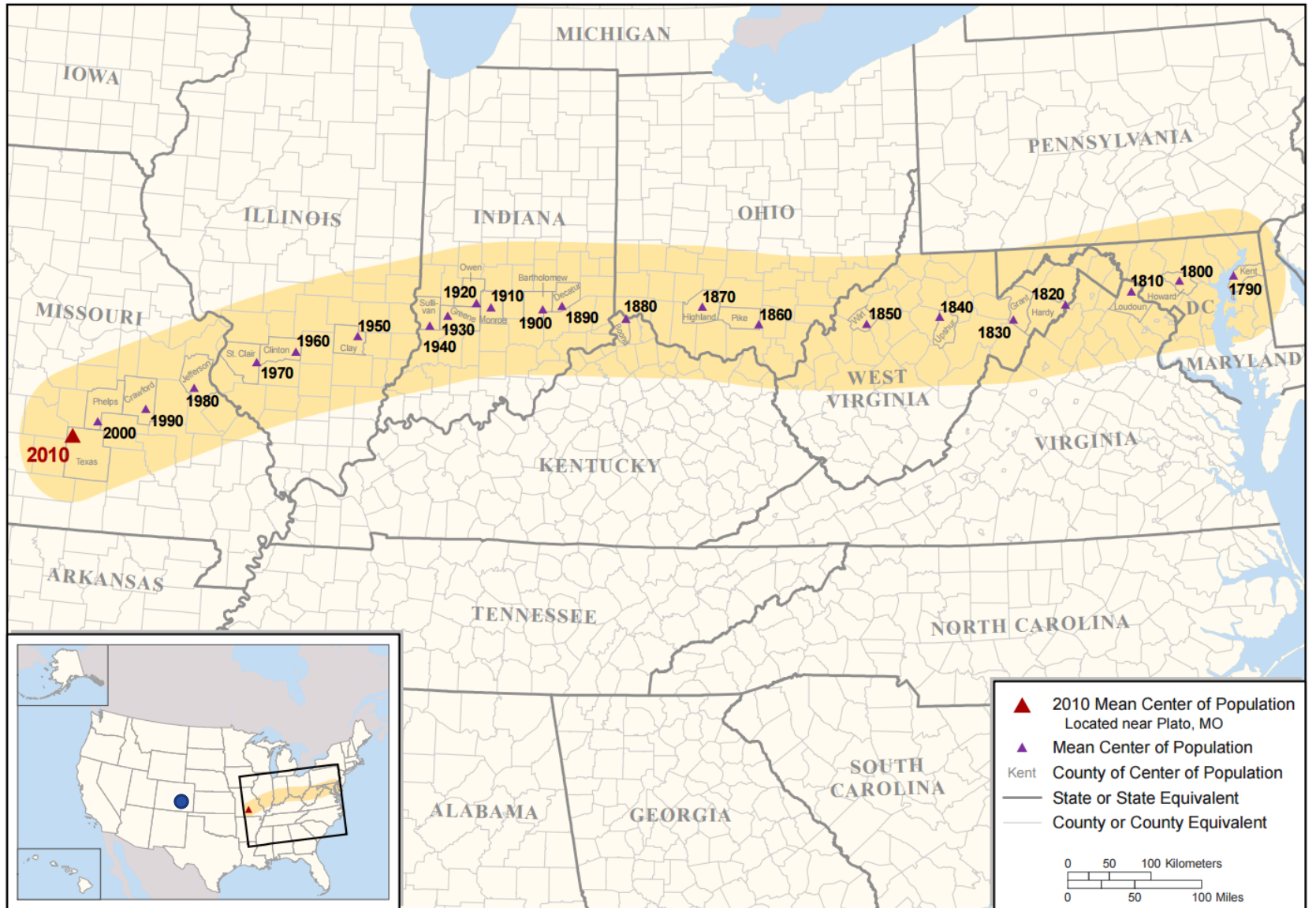


United States
Census
Bureau

Source: U.S. Census Bureau, 2010 Census Urban Area Delineation Program



Mean Center of Population for the United States: 1790 to 2010



Projections of the Size and Composition of the U.S. Population: 2014 to 2060

Population Estimates and Projections

Current Population Reports

By Sandra L. Colby and Jennifer M. Ortman

Issued March 2015

P25-1143

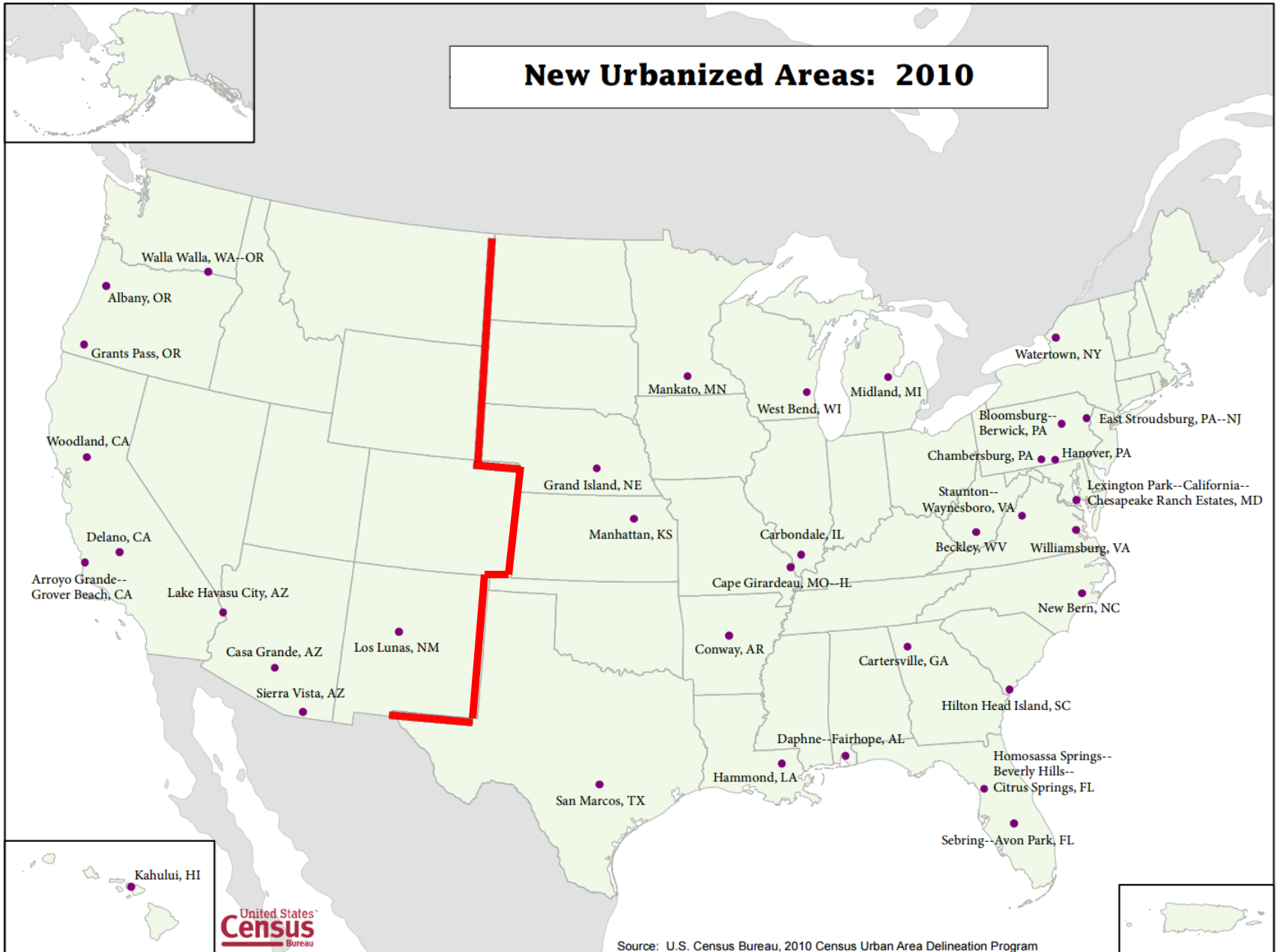
INTRODUCTION

Between 2014 and 2060, the U.S. population is projected to increase from 319 million to 417 million, reaching 400 million in 2051. The U.S. population is projected to grow more slowly in future decades than in the recent past, as these projections assume that fertility rates will continue to decline and that there will be a modest decline in the overall rate of net international migration. By 2030, one in five Americans is projected to be 65 and over; by 2044, more than half of all Americans are projected to belong to a minority group (any group other than non-Hispanic White alone); and by 2060, nearly one in five of the nation's total population is projected to be foreign born.

demographic components of change—births, deaths, and net international migration. The projections, based on the 2010 Census and official estimates through 2013, were produced using cohort-component methods. Such methods project the components of population change separately for each birth cohort (persons born in a given year) based on past trends. The base population is advanced each year by using projected survival rates and net international migration. A new birth cohort is added to the population by applying the annual projected fertility rates to the female population. The projections cover the period 2014 to 2060.

The 2014 National Projections are the first series of Census Bureau projections to incorporate separate

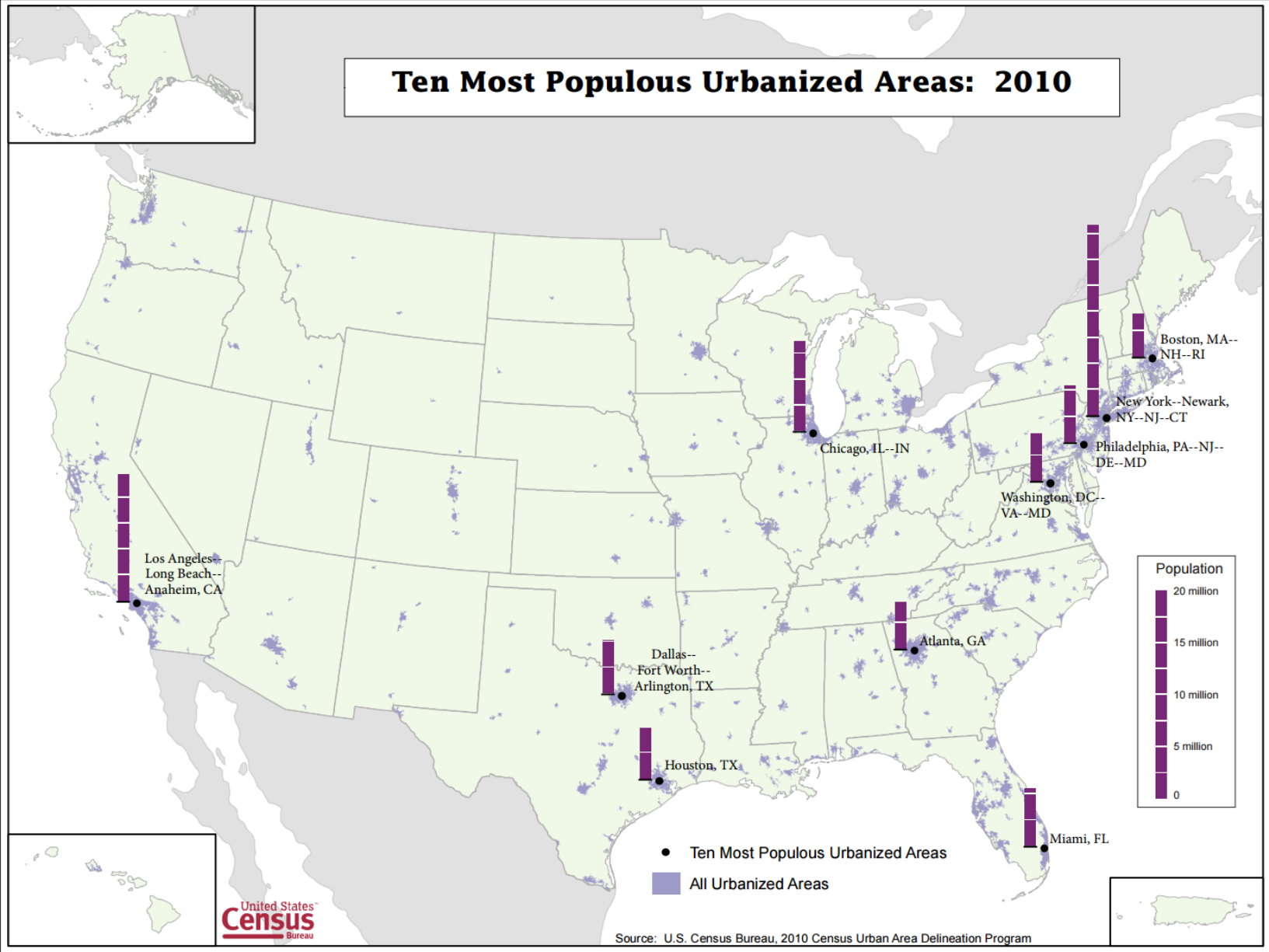
New Urbanized Areas: 2010



United States
Census
Bureau

Source: U.S. Census Bureau, 2010 Census Urban Area Delineation Program

Ten Most Populous Urbanized Areas: 2010



United States
Census
Bureau

Source: U.S. Census Bureau, 2010 Census Urban Area Delineation Program



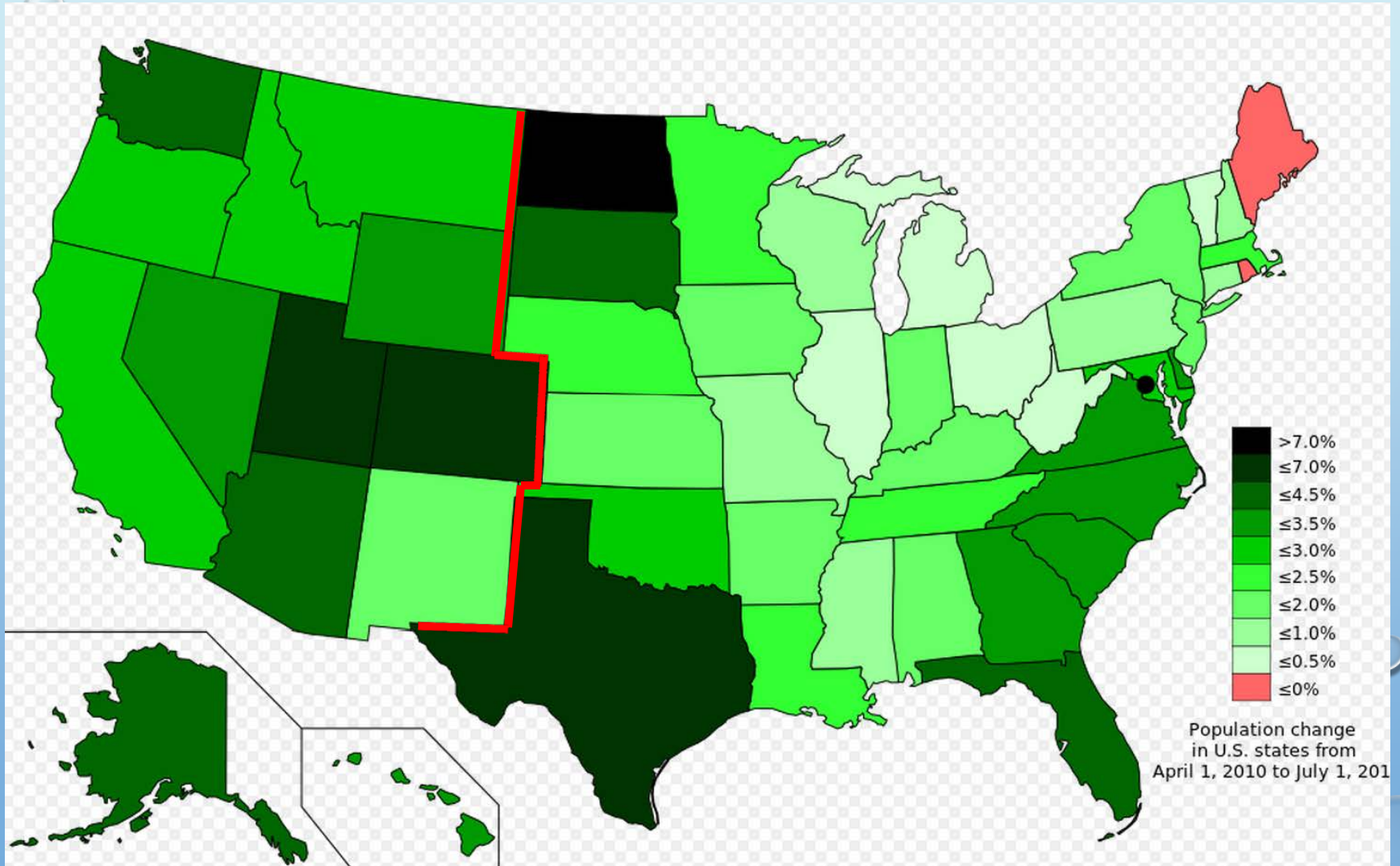
Beyond Traffic 2045

TRENDS AND CHOICES



U.S. Department of Transportation

POPULATION CHANGE SINCE 2010



FHWA MAY TRAFFIC STATISTICS

- Traffic in the West, a bloc of 13 states including Alaska and Hawaii, climbed to 58.4 billion unadjusted VMT, a gain of 5.3 percent over the previous March and the 18th consecutive month of increased traffic for the region. The South Atlantic, a region of seven states and Washington, D.C., rose sharply by 5 percent over the previous March to 57 billion VMT.
- At 9.5 percent, Montana led the nation with the largest unadjusted single-state traffic percent increase compared to the same month a year earlier, followed closely by South Dakota at 9.0 percent and Hawaii at 8.2 percent.

BEYOND TRAFFIC

Population Increase

2015: **320 million people**
2045: **390 million people**

In 30 years our population is expected to grow by about

70 million

... that's more than the current populations of



Bumper-to-Bumper

On average, we spend over **40**  hours stuck in traffic each year

The annual financial cost of congestion is

\$121 billion



Older Americans — Redefining Longevity

By 2045, the number of Americans over age 65 will increase by

77%



About **one-third of people over 65** have a disability that limits mobility. Their access to critical services will be more important than ever.

Millennials — Shaped by Technology

There are **73 million Millennials** aged 18 to 34. They are the first to have access to the internet during their formative years and will be an important engine of our future economy.

Millennials are driving less. By the end of the 2000s, they drove over **20% fewer miles** than at the start of the decade.



Income Inequality

10% of the population takes home **one-third** of our national income.

Transportation is the **second-largest** expense for U.S. households.



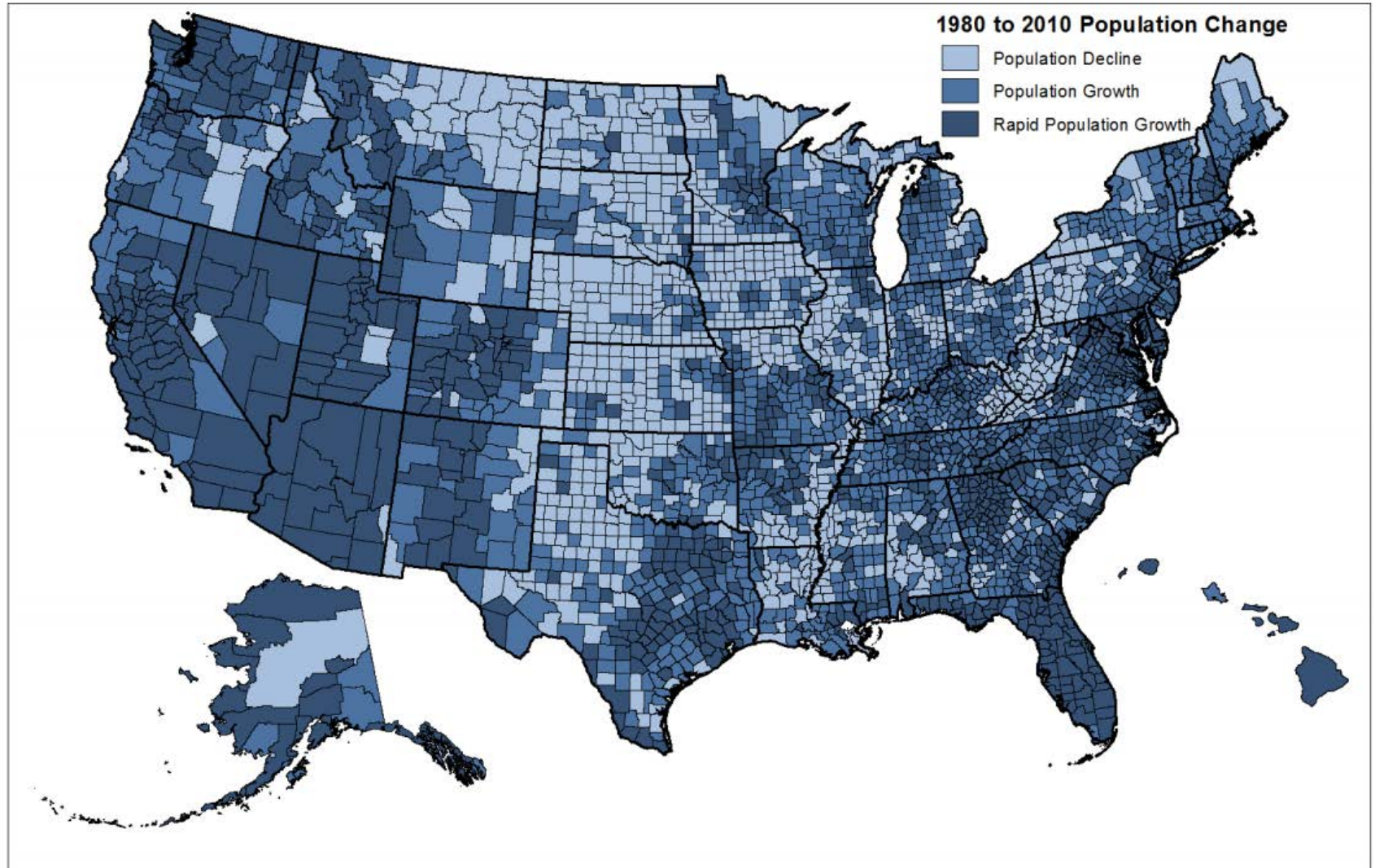
Megaregions and Shifts in Population Centers

11 megaregions are linked by transportation, economics, and other factors.

They represent over **75%** of our population and employment.

In 2014, **365,000** people moved to the South—up **25%** from 2013—and moves to the West doubled.

County Population Change 1980 – 2010



PEAK PERIOD CONGESTION ON THE NHS 2011 TO 2040

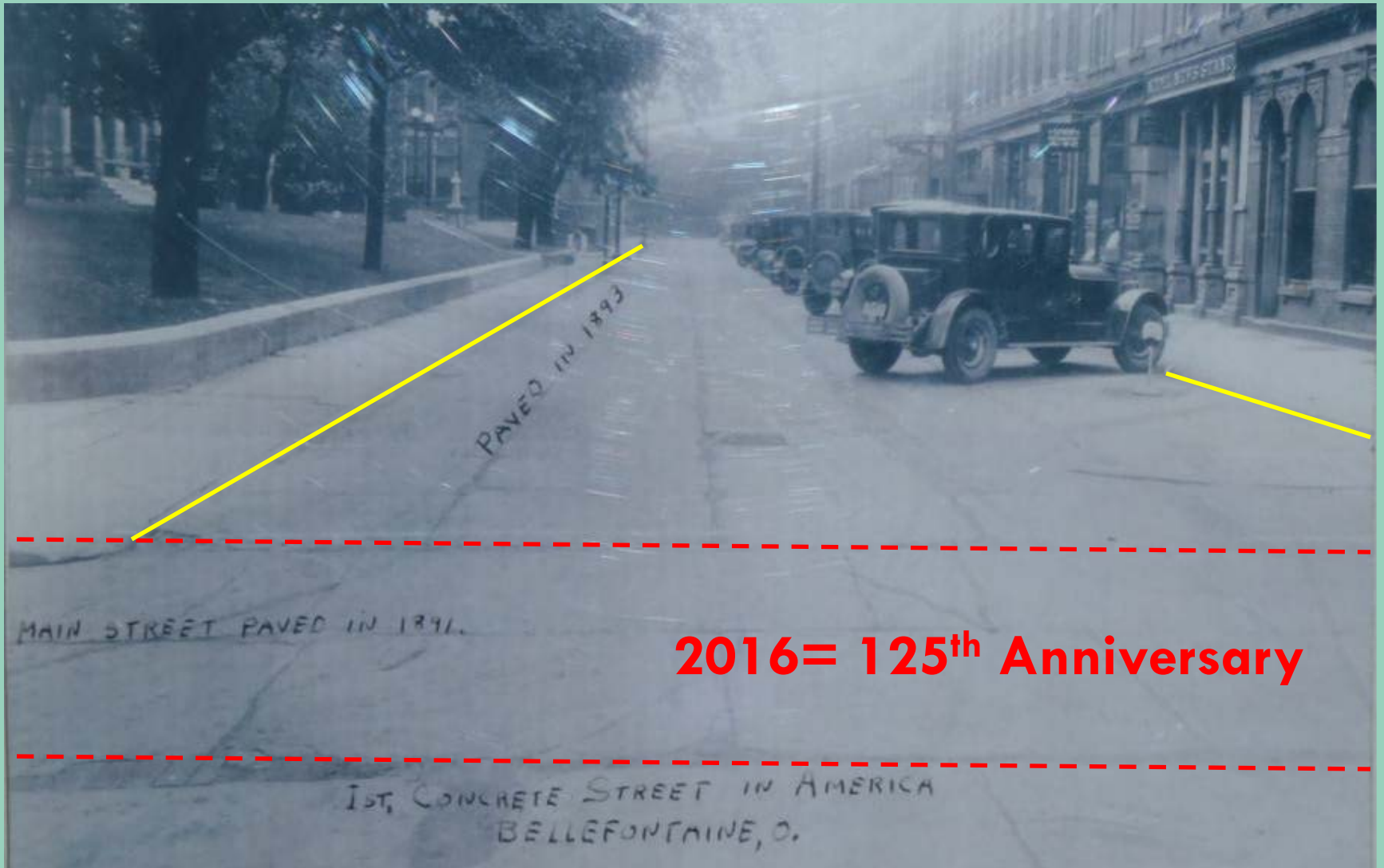
2011

2040



WHY CONCRETE PAVEMENT PRESERVATION

BELLEFONTAINE, OHIO 1925



2016 = 123rd Anniversary

**122
Years
Old**



CONCRETE PAVEMENT PRESERVATION GUIDE

National Concrete Pavement
Technology Center



September 2014

Second Edition

CONCRETE PAVEMENT PRESERVATION GUIDE



U.S. Department of Transportation
Federal Highway Administration

FHWA Publication No. FHWA-HIF-14-014



CP TECH CENTER PAVEMENT PRESERVATION WORKSHOPS

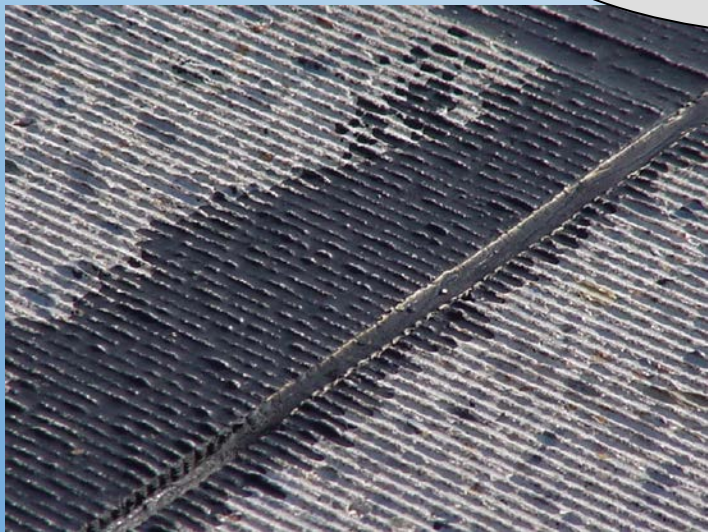
Date	Location
October 5-8, 2015	Northern California
October 20, 2015	Illinois
October 19-22, 2015	Southern California
November 4-5, 2015	Nebraska
December 14-17, 2015	North Dakota
March 28-31, 2016	State of Washington

TYPICAL CONCRETE PRESERVATION ACTIVITIES

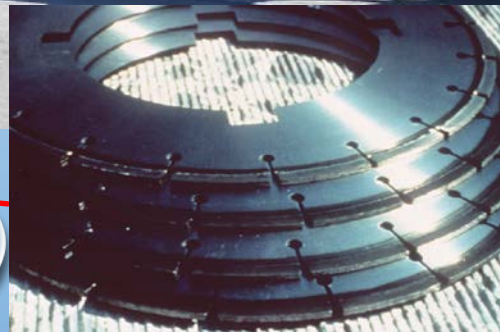
- DIAMOND GRINDING OR DIAMOND GROOVING
- PARTIAL DEPTH OR FULL DEPTH PATCHING
- DOWEL BAR RETROFIT
- JOINT SEALING OR RESEALING
- SLAB JACKING
- LONGITUDINAL CRACK STITCHING



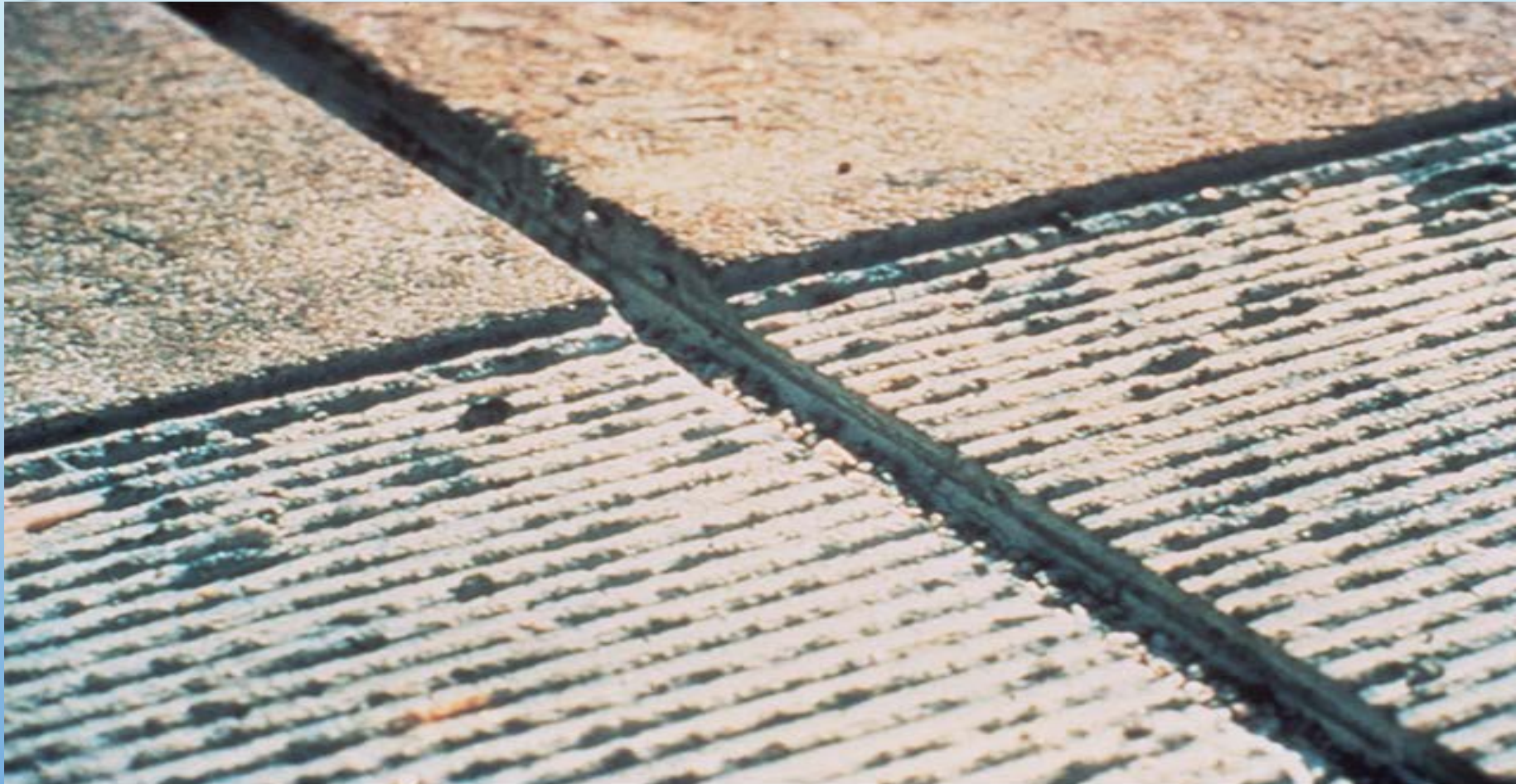
**Grinding
Concrete**



DIAMOND GRINDING EQUIPMENT



DIAMOND GRINDING



DIAMOND GRINDING

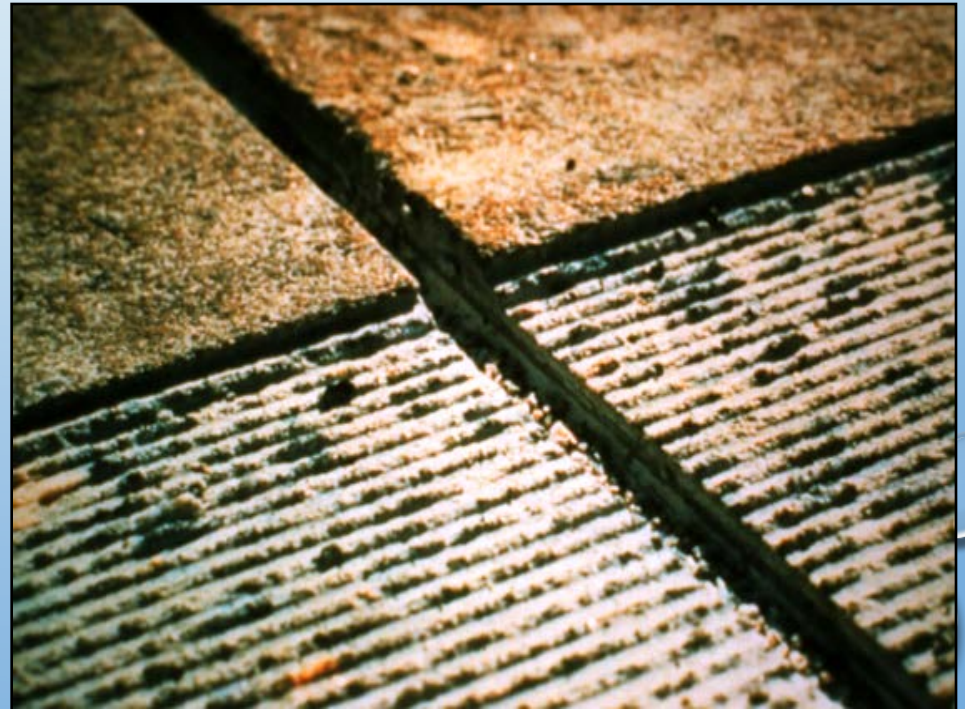


DIAMOND GRINDING



- **Removes Faulting**
- **Improves Ride**

- **Improves Friction**
- **Reduces Noise**



EFFECTIVENESS OF DIAMOND GRINDING - CALTRANS

CALTRANS HAS DETERMINED THAT THE AVERAGE LIFE OF A DIAMOND GROUND PAVEMENT SURFACE IS 17 YEARS AND THAT A PAVEMENT CAN BE GROUND AT LEAST THREE TIMES WITHOUT AFFECTING PAVEMENT STRUCTURALLY.



STATE OF CALIFORNIA
DEPARTMENT of TRANSPORTATION

**DIVISION OF
ENGINEERING SERVICES**

**MATERIALS ENGINEERING
AND TESTING SERVICES**

**OFFICE OF RIGID PAVEMENT
AND STRUCTURAL CONCRETE**

**5900 Folsom Boulevard
Sacramento, California 95819**



**THE EFFECTIVENESS OF DIAMOND GRINDING
CONCRETE PAVEMENTS IN CALIFORNIA**

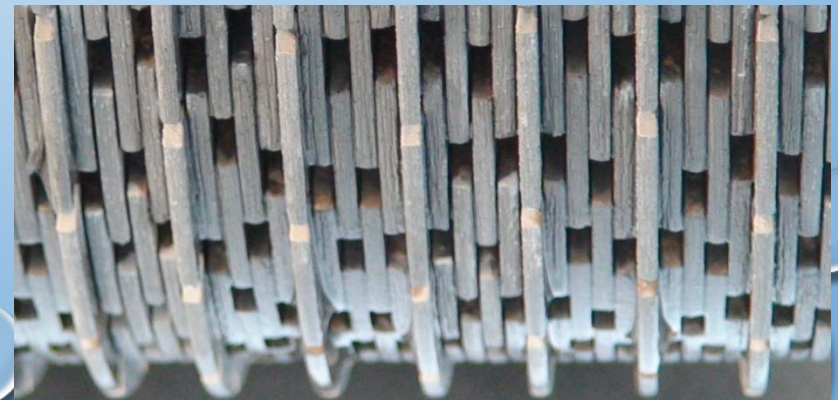
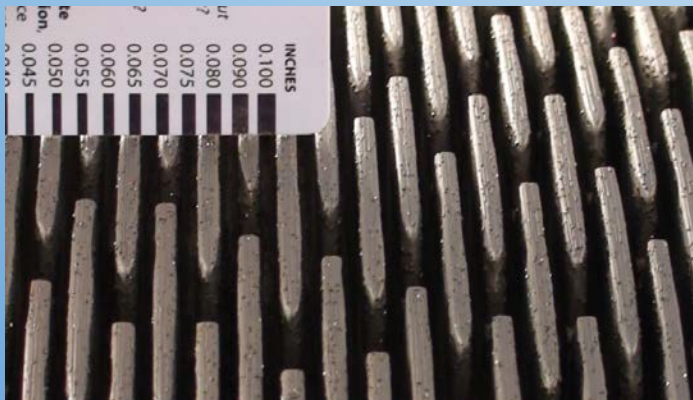
November 2004

NGCS IS A DIAMOND GRINDING PROCEDURE



CDG

NGCS



DIAMOND GROOVING

- **CUTTING PARALLEL GROOVES INTO THE PAVEMENT USING DIAMOND SAW BLADES**
- **LONGITUDINAL (MORE COMMON) OR TRANSVERSE**
- **BENEFITS**
 - **IMPROVED WET WEATHER FRICTION**
 - **REDUCTION IN SPLASH AND SPRAY**

DIAMOND GROOVING



SPLASH AND SPRAY DURABILITY

ARFC



**Longitudinally Grooved
PCCP**



**March 2006 after 143 Days w/o
Rain**



Full Depth Repair



FULL-DEPTH REPAIRS

- **“WORKHORSE” TREATMENT**
- **REMOVAL/REPLACEMENT OF CONCRETE PAVEMENT AT DETERIORATED JOINTS/CRACKS**
- **FOCUS ON WORKMANSHIP**
 - **DOWEL BAR INSTALLATION**
- **NEED FOR RAPID OPENING TIMES**
 - **ACCELERATED MATERIALS**
 - **PRECAST REPAIRS**



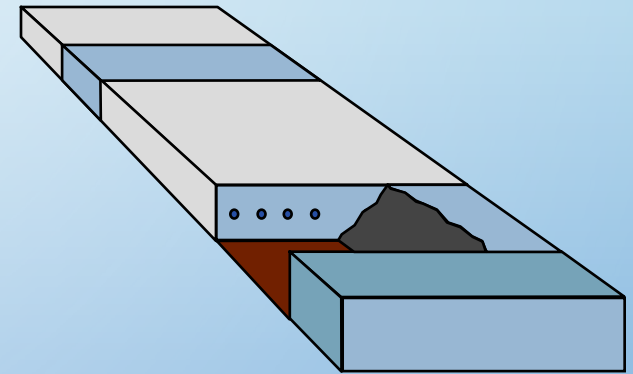
FULL DEPTH REPAIR



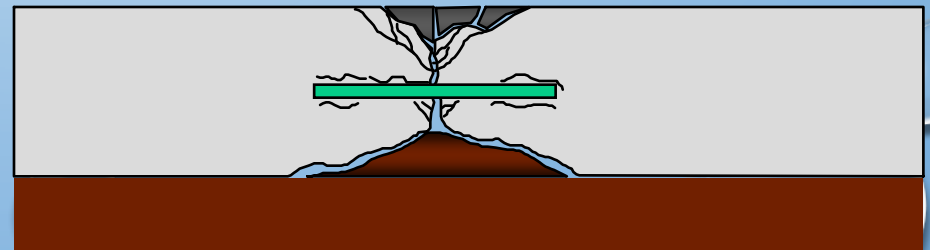
FULL DEPTH REPAIR



May also need to:
**Stabilize
Sub Base**



If distress greater
than $1/3 - 1/2 D$



FULL DEPTH REPAIR





**Partial Depth
Patching**



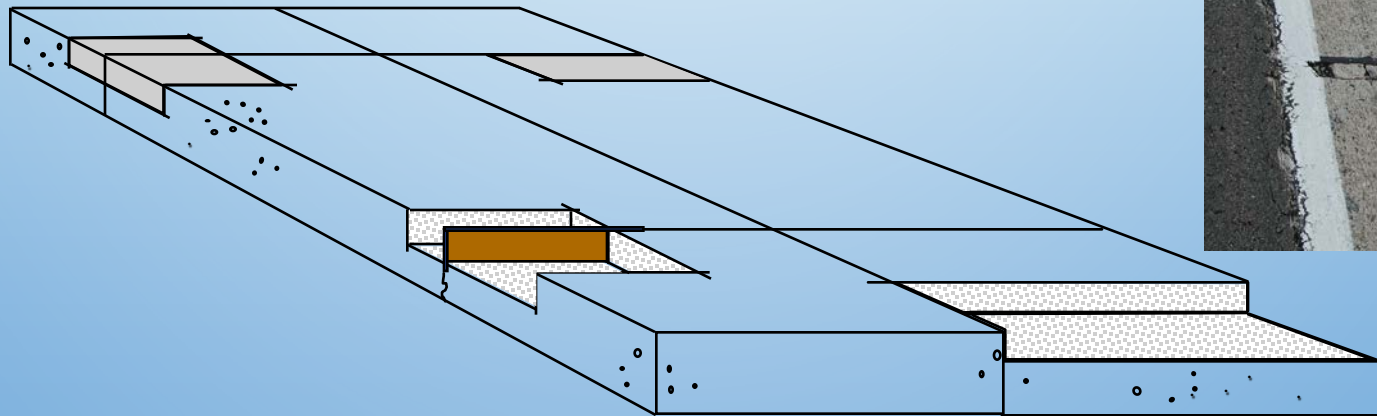
PARTIAL-DEPTH REPAIRS

- **REMOVAL AND REPLACEMENT OF SMALL, SHALLOW AREAS OF DETERIORATED CONCRETE**
- **EXPANDED USE AS REPAIR TECHNIQUE**
- **GREATER USE OF MILLING FOR PREPARATION**
 - **PRODUCTIVITY**
 - **BONDING**
- **NEW PATCHING MATERIALS**



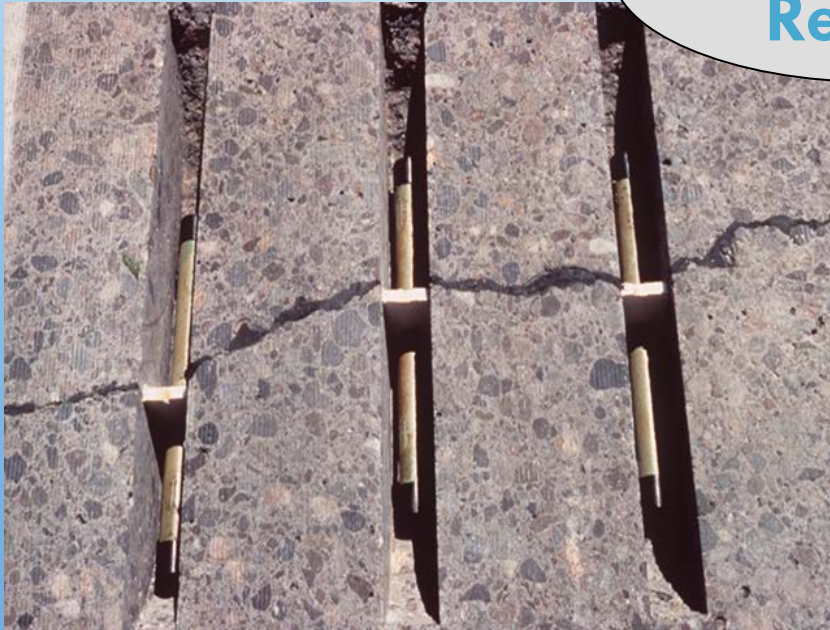
PARTIAL DEPTH REPAIRS

- **REPAIRS DETERIORATION IN THE TOP 1/3 – 1/2 OF THE SLAB.**
- **GENERALLY LOCATED AT JOINTS, BUT CAN BE PLACED ANYWHERE SURFACE DEFECTS OCCUR**

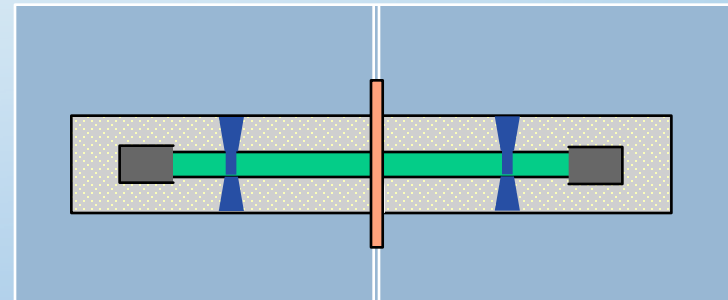
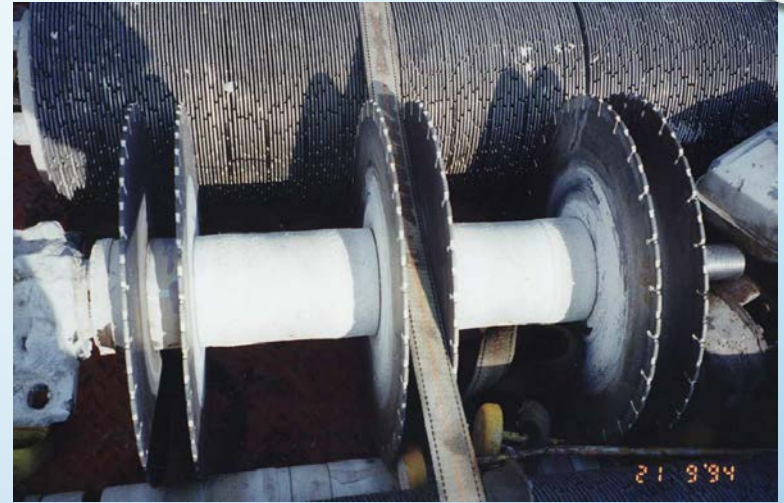




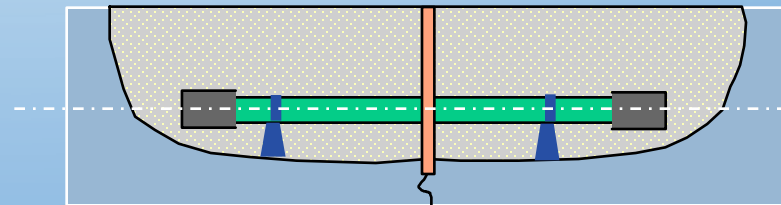
**Dowel Bar
Retrofit**



DOWEL BAR RETROFIT



**Also need to:
Reseal Joints**

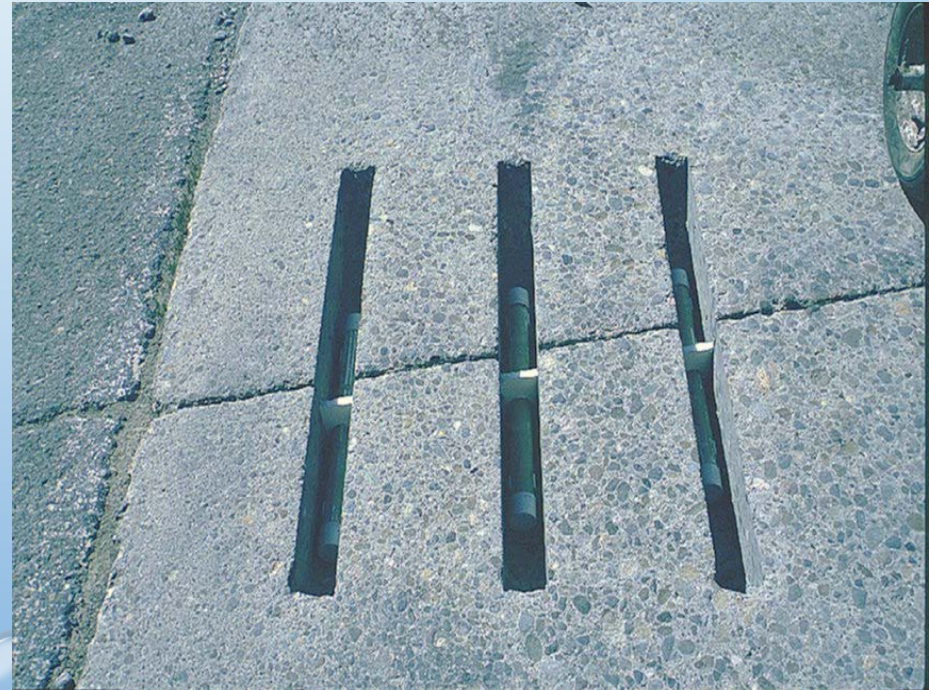


LOAD TRANSFER RESTORATION (DBR)

➤ **PLACEMENT OF LOAD TRANSFER DEVICES ACROSS JOINTS OR CRACKS OF EXISTING PAVEMENTS**

➤ **CANDIDATE PROJECTS**

- **POOR LOAD TRANSFER (< 60 %)**
- **PUMPING**
- **FAULTING**
- **CORNER BREAKS**



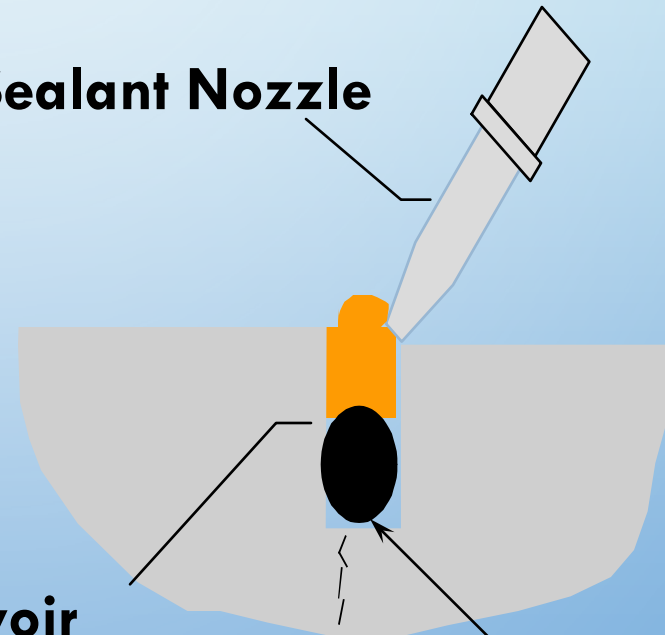
SEALING AND RESEALING



Sealant Nozzle

Reservoir

Backer Rod

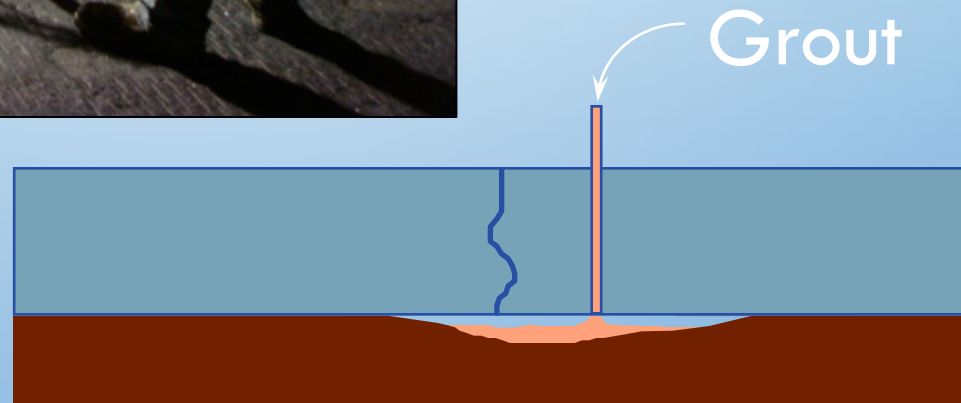




**Slab
Stabilization/
Jacking**



SLAB STABILIZATION



○ Fill Void or Level Slab

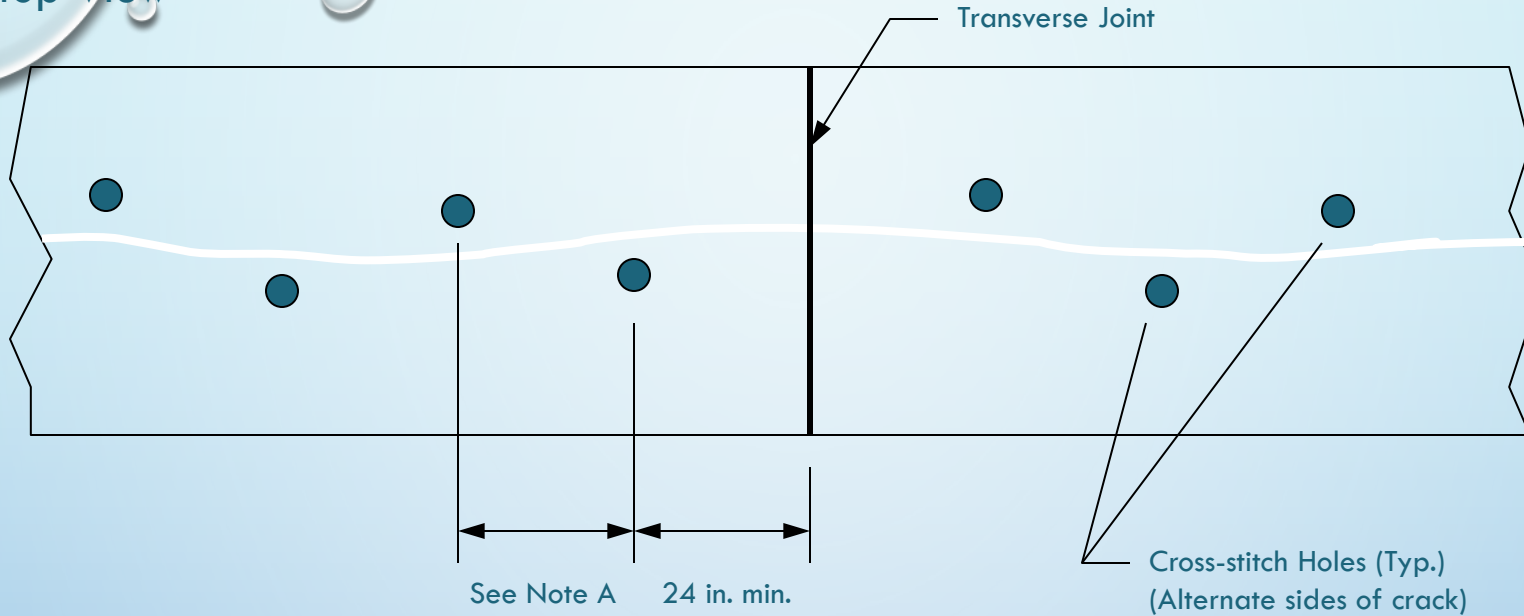


**Cross
Stitching**

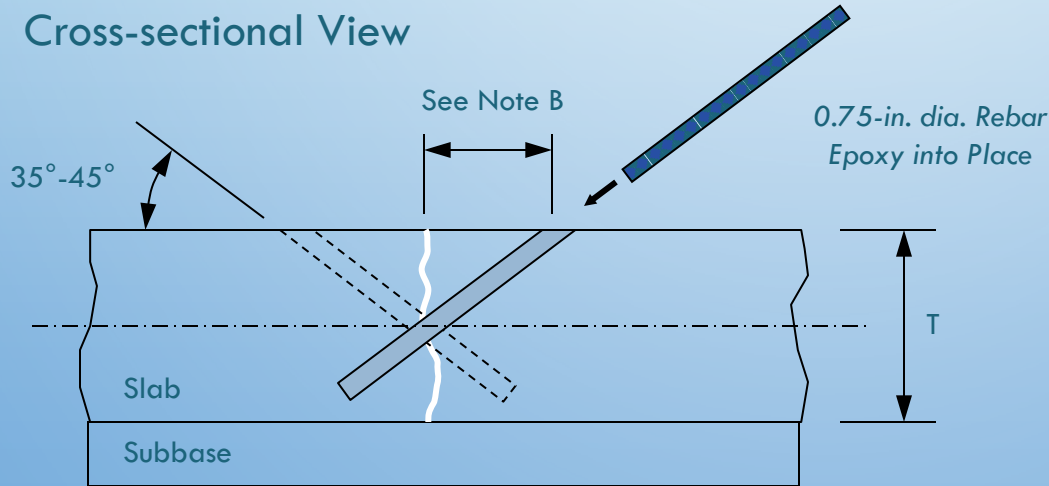


CROSS STITCHING

Top View



Cross-sectional View



Note A: Distance between holes is 24 in. for heavy traffic; 36 in. for light traffic

Note B: Determine distance from longitudinal crack to hole based on slab thickness T and drill angle. Slabs less than 12 inches thick require a 35° insertion angle.

WHAT IS DIFFERENCE IN THE URBAN ENVIRONMENT

\$\$ EXPENSE \$\$

AND

TRAFFIC

URBAN ENVIRONMENT ISSUES - GENERAL-

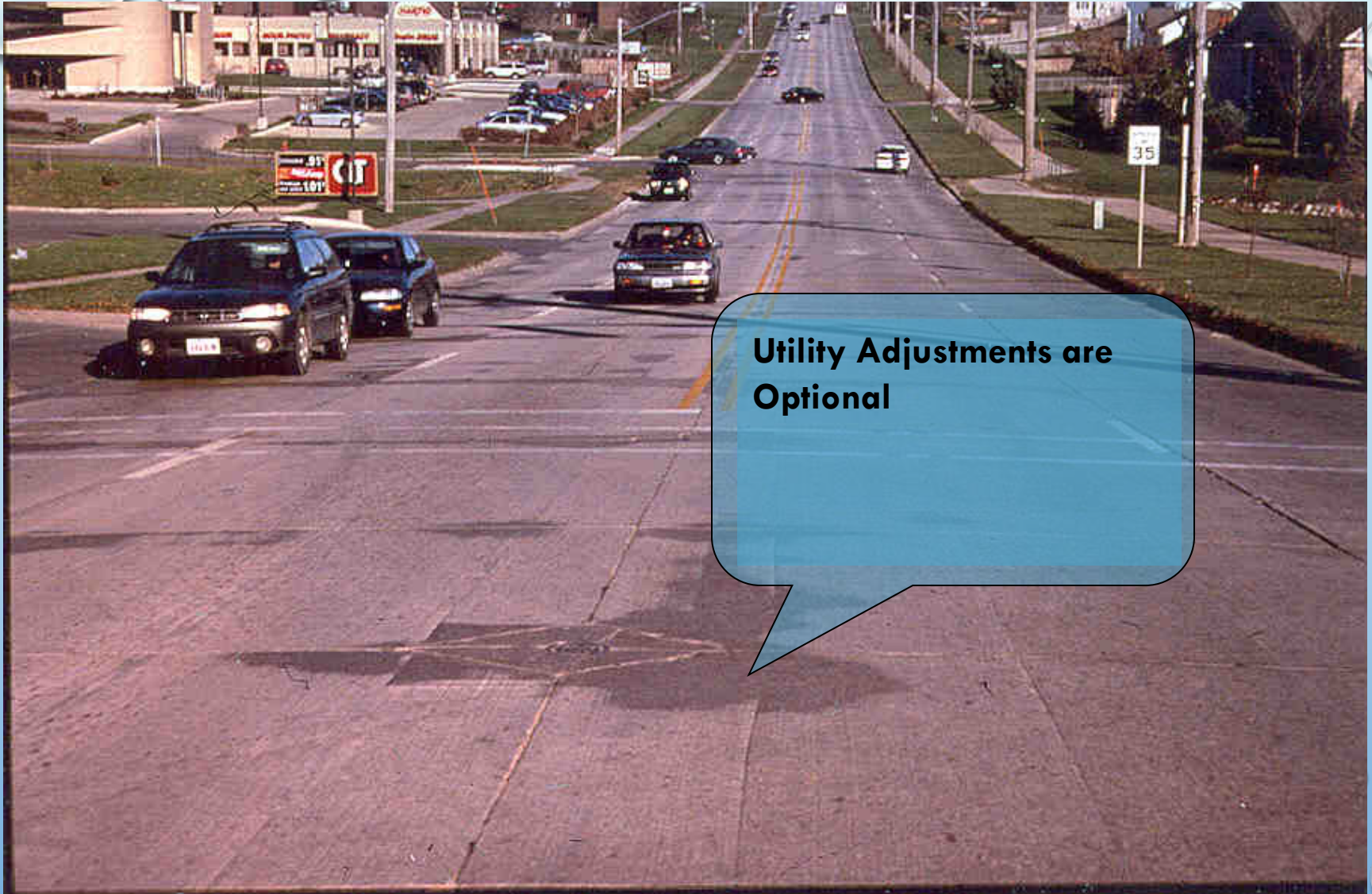
- **GETTING IN AND OUT OF TRAFFIC**
 - **SOMETIMES DIFFERENT EQUIPMENT REQUIRED- NO SEMIS**
- **WORK IS OFTEN ON A SMALLER SCALE**
- **SOMETIMES OLDER PAVEMENTS AND POORER CONDITION**
- **LODGING OFTEN MORE EXPENSIVE OR FURTHER AWAY**
- **LOWER PRODUCTIVITY**
 - **SHORTER CLOSURES**
 - **MORE DIFFICULT SCHEDULES**
- **MAINTENANCE AND PROTECTION OF TRAFFIC**
- **PRODUCT SELECTION**

FHWA PERFORMANCE MEASURES

Measure	Surface	Assessment					
IRI (in/mi)	All Pavements	Population Consideration					
		Population < 1 Million			Population > 1 Million		
		Good <95	Fair 95 - 170	Poor >170	Good <95	Fair 95 - 220	Poor >220
		No Population Considerations					
Cracking Percent	Asphalt Jointed PCCP	Good <5	Fair 5 - 10	Poor > 10			
		No Population Considerations					
Rutting (in)	Asphalt	Good < 0.2	Fair 0.2-0.4	Poor > 0.4			
		No Population Considerations					
Faulting (in)	Jointed PCCP	Good < 0.05	Fair 0.05-0.15	Poor > 0.15			
		No Population Considerations					
Cracking Percent	CRCP	Good < 5	Fair 5 - 10	Poor > 10			
		No Population Considerations					

URBAN ENVIRONMENT ISSUES - DIAMOND GRINDING -

- **GETTING WATER AND DISPOSAL OF SLURRY**
- **DIFFICULTY IN SLURRY DISPOSAL**
 - **TYPICALLY FURTHER HAUL**
 - **MAY HAVE TO USE TREATMENT PRIOR TO DISPOSAL**
- **SUB URBAN LEVEL OF EXPECTATION IS MORE DIFFICULT—
GRINDING AROUND MANHOLES WATER VALVES**
- **INTERCHANGES**
- **BUSINESS ENTRANCES**



**Utility Adjustments are
Optional**

MANHOLES DO NOT REQUIRE ADJUSTMENT

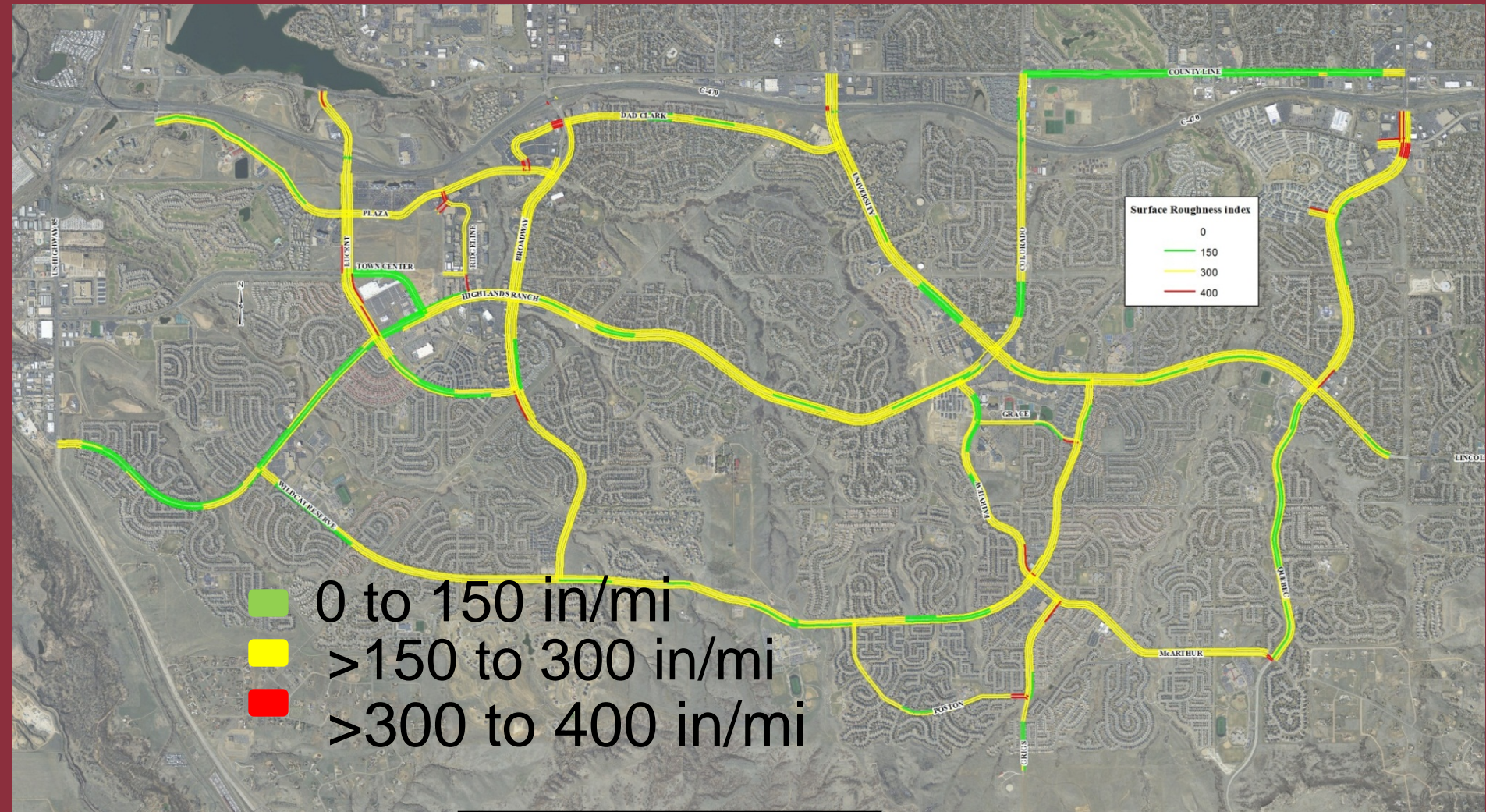


NO ADDITIONAL WORK AT DRIVEWAY ENTRANCES





DOUGLAS COUNTY 500,000 sq yds OF DIAMOND GRINDING



Slide Courtesy of

UTILITY CUT REPAIRS

- **OPENING STREET TO GAIN ACCESS TO UTILITIES**
- **ON-GOING ISSUE OF RETURNING PAVEMENT TO GOOD CONDITION**
- **GUIDANCE ON:**
 - **SIZING CUTS**
 - **CREATING/REMOVING**
 - **JOINTING**
 - **BACKFILLING**
 - **EMBEDDED STEEL**
 - **OPENING TO TRAFFIC**



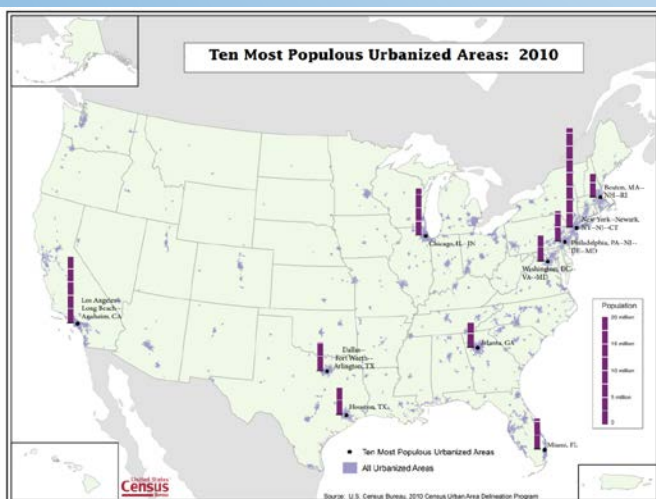
URBAN ENVIRONMENT ISSUES

- DBR, SEALING, PARTIAL AND FULL DEPTH SLAB REPAIR-

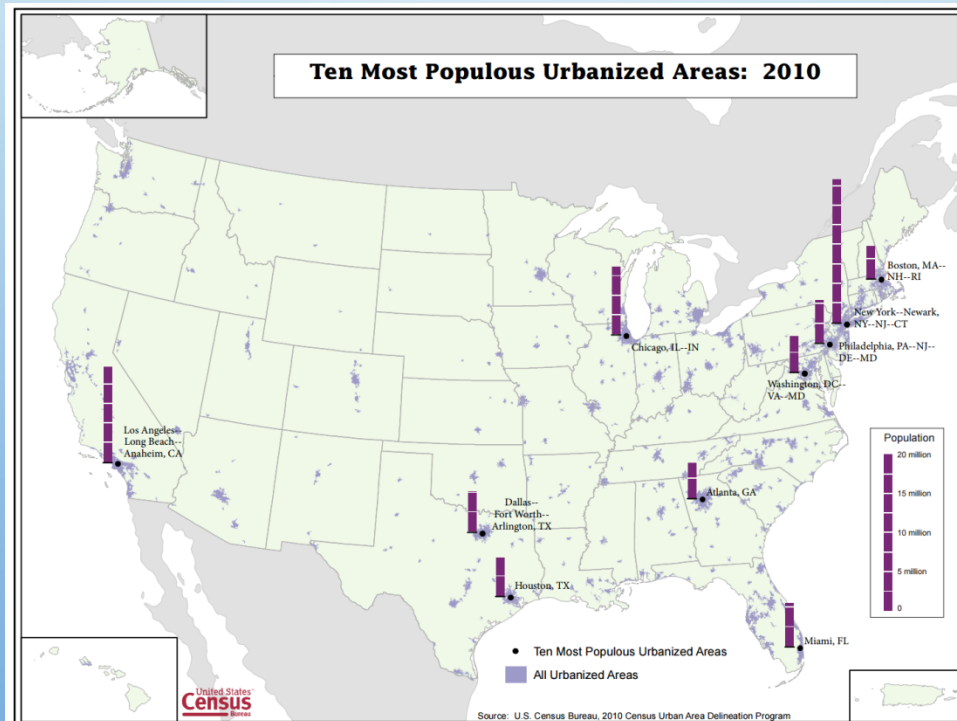
- **PRODUCT SELECTION AND INSTALLATION PROCEDURES**
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PRECAST CONCRETE REPAIRS

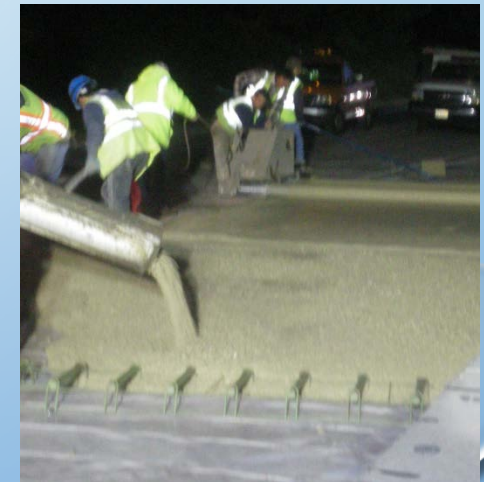
- **ADVANTAGES**
 - **BETTER QUALITY CONCRETE**
 - **CONTROLLED CURING**
 - **MINIMAL WEATHER IMPACTS**
 - **RAPID OPENING**
- **EXPERIENCE IN CA, CO, MI, DE, MN, MO, NJ, NY, IL, UT, VA**
- **GOOD PERFORMANCE TO DATE**



RAPID STRENGTH CONCRETE FOR PAVEMENTS (Extreme cases)



RSC is typically proportioned with superplasticizers for achieving desired (often near-flowable) consistency while maintaining low water to cement ratio (W/C). Hydration controlling admixtures extend time within which RSC retains workable consistency. Optimized consistency and cohesiveness accelerate construction of pavements.



WORKABILITY

Limited bleeding of RSC allows for prompt finishing. Fast setting of RSC and subsequent accelerated gain of tensile strength mitigate risk of plastic shrinkage cracking associated with the use of low-bleeding concrete.



FINISHABILITY

SUMMARY

- **CONCRETE PAVEMENT PRESERVATION WORKS IN ALL ENVIRONMENTS AND BASED ON TRAFFIC AND SCHEDULE THE APPROPRIATE TECHNIQUES AND PRODUCTS NEED TO BE SELECTED**
- **URBAN CONSTRUCTION IS GENERALLY MORE DIFFICULT AND MORE EXPENSIVE**

In 1983, president Reagan passed a gas tax increase and was re-elected in 1984

TALKING POINTS

- **WHAT ARE THE COMMON PAVEMENT PRESERVATION TREATMENTS USED IN URBAN AREAS?**
- **WHAT ARE THE BENEFITS OF PRESERVATION FOR CONCRETE?**
- **IS THERE ENOUGH PCC PAVEMENT PRESERVATION, OR SHOULD MORE BE DONE?**
- **PCC PAVEMENT PRESERVATION RESEARCH. IS IT BEING DONE AND OR SHOULD MORE BE DONE?**
- **SUGGESTIONS ON WHAT STATE AND LOCAL TRANSPORTATION OFFICIALS CAN DO TO IMPROVE PRESERVATION FOR CONCRETE.**
 - **EXAMPLES OR BEST PRACTICES FOR TRACKING PRESERVATION FOR CONCRETE WITHIN A PMS TRACKING / REPORTING PERFORMANCE OF PROJECTS IN PMS SYSTEMS.**

THANK YOU

AND

VISIT US ON THE WEB

www.igga.net



Diamond Grinding



Your Pavement Preservation Resource® since 1972