

# Limestone Cements

Why are we doing this? What are they? What's in it for you?

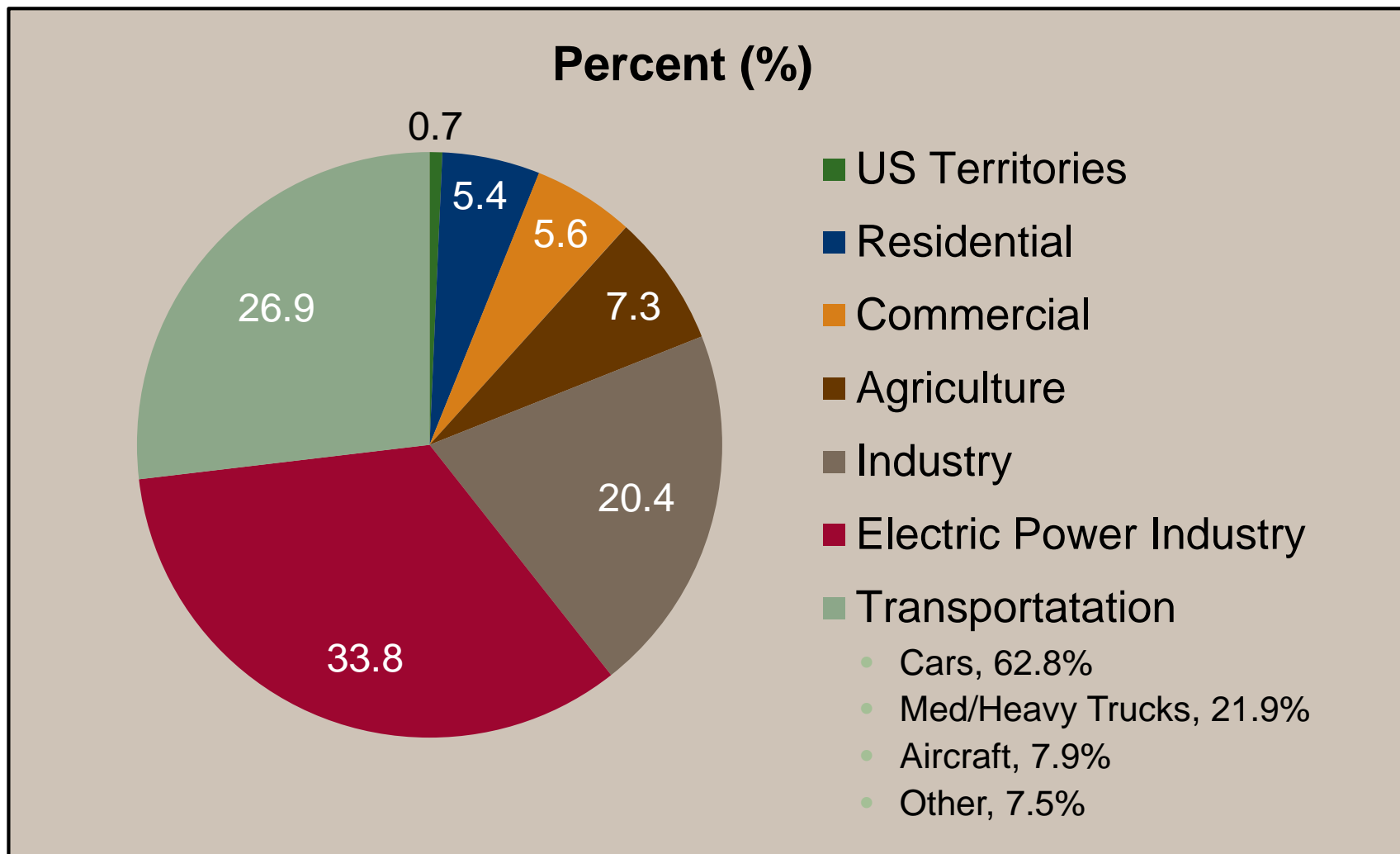




## Limestone Cements

**Why are we doing this?**

# Greenhouse Gas Allocations by Sector



Source: 2010 GHG emissions allocated to economic sector in the US (EPA 2012)

# Greenhouse Gas Emissions



## **World**

34,800,000,000 tons

## **United States**

5,900,000,000 tons

## **US Transportation**

1,600,000,000 tons

## **US Hwy/Street Construction**

117,000,000 tons

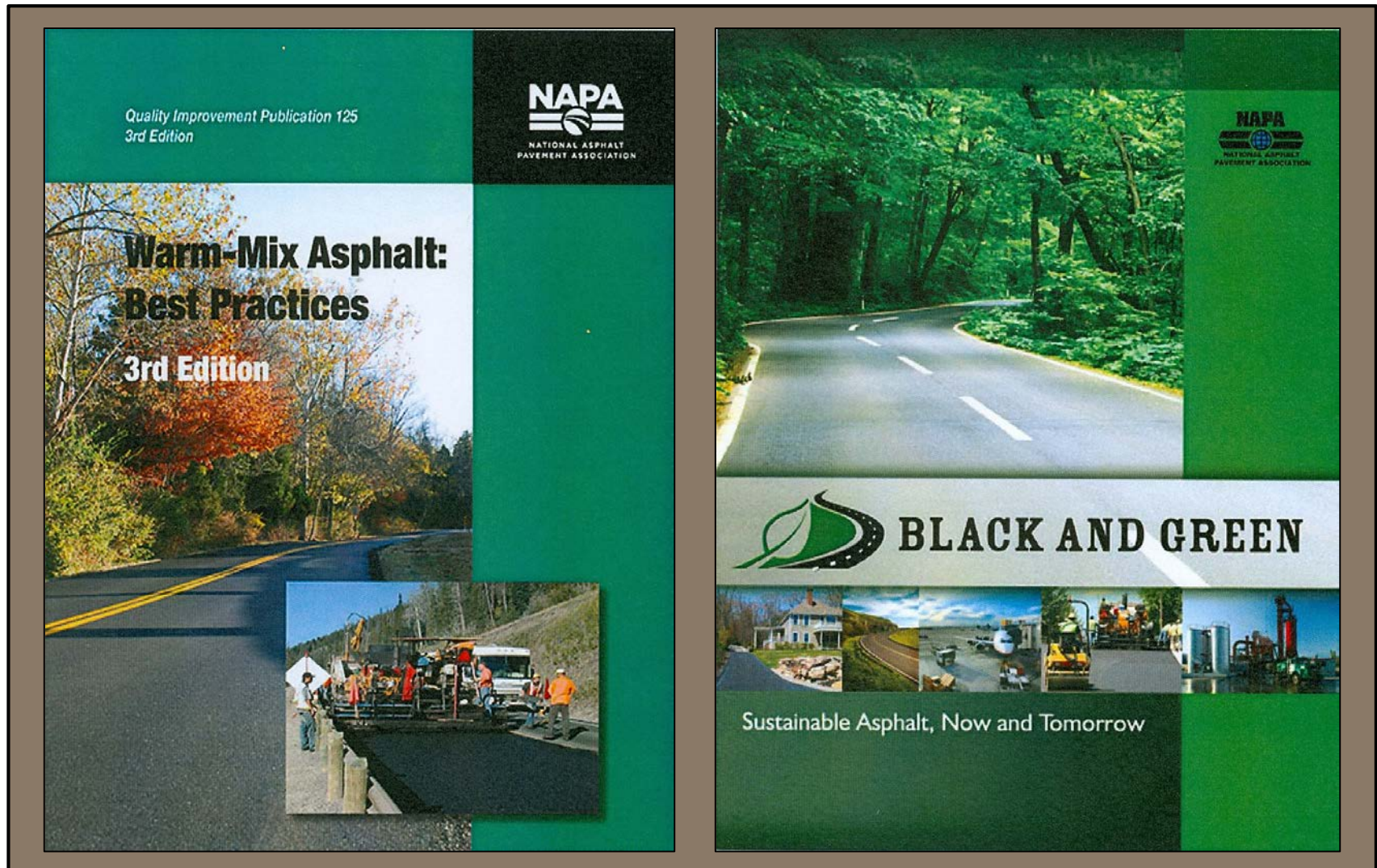
## **US Pavement Construction**

82,000,000 tons

Source: FHWA; Reference document for Sustainable Pavement Systems; Chapter 2, Concepts of Pavement Sustainability, page 2-5



# Look at What the Other Guys Say





A photograph of a construction site. In the background, there's a large white structure, possibly a crane or part of a building frame. In the middle ground, a long concrete slab is being prepared. A yellow string line is stretched across the site, with black stakes and red flags marking points. In the foreground, there are piles of dark, clumpy material, likely soil or mud, and some green pipes. The overall scene is a construction site for a concrete structure.

Limestone Cements

**What are they?**

**How do they perform?**

# What are they?

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Limestone cements are:

- Blended cements that contain 5 – 15% limestone
- Cements that are accepted in ASTM C595 and AASHTO M 240
- Cements that have a history of proven performance



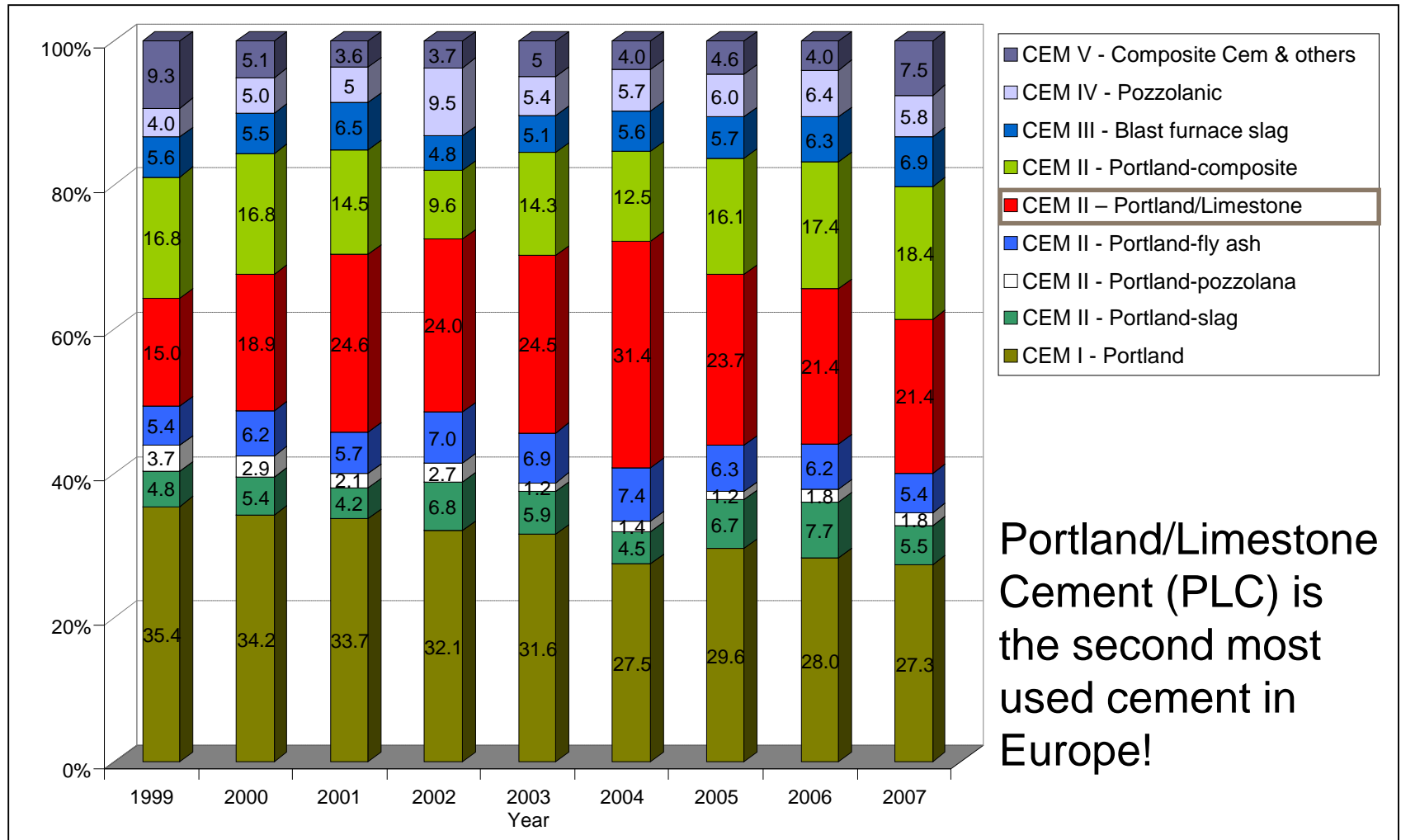
# History of Limestone in Cements

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- 1965 cement with 20% limestone in Germany for specialty applications
- 1979 French cement standards allows limestone additions
- 1990 15 +/-5% limestone blended cements routinely used in Germany
- 1992 UK specs allows up to 20% in limestone cement
- 2000 EN 197-1 creates CEM II/A-L (6-20%) and CEM II/B-L (21-35%)
- 2008 CSA, A3001 includes PLC containing 5%-15% limestone
- 2012 ASTM C 595 and AASHTO M240 includes limestone addition of 5 to 15%



# Cements Types Commercialized in Europe (According to Cembureau)



# **What, Why, and How of Portland/Limestone Cements**

## **How is it made?**

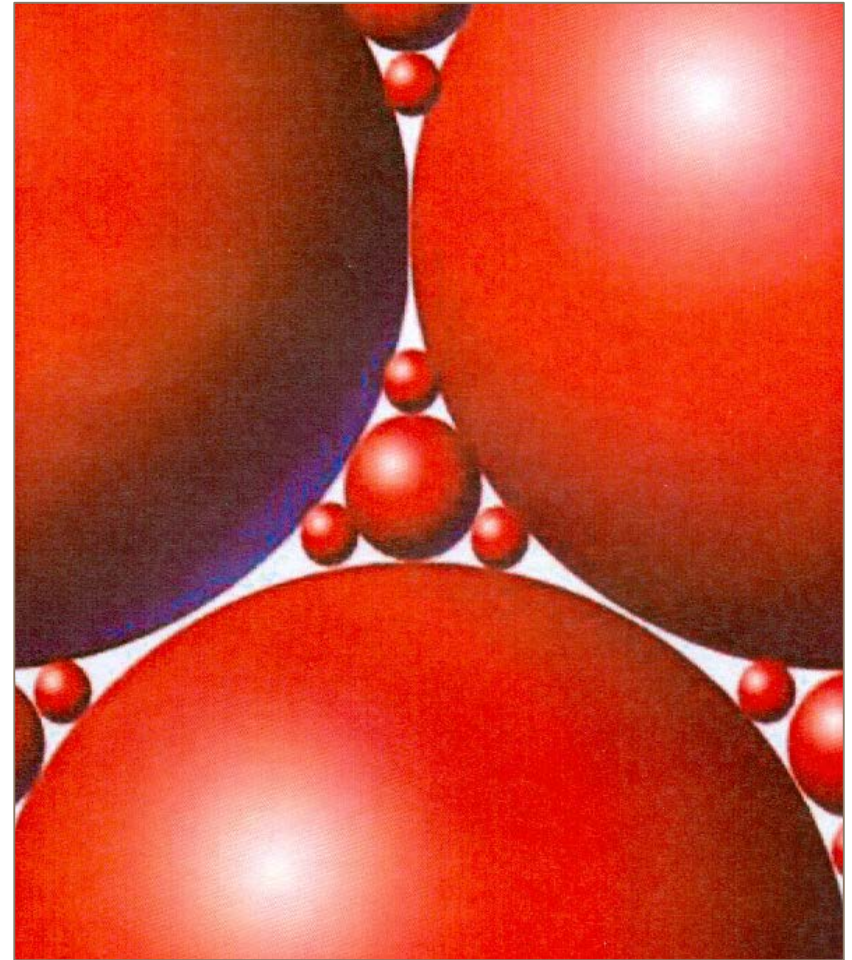
- A metered portion of crushed limestone is fed to the finish mill along with clinker and gypsum
- Limestone is softer than clinker and is more easily ground and is concentrated in the fine particles
- Overall fineness must be higher for equivalent performance
- Production rate in the mill is reduced



# How Limestone Works

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- **Particle packing**
  - Improved particle size distribution
- **Nucleation**
  - Surfaces for precipitation
- **Chemical reactions**
  - Only a small amount, but...



Source: PCA

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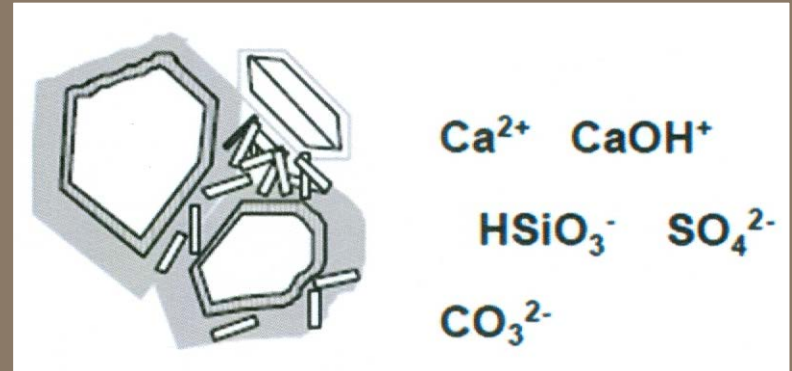
Source: PCA



# How Limestone Works

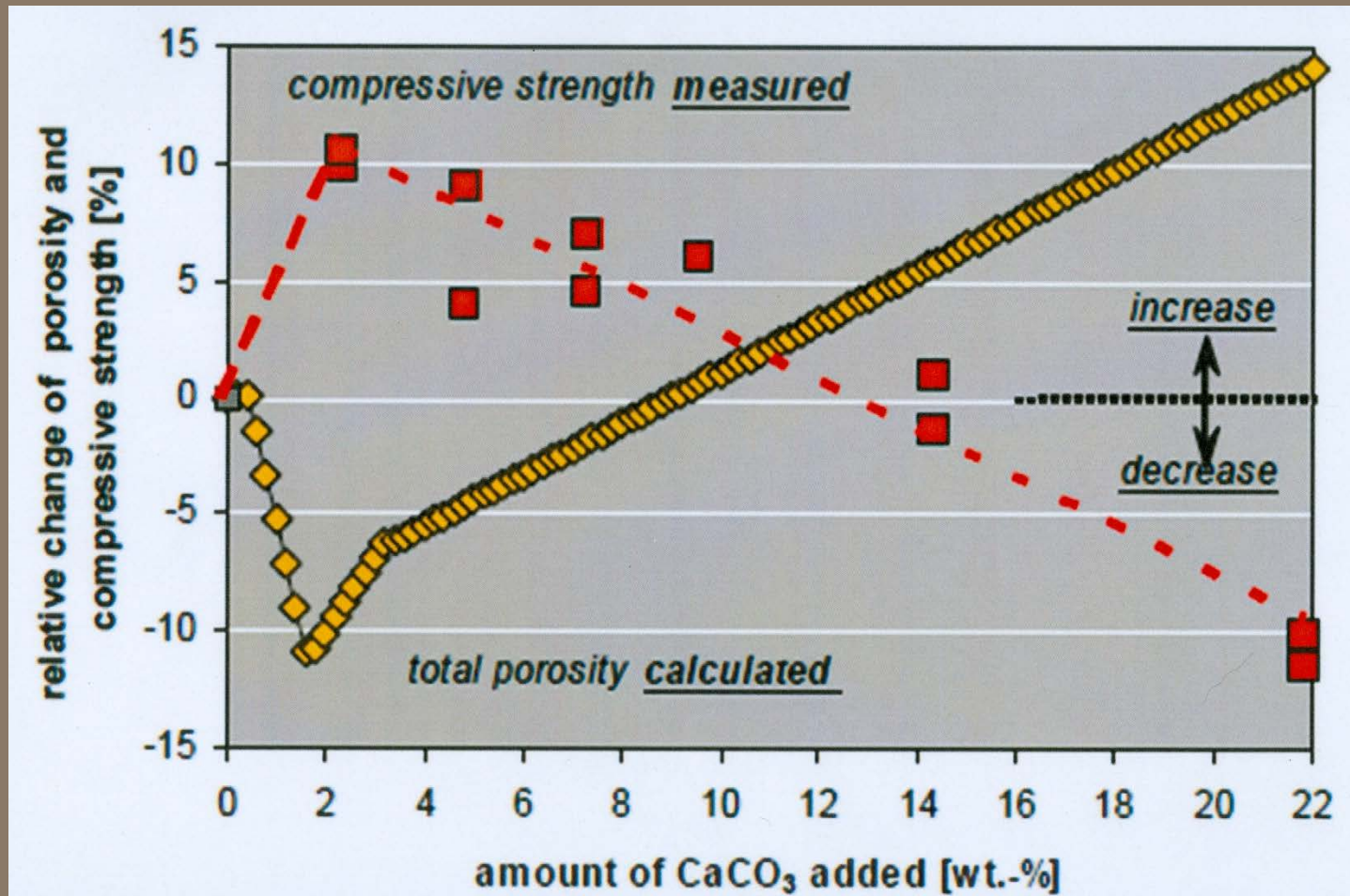
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- Particle packing
  - ▶ Improved particle size distribution
- Nucleation
  - ▶ Surfaces for precipitation
- **Chemical reactions**
  - ▶ Only a small amount, but...



Source: PCA

# Why 15%

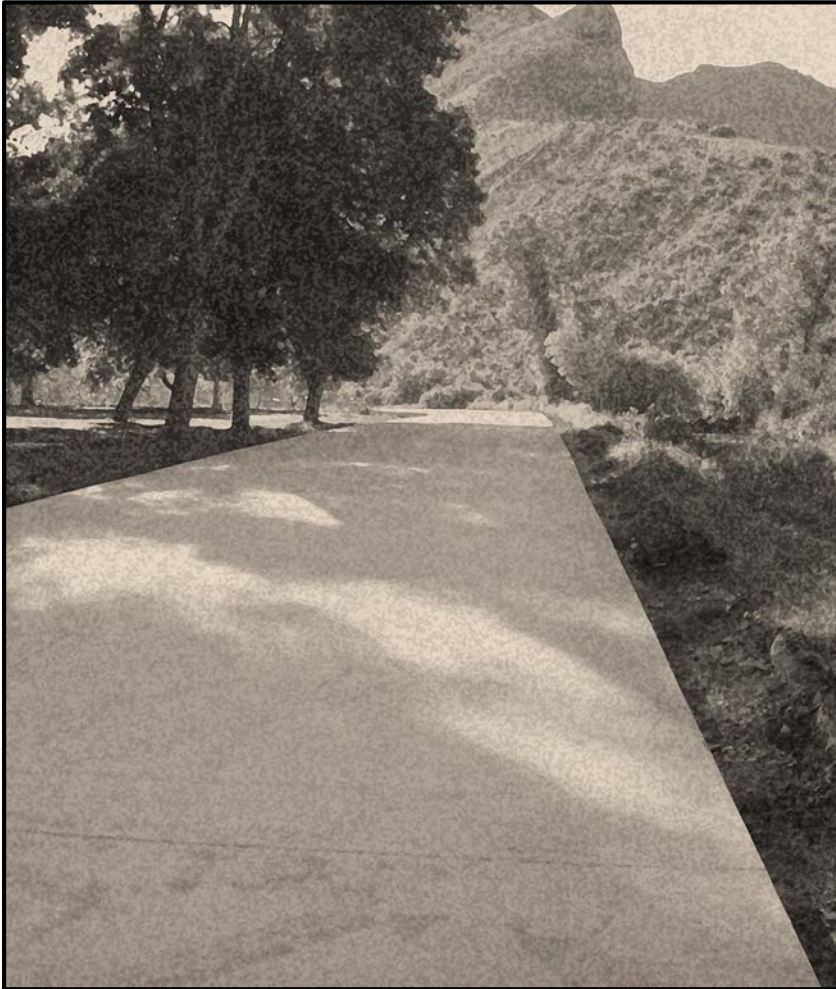


Source: PCA



# How do Portland/Limestone Cements perform?

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In all cases we have equal or better performance to the plant's Type I product in:

- ▶ Strength
- ▶ Freeze-thaw Durability
- ▶ Salt Scaling Resistance
- ▶ Shrinkage

# How do Limestone Cements perform in the field?

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**Limestone Cements have equal or better performance than C150 cements in:**

- ▶ **Strength**
- ▶ **Set Time**
- ▶ **Water Demand**
- ▶ **Finishability**



**Equivalent to Type I**



# **There has to be a catch . . .**

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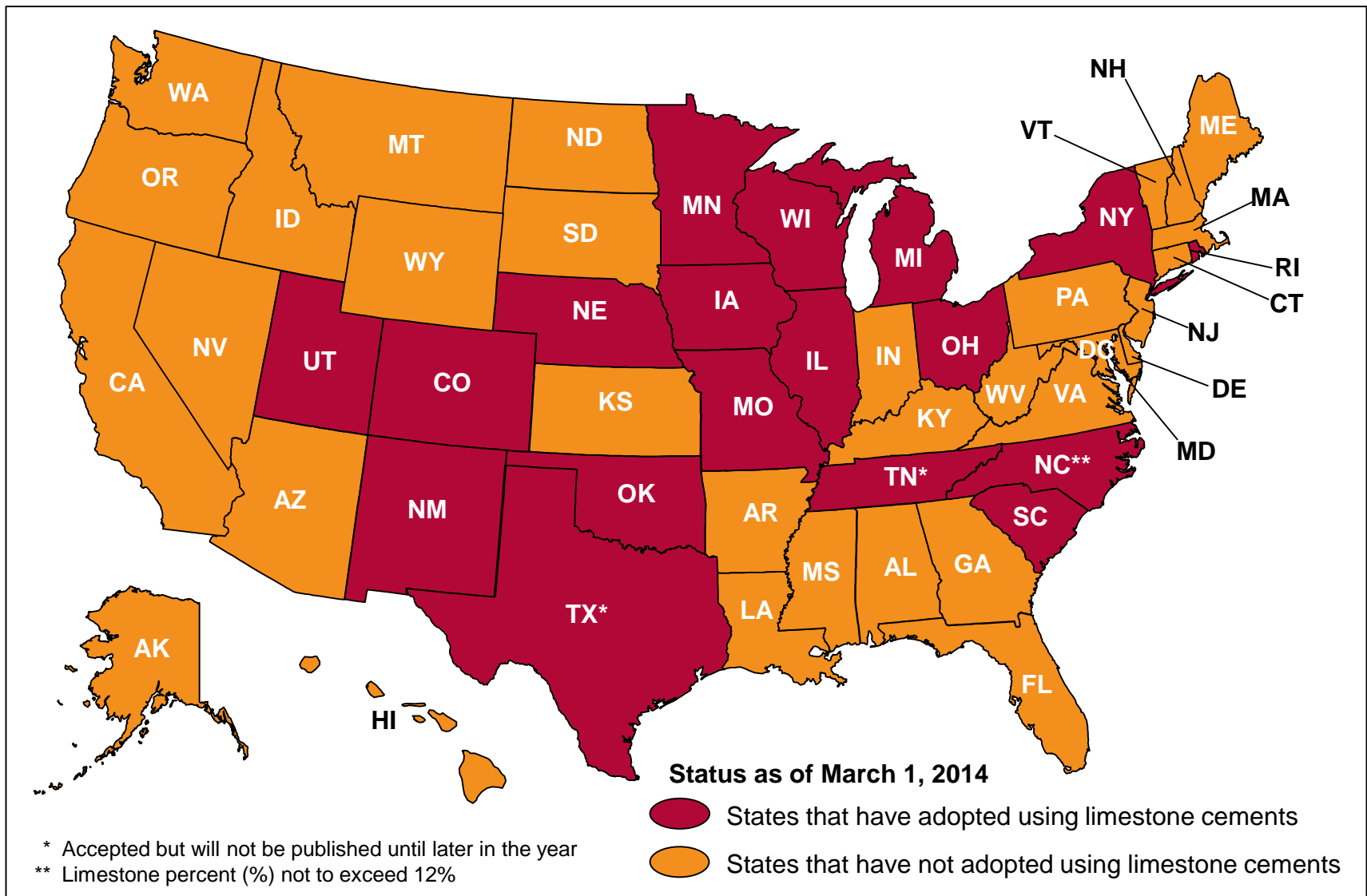
**“Can I still use my normal amount of slag or flyash?”**

**“Do I have to change my admixture?”**

**“Do I have to change my saw cutting?”**

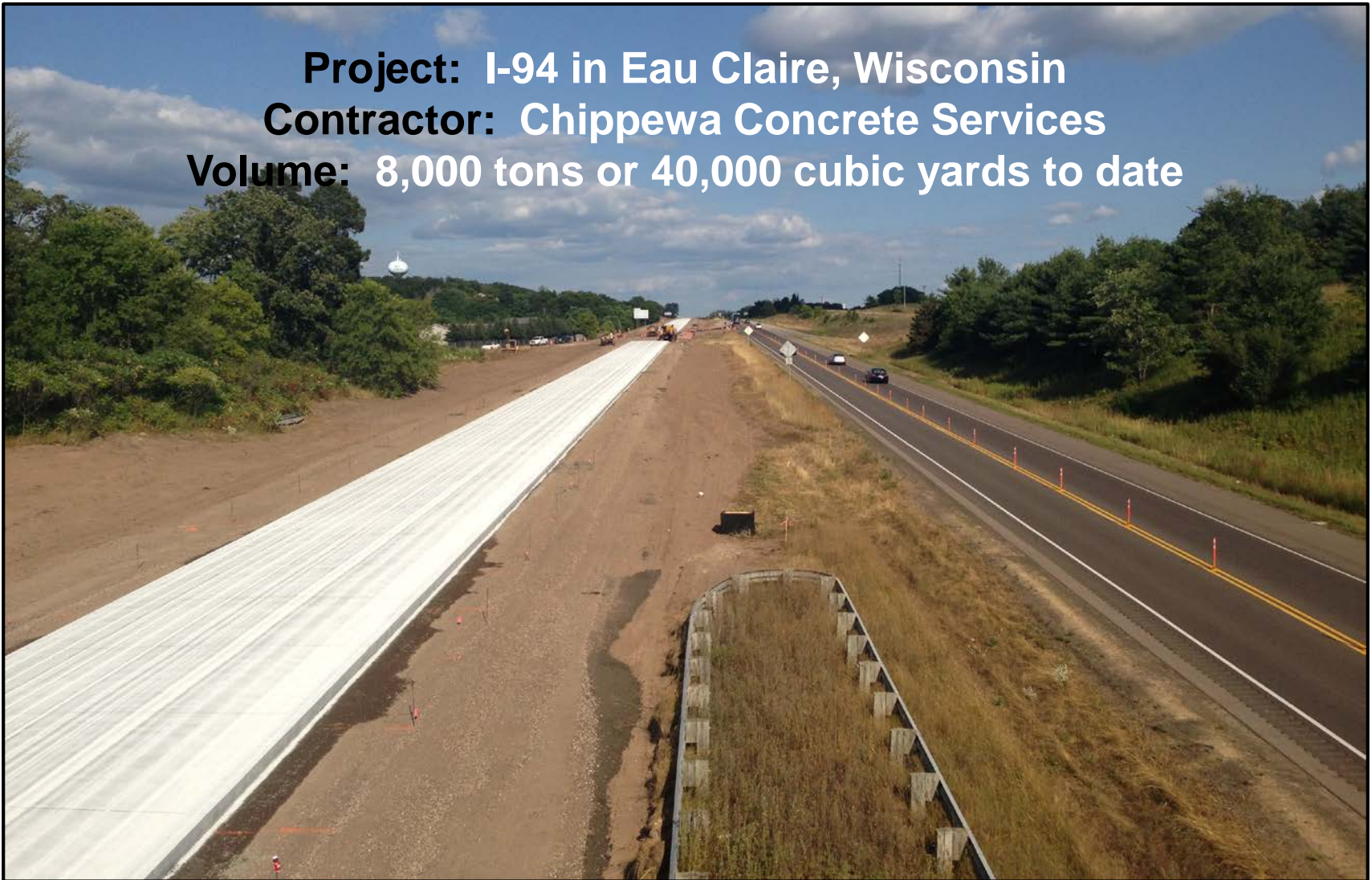


# States That Have Adopted Using Limestone Cements



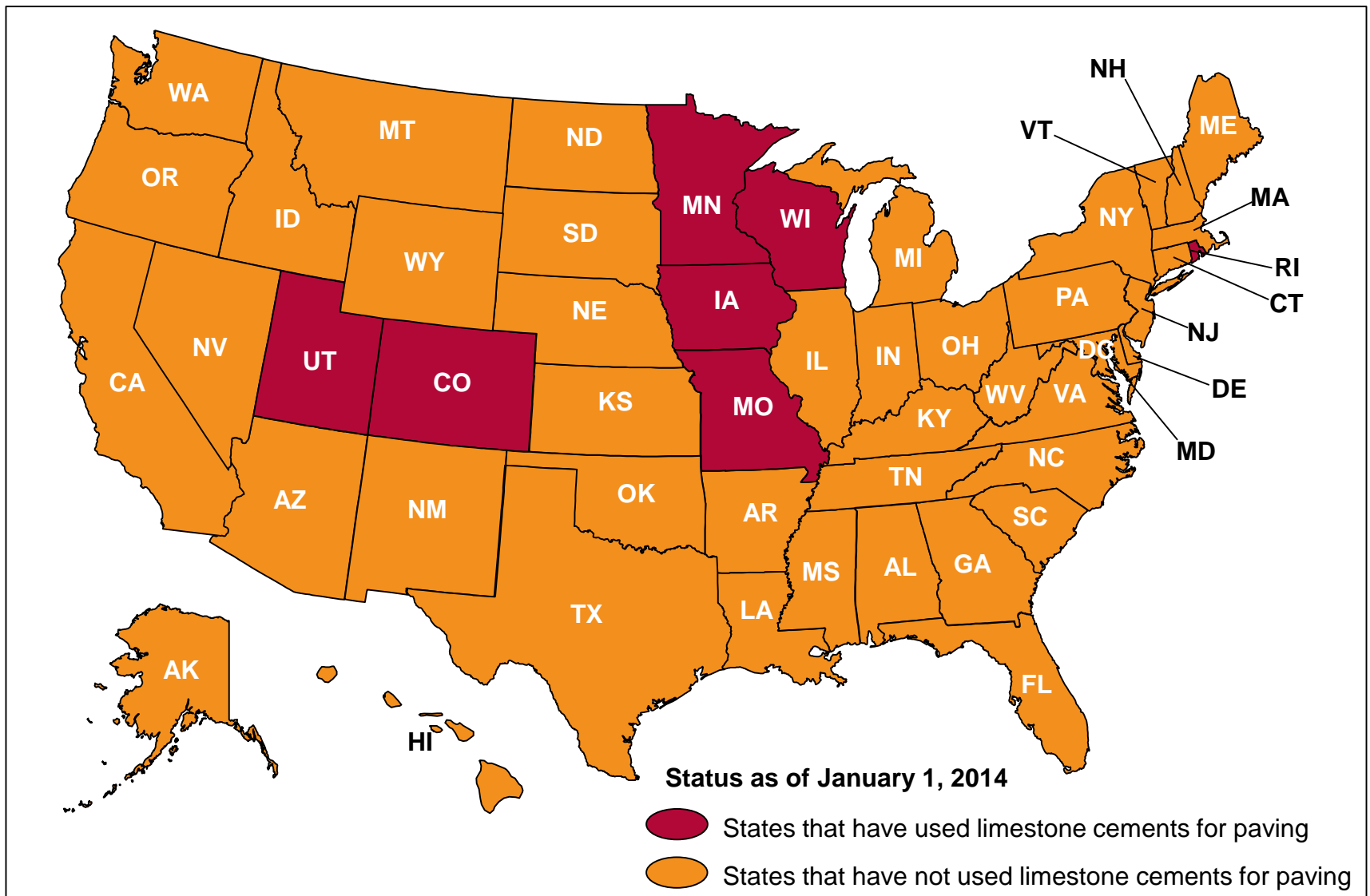
# Wisconsin Paving Project

**Project:** I-94 in Eau Claire, Wisconsin  
**Contractor:** Chippewa Concrete Services  
**Volume:** 8,000 tons or 40,000 cubic yards to date





# Over 200 Miles of Paving Using Limestone Cements



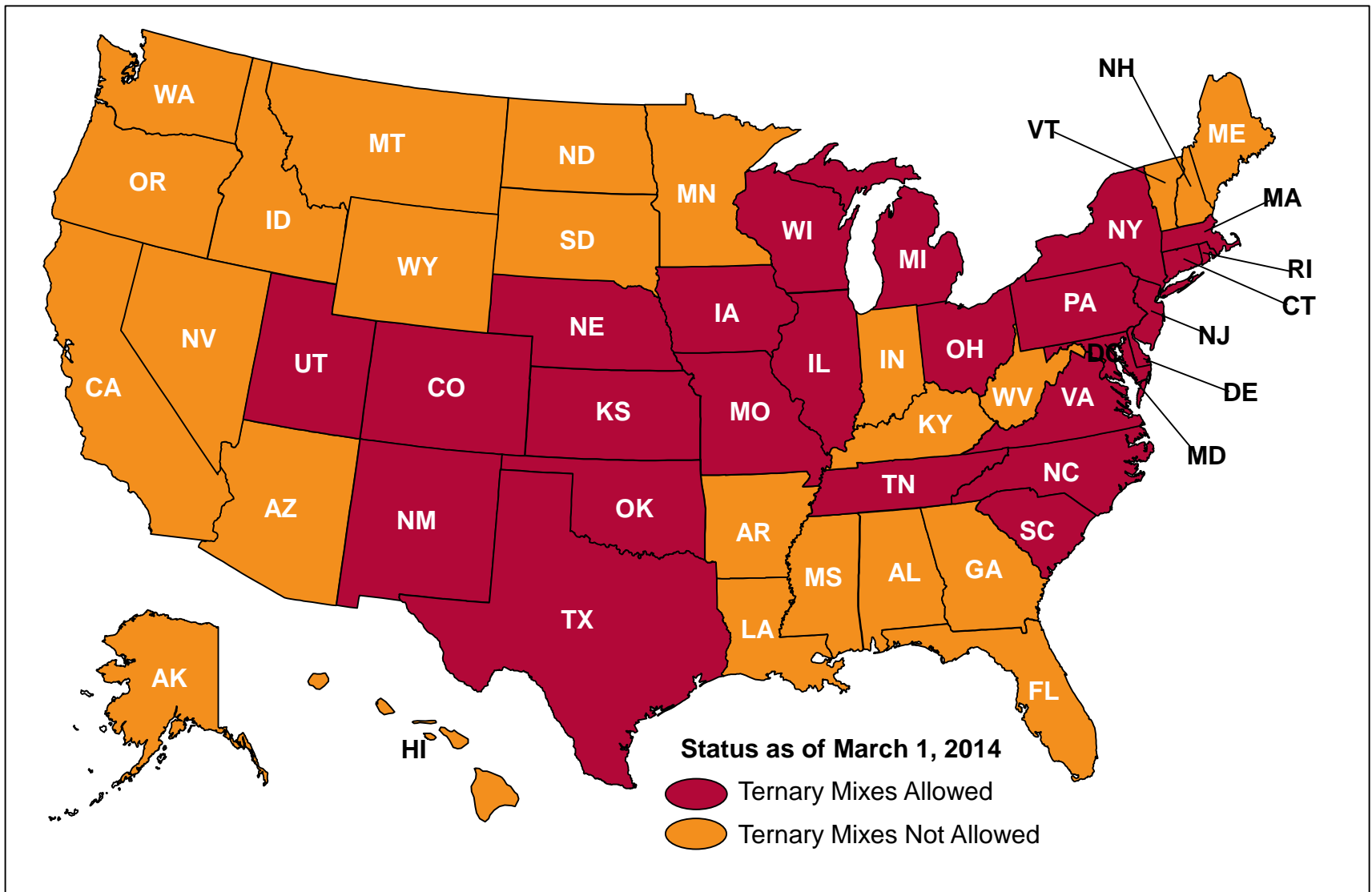
# Oklahoma Paving Project

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**Project: Beckham Weigh Station, Oklahoma**



# Ternary Blends—Pavement Mixes Only





# Environmental Impact

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Limestone cements are designed to replace portland cement without changing your operation at all

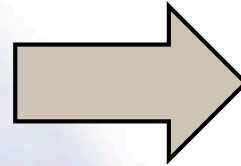


Just Lower Environmental Impact

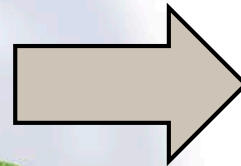


# The Future

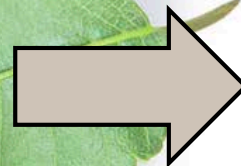
People will change if:



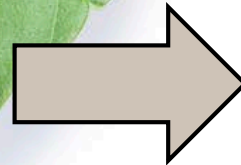
It is good for the environment



It does not make life more complicated



It is every bit as good as what you were using



It does not cost more

**Limestone Cements Fit These Requirements**

# The Future Will Not Look Like the Past

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## What Can We Do to Prepare?

