

# Cold Central Plant Recycling (CCPR) China Experience

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Meadwestvaco



# Outline

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- Background
  - China roadway network
  - Loading and structural needs
- Cold Recycling specification overview
- Project examples
  - Pavement section
  - Construction
  - Performance
- Summary

# Roadway networks



- Chinese express way 104,500 km (65,300 mi)
- World's largest expressway system by length)
- 34 provincial-level administrative units

- 50 States
- 3,077 U.S. counties
- 4,374,563 km of paved roads
- 2,118,792 km of unpaved public roads
- 75,440 km of Interstates

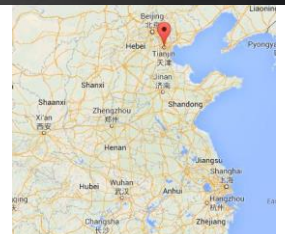
# China Traffic Considerations

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- Peak load traffic is typically at night



Tianjin Expressway



# China Loading



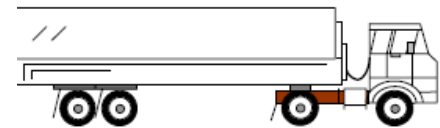
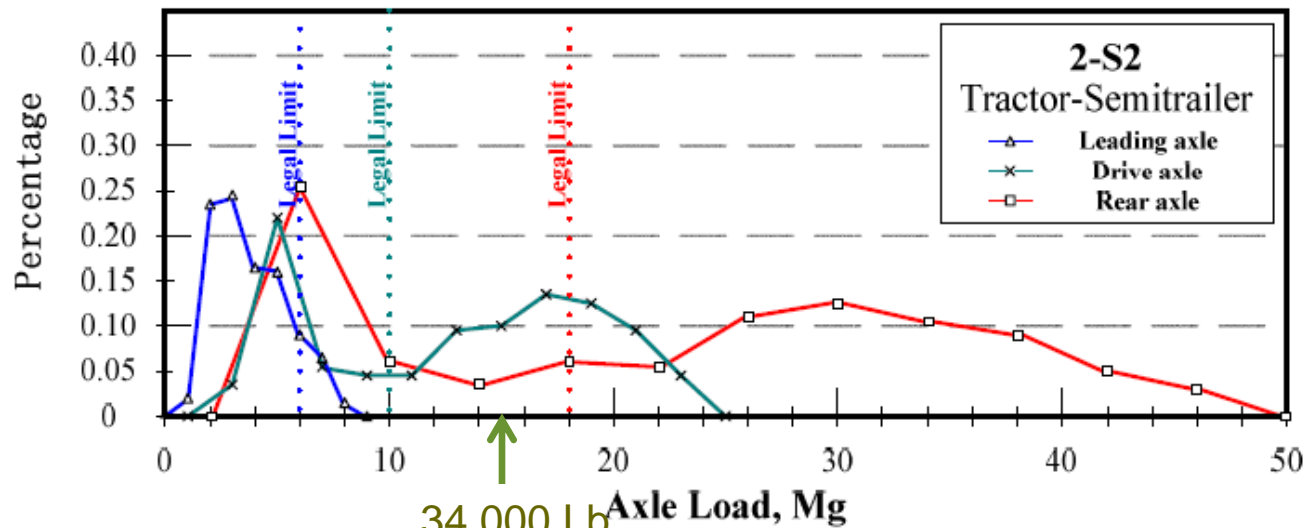
- Pictures of traffic on Cold Recycling section constructed in August 2011 in Tangshan



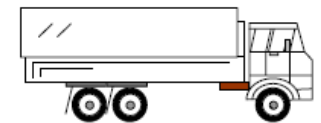
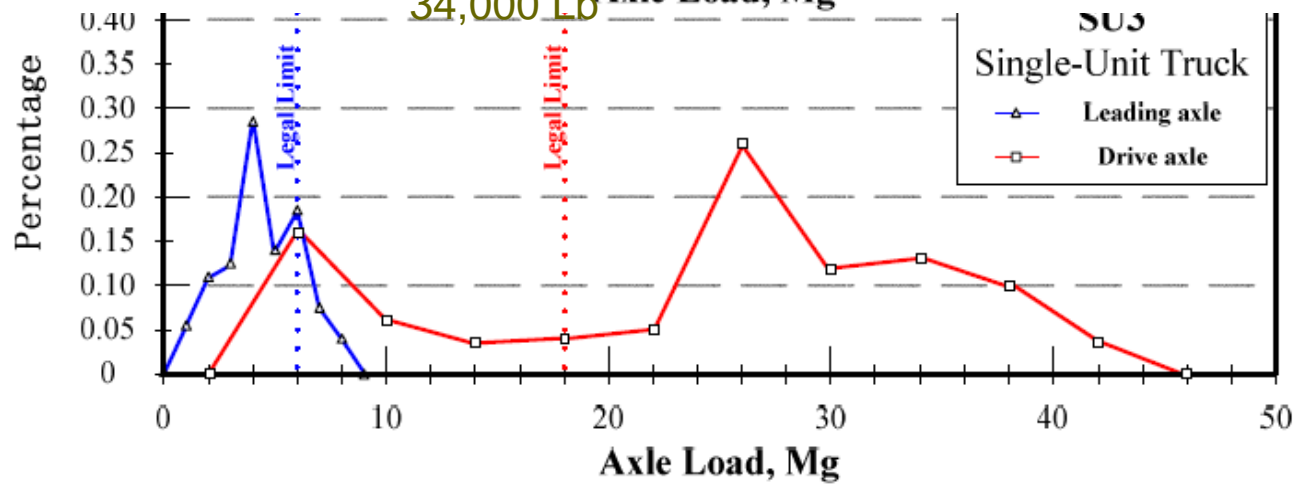
24/7 trucks that supply iron plant

# China Heavy Traffic Loading Considerations

- About 50% or more of axles are overloaded



2-S2 Tractor-Semitrailer

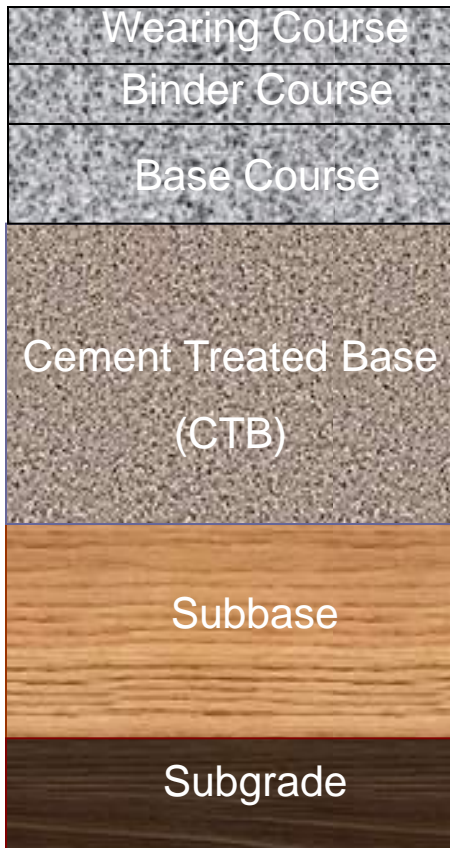


SU3 Single-Unit Truck

# China Typical Pavement Structure

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- Driven by heavy loading, pavement structure is typically semi-rigid



- Distresses in CTB will lead to major rehabilitation
- > Opportunity for CCPR**

# Cold Recycling Specification - RAP

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## □ RAP Requirements

Material	Test items	Requirements
RAP	Moisture content	Measured
	RAP gradation	Measured
	Asphalt content	Measured
	Flakiness	Measured
	Sand Equivalent (%)	> 50
Recovered Asphalt	Penetration	Measured
	Dynamic viscosity	Measured
	Softening Point	Measured
	Ductility	Measured



# Cold Recycling Specification – RAP Gradations

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Sieve Size (mm)	Coarse	Medium	Fine A	Fine B
37.5	100			
26.5	80~100	100		
19	—	90~100	100	
13.2	60~80	—	90~100	100
9.5	—	60~80	60~80	90~100
4.75	25~60	35~65	45~75	60~80
2.36	15~45	20~50	25~55	35~65
0.3	3~20	3~21	6~25	6~25
0.075	1~7	2~8	2~9	2~10

# Cold Recycling Specification – Emulsion Requirements

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Properties		Requirements
Type		Cationic (+)
Sieve (1.18mm)		≤0.1
Viscosity	Viscosity <sub>E<sub>25</sub></sub> , %	2~30
	25°C Vs, Sec	7~100
Residue	Emulsion Residue, %	≥62
	Solubility, %	≥97.5
	Penetration, dmm (25°C)	45~150
	Ductility, cm (15°C)	≥40
Emulsion Settlement		Requirement
Time	1d, %	≤1
	5d, %	≤5

# Cold Recycling Specification – Cold Recycling Design Requirements

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Property	Requirements
Air Voids, %	7~12
40 °C Marshall stability (Ø152.4mm) (*), kN	≥13.5 (3,000 lb)
40 °C immersion Marshall residual stability, %	≥75
15 ° C Dry Indirect Tensile Strength, MPa	≥0.5
15 °C dry and wet splitting strength ratio, %	≥75
Freeze-thaw splitting strength ratio (TSR), %	≥70
60 ° C for dynamic stability, passes/mm	≥1000

Note: Marshall compaction of 15 cm tall specimen. Primary compaction at 25°C with 150 blows each side. Secondary compaction 70 blows each side after placing specimens in a 60°C oven for 48 hours

# Cold Recycling Specification – Cold Recycling Design Requirements

Property	Requirements
Air Voids, % <b>Compactibility</b>	7~12
40 °C Marshall stability (Ø152.4mm) (*), kN	≥13.5
15 ° C Dry Indirect Tensile Strength, MPa <b>Stability/Strength</b>	≥0.5
40 °C immersion Marshall residual stability, %	≥75
15 °C dry and wet splitting strength ratio, %	≥75
Freeze-thaw splitting strength ratio (TSR), %	≥70
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<b>Moisture Resistance</b>	
15 °C dry and wet splitting strength ratio, %	≥75
Freeze-thaw splitting strength ratio (TSR), %	≥70
60 ° C for dynamic stability, passes/mm	≥1000

# Cold Recycling Specification – Cold Recycling Design Requirements

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Wheel tracking Test for Rutting Resistance

# CCPR RAP Crushing and Screening



# CCPR Stockpiles

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## □ Typical stockpiles

- 0-5 mm (0-#4)
- 5-10 mm (#4-3/8")
- 10-20 mm or 10-30 mm (3/8"-3/4" or 3/8"-1.25")
- Coarse Virgin Aggregate as Needed





# CCPR Mixing Pugmill Configurations

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## □ Single pugmills



## □ Dual pugmills

# Dual Pugmill

Filler Feeder  
(i.e. cement)

RAP and/or  
Aggregate Bins

Truck Loading  
Area

Conveyor to Secondary  
Pugmill



Primary Pugmill  
(Filler and Water Addition)



Secondary pugmill  
(Emulsion Addition)

# CCPR Mixture Production

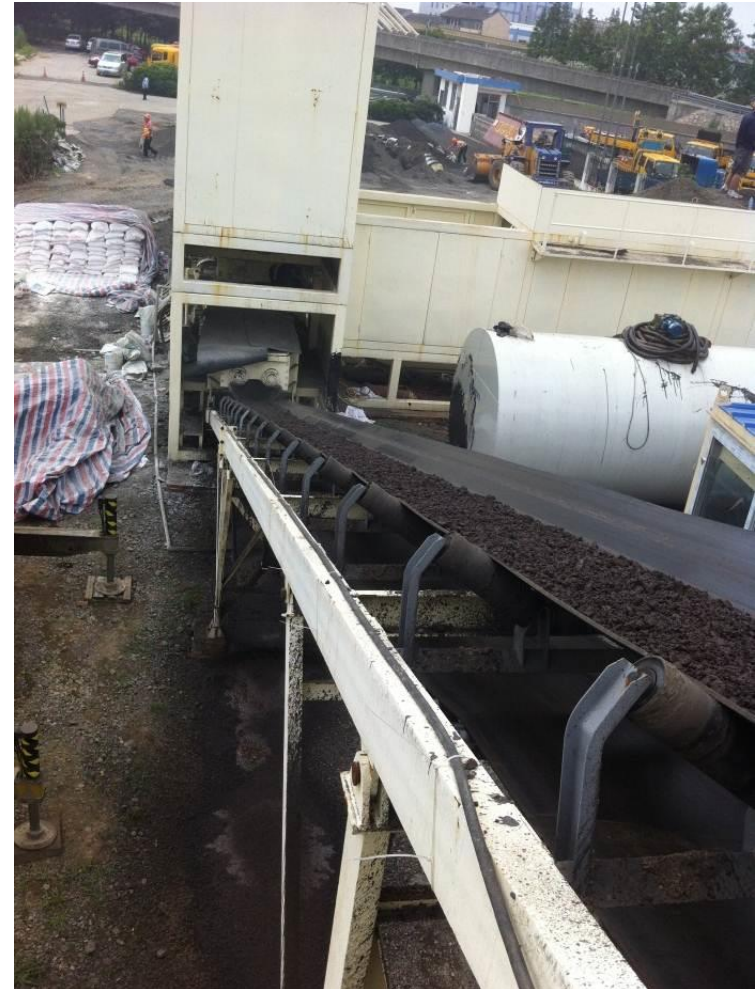
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CCPR Portable Plant of Beijing Saint Ground Highway Technology Company(SGT)

# CCPR Mixture Production (Cont.)

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# CCPR Mixture Production (Cont)

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# CCPR Mixture Production (Cont)

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# Paving Operation

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# Compaction Operation

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Heavy compaction equipment suitable: 2x18T Single Steel, 1x13T Double Steel, 2x30T Pneumatic Rollers



# Quality Control

## □ On site laboratory

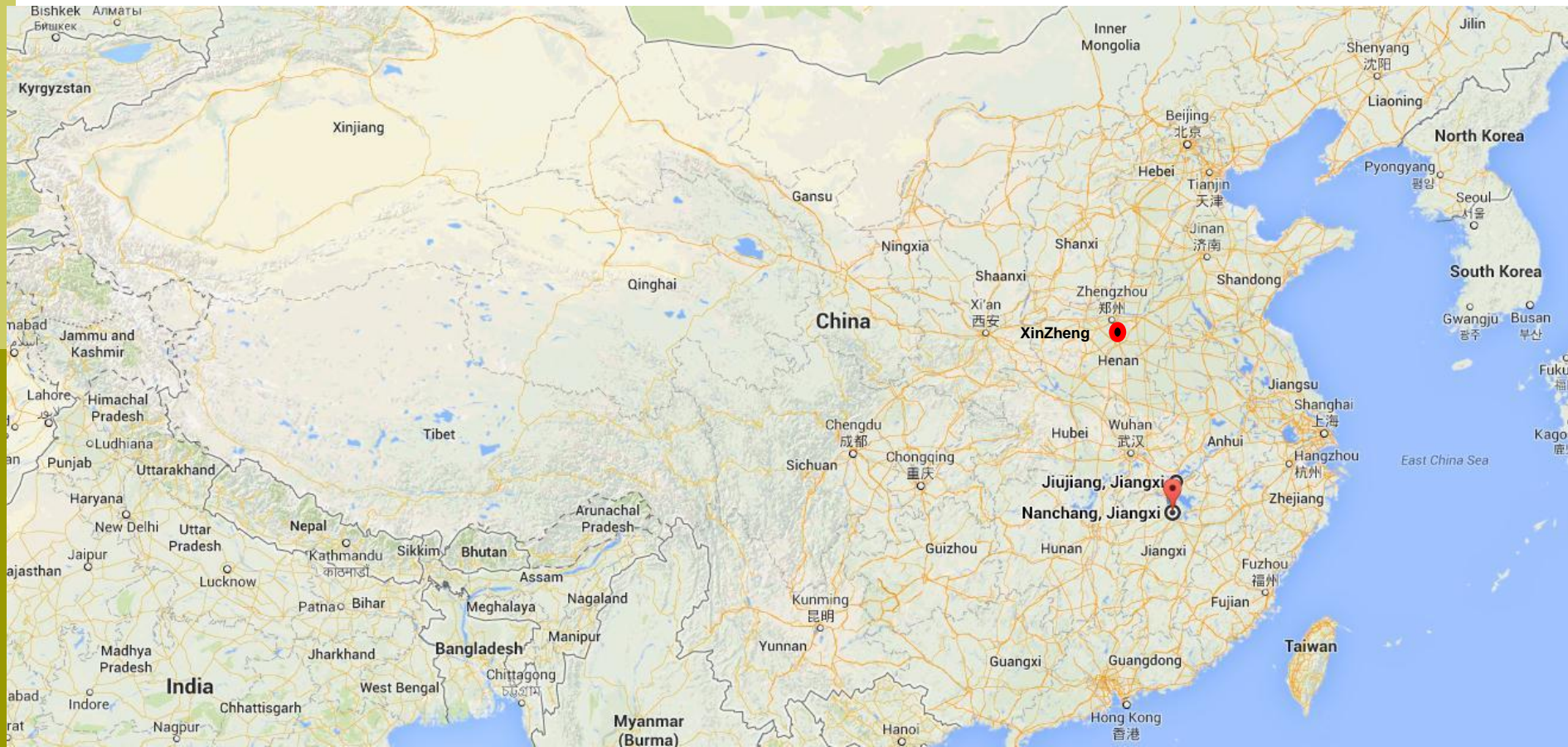


Portable QC Laboratory of Beijing Saint Ground Highway Technology Company(SGT)



# Project Examples

- Nanchang to Jiuiang (ChangJiu) G70 – Jiangxi
- Xinzheng G107 - Henan



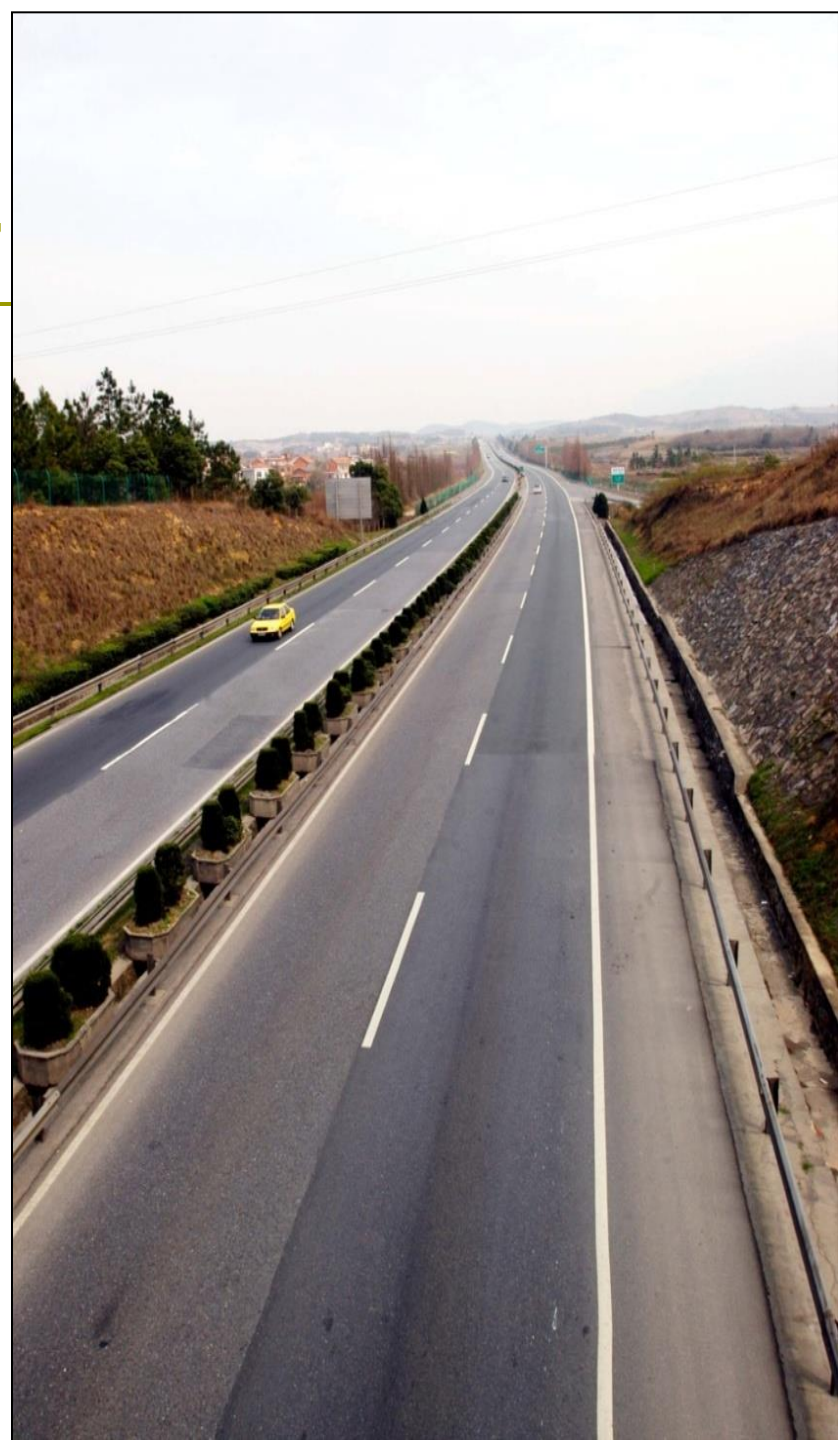
# Project 1-Nanchang to Jiujiang (ChangJiu) Expressway – 2006/2007

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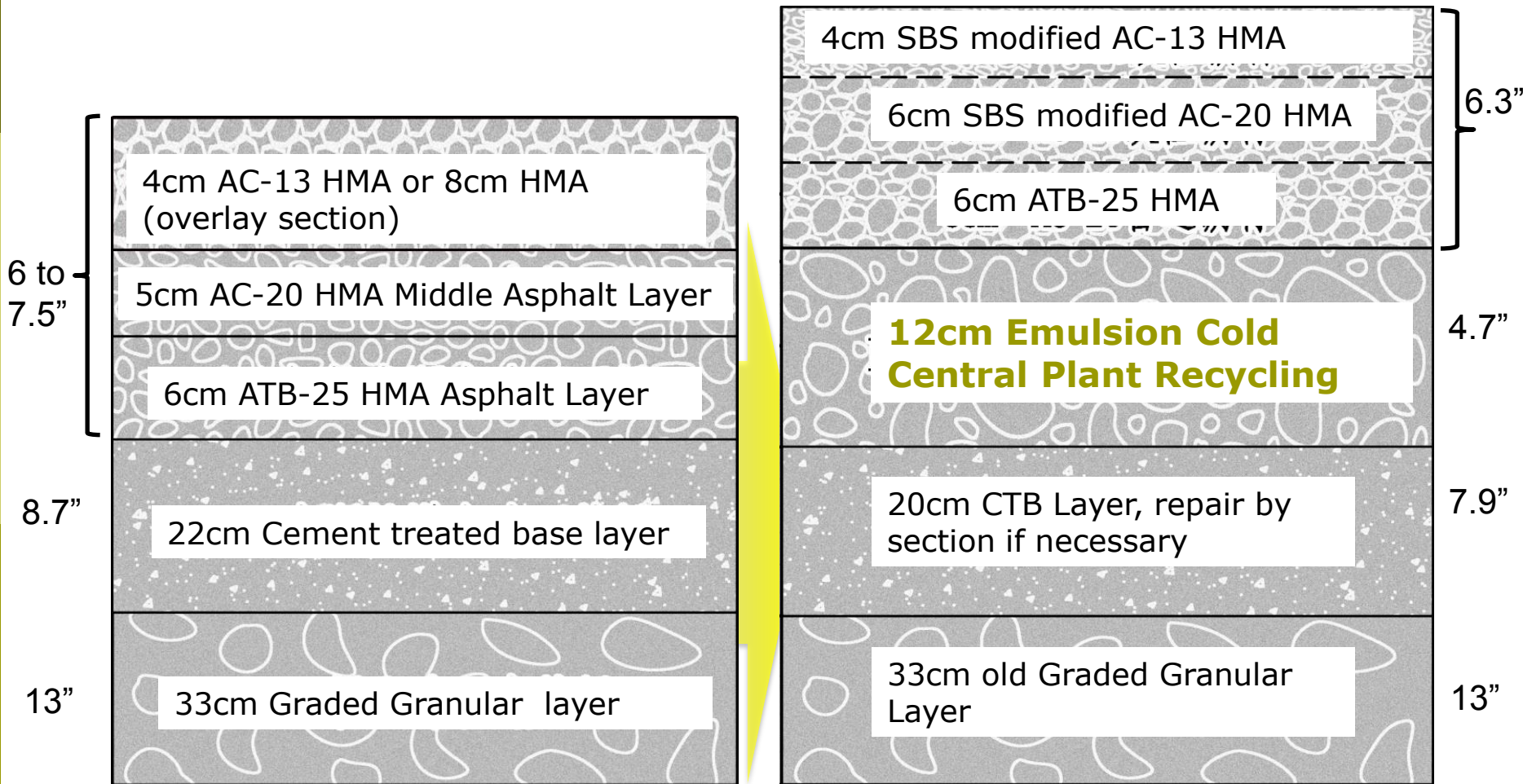
## □ G70 Before condition



## □ 108 km rehabilitation using Emulsion CCPR



# Changjiu G70 Pavement Structure



Old Pavement Structure

New Pavement Structure

# Project Construction

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# Project 1-Nanchang

## Jiangxi Jiujiang Expressway

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- Condition after 8 years



- Satisfactory performance with minimal cracking

# Project 2 - 2013

## Henan G107 (Xinzheng City )

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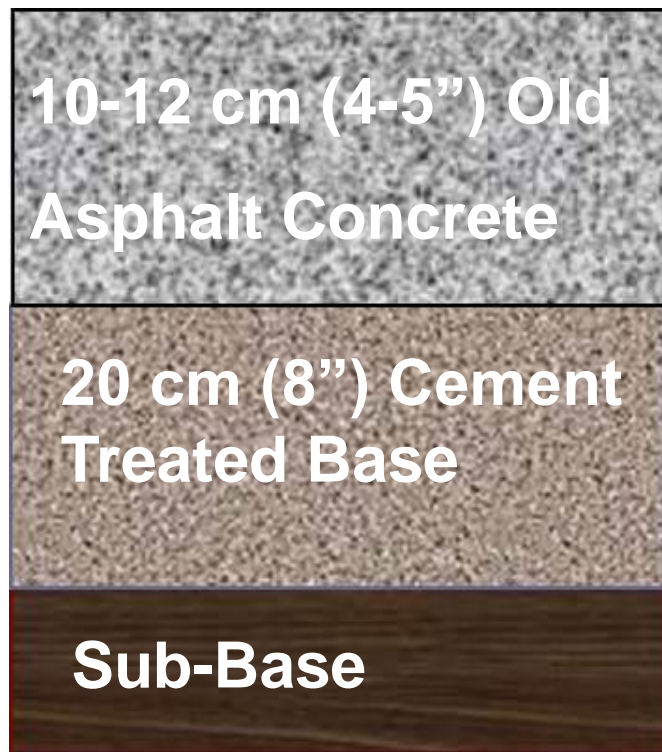
- Before condition
  - Rutting
  - Cracking



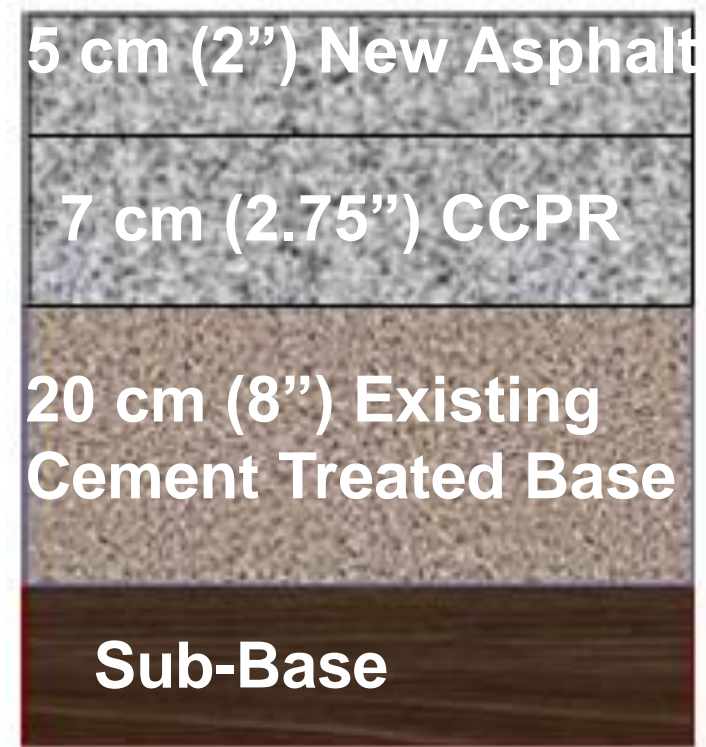
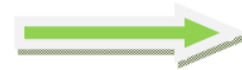
# Henan G107

## Pavement Structure

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Old Pavement Structure



New Pavement Structure



# Henan G107 (Xinzheng City ) Construction and Performance

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CCPR Construction



CCPR Finished Mat



CCPR Mat Left Open to Traffic for  
a Few weeks Before HMA  
Overlay

# Emulsion CCPR

## Upcoming Projects

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- 2013-2015 Project list example from single contractor: Beijing Saint Ground Highway Technology Company(SGT)

No.	Project name	Province	Length(km)	RAP amount (Metric T)	Construction timeframe
1	Changzhang	Jiangxi	98	497,000	2014.6~2014.12
2	Changtai	Jiangxi	147	287,000	2014.8~2015.6
3	Taigan	Jiangxi	128	280,000	2013.9~2014.12
4	Changjin	Jiangxi	168	130,000	2013.9~2014.12
5	Liwen	Jiangxi	245	120,000	2014.8~2015.6
6	Wenhou	Jiangxi	35	100,000	2014.9~2015.6
7	Jingshi	Hebei	192	80,000	2014.5~2014.8

Total: 1,013 km    Total: 1.5 Million Tons  
(633 center lane mi)

# Summary

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- Emulsion CCPR is an effective rehabilitation technique that can be used on low to high volume traffic roadways
  - CCPR followed by HMA overlay in China (high traffic)
  - Satisfactory performance overall (especially reflective cracking resistance)
- CCPR system needs to be properly designed and constructed to meet specification and project requirements

# Summary (Cont.)

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- Construction steps important to final quality:
  - RAP stockpile preparation
  - Pugmill mixing (accurate proportioning)
  - Paving and rolling
  - Logistics
  - Quality Control
- CCPR is being implemented on a relatively large scale
  - More than 600 center miles of emulsion CCPR projects scheduled for the next two years in two provinces

# Thank you – Questions?

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MWV



2014 Interstate Project Near Shanghai (China)