

Review of Surface Treatments in China

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Review of Surface Treatments in China

- › China Highway Data Review
- › Chip Seal
- › Slurry Seal & Micro Surfacing
- › Others: Fog Seal, etc.
- › New Development





China Pavement Data Review

- Expressway: 110,000 km  3,000M m²
 - Over 90% is asphalt concrete
- National Highway (inter-state): 200,000 km (including expressway)
- Regional Highway (intra-state): 330,000 km
- Countryside Road 3.5 million km
 - (33% unpaved roads, 20% asphalt pavement, 47% cement)
- Surface Treatments are predominantly used for pavement preservation and rarely used for application on new construction.



Chip Seal: China Emulsion Specification

试验项目		单位	品种及代号Type									
			阳离子Cationic				阴离子Anionic				非离子Nonionic	
			喷洒用Spray			拌和用Mix	喷洒用Spray			拌和用mix	喷洒用	拌和用
			PC-1	PC-2	PC-3	BC-1	PA-1	PA-2	PA-3	BA-1	PN-2	BN-1
破乳速度			CRS	CSS	CRS&CSS	CSS	快裂	慢裂	快裂或中裂	慢裂或中裂	慢裂	慢裂
粒子电荷			阳离子(+)				阴离子(-)				非离子	
筛上残留物(筛) 不大于		%	0.1				0.1				0.1	
Viscosity	恩格拉粘度计E ₂₅		2-10	1-6	1-6	2-30	2-10	1-6	1-6	2-30	1-6	2-30
	道路标准粘度计C _{25.3}	s	10-25	8-20	8-20	10-60	10-25	8-20	8-20	10-60	8-20	10-60
蒸发残留物 Residue	残留分含量 不小于	%	50	50	50	55	50	50	50	55	50	55
	溶解度, 不小于	%	97.5				97.5				97.5	
	针入度()	dmm	50-200	50-300	45-150		50-200	50-300	45-150		50-300	60-300
	延度(), 不小于	cm	40				40				40	
与粗、细粒式集料拌和试验			—			均匀	—			均匀	—	



Chip Seal

- Unlike the rest of the world, chip seal is not the No.1 surface treatment in China. Development of high performance specifications are in process.
- Dirty aggregate.
- Production/Application challenges.
- Chip seal is viewed as an “old”, low quality technology due to extensive application failures in China in the past.
- Chip seal is used primarily in remote and secondary roads as a “cheap” seal.



Slurry Seal and Micro Surfacing

- Introduced in China in the 1990's and is the No. 1 surface treatment used in China.
- Specifications aligned with ISSA's A105 and A143 Guidelines.
- Over 300 quality paving machines supplied by Bergkamp, VSS, Breining, etc.
- Slurry seal is widely used to protect secondary roads due to its ability to work across a wide variety of materials and conditions.
- It's estimated around 50 million m² applied each year.



Slurry Seal and Micro Surfacing

- Micro surfacing is the leading surface treatment on expressways and primary highways in China.
- Over 100 million m² of micro surfacing was applied in the peak year (2010).
- Drivers' complaints regarding the increase in road noise with Type III micro has significantly impacted its use in heavily populated metropolitan areas such as Shanghai.





Fog Seal and Rejuvenating Seal

- Fog Seal used to be a significant preventative maintenance tool in western China because of its dry climate. However, the market is down significantly due to its very short service life and vehicle accident reports on highways due to improper application rates. Application on dense graded pavements provides significant challenges due to potential decreases in surface texture.
- Rejuvenating seal containing polymer such as RejuvaSeal™ has limited market acceptance due to its slow, manual application and high cost.



New Developments

- Fiber-Enhanced Micro Surfacing: Beijing Case Study
- Dense Graded Thin Overlay : Beijing Case Study
- Sand-Containing Seal Coat:





Fiber Enhanced Micro Surfacing

■ Beijing DOT's Challenges

- Overwhelming traffic issues are placing significant pressure on the road administration authorities who don't want to be seen as the source of Beijing's traffic problems.
- Vehicle exhaust emissions contribute significantly to Beijing's serious air pollution problem, particularly in the downtown area.
- Due to the increase in road kilometers requiring maintenance as a result of the Olympics, there is ever-increasing pressure to balance rising road preservation costs with smaller transportation budgets.





Beijing Road Map

Beijing Total: 16,411 km² vs. 12,000 km² Great Paris

Beijing Downtown: 81 km² vs. 105 km² Paris



Microsurfacing Jobsite

Downtown Beijing Map



The Choice: Fiber Enhanced Microsurfacing

- › Delay the cracks reflected
- › Minimize the traffic control
- › Almost no fume
- › Make the road looks pretty
- › Cheap vs. HMA overlay to maintain more road





Candidate Road for Micro Surfacing

Not targets:

- Nearby Tian An Meng square : Not for Pretty Face
- Not in Central Business District (CBD) and Shopping Center:
too many manhole covers

The ideal candidate roads for micro surfacing:

Urban Fast Transportation System: No.5, No.6 Ring Road; the roads connecting cities to the suburbs.



Beijing Case Study

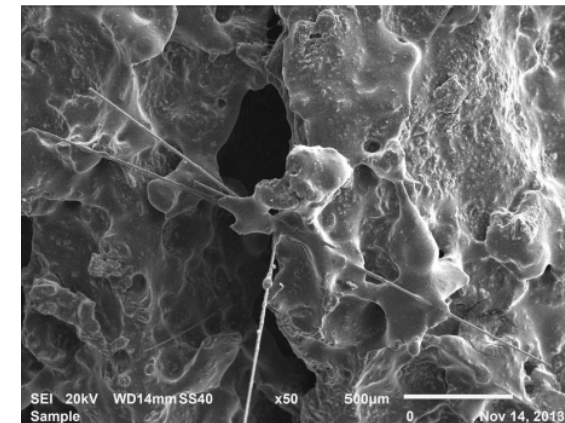
› Mix design

- Aggregates: Type II ISSA (0-6mm)
- Emulsion: 11.2%, CQS-2L (softening point of residue: 58°C)
- Cement: 1%
- Fiber: 0.2% (by weight of aggregate), glass fiber

› Evaluation:

- Mix time: 70 seconds
- Cohesion: 1.7 N.M in 30 min; 2.3 N.M in 60 min at 15°C indoor
- WTAT : 350g/m² , 6 Day

Glass Fiber Distribution



Application

In 2013-2014, around 1 million m² was paved in Beijing City between No.5 Ring to No.6 Ring



Secondary Strike Off



Night application: 12°C.





Road Condition - 2 Years After Application





Dense-Graded Super Thin Overlay (ECA2.5)

- Novachip® is the most popular super thin overlay (2cm thick) in the past 10 years
- Novachip's limitation
 - Removal of snow from surface macrostructure in the winter in northern China
 - Concern with damage from freeze-thaw cycles
 - Not compatible with the popular dense graded surface if it's used in one lane
 - Difficulty in obtaining high quality CRS-2P emulsion.



Dense Grade Super Thin Overlay



Dense-Graded Super Thin Overlay (ECA2.5)

- Two Primary Challenges in Achieving Superior Performance
 - Density of the mix
 - Rapid reduction in mix temperature makes compaction difficult.
 - Adhesion to the surface
 - High shear force makes the bonding critical for long term success



Dense-Graded Super Thin Overlay (ECA2.5)

■ Solutions

- Compaction aid additive to help compaction at lower temperatures
 - 0.7% to bitumen
- Epoxy-modified asphalt emulsion to improve bond strength between the overlay and the existing pavement surface
- Other additives
 - Mix modifier to replace PMA for easy production
 - Polyester fiber

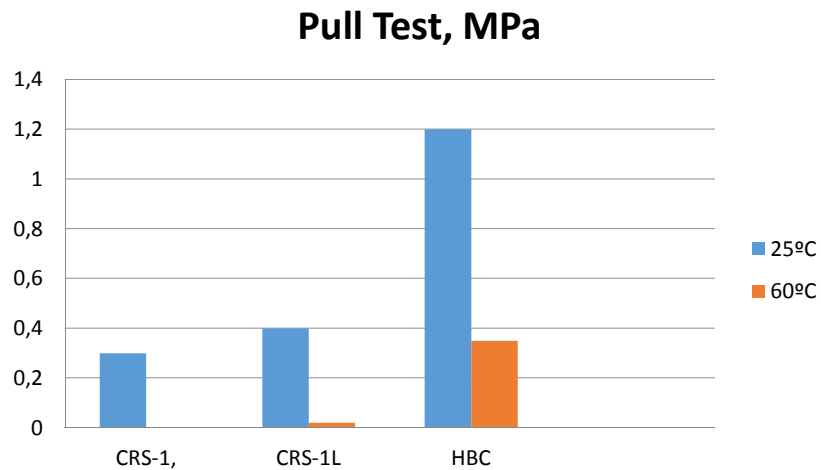


Innovative Epoxy-Modified Asphalt Emulsion

- Over 24 hours storage life for easy application
- Superior bonding strength at high temperatures



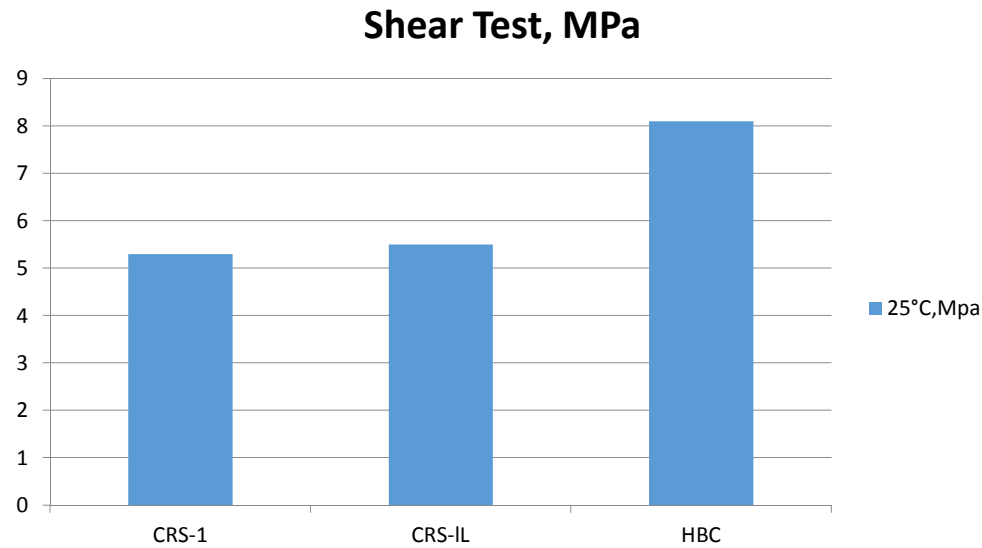
Innovative Epoxy-Modified Asphalt Emulsion



Tack coat: 0.35L/m²



Innovative Epoxy-Modified Asphalt Emulsion



Tack coat: 0.35L/m²





Beijing Case Study

Mix Evaluation Test

Test	Result	Specification
Marshall Stability, (kN)	11.4	>7kN
Dynamic Stability @ 60°C, (次/mm)	4500	≥3000
Stability Residue, (%)	91.2	≥80
TSR, (%)	87.6	≥75
Surface Texture, (mm)	0.84	>0.55
Water Penetration, (ml/min)	10	≤150



Beijing Case Study

Beijing paved approximately 2 million m² of ECA-2.5 in 2013-2014



2-in-1 paver



2.5 cm thick after compaction



Jobsite right near Tian-An-Men



Seal Coat on Highways

- Seal coats were introduced to China approximately 10 years ago and were primarily used on airport runways/taxi ways and highway shoulders.
- 5 years ago, seal coat with modification began quickly expanding to highways to target the fog seal market.
- While seal coat technology continues to evolve, the challenge in China is to overcome the reality that failed projects are nearly equivalent in number to successful ones.



Seal Coat on Highways

- Improvements to traditional seal coat
 - Contains 15-20% sand based on seal coat mortar
 - Sand is less than 0.6mm
 - The sand is either added at the plant or on site.

- Optimized application process
 - Specific spray equipment designed to handle sand
 - Normally 2 passes total about 1-1.5kg/m²
 - Traffic return about 2-5 hours.



Seal Coat on Highways

- Application



Seal Coat on Highways



City Road



Expressway



Conclusion

- › Slurry Seal and Micro Surfacing are the only surface treatments widely adopted in China.
- › Chip Seal's future depends on developing the right specifications and successful application to overcome Chip Seal's poor quality, "cheap" image.
- › Commercial and technical success of new technologies heavily depends not only upon proper specifications but compliance with those specifications to achieve quality workmanship.





THANK YOU!

QUESTIONS?

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