

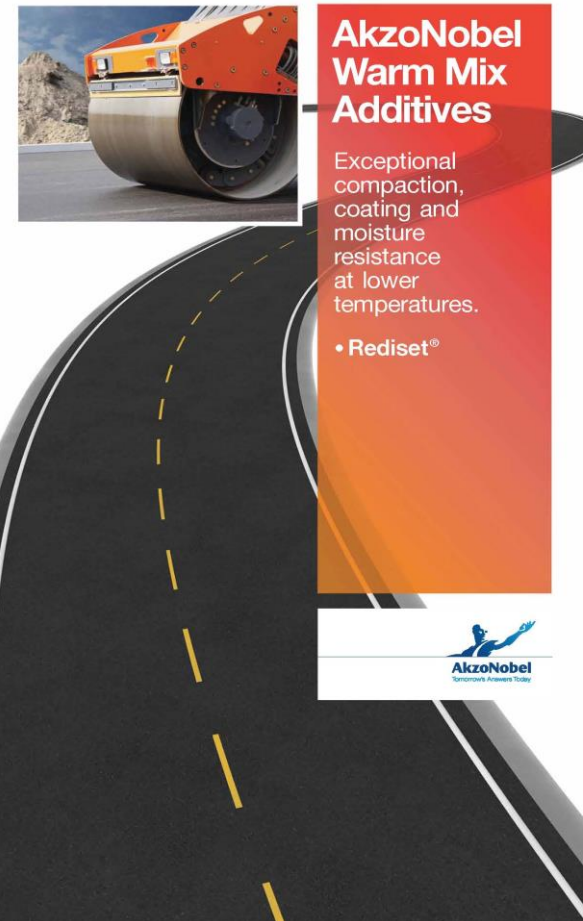
Rediset[®] Warm-Mix Additives

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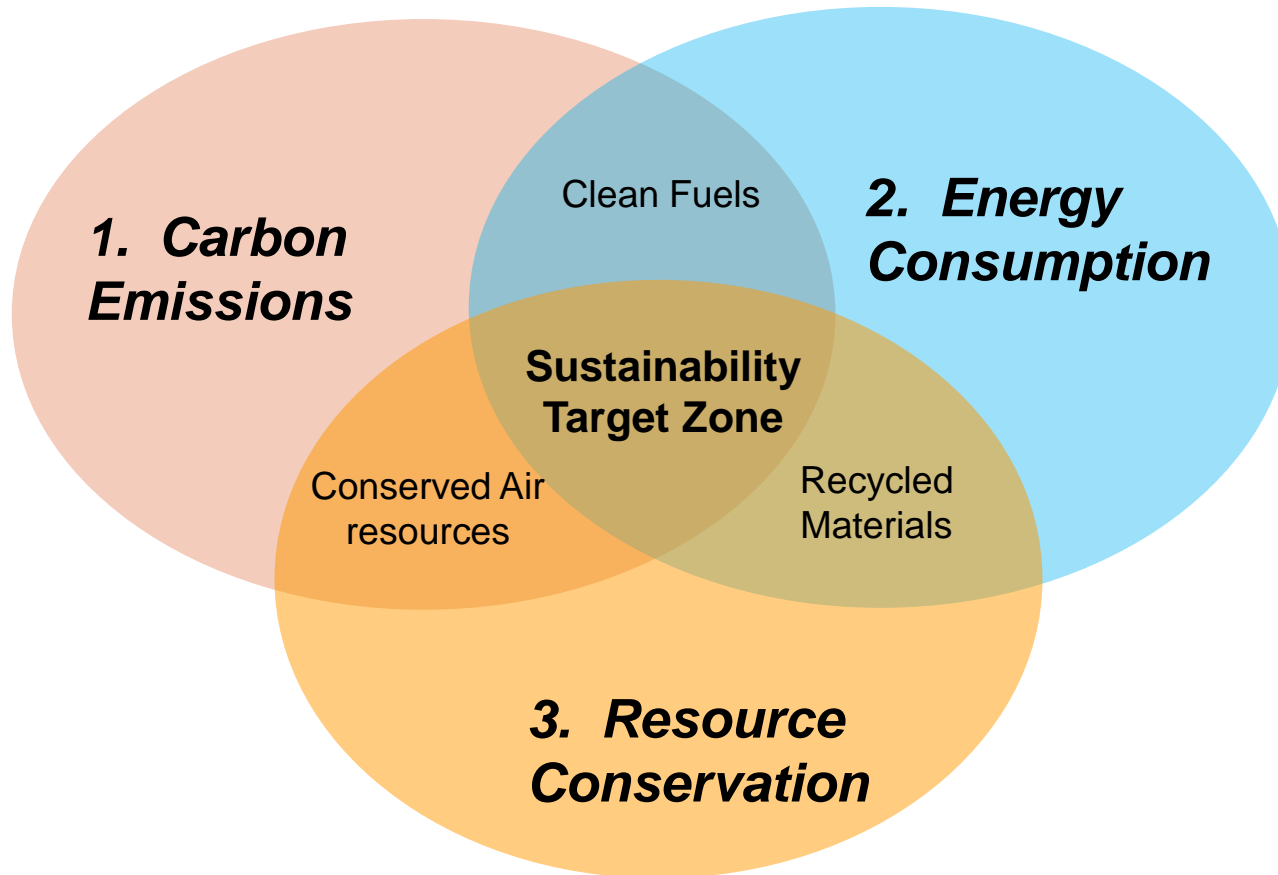
Content

1. Sustainability in asphalt paving
 - Sustainability and AkzoNobel
2. Overview of Rediset warm-mix additives
3. Use of Rediset LQ at the O'Hare airport warm-mix project
4. Use of Rediset to improve the properties of foam mixes



Sustainable Roads – Focus Areas

- *H. D. Bahia., and T. D. Miller*



Opportunities to improve Sustainability in asphalt related paving

- 1. Reduction of Emissions and Energy**
 - Warm-mix
 - Cold-mix
 - Elimination of cutbacks

- 2. Recycling best way to conserve resources**
 - Reclaimed Asphalt Pavement (RAP)
 - Recycled Roofing Shingles (RAS)
 - Crumb Rubber (from tires)
 - Steel slag
 - Glass

Combining warm-mix with recycled materials such as RAP greatly enhances sustainability

AkzoNobel and Sustainability

- Sustainability a major focus for AkzoNobel
- In 2013 and 2012 ranked first place on the Dow Jones Sustainability World Indexes (DJSI)
 - Chemicals Supersector
 - AN ranked top 3 since 2007
- Reduction of energy use, emissions and conserving resources fits very well



Rediset[®] Warm-Mix Systems

- **Rediset additives are based on surfactants**
- **Rediset WMX**
 - Solid version for difficult to compact mixes
- **Rediset LQ**
 - Liquid product
 - Customers prefer liquid version for easier handling
 - Can metered in using existing systems for anti-stripping additives
- **Rediset LQ Additives** can be used to improve properties of foam mixes

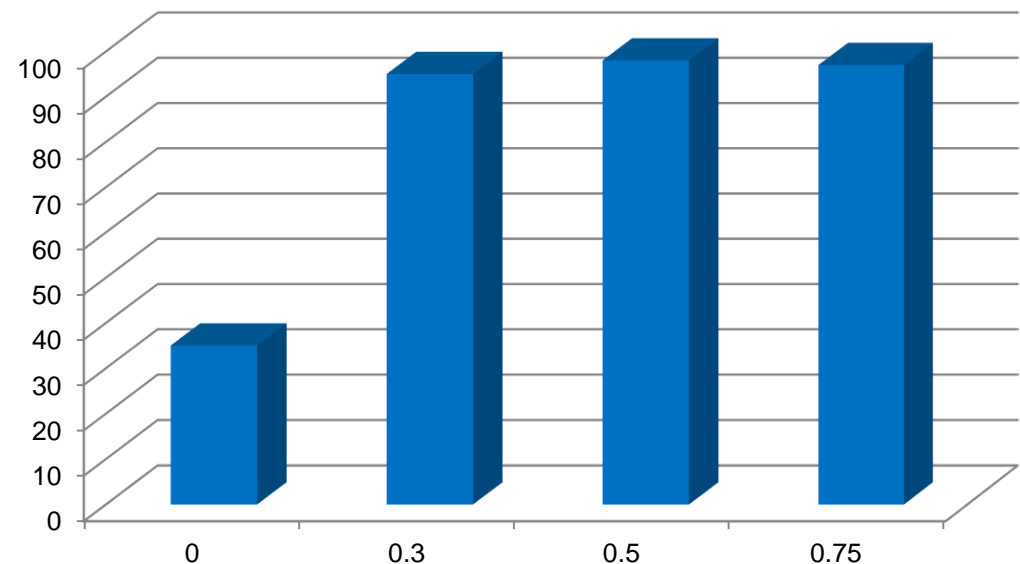


Rediset[®] LQ Main Features

1. Significantly improves workability and compaction
2. Mix remains workable for longer periods compared to foam mixes
3. Warm-mix additive and high performance anti-stripping additive in one
 - Active adhesion
4. Minimal effect on PG



Static Immersion Test Retained Coating after 2 days conditioning at 177°C at various dosages of Rediset LQ



Selection of projects for 2011- 2013 using Rediset LQ



O'Hare Modernization Program (OMP) Warm-mix project with Rediset LQ

- OMP one of the biggest structural rehabilitation programs in the US
- Goal is to modernize the system of runways
- OMP promoting green technologies in paving
Warm-mix with RAP containing mixes
- Taxiways paved with multiple layers of warm-mix containing Rediset LQ
- Total of ~100,000 Tons of mix for this project



OMP Warm-Mix Paving

Temperatures, Densities & Moisture Sensitivity Results

- Typical temperature reduction was 40-50°F at the plant and 40-60°F behind the paver
- The ambient temperature ranged between 40-75°F

Mix Type	Binder PG	RAP %	Field Densities	Moisture Sensitivity	
				TSR, %	Hamburg
K110H2208 WMA BIT Base CSE, N50 REC	PG 58-22	40	Range 94.4 to 95.1	86.1	-9.3 mm @20,000 passes
K110H2204 WMA BIT, N50, 19.0 REC Binder	PG 64-22	20	95.9, 95.8	95.3	-7.6 mm @20,000 passes
K110H2409 N70 DREC Surf	PG 64-22	10	Range 93.2 to 94.5	95.3	-5.8 mm @10,000 passes -9.3 mm @20,000 passes
ATPB	PG 64-22	0	95.4	NA	NA

O'Hare OMP Warm-Mix Paving

Binder course 10/07/2011



O'Hare OMP Warm-Mix Paving

ATPB Paving -11/01/2011



Additives for Foam Mixes

- 1. Warm Mix with foam widely used in US**
- 2. Foam mix has the following limitations**
 - Limited temperature reduction (20 to 30°F)
 - Lack of good coating of the aggregate
 - Limited workability window especially during cooler weather
 - Clumping of the mix when stored in Silo
- 3. Rediset has helped to solve the above problems**
 - Demonstrated by laboratory testing and field trials



Field Trial with Foam Mix APAC, TX

- PG 64-22 Mix with 15% RAP and 5% RAS
- Rediset dosage at 0.3% to 0.5% by weight binder
- Mix Temperature reduced $>40^{\circ}\text{F}$
- Good coating and mixes passed the Texas Boil Test ($>95\%$)
- Much improved workability and compaction
- Overnight silo storage did not produce clumps
- APAC TX use additives with foam mix during cooler months
 - Rediset LQ used in a SMA project with foam



Rediset® Warm-Mix Additives

- 1. Combination of warm-mix with recycled material greatly improves sustainability**
- 2. Rediset warm Mix Additives**
 - Significantly improves workability and compaction
 - Warm-Mix additive and high performance anti-stripping additive in one
 - Minimal effect on PG
 - Rediset LQ significantly improves properties of foam mixes



AkzoNobel Warm Mix Additives

Exceptional compaction, coating and moisture resistance at lower temperatures.

- Rediset®

Thank you for your attention

