



Eco-Friendly Warm-Mix Asphalt Pavement

LEADCAP

www.leadcapwma.com

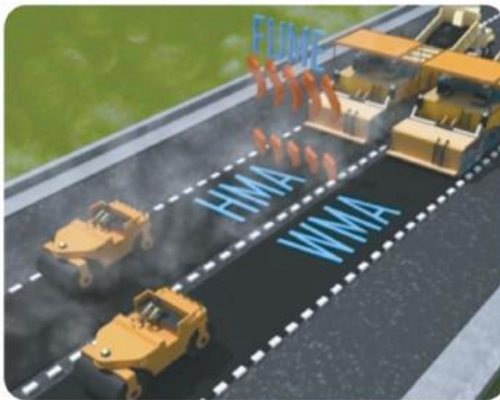


“Sustainable Asphalt Pavement using LEADCAP”



Warm-Mix Asphalt Pavement?

Mixing, placement, and compaction of asphalt mixes at significantly lower temperatures than HMA



Benefits of Warm-Mix Asphalt

Green

- Lower fuel consumption
- Less emissions
- Lower smoke and odor
- Less exposure of worker to fume
- Use of higher percentages of RAP

Construction

- Late season paving
- Early site opening
- Cold weather paving
- Longer haul distance
- More comfortable working conditions for plant and paving crews



| Hot-Mix Asphalt |



| Warm-Mix Asphalt |



| Temperature of WMA |



Intro

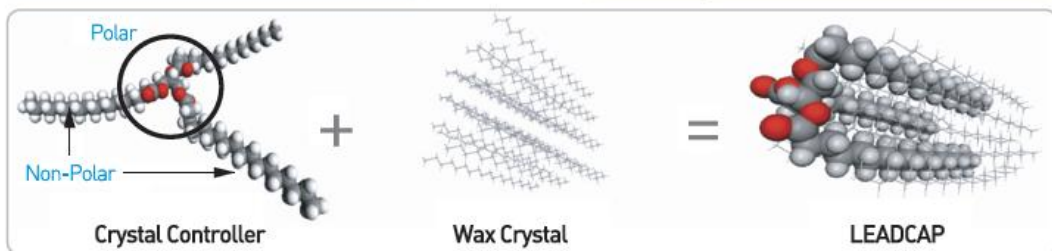
- Developed by Korea Institute of Construction Technology(KICT) and Kumho Petrochemical
- An organic additive of a wax-based composition including a crystal controller and synthetic materials
- Enough workability and better compaction asphalt mixes at 110°C
- Better performance of rutting resistance and moisture damage than HMA

Distinctive Characteristics

- Normal wax-based WMA additives have too high crystallinity and brittleness at low temperature



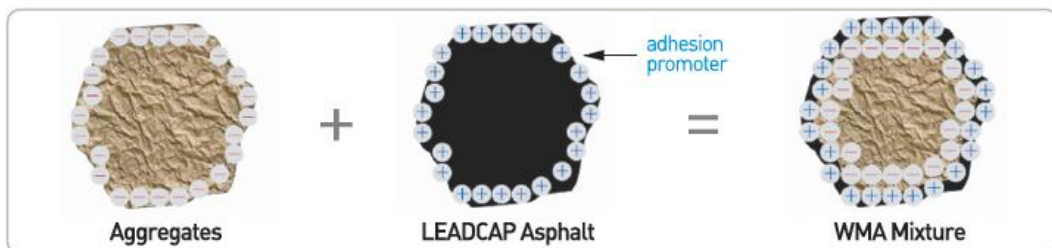
- LEADCAP contains crystal controller and adjusts the wax crystallinity
- Improve crack resistance of asphalt mixture at low temperature



- WMA additives may have poor adhesion between aggregates and asphalt binder



- LEADCAP contains adhesion promoter
- Improve the moisture susceptibility of the asphalt mixture



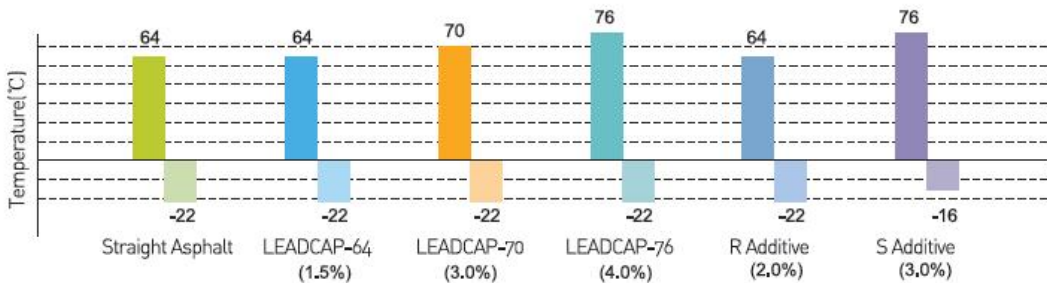
LEADCAP: Low carbon warm-mix asphalt pavement using an organic WMA additive
 (Low Energy and Low Carbon-Dioxide Asphalt Pavement)



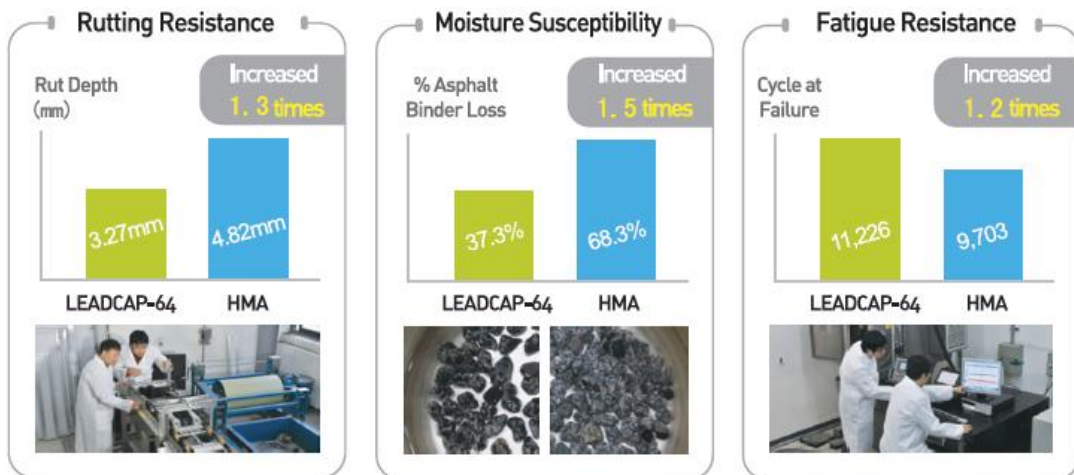
Three LEADCAP Additives



Comparison of Warm Asphalt Binder



Performance of LEADCAP Warm-Mix Asphalt Mixture





Application

- Adding to an asphalt plant mixer [dry process] or asphalt tank [wet process]
- Paving with the same HMA method and equipment
- Applying to surface, intermediate and base courses

Construction Process

■ Mix Design

- Applying the same HMA method



| LEADCAP Additive Added into Plant Mixer or Asphalt Tank |

■ Production

- Dry or wet process
- Produced at 130°C [LEADCAP-64 & 70] and 140°C [LEADCAP-76]



| Production |

■ Construction

- Paving with the HMA method and equipment



| Placement and Compaction |

Production and Paving Temperatures



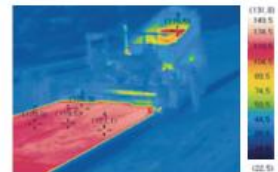
| Production |



| Lay-down |



| Placement |



| Infrared Thermal Image |



Field Trials in the World



Republic of Korea

- 1st Trial : Interstate Highway in 2008
- 2nd, 3rd, 4th Trials : Interstate Highway in 2009
- 5th, 6th Trials : Interstate Highway in 2010
- 7th, 8th Trials : Youngdong Expressway and Kyungbu Expressway in 2010
- 9th Trial : Interstate Highway in 2011



Japan [Himeji] 2010.12.



USA [Iowa City] 2011. 8.



China (Jiangsu) 2011.9.



Thailand (Kamphaeng Phet) 2011.9.



Italy [Milano] 2010. 11.



Portugal [Porto] 2010. 9.





Energy Saving and Less Emission



HMA



LEADCAP WMA

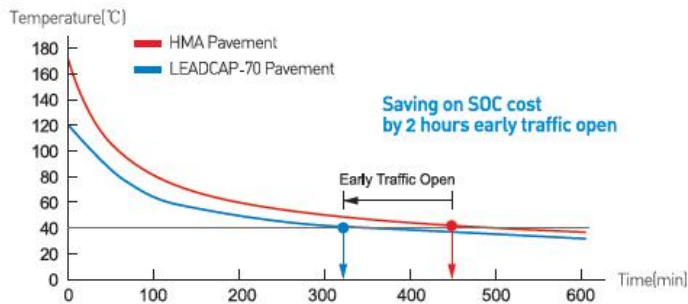
LEADCAP reduces odors and fumes generated during asphalt mix production and paving process



Emission	HMA	LEADCAP WMA	Reduction
CO.(%)	3,2	1,9	40,7%(↓)
CO(ppm)	983	262	73,4%(↓)
NO.(%)	75	21	72,0%(↓)
SO.(ppm)	60	35	41,7%(↓)
Fuel Consumption (l/ton)	9,3	6,3	32,3%(↓)



Traffic Opening Time





“Eco-Friendly Green Highway is No More Option”

To expand the green growth development, Korean government initiates to establish Low Carbon Green Growth Regulations and operate Green Business Certification and Incentive System!



KUMHO PETROCHEMICAL

Kumho Asian Main Tower 22F 115, Sinmunno 1-Ga,
Jongno-Gu, Seoul, 110-857, Republic of Korea
Tel) +82-42-865-8790 Fax) +82-42-862-5651
E-mail) boojang@kkpc.com
<http://www.kkpc.com/eng/index.asp>



**KOREA INSTITUTE OF
CONSTRUCTION TECHNOLOGY**

(Daehwa-Dong)283, Goyangdae-Ro, Ilsanseo-Gu,
Goyang-Si, Gyeonggi-Do, 411-712, Republic of Korea
Tel) +82-31-910-0180 Fax) +82-31-910-0161
E-mail) sdhwang@kict.re.kr
<http://www.kict.re.kr/eng>

www.leadcapwma.com