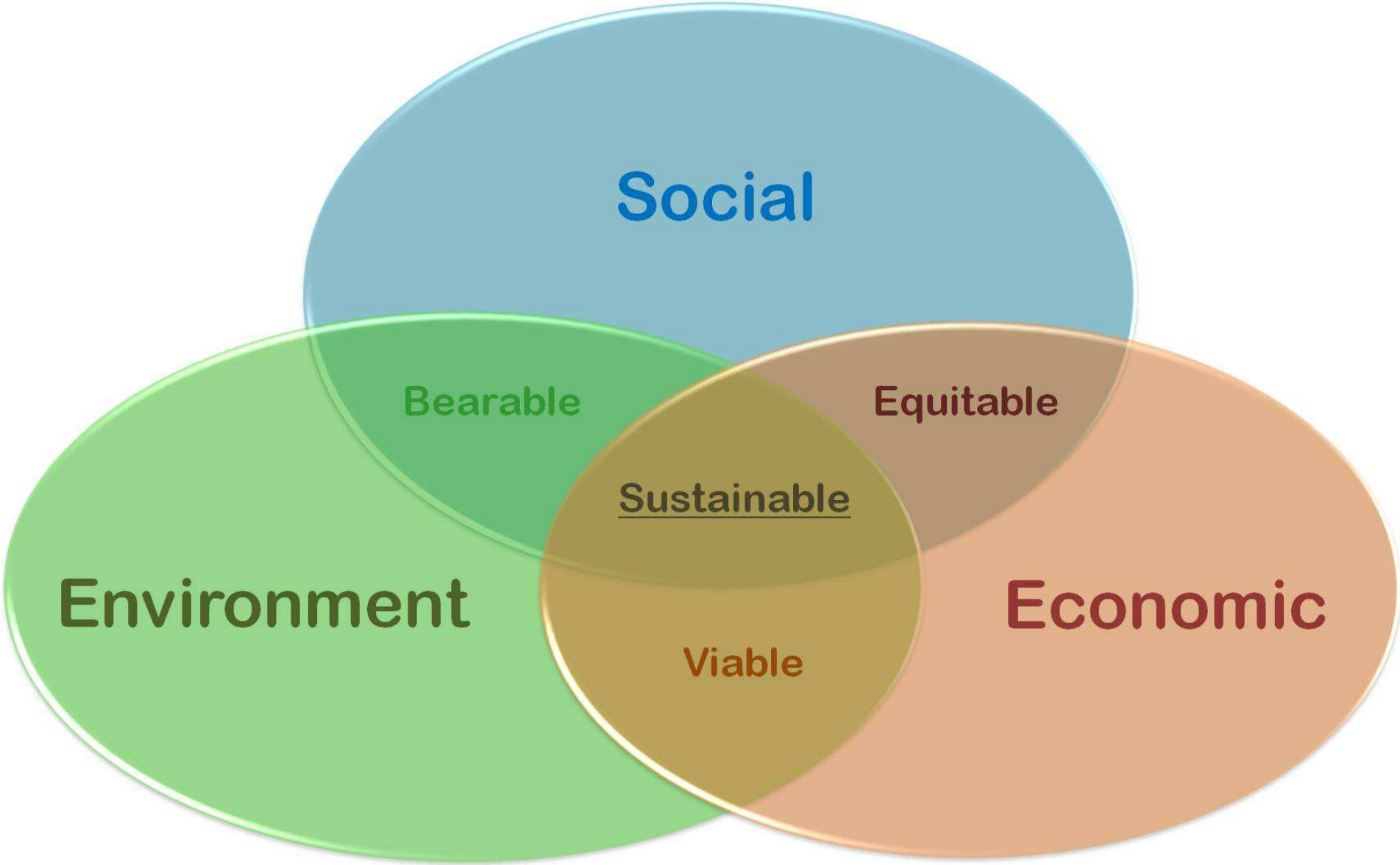
Brescia, 7 Settembre 2011

Società Italiana Infrastrutture Viarie

I conglomerati bituminosi a basso dispendio energetico. L'esperienza spagnola.

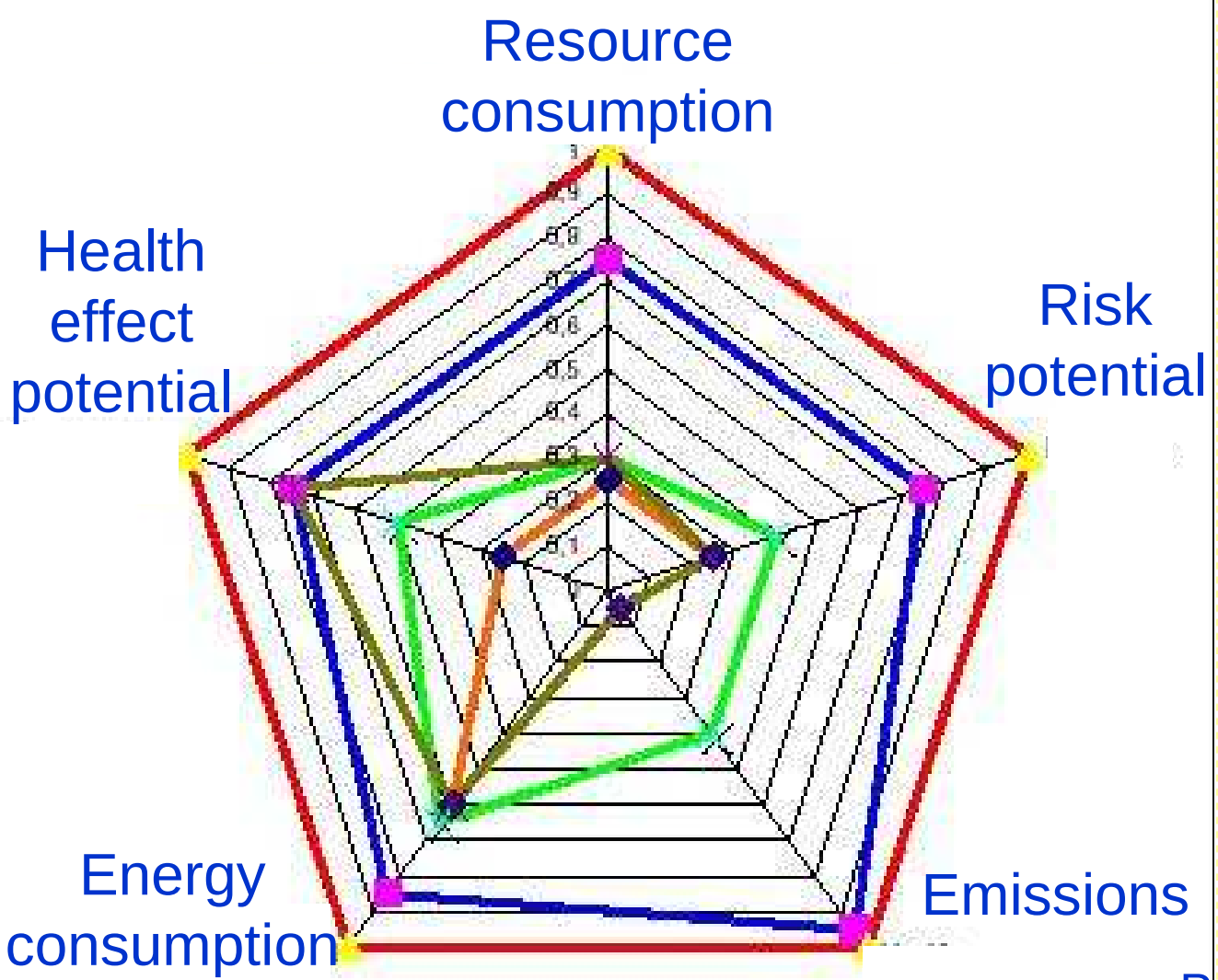
Prof. Dr. Ing. Miguel A. del Val
Politecnico di Madrid


Social
Bearable
Equitable
Sustainable
Environment
Economic
Viable

Low-temperature asphalt. The framework

- Reduction of emissions (CO_2, NO_x, SO_2, CO)
- Energy savings
- Occupational safety and health improvements
- Recycling requirements (Hot-mix asphalt with high ratios of RAP)

The main goal: to improve eco-efficiency



The pentagon of Takamura

Prof. Dr. Ing. M.A. del Val

Classification of low-temperature asphalt

Warm-Mix Asphalt (WMA)

(FR: *Enrobés tièdes*)

(ES: *Mezclas semicalientes*)

Half-Warm Asphalt (HWA)

(FR: *Enrobés demi-tièdes*)

(ES: Mezclas templadas)

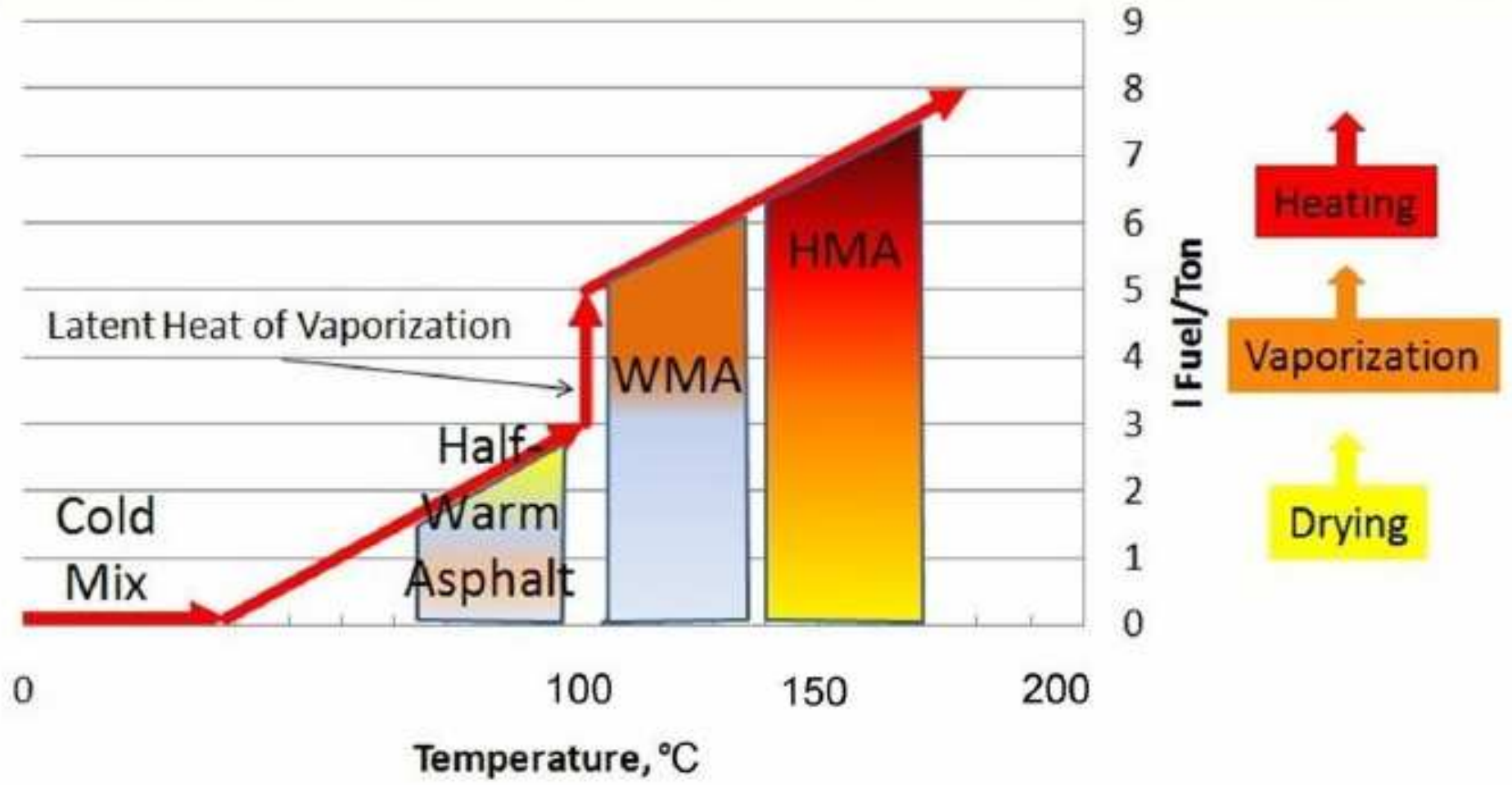
Warm Mix Asphalt (WMA)

Mix and lay at 30-40 ^{o}C less than hot-mix asphalt

Half-Warm Asphalt (HWA)

Mix and lay below 100 ^{o}C

Classification of low-temperature asphalt (FHWA, 2008)



WMA Technologies

- Organic additives: High molecular weight waxes (Sasobit® , Asphaltan B®, Licomont BS 100®, 3E-LT/Ecoflex®)

- Foaming processes:
  - Inorganic additives: synthetic zeolites (Aspha-Min®, Advera® , LT Asphalt®)
  - Bicomponent binders (WAM-Foam®)
  - Adapted asphalt plants (Double-Barrel Green®)

WMA current research lines

- Process control in mixing units
- Mix workability
- Waiting time before opening to traffic
- Long-term performance
- Involved costs: adaptation of asphalt plants, additives, royalties, …

Half-Warm Asphalt Technologies

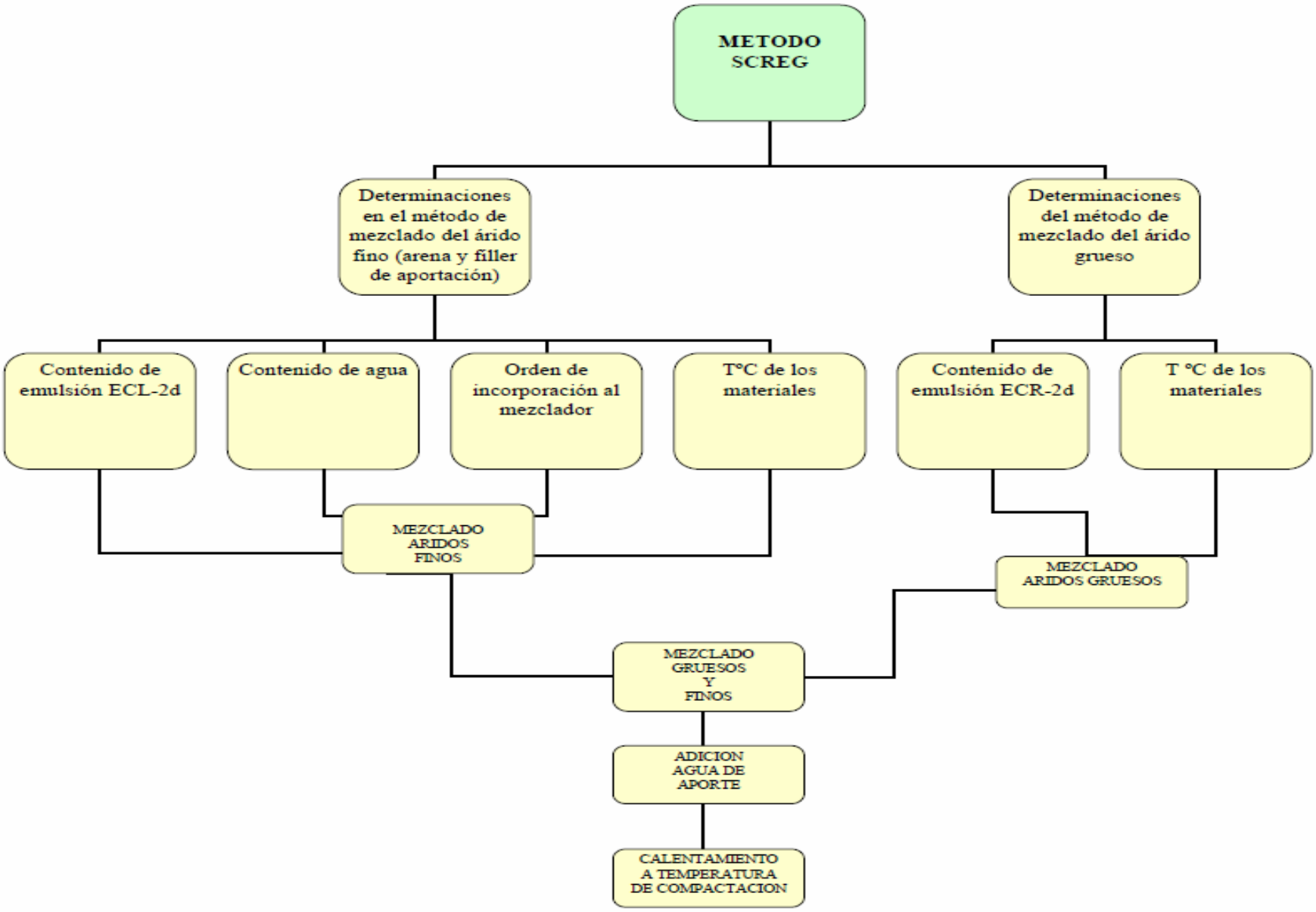
- Bitumen emulsions (pure or modified bitumen 70/100), and mix with a light heating (70-90 ºC)

- Foamed bitumen, using sand moisture and adding water into bitumen or into mixture (LEAB®, EBE®, EBT®)

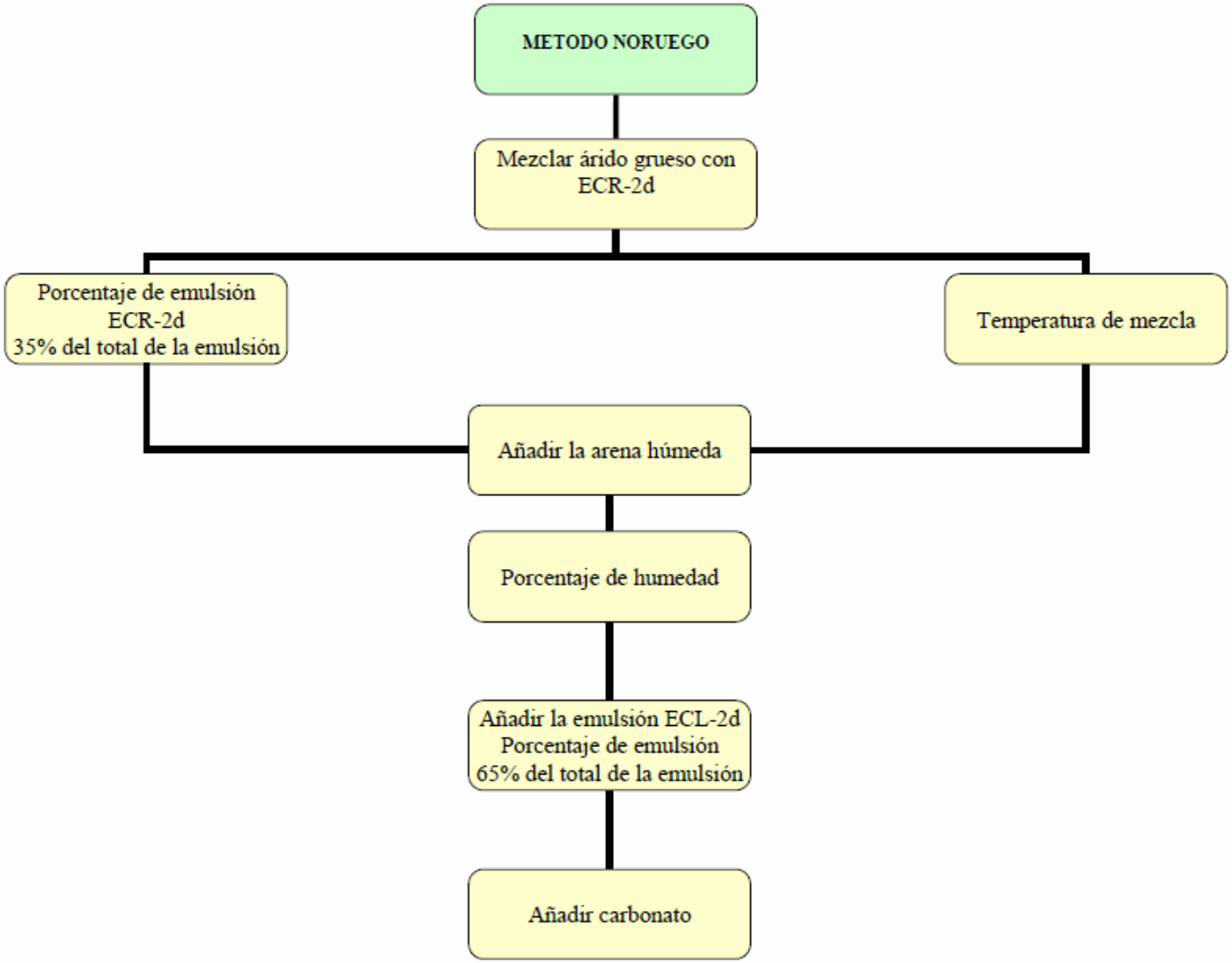
Final properties of WMA and HWA

- WMA: similar to HMA, but using patented additives or processes
- HWA with foamed bitumen: similar to HMA, but using patented processes
- HWA with bitumen emulsions: ¿ ?

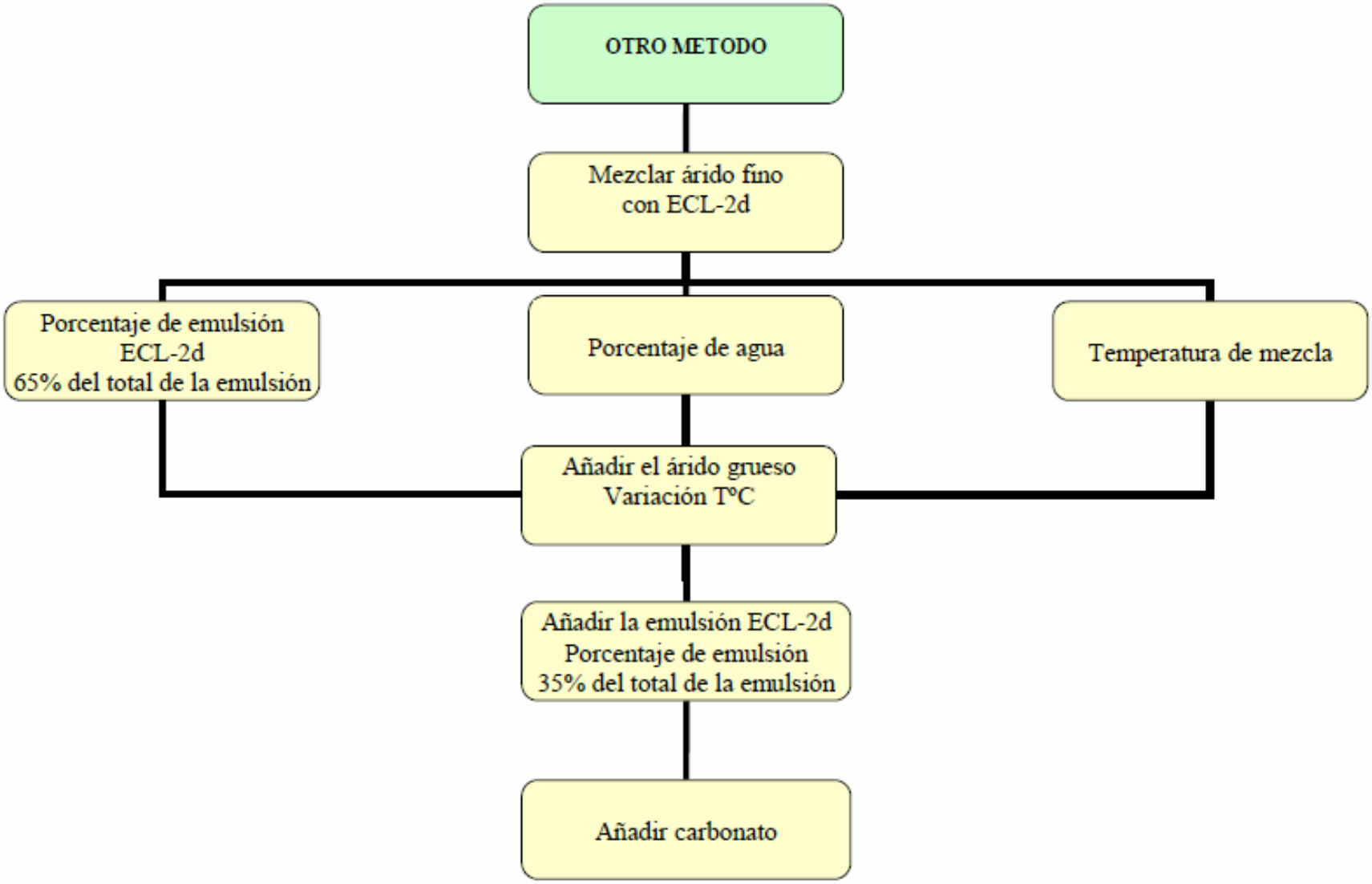
HWA Design (I)


METODO SCREG
Determinaciones en el método de mezclado del árido fino (arena y filler de aportación)
Determinaciones del método de mezclado del árido grueso
Contenido de emulsión ECL-2d
Contenido de agua
Orden de incorporación al mezclador
T°C de los materiales
Contenido de emulsión ECR-2d
T °C de los materiales
MEZCLADO ARIDOS FINOS
MEZCLADO ARIDOS GRUESOS
MEZCLADO GRUESOS Y FINOS
ADICION AGUA DE APORTE
CALENTAMIENTO A TEMPERATURA DE COMPACTACION

HWA Design (II)



HWA Design (III)



Performance of HWA bitumen emulsions based

- Short-term performance
  - ✓ (Dissertation of Fátima Batista, Porto University, 2004)
- Long-term performance
  - ✓ Prediction
  - ✓ Evaluation

Prediction of long-term performance of HWA bitumen emulsions based

- Correlation between design tests results and initial characterization tests results
- Correlation between long-term performance and laying and compaction processes
- Correlation between short-term performance and curing process

Evaluation of long-term performance of HWA bitumen emulsions based

- Identification of distress processes (cracking, rutting, etc.)
- Selection of structural monitoring methods
- Selection of structural performance

Characterization of long-term performance of HWA bitumen emulsions based (conclusions)

- Need of new rheological models
- Need of new structural models

→No more Burmister!

→Can we consider FLAC (*Fast Lagrangian Analysis of Continua*)?

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Two final considerations:

- *Road innovation is subordinated to energy efficiency and environment protection.*

- *We must use systematically Life Cycle Assessment.*

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Two essential references:

- *Warm-Mix Asphalt. European Practice,* International Technology Scanning Team, FHWA, Washington D.C., 2008.

- *The use of Warm Mix Asphalt. EAPA Position Paper,* European Asphalt Pavement Association, Brussels, 2009.

Vi ringrazio per la vostra atenzione!