



INFLUENCE OF COMPACTION AND MATURATION TIME ON COLD-RECYCLED ASPHALT PAVEMENTS WITH FOAMED BITUMEN AND CEMENT



Thursday 28 June 2007 – University of L'Aquila – Faculty of Engineering



ASPHALT PAVEMENTS DEGRADE

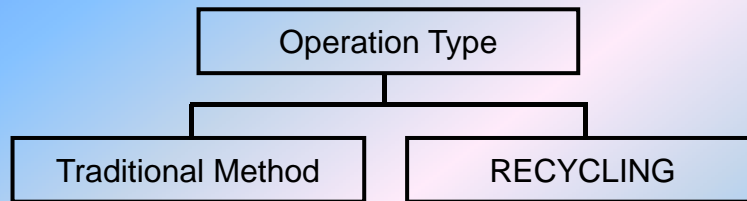
REASONS

- | | |
|--------------------------|----------------------|
| 1) ENVIRONMENTAL FACTORS | 2) TRAFFIC LOAD |
| • thermal excursions | • load entity |
| • water presence | • number of passages |
| • solar action (UV ray) | |

EFFECT

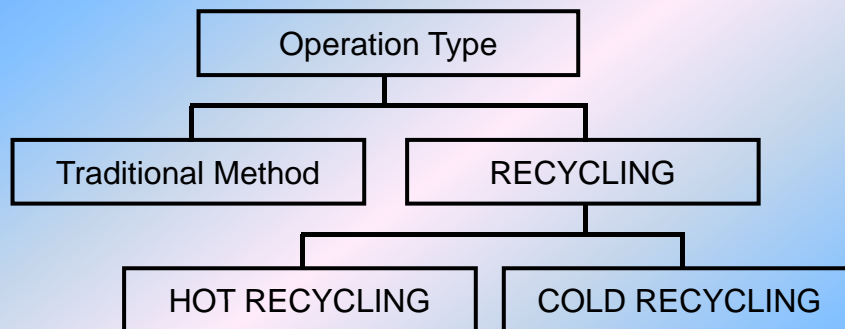


ROAD PAVEMENTS MAINTENANCE



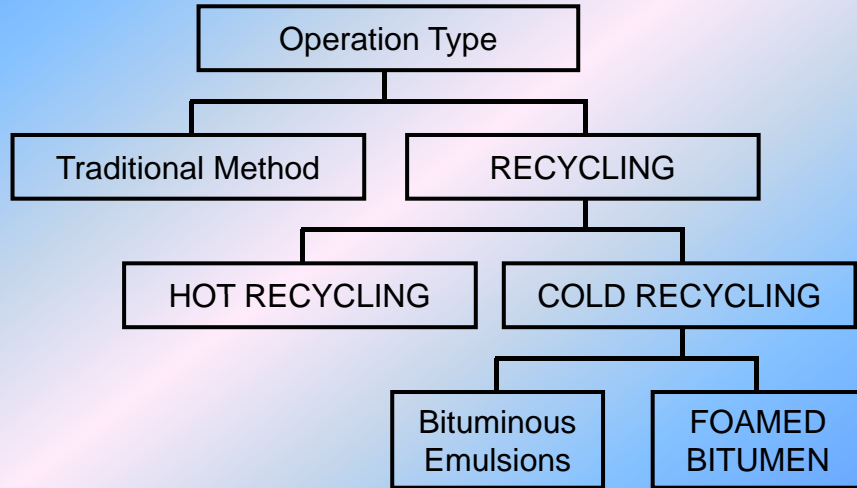
- Milling operation
- Putting the milled asphalt concrete into dump
- Hot mix asphalt spread out with virgin aggregates taken from quarry

ROAD PAVEMENTS MAINTENANCE



Heating milled asphalt
(more energy and smoke emission)

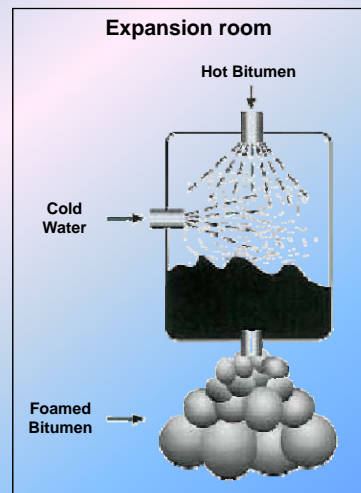
ROAD PAVEMENTS MAINTENANCE



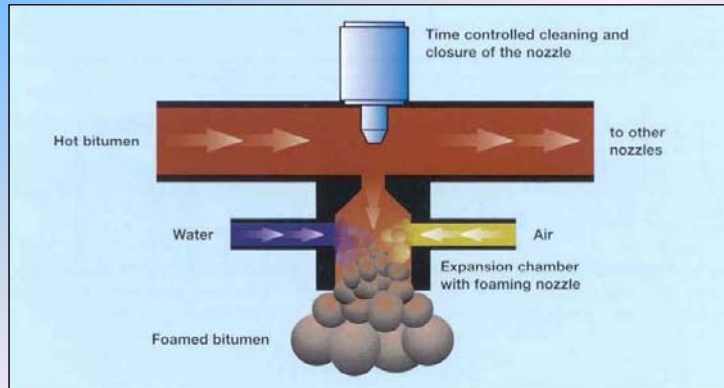
FOAMED BITUMEN

Foaming process

The foamed bitumen is obtained by a process carried out inside an expansion room in which both the hot bitumen (170-180 °C) and a little quantity of water (1-2 % of the bitumen weight) that is introduced at environmental temperature and at a pressure of 10-12 bars, are sprinkled. Such process produces a foamy product that expands remarkably up to 15-20 times in comparison to the bitumen initial volume.



FOAMING PROCESS



The foam produced dissolves in less than one minute and the binder regains its initial properties. Therefore, the bitumen must immediately be mixed to the aggregate.

RECYCLING WITH FOAMED BITUMEN



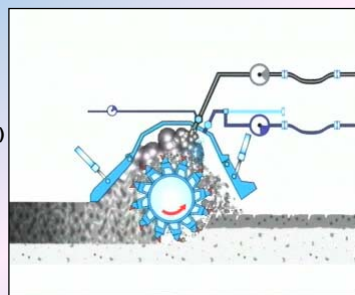
Foamed water
 (1-2 % of the bitumen weight)

Production

180 ÷ 300 m³/h



ROTOR OF MILLING-MIXING



direction of work



Binder (160 ÷ 180°C)

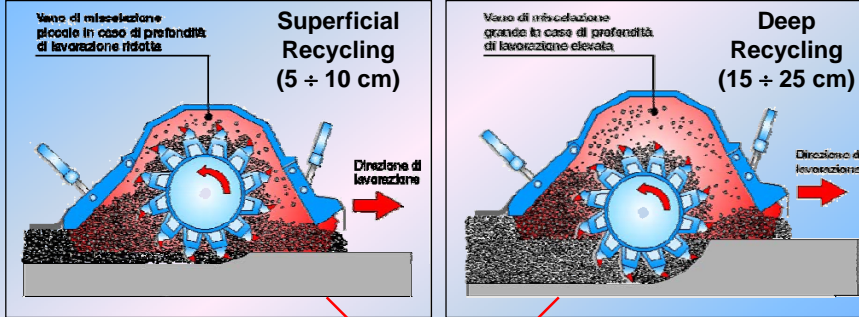
Water (3-4 % of the RAP weight)



Speed of advancement:
 v = 8 ÷ 15 Km/h

RECYCLING WITH FOAMED BITUMEN

CATEGORIES OF COLD RECYCLING



RECYCLING WITH FOAMED BITUMEN

RECYCLING TRAIN



Roller machine

Grader

Recycling machine

Bitumen tanker

Water tanker



EXPERIMENTAL PHASES

- Laboratory survey

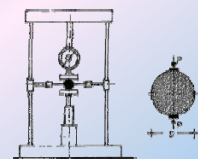


- Works performed in site

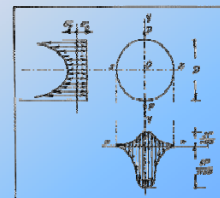


- Investigation on the specimens taken from the site

INDIRECT TENSILE TESTS

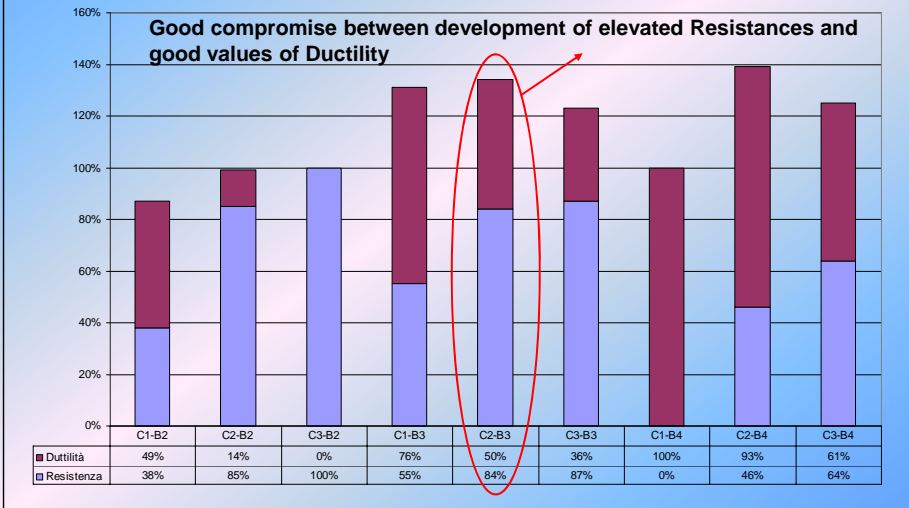


The instrument's scheme



Tension state of the specimens

THE OPTIMAL MIXTURE



INVESTIGATION ON THE SPECIMENS WITHDRAWN IN SITE

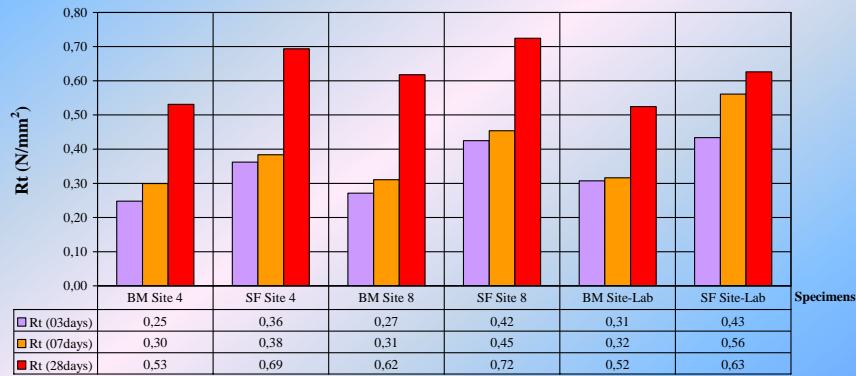
Objective

- The purposes of this study are:
 - To evaluate the influence of the compaction degree on the mechanical properties of the mixtures (4 and 8 passages of roller compactor and Marshall compactor in laboratory);
 - To evaluate the influence of the maturation time on the mechanical performances of the mixtures (3, 7 and 28 days).

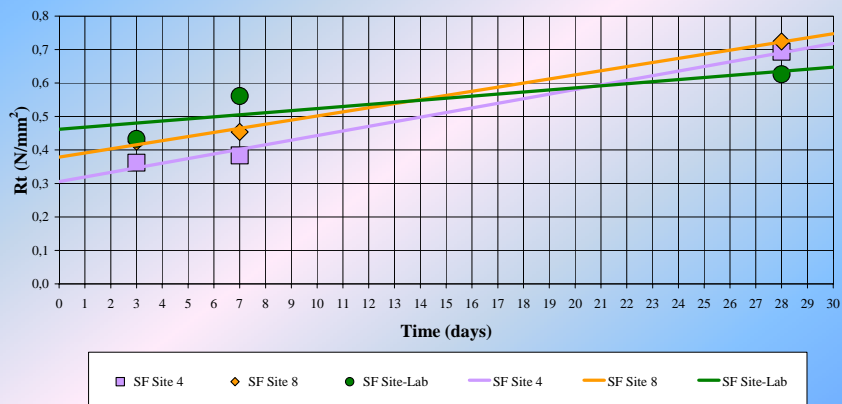
Way

- Indirect Tensile Tests

INDIRECT TENSILE STRENGTH



TIME INFLUENCE ON THE INDIRECT TENSILE STRENGTH



MATURATION VELOCITY OF THE MIXTURES



CONCLUSIONS

The mixtures compacted with lower energy (4 roller passages) are featured by a maturation velocity higher than that of mixtures compacted with higher energy (8 roller passages).

		Mechanical Properties		
		Rt values to short time	Velocity of maturation	Rt values to long time
Density Properties	more compact mixtures	acceptable	low	good
	less compact mixtures	low	high	good

Is this a good thing? What are their fatigue behaviors?

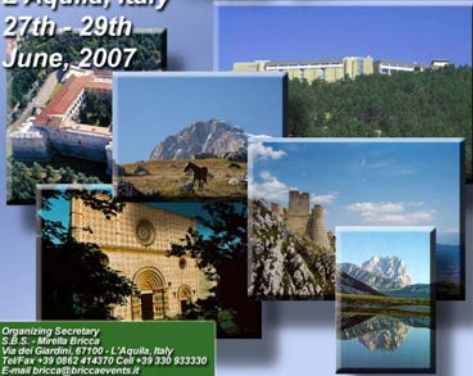
THESE ARE MY QUESTIONS

VI International Congress
Valorisation and Recycling of Industrial Waste

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L'Aquila, Italy
27th - 29th
June, 2007



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Thank you for
the attention

FACOLTA' DI

INGEGNERIA

