

OPTIMIZATION OF BITUMINOUS SUBBALLAST IN RAILWAYS INFRASTRUCTURE UNDER SUSTAINABILITY CRITERIA

PhD STUDENT: ESR12 Luca Pirozzolo **SUPERVISORS:** Dr. Rubio Gámez ; Dr. Moreno Navarro
 lucap@ugr.es mcrubio@ugr.es fmoreno@ugr.es



INTRODUCTION

Bituminous sub-ballast are becoming a common solution in railway tracks since this layer allows for the increase in bearing capacity at the same time that higher substructure protection (lower permeability and greater capacity to dissipate stress) is obtained in reference to the conventional solution of granular sub-ballast. At the same time, the application of hot-mix asphalt as sub-ballast can lead to an important increase in construction costs, pollution and energy consumption, mainly associated with the process of manufacturing at 160 °C.

OBJECTIVES

General aim

Optimization of bituminous subballast in railways infrastructure by considering sustainability criteria through the reuse of waste, reducing energy consumption and gas emissions

Specific objectives

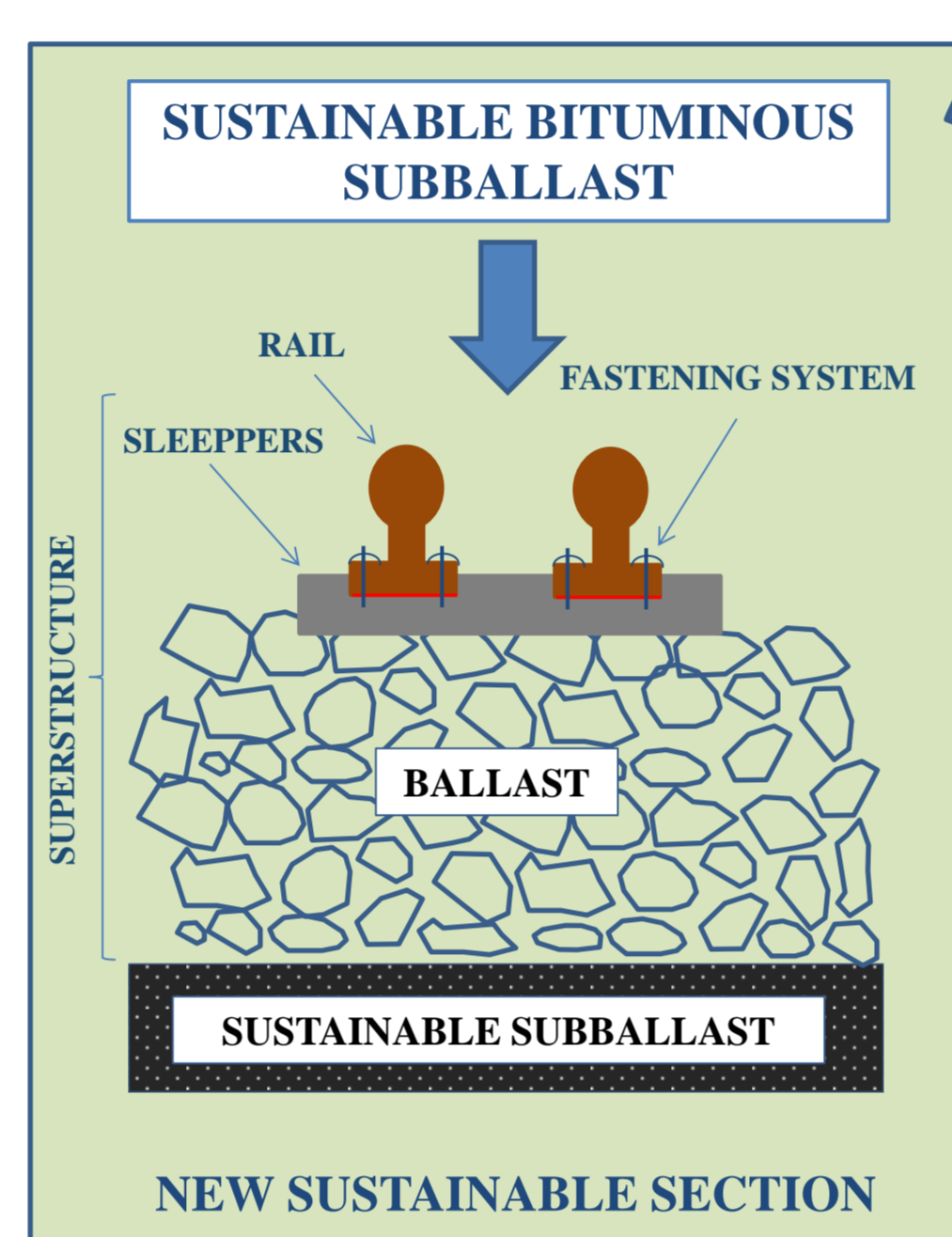
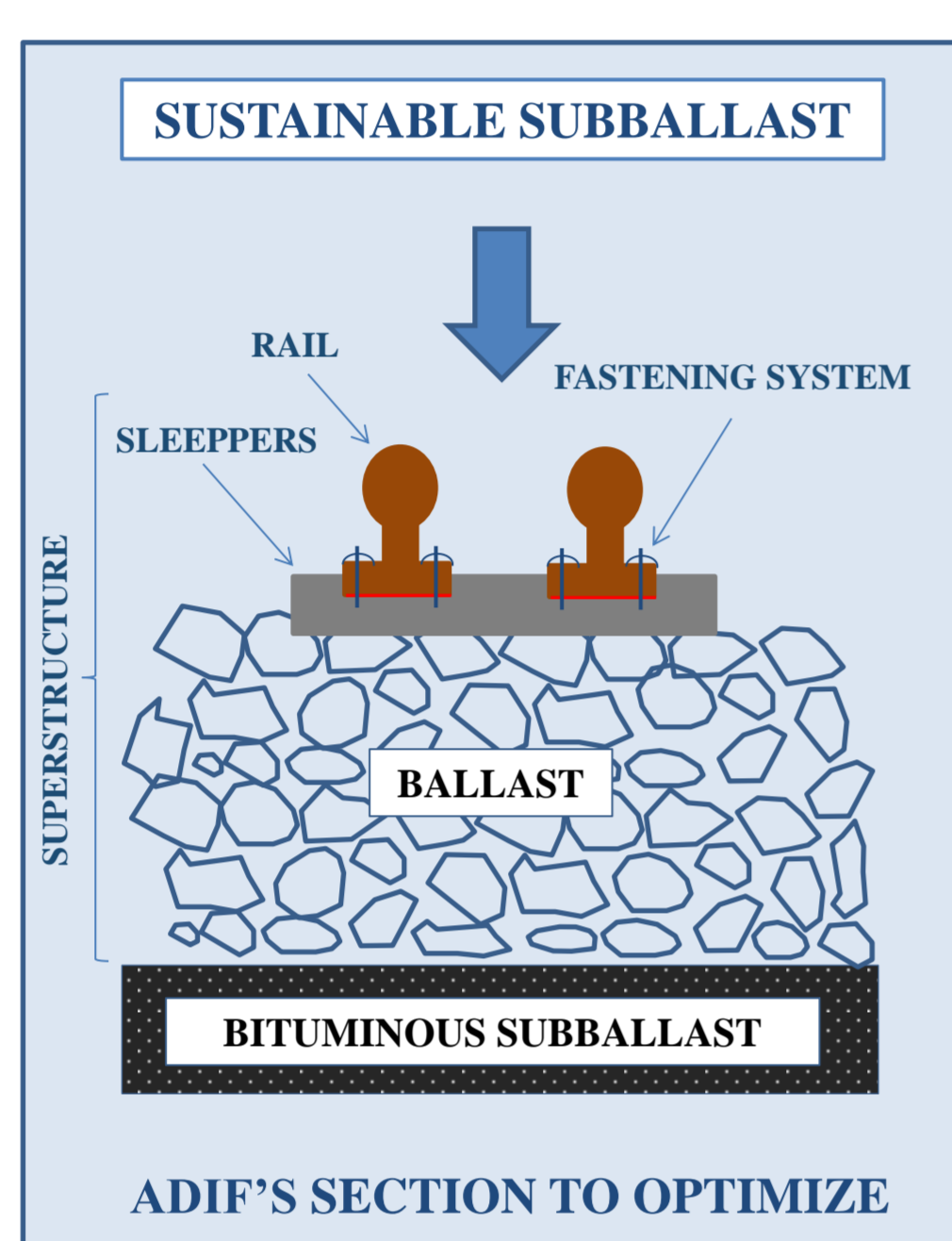
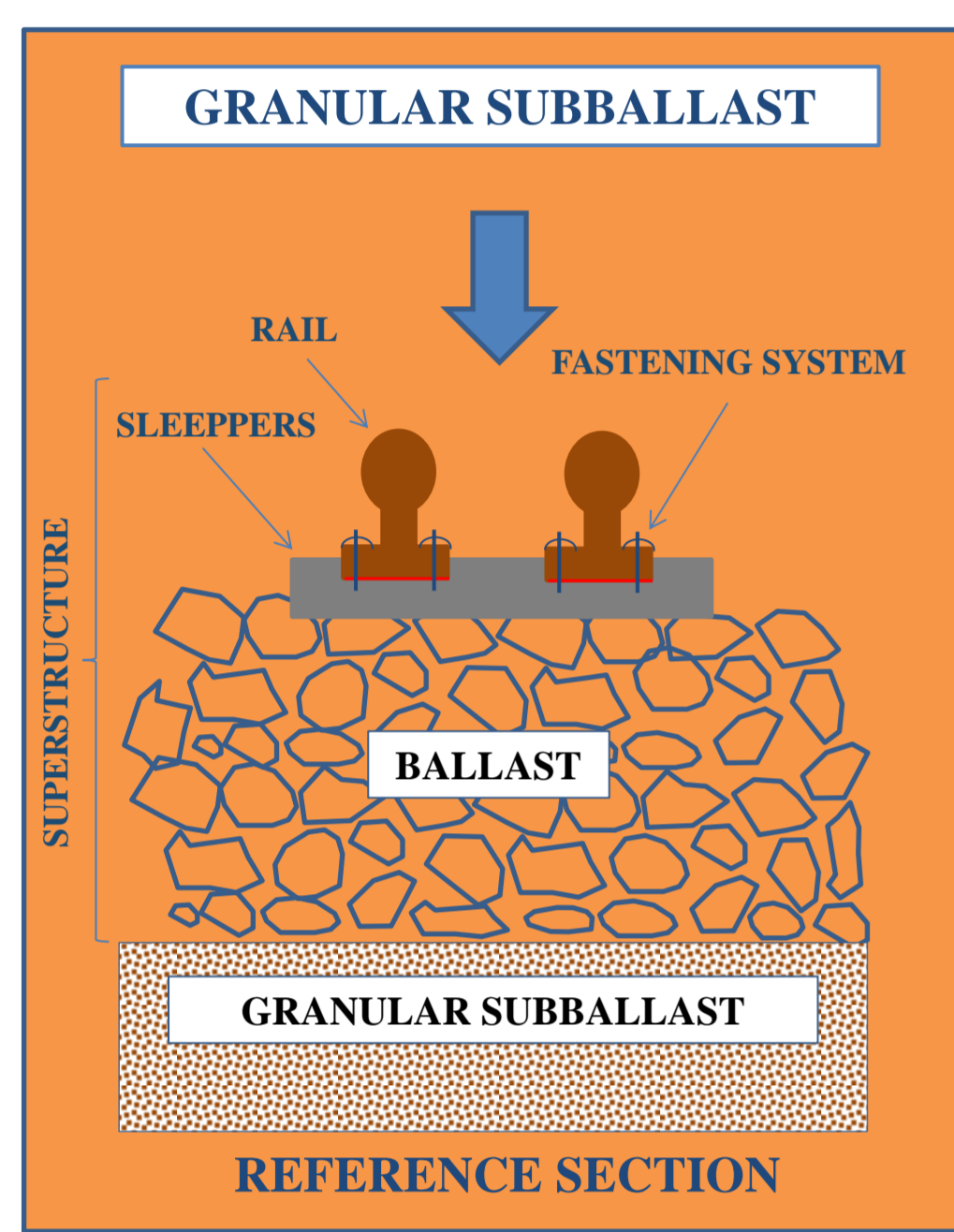
Optimum design of conventional bituminous subballast

Analysis of the behavior of bituminous mixtures manufactured from recycled material

Design and manufacturing of bituminous mixtures by low-temperature technology

MATERIALS

For this study, three types of subballast section will be employed, one granular and two bituminous sections and: traditional granular subballast will be used as a reference; conventional hot mix asphalt will be optimized and used as a reference; and sustainable bituminous subballast will be designed to be utilized as subballast.



WARM MIX ASPHALT SUBBALLAST

HALF MIX ASPHALT SUBBALLAST

RECYCLED ASPHALT (RAP-CRUMB RUBBER) SUBBALLAST



Track bed



Granular section



Bituminous section

ELEMENT OF SUPERSTRUCTURE

Rail	UIC 54 250 mm
Sleeper	Concrete 250x357 mm
Fastening system	Standard on Spanish rail track
Ballast	Ophite 22,4/63 mm

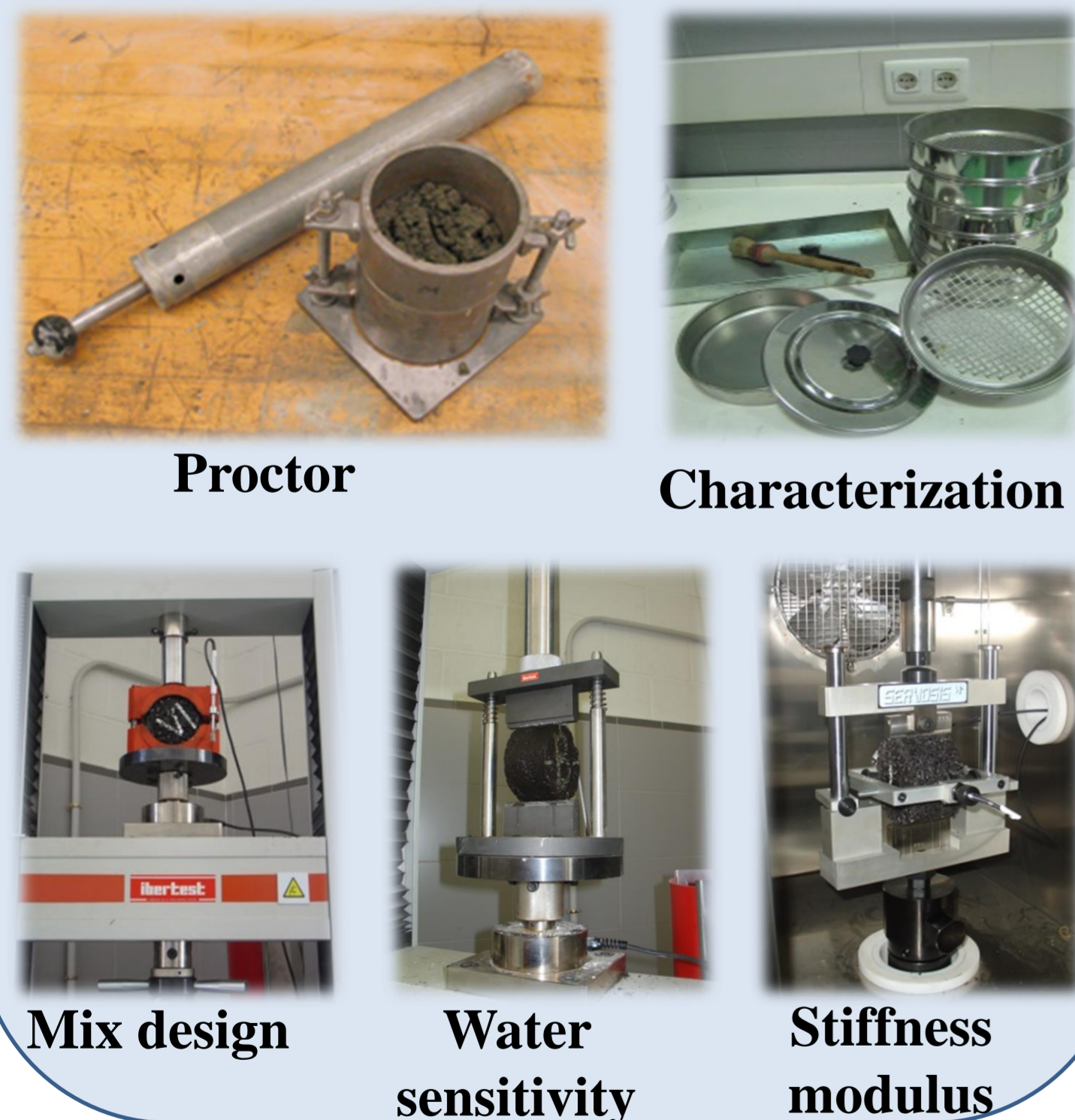
SUBBALLAST LAYER

Granular	0/31,5 mm
Conventional bituminous	AC 22S
Warm-Half mix asphalt	Chemical additives
Recycled asphalt	Rap – Crumb Rubber

METHODOLOGY

In order to compare the mechanical performance of the sustainable asphalt mixtures used as subballast with the conventional HMA and granular sub-ballast, a number of laboratory tests will be carried out to characterize their behaviour and to evaluate their response under different failure modes that can take place during its service life in railway tracks. Moreover the configuration with conventional HMA will be optimized looking the best solution depending on the thickness.

Physical and mechanical properties



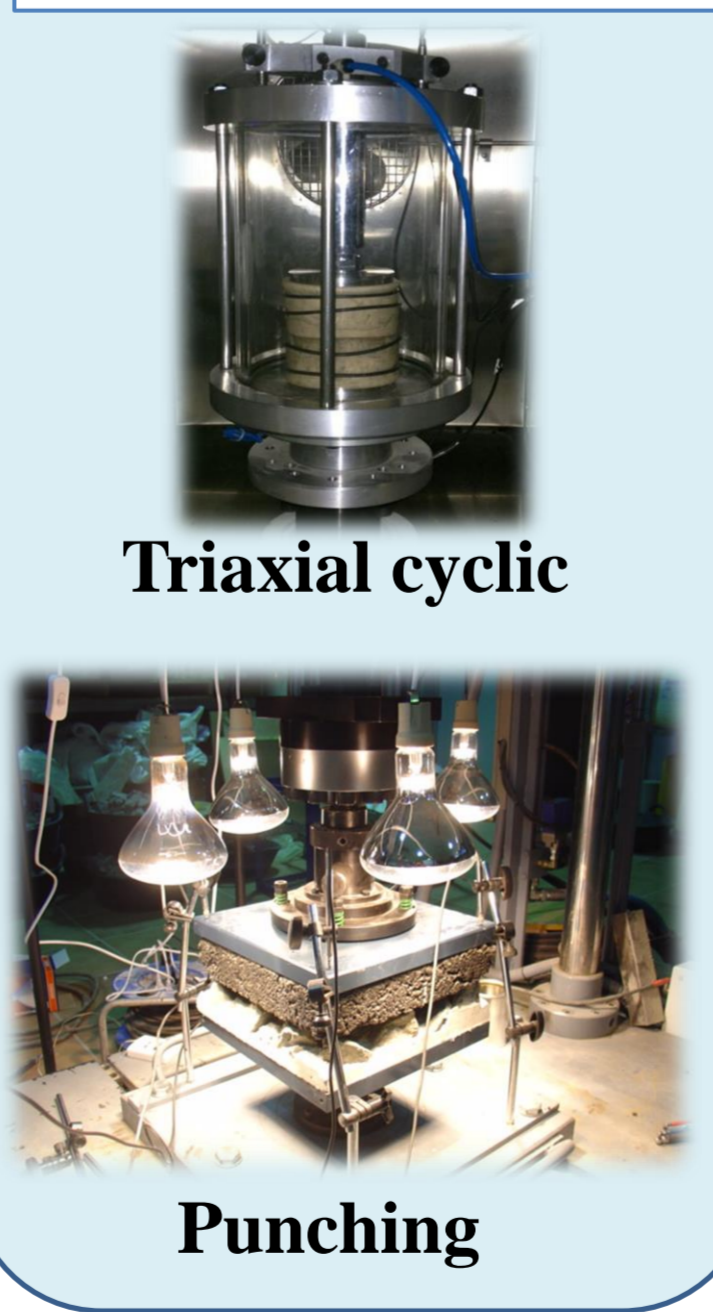
Permeability

12 cm
Thickness
8 cm



Permeameter

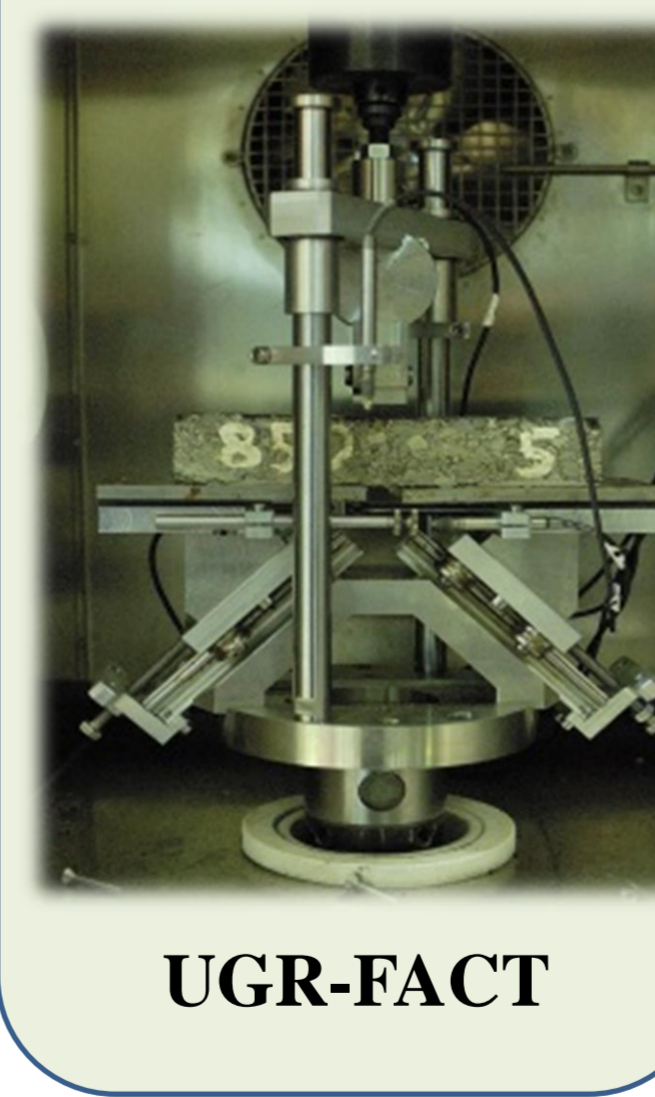
Plastic deformation



Triaxial cyclic

Punching

Cracking resistance



UGR-FACT

Bearing Capacity and stress dissipation

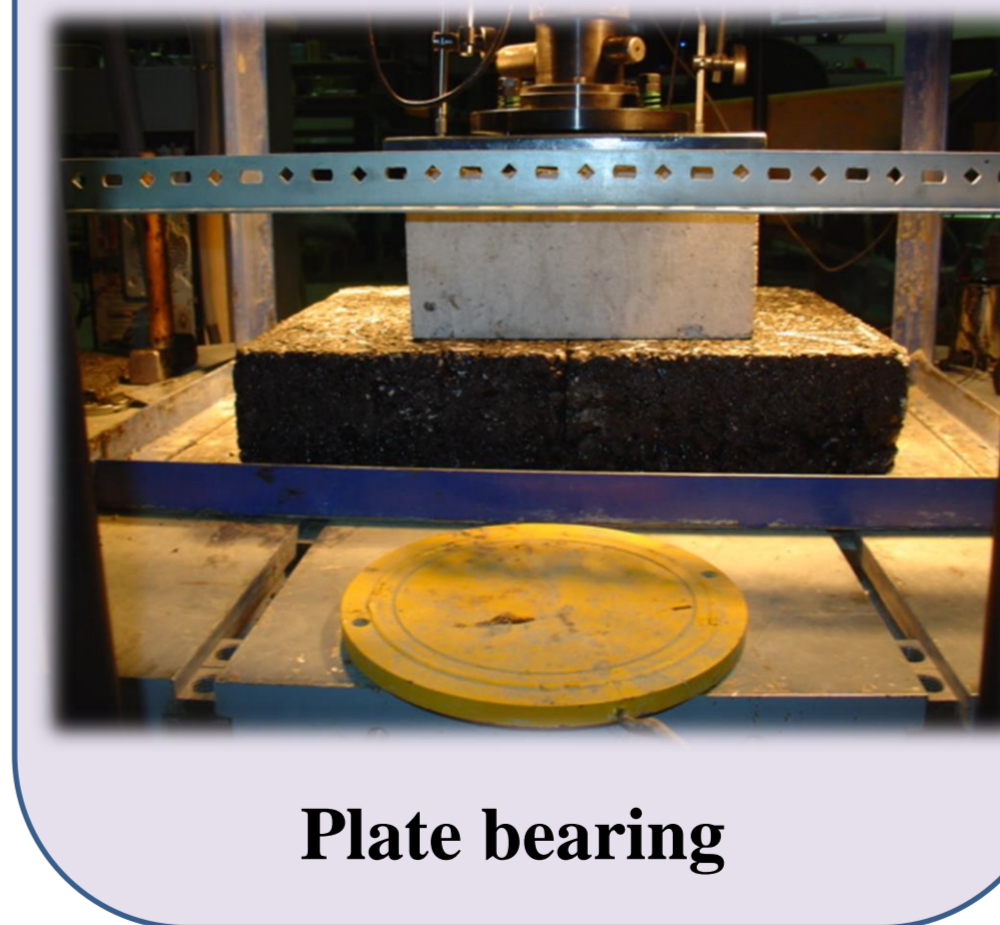
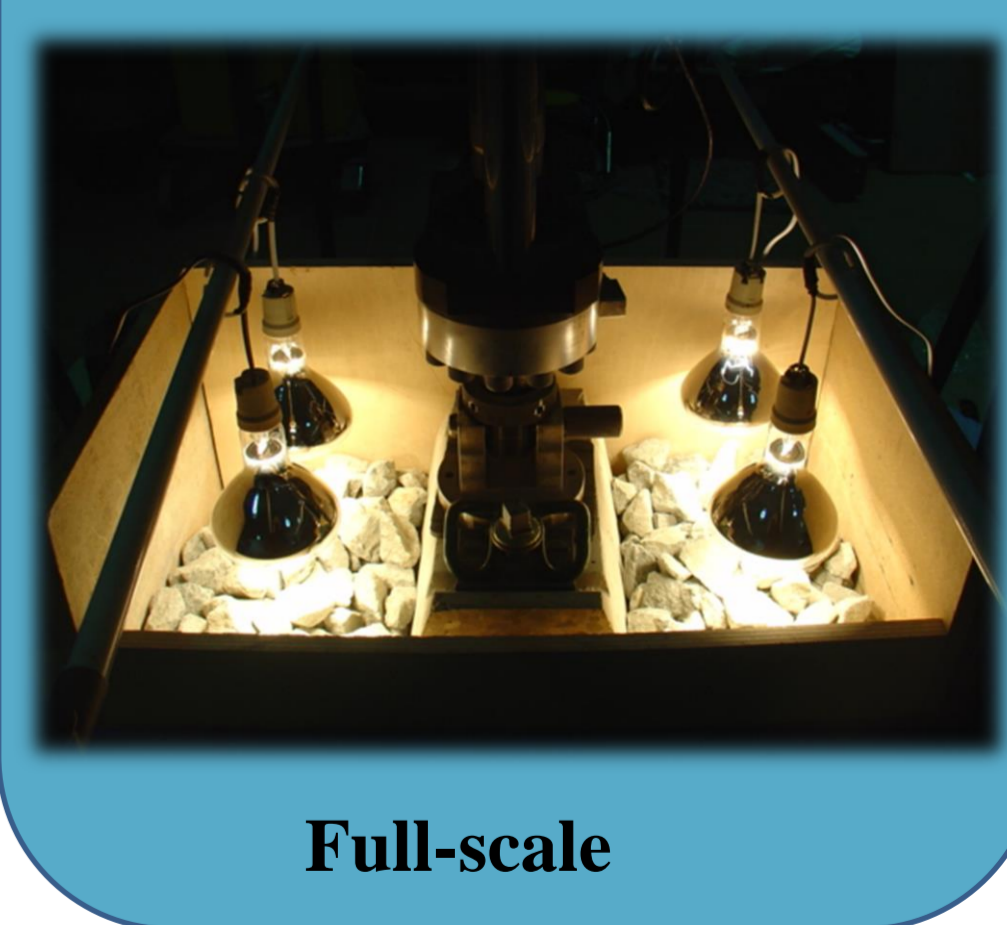


Plate bearing

Response of the track section



Full-scale

Temperature



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