

Detailed informations

Topic : Experimental study and modelling of the mechanical behaviour of RCA (reclaimed crushed concrete aggregates) and RAP (reclaimed asphalt pavement) mixes under large number of cyclic loadings at various initial hydric states, temperatures, curing time and rest period. Design of road pavements.

Granular materials like unbound granular materials (UGM), reclaimed crushed concrete aggregates (RCA), reclaimed asphalt concrete aggregates (RAP) or mixes of these materials are more and more used in the road pavement structure and become a key point in pavement life cycle assessment (LCA).

The mechanical behavior of these materials is generally out of standards and has to be studied with repeated load triaxial tests (RLTT) in which the elastic response is defined as the resilient behavior after a conditioning loading. The influence, either on the elastic behaviour or on the plastic behaviour of these granular materials, of the unsaturated state (suction), the temperature, rest periods and curing time has never been studied or taken into account in models for road pavements. Previous Ph.D. studies have been performed recently in our team with either UGM (Ph.D. of N. HO (2013), P. JING (2016)), RAP (Ph. D. of L. Gaillard (2019)), or RCA (Ph.D. C. WANG (2023)). We have all the knowledge of the initial behaviour of these materials considered alone, the behaviour of the mixes will have to be studied.

In this context, we propose to study the influence of the unsaturated state, temperature, curing time, rest periods, mix design (amount of RAP and RCA) on the cyclic mechanical behaviour (elastoplastic) of a compacted mixes of crushed concrete and asphalt concrete aggregates with a repeated load triaxial cell. We will first study the chemo-physical properties of RCA, then RAP, then try during these tests to measure the suction evolution at different height in the sample. These experimental results will provide the necessary database to add the curing time effect and the bitumen content in an elasto-viscoplastic model which could be based on the shakedown theory, developed for the cyclic behaviour of these granular materials. This model will be implemented in the finite element (FEM) code Cast3M or DEM code (LMGC90), and it will be used to simulate the behaviour of road pavement subjected to traffic loading and various environmental conditions.

- **CV of Pr. Cyrille Chazallon**

- **Some papers already published**

Asphalt concrete aggregates :

Resilient modulus prediction of RAP using the Contact Dynamics Method, Transportation Geotechnics (2020)

Hydro-Mechanical Behaviour of an Unbound Granular Base Course Material Used in Low Traffic Pavements, Materials (2020)

Study of the mechanical behaviors and self-cementing properties of recycled crushed concrete aggregates, BCRRA (2022)

Curriculum vitae

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2010 - present : Professor INSA de Strasbourg

Associate editor of the International Journal of Road materials and Pavement Design

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H. Nowamooz, G. Koval, S. Mouhoubi, J.C. Quezada

Current phd students : C. Wang, H. Ge, O. Hammoud, L. Ma, V. Desloges, L. Coulon

- *Articles*

2023

Juan Carlos Quezada and **Cyrille Chazallon**, Discrete element modeling of hot mix asphalt complex modulus using realistic aggregate shapes, International Journal of Road materials and Pavement design, Received 19 Feb 2021, Accepted 21 Jan 2022, Published online: 18 Mar 2022 [doi : 10.1080/14680629.2022.2042367](https://doi.org/10.1080/14680629.2022.2042367)

Dansou, S. Mouhoubi, **C. Chazallon**, and M. Bonnet , Modelling of the fatigue cracking resistance of grid reinforced asphalt concrete by coupling fast BEM and FEM (accepted by International Journal of Road Materials and Pavement Design) Pages: 1-22 | DOI: 10.1080/[14680629.2022.2029755](https://doi.org/10.1080/14680629.2022.2029755)

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Haitao Ge, Juan Carlos Quezada, Vincent Le Houerou, **Cyrille Chazallon**, Multiscale analysis of tire and asphalt pavement interaction via coupling FEM–DEM simulation, Engineering Structures, Volume 256, 1 April 2022, <https://doi.org/10.1016/j.engstruct.2022.113925>

Laura **Gaillard**, Cyrille Chazallon, Pierre Hornych, Juan Carlos Quezada, Jean-Luc Geffard [Study of the Influence of the Mastic Coating of Untreated Reclaimed Asphalt Pavement on](#)

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Haitao Ge, Juan Carlos Quezada, Vincent Le Houerou, **Cyrille Chazallon**, Three-dimensional simulation of asphalt mixture incorporating aggregate size and morphology distribution based on contact dynamics method, *Construction and Building Materials*, Volume 302, 2021, 124124, <https://doi.org/10.1016/j.conbuildmat.2021.124124>.

M.L. Nguyen, P. Hornych, X.Q. Le, M. Dauvergne, L. Lumière, **C. Chazallon**, Mehdi Sahli, S. Mouhoubi, D. Doligez, E. Godard, Development of a rational design procedure based on fatigue characterisation and environmental evaluations of asphalt pavement reinforced with glass fibre grid, *International Journal of Road Materials and Pavements Design*, Volume 22, 2021 - Issue sup1: EATA2021, Pages S672-S689, DOI: 10.1080/14680629.2021.1906304

L. Coulon, G. Koval, **C. Chazallon** & J.-N. Roux (2021): Analytical modelling of thixotropy contribution during T/C fatigue tests of asphalt concrete with the VEnoL model, *Road Materials and Pavement Design*, Volume 22, 2021 - Issue sup1: EATA2021, Pages S536-S559, DOI: 10.1080/14680629.2021.1911833

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2020

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Laura Gaillard, Juan Carlos Quezada, **Cyrille Chazallon**, Pierre Hornych, [Resilient modulus prediction of RAP using the Contact Dynamics Method](#), *Transportation Geotechnics*, Volume 24, September 2020, Article 100371, <https://doi.org/10.1016/j.trgeo.2020.100371>

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