eRoads Group (from a pavement point of view)
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**Context**: in order to attain the reduction of CO2 emissions under the objectives of European Energy Agency (EEA 2016), a promising solution is the development of electrified Roads (eRoads) → Challenge for 2030!

**Induction**

A first solution, for inductive charging, is the development of prefabricated concrete slabs, incorporating inductive charging loops. This solution was evaluated on the IFSTTAR APT (Pérez *et al.*, 2016) (Fig. 1).

Dynamic charging of electric vehicles by induction can be achieved through a prefabricated Charging Unit (CU) placed underneath the top asphalt layer (AC) of existing flexible pavements. However, such a box inclusion generates a material discontinuity in the pavement layer and points of singularities, inducing failure in the materials under heavy moving loads (Fig. 2). The shape of the box can be optimized to avoid top corner singularities (Chen *et al.*, 2019). But in any cases, the problems to be solved include finding pavement structural solutions to avoid a possible debonding phenomenon between the CU inclusion and other pavement materials (Chabot & Deep, 2019).

**Conduction**

The ground module is the key of the in-road live rail ERS conductive solution. It is an original system that contains rails protected by an elastomeric material embedded on the pavement’s surface. The power transfer between the electric power source and the vehicles is ensured by the direct contact of a Pick-up unit with the segmented electrified rails embedded longitudinally on the road infrastructure. First ERS prototype sections tested on site and in laboratory showed different types of damage: rutting and interface debonding due to traffic as well as thermal cracking due to daily temperature variations (Hornych *et al.*, 2020). The inclusion of other materials inside an AC can generate differential stresses and strains fields which can cause premature failure. A thermal cycling test was developed at Ifsttar in order to simulate the behaviour of the ERS conductive solution under daily thermal solicitations (de Freitas Alves *et al.*, 2020) (Fig. 3).

**Triboelectricity**

Triboelectricity could be one of the possible options converting the mechanical energy from the contact of the tires of vehicles with the roadway (Fan *et al.*, 2012) (Kane & Basset, 2019) (Fig. 4). The idea is to develop a system generating sufficient energy from the tire-road contact zone after each passage of vehicle to allow sending, by low-power wireless communication, a sensor information, for example for the triggering a safety signal in a risky zone, or information on the type and/or weight of a vehicle, the humidity of the roadway, etc.

**References**


Kane M., Basset P., 2019. Exploring triboelectric power generation possibilities from the mechanical energy of tire-road contact. Ifststar/Eseei PhD proposal.