

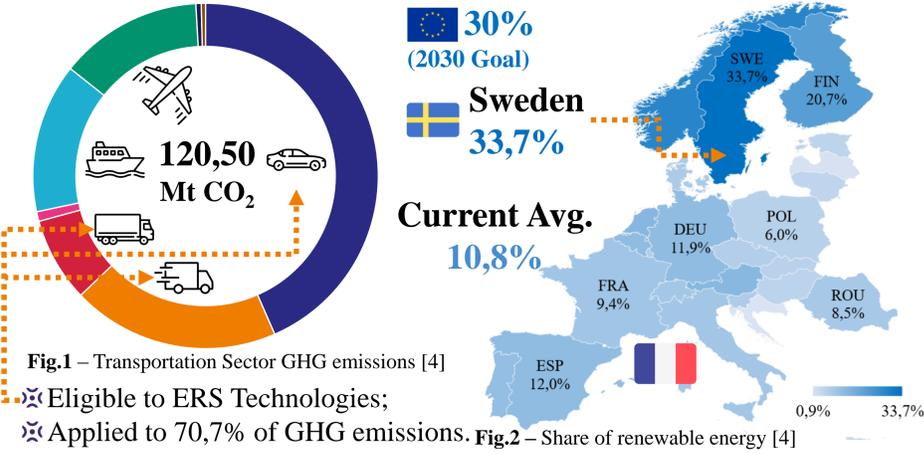
Thermo-Mechanical (ThM) Modelling of Conductive Electric Road Systems (ERS)

Thermo-Viscoelastic and Thermo-Viscohyperelastic Response under Diurnal Thermal Cycles

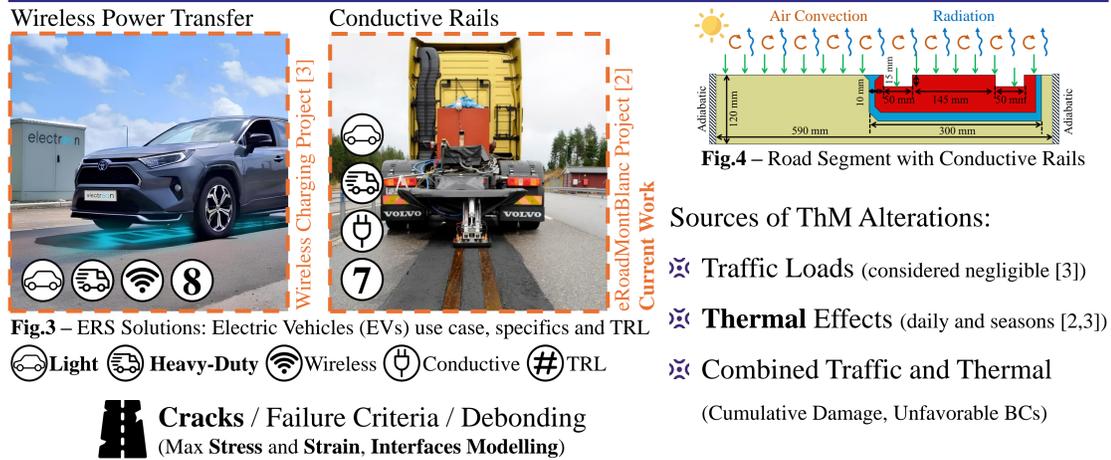
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1. CO₂ Emissions & Fossil Fuels Dependency

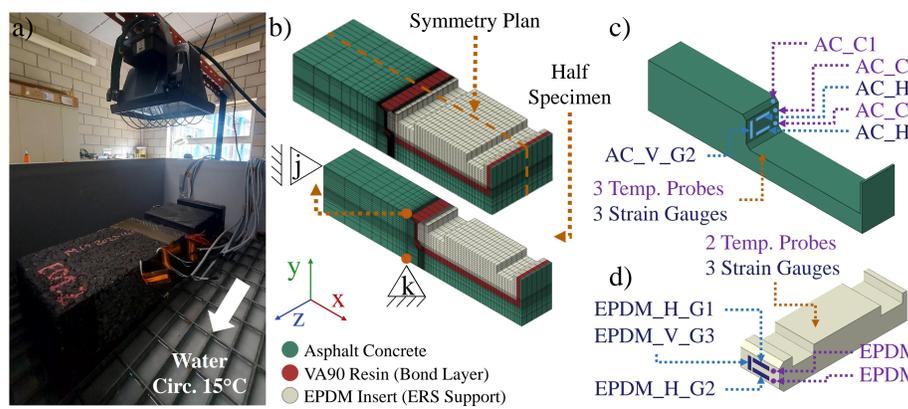


2. Electric Roads Solutions (Technologies)



3. Experimental vs. FEM Modelling

3.1. Thermal Fatigue Test Prototype

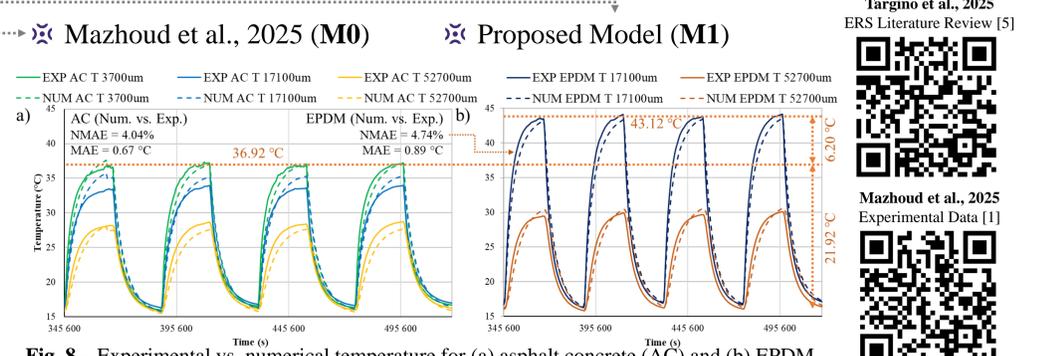


3.2. Thermomechanical Models Param. Evaluation

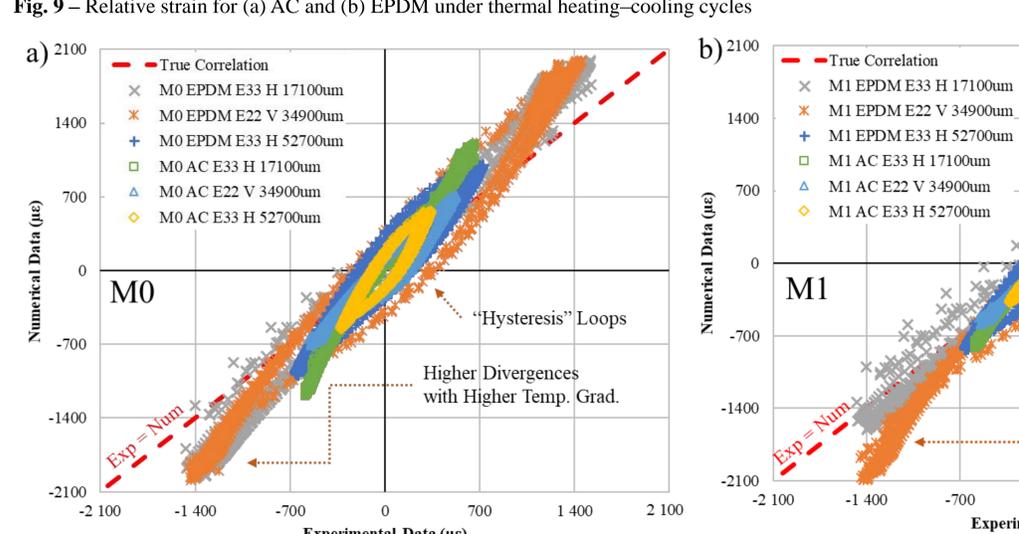
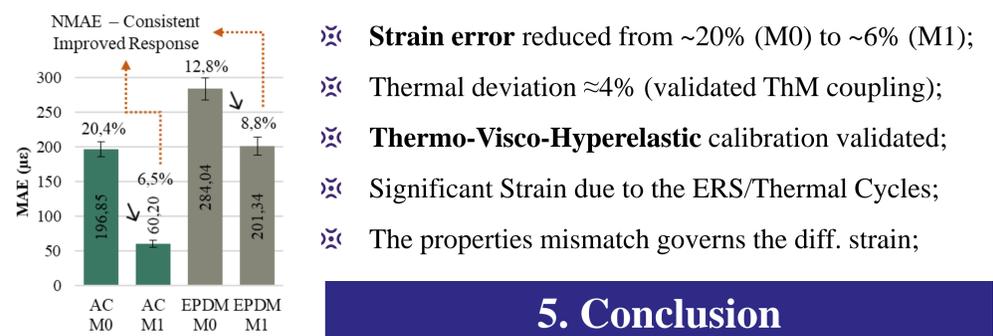
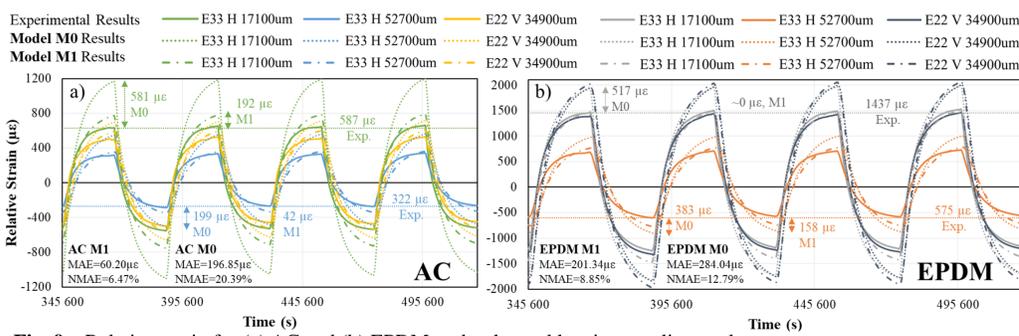
Model	Asphalt Concrete (AC)	Resin	EPDM
v0*	Thermal	Thermal	Thermal
v1	ThermoViscoElastic	ThermoElastic (ThE)	ThermoElastic
v2	ThermoViscoElastic	ThermoViscoElastic	ThermoViscoElastic (ThVE)
v3	ThermoViscoElastic	ThermoViscoElastic	ThermoHyperElastic (ThHpVE)

*Thermal simulations only

Legend: +Mech. Coupling, +Viscoelasticity, +Hyperelasticity.



4. Results and Discussion



5. Conclusion

- Strain error reduced from ~20% (M0) to ~6% (M1);
- Thermal deviation ≈4% (validated ThM coupling);
- Thermo-Visco-Hyperelastic calibration validated;
- Significant Strain due to the ERS/Thermal Cycles;
- The properties mismatch governs the diff. strain;
- Avg. Divergence Error for M0 (ThVE) of 20% 😊
- Avg. Divergence Error for M1 (ThHpVE) of 6% 😊
- The refined ThM FEM, reduced strain prediction error from ~20% (M0) to ~6% (M1);
- Temperature evolution with low deviation (≈4%), supporting thermal-mechanical coupling;
- The ThM model is a basis for damage assessment.

6. Ongoing Research

- Validation in Larger Scale / Pilot Projects
- Temperature and Humidity Effects;
- Damage Assessment (Advanced FEM and Tomography)

Collaborations

Advanced FEM Modeling of Conductive Pavements Incorporating Viscoplasticity and Damage. Master Thesis - M.Sc. Solomon MANZI - KTH ABE School.

AI-Assisted Finite Element Modeling (XAI) for Optimization and Sensitivity Analysis. M2 Internship Subject - M.Sc. Jamile GUARDA - UFRGS.

Data-Driven Machine Learning Modelling of Mechanical/Rheological Properties of Asphalt Mix. Master Thesis - M.Sc. Rahadian AMIDARMO - KTH.