



STEEL Solutions for Safe and Smart Structures of Electric Vehicles



Brochure 2

STEEL S4 EV: Main results

Project description and objectives

STEEL-S4EV completes the research on a new trend in vehicles manufacturing approach based on high strength steels. Principal features of the project are urban electric vehicles design and its novel manufacturing environment.

Vehicle chassis design is based on **advanced high strength tubular steels**, which are meant to comply with crash regulations and Euro NCAP demands. Research within **weld joint design** and welding methodologies has been carried out to maintain material properties in weld areas, ensuring robustness and long term durability.

The microfactory proposal depicts a cost-effective, energy efficient and low-investment manufacturing process, allowing a flexible response to the market demand of different vehicle architectures (passenger vehicles with three or four wheels, pick-ups, delivery vans, taxis, etc.) with a single chassis. It will be achieved by a **modular and flexible** structural design based on a 3D skeleton frame of welded tubes bent with high accuracy using programmed laser cuts.

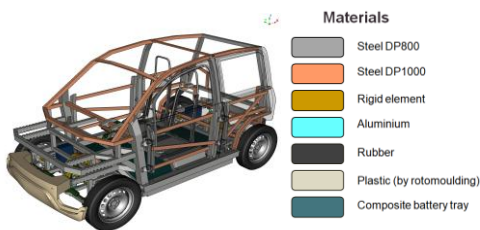
The aim is to satisfy the great majority of people needs without compromise on safety, automotive quality standards, ergonomics, smartness, aesthetics or costs.



Final results

SELECTION OF MATERIALS, TECHNOLOGIES AND NOVEL MANUFACTURING APPROACHES

Vehicle structure based on Advanced High Strength tubular Steels (AHSS).



Modular design...

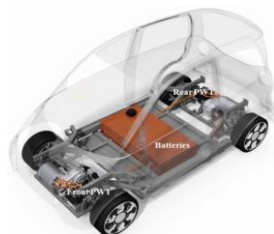
...regarding the structure

Three or four wheels passenger vehicle, delivery vans, pick-ups...



...regarding the powertrain

4WD through two identical motorised axles



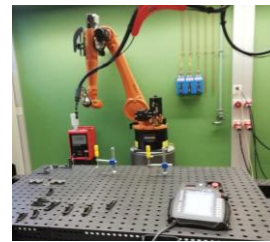
...regarding the battery pack

Modular battery pack up to 50 kWh to satisfy different market demands.

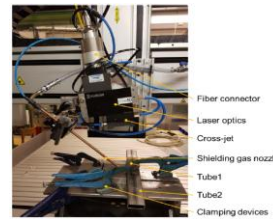
WELDING PROPERTY OPTIMISATION

Several advanced welding technologies and post weld heat treatments are being developed for joining dissimilar high strength steel grades.

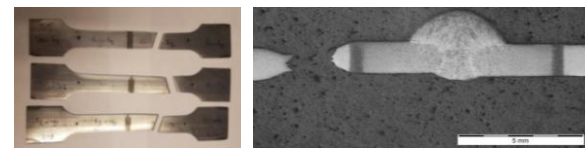
MIG/MAG welding



Laser welding



The processes aim to minimize the material degradation in the heat affected zone, improving the fatigue behaviour of the joints.



LCA AND PLM

Integration of CAD softwares with a Product Life Cycle Management software, finding the right trade-off between technical, environmental and economic criteria for the design of urban electric vehicles

STEEL S4 EV: Main results

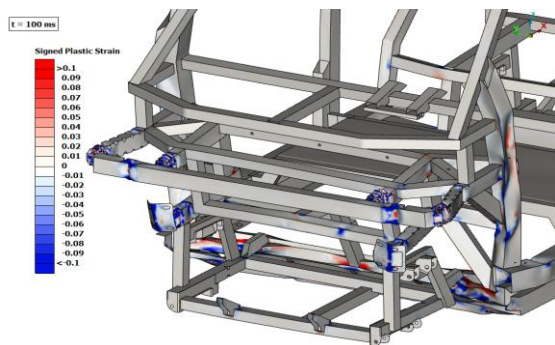
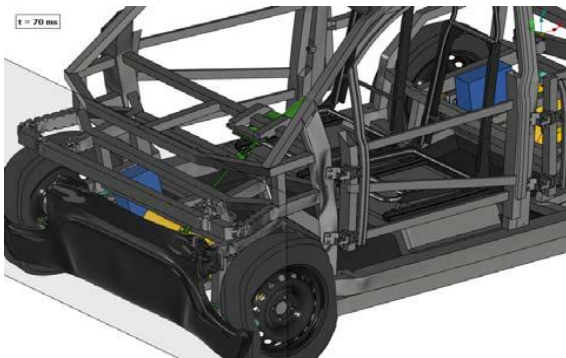
DESIGN OF NEW VEHICLE TYPES: WEIGHT OPTIMISATION, FULLY INTEGRATED SAFETY, VULNERABLE USERS PROTECTION

Vehicle designed and tested under Euro NCAP protocols for M1 vehicles.



Frontal crash

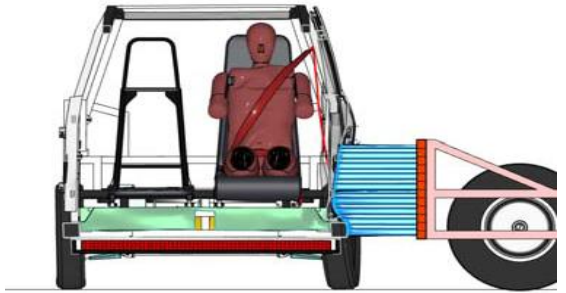
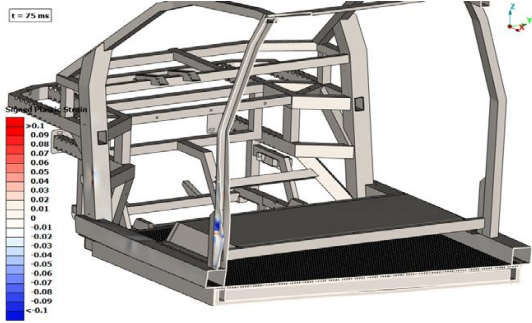
- ▶ OLC: 44.2 g
- ▶ Intrusions:
 - Floor areas < 40 mm
 - Steering column < 60 mm
 - Cockpit < 50 mm
- ▶ Suitable biomechanical values



Equivalent plastic strain results. Most energy absorbed by collapsible elements.

Lateral crash

- ▶ Maximum deceleration < 45 g
- ▶ No important intrusions
- ▶ Suitable biomechanical values

Equivalent plastic strain results. All energy absorbed by B pillar.

FUNCTIONAL AND SAFETY TESTING

Vehicles manufacturing is ongoing



It is planned to perform real tests of bending, torsion, fatigue, front crash and lateral crash in summer this year to validate the results obtained in the simulations.



Conclusions

STEEL S4 EV project has achieved its challenging objectives during its three years duration thanks to the funding programme in which the project is performed, and to the work of the six partners.

The main outcomes of the project are:

- Advanced High Strength Steels (AHSS) structure based on welded tubular profiles
- Optimised modular vehicle design to adapt customer needs
- Selected manufacturing processes to ensure Advance High Strength Steels properties in weld joints
- Good safety performance for vehicles occupants and Vulnerable Road Users
- Minimum environmental impact and costs





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Partners

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I-FEVS

IB research
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RFCS

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**Research Fund
for Coal & Steel**

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