D5.2 Report on impact resistance

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Deliverable Information sheet

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0.2	27/01/2026	AM	Bending impact test contribution

Executive summary

This deliverable presents the results of the experimental campaign conducted within WP5 to evaluate the impact resistance and crash-related behaviour of the six third-generation Advanced High-Strength Steels (3rd Gen AHSS) studied in Sup3rForm. The objective of the report is to characterize the materials performance under conditions relevant to crashworthiness, anti-intrusion, and energy absorption in crash-safety automotive structures.

To achieve this, three complementary testing methodologies were employed:

1. L-profile quasi-static compression tests (VAS): a laboratory-scale test designed to rank materials by crash foldability through the calculation of a Crash Index (CI) and to track crack initiation during progressive folding.
2. Axial impact tests (VAS): semi-industrial dynamic crash tests using hat-profile components at controlled impact speeds; these results verify the correlation between quasi-static CI and real crash behaviour.
3. Bending impact tests (AM): drop-tower 3-point bending tests on two geometries—a standard anti-intrusion sample and a notched sample—to assess anti-intrusion performance, ductile fracture sensitivity, and resistance to strain localization.

Across all experiments, the materials exhibited clear trends reflecting their strength, ductility, and microstructural differences. Lower-strength grades (~980 MPa) showed superior foldability and stable deformation during axial impact, whereas higher-strength grades (>1270 MPa) displayed limited bendability and a tendency toward early crack formation under axial crushing. Bending impact tests confirmed that all grades, except one, remained free from critical fractures under anti-intrusion loading. In membrane-mode bending of notched samples, all steels fractured except MMn1000, which displayed exceptional elongation.

Overall, the results reveal consistent correlations between static and dynamic crash tests, with quasi-static L-profile testing proving to be a fast and reliable screening tool for crash foldability. The findings support subsequent modelling in WP6 and will guide the selection of suitable steel grades depending on whether energy absorption or anti-intrusion is the primary design requirement in targeted automotive components.