



WorldAutoSteel Showcases Steel E-Motive: Fully Engineered Concepts Demonstrating Pathway to Net Zero for Ride Sharing Vehicles

World's First Steel Body-in-White concept for autonomous MaaS vehicle applications delivers key sustainability, performance targets

August 1, 2023, Traverse City, Mich. – Results of a global steel industry initiative aimed at developing the world's first fully autonomous, electric vehicle body structure concept for ride sharing were unveiled today, highlighting key sustainability and performance achievements. The project, called Steel E-Motive, is the culmination of a three-year research program led by WorldAutoSteel and in partnership with global engineering firm Ricardo. Its objective was to create a fully autonomous ride sharing vehicle concept showcasing the strength and durability of steel with a critical focus on sustainability for reaching net zero emissions targets. The result are safe, comfortable, and affordable body structures that support automakers in the continued development of Mobility as a Service (MaaS) ride sharing models.

Key program results include:

Sustainability

- **Potential for ~86% total lifecycle CO₂ emissions reduction.**
- **282 kg body structure, 25% mass reduction** over an expected reference vehicle of 374 kg.

Safety and Comfort

- Advanced High-Strength Steel (AHSS) body structure and closures **purpose fit for Mobility as a service (MaaS) electric vehicles.**
- **World's first autonomous vehicle** engineered to **meet global high speed crash regulations** that can achieve the IIHS "Good" rating.

- **Seven Advanced High-Strength Steel structural innovations** that provide safe, efficient and economical vehicle architectures.

Economy

- **Intelligent battery packaging** that is **37% lighter and 27% lower in cost** than average reference battery pack structures, and applicable for current BEVs in development.
- **Manufacturable** using global manufacturing and supply infrastructure at costs that can support profitable margins, both for the vehicle manufacturer and mobility service providers.

“The objective of Steel E-Motive was twofold: one, as an industry, to create a solution that supports a sustainable, safe, and affordable future for urban mobility; and two, to showcase the role modern steel can play in making that future a reality,” said Cees ten Broek, Director, WorldAutoSteel. “This project represents an important step forward for autonomous ride sharing and zero-emission transport, and truly demonstrates how working together as an industry yields important results.”

Steel E-Motive is the latest in a history of steel industry demonstrations over the past 25 years that showcases new AHSS applications for automotive structures. WorldAutoSteel, the automotive group of the World Steel Association, which comprises 18 global steel producers, led the project, working closely with Ricardo, who managed the overall engineering design, testing, and development.

Vehicle Specifications

The program highlights two virtual concepts designed for 2030-35+ deployment: SEM1, a four-passenger urban transport, and SEM2, a six-passenger extra-urban commuter, both designed for level 5 autonomy with no steering or pedal box. Other specifications include:

- Compact size with short front and rear overhangs
- Average tensile strength for the body structure = 1259 MPa.
- Low step-in height and scissor doors encasing virtual B-pillar to achieve wide door access for ease of ingress/egress.
- Flexible, open interior. Designed for rear-facing front occupants for an enhanced journey experience.
- Battery agnostic – designed for maximum battery volume.
- Adaptable to carry cargo in off-peak hours.
- 4-wheel steering for tight turning circles for navigating inner city roads.
- High volume production >250,000.

“We’re extremely proud of our collaboration with WorldAutoSteel to help Steel E-Motive become a reality,” said Neil McGregor, Chief Engineer, Vehicle Systems Integration, Ricardo Automotive and Industrial Division, EMEA. “The impressive performance, safety, and lifecycle results of this

program are validation that steel is infinitely tunable, offering engineering and design flexibility that enables efficient and effective solutions.”

Steel Innovations

Using the newest steel grades and fabrication processes, Steel E-Motive's portfolio enables tailoring vehicle properties that achieve significant safety, cost, and comfort advantages with seven key innovations only possible using steel:

1. **B-Pillarless**, one-box open body structure provides a wider door aperture for easy ingress/egress, disabilities access, and facilitates delivery services.
2. **AHSS Extended Passenger Protection Zone** provides excellent intrusion protection for rear-facing passengers.
3. **Short Front Crash Zone structure** meets the most stringent global crash requirements. Dual Phase (DP) Tailor Welded Blanks enable efficient design.
4. **Small Offset Crash Glance Beam** minimizes cabin intrusion and lowers crash pulse while preserving door ring and battery in 64 kph small overlap rigid barrier simulations.
5. **(Rocker) Hex beam energy absorbers**, made of roll-formed DP steel, are low cost, compact, and mass efficient, minimizing side crash intrusion and achieving superior battery protection.
6. **Virtual B-Pillars** are integrated into the doors, creating a compact section for better passenger visibility and improving passenger access. Bake Hardenable steel's Class A-quality surface combined with a scissor door design enables complete elimination of the body side outer for mass and cost savings.
7. **Industry-First Battery Carrier Frame** eliminates the conventional battery case, utilizing the existing floor as the top cover, and features an AHSS triple-skinned bottom cover that seals the battery and provides protection from road debris and jacking errors. These efficiencies result in 37% mass savings (-27% less cost) and can be assembled offline for efficient vehicle integration.

"Steel E-Motive serves as a foundational blueprint for a wide range of applications. Startups and vehicle manufacturers can benefit from fully engineered concepts that can significantly reduce both cost and time to market. It also provides demonstrated results that meet or exceed stringent global crashworthiness standards enabled by the use of high-strength steels – applicable on BEVs in the near-term or future," explained George Coates, Technical Director, WorldAutoSteel. "From a cost perspective, the study highlights important benefits as well. We engineered this program to be affordable for production and to achieve the lowest total lifecycle emissions, putting us squarely on the path towards Net Zero. Using steel supports the use of existing manufacturing infrastructures, which helps to provide low ownership costs, critical for broad adoption."

Program Results Available

As with previous steel industry demonstration programs, Steel E-Motive results, data, and CAD models are given freely to automotive manufacturers and others around the world to study and apply its learnings and innovations to produce a new generation of efficient, economic, and sustainable vehicles. For more information visit <https://steelemotive.world/>.

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About WorldAutoSteel

WorldAutoSteel, the automotive group of the [World Steel Association](#), is comprised of 18 major global steel producers from around the world. Our mission is to advance and communicate steel's unique ability to meet the automotive industry's needs and challenges in a sustainable and environmentally responsible way.

[Steel E-Motive](#) follows a long history of steel industry demonstrations to showcase new AHSS applications for automotive structures. The UltraLight Family of Research, which began with the first industry effort of its kind in the world, the UltraLight Steel Auto Body (ULSAB), as well as the most recent program, FutureSteelVehicle, are noted for their contributions in helping automakers apply AHSS to achieve lightweighting, performance improvement, and crash safety goals. Visit www.worldautosteel.org to learn more.

About Ricardo

Ricardo plc is a global strategic, environmental, and engineering consulting company, listed on the London Stock Exchange. With over 100 years of engineering excellence and employing close to 3,000 employees in more than 20 countries, we provide exceptional levels of expertise in delivering leading-edge and innovative cross-sector sustainable products and solutions. Every day, we enable our customers to solve the most complex and dynamic challenges to help achieve a safe and sustainable world. Visit www.ricardo.com.