

# The Automotive Extrusion Market

## Where We Are Today and Where We Need to Be

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*Editor's Note: This is the first in a series of six articles in which the author will explore opportunities for the aluminum extrusion industry in the automotive market. The series will specifically address the supply chain, raw material supply, extrusion, fabrication, and assembly.*

### Understanding Automotive Demand

**A**utomotive is a strong and growing market segment for the aluminum extrusion industry, but predicting the rate of increasing demand for extruded aluminum components and assemblies over the next five years is complicated. There are numerous factors to consider, such as government regulations, economic conditions, advancing technologies, consumer preferences, and the strength of the extrusion industry to scale, innovate, and meet the expectations of automotive OEMs.

As OEMs have been exposed to the attributes of aluminum and the extrusion process, they have come to understand its advantages and ultimately expand applications to include structural components, crash management systems, body, powertrain, interior, thermal management, lighting, and more. In the last decade alone, the use of extruded shapes in vehicles has more than doubled to around 50 lbs per vehicle in 2022. That doesn't include the pipe, tube, rod, and bar sectors, which have been relatively static. It is likely that this increased per vehicle demand for aluminum solutions will only accelerate in the years ahead.

This is due in large part to the mounting pressure on OEMs to reduce emissions and improve fuel economy. In a recent study by the AEC, Ducker notes that the National Highway Traffic Safety Administration (NHTSA) will boost fuel efficiency requirements by 8% for both the 2024 and 2025 model years and 10% in 2026. As a result, it is expected that per vehicle demand for lightweight aluminum solutions will increase by 10-15% in the next five to seven years.

Concurrently, OEMs have overwhelmingly committed to move to electric vehicle platforms. According to Ducker, over \$46 billion is being invested in zero-emission vehicle (ZEV) technologies, such as plug-in hybrid electric vehicles (PHEV), battery-electric vehicles (BEV) and fuel cell electric vehicles (FCEV). That's in addition to \$7.5 billion being invested in electric vehicle charging infrastructure. As a result of this shift by OEMs, overall demand could grow 70% by 2027. Combined, the total anticipated growth of extruded components and assemblies is 528 million lbs by 2027, maintaining aluminum as the material of choice for automotive—second only to steel.

### Automotive OEM Expectations

As the extrusion industry looks at supplying advanced automotive applications, it must understand the challenging OEM expectations of its supply base. Today's applications start with advanced engineering, simulation, and rapid prototyping support for efficient product development and optimization. Additionally, in terms of cost and product performance, extruders must consider

alloy development, profile design, metallurgy, tolerance capability, assembly, and the ability to join components for multi-material and multi-process assembled solutions. This development work often leads to the ongoing creation of advanced profiles and alloys to meet specific automotive OEM requirements for improved strength, durability, crush performance, corrosion resistance, process efficiency, and environmental sustainability.

Once the profile and alloy design is complete, it is critical to identify the appropriate extrusion press line and auxiliary systems. As a result of profile complexity, tolerances, and metallurgical specifications at scaled volumes, the equipment, control of process, and advanced technical skill increases. Very minor thermal, tooling, cycle, and pressure variations can often lead to extrusion outputs not meeting OEM specifications. Stringent testing ensures end use safety and performance (Figure 1), while also mitigating the risks associated with large-scale recalls.



Figure 1. Crush testing of custom alloy extrusions for crash management systems.

Automotive OEM needs go beyond an extruded lineal to include finished components and complex assemblies, requiring full vertical integration of specialized processes and equipment (Figure 2). This may include tightly controlled heat-treating both pre- and post-fabrication, efficient tight tolerance computerized numerical control (CNC) cutting, multi-axis CNC machines (3-axis, 4-axis, and 5-axis) capable of machining long-length components, multi-axis compound bending with self-correcting artificial intelligence (AI), welding, assembly, and advanced joining techniques.

The aforementioned value stream, from billet to final assembly, must happen in an environment capable of delivering quality, repeatability, and traceability through advanced processes with continuous development. These capabilities should be supported by the necessary controls, quality labs, and certifications, without failure and scalable to high volume. As a result, despite the appeal of significant growth and opportunity that the automotive market brings, the complex expectations, capital, volatility, and associated risks will prevent many in the aluminum extrusion industry from entering the market.



Figure 2. Automated robotic work cell for the fabrication of extruded profiles.

### Current State of the Supply Base

So, where are aluminum extruders as an industry? Where does the industry need to be in order to support current and future automotive market demand? To answer this, extruders must examine their approach in terms of capacity, innovation, expertise, and sustainability.

It is estimated there are approximately 7 billion lbs of aluminum extrusion capacity in the U.S. and Canada, spread across 531 presses. Of those presses, it's estimated less than 27% are qualified to support the future automotive market.

While expansions are expected to result in an additional 340 million lbs of capacity over the next five years, the extrusion industry will need to go beyond equipment installations and efficiency improvements to truly meet automotive market demand. By investing significant resources towards the research, development, and advancement of new high strength alloys, the industry will ensure that aluminum remains the automotive material of choice. Similarly, extruders must invest in new technologies, automation, and controls to improve production capacity, efficiency, and quality, while preserving extrusion as the manufacturing process of choice.

In terms of people, the extrusion industry has experienced a significant shortage of technical talent. While automation has its place in manufacturing, the talent extruders attract, develop, and retain is critical. It is the expertise and skill of its people that enables the industry to innovate and grow in support of the most demanding markets. While equipment can be purchased, capabilities must be developed. As business leaders and as an industry, extruders must remain steadfast in their commitment to developing talent. The Aluminum Extruders Council (AEC) is committed to supporting the industry in addressing these challenges within the Academic Engagement and Workforce Development team through several initiatives led by Duncan Crowdis.

"We recognize that the effectiveness of introducing new and more sophisticated technology is conditional on bringing the right talent and skills to the table," explained Crowdis. "Over the past year, we have undertaken two significant initiatives that directly address the need to attract, develop, and retain these key skills. The first is the introduction of an AEC-sponsored apprenticeship program that is initially focused on industrial maintenance, but will soon be expanded to include other key skill areas that are critical for the industry's ability to expand its capabilities and capacities. The second initiative is col-

laborating with LIFT (Learning Innovations for Tomorrow) and the U.S. military to develop skills in service personnel transitioning to civilian life, providing them with excellent and rewarding career opportunities in manufacturing. This training is currently being offered in CNC machining, robotics, welding, and industrial maintenance, all critical to our industry's growth."

Finally, sustainability, emissions, and carbon neutrality are an increasingly important focal point of automotive OEMs in selecting their suppliers. For example, General Motors is demanding that suppliers sign a carbon-neutrality and sustainability plan pledge, and BMW and Volvo announced CO<sub>2</sub> targets for components as part of their sustainability strategies. In addition, 50% of Daimler suppliers have committed to supplying carbon-neutral components.

Fortunately, the extrusion industry is well-aligned, given that aluminum is such a highly recyclable material, with a robust recycling network in place. Plus, aluminum's high strength-to-weight ratio (as much as 50% compared to mild steels) means it is ideal for use in lightweight automotive components, which ultimately improve vehicle fuel efficiency, making it a more sustainable choice for the automotive industry.

According to the AEC, "In conventional, internal combustion-powered vehicles each pound of aluminum replaces about 2 lbs of steel, saving 3.1 gallons of crude oil and 20 lbs of CO<sub>2</sub> over the life of the vehicle. Extrusion usage in the average North American car or light truck has nearly doubled to about 50 lbs over the past ten years, generating an annual savings of over 100 million gallons of crude and nearly 700 million lbs of CO<sub>2</sub> per year. For battery powered vehicles, lightweighting using aluminum extrusions also extends vehicle range."

Furthermore, studies show that over 90% of aluminum from vehicles is recycled at end-of-life, compared to much lower recycling rates for other materials. Recent environmental product declarations (EPDs) show a North American average at 53% recycled content. Sensitivity analysis also shows that the extrusion process is a relatively small part of embodied carbon in extruded products. The biggest levers to reduce carbon are increasing recycled content and shifting prime content to low carbon sources.

### Conclusion

As an industry, aluminum extruders know the automotive market represents a tremendous opportunity for growth. To avoid the potential loss of market share to competing materials and processes—such as steel, composites, magnesium, die castings, mega castings, etc.—the industry must continue to push itself to successfully meet the challenging expectations of automotive OEMs. This goes beyond the simple purchase of equipment; it requires innovation, the development of talent, and a unified industry committed to sustainable growth. ■



*With more than 30 years of experience in the aluminum extrusion industry, Mark Butterfield is currently president of Manufacturing at Metal Exchange Corporation, which includes the Pennex and Electro Cycle brands. An established industry leader, he also serves the Aluminum Extruders Council (AEC) in multiple positions, including vice chairman of the board of directors, chairman of the Automotive Committee, and vice chairman of Extrusion Technology 2024.*