

## Delphi Steering Ups the Magnesium Ante on Ford F-150

**D**elphi Steering, Saginaw, Mich., a supplier of advanced steering and driveline technology, has been using magnesium in its automotive steering columns for two decades, but never so much as in its latest project for the 2009 Ford F-150.

“The F-150 by far is the most magnesium-intensive column we’ve put into production,” said Rick Nash, Delphi Steering’s chief engineer for steering columns. “The new Ford F-150 steering column is more than 60% magnesium based on volume, and represents a more than 40% weight savings over the prior model F-150 steering column.”

Magnesium’s light weight gives the Ford F-150 an advantage in cost and fuel econ-

omy. Cost savings vs. the more steel- and aluminum-intensive prior model F-150 steering column were realized through the integration of several components, such as , such as brackets that must be welded or

bolted on, into a single component. Specifically, the steel main tube and several brackets that were previously welded together, as well as an aluminum support casting that was bolted on, were integrated into a single magnesium die casting. Utilizing die cast magnesium also facilitated the integration of optional construction for the engineered steering column energy absorption features. This allowed Ford and Delphi Steering engineers to optimize the steering column’s contribution to driver-side vehicle crash safety.

Combining various steel subassemblies into single magnesium die castings while still meeting the truck’s strength and stress requirements was not easy. Delphi Steering needed to design a



*The 2009 Ford F150 is considered America’s safest full-size pickup after receiving top safety ratings and a segment-leading list of standard safety features.*

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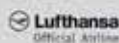
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steering column package that met the function of the application, acted as a robust energy absorber during a crash, incorporated a tilt adjustable steering mechanism and exhibited the desired noise vibration and harshness performance.

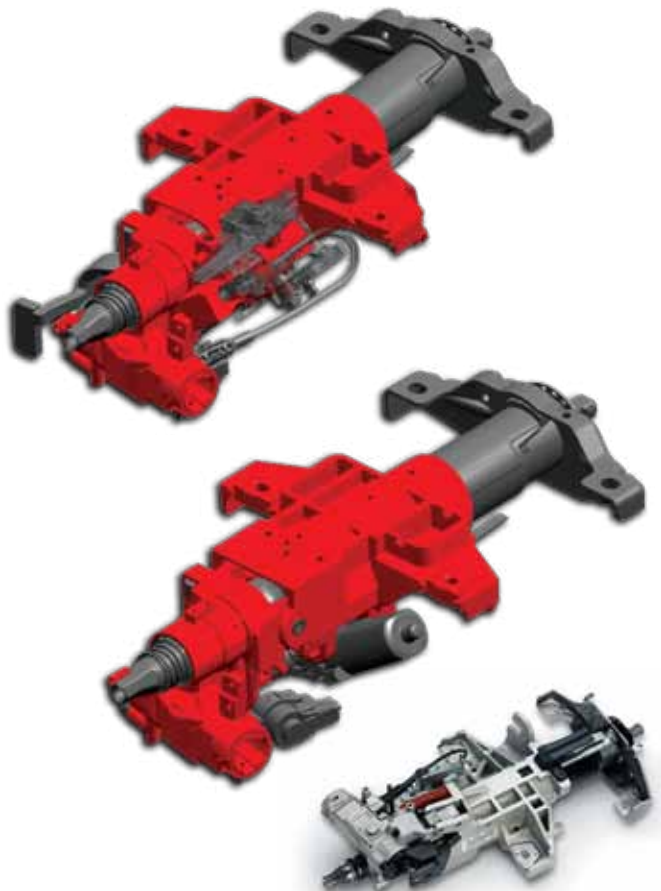
“Working with magnesium requires more upfront work, especially in instances where high strength or fatigue cycles are required,” Nash said. “We performed a lot of finite element analysis and collaborated with our suppliers. Without the modeling capabilities, this magnesium steering column would probably still be on the drawing board.”

Delphi Steering’s engineering team collaborated with its die-casting suppliers on the castability of various design iterations. The challenge was to find the right balance of structural design elements, such as thick cross sections for strength, while staying within the capabilities of the die-casting process. Casting simulation software was used to predict porosity and other die-filling challenges. Delphi Steering used finite element analysis to examine high stress and high load areas.

“We can’t do our analysis in a vacuum,” Nash said. “We have to work with our suppliers. For example, maybe a section we are designing is not castable at the supplier-level. This is why it’s important to collaborate with the suppliers on the design.”

The final steering column magnesium components consists of the main body of the steering column, tilt housing support, key ignition lock housing, and the column shift mechanism. The overall steering column design contributed to the F-150’s five-star crash rating. The truck also was named the 2009 Motor Trend Truck of the Year and the 2009 North American Truck of the Year.

Visit [www.delphi.com](http://www.delphi.com) for more information.



*The magnesium steering column package aided the truck’s fuel economy and accommodated the required safety features. The magnesium content of the package is shown in red on the computer models.*