

Ferrabyrne

World Class Ride & Comfort with Rubber to Metal Bonded Components Designed using MSC Marc's Advanced Non-linear FEA Solutions

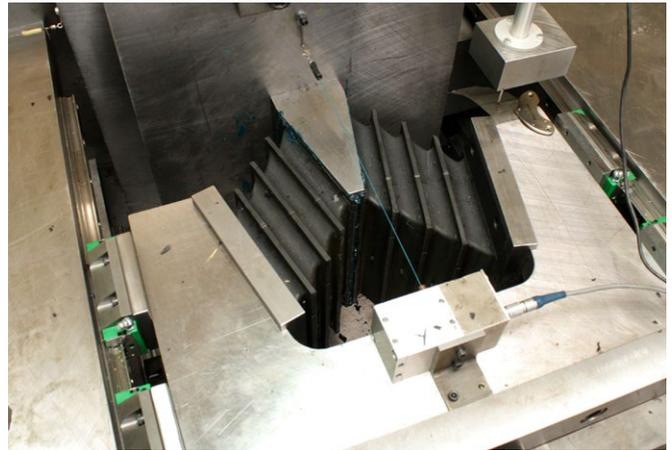
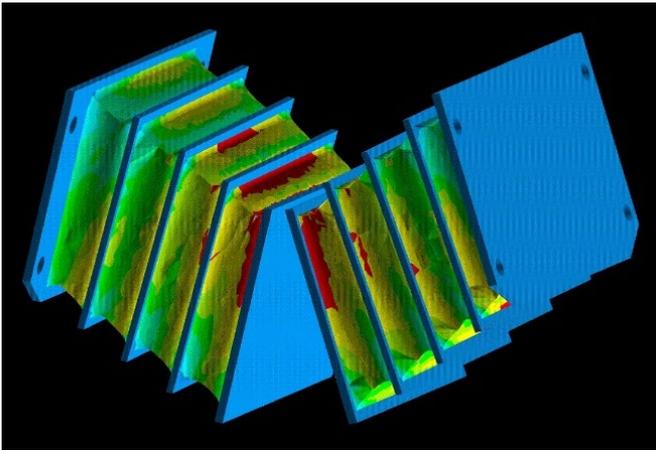


“By more accurately predicting the performance of Rubber to Metal parts, we have been able to streamline our prototype and validation processes, cutting out many iterations of costly redesigns and tool modifications.”

Max Bradley,
Senior Design Engineer

If you've ever travelled on a high-speed train you've likely enjoyed the smooth ride and comfort delivered by Ferrabyrne's rubber-to-metal components suspension systems and Anti-Roll bar assemblies.

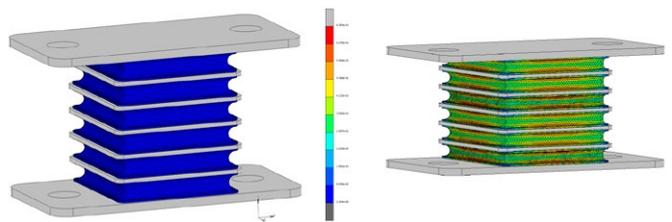
Ferrabyrne, located in the United Kingdom, specialises in dynamic suspension system solutions for rail, commercial vehicles, wind turbines and industrial equipment. They design and manufacture connections in dynamic systems including anti-roll bars, suspension units, bushes, joints, links, couplings, and mounts.



Challenge

It is rare to find engineering companies who offer end-to-end customer service from bespoke design, engineering development, testing, and, manufacturing to the servicing, condition assessment and life extension of components. For companies integrating critical components this can mean a difference between as-designed, as-manufactured, and in-service. To develop a successful engineering company with extensive expertise across all these different domains requires that Ferrabyrne utilize the most productive simulation tools.

Delivering accurate non-linear FEA reports for challenging geometric, hyper-elastic materials and contact non-linearity is essential in supporting “one-time” prototyping and validation. These results are obtained early in the design process and enable clear, accurate and timely data for their customers who also need to validate their own vehicle dynamics.

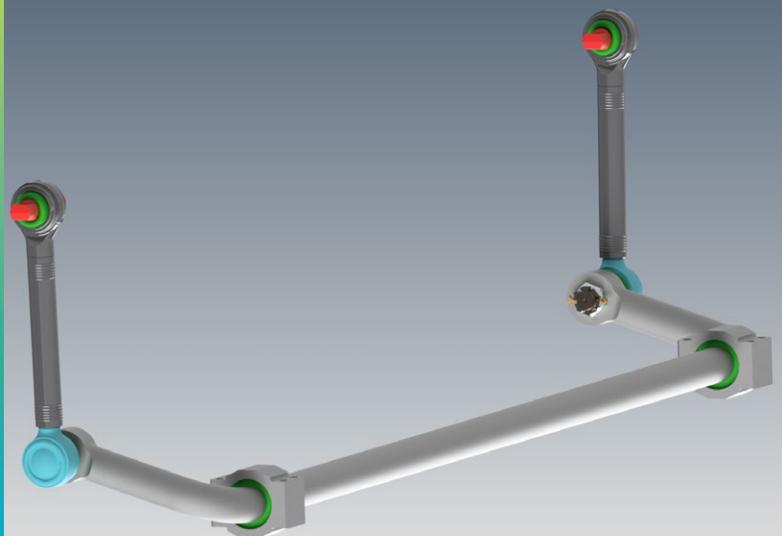


Primary Lateral Buffer designed for enhanced control. The buffer has a height of 30mm with a peak deflection of +/- 7mm.

Ferrabyrne cites one example of one customer who had built a train and was close to delivery of the vehicle to their own customer. In the final testing they discovered the lateral stiffness was too low; and the car body was moving significantly from side to side. They came to Ferrabyrne with a very short time frame in need of a custom solution to correct unwanted movements and avoid the risk of losing the sale of their rail vehicle.

“ This project had to move very quickly, and we needed a full picture of the stiffness throughout the full dynamic range before even making the part! Marc is both accurate and reliable, without Marc we would not have been able to retrofit our customers vehicle to resolve their dynamics in the tight time frame required. Marc’s re-meshing capabilities has been a key to keeping the total simulation run times down, in particular for high strains and large deflections.”

Max Bradley,
Senior Design Engineer



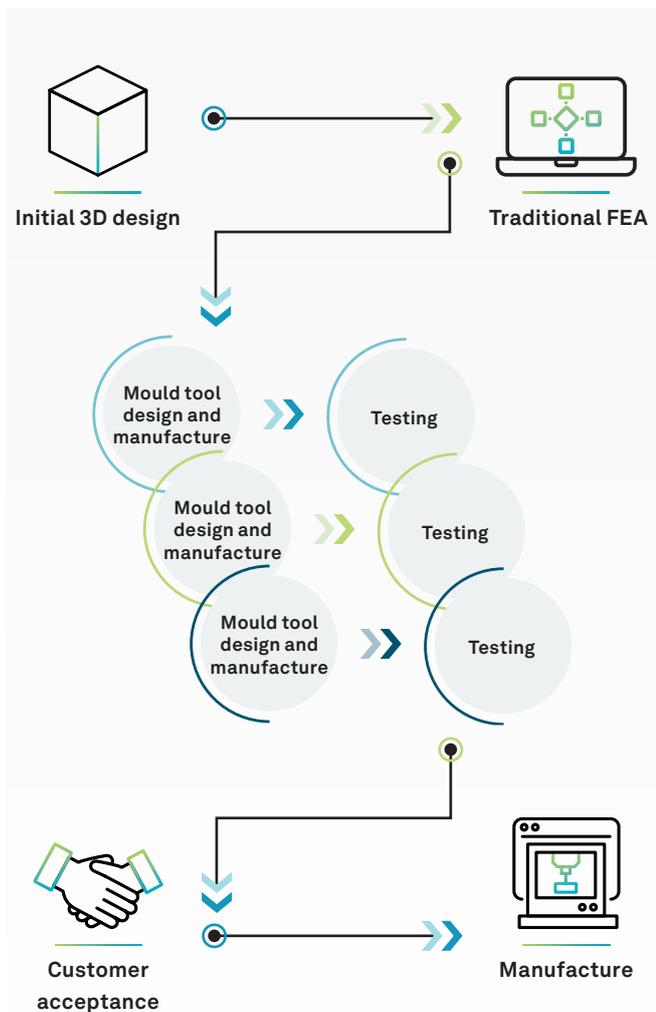
Solution

Rubber to metal bushings are specifically designed using non-linear FEA to predict radial, torsional and conical behaviour. Ferrabyrne can then confidently offer several material combinations to customers that encapsulate an optimised selection based on the strength, weight, physical size and cost constraints of the application. Simulation also plays a significant role in understanding the life expectancies of bushings and the ability to extend periods between services to reduce the number of services and therefore reduce operating costs.

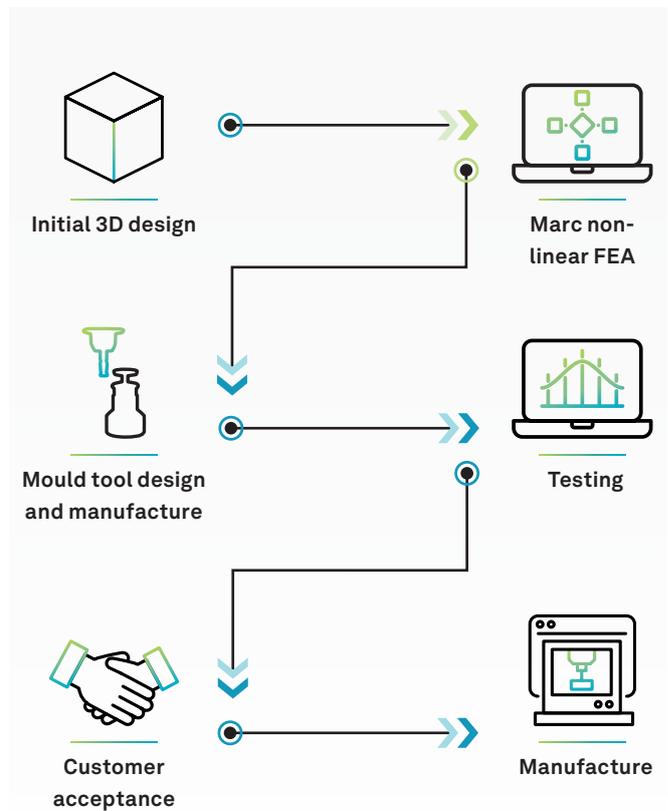
Ferrabyrne first introduced MSC Software's non-linear FEA solver Marc over two years ago and have subsequently experienced major improvements in their design process. Productivity gains by replacing physical tests with simulation is offering Ferrabyrne's engineers more confidence in their ability to deliver a project on time and within budget, thus raising the level of customer service.

“ Marc enabled us to get it right the first time, reducing the whole redesign and testing time by 50% and delivering the bespoke retrofitted lateral buffer within 5 weeks.”

Max Bradley,
Senior Design Engineer



Before implementing Marc as their analysis tool, Ferrabyrne engineers spent a significant portion of time and money iteratively re-designing their components based on physical test data.



After implementing MARC as their analysis tool, Ferrabyrne engineers can learn early on how a component will behave, reducing and sometimes eliminating the need for re-design and re testing.

By doing every step of the workflow under one roof Ferrabyrne's Engineers are better able to meet customers' requirements by optimizing for critical design criteria like multi-axis stiffness rates, stress/strain levels, peak deflections, or fatigue life. Ferrabyrne engineers can also reverse this workflow to use Marc to re-engineer improved designs from existing in-service vehicles.

"Using Marc we are free to design the system that meets all of our customers' requirements quickly and efficiently", says Max Bradley, senior design Engineer.

As a result, Ferrabyrne's worldwide customers have confidence that these components will function exactly as intended in the complete dynamic assembly.

Results

The engineering time savings afforded by MSC Marc's robust, reliable, accurate and high-performing non-linear FEA is allowing Ferrabyrne to focus on new challenges ahead.

Custom materials and bespoke compounds together with a very carefully controlled bonding process and sympathetic vulcanisation methods also play a large part in Ferrabyrne's rubber to metal bonded components and as a result they are internationally trusted for their durability for safety critical components. While the company has had no bond failures with their components for more than 10 years they have been able to implement and design to new industry safety regulations and challenges with safety, such as developing rubber compounds which are compliant with the EN45545 Fire Safety Standards together with market leading low creep compounds for optimum product life.

Rail, an industry which has been predominantly electric for some time, is placing more emphasis on fire safety. While

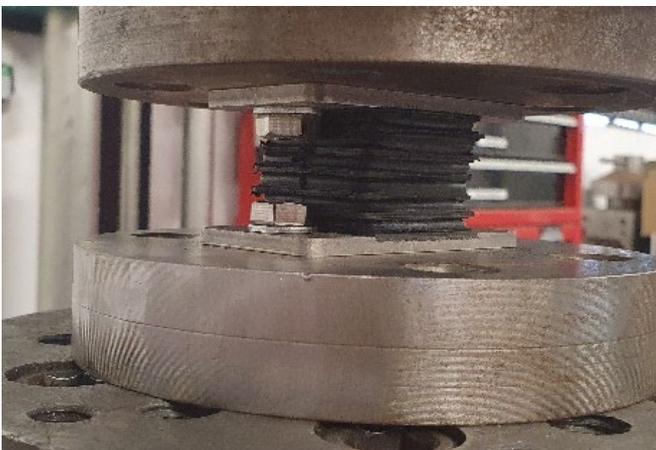
many parts of the design and engineering workflow are similar between diesel and electric vehicles, components like mounts that are close to heat sources are increasingly required.

Their expert experience with Marc's non-linear material modelling makes Ferrabyrne strategically ready to handle redesigning components with newer fire-resistant compounds. Utilizing Marc's FEA to optimise experimental studies on the stiffness and strength of many different new compounds simply by uploading the key material properties such as Mooney Rivlin help Ferrabyrne accelerate the whole design and validation process.

"In most cases Marc eliminates multiple iterations of redesigns of highly complex parts. Testing of prototypes becomes a case of fine-tuning parts rather than resulting in time consuming and costly tool modifications." – Max Bradley, Senior Design Engineer

Physical testing as part of the design of bespoke components would have been prohibitive to Ferrabyrne winning this business. Physical tests include obtaining materials, creating a mould tool, manufacturing the component, testing the component and redesigning based on test results. With physical testing there is both the time and cost to consider, a mould tool alone can take 4-6 weeks to produce.

Confident design by simulation was critical to being able to meet the customer's specific requirements within the time-frame needed to deliver their vehicle. Ferrabyrne was able to use Marc to give that customer comprehensive stiffness curves, allowing them to feed that data into their own simulations such as "Vampire" to check the integration of a part into a wider system. Ultimately this rail customer was able to deliver their train on time and we are all now enjoying a smoother and safer ride thanks to Ferrabyrne.

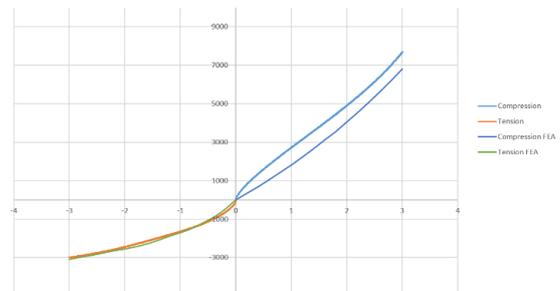


Primary Lateral Buffer in a static stiffness test and full dynamic range from Marc.

Bolster Spring tested in tension, compression, and lateral loading. The test showed close agreement between the Marc-predicted behaviour and the final manufactured component.

Marc FEA vs Real World Test Comparison

Bolster Spring tested in Compression and Tension



About Ferrabyrne

Ferrabyrne, founded in 1970, supplies most major OEM rail companies around the world with Suspension System and Rubber to Metal (RTM) design services and manufacturing. The primary function of the RTM parts is to isolate the car body from the bogie to limit noise and vibration making its way into the passenger compartment.



These parts deliver more than a comfortable and quiet ride, they are classed as safety critical as they play a huge role in the dynamics of a rail vehicle.

As well as the rail industry, Ferrabyrne supplies components to the commercial vehicle suspension sector as well as industrial, military, renewable energy and leisure applications. Ferrabyrne employs modern technology in their design and manufacturing and is an ISO 9001:2015 company with IRIS certification.

10% of Ferrabyrne employees are engineers and many of them are utilizing MSC Marc. The engineers look forward to future technical challenges such as reducing noise with better damping components and to explore new industrial applications requiring their expertise with rubber to metal bonded mounts such as wind energy.



Key Highlights

Product: MSC Marc

Industry: Rail, Automotive, Aerospace, Wind

Benefits: Marc significantly reduced the number of designs to manufacturing cycles saving time and money for Ferrabyrne, an end-to-end engineering firm delivering rubber to metal bonded components for the Rail and other industries.



Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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