GS ENGINEERING™

LOAD CASE DEVELOPMENT FOR NEW PRODUCT DESIGN

GS ENGINEERING INC.
906.482.1235

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OFTEN TIMES WHEN THERE IS A DESIRE TO DESIGN A NEW PRODUCT OR COMPONENT, initial design criteria or constraints may not exist. Whether the new design is a simple bracket, a large structure, a completely new product line, or a retrofit to an existing platform, an understanding of the system input loads are required to support virtual prototyping.

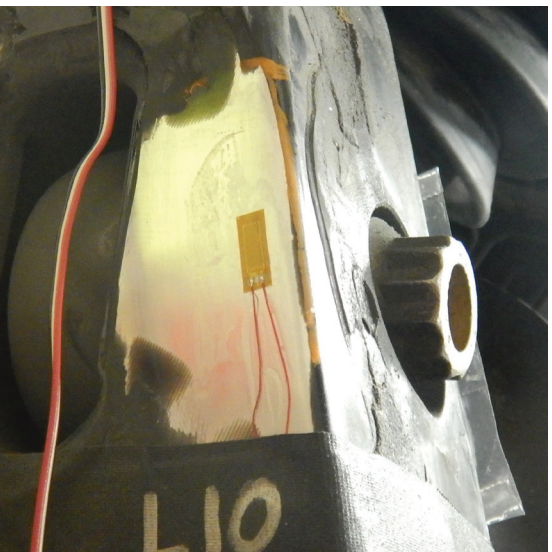
This ensures a robust design prior to any initial fabrication or physical prototyping—preventing delays and reducing overall project cost. Working closely with the client, GS Engineering is capable of defining these input loads utilizing CAE analysis coupled with real-world field test data.

Once a comprehensive set of load cases is determined, it can be used to verify the new design through structural analysis and offer design improvements as needed based upon results. This process can come full circle by then performing physical testing on the new design.

GS Engineering's approach to load case development consists of several key phases:

- Initial notional load case generation & preliminary analysis
- Test plan development
- Instrumentation & data collection
- Data analysis
- Design verification

Rapid product development relies on complicated system models and simulations. To accurately predict vehicle performance, care is taken to ensure simulations are created that represent reality. Our load case development process aids engineers in validating system performance and increases accuracy of the models with a detailed correlation approach.

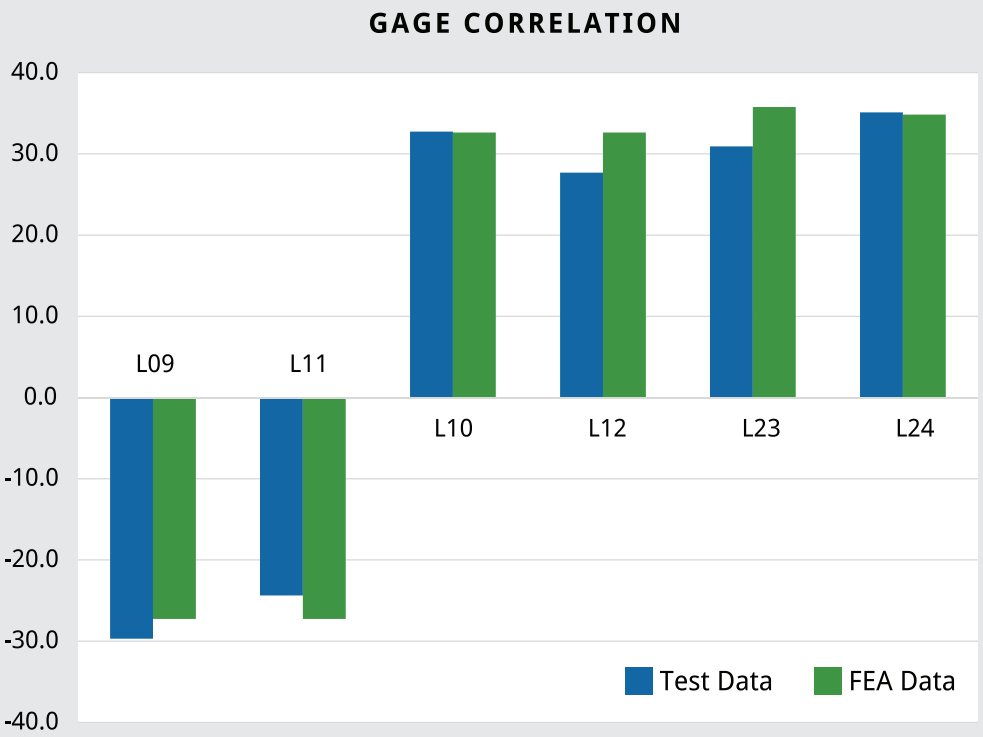


The first step in the process is to develop an understanding of the behavior of the test article to the greatest extent possible such that a test plan and instrumentation layout can be established.

The test article can take a variety of forms including a legacy design, an early prototype of the new design, or some other representative surrogate. Input from the client at this stage is also critical in defining how the system is to be used.

An initial set of notional load cases are put forward based on all known operating conditions and the response of the test article to these loads is subsequently predicted via an analytical model–typically a finite-element model.

Following the initial notional load investigation, test plan development and data acquisition layout can begin. A focus on typical expected field use as well as controlled specified input events generally comprise the tests to be performed.



Accurate analysis models are critical to ensure the predictions represent reality. To accomplish this, our team utilizes a robust process to gather data to refine the load cases used during analysis. A combination of strain, acceleration and inertial data is used to refine the load cases and modeling setup to align the analysis results with the test data.

Initial analysis results are used to determine what type and location of instrumentation to be installed for data collection. This data may include strain measurements, hydraulic pressures, acceleration, displacement (suspension and/or component specific), vehicle dynamics (roll, pitch, yaw), vehicle speed, vehicle weight, and video.

Data collection can begin following completion of instrumentation. Testing may be performed on a variety of terrain types that could include both public roads and private closed courses. Data may also be collected during operation of the test article by end users in real-world scenarios.

Creation of specific obstacles or events may be performed to provide controlled inputs to key-targeted areas of the vehicle.

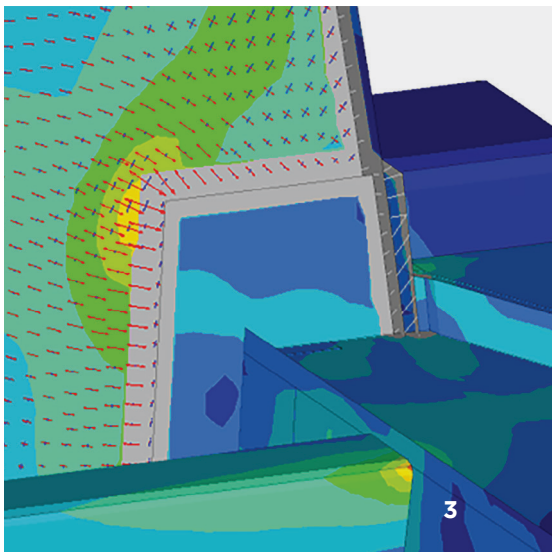
Upon completion of testing, GS Engineering utilizes proprietary developed software to quickly and efficiently analyze collected data and begin updates of the notional loads.

This data analysis process is a critical step where measured data are compared to results from the notional load investigation and the actual loads encountered during operation are determined.

GS Engineering's team of analysts possess the technical knowhow, attention to detail, and critical thinking skills required to mine these large datasets for key events and interpret them properly at arm's length from the assumptions that went into the generation of the notional load cases.

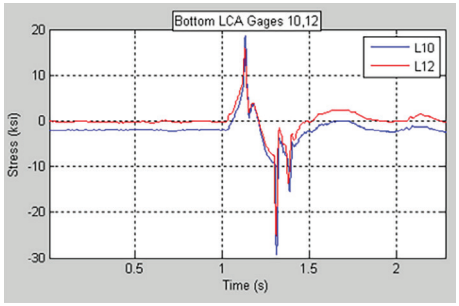
Once actual loads have been established, GS Engineering can leverage an analytical model of the new design to evaluate its performance under those conditions.

GS Engineering scrutinizes the results of these models and works collaboratively with their clients, identifying areas for improvement and providing design recommendations–ultimately arriving at a robust design. Depending on the level of verification required, testing can then be performed on the final design to close the loop.



Testing may consist of the same tests performed initially or additional durability testing over a designated profile and duration.

It may also require an accelerated durability test run on a Multi-Axis Simulation Table (MAST) where inputs for the accelerated durability profile are generated from the initial load case testing.



Data for accelerated testing is compressed to include only events that contribute significantly to the overall accumulation of fatigue damage to the test article, resulting in a substantially reduced test duration.

Confidence in a new design prior to prototyping or initial fabrication is essential when trying to keep a project within budget and on schedule; this confidence starts with an understanding of the system inputs.

GS ENGINEERING'S APPROACH TO LOAD CASE DEVELOPMENT PROVIDES A PATH TO A SUCCESSFUL DESIGN SOLUTION AND INCLUDES A COMPREHENSIVE OFFERING OF SERVICES FROM START TO FINISH.

Instrumented vehicle testing programs employ the latest technology to characterize vehicle performance by collecting data for vehicle speed, location, suspension displacement, acceleration, frequency, strain, and other measurements based on vehicle application.