

# Comil Ônibus Reduces Distortion by 75% Using Weld Planner Simulation Software




## Challenge

Comil needed to reduce geometrical distortions of a bus door frame induced by welded assembly.

When the traditional trial-and-error method, and consequential mechanical rework, failed to reach the required quality, Comil turned to ESI simulation software Weld Planner to enable them to meet specifications and cut development time and spending.

## Benefits

- Meeting tolerance requirements of welded assemblies without tedious trial and error on the shop floor
- Improved product quality, with a favorable customer perception
- Drop in development time, rework activities, and costs previously related to multiple physical trials
- A new cost-reducing workflow that integrates simulation early in the design process

*"Simulating the steel welding sequence using Weld Planner software significantly reduced manufacturing cost and time. The simulation results allowed us to control the dimensions of critical parts and avoid rework in our assembly line."*

**André Luis Petry,**  
Engineering Supervisor  
Comil

## Story

Comil Ônibus S.A., a Brazilian company, manufactures buses that can be seen on the streets of more than 30 countries. It has a complete line of vehicles that include coach, urban, micro, and special buses.

One particular Comil bus design incorporated a front door with an inner structure made of steel; a configuration intended to be compliant with the ABNT NBR 7008 standard. The different components of the door were to be assembled and welded by Gas Metal Arc Welding (GMAW). Comil's prototyping department was in charge of developing the welding device and the welding sequence.



Fig. 1: Comil's Versatile vehicle and its door frame.

In order to develop the welding process, the prototyping team had to perform physical tests and use trial-and-error to optimize the welding device and welding sequence. Such iterations were both time consuming and costly. Moreover the tests consistently revealed excessive welding distortion (up to 20mm) and consequentially led to the rejection of the bus' front door inner structure on the basis of inadequate quality. The absence of a Computer Aided Engineering (CAE) tool capable of predicting the behavior of the assembly during the welding process prevented a structured corrective approach to design improvement. Through trial and error, Comil could only rely on experience to modify the welding sequence and clamping positions; a method too costly to sustain. In addition, the only way to deal with distortions out of design tolerances was to perform mechanical operations – applying forces and displacements in such a way as to compensate for welding distortions.



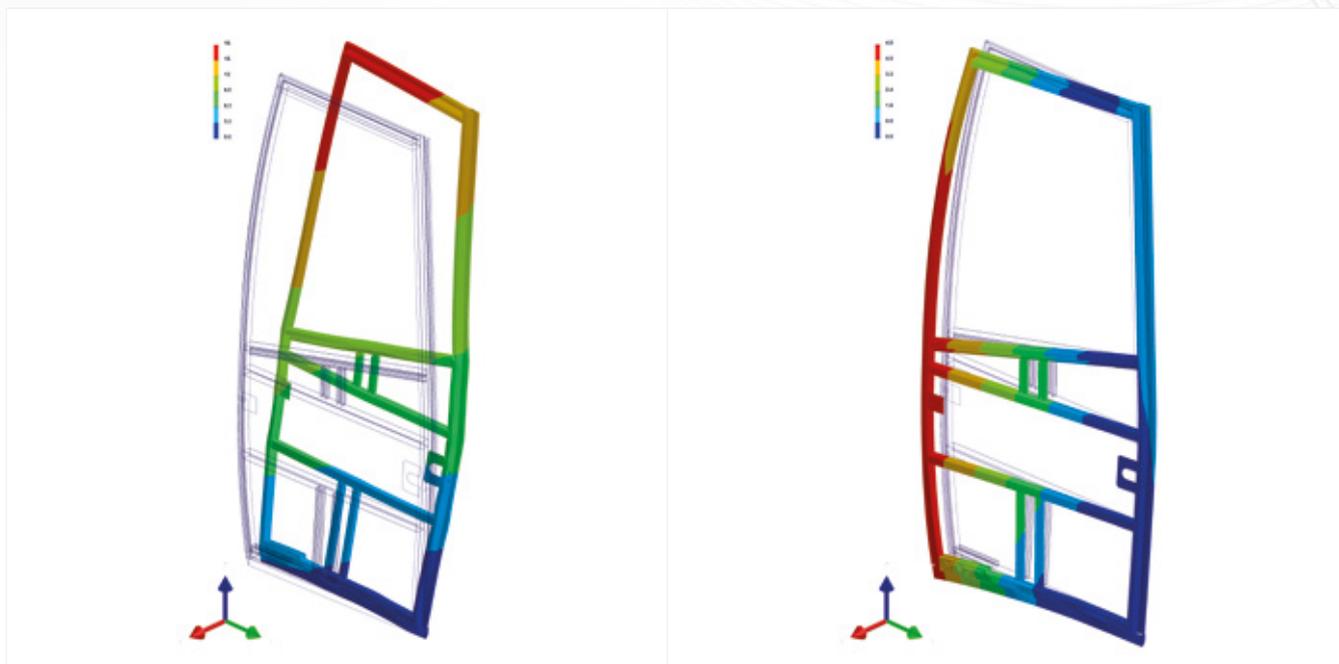


Fig. 2: Local deformation of the welding assembly. Before the use of Weld Planner (left) and after the use of Weld Planner (right).

## Comil implemented Weld Planner in three phases:

1. In the first phase, ESI developed a benchmark for Comil to demonstrate Weld Planner capabilities and show the correlation between numerical and test results. The correlation was impressive enough to convince Comil to acquire the software and start deployment.

2. In the second phase, Comil became familiar with the software through a formal training program and launched their first project and the task of integrating CAE simulations into their welding process development workflow. Comil started to simulate a family of welded assemblies and compared the numerical results with existing physical tests. Through a process of progressive calibration they reached satisfactory correlation.

3. The third and most significant phase required full integration of Weld Planner in Comil's workflow, and consistent use throughout their welding process development. Quickly, Comil was able to make decisions based on numerical results.

Before initiating the new process the welded bus door frame was distorted by as much as 18.9 mm. It was so bad that it was not possible to assemble the door panels without mechanically reworking the structure. After the optimization of their welding plan, using Weld Planner, the maximum distortion was reduced to 4.7 mm; a 75% reduction. Comil was then able to trim the welded bus door structure without any compensation or rework.

Based on success in the first study, Comil started to implement a standard methodology that integrated the use of Weld Planner to support the design of mockups for welded components and to define welding sequences. Integrating simulation has empowered Comil to reach its targets for cost, quality and product launch timing.

*"Weld Planner brings great benefit in dimensional distortion control of welded structures, allowing the study of different welding sequences. Results are fast and highly accurate, ensuring significant technological improvement for our company, and consequently reducing costs previously spent on prototypes and materials that were just scrapped when they didn't meet specifications."*

**Thiago Sotilli,**  
Corporate Engineering  
Comil



virtual manufacturing | ground transportation



### About Comil Onibus

COMIL Ônibus S.A. is a major bus manufacturer in Brazil and present on the streets and roads of more than 30 countries. It has a complete line of vehicles that includes coach, urban, micro, and special buses produced through careful market research. Over 28 years on the road, COMIL has worked to improve the everyday life of people with transparency, integrity, and much passion. And this is our main motivation: passion in doing, innovating, and growing. New processes and technologies are constantly being implemented. Specific models are developed according to market needs. Attention to every detail makes COMIL vehicles stand out as unique. With solid technical expertise and periodic evaluations of products and services, we work with a total focus on quality and because of this we invest in people. We believe that the joining of competencies, talents, experiences, and knowledge result in a quality product, and ensure the satisfaction of passengers, drivers, and fleet owners.

All this because our primary goal, besides producing buses, is to offer intelligent, profitable, perfect fit transportation solutions for our customers.

### About ESI GROUP

ESI is a pioneer and world-leading provider in Virtual Prototyping that takes into account the physics of materials.

ESI boasts a unique know-how in Virtual Product Engineering, based on an integrated suite of coherent, industry-oriented applications. Addressing manufacturing industries, Virtual Product Engineering aims to replace physical prototypes by realistically simulating a product's behavior during testing, to fine-tune fabrication and assembly processes in accordance with desired product performance, and to evaluate the impact of product use under normal or accidental conditions.

ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping. These solutions are delivered using the latest technologies, including immersive Virtual Reality, to bring products to life in 3D; helping customers make the right decisions throughout product development. The company employs about 1000 high-level specialists worldwide covering more than 40 countries. ESI Group is listed in compartment C of NYSE Euronext Paris.

ESI Group Headquarters | 100-102 Avenue de Suffren | 75015 Paris | FRANCE | T. +33 (0)1 53 65 14 14 | F. +33 (0)1 53 65 14 12 | info@esi-group.com