get it right®

PRECISE ENGINEERING

Precise Engineering Cuts Progressive Die Start-Up Costs by 80% with PAM-STAMP 2G Stamping Simulation Solution

THE CHALLENGE

- To design a progressive die to produce an automotive component with a narrow stock width
- To investigate several designs within a short time to market

THE BENEFITS

- Reduction of stock
- Elimination of time consuming and costly trial-and-error process
- Faster progressive die design validation

"Computer simulation reduced the amount of time and money required to determine a successful forming process based on the defined stock width from an estimated $18,000 to only $3,600, concluded Rick Barnard, Precise Engineering's General Manager. "The key to these savings was the use of PAM-STAMP 2G to quickly and inexpensively simulate the performance of a wide range of die designs. Creating a virtual reality progressive die takes the try-out process off the shop floor and into the engineering office where it can be carried out faster and without tying up presses. We determined the process, developed the initial blank, accurately determined the flow of material during the first draw form, evaluated the impact of springback on finished tolerances, and monitored thinning percentages before we even began building the die."

Precise Engineering USA based company, designs and builds complex progressive dies. Engineers simulate every die to validate the process before the actual design stage begins.

Precise Engineering faced the challenge of designing a progressive die to produce an automotive component with a narrow stock width that made it difficult to accomplish a successful draw. Originally, the part had been designed to be run two across with a stretch carrier on each side and one in the middle to avoid the risk of thinning. As a cost reduction measure, the customer requested that the stock width be reduced by two inches, making it necessary to eliminate the middle stretch carrier.

If Precise Engineering had designed the die based on experience, President Pat Quinlan estimates that it would have cost $18,000 to overcome the inevitable thinning problems during startup. Instead the company's engineers simulated the drawing and forming process until they perfected the die for a total cost of $3,600.

Deep draw creates thinning risk

The part is challenging to produce because the combination of a deep draw and a tight material allowance makes it difficult to absorb the stretch during the drawing operation without thinning. Precise Engineering engineers originally set out to carry the parts two across with three stretch carriers. The

original strip provided to the customer for approval had a stock width of 27 inches and a pitch of 12.1 inches. The customer asked Precise Engineering to reduce stock width to 25 inches to comply with the quoted material usage that the customer had submitted to the original equipment manufacturer.

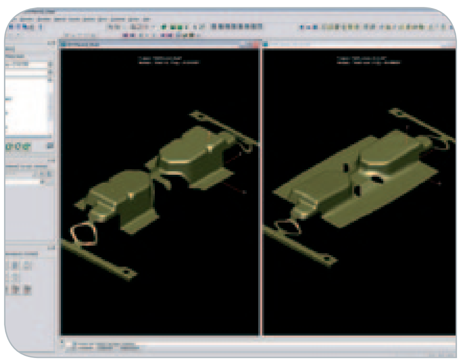
The only way to accomplish this reduction in stock width was to remove the inside stretch carrier that had previously been between the two parts. The challenge was to produce a successful draw without the luxury of this stretch carrier and without exceeding the 20% thinning allowance. The depth of the draw makes it necessary to provide a pad on the blank to hold the material during the drawing operation. The stretch carriers are created by a trimming operation that precedes drawing and creates a weaker area that allows the blank to pull in, compensating for the stress of the drawing operation, and avoids damage to more critical areas. Then the stretch carriers are trimmed off in a later operation.

Replacing intuition with computer simulation

To address this type of problem most die designers design the die using intuition and experience. On a complicated 12-station progressive die with the issues that were involved here, the initial design would have been almost certain to fail because of thinning. Knowing where the parts were too thin would provide only limited assistance to the designers as they made changes to the die design. After they created the new design, the existing die would have to be sent to the machine shop for repairs and then tried out again on a stamping press, substantially driving up the cost of the die.

Developing a virtual reality progressive die

Precise Engineering die designers began by developing the initial die configuration using VISI die design software. They created the forms in the process one by one in order to formalize the layout of the strip. Engineers then exported the strip geometry to an IGES file which was imported into PAM-STAMP 2G. Gary Wysocki , Engineering Manager and Simulation Expert for Precise Engineering, then simulated the first drawing operation in order to determine exactly how much of the forming process could be accomplished in the first hit without excessive thinning. He performed a series of iterations in which he changed the drawing depth, pressure on the binder, percentage of standoff, and other controllable parameters. He even tried forming the part into a cavity as an alternative to drawing but discovered that it was impossible to control the material, resulting in wrinkling.



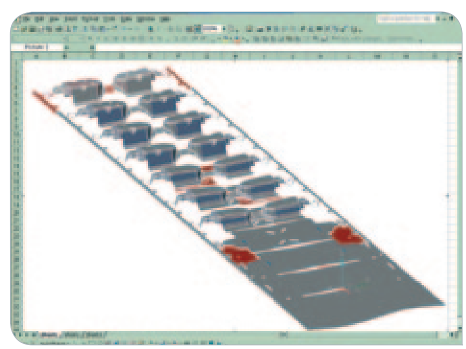
Cross-section of virtual die during forming simulation

Even simulation iterations such as this one in which the proposed design failed, helped by providing diagnostic information that helped move more quickly to an optimized design. When he found that he had difficulty achieving the required draw depth, he changed the geometry of the blank to provide several slots which provided a bit of extra stretch that turned out to be just what was needed to finish the part.

The next step was simulating the second and third stations where retrim operations were performed. At this stage the positioning of the legs of the bracket is critical as the legs are subject to relatively tight tolerances. For each iteration of the retrim station, he simulated the entire strip to determine how the retrim design affected the geometry of the finished part. It turned out that his ability to use simulation to maximize the depth of the initial drawing operation made it possible to use forming operation instead of drawing at the fourth station.

Simulation reduces time and expensive of die startup

"The simulation pointed us in the right direction and help us determine the drawing depth, pad pressure, how much to retrim, and where to place the slots to achieve the right amount of stretch," said Gary Wysocki, *"The next step was building the die and evaluating its performance on a real press. The very first iteration of the die worked perfectly."*



Progressivedie strip developed with information provided by PAM-STAMP 2G

To find out more about ESI's solutions for Metal Forming Solutions, please visit : www.esi-group.com/metal-forming

ABOUT PRECISE ENGINEERING

Precise Engineering was founded in 1989. For 18 years, Precise Engineering was a leader in the Tool and Die Industry. Realizing the importance of global integration, Precise Engineering began developing a strong offshore supplier base almost 10 years ago. For the past 3 years, Precise Engineering has dedicated all of our efforts into providing our customers with unsurpassed quality, on time delivery, and globally competitive prices. For further information,visit www.precise-engineering.com

ABOUT ESI GROUP

ESI is a pioneer and world-leading provider in virtual prototyping that takes into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs over 750 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit www.esi-group.com.

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**