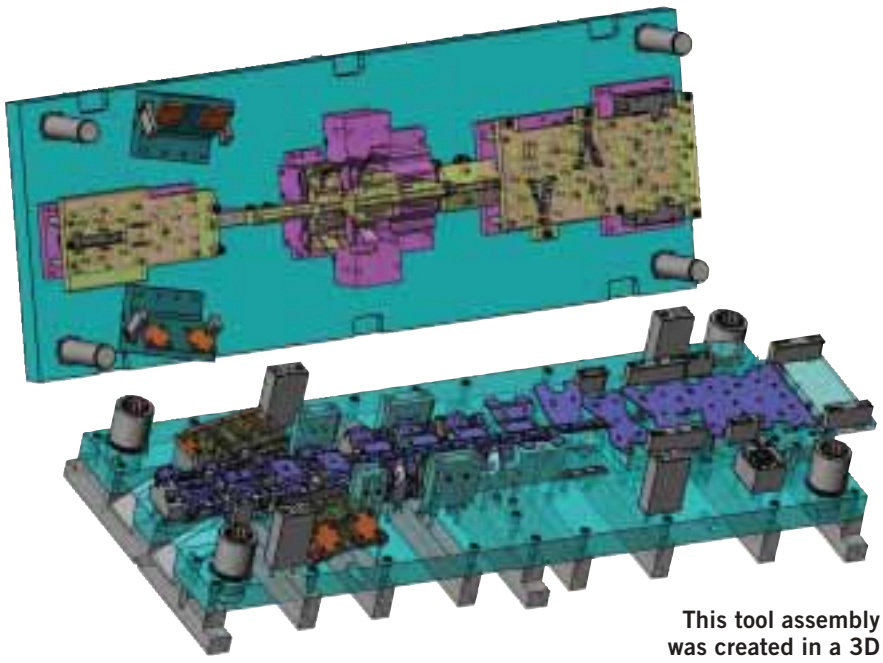
Die Design Goes Full Bore into Another Dimension

The growing use of 3D die design has resulted in highly accurate tooling delivered on a timely basis without excessive and costly tryouts or time-consuming redrafts.

BY RAYMOND J. PROEBER



This tool assembly was created in a 3D die-design package by Accurate Die Design for Reich Tool & Design for its customer, Tier Two automotive supplier ODM Tool and Manufacturing. Three-dimensional design allows designers and customers to see the die as if it were already built, and greatly eases the design review process, an arduous and often mistake-prone exercise when undertaken with 2D prints, according to the author.

3D die-design software hit the market a few years ago with relatively little fanfare. Why? It was new, expensive, difficult to use and designed only for very expensive CAD systems. Now, while still more expensive than its 2D cousin, 3D die design is within reach of even the smallest companies.

2D to 3D—What to Expect

Some people say that designing is faster in 3D than in 2D. I have heard that it cuts design time in half. That has not been proven to me, but I'm not going to say it's not possible, especially if the dies to be designed are similar or have consistent and similar features.

Speed depends on a number of factors. Here's one: Do the parts resulting from these die designs have 2D linear bends, i.e bent parts, or are they stamped parts that require 3D machining of die components?

For bent parts, 3D design is quicker and that gap is widening due to progressive-die-design packages that automate strip creation to a high degree. These packages also simplify the process of making changes to the strip. Another benefit: a designer working with a fully parametric system such as SolidWorks can create drawings easily, and the drawings update as the model changes.

With stamped parts, speed depends on additional facts. The vast majority of people that I ask say that 3D design of a stamped part, when compared to 2D design, takes a bit longer, but that this time is well spent. Two-dimensional design invites many more mistakes that can cost time and money during die tryout and debugging. That burns up much more time and money than

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what's spent upfront during 3D design.

Also consider that upon completion of a die design for a stamped part, the modeling and any surfacing required to machine the die components are completed—significant time savers. I have modeled parts for customers after they have given me their 2D design, and had to tell them that their part will not be the same size as was indicated in the 2D drawing. Such occurrences are more common than not.

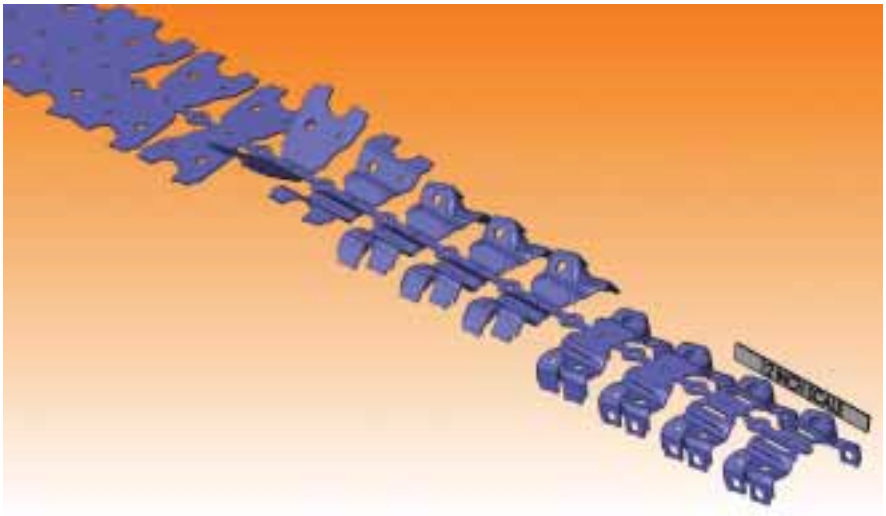
Performance Improving as Computers Catch Up

When switching from 2D to 3D, don't skimp on computer hardware, as that directly affects how a 3D-design program performs. While I can't speak to all CAD packages, in the case of SolidWorks, performance increases recently demonstrated, and set to debut in a few months, are monumental. But we still may be at least two years away from commonly available computers offering the speed needed to eliminate slowdowns in 3D design. Though, as yet, it's not possible to have a computer that is fast enough for 3D design, work within your budget to invest in the fastest available hardware. And work with your reseller to make sure that the hardware you buy matches your software needs.

Take advantage of vendor-supplied training, too, as training holds the key to 3D-design success. Though the learning curve has flattened with some 3D packages, it still is much steeper than the 2D-design curve. Training provided by the software vendor to the designer's particular software is invaluable, and as with the hardware, pays for itself within months.

Making the Switch—A Case Study

We at Accurate Die Design are switching from 2D to 3D design. A couple of years ago I designed a large transfer die as well as a large progressive die for an automotive client. I designed these dies in SolidWorks without any third-party die-design-specific package. After finishing the second die, I realized that it wasn't practical for our company to design dies in 3D until a third-party package specifically made for designing progressive dies came along.



Here's a strip assembly as captured in 3D progressive-die-design software. In preparing the tool design for Reich's customer, Accurate Die Design had to incorporate a number of changes to the strip assembly in less than a day. One change called for rotating the part 10 deg. in the strip from its original orientation. Making the changes took a few hours, longer than might be the case with 2D design, but that time is made up down the line when a more accurate die design is delivered, simplifying the tool-building and die-tryout portions of the project.

Today, two packages specifically created for SolidWorks are available for progressive-die design, and our company recently was named the United States Technical Center for Logopress3, one of those packages.

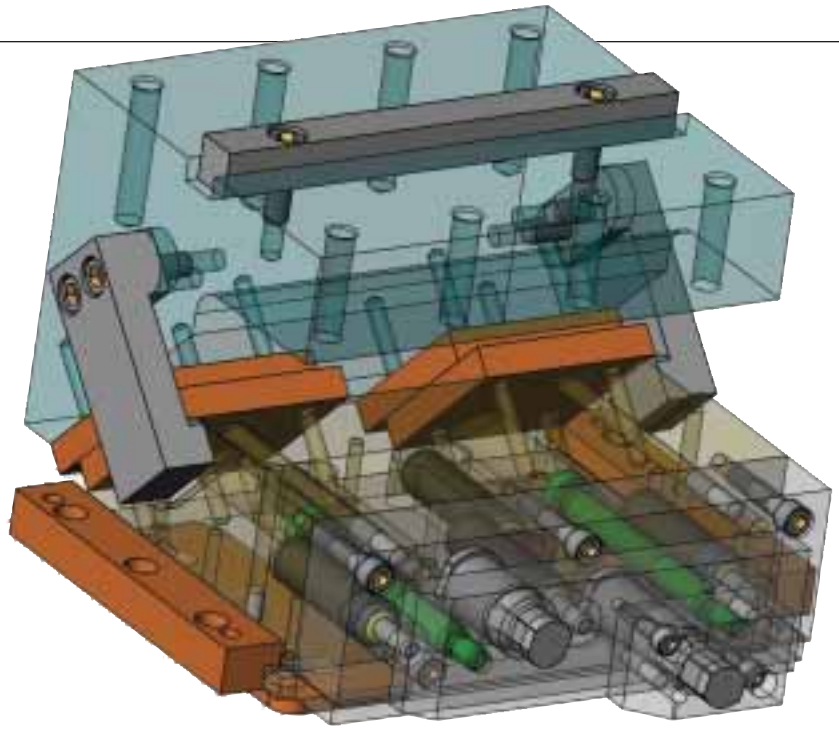
I have been a Certified SolidWorks Professional for a couple of years and besides myself, one other employee performs 3D design exclusively. Once he is up to speed we will switch over the third employee from 2D to 3D. We're phasing in 3D design as it's impractical to flip a switch and change over an entire design staff overnight.

How to Create in 3D

The first step in creating a 3D design is determining the usability of the imported model. With a bent part, in most cases the imported model is all you need. But with a stamped part, sometimes the part must be recreated using the original as a guide.

Another important initial step when designing a die for a stamped part is to run the part through formability-analysis software to predict problems in forming the part. This step automatically provides a flat blank, saving several trips in and out of the press during die development. Ideally, perform analysis at the estimating stage, as this often is the one thing most responsible for ensuring profitability on the die build and also on production, due to material usage. This step is considered so important that most 3D die-design software packages offer some form of integrated formability-analysis software. We have really been missing the boat on this one in the United States, as formability-analysis software sells at a more rapid pace in Asia than here.

The next step involves creating the strip. This is where 3D die-design software really starts to shine because the strip comes to life and it looks exactly as it will appear coming out of the finished die. This makes a great visual aid for others in your company and for your customer. A solid model of the strip at this stage goes a long way in minimizing or eliminating design changes that normally would occur downstream when designing in 2D. (See sidebar for a dis-



This cam assembly, used to pierce holes, forms a section of the die supplied to Reich Tool and Design by Accurate Die Design. The assembly had been used in a previous 3D design, so the designer was able to

cussion of eDrawings, a tool that allows simple visual sharing of CAD files.)

As you move on to the actual die design, undertake multiple design reviews, particularly in the early stages. During this part of the process, it is easier to delete lines and circles in 2D than it is to change 3D models. But as the design matures, changing the 3D design becomes easier because the section views update automatically, whereas if you have already created the section views in 2D, changes become much more time-consuming. Section views in 3D are always correct in relation to the plan views. You may shudder at the thought of more design reviews, but remember, in 3D we're not talking about sifting through stacks of 2D drawings. All you need to do is rotate and manipulate a 3D model of the die. Such reviews occur quickly and provide confidence that reviewers saw and understood the design. It cannot be stressed enough how easy design reviews are when using a projector and a laptop. You also gain identical benefits by conducting a design review over the Internet. This simple process allows for improved communication compared to paper drawings, although you still may wish to plot a few drawings for referencing actual sizes and thicknesses.

Improved Viewing, Changing Communication

The illustrations included in this article are of an 80-in.-long, 13-station progressive die we modeled in SolidWorks along with Logopress3 die-design software. The die is being built by Reich Tool & Design Inc., Menomonee Falls, WI, for use by ODM Tool & Manufacturing, McCook, IL, a Tier Two supplier of automotive stamped components.

These illustrations, screen captures from our 3D design package, allow designers and customers to see the die as if it were already built. This is one of the most significant benefits of 3D design. With a 2D design, you'd see only lines, circles and arcs. Even experienced personnel can't be completely accurate in transferring the design from 2D to finished product in their minds and can miss clearance issues, feeding issues, etc.

The following shows how helpful 3D design can be when dealing with challenges often faced by die designers.

We began designing this die only a week or two before METALFORM'05 this past March. Since we were exhibiting at the show, we wanted to get a good jump on this design beforehand. We no sooner had the strip approved and made a good start on the project when it was placed on hold due to a pending engineering change. It was released a couple of days before the show started, and what had been a one-

Simplified CAD Sharing

When designing in 3D, you can create 2D views and section views quickly and then send them to your customer via e-mail. Greatly simplifying the process is eDrawings, a free viewer and markup tool from SolidWorks, available for download at www.solidworks.com. eDrawings files supply accurate representations of 3D models and 2D drawings created with the most widely used CAD systems on the market. The product offers capabilities such as point-and-click animations that make it simple for anyone with a PC, even those who don't own a CAD program, to interpret and understand 2D and 3D design data. To protect against information theft, eDrawings hides proprietary data while retaining external graphical details as well as dimensions and mass properties of the CAD model. It can be sent with a built-in viewer in a self-extracting e-mail. To view, the receiver needs only to double-click on the attachment. It allows users to add markups to a model and send it back and forth with each party continuing the threaded markup just as might occur in a regular e-mail.

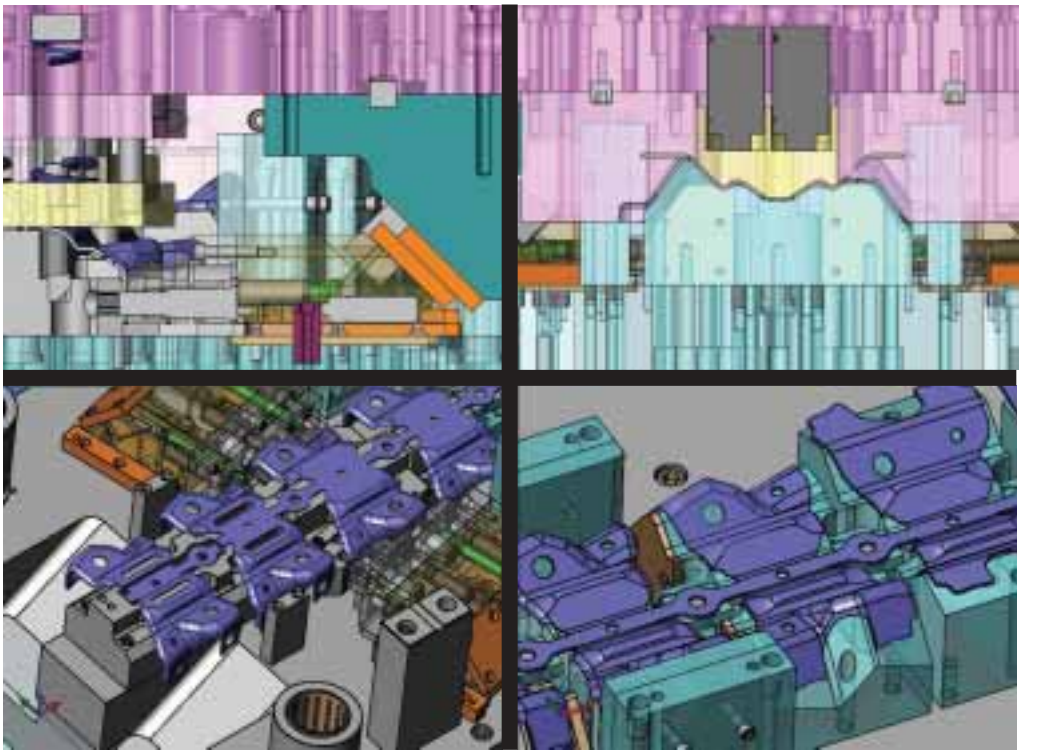
out die now was a two-out die with major changes in the model. We requoted the design and modeled the new strip layout in time to present it to our customer before leaving for the show. I received a call at home from Dennis Kopatich of Reich Tool and Design on the Friday night before the show. Since Reich also was exhibiting, we had to square this away before leaving.

Kopatich had a few minor changes to the strip layout. Of course, minor is a relative term. The last change: Rotate the part 10 deg. in the strip from its original orientation. That one involved hours of work since this was a stamped part. In the case of a bent part, a change like this can be made in just a few minutes.

"By the way," he said, "my customer would like it completed Monday morning because its customer is coming in Tuesday morning to review the design."

After spending a couple hours that night and a couple hours Saturday morning, I made the strip changes and e-mailed the work back to him. Note that changes to the strip layout on a stamped part may take longer in 3D than in 2D, but as the strip layout forms the foundation for the rest of the die in 3D design, much more is changed than if producing only a new 2D strip layout. As mentioned earlier, accurately updating the entire strip in 3D for a bent part only requires a few minutes.

Overall, creating the strip layout in 3D allowed for accurate changes and paves the way for a simpler and less costly—in time and money—die design,



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