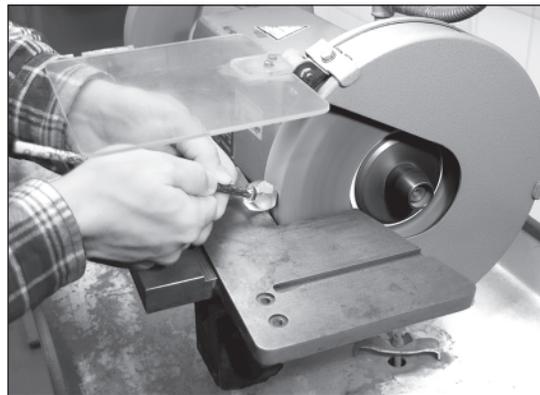


The most important aspect of grinding and sawing is safety, for both you and the stone. These machines can be dangerous and destructive if used improperly. Simple grinding and sawing safety tips include:

- If at all possible, do not hold the gem material directly in your hand. Consider dopping the rough temporarily to a piece of wooden dowel, such as that used by cabochon cutters (Figure 8-2).
- In order to avoid overheating and potential damage to the stone and machine, make sure that you are using the correct type and amount of lubricant.
- Wear safety glasses and avoid loose clothing that can become entangled.
- Consult the manufacturers instructions and / or your local expert before switching on.

Finally, you should keep in mind that these crude pre-forming devices are exactly that: crude. You should always stop well before the stone reaches its final shape and size. This will give a safety margin to allow removal of any subsurface damage while bringing the gem to its proper final outline on the faceting machine.

Figure 8-2 A grinding wheel (shown) or trim saw (Figure 4-29) may be an excellent choice for pre-forming. Note the safety precautions: a shield to protect the face and a dowel rod (here a pencil) to protect the hands.



8.3.2 Facet-Machine Pre-Forming

For modest-sized gems or expensive material, you already have all the equipment you need for pre-forming: just dop up the rough and get going with a coarse lap on your faceting machine.

There are two main approaches to facet-machine pre-forming: free-wheeling and standard cutting.

Free-Wheel Pre-Forming

Some authors recommend “free-wheeling” for pre-forming. This essentially involves disengaging the index wheel and freely rotating the stone against the coarse lap. The result is a cone (or series of cones) approximating the pavilion, and a cylindrical form for the girdle (Figure 8-3).

Although it is quick and easy, I do not use the free-wheel pre-form technique for a variety of reasons. First, and most obviously, free-wheeling will not work on non-round gem designs –

you can hardly free-wheel an emerald pre-form. Also, even so-called “round” designs are not really round. A cone or cylinder may not be a good approximation, leading to lost yield or extra effort at the next stage (see “Cone Loss” below for more on this). Finally, going through the process of roughing in a couple of facet tiers using conventional cutting techniques and a coarse lap forces you to become familiar with the piece of rough and the sequence of initial, critical cuts.

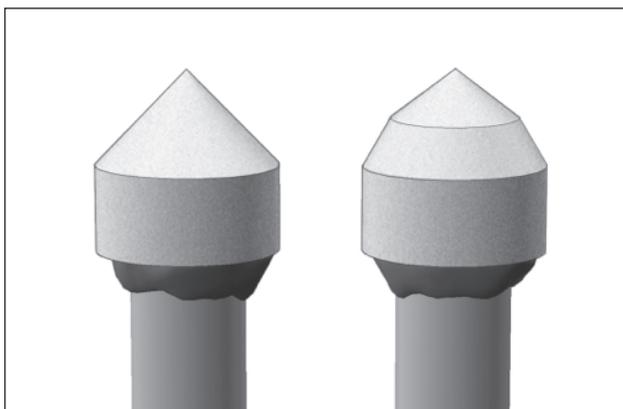


Figure 8-3 Free-wheel pre-forms. Choosing several cutting angles (right image) may allow a closer approximation to the final gemstone.

Pre-Forming by Cutting

Here is where the procedures of pre-forming and facet cutting merge. The “standard cutting” approach to pre-forming involves cutting some of the gem facets in the usual way on a coarse lap. This usually means working directly from the initial cuts of the gem design, such as the main and girdle facets. Clearly, it makes no sense to rough in the gem shape using the finer details, and meet points should serve only as approximate guideposts.

Chapter 5.5.3 provides a detailed tutorial for pre-forming in this way. The advanced techniques explained in Chapter 17 for establishing the gem outline may also help at the pre-form stage.

A final word of (oft repeated) caution: although considerably more refined than a grindstone or rock saw, the coarser laps – say, grit 260 and lower – can cut surprisingly aggressively on a faceting machine. They also can create every bit as much subsurface damage as a grinding wheel or saw blade. As always, you should halt the pre-form process well before you reach the final gem shape and size.

Cone Loss

Free-wheel pre-forming implicitly assumes that gemstones look more or less like cones – or perhaps more accurately, a couple of cones stuck base-to-base (Figure 8-4). Yes, truncating the crown-side cone certainly improves things, but how good is this assumption?

Clearly, this question translates directly to the issue of whether free-wheel pre-forming is wasteful of gem rough. In other words, if you execute a conical pre-form, do you end up with a smaller gemstone than you otherwise would?

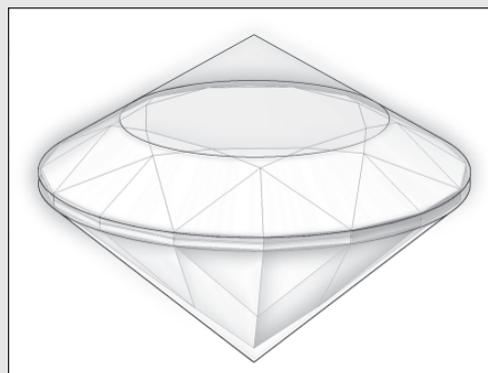


Figure 8-4 Free-wheel pre-forming assumes that the gemstone resembles a pair of cones.

I think that the answer is yes, and here's why. If you grind away gem rough until a perfect cone emerges, then clearly the final gemstone must fit inside that cone. Put more mathematically, the cone must *circumscribe* the eventual gem.

One way to measure how well the gem fits inside the cone is to compare the volume of the cone to that of the pavilion (Figure 8-5). Simple mathematics and the volume calculation of GemCAD make this comparison fairly straightforward (see Chapter 15.3.1 for more on GemCAD).

For a standard round brilliant with classical angles, the pavilion fills approximately 90% of the volume of the cone. Pretty good, I suppose, but then again, with sixteen sides, an SRB is very close to a circular shape. For a gem with fewer girdle facets – for example, GeM101 from Chapter 5 – the fit will be considerably worse. In fact, for this hexagonal design, the pavilion occupies less than 80% of its cone. This means that if you free-wheel pre-form GeM101, you will still have to cut away about a quarter of the remaining gem material to make the pavilion (Figure 8-5).

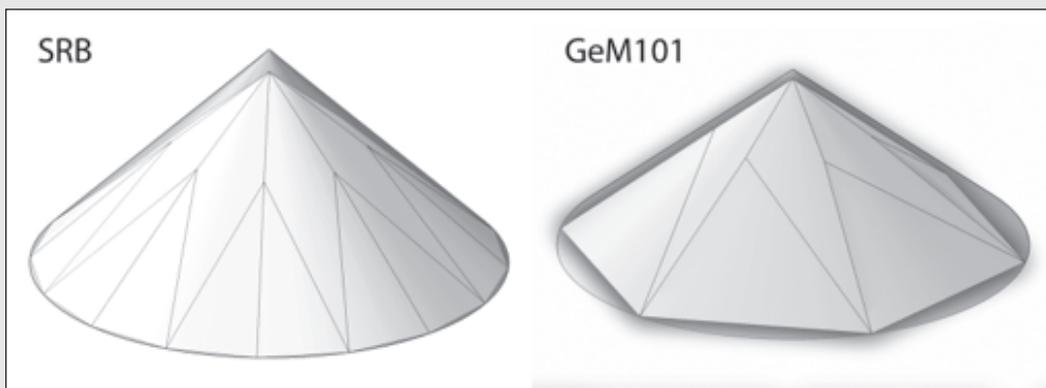


Figure 8-5 The final gemstone must fit inside the pre-formed cone. Comparing the volume of the pavilion to the volume of the circumscribing cone gives a measure of how good a match this type of pre-form actually is. An SRB (left) is a better match than a hexagon (right).

Free-wheelers may argue at this point that life is tough, and that you would have had to cut away that material anyway. Not so. In fact, I always try to match projections and divots in the rough to the rotation of the gem design in order to maximize yield. A cone has no preferential rotation. Figure 5-25 shows an example where a more thoughtful choice of orientation – in other words, not immediately grinding a cone – leads to an improvement in yield of about 50%. Chapter 17.3.3 takes this strategy one step further.

Perhaps an extreme example will make it even clearer. Imagine that you are cutting GeM101 and have a more or less hexagonal piece of rough, in other words, a pretty good match to the gem outline. Would you free-wheel pre-form a cone and then begin cutting another hexagon? Of course not. Needless to say, not every piece of gem rough matches the design right out of the ground, although hexagonal crystals are fairly common (see Chapter 12.10). In any case, you should be guided by the raw stone in selecting both the gem design and rough orientation. It makes no sense to throw away half that guidance – and significant gem rough – by always pre-forming a cone.