COMPUTER GENERATED CUTTING DIAGRAMS

--making use of the "ALPHABET SOUP" and planning the use of your rough.

The source of this information was an article on the subject in the Columbia-Willamette Guild's Newsletter. It was written by Grover Sparkman, and we thank him for his permission to use this edited version.

The development of computer-generated faceting designs has brought a revolution to the presentation of cutting diagrams. Computerized techniques have given designers great advantages, and for the faceter who uses them, computer-generated designs include much more information than it was practical to obtain in pre-computer times. Since it just wasn't available previously, there's a tendency for the faceter to skip looking at the new information--but it is very valuable, easy to use, and attention paid to it will be rewarding. It will help you get the most from your gem rough.

The information that appears after the cutting instruction is made up of letters and ratios (like: L/W=1.3--it was Bob Strickland, who developed the program "GemCad", who called all those letters "**Alphabet Soup**"). Well, it may look like Alphabet Soup--but the information is meaningful, and useful for the faceter. To effectively use the information takes a little understanding--and that's what we offer here. Don't be intimidated--it's logical, and the arithmetic is simple.

Each letter (L, W, V, etc.) represents a characteristic of the stone (a dimensional characteristic, such as "L" representing "length" , or "W" representing "width", or a physical characteristic, such as "V" representing "volume"). The designation "L/W" indicates a ratio between L and W (L/W is another way of writing L÷W. If in the design, L(length) is 10mm and the W(width) is 5mm, then L/W=2).

See the dimension lines in the diagram. These dimension lines will always be parallel to the edges of the paper. Each dimension line has an identifying letter--they are:

L = Length, and **W** = Width -- On stones other than rounds and squares (for which L/W always equals 1) the length L will always begreater than width W, so the ratio L/W is always greater than 1. GemCad automatically picks the larger dimension for L.

P = Pavilion height -- P is measured from the highest point on the pavilion, at the girdle, to the tip of the culet.

C = Crown height -- C` is measured from the table down to the lowest point on the crown facet, at the girdle.

T = Table dimension -- GemCad picks the larger of the two table dimensions and calls it T.

H = Height -- The total overall, Table to Culet

USING THE INFORMATION. The main use of all the ratio information is that it allows you to plan the use of your gem rough--to know with reasonable accuracy what would be the largest stone of any particular design that your rough material will yield. To show how it works, it's easiest to use an example, and for that purpose let's use the "Lucky Stars Pear" design on the next page, and, an "imagined" piece of gem rough.

In a diagram you will see a series of ratios (they work as formulas for your later calculations). In the "Lucky Stars Pear" design, the first ratio shown is the L/W = 1.334--and after that there are a number of other ratios shown. You can use those ratios to determine the largest "Lucky Star Pear" that you can get out of your particular piece of rough. And after you calculate that, you can use the Volume formula to estimate the gem's final weight.

Working first with the dimensional ratios -- use a millimeter caliper to do some measuring. Let's say...

You measure the long direction on your rough and find it will allow a stone 10mm long. Do you have enough width to cut the design? The L/W ratio will tell you how much material you'll need:

L ÷ W = 1.334 (substituting the measured 10 for L, we get...)
10 ÷ W = 1.334 (a simple formula to solve...as follows...) 10 = 1.334 X W
10 ÷ 1.334 = W W = 7.496, or more practically, W = 7.5.

Well, now measure the available width--is there enough material to get the 7.5mm? Yes? OK. No? Well, how much material do you have? Let's say you see that the maximum width is 6.5mm. Let's revisit the L/W ratio formula to determine the length you will get for a width of 6.5mm.

L ÷ W = 1.334 (substituting the 6.5 width...)
L ÷ 6.5 = 1.334 (and solving...)
L = 8.674, or more practically, L = 8.7

OK. So we've determined that we can get a stone that measures 8.7 long by 6.5 wide. Whoops--don't forget the height--we've got to look at that too (we live in a 3 dimensional world). the design tells us that the ratio H/W = .862. So, back to the formulas...

H ÷ W = .862
H ÷ 6.5 = .862
H = 5.6

Check the available material for the height with the calipers. Got enough? OK. It looks like you've got about 8mm? That means about 2.4mm will come off. Keep in mind, when you measure the Height direction of the rough, that you will lose some material before you attach the stone to the dop--when you grind the preliminary Table. You need to allow for that (on this particular design you need to be extra careful--the finished Table is very small (notice that T/L = 0.121, which, if you do the arithmetic will show the table on our 8.7mm long stone will be only 1mm--and you have to consider that you will need to grind away enough material to obtain a preliminary table that's wide enough to attach a flat dop; it doesn't mean you can't do the design if the rough has barely the 5.6mm depth, but it would take some dopping "inventiveness").

So, you see how the ratios are used. Here are some questions that arise--and some observations:

The rough in our example measured 10mm long, but only 6.5mm wide, which meant that the finished length became 8.7. To obtain a better yield, wouldn't it be better to use a design where L/W ratio is larger? The answer to that is yes, (but if we used a perfectly proportioned stone as our imagined example, it wouldn't have been as educational)--and anyhow, more often than not, you will start out wanting to cut some particular design.

In the first step of the example (determining the required width), expressing the ratio as L/W made the calculation a step or two longer than if it were given as W/L. Right--but L/W has become the custom--if you prefer using the W/L ratio, it's the reciprocal of the L/W (in the example W/L = .75 (W/L=1 ÷ 1.334).

The P/W or C/W ratio (the P/H or C/H as well), lets you calculate the dimensional position of the girdle from the top or bottom of the stone. That number can be used to mark the girdle position on the rough, as an aid during faceting.

An H/W ratio is given along with a formula. Here's what's going on--the overall height (H) is the sum of the Pavilion (P) + the Crown (C) + the Girdle (.02 of the Width)--GemCad assumes a girdle thickness of 2% of the width W. When you define the ratio H/W as (P + C + .02W)/W, it simplifies to: H/W=([P+C]/W)+0.02 (that's not much of a "simplification" in the common use of the word). Anyhow, it's worth mentioning since that formula appears on the page (perhaps just to remind you of the .02W Girdle thickness factor).

Now, if you want to estimate the carat weight of the finished stone, the Alphabet Soup provides a value given that makes this possible-- $V/W^3=0.355$ (actually, shown on the diagram as Vol./W^3=0.355). The formula to get carat weight uses that value, as shown below:

Carat weight=$V \times W^3 \times d \times 5$

Where V = volume factor from the diagram, that is, 0.355
W = width measured in centimeters cm
d = density (specific gravity) of material in grams/cc
5 is a constant that converts the answer from grams to carats.

Using our example for "Lucky Star Pear". Let's say our material is Amethyst. Here's a list of values that are used for the formula:

for V, substitute 0.355 (given in the diagram)

for W in the formula, we know that W=6.5mm. We need to convert that to cm, by dividing the mm by 10, that is, 6.5 ÷ 10 = .65 .

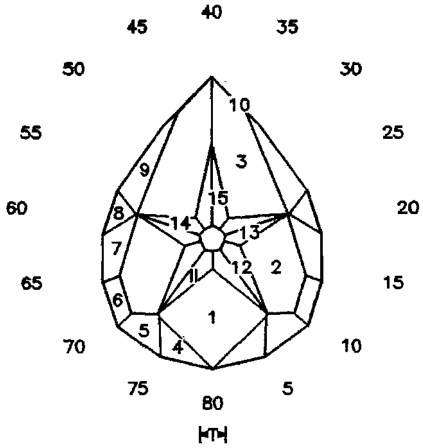
for d, the specific gravity of quartz is 2.66 g/cc. (you can look that up on the chart in Appendix 2.

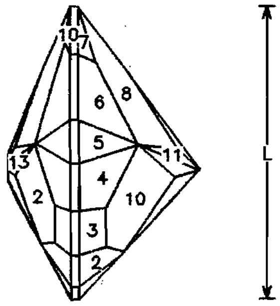
Entering these values into the formula:

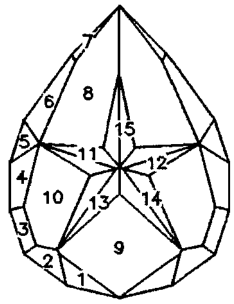
Weight=$0.355 \times 0.65^3 \times 2.66 \times 5 = 1.3$ carats.

Keep in mind that the volume factor used reflects GemCad's assuming a girdle thickness of 2%. A thicker girdle will make for a heavier stone (and larger volume factor).

Well, hopefully, that serves as an explanation of the "Alphabet Soup" of the computer designs. Certainly, planning the use of your rough--using the dimensional ratios--beats starting to work on a stone because the rough "sort of" looks OK--and then modifying sizes as the work proceeds. We've all done that--well, we all used to do that.

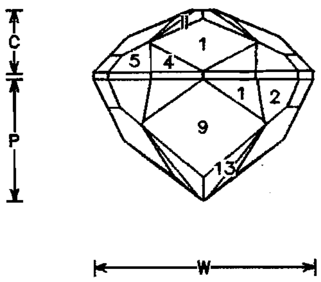






"LUCKY STARS" PEAR

By - Ralph Mathewson



Briteness Av.59.6%, ISO 78.1%   10 Tilt 59.5%-74
Angles for R.I. = 1.54
59 facets + 14 facets on girdle = 73
1-fold, mirror-image symmetry
80 index
L/W = 1.334 T/W = 0.119 T/L = 0.089
P/W = 0.558 C/W = 0.288
H/W = (P+C)/W+0.02 = 0.866
P/H = 0.644 C/H = 0.333
Vol./W^3 = 0.368

PAVILION

	90.00	50
	90.00	30
	90.00	52
	90.00	28
	90.00	56
	90.00	24
	90.00	60
	90.00	20
	90.00	64
	90.00	16
	90.00	08
	90.00	72
	90.00	03-77
1	55.30	03-77
2	63.00	08-72
3	63.00	16-64
4	64.00	20-60
5	70.00	24-56
6	66.40	28-52
7	65.00	30-50
8	43.50	32-48
9	43.50	80
10	43.50	16-64
11	41.00	31-49
12	41.00	17-63
13	41.20	01-79
14	41.20	15-65
15	41.20	33-47

CROWN

1	28.00	80
2	28.00	16-64
3	28.00	32-48
4	35.80	03-77
5	41.30	08-72
6	43.80	16-64
7	46.00	20-60
8	54.00	24-56
9	50.00	28-52
10	74.00	30-50
11	24.30	02-78
12	24.30	14-66
13	24.20	18-62
14	24.20	30-50
15	24.50	34-46
	0.00	Table