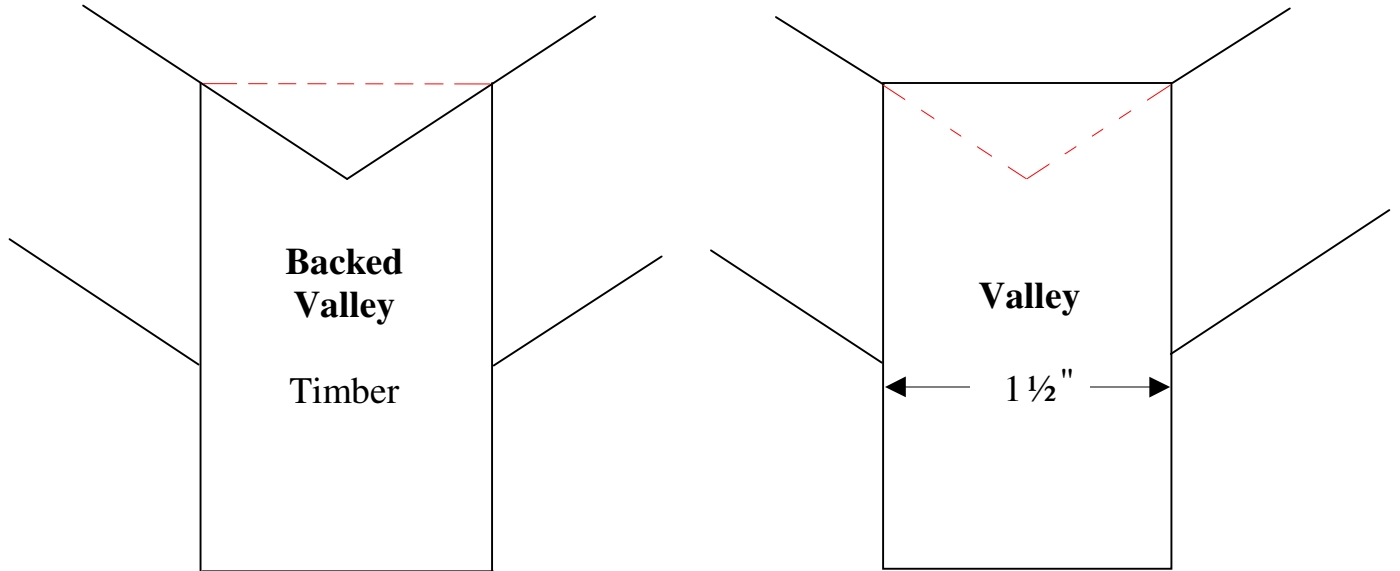


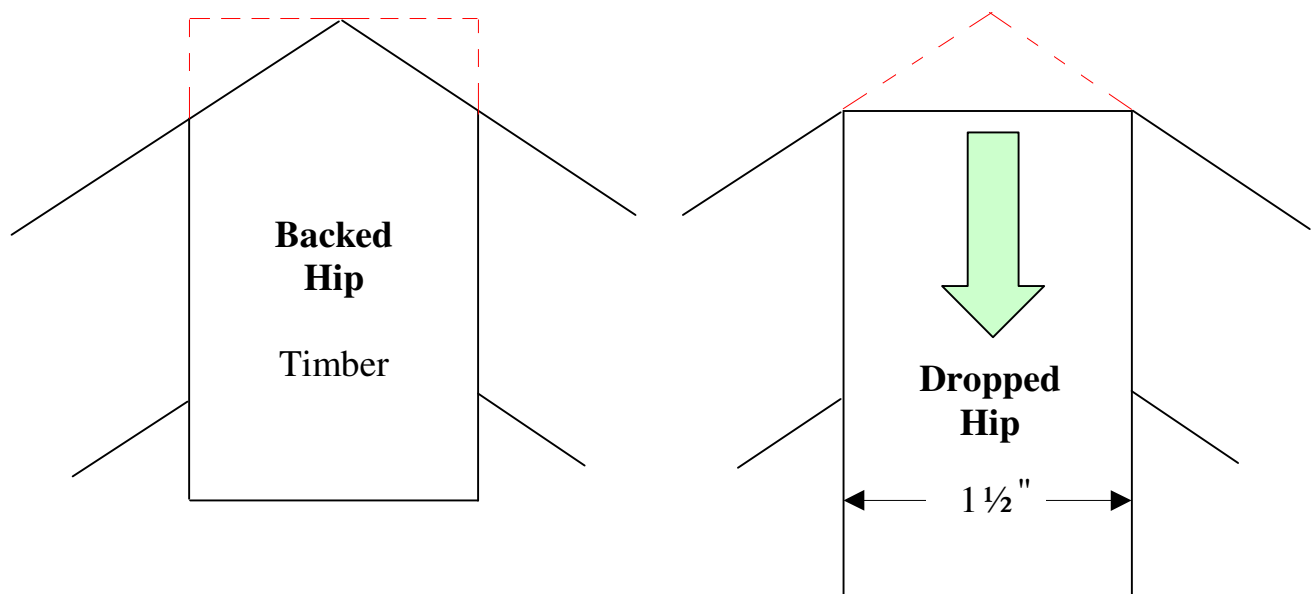
Valley Rafter Cross Sections

The projected point of intercept of the jack rafters lies **below** the Valley rafter shoulders. The jack rafters plane the same regardless of whether the Valley is backed or not.



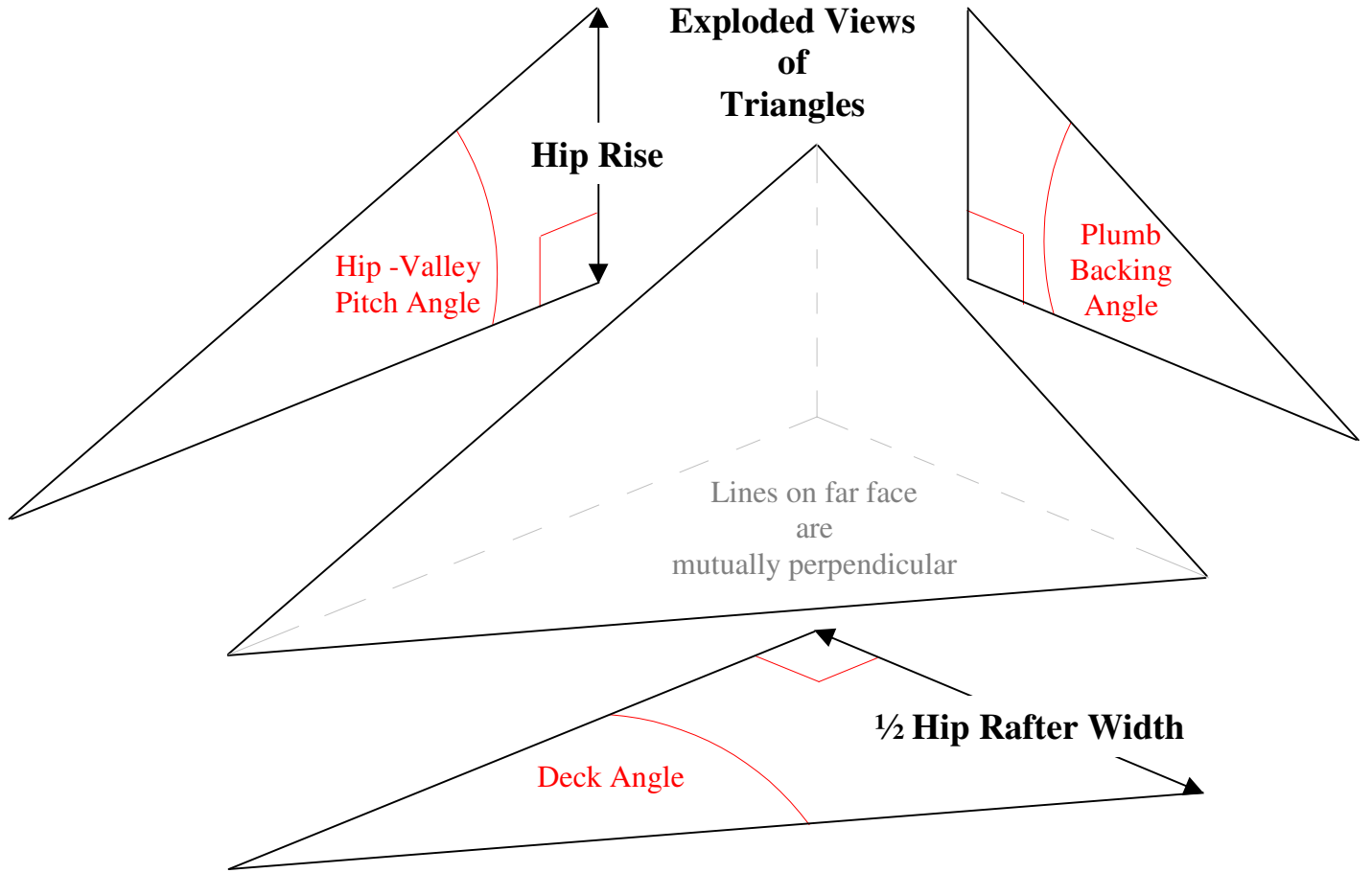
Hip Rafter Cross Sections

The projected point of intercept of the jack rafters lies **above** the Hip rafter shoulders. The Hip rafter position must change as shown in the sketch on the right in order for the jack rafters to intercept the shoulders.



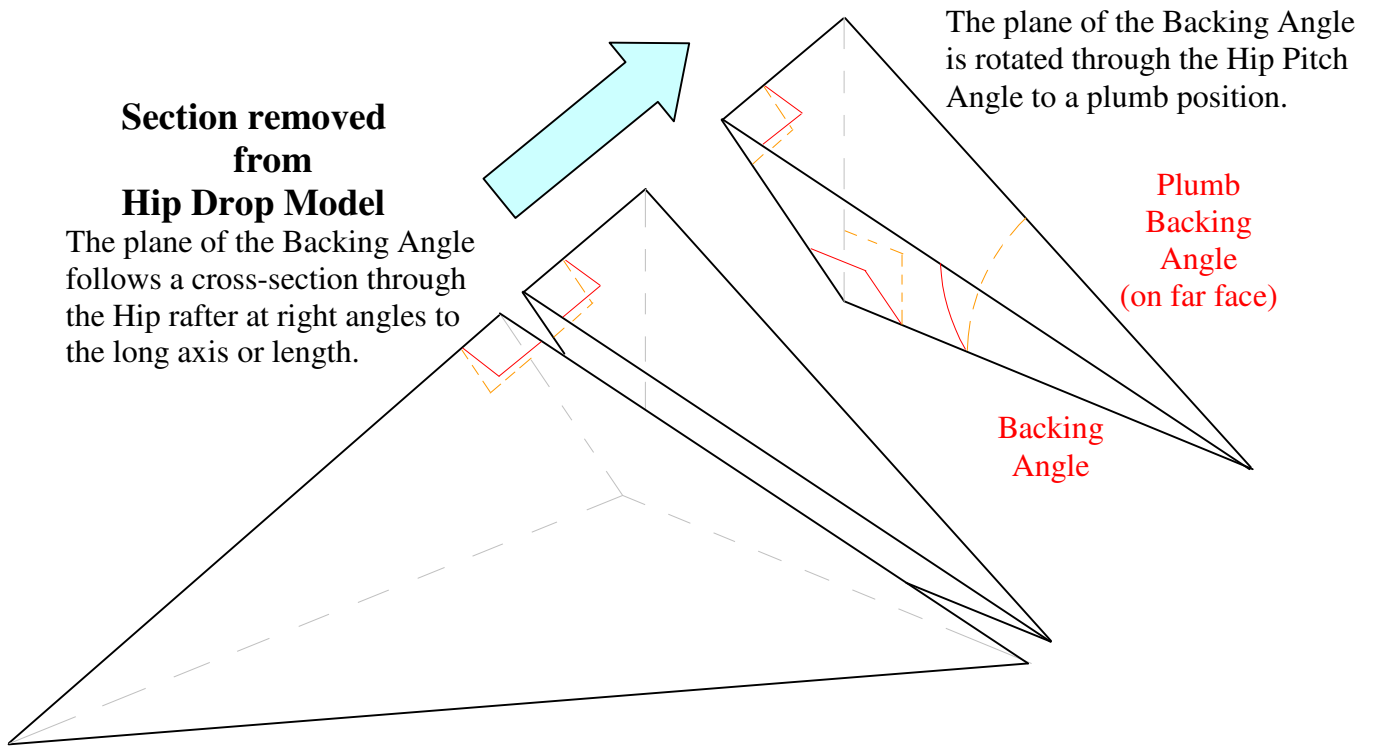
**Assembled Trigonometric Model
and**

**Exploded Views
of
Triangles**

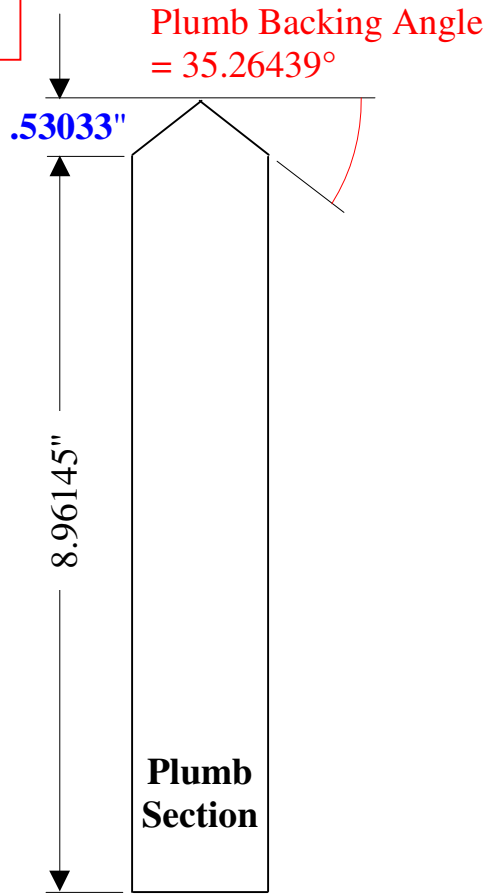
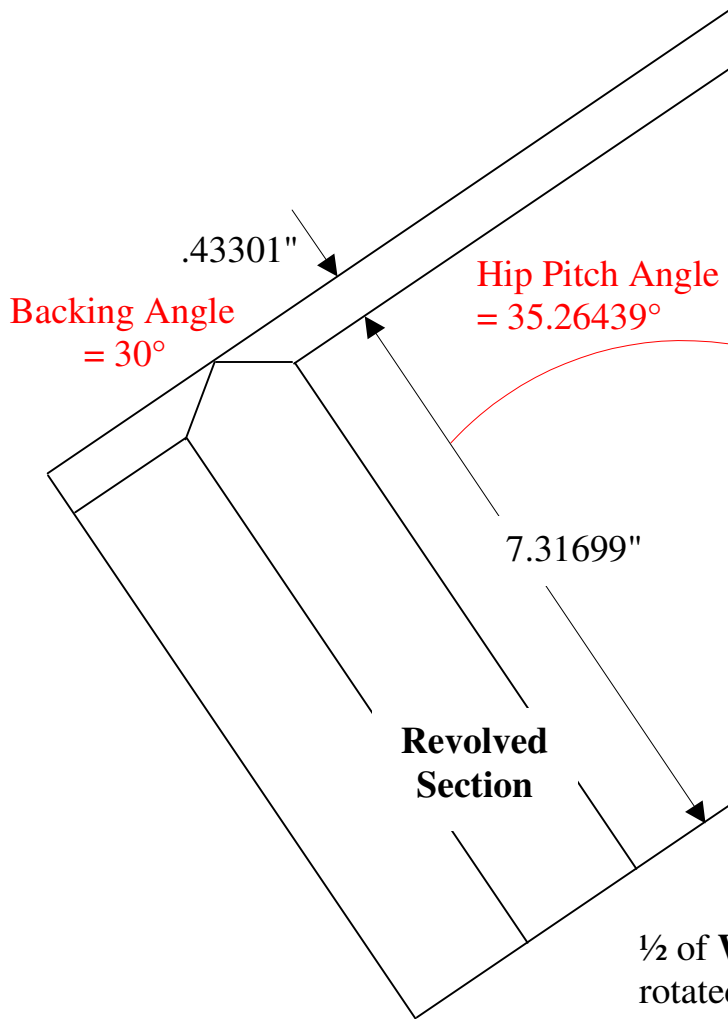


**Section removed
from
Hip Drop Model**

The plane of the Backing Angle follows a cross-section through the Hip rafter at right angles to the long axis or length.



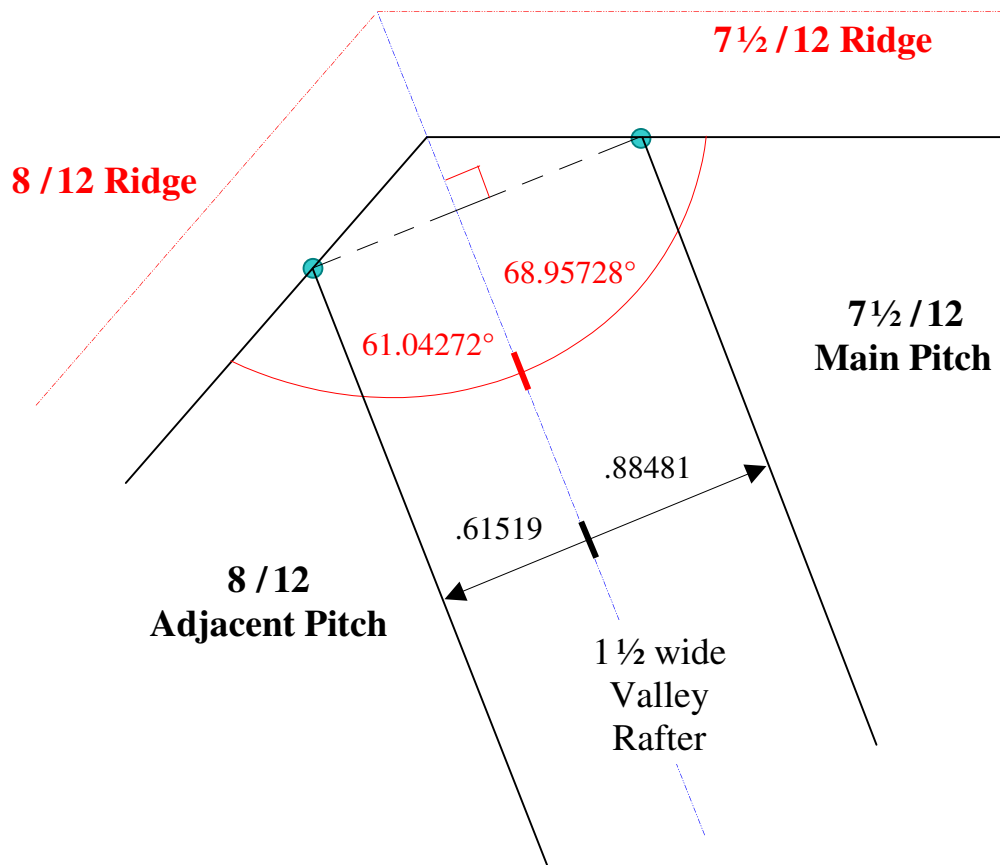
HIP RAFTER
12/12 Commons meet at 90°
Common Pitch Angles = 45°
Hip Pitch Angle = 35.26439°
Backing Angle = 30°
Plumb Backing Angle = 35.26439°
Hip Rafter Depth = 7.75"
Width = 1.5"
Depth along Plumb Cut = 9.49177"



½ of **Width** × tan **Backing Angle**, and rotated through **Hip Pitch Angle**:
.75" tan 30° = .43301"
.43301" ÷ cos 35.26439° = **.53033"**
Calculating directly from the **Plumb Backing Angle**:
.75" tan 35.26439° = **.53033"**

IRREGULAR VALLEY RAFTER PLAN

Total Angle between Ridges = 130°

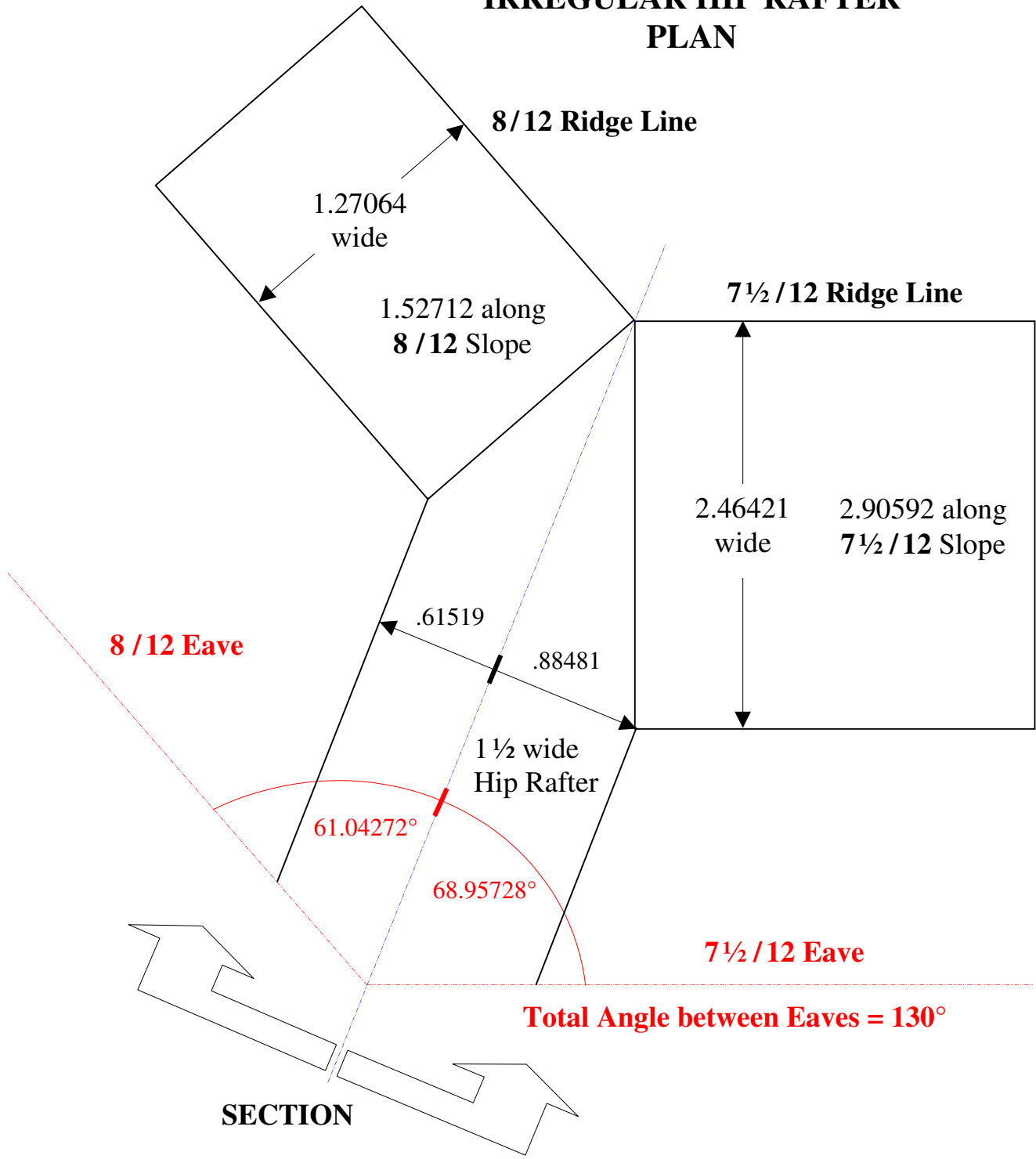


Cutting the trough as per the ratios in the drawing produces a Valley rafter with **equal plumb sides**.

The line of the Valley width, **intercepting the long axis of the Valley at right angles**, connects the working points as shown in the sketch. This facilitates cutting bird's-mouth and/or shoulders if the Valley meets a post.

Ridge beams of reasonably close widths can be created. The **ridge beams** can both be scaled to be of **equal depth** to plumb lines created on both sides of the Valley by the compound angle cuts at the Valley peak.

IRREGULAR HIP RAFTER PLAN



IRREGULAR HIP RAFTER: PLUMB SECTION

Main Pitch = 7 1/2 / 12 SIDE

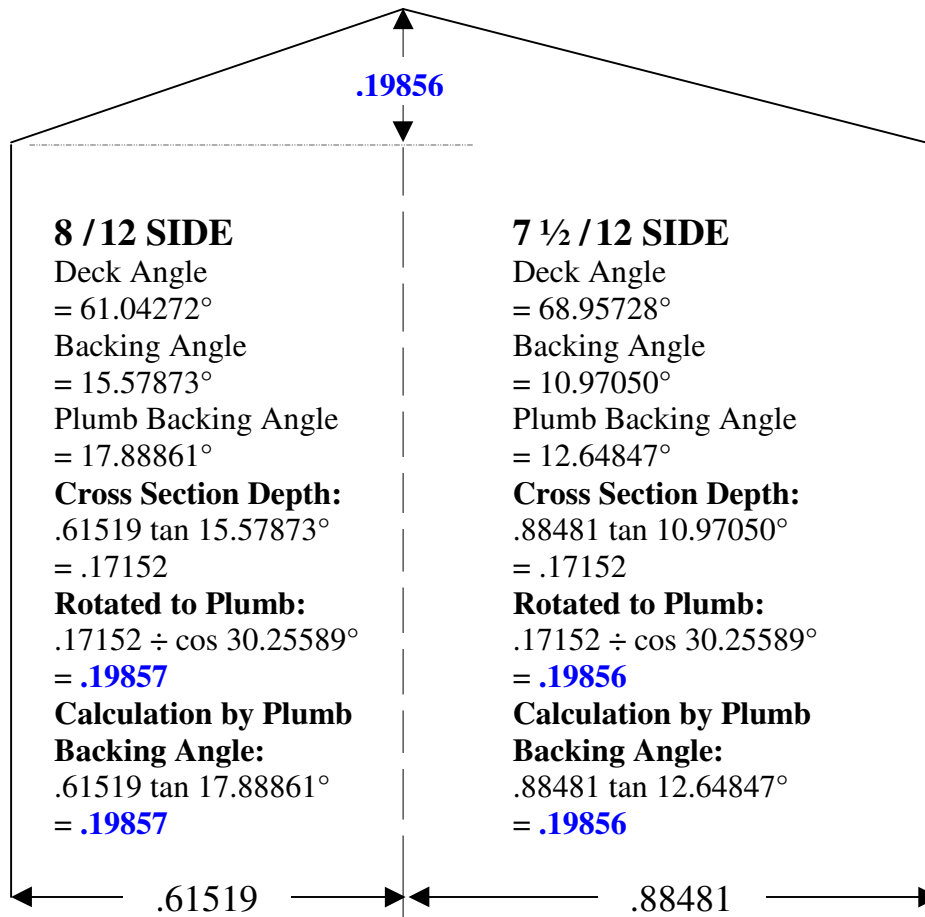
Main Pitch Angle = 32.00538°

Adjacent Pitch = 8 / 12 SIDE

Adjacent Pitch Angle = 33.69007°

Angle between Eaves in Plan = 130°

Hip Pitch Angle = 30.25589°



Overall Width = 1.5

Balanced Hip -Valley Rafters

Proportioning a Hip -Valley Rafter about the Ridge -Trough
to produce Sides of Equal Height

Irregular Pitches meet at a 90° Deck Angle

Example: Main or Major Span Pitch = 8/12

Adjacent or Minor Span Pitch = 5 ½ /12

If the denominators of the pitches are equal, the
Hip -Valley **Unit Width** ratios may be solved using only
the numerators of the pitches as follows:

$$\text{Main Side} = \frac{5.5 / 8}{5.5 / 8 + 8 / 5.5} = .32095$$

$$\text{Adjacent Side} = \frac{8 / 5.5}{5.5 / 8 + 8 / 5.5} = .67905$$

Multiply the **Unit Width** ratios by the overall Hip -Valley
rafter width to calculate the Ridge Line offset.

Irregular Pitches meet at any Deck Angle

The following two formulas are general in scope.

Example: Main or Major Span Pitch = 7½ / 12

Adjacent or Minor Span Pitch = 8 / 12

Total Deck Angle = 130°

Calculate the tangents or rise/runs of the Main Side Deck
angle **DD** and Adjacent Side Deck angle **D**:

$$\tan \mathbf{DD} = 2.59929 \quad (\mathbf{DD} = 68.95728^\circ)$$

$$\tan \mathbf{D} = 1.80722 \quad (\mathbf{D} = 61.04272^\circ)$$

$$\text{Main Side} = \frac{\tan \mathbf{DD}}{\tan \mathbf{DD} + \tan \mathbf{D}} = .58987$$

$$\text{Adjacent Side} = \frac{\tan \mathbf{D}}{\tan \mathbf{DD} + \tan \mathbf{D}} = .41013$$

Calculation of Irregular Hip Rafter Ridge Line Offset

refer to diagrams of Irregular Hip Rafter

Plan and Plumb Section

$$\text{Main Side (7½ / 12 Side)} = 1.5 \times .58987 = .88481$$

$$\text{Adjacent Side (8 / 12 Side)} = 1.5 \times .41013 = .61519$$