BCT 122
Roof Framing Calculations

Common Rafter Unit Line Length
The unit LL run for all common rafters is 12 inches. The unit rise will be also be expressed in inches. The unit line length is the hypotenuse of the run and rise.
Formula: run² + rise² = hypotenuse². Sq root = unit LL.
Unit LL divided by 12 = unit LL factor.
Example: 6 / 12 roof slope LL = 6² + 12² = 180 / 180 sq. root =13.416 inches.
13.416 divided by 12 = 1.118 unit LL factor.

Hip/Valley Unit Line Length
The unit LL run for all hip/valley rafters is 16.97 inches. The unit rise will be expressed in inches same as the common rafters. The unit line length is the hypotenuse of the run and rise. Use the same formula as common rafters only use 16.97" as the run.

Hip Rafter Drop
Formula for any regular hip drop is ½ hip thickness times the hip rise factor (16.97 ÷ rise). This is a direct ratio of hip/valley rise & run to (½ hip thickness = run) & (X = rise or drop).

Hip/Valley Miter Bevel (Cheek Cut)
Multiply the rafter thickness (o) side by the hip unit LL factor. = adjacent side (a)
ao tan¹ = cheek cut degrees

Rafter Frieze/Bird Blocking
Compound miter cuts of rafter frieze/bird blocks between the last jack rafter and a hip or valley rafter may seem difficult to determine. **The angles of these cuts change with each different roof slope.** Frieze or (Bird Blocks) run perpendicular to the wall between the rafters at the outer edge of the wall and form the cornice of most open eave framed houses. The blocks between common rafters are cut square. The blocks between last hip jack and hip rafter need a compound miter at the hip and valley rafters. These formulas will solve for hip and valleys with 90° corners.
See handout bird block degrees

Bay Roofs

45° bay rafters have hips that run at 22.5° off the common rafters. Blocks that are perpendicular to these hips near the ridge are sometimes used to make attaching the top of common rafters easier.

Plumb cut angle = [(tan . 22.5°) . (cosine . ∠ B°)] tan¹ = plum cut degrees

Miter angle = [(sin 22.5°) . (sin ∠ B°)] sin¹ = bevel degrees

Plywood Sheathing

Another difficult cut to determine is the angle of plywood sheathing where it intersects into a valley. Valley rafter plywood cuts with 48 in. wide sheathing. The following 2 formulas will give the inches to add to the short point edge so plywood will match the valley rafter. Plywood width = W

1. W ÷ LL factor = horizontal inches to add from short point to long point of the cut angle from the bottom to the top of the sheathing.

or

2. Find the common rafter incline degree of the unit rise to unit run.

Formula: W x cosine° = horizontal inches to add from short point to long point of the cut angle from the bottom to the top of the sheathing.

Jack Rafter Miter Cut Angle

The exact miter/bevel angle for jack rafters formula is tan¹ sine. common slope angle

Example 6/12 slope. tan¹ sin.26.55º = 39.87º. 90º- 39.87º = 50.13º saw setting. Because most saws will not allow us to tilt to these degrees jacks are usually cut at 45°.

Will this affect the jack rafter length? _____