Modular Framing For Dioramas and Layouts (w/o Photos)

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Over the years, I have started and abandoned many layouts. Something always seemed to stop my progress. Either I moved or I changed scale, era, or gauge. In any case, I never managed to take any layout all the way to completion. Not that any layout is ever totally completed; mine just never seemed to get to the stage where a logical end was in sight.

With each new attempt, I experimented with something different. Starting with the tried-and-true “L-girder” bench work and plaster terrain, I progressed through many evolutions of framing and scenery techniques. I have used wood, metal, PVC tubing, and even rigid foam for structural members. My terrain construction has progressed from the original plaster coated screen through Hydrocal dipped paper towels to carved foam and expanded geodesic foam methods. With each iteration, the layout sections became lighter and stronger.

It finally dawned on me that I will – in all probability – never have enough space, or stay in one place long enough to build a conventional layout. I have, therefore, resolved myself to building dioramas and layout modules rather than complete layouts. There is an advantage to building modules. I can vary my modeling activity to suite my current interest. And I never stay on one module long enough to become bored with it. When one is finished, I simply crate it up and put it into storage. Another advantage is that – at least in theory – I can someday connect all of the modules together and have a completed layout.

Once I convinced myself that modules were the way to go, I found that it was relatively easy to make them transportable. This allowed me to display the modules to a much wider audience than could possibly visit my home. It also encouraged attention to detail, and resulted in several contest-quality models. Of course, building transportable modules means dealing with some size, weight and durability issues that a permanent home layout doesn’t require. On the other hand, any module technique that stands up to the rigors of transportation and storage will definitely survive a typical layout room.

After building about a half-dozen modules, each with differing size and construction characteristics, I finally realized that a standardized framing method would greatly simplify my efforts. This hastens the speed at which I can complete the mundane, structural support work and allows me to get on with the part I like best – namely, the scenic detailing.

After much experimentation, I have settled upon a basic triangle element as my common building block for module frames. The triangular shape provides the maximum strength with the least amount of material. By combining these common building blocks, I can quickly fabricate a module frame in a wide variety of finished shapes and sizes. The size of the triangle was chosen to provide finished modules that fit through standard doorways. The size was also influenced by my decision to use 36-inch minimum radius curves.

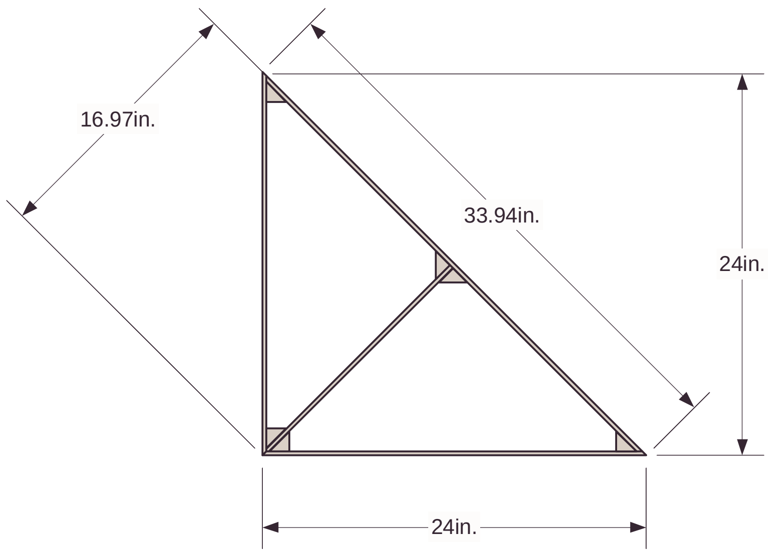

Figure 1. Basic Triangle Element

The basic triangle element is made from four pieces of 13/8” x ¼” pine lattice and six gusset plates cut from 1” x 2” pine. The base and height of the assembled triangle are 24” long. The hypotenuse is slightly less than 34” long. I insert another section of lattice as a stiffener between the midpoint of the hypotenuse and the ninety-degree angle.

The joints are strengthened with six small gusset plates made from leftover pieces of pine 1” x 2” cut at a 45-degree angle. All joints are glued and no fasteners are required. The assembled triangle element is extremely strong and rigid, but still lightweight. Actual dimensions of the individual component pieces are detailed in Figure 3.

Since this basic triangle element is used exclusively for all of my modules, I can mass-produce all of the individual component pieces ahead of time, and quickly assemble the triangles using a single jig. This assures the interchangeability of all triangles at any location within a module frame. It also assures that the mating edges of adjacent triangles and modules will be identical.

For the remainder of this handout, the basic triangle element will be represented with the shaded triangle as shown in Figure 2.

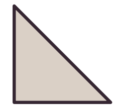

Figure 2. Symbol For Basic Triangle Element

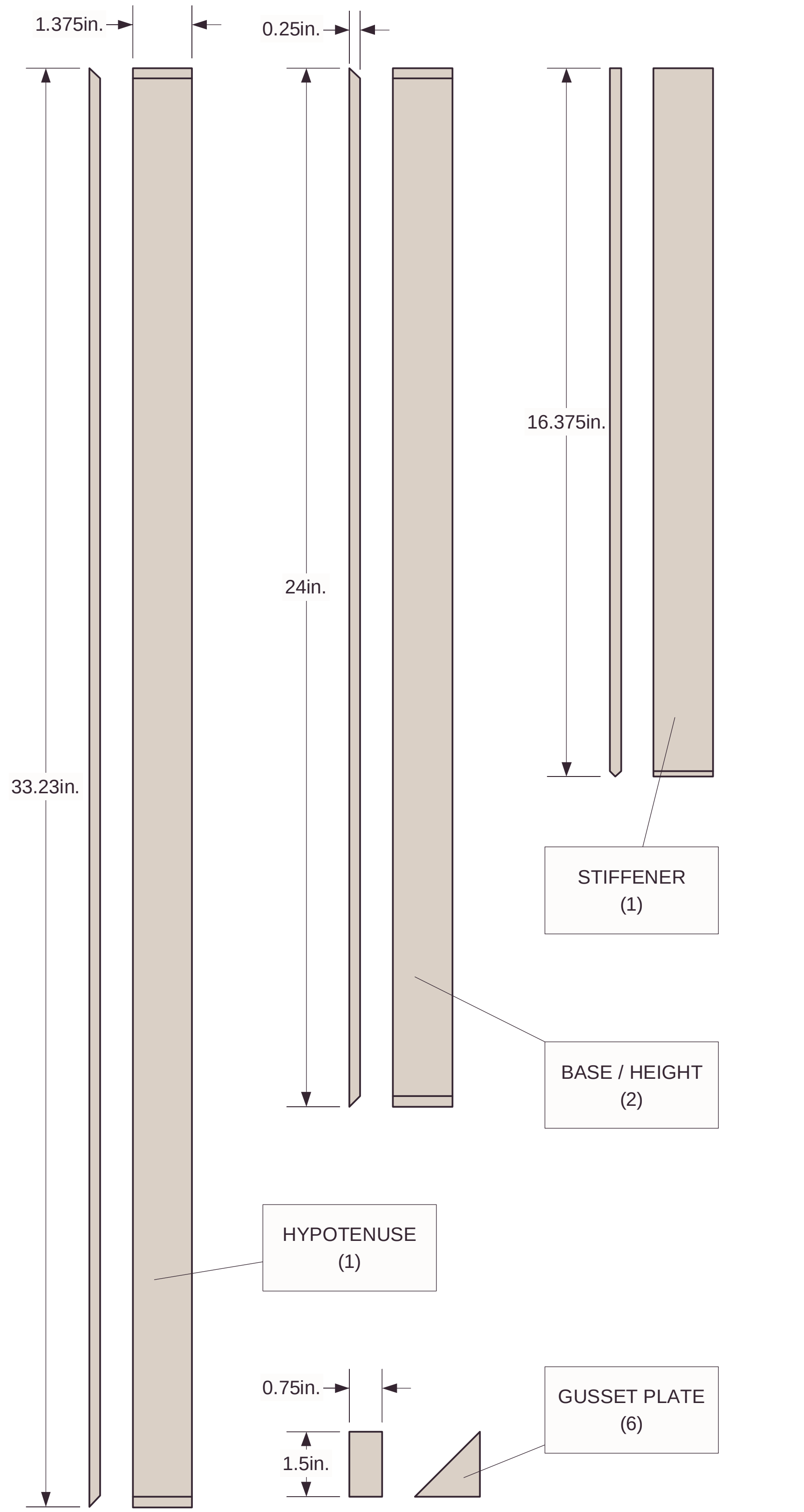

Figure 3. Basic Triangle Element Component Pieces

If two triangles are joined along their 34-inch edges, the resultant rectangle is 24 inches square. Any number of these 24-inch squares can be assembled into completed 24-inch increment rectangles as shown in Figure 4. For example, two squares form a 2x4 foot rectangle; three squares form a 2x6 foot rectangle; eight squares form a 4x8 foot rectangle; and so on.

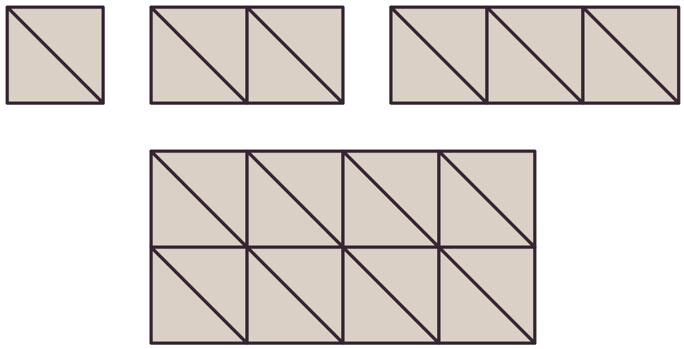

Figure 4. 24-Inch Increment Rectangles

If four triangles are joined along their two-foot edges, the resultant rectangle is 34 inches square. Any number of these 34-inch squares can be assembled into completed 34-inch increment rectangles as shown in Figure 5. For example, two squares form a 34x68 inch rectangle. The 34-inch width is ideal for portable modules since it fits comfortably through a standard 36-inch doorway.

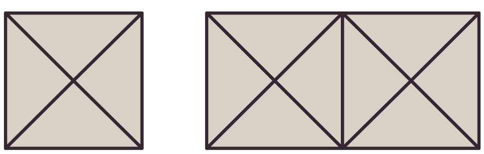

Figure 5. 34-Inch Increment Rectangles

Any number of triangles can be joined to form a 17-inch wide shelf as shown in Figure 6. The length of the shelf can be adjusted to fit along a wall. This geometry lends itself well to going around inside or outside corners, since the ends of the shelf form a perfect 45-degree angle.

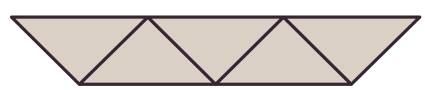

Figure 6. 17-Inch Wide Shelf

Although the rectangle shape would appear to be ideal for modules that are to be joined together, there are some inherent disadvantages. First of all, rectangular modules result in inter-module joints that are perpendicular to the front edge of the modules. These joints are difficult to disguise. But most importantly, although rectangles are ideal for long straight sections of track, they waste a lot of space when modeling twisting curving scenes.

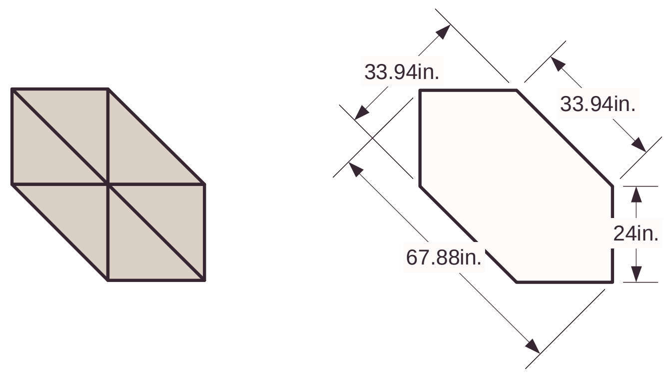

Figure 7. Basic Module Configuration and Dimensions

Since I model the RGS, I don't need a lot of long straight sections. For these reasons, I have chosen the elongated, hexagon shape shown in Figure 7 as my basic module configuration. This module is made from six basic triangle elements.

The hexagon shape provides many advantages over a rectangle. It can mate with additional hexagons, either along the 24-inch or 34-inch sides. It can also mate with both 24-inch and 34-inch increment rectangles, as well as 17-inch wide shelves. Some of the mating possibilities between the hexagon, rectangle and shelf modules are shown in Figure 8. All modules shown are made from the basic triangle element. Of course there are many other complex shapes that can be made from the basic triangle element as well.

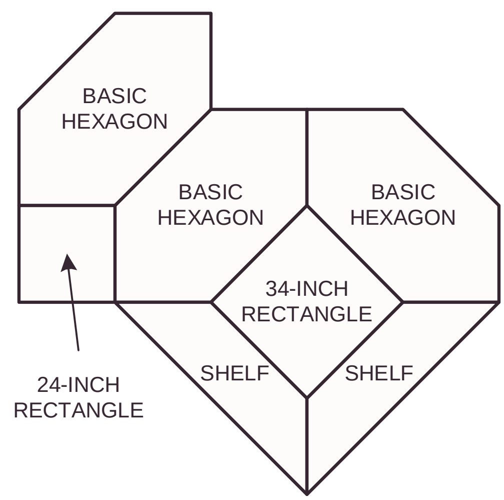

Figure 8. Module Mating Possibilities

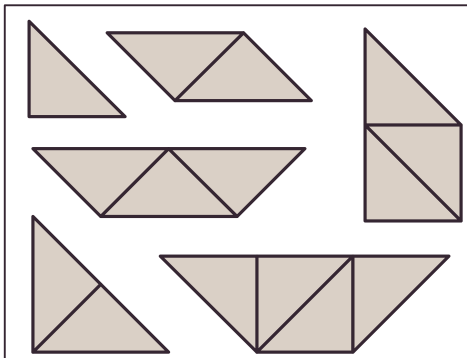
Figure 9. Scenic Filler Modules Made From Basic Triangle Elements.

The basic triangle element can be used alone or with other triangles as "scenic filler" modules to fill-in the open spaces around the hexagon, rectangle or shelf modules. Some of these filler modules made from 1, 2, 3 and 4 triangle elements are shown in Figure 9. Since all modules are based on the same triangular element, the resulting framework is incredibly strong, yet lightweight, and mates together perfectly. Together, the combined hexagon, rectangle, shelf and filler shapes allow the modeler to create a nearly limitless number of possibilities for corner, shelf, peninsula, or island shaped modules, dioramas and layouts.

Figure 10 shows four basic hexagon modules combined with various scenic filler modules. The filler modules are shaded for identification. The curved line represents the track location with a 36" minimum radius.

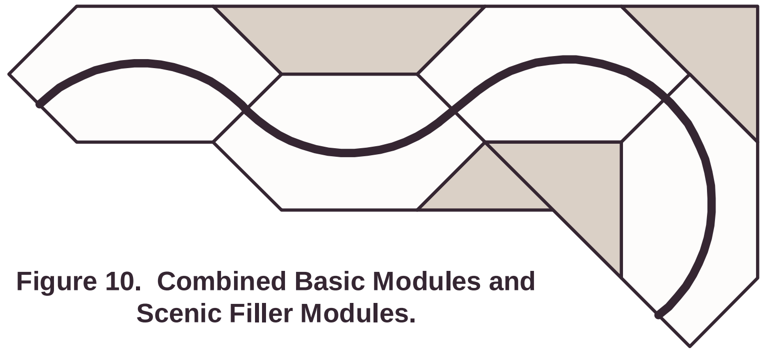

Figure 10. Combined Basic Modules and Scenic Filler Modules.

Four hexagon or shelf modules can be connected to form a large helix support structure as shown in Figure 11. The interior of either helix is a 24-inch square opening for easy access. The superimposed circles represent track loops of various radii in 3-inch increments. The hexagon-based helix supports radii from 27 to 45 inches. The shelf-based helix supports radii from 27 to 33 inches. As with any helix, there may be as many stacked loops as necessary to gain the desired height.

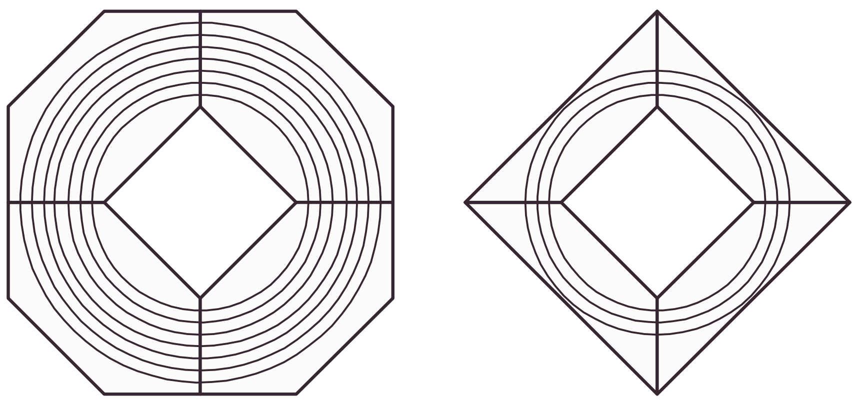

Figure 11. Helix Structure Supports Made From Four Hexagon or Four Shelf Modules

Radius	Rise	Length	Grade
27	6	169.65	3.536777
30	6	188.5	3.183099
33	6	207.35	2.893726
36	6	226.19	2.652582
39	6	245.04	2.448538
42	6	263.89	2.273642
45	6	282.74	2.122066

Figure 12. Helix Grades

If the rise per 360 degrees (full circle) of track is maintained at 6 inches, the resultant lengths and grades for the various radii curves in the helix are as shown in Figure 12. All values are in inches except Grades which are in percent. The length represents one full circle of track.

The curved track shown in Figure 10 has a minimum radius of 36 inches. Over the course of four modules, it makes approximately four ninety-degree turns. It is therefore approximately equal to one 360-degree loop in a helix, or about 226 inches long. If the track rises 6 inches from one end to the other (1½ inches per module), Figure 12 shows us it must be about a 2.65% grade.

I have found that a maximum track rise of around 1½ inches per module is all that is required for replicating most grades. If you look at just one of the hexagon modules in the Figure 11 helix, you will notice that although all concentric curved tracks rise 1½ inches from one edge of the module to the other, the grades vary from around 2% to 3½%. This is because each curve has a different length.

On a hexagon module, a track length will vary from almost nothing to around 75 inches, depending on where it enters and exits a module. This gives you great latitude in establishing grades.

If we know the track length and rise, the following formula calculates the grade:

$$G = 100 * R \div L,$$

where G is the Grade in percent, R is the rise of the track in inches, and L is the length of the track in inches. For example, if the track in Figure 10 had a rise from one end to the other of four inches, the grade would be 100 times 4 divided by 226 or 1.77%. Likewise, a track 90 inches long that rises 2 inches equals a grade of 100 times 2 divided by 90 or 2.22%.

If we know the track length and grade, the following formula calculates the rise:

$$R = G * L \div 100,$$

where R is the rise in inches from one end of the track to the other, G is the Grade in percent, and L is the length of the track in inches. For example, since the track in Figure 10 is 226 inches long, if we want a 3 percent grade, then the rise is 3 times 226 divided by 100 or 6.78 inches.

Just as with track lengths and grades, the possible module combinations are almost endless. This is the biggest advantage of the building block system of module framework. Not only is it strong and relatively cheap to build; it will adapt to almost any module or layout situation. Try it…I think you'll like the results.