Flex-Shell Architecture



Flex-Shell Precision Contour Control Framing

Framing up a sturdy and beautiful fluid organic shelter form is a fast and fun process that allows exploration of amazing organic forms while maintaining accurate dimensions for important plan-specified structural shapes.

The Flex Shell Framing

This method uses readily available 6-inch grid wire, the 6-6-10 welded wire concrete steel that comes in the 150 feet rolls from most hardware stores.

Short segments are trimmed from the roll and quickly made into the Block Wire Trusses, the Free-Formed Funnel Columns, the Curvilinear Cantilevered Single-Shell Awning, and other forms that are smoothly blended into an ultra sturdy form.

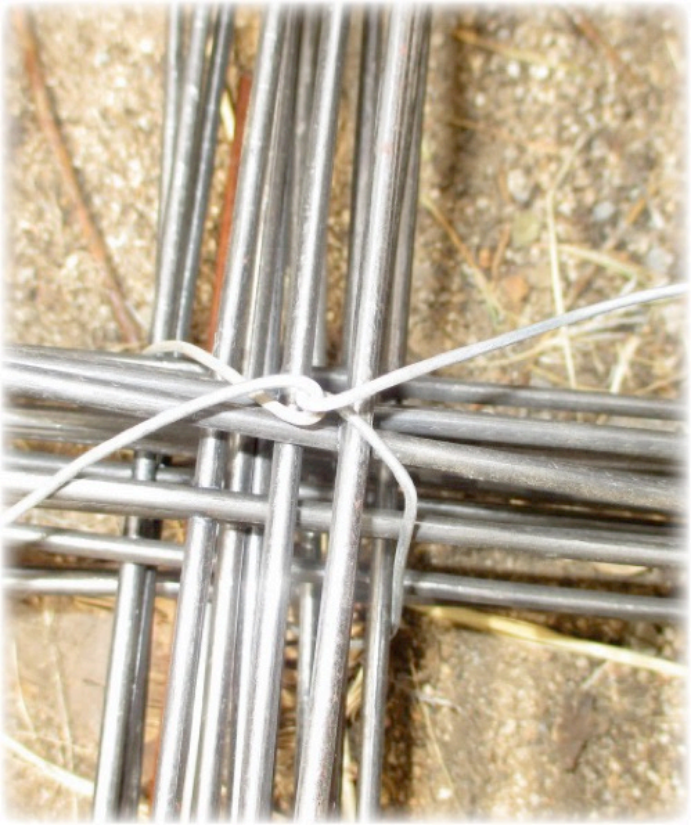
It will surprise you how fast and accurate the life-like biometric core shelter takes shape.

The heart of this sturdy precision contour framing method is the Block Wire Truss. These trusses have a high strength-to-weight ratio, Meaning they are very strong considering how little steel is used.

They provide a rigid structural-sandwich main roof and columns that not only is much stronger than a single shell approach, but this stress-skin design provides an important insulating thickness.

These trusses enable precision control of contours because they are built in place using flexible truss chords that can be adjusted to the perfect shape and blended with adjoining shapes.

The trusses can easily taper to a single shell. They can twist, if needed, and they can help reveal shapes that are not easily seen in the structural drawings**.**



Material and Cost

The amount of grid-metal material used for a length of truss is based on a 4.5-foot section that averages 17.5 feet of steel from a roll of steel. This comes out to about $2.15 per foot of finished truss.

Each 9-block truss segment is reinforced on both sides using a triangular or sturdy 'X' pattern. This overlapping pattern is important for the strength of the truss.

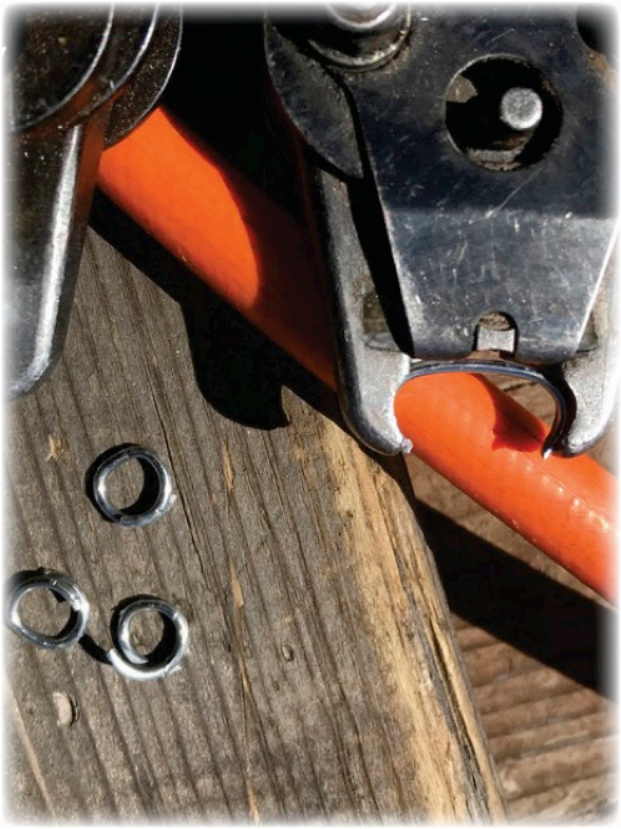
The materials used for each 9-block segment are:

4 - 3x4 flats grid steel, 2 - 2x5 flats of grid steel and 4 - 2x4 flats of grid steel.

The top and bottom chords of this (4.5 foot long truss) are made with narrow ribbon cuts, about 20 feet of the 1x10 flats that are heavily overlapped so they cannot slip, which is also important for a strong truss design.

The Hog Ring Gun

The steel is quickly assembled into the trusses into the exact truss shape needed using a 3/4 inch SC7 pneumatic 'C' ring gun, often called a hog ring gun. Often called a hog ring gun. The gun is fast, light and fun to use.



Processing the Steel

As the steel is cut from the roll, the flat pieces are trimmed into the steel needed for truss reinforcing or folded into blocks, using the Block Folding Machine pictured in the far right column of this page.

Two workers can process a 150-foot roll of steel into truss framing and other types of framing in about 3 hours.

A small building like the one pictured below, takes about 1 roll of steel but a small 300 square ft home with an extensive awning and outdoor garden wall partition, would take about 10 to 15 rolls of steel.

The Precision Contour Control Framing represents about 1/3 to 1/2 of the labor for the finished product. It takes about a week to do the framing for a small Flex-Shell Core Monolith Pavilion home, while the lath fabric and plaster shell take the remaining time.

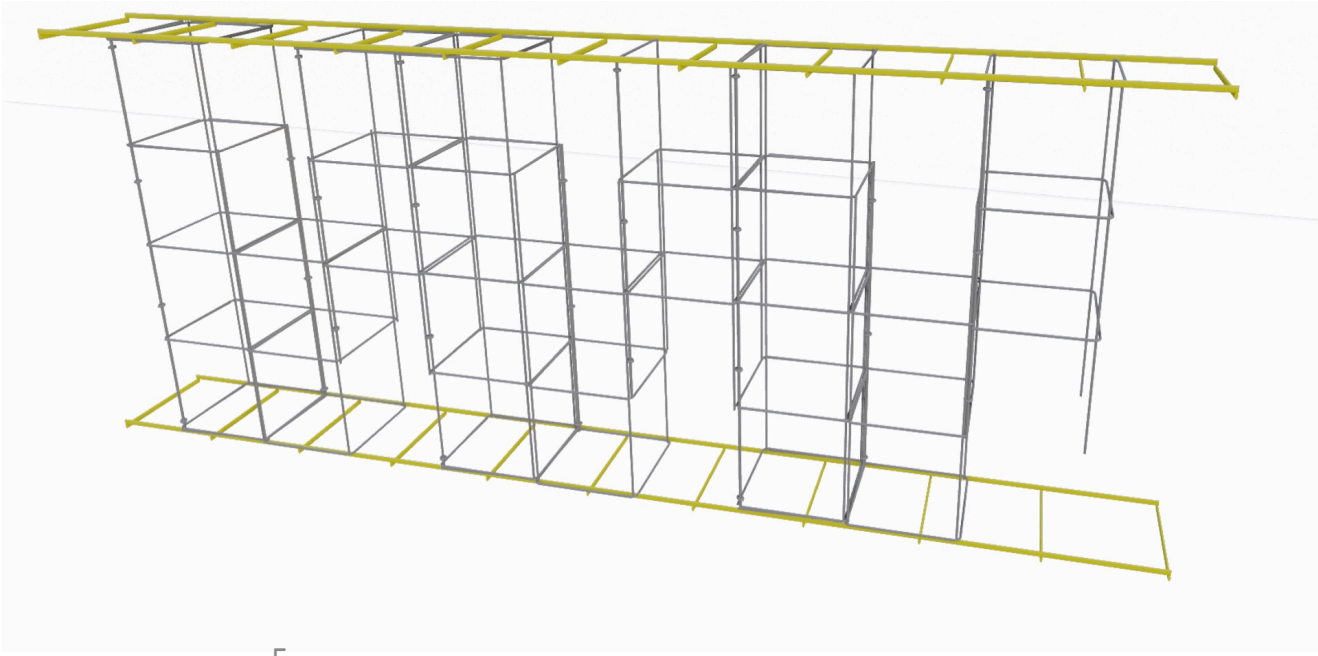
This Flex-Shell Precision Contour Control Framing method, that includes the Truss Framing, Funnel Column Framing, Surface Shell Framing and Cantilevered Curvilinear Awning Framing, is central to Flex-Shell Architecture.

You can learn more about it at: **Flex-Shell-Architecture.com**

This Truss Framing Method is key to smoothly blending and controlling biometric form while providing a very thick, insulating thickness and the internal framing between the two surface shells that ensures a true Structural Sandwich (make that word a link on the website) or "Stress-Skin" effect.

The truss design was developed to be specific for curvilinear structural-sandwich or stress-skin framing, which relies on a high-strength composite for thin but durable shell surfaces.

The surface framing, made with the same triangular layering of the same steel, provides ideal reinforcing for the high-strength composite while the reinforcing for the high-strength composite while the light wire truss framing allows the surface shells to flex predictably under tremendous bending strains.



This helps transfer dynamic loads smoothly and resiliently to a larger area to prevent structural damage.

This process results in durable low-cost buildings that are well-insulated, easy to build and that can endure strong earthquakes, fires, tornados and floods safely, without structural damage.

An initial stage establishes a flex-stable Core Monolith Pavilion, the columns, roof and awning, firs in the more stable natural terrain.

The entry walls, which can be made from cob or a variety of other materials, can be easily changed over time to express individual tastes, and are keyed into the rounded columns and built under shelter on flat pads that are terraced in with durable thin-shell walls.

This extreme durability approach focuses on using durable thin-shell retaining walls to terrace in runoff gardens to better protect the columns and stabilize the terrain.

This naturally fosters restorative and sustainable values of adaptability, land stewardship, tolerance and self-reliance because an environment of sheltered gardens is created that benefit, in many ways, from careful integration into the natural flow of nature.

Here is a list of the components made from the roll of steel to make the truss framing for a 26 inch stress skin roof frame. This thickness provides enough insulating thickness for most climates when a light 26 pcf neat cellular concreter (aircrete) is pumped in to fill in around the truss frame through a small hole in the surface shell:

Pre-Cut Steel Pieces

**4x10 Full Sheet - 7 used per 9 Block Truss Segment to make blocks and flats.

10 Cube Block - 3 used per 9 Block Truss Segment.

3x10 Ribbon Source Sheet - for making 2 - 1x10 Ribbons for Primary Reinforcing.

1x10 Ribbons for Primary Reinforcing.

Truss Blocks:

4 Cube Blocks - 3 used per 9 Block Truss Segment

2 Cube Blocks - 6 used per 9 Block Truss Segment

Primary Reinforcing Group:

1x10 Ribbons - 2 used for top and bottom chord.

3x4 Flats - 4 used for corner-to-corner main reinforcing on both sides of truss.

2x4 Flats - 2 used for overlap bridging between 3x4 flats.

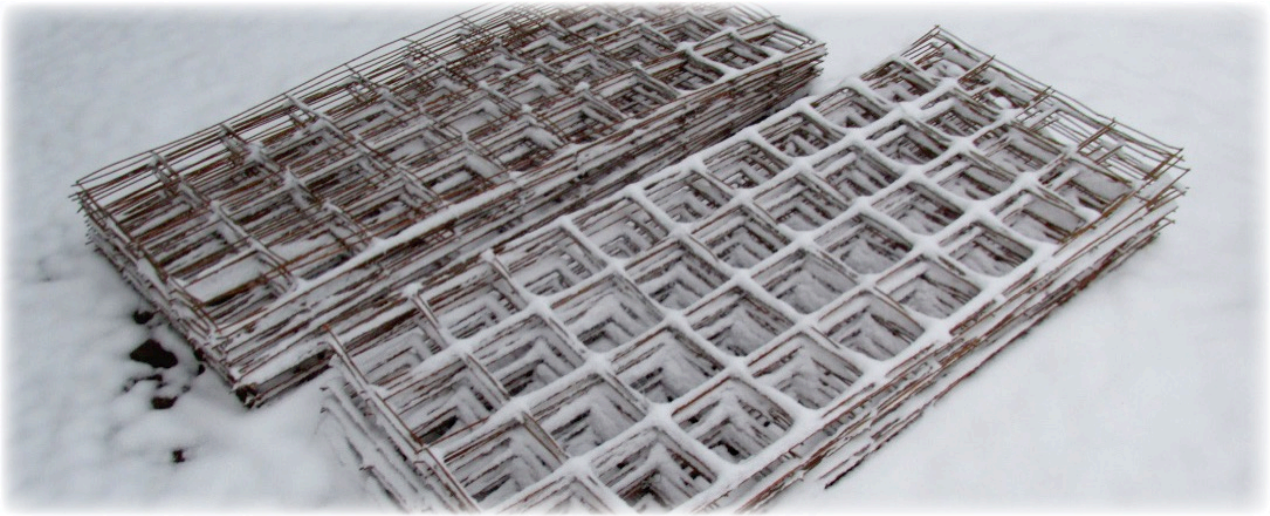
Second Layer Reinforcing Group:

2x5 Flats - 2 used for overlap reinforcing between truss segments.

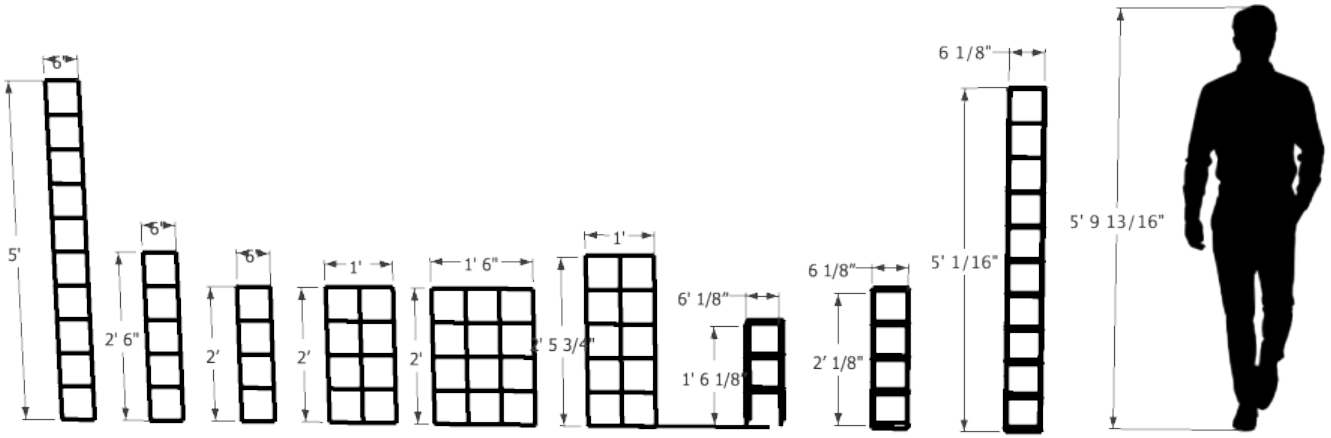
2x4 Flats - Repeat STL file. 2 used for overlap reinforcing between truss segments

1x5 Ribbon Flats - 2 used for overlap reinforcing on top or bottom chord seam.

1x4 Ribbon Flats - 2 used for overlap reinforcing on top or bottom chord seam.



** 7 - 4x10 Full Sheets and 1 - 3x10 Ribbon Sheet is used for this 9 block segment. This is 19 feet of steel from the 5' roll to make 5.1 feet of truss. The 150' roll of steel makes an average of 41 feet of truss per 157 pound roll of 6x6-10 steel. Each 5.1' truss Segment weighs 19.53 lbs or 3.83 lbs per foot of truss. At $90.00 a roll, the cost of this truss is about $2.20 per foot."



Truss Assembly Process

This truss can be wider or shorter than the 24 inch frame demonstrated here, or it can taper, when a tapered truss is necessary for the design you want.

This process describes the 24 inch truss frame that would provide plenty of insulation to pass insulation requirement codes in cold climates in the US. This thickness is appropriate for spans that are less than 35 feet.

To make spans greater than 35 feet, a broader truss design would be necessary, conversely, for a small building, a smaller 12 inch or 6 inch truss design will provide plenty of insulating thickness.

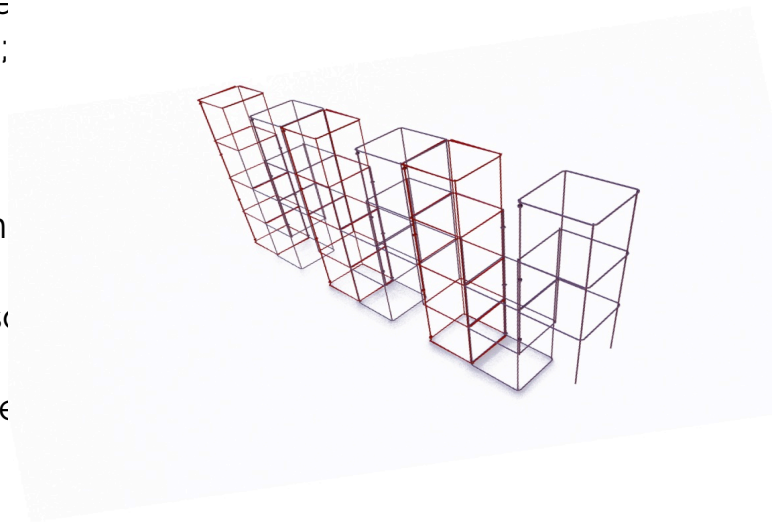
Whatever you need, this truss design is versatile and can accommodate many climates and building sizes while enabling precision control of complex, life-like biometric forms to perhaps honor our connection to nature.

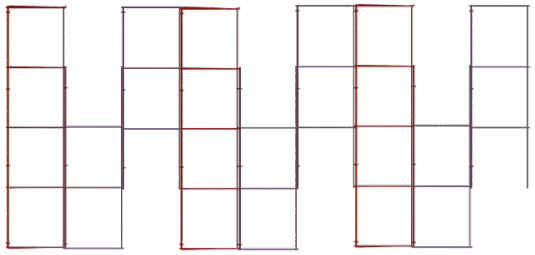
9-Block Only Frame - The main building block of this design is the 9 cubical wire blocks of two sizes; the taller 4 cube and the 2 cube.

The assembly starts with the 4-cube block standing upright, then a 2 cube block upright, then the next 2 cube block upside down, so it joins corner to corner with the other 2 cube block to better fill the rectangular frame evenly with blocks.

The pattern is: 4 cube block, 2-cube block, 2-cube block, upside down. That is repeated 3 times to get a 9-block segment.

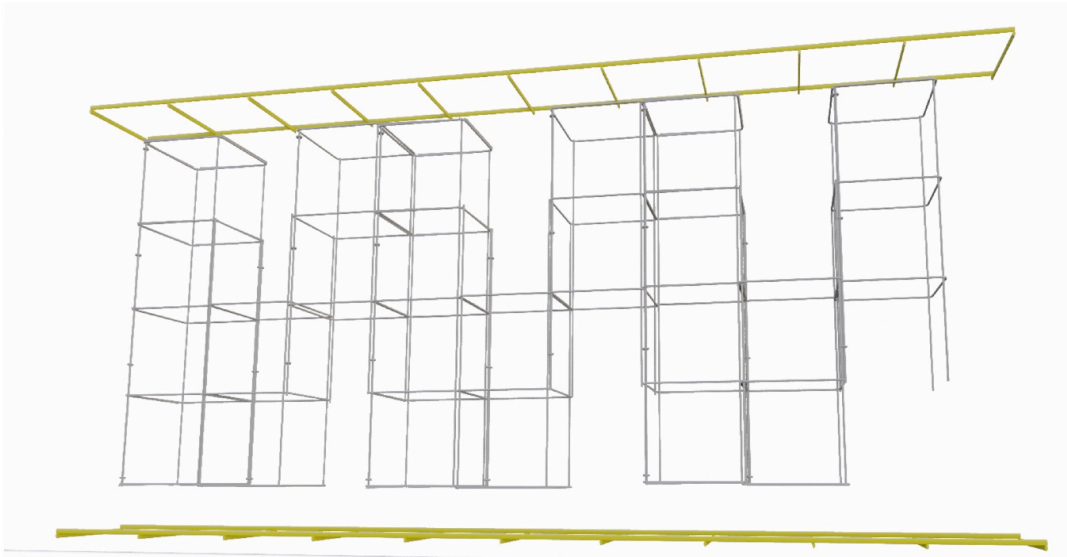
The blocks are attached sequentially to build the truss in situ. This helps the truss to follow a desired shape or follow a specified radius and height while smoothly blending an intersection of complex contours when necessary. This adds an exciting depth to design and construction that is sculptural exploration of form, even when restricted by specifications for precise radiuses and heights in certain locations.



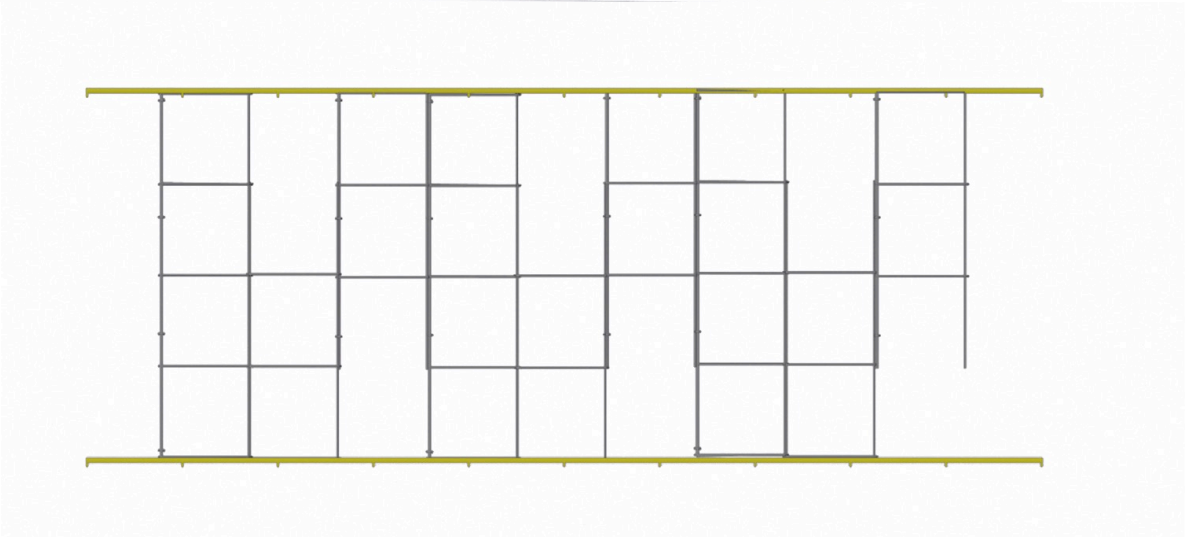


1x10 Flat Ribbons Attached o
Top and Bottom of Block Fra

The next step uses two of the 1x10 Ribbons (Primary Reinforc Group) are placed above and below the block frame to show how they will be positioned on the block frame before it gets cluttered in with the frame.



These ribbons become Truss Chords. The Truss Chords allo the frame to start to perform like how a bridge truss works by locking the shape into a rigid frame but still allowing final adjustments into the precise curve that is needed for that section.



Chord Ribbons Attached

The Truss Chord Ribbons are at first attached on the parallel wires, using the SC7 3/4 inch hog ring gun. After the shape is finalized, the second layer of reinforcing is added on top of the first layer of top

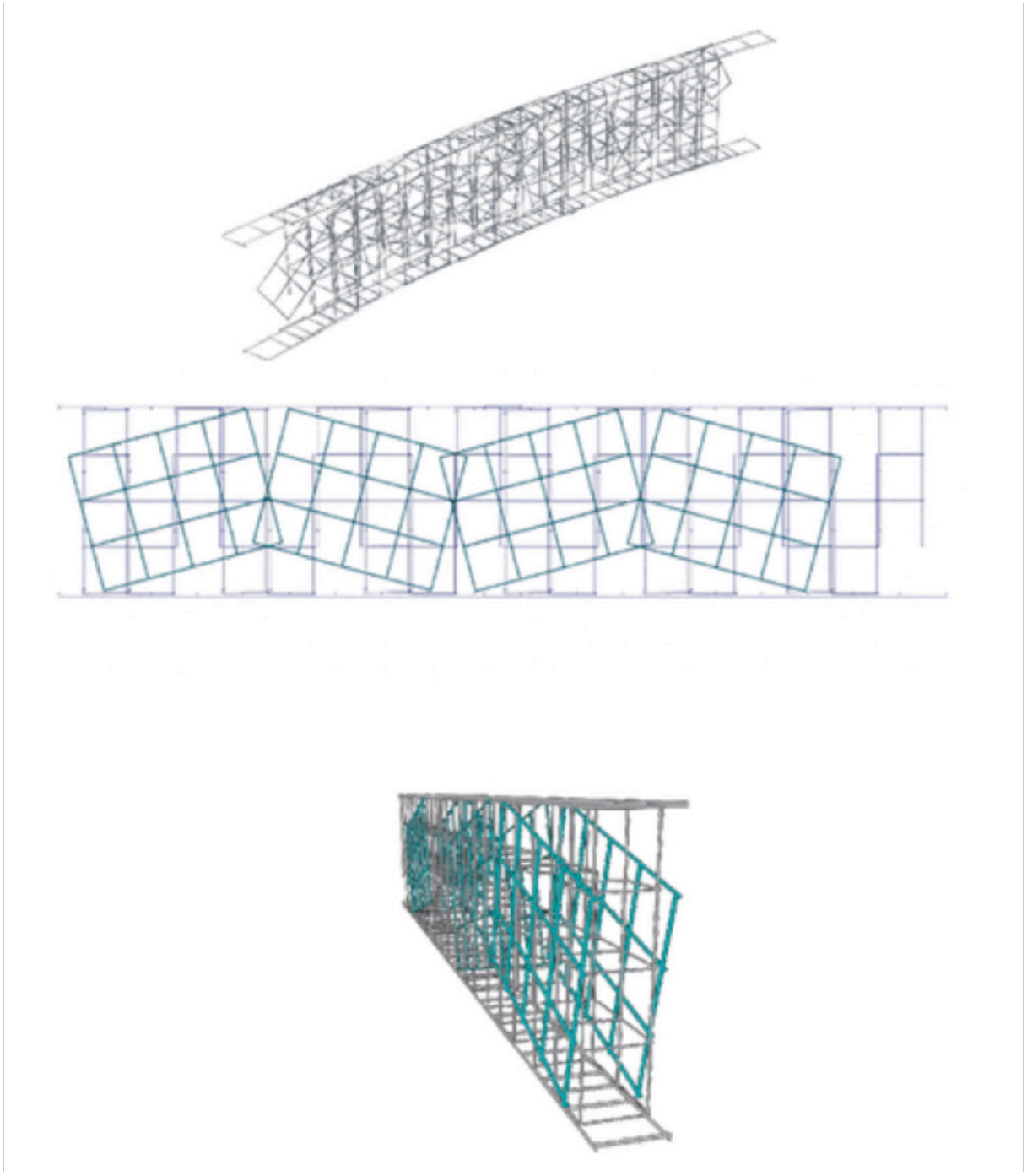
and bottom truss chord to bridge the connection with extra steel so it is very solid, AND, to allow connects on the lateral wires so the truss chords cannot slip or move."

This rectangular truss segment can be used for curved trusses and can also twist 20 degrees.

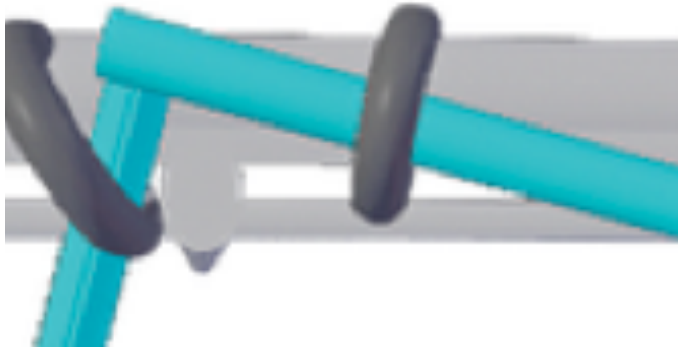
First Layer of Side Reinforcing Attached

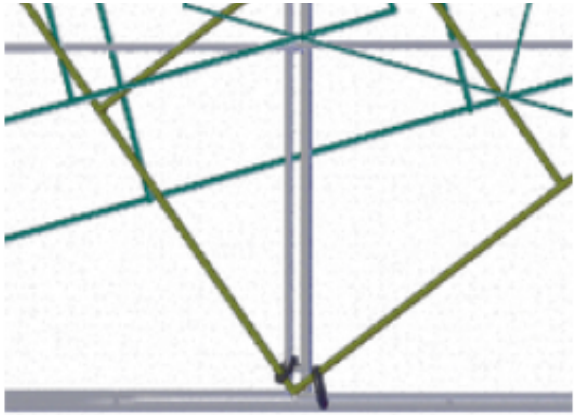
The 3x4 flat reinforcing is attached on the side at crisscrossing angles while maintaining a good overlap. This crisscross angling of side reinforcing also helps the truss design to become a true truss, by locking the top and bottom chord together with a triangular pattern that prevents the truss chords from moving independently or the blocks from leaning. This pattern, along with no-slip truss-chord placement, is key to this light-wire truss design performance as a true truss.

This reinforcing happens on the opposite side of the truss as well, and the triangular pattern helps lock the entire truss into a rigid position so it is sturdy and cannot bend.



The corner of the 3x4 grid wire flat attaches to the top or bottom edge of the truss as we show here, in the close up illustration in the middle of this page. The corner point very slightly protrudes above the truss to allow 2 hog ring connects to attach on either side of that triangle tip to bond that piece securely to the top and bottom chords and or the top wire of the blocks.

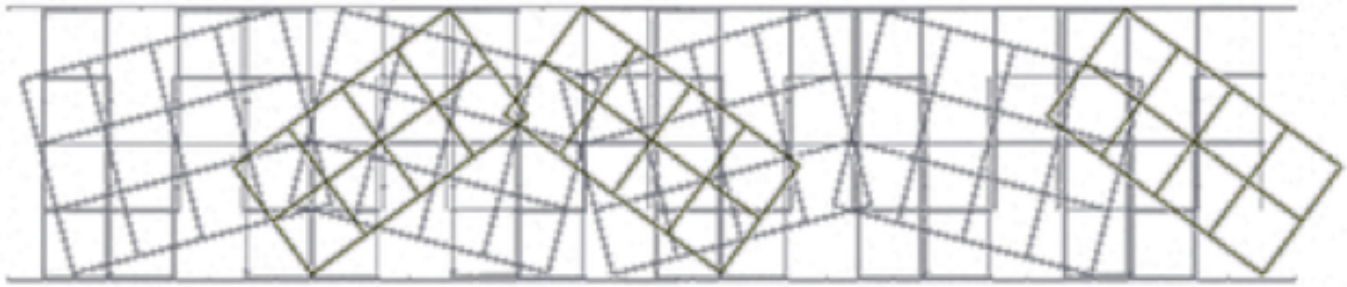




2x4 Side Truss Flat Primary Reinforcing Attached

The green 2x4 flat attached to the bridge over the larger space that is the weaker overlap area between the two 3x4 flats.

The corners are securely attached with two hog rings and hog rings are attached on nearly every intersection of wires to create that important 'no-slip' overlap that helps the entire truss to be very rigid which then helps the entire stress-skin, or, structural- sandwich, roof become one very firm form that can't be pulled apart.



The second layer of smaller reinforcing helps the side reinforcing be extra solid.

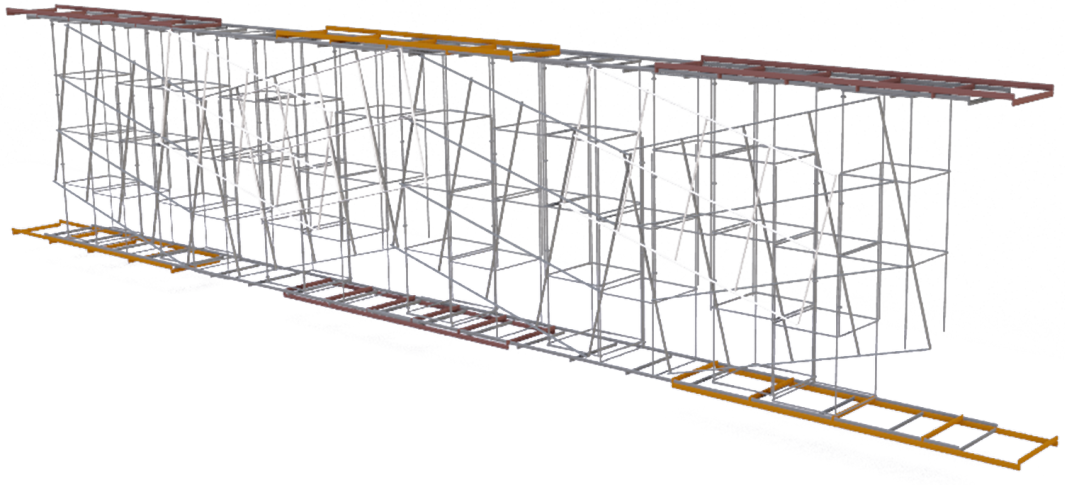
Truss Segments Combined

Two of these 9-block sections put together present how the Second-Layer Reinforcing is used to bridge to the adjoining truss segments with good strong overlaps that maintain a tilted triangular pattern with the block steel and adjoining layers when possible.

Second-Layer Ribbon Chord Overlap Reinforcing Attached

2- 1x4 and 2- 1x5 ribbon segments floating over their proper placement to create a secondary reinforcement for the chord seams.

It is important for the overlaps to connect one or more short lateral wires known as Ladder Wires on one truss segment to the ladder wires on the adjoining truss to ensure there is no slipping or shifting that could cause the truss chords to change length, which can change the curved trajectory of the truss slightly.



Second-Layer Double Ribbon Side Flat Reinforcing Attached

2 – 2x5 flats and 2- 2x4 flats attached to both sides.

.The reinforcing is doubled because it is for two truss segments. The 2x5 flat attaches corner to corner across one seam, the 2x4 flats bridge the next seam.

These truss frames not only create the insulating thickness and sturdy structural-sandwich effect fro the roof, they are the central frames for the round columns that support the roof. This helps provide the same insulating thickness for the walls and a proper sized column for supporting the large spans.

Branching Pattern: The Truss Frame inside of the columns truss starts vertical from the foundation then intersects the ring truss.

This provides a rigid frame to build the roof trusses on and a rigid frame to anchor the tapering fluid shapes that are:

The Cantilevered Awning, (Make word a link and put a photo of the curled-edge awning)

The Entry Wall Archway (put a photo of the entry wall Archway)

From the horizontal ring truss, the roof trusses follow a pattern of short segments placed in that important triangular pattern. This triangular pattern is not only important for flex-stability, rigidity; the triangular pattern is key to the accurate blending of shapes; the smooth blending of biometric form.

Creating a form that is flexible, homes that are not too rigid, is key to longevity and aligning with the enduring and peaceful spirit of nature.

Let us know if you are interested in taking part in a workshop for Precision Contour Control Flex Shell Framing

We offer a certification-training program for people who want to build a business based on biometric design or more basic workshops that will help you with your
own project.

Level One Certification Training is available online. Passing this first level will make you eligible for an In Field Training Workshop where you will be assigned specific tasks on a schedule for a five day project.

Flex-Shell Certification can be the beginning of a great career in freeing people's minds and healing our world with beautiful organic form and didactic sustainable architecture.

These skills can help you learn a cutting-edge method for longer lasting, water-tank materials, water falls, ponds, wild and beautiful landscaping, safety shelter, homes, emergency shelter, Aquaponic systems, furniture, and giant ear-shaped flowers that you can sleep in while listening to the stars.

You control your destiny and your imagination is the limit.