

~~TRIO~~DETTIC*

MULTIPOINT®

FOUNDATION

FRAMES



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27. CONTACT **INFORMATION**



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1. COMPLETE FLEXIBILITY OF DESIGN

- ❖ Custom design of the Triodetic system allows for limitless geometric configuration. Foundation frames are fabricated to conform to the building layout.
- ❖ Foundation systems can be expanded in any direction at any time without the need to redesign or reinforce.
- ❖ The foundation system can be utilized as a rigid undercarriage in the event that a house requires relocation,
- ❖ Modules can be omitted as an allowance for a septic tank and/or services.
- ❖ Homes which are deemed to have serious structural problems due to conventional foundations can be retrofitted with this system.

2. MINIMUM SITE PREPARATION

- ❖ No sand or gravel pad is necessary.. Just clear and level the area to permit the construction of the foundation frame.
- ❖ A gravel layer below the frame is helpful in maintaining drained conditions at the base plate footings.

3. SIMPLE AND EASY TO CONSTRUCT

- ❖ No heavy equipment or specialty tools are needed.
- ❖ Precision made components ensure proper fit and a minimal variety of components both simplify and facilitate the assembly process.
- ❖ Relatively light-weight components (approx. 15 lbs for connectors and 40 lbs for tube members) are readily shipped in compact crates and easily handled during construction.
- ❖ Using easy to follow assembly instructions included with each foundation, the frames can be assembled using local labor.



4. MAINTENANCE FREE

- ❖ A hot-dipped galvanized finish gives long life corrosion protection to tubing, base plates, saddle brackets and washers.
- ❖ With the foundation frames ability to bridge soft spots and move as a rigid slab under frost heave and thaw conditions, the structural integrity of the building is preserved.

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5. ECONOMICAL

- ❖ Minimum site preparation.
- ❖ No heavy equipment required.
- ❖ Use of local labor minimizes travel and lodging costs.
- ❖ Fast installations - a 1200 Ft². (111 m²) unit can be installed by a crew of 3 people in a day.
- ❖ No maintenance required on the frame.
- ❖ Racking of house and resulting damage to building is eliminated.



6. BUILDING SIZES

- ❖ Single storey structures up to 7000 Ft². have been constructed.
- ❖ Two storey structures up to 2000 Ft². per storey have been constructed.

7. PROVEN RELIABILITY RECORD

- ❖ The Triodetic method of connection, which involves the forming of the ends of round tubing with a 'flattened thread' to fit into matching slotted hubs, is a Canadian invented system with a domestic and international reputation exceeding 35 years,
- ❖ Since 1985 the Triodetic system has been utilized in the construction of foundation frames in northern communities. Some 800 units have been built to date, all exhibiting perfect behavior.
- ❖ Extensive testing and field monitoring has confirmed the effectiveness of the frames in eliminating racking of buildings in even the most difficult soil conditions.

8. FINANCIAL BENEFITS


- ❖ Foundations can be constructed year round using unskilled labor.
- ❖ Very little site preparation is required.
- ❖ Eliminates long term problems associated with differential settlement.
- ❖ Lending institutions remove risk of devaluation of buildings caused by foundation failures.
- ❖ Insurance underwriters minimize exposure as foundations can be relied upon to eliminate differential settlement.

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9. COMPARISON CHART

Characteristic	TRIODETTIC*	Post & Pads	Screw Jacks	Steel Piles	Timber Piles
<i>Ease of Installation</i>	Excellent	Average	Moderate	Considerable Effort	Considerable Effort
	Easily Assembled Non Skilled Labor No Heavy Equipment No Survey needed	Excavation Required Skilled Labor Heavy Equipment Survey Required	Easily Assembled Non Skilled Labor No Heavy Equipment Survey Required	Drilling or Impact Required Skilled Labor, Heavy Equipment, Survey Required, Welders	Drilling or Impact Required, Skilled Labor, Heavy Equipment, Survey Required
<i>Site Preparation</i>	NONE	Excavation Required	Minimal	Drilling or Impact, working Pad, Compaction Required for Heavy Equipment, Welders	Drilling or Impact, working Pad, Compaction Required for Heavy Equipment
<i>Interior Cracking & Failure of Building Envelope</i>	NONE	High Potential	High Potential	High Potential	High Potential
<i>Use of Skilled Labor</i>	NO	YES	YES	YES	YES
	Local non skilled labor can be used	Skilled & Licensed Labor required	Non-Skilled Labor can be used after survey completed	Skilled & Licensed Labor required	Skilled & Licensed Labor required
<i>Differential Movement Between Supports</i>	NONE	High Potential	High Potential	High Potential	High Potential
<i>Ease of Building Construction</i>	Excellent	Average	Average	Average	Average
	Building Construction starts immediately with a level & plumb base	Extra Construction and adjustments to leveling required before building construction can start	Leveling & squaring required before building construction can start	Extra Construction and adjustments to leveling required before building construction can start	Extra Construction and adjustments to leveling required before building construction can start
<i>Heavy Equipment Required</i>	NONE	YES	NONE	YES	YES
 <i>Recyclable Material</i>	80%	Varies	Varies	Varies	Varies
<i>Total Valuation from 1 to 10 Score</i>	10	5	3	8	6

10. KEY ADVANTAGES

- ✓ Cost competitive to alternative foundations
- ✓ Typical assembly with hand tools in 1 day
- ✓ Elevates the building 3ft. (or more) above grade
- ✓ No need for excavation, piers, piles, concrete
- ✓ Pre-engineered for each building plan
- ✓ Durable Galvanized Steel & Aluminum
- ✓ Securely anchored against wind forces
- ✓ Uniformly supports & stiffens the building
- ✓ Screw-down feet adjust to variable levels
- ✓ Frame easily modified for future additions
- ✓ Used in both new & retrofit applications
- ✓ Engineering & Warranty provided



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11. DESIGN CRITERIA OF TRIODETTIC MULTIPOINT FOUNDATIONS FRAMES

The Triodetic® Multipoint® foundation is designed to provide structural strength to the building. The geometric configuration and structural strength of the foundation frame is such that it ensures that the building as a whole has the capability and torsional stiffness to resist the forces created when soil displacements occurs.



This engineering concept is radically different from the prevailing design approach which concentrates on the underlying soil conditions. It is acknowledged that an understanding of the site conditions is helpful as it may influence site preparation or sizing of bearing pads.

Giving strength to the building is foremost in establishing the structural requirements of the multipoint foundation frame.

The design described herein is based on development work and field observations undertaken in 1984 and continued to date. This original work led to the formulation of design criteria and material specifications.

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The design and development of this foundation system involved extensive computer modeling and a probability study on a variety of possible support conditions. Support conditions may range from full support to a condition where only a minimum of three bearing points are doing all the work.

Of course the ultimate bearing capacity of the soil influences the pattern of support. For instance if a particular support under load creates a condition of soil failure then immediately adjacent to this "failed" support an array of other supports will pick up the load creating a safe load bearing condition which in turn relieves the failed support converting it to a safe load situation. This progressively creates a condition of equilibrium and uniform bearing capacity.

The support pads are 10" x 10" which is relatively small and in localized areas may overload the soils resulting in soil failure. This is in fact a desirable phenomena as it results in further distribution of stresses throughout the three dimensional grid.

From the numerous loading patterns studied, a selection of structural components is made which satisfies the conditions of load and support for the lifetime of the building. In making this selection, uniformity of materials is a governing factor.

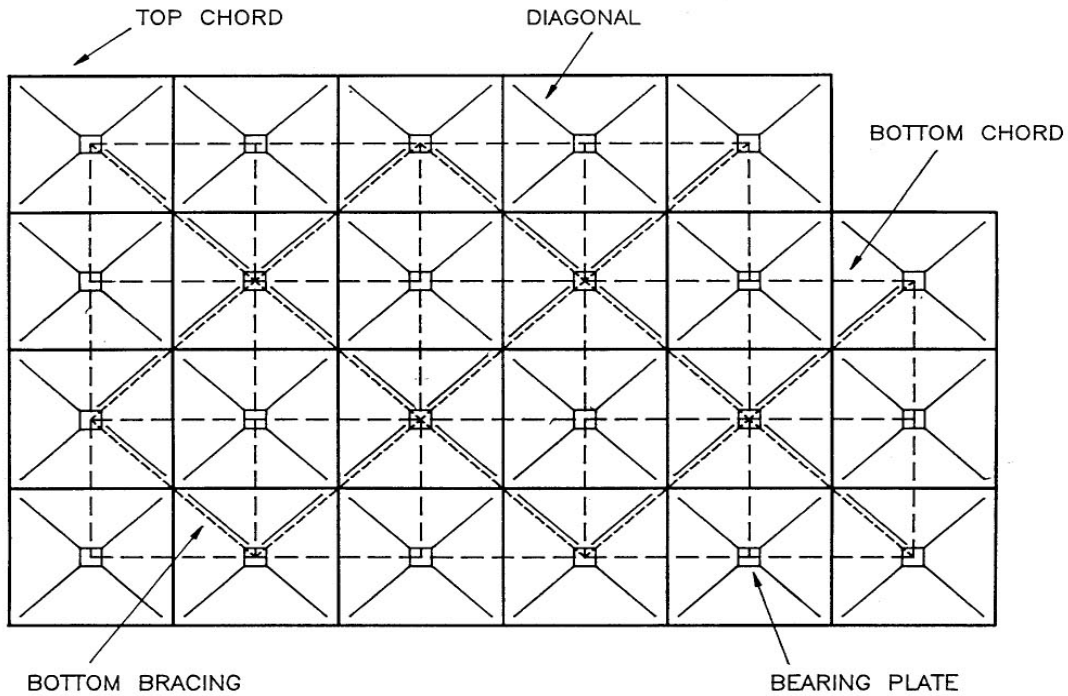


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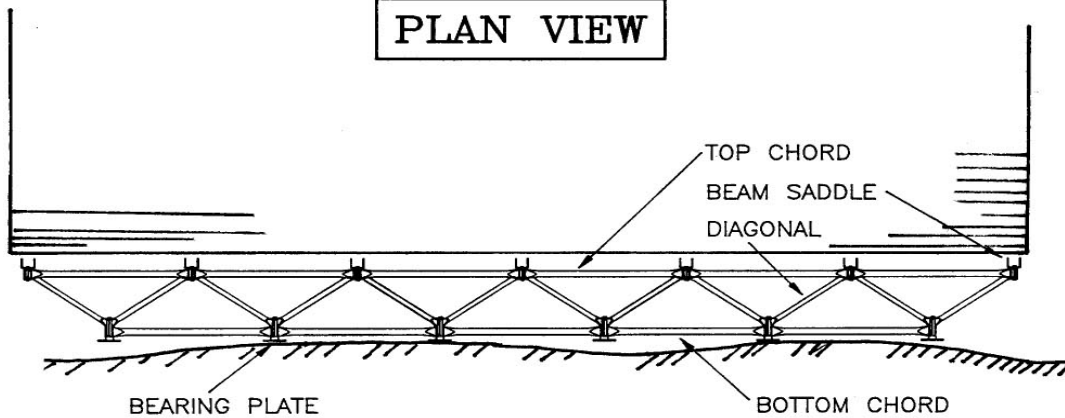
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12. PLAN & ELEVATION VIEWS



PLAN VIEW



ELEVATION

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13. WHY AND HOW THE FOUNDATION SYSTEM WORKS

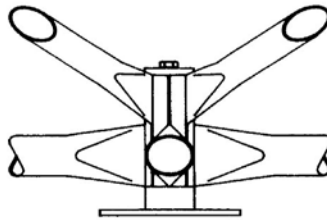
WHY AND HOW DOES THIS FOUNDATION SYSTEM WORK

■ BRIDGING STRENGTH

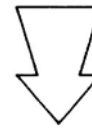


■ HIGH SINGLE POINT CAPACITY

ALLOWABLE SAFE LOAD FOR EACH BASE SUPPORT

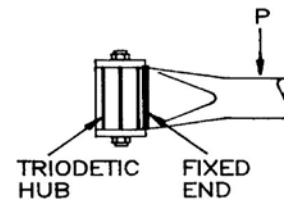
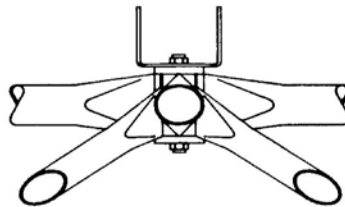


30,000 lbs
(133 kN)

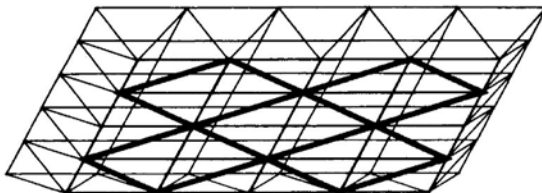


■ HIGH BENDING CAPACITY

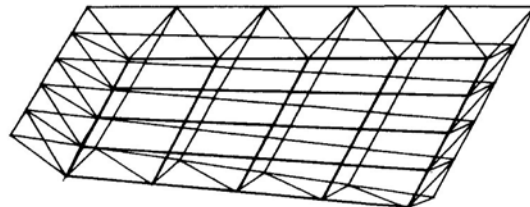
BENDING MOMENT AT ENDS OF ALL TUBING



■ TORSIONAL BRACING



FULLY BRACED SQUARE MODULES TO PROVIDE TORSIONAL STIFFNESS



FRAME WILL DISTORT IF IT HAS NO TORSIONAL BRACING

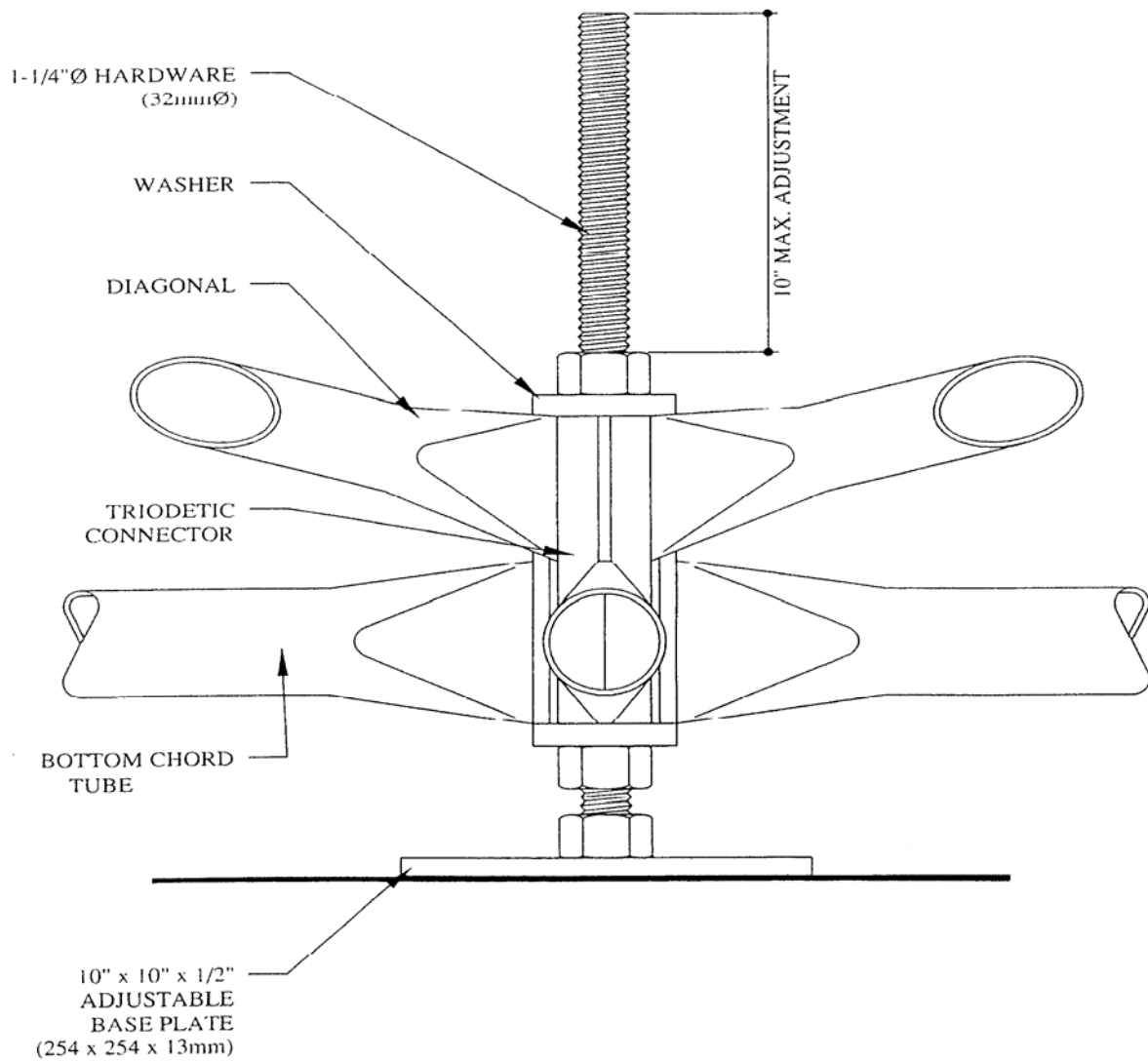


14. TYPICAL ADJUSTABLE BOTTOM JOINT

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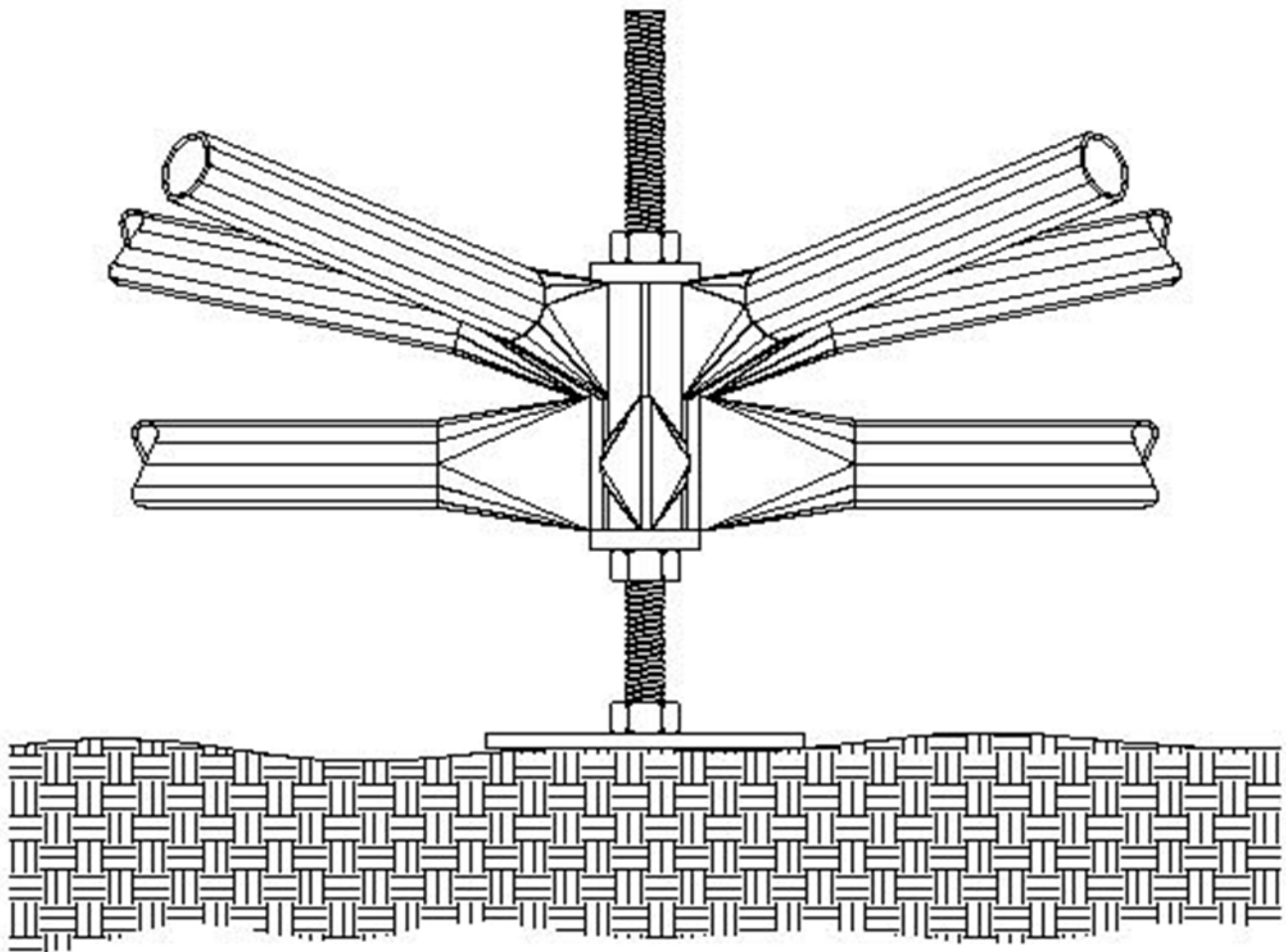
TYPICAL ADJUSTABLE
BOTTOM JOINT

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15. TYPICAL BOTTOM JOINT WITH BEARING PLATE



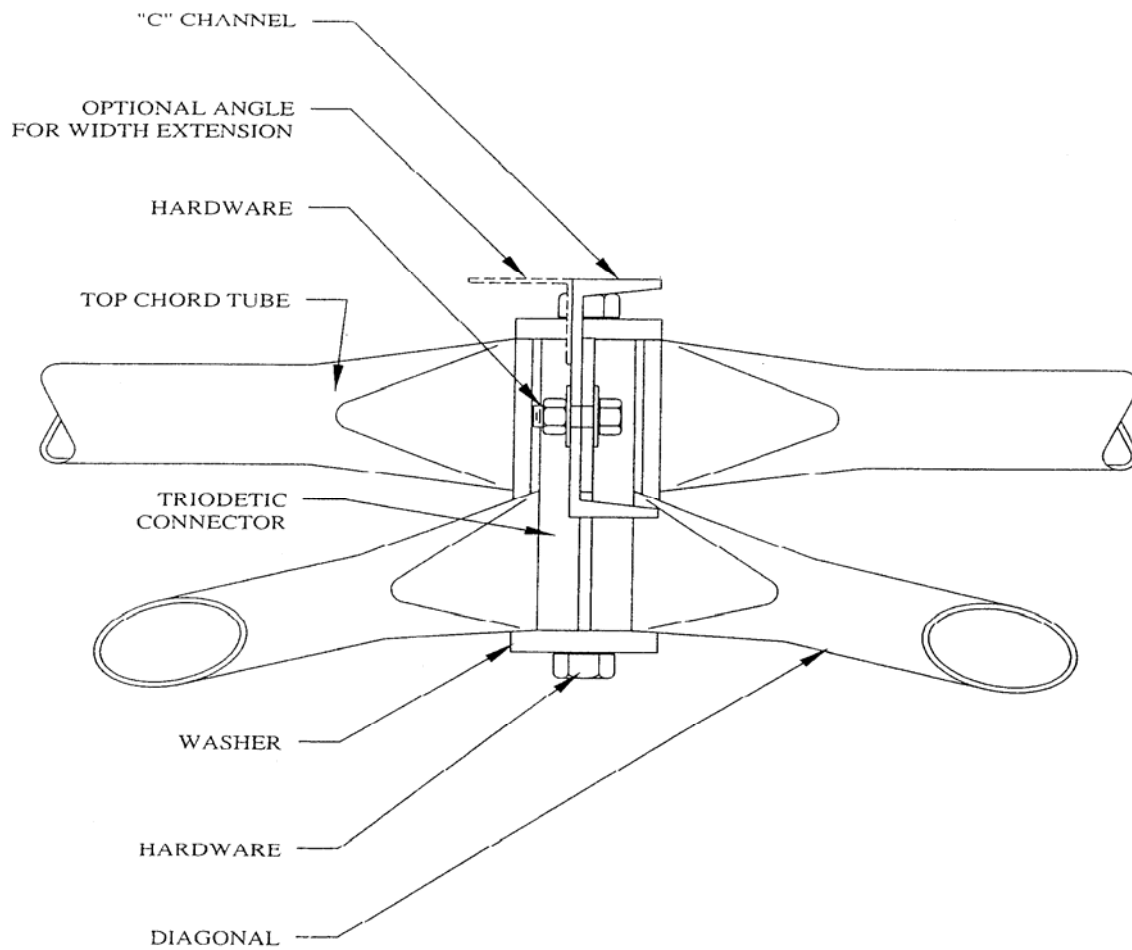
A: ADJUSTABLE BASE PLATE TO ACCOMODATE UNEVENLY GRADED SITE. FOR NEW OR RETROFIT APPLICATIONS.

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16. TYPICAL TOP JOINT WITH "C" CHANNEL BEAM SUPPORT



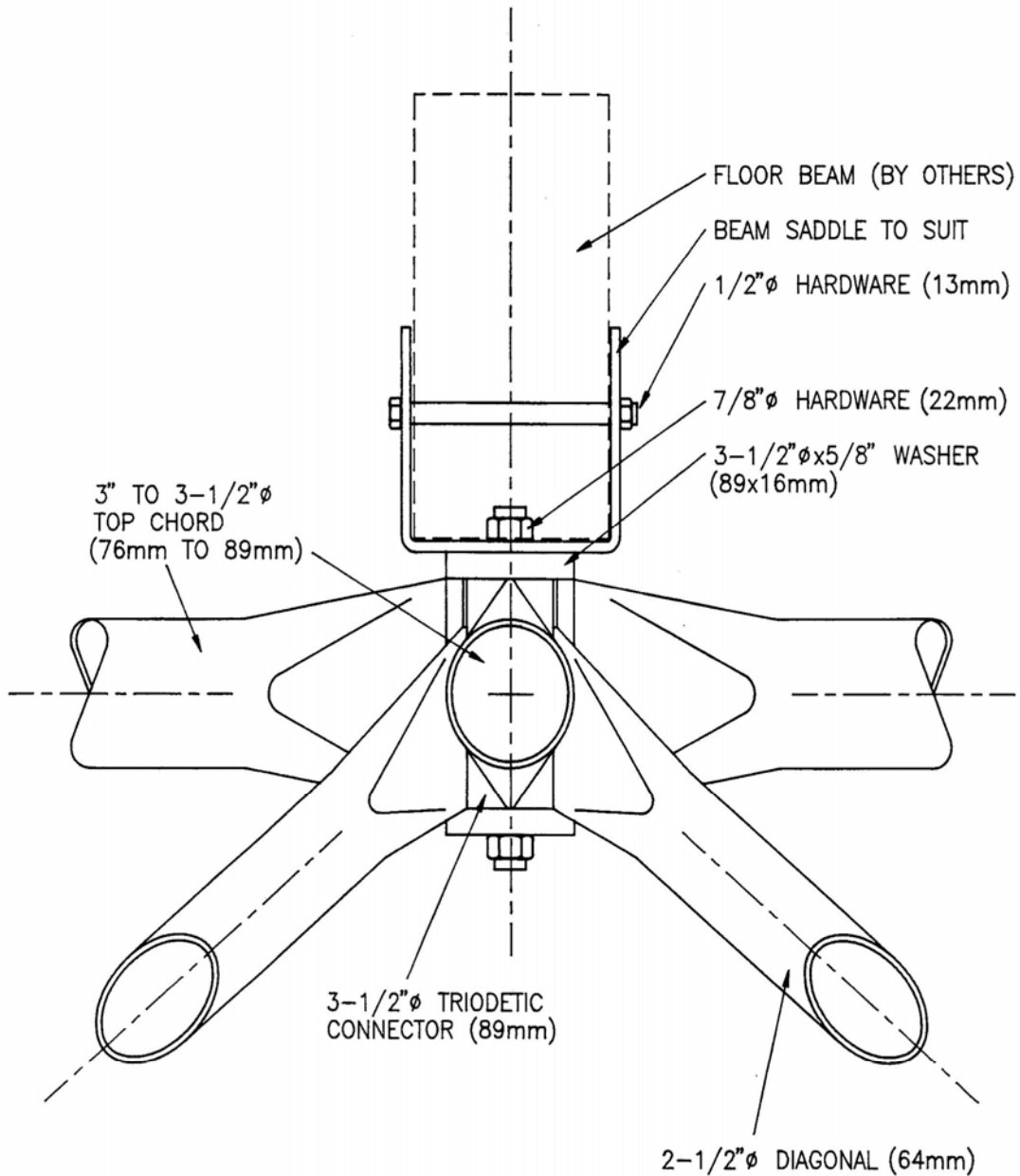
TYPICAL TOP JOINT
WITH "C" CHANNEL BEAM SUPPORT

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17. TYPICAL TOP JOINT WITH SADDLE BRACKET

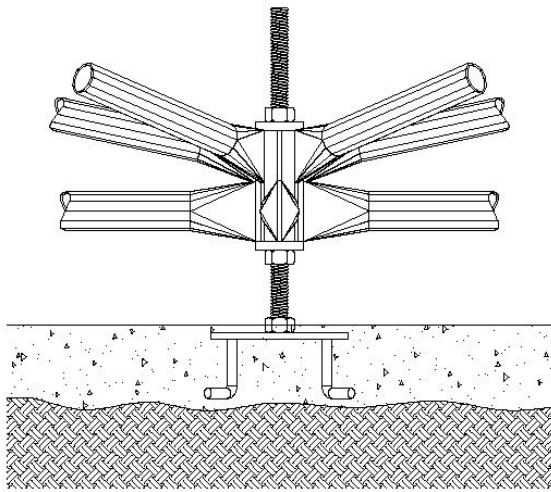


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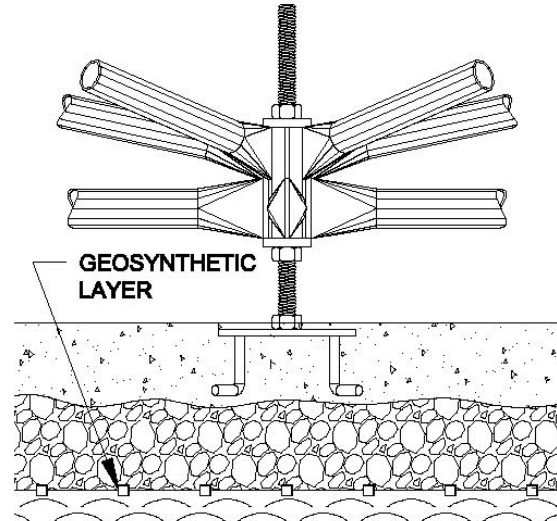
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SYSTEM 1: CONCRETE SLAB OPTION

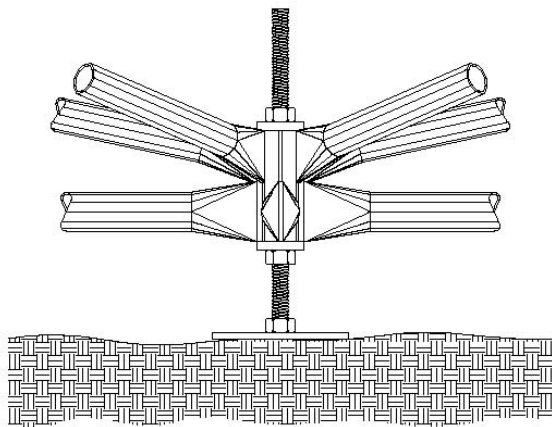


A: BASE PLATE EMBEDDED IN CONCRETE SLAB.

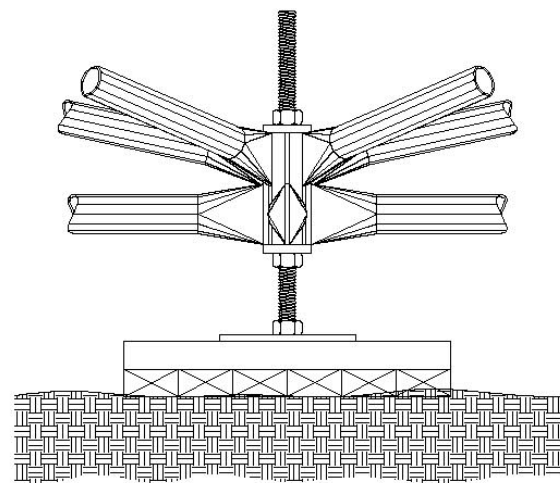


B: BASE PLATE EMBEDDED IN CONCRETE SLAB ON GRANULAR FILL AND GEOSYNTHETIC LAYER OVER SOFT WET SOILS.

SYSTEM 2: BEARING PAD OPTION



A: ADJUSTABLE BASE PLATE TO ACCOMODATE UNEVENLY GRADED SITE. FOR NEW OR RETROFIT APPLICATIONS.



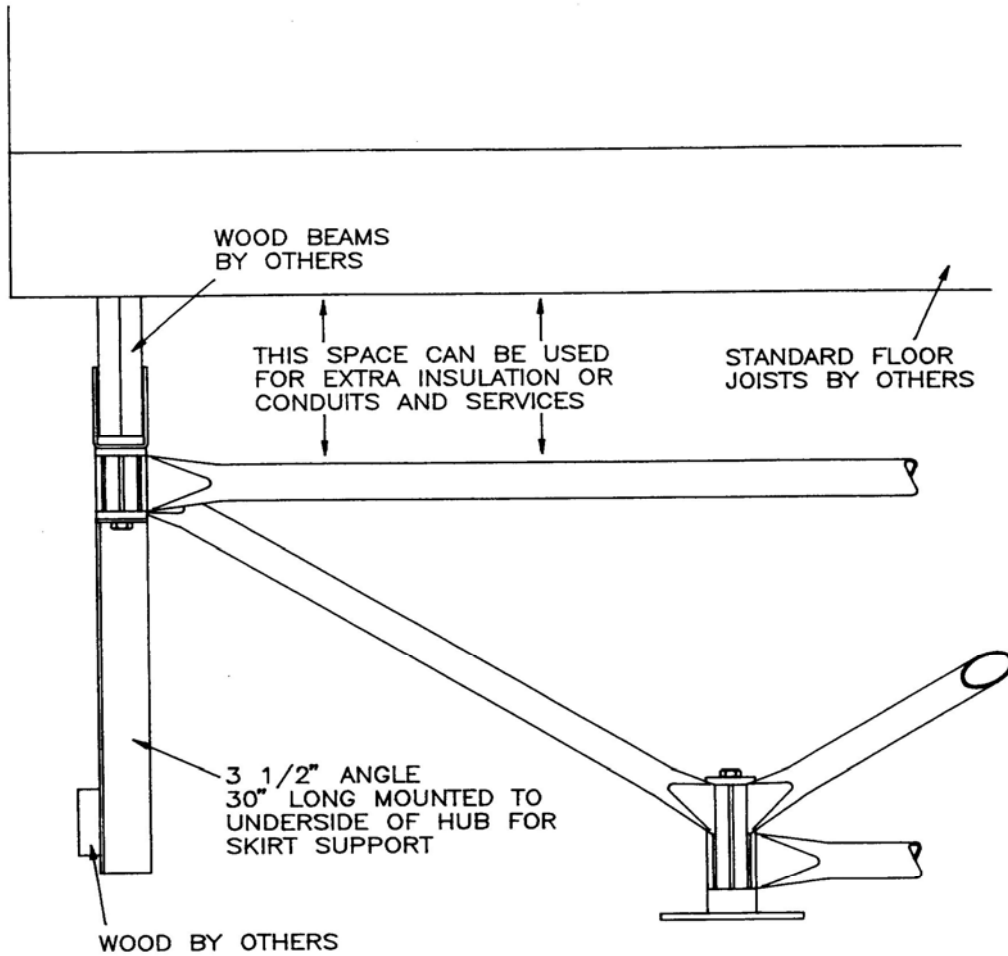
B: BASE PLATE BEARING ON TIMBER PAD ON SOFT SOIL.

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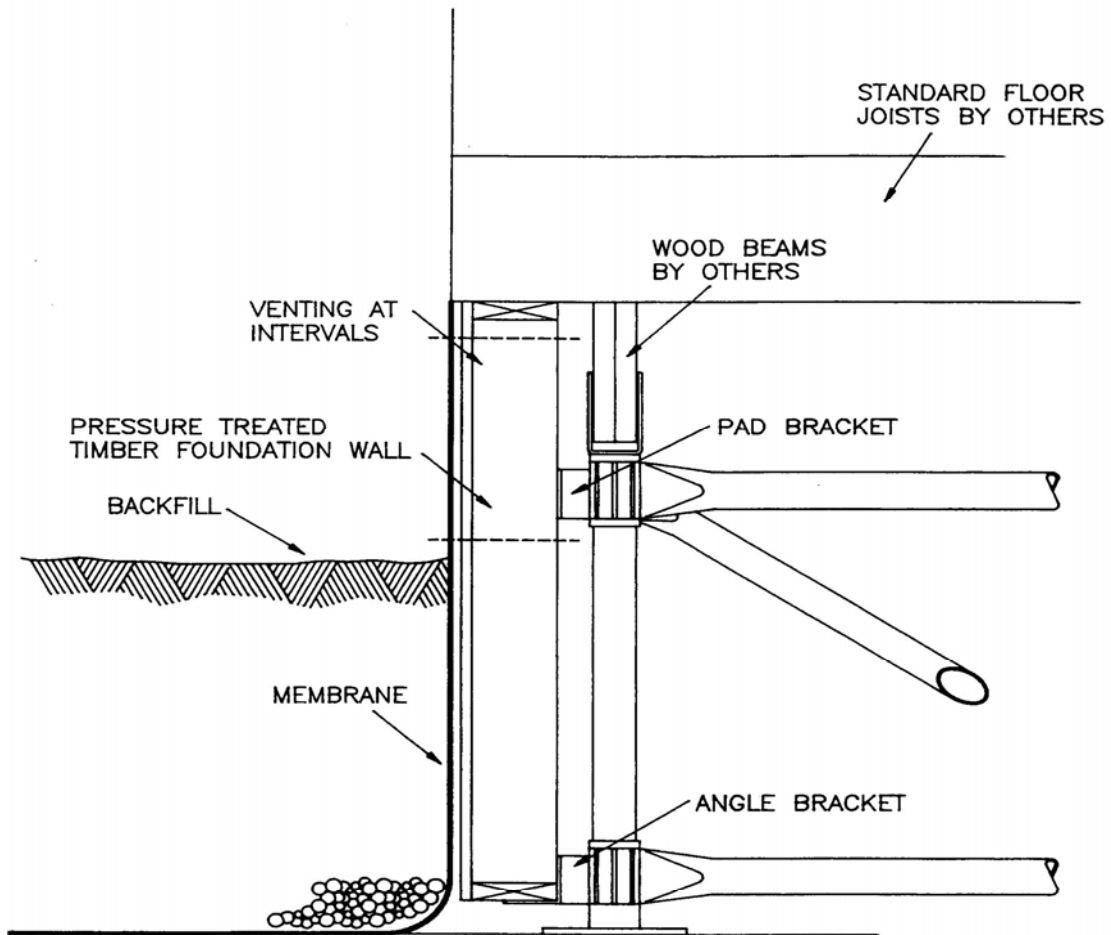
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19. PERIMETER SKIRT FRAMING



PERIMETER SKIRT FRAMING

20. SUB-SURFACE FOUNDATION DETAIL



NOTE:
SOME SITE CONDITIONS MAY REQUIRE
WATERPROOF MEMBRANE TO EXTEND BELOW
ENTIRE TRIODETTIC FOUNDATION FRAME AND
UP ALONG THE EXTERIOR OF FOUNDATION
WALL

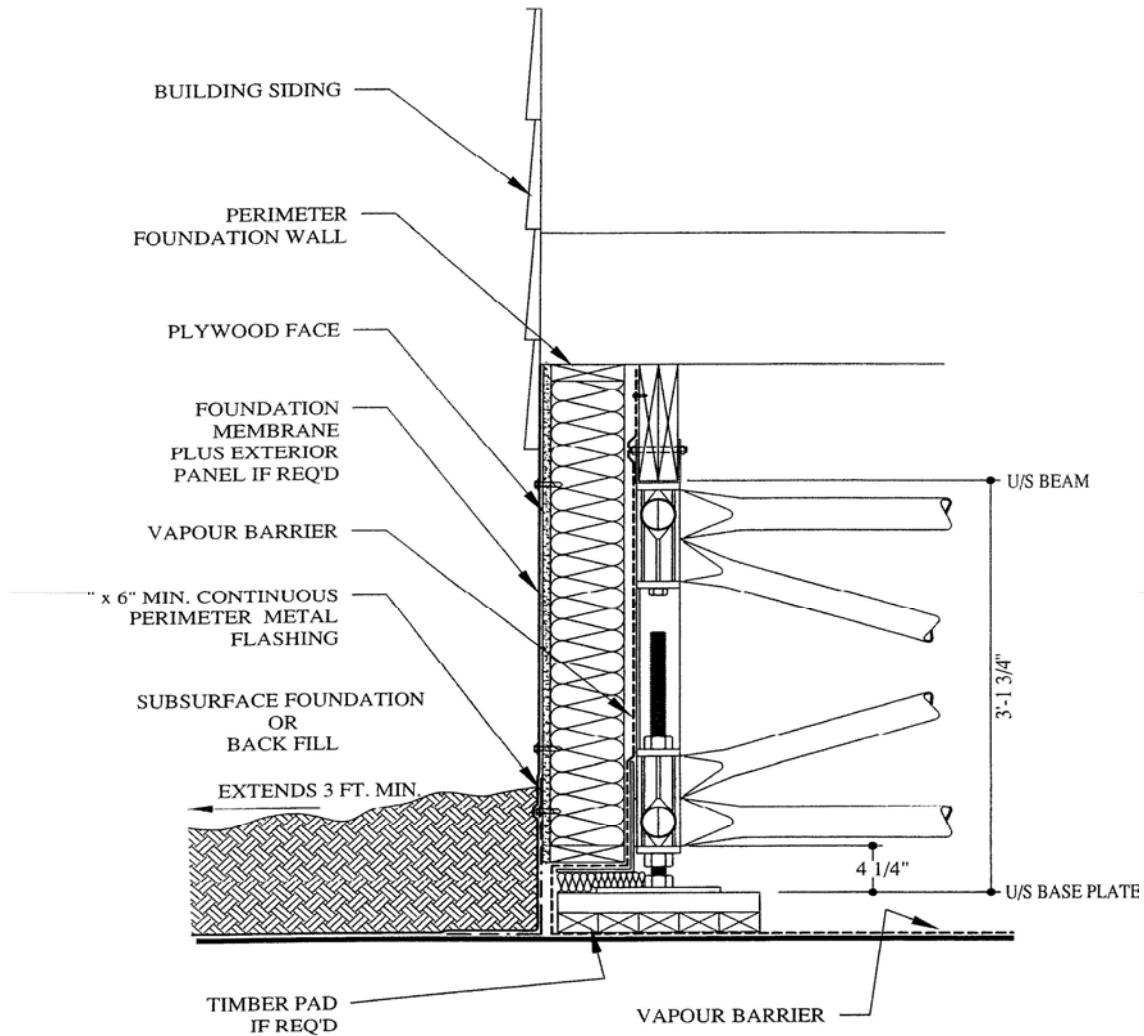
SUB-SURFACE FOUNDATION DETAIL

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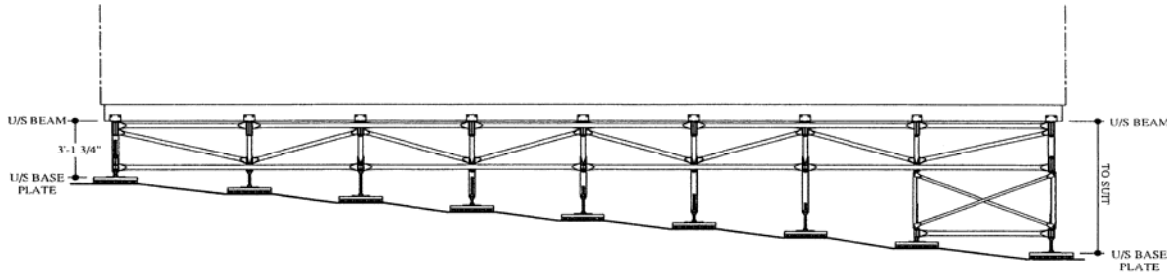
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21. PONY WALL PERIMETER FOUNDATION SYSTEM FOR SUNSURFACE OR BACKFILL CONDITION



PONY WALL PERIMETER FOUNDATION SYSTEM FOR SUBSURFACE OR BACKFILL CONDITION

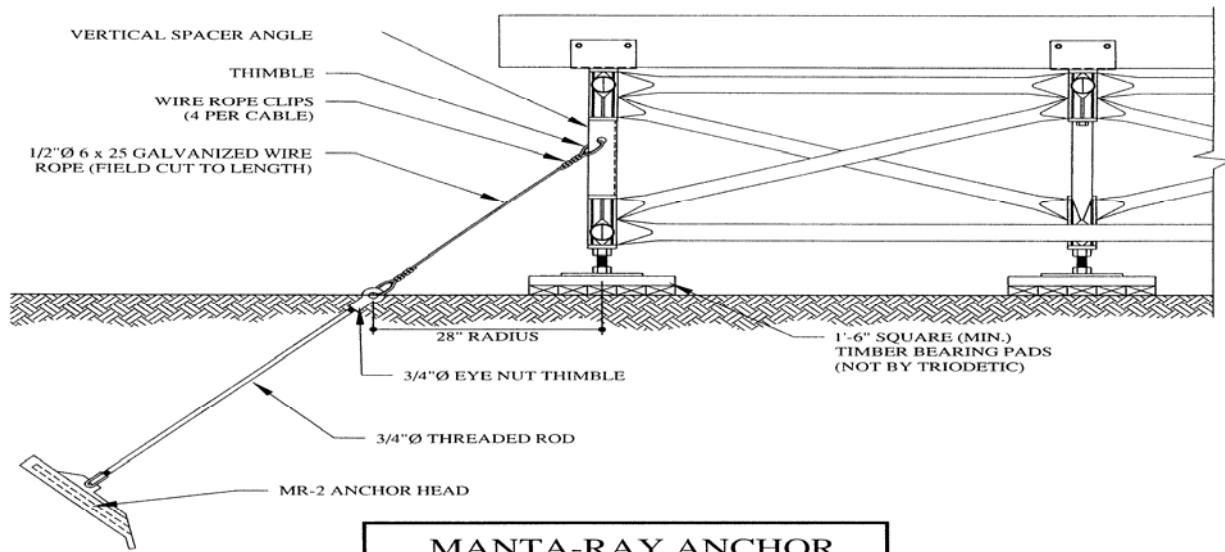
22. MULTIPOINT FOUNDATION FOR SLOPER TERRAIN



MULTIPOINT FOUNDATION FOR SLOPED TERRAIN



23. MANTA-RAY ANCHOR DETAIL



MANTA-RAY ANCHOR DETAIL

24. TECHNICAL FOUNDATION FRAME SPECIFICATION

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PART 1. QUALITY ASSURANCE

a. Manufacturers Qualifications:

- i. The foundation frame shall be manufactured by a firm having a minimum of five years experience in the design, fabrication and construction of foundation frames for permafrost, discontinuous permafrost and other problem soil areas.
- ii. Submit evidence that the framing system has been used successfully on previous foundation applications of similar nature and complexity, and that previous installations have been monitored to verify their performance characteristics under these design and service conditions.

b. Installer's qualifications:

- i. The foundation frame installer will be trained by the manufacturer or its representative and shall be certified by the manufacturer as a qualified installer to undertake the assembly or disassembly of the foundation frame.

c. Design Criteria:

- i. **General:** The foundation frame structure will be designed in accordance with all the provisions of the specified building code having jurisdiction as well as design criteria established by previous tests and field observations of the behavior and performance of foundation frames.

- ii. **Design Loads:** The foundation frame shall be designed for its self weight, the dead load of the building plus live loads and seismic loads dictated by the applicable building codes for the specific use and classification of the building as well as special loads as indicated on the contract documents.

iii. Geometric Layout.

- 1. The geometric layout of the foundation frame shall consist of a fully triangulated array of structural components. The modular components in the top layer are separated from the bottom layer by means of a network of diagonals which interconnects the top and bottom layers. This modular array shall be capable of distributing forces in a three dimensional pattern.
- 2. For purposes of keeping the number of components to be assembled and the number of connections to be made on site to a minimum, the total number of framing members, diagonals and chord sections shall be limited to a maximum of 220 per 1000 ft² of foundation frame.

iv. Torsional Rigidity.

- 1. For square or rectangular patterned geometric layouts, a horizontal diagonal brace shall be placed in each module from corner to corner to resist distortion of these squares or rectangular modules.
- 2. Where the floor framing and supporting beam system of the building can be relied upon to provide the necessary resistance to frame distortion, these braces may be omitted in the

upper layer.

3. In all cases the bottom layer shall have a brace in each module resulting in a fully triangulated bottom layer.

v. **Support System for one and two storey buildings.**

1. Unless otherwise noted on the drawings each lower node or hub where structural members interconnect in the lower layer shall have a bearing pad.
2. Regardless of the soil bearing pressure capacity, the minimum design load for support pads and diagonal members framing into them shall be based on the total dead load of the building plus half the live load forces where this total load is distributed over a maximum of four supports for every 1000 ft² of building area. The total number of effective supports so obtained shall be rounded off to the nearest whole number. The minimum member sizes selected to accommodate this point load and the corresponding axial loads in the diagonal members shall be constant throughout the foundation frame except in areas where special loads occur, as may be indicated on the contract drawings in which case larger sizes may be warranted.
3. The support pad assembly shall be capable of providing lateral stability and resistance to side sway by designing it to resist a horizontal force equal to 15% of the vertical design load of the support pad.

vi. **Jointing system.**

The jointing mechanism used to interconnect the structural components shall be capable of transmitting axial and bending stresses.

vii. **Bridging strength.**

1. The foundation frame shall have the structural capacity to span between a broad array of possible support conditions under total dead load plus live load.
2. The foundation frame shall, under full dead load and live load, be capable of bridging or cantilevering over supports which have become ineffective.

viii. **Displacements.**

1. The foundation frame shall have adequate stiffness and stability to provide structural rigidity to the building to eliminate undue stress to building materials and building components.
2. The out of plane displacements or deflections of the foundation frame shall not exceed L/300. Where L is the span between two effective supports, or in the case of a cantilever condition one half of the length of the cantilever section.
3. Due to the indeterminate nature of a multi point support system an infinite number of effective supports is possible, therefore the radius of curvature R of the deflected shape anywhere across the frame surface shall be equal or greater than 13,500 inches.

For $\frac{L^2 + 4(d)^2}{8(d)} = \text{or } > 13,500 \text{ inches}$

where L = distance in inches over which deflection d is measured

d = deflection in inches

ix. **Component Sizes and Material.**

1. For tubular steel chord members and bracing members of lengths varying between 7 and 13 feet in both the top and bottom layer, the diameter shall not be less than 3 inches and the wall thickness not less than 0.148 inches.
2. For tubular steel chord members and bracing members of lengths less than 7 feet, the diameter shall not be less than 2 1/2" and the wall thickness not less than 0.120".
3. For tubular steel diagonal members of lengths varying between 5 and 7 feet the diameter shall be not less than 2 1/2" and the wall thickness not less than 0.148".
4. For tubular steel diagonal members of lengths less than 5 feet the diameter shall be not less than 2" and the wall thickness not less than 0.120".
5. If aluminum chords or diagonals are used, the minimum requirements listed above shall be increased to compensate for the Modulus of Elasticity of aluminum being 1/3 that of steel resulting in a three fold increase in displacements and differential settlement.

PART 2. PRODUCTS

d. Manufacturers:

- i. The foundation frame as specified herein is based on the round steel tube and Triodetic hub connector system as manufactured by :

Triodetic Building
e-mail: info@triodetic.com

- ii. Substitutions may be considered. The substitute product must be proven to be equivalent to the specified system by submitting drawings, details, samples and structural design data and calculations for engineers review and evaluation prior to bid.

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e. Materials:

- i. Round tubes formed to suit connectors: Steel ASTM A500 Grade B or C.
- ii. Triodetic connectors and connector plugs: Aluminum Alloy AA 6351-T6.
- iii. Connector washers and all miscellaneous structural sections, brackets, weldments and connection plates: Steel ASTM A36
- iv. Threaded hardware: Steel ASTM 307, A325, A490 or A193-B7 as required by design.

f. Fabrication:

- i. Structural elements will be factory prefabricated round tubular sections with cold-formed tooth ends to suit the mechanical connector. Tubular members will be accurately controlled in the forming operation to maintain precise length and angles in accordance with the required geometry.
- ii. Mechanical connector nodes will be cylindrical aluminum extrusions, factory milled to the required length to accommodate the full length of the formed tubular members.
- iii. All miscellaneous ancillary components as required by the contract documents will be accurately custom fabricated to ensure compatibility with other related elements of the work.

g. Finish:

- i. All steel structural tube elements shall have a factory pregalvanized finish.
- ii. All miscellaneous steel components shall be hot dipped galvanized or have a cold galvanizing factory applied paint finish.
- iii. All threaded hardware shall have a zinc plated finish.

PART 3. FIELD ASSEMBLY

h. Site examination:

- i. Before proceeding with the assembly work, the site shall be examined for evenness. It is of utmost importance that the site be as level as is possible, this will greatly enhance the assembly and will also benefit the ultimate structural performance of the foundation frame.

i. Erection:

- i. The installation work will be undertaken by an authorized erector who has been fully trained by the manufacturer or his representative.
- ii. Assemble and erect the foundation frame in accordance with manufacturer's installation instructions and in accordance with shop and assembly drawings.
- iii. Apply a clear lubricant at the interface between the formed tooth ends of the structural tube components and the connector node in accordance with manufacturer's recommendations.
- iv. Use only special rawhide-faced hammers as provided by the manufacturer for assembly of the tube components. Metal hammers are not permitted.

CONTACT INFORMATION

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