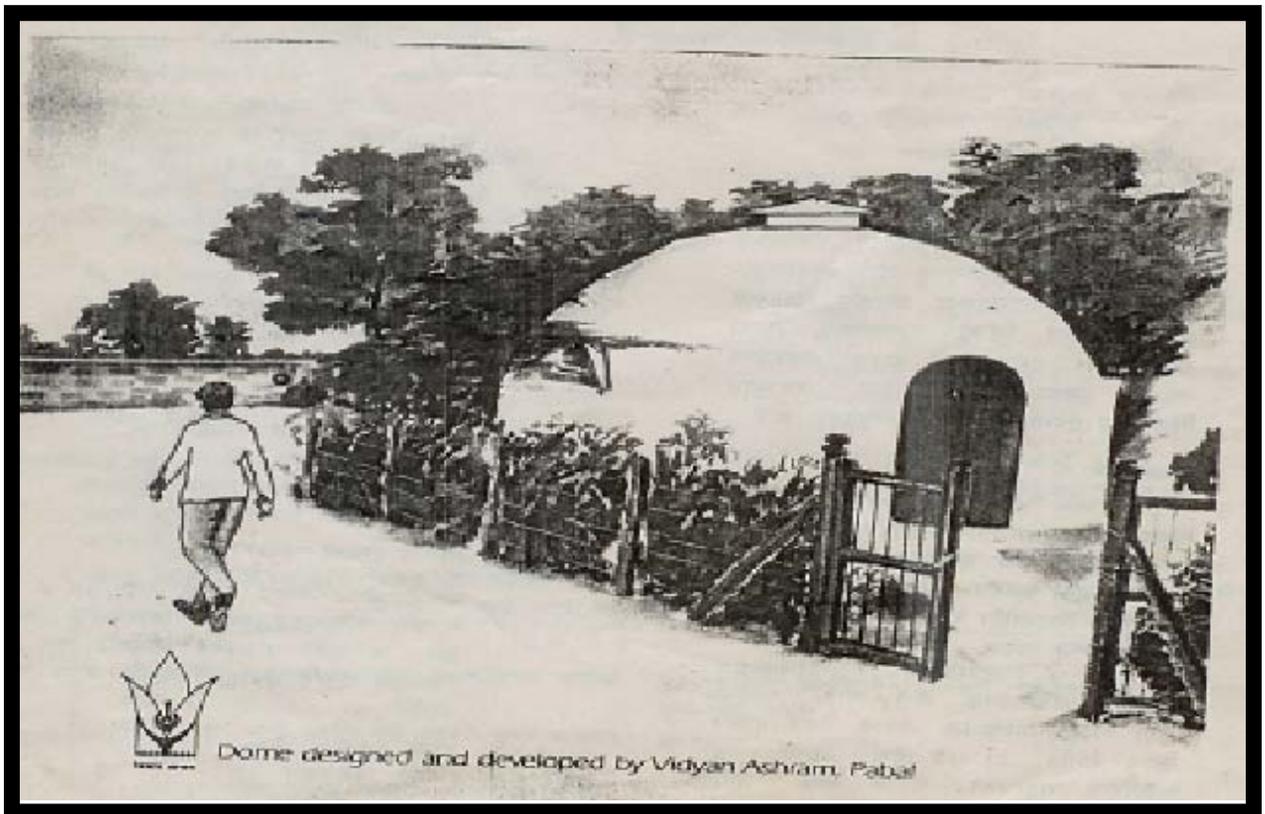


PABAL DOMES

Instruction Manual



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1.Components of the kit.

The kit given to you consists of :

Black struts	30 nos.
Red struts.....	55 nos.
White struts.....	80 nos.
Curved truss.....	2 nos.
White discs.....	15 nos.
Black discs.....	6 nos.
Mixed discs.....	40 nos.
Not – bolts	660 nos.
Long bolts for windows, door, 12 inch long.....	5 nos.
2 inch long.....	8 nos.
foundation angles with clamps.....	15 nos.
foundation frames with hinges	4 nos.
Door frame † shutter frame	1 nos.

OPTIONALS

Window shutters of M.S. sheet, with latches and bolts fixed.

Door – M.S. sheet fixed on to the door frame, one outside latch , 2 handles.

Ventilator:

Black struts 5 nos.

Red struts 5 nos.

Clamp bolts 5 nos.

Nut bolts40 nos.

Triangular M.S. sheets..... 5 nos.

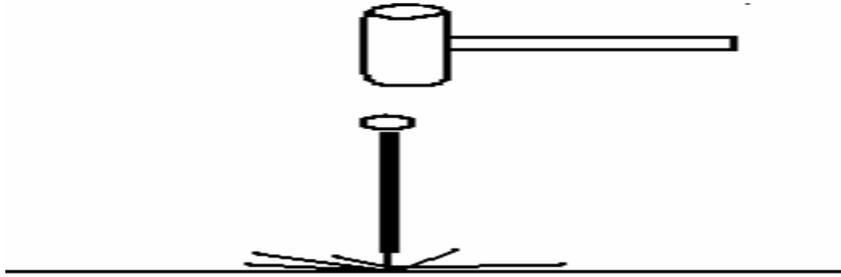
From May 1993, the ventilator is part of the basic kit . the doors are now made of box – section and windows of Z – section..

Domes of 7 m and above have 25 mm angles for struts and 8 m domes and bigger have double the number of discs, as two discs are used at each junction. All windows for sizes larger than 6m , have rectangular windows, with built in grill.

PLEASE COUNT THE ITEMS ON ARRIVAL

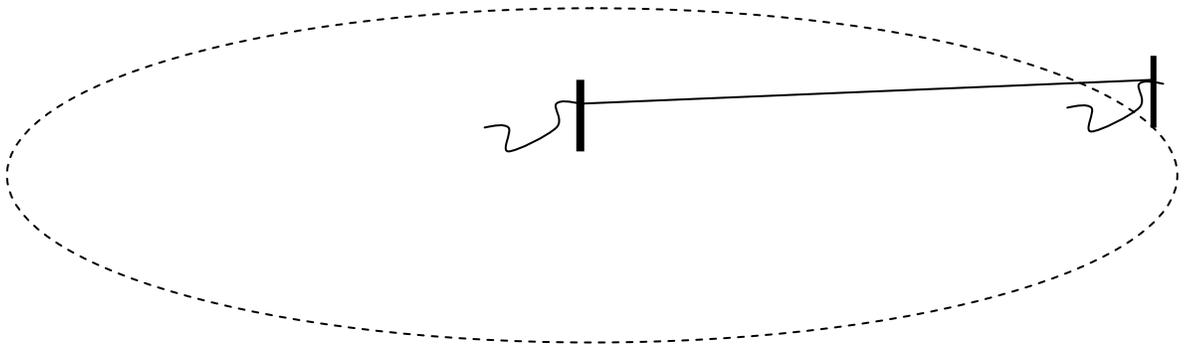
2. Where? and how? to start.

1. Choose the site: Mark the center by fixing a rod at the point on ground . Do not remove this rod till the foundation is complete.

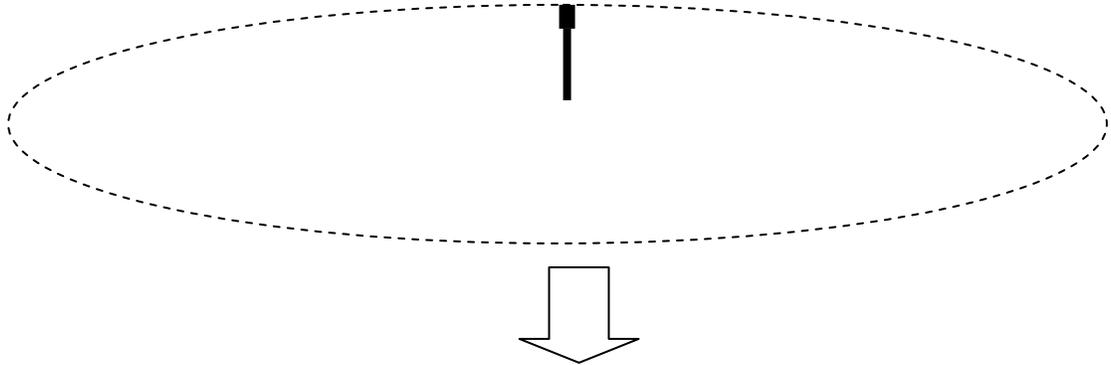


2. Make a circle of radius **X** meter with the help of a string and stick. Sprinkle chalk powder along the line.

Where 'x' is Dia of Dome / 2.06.

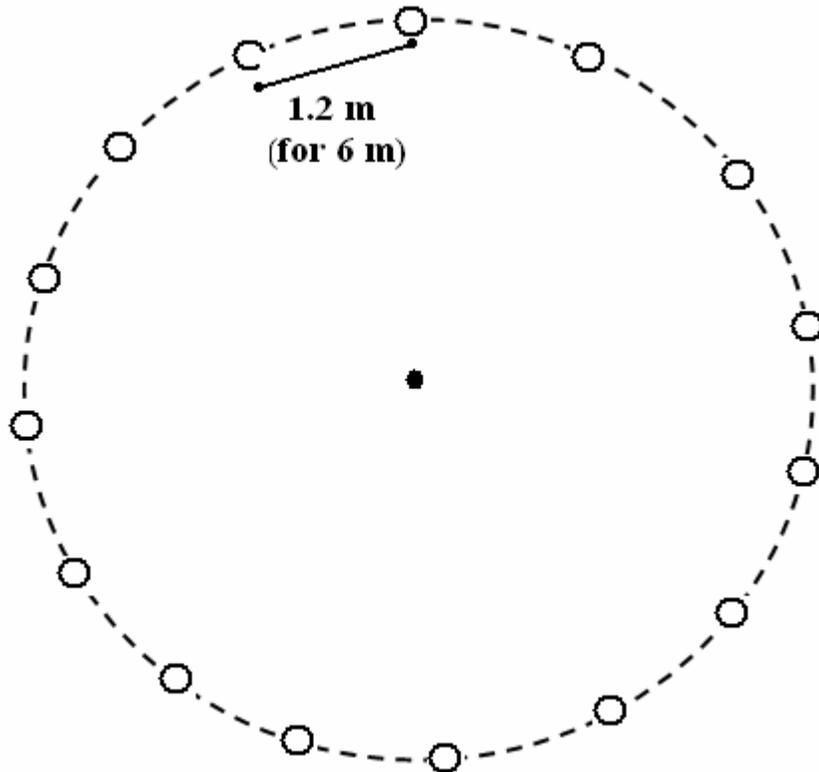


3. Fix the position of door.



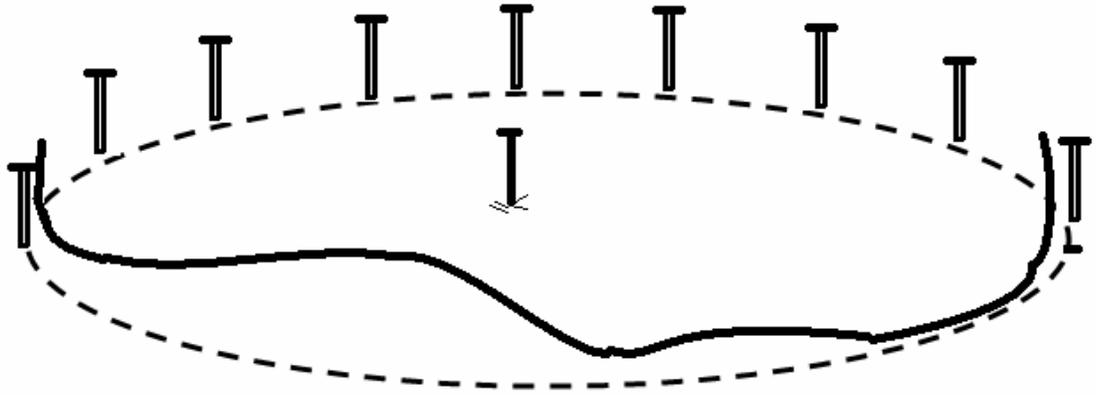
4. Divide the circle into 15 equal parts, starting from this point. the chord length is 1.2 meters, for 6m dia Dome.

For all sizes, use chord length = dome dia / 5



5. Dig holes at these points of 1 foot depth and 1 foot diameter.

6. Fix foundation angles temporarily with stones in these pits and level tube.



7. Assemble the bottom circle of the dome so that your foundation angles are exactly in position.

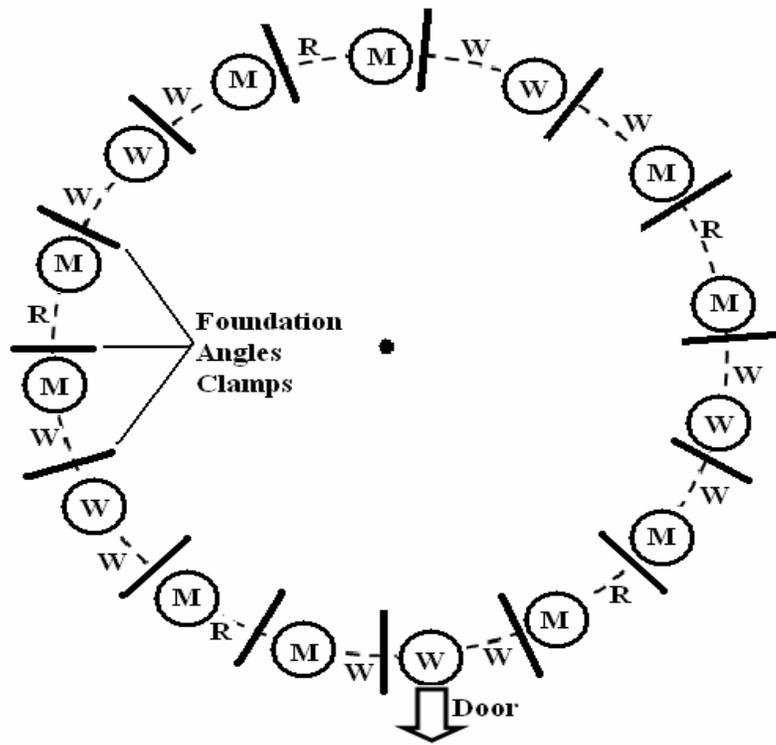
For this take

White struts ... 10

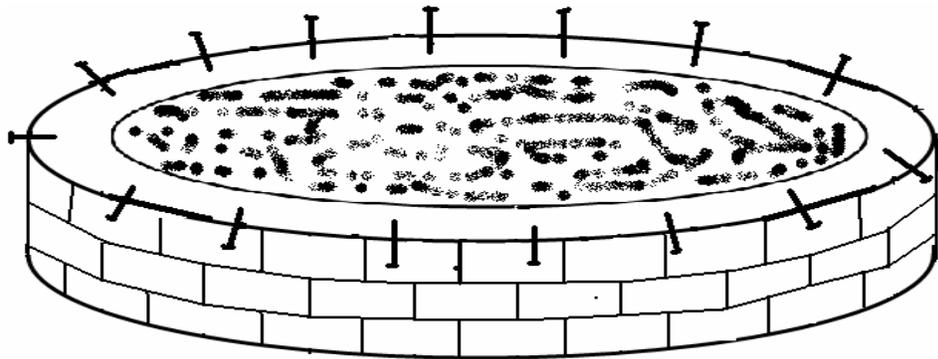
Mixed discs 10

White discs 5

Red struts 5

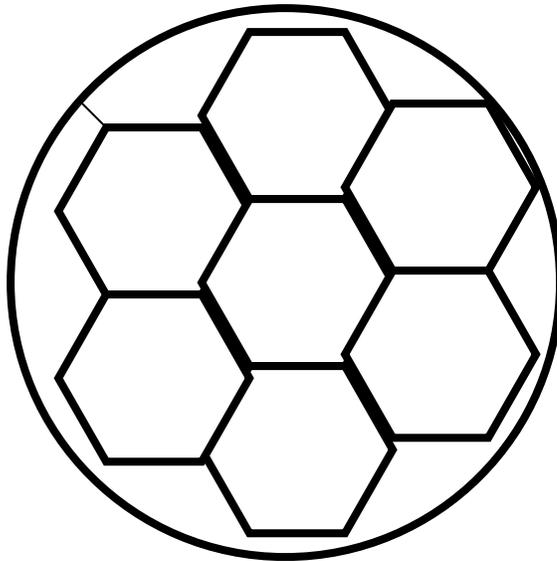


8. Grout the angles in concrete Measure from center once again to see whether all discs are at same distance from center .
9. Disassemble the bottom circle.
10. Build plinth up to the clamps. keep hollows where the disc can bury into the plinth.



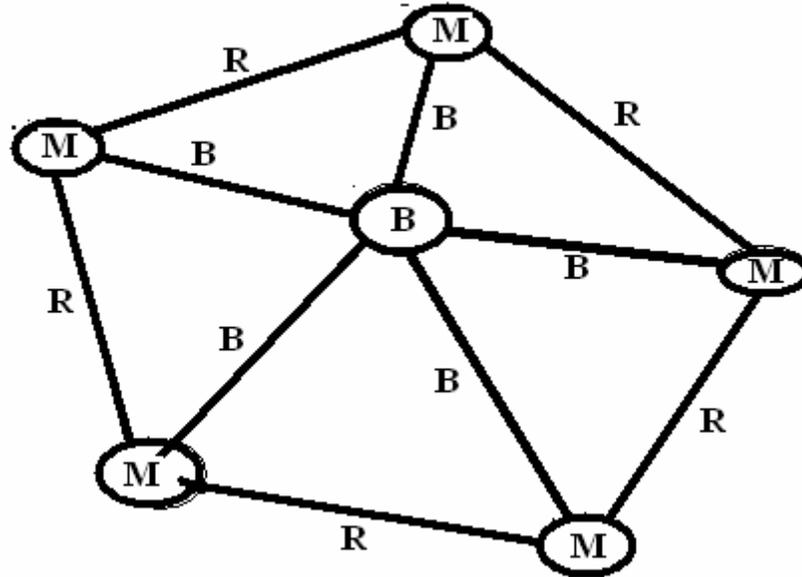
3. Assembly

- A football is a good model for the dome. Divide the pentagons and hexagons into triangles with a coloring pen.

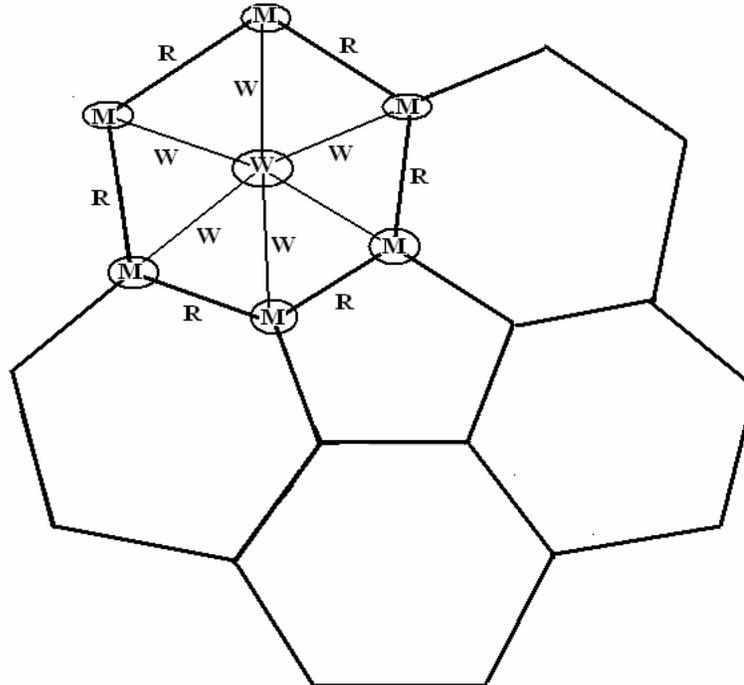


- For assembling the dome you need a set of 14-15 spanners and 5 tripods. Tripods can be made by tying 3 bamboo poles together.
- Symbols:
B....black strut b...black disc
W...white strut w...white disc
R....red strut m...mixed disc

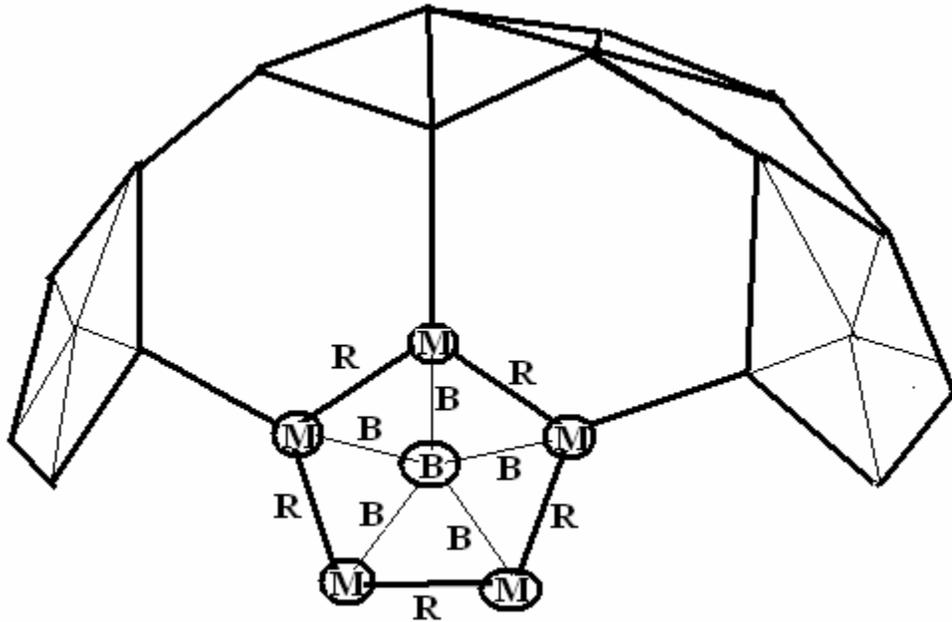
- Step 1.
Top pentagon is assembled . This is kept on 5 tripods. Check the orientation of the mixed discs.



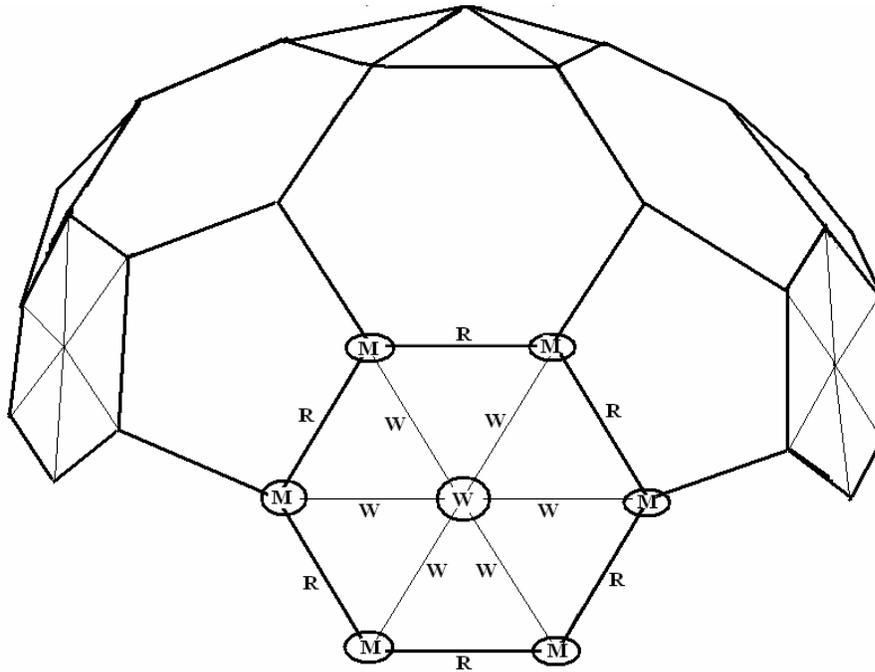
- Step 2.
5 hexagons are built up on all the 5 sides. Each circle is completed before beginning the next . The dome is lifted and placed on the tripods successively.



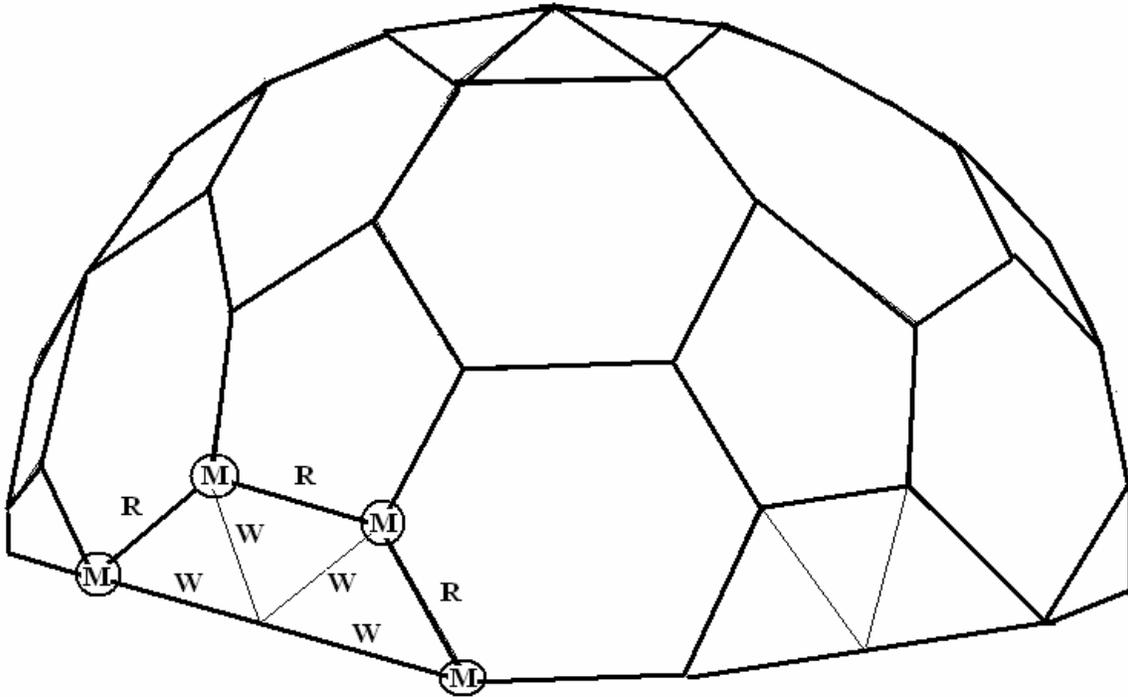
- Step 3.
5 pentagons fit into the corners.



- Step 4.
Bottom hexagons are assembled.



- Step 5.
Bottom half hexagons are assembled.

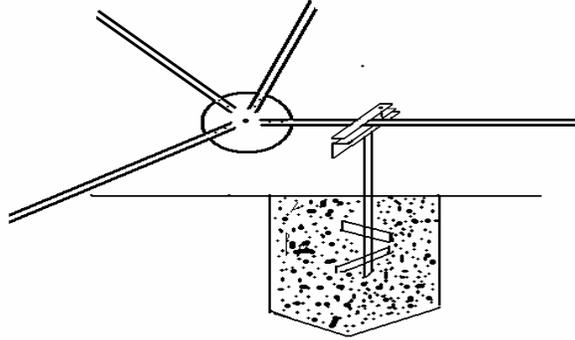


Do not tighten the Dolts while assembling This can be done once the dome is fixed on foundations. If the shape is found to be distorted or the struts do not fit ,check the previous struts, discs orientation , etc.

Do not climb over the dome at this stage.

4. Foundations

Once the dome is completely assembled, it can be lifted and kept on the angle foundations and clamped. Clamping of bottom struts should be near the discs and not the middle of members to prevent bending.

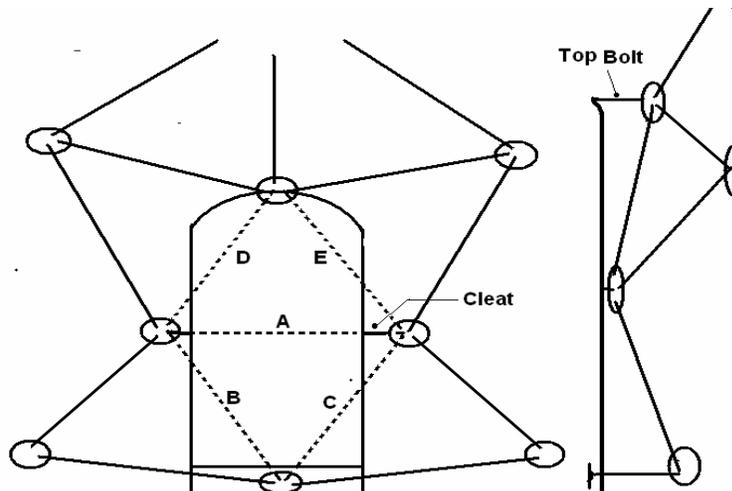


5. Doors and Windows

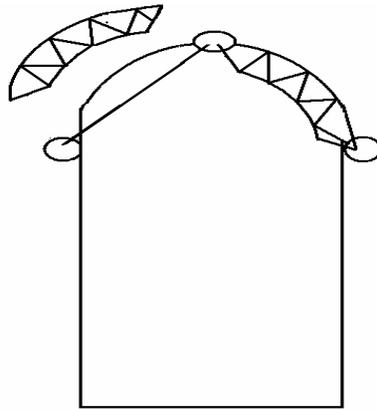
The five pentagons located symmetrically around the dome form the natural choice for door and windows. While clamping the dome, the pentagon on which the door is to be fixed should be facing the correct direction.

DOOR

Remove members A,B,C,D and E . Insert the top bolt in pentagon vertex and fasten the side cleats of door in the figure . Adjust the door frame with a plumb line and grout the bottom cleats in concrete.

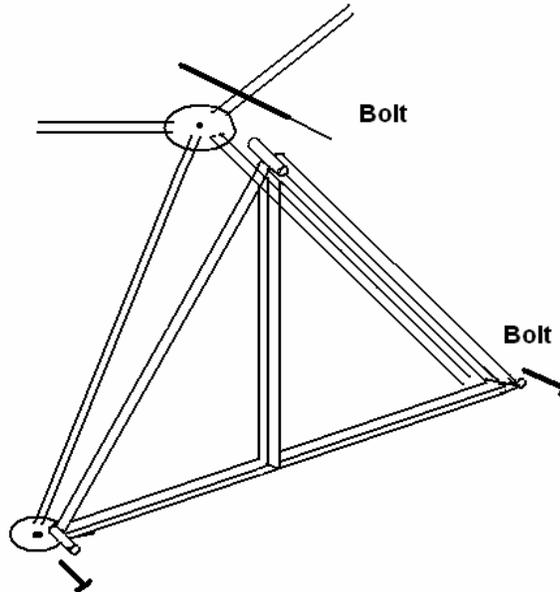


- Instead of the struts D and E , the curved trusses are fitted in their place.



WINDOWS.

locate the other four pentagons and fix the windows. Adjust the top bolt till the windows get vertical.



After fixing the door and windows , all the nut bolts are tightened.

Windows : 7m and above

In the case of bigger domes , (7m and above) the windows is Slightly different. The middle member , (base of the triangle) has to be removed and cleats fitted on the window frame have to be fixed in its place.

To assemble the ventilator , take the following components.

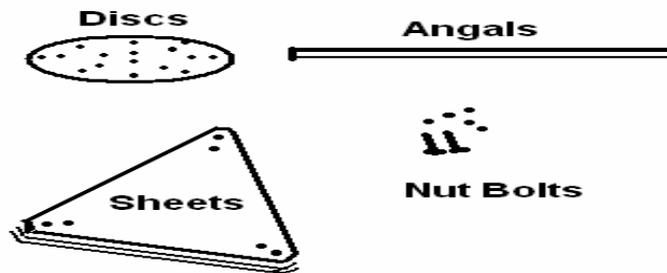
Mixed discs 5

Black discs 1

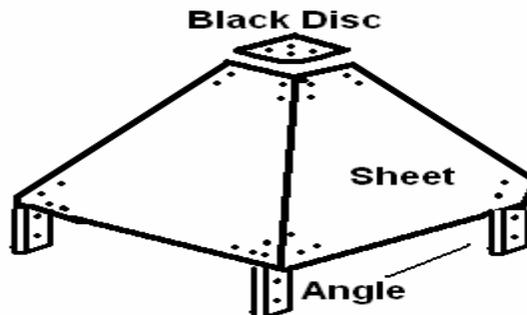
Black struts (small size) 5

Red struts (small size) 5

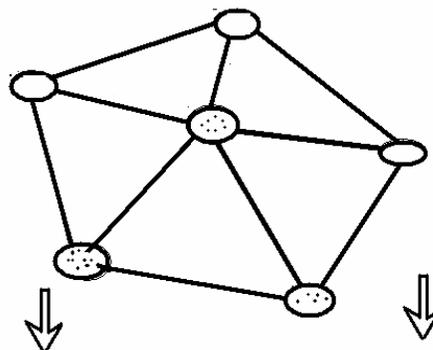
Triangular sheets and nut bolts.



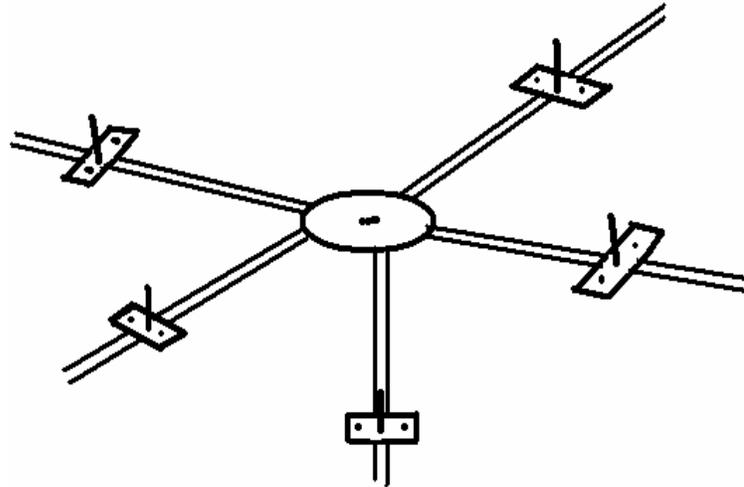
Start with the black disc. Fasten one set of holes on the disc, 2 Sheets and one black struts in that corner. Move on to the next set after this is completed.



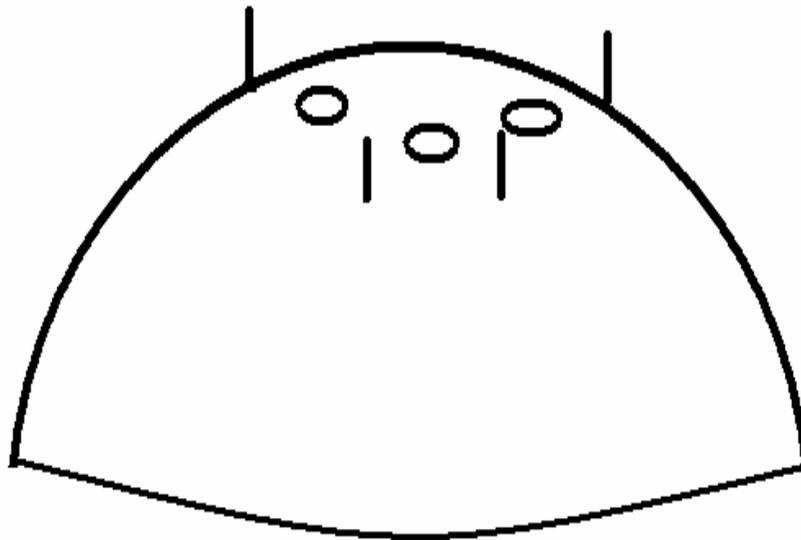
Mixed discs are nut bolted at bottom five corners after this . The five red struts are also fitted on to the edges. This pentagon forms the ventilator.



Clamp the five bolts on to the top pentagon struts after aligning the holes in the ventilator. After the bolts are tightened into place , the ventilator can be removed.



While mortaring the dome, 5 vents of dia 10 cm are left for air circulation , well inside the ventilator canopy.



7. Reinforcement.

Materials required :

Weld mesh 4" × 4" × 12 swg , 4 ft wide
100 ft long.....2 bundles

Scrap 24 g sheet strips5 sq ft

Chicken mesh 24 swg × 3 / 4 " , 3ft
wide, 100 ft long2 bundles

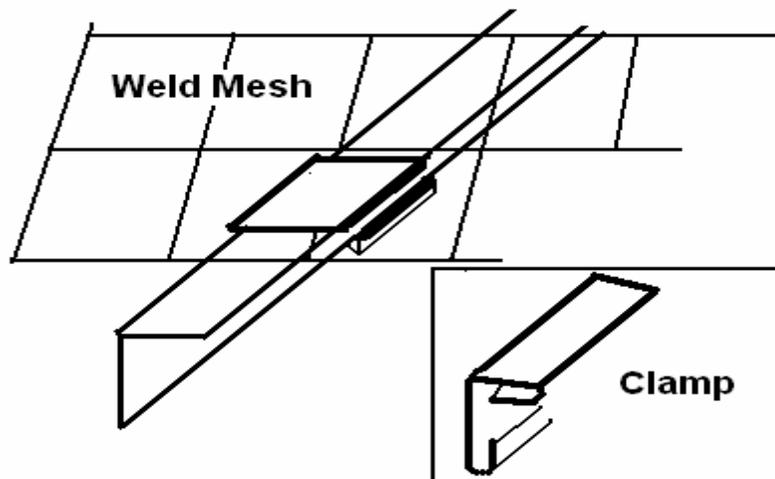
G.I. wire24 swg 3 kg.

Tools :

Pliers, Weld mesh cutter or chisel , side cutter, Tin cutter

Procedure:

Cut pieces of weld mesh of 2m lengths and clamp them on to the angles. Clamps are of scrap 24 swg M.S . sheet strips (old oil or biscuit cans etc are ideal) . The weld mesh is strapped with these strips on to the angles .



The Geodesic Dome

The geodesic structure is the pattern of pentagons and hexagons you see on the football. First popularized by Buckminster Fuller for housing, it has now turned out to be a very fundamental structure in nature.

About 10 – 12 years ago, the scientists discovered that the dreaded AIDS virus has this geodesic structure. More recently, other scientists working in an entirely different area found a new crystalline form of carbon, different from diamond and graphite. This was again the geodesic structure, popularized by Buckminster Fuller. In his honour this 'carbon ball' structure has been named Fullerene. It has very unusual properties. It dissolves in benzene and on doping with certain elements, becomes a superconductor!

Buckminster Fuller had once stated that he does not try to design something for beauty. He tries to blend with nature. Anything that really fits into nature will automatically be beautiful. How true his words have come!

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

9 – Mortaring

Recommended mortar mix

Cement :sand - 1:3

Acco waterproof powder for waterproofing and various other additives can be used for easy workability .

Since mortaring is not completed in one single day , certain procedures have to be observed to get satisfactory joints. Before new mortar is placed against a completed panel, the exposed edge is first cleaned with fresh water and a bonding agent of cement grout applied . This should be brushed well into previously dampened surface and the new mortar placed against it as soon as possible .

Outside is finished with cement paint with accoproof additive when the mortar is still wet .

Inside is finished with mortar (1:4 or 1:5) .Although a smooth finish with neeru looks good, rough finish is recommended for reducing the echo .

Mortaring from bottom to top with no hard joints .Mortar is forced in with floats and trowels for good penetration and avoidance of air trapping.

Outside is finished with cement and accoproof paint while the mortar is still wet for good bonding and impermeability .

Advantages:

Mortaring is really fast operation taking no more than 8 Mondays. Joints are good .

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Yet another : way to avoid the disadvantages of both these methods has been successfully tried out . The procedure is as follows .

After applying the weld mesh and chicken mesh , the dome is wrapped up with gunny cloth (Preferably with large apertures) . The cloth is stitched with jute strings after wetting it , taking care that it is well stretched .

A cement coat (cement: water 1:1) with accoproof additive is brushed over this . After it is dried up , another coat is applied . When cement dries, the stretched gunny cloth stiffens into a hard impermeable shell acting as a shuttering surface for mortar application from inside.

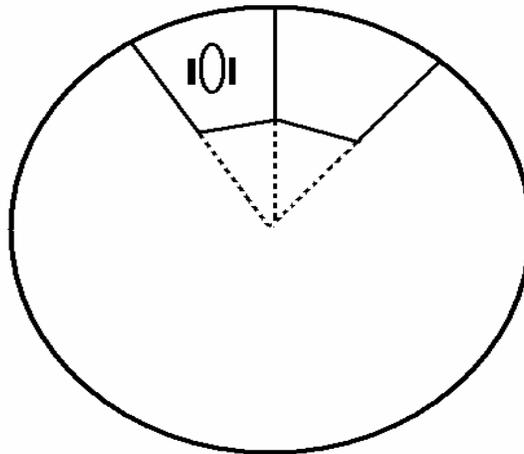
For mortaring , a thin layer of mortar (cement :sand 1:3) is first thrown and then a finishing plaster is applied over this .

Our acknowledgments to vigyan shiksha Kendra banda ,U .P .for contributing this technique .

10 . Partitions and Extra Fittings.

When you have a spherical canopy ,segmentation can make it confined andun becoming . however, certain partitions are necessary for daily conveniences. This can be done by dividing the dome radially. one brick thick wall is sufficient. For extra strength , two bond beams are cast, one at the center and one at the top. The reinforcement of these bond beams should preferably be joined to the angle iron framework of the dome.

with a little bit of planning , hooks for electrical fittings etc . can be attached on the dome before it is cast . However , if it is necessary , j hooks etc. can be nut bolted on to the shell by making a through hole . the gap is subsequently finished with cement and cotton waste.



Various attachments can also be made to angle framework by

1. Welding
2. Drilling and nut bolting .

Banda technique *

Yet another way to avoid the disadvantages of both these methods has been successfully tried out. The procedure is as follows. After applying the weld mesh , the dome is wrapped up with gunny cloth { preferably with large apertures } . The cloth is stitched with jute strings after wetting it taking care that it is well stretched.

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For mortaring , a thin layer of mortar { cement : sand 1: 3 } is first thrown and then a finishing plaster is applied over this.

11. Glossary .

Chord	straight distance between two points in an arc.
Chicken mesh	Hexagonal woven mesh .
weld mesh	Square mesh made by spot welding wires.
Discos	M. S. sheet rounds on which holes are punched.
: Black	Black colored / coded disc.
: White	White coded disc.
: Mixed	Red disc with different colures.
Guage	Standard wire guage – measure of wire or sheets.
Hexagon	A figure having 6 sides .
Pentagon	A figure having 5 sides.
Struts	Angle members.
Level tube	A transparent flexible tube filled with water used for getting levels.

List of materials for completing the dome and their cost on sept
88at pune

Geodesic Kit complete with door and windows

Rs. 4650.00

Cement		37 bags
	2960 .00	
Weld mesh		800 sqft.
	1200 .00	
Chicken mesh		600 s. ft.
	270.00	
Sand		300 cft
	605.00	
Bricks / rocks		500 nos
	300.00	
Miscellaneous		
	900.00	

	Total	10885.00

Labour
75 Mondays.

Unskilled

Skilled

20

Vijay Kumar K.P.
The main architect of Pabal Domes.
made a dream,into a reality
at Vighyan Ashram . { Dec 85 – March 92 }

.....

Dear customer ,

This questionnaire is intended to give feedback so that we can build on the experience gained by everyone. you can be assured that any new idea or suggestion witch we find worthwhile to be adopted will be acknowledged and rewarded.

Kit ,No -----

Nsme

Address :

Questionnaire,

1. When did you erect the dome kit -----

2. What is it being used for -----

3. Did you find the information in the brochure adequate ? If no , which part did you find difficult to follow or is in need of more details -----

4. What is the cost of your completed Dome ?

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