Chapter 4
Design

You cannot better the world by talking to it.
Philosophy, to be effective, must be mechanically applied.
Buckminster Fuller

Introduction

Heroes can be too easily made, but one that can be readily accepted is Buckminster Fuller whose thoughts follow here.

The word “design” is generally understood as being what it looks like and/or how it works. Buckminster Fuller had insights into the design process which are worth reporting before moving on. As an architect and a general system theorist he was ahead of his time on the matter of design. He considered it to be the driving force for the advance of civilisation, technology and the winning of wars at sea by “The Great Pirates”. Those “Pirates” who could do “MORE WITH LESS” won the battles. The battle of Trafalgar was won by the British fleet being able to fire their guns every 4 minutes against 12 minutes for the French and Spanish, whose ships were quickly turned from gun platforms into burning wrecks. The British Empire was built on the subsequent mastery of the oceans. On such apparently small technical matters are the fortunes of nations and empires determined.

Buckminster Fuller spoke of Ecology half a century ago and was aware of the unity and utility of everything which he called simply “Universe”.

To do MORE WITH LESS in energy terms is the fundamental drive of life where the efficient use of energy is paramount to survival, reproduction and evolution.
Evolution is driven by consciousness’s pursuit of pleasure and avoidance of pain.

Buckminster Fuller considered that any invention or design that would survive and thrive would have to do MORE WITH LESS. An example includes the radio valve, which was superseded by the transistor, which in turn was superseded by the microchip. All are gates through which an electrical signal passes in one direction, but each did **more with less** material and energy. Another example is of a stacking, polypropylene chair which superseded hand or machined wood ones. Further darker examples include the AK47, atomic weapons and the stealth bomber.

The concept of “Design/Science” was also initiated by Buckminster Fuller. Design and Science are normally treated as separate subjects at different ends of a school curriculum with Humanities in the middle and Sport somewhere outside in the rain. This school approach has given us design “as it looks”. It has trivialised design and is no longer inventing, designing, constructing and using made objects, but exhibiting good taste, found on webpages and in the department stores across the planet, not on its battlefields…… nor in its apiaries.

Buckminster Fuller said that we have to make up our minds to either make sense or make money, if we want to be designers. To make sense, designs need to be made

from the things we see around us that are perhaps already being used for something else, are deemed waste and have a low embodied energy.

Buckminster Fuller's understanding of Science is "taking something apart to understand it" and of Design as "putting something together" to use it. Design and science were therefore as inseparable as two sides of the same coin. Without design, science has no practical purpose. Without science design is just good taste. This leads seamlessly on to "Design Method". What is the process of Design if not a simple "how it looks" selection of colour, proportion and texture?

There are five strands to the process that occurs when designing something that is beyond a mere visual experience. These strands are **Objective/ Research/ Design/ Construction/ Feedback.** This is not a linear process, but a circular one over time. Research, when carried out will perhaps lead to a restating of the Objective. The Design process may indicate a fresh Research strand to be pursued. Feedback is not something that happens at the end of the design or construction process, but permeates the whole.

Design may result in an object, but may also be just a system change. Biological and man-made systems have critical and non-critical parts. Destroy the former and you have collapsed the system. Destroy the latter and the system remains, but changes.

Better by design for the bees

- The ZEST hive concept is to improve bee health by being warm and dry rather than cold and damp. It has top bee entry and ventilation without any cooling stack effect.
- Thermal insulation and mass assists the bees in thermo-regulating the colony allowing it to rise easily to the ideal, determined by the bees. This speeds the biological process, reducing the time in the cells for the varroa mites to mature. Their numbers fall.
- The bees draw out natural honeycomb which has smaller cells. This again reduces the pupation period and the time available for the varroa mite to mature. Their numbers fall further.
- It can be a let alone hive.
- The bees do not readily die and are substantially free of disease.

Better by design for the beekeeper

- A mostly DIY hive made from readily available, cheap materials. A third of the cost for the same honeycomb area.
- Maintenance free and let alone management.
- No wax foundation costs.
- Better tempered bees.
- The bees do not swarm readily, but supersede.
- The number of colonies can be multiplied in late spring by taking off 3 frame nukes and keeping them within the same ZEST to make queen cells which are

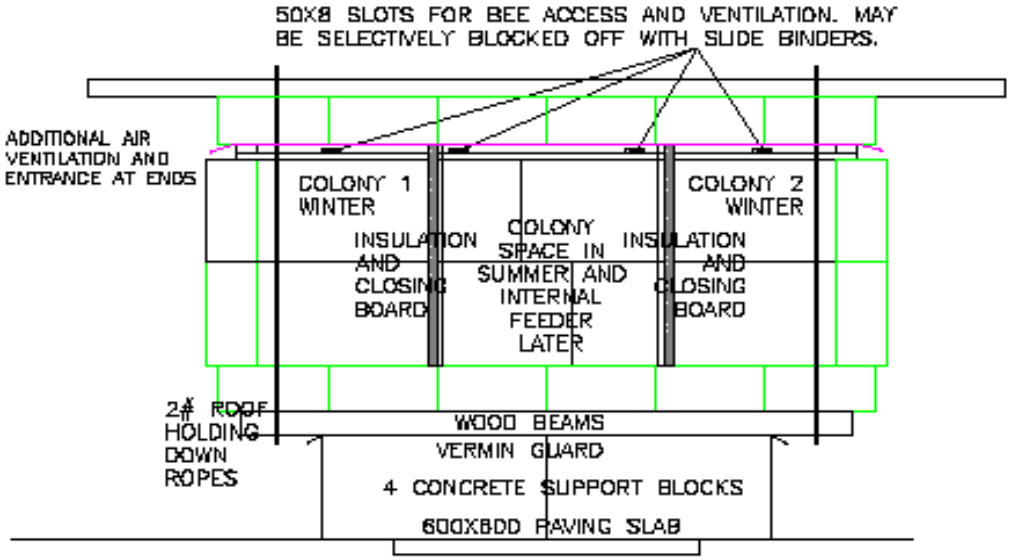
then taken to a distant “stud” apiary for mating. (For the detail go to the queen breeding section of the Management Chapter).
- The bees do not die in winter. A surplus of colonies in the spring gives normally un-accustomed options.
- Surplus honey can be harvested in the autumn or spring.
- Equipment storage space is not needed, being in the hive.
- 4 kg. Maximum lift of one honey full frame.
- Only 1 visit needed to collect honey.
- No queen excluders needed, but are available.
- Highly robust.
- Expensive honey extractors not required.

There are two fundamental aspects to any hive design, **the external envelope** and the **internal fittings**. These are now drawn and explained here.

The ZEST Hive Basic design Principles

Design Principles

Doing MORE with LESS



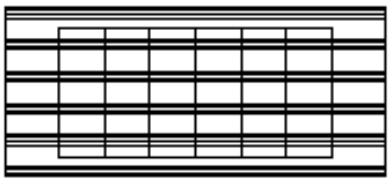
1. Insulated block external envelope.
2. Insulated internal partitions.
3. Adjustable top bee entries & vents.
4. Maximum lift of 4kgs. (meets H&S)
5. 1 summer colony in the middle
6. 2 overwintered ones at ends.
7. Hang and drain honey harvest.
8. No wax foundation.
9. Minimum intervention (Letalone).
10. Plastic cover sheet.
11. Scrap metal sheet roof.
12. Internal feeder

Warm Dry Healthy Cheap.

The ZEST hive design for materials available in Europe

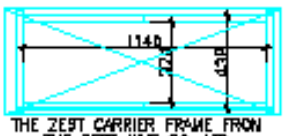
THE ZEST HIVE FOR B.S. NATIONAL CONVERSION OPTION 1 TO DEPLOY 600 LONG BLOCKS

COMPONENTS



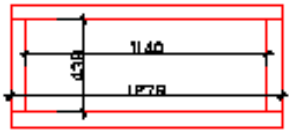
ROOF

1800 X 1000 METAL SHEET HELD DOWN WITH ROPES AT EACH END ONTO ROOF BLOCKS. PROVIDE 2 SHORT PIECES OF 12 DIA. HOSE TO PROTECT THE ROPE AGAINST THE SHEET EDGE.



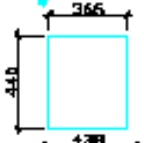
THE ZEST CARRIER FRAME FROM THE ZEST HIVE CO. LTD (also showing 1300x500 heavy duty plastic cover sheet)

OR

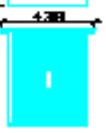


MAKE WOOD CONTAINMENT FRAME FROM 89X25 SOFTWOOD AND STAPLE AT CORNERS. SEE NOTE 16 BELOW. and set the frames down on the wall blocks

24 PLASTIC ZEST FRAMES FROM THE ZEST HIVE CO. LTD



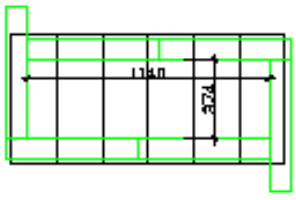
2# 6MM. PLASTIC CORDEX BOARDS TO TURN 2 QUEEN EXCLUDERS INTO PARTITIONS TO LIMIT COLONY SPACE. FROM THE ZEST HIVE CO. LTD



4# PLASTIC QUEEN EXCLUDERS. FROM THE ZEST HIVE CO. LTD. (2 TO FORM THE BASE FOR THE 2# CORDEX PARTITION INSERTS WHICH SHALL RECEIVE A WINE CORK SIZED HOLE FOR CORK AND TO ALLOW IN-HIVE FEEDER ACCESS)

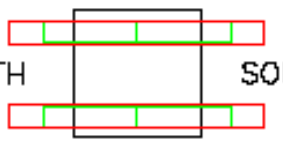
1# 1200x450x50MM. WINTER ROOF INSULATION

2# 20MM. WINTER PARTITION INSULATION



BLOCK EXTERNAL ENVELOPE

FLOOR WALLS AND ROOF FORMED FROM 24#800X215X100 LIGHTWEIGHT INSULATING BLOCKS.



SUPPORT EXTERNAL ENVELOPE

2# 1200X100X50 TREATED SOFTWOOD BEAMS. INSTAL OVERHANGING POLYTHENE D.P.C. (TO DETER CLIMBING VERMIN) ON 4# 440X215X100 HEAVY CONCRETE BLOCKS CANTIVERED OUT OVER EDGES OF 600X600 CONCRETE SLAB.

BLOCKS

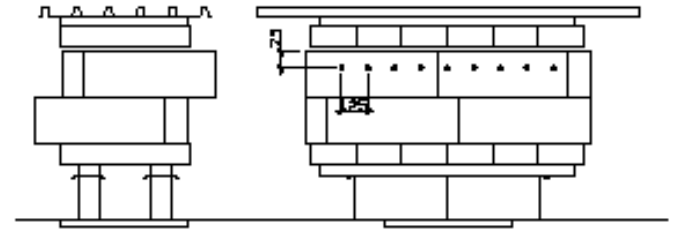
WOOD

INSULATION

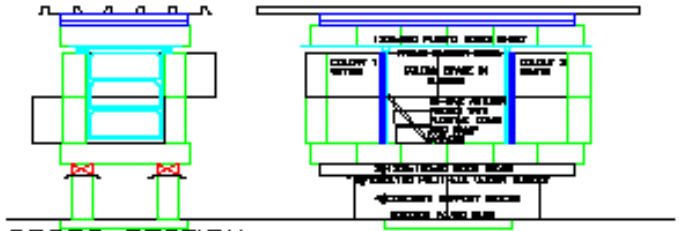
PLASTIC

5# TOTAL SLIDE BINDERS TO MAKE
10# 75 slide binders to allow adjustable bee access and ventilation.
8# 100 slide binders to join carrier frames in the middle of the sides

ASSEMBLY



END ELEVATION LONG ELEVATION



CROSS SECTION LONG SECTION

Guidance on building your ZEST hive

1. Clear the ground and level it. Treat it with something unpleasant (like used engine oil) but not dangerous. To prevent burrowing rodents from undermining the foundation slab.
2. Lay the 600x600x65 foundation paving slab. Level with a spirit level. There is only one slab so that any uneven settlement can be easily dealt with by levering it up and repacking with earth to re-level it.
3. Lay the 4# 440x215x100 heavy foundation blocks on the slab as shown on the drawing, being corbelled out from the foundation paving slab.
4. Lay 2#P1000x1400 polythene d.p.c. vermin guards on the foundation blocks.
5. Lay 2#P1200x100x50 treated softwood on blocks as floor support beams.
6. Lay 24#600x215x100 lightweight insulating blocks on the wood beams to form the floor, roof and walls. These blocks are to be as ultra lightweight as possible such as "Durox Aircrete". If not available other lightweight blocks may be used. The walls can also be formed from 18#440x215x100 ultra lightweight blocks instead of 12# 600x215x100.
7. Assemble the plastic carrier frame. Lay it on the block floor so that is central in both directions and mark the internal volume of the ZEST hive on the floor. Lay the wall blocks
8. Ensure that the vertical joints are staggered in the second course to achieve bond. Blocks are laid loose.
9. Place the carrier frame onto the top course of wall blocks and ensure alignment.
10. Assemble and insert the plastic frames, partitions and queen excluders as required into the hive.
11. Refer to the drawing "Zest Transition and Management Diagrams" for colony insertion from a traditional B.S. hive.
12. Deploy the 2# closing partition insulation boards on the side of the partition away from the bees.
13. Deploy the plastic cover sheet on the frames and the edging.
14. The 6 roof blocks are placed on the top edge of the carrier frame or the wood containment frame, whichever is used.
15. Lay the 2000x1000 roof sheet on the roof blocks and roped down This can be scrap metal and is optional.
16. Hold the roof sheet down with holding down ropes at each end with the rope passing under the floor beams. Protect the rope at the sheet edge contact points with plastic hose. Additional insulation is best deployed on the roof blocks in winter.
17. Deploy the 10# slide binders at the entrances if the plastic carrier frame is deployed.
18. The ZEST plastic carrier frame can be replaced with a wood containment one. Ventilation and bee access holes of 82mm. (wide soak steel) will need to be drilled through the block approximately 75mm. down where shown on the elevation. These will receive virgin cages which can be open or closed to bees and/or air as required.

The ZEST Hive Construction.

The original ambition of the ZEST hive design was one of being entirely DIY and for those with the skills it remains so, but the difficult to do DIY bits can now be replaced by the ZEST plastic frames, carrier frame, partitions and queen excluders. The rest can be acquired from a builder's merchant and built to the drawings shown here and is as follows:-

1. Always read the drawings first. Fully understand what is needed in both equipment and tools and have them all to hand. Night classes are not required.
2. Find some flat ground that is sunny and sheltered. Lay **one** 600x600 paving slab and level it after treating the ground with creosote to deter vermin from living and undermining it. You may need to level the slab again if it tips up in use. This is easily done with a long crowbar or similar device deployed as a lever. When the lever is deployed ram some earth under the slab with a spade at the low part until it is levelled.
3. Take 4# of the 440x215x100 heavy weight concrete blocks and position them in 2 x 2 rows so that the ends of the blocks cantilever equally out over the edges of the paving slab. Allow a gap of about 300 between the 2 rows. Orientate the long sides of the ZEST North/South so the sun gets on both sides at some time of the day.
4. Take 2#1000x150 pieces of polythene such as that used as a damp proof course to guard against climbing vermin and lay it with equal overhang all round on the blocks. The only vermin so far found inhabiting a ZEST are ladybirds which fly in and spiders which abseil.
5. Take the 2#1200x100x50 treated softwood floor support beams and lay them loose on the vermin guards. They will overhang equally at each end.
6. Take 6# of the 600/610/620x215x100 super lightweight insulating blocks by Tarmac Durox, Aircrete, Yong or Solar by H+H Celcon,. Lay them flat on the floor support beams to form the floor. Lay them loose. Do not stick together.
7. Make and assemble carrier frame in wood or plastic, which supports the beehive frames and the roof blocks. Use it to ensure the accuracy of the void formed by the block walls by laying it on the floor and marking where the walls are to be built. (Alternatively a wood surround can be provided as containment to the plastic frames which rest directly on the blockwork walls. The bees enter and leave through 20 diameter holes in the walls, which can be controlled by installing virgin cages which can be open, closed or just ventilated).
8. Take 12#600 long (option 1) or 16#440 long (option 2) of the insulating blocks and build the walls. Stagger the joints vertically so that "bond" is achieved. There is no need to cut the end wall blocks which can simply hang out at the ends. (They will be useful to hang the roof holding down ropes on when the roof is removed.) It is important that the void formed is 1140x374 for the B.S. National hive conversion.
9. Lay the carrier frame on the walls when built. Adjust the walls to fit the top bearer frame accurately if required, (but see Note 7 above).
10. Deploy the partitions and queen excluders matching the hive cross section profile to ensure bee tightness. Do not make the internal width (374) void so tight that the excluders are difficult to position.

11. Insert the ZEST beehive frames. If wood, then with wax starter strips. If plastic, it is preferred that they are brushed or dipped in hot bees wax to recycle it. Deploy two of the partitions as colony containment.
12. Deploy 25mm. foil backed insulation behind the partitions, away from the bees. Hold upright with a spare frame.
13. Take a 1300x500 thick polythene sheet and deploy as a top of frame cover that can be peeled off carefully.
14. Take 6# of the 600/610/620x215x100 ultra lightweight insulating blocks (as the floor and walls) and lay on the plastic to form the roof structure.
15. Purchase or find from a scrap yard, metal roof/wall profile section, cut to size and lay upon the block roof. In winter include a 1200x600 foil faced insulation board under the sheet metal
16. Hold down the roof sheet at each end of the ZEST with rope tied tightly under the floor beams. Where the rope passes over the 2 exposed metal sheet edges deploy a piece of hosepipe as protection.
17. Deploy the slide binder entrance blocks to suit the colony requirements. In winter shut it up almost entirely, leaving just enough to allow bee entry and trickle ventilation at each entry. Discourage dead air areas internally.

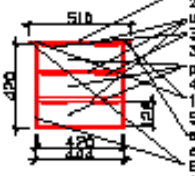
…….and it may look like this. Think IKEA, but in any colour.

The ZEST hive design for materials available in the USA

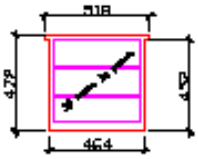
THE ZEST HIVE FOR LANGSTROTH CONVERSION
OPTION 2 FOR USE WITH BLOCK SIZES IN THE USA

BLOCKS
WOOD
INSULATION
PLASTIC
MASTIC SEAL

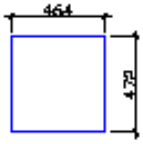
COMPONENTS



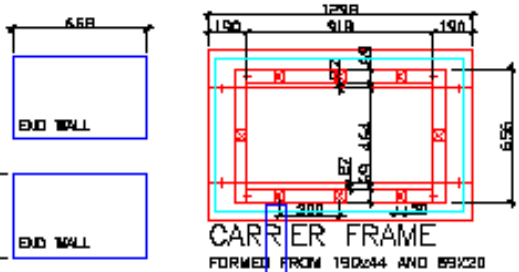
The 3 part ZEST Stacked, Season Gravity Frame.
1. Assembled out of 20x12 wood battens as shown.
2. 3mm. depth saw cut groove in underside of horizontal bars allows use of melted-in wax starter strips as shown.
3. Assembled on a jig formed from a plywood partition board with 3# 430mmx120mmx12mm. ply void panels temporarily fixed to the plywood partition board for the voids.
4. Staple gun the frame meeting points together on both sides with 16# staples.
5. Drive glnp pins through the top bars and into the ends of the side bars to prevent horizontal movement at top joints when levering apart.
6. Domed head, brass, drawing pins at underside of lugs ensure that the frame is vertically aligned precisely by gravity.
7. The frame spacing is determined by 4# 38mm panel pins per frame driven through the side bars (Hoffman style) on the left side of top and bottom where shown leaving the pins proud by 14mm ensuring a 38mm frame spacing.



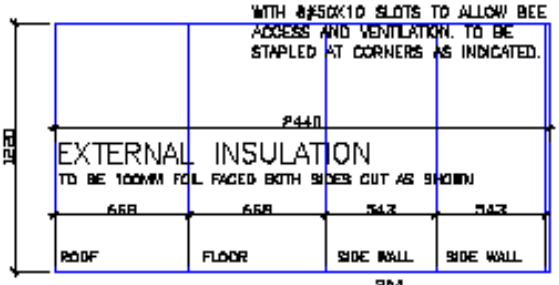
PARTITION
TO BE 12MM PLYWOOD



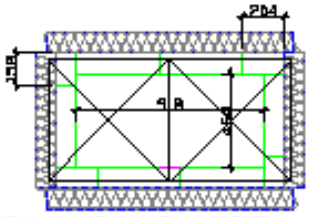
INSULATION
TO BE 50MM FOIL FACED



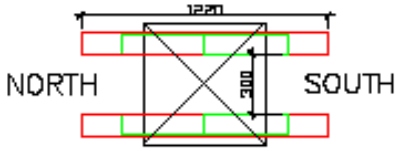
CARRIER FRAME
FORMED FROM 190x44 AND 69X20 PLANED SOFTWOOD AS SHOWN AND WITH 8#50X10 SLOTS TO ALLOW BEE ACCESS AND VENTILATION. TO BE STAPLED AT CORNERS AS INDICATED.



EXTERNAL INSULATION
TO BE 100MM FOIL FACED BOTH SIDES CUT AS SHOWN



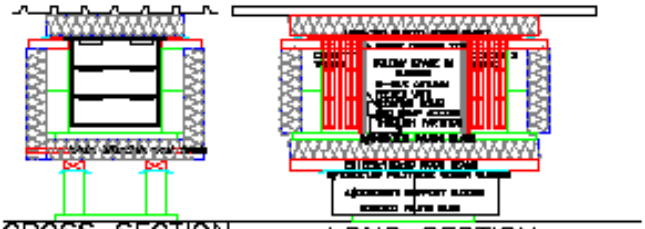
BLOCK AND INSULATION EXTERNAL ENVELOPE
FLOOR WALLS AND ROOF FORMED FROM LAID LOOSE 12#406X203X100 AND OTHER CUT BLOCKS AS SHOWN TO BE 2 STAGGERD COURSES TO OBTAIN BOND.



SUPPORT EXTERNAL ENVELOPE
2# 1220X100X50 TREATED SOFTWOOD BEAMS. INSTAL OVERHANGING POLYTHENE D.P.C. (TO DETER CLIMBING VERMIN) ON 4# 406X203X100 HEAVY CONCRETE BLOCKS CANTIVERED OUT OVER EDGES OF 600X600 CONCRETE PAVING SLAB.

ASSEMBLY

END ELEVATION
LONG ELEVATION



CROSS SECTION
LONG SECTION

Guidance on building your ZEST hive

1. Clear the ground and level it. Treat it with something unpleasant (like used engine oil) but not dangerous. To prevent burrowing rodents from undermining the foundation slab.
2. Lay the 610x610x38 foundation paving slab. Level with a spirit level. There is only one slab so that any uneven settlement can be easily dealt with by levering it up and repacking with earth to re-level it.
3. Lay the 4# 406x203x100 concrete blocks on the slab as shown on the drawing, being corbelled out from the foundation paving slab.
4. Lay 2#1220x150 polythene d.p.c. vermin guards on the foundation blocks.
5. Lay 2#1220x100x50 treated softwood on blocks as floor support beams.
6. Lay 100mm insulated floor panel onto the wood beams.
7. Lay on the insulation panel 2#610x610x38 paving slabs to support the walls all round.
8. Lay 12#406x203x100 and 4#150x203x100 and 4# 204x203x100 concrete blocks onto slabs to form the walls all round.
7. Assemble the 190x44 wood carrier frame. Lay it on the insulation forming the floor so that is central in both directions and join the carrier frame with staples. Mark the internal volume of the ZEST hive on the floor. Lay the wall blocks to those lines.
8. Lay the wall concrete blocks. Ensure that the vertical joints are staggered in the second course to achieve bond. Blocks are laid loose.
9. Place the frame containment frame onto the carrier frame and ensure alignment. Join with staples.
10. Insert the frames, partitions and queen excluders as required into the hive.
12. Deploy the 2# closing partition insulation boards on the side of the partition away from the bees.
13. Deploy the plastic cover sheet on the containment frame.
14. Lay on the insulation roof sheet on the plastic cover sheet.
15. Lay the 2000x1000 roof sheet on the roof insulation. This can be scrap metal and is preferred as it is light weight.
16. Hold the roof sheet down with holding down ropes at each end with the rope passing under the floor beams. Protect the rope at the sheet edge contact points with plastic hose.

The ZEST Nuke and Carrier hive

Converted from a Paynes polystyrene Nuke box to deploy ZEST design principles as listed below.

1. Insert 5mm. plywood board to form solid floor at all times
2. Cut 2 top bees entries and ventilation slots.
3. Install 2 perspex strips to spread load of frames at ends.
4. Fill original entry hole with virgin queen holder in vent or closed mode.
5. Wrap in insulated blocks during winter and protect from rain with a metal sheet held down with ropes.

The ZEST Third World Larder Hive

A Declaration of Rights is, by reciprocity, a declaration of duties also.
Whatever is my right as a man is also the right of another; and it becomes my duty to guarantee, as well as to possess.
Tom Paine

The sustainable principles and design of the ZEST hive remain sound for the Third World, which has a tendency to be in hot climates. The problem for the bees is less about keeping warm and more about keeping cool. Not only are insulated blocks not available in the Third World, using them would be detrimental to the bees wellbeing, whose need is generally to cool the colony, certainly in the day, but less so at night
This design is being tested in 2020 in the Spice Islands by Khamis pictured below with a bamboo frame. The changes listed below to the ZEST design for hot countries are a simplification of that for cold climates. Apart from these design changes, all else remains the same.

1. Use heavy weight concrete (or baked mud) blocks which are readily available in the Third World. These will store the cool of the night and carry it through into the heat of the day. Conversely they will carry the heat of the day into the cool of the night. The extremes of temperature are moderated, alleviating the thermo-regulation demands upon the bees.
2. Incorporate an overhanging polythene sheet vermin guard onto a raised floor plinth to build the walls upon. Hot countries have termites and ants as pests to honeybees. A turned down plastic sheet at the floor/wall junction and covering the hive floor should act as a termite guard. They cannot abseil round the edge of the plastic overhanging sheet.
3. Deploy wood load spreading battens around the top edge of the walls. The end ones to be removable to allow extreme ventilation. These will carry and spread the load from the bamboo frame support ends.
4. Deploy further wood battens all round to enclose the lug ends (with bee entries at each side) and to give the bearing for the roof blocks which span onto them.
5. Cover the blocks with corrugated metal roof sheet held down with concrete blocks or with a padlock and chain.

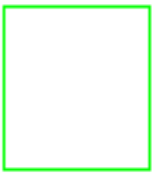
THE ZEST HIVE FOR ZANZIBAR

BLOCKS

WOOD

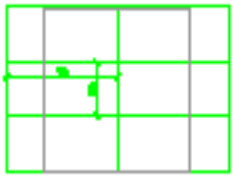
METAL

PLASTIC



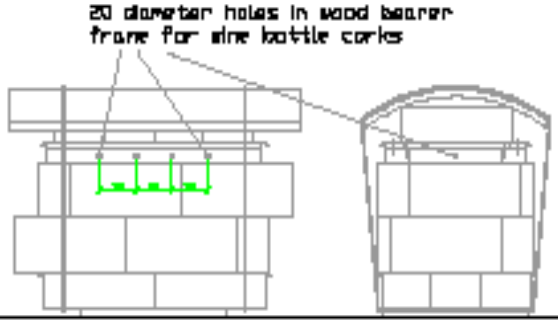
FOUNDATION

600X600 (24"X"24") CONCRETE PAVING SLAB LAID FLAT AND LEVEL ON HARD GROUND.

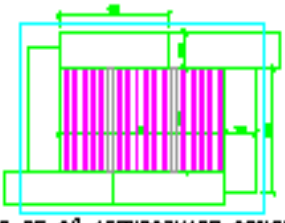


FLOOR

6# 458X203X128 (18"x8"x5") CONCRETE BLOCKS LAID ON PAVING SLAB. CONCRETE BLOCKS CANTIVERED OUT OVER EDGES OF PAVING SLAB AS SHOWN.

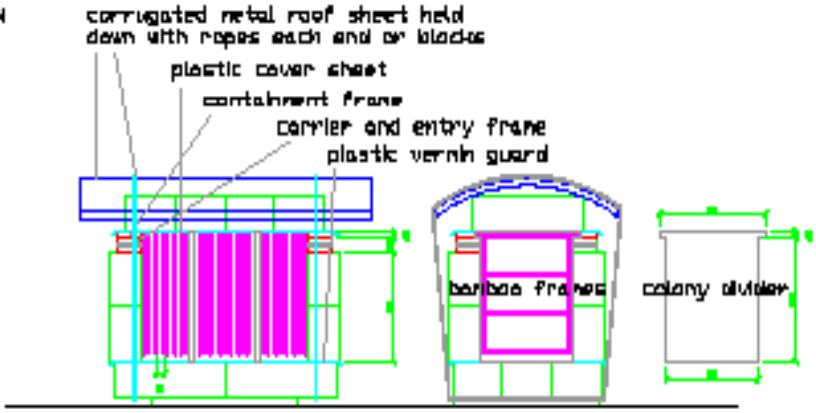


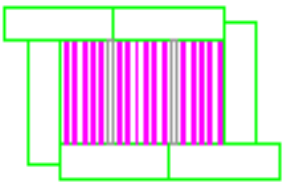
SIDE ELEVATION END ELEVATION



WALLS 1

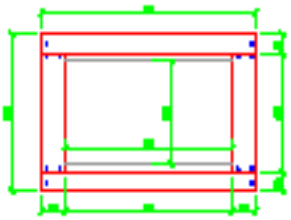
FIRST COURSE TO BE 6# 458X203X128 CONCRETE BLOCKS LAID AS SHOWN ON 1000X700 PLASTIC SHEET TO ACT AS TERMITE GUARD.



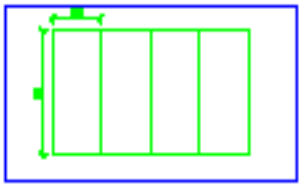


WALLS 2

SECOND COURSE TO BE 6# 458X203X128 CONCRETE BLOCKS LAID AS SHOWN IN 2 COURSES.

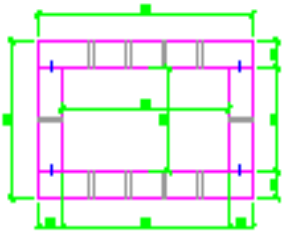


25MM CONTAINMENT FRAME.



ROOF

4# 458X203X128 BLOCKS AS ROOF ON 1000X500. PLASTIC SHEET ON WOOD CARRIER AND CONTAINMENT FRAME.
ALTERNATIVE ROOF MATERIAL TO CONCRETE BLOCKS COULD BE POLYSTYRENE



50MM. CARRIER AND ENTRY FRAME

View into third world hive with empty bamboo frames. Marks on containment frame for frame positions

View into third world hive with bees on bamboo frames.

Khamis from Zanzibar, taking up the challenge

Deploying existing wood hive equipment as supers on a ZEST in the summer only

The ZEST may be ideal winter accommodation, but in summer B.S. wood boxes over horizontal queen excluders can be deployed. The ZEST frames are set down on the block walls. A wood containment frame (visible) is deployed on the walls with drilled bee access and ventilating holes through the walls. These can be filled with virgin cages that allow adjustable access and ventilation

ZEST Hive Fittings

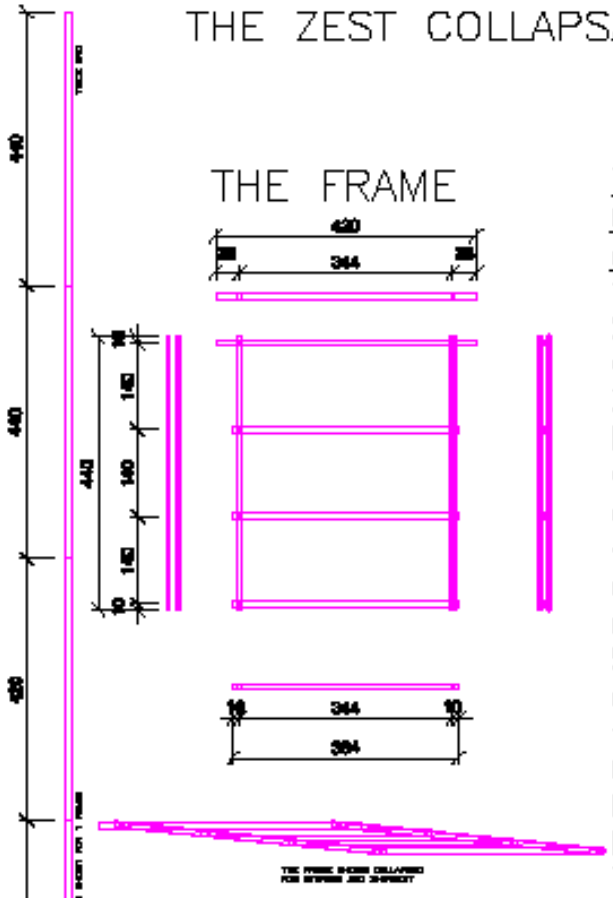
There are three frame choices available, their use being determined by the context. They are DIY bamboo frames for the third world, wood ones for where machine technology is available and plastic, which is supplied by the ZEST Hive Co. Ltd. together with queen excluders, parting boards and 46mm additional snap on frame spacers exclusively for honey storage.

The ZEST collapsible bamboo frame.

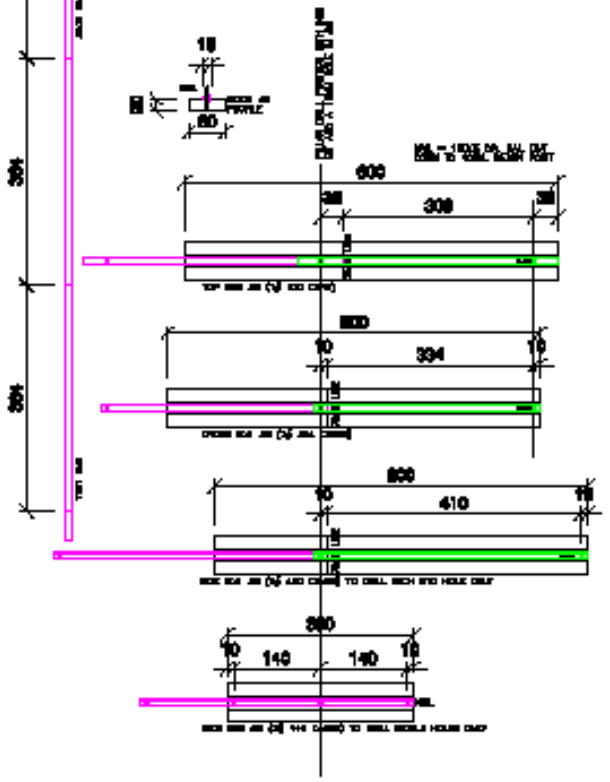
The ZEST collapsible, bamboo frame has the merit of being suitable for making and using in a third world country. It can be collapsed and then just shaken out and put into ZEST's without further work. To make 200 of these frames by hand took about 12 hours. The pieces cost about 40p for each one, made in this country, but in China would be made from a free, in the garden, weed. A 2400 long cane makes one frame. A hive tool is not needed to lift it from the colony. The bees do not stick it down as much as the machined frame. Felt tip marks need to be made on the carrier frame to space the frames.

THE ZEST COLLAPSABLE BAMBOO FRAME

THE FRAME



THE FRAME TEMPLATE



<u>The Merits of the 3 Part ZEST Collapsable Bamboo Gravity Frame over the machined wood version.</u>

1. Simply made out of bamboo.
2. Can be made in the third world where income can be generated.
3. Only needs the undersides of the bamboo cross bars to be brushed with hot wax to allow bees a firm grip from below.
4. Domed head, brass, drawing pins at ends of lugs not needed as machined frame.
5. The 3 available voids for drawing out comb ensure 3 work stations for the bees on each frame.
6. The frame spacing is determined by felt tip marks on the frame bearer. No spacer nails
7. Joints held together at junctions with paper paper fasteners or paper clips.
8. Can be made and collapsed for shipment and storage.
9. When delivered collapsed it merely needs shaking out.

<u>Additional Notes</u>

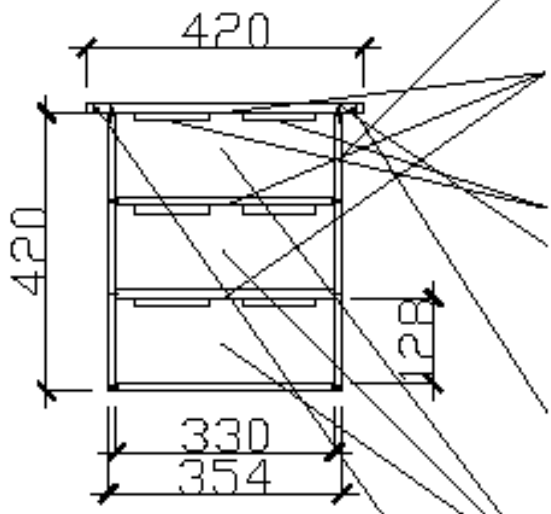
1. Use a 2240 bamboo cane for 1 frame
2. Drill 16# 5mm dia. holes in the canes using jigs as shown.
3. Use the largest diameter canes for the side bars which are split and the thinnest for the 3 cross bars.
4. Split the side bars vertically and place them back to back on each side of the horizontal cross bars.
5. Threadle the bars onto the paper clips and bend them to secure.

The ZEST stapled wood frame.

The ZEST stapled, wood, spacer, frames can be used if machine technology is available. Gimp pins are driven through the top bar at each end into the side bars to fix the joint laterally. Spacer nails are deployed on the same spacing principle as Hoffman frames. 2 wax foundation strips are needed on each cross bar from which the natural comb can be drawn. They are melted into saw cut grooves by dipping the wax strip in very hot water first.

Note that the bees have put the brood at the top where it is warmest and more accessible from the outside. The stores are at the more safe from robbers at the bottom of the frames.

THE ZEST STAPLED WOOD FRAME



<u>The Merits of the 3 part ZEST Stapled, Spacer Gravity Frame.</u>

1. Simply made out of 20x12 wood battens gun stapled together.
2. Groove of 3mm. depth in horizontal bars allows use of melted–in wax starter strips. To be 2# $\frac{1}{3}$rd. sheet wide.
3. Gimp pins through top bar and into end of side bar to prevent horizontal movement at joint when levering apart.
4. Domed head, brass, drawing pins at ends of lugs ensure that the frame is vertically aligned precisely by gravity.
5. The 3 available voids for drawing out comb ensure 3 work stations for the bees on each frame.
6. The frame spacing is determined by 40mm panel pins driven through the top bar on the left side of both its sides leaving the pins proud by 18mm ensuring a 38mm frame spacing.
7. Made on a jig formed from a partition board with 3#330xx128x12mm. ply panels temporarily fixed to the partition for the voids.

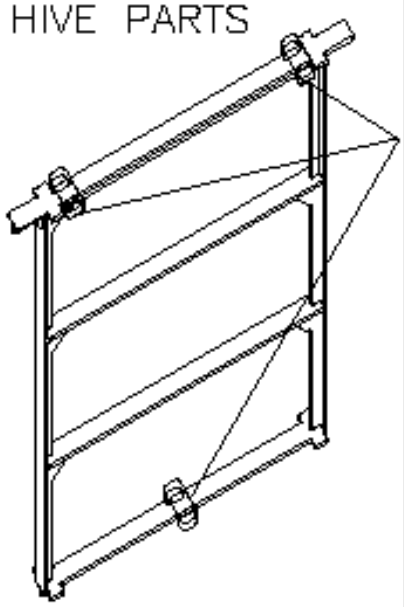
For Langstroth size frames increase widths by 90mm.

The ZEST plastic frame.

The third and final choice preferred over all others is an injection moulded rigid PVC plastic frame. Plastic is a by-product of the fuel industry, but once obtained is recyclable. It is mined rather than burnt and is a useful legacy of the oil industry.

The first 2 frame types (bamboo and wood) were tested in quantity during 2011. The plastic frame was tested during 2013 and 2014 proving the concept. Refinements of the plastic prototype were initiated in 2014. They are not DIY, but can be bought from www.thezesthive.com in boxes of 12.

AVAILABLE ZEST HIVE PARTS



BOXES OF 12 B.S. UNIVERSAL PATENTED PLASTIC FRAMES FOR NATURAL HONEYCOMB MAKING

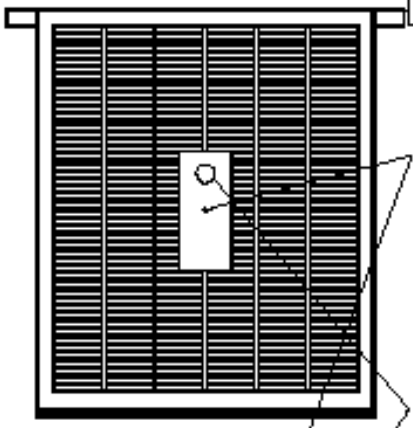
The standard plastic ZEST frames are at 35mm c/c. 3 snap on spacers can be added to the frames after the comb is drawn out to give 45mm. c/c for exclusive honey storage outside the brood area.

These can be deployed in B.S.National hives boxes as follows:—
2 B.S. Brood boxes.
3 B.S. Supers or
1 B.S. Deep brood box with a super
or
in a full ZEST hive.
www.thezesthive.com

CUSTOMER AQUIRE IF FULL ZEST HIVE IS REQUIRED

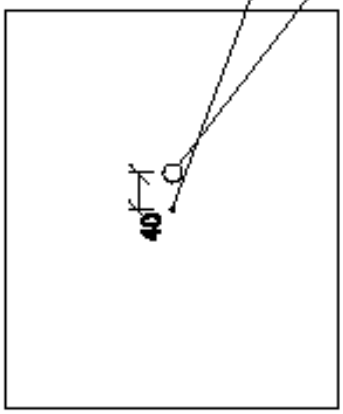
The customer will also need to source the following.

A. 1# 600x600 paving slab.
B. 4# 440x215x100 concrete blocks.
C. 2# 1200x100x50 wood bearers.
D. 24# 600x215x100 lightweight insulating blocks.
E. 1800min. x1000 corrugated roof sheet
F. 2# roof holding down ropes
G. 2# d.p.c vermin guards on item B above.
H. 3 # 374x6 plyplastic strips to act as feed ramp and air block under partitions.
I. 1# 1300x50 heavy duty plastic cover sheet.
J. 10# Slide binders.
K. 2# 450x370x25 foil faced insulation



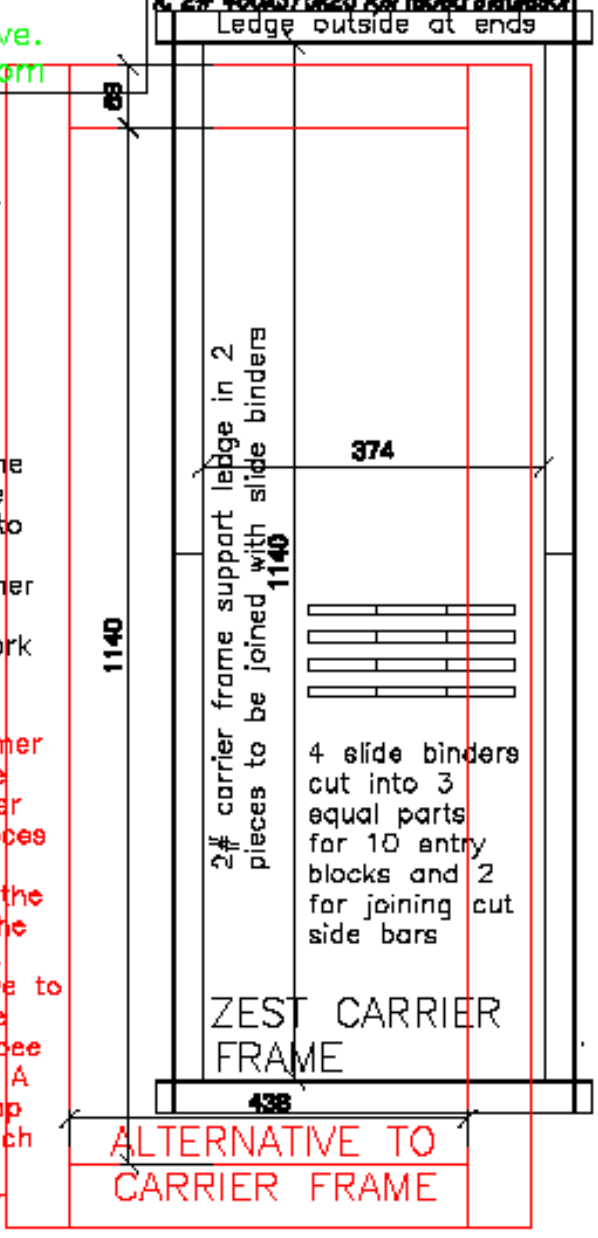
4 QUEEN EXCLUDERS (2 FOR PARTITIONS) FOR ZEST HIVE ONLY

Partition boards with 6mm white plastic Cordek sheets push fitted into face of excluder and bolted through with a 25x6mm bolt and 2 penny washers.
The 20dia. hole in the partition to allow bee entry via a ramp onto pieces of honeycomb in an in-hive container holding feed.
Fill hole with wine cork when not in use

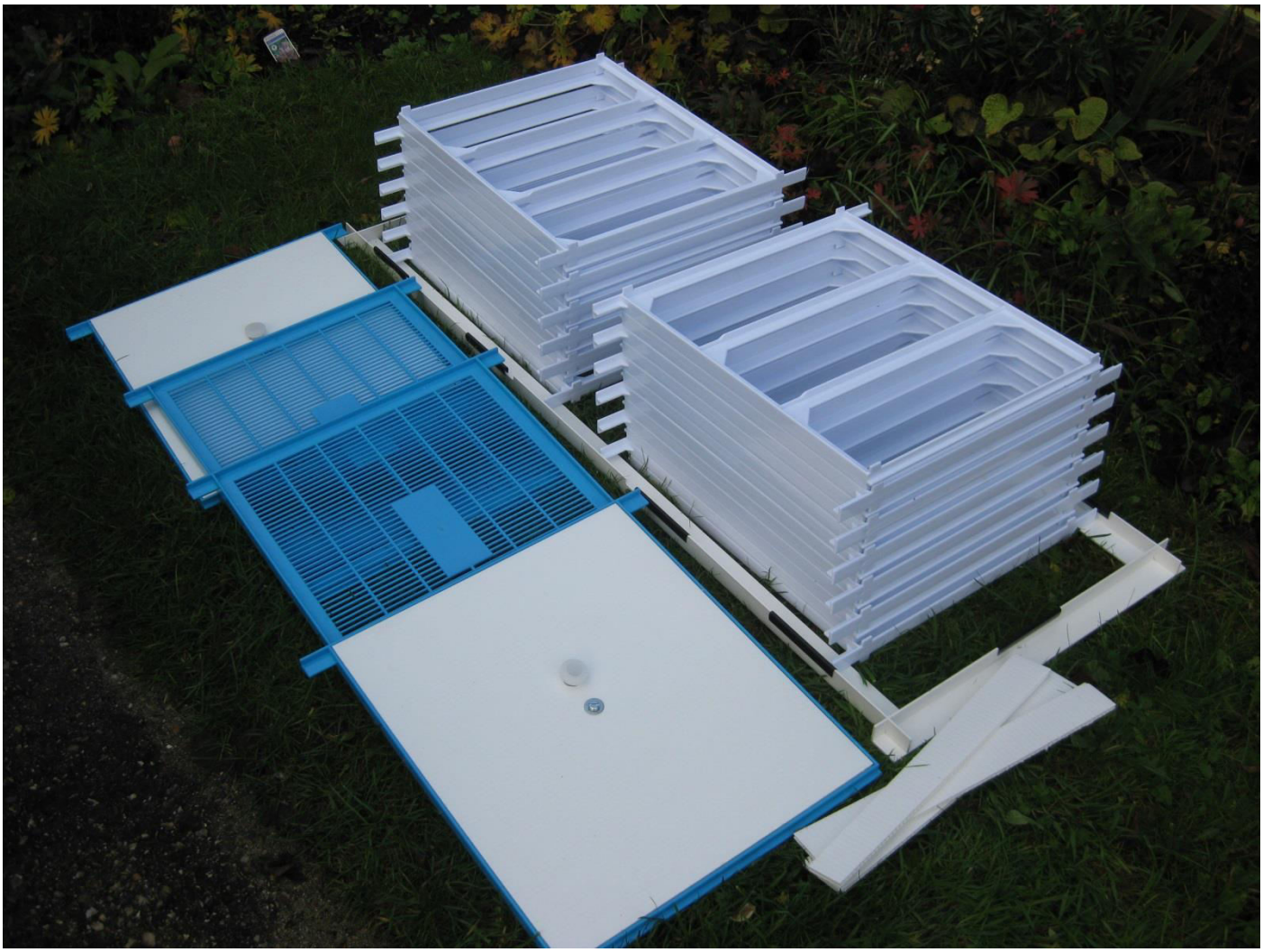


2 BOARDS
To convert 2 Queen excluders into partitions

The ZEST hive customer may wish to dispense with the plastic carrier frame and buy 4 pieces of 69x20mm wood battens and support the frame end lugs on the insulation block walls. 22mm. holes will have to be drilled through the block walls to allow bee entry and ventilation. A virgin cage with a cap to be deployed in each hole to control bee access and ventilation



The ZEST pack (For the DIY disinclined)



2 boxes of 12 frames, 1 box of queen excluders and partitions and a carrier frame. They arrive with additional plastic spacers to allow some of the 35mm. brood frame spacing to be increased to 45mm. for just honey storage. Deploy 2 at each end of the top bar and 1 in the middle of the bottom bar. Only do so with frames that are already drawn out and are open.

Historical perspective of frame design

The ZEST Hive mission commenced in late 2008 with the introduction of bamboo frames into a populated B.S. National brood box hive. The ambition was to develop a frame that could be deployed in the developing world which was made from locally available materials such as fishing line and bamboo. Within a week wild comb had been drawn out and partially filled with blackberry honey.

From such a small and partial success (the fishing line stretched and sagged) locked-in preconceptions held for many years of what constituted acceptable beehive design and practice were shattered. Existing beehive frame design and the enclosure to contain them suddenly did not meet sensible criteria. Such a realisation imposed a burden to speak and to design better.

The ZEST frame can be deployed in a horizontal ZEST hive or in various combinations of traditional ones such as:-

A. Double B.S. National brood boxes.

B. Triple B.S. National supers.
C. A deep B.S. National with a super.

It is preferable to convert them to the Zest Hive principle of:-.

1. Top bee entry and trickle cross top ventilation. This avoids the cooling stack effect which is greater in winter.
2. An external hive envelope wrap of insulating blocks that reduces the colony burden of thermo-regulation by both insulating and providing a measure of thermal capacity (or lag) to the hive envelope.
3. The drawing of natural comb on a frame lattice of bamboo, wood strips or from plastic T-Bars where the tail of the T form starter strips for the natural comb.

The advantages of the ZEST plastic beehive frame are:-

1. Half the cost, for the same comb area of a traditional wood frame.
2. A virtually forever frame.
3. No foundation needed. The bees act naturally to make their own comb. The cells tend to be smaller and the pupation time is reduced.
4. No assembly or winter maintenance needed.
5. Just unpack and drop into the hive. Hot wax can be added to the T-Bar tails.
6. Always hangs perfectly vertical.
7. Spacer tabs incorporated at top and bottom to give Hoffman spacing of 35mm. which is suitable for the brood.
8. Additional snap on spacers are also available to give 45mm.c/c. These are for deployment for just honey storage in frames from where the queen is excluded.

The Standard ZEST Beehive Plastic Frame

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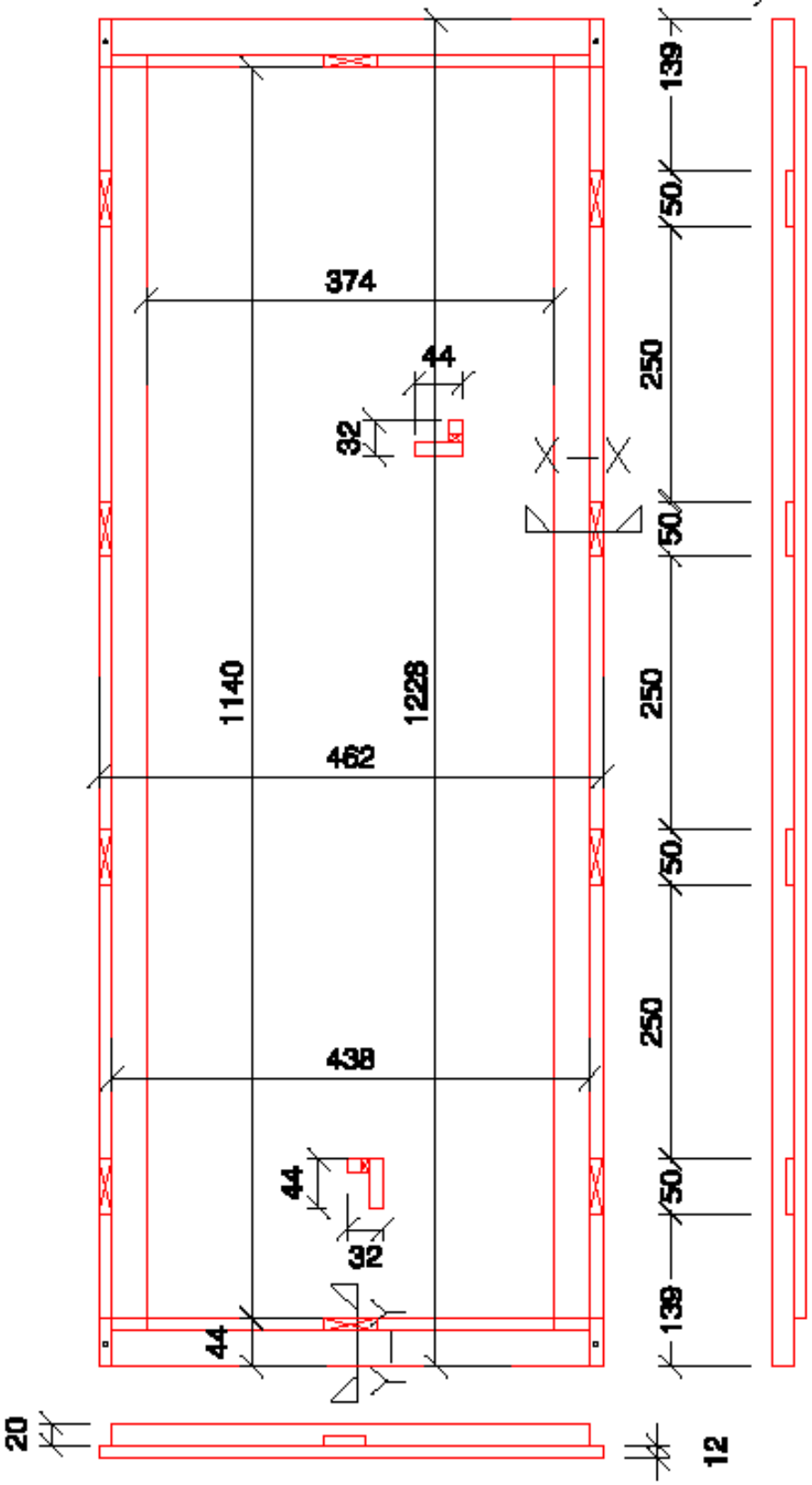
The ZEST Wood Carrier Frame

It is a DIY item.

B.S NATIONAL WIDTH WOOD CARRIER FRAME (LANGSTROTH TO BE 90MM WIDER)



If this plywood carrier is made and deployed with ZEST plastic excluders and partitions a 10mm plywood floor will need to be added into the ZEST enclosure to ensure that they fit correctly.

The ZEST Plastic Carrier Frame

Carrier frame is engineered from plain plastic angles and is available from the ZEST hive.co.uk. Plastic cover sheet over the frames is not shown for clarity. To adjust the opening sizes deploy short sections of slide binders.

The ZEST In-Hive Feeder

See the 20mm. hole drilled in the partition and the ramp from it to allow access to the tub contents which may be honey and/or bee feed. It is outside the brood enclosure so they will rob it. When not in use the hole is blocked with a plastic wine cork. The ramp and honey comb is used by the bees as a platform to access the feed. The bees will recycle with enthusiasm any honey, pollen and wax. Ensure no access from outside for wasps or robbers to enter. This ZEST in-hive feeder allows over roof contact feeders to be dispensed with. The holes in the roof blocks are now just used for fondant as over wintering insurance and feeding back the harvest residue any time after.

The Propolis Trap

Prior to use.

ZEST Accessories
Honey and Wax Heaters

A. Every ZEST owner needs a honey warmer so that:-

1. The residue honey and wax from the nylon bag drain down technique can be melted and collected.
2. Granulated honey in jars can be made runny.
3. The tops of ZEST frames can be dipped severally into melted wax so as to return the sterilized wax to the bees for reuse. .

B. A number of options are available including:-

1. Your microwave or oven.
2. A shallow insulated container with a sheet of glass over it to solar heat the comb contents on a raised close mesh sieve to separate wax from honey.
3. A disused fridge with a digitally controlled 100watt.heating element shown below.
4. Insulated plywood boxes as shown in the drawing.

C. If all this is a bit too much, the low tech option favoured by ZEST owner Judy Challoner is as follows:-

1. Cut out the honey comb into a mesh bag and hang it over a tub with a tap. Drain out the honey. Assist this by squeezing the bag.
2. Take the contents remaining in the bag and put them into a plastic tub with a lid until the early spring. It can also be kept until there is a dearth of honey and the bees are being bad tempered, because their larvae are starving.
3. If used In the early spring feed the contents back to the bees remotely in small quantities and on a daily basis. Do it at the same time every day. They will tell you off, if you are late.

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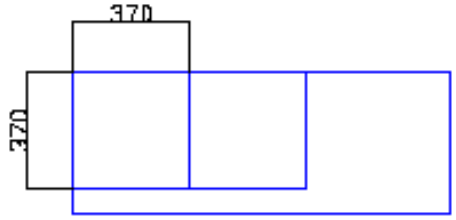
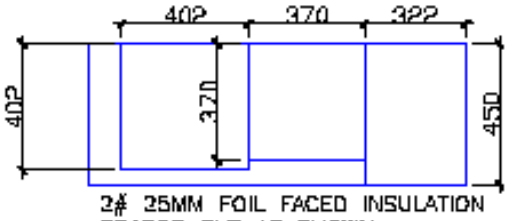
See option B3 above.

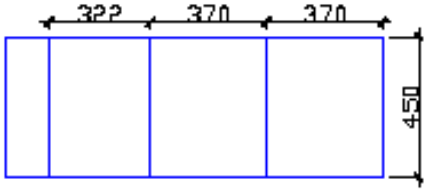
THE ZEST SMALL HONEY WARMER AND QUEEN CELL REARER



1# 25MM FOIL FACED INSULATION BOARDS CUT AS SHOWN

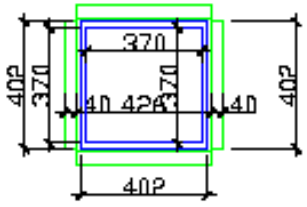


2# 25MM FOIL FACED INSULATION BOARDS CUT AS SHOWN

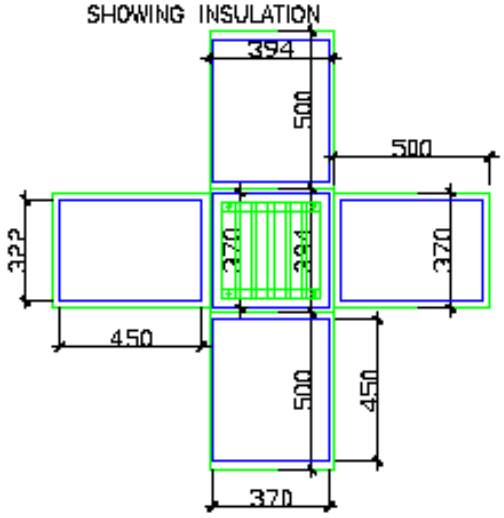


2# 25MM FOIL FACED INSULATION BOARDS CUT AS SHOWN

12MM PLY LID LAID OUT FLAT SHOWING 2 LAYERS OF INSULATION



12MM PLY BOX LAID OUT FLAT SHOWING INSULATION

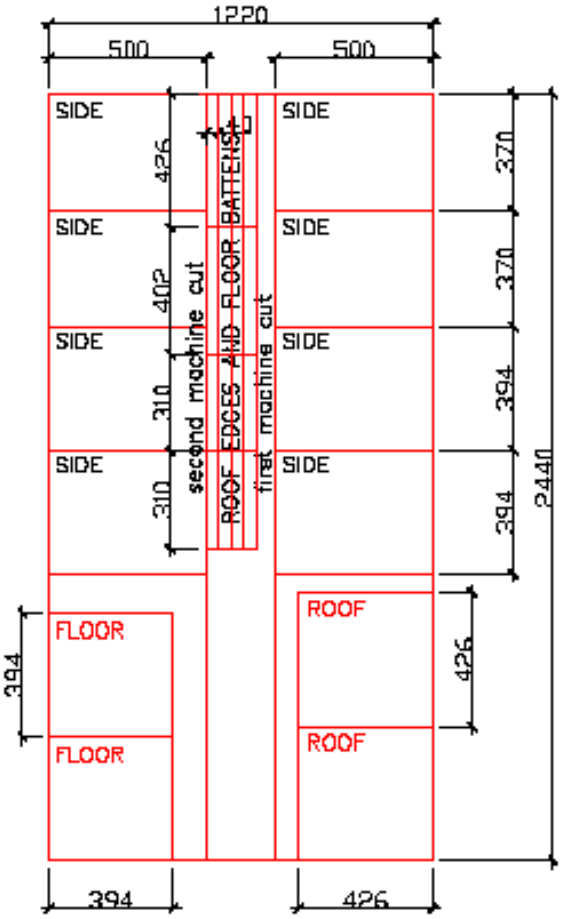


2# HONEY WARMERS FROM 1# 12MM PLYWOOD SHEET

A 100W. Heating element can be purchased from "Ecostat" (01326 378654).
For queen rearing and accurate honey and wax melting temperatures obtain heating element wire from Ecostat and a digital thermostatic control unit.

2no. 310x44x32mm wood battens for supporting 4# 310x40x12 ply floor battens and forming a void for the heating element wire to be entirely suspended on silicon rubber bands supplied for that purpose

12no. 310x40x5mm ply battens for between jar layers



WOOD PATTERN

WOOD ASSEMBLY

INSULATION