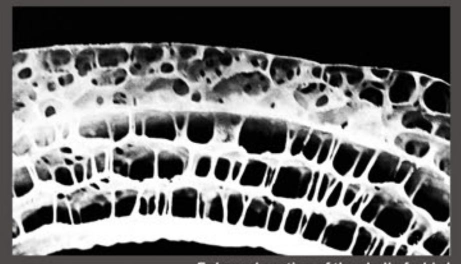
TC120

Development of non-directional Spacial Skeleton Structure

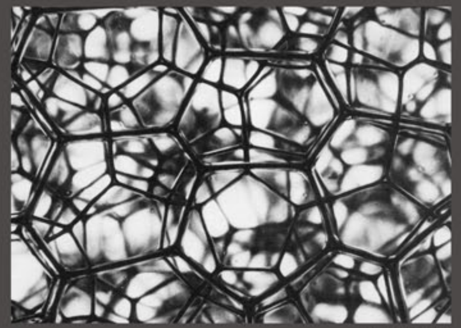
Non directional space frame structure as exhibited from soap bubbles to coral reefs was investigated to meet the primary condition of programmatic cellular growth of the building. This non directional space frame structure could be approximated/mimicked by inflatable/pneumatic moulds technique to create space/rooms.



Enlarged section of the skull of a bird

The primary condition that had to be met was to achieve programmable cellular growth to meet the fluctuating level of housing/space demand.

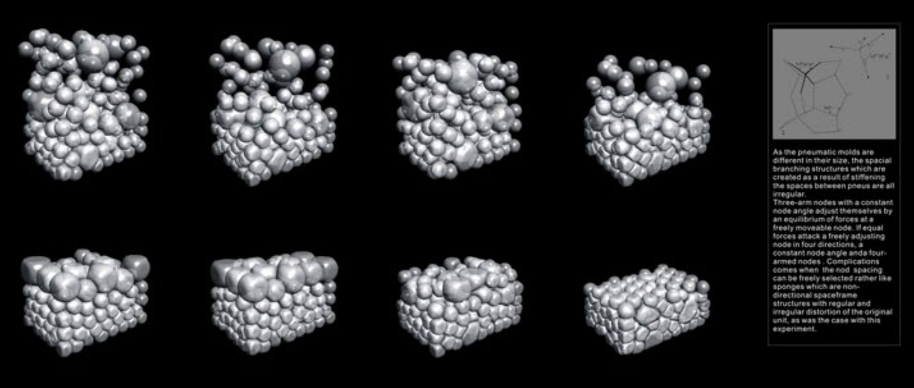
The result is the development of a wide-span reinforced concrete structure with optimized mass (spacial skeleton structure). The concrete filled pneumatic mould intersections produce a spatial skeletal structure. The cost exponentially decreases as the process is duplicated with each stage of cellular growth. It is an economical, rapid and relatively easy technique.



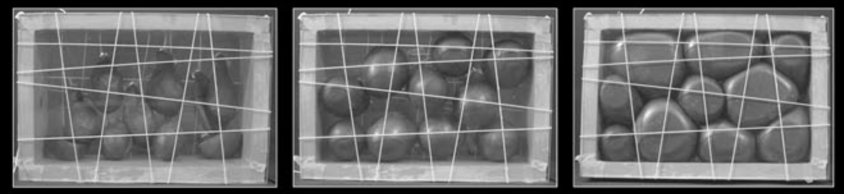
Plastic foam

To meet the need for spatial differentiation five different sized pneumatic molds were used. This deviates from the ideal 3-dimensional network of bubbles of equal size. Therefore it means that the little control can be exercised over the x, y and z planes of the space created. The solution to this is to apply a frame around the bubbles/pneus to control the height, z, and control the x and y direction by the inputted volume of the bubble, thus controlling the resultant floor area. The bubbles within the frame form into a tight packing order, which gives a stable configuration at a low energetic level. This turns out to be the shape with least surface area for the volume of the bubbles.

The pneumatic mould structure displays geometrical properties of a non directional space frame structure. They distribute applied forces three dimensionally like a composite material and not via a single independent element. When the structure is duplicated and layered on top of the original structure, rigidity and therefore stability is increased considerably. These structures are used when very large spans are required. To maintain the properties of non directional space frame structure a joining structure is constructed. A new set of pneumatic molds are placed between the two layers and casted. From the point of view of building construction, this joining structure is a two dimensional constructional element having the function of a truss. However, primarily function is to transfer the loading stresses throughout the structure. The secondary function is to use it as ventilation and utilities connection shaft.

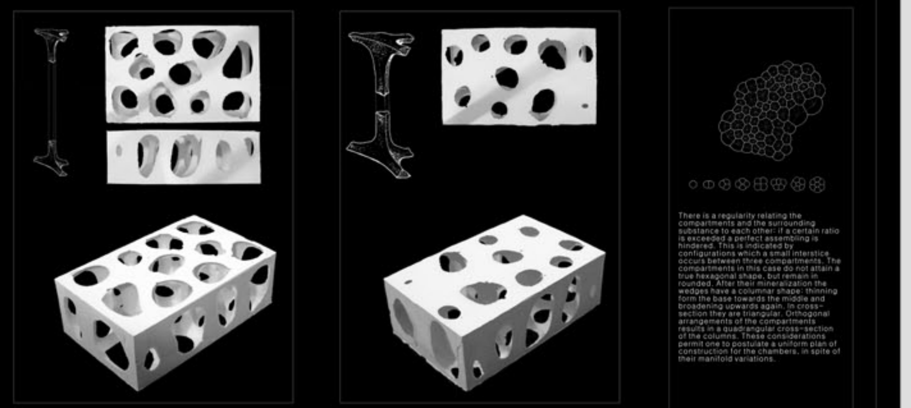


Experiment 01

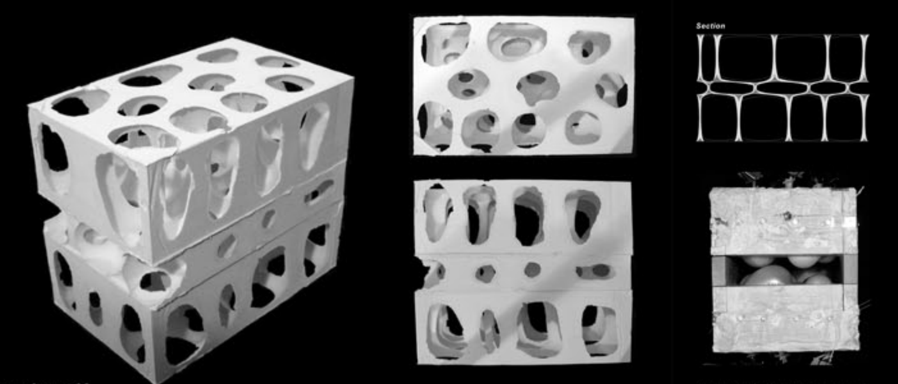


The form of the chamber is determined by the tensional conditions in the system of neighboring chambers.

When two compartments (pneumatics) are arranged side by side, the interface between them is flattened. This results in the layers coming into immediate contact, together forming a double membrane. The remainder of the compartmental surface remains spherical. The angle between the contact surface and the tangent is 120 , following the laws of nature. If three or more compartments assemble the surface necessarily deforms accordingly. While all contacts surfaces become mutually flattened. The free surfaces of the peripheral compartments retain their original spherical form. External forces deform the original shape of such a raft by propagating from pneu to pneu. If the tensile force is smaller than the sum of the adhesive forces then the whole raft can be pushed and pulled and be deformed. The result of these processes is the closest possible packing of the spherical bubbles within a hexagonal raft pattern.



Experiment 02



Experiment 03

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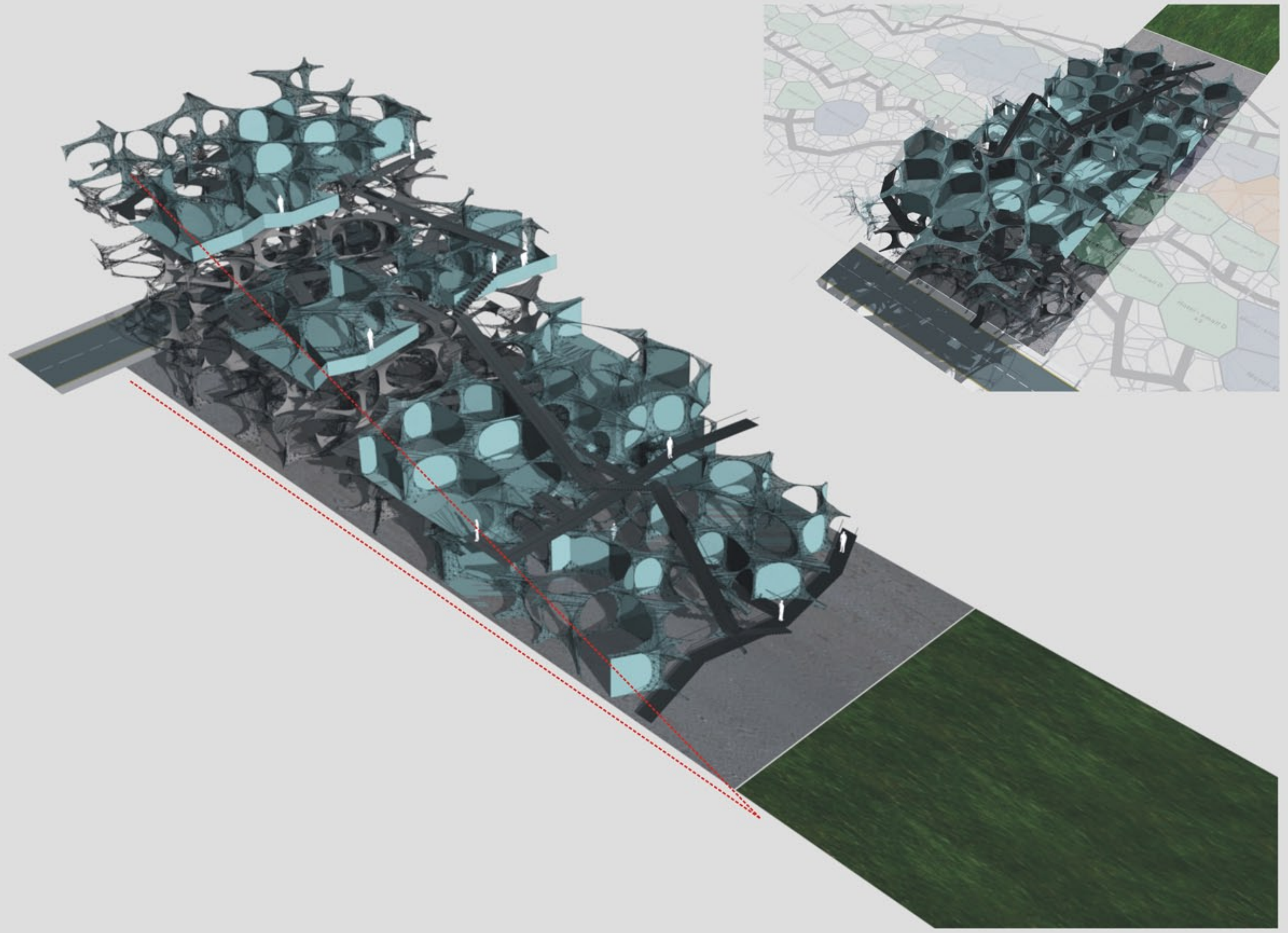
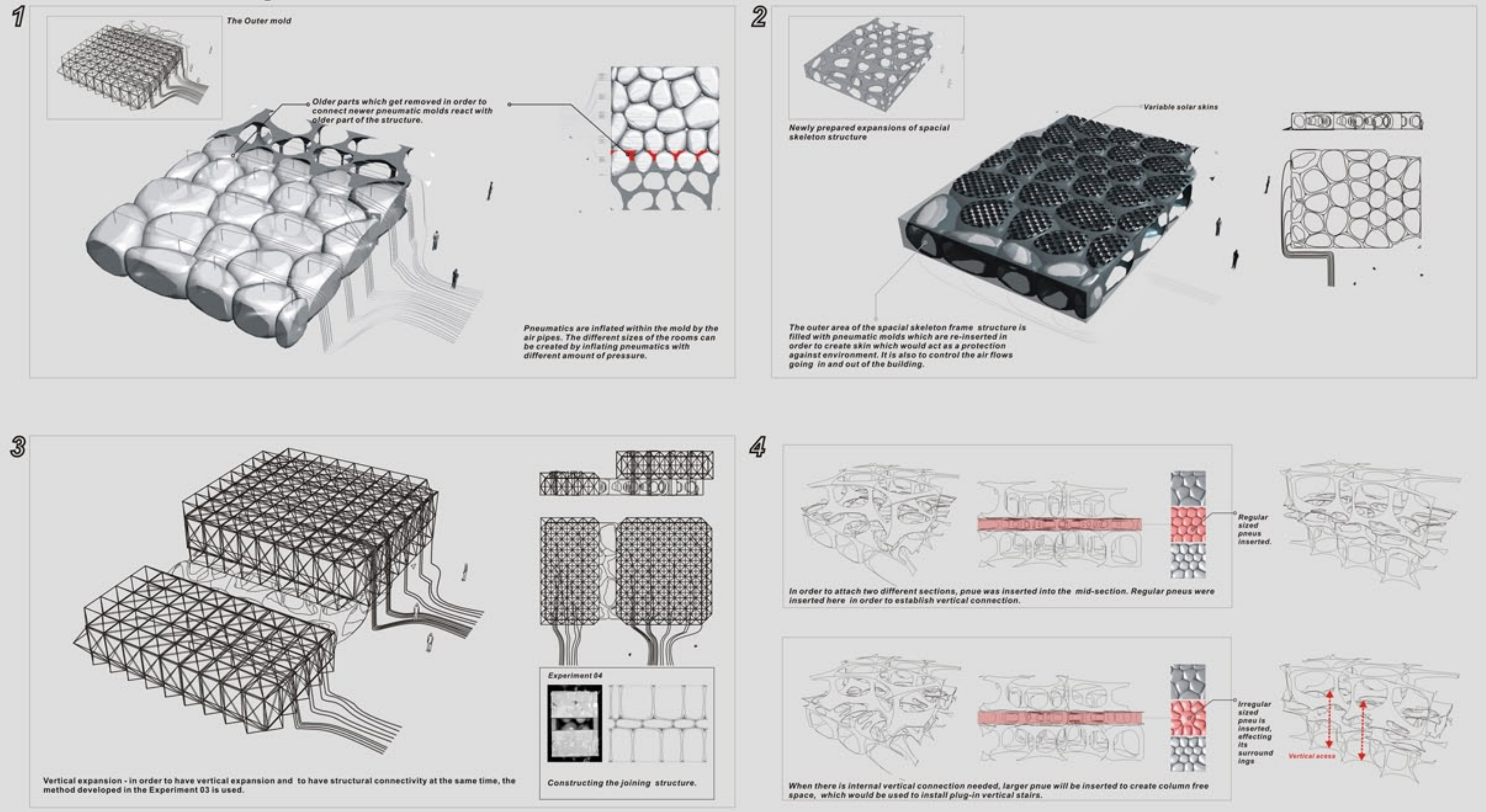


Construction sequence



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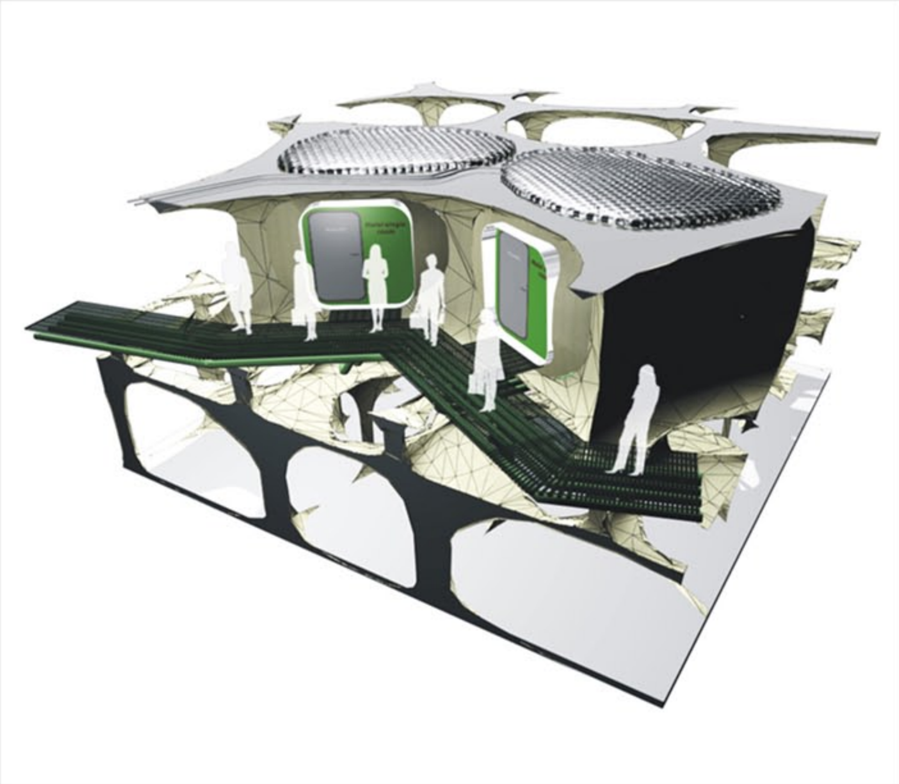

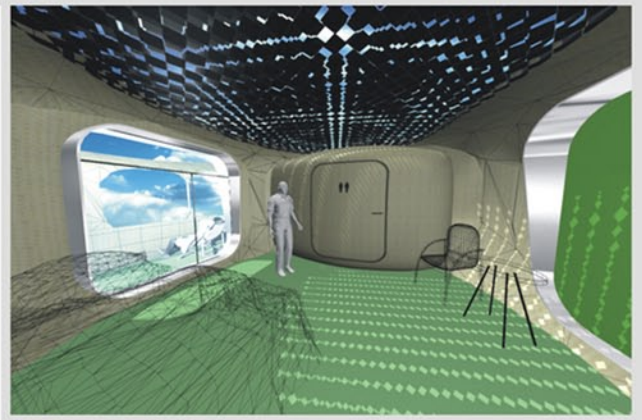

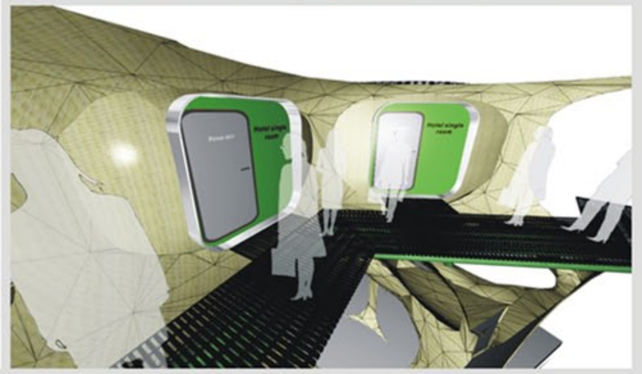

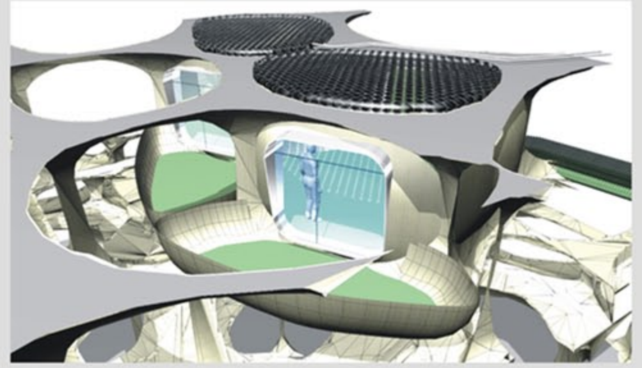

Manufactoring process of Creating a single hotel room