

## **Ecospace's Foundation Requirements for Standard Buildings**

### **1.0 The Ecospace Concept**

1.1 Ecospace studios were developed between 2003 and 2005 in response to clients requiring additional live/work space as an annex to their main dwelling. As architects and structural engineers with experience of working on traditionally designed and procured projects, our aim was to improve on the efficiency and sustainability of these modest domestic projects. We developed an innovative lightweight modular building using Modern Methods of Construction (MMC), that could be easily configured to specific sites. The principle benefits of the Ecospace buildings are based upon part offsite construction in a controlled environment using proven design details which are more cost effective and sustainable than traditional construction. We have developed the buildings to be an innovative and fast track alternative to a traditionally procured building and we now wish develop further a lightweight foundation system that complements the nature of these lightweight buildings. Our initial bearing support design was featured in The Architects Building Design Publication 2005.

### **2.0 Principle of the Building Structure**

2.1 Ecospace buildings are single storey flat roof or mono pitch timber framed structures. Our structures are built using a form of construction known as Structurally Insulation Panels (SIPS) load bearing panel system. We use this for the roof, floor and walls. The SIPS system consists of two structural facings, comprising of Oriented Strand Board (OSB) bonded to a lightweight insulating core. The SIPS panels are connected together at vertical junctions in the walls and horizontal junctions in the roof and floor with timber studs set within the thickness of the insulation.

### **3.0 Foundations**

3.1 It is a well known fact that all building foundations are subject to settlement caused by compression of the soil supporting the foundation due to the additional weight of the building. This is often referred to as consolidation settlement and in time it will diminish. Settlement may also occur due to seasonal changes in soil moisture content especially heavy clay soils. Roots from vegetation can exacerbate seasonal movement because they abstract moisture from the soil. If the settlement is even across the whole building it is unlikely that it will be noticed, problems can arise when differential foundation settlement occurs. Differential foundation movement distorts the building structure especially the weaker panels with large openings and in the worse cases doors and windows will bind in their frame.

3.2 Unlike traditional masonry structures, the Ecospace form of construction results in inherently rigid walls capable of tolerating minor differential settlement. The structure is elevated off the ground on engineered and designed adjustable steel shoes that will compensate for situations where differential foundation movements occur. These shoes support the floor and walls and if required steel support beams within the structure of the floor. All loads are transferred back through these points to the foundation. Foundations are located at the critical locations to suit the loading and site conditions.

3.3 The steel bearing shoe combined with a concrete plinth style of foundation is an efficient cost-effective foundation to use with the ecospace structure when compared with the cost of traditional trench fill mass concrete foundations. In addition, the shoe and plinth foundation increase efficiency and accuracy, providing a fast-track alternative to traditional groundwork.

## **4.0 Solutions for Tree conservation at the planning stage**

4.1 We are regularly challenged at the planning stage with restrictions to foundation depths and ground disturbance. Conservation and Tree Preservation Orders can require a different approach to building altogether. In such situations, our plinth style of foundation is an eco-sensitive solution to this problem, thus reducing impact to the environment and damage to the root structure of any nearby trees.

4.2 Our system has been accepted and welcomed by Arboriculturists and Planners alike. Our minimum requirement for a structural bearing has been considered and designed by our in-house structural engineering team.

4.3 The design of SIPS structural timber and steel floors, allows the flexibility to move or relocate the pad foundations at the design stage or during site works where required to avoid any damage to tree roots and to ensure their protection.

## **5.0 Method of installing Swift Foundation**

5.1 Remove the root layer. (Use a turf cutter if appropriate).

5.2 Dig out by hand the holes (700mm x 700mm x 200mm deep) for the Swift Plinths as per the building ground plan and the base layer structure.

5.3 Fit the sub base Swift Membrane into each hole.

5.4 Position the Swift Grid onto the Swift Membrane.

5.5 Pour the pea gravel into the Swift Grid and level it out across the top surface.

5.6 Place the Swift Base Stone onto the gravel filled Swift Grid.

5.7 Set the adjustable nut on the Swift Bracket Assemblies to the zero position (i.e. where the nut is turned fully up to the underside of the bolt head).

5.8 Temporarily fit the Swift Top Stones and Swift Bracket Assemblies and check the final alignment of the building base. Make any adjustments to the position of the Swift Base Stones at this time. Remove the Swift Top Stones and Swift Bracket Assemblies.

5.9 Back fill the space around the each Swift Grid and Swift Base Stone. The back fill material is customer supplied.

5.10 Lay a single layer of permeable membrane over the entire area of the building ground plan. This is optional and customer supplied.

5.11 To accommodate localised contours or site gradient and achieve an approximate building level within 50mm, place additional Swift Base Stones onto the primary Swift Base Stones as required.

5.12 Place the Swift Top Stones and Swift Bracket Assemblies onto the uppermost Swift Base Stones.

5.13 Apply surface dressing of the building ground plan at this stage. This surface dressing is customer supplied.

5.14 Assemble the building base layer onto the Swift Bracket Assemblies and screw into position using 2 off fixings (See Note 2).

5.15 Final levelling of the building can be performed at any stage after step 14 and building completion by adjusting the nut on the Swift Bracket Assemblies. Having performed step 7, an adjustment range of 50mm is available. If the adjustment falls outside this range, jack up the building at that point, return the adjustment nut to the zero position and add another Swift Base Stone.

## **6.0 Building Control**

6.1 The current building regulation requirements for foundations can be inefficient and unsustainable for the Ecospace style of structure and end use.

6.2 The Building Regulations refer to BS8004 for foundation design. BS8004 identifies the hazards in the ground, and take necessary measures to ensure that the building can accommodate these hazards without damage to the structure and therefore the building remains fit for purpose. The adjustable designed plinth foundation system meets the requirements of BS8004.

6.3 Problems can arise, when our clients require the ecospace designated for sleeping accommodation, and thus requiring full building regulation compliance. Although the Ecospace structure has been design and approved under our partnering local authority and in house structural engineers, the site requirements may vary. As explained earlier, our Ecospace structures are designed to accommodate nominal ground movement. In certain situations, depending on the site and the building layout, our structural engineers may recommend additional structural reinforcement around extended openings, ie window openings. In situations such as this, our clients are made aware of the alternative options, and given the choice of a more substantial foundation such as reinforced concrete. In certain circumstances this is not an option due to planning conditions.

6.4 As an alternative, the client would accept the potential for nominal movement without any compromise to the integrity to the structure as explained in this report. In such scenarios our clients are provided with an operating and procedures manual. This ensures that Ecospace, or a third party can revisit site and adjust the bearing shoes should it be required.

## **7.0 Conclusion**

7.1 We consider that this foundation proposal is a further development in Modern Methods of Construction. We further believe that a fully integrated Ecospace Building together with this foundation system complement one another to ultimately improve the sustainability and viability of such projects. We therefore hope that our proposal will be accepted under the building regulations.