Insulated Concrete Formwork

by Brian Ó Murchú

House Killaloe, Co. Clare

The picturesque village of Killaloe, Co. Clare is the location for one of Ireland's first Insulated Concrete Formwork houses. The initiative to introduce the 'EUROMAC2' ICF system to Ireland is the work of American businesswoman Susanne McAllister, managing director of 'Rapid Build Modular Homes Ltd.' and exclusive agent in Ireland for the French Manufacturer 'EUROMAC2 s.a.r.l.'.

Originally invented in Austria, ICF's' have been successfully used in central Europe for 30 years with over 100,000 completions to date by EUROMAC2 alone. Germany, Switzerland and France are currently Europe's biggest market places for ICF's', although other European countries including, Spain, Portugal, Italy, Netherlands, Norway, Russia and Poland are also growing markets for the product. Approximately 60% of completions are houses while the remaining 40% are used to construct a range of building types including Hotels, Schools, Apartments, Sports buildings as well as Manufacturing and Storage facilities.

Insulated Concrete Formwork, sometimes referred to as Permanent Insulated Formwork (PIF), is a permanent, self-finishing shuttering for the construction of solid monolithic concrete walls, floors and roofs. The formwork remains in place after the concrete is poured, as a permanent part of the wall's assembly. The left-in-place forms not only provide a continuous insulation and sound barrier, but also a dove-tailed backing for dry-lining on the inside and plaster on the outside. To accommodate electrical and computer wiring, the EPS internal insulation can be easily cut to form a chase for conduit. Brick facings, timber planks, tiles or stucco can also be used as external finishes.

When rendering, the use of waterproof mineral based renders is stipulated and these are applied to a loose weave fabric mesh to ensure adequate adhesion. A thick, one coat spray-on system is available from a number of suppliers. These systems are available in a wide range of colours and carry a 10 year guarantee against fading. Internal spray-on plaster is also available if required.

'Forms' are typically made from expanded polystyrene with a density of between 25kg to 45kg granulate/m^3. Although all ICF's' are identical in principle, the various brands differ widely in the details of their shapes, cavities and component parts. Systems comprise either preformed concrete blocks or panels connected with plastic or steel ties.

ICF's' have some of the advantages of off-site construction, notably in relation to speed of construction. Typically, three experienced operatives can assemble a single storey and make the concrete pour in 2 days. The EUROMAC2 system is particularly fast to assemble since it arrives on site in large pre-assembled panels (max.1750 mm x 600 mm) with integral steel wall ties which provide rigidity during the pour. According to 'House Builder' and part time lecturer in building studies, Richie Hennessy, this 'rapid build' aspect makes EUROMAC2 particularly attractive to builders and developers.

The edges of the panels snap into place when downward pressure is applied. The polystyrene formwork joints are staggered by 250mm to achieve stability against wind loads and bursting forces during the pour.

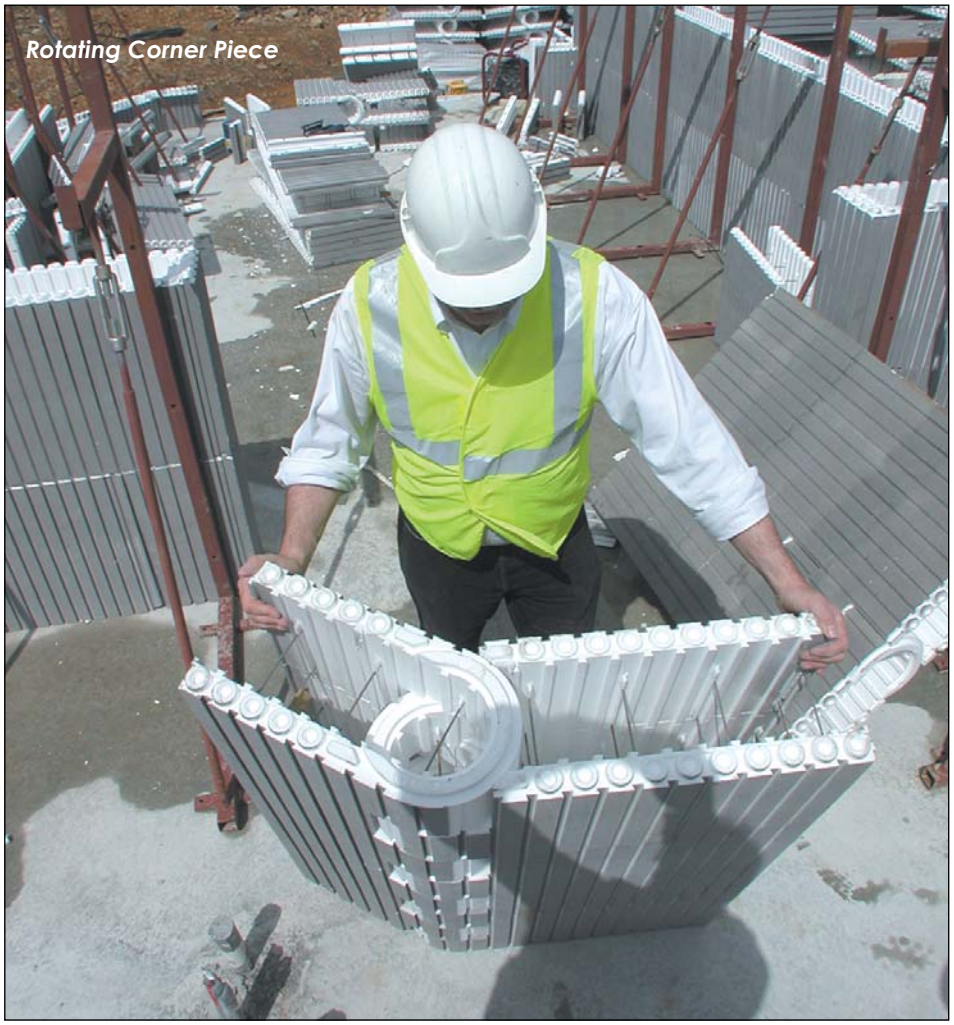
Wall thicknesses of 250mm, 300mm and 450mm are available. The system has high thermal efficiency and qualifies for S.E.I. (Sustainable Energy Ireland) grant schemes, in addition to complying with Part L of the Building Regulations 2003. Another thermal attribute of this system is that the mass concrete acts as a 'moderating mass' by storing heat or coolness and releasing it back slowly into the rooms. This not only makes temperature more even, but conserves energy in the process. Air tightness is another energy saving feature of buildings constructed using Insulated Concrete Formwork.

The EUROMAC2 system also includes engineered polystyrene slab roof sections.

These interconnect with the rising walls to form a complete concrete envelope. The pitched roof system typically requires only one purloin and no cross trusses. A habitable attic space, with a concrete floor, is easily created.

Because concrete is inherently fire resistant, extremely good fire resistance can be achieved using ICF^{s}'. A 250mm thick wall (including the thickness of the polystyrene forms) has a fire resistance of 90 minutes. The EPS forms are treated with fire retardant to prevent spread of flame.

The system offers a full range of solutions for external and internal concrete walls, floors and roofs and is particularly suited for low to medium rise, multiple occupancy residential and Hotel developments, where sound insulation is a specific requirement.


Rotating Corner Piece

Openings such as doors and windows are formed using a hand cutting tool while polystyrene closure pieces act as stop ends at doors and windows. The EUROMAC2 system also features an ingenious 'rotating corner piece' which rotates to the required


Hand Cutting Opes


Wall/Floor Junction


Typical Wall Assembly

angle when a small force is applied. This is particularly suitable for forming splayed corners and bay windows.

Relatively low skill levels are required to install the formwork, although some training is required. Conduits and pipes for services are installed in the cavity and supported so as to be able to withstand impact while the concrete is being poured. Where basements or retaining walls are being constructed, reinforcement is placed into the formwork to the engineer's specification. The formwork is stabilised during the installation process by positioning temporary struts both internally and externally which can be adjusted to double-up as scaffolding.

When the formwork has been adequately stabilised, a high workability ready-mixed concrete is pumped into the cavity. For most wall applications a grade C25 pumped concrete is used with maximum 16mm aggregate size. A grade C35 pumped concrete is normally used for floor applications. Concrete is normally placed without the use of a vibrating poker. In multi-storey applications, compaction is often achieved using a gentle, hand held poker which compacts the concrete without unsettling the formwork. Plasticizers can be used to achieve workability in the concrete mix but they are not normally required. The curing time is dependent upon ambient conditions, but 12 hours is normally sufficient. When the concrete has cured, the result is a monolithic concrete envelope with excellent structural stability, durability and thermal insulation properties.

The are many advantages to this type of system including, speed of assembly, no craneage or lifting requirements, excellent fireproofing, soundproofing and thermal properties. There is no doubt that many clients will choose to opt for this type of system in preference to the many lightweight prefabricated options which are on the market.

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Rotating Corner Piece - Supporting Struts