

# THE RISING TREND OF INSULATED CONCRETE FORM CONSTRUCTION



## INTRODUCTION

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Australia's accelerating construction industry is putting the pressure on building professionals to find ways to increase efficiency, while still producing high quality, sustainable buildings. The popularity of Insulating Concrete Forms (ICF) has risen due to its unique ability to address these issues. This white paper will identify the benefits of implementing ICF in construction projects and compare available solutions.

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## AN ACCELERATED INDUSTRY

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The Australian building industry is operating in an increasingly competitive environment. In the past five years, the average completion time for new houses and townhouses has declined in five of the country's States and Territories, compared with the five years prior. The largest decrease has come out of Western Australia, where completion time for new homes and townhouses has contracted by 0.24 and 0.47 of a quarter respectively. The average completion times for flats, units or apartments has remained similar over the past ten years.<sup>1</sup> However, when the trend towards population density and high rise living is taken into account, it suggests more apartments are being packed into each project in a similar amount of time that it used to take to construct a much smaller building.<sup>2</sup>

Developers are also facing a rise in the cost of doing business, putting pressure on their bottom line. This is showing no signs of easing, with upwards pressure on labour costs expected to be sustained and nearly a third of businesses anticipating major to moderate rises in the cost of construction materials.<sup>3</sup> This pressure is transferred to architects, who are expected to speed up the construction process, without compromising a building's quality or impact on the environment<sup>4</sup>, all often on a smaller budget.<sup>5</sup>

The construction industry is innovating to deal with the issues it faces. By completing projects in less time, costs can be reduced dramatically. Savings can be made on site overheads such as labour and clients can begin generating an income earlier.<sup>6</sup> Less time spent on each project allows for more to be completed each year and a greater utilisation of the small window to do construction each year, particularly in high rainfall and Alpine areas.



## INSULATED CONCRETE FORM – FAST, STRONG AND SUSTAINABLE

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An effective means of speeding up the construction process is by incorporating permanent formwork into a design. Insulated Concrete Forms (ICF) are modular units made from polystyrene or polyurethane foam. The units are interlocking blocks or panels, which are filled with block fill concrete using a concrete pump. The method is suitable for residential, commercial, industrial and civil works and for construction of swimming pools, spas, saunas, water tanks, detection tanks, music rooms, retaining walls, cellars, basements, lightweight cladding and more.

### Speed and precision

One of the largest benefits of ICF is the speed at which it can be installed. The need for little on-site adjustment and change means that its construction is faster than most other building methods.<sup>7</sup> Reputable manufacturers can provide teams who can install walls in as little as one to two weeks per floor level, saving up to a week and half per floor level in construction time compared with conventional brick veneer and double brick builds. Once the reinforced concrete is poured, the superstructure is quickly ready for the slab or roof to go on.

### Reduced labour

ICF is much easier to install than block or brickwork as they interlock without mortar, it is very light and easy to handle and all the heavy work is completed with the concrete pump. Many manufacturers provide products which can be hand unloaded from a truck and to the first floor, eliminating the need for a crane, brick hoist or forklift. It is ideal for difficult access or sloping sites.

### Structural capability

ICF blocks lock together to create a structure capable of withstanding the pressure of concrete. Once the concrete sets, it provides the loadbearing structural capacity of the system.<sup>8</sup> The reinforced concrete structure is up to nine times stronger than a conventional brick or block construction and some products are cyclone rated to category 4 or 70m per second. It is non-hygroscopic, non-irritant and rot-proof, meaning it

does not deteriorate over time and it provides constant insulation value across the full life of a building, as low as 0.038W/Mk for white colour.

### Sustainability

ICF provides significant energy and resource savings. The level of insulation provided by ICF construction depends on the type of ICF units used, but it is often greater than R3.<sup>9</sup> The efficient insulation of ICF facilitates a more consistent temperature year-round due to the thermal mass of the concrete core, resulting in reduced dependence on appliances and energy use. This leads to lower cooling and heating bills.

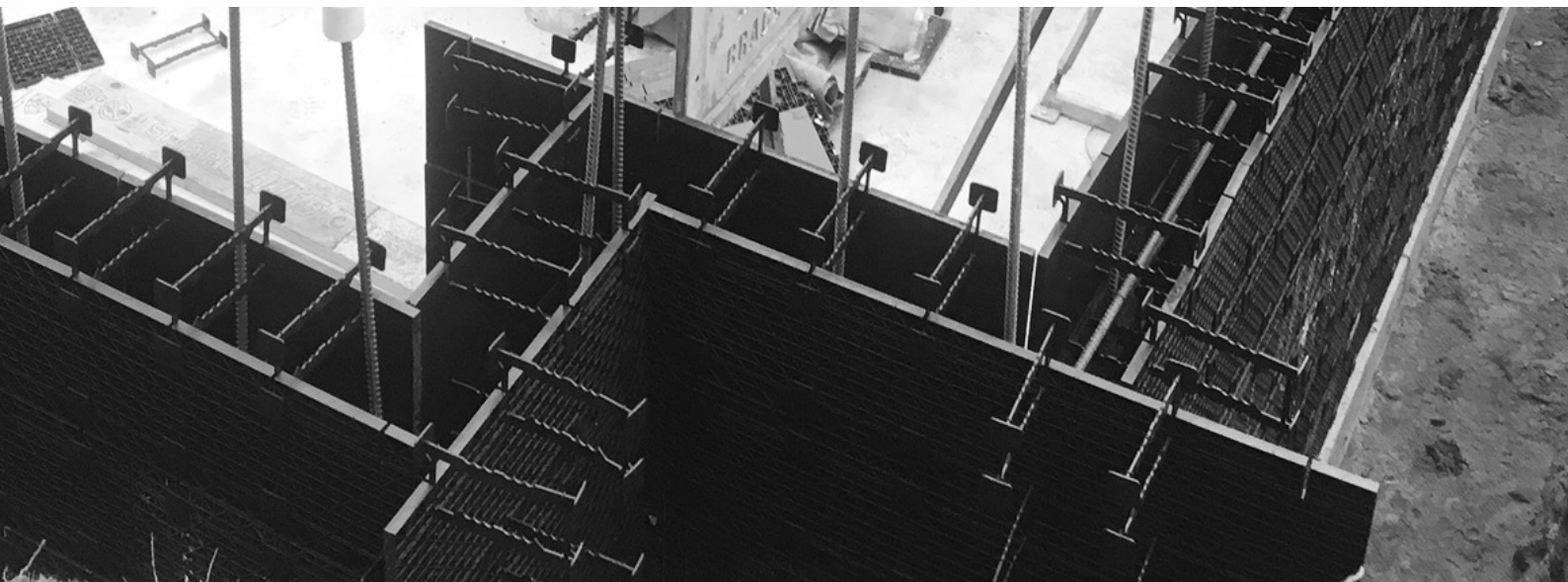
The use of concrete, plastic derived from oil and steel in ICF is arguably a highly responsible way of using limited resources for long-life, energy efficient structures. As ICF has a long-life span, the energy used in creating the material is recouped over many decades. The foam used to make the forms (expanded polystyrene or EPS) is part of a group of construction materials that have the least possible environmental impacts. It is also 100 per cent recyclable at many stages of its life cycle.

### Fire resistance

Polystyrene and polyurethane foam do not burn or support flame or fuel fire, but when they melt they release fumes – no worse than the toxins released by burning wood. However, the foam is protected from the heat by layers of plasterboard or render. Usually manufacturers will add flame retardants to the foam, and overall the fire resistance is very good.<sup>10</sup> Some manufacturers can easily achieve a certified Fire Rating as per AS3600 and AS 3959-2009 for different thicknesses of concrete with excess of FRL 240/240/240.

### Sound insulation

The combination of foam and concrete generally makes ICF airtight and a good sound insulator. Typical 300mm overall finished walls with a 150mm concrete core deliver a sound transmission class rating of around 48, while some manufacturers can achieve 50+.<sup>11</sup>



## INSULATED CONCRETE FORM VERSUS POLYMER SYSTEMS

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ICF has several advantages over polymer systems. The simplicity of installing ICF extends into finishing. The surface does not need to be pre-treated and traditional builder renders can be used. The most common finish used is acrylic, smooth or textured renders while battening and weatherboard, colourbond, mini orb, aluca bond, tiling, stone facing and even glass and stacked stone can be used. It is possible to delineate and demarcate between selected surfaces with aluminium, brass, stainless steel and edging and shadow grooves can be cut into the surface of the foam to create a certain look. All of this can be achieved using traditional carpentry and workmanship.

ICF keeps the process of chasing simple. Plumbing and electrical services can be chased vertically and horizontally through the insulated foam using standard carpentry tools. This eliminates the need for a chaser or specialised tradesperson and the potential for structural damage, as only the insulated foam is chased, not the concrete.

Insulating with ICF is easy and does not pose any constraints. If a traditional air conditioning unit is installed correctly, it is usually half the horse power of a traditional build due to ICF's insulation capabilities. Maintenance and ongoing running costs are also reduced as the air conditioner's need to be used is minimised.

The use of polymer can create some design limitations. Often thin coats are applied to surfaces unable to take the weight of durable thicknesses of render, providing a finish only equal to the straightness of the subsurface. If a thick coat of render is applied to a polymer surface which is not scuffed or rubbed substantially, over time the expansion and contraction of the render will cause it to delaminate.

Chasing with polymer systems can be easy, but only if the tracks are in the right place and clients are restricted to placing plumbing and electrical services in crack inducing grooves. In addition, insulation for systems like polymer, precast and other panelling often must be ordered and installed separately, scheduled and shop drawings provided, whereas ICF allows workers and builders to start immediately upon delivery.

## WATERPROOFING

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ICF can pose some waterproofing challenges, particularly when it is below grade. Some suppliers perpetuate the myth that their products do not need waterproofing, which is generally not the case.<sup>12</sup> If not correctly waterproofed, there is potential for water to penetrate the interlocking edges of the blocks or migrate through channels or pockets between the concrete and the ICF.<sup>13</sup> An industry leader in the manufacture and supply of ICF, ZEGO, advises their products used as a retaining wall or basement wall

One of the largest benefits of ICF is the speed at which it can be installed.



should be waterproofed with sheet membranes or acrylic spray on finishes, protection board and/or cell drain and perimeter ag-lines to drainage points or pump pits in basements. As a secondary precaution, a Bentonite/Kuniseal by Xypex can be used along the wall line between the slab and wall junction to act as expanding water stop. In addition, the ZEGO FireFORM or ReFORM walls can be poured with a high MPa concrete and/or additives like Xypex or Caltite waterproofing additives.

## CASE STUDY: WYNDHAM VACATION RESORT, FIJI

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Wyndham Vacation Resort in Fiji was constructed using a combination of ZEGO's FireFORM and ReFORM to achieve substantial cost savings.

Pacific Building Solutions was commissioned to design, develop and refurbish the pool area and café, reception, lobby and kids club, and to relocate and construct a new restaurant. This phase of development also included the construction of 63 apartments positioned around landscaped gardens and a new pool with a swim-up bar.

The use of ZEGO ReFORM formwork system unlocked savings by allowing reuse of the panels multiple times on the external face and the ZEGO FireFORM foam panels were utilised in the internal walls to provide insulation. The internal insulation also acts as a service duct for various internal services including plumbing, electrical power and lights. The ReFORM on one side provided a class 4 finish on the external side and 60mm FireFORM panel of insulation internally.

The ReFORM saved 45 per cent on freight cost as the plastic panels were reused over 30 times. Savings were also made in render finish on the Class 4 concrete finish by using a standard cement and base coat render instead of an acrylic based render to be used on the Foam surface.



## ZEGO

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ZEGO is an Australian family-owned company offering a sustainable, energy efficient and faster way to build the walls of a residential or commercial building. The company has been providing insulated concrete formwork and alternative wall building systems to Australians since 2001 and can look after your export requirements.

ZEGO's products are a step above and are very popular with eco-architects and designers due to their insulating properties and metric size. ZEGO's solutions can be laid horizontally, like traditional brick work or vertically in a stack bond pattern. They utilise a dove tail groove to support render and plasterboard, mechanically locking the acrylic render and cornice cement for plasterboard to the surface of the ZEGO Insulating panels. ZEGO has a diamond interlock system, not a slip joint and hence does not require special internal and external corner forms. ZEGO also provides a design registered, fully Work Cover approved wall alignment system and WMS.

With over 30 years' experience as Clerk of Works in both commercial and residential construction, building professionals can be sure their project is in good hands with ZEGO.

- 1 ABS. (2016). Average Dwelling Completion Times. Building Activity, Australia, June 2016.  
<http://www.abs.gov.au/ausstats/abs@.nsf/0/BEF19E4062997FEFCA25759A001A1E49?OpenDocument>
- 2 Australian Bureau of Statistics. (2016). Regional Population Growth, Australia 2014-15. ABS.  
<http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/3218.0Main%20Features152014-15?opendocument&tabname=Summary&prodno=3218.0&issue=2014-15&num=&view=>
- 3 AiGroup. (2016). Rain and roads will lift major construction. Construction Outlook 2016.  
[http://cdn.aigroup.com.au/Economic\\_Indicators/Construction\\_Survey/2016/construction\\_outlook\\_Oct16.pdf](http://cdn.aigroup.com.au/Economic_Indicators/Construction_Survey/2016/construction_outlook_Oct16.pdf)
- 4 Andjelic, D. (2017). As land prices grow, developers and contractors turn to prefabricated construction techniques. The Sydney Morning Herald <http://www.smh.com.au/business/property/true-lies-modular-construction-20170208-gu8h7h.html>
- 5 Leeds, R. (2016). Top 4 Challenges Facing The Construction Industry. Digitalist Magazine.  
<http://www.digitalistmag.com/future-of-work/2016/08/15/top-4-challenges-facing-construction-industry-04388065>
- 6 PrefabAUS. (2017). What is Prefab. PrefabAUS.  
<http://www.prefabaus.org.au/what-is-prefab/>
- 7 Downton, P. (2013). Insulating concrete forms. YourHome.  
<http://www.yourhome.gov.au/materials/insulating-concrete-forms>
- 8 *ibid.*
- 9 *ibid.*
- 10 *ibid.*
- 11 *ibid.*
- 12 ICF Builders Network. Q&A.  
<http://www.icfhomes.com/DYKpages/dykTRUTHmyth8.htm>
- 13 Polk, D. Waterproofing ICFs: Why it's important to get it right. Waterproof! Magazine  
[https://www.waterproofmag.com/back\\_issues/200810/waterproofing\\_ICFs.php](https://www.waterproofmag.com/back_issues/200810/waterproofing_ICFs.php)