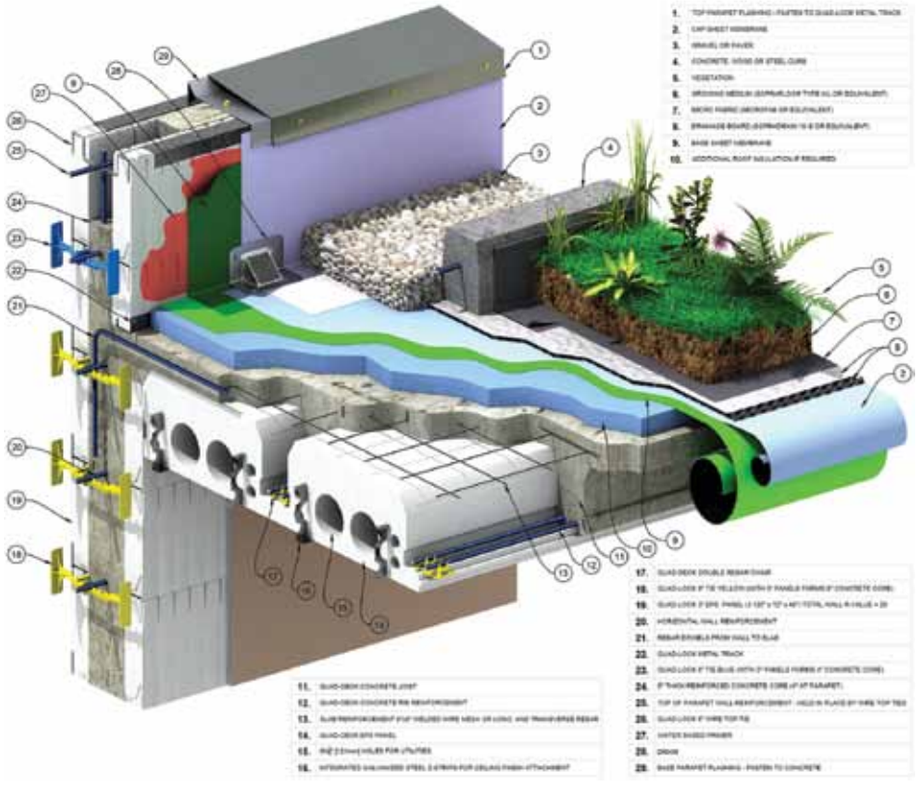
Concrete Brings In the Green

ICF/Concrete roof systems ideal for supporting green roofs.

BY DOUGLAS BENNION



Detail showing intersection of ICF walls and roof, topped with green roof system.

Most ICF floor/roof systems rely on reinforced concrete T-beam design, employed for decades by structural engineers for support of our largest and heaviest structures, like bridges and parking garages. The ICF industry brings efficiency to both construction and operation of buildings by employing "one-way" reinforcing in suspended concrete floors and roofs. Traditional "flat-plate" suspended slabs are giving way to lighter, more efficient floor and roof structures where concrete and steel consumption are reduced 40 to 50 per cent by the "voided slab" design. Though extremely lightweight, ICF floor and roof panels can support crews and concrete during placement, and are typically supported by about half of the shoring used for traditional suspended forms.

Though containing far less concrete and steel, these T-beam structures can safely carry loads across clear spans and resist stresses from wind and seismic events. After concrete is placed and cured, ICF panels provide permanent insulation ranging into the mid-to-high R-30s.

Emerging building codes in the US and Canada are raising the bar for thermal performance and durability in residential and commercial structures. As a result, design professionals are often left at a loss for cost-effective solutions to meet new requirements. Traditional building methods can quickly meet "economic limitations" when subjected to modern computer modeling exercises; i.e. Thermal envelopes created with traditional wood-framing and masonry often fall short of expected performance levels, unless augmented with expensive (and space-intensive) additional layers of insulation and air sealing measures. However, an immediate and effective solution has come from a somewhat unexpected source: the concrete industry. More specifically, a marriage between insulation and concrete.

A CONCRETE SOLUTION

More residential and commercial designs are calling for exterior building shells constructed of well-insulated, reinforced cast-in-place concrete, usually in lightweight permanent forms made from expanded polystyrene, called ICFs (Insulating Concrete Forms). Unlike traditional removable concrete forms, ICFs are left in place after pouring to provide excellent insulation for the concrete structure and a substrate upon which to fasten interior and exterior finishes. The result is a wall assembly that combines the best available performance as both a durable structure and a thermal enclosure. Dual layers of insulation eliminate thermal bridging across structural elements and the (formerly-liquid) concrete creates an impenetrable air barrier across opaque wall areas. Now it is just up to the builder to ensure that doors and windows are well sealed, in addition to wall-to-roof connections.

HIGH PERFORMANCE BUILDINGS

One example of how appealing ICF/Concrete buildings can be to owners is in the mid-rise rental market. University of Waterloo students, in Kitchner ON, may very likely be housed in one of about 80 ICF buildings built over the last 10 years in that area. These insulated concrete apartments are rented at market rates (including utilities), but are operated at a fraction of the cost of competing structures built with older technology, altering the return-on-investment formula well in favor of the building owner by increasing available cash flow. Such a level of performance can be attributed to the three key features of ICF/Concrete structures:

- High levels of insulation protecting the concrete throughout the day and the seasons
- Low porosity concrete effectively mitigating uncontrolled air infiltration, and
- High mass concrete, which buffers rapid changes in temperature in the thermal shell

RAISING THE ROOF

High performance exterior walls are not the only show in concrete's troupe of green actors; Efficient and cost effective ICF/Concrete floor and roof systems are now widely available.

GREEN REAL-ESTATE BOOM?

ICF/Concrete roof structures hold great promise for adoption of green roof technology due to their superior bearing capacity and resistance to water damage. Dr. Maureen Connelly at British Columbia Institute of Technology's School of Construction and the Environment calls green roofs "the greatest real-estate opportunity of this century."

Dr. Connelly and her team performed a two-year study of an ICF/Concrete REM (Roof Evaluation Module) against traditional wood-framed structures. The ICF/Concrete REM demonstrated a 98 per cent reduction in heat gain during summer months, and a 77 per cent reduction in heat loss. During winter months, the ICF/Concrete REM reduced heat loss by 50 per cent. Storm water runoff was reduced by an average of 66 per cent for an entire year-long cycle.

WHAT DOES THIS MEAN?

ICF/Concrete building designs bring new and effective tools to building designers and owners who seek the best value for the dollar invested. Reduction in the total cost of ownership benefits building owners and a greatly-reduced energy footprint benefits the surrounding community and the world at large. **CB**

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