Presentation to Irish Building Control Institute

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26th March 2009
Irish Concrete Federation

- National Representative Organisation
- 100 members (350 production locations)
- Services include
  - Marketing & PR
  - Planning & Environment
  - Training
  - Health & Safety
  - Technical Services
# Role of Concrete in Society

<table>
<thead>
<tr>
<th>Sector</th>
<th>% of Output (2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing (Private)</td>
<td>51%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>21%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2%</td>
</tr>
<tr>
<td>Commercial</td>
<td>19%</td>
</tr>
<tr>
<td>Housing /Offices (Public)</td>
<td>8%</td>
</tr>
</tbody>
</table>
Life Cycle Analysis

- Manufacture of building material
- Construction
- Use
- Maintenance
- Demolition
- Recycling

- 80% - 90% of energy used during life cycle of a building is during use!!
Sustainable Concrete

- Locally available raw materials
- Durability / Longevity
- Adaptability / Flexibility
- Fire Resistance
- Sound Insulation

- Recyclable
- Robustness
- Thermal Mass
- Moisture Resistance
- Energy saving
- No protective treatment
Key Sustainable Benefits of Concrete

Durability
Durability / Longevity

• Service life is a prime characteristic for a sustainable building

• Up to 200 years service life (need to design for flexibility)

• Withstands moisture, weather, mechanical wear and tear, shocks, accidents, vibration

• Reduced repair and maintenance

• Cost savings

• Flexibility -
Sustainable Benefits of Concrete

Fire Safety
Fire Safety

• Non combustible material
• Class A1 – European Fire Classification
• Proven fire resistance
• Prevents fire spreading
• Remains robust in extreme fire
Sound Insulation

• Airborne Sound (e.g. loud speech)
• Impact Sound (e.g. footsteps)
• Vibration
• Proper sealing necessary
Embodied Energy

- 80% - 90% of energy used during life cycle of a building is during use!!

- Cement CO$_2$ Emissions – 5% of total emissions (Buildings – 45%!!!)

- Limestone – CEMII

- Ground Granulated Blast furnace Slag

- Pulverised Fuel Ash

- Alternative Fuels
Embodied CO$_2$

**REMEMBER!!!!!!**

1 tonne concrete $\neq$ 1 tonne CO$_2$

Standard Concrete Blocks = 75kg CO$_2$ /tonne

Concrete Built is Better Built
Thermal Mass – A Benefit of Concrete

- Absorbs, stores and later radiates heat
- Reduces daytime temperatures in summer (store)
- Stores heat from winter and summer sun
- Delays and reduces temperature peaks
Thermal Mass During the Day

7.00 am to 10.00 am
The early morning is the hardest time for passive solar heating to maintain comfort. The thermal mass has usually given up most of its heat and the occupant must rely on supplementary heating. However, good airtightness and insulation help minimise this need.

10.00 am to 5.00 pm
Sunlight enters south-facing windows and strikes the thermal mass. This heats the air and thermal mass. On most sunny days, solar heat can help maintain comfort from mid-morning to late afternoon.

11.00 pm to 7.00 am
The occupant adjusts the heating so only minimal supplementary heating is needed. Good airtightness and insulation minimise heat loss.

5.00 pm to 11.00 pm
After sunset, a substantial amount of heat has been stored in the thermal mass. This is then slowly released, helping to maintain comfortable conditions in the evening.

Concrete Built is Better Built
Thermal Mass & Sustainable Housing


• CO₂ emissions are considered in the “Construct” Phase and the “In Use” phase

• Due to lighter weight, timber has a marginal advantage in the “Construct” phase (4% - 15%)

• After 11 years of the “In use” phase heavyweight concrete and timber frame have identical CO₂ footprints

Concrete Built is Better Built
**Building Regulations 2007/08**

- Effective July 1\textsuperscript{st} 2008
- Consumption of Primary Energy (\downarrow40%)
- CO\textsubscript{2} Emission Rate (\downarrow40%)
- Renewable Energy Requirement: 10Kwh/m\textsuperscript{2}
- Air Permeability: Max = 10m\textsuperscript{3}/hour/m\textsuperscript{2}
- Boiler Efficiency: (Min efficiency = 86%)

Concrete Built \textit{is} Better Built
First Irish A-Rated Home, Roscommon
Second Irish A-Rated Home, Cork
### 13 Steps to Achieving an A- Rated Home

<table>
<thead>
<tr>
<th>Energy-saving measure</th>
<th>Primary energy consumption, kWh/m²/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2005 building regulations compliant dwelling</strong></td>
<td>75</td>
</tr>
<tr>
<td>Change lamps from incandescent to CFLs</td>
<td>100</td>
</tr>
<tr>
<td>Improve ground floor and external wall insulation</td>
<td>125</td>
</tr>
<tr>
<td>Reduce thermal bridging in external fabric</td>
<td>150</td>
</tr>
<tr>
<td>Use condensing boiler instead of standard</td>
<td></td>
</tr>
<tr>
<td>Remove open fireplace, install wood pellet stove and balanced flue</td>
<td></td>
</tr>
<tr>
<td>Improve window and door U-values</td>
<td></td>
</tr>
<tr>
<td>Improve window orientation</td>
<td></td>
</tr>
<tr>
<td>Increase hot water cylinder insulation</td>
<td></td>
</tr>
<tr>
<td>Insulate primary circuit pipework</td>
<td></td>
</tr>
<tr>
<td>Install solar water heating</td>
<td></td>
</tr>
<tr>
<td>Build draught lobby</td>
<td></td>
</tr>
<tr>
<td>Improve air tightness and do pressurisation test</td>
<td></td>
</tr>
<tr>
<td>Install heat recovery ventilation</td>
<td></td>
</tr>
</tbody>
</table>

**Building Energy Rating**

- A3
- B1
- B2
- B3
- C1
Where to Insulate

Reducing Heat Loss

- Insulate Attic at joist level
- Insulate Walls
- Insulate Floors

WALLS ~ Max U Value 0.27
FLOORS ~ Max U Value 0.25
ROOFS ~ Max U Value 0.20
U - VALUES

• Building Regs 2005/7:
  – Walls: 0.27 W/m²K
  – Roofs: 0.16-0.20 W/m²K
  – Ground Floors: 0.25 W/m²K

• Suggested A – Rating:
  – Walls: 0.20 W/m²K
  – Roofs: 0.16 W/m²K
  – Ground Floors: 0.20W/m²K

IMPROVES ENERGY EFFICIENCY BY 4-5%,
Windows & External Doors & Window Orientation

• Improve U-Values of windows & doors from 2.2 W/m²K to 1.5 W/m²K by using triple glazed argon filled windows

• Improve window orientation to maximise benefits from solar gain

• Significant improvement in energy efficiency
**Thermal Bridging**  
*(Acceptable Construction Details - ACDs)*

**Using the ACDs:**

- Introduction (Key Design Aspects)
- 7 Sets of Details, 6 Construction Types
  - General Details
  - Group 1 Cavity Wall – Insulation in Cavity
  - Group 2 Masonry – External Insulation
  - Group 3 Cavity Wall – Internal Insulation
  - Groups 4, 5 Timber and Steel Frame
  - Group 6 Cavity Block – Internal Insulation
Use of ACDs in DEAP

- Details not obligatory
- Achieving target Psi values is not obligatory
- Previously standard default “y” value of 0.11 for use in DEAP calculations – no longer an option
- Full set of ACDs available and used: Default value of y=0.08 may be inputted into DEAP
- Also easy option of longhand calculation of real “y” value for use in DEAP calculations
Important Design Details

- Think out all elements at design stage to avoid problems later
- Avoid mixing construction types
- Careful design of junctions
- Examine construction sequence: e.g. installation of eaves insulation
- Favour simplicity of form
- Ensure continuity of insulation
- Ensure continuity of air barrier line
- Carry out testing at earliest possible time to minimise possible remedial works
## Reduced CO₂ Emissions

<table>
<thead>
<tr>
<th>House Area</th>
<th>BER Rating</th>
<th>Heating</th>
<th>CO₂ Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 m²</td>
<td>A3</td>
<td>Gas</td>
<td>1.4 tonnes / yr</td>
</tr>
<tr>
<td>100 m²</td>
<td>B1</td>
<td>Gas</td>
<td>1.9 tonnes / yr</td>
</tr>
<tr>
<td>100 m²</td>
<td>C1</td>
<td>Gas</td>
<td>3.2 tonnes / yr</td>
</tr>
</tbody>
</table>

- **Average House in Ireland emits** 8 tonnes CO₂ / yr
- **Driving from Drogheda to Dublin and return in standard car:** 6 tonnes CO₂ / yr
The Future

• Possible Review of ACDs in 2009 (y< 0.08 for 2010 Regulations)
• Group 7 - Part cavity fill with internal insulation ??
• Education of Specifiers and Builders
• Practical Difficulties - possible changes to normal practices
• Product innovation may be required
• Zero Carbon now set for 2013!! - U and Y values?
• Concrete industry (masonry, in-situ and precast) has responded to the challenge
Zero Carbon Emissions House

- November 2007, ICF Commitment to Minister Gormley, T.D

- Up to 50 definitions of Zero Carbon throughout Europe

- ICF working to generally held definition:
  “Zero Carbon Footprint from Space Heating, Water Heating, Lighting, Ventilation and any Motive Power required to achieve these”
Zero Carbon Emissions House

- Energy performance of the building fabric maximised through orientation, design and specification.

- Low energy requirement for the above is partially met from an appropriate and efficient suite of “Renewables”

- Zero Energy is purely a matter of extra loading of renewables
Zero Carbon Emissions House

• Demonstration of the modernity of Concrete products

• Use of products and techniques of long standing: e.g. concrete raft foundation; 100mm solid blocks on the flat (215mm); 100mm wide slab with 100mm structural screed.

• External insulation allows the Thermal Mass aspect of concrete to be maximised

• Raft on a bed of non-compressible high strength insulation to minimise heat loss through the floor etc.

• Enthusiastic partners
Thank You

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