

**New Construction  
Technology**

**CPWD  
APPROVED**



**RELIABLE**  
BUILDING SOLUTIONS

**INSULATED CONCRETE FORMWORK**



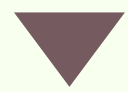


**BUILDING**  
*excellence*

**Faster Safer Greener Stronger**

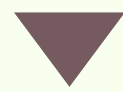
# ADOPTION OF NEW & EMERGING TECHNOLOGIES IN FUTURE CONSTRUCTIONS, VIDE CPWD'S CIRCULAR

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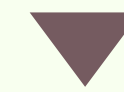


## RELIABLE ICF

Our Insulated Concrete Formwork (ICF) technology is approved by Min. of Housing & Urban Affairs, Government of India. Specifications for the same will be included in the DSR that is currently under process.



Design and construction with RELIABLE ICF, for mass housing or any Government project can be adopted across the country in future.



While all future government constructions are to use any one of the new technologies listed by CPWD, RELIABLE ICF is the only one that has the added benefit of being fully insulated (100% insulation on walls and roof).

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## F. STAY IN PLACE FORMWORK SYSTEM (7)

11	Expanded steel panel reinforced with all galvanized steel wire-Struts serving both as the load-bearing steel structures and as the stay-in-place steel formwork filled with EPS-alleviated concrete
12	Structural Stay in Place Galvanized Steel formwork system for walling with the same bottom single layer formwork for slabs/in-situ slab
13	Factory Produced PVC stay in place formwork with in-situ concrete & reinforcement in walling units and cast in situ RCC Slab
14	Fully Load bearing wall with 150 mm monolithic concrete core sandwiched inside two layers of EPS as walling. The form are open ended hollow polystyrene interlocking blocks which fits together to form shuttering system
15	Stay in place light weight polymer formwork with cast in situ reinforced concrete & in-situ reinforced concrete & in-situ flooring slab
16	Fast Bloc, insulated Concrete Form (ICF), acting as formwork for concrete and rebar, Column/post and beam construction, creating and strong skeleton in the walls
17	Formwork system "Plaswall" with Two fibre cement boards (FCB) & HIMI (High Impact Molded Inserts) bonded between tow sheets of FCB and erected to produce a straight-to-finish wall with in-situ concrete

For the 17 nos. New & Emerging technologies approved herein, DSR, DAR & Specifications of respective items are under process and shall be issued in due course.

As per mandate of MoHUA at least one of the approved New and Emerging Technology (which now are 60 nos. including 43 approved earlier and additional 17 nos. as listed above) is to be adopted in future projects, irrespective of location and cost. Accordingly as decided earlier, in case it is not found feasible to implement this mandate/direction in a particular project, specific permission must be obtained from DG, CPWD on case to case basis with detailed justification.

This issues with the approval of DG, CPWD.

  
(Divakar Agrawal)

Superintending Engineer (TAS)

Copy to:

1. All the SDGs/ADGs/CE cum EDs/CEs/SE cum PDs/SEs/EE & SMs/EEs of CPWD & PWD (GNCTD) for information and necessary action please. (through <http://cpwd.gov.in>).

  
(Divakar Agrawal)

Superintending Engineer (TAS)

# Adoption of New & Emerging Technologies

Reference No.

17/SE(TAS)/BMTPC/2020/381-H

Date 23/09/20



# WHAT Is Reliable ICF?

A convenient construction system with light weight, hollow, "Self Extinguishing" grade EPS (expanded poly styrene) forms having inter-locking edges

A load bearing wall shuttering that is not removed after concrete pouring for an economic and environment friendly method of monolithic wall construction.

This permanent insulated form work is the shell for a super fast & energy saving building with concrete core



# Why Reliable ICF?



**Reliable ICF is a Convenient on site technology :**

Easily assembled, with minimal components, tools/tackles  
Uses minimal, semi-skilled manpower

stacking of light weight, interlocking, modular blocks saves time and leaves no waste



**Because it is :**

“A Convenient construction, Greener, Safer & Faster than the traditional systems”



**Wall shuttering with door - window openings created up to 3m roof height at a time**

Reinforced concrete inside the forms, cures adiabatically (at constant temperature and pressure), without any water even in cold climate (-25 deg C)





# Construction with Reliable ICF is Greener :

1

Resource conservation both during & after construction.

And a zero wastage formwork system

2

Adiabatic concrete curing, uses no water at site

Reduces 80% of HVAC energy

Lower carbon footprint = highly sustainable

3

Reduces HVAC capacities by 50-75%

“Green” or recycled concrete with higher fly ash content due to zero thermal stress in concrete





# CONSTRUCTION WITH RELIABLE ICF IS SAFER :

Monolithic, loadbearing concrete walls  
for **strong, disaster proof structure**

Withstands fire, earthquakes, floods & cyclones

Thermal protection keeps cracks free concrete inside

No heavy equipment for construction ensures zero  
accidents

Ideal for bunkers, explosion-proof structures

Remote locations, extreme weather conditions





# Construction with Reliable ICF is Faster:

**DAY 1&2**



Formwork  
assembly,  
propping  
&  
inspection

**DAY 3**



Concrete  
Pour

**DAY 4&5**



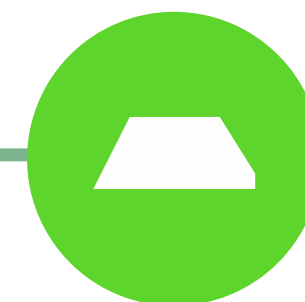
Roof  
shuttering,  
conduits

**DAY 6**



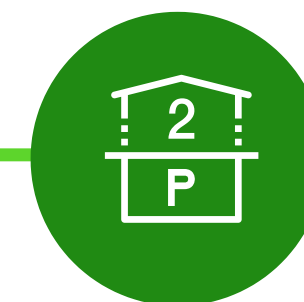
Roof  
Reinforce  
ment

**DAY 7**



RCC Roof  
slab cast

**DAY 8**



2nd floor  
can begin



# Indoor Comfort in ICF Buildings

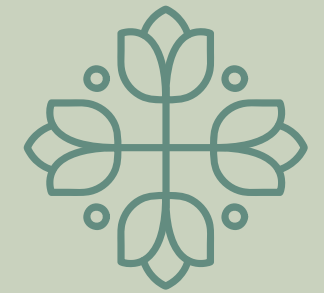
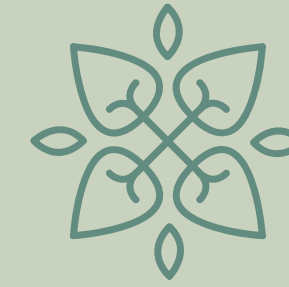
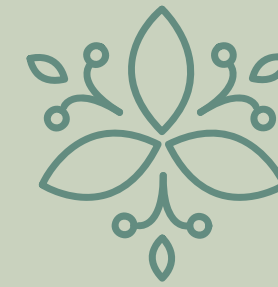
- Warm even in extreme winters and cool in hot summers
- **High thermal insulation**  
thermal resistance value R-19 (3.35 SI) against R-2 of traditional
- No bridging, **thermal stability**
- High thermal inertia of concrete core for 12 hours lag
- Excellent **air tightness** - of 0.5 ACH (Air change/ hr) as against 10 ACH of leaky buildings, make ICF buildings dust & draft free, dry and comfortable even without HVAC







# Acoustic Insulation



## QUIET INDOORS DUE TO -

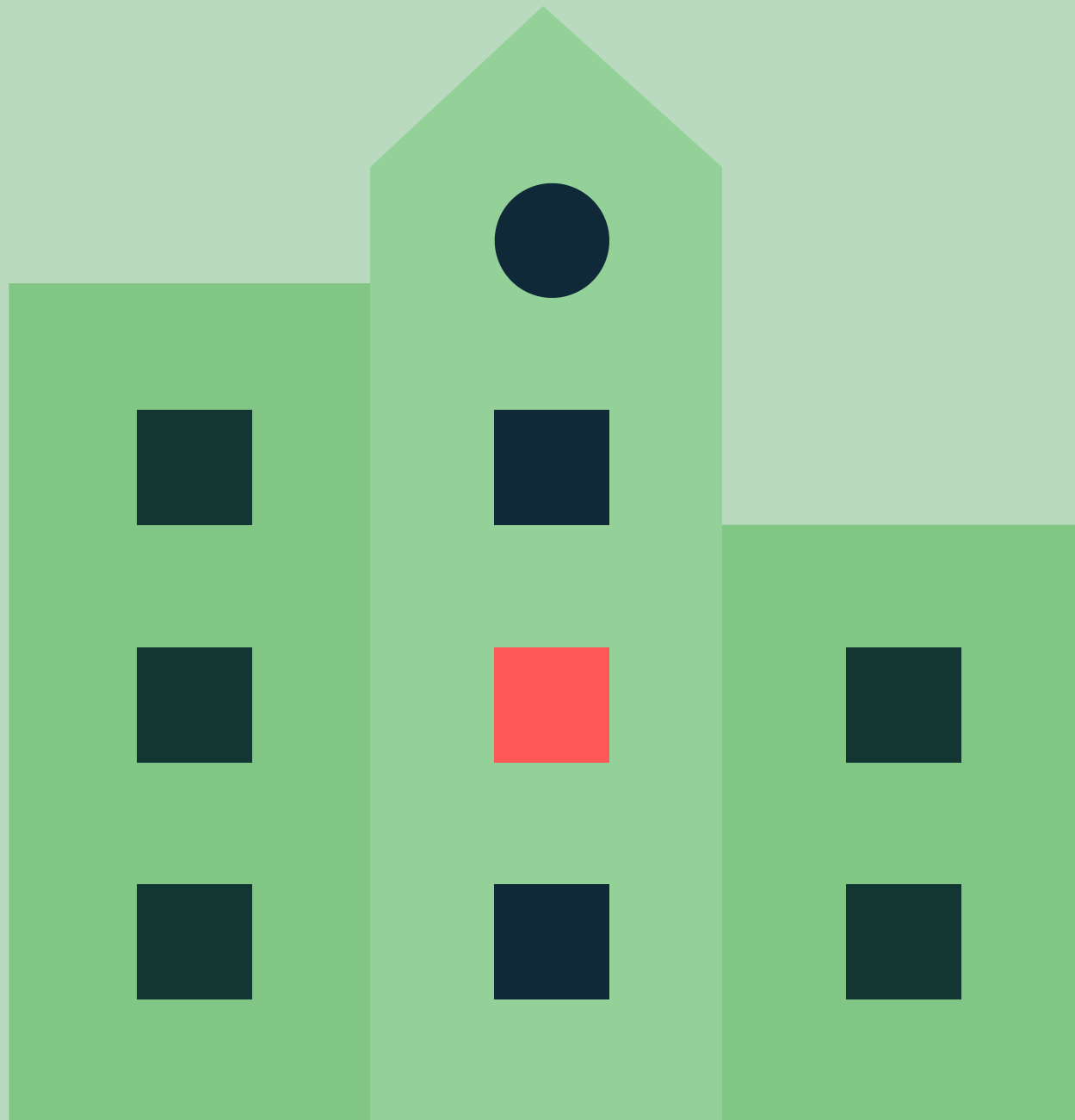
IMPACT SOUND  
DAMPENING OUTER  
SKIN & AIR TIGHTNESS

HIGH MASS  
CONCRETE CORE,  
DAMPENING AIR BORNE  
SOUNDS

KEEPS OUTSIDE NOISE  
OUT, UP TO 50DB,  
MUCH MORE THAN  
TRADITIONAL ONES

“MOST SUITABLE FOR  
SCHOOLS, HOSPITALS,  
HOTELS & HOMES IN  
BUSY AREAS

# HEALTHIER BUILDINGS



Air tight walls

No inward leakages of dust, pollen and other allergens

Thermal insulation layer prevents moisture condensation

No mould growth or damp, unhealthy interiors



# Sustainability Factor

Resource conservation  
in ICF buildings - less materials &  
manpower than framed structure

1

Strip  
Foundation

2

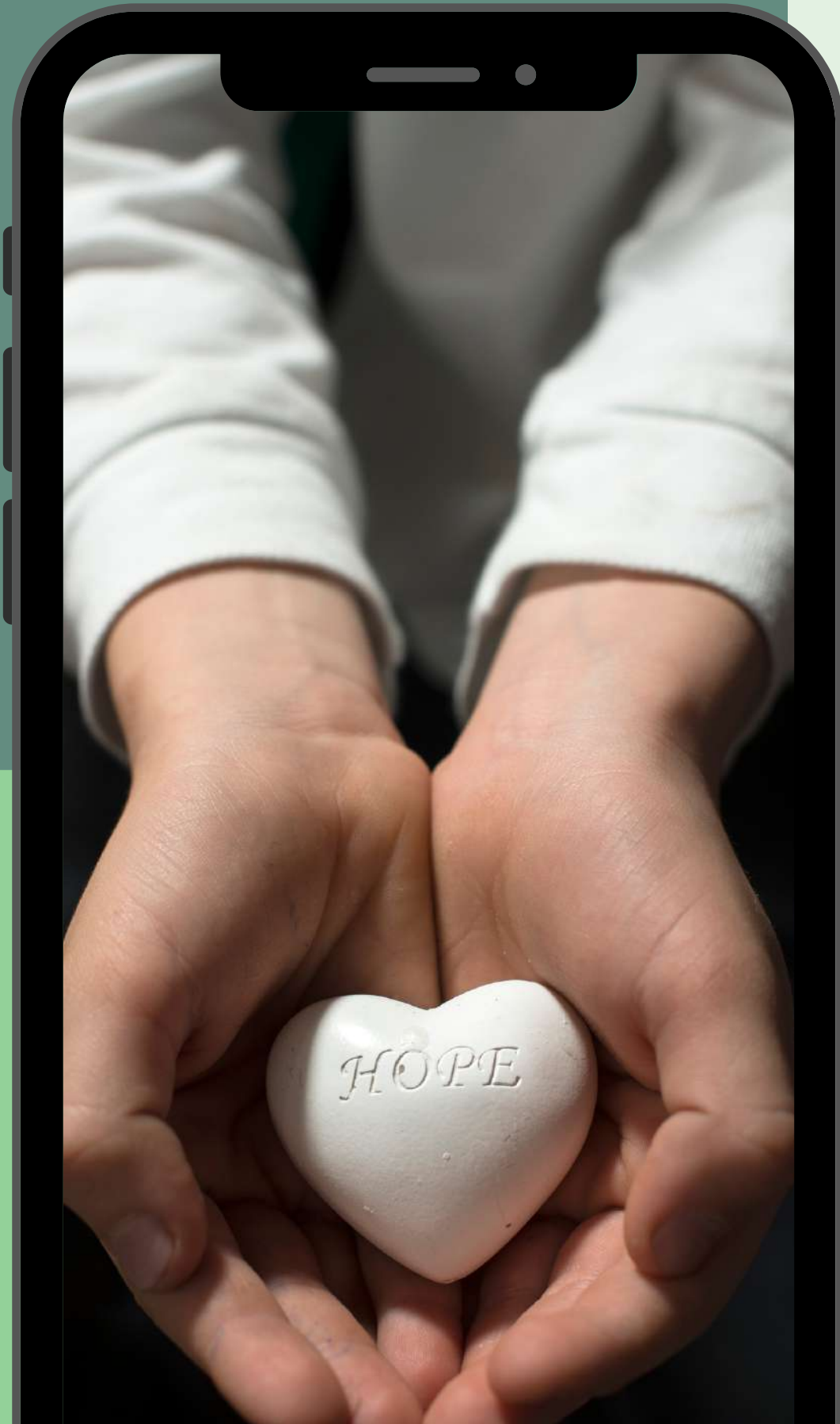
Concrete  
saving

3

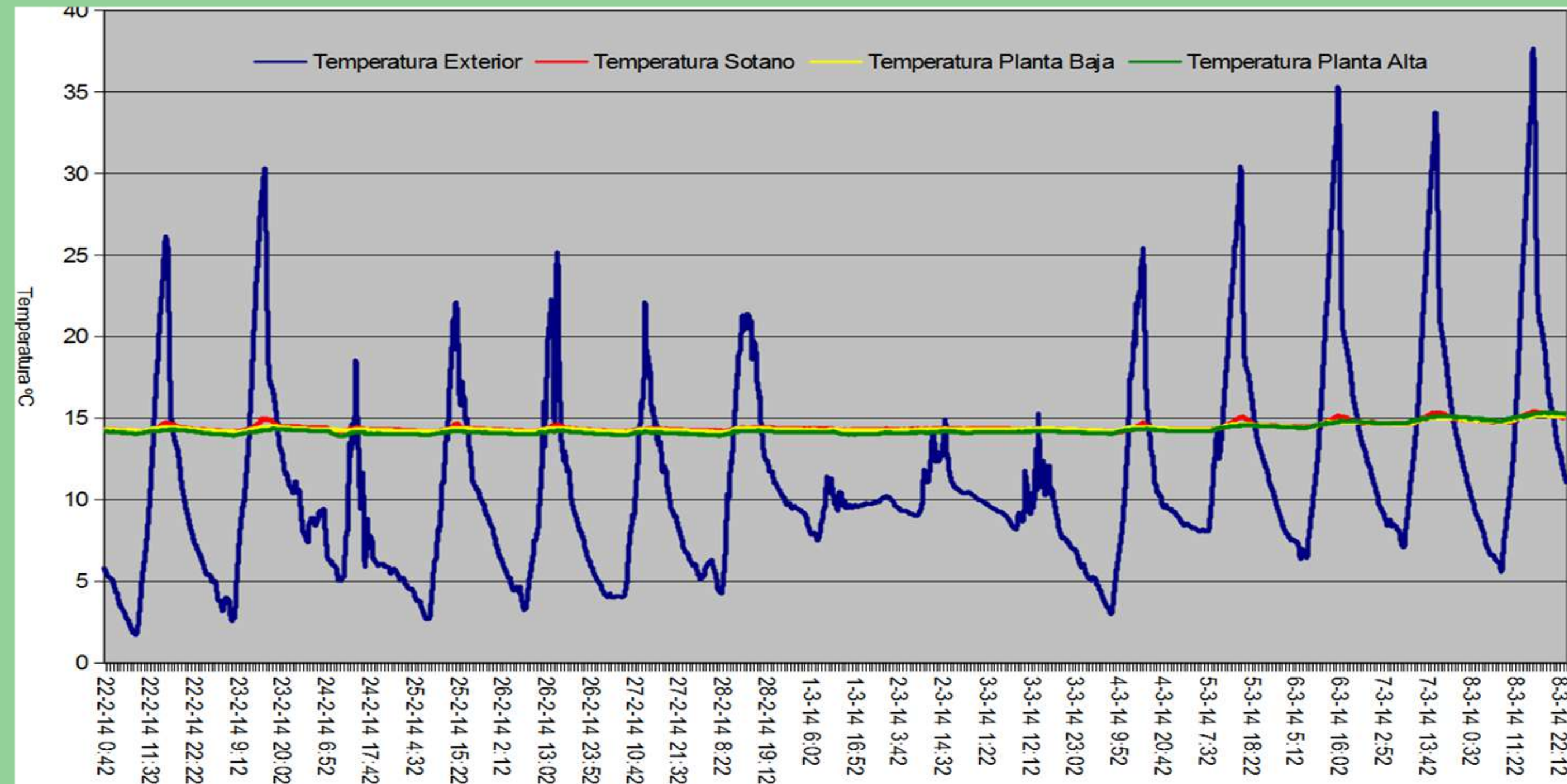
Lower  
Steel

4

Less  
Water



# RECORD OF TEMPERATURE INSIDE AN ICF HOUSE from 22nd February to 8th March 2014




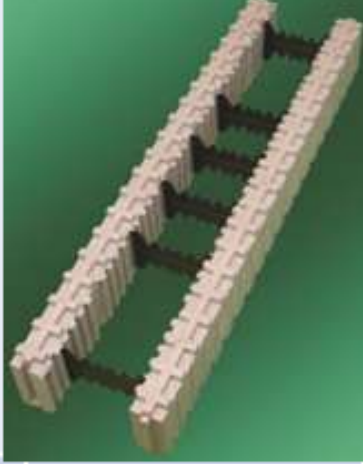
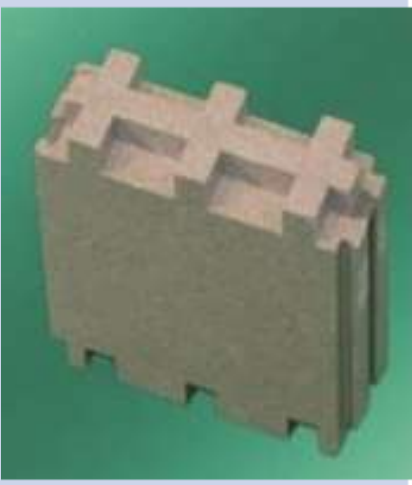
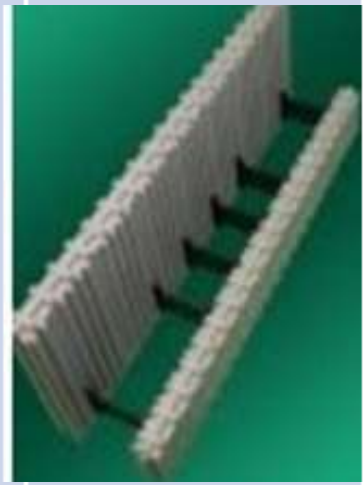


An ICF customer (in Granada, Spain), was so impressed with the results that he maintained temperature records over 15 days. There was no body staying in the house and neither was there any air conditioning or heating.

In this graph, while ambient temp fluctuates from 20 to 380 C, inside temp. is almost constant at 15 0 C.

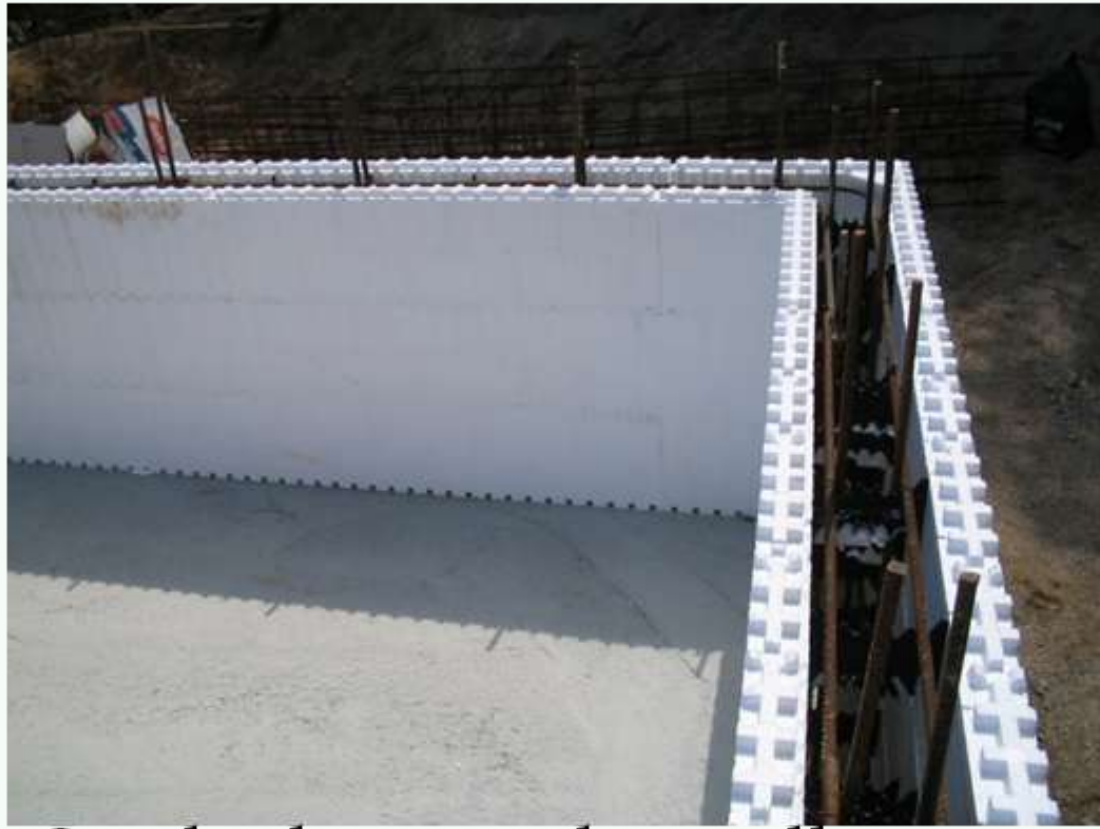


# Product Details - The Formwork

S. No	Block	Description	Size	S. No	Block	Description	Size
1.		<b>STANDARD BLOCKS</b> form bulk of the building and have 50mm of inter-locking EPS Panels on both sides held together by 8 plastic hard ties	1000mm x 250mm x 250mm	4.		<b>LINTEL BLOCKS</b> along with Half height blocks form the top layer of all window / door openings. These blocks contain the lintel concrete in a thermal bridge free manner	1000mm x 250mm x 125mm
2.		<b>CORNER BLOCKS</b> form the 90° corners of a wall. Two L-shaped 50 mm thick interlocking EPS panels are held together by 8 plastic hard ties	750/500 mm x 250mm x 250mm	5.		<b>HALF HEIGHT BLOCKS</b> along with Lintel blocks form the top layer of all window/door openings. These blocks hang the steel beams for lintel	1000mm x 250mm x 125mm
3.		<b>END PIECES</b> form the wall endings by snugly fitting in inside all the other blocks, thus providing a smooth and thermal bridge free wall closures	150 mm x 125mm x 50mm	6.		<b>FLOOR EDGE BLOCKS</b> form the top most layer of all walls, where the wall ends and new floor begins. These contain the floor slab preventing thermal bridging	1000mm x 250mm x 375 / 125mm



# Product Details - Walls



Steel rebars in the wall



Arch created in a wall



View of lintel beam



Window openings (3m+) and gable creation



Double height wall 5.25 m



# Product Details - Foundation



Sewage lines with traps



Sewage Pipeline Network

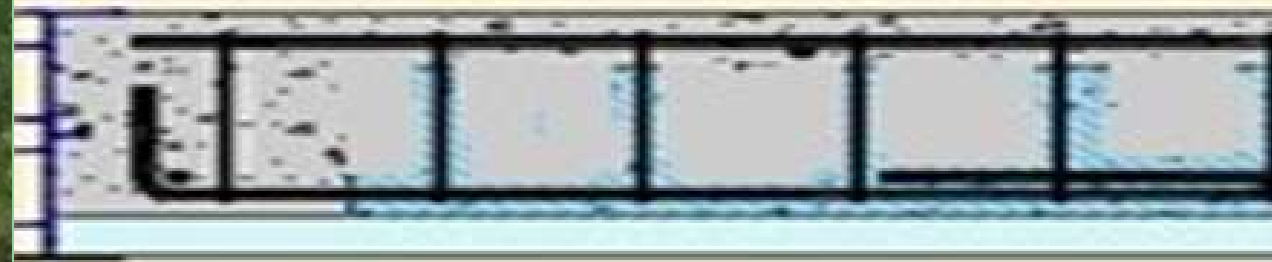


Strip Foundation / Plinth beam with starting steel



Raft Foundation for basement with double layer steel





Speed Floor to avoid waiting for shuttering support removal during Concrete strengthening period of 14-28 days



## PRODUCT DETAILS – ROOF

Conventional Roof Shuttering with wall steel Jointing done as in schematic on top right corner.

The Extended portion of floor edge block to contain the roof slab and avoid thermal bridging



# PRODUCT DETAILS- SCAFFOLDING

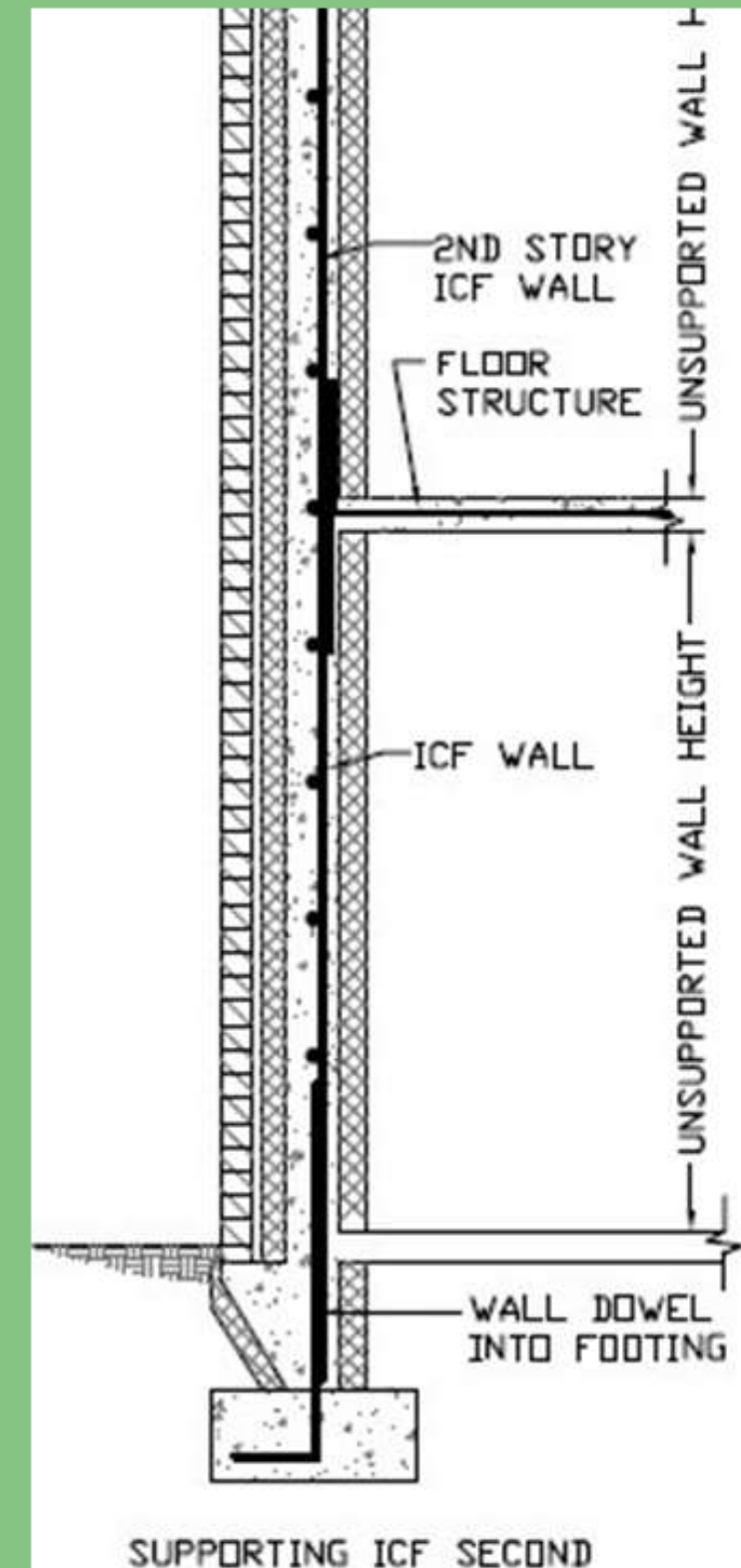
- Scaffolding called Trestles
- Made of square steel tubes.
- Supported by screws fixed to the floor both for diagonal & straight
- Straight portion is screwed onto the hard ties in the formwork
- Supports Formwork during concrete pour
- Diagonal turnbuckle used to straighten the formwork
- Cantilever portion takes in the chali or wooden planks to act as walkway

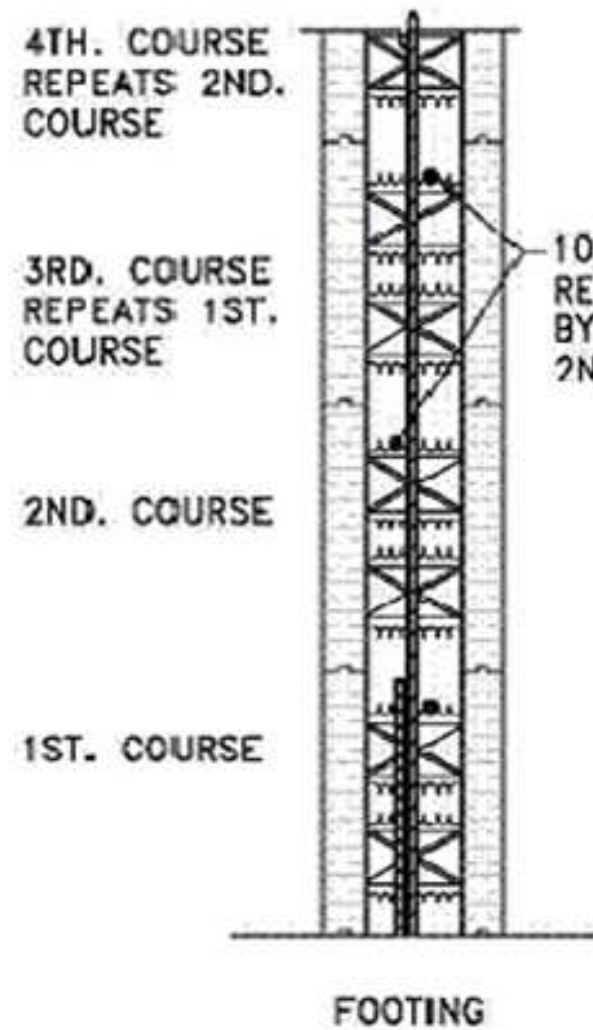




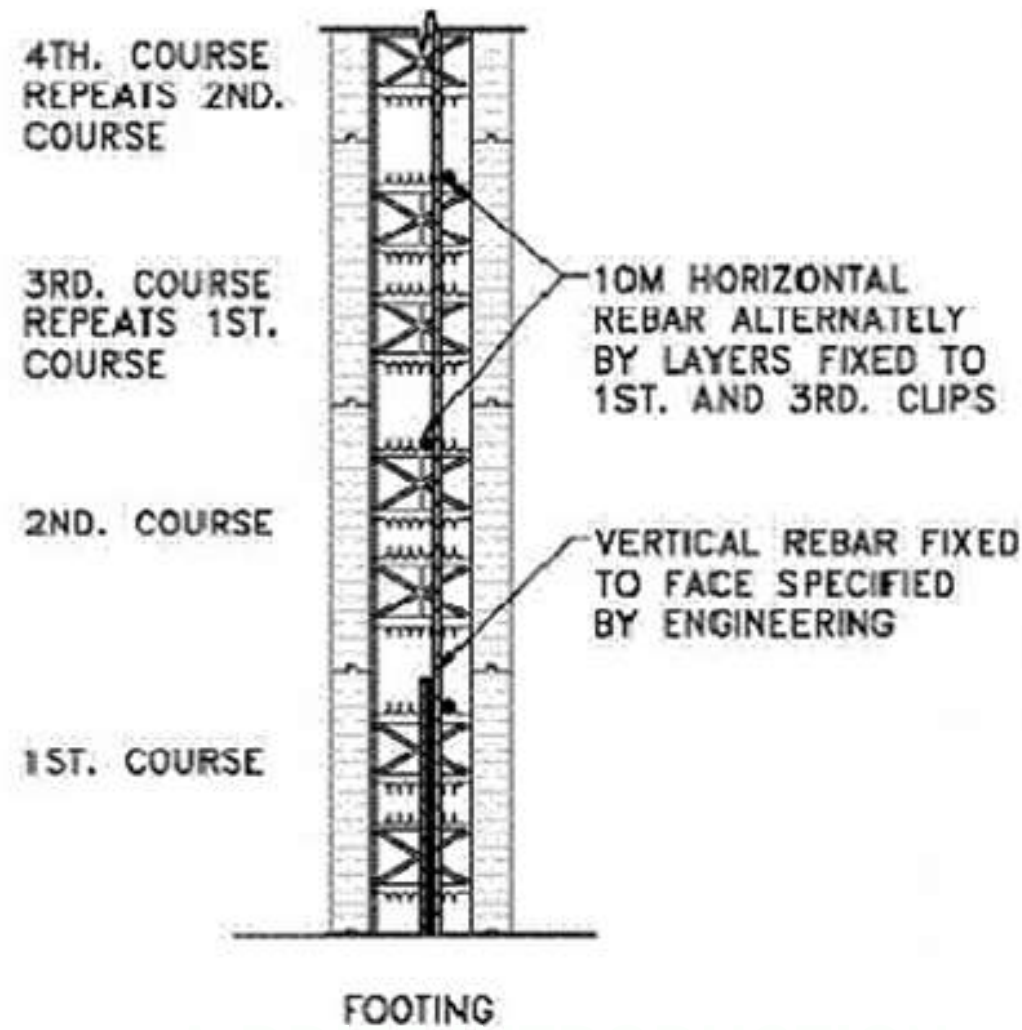
# Product Details - Reinforcement Steel Placement

- Steel design for a load bearing, 150mm concrete wall -.
- Horizontal bars are clipped onto the hard ties in each or alternate layers
- Vertical bars are placed from the top of the completed formwork.
- Vertical bars are placed adjoining the steel dowels jutting out of the foundation.
- Vertical bars are confined between the staggered horizontal bars and the hard ties.
- This meets the criteria for non contact Splices as per AC318 at 25.5.13

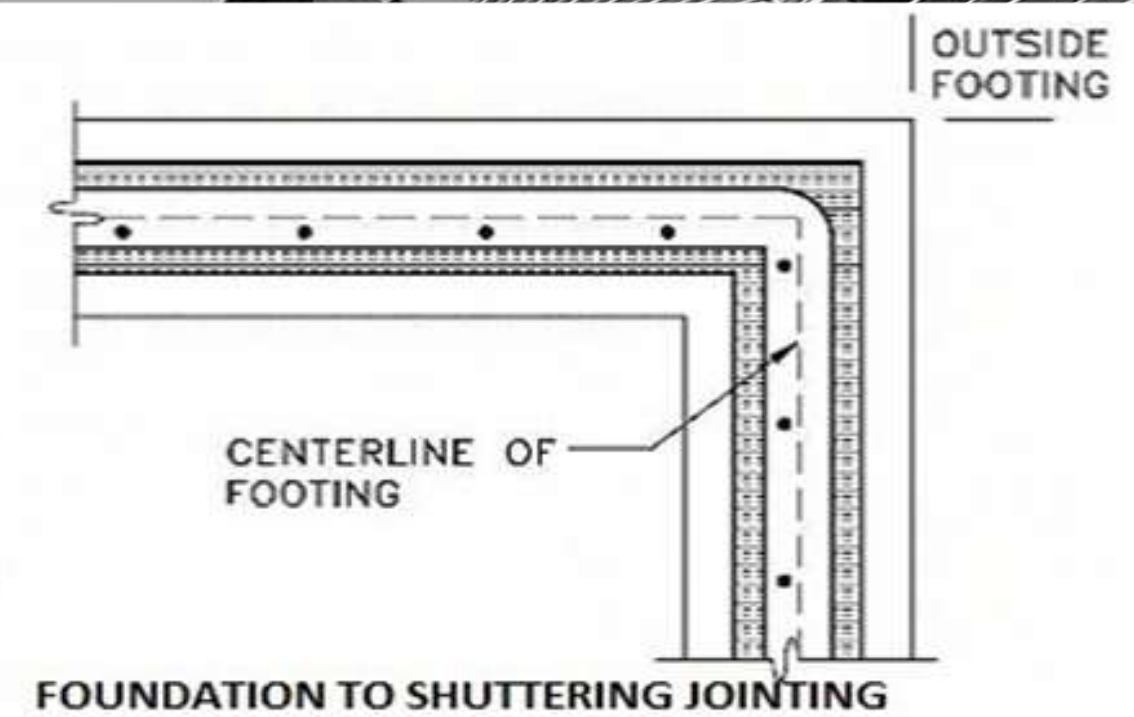




REBAR FIXED TO WALL CENTERLINE



REBAR FIXED TO SPECIFIED FACE



Horizontal & vertical rebar overlapped 450 mm (18") for 10M bar and 650 mm (26") for 15M bars

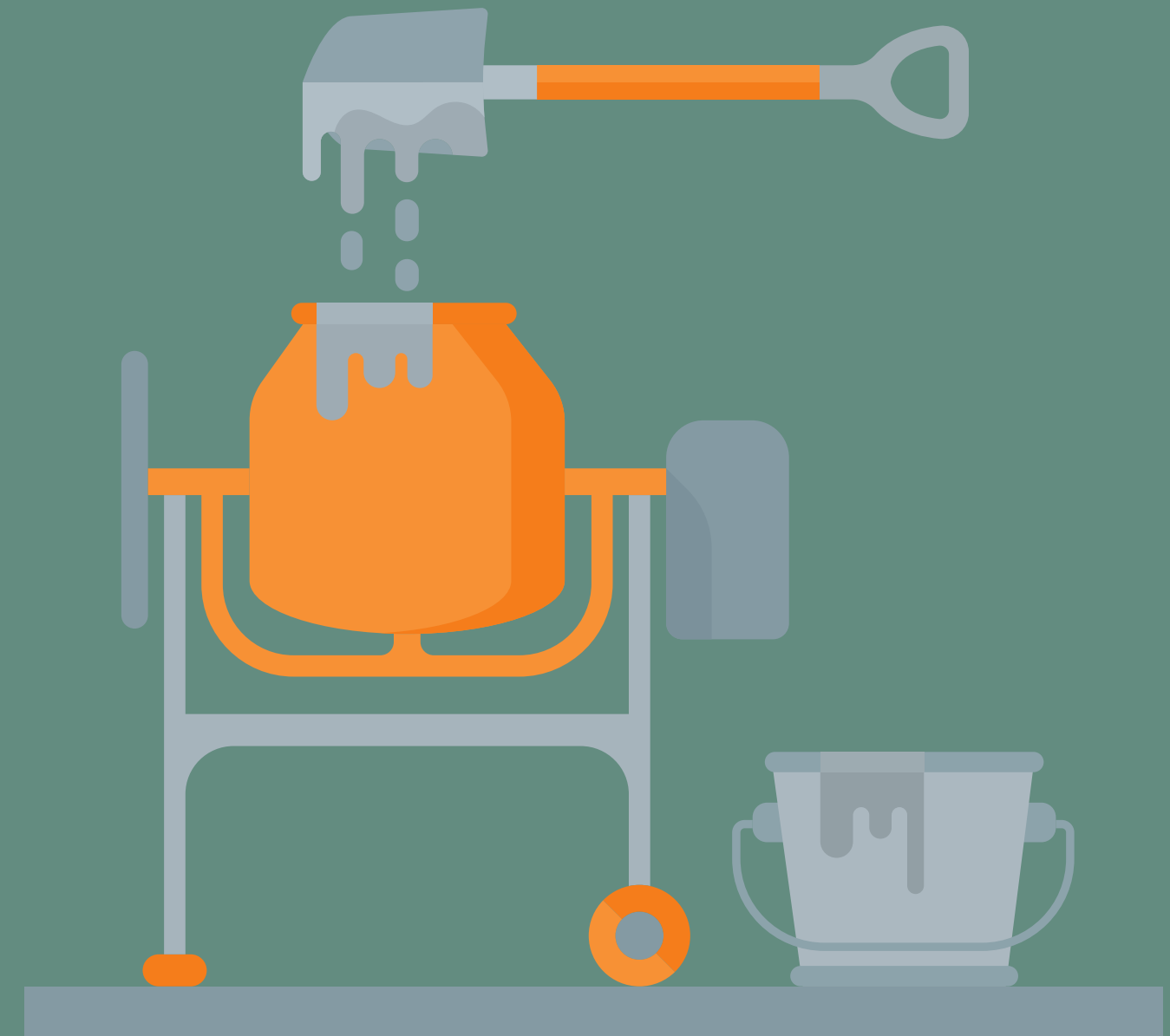
## Product Details - Reinforcement Steel Placement

AC318 at 25.5.13 states: "For noncontact splices in flexural members, the transverse center-to-center spacing of spliced bars shall not exceed the lesser of one-fifth the required lap splice length and 6 in"



# Product Details - Concrete

- Concrete should be as per Structural Engineer's design requirements
- High slump concrete (Slump -150) with aggregate size of 10mm (at least 70%) and none more than 20mm.
- In most constructions M-20 concrete suffices
- As the thermal stresses within the concrete is near zero with minimal chances of cracks, green concrete with high levels of fly ash and other recycled content (recycled aggregates) can be used.
- “Green” concrete can be used, reducing the embodied energy of construction substantially.



# Product Details - Concrete

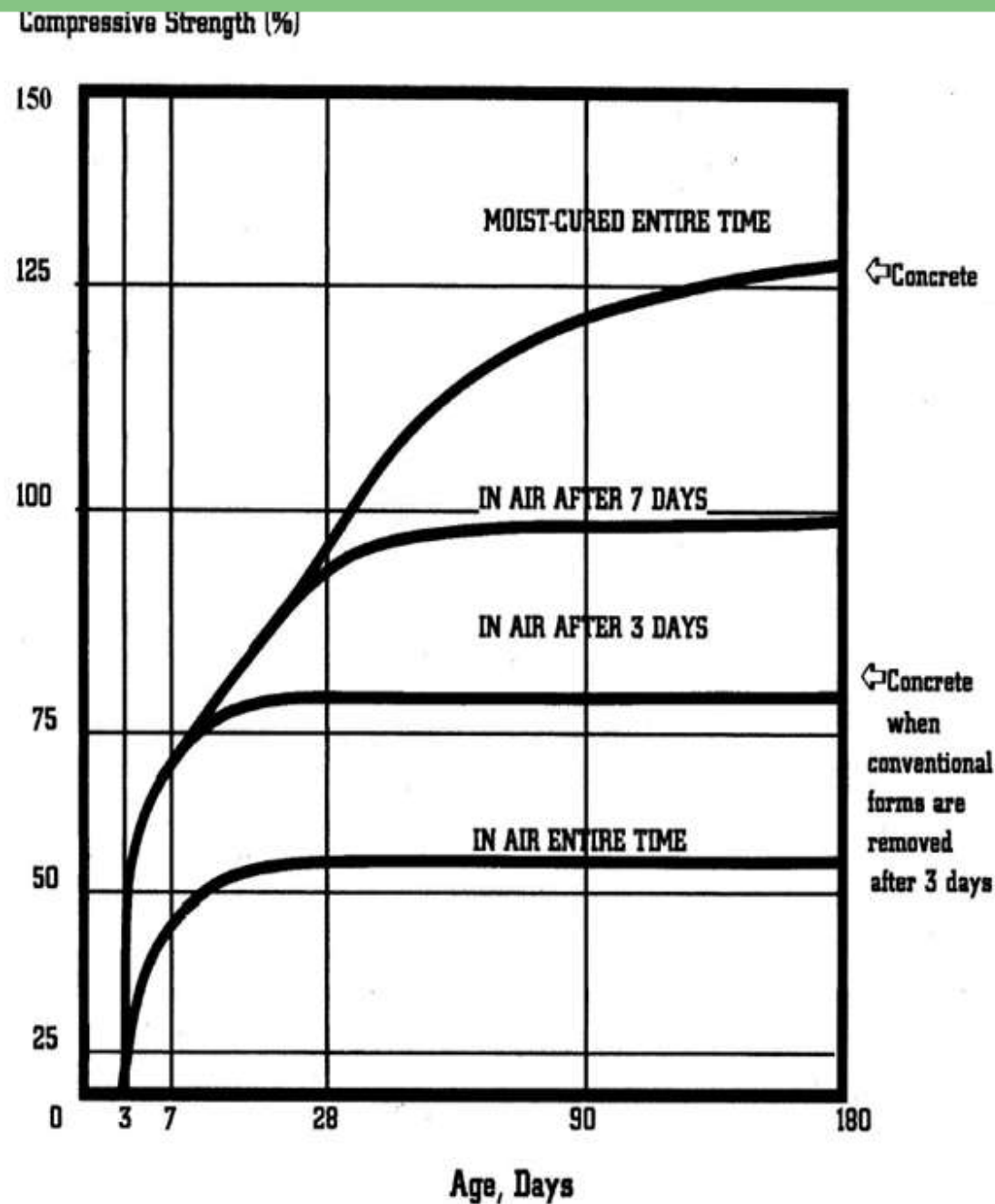


Figure 1-4 Hydration at work (Courtesy of Portland Cement Association, USA)

- Water in concrete is retained within formwork
- Heat of hydration generated in concrete is retained within the insulated formwork
- This heat cures the concrete “Adiabatically” i.e. at constant temperature & Pressure
- Such slow & moist cured concrete has >125% of strength as per PCA study



# THINK BOX

## DISASTER PROOF

FOR DISASTER RESISTANCE, DO NOT THINK OF HOUSES IN TERMS OF

- FLOORS
- WALLS
- ROOFS

THINK OF WALLS, FLOORS AND ROOFS IN TERMS OF INTEGRAL PARTS OF A BOX

- ALL SUCH ELEMENTS MUST BE SECURELY CONNECTED IN SUCH A WAY AS TO EMULATE MONOLITHIC REINFORCED CONCRETE



# **Adoption of RELIABLE ICF in YOUR future projects**

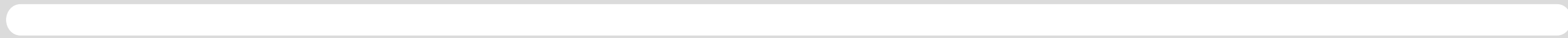
**As we seek your active support in our future ventures,**

**We welcome your collaboration to promote RELIABLE ICF, as ideally  
suited for Green Building constructions across all states in India**

**And**

**Look forward to your valuable design and specifications inputs for  
giving shape to sustainable constructions**





Thank  
you!