



NBCMSO

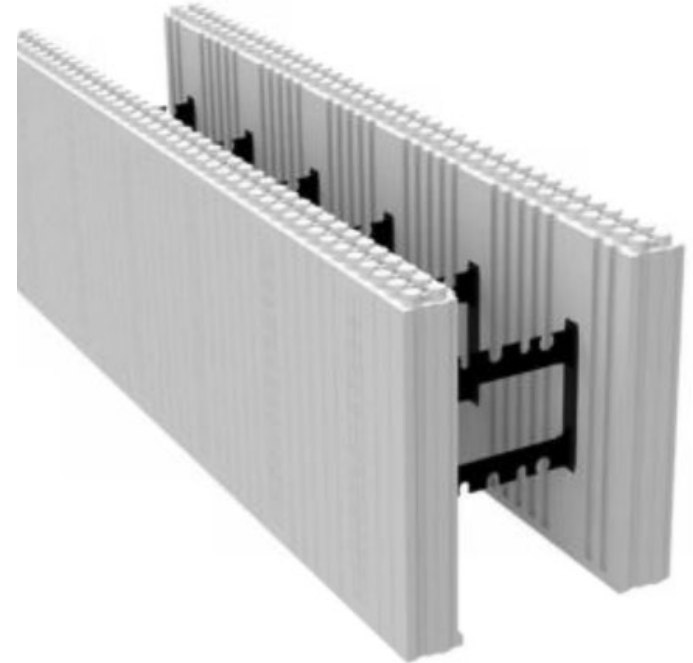
Insulated Concrete Formwork-ICF Fire Officers Perspective

- ▶ PRESENTER: NOEL CRONIN & MICHAEL FLYNN
- ▶ 31 | JANUARY | 2024

Disclaimer

Kerry County Council make every effort to ensure the accuracy and comprehensiveness of the information supplied within this presentation. This presentation is the experience KCC are finding on construction site walks in 2022/2023.

You are reminded to check with the supplier/producer of the ICF or PV Array system/product for specific details.



▶ AGENDA

1) What is ICF – Modern Method of Construction - MCC

- ICF within Ireland
- What is EPS – Block Material
 - Fire Characteristics
 - Irish Fire Safety Regulations

2) Agreement Certificate - ICF

- Details to be considered
- Construction challenges with ICF

3) Summary

What is ICF - Modern Method of Construction

Insulating Concrete Formwork (ICF) originated in Germany in the 1930 - 1950s.

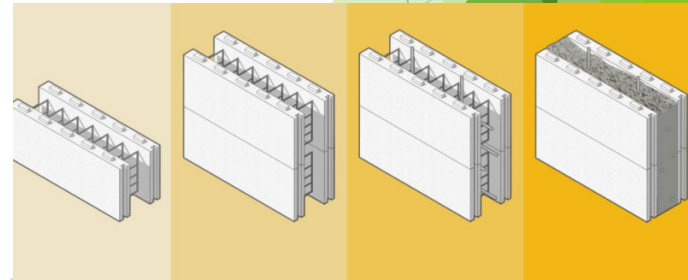
Specialist foam/Insulated blocks pieced together, much like LEGO, to form the shape of the building and reinforced with rebar.

These blocks (EPS) serve as a mould for concrete to be poured into.

External Render – Mainly Acrylic which is NSAI approved system.

Many Benefit's:

- Installation speed – blocks can be assembled extremely quickly
- Energy efficiency and air tightness – NZEB Standard
- Soundproofing
- Ease of use – Ease install services
- Structural integrity



ICF within Ireland

Numerous – ICF System / Manufacturers – NSAI Certified – Agreement Cert



NSAI
Agrément

IRISH AGREEMENT BOARD
CERTIFICATE NO. 07/0277

Amvic Ireland
Unit 15, Roscommon Business Park,
Roscommon, D11 Y882,
Ireland
Tel: +353 1 8991200
Fax: +353 1 8991201
Web: www.amvic.com

Insulating Concrete Formwork System

NSAI Agreement Certificate is designated by Government to issue European Technical Approvals.
NSAI Agreement Certificates establish proof that the certified products are "proper materials" suitable for their intended use under Irish site conditions, and in accordance with the Building Regulations 1997 to 2019.



PRODUCT DESCRIPTION:
This Certificate relates to the Amvic Insulating Concrete Formwork (ICF) System, which consists of modular interlocking expanded polystyrene (EPS) building blocks (groutable enhanced) for permanent formwork for the construction of in-situ concrete walls. Each block (form) is based on two EPS panels with polypropylene connectors connected into the polystyrene panels and spaced 150/200mm vertically. An external render system and 50° lean sections. An external render system approved by NSAI Agreement is applied to the exterior finish. Stakeboard slabs are screwed to the polystyrene connectors as an internal finish.

USE:
The Amvic ICF System is certified for use in the construction of buildings of up to five storeys (1.5m) in height to the top storey in TGO to Part 8 Volume 2 of the Building Regulations 1997 to 2019, and for use to six storeys (1.5m) in height to the top storey in purpose groups 1(C), 2(A), 2(B), 3, 4(A) and 5 as defined in TGO to Part 8 of the Building Regulations 1997 to 2019. The system has been assessed for use as load bearing and non-load bearing walls in the construction of specifically designed buildings. Fire and sound rated walls may also be constructed using the system.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by Amvic Ireland.



NSAI
Agrément

IRISH AGREEMENT BOARD
CERTIFICATE NO. 08/0310

Thermowall Ltd, Co. Wick,
Thermowall Way, CO. Wick,
Tel: 045 803707
Fax: 045 863706
Email: info@thermowall.com
Web: www.thermowall.com

ICF System

Système pour construction
BauSYSTEM

The Irish Agreement Board is designated by Government to issue European Technical Approvals.
Irish Agreement Board Certificates establish proof that the certified products are "proper materials" suitable for their intended use under Irish site conditions, and in accordance with the Building Regulations 1997 to 2019.
The Irish Agreement Board operates in association with the National Standards Authority of Ireland (NSAI) as the National Member of UEAC.



PRODUCT DESCRIPTION:
This Certificate relates to the Thermowall ICF (Insulating Concrete Formwork) System, which consists of modular interlocking expanded polystyrene (EPS) building blocks (groutable white and grey) for permanent formwork for the construction of in-situ concrete walls for use with ICF systems approved by NSAI Agreement. An external render system approved by NSAI Agreement is applied to the exterior finish. Stakeboard slabs are screwed to the polystyrene connectors as an internal finish. Alternative finishes may be used in accordance with the Thermowall ICF installation manual. Stakeboard is used directly.

USE:
The Thermowall ICF System is certified for use in the construction of buildings up to six storeys in height. The system has been assessed for use as load bearing and non-load bearing walls in the construction of specifically designed buildings. Fire and sound rated walls may also be constructed using the system.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by Thermowall Ltd.



NSAI
Agrément

IRISH AGREEMENT BOARD
CERTIFICATE NO. 20/0415

Thermowall Ltd, Co. Wick,
Thermowall Way, CO. Wick,
Tel: 045 803707
Fax: 045 863706
Email: info@thermowall.com
Web: www.thermowall.com

Insulating Concrete Formwork System

Système pour construction
BauSYSTEM

NSAI Agreement Certificate is designated by Government to issue European Technical Approvals.
NSAI Agreement Certificates establish proof that the certified products are "proper materials" suitable for their intended use under Irish site conditions, and in accordance with the Building Regulations 1997 to 2019.



PRODUCT DESCRIPTION:
This Certificate relates to the Thermowall Insulating Concrete Formwork (ICF) System, which consists of modular interlocking expanded polystyrene (EPS) building blocks (groutable enhanced) for permanent formwork for the construction of in-situ concrete walls. Each block (form) is based on two EPS panels with polypropylene connectors connected into the polystyrene panels and spaced 150/200mm vertically. An external render system and 50° lean sections. An external render system approved by NSAI Agreement is applied to the exterior finish. Stakeboard slabs are screwed to the polystyrene connectors as an internal finish. Alternative finishes may be used in accordance with the Thermowall ICF installation manual. Stakeboard is used directly.

USE:
The Thermowall ICF System is certified for use in the construction of buildings of up to six storeys (1.5m) in height to the top storey in TGO to Part 8 Volume 2 of the Building Regulations 1997 to 2019, and for use up to six storeys (1.5m) in height in purpose groups 1(C), 2(A), 2(B), 3, 4(A) and 5 as defined in TGO to Part 8 of the Building Regulations 1997 to 2019. The system has been assessed for use as load bearing and non-load bearing walls in the construction of specifically designed buildings. Fire and sound rated walls may also be constructed using the system.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by Thermowall Ltd.
(NSAI is a signed Business Case member)

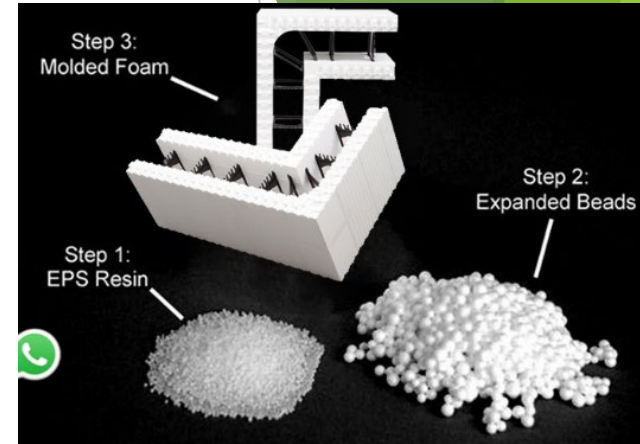
Where ICF is Used

- Housing estates
- One off houses
- Guest houses
- Terraced houses in towns and cities.
- Schools
- Multi Unit Apartment Blocks – Up to 18 metres – 6 Storeys.



WHAT IS EPS- Expanded Polystyrene

- European Manufactures of EPS - EUMEPS for information.
- ICF use EPS as the material to form the Block Structure.
- Polystyrene is a synthetic aromatic hydrocarbon polymer.
- Solid beads/resin of polystyrene is heated via Steam.
- Expands to > 40 times its original size. **EPS is 98% air to be exact.**
- Expanded Polystyrene (EPS) lightweight, rigid, plastic foam insulation material.



EPS - Fire Characteristics - From EUMEPS

Reaction to Fire = Euro Class E or Class 4 (Irish Building / National Class).

EPS is produced in 2 types: the standard quality & fire-retardant modified 'SE grade'.

EPS-SE grade contains a small quantity of a fire retardant agent (max. 0.5 %). This is the fire retardant hexabromocyclododecan (HBCD).

The foam shrinks rapidly away from the heat source, thus reducing the likelihood of ignition.

EPS temperatures above 100° C, it begins to soften, to contract and finally to melt.

Small flames will ignite EPS readily unless it contains flame retardant additives (SE Grade).

EPS - Fire Characteristics - From EUMEPS

The transfer ignition temperature is 360°C. In the case of EPS-SE, this is 370° C.

The calorific value of expanded polystyrene materials (40 MJ/kg) is about twice that of timber (18.6 MJ/kg)#.

Heat release from expanded polystyrene materials is about three times as rapid as from softwood timber.

“It is strongly recommended that expanded polystyrene should always be protected by a facing material, or by complete encapsulation.” – From EUMEPS – EPS Fire Behaviour.

Ireland - Fire Safety - Regulations

EPS - Reaction to Fire = Euro Class E or Class 4 (Irish Building / National Class).

TGD – B Vol 1 & 2 – Section A9 - Internal Linings;

“(TGD-B; Class 4 ratings are not acceptable under the provisions in this document)”

Euro-class EN 13501-1	England, Wales, Northern Ireland	<u>EXAMPLE</u>	Scotland
A1	Non-combustible	Concrete	Non-combustible
A2 (or better)	Limited Combustibility	rockwool	Non-combustible
B-s3, d2 (or better)	0	Gypsum boards	Low Risk (0)
C-s3, d2 (or better)	1	Phenolic foam	Medium Risk (1)
D-s3, d2 (or better)	3	Timber	High Risk (2 & 3)
E-s3, d2 (or better)	4	EPS	Very High Risk
F-s3, d2 (or better)	Not Classified	Not tested	Very High Risk

1) Agreement Certificate Scope/Text to be considered

“The system has been assessed for use as load bearing and non-load bearing walls in the construction of specifically designed buildings.”

Who has designed these buildings ? What is excluded from the Agreement Cert?

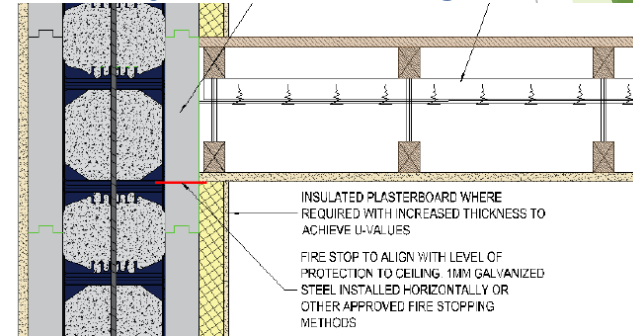
Disproportionate collapse – design check ?

“Structure: The required concrete strength will be specified by chartered structural engineer and will depend on building height and load take down.”

Important B.C.A. checks this. Ensure a structural engineer has checked this.

2) Agreement Certificate Text/detail to be considered

*“Timber Floor In two storey construction, first floors are assumed to be formed using timber floor joists fixed into the load bearing walls using the Simpson Strong Ties or a ledger board secured to the concrete using the xxxxx standard heavy load fixing detail. Interior **fire stops**, where required (see Section xxx), must be installed at the top of the 12.5mm gypsum plasterboard, immediately below ceiling level.”*



Item can be missed on site. The “fire stop” detail and metal provided by ICF manufacturers to site has **no mechanical fixings** consider EPS losing its rigidity. **Often this detail is not in Agreement Cert Fig Details.**

3) Agreement Certificate Detail/Text to be considered

External / internal Fire Barrier – At Compartment Lines.

External Finish

*Before this can proceed, the **fire barriers** must be fitted opposite all separating walls and floors*

***Fire barriers** are created by placing strips of galvanised steel 1mm thick (weight 2.68kg/m²) the full depth of the expanded polystyrene, installed as shown in Figure XX or as described in Section 3.3.4 of TGD to Part B*

The ICF “fire barrier” provided by the ICF Manufacturers is a straight 1mm steel strip. Pushed in between the EPS and not mechanically fixed. A Friction fit!

How will this perform in fire conditions or was it tested/certified in its friction fit position?.

3) Agreement Certificate Text/detail to be considered



(2) WALLS: EXTERNAL INSULATION ON SOLID MASONRY/HOLLOW BLOCK

Concrete Separating

TGD- B – 3.3.4 Fixing of Cavity Barrier

Cavity barriers should be tightly fitted to rigid construction and mechanically fixed in position wherever possible. ... or failure in a fire of their fixings; or

Proprietary and confidential – do not distribute

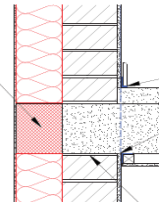
THERMAL PERFORMANCE CHECKLIST (TICK ALL)

Continue external wall insulation across floor abutment zone. (Use appropriate material where cavity barrier is required)

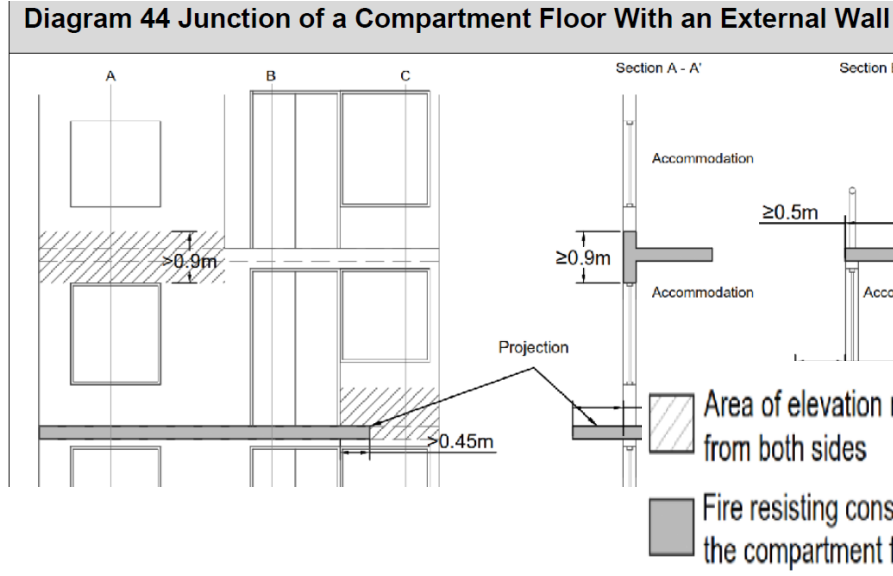


2021 Acceptable

Construction Detail (ACD)



3) Agreement Certificate Scope/detail to be considered



(2) WALLS: EXTERNAL INSULATION ON SOLID MASONRY/HOLLOW BLOCK

Masonry Separating Wall - Plan

THERMAL PERFORMANCE CHECKLIST (TICK ALL)

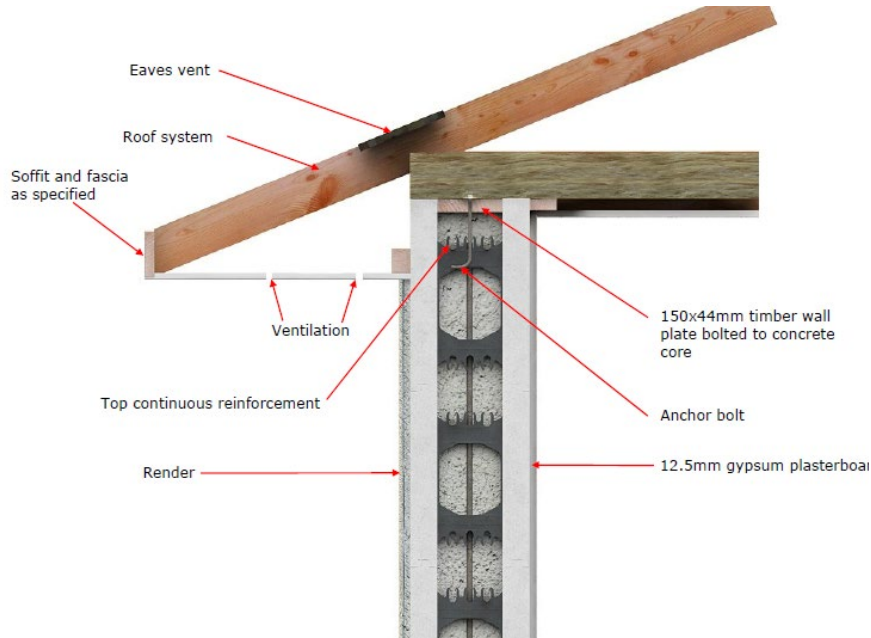
Continue external wall insulation across abutment zone. (Use appropriate material where cavity barrier is required)

2021 Acceptable Construction Detail (ACD)

How do you deal with a “stepped” elevation – Architectural detail with ICF.

New DRAFT TGD-B 2023 – shows 900mm fire resisting construction to external wall at compartment floor.

4) Agreement Certificate detail to be considered



(3) WALLS: INTERNAL INSULATION		Eaves - Insulation Between and Under Rafters Ventilated Rafter Void - Dormer
<p>THERMAL PERFORMANCE CHECKLIST (TICK ALL)</p>		<p>2021 Acceptable Construction Detail (ACD)</p>
<p>Ensure insulation is installed tightly between rafters and is in contact with under-rafter insulation</p>	<input type="checkbox"/>	
<p>Ensure gap between wall plate and proprietary eaves vent is completely filled with insulation having a minimum R-value per relevant detail in section 6</p>	<input type="checkbox"/>	
<p>Ensure full depth of insulation between and over joists abuts eaves insulation</p>	<input type="checkbox"/>	
<p>Ensure continuity of Insulation throughout junction</p>	<input type="checkbox"/>	
<p>Ensure wall insulation or cavity barrier, as appropriate, tightly abuts underside of ceiling joist</p>	<input type="checkbox"/>	

Compare ICF details to Acceptable Construction Details ACD's – Some differences.

5) Agreement Certificate detail to be considered

"Services

Electrical cables should be ducted (to avoid plasticizer migration). The cables must be placed in PVC conduit and must be sized to minimise heat build-up with resulting fire risk, in accordance with ETCI (Electro-Technical Council of Ireland) requirements documents I.S. 10101[12] and ET 207[13]."

Important to duct electrical cables -EPS is a class E product. Do socket boxes require an internal intumescent socket shield/fire putty ?

What about other services passing through the EPS ? Fuse Boards ??



6) Agreement Certificate Text/detail to be considered

Figure x; The xxx proprietary EPS “Cavity Closer” is made of EPS, a Euro Class E product.

TGD B requires a Cavity Barrier to have a fire resistance of EI 15 & E30.

If a uPVC window frame fails in a fire the fire/heat/smoke can easily spread to the EPS.



7) Agreement Certificate Scope to be considered

Argue it is not a cavity or a fire barrier is not required is questionable.

EPS = 98% Air

BR 135 Fire performance of External thermal insulation for walls of Multistorey buildings, this highlights the need for properly fixed fire barriers with EPS. (referenced in BS 8414 : 2020 Fire performance external cladding Systems)

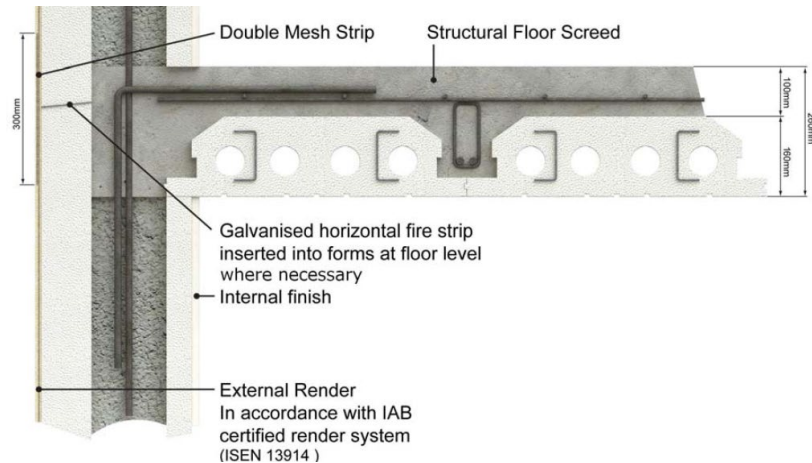
“Thermoplastic products

Thermoplastic products such as expanded polystyrene (EPS) will typically soften and melt in the early stages of a fire, generating a void behind the external render finish coat. If inadequate fixings have been used, without the support of the insulating material the finish coats will sag and crack, producing a direct entry route for the fire to the insulation material. Once the material ignites, **rapid fire spread can occur if suitable fire barriers and fixing details are not provided**. The relatively low softening and melting points of EPS mean that damage can occur to the insulation layer well away from the seat of the fire.”

8) Agreement Certificate Text/detail to be considered

Plasterboard

“12.5mm plasterboard slabs fixed directly through the EPS into the concrete core with plastic insulated anchors”



Important the plasterboard is mechanically fixed to the concrete core. Prevent the plasterboard slab failing/falling – If EPS melts.

8) Agreement Certificate Text/detail to be considered

ICF Floor Systems

ICF Roof Systems

ICF Wall Systems



Rooms or Attic space completely encapsulated with ICF on all sides.

Important the plasterboard is mechanically fixed to the concrete core.
Prevent the plasterboard slab failing/falling – If EPS melts.

9) Agreement Certificate Scope/detail to be considered

- The Attic space

Viewed as non-habitable, and no plasterboard required.

- Internal protected Stairs

Should this have a “Fire Stop” internally where stair abuts internal EPS wall ?



10) Agreement Certificate Scope/detail to be considered

TGD – A

It would be beneficial if guidance was given when this movement joint is required.

These locations need to be decided by the Structural Engineer.

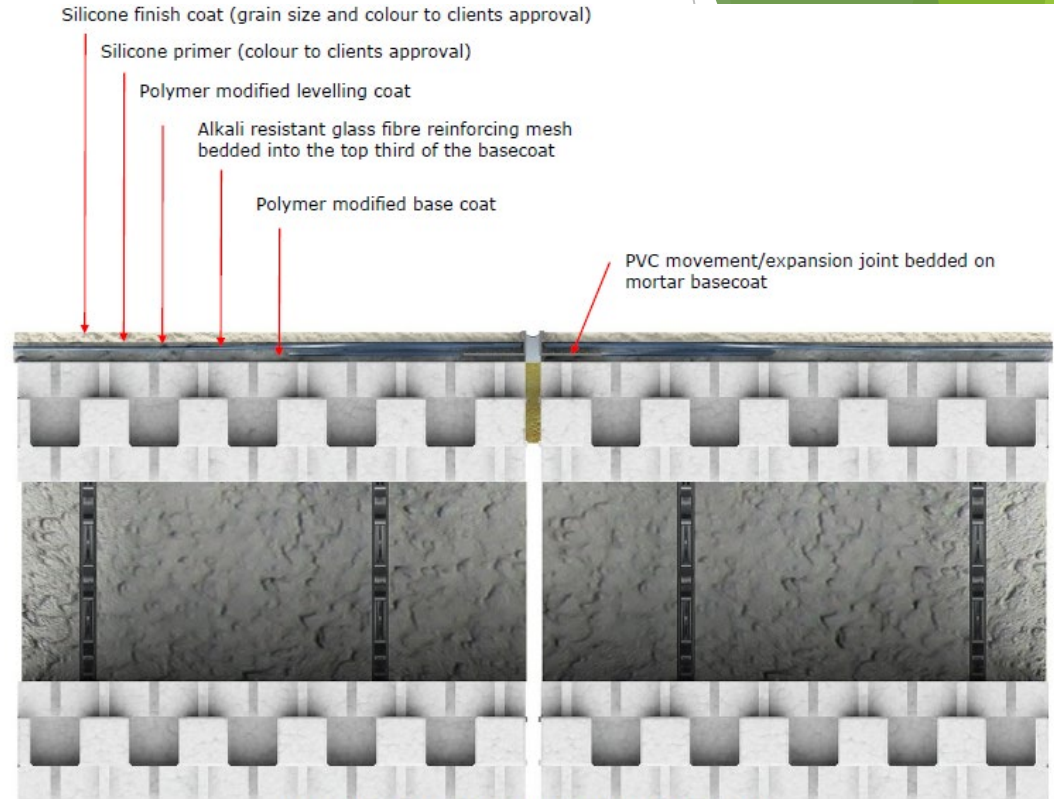


Figure 10: Movement/Expansion Joint Detail

11) Construction Challenges

- Builders lack of Knowledge of Details/System
- Concrete too dry
 - Compaction issues
- Concrete too Wet
 - Leakage issues
- Defects often hidden
 - Cracks in Concrete
 - Voids in Concrete
 - Rebar coverage not achieved



Summary

- Consistency missing with terminology “Fire Stop” – “Fire Barrier” etc.
- Fire Barrier / Fire Stop detail – friction fix will that withstand a fire/ tested?
- Attic Space; consideration to be given if it should be encased in plasterboard
- Clarity on the use or need for intumescent putty packs in electrical sockets or service penetrations where EPS is exposed.
- More consistent detailing in align with ACD’s.
- NSAI MMC Agreement Cert reassessment every 5 yrs.
- Insurers lead the change here.
- No consideration given to Fire Fighter entering room of ICF.

