NFRC RoofCERT Rainscreen Report

Introduction and Background

Executive Summary (include recommendations)

The project started in July 2020 after a relaunch following extensive cuts to funding from CITB. The objective of the original Project was to provide a 'proof of concept' for an accreditation structure and related technical and behavioural training modules that have the ability to significantly reduce industry failure rates on installations and inspections to improve the build quality of rainscreen claddings. This report focuses on the development and delivery of the technical and behavioural training modules. It provides recommendations on how this might fit into the broader structure for accreditation.

Definition of "*Trained Supervisor model*"

We define the trained supervisor as an individual working alongside a core group of competent installers, labourers and new entrants. They are the lead installer carrying responsibility for delivery of the rainscreen system in line with design drawings, specification and construction build schedule.

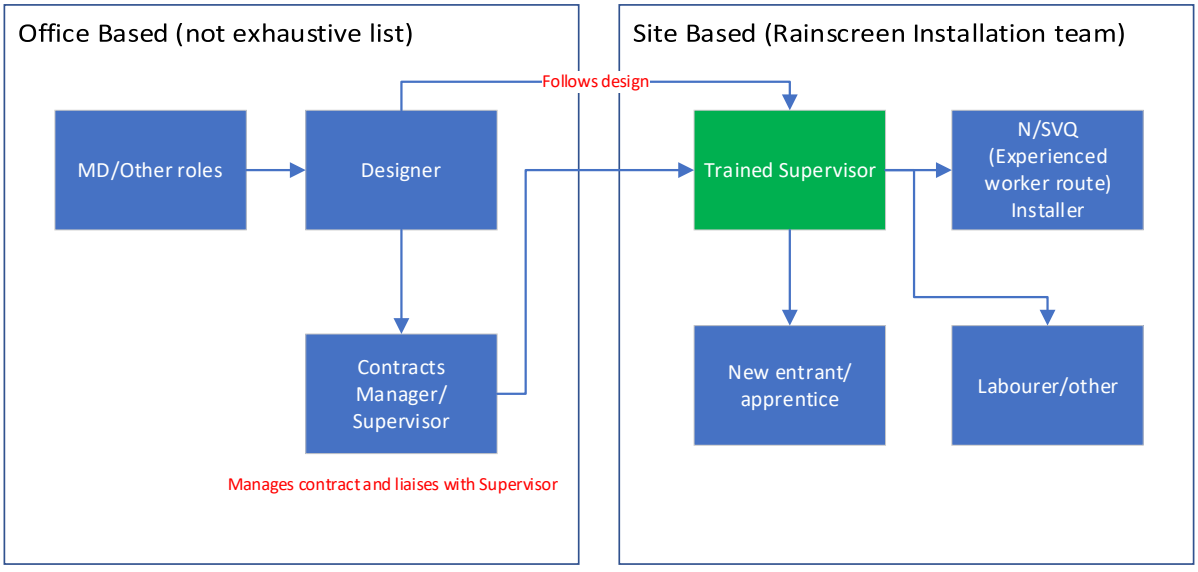
Future Rainscreen gang visualised

Trained Supervisor

N/SVQ qualified installers

Labourers

New Entrants/apprentices



Purpose

The formation of the technical working group comprising of Justin Lewis, Rockwool, Alex Owens, Proclad, Brian Mack, EJOT, James Patrick, Kingspan, Lee Davies, CA Group, Paul Clayton, Euroclad, Roger Fox, Progressive Systems, Tony Ryan, Kingspan and Colin Yeates CY Associates took place and setting initial tasks associated with development of the training course and all associated materials ready for a series of 3 pilot training sessions, which included importantly the technical knowledge tests. The purpose of running a series of 3 evolving Pilot training sessions is to test the theory that a trained Supervisor model could help improve quality and safety of installation. To test whether the operatives can take the knowledge and practical application delivered during the training and apply it to their own skills (upskilling them firstly) and then also in the oversight of any cladding installers they supervise or work alongside on site (ensuring others do it right first time). A part of the training relates to continuous professional development (CPD) and those softer skills which can bring real cultural change.

Engagement started with key stakeholders within the building envelope sector to gather support for the concept and for organisations to take active part in the pilots through a mapping and engagement strategy. Discussions with major tier one main contractors including the likes of Wates indicated some interest but too early at this stage to actively participate. This kind of reflection was repeated across other stakeholders and the project team worked tirelessly in order to obtain commitment. Nonetheless it should be noted material manufacturers and Rainscreen installation specialist subcontractors provided significant material and human resource in support of the Pilots.

At the early stage of the project and prior to the delivery during pilot one, one of the biggest issues was access to a suitable instructor to deliver the training. One was eventually sourced and utilised during pilots one and two, and whilst there were plenty of positives there were some issues with the delivery of the training through lack of in depth and up to date knowledge.

A Communications and marketing strategic plan was produced and targeted to certain stakeholders with keen interest in this particular area, namely tier one contractors, and those installation organisations. It was evident that in the early stages of the project there was hesitance and reluctance from key stakeholders to commit, including other associations in this space.

What this report intends to answer

This report intends to identify if the training and assessment developed during the three pilots can conclude that on mass roll out this will have a positive impact on the installation and supervision of Rainscreen Cladding work. This report will conclude with recommendations on future development along with key lessons learned, It is not intended to contain information on the future of training and development of Rainscreen Cladding installation and supervision which will be a separate proposal as and if/when required.

Key training Outline (Appendix 1)

- How to inspect a backing wall for compliance prior to installation
- How to check an aperture through a backing wall for weather tightness
- What is a cavity barrier/fire stop, the principles of them and how they work?
- Where should they be positioned on a wall and why.
- How to install fire breaks correctly
- How to set out helping hand brackets
- The difference between a fixed point and a sliding point
- How to install insulation, the different types of fixings and cutting round the support system
- How to install the vertical/horizontal carrier system
- What happens if a part of the carrier system affects the position of the fire barrier?
- How to install a movement joint
- How to fix the outer panel
- How to formulate a robust inspection and test plan; the 4 key stages of stop and check the work in progress
- How to insert hold points into the works for inspection
- How to sign off a recorded defect and provide evidence
- How to record inspection information at all relevant stages

Key Requirements

Prior to starting the training

- The installers undertook the short multiple-choice knowledge test/assessment consisting of 35 questions to get a baseline of their current knowledge and understanding
- The training then commenced and ran for approx 2 days.

During the training

- The installers undertook a mix of classroom and practical hands on training during which the trainer accessed each operative providing feedback on a wide ranging issue and application mix particularly areas where they perform strongest whilst reinforcing the training areas needing improvement.

At the end of the training

- The installers then undertook a similar multiple-choice knowledge test/assessment to give an initial indication as to whether there had been an increase in their knowledge and understanding as a first measure.

After the training

- The project team planned to check in with the Pilot partners at regular intervals for any site improvement noted.
- A 6-8 week on site assessment/ interview with the Pilot partner to be carried out to assess the quality and safety of installation work improvement.

Pilot One Summary

The first pilot took place from 16th to 18th June 2021 at SPV Group training centre in the West Midlands. Initial design for this first training rig was provided by the trainer and full drawings contracted to Redtec services. A first prepared Lesson plan using Powerpoint was progressed initially alternating between classroom and hands on assembling the built-up elements of the rainscreen. The selection of a more complex 'plank' profiled outer panel resulted in far more time needed to assemble than was allowed for. The basic rig as built was found not to be to drawing and certain details were not possible to replicate. Moreover, the fact the CP board had not been previously installed caused further delay. At the conclusion of the training there were a number of identified lessons such as these mentioned which we learnt from and adapted the next Pilot accordingly. However, there were also positives to be taken away from the training and assessment. All the individuals who received the training maintained or increased their knowledge score post training when compared to pre-trained with extremely positive feedback provided all round. Pilot one lacked technical oversight which was a main finding on this occasion. For more information, please refer to previously submitted reports

Pilot Two Summary

The second pilot took place on 12th and 13th July 2021 at Southwest Roof Training Group with operatives from Progressive Systems Ltd. A revised rig design was built on two walls in the training centre of much lighter gauge top hat sections, and we continued to persevere with the plank profile outer sheet. Redtec Services again provided the rig drawings. Having carried out over 40 Knowledge tests/assessments it became clear the installers tested revealed product and installation training needs for both membrane and cavity barrier installation. We therefore focused more so on these areas particularly. This pilot was different from pilot 1 in that the operatives were more technically experienced in Rainscreen and thus were in a position to provide constructive feedback on ways in which the training needed to be refined to enable it to deliver the best outcome. Despite significant effort from the team a number of issues were identified with the build-up of the rig and drawings which were unable to be rectified on site at the time, which meant less time was spent on the classroom element of the training.

Further due to circumstances outside the teams control the final knowledge test could not be run as planned and had to be done using the operatives handheld devices, this resulted in one operative not wanting to take the test in this way. An oversight from the onsite team also meant that evaluation forms were not completed immediately following the training and only 2 of the 4 were received.

As with pilot 1 there were a number of issues and opportunities identified that can be improved upon moreover the need to include current legislation and Industry best practice reference and demonstrate fulfilment a key addition. The technical consultant, Nick Jenkins attended the pilot and made recommendations on actions to be taken into pilot 3 as lessons learned. It became very clear we needed to simplify the rig design and build in detailing and component interfaces that post Grenfell building surveys have identified as common defects. A focus was given on achieving robust compartmentation and on ensuring effective weather sealing and build quality of all interfaces with other elements of the external walls. Nick's suggestion of a 3m x 3m design was agreed. It was further agreed to simplify the external wall element using through fixed external panels.

To reflect the learnings from Pilots 1 and 2 the power Point lesson plan was significantly reworked for Pilot 3. Considerable time and expertise was put into re writing the Lesson plan by focusing on achieving compliant compartmentalisation as well as ensuring it was inclusive of all best practice guidance given by trade and industry associations including the CWCT (Centre for Window and Cladding Technology) and MCRMA (Metal Cladding and Roofing Manufacturers Association). These organisations were informed throughout the process and a number of member manufacturers positively assisted with the Pilots and technical presentations.

The considerable time invested and further reworking of the lesson plan before Pilot 3 resulted in a revised 2 day training course that we believe fulfilled the original brief with the essential focus on evidenced training needs.

Pilot 3 Summary

Pilot 3 took place at the Scottish CITB National Construction College, Inchinnan on 10th and 11th May 2022. The revised lesson plan was well rehearsed beforehand, and checks were made that a full complement of all materials for the hands on build on site had been delivered. The backing wall of the rig was built by CiTB instructors prior to the training to the point including the installed CP boards which would be typical of the rainscreen specialist contractor involvement.

The pilot was attended by 4 operatives from Precision Projects and 3 students studying the Roof Sheeting & Cladding apprenticeship course.

The delivery of the training was based on Nick's belief that if the industry is to avoid repeats of legacy defects that are costing the industry billions to rectify, and as we are all too well aware, in a number of instances, people their lives, it was important that the students were not simply told what is required but were educated as to why these requirements are in place with some history and context provided.

The delivery of training focused students' minds to recognise that the quality and safety of any external wall is ultimately dependent on the competence of the installers and the robustness of the QA applied.

The training aimed to improve rainscreen façade installer competence and understanding and was structured to provide a balance of classroom learning regularly interspersed with practical training to help to reinforce understanding and embed the classroom messaging and discussions.

The visuals used for the classroom discussions utilised a 3D model of the training rig used in the for the practical elements so as to seamlessly link the two elements of the training.

One of the key realisations was that whilst under Regulation 38 requirements a register of materials has to be created for all components associated with the design. It is very difficult/practically impossible for those on site handling the materials and components and quality assuring installations to establish if what's been supplied and integrated into the external wall, aligns with the original specification.

The external wall associated with the training rig had 33 individual components. Whilst some of the products featured brand marks only 2 had marking that allowed the installers to easily confirm their EN 13501-1 reaction to fire classification.

On completion the 3 apprentice installers and 4 installers with a few years experience behind them already, all demonstrated a measured and significant improved understanding of:

- What represents a functional and compliant rainscreen cladding system used as part of an external wall assembly.
- A brief overview of the relevant legislation with respect to the external cladding system depending on the nature of the building and which region in the UK it is to be constructed.

Installation defects that could compromise the functional performance of the system in respect to: Weather resistance, thermal performance; acoustic performance; fire resistance; structural performance; aesthetics.

Knowledge Assessment Overview (Appendix 2)

All learners (rainscreen operatives) across the 3 pilots and apprentices (Roof & Wall Cladding) from the session in Scotland completed a knowledge test pre and post training. In nearly all instances the results of the knowledge test post education showed signs of increased knowledge, or as a minimum no decline.

The knowledge test was not a pass or fail, but more a measurement of knowledge in two separate instances of time, prior to and after the education was delivered. It consisted of 35 knowledge questions with results provided at the end of each test. It is clear that the education provided had a positive impact on the short-term knowledge gain for application on site.

Tests were conducted both electrically and in paper-based formats.

Assumed costings of materials for training rig associated with pilot 3

1. Design and manufacture 2 No wall panels 3.05 X 1.2 M to suit drawing in a 92 x 47 x 1.2mm stud and supply 6 No 300 x 100 x 1.5mm C sections for fixing to the walls. Supplier Saucer solutions £1036.00 plus VAT £1243.00 Total
2. CP boards to fit Rig 3 above supplied by Academy Consultancy and Design @£14.00/M2. Total 9 M2 @ £126.00 plus VAT £151.20.
3. Wraptite membrane 1.5m x 50m @ 3673.81/roll , Wraptite tape 150mm x 50mm @ £117.65/roll , Wraptite 600mm ‘sausage’ @ £18.52 each, Wraptite Corners @ £10.70 each supplied by Proctor Group. Total cost per 9 M2 £160.00 approx plus VAT £192.00
4. Rockwool insulation 100mm thickness @ £33:00 per M2. 9 M2 total £297:00.
5. Siderise Cavity barriers vertical, horizontal with fixing brackets as listed.
6. 12 Linear metres of RH 90/30 , 12 metres of RV 90/30 (supplied as full sized slab to be cut during training) all with Galv brackets and foil tape, 29.28 Linear metres of OSCI 12200100 x 30mm (24 lengths), 2 rolls of spare RFT tape all to suit the Rig, @ £230.00 in total.
7. Helping hand Aluminium subframe, support rails for brackets and T sections including window jambs, Cill, heads, pipe bracket and brace plus external Aluminium wall panels. Transport included a total estimate of £1,200.00.

8. Sealants, piping sample, Stainless steel fasteners, drill bits, electric screw guns and drills for installation as per the drawing estimate of £1,500.00

Total cost of materials is approx. £4,813.20

Please note in addition to the above costs, fees for training space and trainers/assessors is in addition to what is provided.

Lessons learned

1. A finished rainscreen system may hide a multitude of defects. In order to assess if the rainscreen system is installed in line with current best practice, is compliant with current legislation and delivers against all performance requirements, it is imperative that the principal contractor should provide robust evidence of the as built condition via QA records. To achieve this a photographic record of the work completed at the very minimum 4 key stages of a rainscreen system build up.
    - 1st Inspection record - The backing wall for the Rainscreen is complete but before the support system and insulation is installed.
    - 2nd Inspection and record- When the Rainscreen brackets are installed but not the insulation.
    - 3rd Inspection and record - When the insulation, cavity barriers and vertical rails are installed.
    - 4th Inspection and record - During the final external wall is attached.
2. Rather than classroom-based education followed by practical demonstration and installation by the operatives, it works better if the classroom activity is interspersed with practical demonstration and installation by the operatives.
3. A standardised approach to the training and assessment is best to ensure that all the learnings are consistently delivered. This includes training standard, presentation materials and delivery, drawings, and rigs.
4. Interactive presentation that directly related presentation material to the training rig to easily identify potential for defects at interfaces between components worked really well and aided improved understanding.
5. That the training can be utilised with modification to support additional roles throughout the facade sector through a modulated approach, for example designers.
6. It was further recognised the desire and need to encourage and grow the softer cultural change a ‘don’t walk by’ behaviour will take time however this approach is an essential element of the training.

Findings

- The pilot proved that short duration training in line with pilot 3 supports improved delivery of knowledge. This knowledge enhances the practical ability of a rainscreen installer, particularly those involved in on the job supervision of others.
- Knowledge increased post training and was particularly evident in the final pilot session where a cohort of finished roof sheeting & cladding apprentices all documented increased results following the 2 day training.
- Theory and practical based short sessions worked well across the delivery to maximise the understanding and increase in knowledge.
- There has been very minimal training obtained previous in rainscreen cladding prior to attendance during these pilots
- A lack of skilled assessors and trainers exist in delivering the level of theory-based knowledge and practical training required to upskill installers and installer/supervisors

Recommendations

- Modular training standards to include different types of backing walls, such as timer frames and structural insulated panels (SIP) and also more complex rainscreen cladding systems such as cassette panels and other variations.
- Manufacturers training needs to complement the training and assessment delivered by this training scheme/pilot and subsequent training standards that are developed. This can also support future CPD requirements highlighted below in a full accreditation scheme.
- Legislation and regulation needs to be constantly reviewed and training aligned, this includes therefore maintenance of the materials and delivery.
- Review how to support new entrants into Rainscreen Cladding in support of meeting current and future industry demands.
- A new suite of training standards are developed to incorporate the modulated approach

Recommendations on how the training might fit into the broader structure for accreditation (full scheme approach)

- Development of a scheme (***RoofCERT Accreditation***) is crucial, to follow a standardised approach. This work needs to be designed, developed and implemented with a cross sector approach, to include but not limited to
    - **Infrastructure** - ensuring that there is adequate provision to deliver the education and assessment requirements
    - **Trainers & Assessors** - There is a severe lack of competent and qualified assessors to deliver the education and assessment required of this programme for installers. Significant investment both financially and time is needed to support this. We recommend that identification, facilitation and support is identified to provide next level trainers and assessors for Rainscreen cladding

- **Financial Funding** - substantial funding is recommended to further develop the pilot into a scheme and build the infrastructure to begin delivery across all regions. Without the funding in place
- **Stakeholders -** The development of a scheme will require a variety of key stakeholders, from industry bodies like NFRC, Tier one contractors, CLC, government and CITB to ensure that the impact of the scheme is not held up through lack of engagement and industry demand.
- **Mandate -** The training and assessment demonstrated in the outcome of this pilot, once further developed, should be mandated to ensure its effectiveness. Without mandate the scheme like many others prior may come up against similar barriers to entry. It is likely that full backing of the sector and government bodies will be required in order to reach desired outcomes
- **Knowledge Testing** - The scheme as proven throughout this pilot should have a technical knowledge test associated with it, this becomes of particular importance when re-validating skills in the future using current methods in line with current industry standards and regulations.
- **Continual Professional Development** - CPD should be included in short duration modules to support re-validation of competence
- **Qualifications** - Ensure that qualification delivery and criteria is robust and supports the outcomes of industry and occupational standards.
- **Accreditation** - Consideration of UKAS licensed accreditation through ISO/IEC 17024:2012 Conformity assessment - General requirements for bodies operating certification of persons.

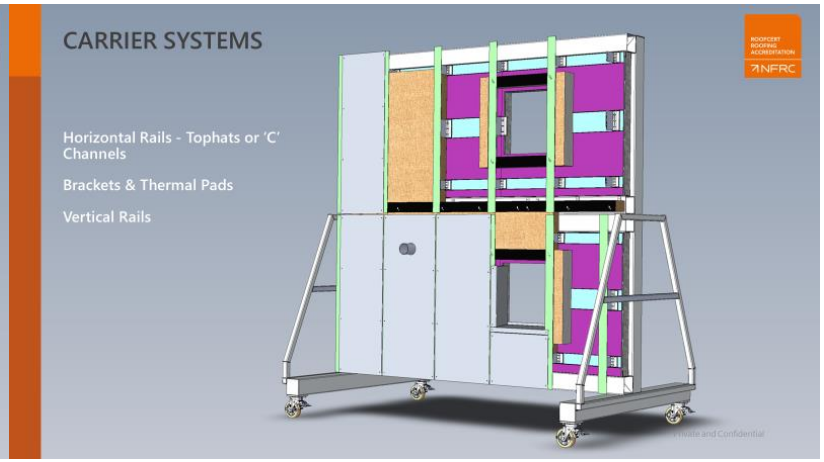
Suggested Next Steps

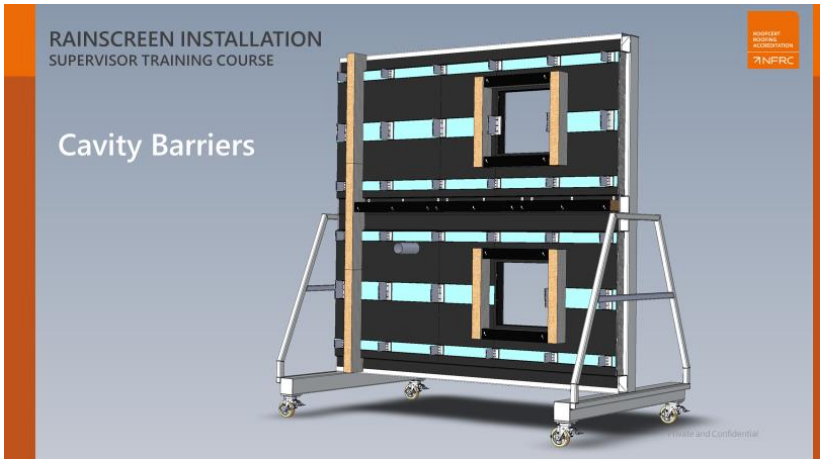
- **CITB arrange meeting with NFRC to discuss report findings and recommendation.**
- **CITB and NFRC invite central government for discussions and proposed high level solutions**
- **NFRC make full proposal for solution of training and re-validation assessment for Rainscreen Cladding supervisors**
- **NFRC run a full project inclusive of recognised and valuable industry stakeholders in the full design, development and implementation of a competence-based approach to re-validation of skills, knowledge and behaviours across working supervisors for Rainscreen cladding installation teams, in line with above recommendations.**

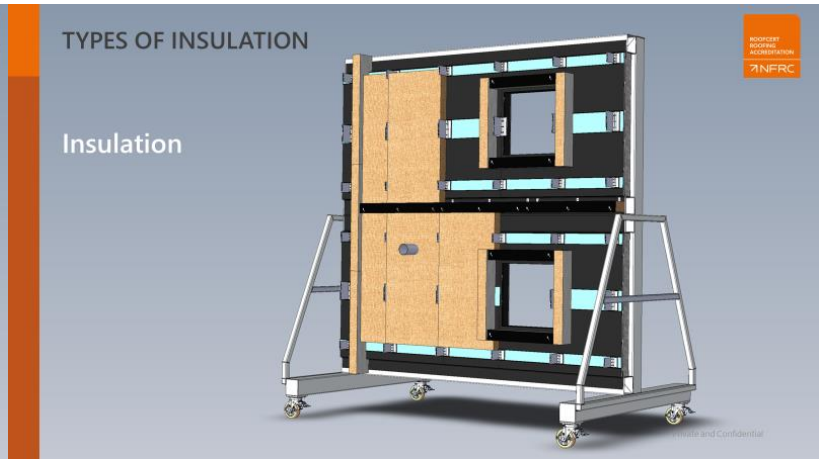
Appendix 1 Presentation and Rig

The below are a selection of images used that demonstrates the quality of the final presentation and rig design in order to fulfil the training and educational requirements.


VAPOUR & AIR BARRIERS
Vapour barrier to outside face of Sheathing board. Often referred to as a Breather Membrane
EPDM


CARRIER SYSTEMS
Horizontal Rails - Tophats or 'C' Channels
Brackets & Thermal Pads
Vertical Rails


RAINSCREEN INSTALLATION
SUPERVISOR TRAINING COURSE
Cavity Barriers


TYPES OF INSULATION
Insulation


RAINSCREEN INSTALLATION
SUPERVISOR TRAINING COURSE
External Panels

THE BUILDING REGULATIONS

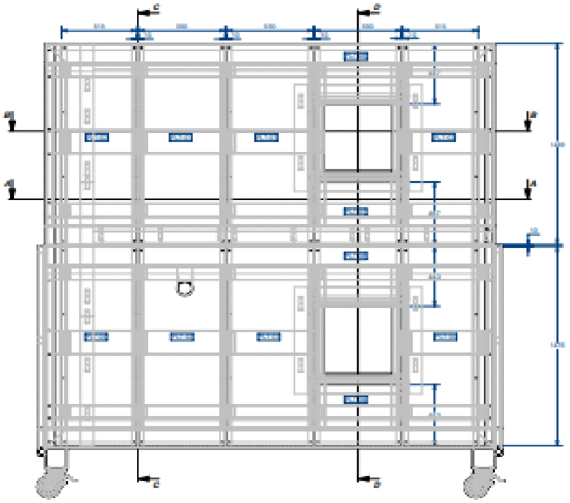
The Building Regulations set out the requirements that must be met in relation to design and building work in the construction of domestic, commercial and industrial buildings.

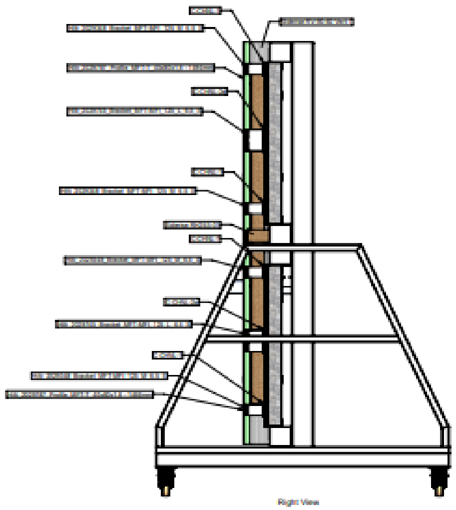
Amendment issued in December 2018 which applied to buildings in England only.

THE BUILDING (AMENDMENT) REGULATIONS 2018

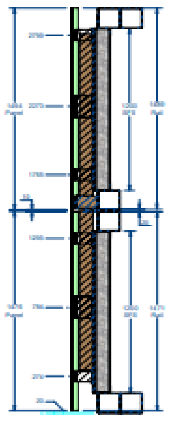
The changes all relate to external walls thus:

Regulation 2 – Interpretation
Regulation 4 – Requirements relating to building work
Regulation 6 – Requirements related to material change of use
Regulation 7 – Materials and workmanship

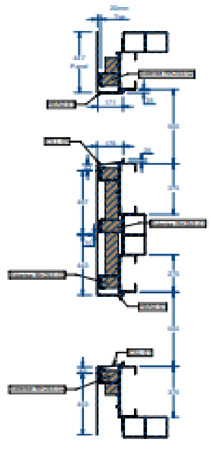




Right View



SECTION C-C
SCALE 1 : 12



SECTION D-D
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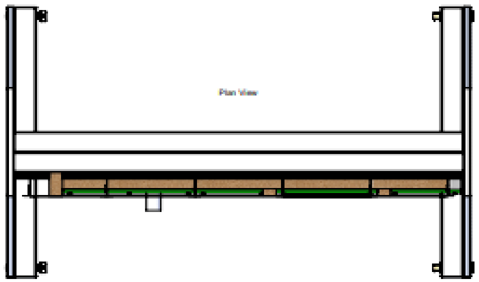
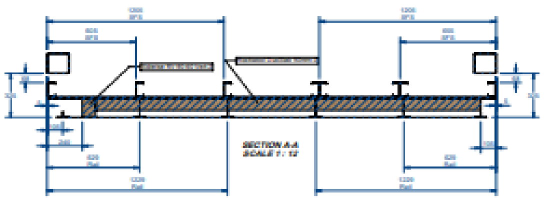


Plan View



SECTION A-A
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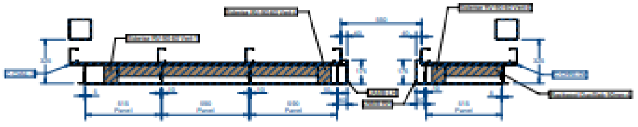

SECTION B-B
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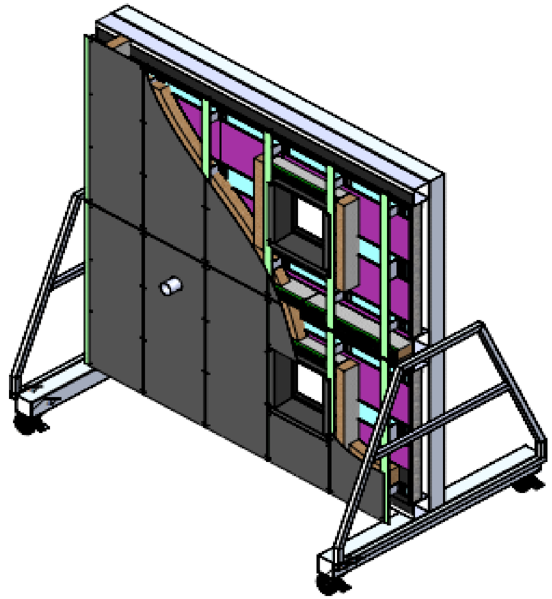

BOM Table

Qty	Length	Width	Part Ref	Description	Material
1			Frame Sketch	Aluminium Box Frame	Aluminium
4	135	135	Plate-01	10mm Aluminium Foot Plate	6063-T6
4			Wicke Castor-328504_01		
4			Wicke Castor-328504_02	Wike Badhane Castor - 160x60	
4			Wicke Castor-328504_03		
16			socket head cap screw_iso		
16			plain washer 10673 type sm_iso		
4	3050		U104050120D-1	SFS	Galvanised Steel
12	1193		C100050120-1	SFS	Galvanised Steel
4	368		C100050120-2	SFS	Galvanised Steel
4	330		U104050120D-2	SFS	Galvanised Steel
4	368		C100050120-3	SFS	Galvanised Steel
2			Smart Board-WD		
1			Smart Board-WD-6		
2			Smart Board-WD-2		
1			Smart Board-WD-3		
6			Hilti_2029787_Profile_MFT-L_40x80x1.8 - 1494mm		6063-T6
24			Hilti_2029368_Bracket_MFT-MFI_125_M_4.5_3	Helping Hand Bkt	6063-T6
11			Hilti_2029745_Bracket_MFT-MFI_125_L_4.5_3	Helping Hand Bkt	6063-T6
4			Hilti_2029787_Profile_MFT-L_40x80x1.8 - 1466mm		6063-T6
4	3050		C-CHNL-1	Aluminium Bkt Channel	Aluminium
2	1823		C-CHNL-2	Aluminium Bkt Channel	Aluminium
2	645		C-CHNL-2a	Aluminium Bkt Channel	Aluminium
2	562	289	JAMB-LH	Window Jamb	Aluminium
2	590	238	CILL-01	Window Cill	Aluminium
2	631	230	HEAD-01	Window Head	Aluminium
2	562	289	JAMB-RH	Window Jamb	Aluminium
2	1494	590	PLT-01	Panel	Aluminium
2	1494	515	PLT-02	Panel	Aluminium
1	1476	590	PLT-03	Panel	Aluminium
1	1476	590	PLT-03a	Panel	Aluminium
2	1476	515	PLT-04	Panel	Aluminium
1	447	590	PLT-05	Panel	Aluminium
1	447	590	PLT-07	Panel	Aluminium
1	453	590	PLT-06	Panel	Aluminium
1	443	590	PLT-08	Panel	Aluminium
1	1028		Siderise RV-90-60 Vert-1	Vert Fire Barrier	
16			Siderise Vertical Support Bracket		
1	993		Siderise RV-90-60 Vert-2	Vert Fire Barrier	
1	938		Siderise RV-90-60 Vert-3	Vert Fire Barrier	
4	793		Siderise RV-90-60 Vert-4	Vert Fire Barrier	
3	907		Siderise RH25G-01	Horiz Fire Barrier	
17			Siderise Horizontal Open Support Bracket		
4	493		Siderise RH25G-02	Horiz Fire Barrier	
1			EPDM-1	10 SQ Metres	
2	1200	400	Rockwool Ductslab 90mm-1		A-Glass Fiber
2	1200	300	Rockwool Ductslab 90mm-2		A-Glass Fiber
1	1200	400	Rockwool Ductslab 90mm-3		A-Glass Fiber
1	1200	328	Rockwool Ductslab 90mm-4		A-Glass Fiber
1	1200	400	Rockwool Ductslab 90mm-5		A-Glass Fiber
1	1200	328	Rockwool Ductslab 90mm-6		A-Glass Fiber
1	114	400	Rockwool Ductslab 90mm-7		A-Glass Fiber
1	296	400	Rockwool Ductslab 90mm-8		A-Glass Fiber
1	324	400	Rockwool Ductslab 90mm-9		A-Glass Fiber
1	86	400	Rockwool Ductslab 90mm-10		A-Glass Fiber
1	300		Extraction Pipe	Extraction Pipe	Aluminium
1			Pipe Bkt		Aluminium
1			Bkt Brace		Aluminium

Appendix 2 - Knowledge tests

The below demonstrates the increase in scores post education. Those highlighted in yellow maintained the same score whilst those in green documented an increase

Digital tests

Session	Start	End	Duration	Finished	Score (p	Score (p	Name
64892471	2021-06-1	2021-06-16 07:56:	00:18:07	Yes	83%	29.00	ashle
65007387	2021-06-1	2021-06-18 10:30:	00:10:37	Yes	83%	29.00	ashle
66141309	2021-07-1	2021-07-12 08:29:	00:14:17	Yes	97%	34.00	Chris
66206688	2021-07-1	2021-07-13 14:28:	00:09:14	Yes	97%	34.00	Chris
64892548	2021-06-1	2021-06-16 08:04:	00:23:54	Yes	83%	29.00	clint
65007475	2021-06-1	2021-06-18 10:34:	00:13:21	Yes	86%	30.00	clint
64892494	2021-06-1	2021-06-16 08:02:	00:23:36	Yes	73%	25.50	dean
65006694	2021-06-1	2021-06-18 10:26:	00:25:06	Yes	73%	25.50	dean
66141412	2021-07-1	2021-07-12 08:40:	00:22:51	Yes	71%	25.00	Gary
66207053	2021-07-1	2021-07-13 14:54:	00:28:01	Yes	76%	26.50	Gary
64892460	2021-06-1	2021-06-16 08:13:	00:35:03	Yes	59%	20.50	muha
65006695	2021-06-1	2021-06-18 10:25:	00:24:18	Yes	71%	25.00	muha
66141315	2021-07-1	2021-07-12 08:35:	00:20:29	Yes	91%	32.00	Natha
66206760	2021-07-1	2021-07-13 14:41:	00:21:57	Yes	91%	32.00	Natha
64892466	2021-06-1	2021-06-16 08:06:	00:28:13	Yes	77%	27.00	Shaur
65006706	2021-06-1	2021-06-18 10:28:	00:26:23	Yes	80%	28.00	Shaur

Paper based test results

For the final session in Scotland only paper based tests were conducted due to poor internet connection. What the below table demonstrates is a further increase in knowledge with the revised presentation and training materials used when comparing to pilots one and two.

Name	Pre test result	Post test result
Eimantias	23	32
Robertas	23.5	29.5
Kyle	26	35
Ewan	27.5	35
Dan	35	35
Victor	27.5	33
Xander	27	29.5

Denis	25.5	33

Appendix 3

List of thanks to people and organisations

Richard Miller NFRC

Colin Yeates. FIOR, MIOD. of CY Associates

Nick Jenkins International Fire Consultants (Part of the Kiwa UK Group)

Haidee Ryan

Alex Owens

A. L. King Roofing Ltd

ACADEMY CONSULTANCY AND DESIGN LIMITED

A.Proctor Group Ltd.

Ash & Lacy

Bobby Conroy

BTS FACADES & FABRICATIONS LIMITED

Daniel Burbridge of Precision Projects (SE) Ltd

EJOT UK Ltd

Fixfast

Fixing Point

Graham Flockhart Russell & National Construction College Scotland

Nvelope Rainscreen Systems Ltd

Progressive

Redtec Services

ROCKWOOL UK

Saucer Solutions Ltd

Siderise Group

Sotech Architectural Facade Systems

SPV Group

Thomas Wiltshire