

**Construction Products Regulations  
Curtain walling**

**Stephen Ledbetter, CWCT**

# Construction Products Regulations

- What they are?
- Harmonised product standard
- CE marking
- Performance characteristics
- Impacts on industry
- Way forward

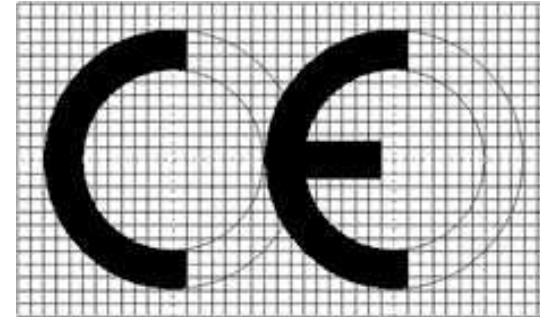


# Construction Products Regulations

- Construction Products Regulations (CPR)
  - A European Union regulation
  - Mandatory in every EU state
  - No national opt-out
  - A legal requirement from July 2013

# Construction Products Regulations

- Construction Products for which there is a harmonised European Standard (hEN) have to be CE marked
- Performance requirements of the hEN have to be declared unless:
  - They do not have a threshold performance  
and
  - They are not part of National Regulations




# Scope of CE marking

- EN 13830 covers:
  - Stick construction
  - Unitised construction
  - Double skin walls
  - *Structural sealant glazing*
  - *Bolted glazing*
- Components
  - Framing members
  - Connections
  - Seals
  - Flashings
  - Closures
  - Interfaces
  - Spandrels
  - Glass

# hEN 13830

- The CE mark is affixed to the wall by the company placing it in the market
- Fire resistance
- Fire propagation
- Resistance to own load
- Windload resistance
- Impact resistance
- Resistance to live horizontal loads
- g-value
- U-value
- ...

	
01234	
AnyCo Ltd, PO Box 21, B-1050	
11	
01234-CPD-00234	
<b>EN 13830</b>	
Curtain walling kit as external walls	
Reaction to fire:	A1
Fire resistance:	EI60
Fire propagation:	EI60
Watertightness:	R4
Dead load resistance:	0,6 kN/m <sup>2</sup>
Wind load resistance:	1,0 kN/m <sup>2</sup>
Snow load resistance:	1,0 kN/m <sup>2</sup>
Internal impact resistance:	I1
External impact resistance:	E1
Horizontal live load resistance:	1,0 kN/m
Seismic resistance - Serviceability:	0,003°
Seismic resistance - Safety in use:	0,007°
Direct airborne sound insulation:	36 dB
Flanking sound transmission:	50 dB
Thermal transmittance:	1,6 W/(m <sup>2</sup> K)
Air permeability:	A1
Solar factor:	0.25
Light transmittance:	0.55
Durability of Watertightness:	
Durability of Thermal transmittance:	
Durability of Air permeability:	

# Performance characteristics

- Reaction to fire
- Resistance to fire
- Fire propagation
- Watertightness
- Resistance to self-weight
- Windload resistance
- Resistance to snow load
- Impact resistance
- Resistance to horizontal live load
- Seismic resistance
- Direct airborne sound
- Flanking sound transmission
- Thermal transmittance
- Air permeability
- g-value
- Light transmittance
- Durability

For some characteristics it is acceptable to CE mark with 'npd'  
(No performance determined)

## hEN 13830

- ‘Curtain walling is not a product which can be completed in all respects within a manufacturing area, but is a series of components and/or prefabricated units which only become a finished product when assembled together on site.’
- ‘Curtain walling is a building façade made of a framework .....  
containing fixed and/or openable infills, which provides all the required functions of an internal or external wall or part thereof, ...’



# System or kit?

- Curtain walling system:

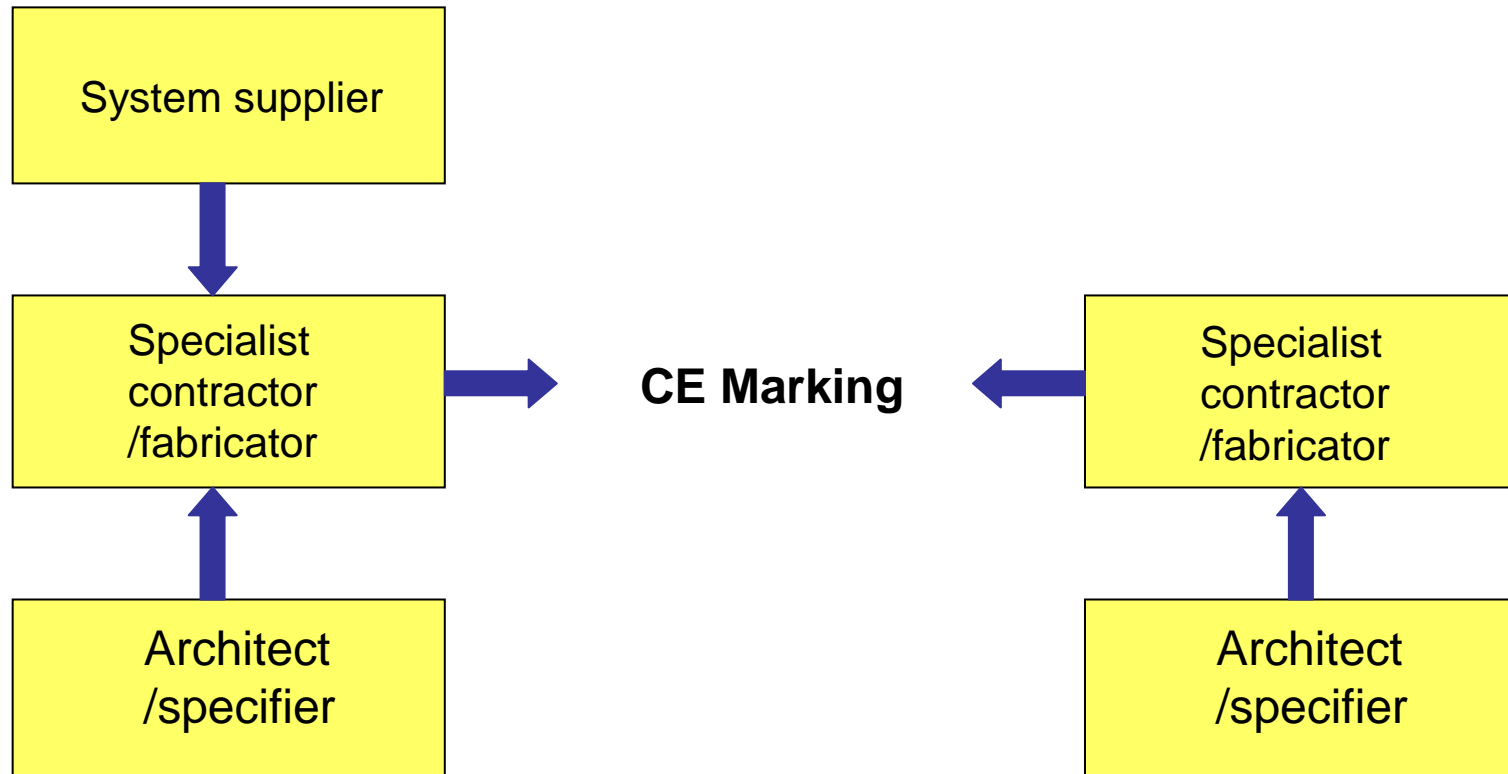
‘Collection of components from which a curtain walling kit may be created for subsequent installation on a building. It can give rise to one or more different kits’

- Curtain walling kit:

‘Collection of components or pre-fabricated units which, when installed on a building, form a curtain wall.’

- A curtain wall kit is CE marked by including the relevant information in accompanying commercial documents.

# Industry structure



# Attestation of conformity

Intended use	Reaction to fire	Attestation of conformity system
Wall with reaction to fire requirements	Class A1, A2, B, C Performance dependent on production process*	1
	All classes Performance not dependent on production process	3
Wall with no reaction to fire requirements		3

\* For instance the application of intumescent coatings

# Attestation of conformity

- System 3 applies to most walls. It requires:
  - Initial type testing
    - By a notified body (*Test house*)
  - Factory production control
    - Quality scheme has to be documented
    - Design has to be documented
    - There is no requirement for third party accreditation (*i.e. ISO 9000*)

# Attestation of conformity

- System 1 applies to some walls with reaction to fire characteristics. It requires:
  - Initial type testing
    - By a notified body (*Test house*)
  - Factory production control
    - Quality scheme certified by a notified body

## Initial type testing (ITT)

- A curtain wall has to be type tested
- A type test is required to define the characteristics but this test may also be used to define the characteristics of walls of similar construction
- ITT of a curtain wall system will be undertaken by the system designer/supplier
- ITT for a bespoke project design will be by the specialist contractor.

## Similar design

- 'Curtain walling modified by the replacement of components (e.g. glazing, hardware, weather stripping) and/or change of material specification and/or dimensional change of profile section and/or methods and means of assembly which will not adversely affect the classification and/or declared value of a performance characteristic' are of similar design
- ITT is valid for walls of similar design
- ITT may be cascaded from a system supplier
- ITT may be transferred laterally.

## When is CE marking required?

- It should be applied to all public procurement in all EU States.
- It may be required by semi-public bodies such as NHBC
- It may be invoked in any specification
- It may be regarded as a benchmark default statement in any post construction contract dispute whether or not invoked in the specification



## Who enforces CE marking?

- Different EU States will take different approaches
- In the UK it is the responsibility of trading standards officers
- This is a complex area that they are not familiar with and not equipped to implement
- It seems unlikely they will proactively enforce the use of CE marking
- However, if inappropriate use of a CE mark is brought to their attention they have a duty to act
- They can request quality documentation, test certificates and calculations for a period of 10 years after construction.

- Any questions?

# **EN 13830 Curtain walling kits – product standard**

**Stephen Ledbetter, CWCT**

# Harmonised standard

- The harmonised product standard for curtain walling is:
  - EN 13830
  - Curtain walling kits – Product standard
- This is being re-written:
  - Final draft late 2012
  - Published early 2014
  - Much is common with the existing BS EN 13830
  - Existing test results remain valid

# Reaction to fire

- Testing of components and materials
  - Framing materials
  - Spandrels
  - Linings
  - Gaskets
  - Finishes
  - Tested by supplier
- Requirement of Building Regulations AD B
- Required for CE marking
- Cascaded from material suppliers
- Some materials (Glass, metals ..) may be classified without further testing (CWFT)

# Resistance to fire

- Testing of complete wall construction
- Tested to EN 1364-4 or 1364-3
- Not always a requirement in Building Regulations AD B
- May be marked 'npd'
- May be cascaded from system supplier
- Depends on glazing type etc. and may require project testing.

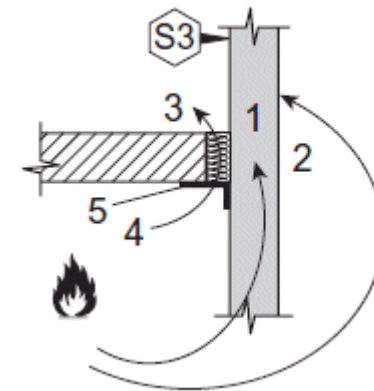
# Fire propagation

- Testing of wall, fire stopping and slab edge
- Tested to EN 1364-4
- Required in Building Regulations AD B even for walls that are not fire resistant
- *The current draft of EN 13830 does not require testing of fire stops but does require them to perform*

# Fire propagation

- Building Regulations AD B
- 'Junction should maintain fire resistance of compartmentation'
- Taken to be the fire resistance of the floor
- Impossible to test as the wall fails before the floor

internal

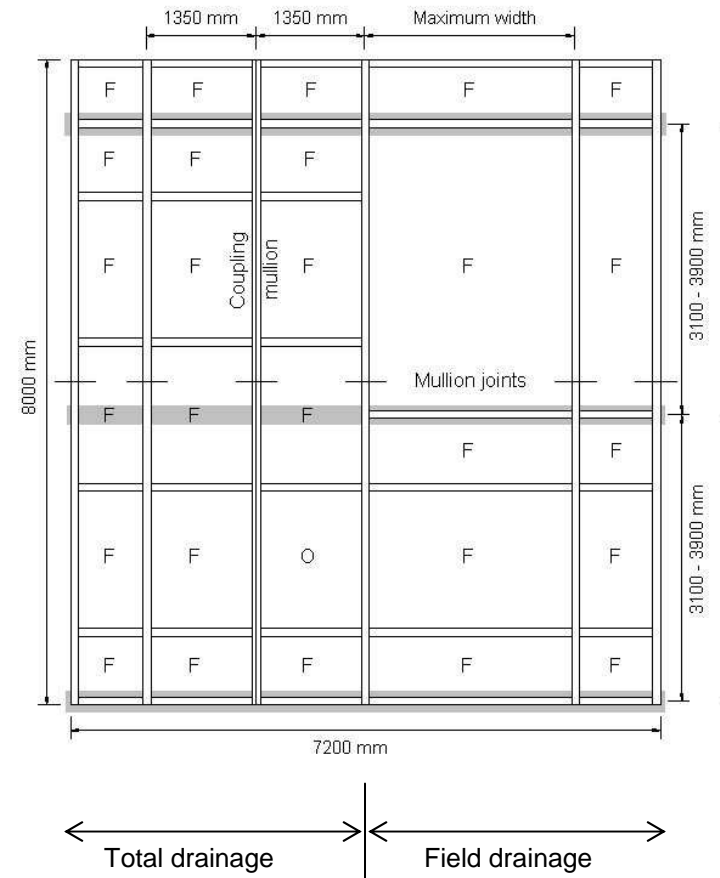




# Watertightness

- Testing of large specimen of wall
- Type test applicable to all geometries and dimensions with comparable dimensions
- Not explicitly required in Building Regulations AD C
- Not required for internal (atrium) walls
- Probably required for CE marking for commercial reasons as 'npd' is not credible.

# Watertightness



# Resistance to self-weight

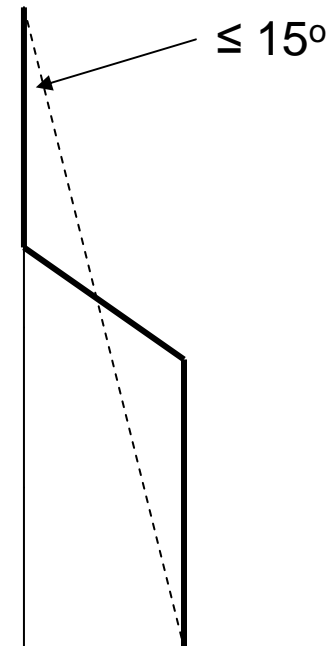
- Checked by calculation
- In accordance with relevant structural Eurocode
  - EN 1999 for Aluminium
- *EN 13830 also requires resistance to a vertical live load*
- Required by Building Regulations AD A

# Windload resistance

- Testing of large specimen of wall
- Calculation for mullions and transoms of different length and cross section
- In accordance with relevant structural Eurocode
  - EN 1990 and EN 1991 for loads
  - EN 1999 for Aluminium
- Explicitly required in Building Regulations AD A
- Required for CE marking

# Resistance to snow load

- By calculation
- Applies to sloping parts of curtain walls
- Curtain wall is envelope within  $15^\circ$  of vertical. It may contain less steep sections.

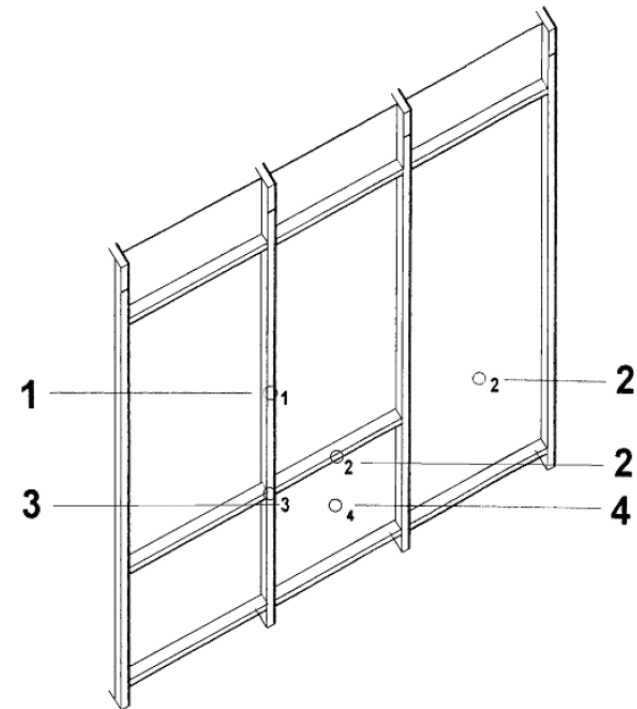


# Impact resistance

- Impact testing of the wall assembly
- Impact applied to:
  - Framing members
  - Opaque infill
- Not explicitly required by Building Regulations AD A or AD K
- CE marking probably required for commercial reasons as 'npd' is not credible
- Not certain how results are transferred to walls of 'similar' design

# Impact resistance

- EN 14019 requires:
  - Impact testing on spandrels
  - Impact testing on full height panels if there is no transom



# Horizontal live load

- By calculation
  - May be applied to a transom
  - May be applied to glazing
- Explicitly required by Building Regulations AD K
- Required for CE marking



# Seismic resistance

- By testing a large specimen of the wall
- Requirements for:
  - Safety
  - Serviceability
- Not a UK issue
- Not required for CE marking in the UK
- Unless exporting to seismic regions!

## Direct airborne sound

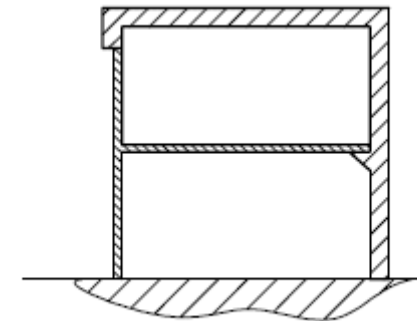
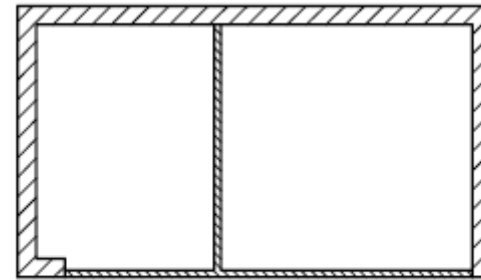
- Testing of a standard specimen
- Specimen is only 1.23 m x 1.48 m
- Later substitution of infill panel with one of higher performance is allowed
- Not required by Building Regulations AD E
- May be a specification issue
- May require testing on a project-by-project basis for larger areas of infill and glazing

# Flanking sound transmission

- Testing of the wall
- Calculation rules for different lengths of interface
- Explicitly required by AD E in some uses
- Often required by specifiers
- Will be required for CE marking of walls for apartments

# Flanking sound transmission

- EN ISO 10848-1 and EN ISO 10848-2 require large specimens
- Different geometries may be calculated
- Possible use of 'standard details'



# Thermal transmittance

- Initial calculation for the framing
- Additional calculation required for overall U-value including infill panels and glazing
- Required by Building Regulations AD L
- May be required by EU regulations in the future
- Required for CE marking

## Air permeability

- Test of large specimen of wall
- Rules for application
  - -100% okay
  - +50% but reduce one class
  - or calculate actual air leakage based on joint length
- Not explicitly required in Building Regulations AD L
- Will be required in specifications
- Probably required for CE marking for commercial reasons as 'npd' is not credible

# Radiation properties

- g-value
  - Product test
  - Calculation
- Light transmission
  - Product test
  - Calculation
- Both depend on glazing and infill panels
- g-value is explicitly required in Building Regulations AD L
- Required for CE marking

# Durability

- 'The curtain wall shall retain its characteristic performance at an acceptable level for the economic life of the wall'
- There is no stated life span
- Not required by Building Regulations
- Mandatory under the Construction Products Regulations



# Durability

- The durability requirements of the Product Standard EN 13830 are being written by:
  - CWCT
  - Politecnico di Milano
- They will be available by February 2013
- Economic life is not defined in EU Mandates
- Interpretation will be:

‘It should be possible to maintain, repair and replace any component of the wall that has shorter service life than the wall’
- This is the current requirement of the CWCT Standard

- Any questions?

# **CPR – Roles and responsibilities**

**Stephen Ledbetter, CWCT**

# Assessing similarity

Characteristic	Hardware and fixings	Gaskets and sealants	Frame material	Frame profile	Glazing	Other infill
Reaction to fire	(Y)	Y	Y	(Y)	N	N
Fire resistance integrity	N	(Y)	(Y)	(Y)	(Y)	(Y)
Fire propagation	N	(Y)	(Y)	(Y)	(Y)	(Y)
Thermal insulation	N	(Y)	(Y)	(Y)	Y	Y
Radiation properties	N	N	N	N	Y	(Y)

Y  
(Y)  
N

Modification will change the characteristic  
Modification may change the characteristic  
Modification will not change the characteristic

# Assessing similarity

Characteristic	Hardware and fixings	Gaskets and sealants	Frame material	Frame profile	Glazing	Other infill
Watertightness	(Y)	Y	(Y)	Y	N	N
Air permeability	(Y)	Y	(Y)	Y	N	N
Wind load resistance	(Y)	(Y)	Y	Y	Y	Y
Horizontal load	(Y)	N	Y	Y	Y	Y
Impact	(Y)	N	(Y)	(Y)	Y	Y

Y            Modification will change the characteristic  
 (Y)        Modification may change the characteristic  
 N            Modification will not change the characteristic

# Assessing similarity

Characteristic	Hardware and fixings	Gaskets and sealants	Frame material	Frame profile	Glazing	Other infill
Thermal shock resistance	N	N	N	N	Y	(Y)
Durability	N	Y	Y	(Y)	(Y)	Y
Direct airborne sound	N	(Y)	(Y)	Y	Y	(Y)
Flanking sound	N	(Y)	(Y)	Y	Y	(Y)
Self-weight	(Y)	N	Y	Y	Y	(Y)

Y Modification will change the characteristic  
 (Y) Modification may change the characteristic  
 N Modification will not change the characteristic

# Assessing similarity

- The tables given in EN 13830 are vague
- Interpretation is required and common practice has to be established
- What is the role of test houses?
- What is the role of system companies?
- What is the role of independent bodies such as CWCT?

# System supplier role

- The system supplier cannot be responsible for:
  - Glazing
  - Infill panels
  - Flashings and closures
- The system supplier cannot CE mark for:
  - Thermal transmittance or g-value
  - Wind load on different geometries
  - Fire propagation
  - Thermal shock resistance
  - *Horizontal live load*
  - *Impact*



# System supplier role

- The system supplier will probably type test for:
  - Watertightness
  - Air permeability
  - Resistance to windload
  - Impact
- The system supplier will provide assembly/construction manuals
- The system supplier may make available software/charts or tables for:
  - Selection of components for windload at different geometries
  - Selection of components for barrier load at different geometries
  - Calculation of U-values for a limited range of glasses
  - .....

# Specialist contractor (fabricator) role

- The specialist contractor will have to CE mark on the basis of:
  - ITT by the system company
  - ITT by component suppliers
  - *Additional testing*
  - Calculation of characteristics for:
    - Resistance to windload
    - Resistance to self-weight
    - Horizontal live load
    - Thermal shock resistance
    - Thermal transmittance
    - g-value

## Specialist contractor (fabricator) role

- The specialist contractor may make recourse to:
  - System company software, charts or tables
  - Component supplier guidance
  - Internal knowledge and skills
  - External consultants
  - Deemed to satisfy details
- The specialist contractor must follow system company assembly/construction instructions.

# Specialist contractor (fabricator) role

- EN 13830 requires:

‘The factory production control system shall document the various stages in the design of products, identify the checking procedure and those individuals responsible for all stages of design. During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken.’

‘This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily’.

*The record is not available to the Client but may be requested by enforcement bodies for a period of 10 years after the contract is completed*

## Specialist contractor (fabricator) role

- ‘Products marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated with that marking, although this does not replace the responsibility on a curtain wall designer to ensure that the curtain wall as a whole is correctly designed and its component products have the necessary performance values to meet the design.’

# Architect's role

- Performance specification
  - CE marking to show compliance
  - What are appropriate levels of performance
  - Not all characteristics are included
- Prescriptive specification
  - Frame type A
  - Glazing type B
  - CE mark may not show compliance with Building Regulations

- Any questions?

# **Issues and way forward**

**Stephen Ledbetter, CWCT**

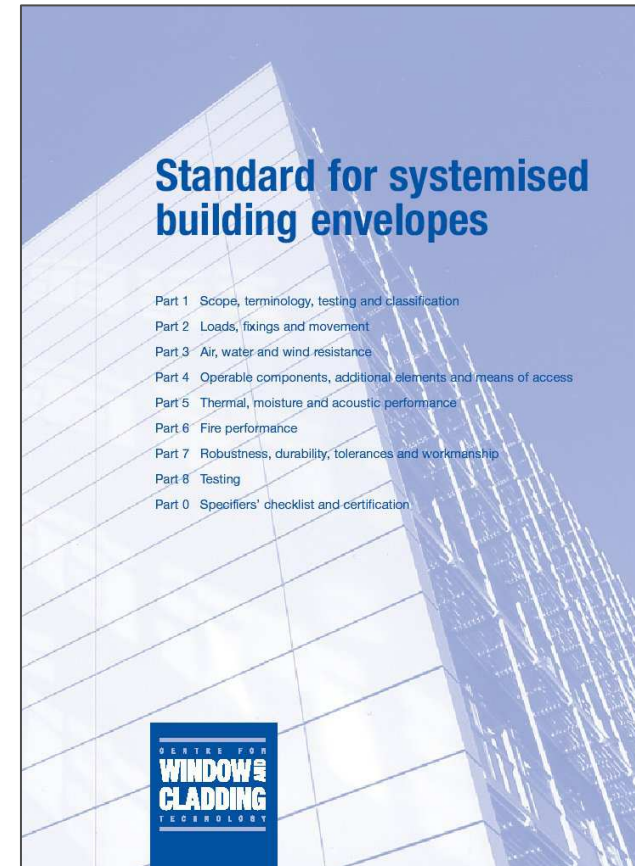


# Issues

- Not all systems on the market in the UK have been tested
- Not all tested systems are compliant
- There is a need for up-skilling by smaller specialist contractors
- Review of design guidance provided by system companies
- Structural calculations will be based on the Eurocodes – is there a transition period?
- Fire stopping may have to be simplified with less testing
- Role of ‘standard details’ – horizontal ITT

# CWCT Standard

- EN 13830 excludes rainscreen walls
- For curtain walling
  - Uses same test methods as EN 13830
  - Non-contradictory complementary information
  - Gives levels of performance acceptable in the UK



# Scenarios

- Wall of simple geometry based on a proprietary system
- Wall of complex geometry based on a proprietary system
- Modified proprietary system
- Custom designed wall

## Proprietary system (simple)

- Initial Type testing of framing by system supplier
- Testing and/or CE marking of infill by suppliers
- Specialist contractor follows instructions in system supplier manuals
- Limited choice of geometry / layout
- Probably single level of performance across whole envelope
- **CE marking is straight forward**

## Proprietary system (complex)

- Initial Type testing of framing by system supplier
- Testing and/or CE marking of infill by suppliers
- Specialist contractor follows instructions in system supplier manuals
- Specialist contractor performs calculations as necessary
- Calculations required may include:
  - Structural
  - Thermal
- Level of performance may vary across the envelope
- **Rules for CE marking need to be interpreted!**

# Modified proprietary system

- Initial Type testing of framing by system supplier
- Additional testing may be required
- System supplier manuals not sufficient
- Specialist contractor performs most calculations
- Specialist contractor assesses non-standard features
- May require testing of:
  - Fire stopping
  - Sound insulation
  - ...
- May use proven / standard details
- **Rules for CE marking need to be interpreted!**

## Custom designed wall

- Initial Type testing of wall by specialist contractor
- Proven / standard details may be carried over
- Specialist contractor performs all calculations
- Specialist contractor assesses all interfaces
- Test specimen is representative of the wall
  - Agreed with Architect
  - Determined by Specialist contractor
- This is the current position
- **CE marking is straight forward**

## Way forward

- CWCT consultation with system suppliers
- CWCT consultation with specialist contractors
- *DCLG (FBE) consultation with CWCT*
- Existing testing is valid
- Top-up testing of systems
- Agreed procedures established
- Standard details established
- Training available
- Probably ready 2014



- Any questions?