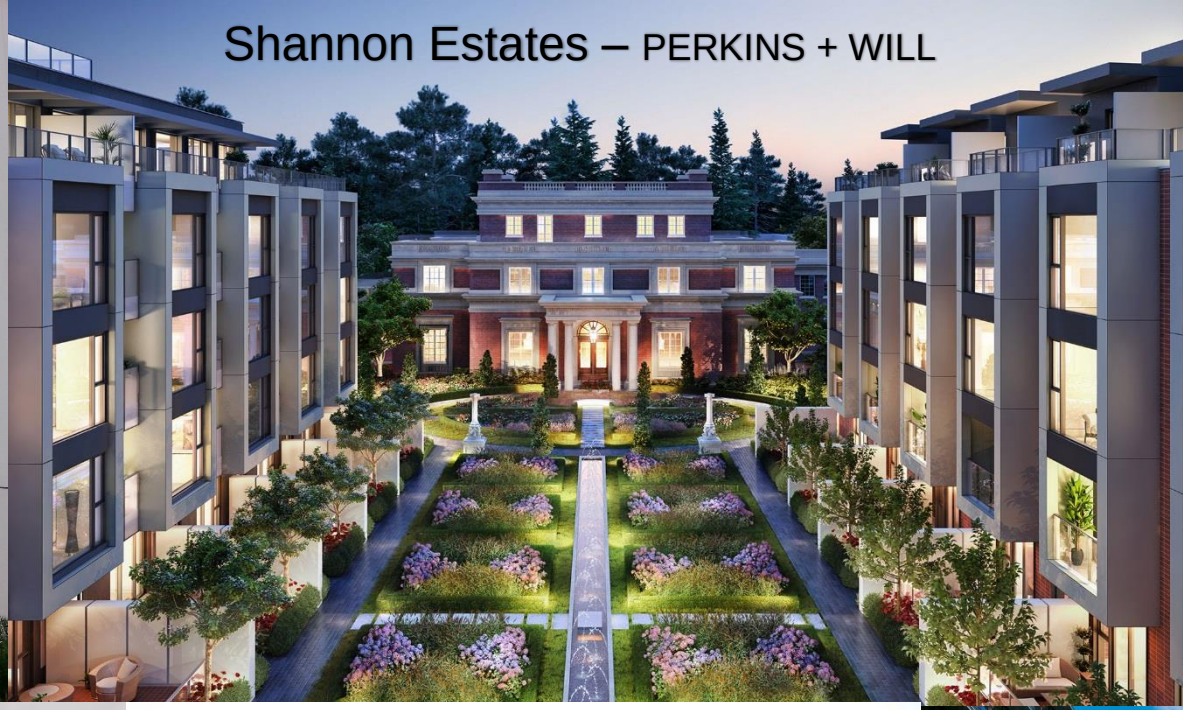
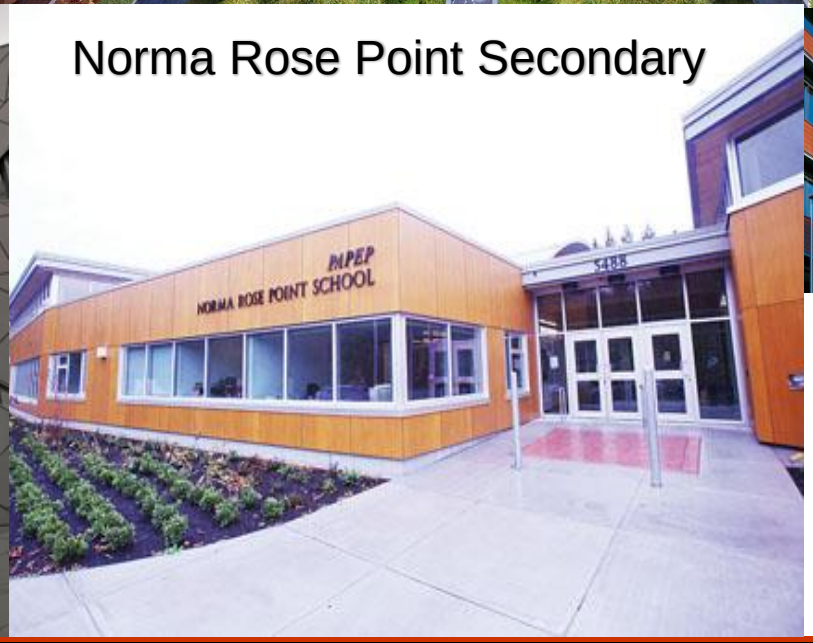
Vanglo House
LWPAC

Shannon Estates – PERKINS + WILL



Erl Tirol - Festival hall
DELUGAN MEISSL

Norma Rose Point Secondary



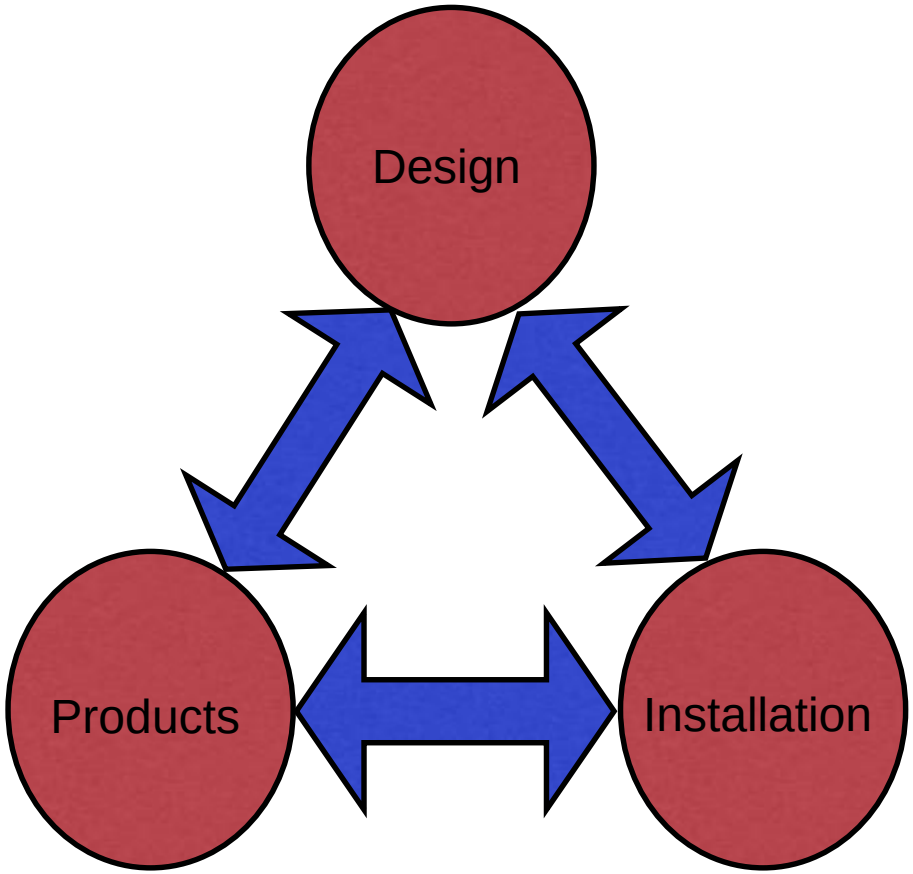
ENGINEERED
ASSEMBLIES

Agenda

- Scope
- Market and code
- Impact to Buildings
- Design Solution
- Future

ENGINEERED ASSEMBLIES

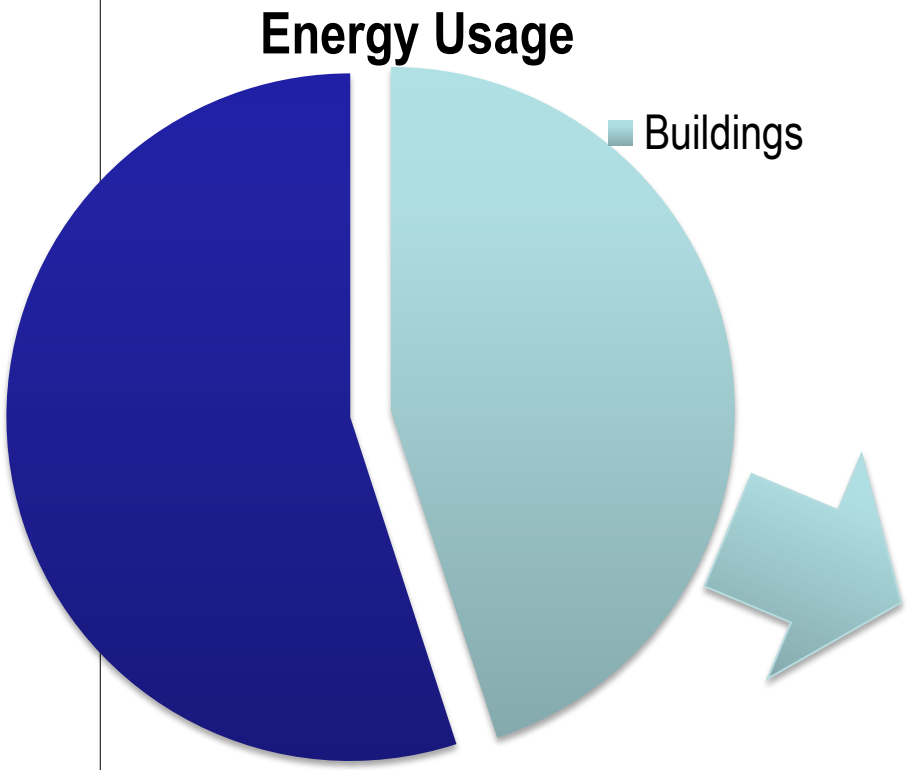
“Uniting the house of Design with the field of Construction”

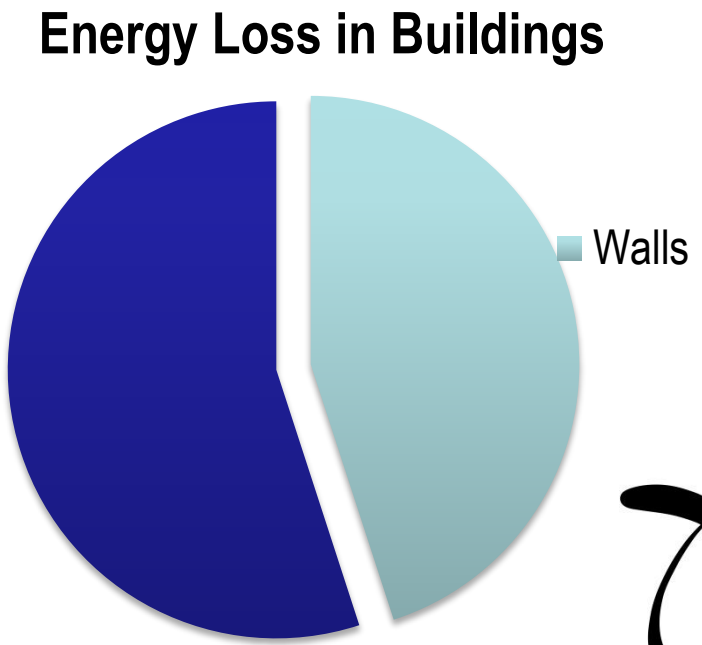


ENGINEERED ASSEMBLIES

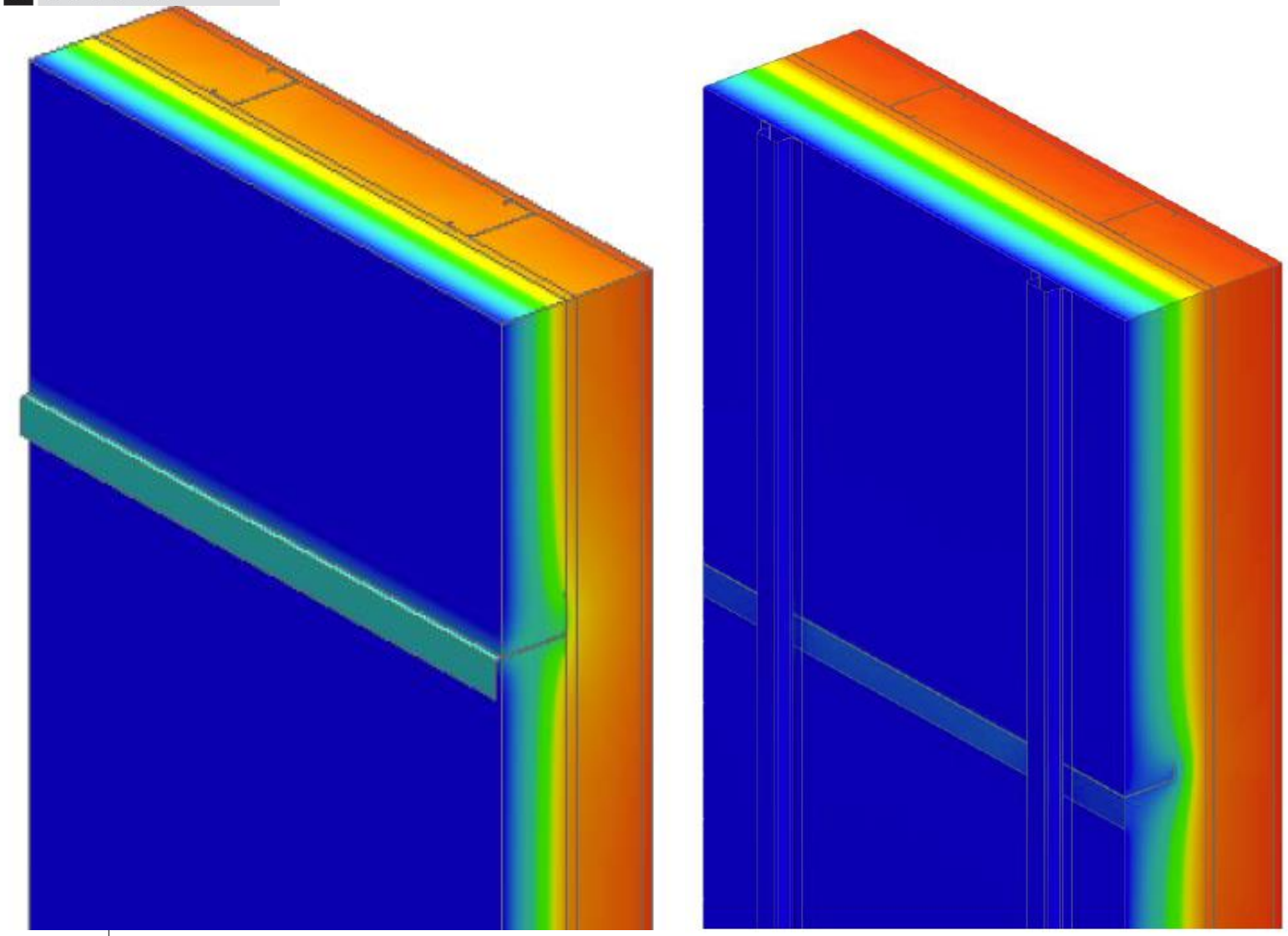
- Thermal bridging
- Exterior opaque walls
- Ventilated Facades using ‘panels’
- ICI building market

ENGINEERED ASSEMBLIES





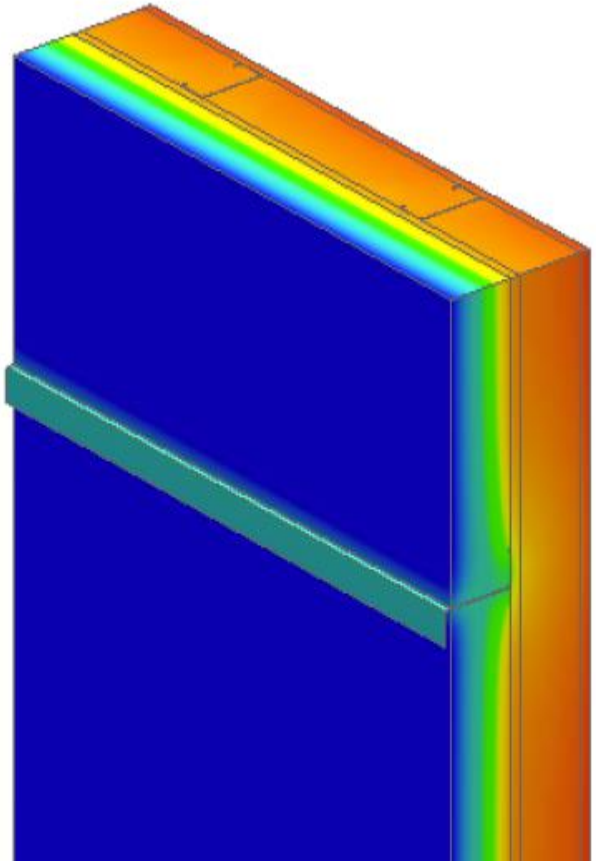
ENGINEERED ASSEMBLIES



Source: Morrison Hershfield

ENGINEERED ASSEMBLIES

Steel through insulation



- Short circuit or leak; need to view in 3D
- Steel 1000 times U Value (conductance)
- Energy loss from warm side, not just studs

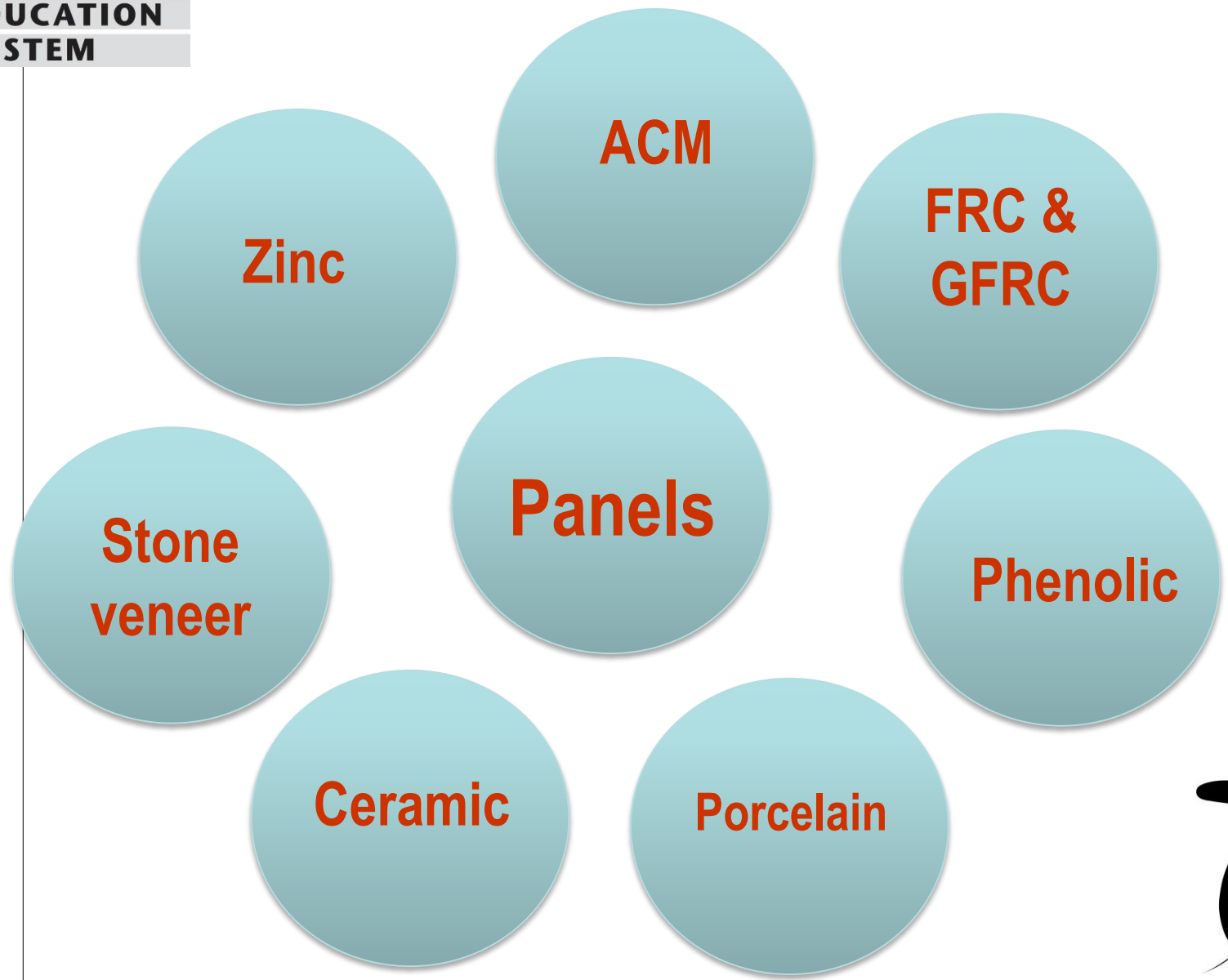
ENGINEERED ASSEMBLIES

Sources to support

- ASHRAE RP 1365
- “2 R’s don’t make your U” – Mark Lawton Morrison Hershfield
- ASHRAE 90.1
- NECB 2011
- Many other – we did not invent this

ENGINEERED ASSEMBLIES

Architect: WZMH

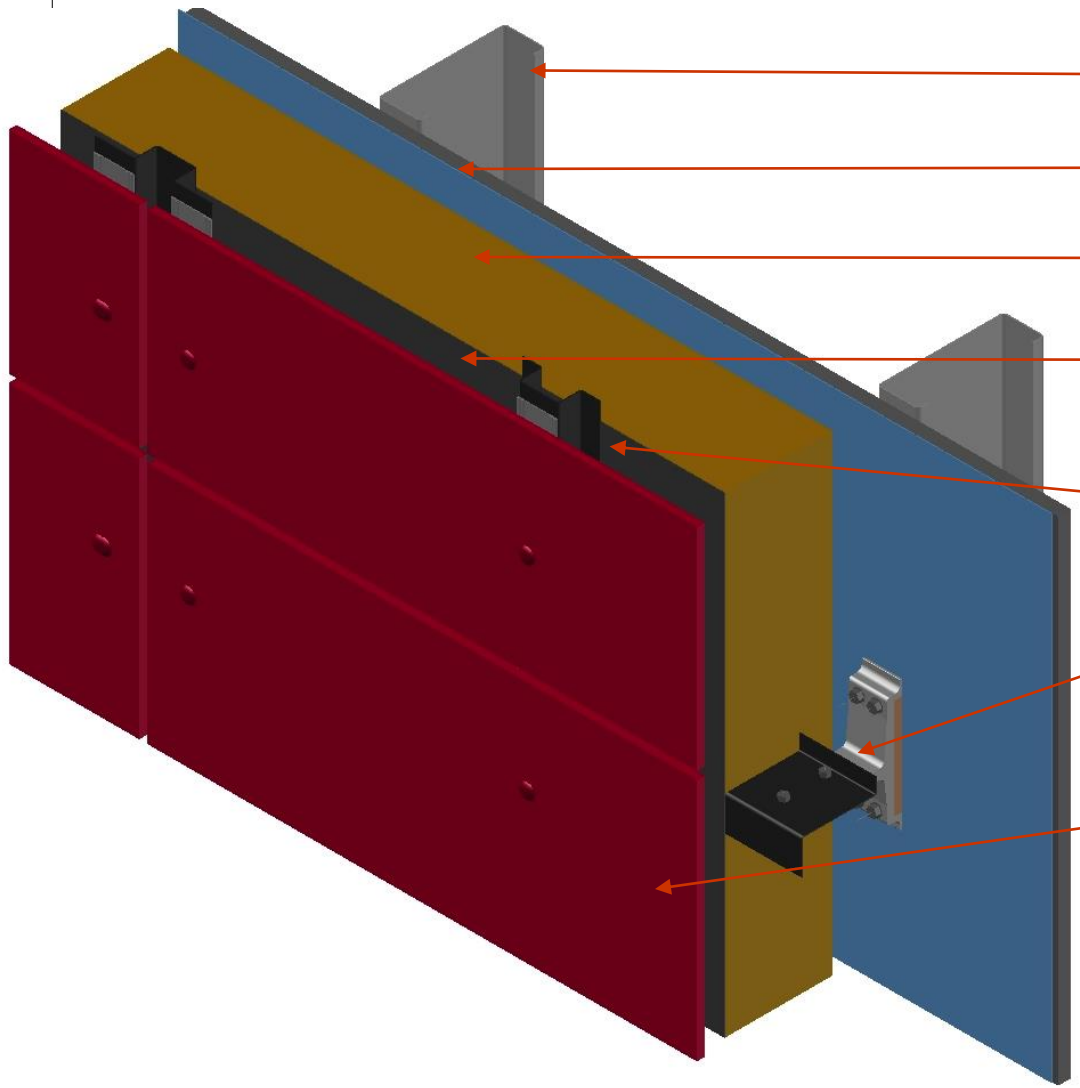


ENGINEERED ASSEMBLIES

AIBC CONTINUING EDUCATION SYSTEM

RVRS Façades

(Rear Ventilated Rain Screen)



Typical

- Structure
- Air/Vapor Barrier
- Insulation
- Breathable Membrane (by EA)
- **Vertical** Girt (by EA) and typical 1” Cavity
- TClip and Horizontal Girt (by EA)
- Panel (by EA)

ENGINEERED ASSEMBLIES

Definitions

- U Value – (thermal conductance) the overall heat transfer coefficient that describes how well a building element conducts heat or the rate of transfer of heat
- R Value – (thermal resistance) the capacity of an insulating material to resist heat flow
- Nominal R Value – thermal resistance where only insulation
  - Typically one point in wall
  - No accounting for thermal bridges
- Effective R Value
  - Total wall performance
  - Input for total building performance
  - Accounts for thermal bridges

ENGINEERED ASSEMBLIES

How did we get here?

ENGINEERED ASSEMBLIES

Shaping Tomorrow's Built Environment Today

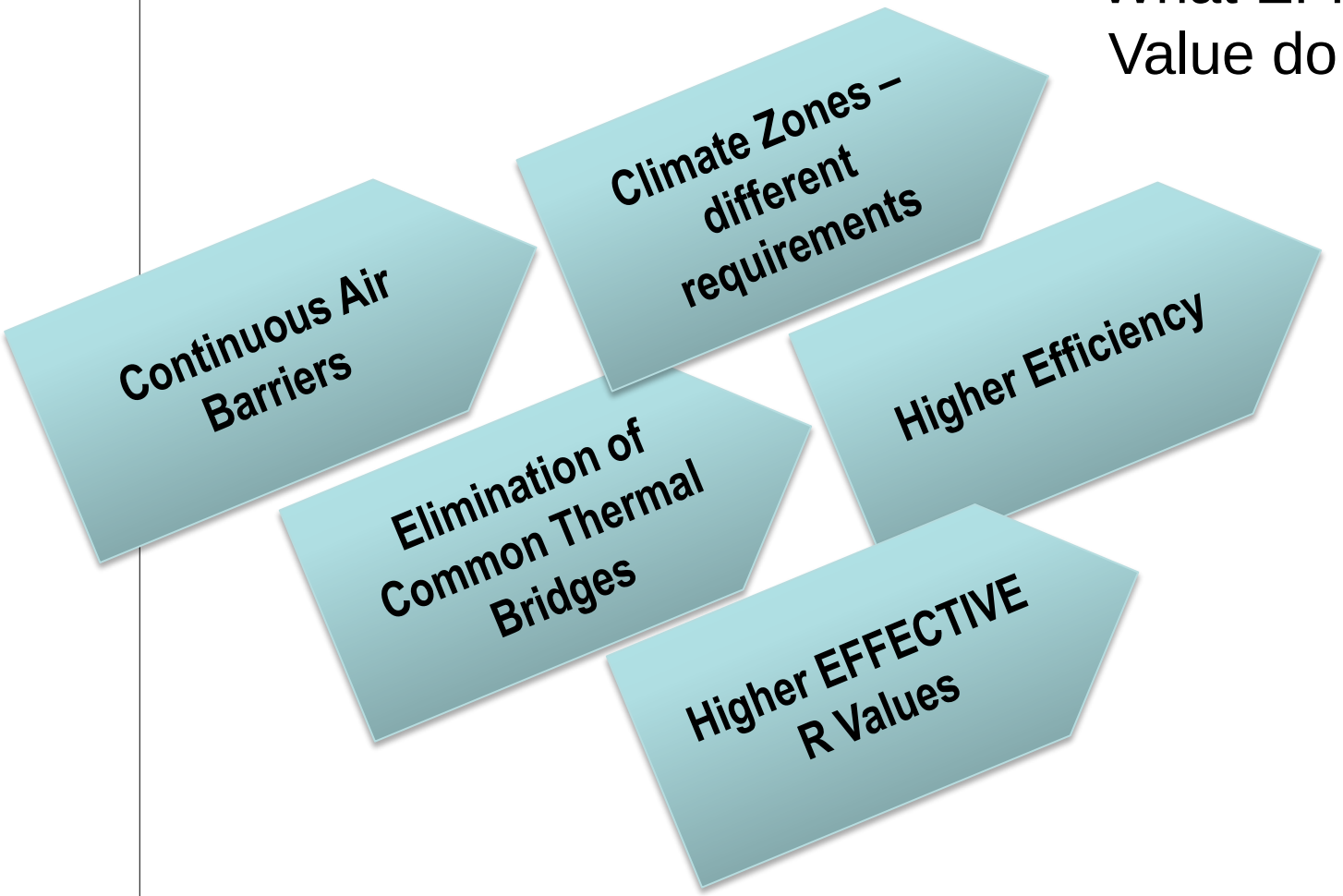
NECB 2011

ENGINEERED ASSEMBLIES

ASHRAE 90.1

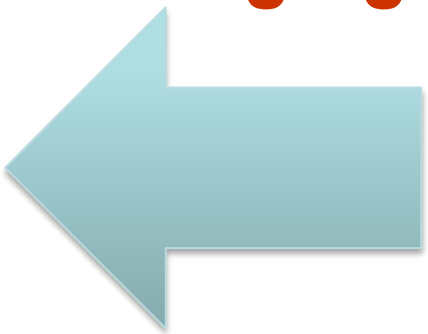
ENGINEERED ASSEMBLIES

What EFFECTIVE R Value do you need?



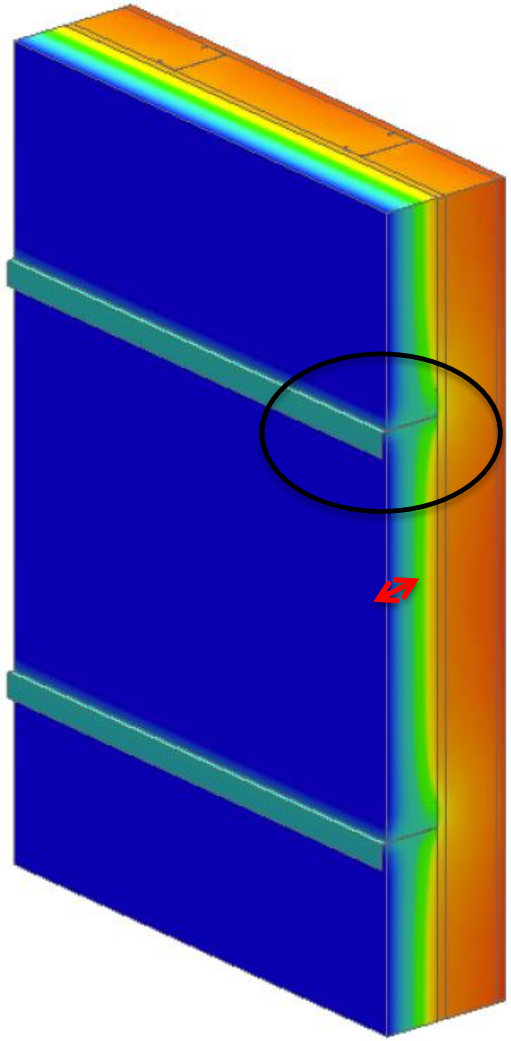
ENGINEERED ASSEMBLIES

Sources of Thermal Bridging



- Metal substructure in cladding
- Window and door frames
- Parapets
- Slab edges

ENGINEERED ASSEMBLIES



Effective R Value = 10.2

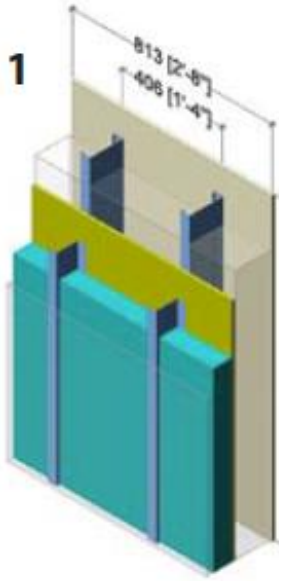
Old Ways Won't Do

Nominal R Value = 16

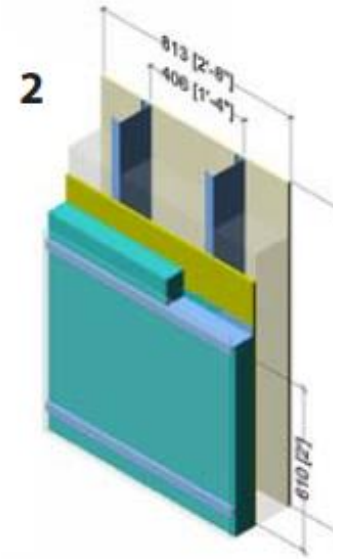
Worse the more insulation is required

ENGINEERED ASSEMBLIES

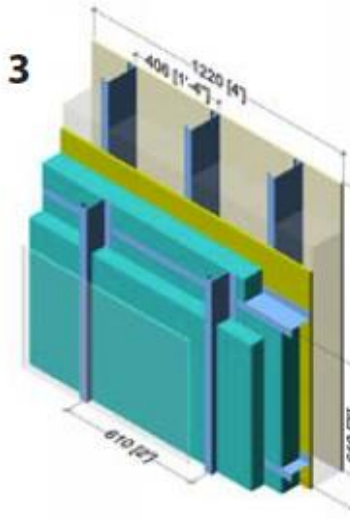
Old Ways Won't Do



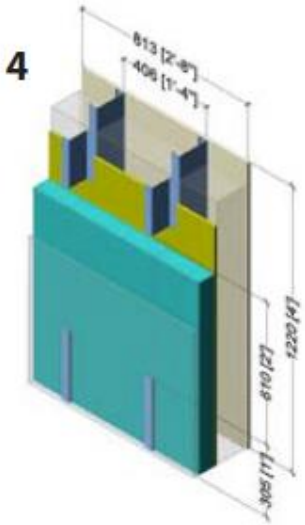
VERICAL Z-GRIT



HORIONTAL Z-GRIT



VERTICAL and HORIZONTAL Z-GRITS



INTERMITTENT Z-GRITS SPACED 12", 24" and 36" APART

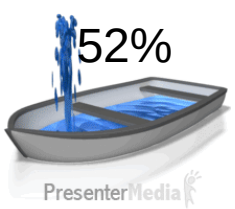
Source Morrison Hershfield

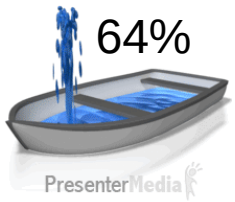
ENGINEERED ASSEMBLIES

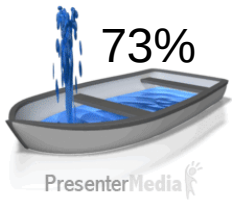
Old Ways Won't Do

Target Effective R Value	Continuous Vertical Girts	Continuous Horizontal Girts	Cross Girts
21 (3.70)	11.1(1.96)	13.5(2.38)	15.4(2.71)

Imperial (Metric)







Source: Morrison Hershfield

ENGINEERED ASSEMBLIES

Figure A-1.1.4.1.(1)
Average annual heating degree-days (C-degrees)

Status of Code

- BC. ASHRAE 90.1-2010
- City of Vancouver. ASHRAE 2010 + 20%,
- Ontario. ASHRAE 90.1 is code SB10 and 12
- New Brunswick and Nova Scotia; NECB 2011 in 2015
- Alberta talking
- Quebec: residential code
- NBC: not sure
- International Construction Code; ASHRAE 90.1 in code

Source: Morrison Hershfield

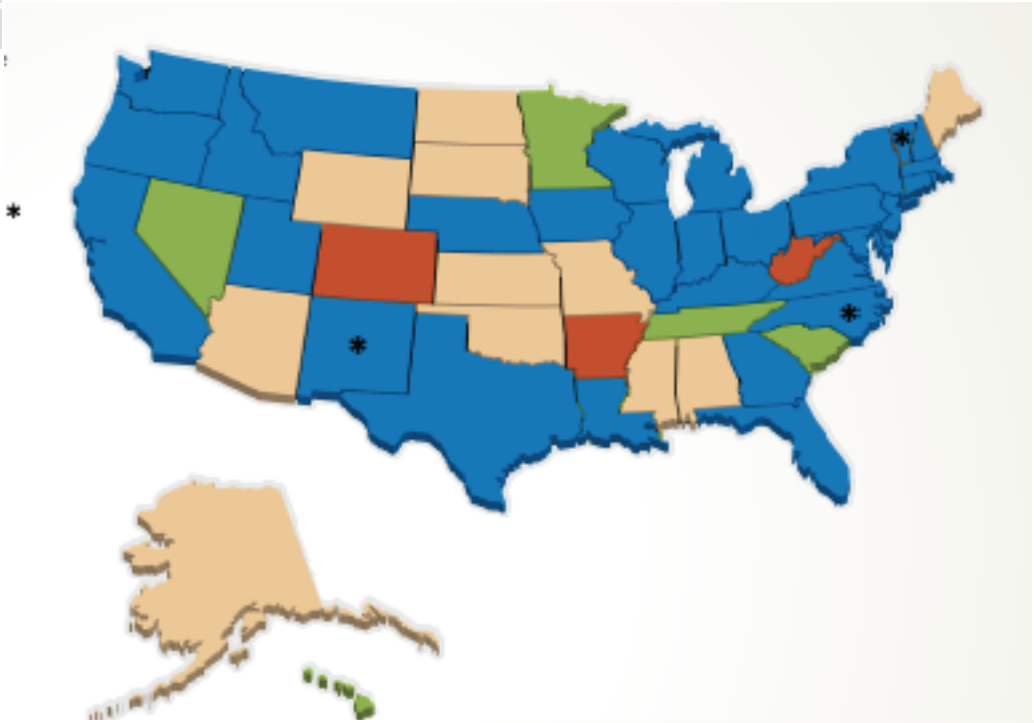
ENGINEERED ASSEMBLIES

USA – 2015 a big year

- The Department of Energy (DOE) is committed to increasing energy efficiency in all buildings…….. cost effectively increase energy savings by 50% through more efficient building codes by 2015.

- BECP engages with states and jurisdictions throughout the adoption process to provide technical assistance and support to ensure that codes ……..adoption strategy that will enable 70% of the states to adopt either 2009 IECC, ASHRAE Standard 90.1-2007 or better by 2015.

ENGINEERED ASSEMBLIES



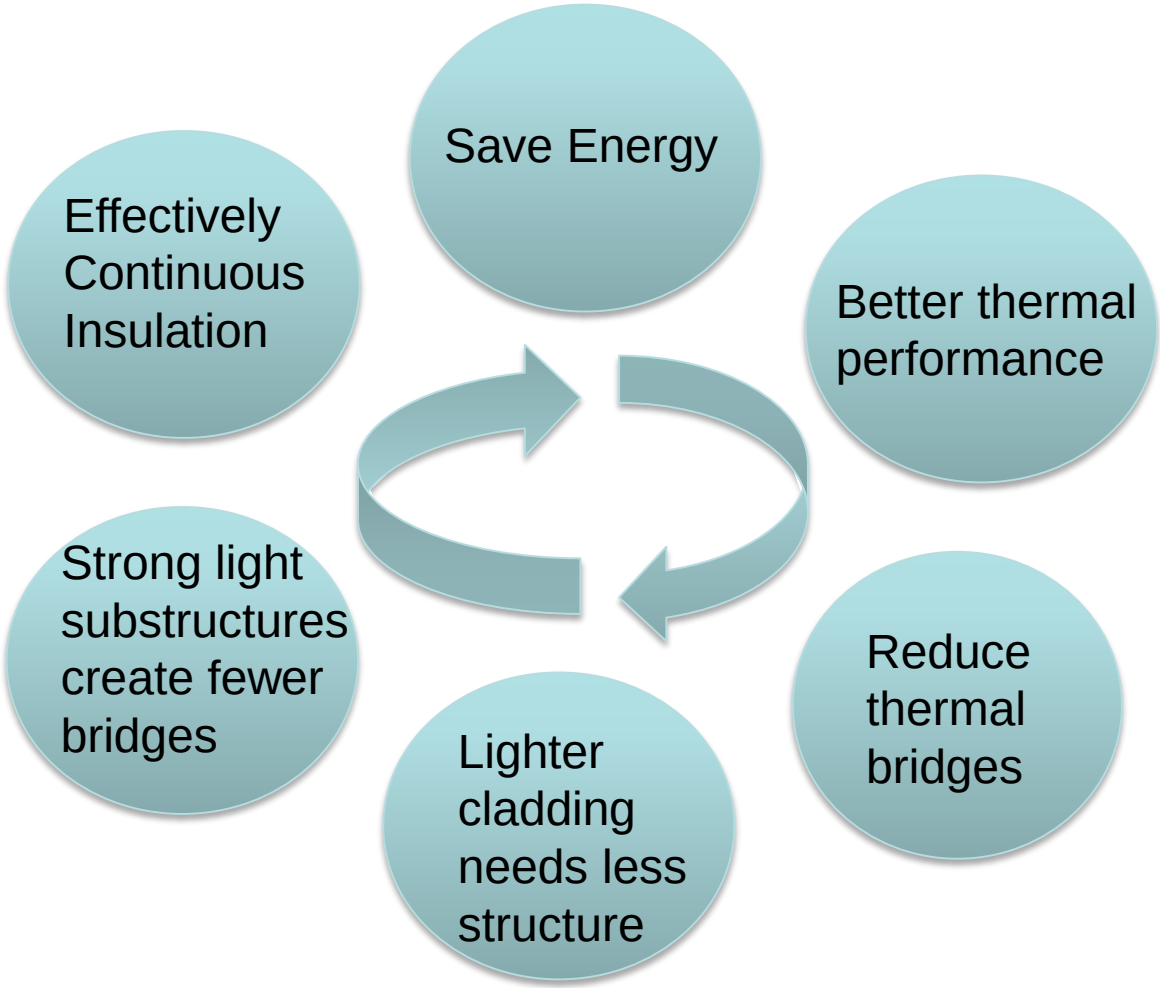
34	ASHRAE 90.1-2007/IECC 2009, equivalent or more stringent
5	ASHRAE 90.1-2004/IECC 2006, equivalent
4	ASHRAE 90.1-2001/IECC 2003, equivalent or less stringent
12	No statewide code
*	Adopted new code to be effective at a later date

ENGINEERED ASSEMBLIES

Impact to buildings

ENGINEERED ASSEMBLIES

Systems Thinking



ENGINEERED ASSEMBLIES

What matters with Thermally Broken Façade Solutions

System	Design Freedom =	Cost effective	Non combustible	Suited for Ventilated facade	Works w All Insulations
	☑	☑	☑	☑	☑

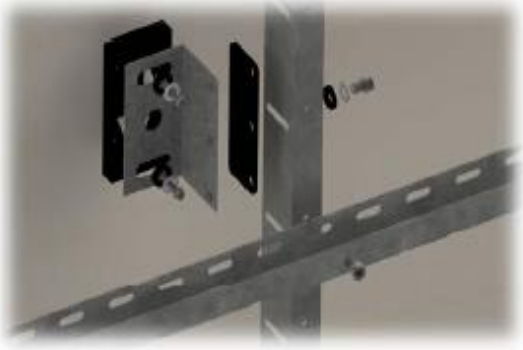
Design freedom = clips free to be anywhere so Architect can create with no limits from substructure

ENGINEERED ASSEMBLIES

Impact

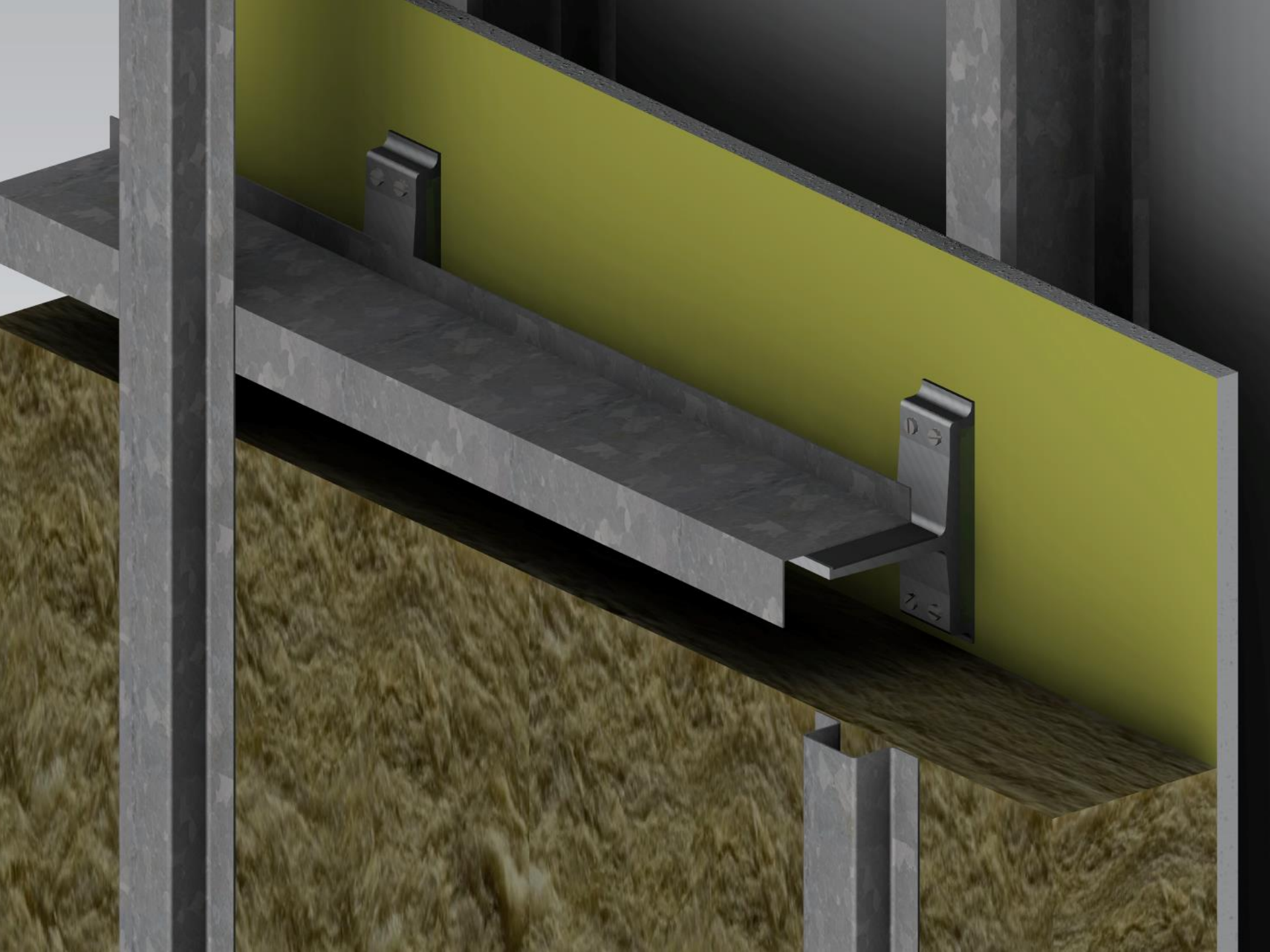
- Thicker walls 4” minimum
- Adjustability for misaligned studs available
- Flexibility for shapes of walls
- ***Design freedom either same or less – watch this issue***
- Continuous AVB possible
- Continuous weather barrier possible

ENGINEERED ASSEMBLIES



SOURCE: WEB

ENGINEERED ASSEMBLIES



Thermal Performance Choice

- All Compliant
- Some with lesser or greater thermal performance
- Modeling of your building only way

- But for sure we know old ways do not work

- Examples to follow

ENGINEERED ASSEMBLIES

Table 2: Clear Field Effective Thermal Resistance with no Interior Insulation

Clip System (Inches of Mineral Wool)	Exterior Insulation Nominal R-Value hr·ft²·°F/BTU (m²K/W)	Assembly Effective R-Value hr·ft²·°F /BTU (m²K/W)					
		E.A. Clip System			Continuous Vertical Girts @ 16" o.c.	Continuous Horizontal Girts @ 24" o.c.	Vertical/ Horizontal Girts @ 24" o.c.
		34" Vertical Clip Spacing	41" Vertical Clip Spacing	48" Vertical Clip Spacing			
T100 (4")	16.8 (2.96)	16.4 (2.89)	16.9 (2.99)	17.2 (3.04)	10.1 (1.78)	11.9 (2.10)	13.2 (2.33)
T125 (5")	21.0 (3.70)	19.6 (3.45)	20.4 (3.59)	20.8 (3.67)	11.1 (1.96)	13.5 (2.38)	15.4 (2.71)
T150 (6")	25.2 (4.44)	22.7 (4.00)	23.8 (4.19)	24.4 (4.30)	11.9 (2.10)	14.5 (2.55)	18.4 (3.24)

99% Pass

52% Fail

64% Fail

73% Fail

Source: Morrison Hershfield

Source Cascadia

THERMAL PERFORMANCE DATA

Assembly information

- Full Height Wall
- Insulation: Stone Wool by Roxul (R4.2/in)
- Values are for 16" O.C. Stud Spacing

Cascadia strongly recommends that the design team retain the services of a qualified building science consultant to review any split insulation applications.

Clip width	3 5/8" Steel Studs	Effective R-Value [FT²·°F·HR/BTU]	Wood Studs	Effective R-Value [FT²·°F·HR/BTU]	
				2x4 Studs	2x6 Studs
3.5"	Empty	14.1	Empty	16.4	16.9
	With R-12 Batt Insulation	18.0	With R-12 or R-19 Batt Insulation	24.4	29.6
4"	Empty	15.7	Empty	18.0	18.6
	With R-12 Batt Insulation	19.5	With R-12 or R-19 Batt Insulation	26.1	31.2
5"	Empty	18.5	Empty	21.1	21.6
	With R-12 Batt Insulation	22.4	With R-12 or R-19 Batt Insulation	29.3	34.4
6"	Empty	21.4	Empty	24.2	24.6
	With R-12 Batt Insulation	25.2	With R-12 or R-19 Batt Insulation	32.4	37.5

ENGINEERED ASSEMBLIES

Source TAC Clip

Insulation Thickness	Nominal R-Value @ R 4.2 / inch
3"	R-12.6
4"	R-16.8
5"	R-21.0
6"	R-25.2

ENGINEERED ASSEMBLIES

TClip Performance Engineering Complete

- Meets the prescriptive requirements for non- residential steel stud walls in ASHRAE 90.1-2007/2010 for all climate zones.
- Performance of the system is validated through Modeling and the Finite Element Analysis (FEA)
- Designed for Mid- and High-Rise (Non-Combustible) building envelopes
- Engineered to accommodate Façade panels generally 8-26mm in thickness
- Engineered for wind loads up to 50psf
- Optimized vertical spacing – 900mm up to 1200mm apart

MORRISON HERSHFIELD

ENGINEERED ASSEMBLIES

Model holds for all insulations

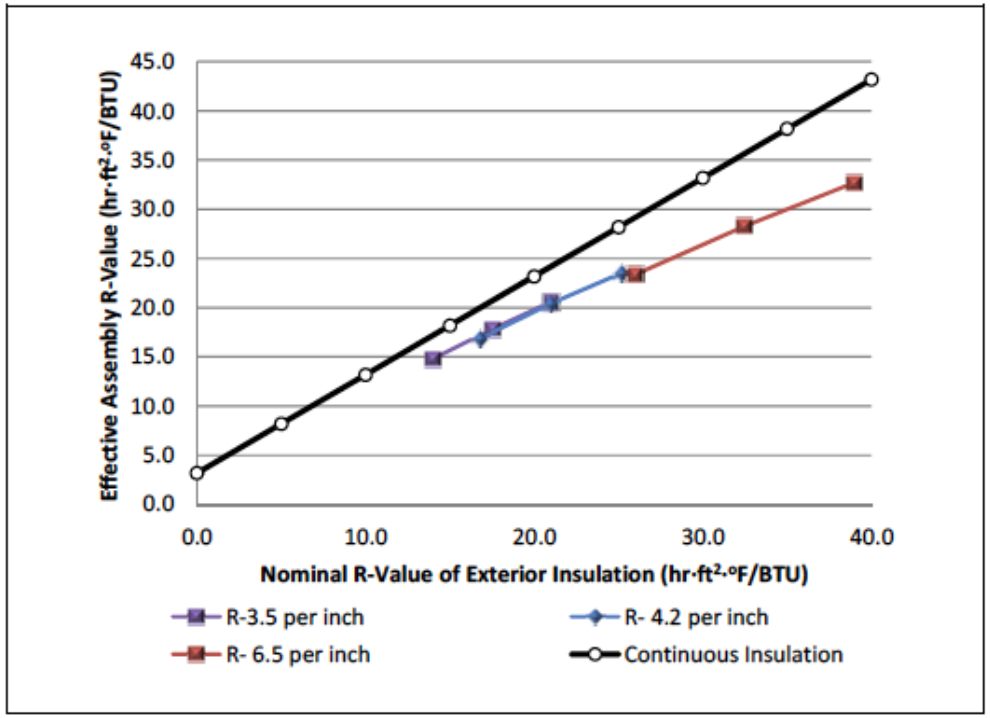


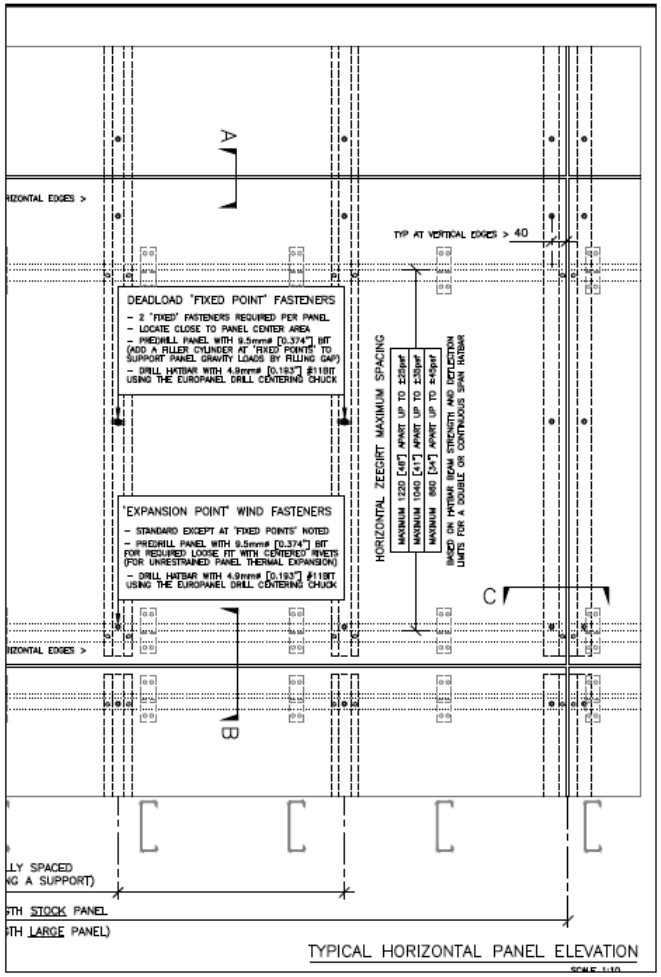
Figure 1: *Effective Assembly R-Value vs Nominal Insulation R-Value for a variety of insulation materials for 41 in clip spacing*

thermal resistance is independent of
-Thickness of insulation
-Type of insulation

So pick the best insulation you can afford, and TClip provides you the ASHRAE 90.1 and highest effective solution

ENGINEERED ASSEMBLIES

How Many Do I need



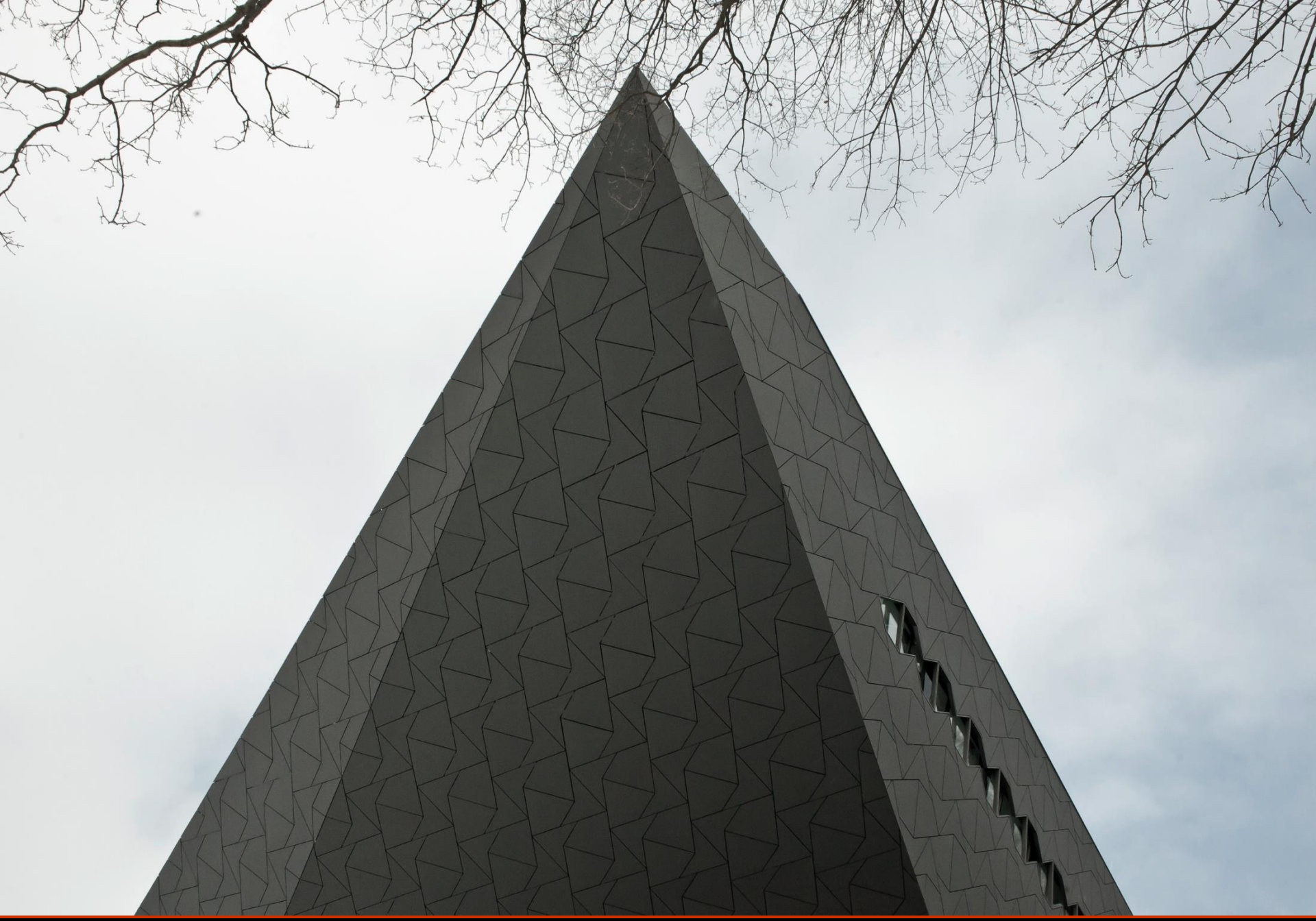
TClip on each stud (400mm o.c.)

1200mm vertical dimension

ENGINEERED ASSEMBLIES

Design Freedom

ENGINEERED ASSEMBLIES

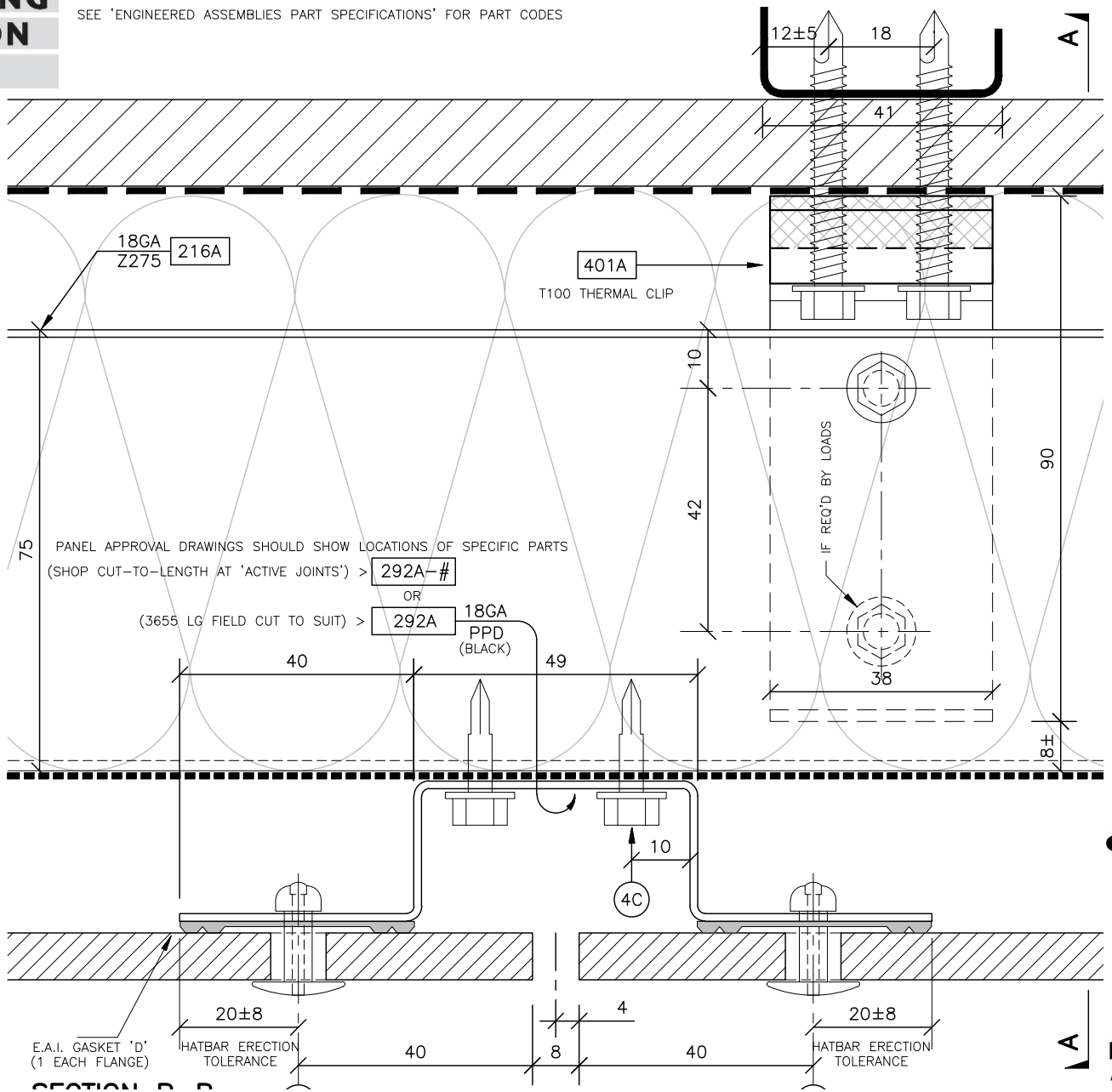


Johann-Sebastian-Bach hall, castle in Köthen,
Busmann + Haberer architects, Berlin


Knox Church
Baird Sampson Neuert
BMO

Location of this
Independent of

This

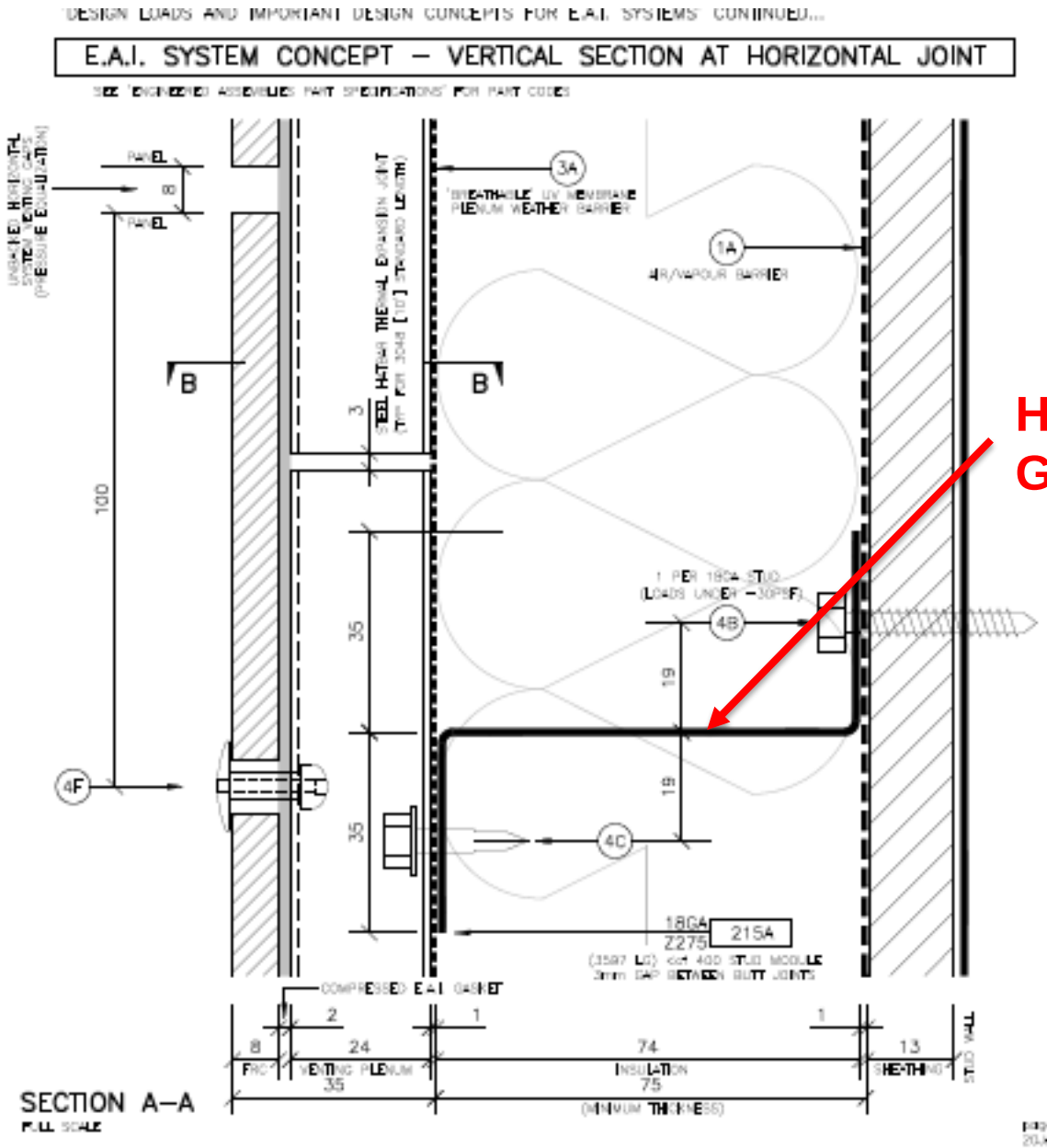


ENGINEERED ASSEMBLIES

Design

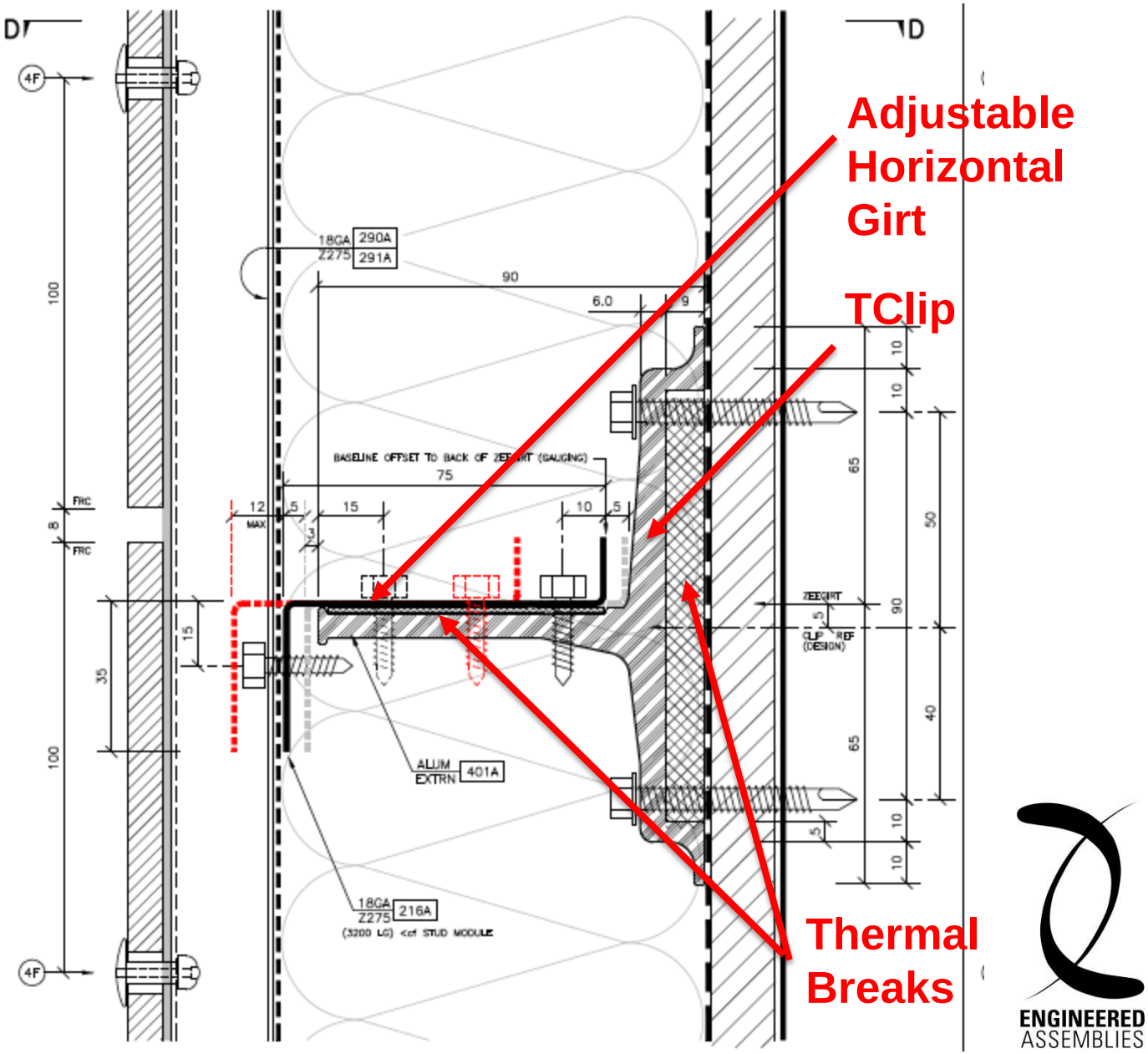
ENGINEERED ASSEMBLIES

The Old Standard



ENGINEERED ASSEMBLIES

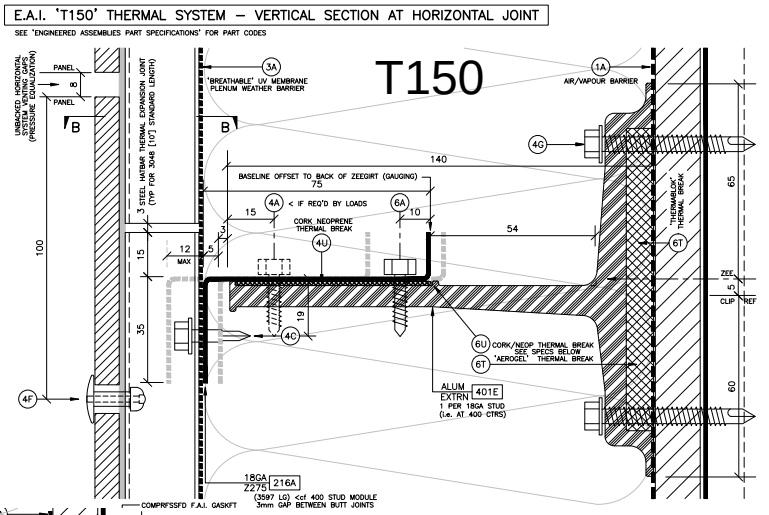
The New Standard

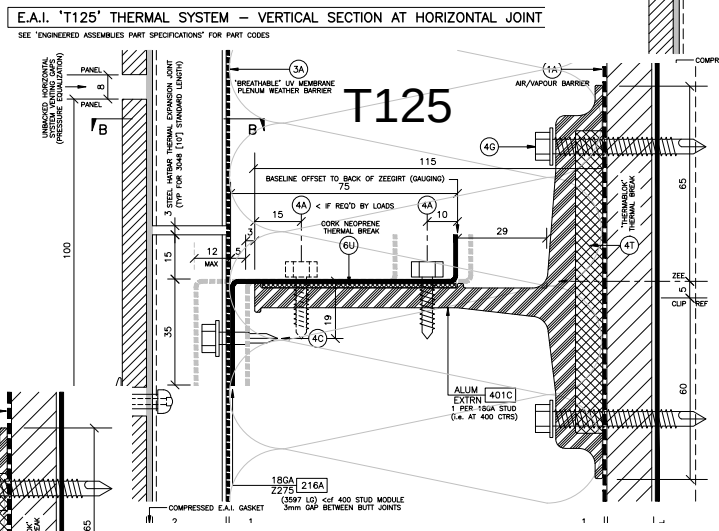


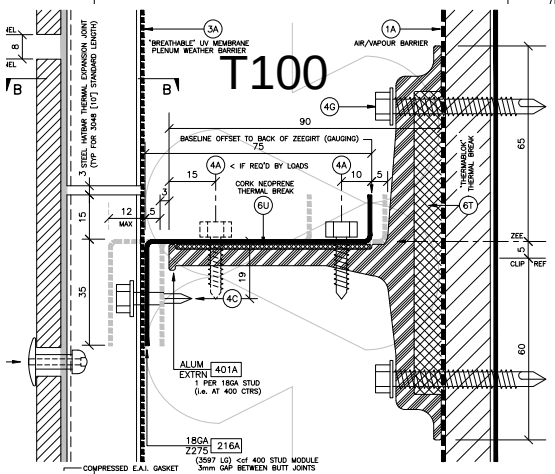
ENGINEERED ASSEMBLIES

Three Clear Field Dimensions

-Adjustable for wall alignment







ENGINEERED ASSEMBLIES

Breather Membrane

Dry!

1. Secondary **drainage plane**
2. Insulation performs better
3. Vapour escapes
4. Not visible
5. UV resistant

ENGINEERED ASSEMBLIES

Constructability

- Adjustability
- Vertical girt independence
- Window detailing simple

ENGINEERED ASSEMBLIES

Adjustability – a big consideration

- Quotes from contractors
  - 3.5” difference across a four storey wall based on slab edge locations typical
  - Old way – adjustable bars
    - **2 x as many bars**
    - Labour expensive
    - Too many things to adjust
    - Insulation hard to install
  - New way – adjustability in clip
    - 130 linear feet of bars per person per day
    - Tools available for easy alignment
    - Installation steps are separate

1. Install Clips
2. Find level plane
3. Install Horizontals to level plane
4. Insulate and membrane
5. Verticals
6. Panel

ENGINEERED ASSEMBLIES

Speed of construction

- Different steps mean different crews with repeatable processes
- Fast alignment means resolving wall easy
- Difficult to fail ; easy to fix

ENGINEERED ASSEMBLIES

Traditional system**	TcLip system	Adjustable system
Horiz bars 3’ o.c. Vertical bars 2’ o.c.	TcLip on each stud Horiz bars 4’ o.c. Vertical bars 2’ o.c.	Adj. Horiz bars 3’ o.c. Vertical bars 2’ o.c.
1.3 Crew hours / 100 sq ft	2.0 Crew hours / 100 sq ft	3.7 Crew hours / 100 sq ft
	$1.2/sq ft premium Material + Labour	$3.0/sq ft premium Material + Labour
	5000 sq ft job = $6k premium	5000 sq ft job = $15k premium

Traditional systems had much less insulation too, so difficult to do apples to apples

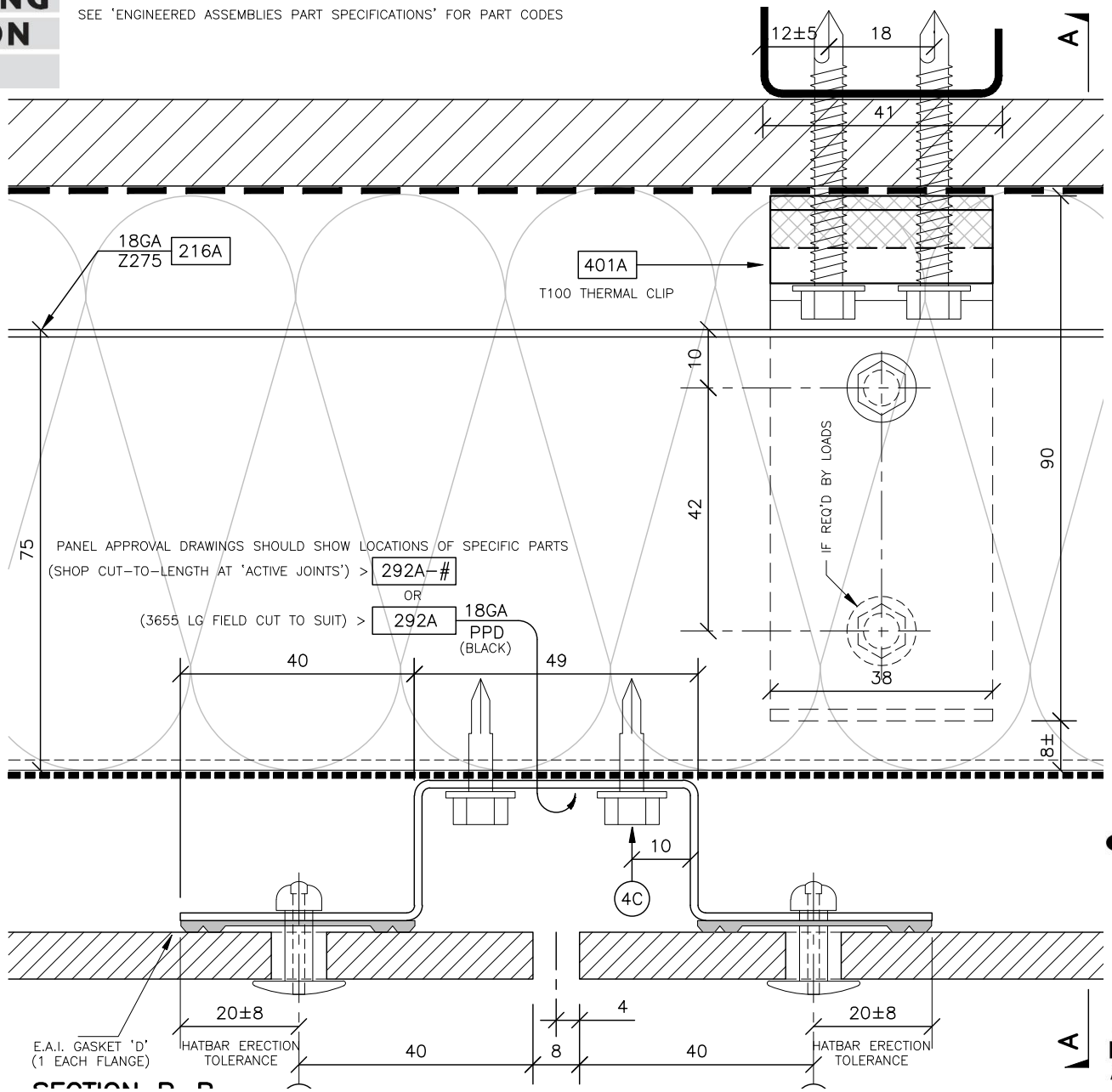
ENGINEERED ASSEMBLIES


SOPREMA
Genie
1


SOPREMA
United Rentals
1-800-UR-RENTS
SKYJACK
www.unitedrentals.com

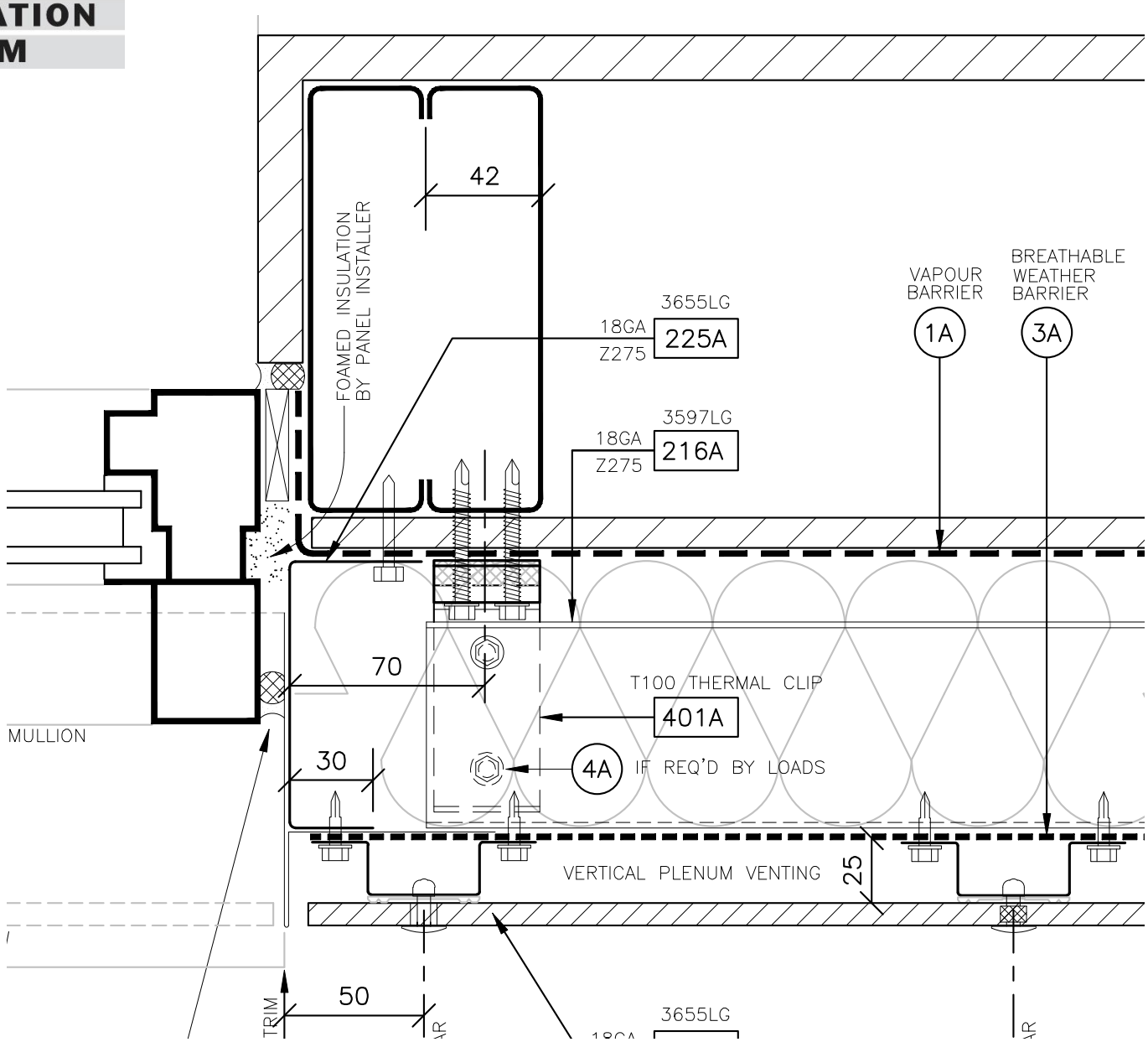

RADIUS
SECURITY
24/7
REMOTE GUARDING
1.877.532.2407
SKYJACK
PIT STOP

Plan View



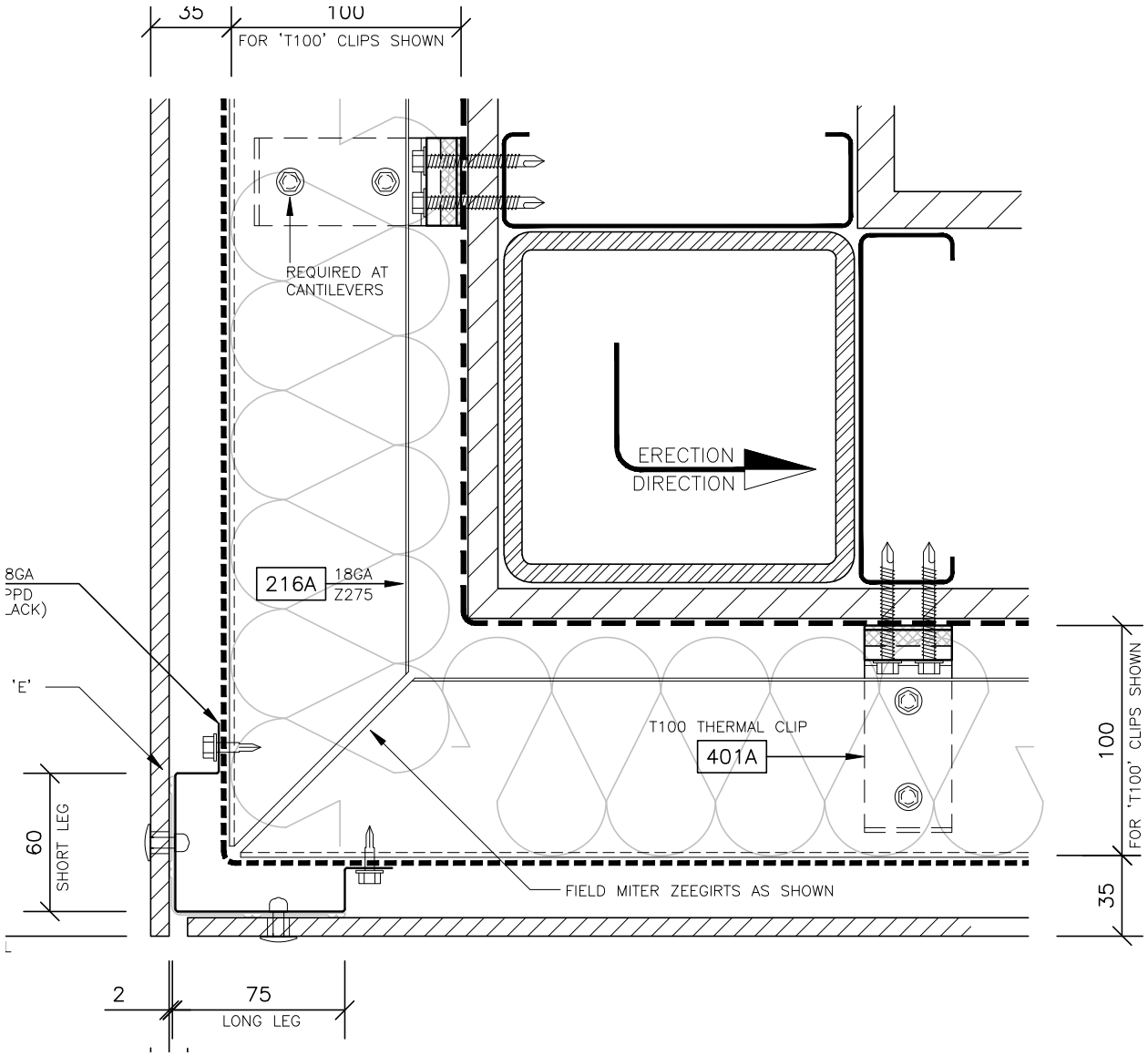
ENGINEERED ASSEMBLIES

Window Jamb



ENGINEERED ASSEMBLIES

Outside Corner



ENGINEERED ASSEMBLIES

How to specify

- Prescribe products
  or
- Set performance requirement

- Otherwise you do not know what you will get.
  'Thermal Spacer' is not enough

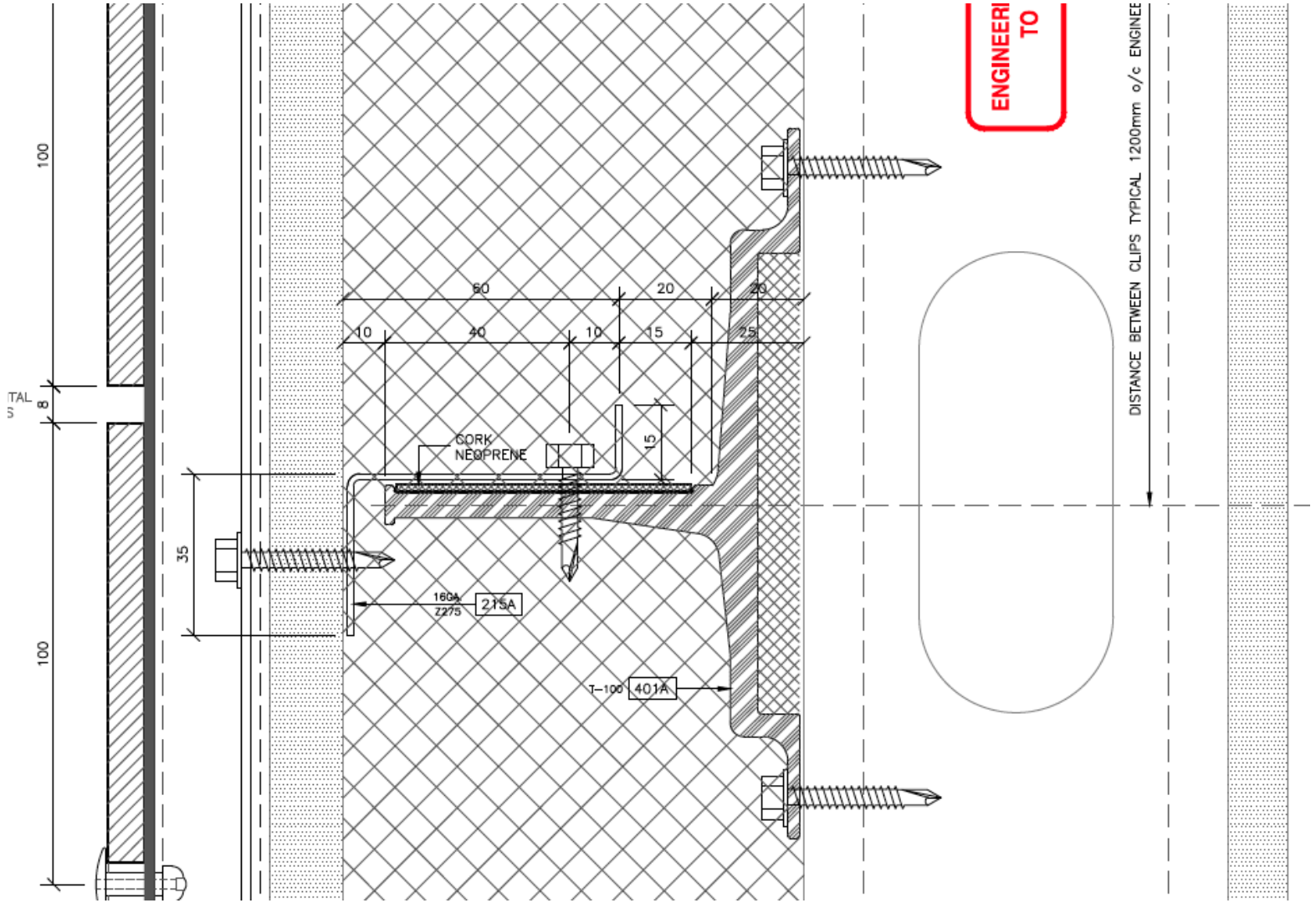
ENGINEERED ASSEMBLIES

Future

- Fewer clips ; skip studs
- New designs
- Other things on outside
  - Stone veneers
  - Solar panels
  - Communication equipment

ENGINEERED ASSEMBLIES

Spray foam – deep cavity solution




WZMH Architects

Hilditch Architects


Perkins Will

What matters with Thermally Broken Façade Solutions

System	Design Freedom =	Cost effective	Non combustible	Suited for Ventilated facade	Works w All Insulations
	☑	☑	☑	☑	☑

Design freedom = clips free to be anywhere so Architect can create with no limits from substructure

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Summary

- Building energy use matters
- Walls matter
- Thermal bridges matter
- ASHRAE has documented and it matters
- Code is setting higher minimums
- Constructable solutions exist
- Detailing constructable
- Cost effective design freedom exist

- So up to you.

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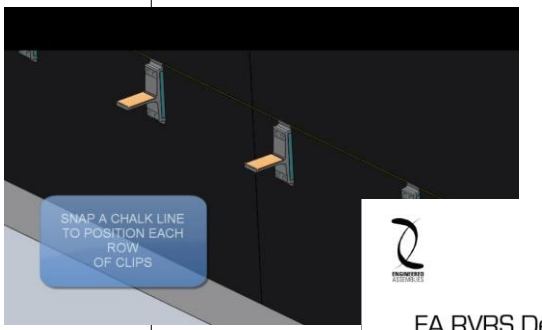
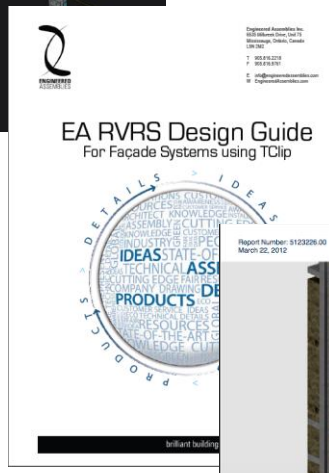
EA has all the info for you



Youtube Installation Animation



Design Guide

MH full report

LnL Preso

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