Detroit Public Schools (DPS)

Masonry Coalition

International Union of Bricklayers and Allied Craftworkers
Local 1 Michigan & Local 9 Michigan

IMI
UNION MASONRY CRAFTWORKERS
CONTRACTORS & CONSULTANTS
International Masonry Institute

MICHIGAN LECET
Laborers-Employers Cooperation
& Education Trust Funds
Locals 499, 1076, &1191

Portland Cement Association

PCA
Great Lakes
CEMENT PROMOTION
ASSOCIATION

Quality Performance
Mason Contractors' Association, Inc.
MICHIGAN

Mason Contractors' Association, Inc.

MASONRY
Institute of Michigan
Accessory, Stone & Block Suppliers

MCE
Michigan Council of Employers of Bricklayers and Allied Craftworkers

Detroit Children's Education

DPS School Construction Project
STUDENTS • JOBS • ECONOMIC GROWTH

- **Building 8 new schools**
  - **4 high schools (approx. 150,000 sf)**
  - **4 PK-8 (approx. 80,000sf)**

Detroit Children's Education

- **Improve district's progress toward creating safe, new, state-of- the-art Centers of Excellence in Detroit**

Opportunity for City of Detroit

DPS School Construction Project
STUDENTS ▪ JOBS ▪ ECONOMIC GROWTH

Phase I

- $500.5 million budget funded by stimulus dollars
  - $284 million for 8 new schools
  - $216.5 million for 4 major and 6 minor renovations
  - 6th largest allocation of construction bonds in the country
- Will create nearly 11,000 jobs

Phase II

- $700 million

Labor Analysis

Good News!

- **Long awaited economic recovery may be under way at last**

Bad News!

- **Detroit still has one of the nation's highest unemployment rates**

Opportunity for City of Detroit

DPS School Construction Project
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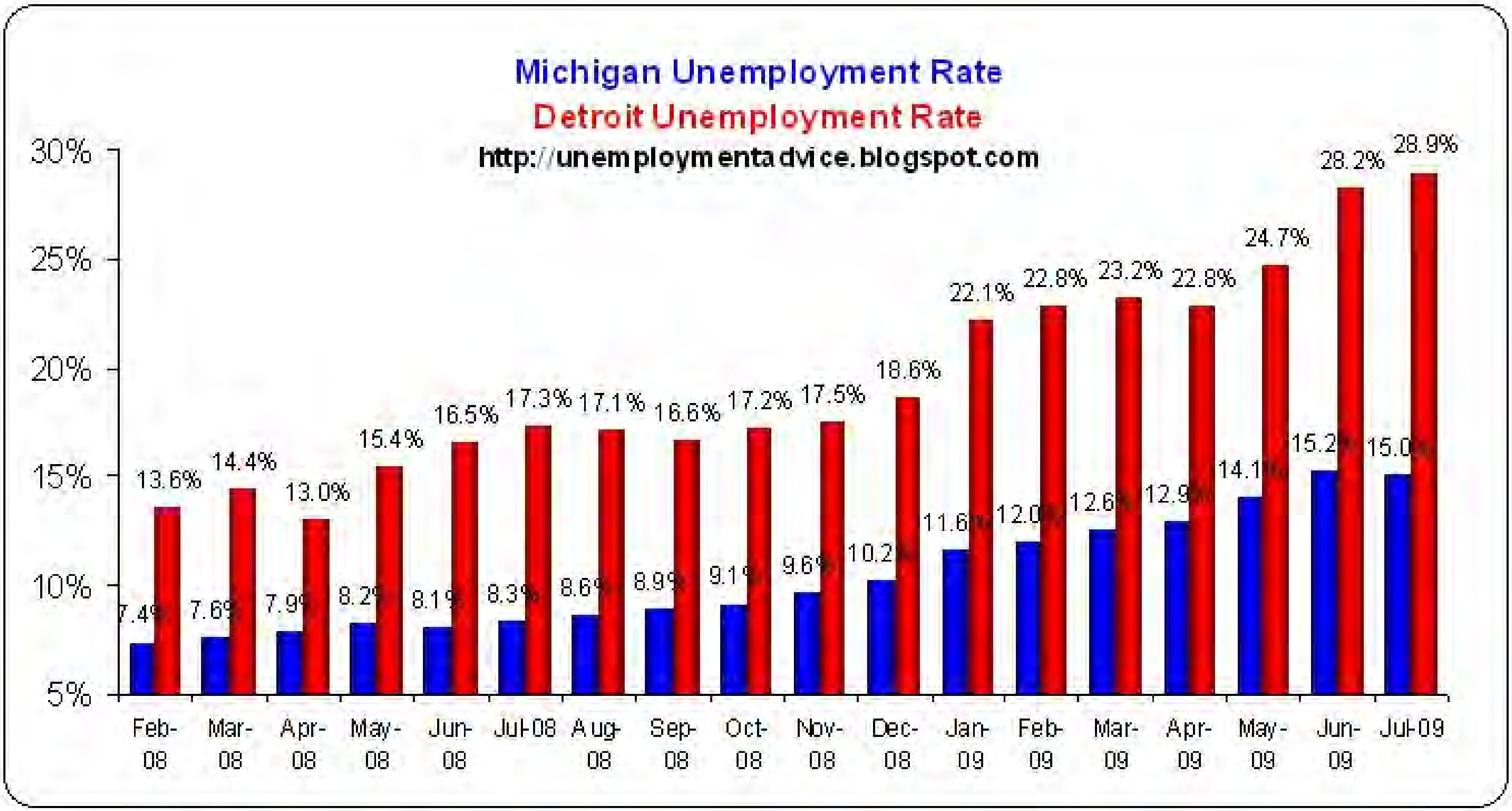

Labor Analysis

DPS School Construction Project
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Masonry Construction Misunderstood

- **Masonry puts more local people to work than any other building system!**
- **That's because masonry is (dare we say it?) labor intensive.**

Labor Analysis

Manpower

- **Bricklayers & Allied Craftworkers Local 1**
  - **192 Detroit resident bricklayer members**
  - **150 Detroit resident mason tender members**

IMI Training Programs

Bricklayer

IMI Training Programs

Pointer, Cleaner, Caulker

Labor Analysis

IMI Training Programs

CPR/First Aid

Labor Analysis

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IMI Training Programs

- AAC
- ACI
- Blue Print I & II
- Confined Space
- Flashing Certification
- Foreman Training I & II
- Grout Certification
- Hydromobile User Awareness
- Instructor Certification
- Jahn Stone Patching
- Journeyman Upgrading
- Marble Upgrading
- Masonry Science I & II
- Masonry Wall Bracing/Restricted Area
- Must Safety Modules & Drug Screening
- OSHA 500
- OSHA 10 Hour 1926
- OSHA 30 Hour 1926
- Scaffold Users
- Self Rescue Rope
- Stone Upgrading

Labor Analysis

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IMI Training Programs

- Suspended Scaffold Competent Person
- Terrazzo Upgrading
- Terrazzo Terra Top Certification
- Tile, Marble & Terrazzo
- Tile Upgrading
- Welding Certification

Labor Analysis

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Velocity of Money

- Brick, block, stone, mortar and grout are made locally
- Masonry materials delivered to the jobsite by local workers
- Masonry materials put in place by local craftpersons
- Nearly every dollar allotted to the masonry wall system remains in the local economy
- Economists estimate that every dollar generated in the local economy multiplies a minimum of four times!

Labor Analysis

■ **$284 million budget for 8 new schools**

■ **Masonry Construction**

324,000 bricklayer hours

178,000 laborer hours

Labor Analysis

Bricklayer and laborers

502,000 hrs	**$27,724,000**

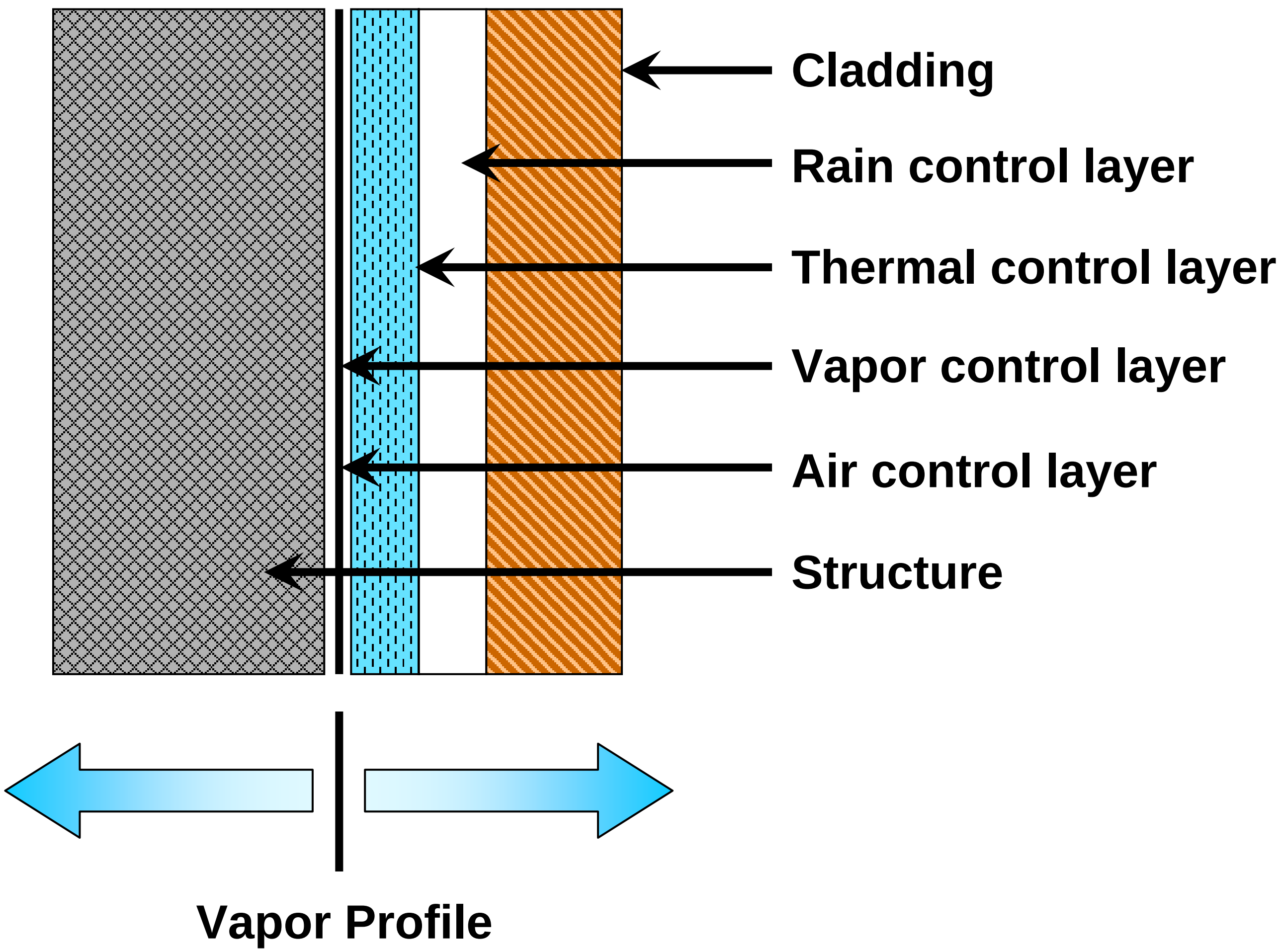
Masonry materials

brick, block, mortar and grout	**<u>$14,876,000</u>**
Dollar benefit to Detroit economy	**$42,600,000**

Velocity of Money (x4)

Total Economic Benefit	**<u>$170,400,000</u>**

Control Layers



The Perfect Wall, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

Environmental Loads

DPS School Construction Project
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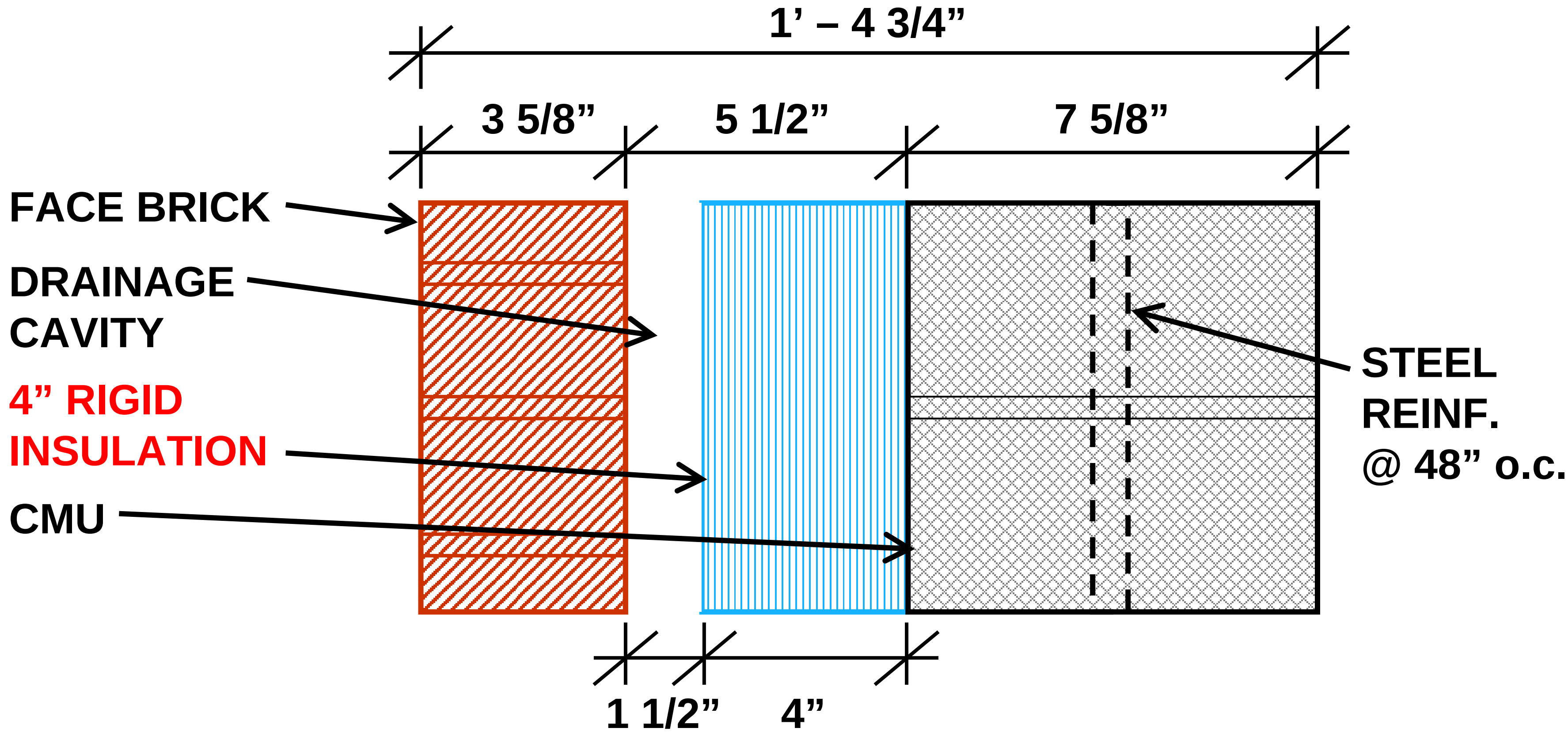
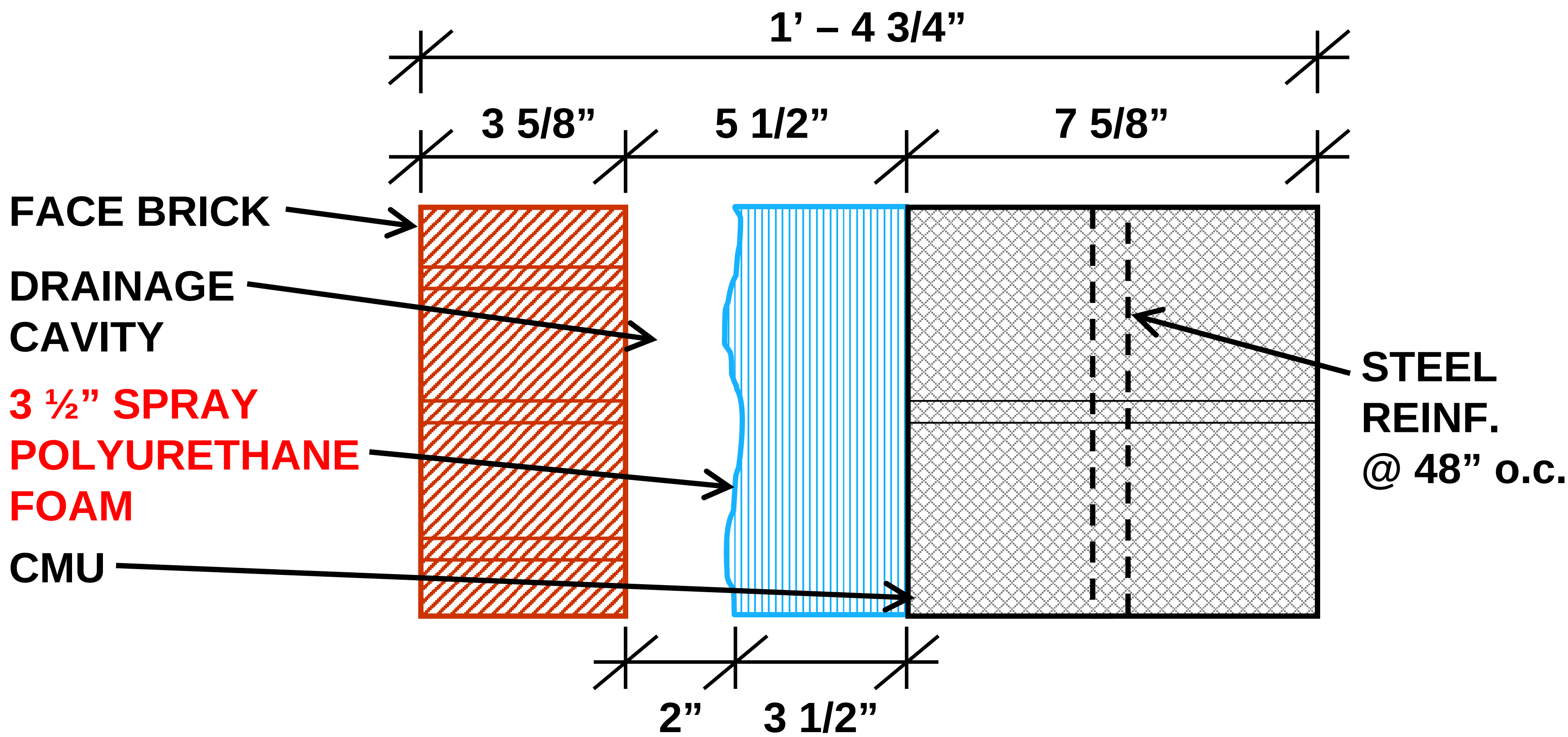


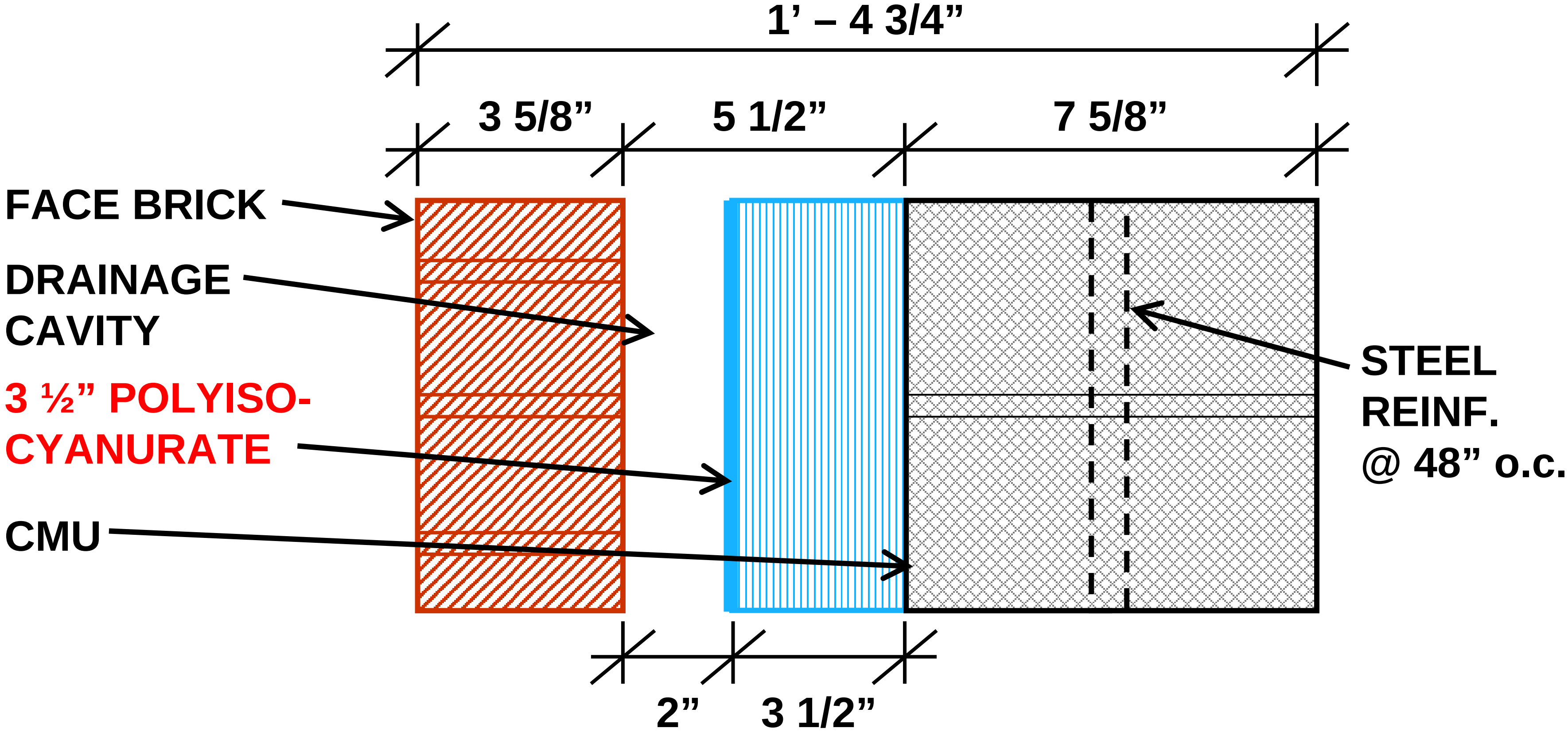
- **Calculated Fire Rating = 9 hours (4 hours)**
- **R-Value = 25.9**
- **STC = 55.2**
- **Control Layers: Rain, Thermal, Air**

Environmental Loads



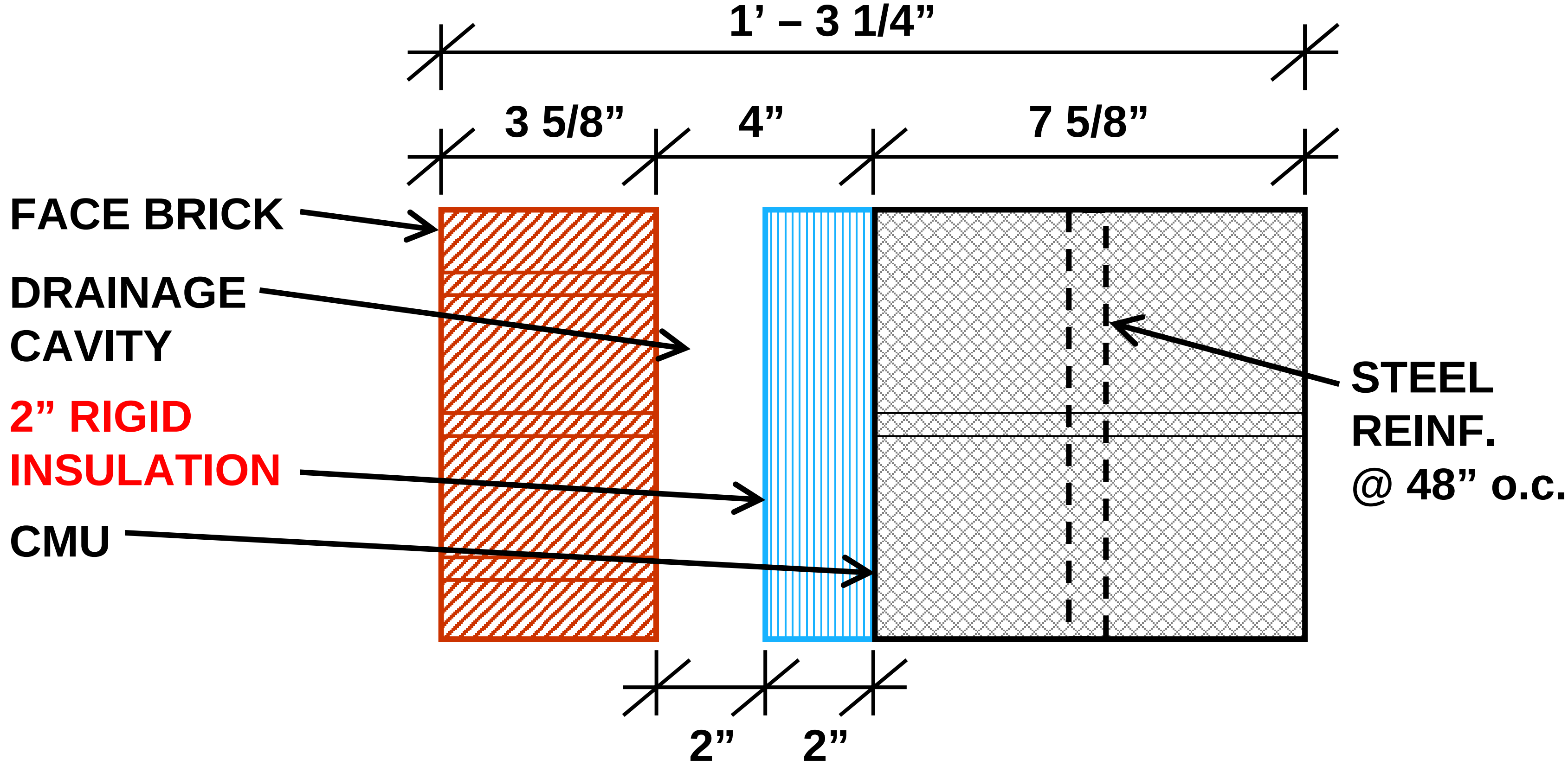
- Calculated Fire Rating = 9 hours (4 hours)
- R-Value = 27.3
- STC = 55.2
- Control Layers: Rain, Thermal, Vapor, Air

Environmental Loads



- Calculated Fire Rating = 9 hours (4 hours)
- R-Value = 29.9
- STC = 55.2
- Control Layers: Rain, Thermal, Vapor, Air

Environmental Loads

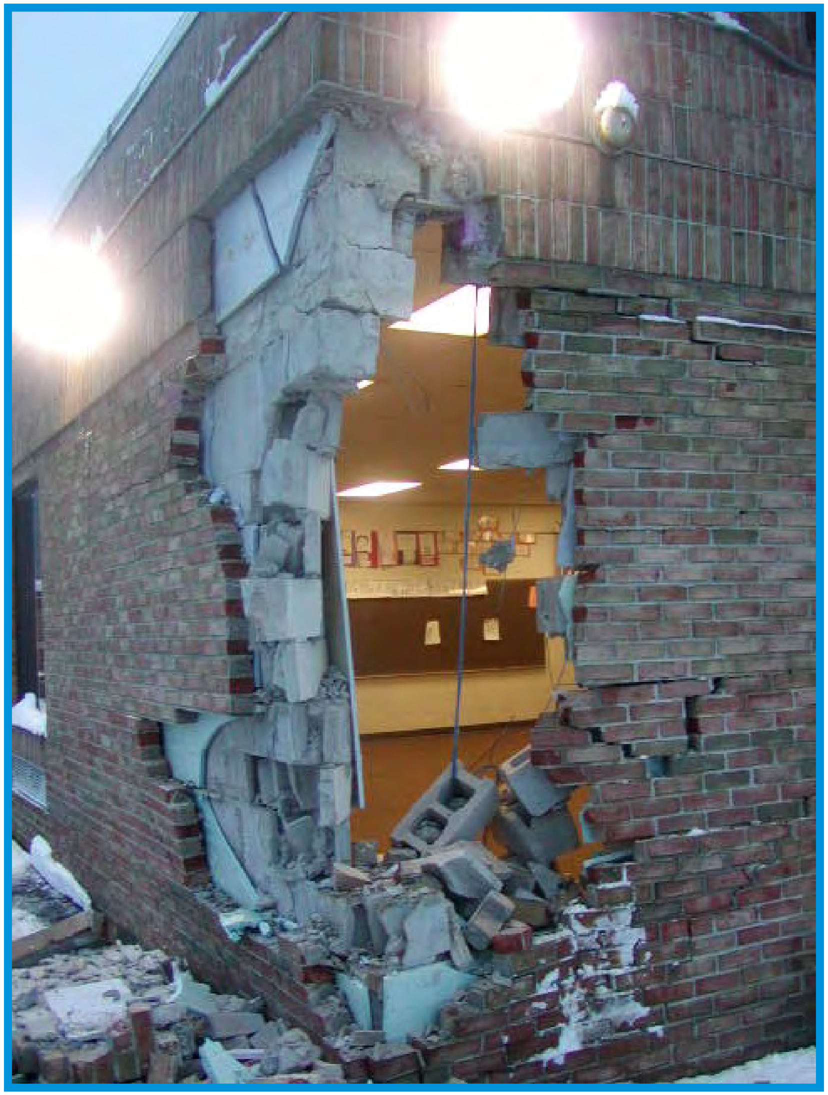


- Calculated Fire Rating = 9 hours (4 hours)
- R-Value = 13.5
- STC = 55.2
- Control Layers: Rain, Thermal

Environmental Loads

Structural Redundancy

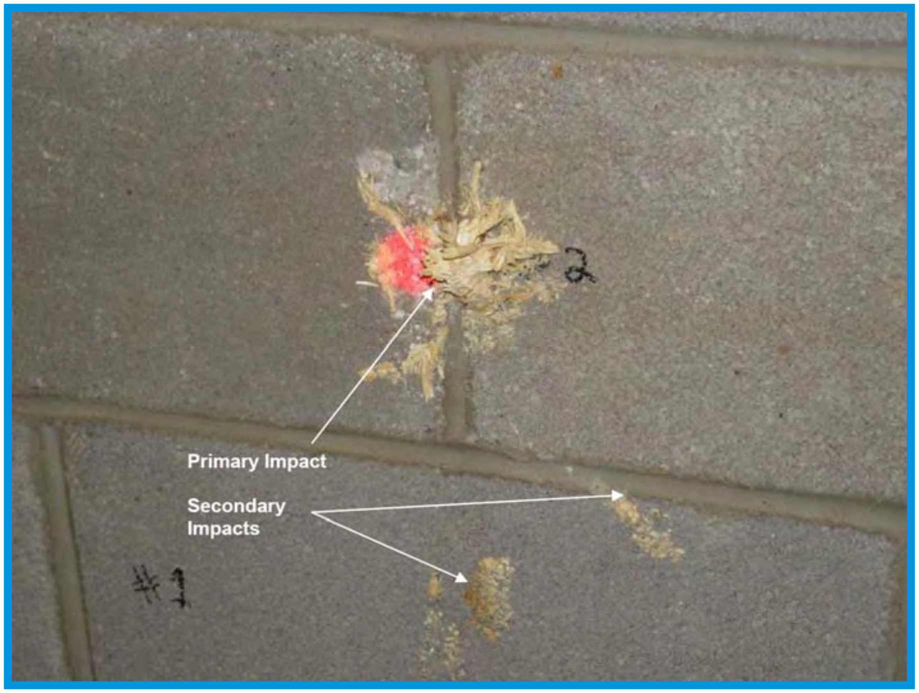
- Alternate load paths
- Added strength
- Added stiffness

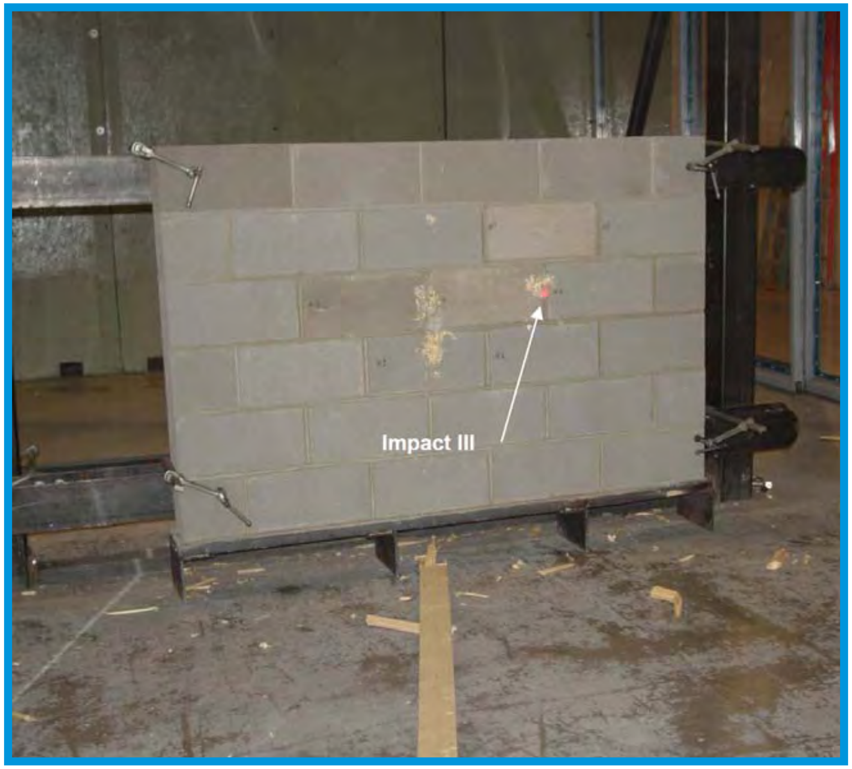


Environmental Loads

Impact

- **Block (solid grouted)**
  - **2x4(15lb) at 100mph**





Saving Energy

CLIMATE ZONES

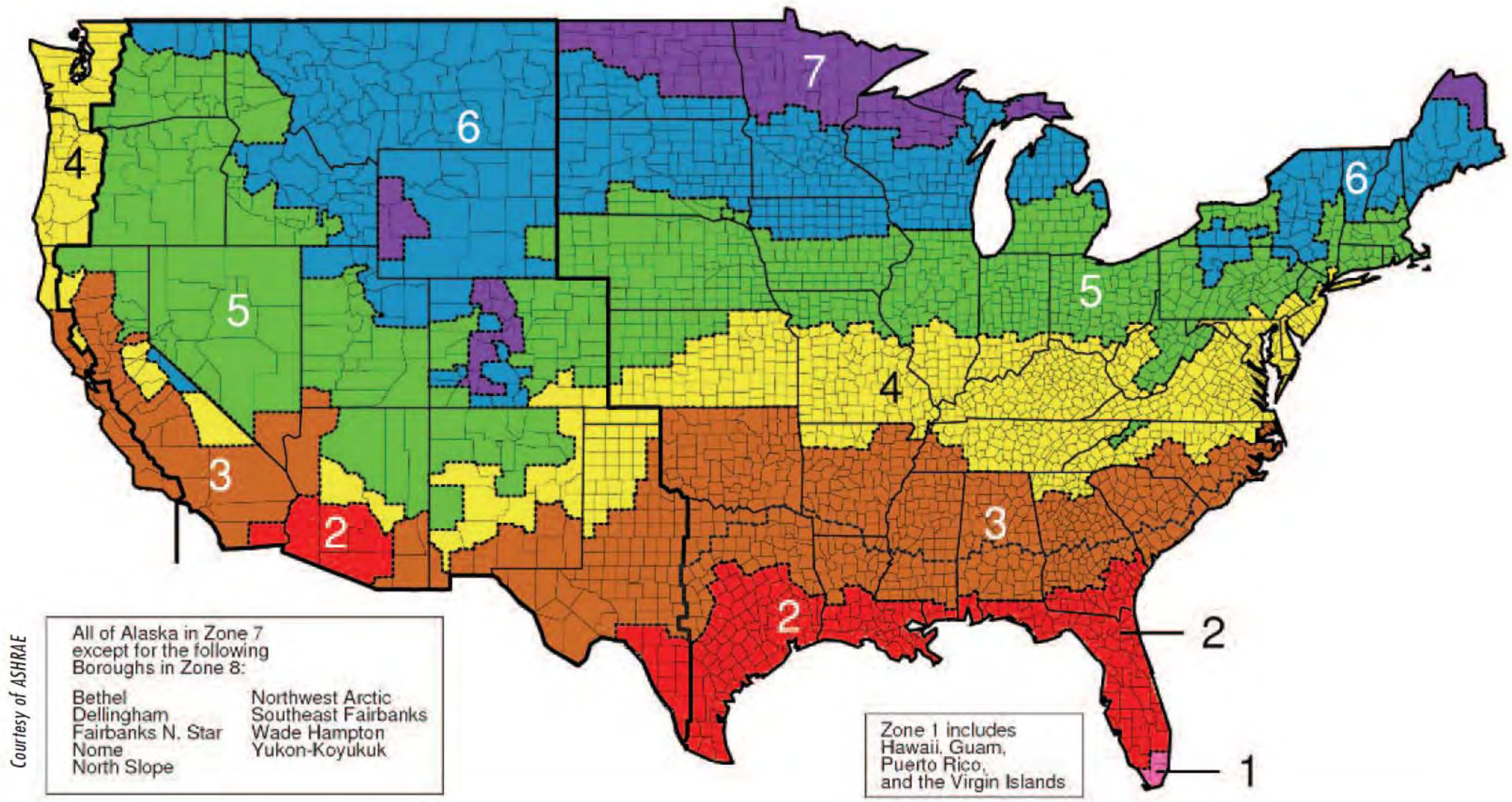


Figure 2 – Climate Zones Recognized by ASHRAE 90.1

The High R-Wall Model, The Story Pole, Vol. 4 No 3.

Saving Energy

- **Prescriptive R-value minimums for continuous insulation for mass walls**
  - **Zone 5 R-7.6**
- **Prescriptive R-value minimums for non-mass walls**
  - **Zone 5 R-13 plus R-3.8 cont. insulation**

Current codes recognize thermal mass by allowing masonry walls to comply using lower R-Values than non-mass walls must meet.

2001 International Energy Conservation Code – ASHRAE 90.1-1999
The High R-Wall Model, The Story Pole, Vol. 4 No 3.

Saving Energy

1000 YEARS AGO, **stone enclosure – R-2**

500 YEARS AGO, **thatched roofs improved enclosures – R-4**

350 YEARS AGO, **post and beam, waddle and daub cavity construction – R-6**

250 YEARS AGO, **log cabin timber construction – R-8**

100 YEARS AGO, **mass wall, 10% glazing ratio – R-8**

IN 1972, **non-thermally broken aluminum curtain walls – R-1.5**

TODAY, **thermally broken aluminum curtain walls – R-2**

The Perfect Wall, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

Saving Energy

- **After 1000 years, we are still designing walls with R-2. It's the energy we are expending at <u>2.5 times</u> that of what we are finding.**
- **Learn <u>glass</u> is most expensive and does not create an energy efficient building envelope**
- **But when more than 30% glass is used in a building, it is not socially responsible.**

The Perfect Wall, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

Saving Energy

- **Modern commercial vertical enclosures (glazing and wall) actually have an R-value that is rarely over 7, and more likely in the range of 3-to-5!**

Prioritizing Green: It's The Energy Stupid, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

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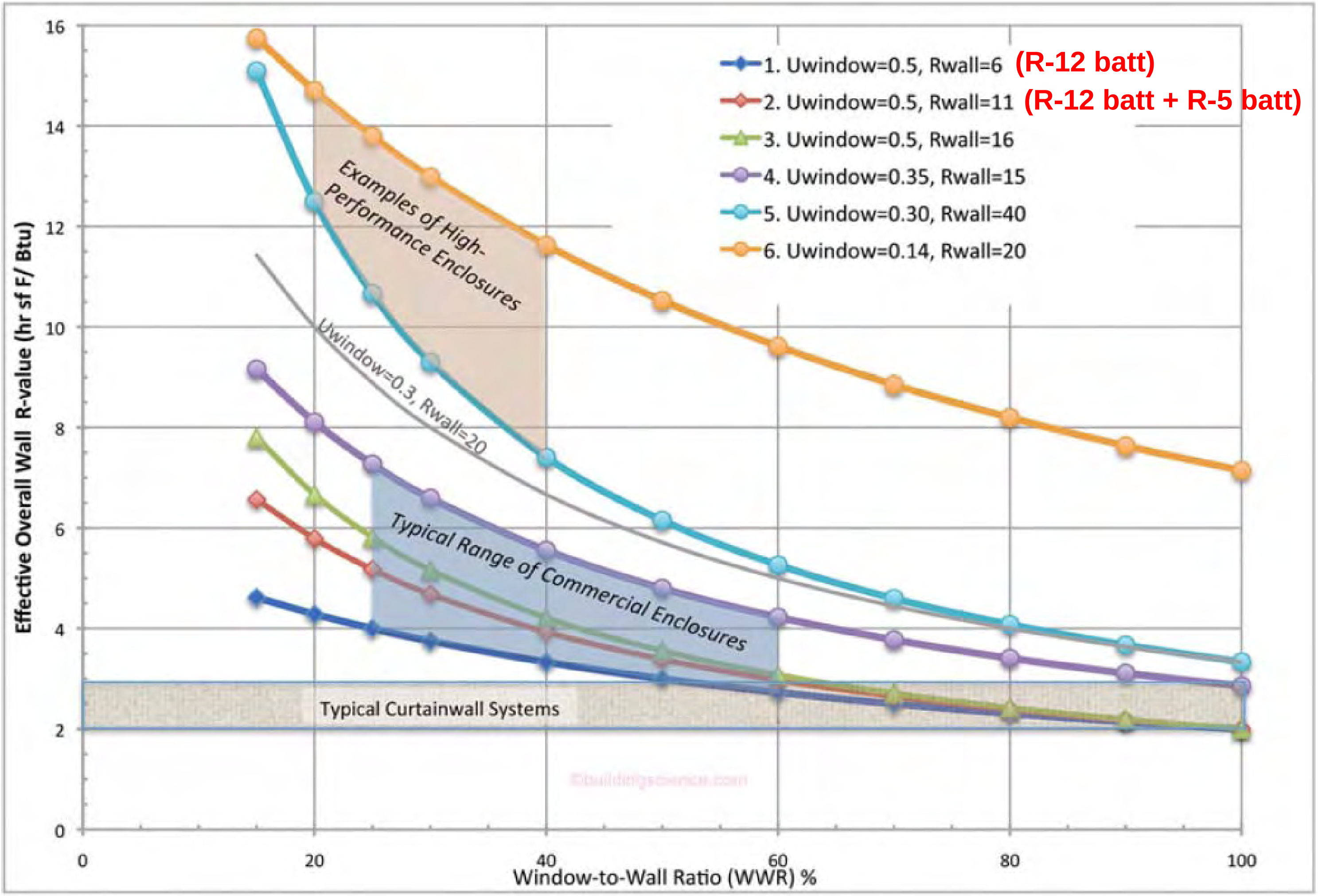
Enclosure R-value versus Glazing Ratio.



Straube, John; Can Highly Glazed Building Facades Be Green?, Building Science Insights, BSI-006, September, 2008.

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20% glazing (R-2) & insulation (R-26)

$$U_{overall}=(WWR*U_{window}+(1-WWR)*U_{wall})$$

$$U = (0.20*0.50)+(0.80*0.039)$$

$$U = 0.131$$

$$U = 1/R$$

$$R = 7.6 \text{ (assembly)}$$

Prioritizing Green: It’s The Energy Stupid, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

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Article reprinted with permission from Vol 4 No 3 The Masonry Edge/StoryPole – Optimize Energy Performance

the High R-WALL Model

Insulated Masonry Cavity Wall Reaches R-30+, 275% Higher Than Required by Michigan's Current Energy Code*

Think Performance!! *by Dan Zechmeister, PE, and Elizabeth Young*

CONTINUING EDUCATION

LEARNING OBJECTIVES

Upon reading the article you will:

1. Be able to calculate R-value for a masonry cavity wall with various insulation types.
2. Discover that the insulated masonry cavity wall has built in flexibility expandable to meet almost any design requirements.
3. Explore options for going well above and beyond today's minimum energy code requirements for commercial buildings.

2008 article "Energy Security (and Saving the Planet)," there is "no such thing as a free thermodynamic lunch." Lstiburek explains, increased demand for hybrid vehicles will result in a struggle over electricity and the natural resources that produce it. Currently, buildings consume more than 40% of the energy in the US, with the transportation industry closing in on 30%. A civilization so married to its cars, we will soon see the transportation industry with the lion's share. Once that happens, Lstiburek predicts "we are going to triple the cost of air conditioning and double the cost of heating" our buildings.

Increasing the thermal performance of the wall envelope will result in a more energy efficient building and lower energy costs over its lifetime, but increased performance of the envelope also allows for design and installation of a smaller, more efficient and less expensive HVAC system.

New Standards Raise the Bar

Since its launch in 2000, nearly 2000 buildings have become certified under the LEED for New Construction (NC) program. That is an impressive number, but LEED remains mostly a voluntary program. Michigan has 131 buildings certified, but another 451 that have been

The High R-Wall Model, The Story Pole, Vol. 4 No 3.

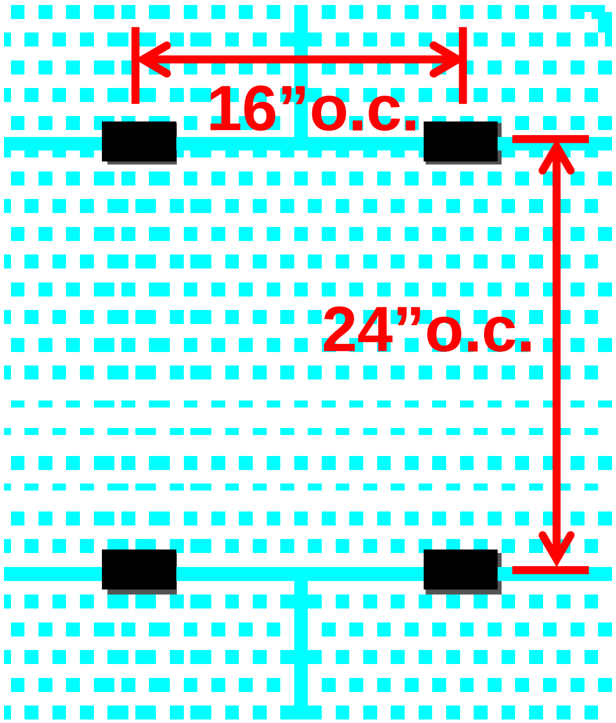
Wall Tie Analysis

2.1.5.3 Noncomposite action

2.1.5.3.1 (e) Specified distances between wythes shall not exceed of 4.5 in. unless a detailed wall-tie analysis is performed.

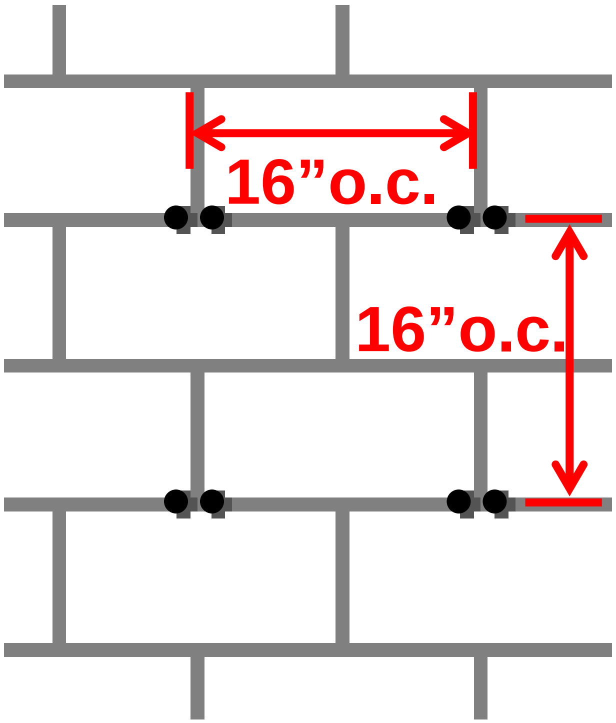
(ACI 530-05/ASCE 5-05/TMS 402-05)

Masonry Veneer



Metal Studs/Block

2.67sf



Block

1.77sf

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Brick and Block Cavity Wall Insulation Options

Table 3: Extruded Polystyrene

100 lbs/tie (5, 5.5) — 42 lbs/tie (6, 6.5, 7)

Table 3: Extruded Polystyrene

BRICK & BLOCK CAVITY WALL										
total cavity space thickness (inches) including insulation and drainage cavity with adjustable ties spaced every 1.77 sf		3.5[1,7,8]	4[1,7,8]	4.5[1,7,8]	4.5[1,7,8]	5[2,7,8]	5.5[2,7,8]	6[2,8]	6.5[2,8]	7[2,8]
	thickness									
outside air surface (winter)[3]		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
4" face brick[3]	3.625	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
air space (winter)[3,6]										
1"	1.0	0.97	0.97	0.97						
2"	2.0				0.97	0.97	0.97	0.97	0.97	0.97
insulation in cavity space										
2.5" extruded polysyterene, R-5.0/inch[5]	2.5	12.50			12.50					
3.0" extruded polysyterene, R-5.0/inch[5]	3.0		15.00			15.00				
3.5" extruded polysyterene, R-5.0/inch[5]	3.5			17.50			17.50			
4.0" extruded polysyterene, R-5.0/inch[5]	4							20.00		
4.5" extruded polysyterene, R-5.0/inch[5]	4.5								22.50	
5.0" extruded polysyterene, R-5.0/inch[5]	5									25.00
8" medium weight CMU[4] (115 pcf, @48"o.c.)	7.625	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
inside air surface (winter)[3]		0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
total wall thickness, inches		14.75	15.25	15.75	15.75	16.25	16.75	17.25	17.75	18.25
calculated R-value		15.86	18.36	20.86	15.86	18.36	20.86	23.36	25.86	28.36

The High R-Wall Model, The Story Pole, Vol. 4 No 3.

Brick and Block Cavity Wall Insulation Options

Table 4: Spray Polyurethane Foam

Table 4: Spray Polyurethane Foam

BRICK & BLOCK CAVITY WALL										
total cavity space thickness (inches) including insulation and air space with adjustable ties spaced every 1.77 sf		3.5[1,7,8]	4[1,7,8]	4.5[1,7,8]	4.5[1,7,8]	5.0[2,7,8]	5.5[2,7,8]	6[2,8]	6.5[2,8]	7[2,8]
	thickness									
outside air surface (winter)[3]		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
4" face brick[3]	3.625	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
air space (winter)[3,6]										
1"	1.0	0.97	0.97	0.97						
2"	2.0				0.97	0.97	0.97	0.97	0.97	0.97
insulation in cavity space										
2.5" spray polyurethane foam, R-6.8/inch[5]	2.5	17.00			17.00					
3.0" spray polyurethane foam, R-6.8/inch[5]	3		20.40			20.40				
3.5" spray polyurethane foam, R-6.8/inch[5]	3.5			23.80			23.80			
4.0" spray polyurethane foam, R-6.8/inch[5]	4							27.20		
4.5" spray polyurethane foam, R-6.8/inch[5]	4.5								30.60	
5.0" spray polyurethane foam, R-6.8/inch[5]	5									34.00
8" medium weight CMU[4] (115 pcf, @48"o.c.)	7.625	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
inside air surface (winter)[3]		0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
total wall thickness, inches		14.75	15.25	15.75	15.75	16.25	16.75	17.25	17.75	18.25
calculated R-value		20.36	23.76	27.16	20.36	23.76	27.16	30.56	33.96	37.36

The High R-Wall Model, The Story Pole, Vol. 4 No 3.

Brick and Block Cavity Wall Insulation Options

Table 5: Polyisocyanurate

Table 5: Polyisocyanurate

BRICK & BLOCK CAVITY WALL							
total cavity space thickness (inches) including insulation and drainage cavity with adjustable ties spaced every 1.77 sf		3.5[1,7,8]	4[1,7,8]	4.5[1,7,8]	4.5[1,7,8]	5[2,7,8]	5.5[2,7,8]
	thickness						
outside air surface (winter)[3]		0.17	0.17	0.17	0.17	0.17	0.17
4" face brick[3]	3.625	0.40	0.40	0.40	0.40	0.40	0.40
reflective air space (winter)[3,6,9]							
1"	1	2.80	2.80	2.80			
2"	2				2.80	2.80	2.80
insulation in cavity space							
2.5" polyisocyanurate foil faced[5]	2.5	17.80			17.80		
3.0" polyisocyanurate foil faced[5]	3		21.20			21.20	
3.5" polyisocyanurate foil faced[5]	3.5			24.60			24.60
8" medium weight CMU[4] (115 pcf, @48"o.c.)	7.625	1.14	1.14	1.14	1.14	1.14	1.14
inside air surface (winter)[3]		0.68	0.68	0.68	0.68	0.68	0.68
total wall thickness, inches		14.75	15.25	15.75	15.75	16.25	16.75
calculated R-value		22.99	26.39	29.79	22.99	26.39	29.79

[1]Cavities up to 41/2" do not need additional submitted structural engineer calculations as per Code

[2]For requirements of expanding the cavity, see Wall Tie Analysis, p.36

[3]BIA Tech Note 4 Heat Transmission (Reissued 1997)

[4]NCMA 6-2B (2009) TEK R-Values & U Factors

[5]R-value may vary by manufacturer

[6]MSJC requires 1" air space minimum; Code Commentary recommends 2" for better resistance to water penetration

[7]100 lb load per tie, see Wall Tie Analysis, p.36

[8]Code load: 42 lbs per tie, see Wall Tie Analysis, p.36

[9]Values include a reflective air space

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Saving Energy

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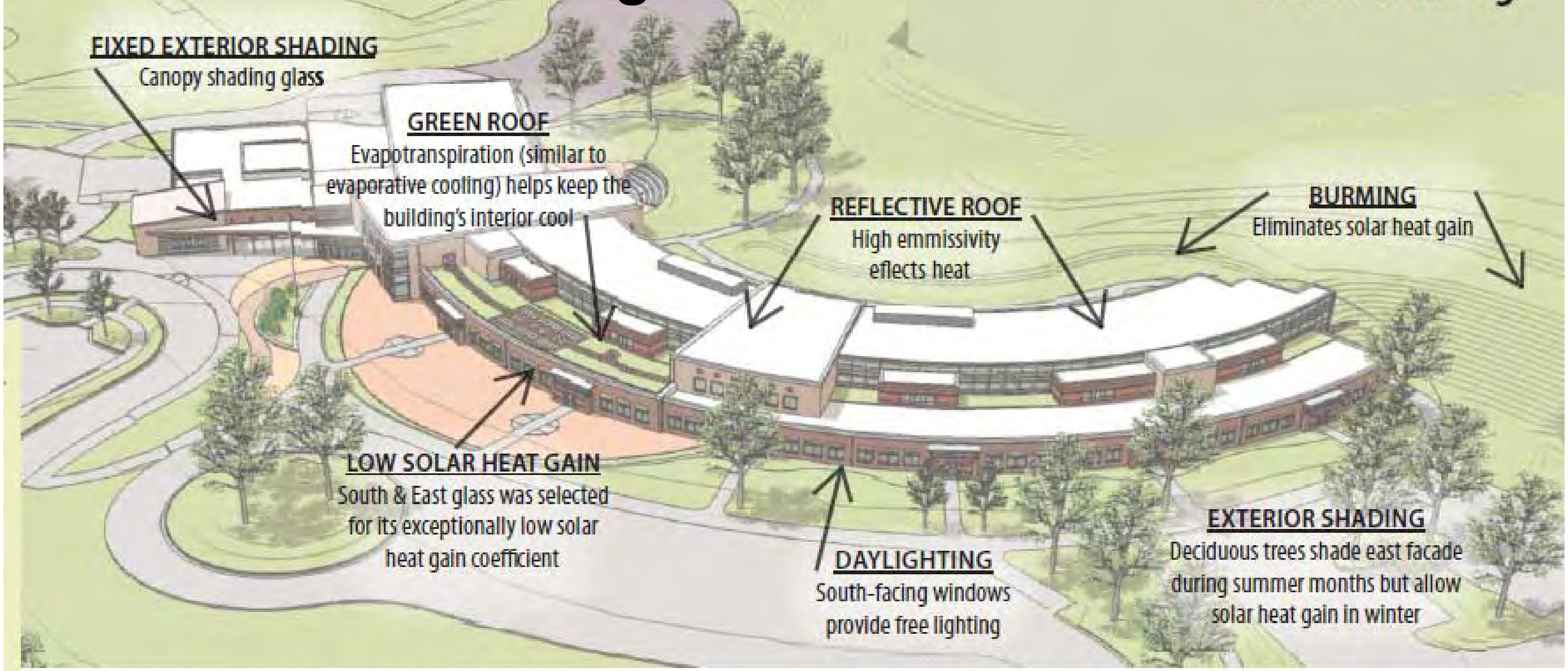
High Performance Low Energy Sustainable Building



Taking advantage of all passive energy conservation measures, beginning with the way a building is oriented on the site, increases the potential for a low-energy, high-performance, cost-effective building.

Do you know what your building energy cost is?, Perry Hausman, PE, LEED AP, TowerPinkster

Saving Energy

DPS School Construction Project
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High Performance Low Energy Sustainable Building

- **16” multi-wythe masonry wall (R-26.3)**
  - **3 5/8” face brick**
  - **1 1/4” drainage cavity**
  - **3 1/2” spray applied insulation**
  - **7 5/8” block**

Saving Energy

DPS School Construction Project
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High Performance Low Energy Sustainable Building

- **The team has designed buildings that are operating as low as $0.77/sf per year and only as high as $1.13/sf per year.**
- **According to the EPA's "Energy Star Target Finder," the average K-12 building consumes $1.39/sf per year.**

Designing high performance low energy sustainable buildings, including higher insulated brick and block walls, has reduced energy consumption from 18.8% to 44.6%

Do you know what your building energy cost is?, Perry Hausman, PE, LEED AP, TowerPinkster

Elevation

DPS School Construction Project

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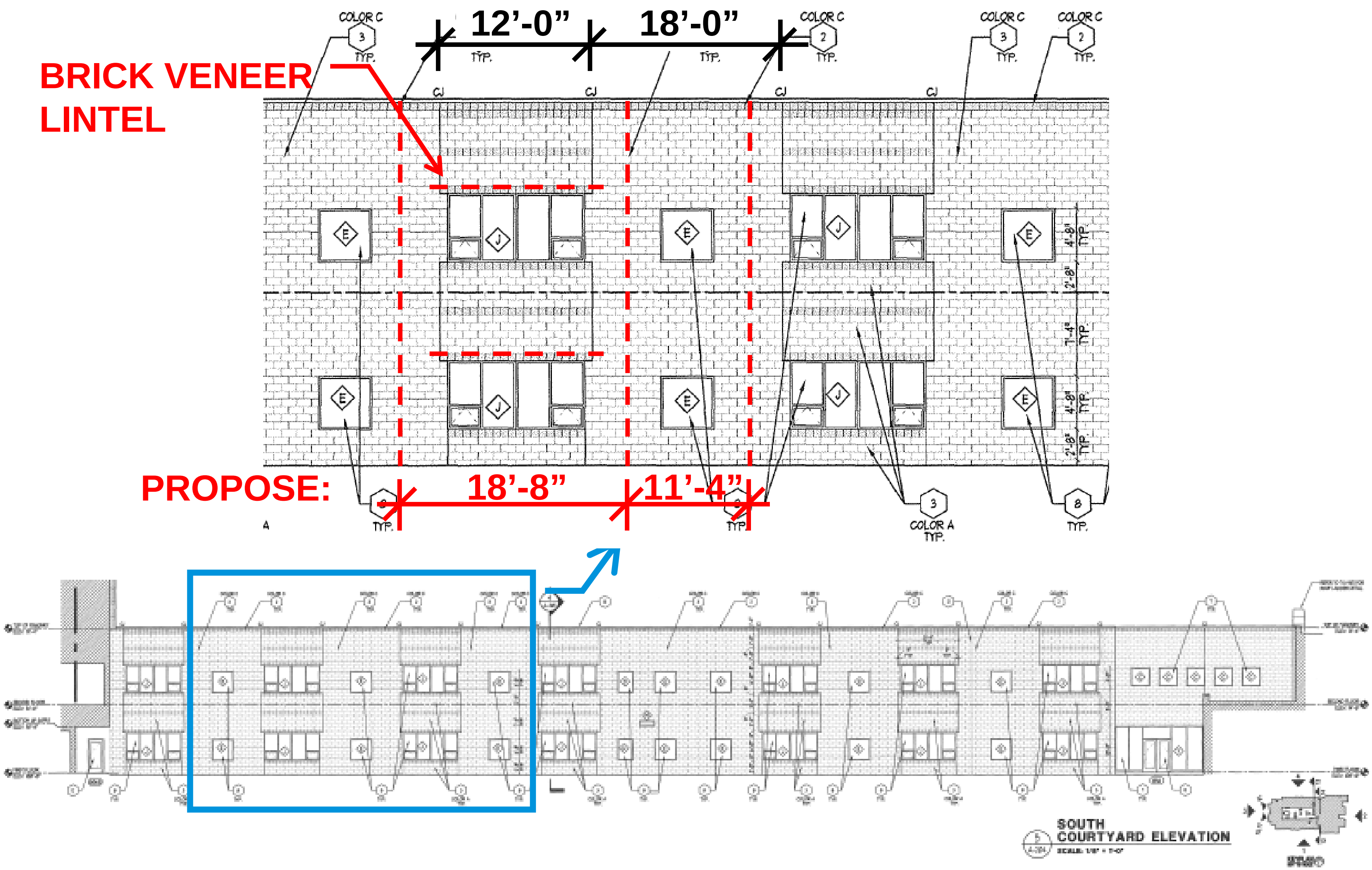


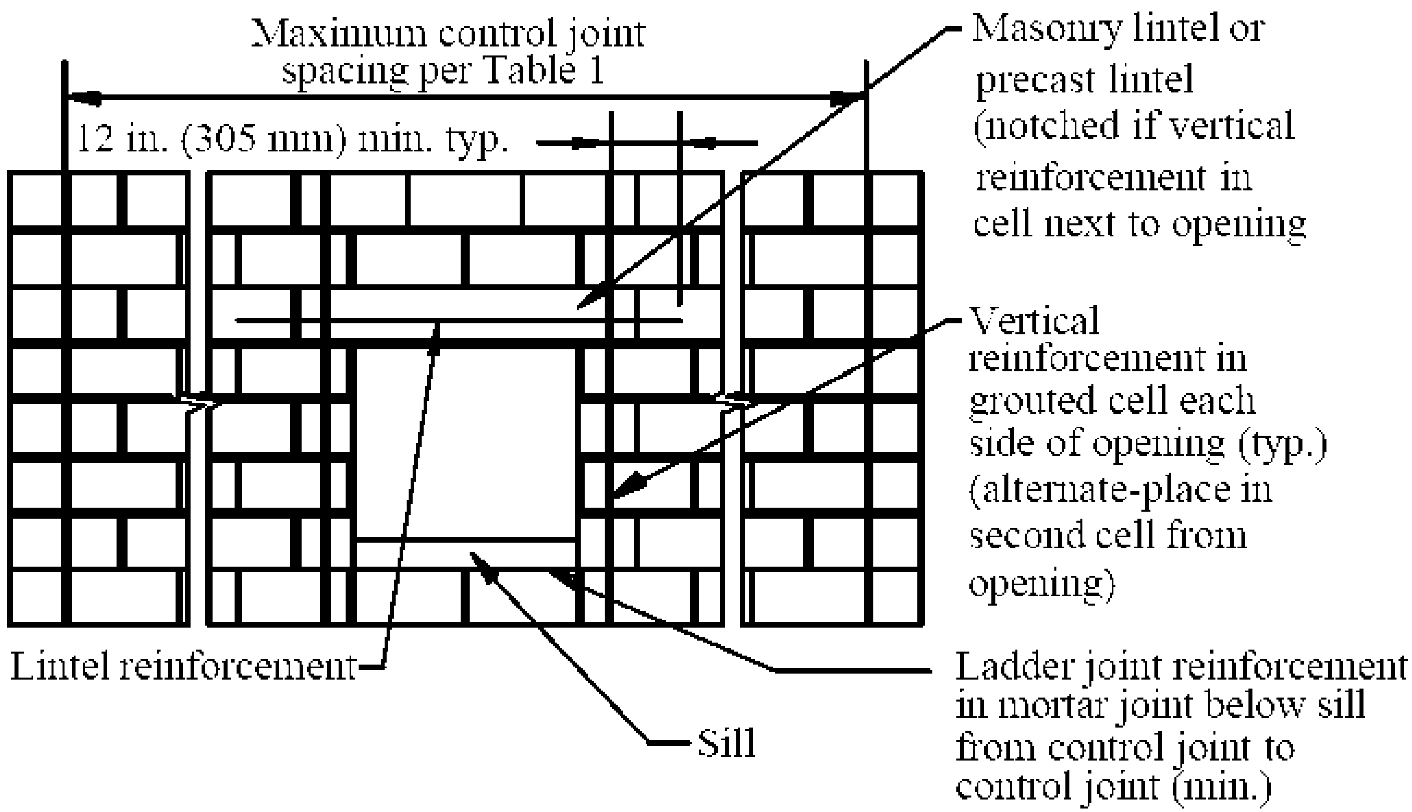
Architectural Details

	H (ft)	H (m)	d* (in)	d* (mm)	k*	M (lb. ft)	M (kN.m)	Lspan (ft)	Lspan (m)
One layer of 9 Gauge (3.76 mm) Wire $A_s = 0.034$ in² (21.9 mm²)	1	0.30	9.33	237.0	0.2499	727	0.99	12.06	3.68
	5	1.52	57.33	1456.2	0.1098	4695	6.37	13.70	4.18
	10	3.05	117.33	2980.2	0.0781	9713	13.17	13.94	4.25
	20	6.10	187.27	4756.8	0.0624	15587	21.13	12.48	3.81
	30	9.14	124.27	3156.5	0.076	10295	13.96	8.28	2.53
One layer of 3/16″ (4.76 mm) Diameter Wire $A_s = 0.054$ in² (34.8 mm²)	1	0.30	9.33	237.0	0.3035	1132	1.53	15.05	4.59
	5	1.52	57.33	1456.2	0.1363	7388	10.02	17.19	5.24
	10	3.05	117.33	2980.2	0.0974	15325	20.78	17.51	5.34
	20	6.10	237.33	6028.2	0.0695	31297	42.43	17.69	5.39
	30	9.14	197.37	5013.2	0.076	25970	35.21	13.16	4.01
Two layers of 9 Gauge (3.76 mm) Wire $A_s = 0.068$ in² (43.8 mm²)	1	0.30	8.00	203.2	0.3541	1000	1.36	14.14	4.31
	5	1.52	56.00	1422.4	0.1532	8793	11.92	18.75	5.72
	10	3.05	116.00	2946.4	0.1092	18763	25.44	19.37	5.90
	20	6.10	236.00	5994.4	0.0779	38841	52.66	19.71	6.01
	30	9.14	247.09	6276.0	0.0762	40701	55.18	16.47	5.02
Two layers of 3/16″ (4.76 mm) Diameter Wire $A_s = 0.108$ in² (69.6 mm²)	1	0.30	8.00	203.2	0.4221	1232	1.67	15.70	4.78
	5	1.52	56.00	1422.4	0.189	13773	18.67	23.47	7.15
	10	3.05	116.00	2946.4	0.1356	29516	40.02	24.30	7.41
	20	6.10	236.00	5994.4	0.0971	61275	83.08	24.75	7.55
	30	9.14	356.00	9042.4	0.0799	93183	126.34	24.92	7.60
Three layers of 9 Gauge (3.76 mm) Wire $A_s = 0.102$ in² (65.7 mm²)	1	0.30	6.66	169.2	0.4419	1029	1.40	14.35	4.37
	5	1.52	54.66	1388.4	0.1862	12358	16.76	22.23	6.78
	10	3.05	114.66	2912.4	0.1327	27226	36.91	23.33	7.11
	20	6.10	234.66	5960.4	0.0948	57234	77.60	23.92	7.29
	30	9.14	354.66	9008.4	0.0778	87382	118.47	24.14	7.36
Three layers of 3/16″ (4.76 mm) Diameter Wire $A_s = 0.162$ in² (104.4 mm²)	1	0.30	6.66	169.2	0.5177	1211	1.64	15.56	4.74
	5	1.52	54.66	1388.4	0.2285	19276	26.13	27.77	8.46
	10	3.05	114.66	2912.4	0.1642	42725	57.93	29.23	8.91
	20	6.10	234.66	5960.4	0.1179	90148	122.22	30.02	9.15
	30	9.14	354.66	9008.4	0.0971	137847	186.90	30.31	9.24

Table 1. Reinforced Brick Lintels. The steel reinforcement centroid location was designated as d* and the depth of the neutral axis is k*d*.

Clay Masonry Veneer Lintel Design, The Story Pole, Nov/Dec 2004

Elevation



By Extending Lintel Reinforcement (Preferred)

NCMA TEK 10-3 (2003)

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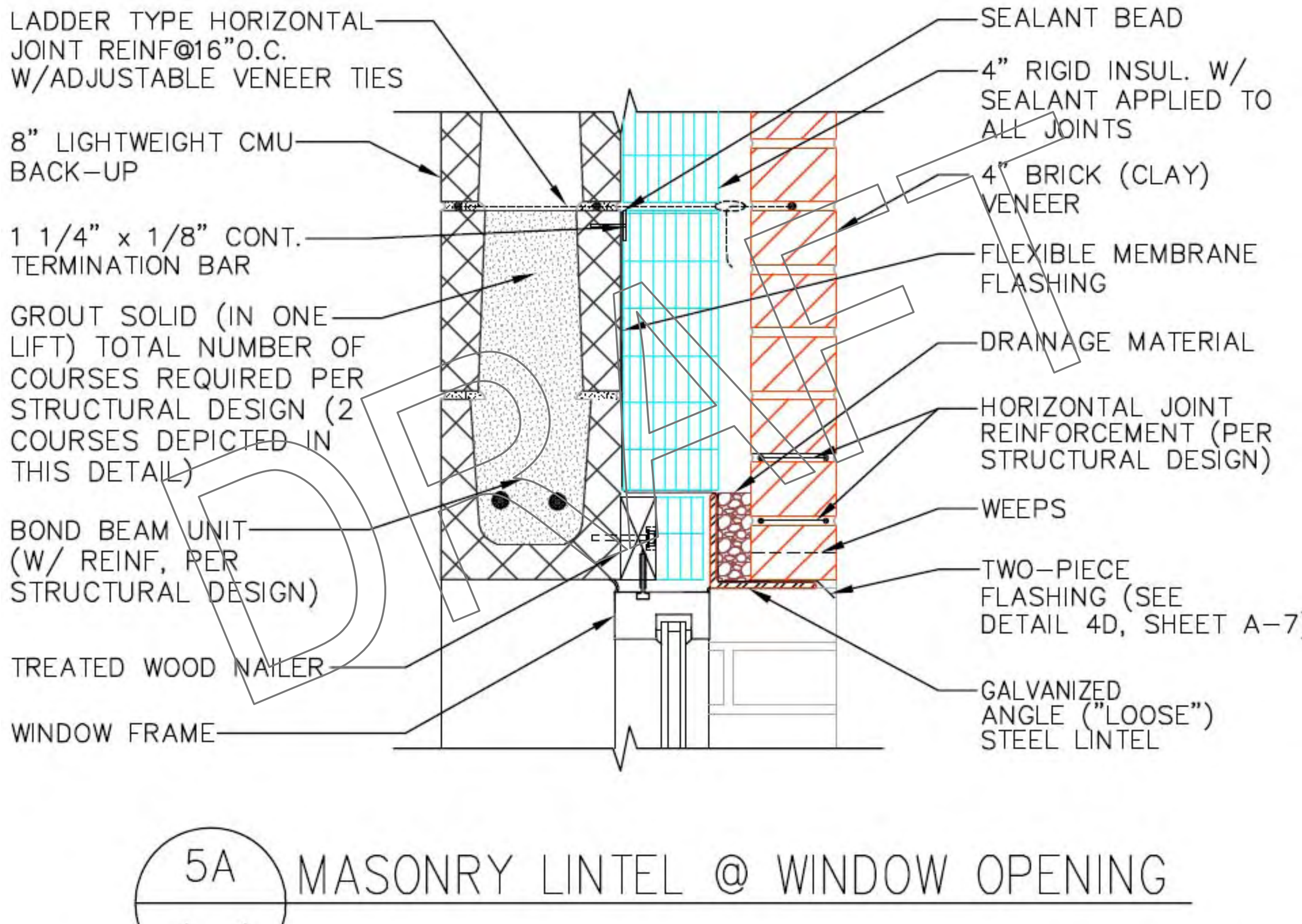
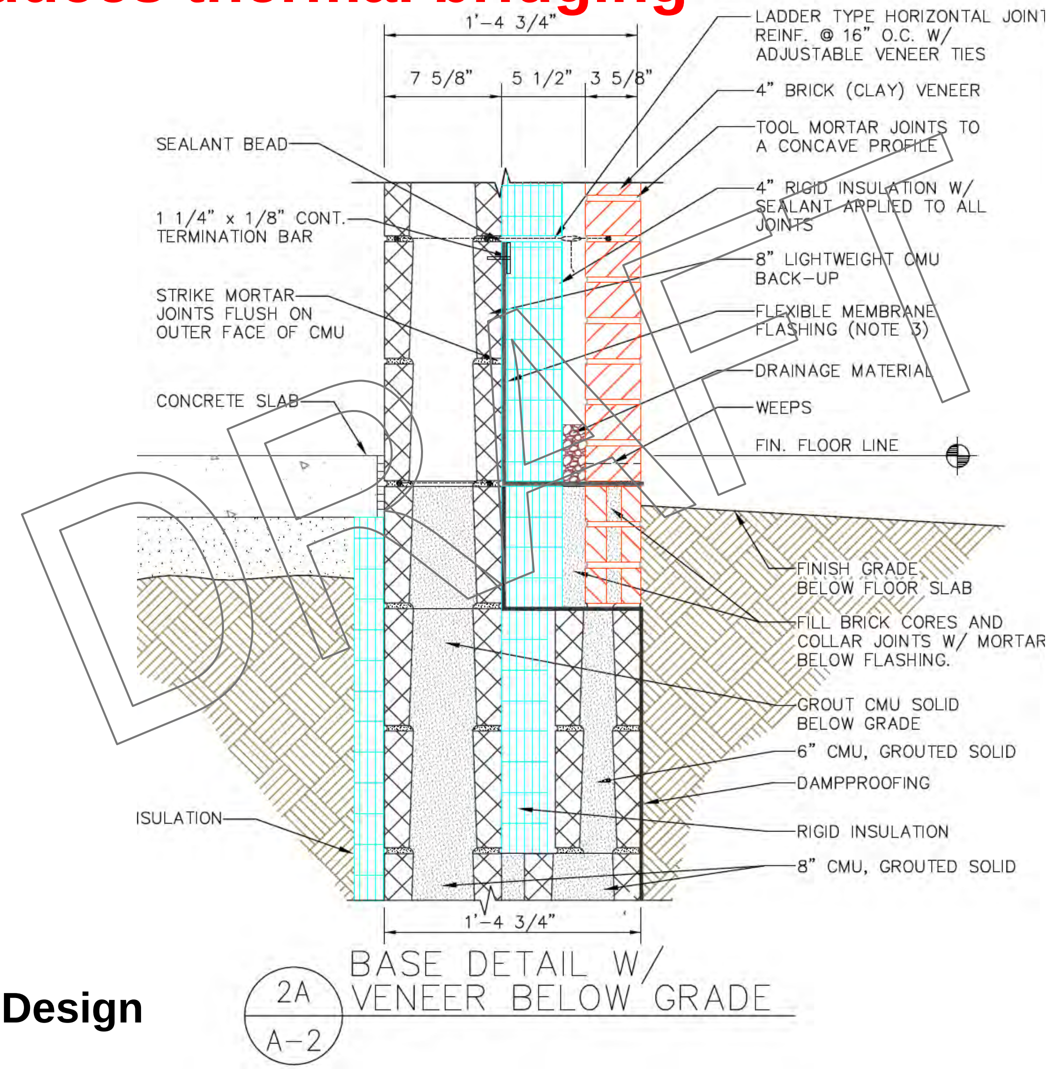
- **Hi R-Wall Detail**
- **Greatly reduces thermal bridging**



MIM Generic Wall Design

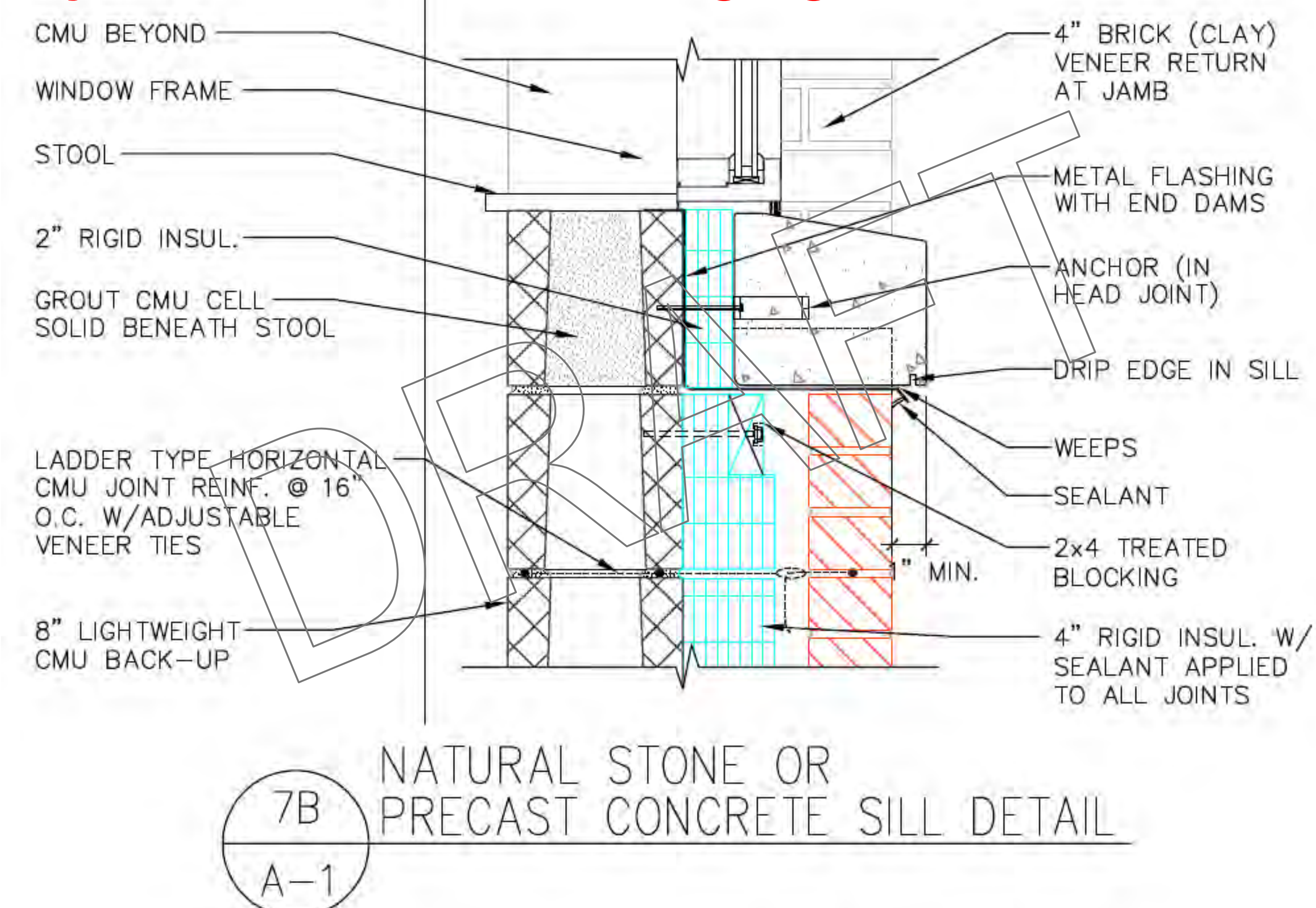
Architectual Details

- **Hi R-Wall Detail**
- **Greatly reduces thermal bridging**



MIM Generic Wall Design

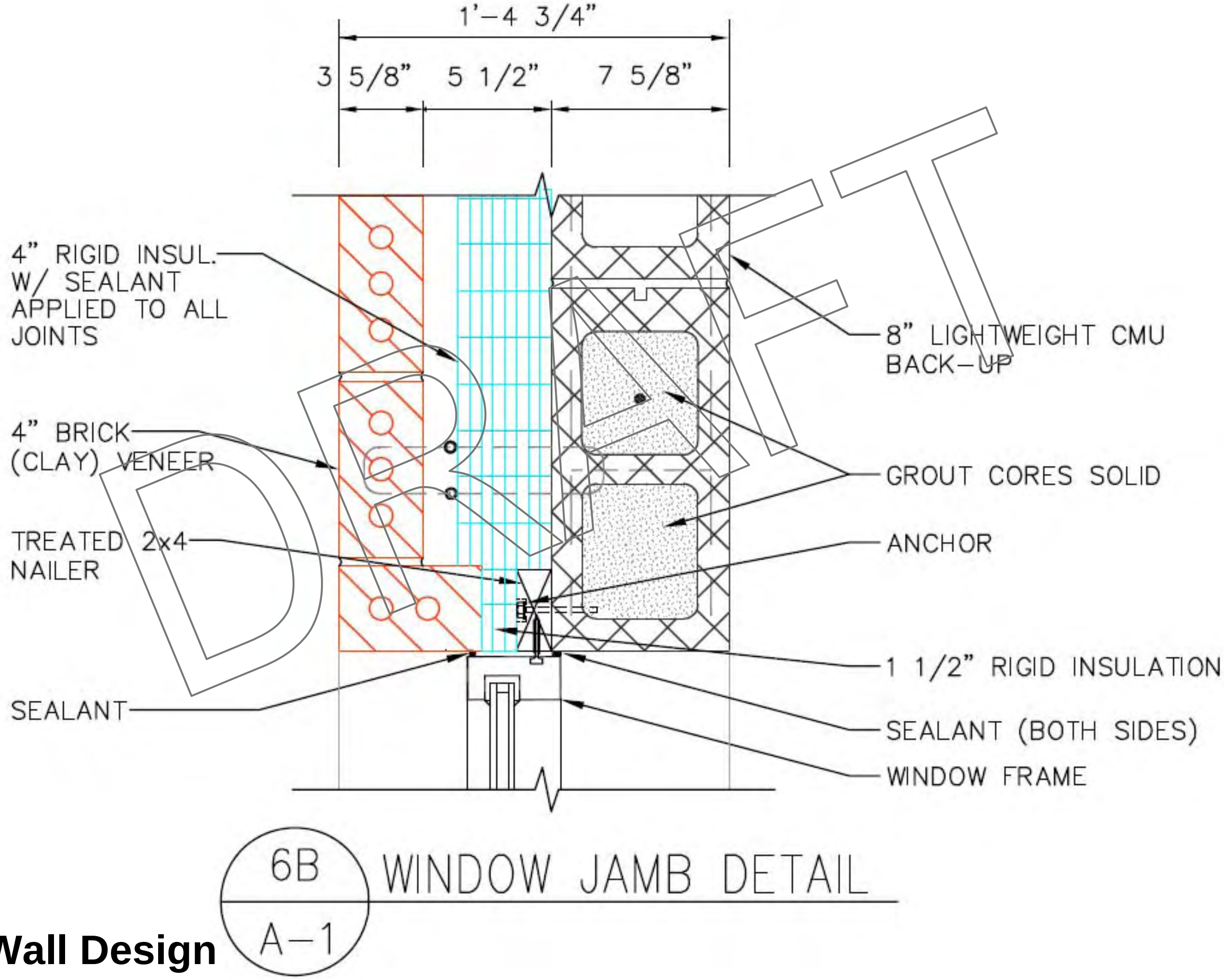
- **Hi R-Wall Detail**
- **Greatly reduces thermal bridging**



MIM Generic Wall Design

Architectural Details

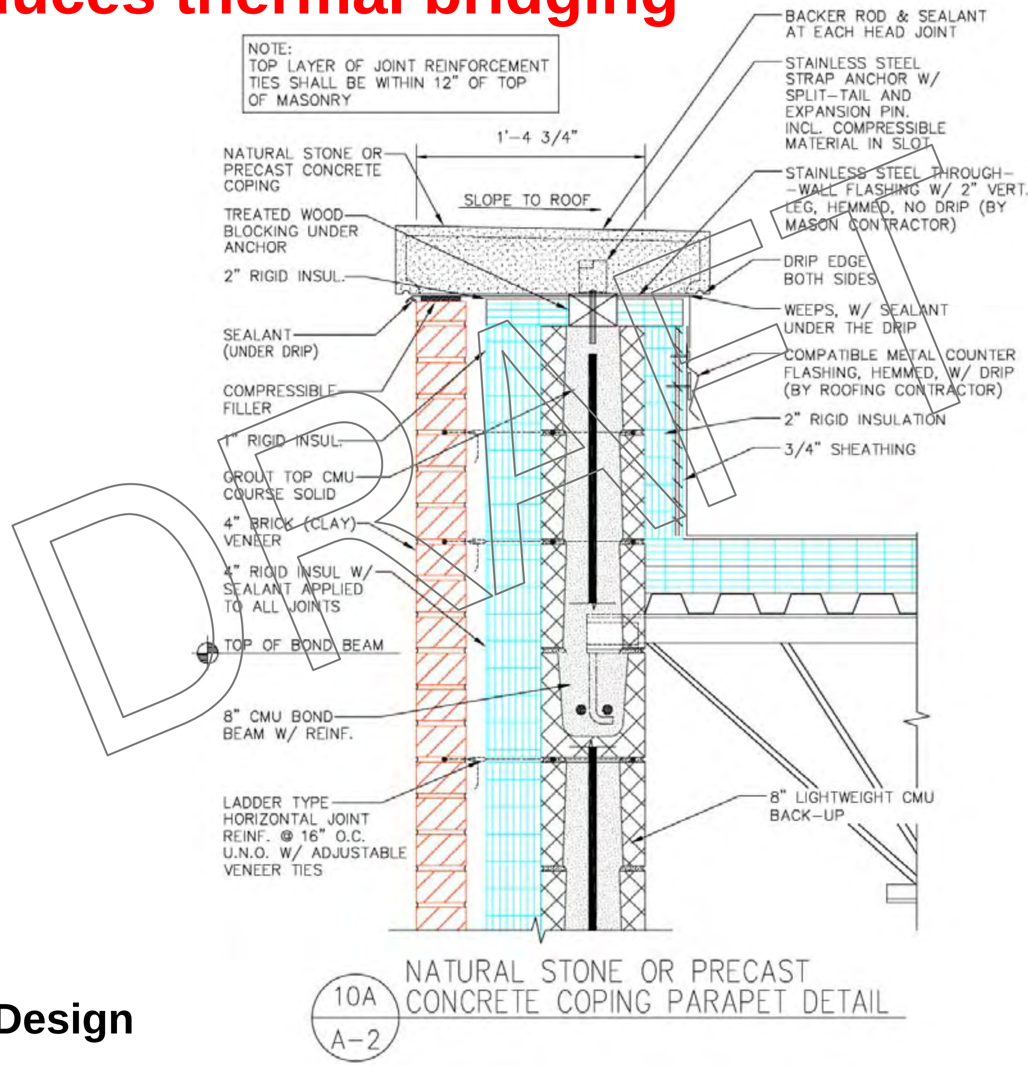
- **Hi R-Wall Detail**
- **Greatly reduces thermal bridging**



MIM Generic Wall Design

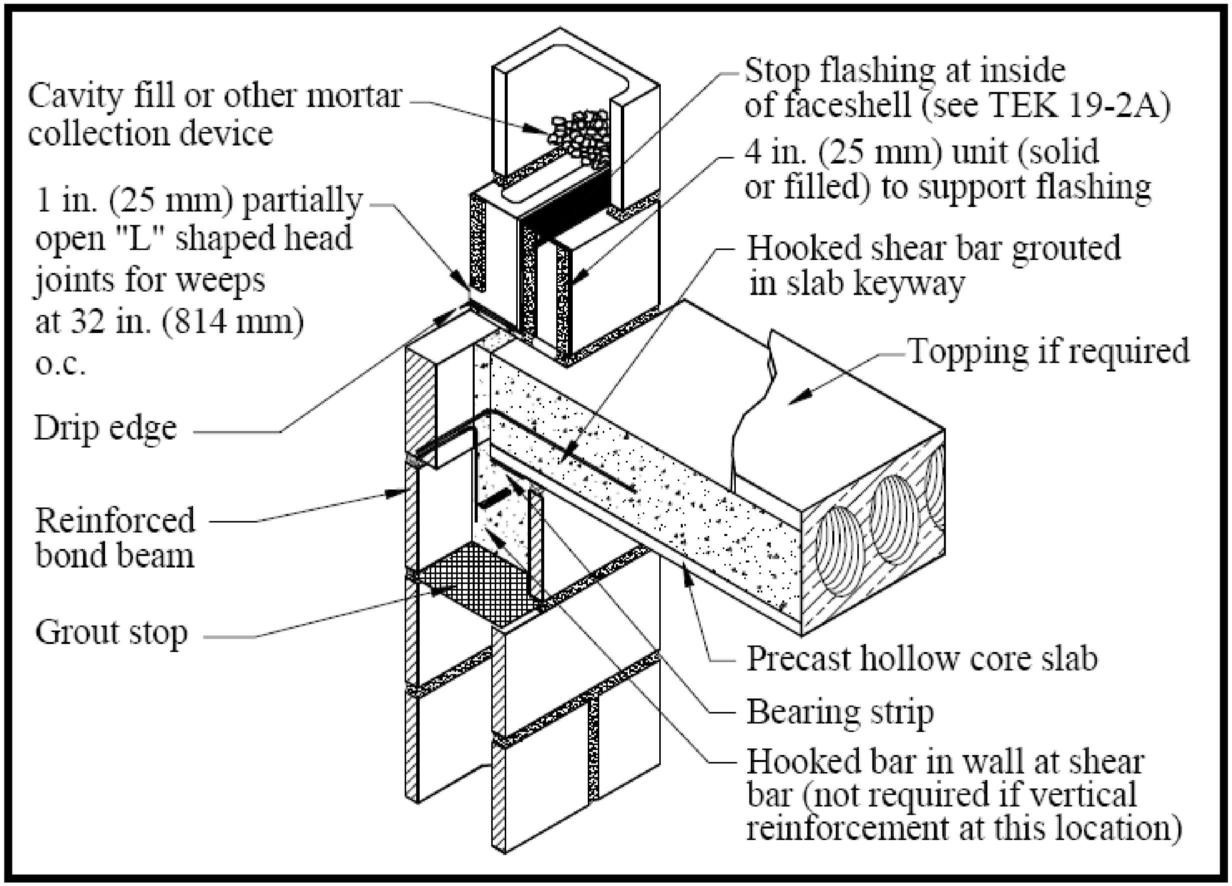
Architectural Details

- **Hi R-Wall Detail**
- **Greatly reduces thermal bridging**



MIM Generic Wall Design

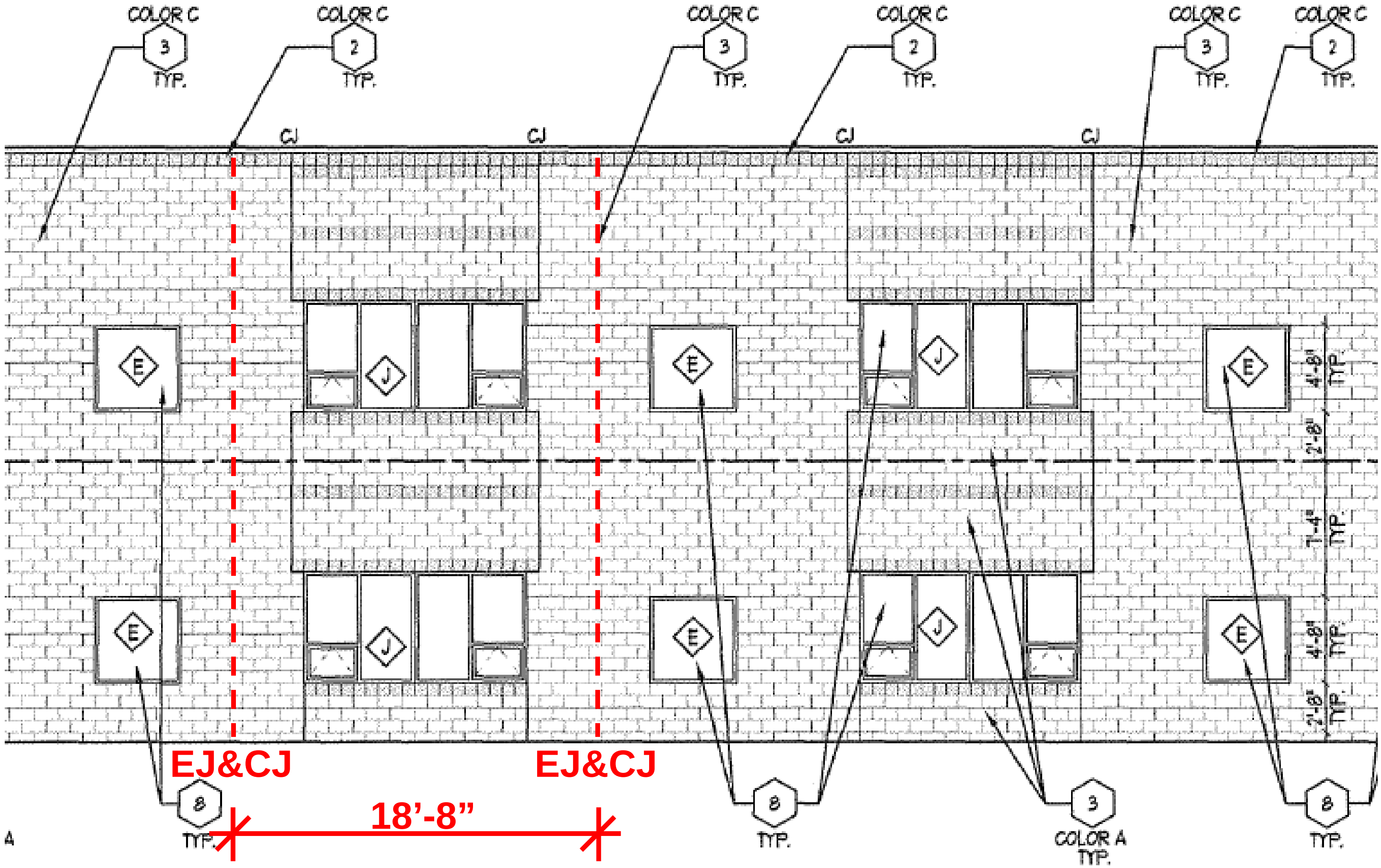
Architectural Details



To enhance construction schedule, recommend hollow concrete planks for floor and roof construction.

http://www.ncmaetek.org/etek/pdf_brand.asp?pdf=TEK 05-07A.pdf&si=ACFD1.jpg

Structural Analysis

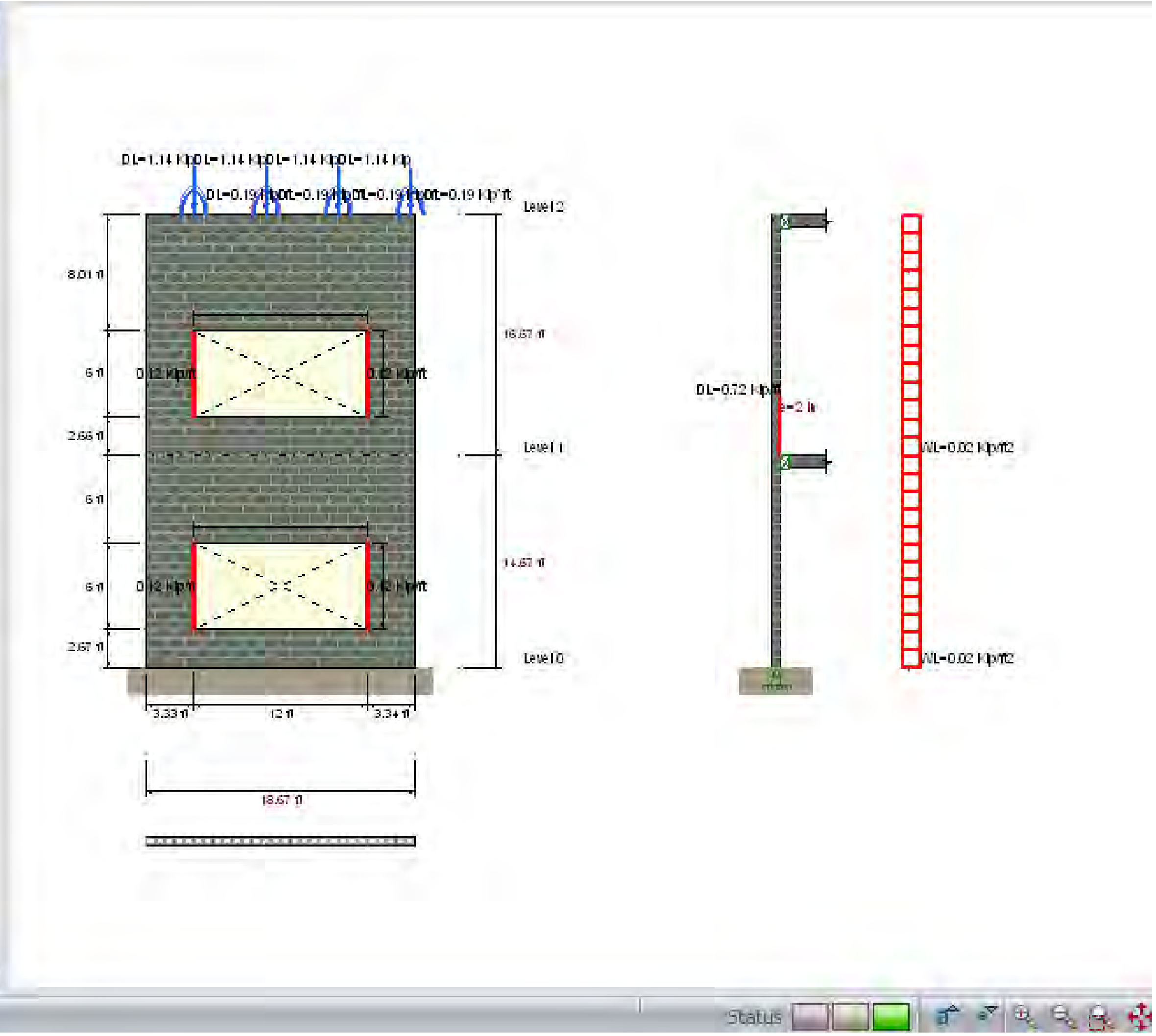


Structural Analysis

RAM Elements – Masonry Module

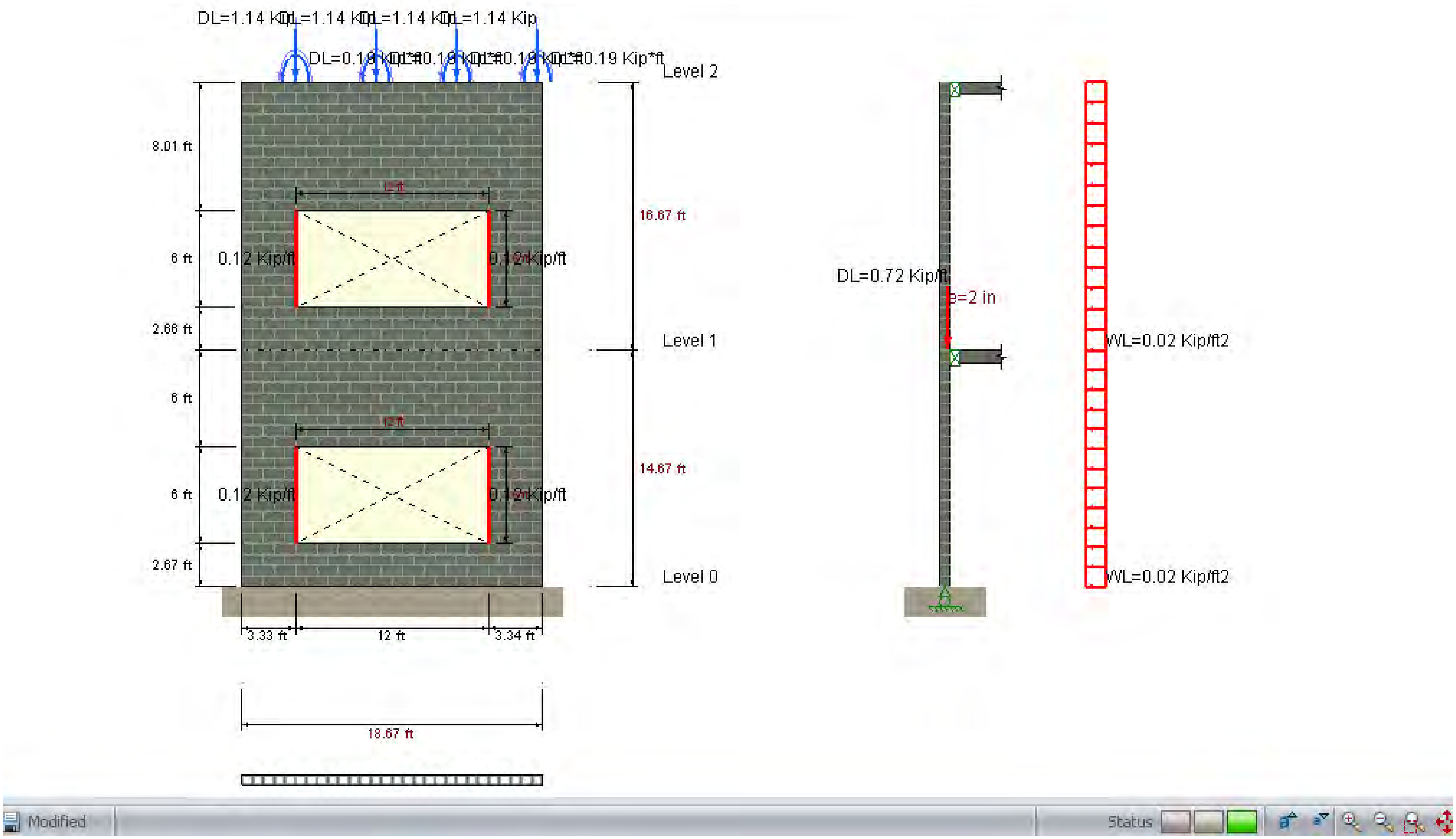
Property	Value
Units system	English
Geometry	
Number of levels	2
Same height levels	☐
Heights	<Heights>
Parapet height	0 ft
Length	18.67 ft
Bond type	Running
Block size	8 inch
Fixity at foundation level	Pinned
Level restraints	Pinned
Openings	<Openings>
Additional strips	<Strips>
Materials	
Material	CMU 2.0-60
Mortar type	Port/Mort - M/S
Mortar bed type	Face shell bed
Grouting type	Partial grouting
Rigidity elements	
Rigidity elements	None
Loads	
Vertical loads	
Self weight	DL
Concentrated	<Loads>
Distributed	<Loads>
Lateral in-plane loads	
Concentrated	<Loads>
Distributed	<Loads>
Seismic weight	<Seismic weight>

Modified



Structural Analysis

RAM Elements – Masonry Module



Structural Analysis

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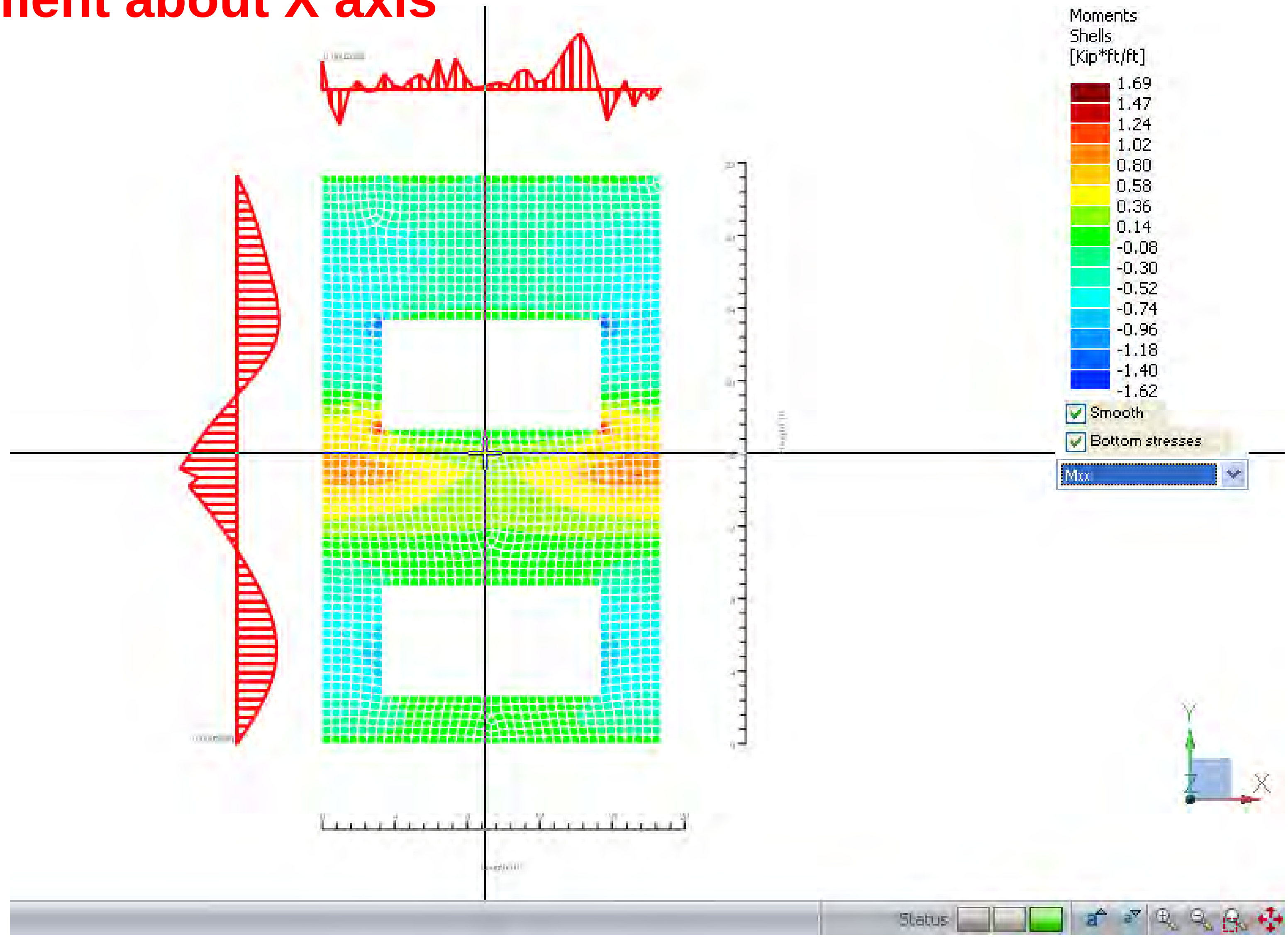
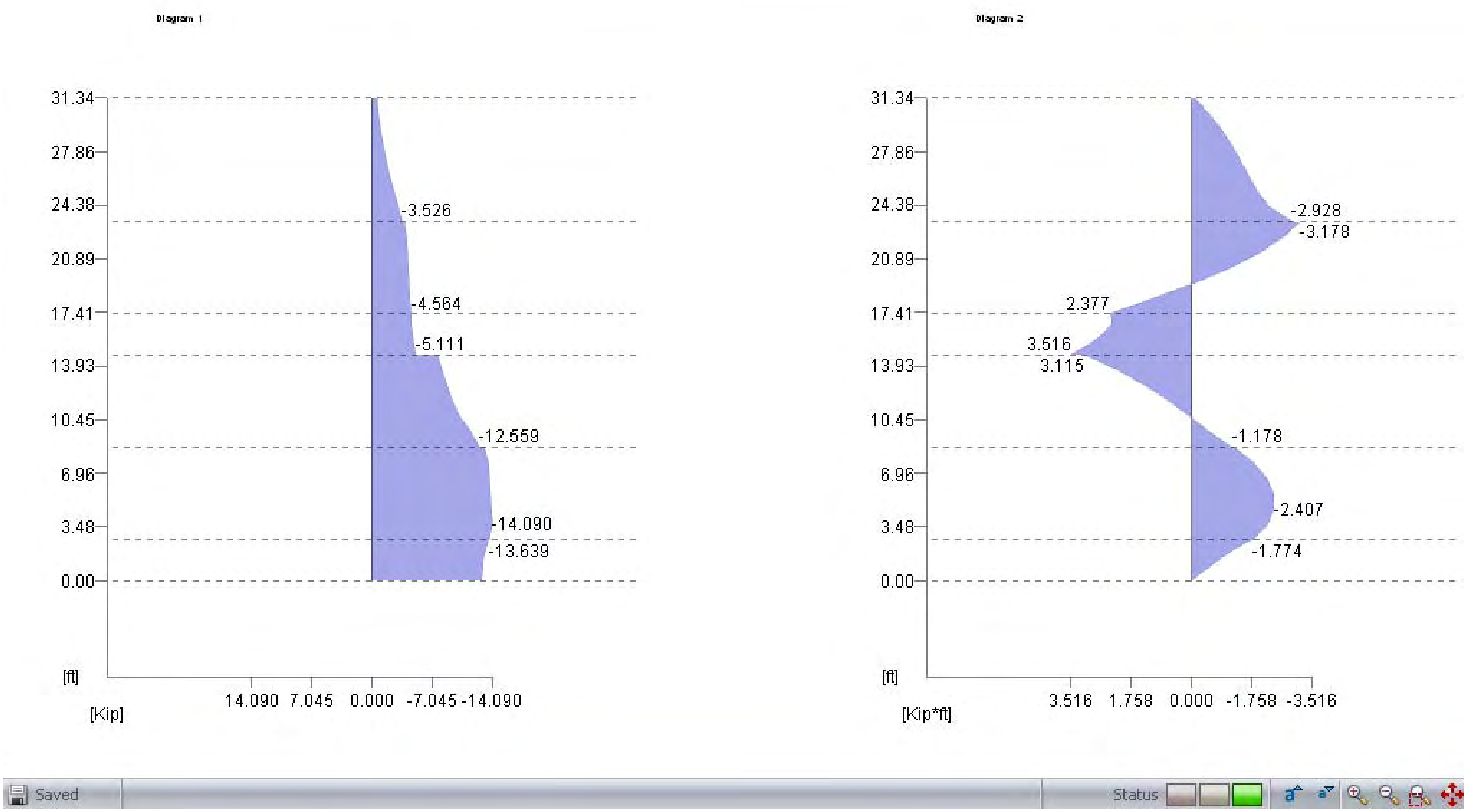
Moment about X axis



Structural Analysis

Axial and Moment Diagrams



Structural Analysis

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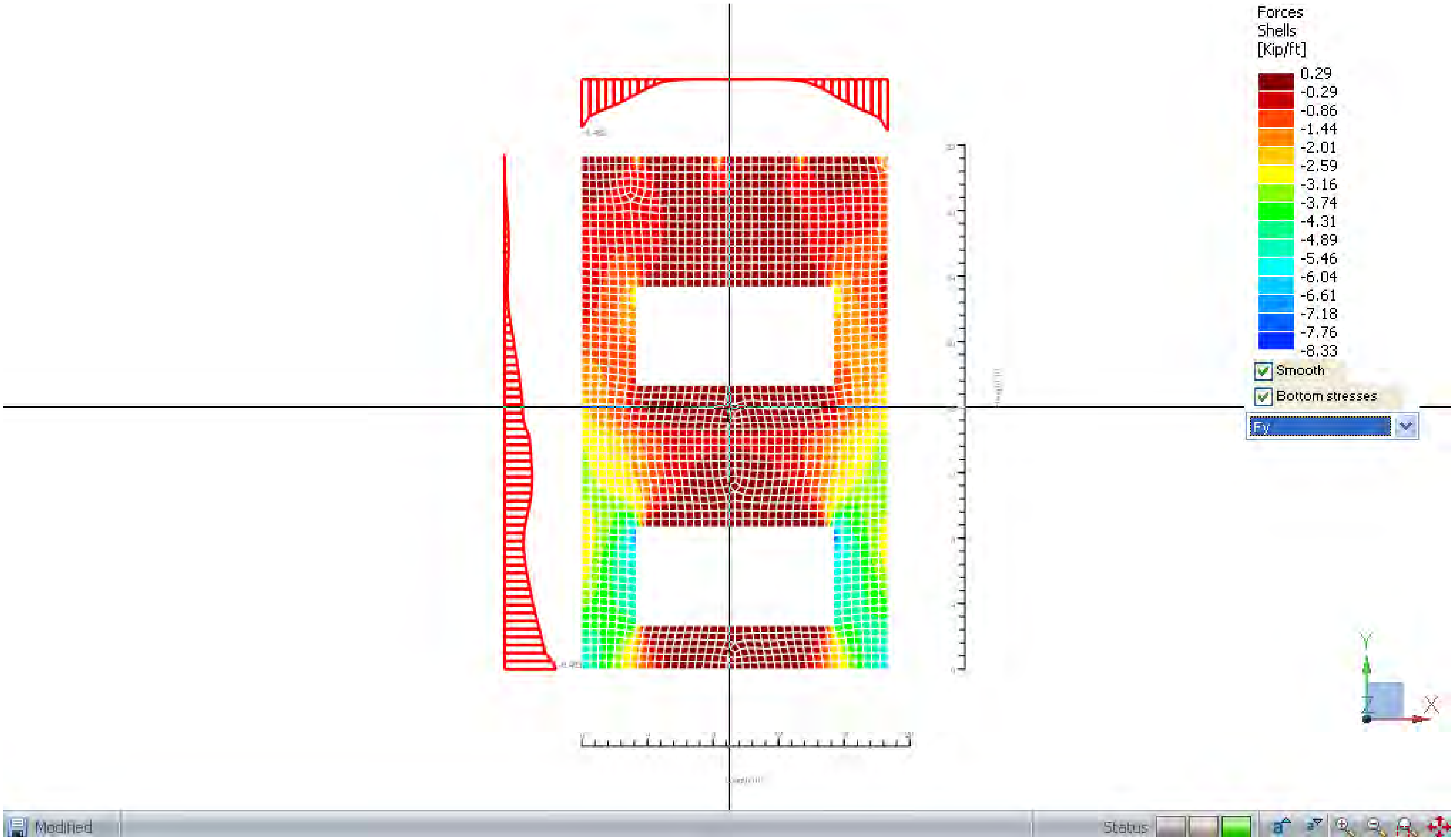
Forces in Y direction



Structural Analysis

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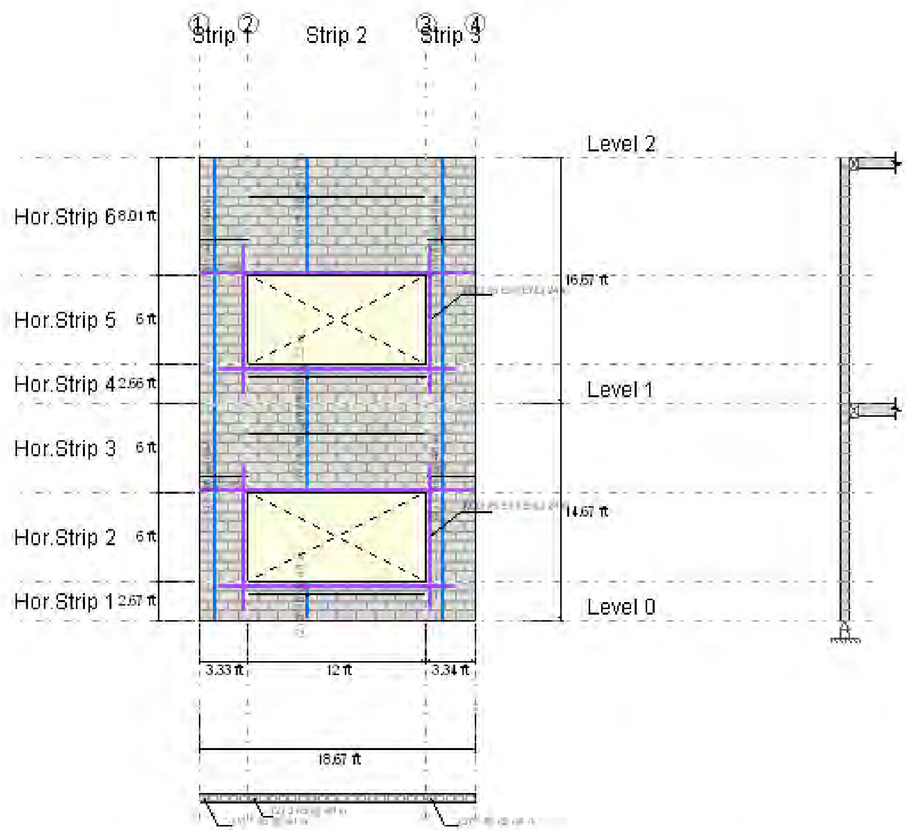
Steel Reinforcement

Vertical | Lintels | Openings

Group	Strip	Quantity	Bar	Spacing	Level	Dist1	Dist2
1	Strip 1	1	#5	48	0	0	14.67
2	Strip 2	3	#5	48	0	0	2.67
3	Strip 3	1	#5	48	0	0	14.67
4	Strip 2	3	#5	48	0	8.67	14.67
5	Strip 1	1	#5	40	1	0	16.67
6	Strip 2	5	#5	32	1	0	2.66
7	Strip 3	1	#5	48	1	0	16.67
8	Strip 2	3	#5	48	1	8.66	16.67



Modified
Status

Structural Analysis

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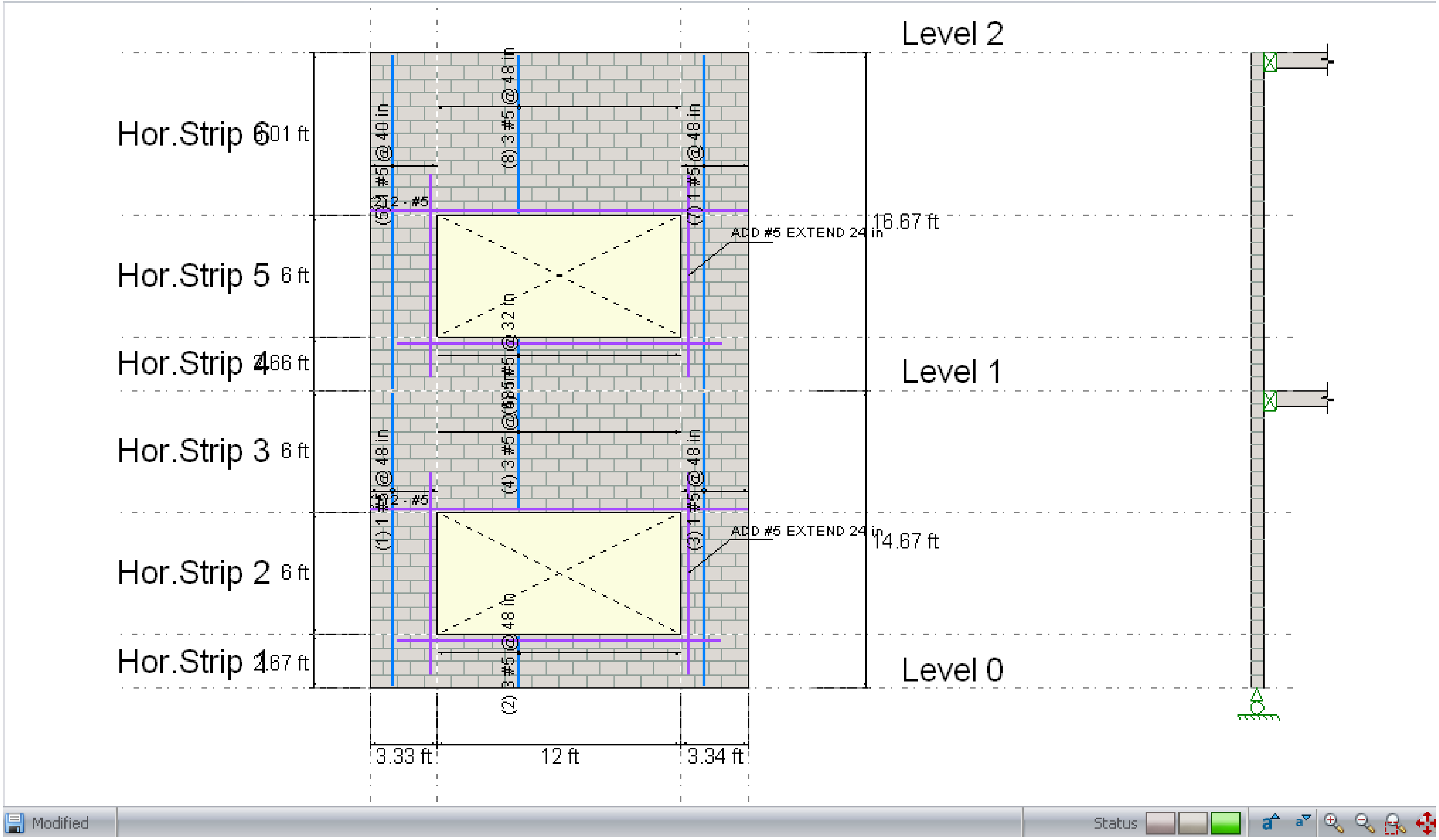
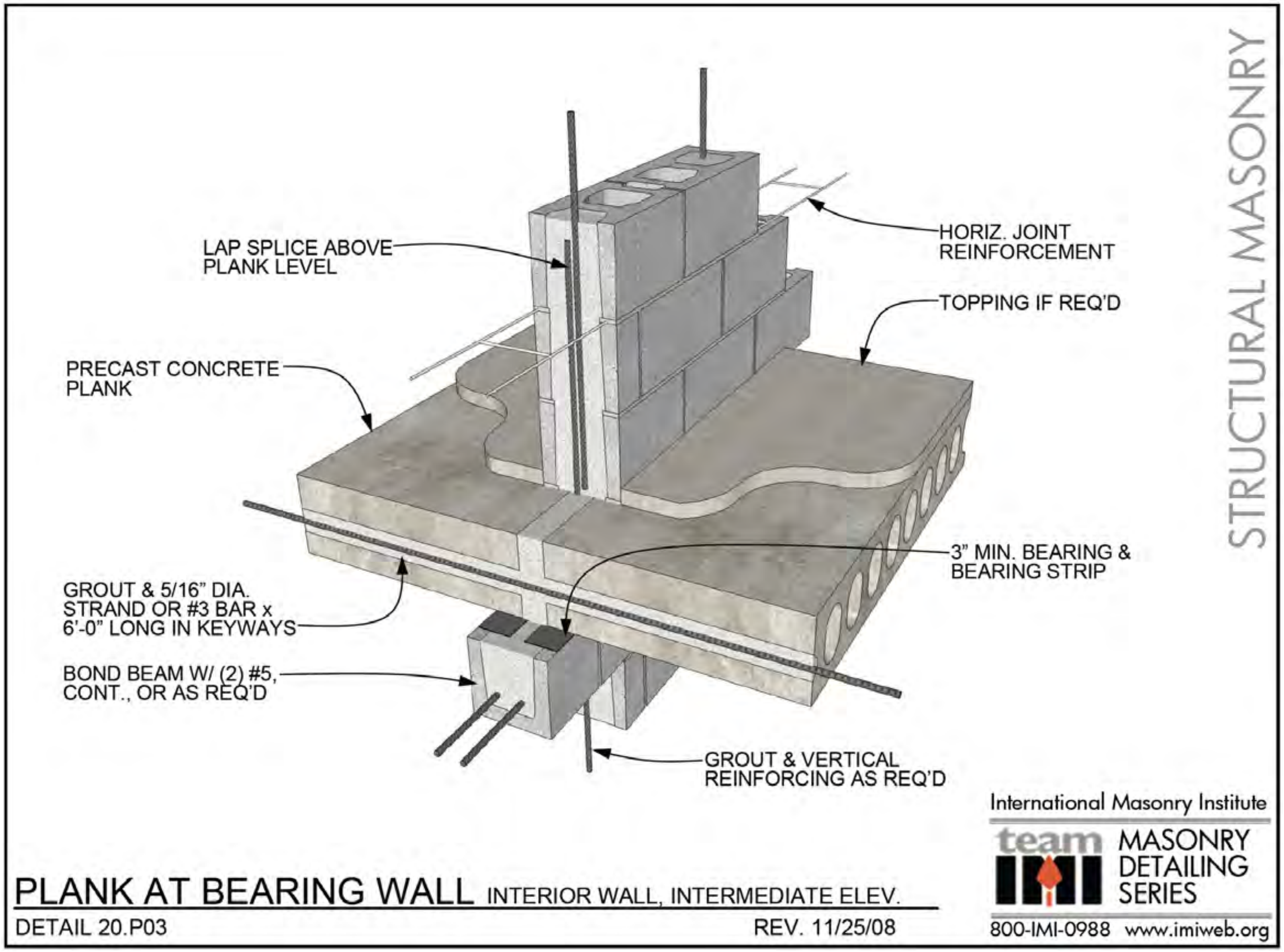
Steel Reinforcement

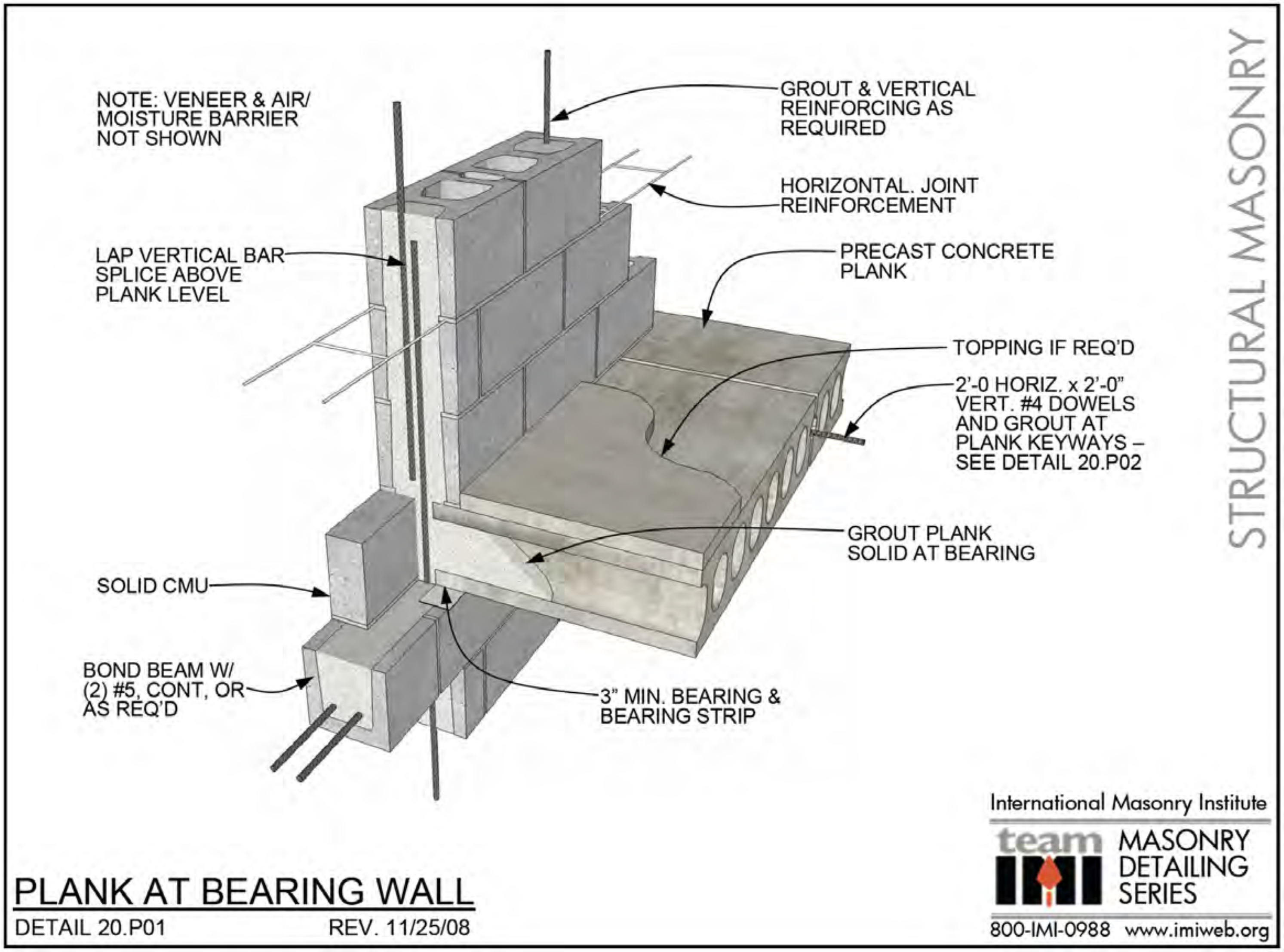


Structural Details



http://www.imiweb.org/design_tools/masonry_details/details/20_p03.php

Structural Details



http://www.imiweb.org/design_tools/masonry_details/details/20_p01.php

LEED Analysis (potential 36 pts max.)

DPS School Construction Project

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LEED 2009 for Schools New Construction and Major Renovation

Project Checklist

Project Name

Date

Sustainable Sites — Possible Points: 24

Y	N	?			
Y			Prereq 1	Construction Activity Pollution Prevention	
			Prereq 1	Environmental Site Assessment	
			Credit 1	Site Selection	1
			Credit 2	Development Density and Community Connectivity	4
			Credit 3	Brownfield Redevelopment	1
			Credit 4.1	Alternative Transportation—Public Transportation Access	4
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2
			Credit 4.4	Alternative Transportation—Parking Capacity	2
			Credit 5.1	Site Development—Protect or Restore Habitat	1
			Credit 5.2	Site Development—Maximize Open Space	1
			Credit 6.1	Stormwater Design—Quantity Control	1
			Credit 6.2	Stormwater Design—Quality Control	1
P			Credit 7.1	Heat Island Effect—Non-roof	1
			Credit 7.2	Heat Island Effect—Roof	1
			Credit 8	Light Pollution Reduction	1
			Credit 9	Site Master Plan	1
			Credit 10	Joint Use of Facilities	1

Water Efficiency — Possible Points: 11

Y	N	?			
Y			Prereq 1	Water Use Reduction—20% Reduction	
			Credit 1	Water Efficient Landscaping	2 to 4
			Credit 2	Innovative Wastewater Technologies	2
			Credit 3	Water Use Reduction	2 to 4
			Credit 3	Process Water Use Reduction	1

Energy and Atmosphere — Possible Points: 33

Y	N	?			
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
W			Credit 1	Optimize Energy Performance	1 to 19
			Credit 2	On-Site Renewable Energy	1 to 7
			Credit 3	Enhanced Commissioning	2
			Credit 4	Enhanced Refrigerant Management	1
			Credit 5	Measurement and Verification	2
			Credit 6	Green Power	2

Materials and Resources — Possible Points: 13

Y	N	?			
Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 2
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
W			Credit 2	Construction Waste Management	1 to 2

Materials and Resources, Continued

Y	N	?			
W			Credit 3	Materials Reuse	1 to 2
W			Credit 4	Recycled Content	1 to 2
W			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 19

Y	N	?			
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Y			Prereq 3	Minimum Acoustical Performance	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
W			Credit 3.1	Construction IAQ Management Plan—During Construction	1
W			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
W			Credit 4	Low-Emitting Materials	1 to 4
			Credit 5	Indoor Chemical and Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
W			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
W			Credit 8.1	Daylight and Views—Daylight	1 to 3
			Credit 8.2	Daylight and Views—Views	1
W			Credit 9	Enhanced Acoustical Performance	1
W			Credit 10	Mold Prevention	1

Innovation and Design Process — Possible Points: 6

Y	N	?			
			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
			Credit 1.4	Innovation in Design: Specific Title	1
			Credit 2	LEED Accredited Professional	1
			Credit 3	The School as a Teaching Tool	1

Regional Priority Credits — Possible Points: 4

Y	N	?			
			Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1

Total — Possible Points: 110

Certified 40 to 49 points   Silver 50 to 59 points   Gold 60 to 79 points   Platinum 80 to 110

LEED Analysis

And enough with the awards before a building is built and the performance is verified. Award plaques should come with removable screws. Show me the utility bills. Compare the building to a building of similar size and similar occupancy in a similar climate. And if you don't show any savings—shut up. You can't be "green" if you don't save any energy.

Prioritizing Green: It's The Energy Stupid, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

LEED Analysis

Don’t talk to me about biological diversity, recycled materials, and natural ventilation until after you have saved the energy. Spare me the social engineering and the smaller is better and how we all have to share the planet and how we are all equal until you have saved the energy. Don’t talk to me about carbon off-sets until you have saved the energy. You need some carbon savings before you can trade any.

Prioritizing Green: It’s The Energy Stupid, Joseph W. Lstiburek, Ph.D, P.Eng., Fellow ASHRAE

Sustainable

- **The ability to meet the needs of the present without compromising the ability of future generations to meet their own needs**

Brick

- Average embodied energy 1240 Btu/lb
- Brick produed in 38 states
- 96.5% used or sold after firing
- Manufacturing
  - Bottom and fly ash
  - Sewage sludge
  - Waste glass
  - Metallic oxides
  - Unwanted chemical waste
  - Coal and sawdust
  - Encapsulating contaminated soils
- Crushed and reused
  - Sub-base
  - Landscaping mulch and trails
- Reused brick buildings (sustainable)
- Salvaged

Sustainable

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CMUs

- Manufacturing
  - Old tires
  - Municipal waste
  - Wood chips and sawdust
  - Shot blasting plastic
  - Burned earth
  - Waste concrete
  - Crushed glass

Cement

- Manufacturing
  - Tires
  - Liquids
    - Used oils
    - Inks
    - Other non-hazardous liquids
  - Petroleum coke
  - Taconite
  - Foundry sand
  - Paint waste and solvents
- Supplementary cementitous materials
  - Granulated blast furnace slag
  - Fly ash

Sustainable

CO₂ footprint

- Masonry cement 0.38 tons per ton of material
- Mortar cement 0.56 tons per ton of material
- Portland/lime cement 0.90 tons per ton of material

- 0.6 lbs of CO_2 will be absorbed by CMU

Initial Construction Cost

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- **Exterior wall cost**

  $26-28/sf

- **Interior wall cost***

  $9-11/sf

***does not include premium finishes**

Loadbearing Masonry Schedule

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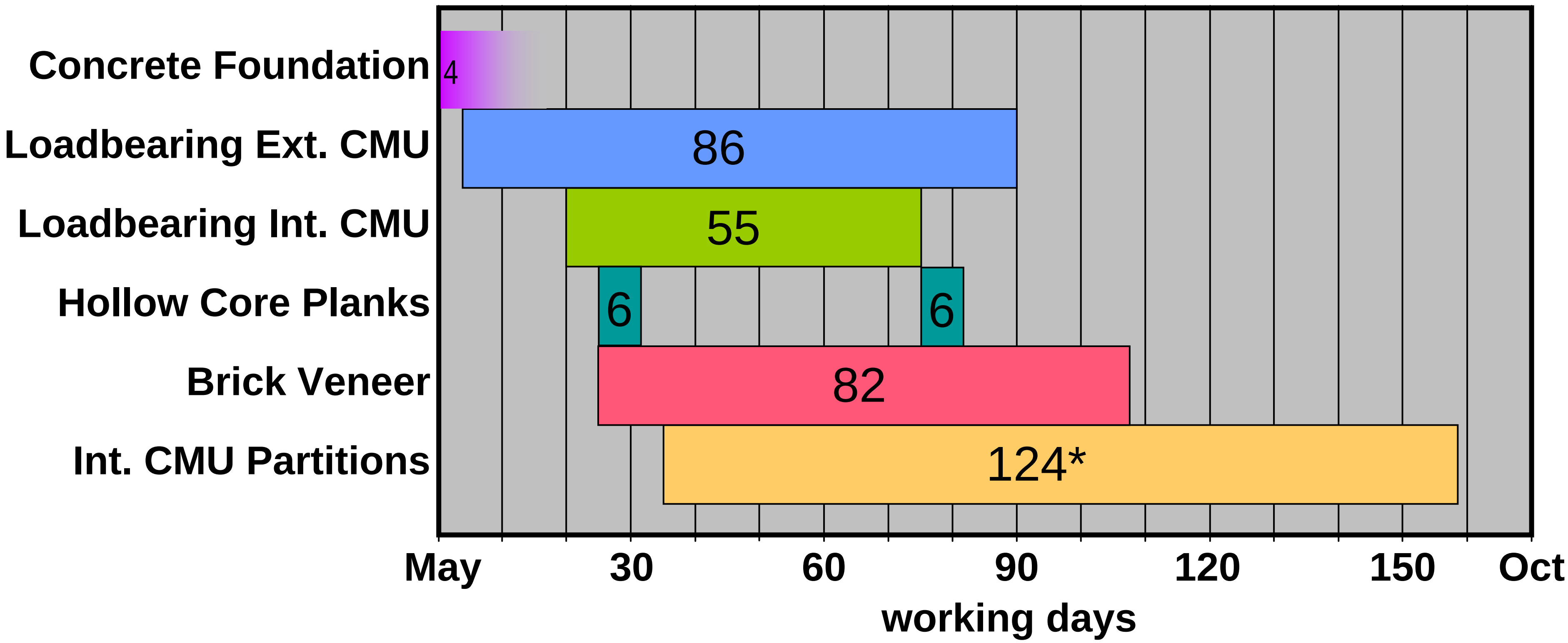

<u>32 working weeks</u>

<u>Average Crew Size</u>

14 bricklayers

11 laborers

***Crew size could increase depending on finishing brick veneer and could save 10 working days.**

Loadbearing Masonry Schedule

- **8” and 12” CMUs are readily available**
- **No lead time required**
- **No shop drawings required**

Life Cycle Cost (70 years)

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	Total Initial Construction Cost	Total Replacement/ Salvage[1]	Total Annual Costs (PW)[2]	Total Life Cycle Costs (PW)	Total Life Cycle Costs/ Wall Square Foot (PW)
Brick Veneer Over Block W/3" Spray Foam	$2.8M	$139,149	$569,079	$3.5M	$35.17
Brick Veneer Over Block W/2" Rigid	$2.9M	$139,149	$971,477	$4.1M	$41.07
Brick Veneer Over 6" Metal Stud W/Rigid Insulation	$3.3M	$208,312	$1,458,132	$5.0M	$50.37
Insulated Precast Panels	$6.3M	$271,490	$702,554	$7.3M	$73.00

[1]clean, repoint, reseal, and paint

[2]energy, fuel, maintenance, and repair

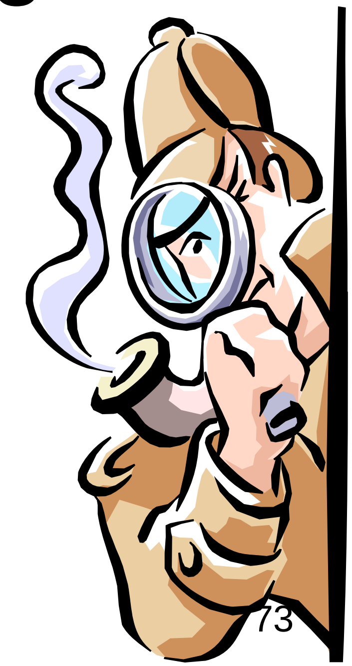
Specification Language

Quality Assurance Program

- MSJC 2005
- Special Inspection
- Mock-Up Panels
- Grout Demonstration Panel

Quality Assurance Program

- Masonry Wall Bracing Plan
- Installer Certifications
- Masonry Pre-Construction Meeting
- Quality Assurance Consultant



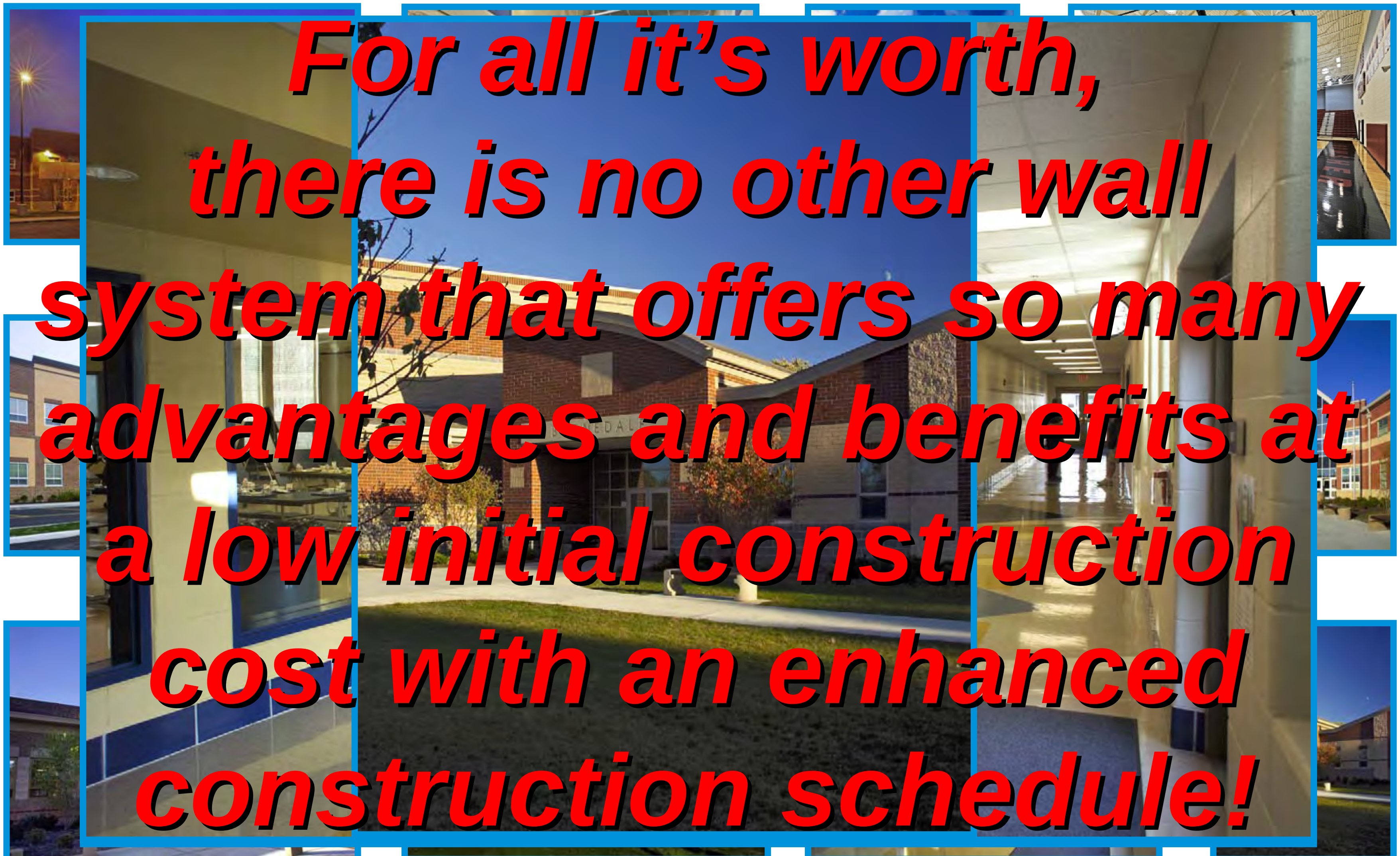
Design Manual

Walbridge Joint Venture For
Detroit Public Schools

Michigan Masonry Industry
Resource and Support Guide

Prepared For
National Organization of Minority Architects
March 24, 2010

Summary



For all it's worth, there is no other wall system that offers so many advantages and benefits at a low initial construction cost with an enhanced construction schedule!

MASONRY Institute of Michigan

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www.mim-online.org