Why Teach Masonry to Engineers?

AIA Course:

06-21-2022

Ece Erdogmus, PhD, PE
Professor and Chair
School of Building Construction
Georgia Tech

The Masonry Society

AIA Provider: 505119857

The Masonry Society is a registered Provider with the American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of completion for non-AIA members are available upon request.

This program is registered with AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

This course will present the barriers and benefits of teaching masonry as part of an engineering program. The presenter's own experiences in teaching masonry design in a variety of ways over the years will be showcased. The course will also provide sample contents for a masonry design course.

Learning Objectives

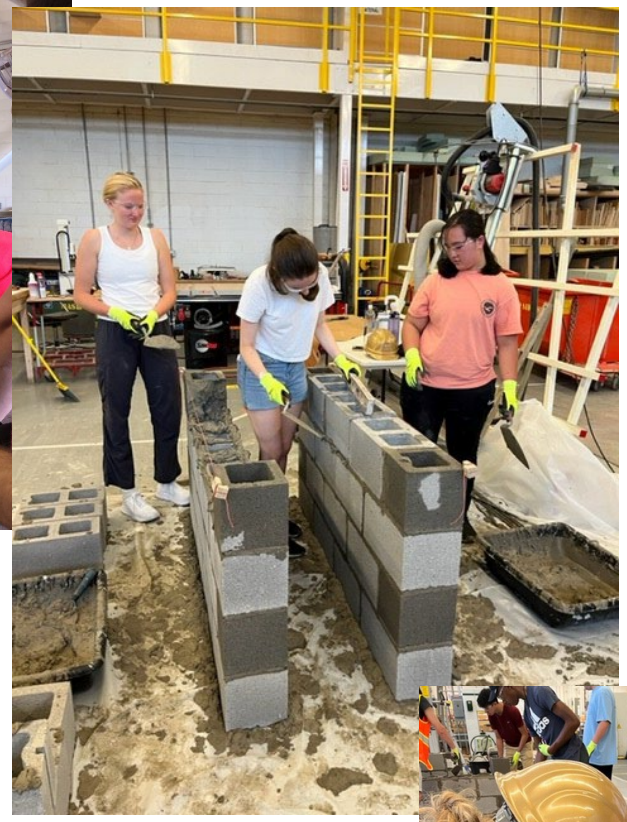
1. Understand the barriers and benefits of teaching masonry in an engineering curriculum
2. Understand strategies to include masonry design in an engineering curriculum
3. Understand potential contents of a masonry course
4. Learn about the various resources available to be used in a masonry course

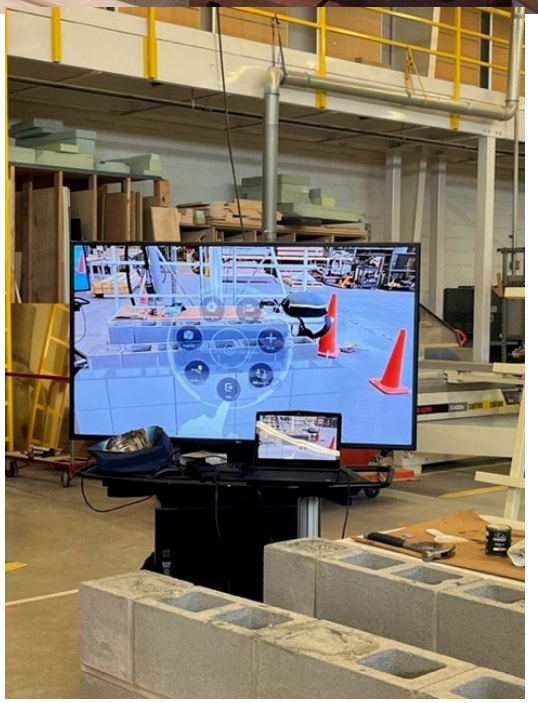
Barriers (Real and Perceived)

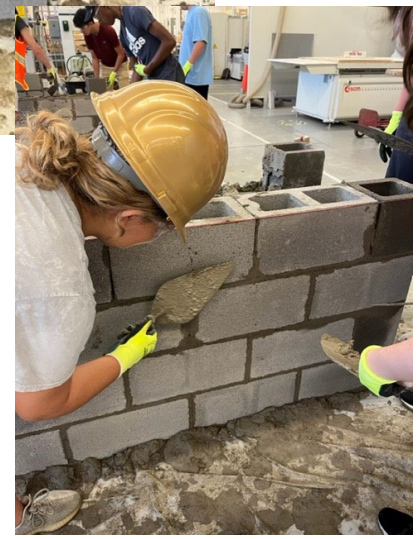
- Full curriculum (or imbalanced curriculum?)
- No faculty with expertise (or interest*)
- Laboratory facilities
- Prioritization of other topics/faculty for the department's mission (*)
- And my opinion… A lack of understanding (in both faculty and students) of the amount of masonry structures constructed and/or repaired in the U.S. on a continued basis

Benefits

- Students
- Faculty
- Department/School
- Industry/Environment







Benefits to students

- Masonry is the most commonly used material in construction – yet, unfortunately, it is **not** taught in many engineering programs. This is a **disservice** to our students.
- Other classes (steel and concrete) focus mostly on horizontal and vertical gravity-load carrying elements (beams and columns), so they do not cover "wall buildings". Therefore, students do not fully grasp lateral loads and related load paths well until they take a masonry design/analysis course.

Benefits to students

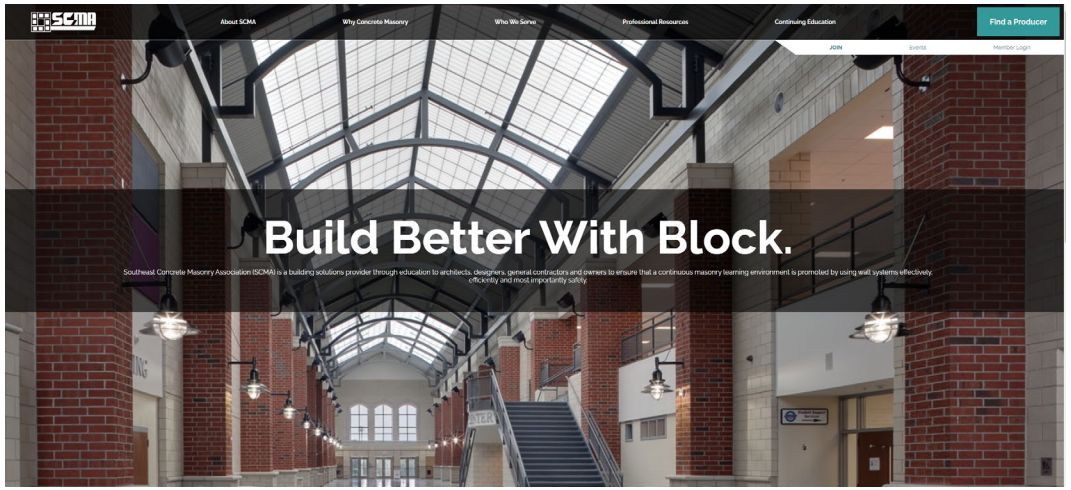
- PE/SE exams:
  - Masonry and lateral load distributions are both very much part of the exams' content
  - Students realize the lack in their education as they prepare. *Case in point: Former graduates constantly contact me to get lecture notes, audit the class, get access to a certain edition of the TMS 402/602, etc…*

Benefits to Faculty

- Successful career path with a “niche” specialization
  - Unique expertise in teaching:
    - Chance to become “indispensable” to your department (Will they miss you if you left? Good! Then, you are a major contributor!)
  - Industry contacts
    - Local masonry groups: They have problems, you can provide solutions!
    - Consulting firms without masonry experts
    - Consulting/training opportunities!
  - Research
    - Many unsolved problems and ideas for research (+)
    - Limited funding (-)* but… competition is also less (+)
      - *There is hope though!

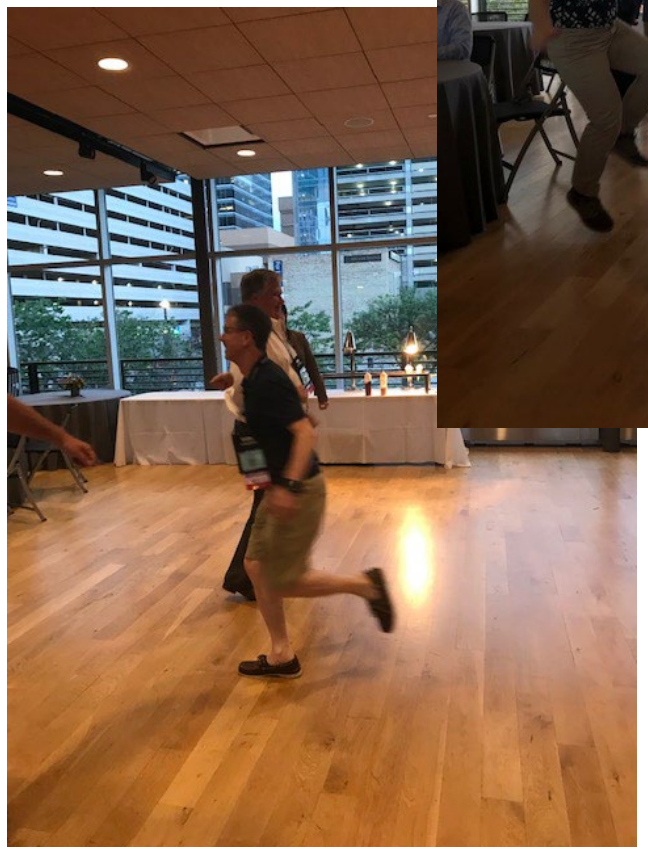
Benefits to Faculty

- Involvement with professional societies (TMS, BIA, NCMA, IMI, NMA, SCMA, MAG, ASTM…)
- Opportunities to contribute to code and standard development



Benefits to Faculty

The best people to work with for collaboration, networking, and getting things done while having fun! Everyone involved is passionate about masonry.



Benefits to Faculty

Many Publication Opportunities

- TMS Journal
  - Very interested and focused audience!
- ASCE Journals
  - J of Structural Engineering
  - J of Architectural Engineering
- ACI Journals
- ASTM Special Publications
- Conferences specifically on Masonry!
  - North American Masonry Conferences (every 4 years)
  - Canadian Masonry Conferences
  - International Brick and Block Masonry conferences
  - Many other held in Europe on retrofit of masonry
- Trade Magazines

Benefits to Faculty

We have our own conference! Submit your abstracts now!!!

https://masonrysociety.org/14namc/home/

Home / News & Events / 14NAMC Call for Abstracts Open Until July 11, 2022

14NAMC Call for Abstracts Open Until July 11, 2022

Filed in: 14NAMC, Featured News, NAMC News

14TH NAMC
OMAHA, NE | JUNE 11-14, 2023

Papers are invited for the **14th North American Masonry Conference (NAMC)**, which will be held from June 11-14, 2023, in the heart of historic Old Market in Omaha, Nebraska.

The conference is being jointly hosted by the Durham School of Architectural Engineering and Construction at the University of Nebraska-Lincoln (UNL) and the Nebraska Masonry Alliance (NMA), and is offered by the Masonry Society (TMS) with the support of a number of sponsors.

The conference seeks to provide a forum for sharing the latest advances in masonry knowledge and applications from around the world. Papers are sought on a wide variety of masonry topics.

Those interested in the conference will want to check the conference website often as new information is posted in the coming months. Information on submitting Abstracts and Papers can be accessed through the Paper Portal, linked from the top right of that website.

Benefits to your Department/School

- Distinguish department/school from other institutions
- A curriculum that is more relevant to the actual trends and actions of our industry

Benefits to the industry

- New hires with knowledge in the most recent code updates and technology applications
- Experts in universities to help with masonry related issues
- Experts in universities to foster *innovation* in masonry and masonry education
- A/E/C companies can broaden their participation in masonry-dominant projects (Educational facilities, warehouses, etc…)

Strategies to Include Masonry in Engineering Curricula

- Workshop/Continuing education course
- A module in another course
  - Part of capstone classes
  - Construction Materials & Methods/Materials Lab course
- Half a course (With another subject such as Timber, PC, etc…)
- Full semester course
- Study abroad
- Summer programs/camps
- Certificates

I've taught masonry design at UNL in 4 different ways in 17 years…

1. Full semester course- Only focused on Reinforced Masonry (RM) Design
2. Full semester course- Reinforced and Unreinforced Masonry (URM) Design
3. Half of a course along with Timber Design (In reality, masonry was 2/3 of the course ☺ …)
4. Added a masonry testing module to our sophomore level Mechanics of Materials course
   - Students build and test prisms. This is a required course and is still taught by PhD students I supervise.

Now I'm "inserting" masonry into GT Building Construction Curricula…

So far in ONE year:

- Two lectures at the Construction Materials and Methods class
- Entire summer camp around the design-build of masonry walls

Plans:

- Add block/brick plant tours to the Intro Seminar (Fall 2022)
- Capstone: Blank slate… (Spring 2023)
- Add a lab course with concrete/masonry/timber/steel testing to UG curriculum (AY23/24)
- New certificate program (???)

Full semester course on RM

- 16 weeks of masonry
- Covered both Strength Design (SD) and Allowable Stress Design (ASD) methods for reinforced concrete elements
- Topics:
  - History of masonry
  - Materials and Components (“learn to speak masonry”)
  - Pure Flexure (curtain walls, beams/lintels)
  - Bearing walls (axial + out-of-plane bending interaction)
  - Shear walls (axial + in-plane bending interaction)
  - Pilasters
  - Able to present current research on masonry in one lecture

Full semester course (RM & URM)

- 16 weeks of masonry
- Covered both Strength Design (SD) and Allowable Stress Design (ASD) methods for reinforced and unreinforced concrete elements
- Topics:
  - History of masonry
  - Materials and Components ("learn to speak masonry")
  - Pure Flexure (panel and curtain walls, beams/lintels)
  - Bearing walls (axial + out-of-plane bending interaction)
  - Shear walls (axial + in-plane bending interaction)
  - Pilasters
  - Able to present current research on masonry in one lecture

AE8510- Masonry and Timber Design

- This is where we have landed for the last several years…
- Why?
  - This allowed me to make MASONRY design **required** in our curriculum!!!
  - Resources: Program chair at the time wanted to have both topics a part of the curriculum BUT we did not have enough room in current curriculum or enough faculty resources

How does it fit in the UNL-AE curriculum

- UNL Architectural engineering is a 4+1 program
- We offer two degrees:
  - Bachelor's degree in architectural Engineering (BSAE)
  - Master of architectural engineering degree (MAE)
- MAE is our ABET accredited degree
- Specialization starts in the fourth year
  - Structures
  - Lighting/Electrical
  - Mechanical/Acoustics

Problems with a partial class

- Faculty needs to stay current with two materials, two industries, two codes: no time to relax!?
- Buying two code books for one class is expensive for the students
- Too much information to present to students at once: causes confusion or "*information indigestion*"

My solutions to the problems

- Faculty needs to stay current with two materials, two industries, two codes: no time to relax!?
  - I deal with it…
    - Remember, we want to be "indispensable!"
  - (Re)Discovered timber design is relatively simple and the industry/code is "slow changing"– it helps
  - Joined TMS 402/602 code committee: I have to stay current anyway and now it is two-birds-with-one-s*c*one!
    - Remember, we want to have a "niche" expertise!
  - If codes do change: You are not a bored teacher ☺ I actually enjoy the challenge. And the students appreciate it if you can explain the changes, or why a relatively confusing code section is the way it is!

My solutions to the problems

- Buying two code books for one class is expensive for the students
  - In Nebraska, NMA buys the masonry codes for students and they provide scholarships!
  - I am sure SCMA/MAG would help in GA, if asked
- Seek help from your local masonry community! They are awesome!!!

My solutions to the problems

- Too much information to present to students at once: causes confusion or “information indigestion”

  Okay, this was a true challenge and I iterated until I found the solution:

  1. **Be selective on content**
  2. **Project-based course**
  3. Graduate/Senior level course

  During COVID, I discovered also…

  + Flip the classroom wherever you can

The UNL Masonry Design Experience

AE8510- TENTATIVE Schedule for 2017

Module	Week	Date	Topic	Term Project Milestones
Module 1: Load Path, Lateral Loads, Building Design	1	1/10	Syllabus & Schedule, Lecture 1: Design Philosophies, Load combos	
		1/12	Lecture 2: Wind Load Calculations (ASCE 7-10)	
	2	1/17	Lecture 3: Seismic Load Calculations (ASCE 7-10)	
		1/19	Lecture 4a: Floor Diaphragm Types, Lateral Load Distributions	
		1/24	Lecture 4b: Floor Diapragm Types, Lateral Load Distributions	
	3	**1/26**	Extra time for completing the module/Review/ Project discussions	
		1/27 (Fri)	*Special REVIT Workshop with Todd Schakelford- PKI 248- 10-12am*	
	4	**1/31**	*AD Presentations*	**Project MS#1 (AD) due!**
Module 2: Masonry Design		2/2	Lecture 5:History of Masonry Construction	
	5	2/7	Lecture 6: Masonry Components and Material Properties	
		2/9	Lecture 6- *Continued*	
	6	2/14	Lecture 7-I: Nonloadbearing Masonry Panel Walls in Out-of-Plane Bending	
		2/16	Lecture 7-I *Continued*	
	7	2/21	Lecture 7-II: Nonloadbearing Masonry Curtain Walls in Out-of-Plane Bending + ASD Method	
		2/23	Lecture 7-III: Reinforced Masonry Lintels	**Project MS#2 (SD) due!**
		2/28	Lecture 8: Masonry Bearing Walls	
	8	3/2	Lecture 8 *Continued*	
		3/3 (Fri)	*Special REVIT & Team Work Session with Todd Schakelford- PKI 248- 1-3pm*	
	9	3/7	Lecture 9: Masonry Shear Walls	
		3/9	Lecture 9 *Continued*	
Module 3: Timber Design	10	3/14	Lecture 10: Wood construction terms and concepts	
		3/16	Lecture 11: Review of Terminology, Bending equation, Bending rules	**Project MS#3 (DD-1) due!**
	11	3/21	**SPRING BREAK!**	
		3/23		
	12	3/28	Lecture 11- *Continued*	
		3/30	Lecture 12: Beam Stability	
	13	4/4	Lecture 13: Full beam design example	
		4/6	Lecture 13- *Continued*	
	14	4/11	Lecture 14: Columns	
		4/13	Lecture 15- Trusses	
	15	4/18	Lecture 16- Bearing walls	
		4/20	No Class- Project work time	**Project MS#4 (DD-2) due!**
	16	4/25	In-class Project Discussions / Semester Review	
		4/27	**Project Final Presentations**	**Project MS #5 (Presentations) due!**
	17	**5/2**	Final Project Reports Due by 5pm	**Project MS #6 (Final Reports) due!**

Condensed content from my “full-semester” masonry course and Klingner (now Tanner) course notes

AE8510- TENTATIVE Schedule for 2017

Module	Week	Date	Topic	Term Project Milestones
Module 1: Load Path, Lateral Loads, Building Design	1	1/10	Syllabus & Schedule, Lecture 1: Design Philosophies, Load combos	
		1/12	Lecture 2: Wind Load Calculations (ASCE 7-10)	
	2	1/17	Lecture 3: Seismic Load Calculations (ASCE 7-10)	
		1/19	Lecture 4a: Floor Diaphragm Types, Lateral Load Distributions	
		1/24	Lecture 4b: Floor Diapragm Types, Lateral Load Distributions	
	3	**1/26**	Extra time for completing the module/Review/ Project discussions	
		1/27 (Fri)	*Special REVIT Workshop with Todd Schakelford- PKI 248- 10-12am*	
	4	**1/31**	*AD Presentations*	**Project MS#1 (AD) due!**
Module 2: Masonry Design		2/2	Lecture 5:History of Masonry Construction	
	5	2/7	Lecture 6: Masonry Components and Material Properties	
		2/9	Lecture 6- *Continued*	
	6	2/14	Lecture 7-I: Nonloadbearing Masonry Panel Walls in Out-of-Plane Bending	
		2/16	Lecture 7-I *Continued*	
	7	2/21	Lecture 7-II: Nonloadbearing Masonry Curtain Walls in Out-of-Plane Bending + ASD Method	
		2/23	Lecture 7-III: Reinforced Masonry Lintels	**Project MS#2 (SD) due!**
	8	2/28	Lecture 8: Masonry Bearing Walls	
		3/2	Lecture 8 *Continued*	
		3/3 (Fri)	*Special REVIT & Team Work Session with Todd Schakelford- PKI 248- 1-3pm*	
	9	3/7	Lecture 9: Masonry Shear Walls	
		3/9	Lecture 9 *Continued*	

This is what it looked like remote

Week	Date	Topic
1	1/12	Big Picture Discussion: Masonry and Timber Structures
	1/14	Syllabus & Schedule + Code/TextBooks + Design Philosophies + Load combos
2	1/19	***Masonry Arch Analysis Presentation***
	1/21	**Term Project Assignment + Wind&Seismic Load Assignment Q&A**
3	1/26	Snow day
	1/28	***REVIT refresher workshop***
4	2/2	Seismic Load Calculations/Masonry Shear Wall Types
	2/4	Lateral Load Distributions
5	2/9	Discuss Timber Videos
	2/11	***Masonry iQ Workshop***
6	2/16	Break out sessions: AD feedback for Teams + Timber Videos Q&A
	2/18	Timber Terminology: Review /Game Show --
7	2/23	***AD Presentations***
	2/25	Masonry Terminology Q&A
8	3/2	***Friedman Lecture through EERI- Earthquake Engineering***
	3/4	***Masonry Trivia Game***
9	3/9 3/11	**No-zoom (Mental Health) Week! Let's avoid Zoom-burnout and take a 2 week break from it! There are still asynchronous activities to do though.**
10	3/15 3/17	**SPRING BREAK!**
11	3/23	Arch analysis/design
	3/25	Discussion on Timber lectures 11&12, updates
12	3/30	Timber design wrap-up
	4/1	***DDS Workshop***
13	4/6	Watch timber videos 13-15
	4/8	Discussion on Timber lectures 13-15, Discussion on SD feedback
14	4/13	Lecture 7-Part 1 and Part 2 in class. Lecture 7-Part 3 as Assignment
	4/15	Lectures 8a and 8b
15	4/20	Lectures 9a and 9b
	4/22	Work on your projects
16	4/27	Review/Remaining items from Lecture 8 or 9.
	4/29	Project presentation draft feedbacks/DD submission feedback
17	5/4	Final Presentations and Final Reports Due

Masonry Topics

- Lateral load calculations (Wind and seismic, ASCE7-10)
- Lateral load distributions for “wall buildings”
  - Rigidities, effect of diaphragm rigidity
- History of Masonry
- Masonry Materials and Components
- Panel and Curtain Walls (URM and RM, SD and ASD)
- Beams/Lintels
- Bearing Walls (URM and RM)
- Shear Walls
- Putting it all together in a project!

Masonry topics/activities sacrificed

- ASD for all topics
  - I only cover it under flexure to give students familiarity with the method and the related code sections, and to be able to go over the theoretical differences with SD
- Pilasters
  - I think they can figure it out from what they have learned under beam-columns (exterior bearing walls)
- “Hand-holding”
  - No time for exams and too much element-by-element homework. They need to be working on their project from week 1 to the end, and add components to it as they progress.

Semester Project Example

2017 AE 8510 TERM PROJECT

College Dormitories in Winnebago, Nebraska

Your engineering firm is hired to design a dormitory complex located in **Winnebago, Nebraska.** This site is the home of a Native American reservation and the community is very interested in low cost and sustainable building construction. For their local community college, they need a new dormitory complex.

- The new building is to be **5,000 ft^2** in plan (each floor), with **two floors,** thus total square footage to be around **10,000 ft^2.**
- The complex should house **at least 15 dormitory rooms** and 1 community room of 1000 sq. ft.
- The community room should be accessed separately from outside and from a hallway inside and be able to also serve as a **tornado shelter**. At least one wall of the tornado shelter should be an exterior wall designed for high wind (tornado) level pressures.
- The lot available is rectangular, **60 ft by 120 ft**, longer sides facing south and north. It is facing a ridge (and a beautiful view of rolling terrain) on the north side. Busier streets on the site are the one along the south face and the east face. Owners do not have a major preference as to where the main entry should be.

Project Design Criteria

- The building's structural system must be designed using only masonry and timber.
- Roof can be flat with tapered insulation, or sloped.
- Roof and floor framing are expected to be in structural timber.
- Openings need to be more than 50% of plan lengths of walls to utilize day lighting.
- Each floor is expected to be about 10ft in height (can vary if justified due to the design/selection of building systems) in height and the openings should be at the middle 6 ft of the elevation (i.e. leaving 2 ft above and 2 ft below)

Broader Scope Considerations

- Preference (i.e. “extra points”) will be given to designs that consider some of the following, in addition to complete and accurate structural design:
  - Use of more sustainable material choices
  - Construction feasibility with thoughtful dimensions and design
  - Conscientious architectural and structural design for lower/optimal cost (initial or life-cycle)
  - Consideration for thermal and acoustical properties of the walls/building envelope
  - System integration (structural versus other systems—even though you are not designing other systems you can consider them in your structural and architectural designs
  - Unique and innovative features
  - Positive utilization of daylighting
  - Consideration for potential future installation of solar energy equipment

Sample Student Work

Next few slides…

(Please do not reuse)

PROPOSED COLLEGE DORMITORY DESIGN IN WINNEBAGO, NEBRASKA

BY

LAR ARCHITECTS AND ENGINEERS

27TH APRIL, 2017

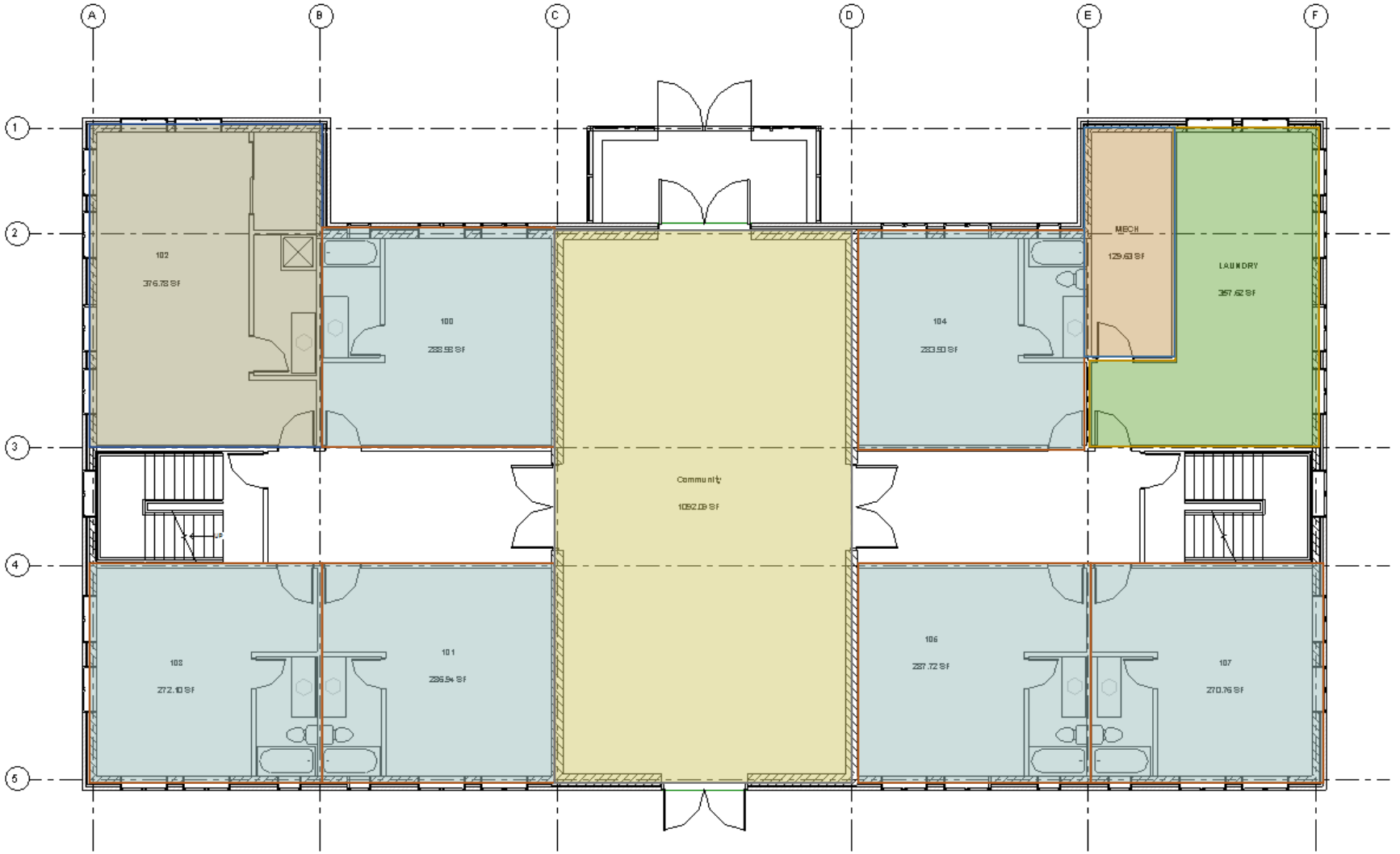
GROUP MEMBERS

Lucy Ampaw-Asiedu

Alexander Bleyhl

Ryan Duren

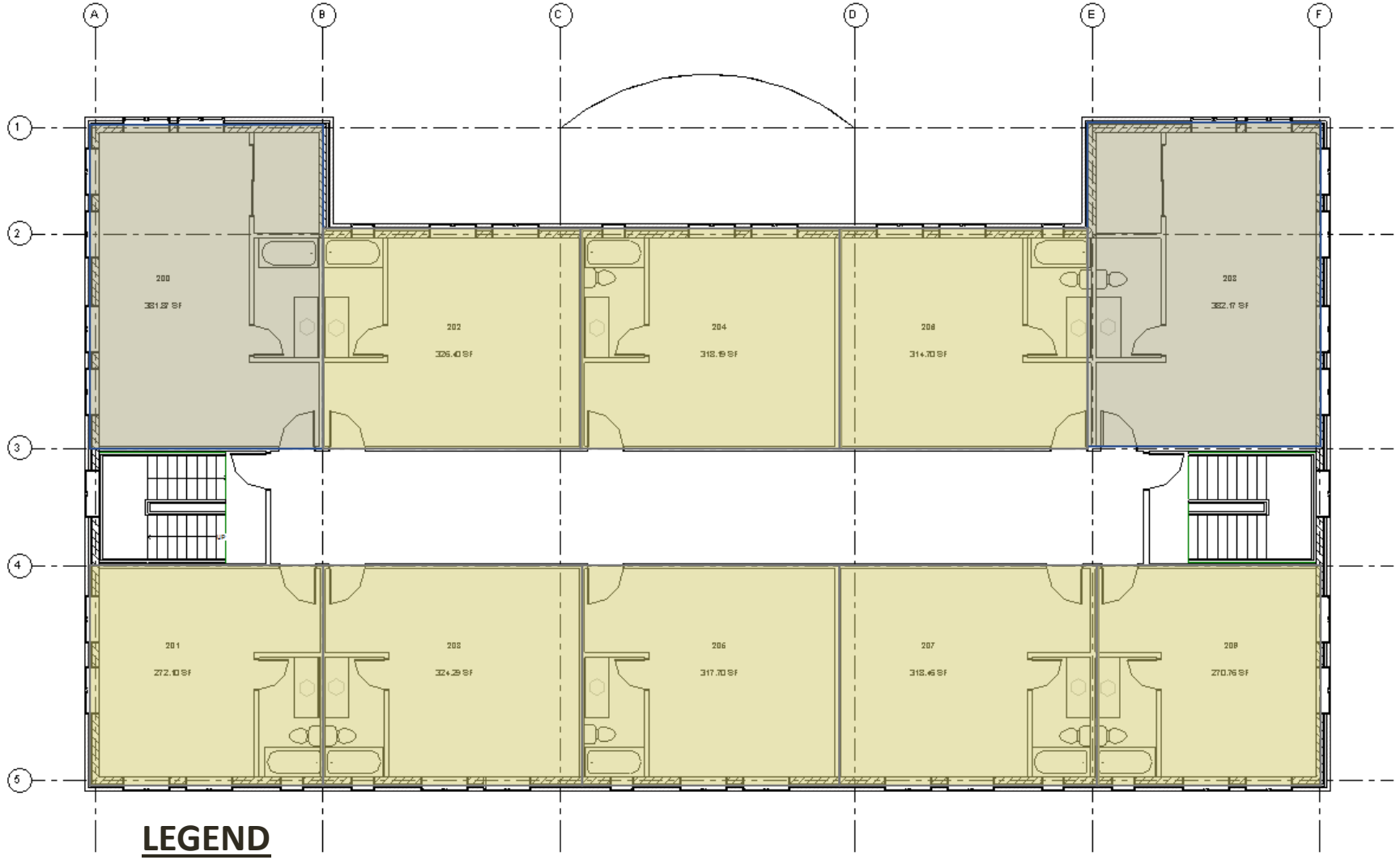
FIRST FLOOR PLAN



LEGEND

- ADA room
- Laundry room
- Dormitory room
- Community room
- Mechanical room

SECOND FLOOR PLAN



LEGEND

Big dorm rooms

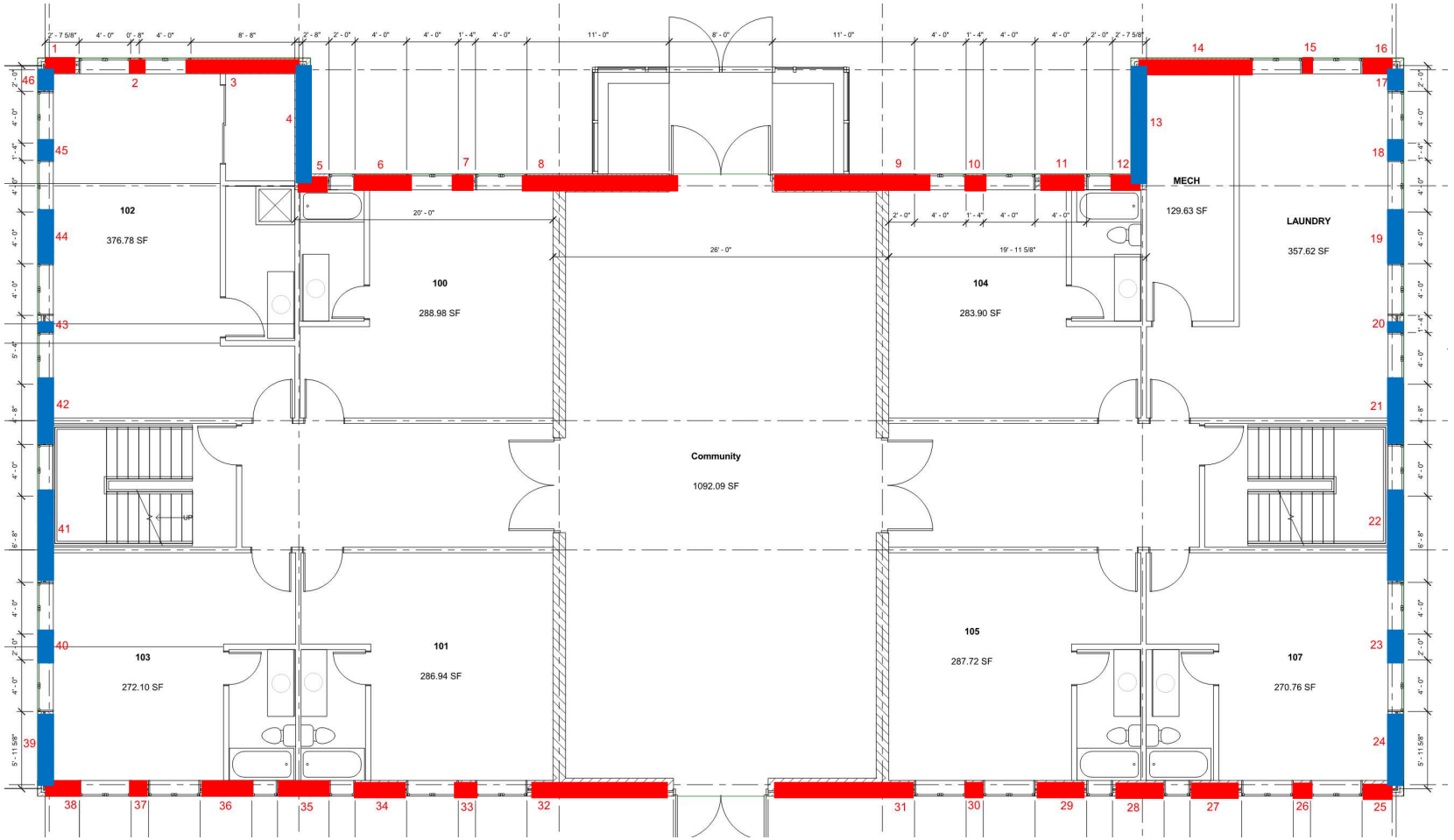
Smaller dorm room

Lateral Wind Loads

Risk Category	Wind Speed	K_d	Exposure Category	K_{zt}	G	Enclosure Category	GC_{pi}
III	120 mph	0.85	C	1.0	0.85	Enclosed	± 0.18
III	250 mph	0.85	C	1.0	0.85	Enclosed	± 0.55

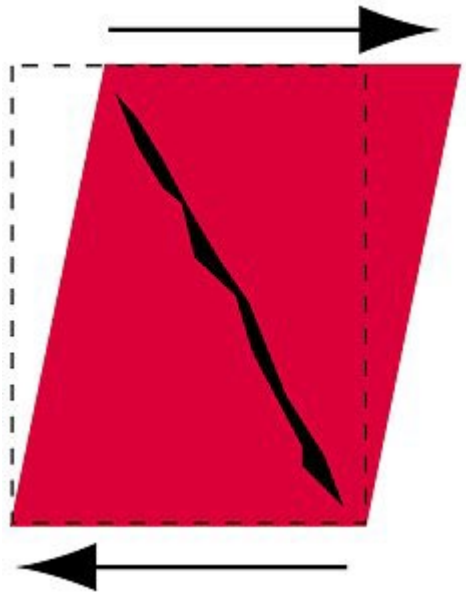
- Wind controlled base shear
  - N-S = 85.8 kips
  - E-W = 47.5 kips
- Impact considerations per FEMA

Shear Load Distribution



Shear Load Distribution

- **Storm Shelter**
  - Direct Shear calculated ignoring torsion in both N-S and E-W directions
    - L/h determined and ratio applied to total shear
  - Eccentricity then determined to find if torsion is necessary
    - No eccentricity for storm shelter
- **Main Building**
  - Direct Shear
  - Eccentricity Calculations
    - Center of Rigidities compared to Geometric Centers
      - Zero eccentricity in E-W direction
      - 10.1 feet eccentricity to the north in N-S direction
  - Torsional effect must be added to Direct Shear calculations!
    - Rigidity factor used in combination of distances to center of rigidity

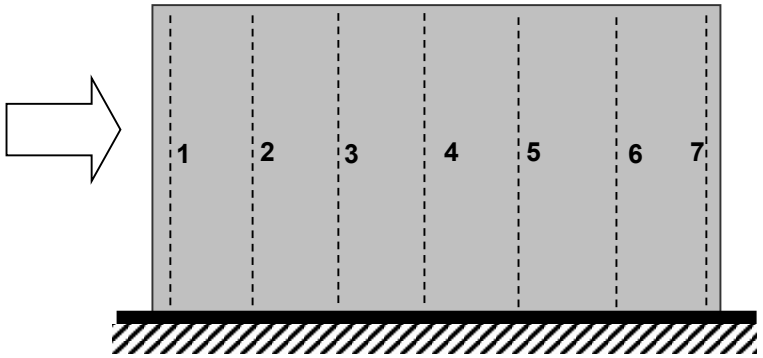


http://www.arch.virginia.edu/struct/pompeii/masonry/masonry-1.html

MASONRY DESIGN

In-Plane Shear Reinforcement

- Each wall was investigated individually
- Excel used to speed up process and make multiple changes.
- Pu and Mu was determined with concentric (CMU self weight) and eccentric loading (Floor level loading)
- Group #1 Walls
  - f'm= 2500 psi
  - Length= 8'-8"
  - Emu= .0035 (CMU)
  - Standard Grade 60 Steel
  - Need #5 bar @ 48" O.C.



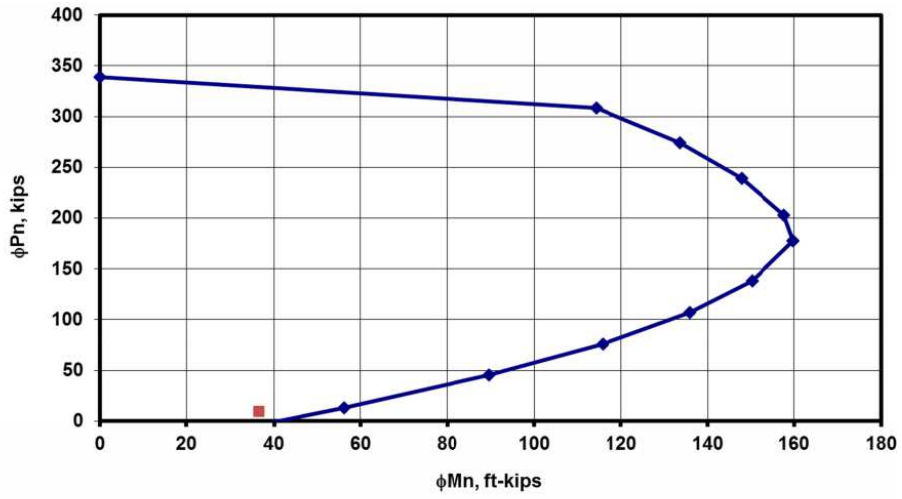
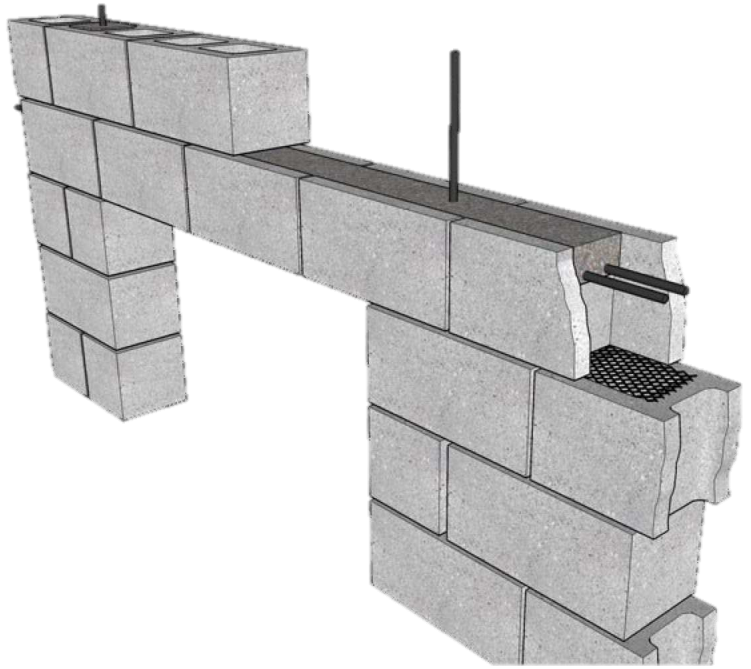


Figure 4: Wall Group #1 (Walls 1,16,25,38)

Lintel Design

- Two lintel designs for N-S walls
  - 2’ openings and 4’ openings
- One designs for E-W Walls
  - 4’ openings
- One design for safe room
  - 8’ openings
- Design
  - L(eff) must be determined as well as d(v)
  - Applied loads were found
  - Check if horizontal shear reinforcement needed
  - Find As required
  - Find moment capacity
    - Must be less than nominal



http://imiweb.org/02-120-0851-blank-at-bearing-wall-top-of-wall/

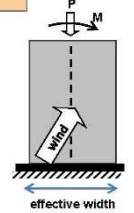
Location	Opening Size	Reinforcement Schedule
N-S Walls	2'	One #4 28" Long, 2" above opening. Beam Height=14"
N-S Walls	4'	One #5 56" Long, 2" above opening. Beam Height=28"
E-W Walls	4'	One #6 at 32” from level above.
Storm Shelter	8'	One #7 bar at 46” from roof.

OUT OF PLANE

- Critical section (middle of the wall)
- Pu and Mu was determined with concentric (CMU self weight) and eccentric loading (Floor level loading)
- Tensile stresses were checked and needed to be reinforced
- Excel used to generate spacing and interaction diagram

8 in solid CMU, #5@16in

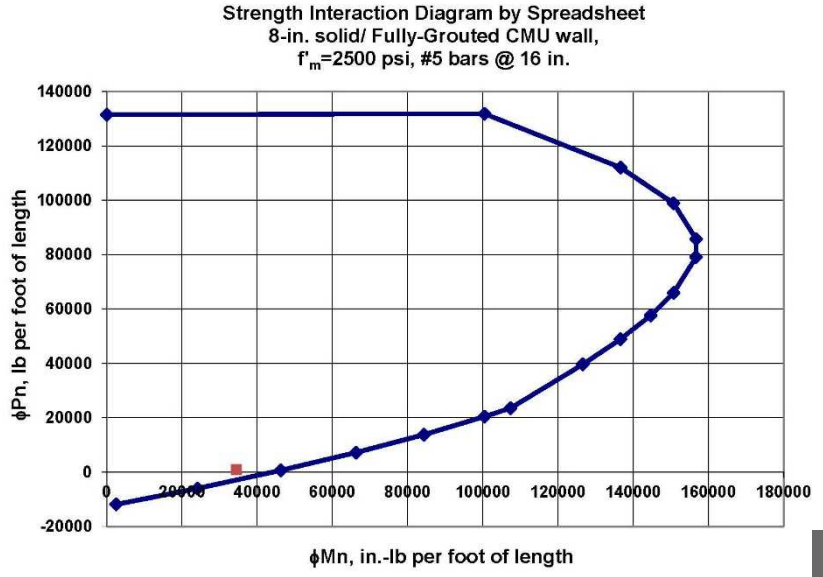
reinforcement at mid-depth	d=t/2	
specified thickness (t)	7.625	
emu	0.0025	
f'm	2500	
fy	60000	
Es	29000000	
d	3.8125	
(c/d)balanced	0.547	(masonry strain/ total strain)
tensile reinforcement area	0.31	
effective width	16	
phi	0.9	



because compression reinforcement is not supported, it is not counted

					Factored!	
Points controlled by steel	**c/d**	**c**	**Cmas**	**fs**	**Moment (PhiMn)**	**Axial Force (PhiPn)**
	0.010	0.038	976	60000	2502	-11896
	0.100	0.381	9760	60000	24112	-5967
	0.200	0.763	19520	60000	46215	621
	0.300	1.144	29280	60000	66308	7209
	0.400	1.525	39040	60000	84392	13797
	0.500	1.906	48800	60000	100467	20385
balance point	0.547	2.086	53404	60000	107352	23493
Points controlled by masonry	0.547	2.086	53404	60000	107352	23493
	0.700	2.669	68320	31071	126588	39614
	0.800	3.050	78080	18125	136635	48911
	0.900	3.431	87840	8056	144672	57606
	1.000	3.813	97600	0	150701	65880
	1.200	4.575	117120	0	156729	79056
	1.300	4.956	126880	0	156729	85644
	1.500	5.719	146400	0	150701	98820
	1.700	6.481	165920	0	136635	111996
	2.000	7.625	195200	0	100467	131760
pure axial load					0	131425
			Points from example:		34515	918

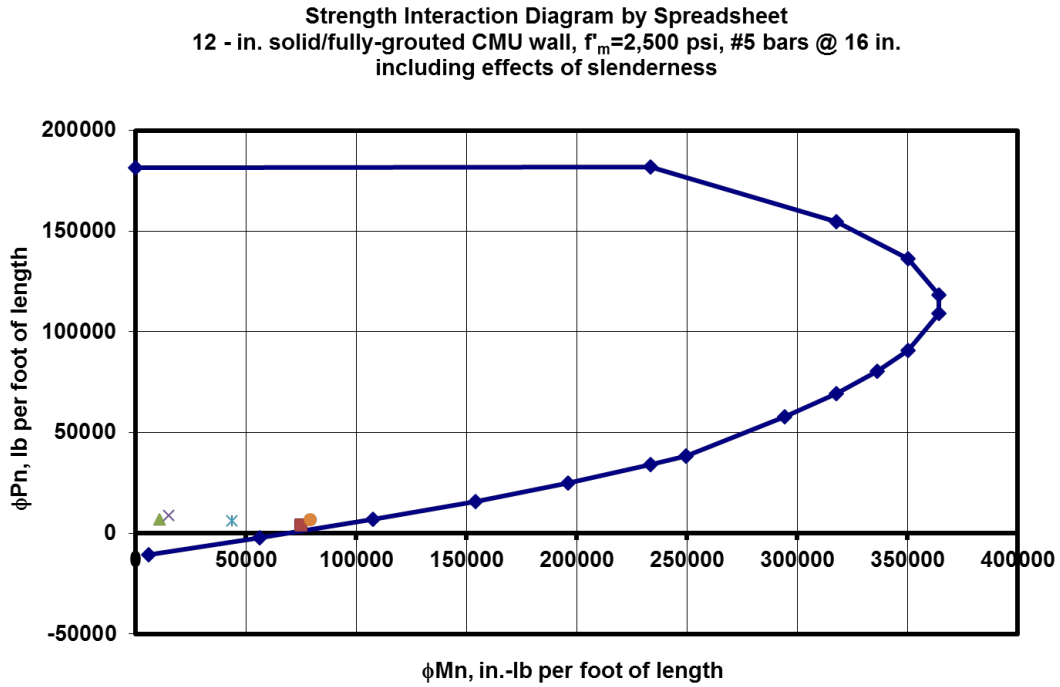
Figure 1: Out of plane bending



SAFE ROOM STRUCTURAL DESIGN

Design Checks

- Out of plane bending and axial load
- In plane bending and axial load
- Out of plane shear
- In plane shear



Design Summary

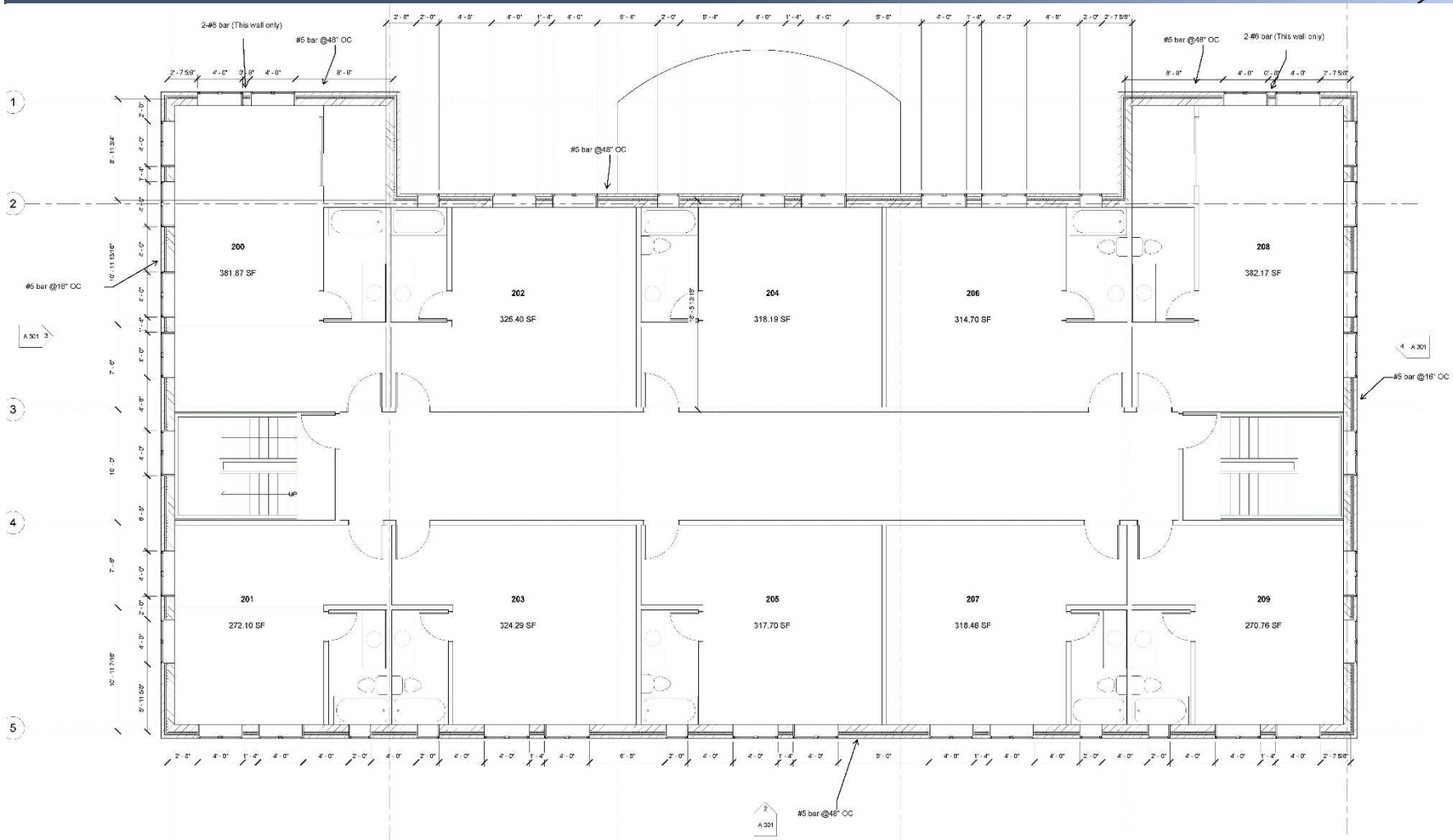
- 12” CMU
- Fully grouted
- #5 Bars @ 16” O.C.
- Lintel
  - #7 bar 46” from roof

FINAL MASONRY STRUCTURAL DESIGN

Safe room with reinforcements

WALLS	REINFORCEMENTS
N&S WALLS	#5@16”OC
E&W WALLS	#5@16 OC

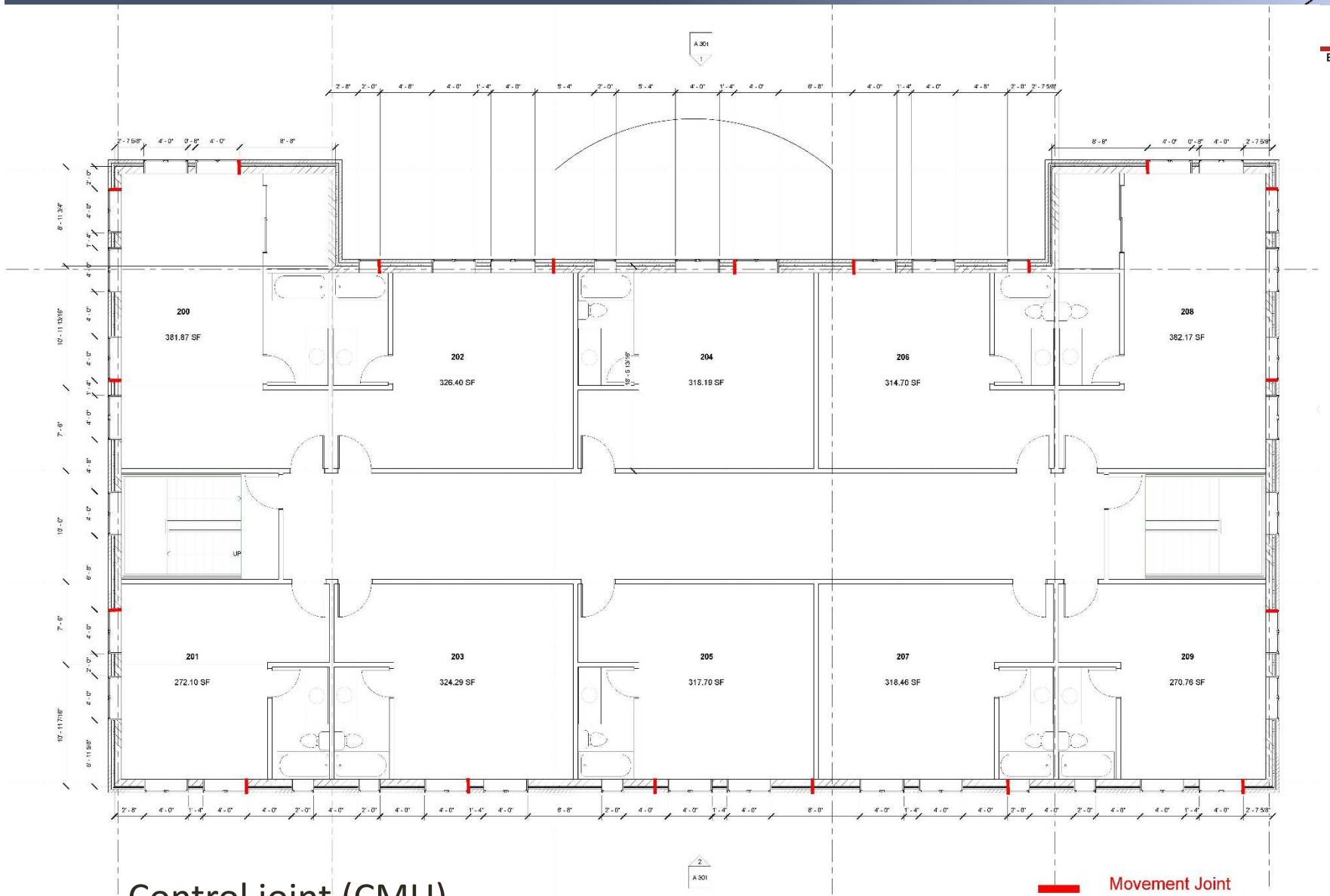
FINAL MASONRY STRUCTURAL DESIGN



Main building with reinforcements

WALLS	REINFORCEMENTS
N&S WALLS	#5@48”OC, 2#6
E&W WALLS	#5@16 OC

MOVEMENT JOINT



Control joint (CMU)

Expansion joint (Clay Brick)

Resources

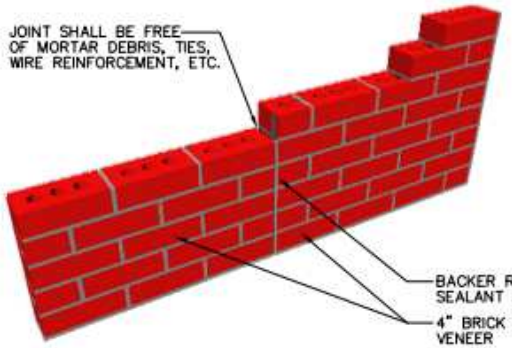
- The Masonry Society
  - https://masonrysociety.org/
  - Join TMS!
  - TMS 402/602 - Building Code and Specification
    - Discounts for code books for group of students (5 or more) are available!
- The National Concrete Masonry Association (NCMA)
  - Students' words: "TEK Notes are awesome!"
  - www.ncma.org
- The Brick Industry Association (BIA)
  - Students' words: "Technical notes are also awesome!"
  - www.gobrick.com

Oth
Res

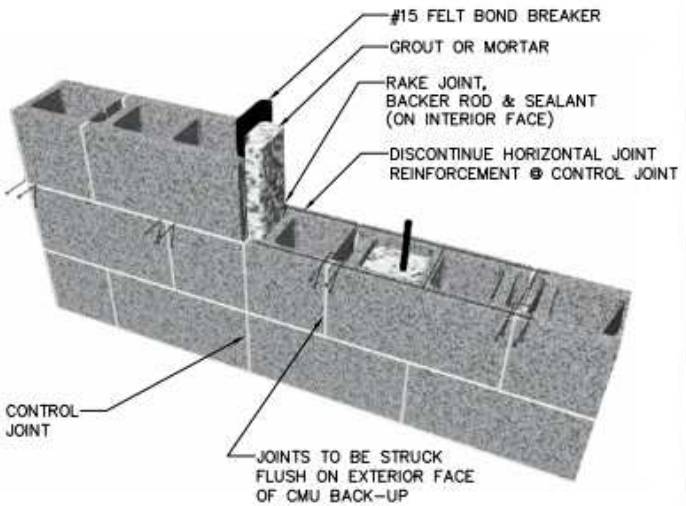
MASON
Institute of Mic

fo.org/

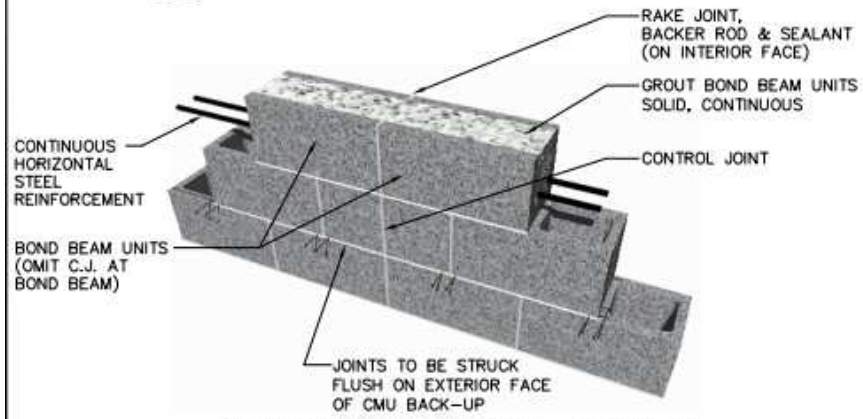
NOTE:
THERE IS USUALLY NO NEED FOR BRICK EXPANSION JOINTS TO ALIGN DIRECTLY WITH CONTROL JOINT LOCATIONS IN THE CMU BACKUP.



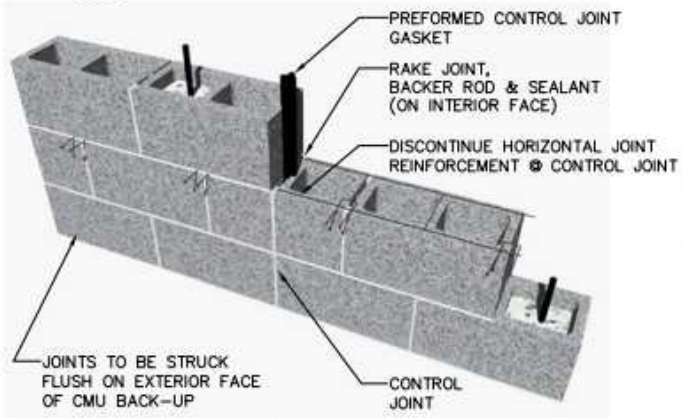
8D / A-1 BRICK EXPANSION JOINT (EJ)



8A / A-1 CMU BACK-UP CONTROL JOINT – MICHIGAN DETAIL



8C / A-1 MASONRY CONTROL JOINT @ CONTINUOUS BOND BEAM DETAIL (PER STRUCTURAL REQUIREMENTS)



8B / A-1 CMU BACK-UP CONTROL JOINT – ALTERNATE DETAIL

DAILEY ENGINEERING, INC.
8466 STEPHENSON ROAD
ONSTED, MI 49265
PH. # (517) 467-9000
FAX # (517) 467-9010

the Masonry Institute of Michigan, Inc.

GENERIC WALL DESIGN – MULTI WYTHE (8" CMU W/ BRICK VENEER)

IN CHARGE:
DRAWN: M.W.F.
APPROVED:
DATE: 05/03/2011
TITLE: CONTROL/EXPANSION JOINT DETAILS
SHEET: A-9

MEGAN SMITH/THE WORLD

An aerial view of the building housing M's Pub on the corner of 11th and Howard St. on Sunday Jan. 10,

In conclusion

- Masonry matters!
  - Masonry is durable and strong
  - Masonry is everything: It is the structural system, architectural interest, and the **building envelope** all at once in a wall building.
  - Masonry is used much more commonly in buildings than many people think!
  - Masonry design skills are sought after in young engineers.

In conclusion

Let's make masonry design a permanent and non-negotiable part of structural engineering/architecture/construction management curricula together!

Thank you!
Questions?

Ece Erdogmus, PhD, PE

Professor and Chair,

School of Building Construction

Georgia Tech

Email: Ece.Erdogmus@design.gatech.edu

This concludes The American Institute of Architects Continuing Education Systems Course

Certificates of Attendance

Session: Why Teach Masonry to Engineers?

Code: 9TG7

- Submit this code through the continuing education link on the workshop resources page
- Select this session from the menu and enter the code shown above (not case-sensitive)