

CONCRETE BUILDINGS **REDEFINED**

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PRESENTATION PREPARED BY CIVIC CONSULTANTS INC
MARCH 2017

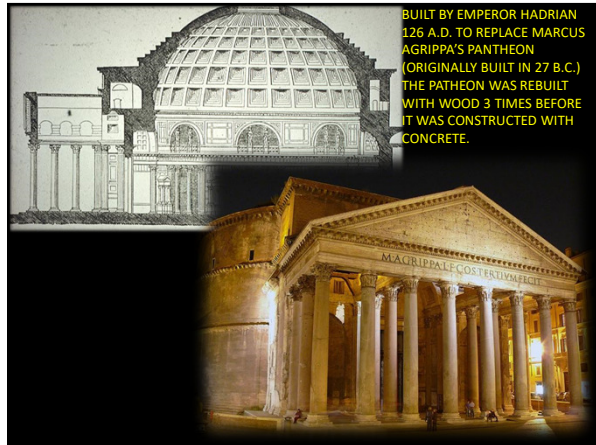
PRESENTATION OBJECTIVES

- REVIEW THE LONGEVITY OF CONCRETE AS A CONSTRUCTION MATERIAL FOR BUILDINGS.
- TECHNIQUES TO ADD DISASTER RESILIENT CONSTRUCTION
- MAXIMIZE ENERGY EFFICIENCY OF THE EXTERIOR SHELL OF A BUILDING.
- TO UNDERSTAND "NET-ZERO" FOR BUILDINGS.
- IMPROVE YOUR BUILDINGS STC RATING.

REVIEW THE LONGEVITY OF CONCRETE AS A CONSTRUCTION MATERIAL FOR BUILDINGS





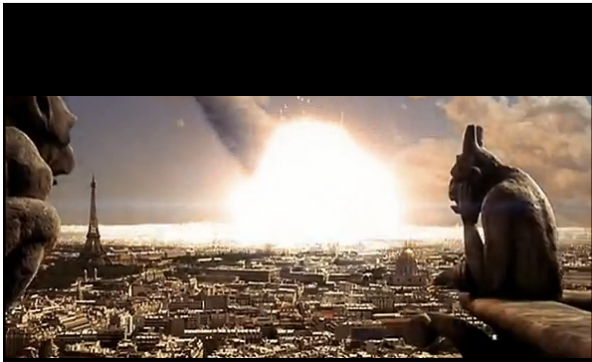






UNION MAJOR GENERAL SHERMAN'S BURNING OF ATLANTA – 1864





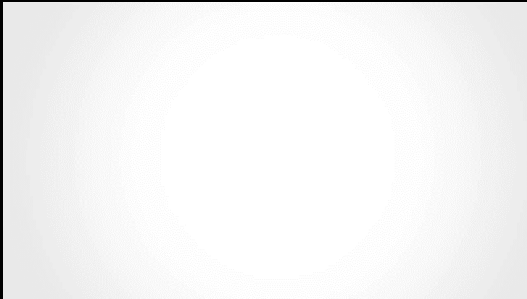
ARCHITECTS AND ENGINEERS ARE DESIGNING BUILDINGS AND STRUCTURES TO WITHSTAND MOTHER NATURE. THE ONLY THING WE KNOW ABSOLUTELY IS MOTHER NATURE WILL WIN! IT IS OUR RESPONSIBILITY TO TRY AND HOLD OFF HER VICTORY FOR AS LONG AS POSSIBLE, AT LEAST PAST OUR LIFE TIME!



BREEZY POINT, QUEENS, NEW YORK – HURRICANE SANDY – OCTOBER 29, 2012



Hurricane Katrina August 2005 - \$108 billion in damages, 1,833 lives taken.





CONDO COLLAPSE

**TECHNIQUES TO ADD DISASTER
RESILIENT CONSTRUCTION...
REINFORCED CONCRETE WITHSTANDS
STORMS**





TILT UP WALL PANEL SYSTEM



POUR IN PLACE WALL SYSTEM





<p>Crittenden Co. Fire Station</p>  <p>Pre-fab Metal Building Built: 2012 Cost: \$692,520 6,418 sq. ft. - \$107.90/sq. ft.</p>	<p>Lewisburg Fire Station</p>  <p>ICF and Masonry Structure Built: 2011 Cost: \$617,792 7,206 sq. ft. - \$85.73/sq. ft.</p>
<p>ICF FIRE STATION – COST LESS, DISASTER RESILIENT, LOWER ENERGY COSTS, MORE ATTRACTIVE</p>	

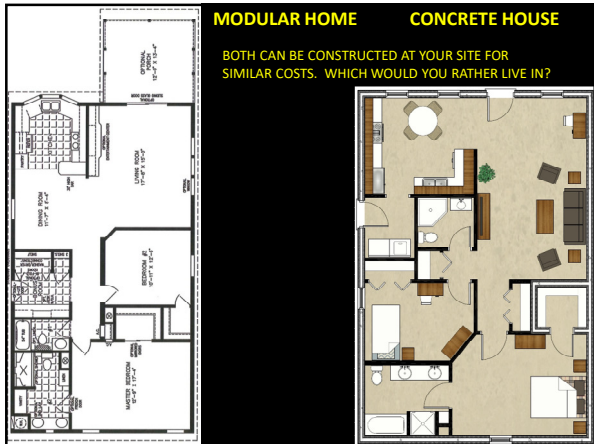
COST OF ICF WALLS IN SCHOOLS

A SCHOOL WITH 96,000 SQUARE FEET OF ICF WALLS SPECIFIED IN OKLAHOMA BID IN JANUARY 2017 HAD THE FOLLOWING PER SQUARE FOOT OF WALL, AND TOTAL.

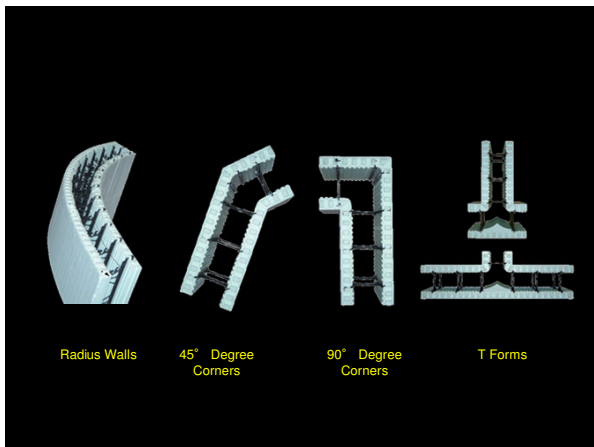
\$11.17	(\$1,072,320)
\$13.93	(\$1,337,280)
\$13.94	(\$1,338,240)
\$16.24	(\$1,559,040)

CMU Wall systems are averaging over \$18 per square foot in the USA.

An average experienced ICF crew can install completely about 16 square feet of wall per man hour, so if you apply \$48 per man per hour, the following costs can be reasonably assumed: \$3 Labor, \$3 for ICF, \$2.10 for Concrete, \$1 for Steel, \$2 for equipment = \$11.10 per square foot of wall.



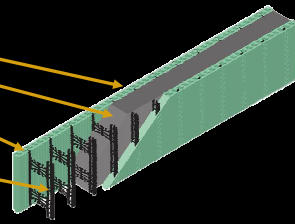




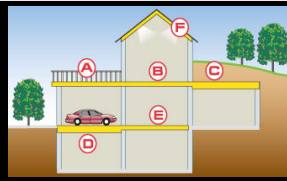
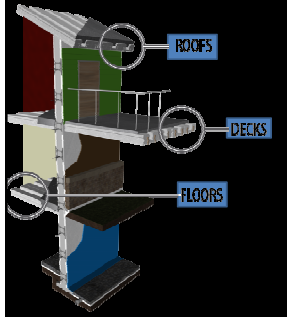
ICF Basics

- Six wall elements


1. Form system
2. Wall structure
3. Insulation
4. Air barrier
5. Vapor barrier
6. Interior and exterior finish anchorage




Having six wall elements in one product eliminates costly building steps and allows your structure to be constructed faster and more efficiently.



A Decks and Patios	D Elevated Garage Floors
B Multi-Story Floors	E Floors
C Flat Roofs	F Pitched Roofs



SEATTLE SEAHAWKS STADIUM,
SEATTLE, WASHINGTON





Breckinridge Co. Public Library



Built: 2012
Cost: \$2,445,000
10,500 sq. ft. - \$232/sq. ft.

**THIS WAS BID AS A METAL STUD AND STEEL FRAME OR ICF BUILDING.
THE COST TO BUILD WITH ICF WAS \$77,000 LESS THAN
CONVENTIONAL METAL STUDS AND STEEL FRAME.
ICF LIBRARY = COST LESS, LOWER ENERGY COSTS.**

Horse Cave Fire Department



Built: 2014
Cost: \$1,026,365
8,794 sq. ft. - \$116/sq. ft.



















[BRECKINRIDGE COUNTY PUBLIC LIBRARY CONSTRUCTION](#)



MAXIMIZE ENERGY EFFICIENCY OF THE EXTERIOR SHELL OF A BUILDING



CAN YOU GUESS WHICH ONE HAS THE MOST ENERGY LOSS?

FOR NEW CONSTRUCTION IN AMERICA

LEED ENERGY REDUCTION GOAL IS
17% LESS THAN ASHRAE 90.2

DEPARTMENT OF ENERGY - BUILDING AMERICA
PROGRAM GOAL IS
50% LESS THAN ASHRAE 90.2 BY 2025

AIA 2030 INITIATIVE IS
NET ZERO FOR COMMERCIAL BUILDINGS

ENERGY COSTS INCREASED 30% IN THE LAST
FIVE YEARS IN AMERICA



AT THIS RATE ENERGY COSTS FOR YOUR HOME
WILL BE MORE THAN YOUR MORTGAGE IN THE
NEXT TEN YEARS

DEFINITIONS

R-VALUE: A MEASURE OF RESISTANCE TO THE FLOW OF HEAT THROUGH A GIVEN THICKNESS OF A MATERIAL (AS INSULATION) WITH HIGHER NUMBERS INDICATING BETTER INSULATING PROPERTIES

U-VALUE: A MEASURE OF THE HEAT TRANSMISSION THROUGH A BUILDING PART (AS A WALL OR WINDOW) OR A GIVEN THICKNESS OF A MATERIAL (AS INSULATION) WITH LOWER NUMBERS INDICATING BETTER INSULATING PROPERTIES.

R-VALUES ARE DECEPTIVE!!!

20% x .025 THE U-VALUE OF WOOD + 80% x .01 THE U-VALUE FOR R-100 INSULATION = .05 + .008 = .058

R-VALUE WALL ASSEMBLY = 1/U-VALUE WALL ASSEMBLY
R-VALUE = 1 / .058
R-VALUE = 17.24

SAME EQUATION WITH R-19 INSULATION = R-5

20% x .025 THE U-VALUE OF WOOD + 80% x .01 THE U-VALUE FOR R-19 INSULATION = .05 + .15 = .2

R-VALUE WALL ASSEMBLY = 1/U-VALUE WALL ASSEMBLY
R-VALUE = 1 / .2
R-VALUE = 5

CURRENT CODES REQUIRE R-13 TO R-19

WALL "R" VALUES

TYPICAL 2x6 WALL CONSTRUCTION

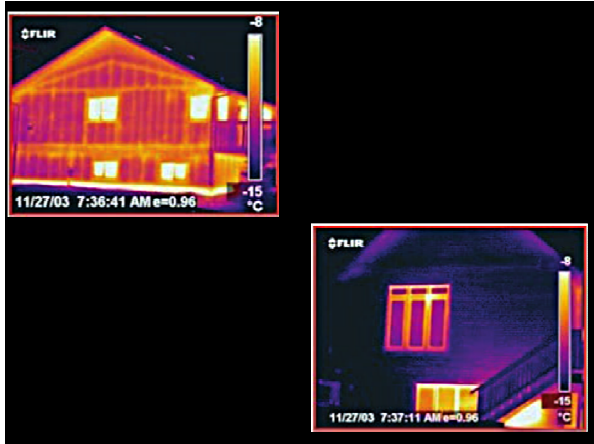
- DOOR HAS "R" VALUE OF 2
- WINDOW HAS "R" VALUE OF 3.33
- WALL HAS "R" VALUE OF 5

TYPICAL ICF WITH 6" CONCRETE CORE WALL CONSTRUCTION

- DOOR HAS "R" VALUE OF 2
- WINDOW HAS "R" VALUE OF 3.33
- WALL HAS "R" VALUE OF 26

THIS IS COLD AIR COMING INTO YOUR HOUSE

WITH THESE AREAS FOR LEAKAGE AS WELL AS OTHERS, IT'S LIKE LEAVING A WINDOW OPEN ON YOUR HOUSE AT ALL TIMES.



WOOD VS. ICF R-VALUE COMPARISON

EXPLODED WALL SECTION FOR 2X6 WALL WITH R-21 BATT INSULATION
SEE WALL CAVITY CALCULATION FOR THERMAL BRIDGING

$R = 0.5$ HARDIE PLANK SIDING
 $R = 0$ BUILDING WRAP
 $R = 0.6$ PLYWOOD SHEATHING
 $R = 12.82$ 2X6 WOOD & INSUL.
 $R = .45$ 1/2" DRYWALL

R-VALUE TOTAL FOR WOOD STUD WALL = 14.37

WALL CAVITY WITH THERMAL BRIDGING - CALCULATED WITH U-VALUE

WALL CAVITY CONTAINS 20% WOOD 80% INSULATION

1" WOOD R-VALUE = 91 (2X6 IS 5.5") R-VALUE = 91 X 0.5 = 45.5
 R-4 WOOD U = 1/8 OR 200 X 20% = 04
 R-21 INSULATION U = 1/21 OR 048 X 80% = 038
 WALL U-VALUES ARE ADDED: 0.28 + 0.4 = 0.68
 $R = 1/U$ THEREFORE THE WALL CAVITY IS
 $R = 1/0.68 = 14.82$

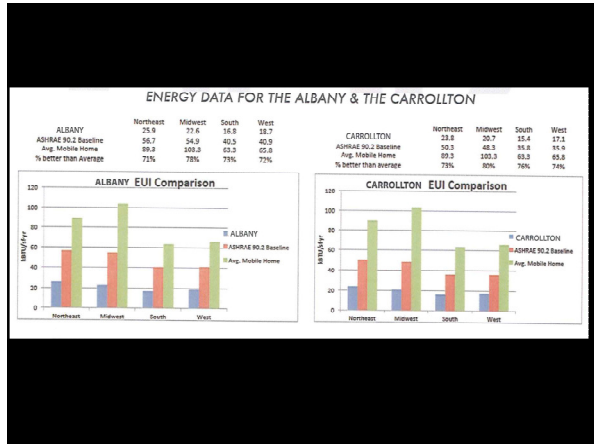
***This is a simplified example for clarity. A full analysis would include all factors such as studs & sheathing and take into account the effect of windows and doors on the building envelope.

EXPLODED WALL SECTION FOR NOMINAL 6" INSULATED CONCRETE FORM WALL

$R = 0.5$ HARDIE PLANK SIDING
 $R = 13.75$ EPS FOAM 2.34"
 $R = .025$ 6-1/8" CONCRETE
 $R = 13.75$ EPS FOAM 2.34"
 $R = 0.45$ 1/2" DRYWALL

R-VALUE TOTAL FOR ICF WALL = 29.075





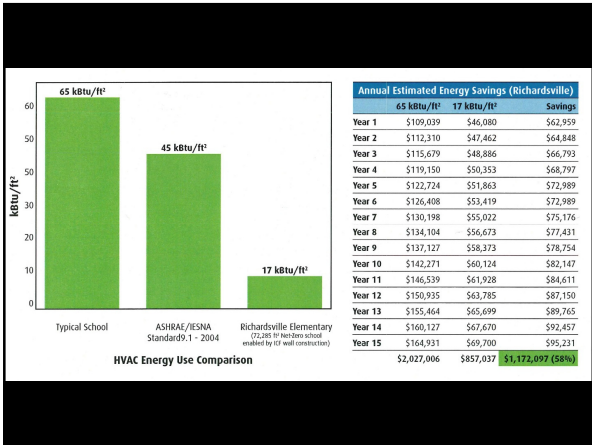
Proven Performance
Hampton Inn - Winchester, Ky
Total Square Footage = 33,000
80% Occupancy
Utility Cost (month) for conventional construction = \$5,500.00
Utility Cost (month) for ICF construction = \$1,850.00
Total monthly savings = \$3,650.00
Operating Cost (month) per Sq. Ft. = \$0.056



Proven Performance
La Quinta Inn & Suites - Louisville, KY
Total Square Footage = 55,000
80% Occupancy
Utility Cost (month) for conventional construction = \$9,075.00
Utility Cost (month) for ICF construction = \$3,000.00
Total monthly savings = \$6,075.00
Operating Cost (month) per Sq. Ft. = \$0.054







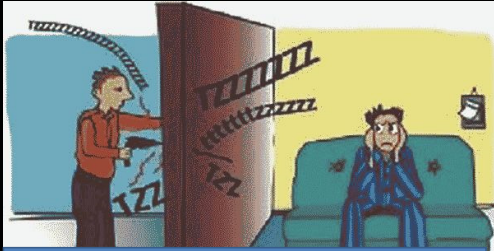




DIVISION OF PROBABLE CONSTRUCTION COSTS BY CIVIC CONSULTANTS INC. 2017 B.C.C.C. 2016		2017 B.C.C.C. 2016		2017 B.C.C.C. 2016	
Item Number of Item	ESTIMATED COST	ESTIMATED COST	Unit Cost	ESTIMATED COST	ESTIMATED COST
Cost per SF of Area	\$/SF	\$/SF	\$/SF	\$/SF	\$/SF
Cost Building Gross SF	444,276	444,276	444,276	444,276	444,276
C11	WOOD COST OPTION	CONCRETE COST OPTION	WOOD COST OPTION	CONCRETE COST OPTION	CONCRETE COST OPTION
	\$/SF	\$/SF	\$/SF	\$/SF	\$/SF
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IMPROVE YOUR BULDINGS STC RATING



STC DEFINITION – SOUND TRANSMISSION CLASS – THE SOUND TRANSMISSION CLASS IS AN INTERGER RATING OF HOW WELL A BUILDING PARTITION ATTENUATES AIRBOURNE SOUND.





Energy Star
Award Winning School
•
CEFPI Southwest Region
Elementary School of the Year




Alvaton Elementary School – Bowling Green, KY

Awarded this project based on the speed of construction.
Construction began – Jan 2007
Completed - July 2007



Bellarmine University Dormitories – Louisville, KY
104,000 sq ft project

Holiday Inn Express



BOWLING GREEN KY, FIRE DEPARTMENT H.Q.



ICF used as infill panels on a concrete frame





935B

2 Bedroom 2 bathrooms
1 story home
935 square feet
22.5 x 41.5 footprint
Plan is accessible for wheelchair

Designed in five exterior style options: Contemporary, Craftsman, Federal, Italianate, Mesa. Various exterior finish options including brick, stone, wood or Hardi/Plank siding, vinyl siding. Siding color/height can be K, C or H.
Optional interior layout and finishes available.
This home can be built on a concrete slab, over a basement, or on a raised platform on stilts.
Optional porches or decks available with each exterior style.
Insulated Concrete Form Exterior Wall construction.
Extremely Energy Efficient, Storm Resistant, Quiet Interior, Low Maintenance Home.
Homes are sold as separate building agreements.
All design, engineering and plan development completed by Civic Design and approved by Civic Construction Inc. Specifications based on current codes in U.S.A. for 2012.

935

All design, engineering and plan development is completed by Civic Design and approved by Civic Construction Inc. Specifications based on current codes in U.S.A. for 2012.

935 ALTERNATE PLANS

1450

3 Bedroom 2.5 bathrooms
2 story home
1450 approx. square feet
22 x 33 footprint
(4 bedroom, 3 bathroom option available)

Designed by Five exterior style options: Contemporary, Craftsman, Federal, Italianate, Mesa
Various exterior finish options including: brick, stone, wood or HardiePlank siding, vinyl siding
Crown molding height can be 4", 6" or 10"
Optional interior finishes and fixtures available.
This home can be built on a concrete slab, over a basement, or on a raised platform or lifts.
Optional porches or stoops available with each exterior style.
Insulated Concrete Form Exterior Wall construction
Extremely Energy Efficient, Green Building, Quiet Interior, Low Maintenance Home
Home size and square footage approximate.

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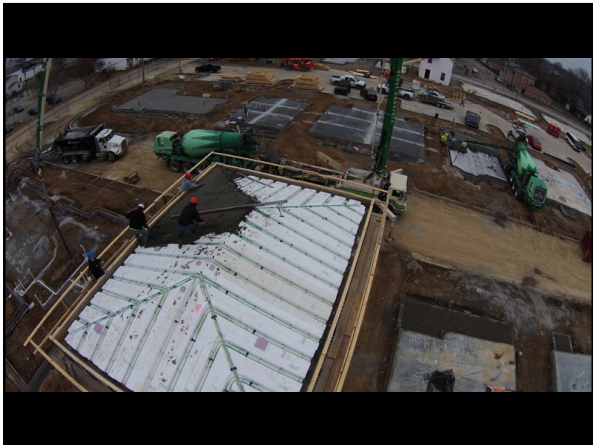
Federal Porch Italianate Porch Craftsman Porch

FEDERAL ITALIANATE CRAFTSMAN CONTEMPORARY MESA

1450





















POP QUIZ!!!

- What Building burned three times when built with wood, then once it was built with concrete has stood for nearly 2000 years?
- Name a type of reinforced concrete form that stays in place and insulates the structure.
- What is another name for a zero energy building?
- What is the minimum R-Value Wall and Roof system for commercial buildings in today's International Building Code?
- What is the minimum STC rating for an interior wall which separates two apartments?

BIBLIOGRAPHY

- [KENTUCKY READY MIX ASSOCIATION](http://www.kentuckyready.com)
- [WWW.BULDERA.COM](http://www.bulldura.com)
- [WWW.KINGSACADEMY.COM](http://www.kingsacademy.com)
- [WWW.BLUFTON.EDU](http://www.blufton.edu)
- [WWW.BONRESALE.SE](http://www.bonresale.se)
- [WWW.FAIRAIR.BLOG.DE](http://www.fairair.blog.de)
- [WWW.GREENALLHISTORY.ORG](http://www.greenallhistory.org)
- [WWW.FIRECOMPANIES.COM](http://www.firecompanies.com)
- [WWW.DIRTTY.COM](http://www.dirtty.com)
- [WWW.ANCESTRY.COM](http://www.ancestry.com)
- [WWW.AEROBIOCHEMICAL.COM](http://www.aerobiochemical.com)
- [WWW.CHICAGOSUBLIME.COM](http://www.chicagosublime.com)
- [WWW.AL.COM](http://www.al.com)
- [WWW.BAVELECTRICO.COM](http://www.bavelectrico.com)
- [WWW.AMERICANRENEWABLETHERMAL.COM](http://www.americanrenewablethermal.com)
- [WWW.SUSTAINABLE-SYSTEM-DESIGN.COM](http://www.sustainable-system-design.com)
- [WWW.TMRBRAD.COM](http://www.tmrbrad.com)
- [WWW.LITEFORM.COM](http://www.liteform.com)
- [WWW.HANKEVANBROWN.COM](http://www.hankevanbrown.com)
- [WWW.QUADOMATED.COM](http://www.quadomated.com)
- [WWW.WET-BASMENT.NET](http://www.wet-basement.net)
- [WWW.BLUEINVO.COM](http://www.blueinvo.com)
- [WWW.SUSTAINABLE-SOLAR-HOME.COM](http://www.sustainable-solar-home.com)
- [WWW.HALCOENERGY.COM](http://www.halcoenergy.com)
- [WWW.BOULDGREENHOME.COM](http://www.bouldergreenhome.com)
- [WWW.GEHOMEINSPECTIONS.COM](http://www.gehomeinspections.com)
- [WWW.GREENBUILDINGMAG.COM](http://www.greenbuildingmag.com)
- [WWW.GARYAND.EDU](http://www.garyand.edu)
- [WWW.THEDAILYGREEN.COM](http://www.thedailygreen.com)
- [WWW.ICC.COM](http://www.icc.com)
- "KNOW THE REAL COMPETITION: SPECIFYING ICF OVER CMU," BY CAMERON WARE
- "THE BEST GREEN DOLLAR" BY CAMERON WARE
- "R-U VINDICATED BY THE NEW ENERGY CODE?," BY CAMERON WARE
- "THE ICF TIPPING POINT," BY CAMERON WARE
- "SLOPED CONCRETE ROOFS," BY UNKNOWN
- "CONCRETE PLANET," BY ROBERT COURLAND, PUBLISHED 2011
- "IT'S RAINING FISH AND SPIDERS," BY BILL EVANS, PUBLISHED 2012
- "RESILIENCE" BY ARIS POPADOPOULOS 2016
- "MECHANICAL AND ELECTRICAL EQUIPMENT FOR BUILDINGS" 12TH EDITION 2014
