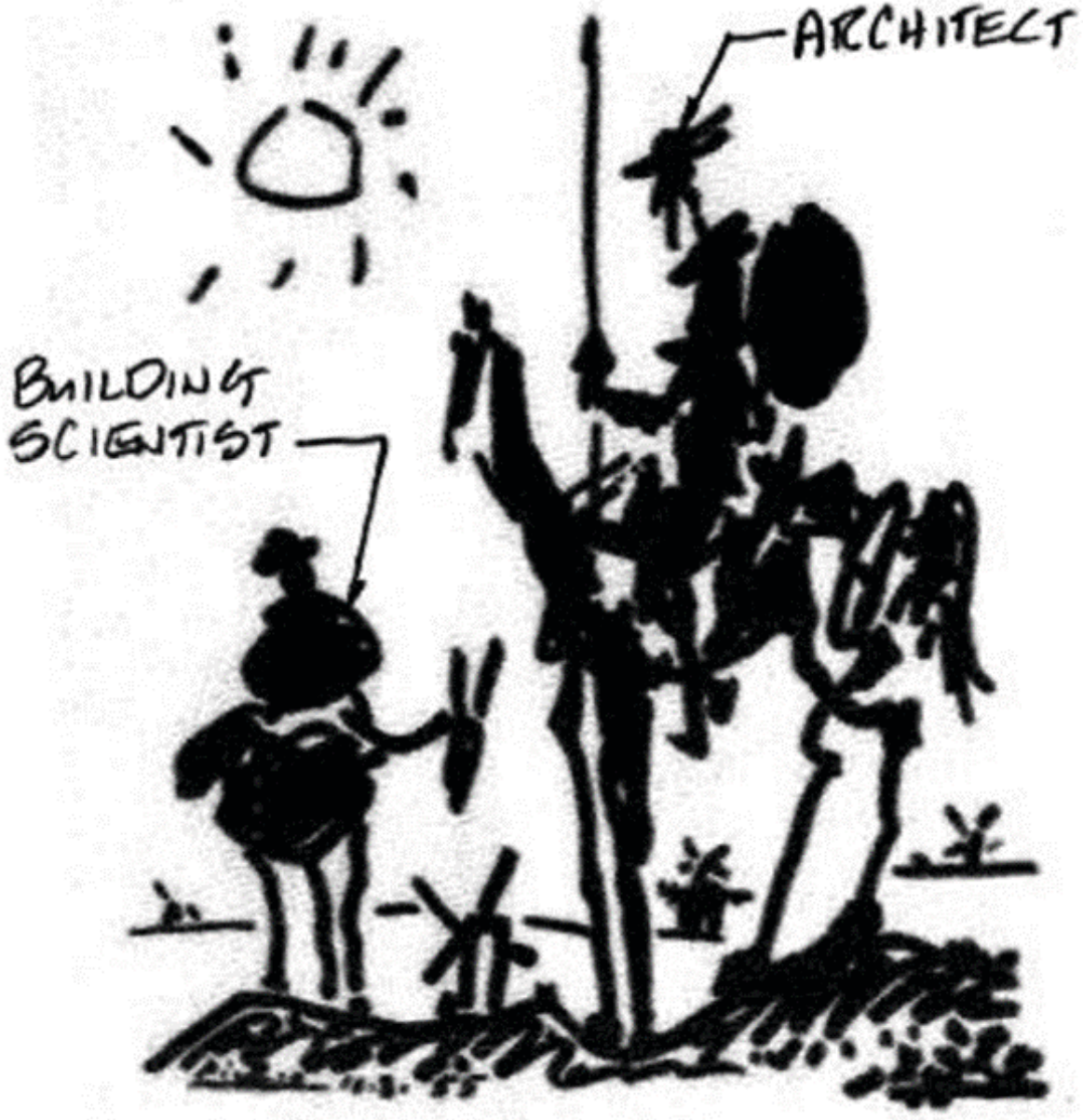

ARCHITECT
BUILDING SCIENTIST

Don Quixote: "Firmitas, Utilitas et Venustas"

Pancho Sanza: Risk, Constructability, Cost

"You have to know so much about materials and engineering….."

"No, that's what we have consultants for."

Ancient Greece: The designers were the builders (designers were not the tradesmen)
Limited number of materials.
Building instructions given by word and through models

Roman Empire : The designers were the builders.
Limited number of materials.
Scaled drawings on paper. One copy. Mostly elevations.

Medieveal: The designers were the builders . The trades had common assembly knowledge.
Limited number of materials.
Plan drawings, elevations, full scale templates.

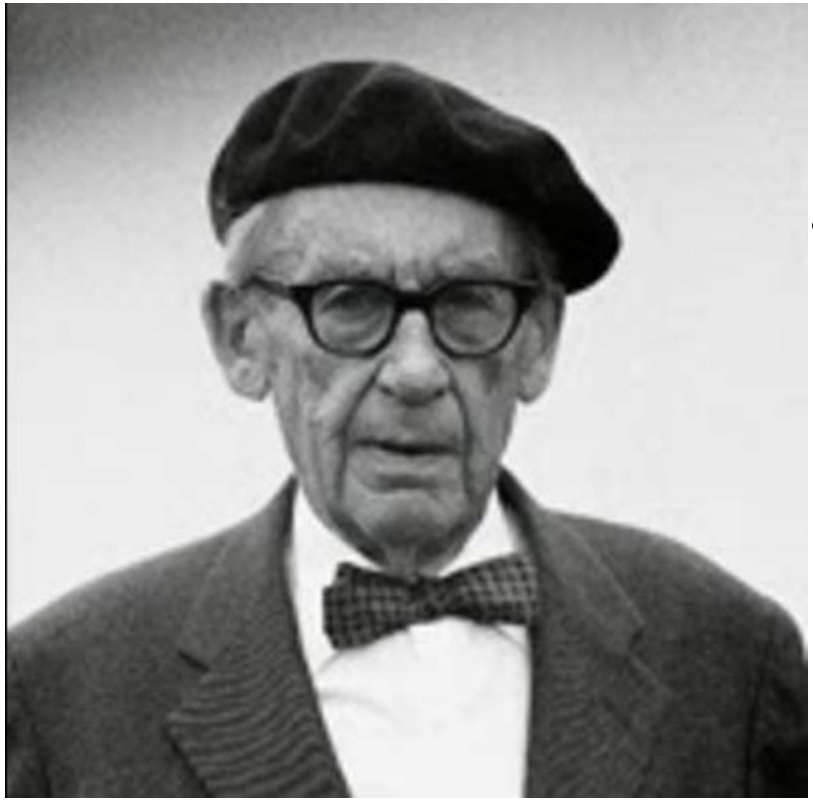
Renaissance: The designers were the builders . The trades had common assembly knowledge.
Limited number of materials.
Perspective drawings and perspective sections, plans elevations.

Industrial: The designers were the builders. Common trade knowledge & details of construction.
Limited number of materials.
Plans, elevations, sections, isometric views.
Few drawing details since the building techniques were common knowledge.

"If I have seen further, it is by standing on the shoulders of giants."

- Isaac Newton

And then……this guy.



Walter Gropius, 1883 - 1969

"Architecture begins where the engineering ends."

"Specialists are people who always repeat the same mistakes."

…liberated from historicism…

….marked the beginning of the end of a historically imitative architecture in the USA.

Let them eat cake.

Architectural Curricula:

1.Beauty

2. Usefulness

3. Strength

Not Desk Ready.

"They're training every student to be the next Zaha Hadid."

- Ed Siegel, 2017

Villa Savoye by LeCorbusier, 1931, Poissy, France.

"…. A manifesto… an iconic building… a UNESCO World Heritage site…"

Letter from client to architect:
It's raining inside.

Architect's response:
The flat roof design has been enthusiastically received by architectural critics worldwide.

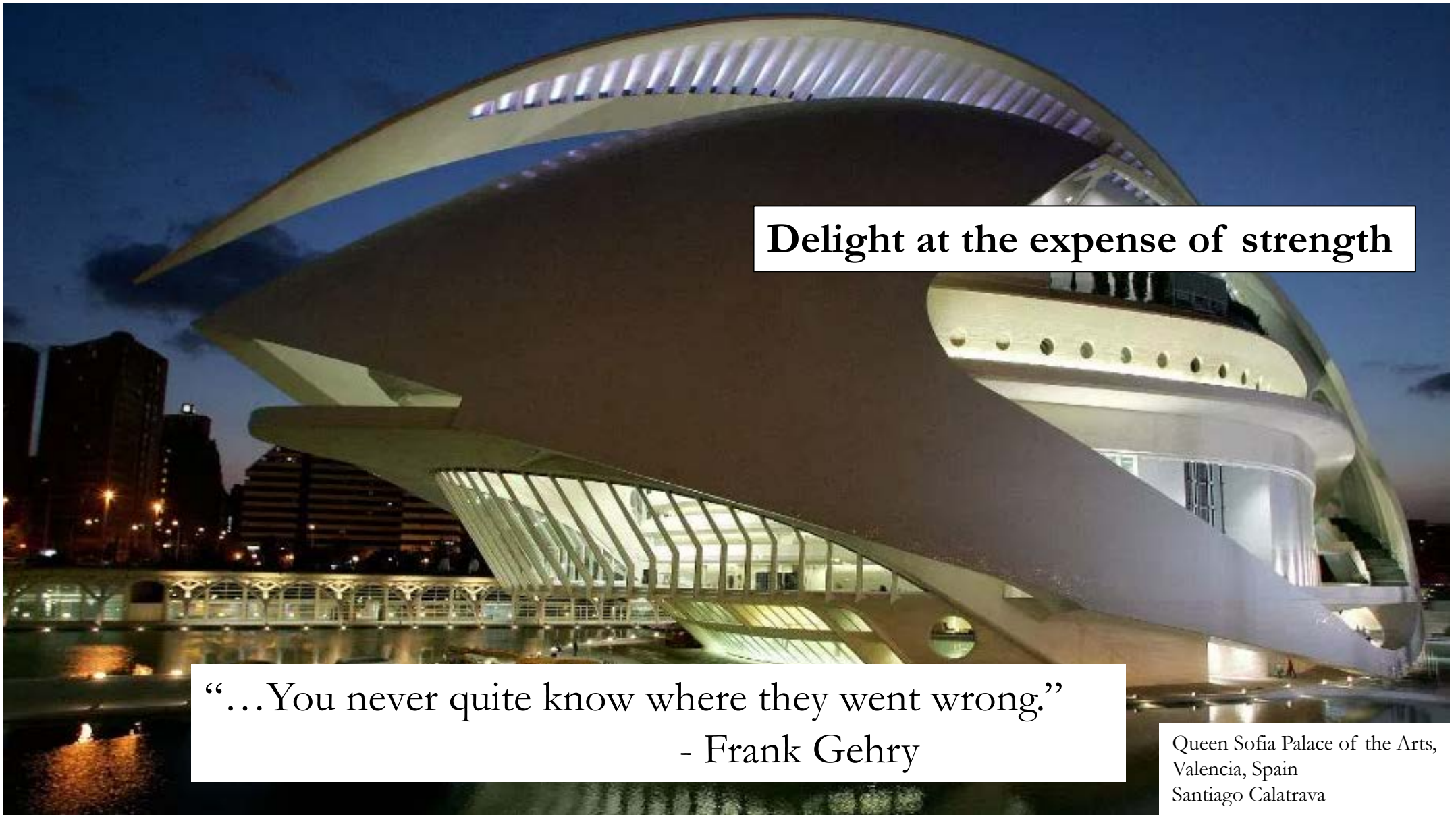
Architecture for the approval of other architects.

The Vitruvius test:

Strength: no **Usefulness: no** **Beauty: ?**

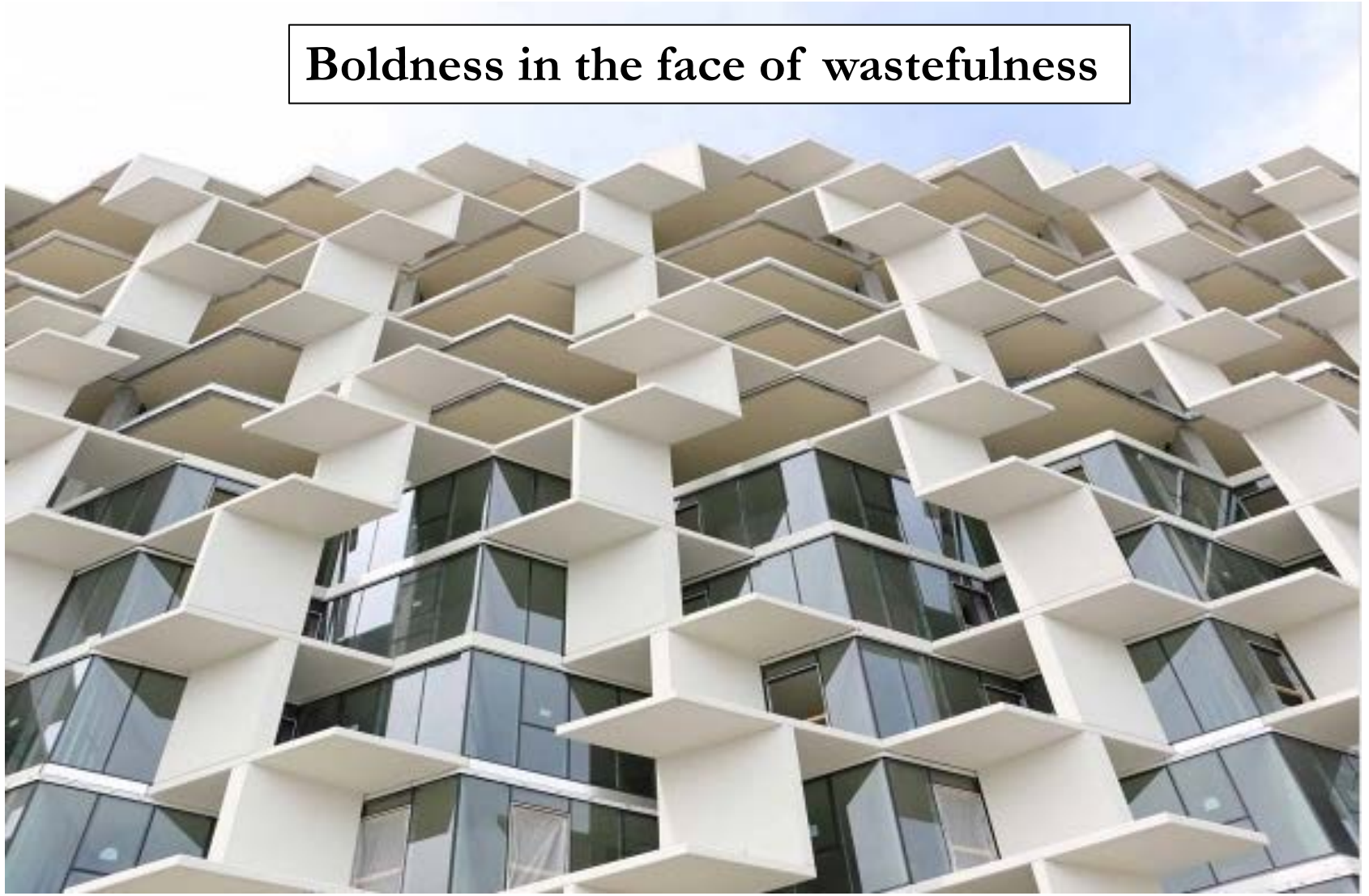
Architecture for the approval of other architects.

“What’s with the flat roofs — you know it rains a lot here, right?”



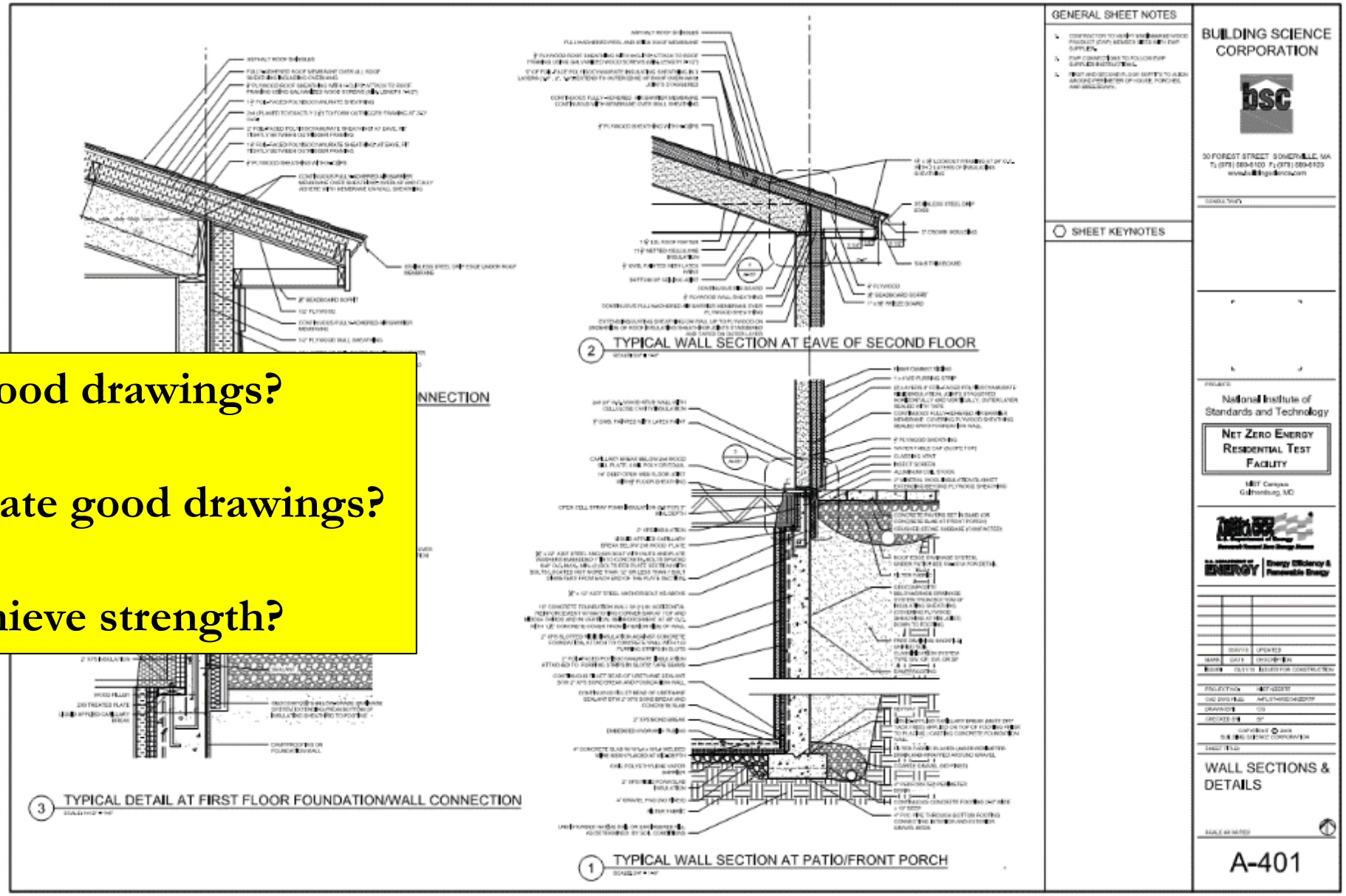
Queen Sofia Palace of the Arts,
Valencia, Spain
Santiago Calatrava

Boldness in the face of wastefulness



Studio Gang, City Hyde Park. Chicago, 2015

Just as many problems with non-starchitect designs.

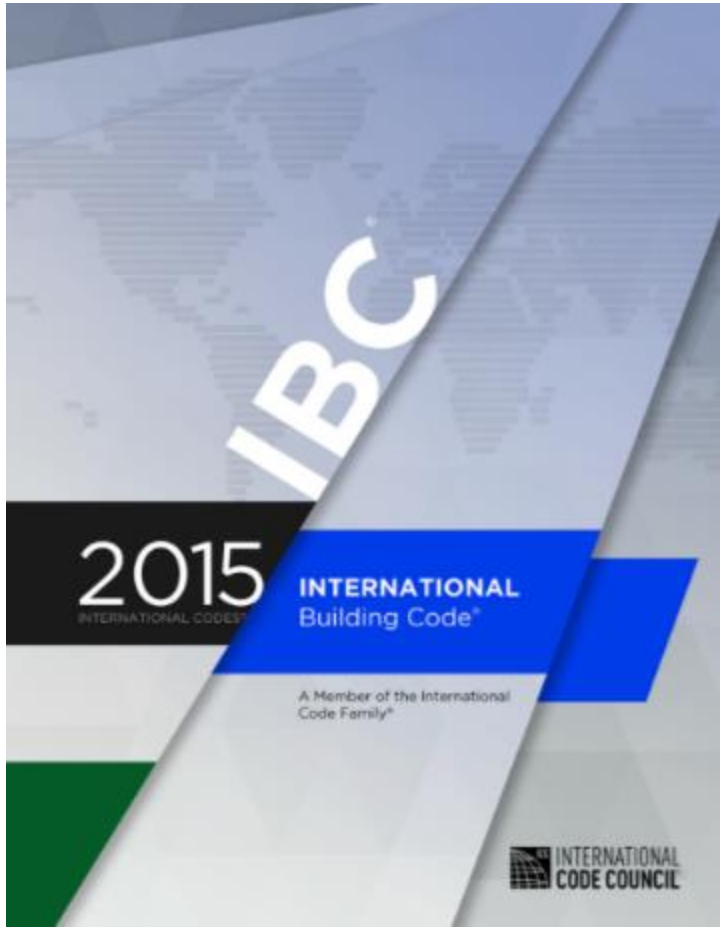


What are good drawings?

How to create good drawings?

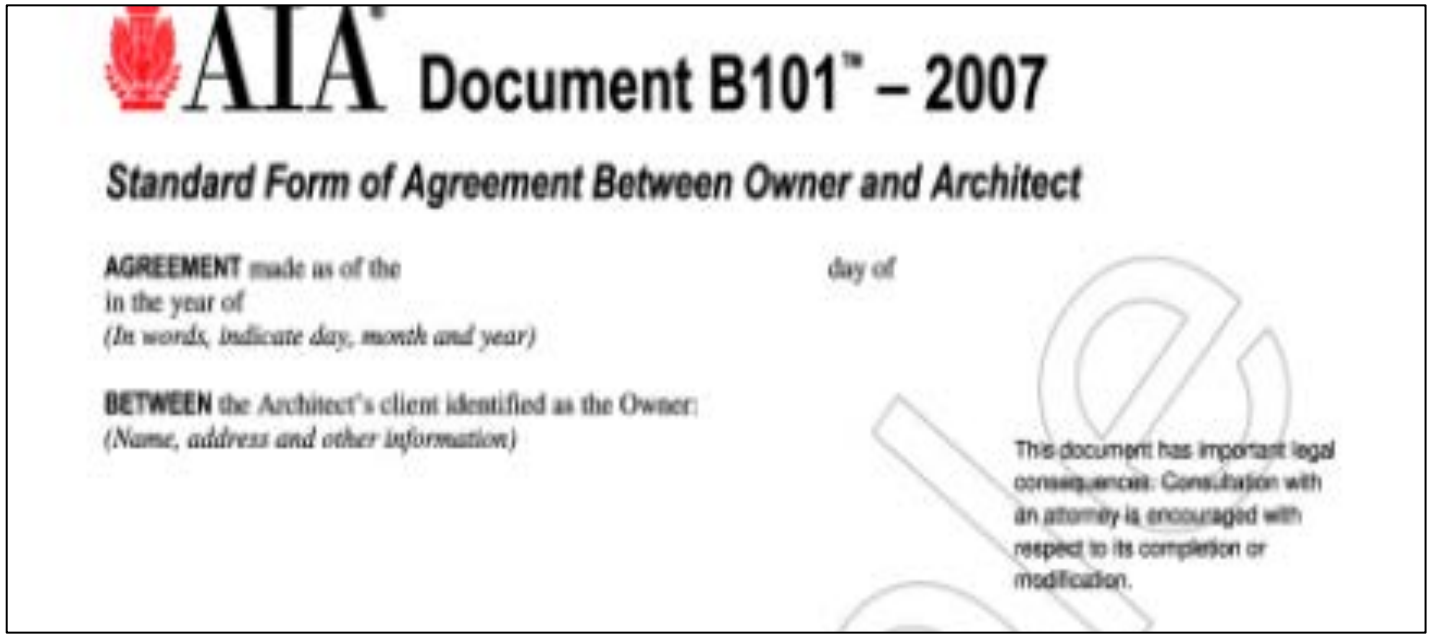
How to achieve strength?

What The Law Requires:



Documents only need to show that the code is met.

What Your Contract Requires:



AIA Document B101™ – 2007

Standard Form of Agreement Between Owner and Architect

AGREEMENT made as of the day of
in the year of
(In words, indicate day, month and year)

BETWEEN the Architect's client identified as the Owner:
(Name, address and other information)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

"… setting forth in detail the quality levels of materials and systems and other requirements …"

PENNSTATE

Office of Physical Plant OPP

Design and Construction
Design Phase Deliverables

SCHEMATIC PHASE	DESIGN DEVELOPMENT PHASE	CONSTRUCTION DOCUMENT PHASE
...or mobilization ...act, contractor ...OT Highway		
LANDSCAPING		
__1. Existing Conditions __2. Landscaping Concept __3. Existing Irrigation	__1. Planting Plan __2. Irrigation Plan	__1. Protection of existing trees and significant plantings during construction __2. Soil Preparation and Planting Specifications __3. Guying Diagrams __4. Piping Diagrams __5. Pipe Sizes __6. Landscape Irrigation Details and legends
STRUCTURAL		
__1. Structural schematic plans __2. Written description, proposed materials, foundation types, design criteria, design loads	__1. Foundation Plan __2. Typical Floor Framing Plan __3. Framing plans at unique features __4. Main member sizes __5. Structural Sections	__1. Definition of Control Joints __2. Beam Column and Slab Schedules __3. M/E housekeeping pads __4. Foundation details __5. Structural Details __6. Structural Notes __7. Structural Calculations
BUILDING EXTERIOR ENVELOPE		
__1. Typical elevations __2. Fenestration Layout (indicate % glass) __3. Material designations __4. Overall building cross sections __5. Roof layout __6. Perspectives __7. Renderings for administrative and Presidents review as directed by Campus Planning and Design	__1. All building elevations w/ dimensioned height __2. Typical Wall Sections __3. Parapet and coping details __4. Roof and drainage plan __5. Exterior Door Details __6. Typical Window Details __7. Expansion Joint Locations __8. Large Scale building cross sections	__1. Roof details __2. Exterior Details __3. Flashing Details __4. Control Joint definition and details

What Your Schooling Taught:

Floor plans.

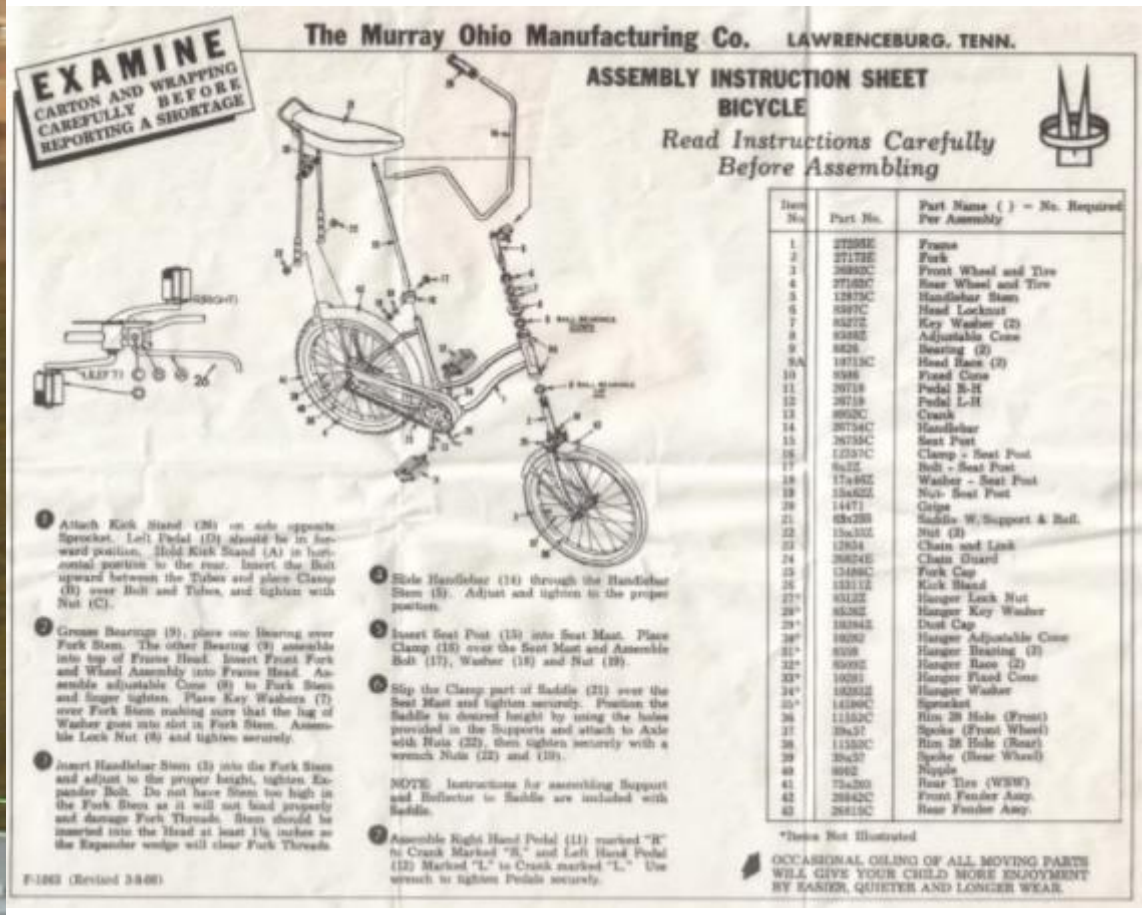
Elevations.

Major Sections.

The only rule:

There are no rules.

What is REALLY needed: These guys need good assembly instructions.



EXAMINE CARTON AND WRAPPING CAREFULLY BEFORE REPORTING A SHORTAGE

The Murray Ohio Manufacturing Co. LAWRENCEBURG, TENN.

ASSEMBLY INSTRUCTION SHEET
BICYCLE
Read Instructions Carefully Before Assembling

Item No.	Part No.	Part Name ( ) = No. Required Per Assembly
1	27295E	Frame
2	27173E	Fork
3	26880C	Front Wheel and Tire
4	27168C	Rear Wheel and Tire
5	12975C	Handlebar Stem
6	8597C	Head Locknut
7	8527Z	Key Washer (2)
8	8588Z	Adjustable Cone
9	8826	Bearing (2)
9A	14715C	Head Race (2)
10	9588	Fixed Cone
11	29718	Pedal R-H
12	29719	Pedal L-H
13	6952C	Crank
14	29734C	Handlebar
15	29735C	Seat Post
16	12537C	Clamp - Seat Post
17	6x32Z	Bolt - Seat Post
18	17x9ZZ	Washer - Seat Post
19	10x8ZZ	Nut- Seat Post
20	14471	Grips
21	6Bx29B	Saddle W/Support & Bolt
22	10x33Z	Nut (3)
23	12824	Chain and Link
24	26824E	Chain Guard
25	13488C	Fork Cap
26	13311Z	Kick Stand
27*	6512Z	Hanger Lock Nut
28*	6526Z	Hanger Key Washer
29*	18394Z	Dust Cap
30*	18092	Hanger Adjustable Cone
31*	8508	Hanger Bearing (2)
32*	8509Z	Hanger Race (2)
33*	10091	Hanger Fixed Cone
34*	18283Z	Hanger Washer
35*	14186C	Sprocket
36	11152C	Rim 28 Hole (Front)
37	39x57	Spoke (Front Wheel)
38	11153C	Rim 28 Hole (Rear)
39	39x57	Spoke (Rear Wheel)
40	8062	Nipple
41	72x2B3	Rear Tire (WSW)
42	26842C	Front Fender Assy.
43	26815C	Rear Fender Assy.

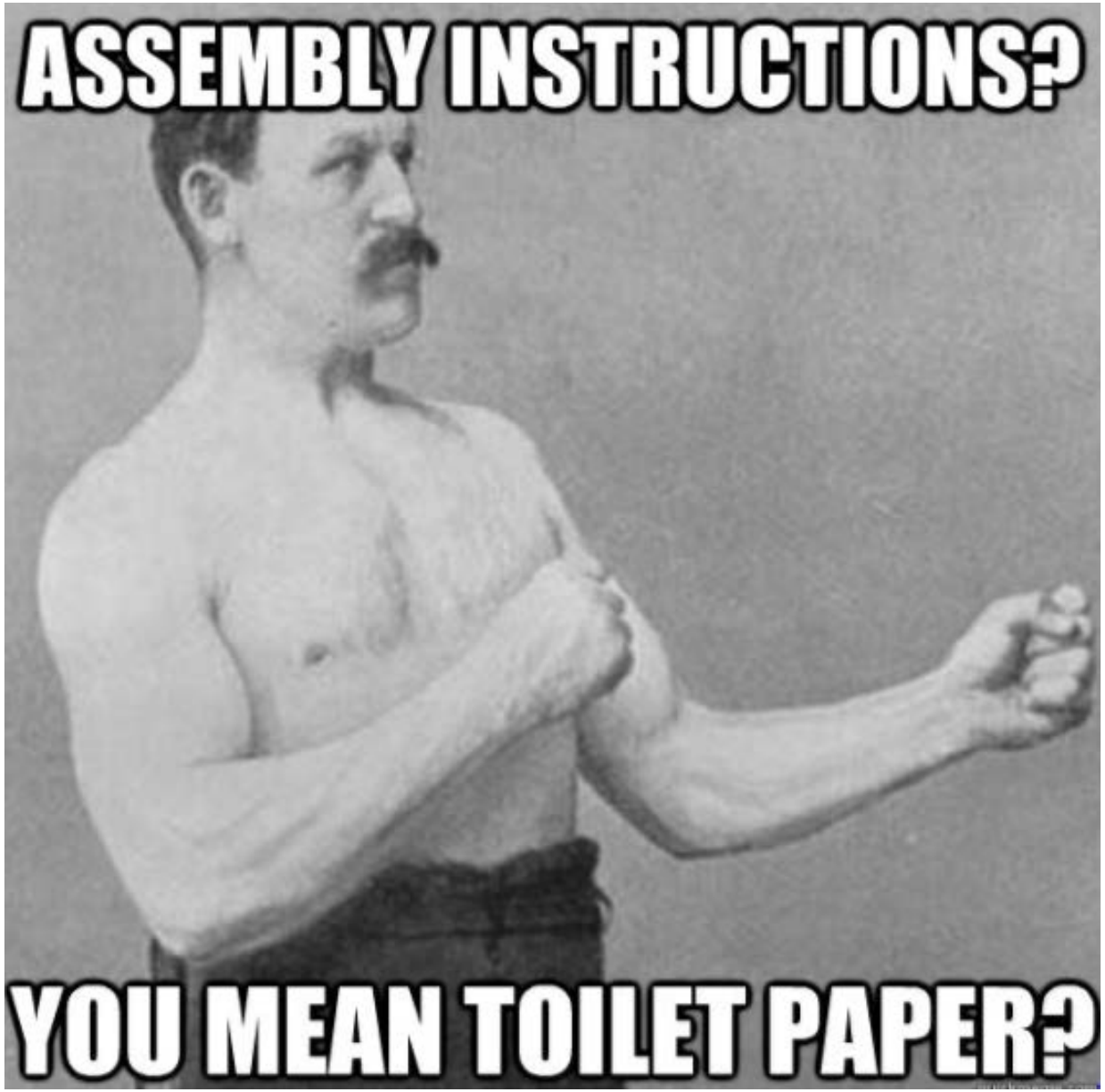
*Items Not Illustrated

1. Attach Kick Stand (26) on axle opposite Sprocket. Left Pedal (D) should be in forward position. Hold Kick Stand (A) in horizontal position to the rear. Insert the Bolt upward between the Tubes and place Clamp (B) over Bolt and Tubes, and tighten with Nut (C).
2. Grease Bearings (9), place one Bearing over Fork Stem. The other Bearing (9) assemble into top of Frame Head. Insert Front Fork and Wheel Assembly into Frame Head. Assemble adjustable Cone (8) to Fork Stem and finger tighten. Place Key Washers (7) over Fork Stem making sure that the lug of Washer goes into slot in Fork Stem. Assemble Lock Nut (6) and tighten securely.
3. Insert Handlebar Stem (5) into the Fork Stem and adjust to the proper height, tighten Expander Bolt. Do not have Stem too high in the Fork Stem as it will not load properly and damage Fork Threads. Stem should be inserted into the Head at least 1½ inches or the Expander wedge will clear Fork Threads.
4. Slide Handlebar (14) through the Handlebar Stem (5). Adjust and tighten to the proper position.
5. Insert Seat Post (15) into Seat Mast. Place Clamp (16) over the Seat Mast and Assemble Bolt (17), Washer (18) and Nut (19).
6. Slip the Clamp part of Saddle (21) over the Seat Mast and tighten securely. Position the Saddle to desired height by using the holes provided in the Supports and attach to Axle with Nuts (22), then tighten securely with a wrench Nuts (22) and (19).

   NOTE: Instructions for assembling Support and Reflector to Saddle are included with Saddle.
7. Assemble Right Hand Pedal (11) marked "R" to Crank Marked "R," and Left Hand Pedal (12) Marked "L" to Crank marked "L." Use wrench to tighten Pedals securely.

F-1063 (Revised 3-8-68)

OCCASIONAL OILING OF ALL MOVING PARTS WILL GIVE YOUR CHILD MORE ENJOYMENT BY EASIER, QUIETER AND LONGER WEAR.



We created this attitude.

Study Good Examples

National Institute of Standards and Technology

NET ZERO ENERGY RESIDENTIAL TEST FACILITY

NIST Campus
Gaithersburg, MD

PROJECT DESCRIPTION

These plans describe an energy efficient net zero single family home to be built in Gaithersburg, MD. The home has four bedrooms, three full baths and a full basement. The detailed set and specifications were developed by the Building Science Corporation with support from the Department of Energy's Building America Program. The home will be registered under USGBC's LEED for Homes program and will target Platinum Certification. During project planning and construction, all efforts should be made to meet the goals of this project.

BUILDING CODE

These plans are submitted under the 2009 Edition of the International Residential Code For One and Two Family Dwellings.

SQUARE FOOTAGES - Area calculations according to ANSI Z765-2003

Basement	1,318 sq. ft.
First Floor	1,318 sq. ft.
Second Floor	1,191 sq. ft.

PROJECT TEAM

CLIENT

MEP ENGINEER

SPECIFICATIONS CONSULTANT

ARCHITECT

LEED for HOMES PROVIDER

CONSTRUCTION MANAGER

DRAWING LIST

ARCHITECTURAL

FIRE PROTECTION

PLUMBING

MECHANICAL

ELECTRICAL

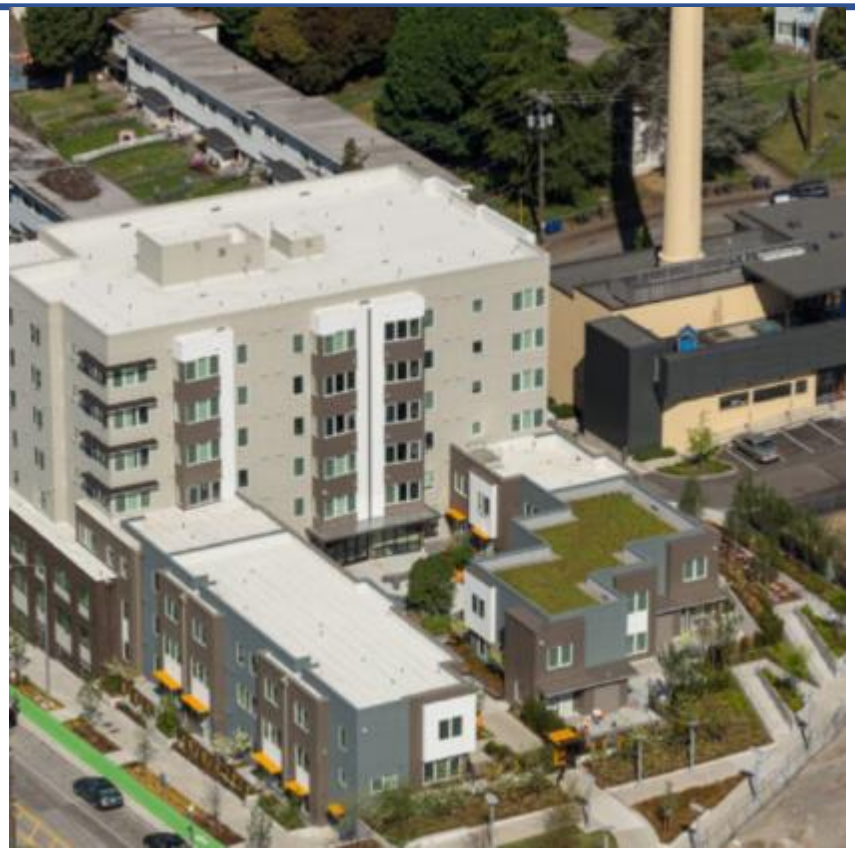
Building Science Corporation
30 Forest Street
Somerville, MA 02143
978.589.5100
Contact: Betsy Pettit
betsy@buildingscience.com

CONSTRUCTION DOCUMENTS
31 MARCH 2010 ISSUED FOR CONSTRUCTION

Energy Efficiency & Renewable Energy

"Foster, you know, they all suck."

- John Ferrarone, Plath Construction



"What we most want is an architect that will work with us and help work through problems."

- Marty Houston, Walsh Construction

“HOW ABOUT LABELING EVERYTHING?!!!”

“HOW ABOUT USING COLOR?!!!”

- Peter Marciano. April 24, 2017, New York, NY

Henry Gifford

Foster:

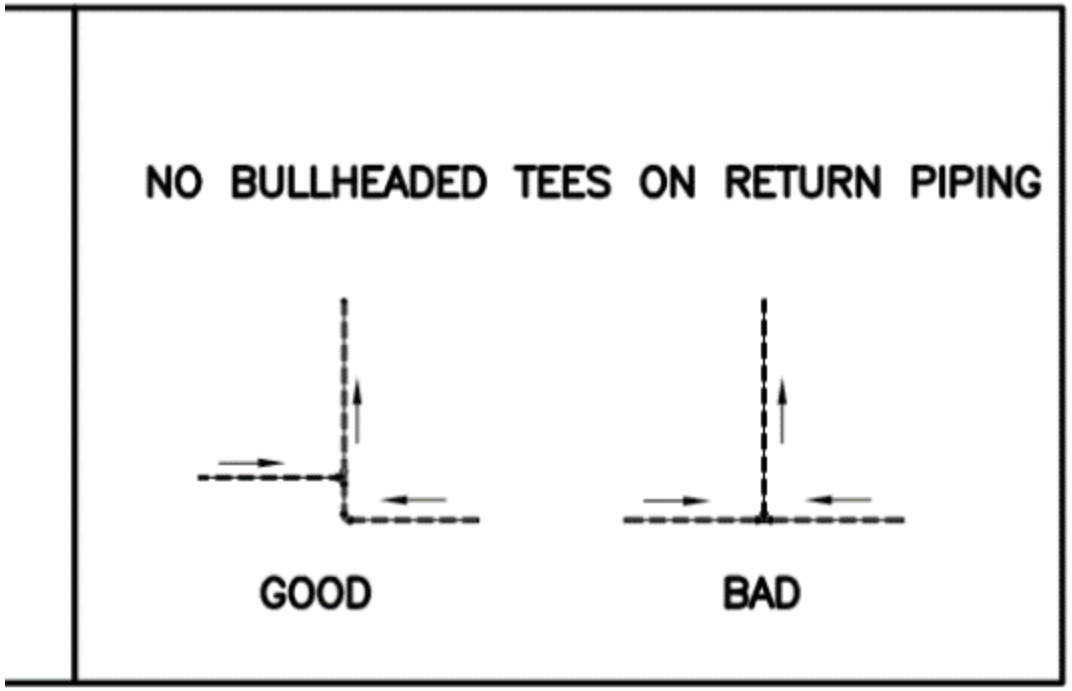
"The fox is watching the hen house."

Henry:

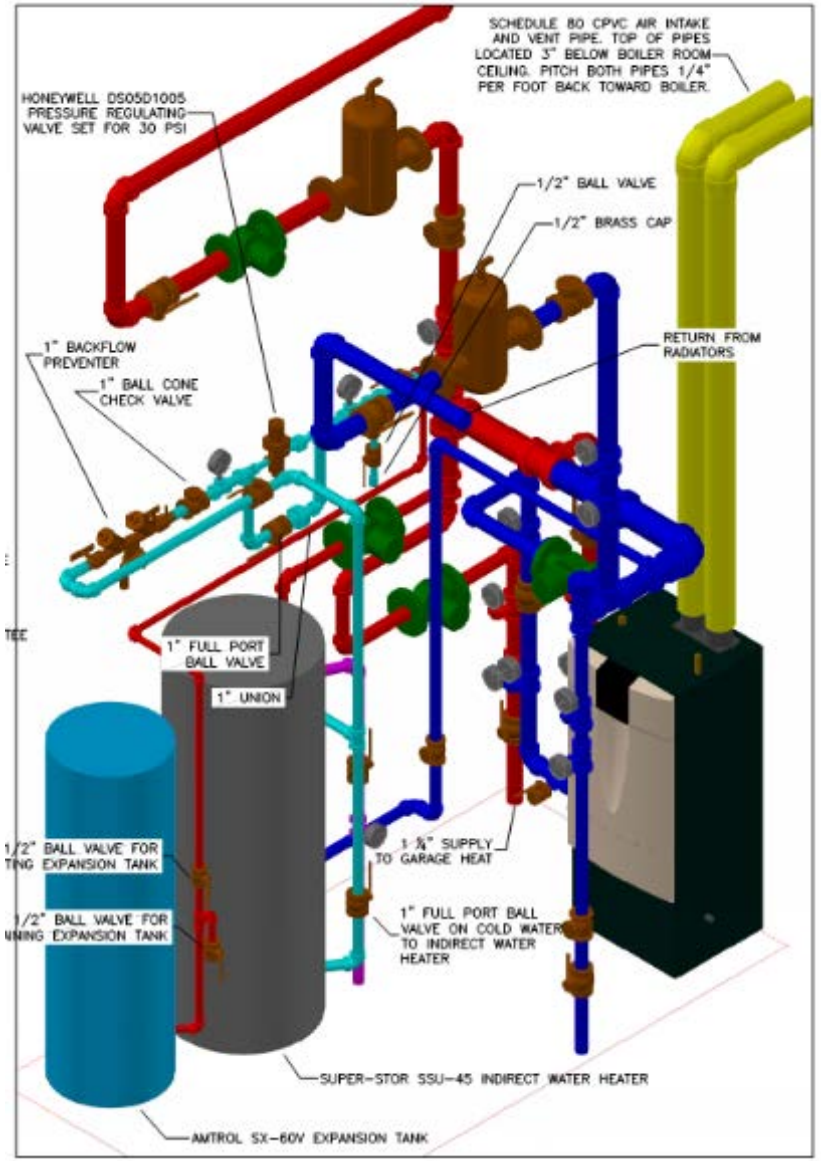
"Bullshit, the fox is designing the hen house."

Study Good Examples

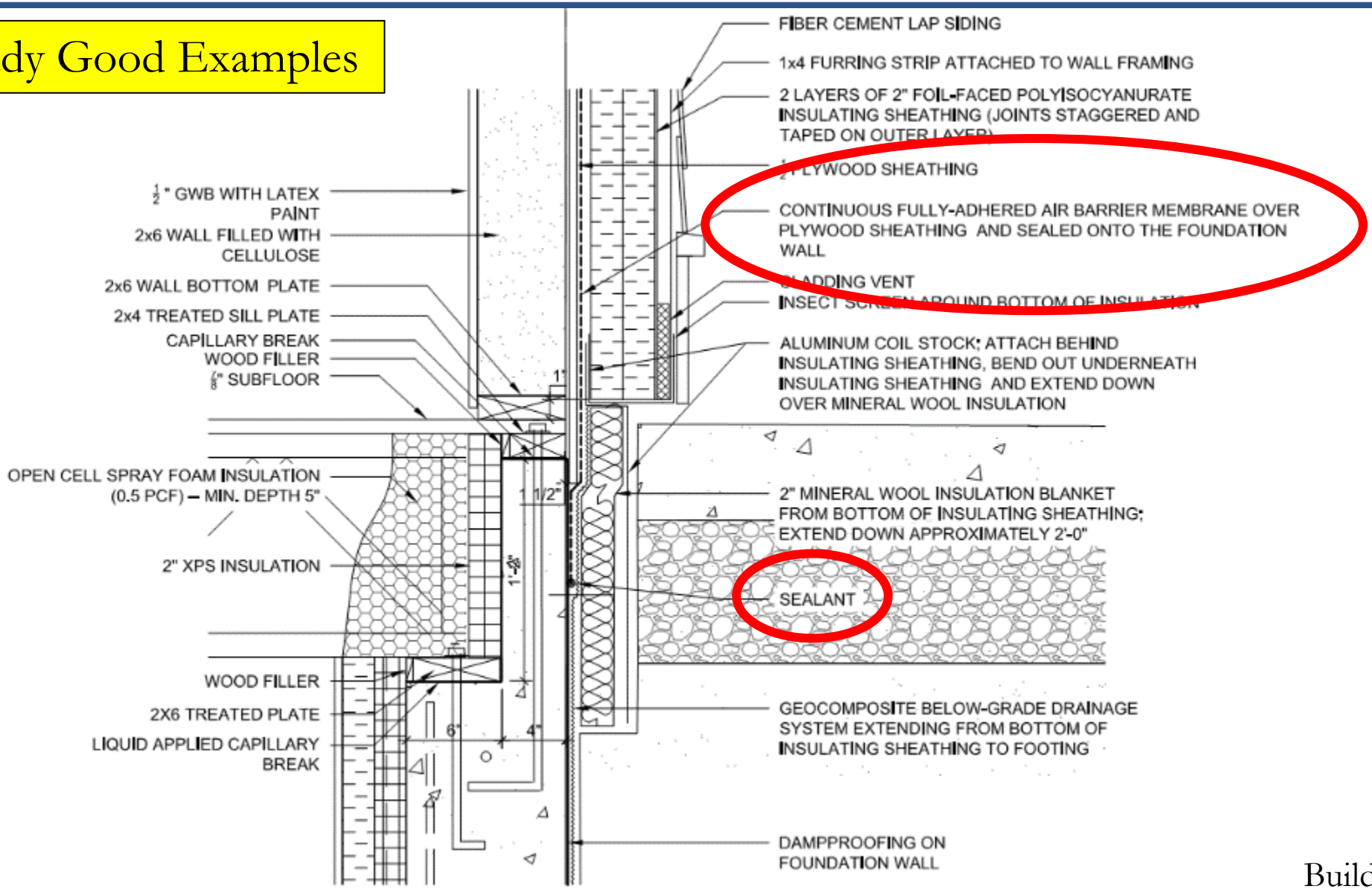
Good things happen when you ignore the dogma:



Henry Gifford, 2010

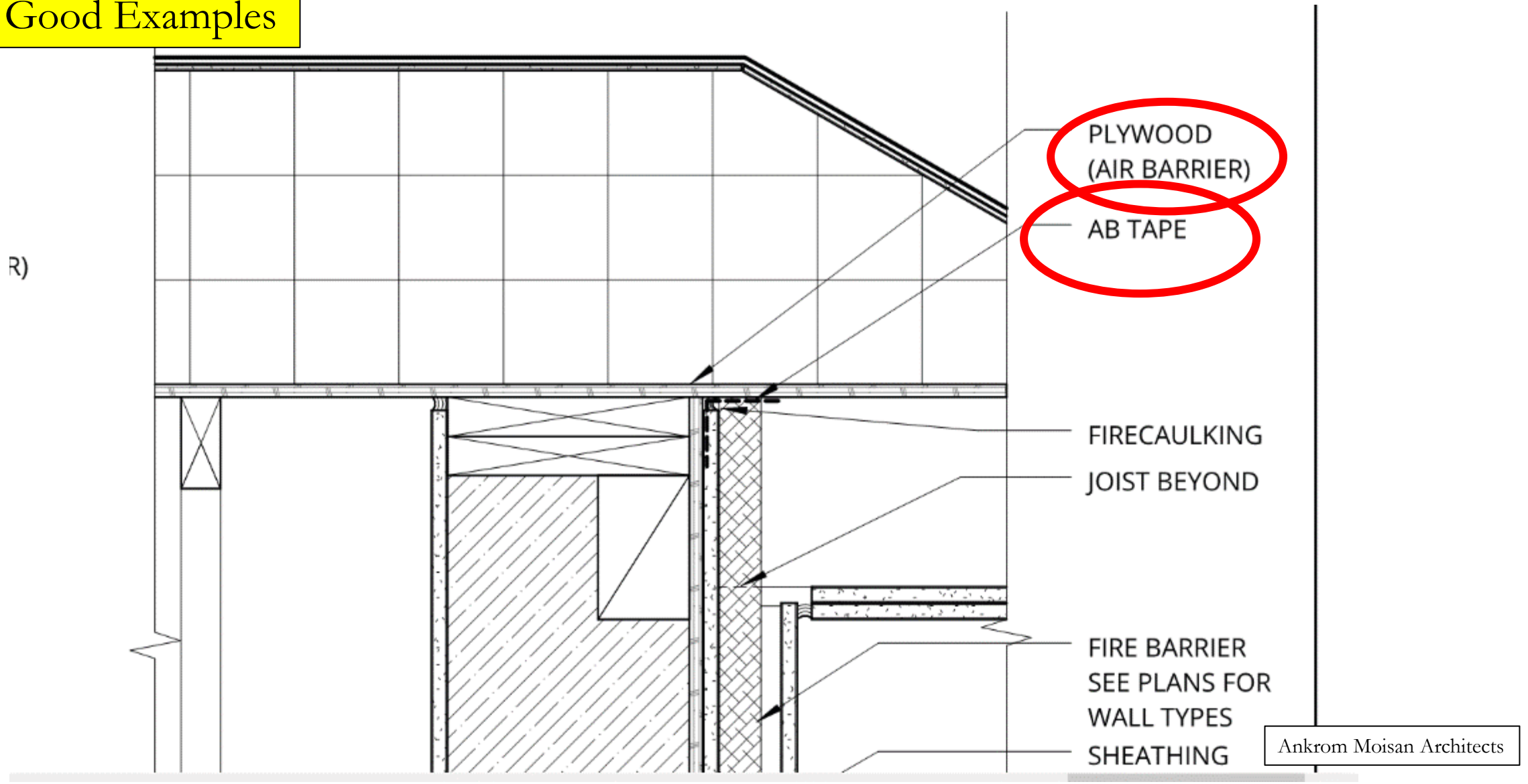


Study Good Examples



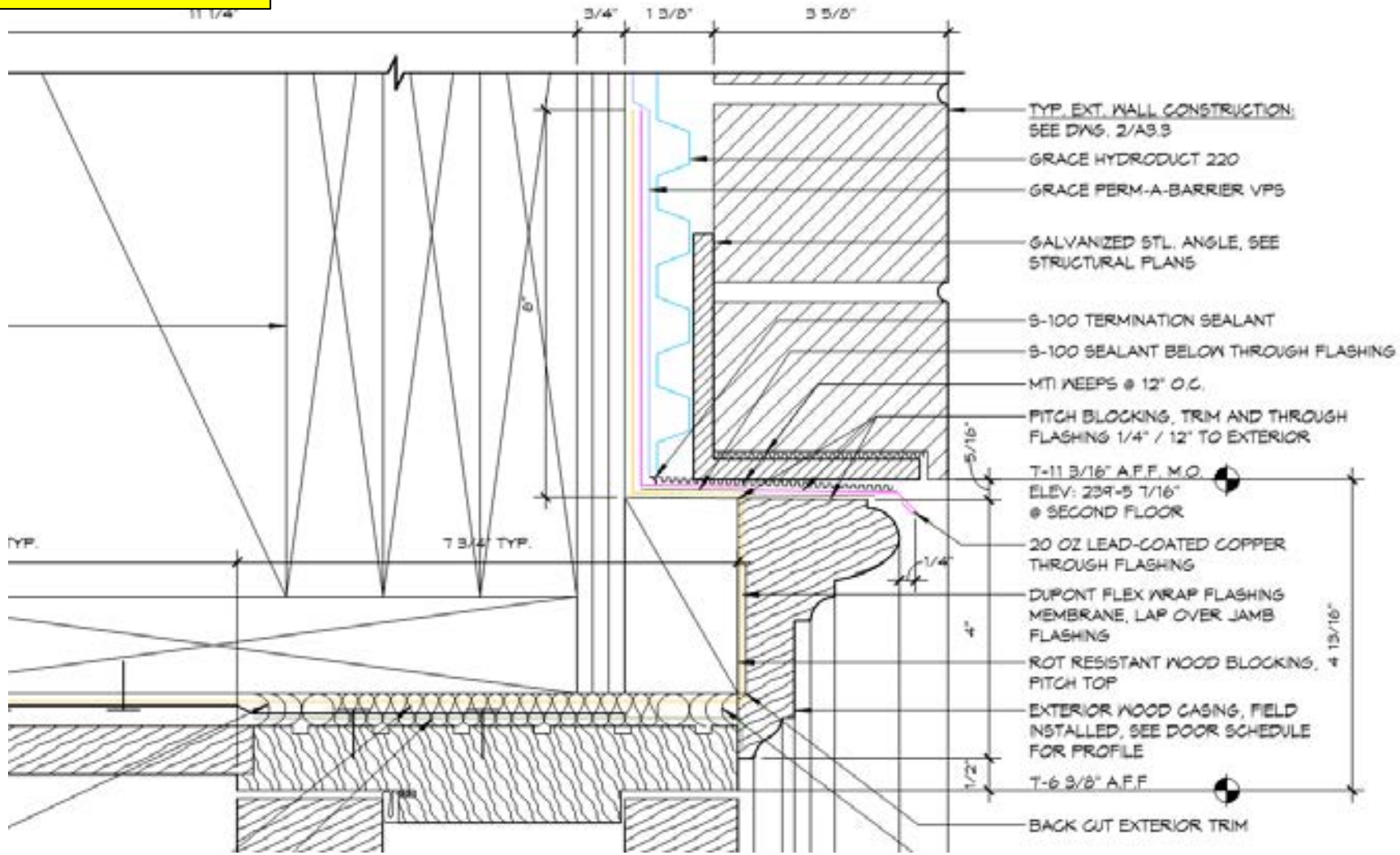
Building Science Corp., 2010

Study Good Examples

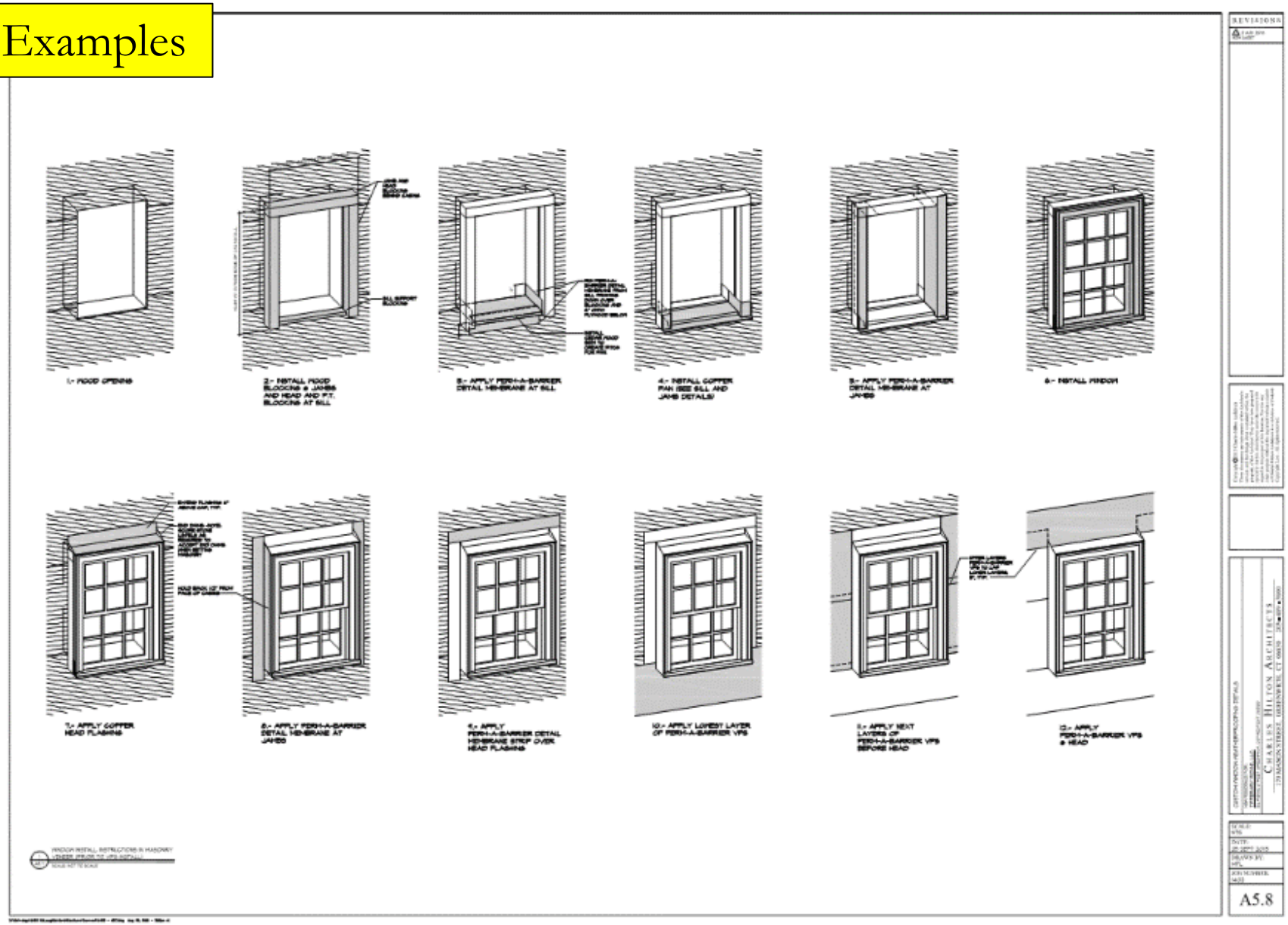


Ankrom Moisan Architects

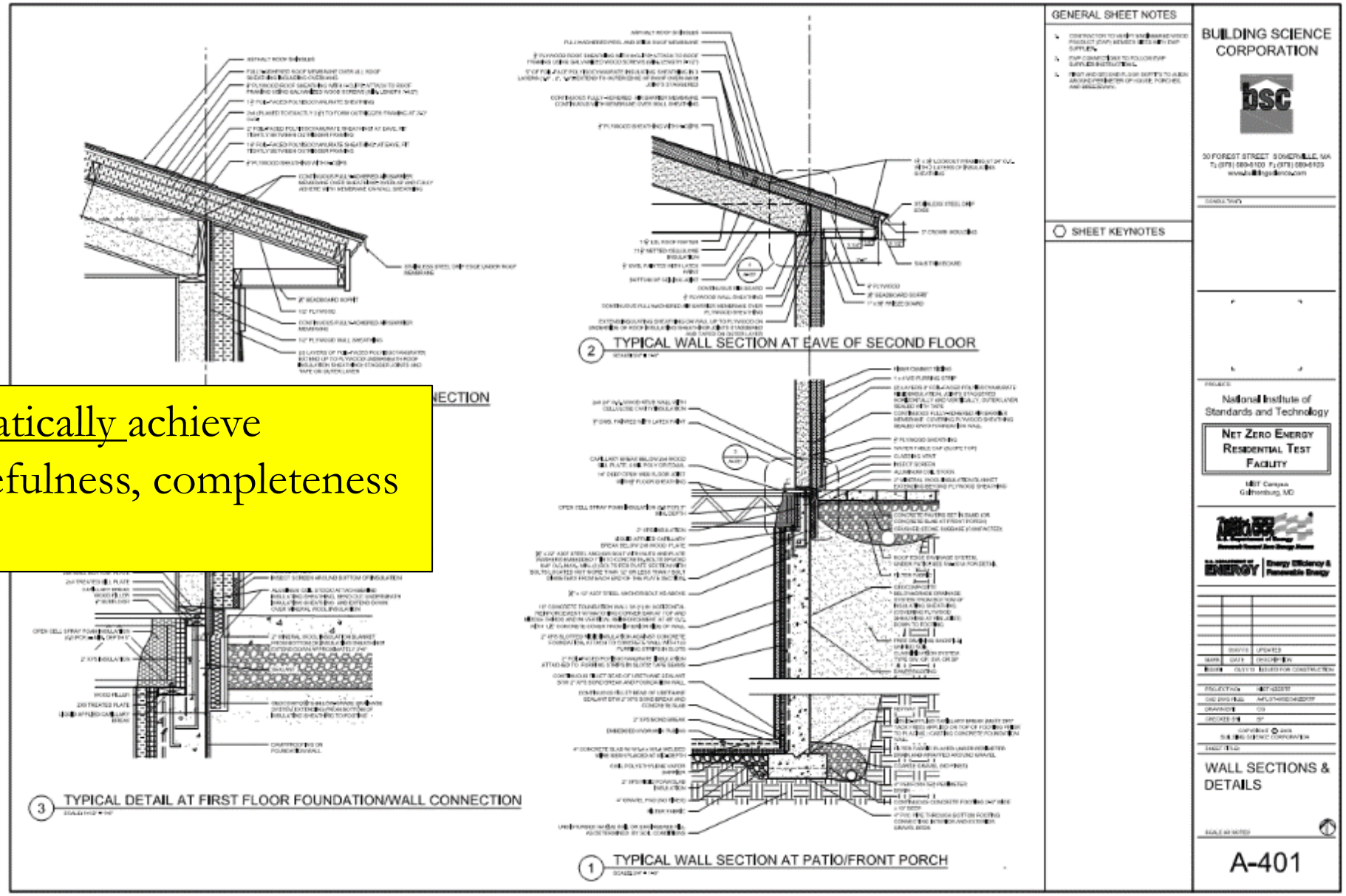
Study Good Examples



Study Good Examples



How to systematically achieve this level of usefulness, completeness and quality?



W. Edwards Deming
1900 - 1993

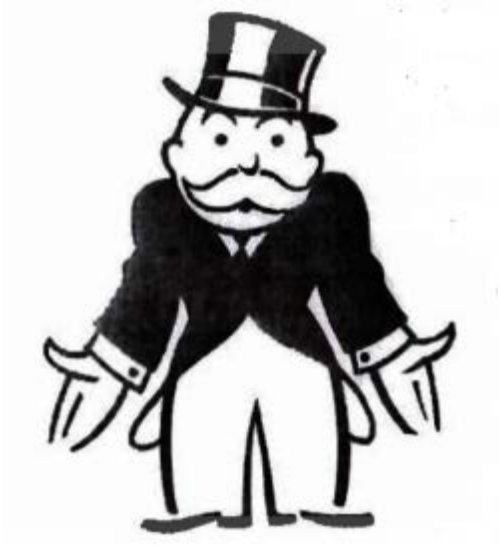
"It is not necessary to change. Survival is not mandatory."

"In God we trust, all others must bring data."

"Defects are not free. Somebody makes them, and gets paid for making them."

85% of the problem is the process. Fix the process.

On the drawings.



Mock – ups.

Empowered tradesmen.

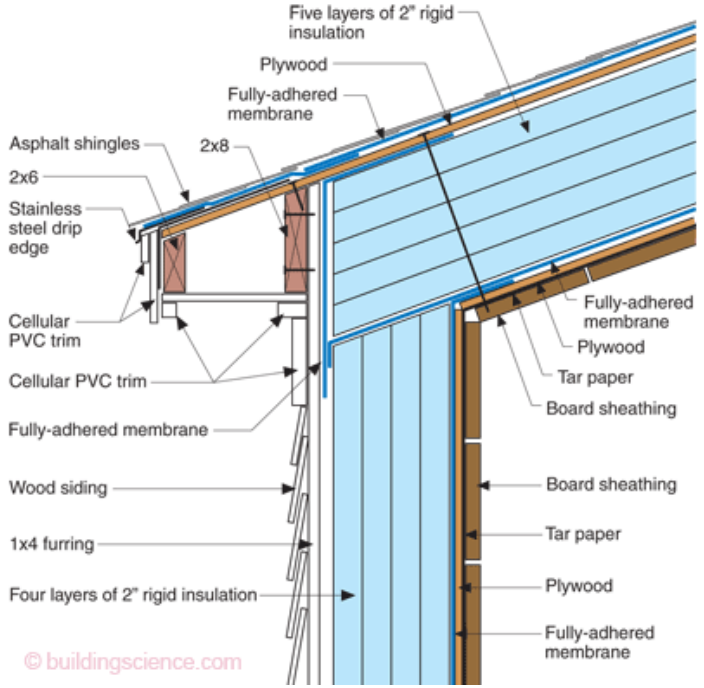
#1
Overall Philosophy

No Elitism. Draw as if your project will be on Rapa Nui.

One shipment. No local stores. Local (untrained) workforce. Supervision by one Peace Corp volunteer.

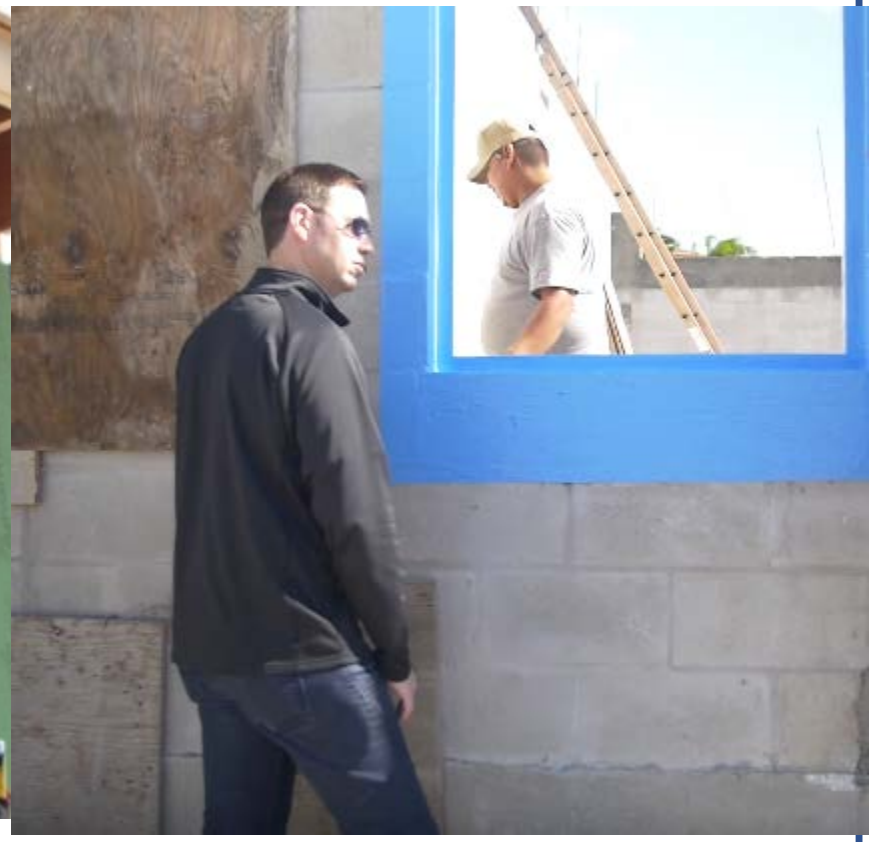
#2 – What damage functions does the building need to withstand?

#3 Major assembly decisions.*



* You've got to know stuff.

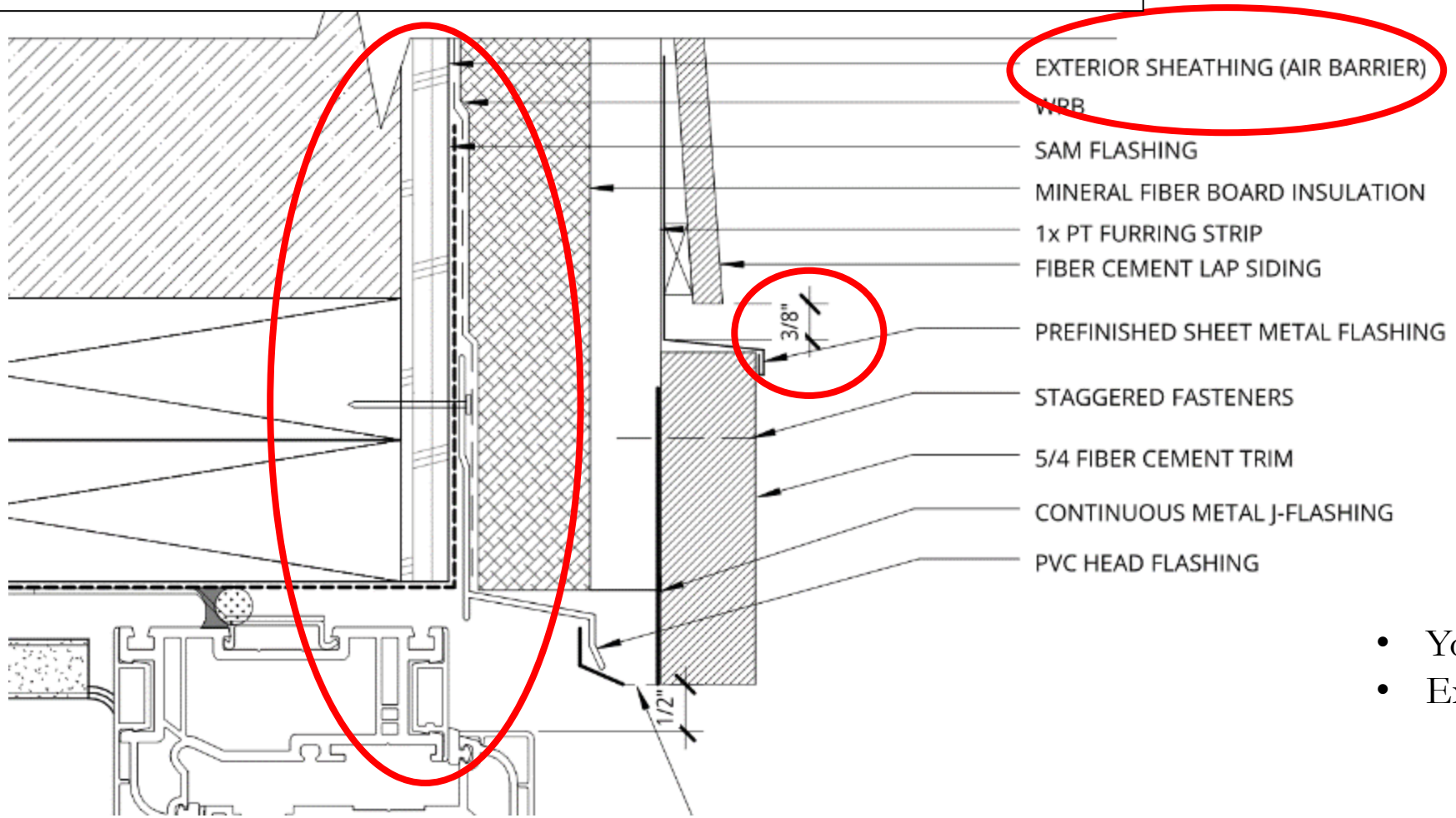
#4 Specifications – choose your materials/assemblies.**



- You've got to know stuff.
- Experience helps.

#5 Figure out where the sections should be cut and what should be shown in greater detail.

#6 Draw and note the sections and details.**



- You've got to know stuff.
- Experience helps.

Ankrom Moisan Architects

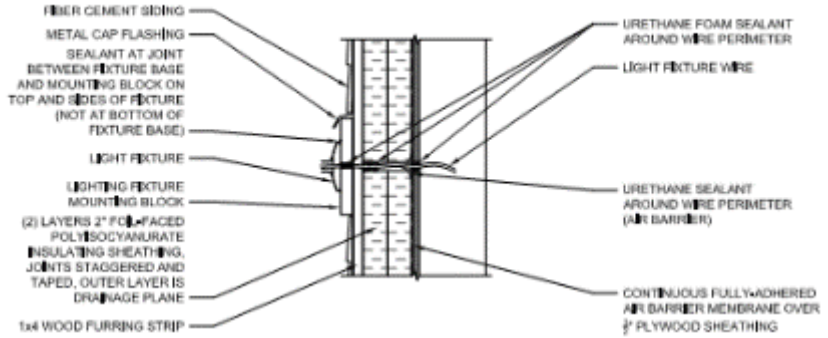
Everything is ID'd

Overlapping drawn properly.

Air Control Layer ID'd.

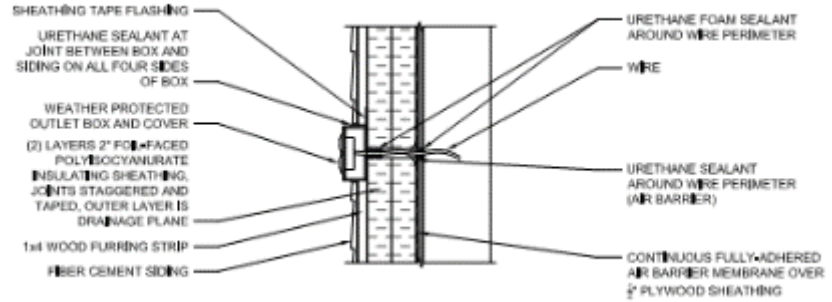
Water Control Layer ID'd

#7 Draw and note penetration details.



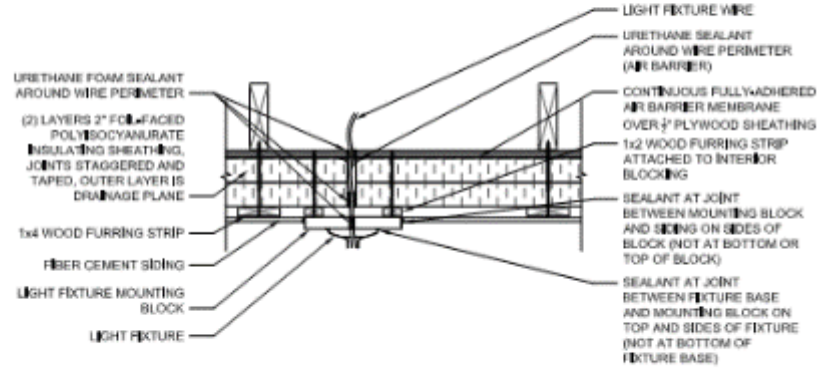
6 EXTERIOR LIGHT FIXTURE SECTION DETAIL

SCALE: 1 1/2" = 1'-0"



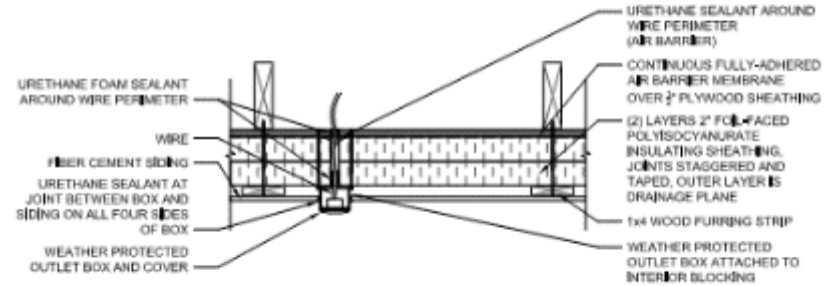
4 EXTERIOR ELECTRICAL BOX SECTION DETAIL

SCALE: 1 1/2" = 1'-0"



5 EXTERIOR LIGHT FIXTURE PLAN DETAIL

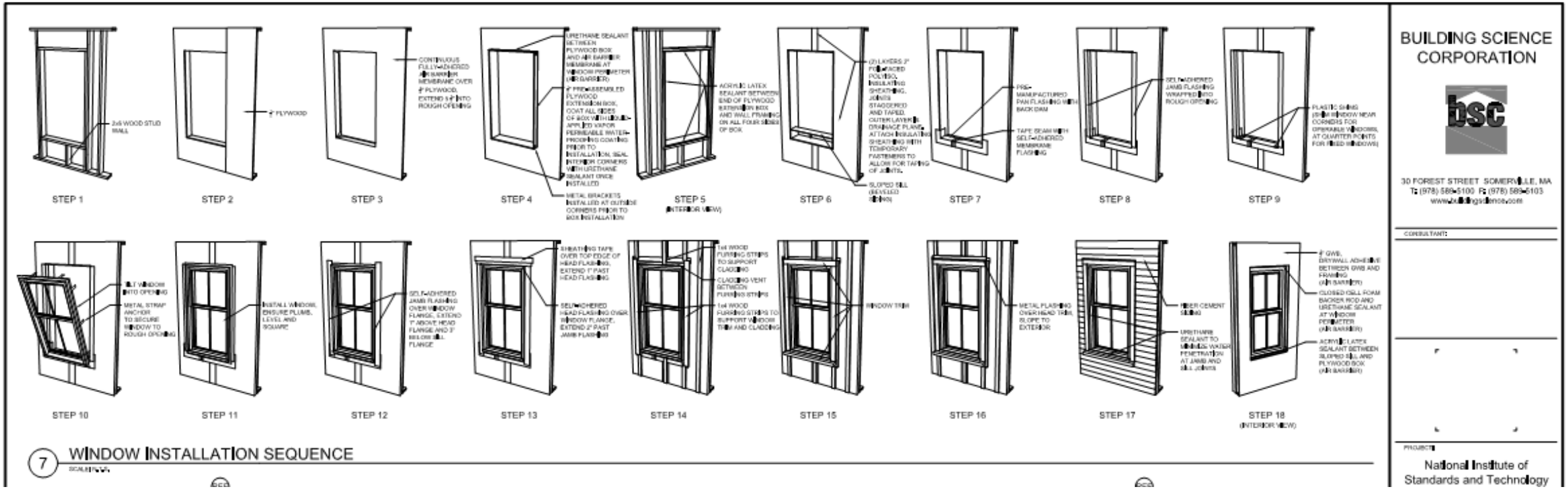
SCALE: 1 1/2" = 1'-0"



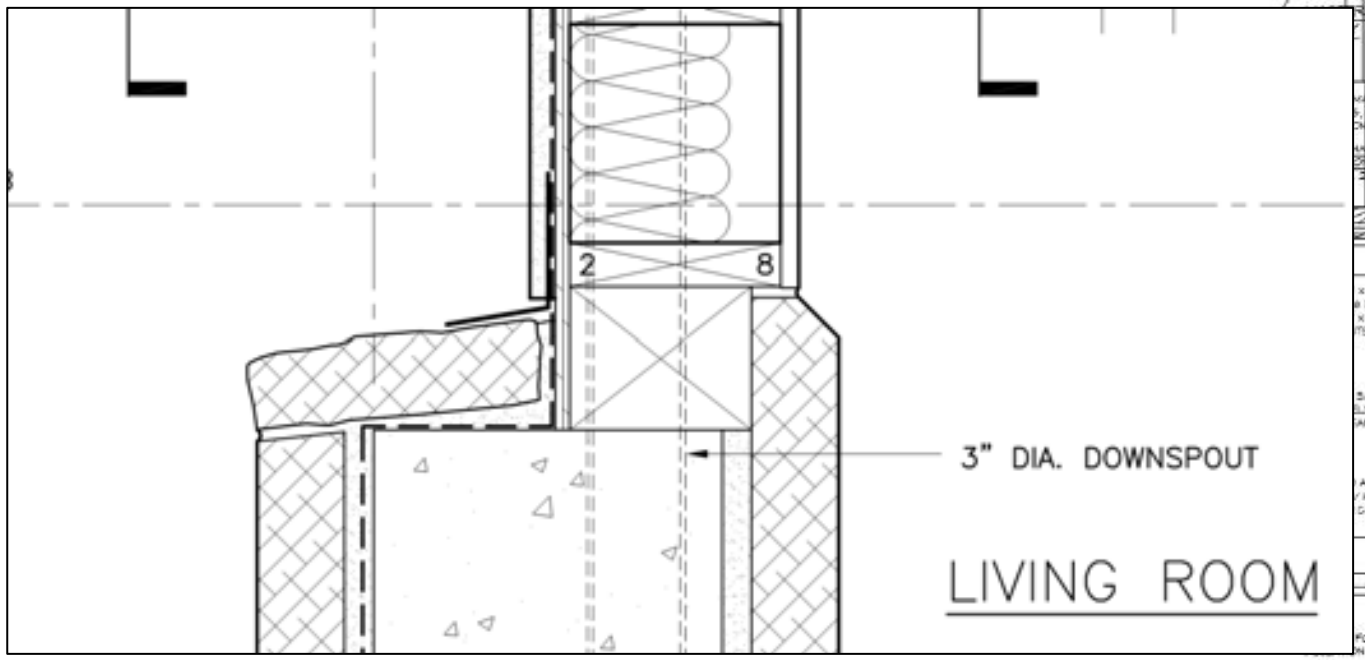
3 EXTERIOR ELECTRICAL BOX PLAN DETAIL

SCALE: 1 1/2" = 1'-0"

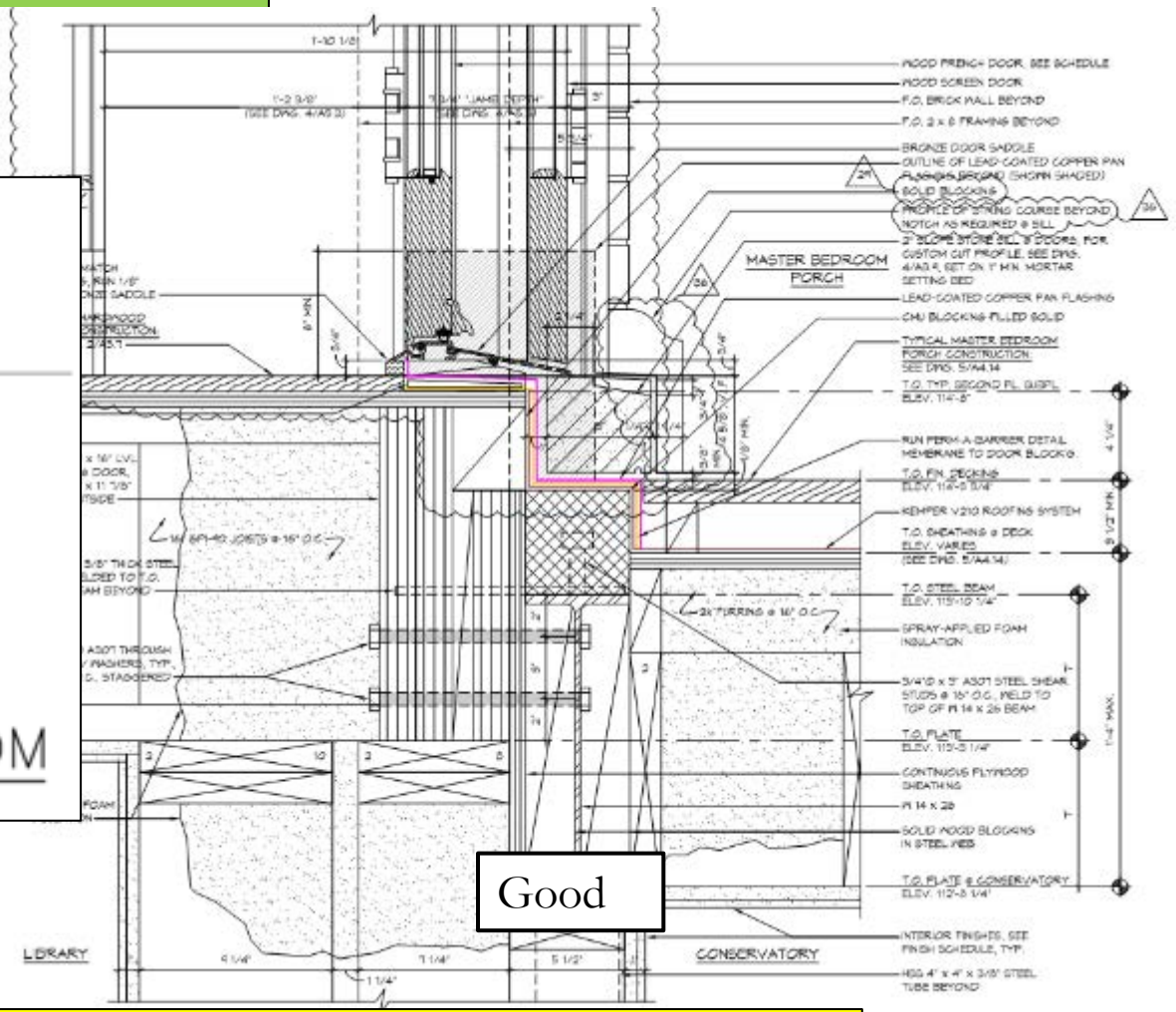
#7 Create Sequence Drawings.



#6 Draw and note the sections and details.



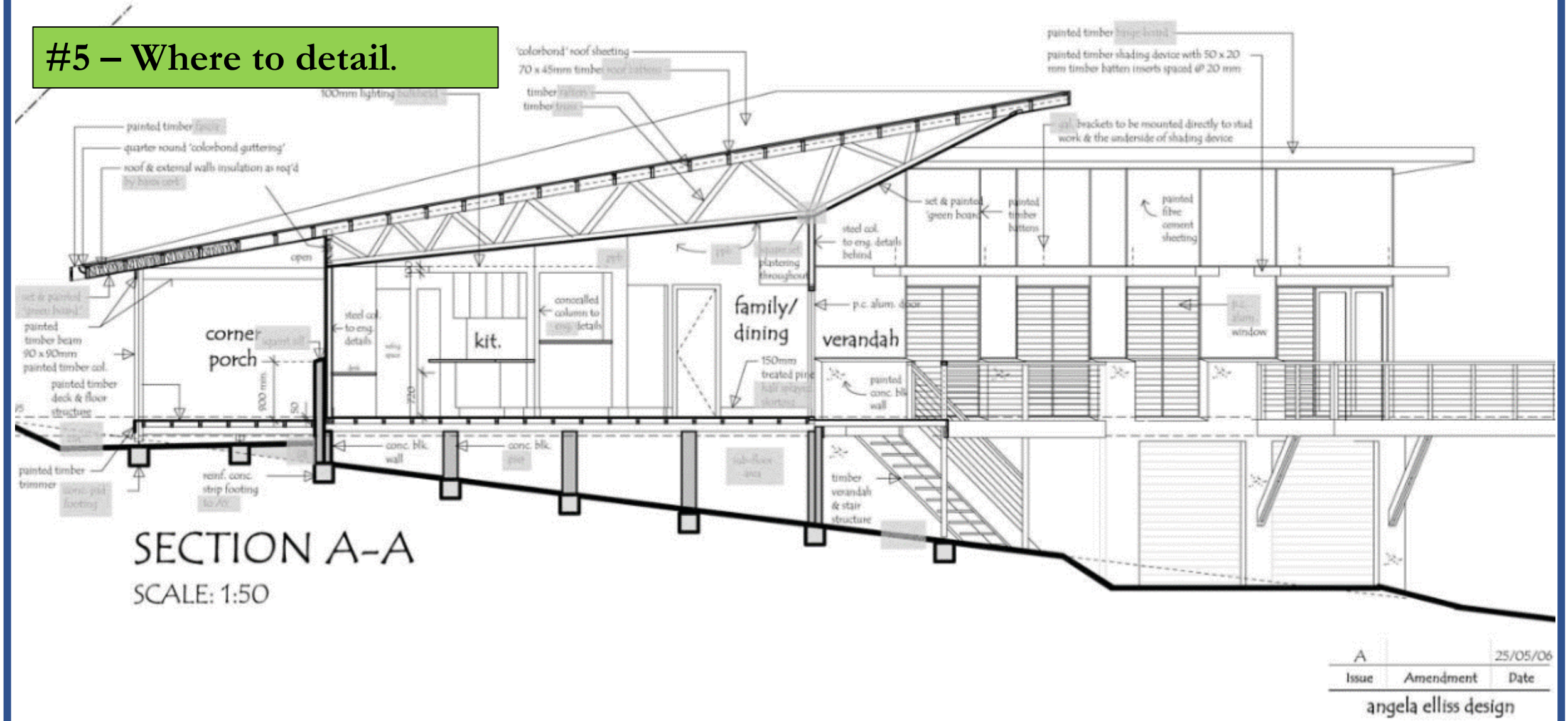
Not Good



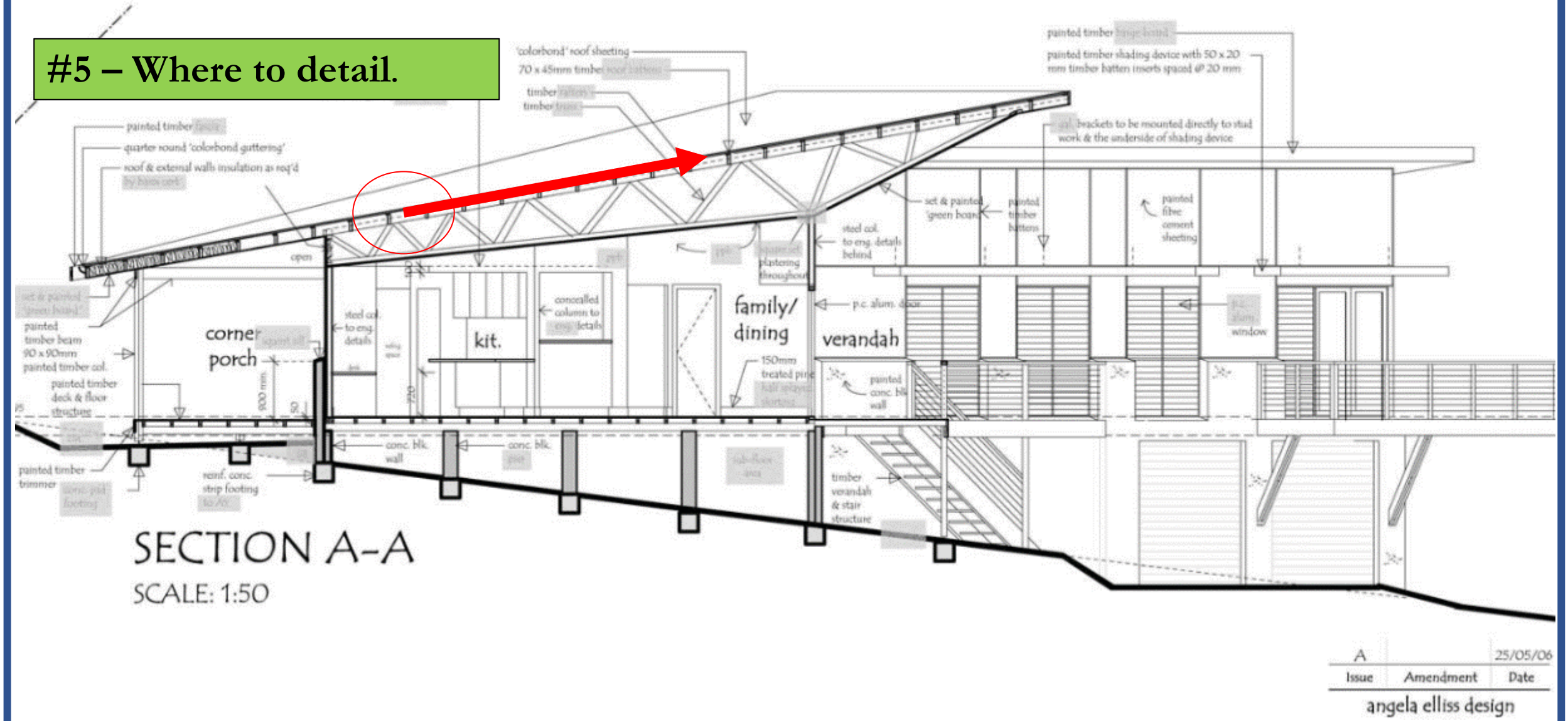
Good

Intent is what you write – not what you only think: Specifications, Typical details ("Typ.", "Sim.")

#5 – Where to detail.



#5 – Where to detail.



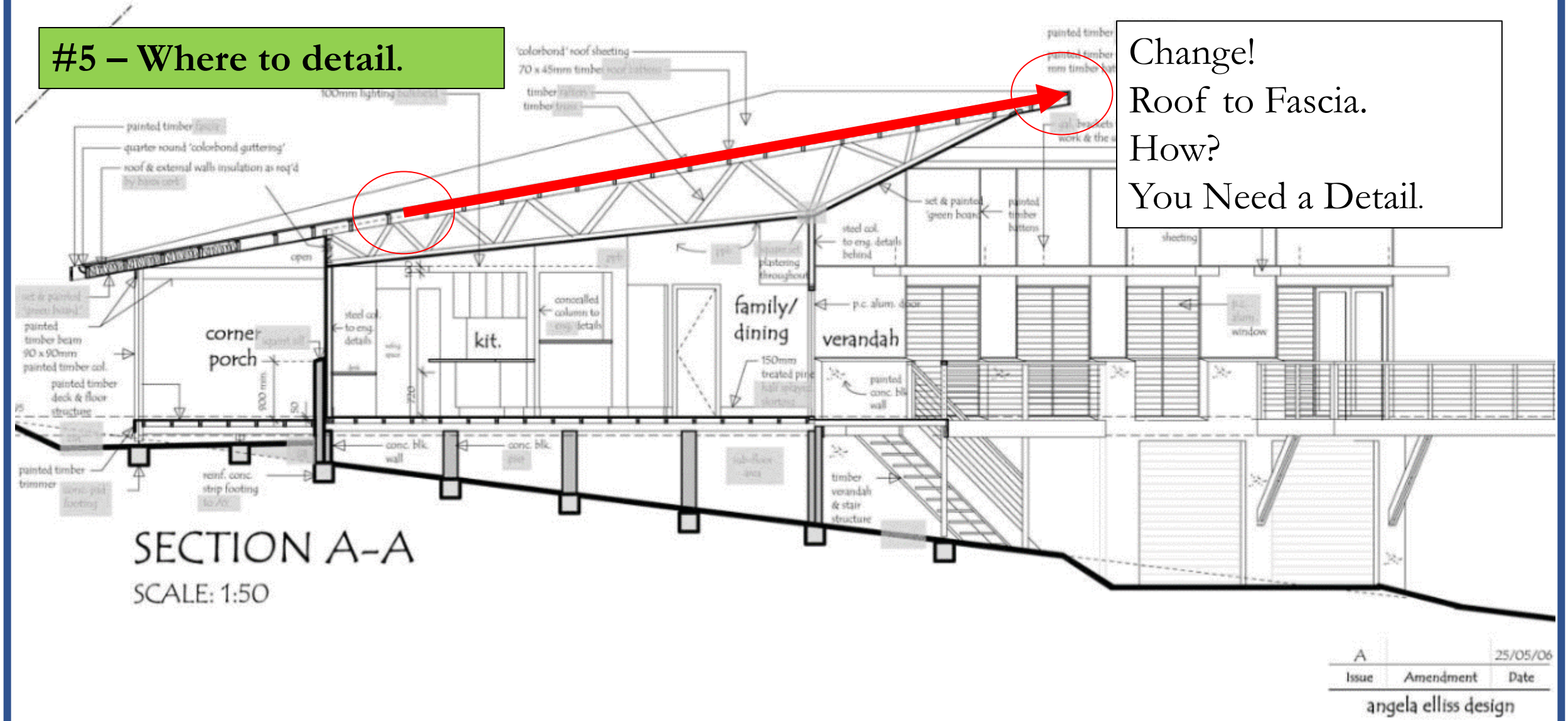
SECTION A-A

SCALE: 1:50

Issue	Amendment	Date
A		25/05/06

angela elliss design

#5 – Where to detail.



SECTION A-A

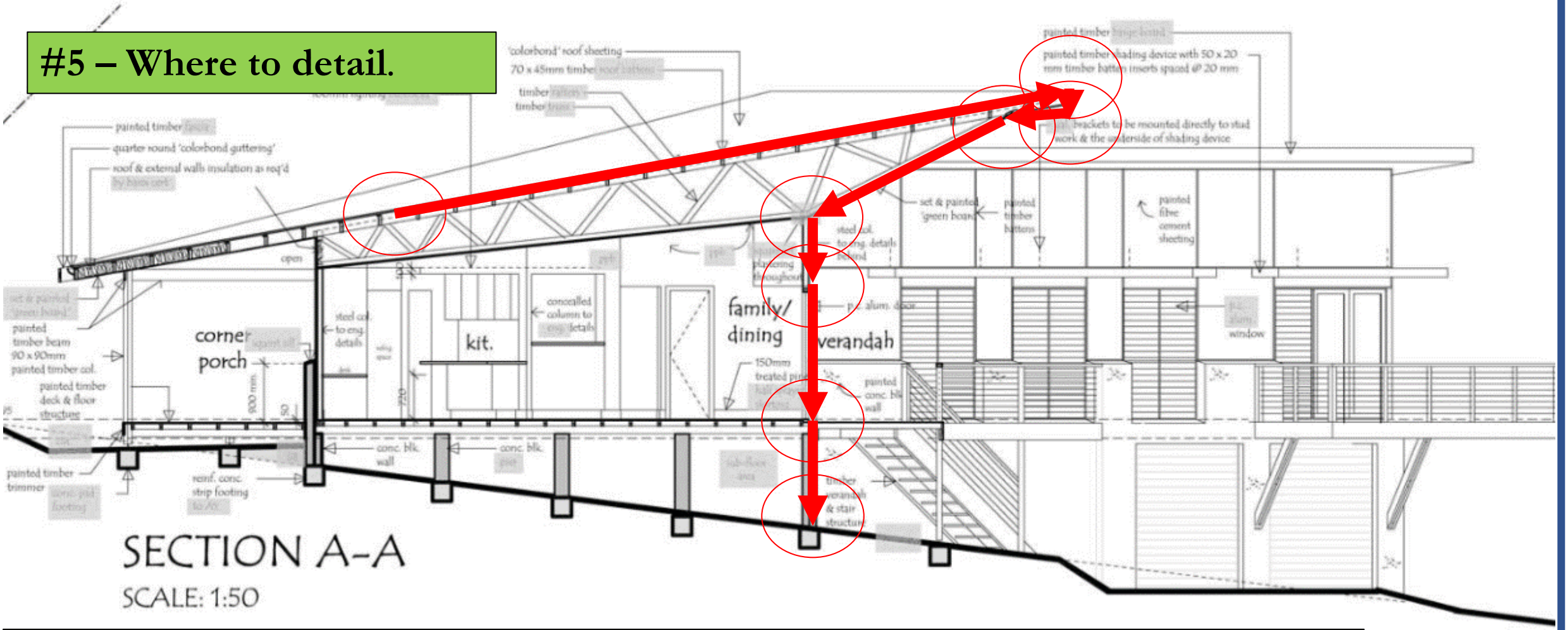
SCALE: 1:50

Change!
Roof to Fascia.
How?
You Need a Detail.

Issue	Amendment	Date
A		25/05/06

angela elliss design

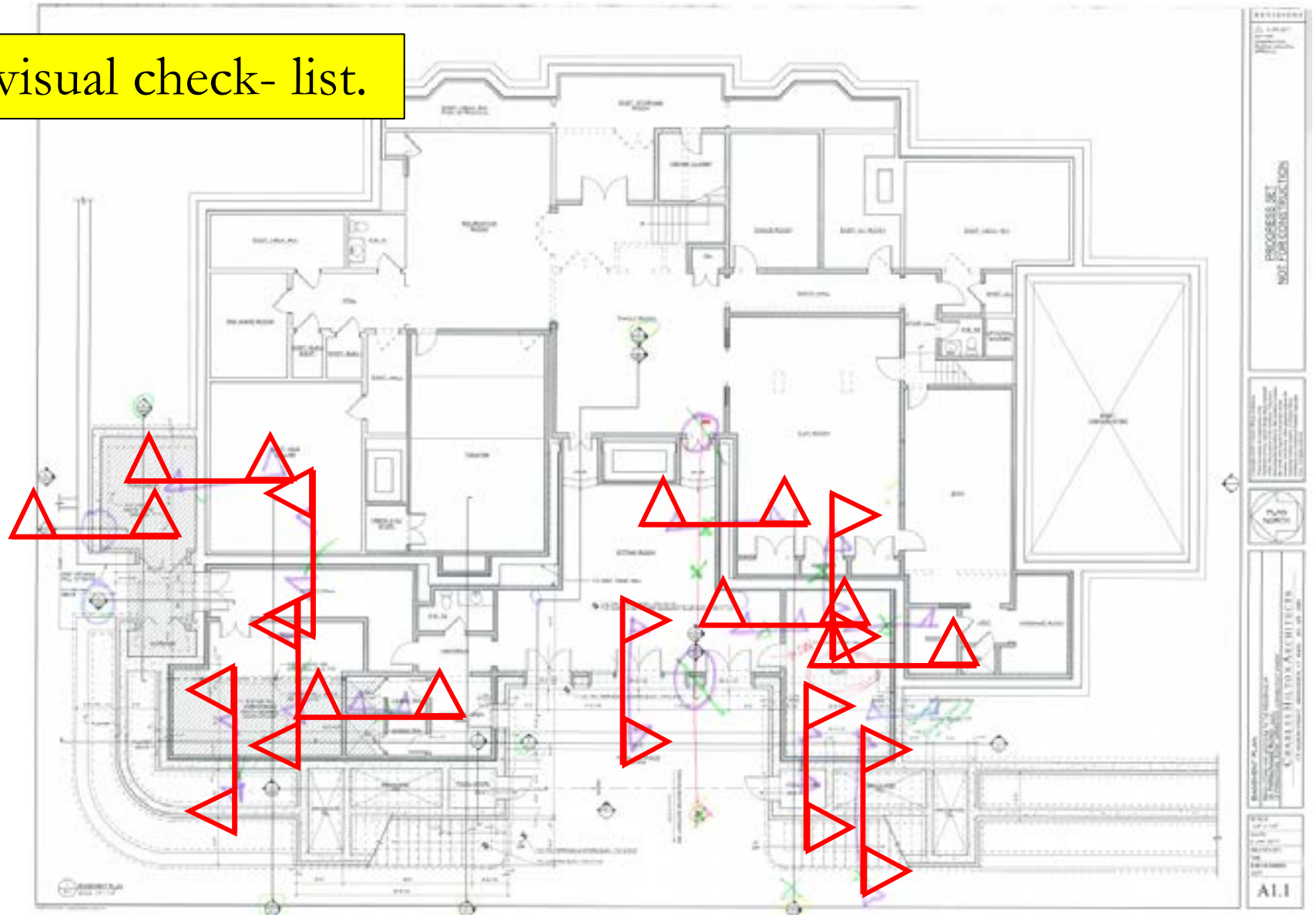
#5 – Where to detail.



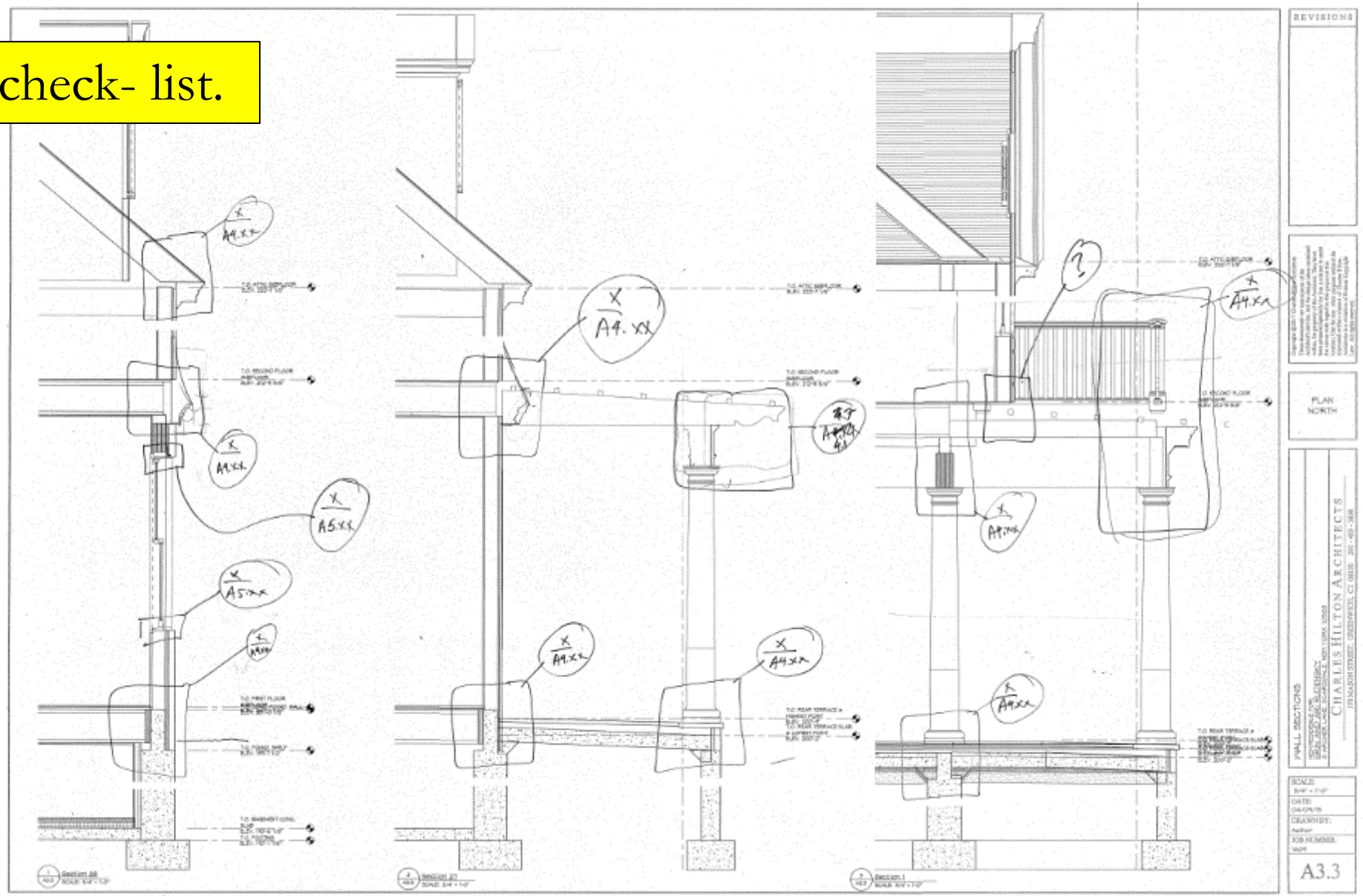
Make the effort remembering that the lawyers will clean up behind you.
Come to peace with the certainty that you won't find them all.

25/05/06
Amendment | Date
angela elliss design

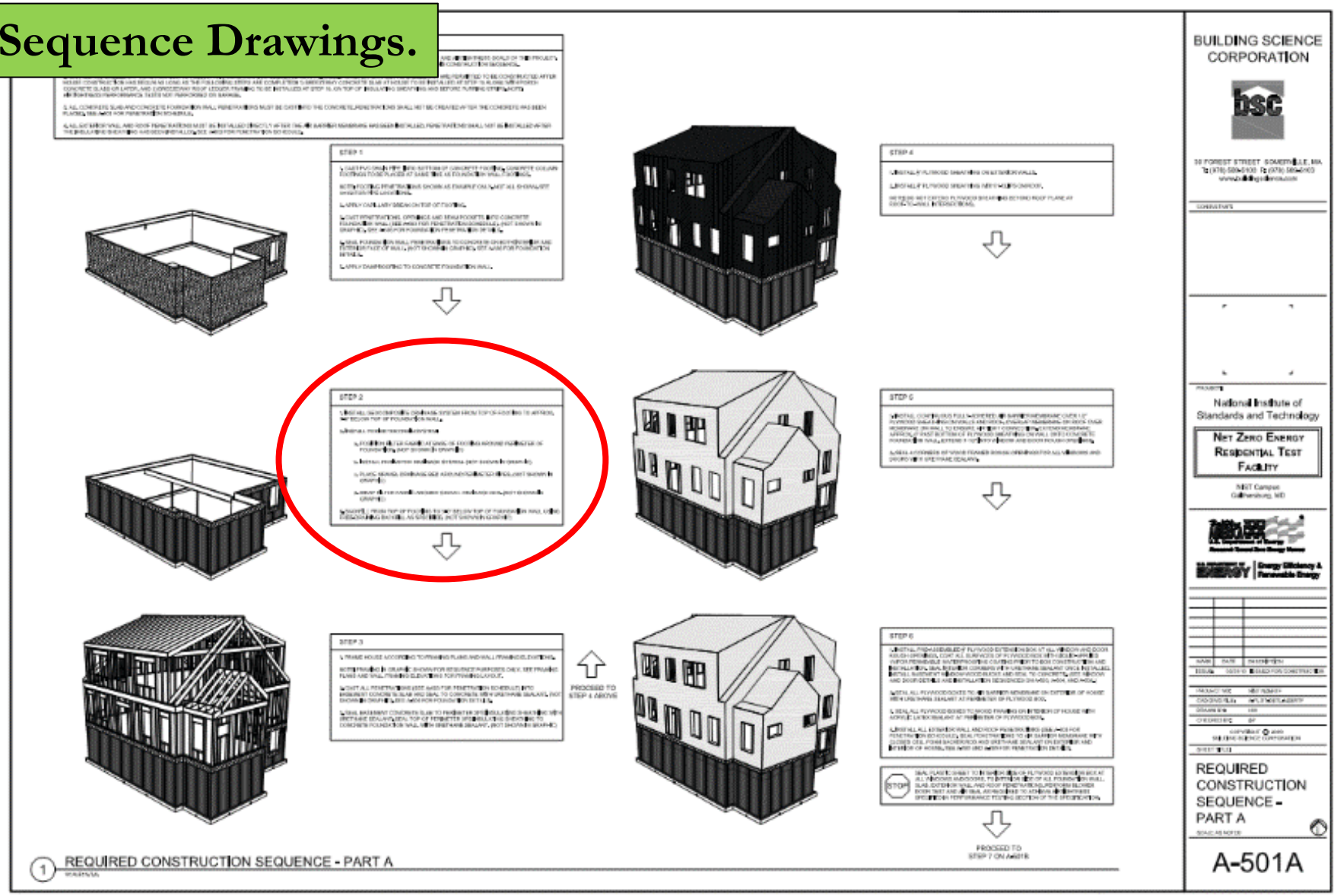
Create a visual check- list.



Create a visual check- list.



#7 Sequence Drawings.



What if there isn't enough fee to draw it or hire a consultant?

Not enough fee?

Material Spec
+
Mock Up

Make sure the
money is in the budget
– allowances.

Photo Credit: Green Building Advisor

What if there's REALLY no money.

No fee, no mock-ups? Copy the Navy SEALS: Empower the Trades & Communicate

Leadership is fluid. Everyone on the team can be the leader.

Real time communication.

The person who knows what to do becomes the new leader.

Follow the leader until there is a new leader.

DRAWING LIST

ARCHITECTURAL

A-001 DESIGN CRITERIA, ABBREVIATIONS, & GEN. STRUCTURAL NOTES
A-101 ARCHITECTURAL SITE PLAN
A-101A ARCHITECTURAL SITE PLAN DETAILS
A-102 FOUNDATION PLAN
A-103 BASEMENT PLAN
A-104 FIRST FLOOR FRAMING PLAN
A-105 FIRST FLOOR PLAN
A-106 FIRST FLOOR KEY PLAN & WALL FRAMING ELEVATIONS
A-107 SCREEN PORCH & GARAGE KEY PLANS & WALL FRAMING ELEVS.
A-108 SECOND FLOOR & LOWER ATTIC FRAMING PLAN
A-109 SECOND FLOOR PLAN
A-110 SECOND FLOOR KEY PLAN & WALL FRAMING ELEVATIONS
A-111 ATTIC FRAMING PLAN
A-112 ROOF FRAMING PLAN
A-113 ROOF PLAN
A-114 LOWER R FRAMING PLAN
A-115 UPPER R FRAMING PLAN
A-121 FIRST AN R REFLECTED CEILING PLANS

A-201 EXTERIO
A-202 EXTERIO
A-203 EXTERIO
A-204 INTERIOR
A-205 INTERIOR
A-206 INTERIOR
A-207 INTERIOR ELEVATIONS

A-301 BUILDING SECTION
A-302 BUILDING SECTION
A-303 BUILDING SECTION
A-304 BUILDING SECTION
A-305 GARAGE, BREEZEWAY & SCREEN PORCH SECTIONS

A-401 WALL SECTIONS & DETAILS
A-402 WALL SECTIONS

A-501A REQUIRED CONSTRUCTION SEQUENCE - PART A
A-501B REQUIRED CONSTRUCTION SEQUENCE - PART B
A-501C REQUIRED CONSTRUCTION SEQUENCE - PART C
A-502 ADVANCED FRAMING DETAILS
A-503 WINDOW DETAILS & INSTALLATION SEQUENCE
A-504 DOOR DETAILS & INSTALLATION SEQUENCE
A-505 ENCLOSURE PENETRATION DETAILS & SEQUENCES
A-506 FOUNDATION DETAILS
A-507 HORIZONTAL DETAILS
A-508 VERTICAL DETAILS
A-509 ROOF DETAILS

A-601 WINDOW & DOOR SCHEDULES & TYPES
A-602 INTERIOR FINISH SCHEDULE
A-603 PENETRATION SCHEDULE

A-701 FIRST FLOOR OPEN WEB FLOOR TRUSS TYPE ELEVATIONS
A-702 SECOND FLOOR OPEN WEB FLOOR TRUSS TYPE ELEVATIONS

A

FIRE PROTECTION

F-001 FIRE PROTECTION GENERAL AND ABBREVIATIONS

F-101 BASEMENT FLOOR PLAN
F-102 FIRST FLOOR PLAN
F-103 SECOND FLOOR PLAN
F-104 ATTIC FLOOR PLAN

F-601 FIRE PROTECTION DETAILS AND MATRIX

F

PLUMBING

P-101 BASEMENT FLOOR PLAN - F
P-102 FIRST FLOOR PLAN - PLUM
P-103 SECOND FLOOR PLAN - PL
P-104 ATTIC FLOOR PLAN - PLUM

P-501 PLUMBING DETAILS

P-601 PLUMBING RISERS AND SC

P

MECHANICAL

M-001 MECHANICAL LEGEND, SCH
M-002 MECHANICAL SITE PLAN

M-101 BASEMENT FLOOR PLAN - H
M-102 FIRST FLOOR PLAN - HVAC
M-103 FIRST FLOOR PLAN GARAG
M-104 SECOND FLOOR PLAN - HV
M-105 ATTIC FLOOR PLAN - HVAC
M-106 BASEMENT FLOOR PLAN - R

M-501 MECHANICAL DETAILS
M-502 MECHANICAL DETAILS

M-601 MECHANICAL SCHEDULES

M

ELECTRICAL

E-001 ELECTRICAL LEGEND , SYMBOLS & LIGHTING FIXTURE SCHEDULE

E-101 BASEMENT FLOOR PL
E-102 FIRST FLOOR PLAN -
E-103 FIRST FLOOR PLAN -
E-104 SECOND FLOOR PLA WER
E-105 ATTIC FLOOR PLAN -

E-501 ELECTRICAL RISER DIAGRAM
E-502 ELECTRICAL DETAILS

E-601 ELECTRICAL PANEL SCHEDULES

E

J Building Science and Performance

Primary purpose:

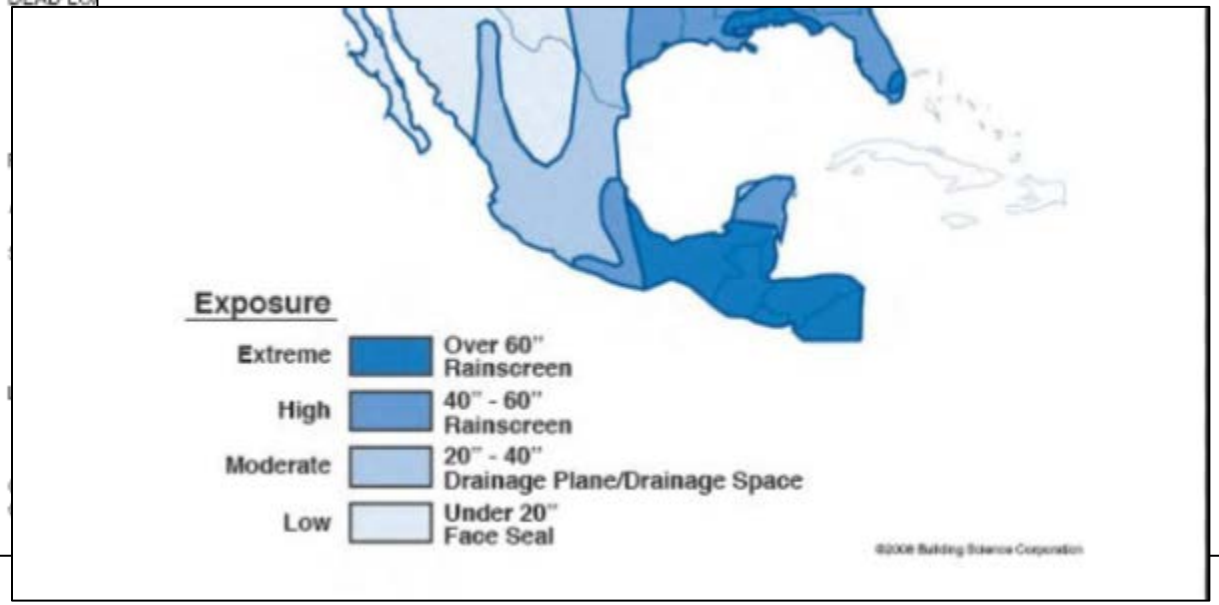
Improve quality of communication.

Unification of:

Language/Understanding
Specifications
Drawings

ENCLOSURE THERMAL ENVELOPE CRITERIA

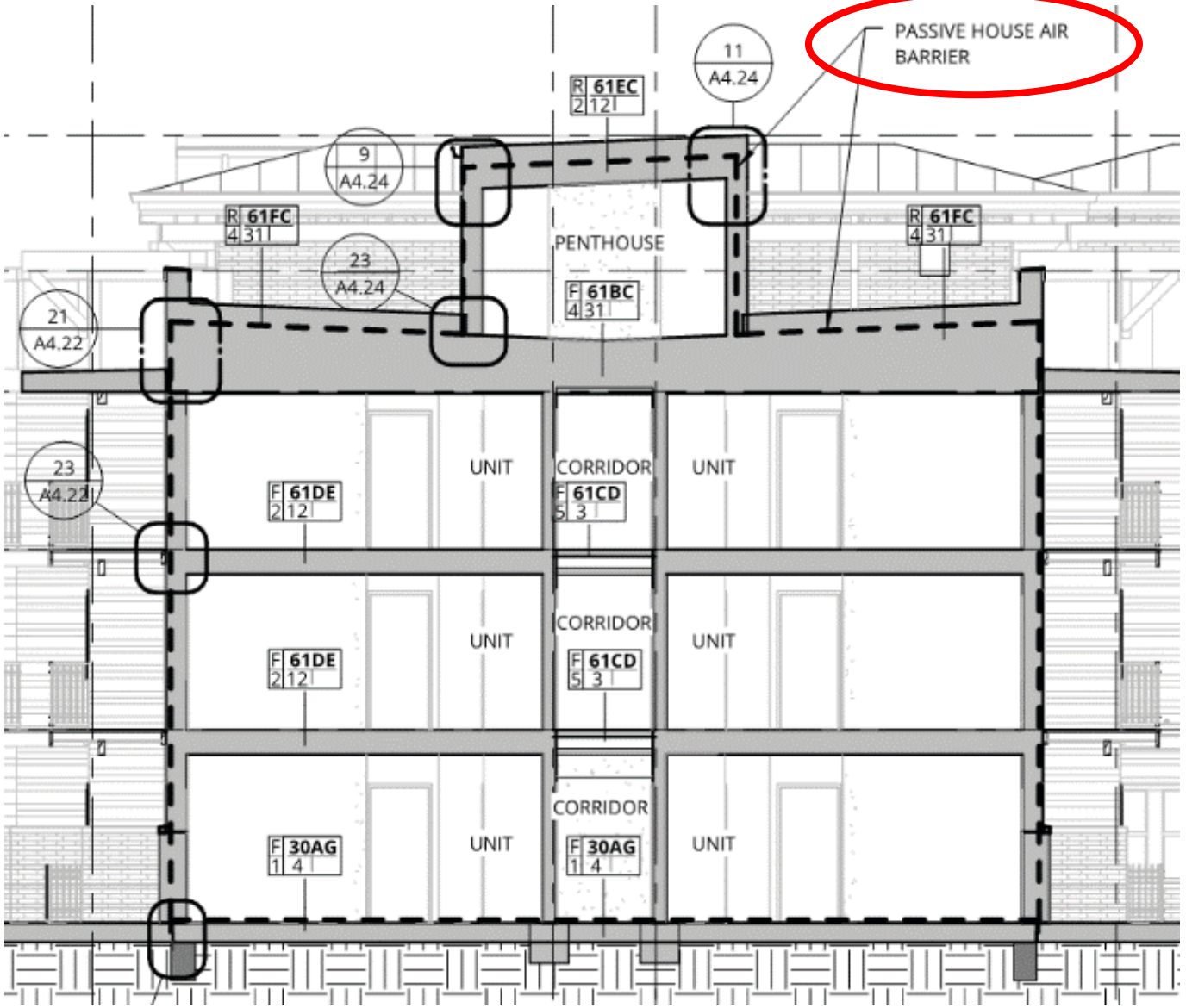
COMPONENT	R-VALUE	U-VALUE
FRAMED WALLS	R-45	
ROOF	R-72	
WINDOWS		U-0.19
BASEMENT WALLS	R-23	
BASEMENT FLOOR	R-10	



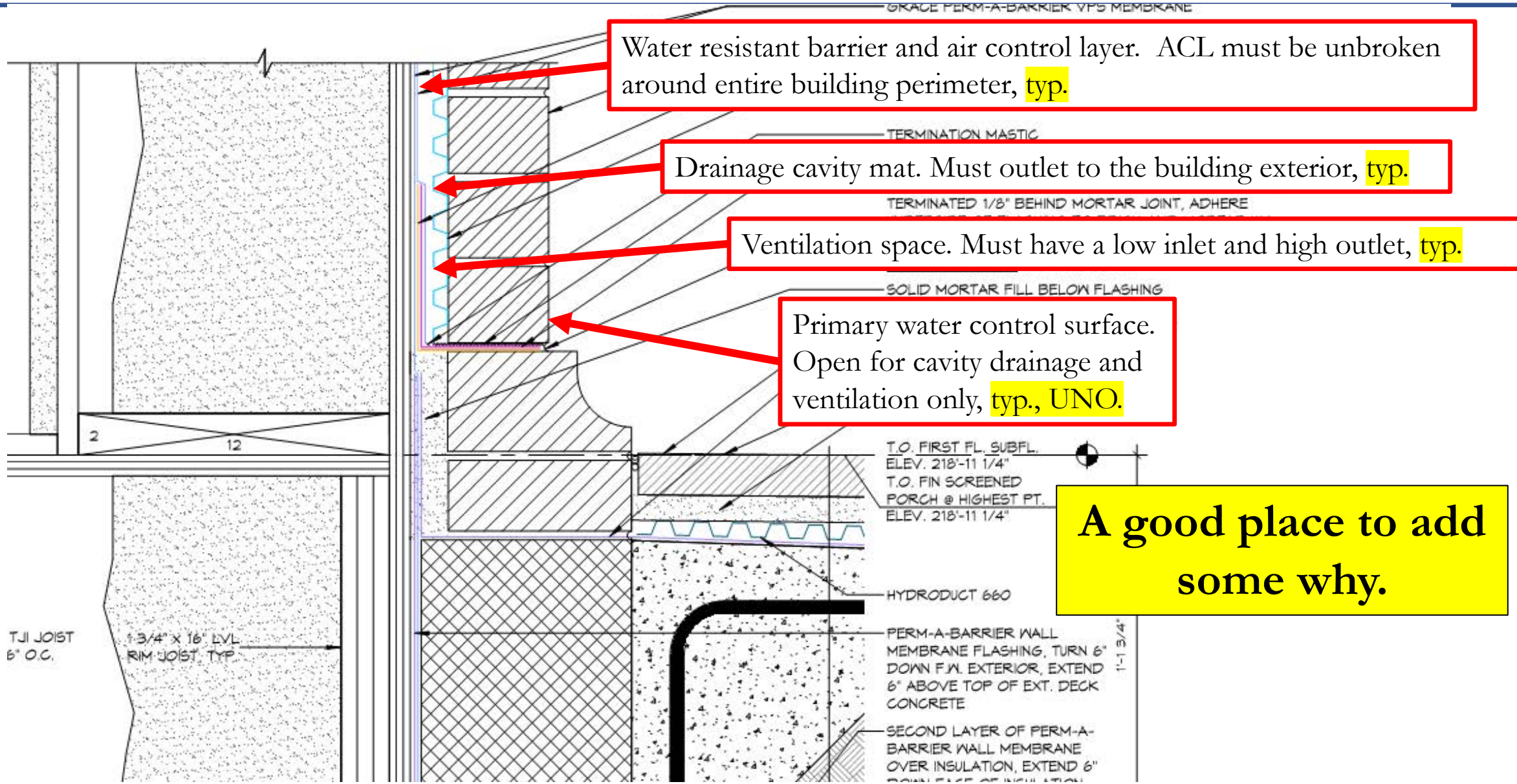
Climatic and Geographic Design Criteria
(Reference IRC Table R301.2(1))

Ground Snow Load	Wind Design			Seismic Design Category	Subject to Damage From			Winter Design Temp (oF)	Ice Barier Underlayment Required	Flood Hazards	Air Freezing Index	Mean Annual Temp.
	Speed (mph) (3 second gust)	Topographic effects	Wind Borne Debris Zone		Weathering	Frost line depth	Termite					
30 PSF	100 mph	NO	n/a	B	Severe	3'-6"	Moderate to Heavy	9 oF	YES	n/a	1500 or less	50.5 oF

US EPA Climate Zone Design Criteria: 5A



Ankrom Moisan Associated Architects 2014


GRACE PERM-A-BARRIER VPS MEMBRANE
TERMINATION MASTIC
TERMINATED 1/8" BEHIND MORTAR JOINT, ADHERE
SOLID MORTAR FILL BELOW FLASHING
T.O. FIRST FL. SUBFL.
ELEV. 218'-11 1/4"
T.O. FIN SCREENED
PORCH @ HIGHEST PT.
ELEV. 218'-11 1/4"
HYDRODUCT 660
PERM-A-BARRIER WALL MEMBRANE FLASHING, TURN 6" DOWN F.W. EXTERIOR, EXTEND 6" ABOVE TOP OF EXT. DECK CONCRETE
SECOND LAYER OF PERM-A-BARRIER WALL MEMBRANE OVER INSULATION, EXTEND 6"
1'-1 3/4"
TJI JOIST
6" O.C.
1 3/4" X 16" LVL
RIM JOIST, TYP.
2
12
Water resistant barrier and air control layer. ACL must be unbroken around entire building perimeter, typ.
Drainage cavity mat. Must outlet to the building exterior, typ.
Ventilation space. Must have a low inlet and high outlet, typ.
Primary water control surface. Open for cavity drainage and ventilation only, typ., UNO.
A good place to add some why.

"Mobile jobsite plan desk! Love it."
- Matt Risinger, April 19, 2017

The Paper Dogma.

Photo credit: Matt Risinger

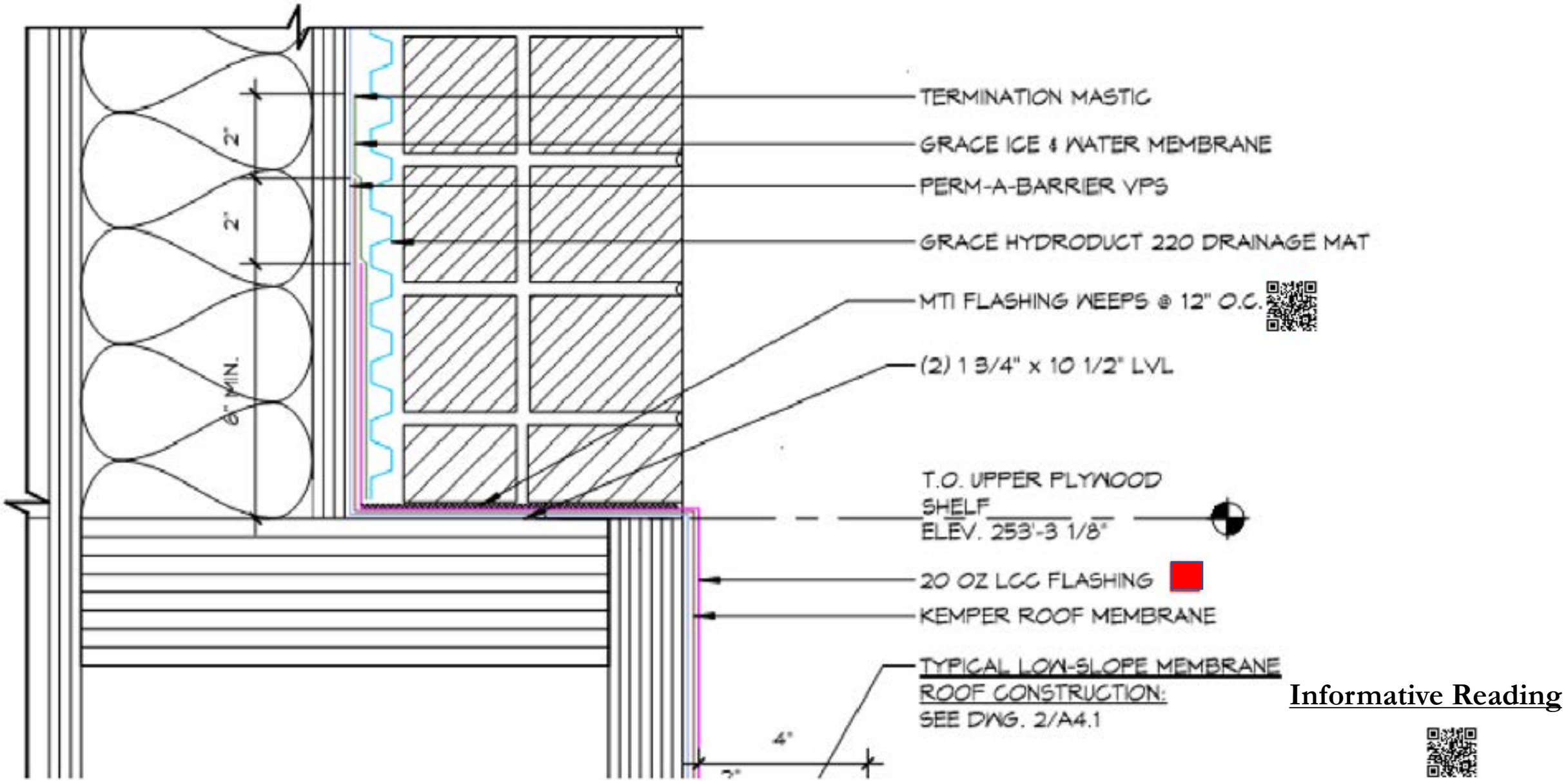
1989

2017

Same phone as the Director of the CIA!

More computing power than that on the last Space Shuttle.

Better screen display also!



Informative Reading

#BuildingScienceFightClub