RESIDENTIAL CONSTRUCTION

SINGLE FAMILY
MULTI FAMILY
RENOVATION
REMODELING
MAINTENANCE

2ND. LARGEST INDUSTRY IN US

580,000+ SMALL BUSINESSES
10+ MILLION EMPLOYED
RESIDENTIAL CONSTRUCTION

SINGLE FAMILY
MULTI FAMILY
RENOVATION
REMODELING
MAINTENANCE

INSTRUCTOR- JOE CROSS
RESIDENTIAL CONSTRUCTION

WHAT YOU MAY LEARN

• THEY DON’T BUILD THEM LIKE THEY USE (AND THAT’S GOOD)

• YOU CAN’T FIX IT (AND THAT’S GOOD, TOO)

• COMPONENTS, ASSEMBLIES – WHAT THEY ARE

• HOW TO HIRE THE “APPROPRIATE” PERSON

• HOW TO (MAYBE) GET WHAT YOU EXPECTED

• COMMON PROBLEMS

• THE THIN LINE OF INSPECTION

• HOW TO CONTRACT YOUR EXPECTATIONS

INSTRUCTOR - JOE CROSS
This cave is perfect but drafty & cold

Neighborhood’s Changing, I don’t feel safe.

Need to get rid of the smoke and I want a new door

With the baby and your mother, we need more space
HOUSING DEVELOPED FROM AVAILABLE MATERIALS & NEEDS

Humans Improvise Using What’s Available

Nature Provides
A BRIEF RECENT U.S. HISTORY OF RESIDENTIAL, CONSTRUCTION

1700’s

Antebellum

Post Civil War

Early 20th Century
“WHICH MODEL TO FOLLOW?”

REGIONAL & PERSONAL

MIES VAN DER ROHE
“Form Follows Function”
“Less is More”

GREEN & GREEN
Bungalow Style

LE CORBUSIER
“The house is a machine for living in”.

FRANK LLOYD WRIGHT
Falling Waters
Prairie Style

UTILITARIAN & MANUFACTURED
AN INDUSTRY MATURES

PROBLEM

Hard to build - No Lay-Out
Bringing In Materials
Unsanitary
No Personal Space
Crowded
No Open Space
No Ownership

SOLUTION

Subdivisions
New Towns

Required a New Way of Construction
MASS PRODUCTION ASSEMBLY LINE

Columbia, Md.
Reston, Va
EVOLUTION OF LIGHT (RESIDENTIAL) CONSTRUCTION

US Industrial Revolution & WW I
- Agricultural Mechanical Revolution drives people to cities
- WW I ramps up mass production

Warren Bechtel & Steven Bechtel (Son)
1920’s & 1930’s Railroads & Hoover Dam Construction by Process & Machinery
Time a consideration

As a Contractor there are three choices:
1. We can build a quality house
2. We can build a fast house
3. We can build an inexpensive house

As the Owner, you can make only two choices
(Old Axiom)
SECRET TO MASS (HOUSING) PRODUCTION: BUILD ‘CHASSIS’ FOR HOUSES JUST AS DETROIT DOES FOR AUTOMOBILES……
HENRY J. KAISER

Abraham Levitt & William Levitt (Son)

1930’s Luxury Homes in Westchester
Post WWII Basic 2-3 bedroom Cape Cod on Long Island

By 1955, one house completed every 16 minutes

Cost and Time can be FIXED
HOW TO CONTROL QUALITY, PRICE AND TIME?

Assemble, don’t build
Standardize components, don’t create
Simplify, don’t confuse

WWII Military-
Project Management

NASA-
Critical Path Project Management
PEOPLE STILL WANT TO CUSTOMIZE & PERSONALIZE
EVOLUTION OF LIGHT (COMPONENT) CONSTRUCTION

Handmade Doors & Windows ➔ Standard Sizes and Shapes

Plaster ➔ Drywall ➔ Wood Beams ➔ Trusses

Single Strand Wire ➔ 3-Wire Insulated

Wood Sheathing ➔ Plywood ➔ Insulated Fiberboard

Terra Cotta & Lead Pipe ➔ Cast Iron ➔ PVC Pipe

Random Sizes ➔ 2 foot x 4 foot Modules ➔ Metric

Over 1,200 new products each year

Globalization Hits.....
YEA!!
THAT’S GOOD

Durable, Inexpensive
Inexpensive, Paintable
Inexpensive, Paintable
Inexpensive, Good Conductor
Quick Connect, Easy Runs
Direct House Connection

MISTAKES HAPPEN

EIFS
Synthetic Stucco

Aluminum Siding

Drywall

Aluminum Wiring

QUEST Pipe

“Hanging” Decks

RAT’S!!
THAT’S BAD

Leaks, Causes Rot & Mold
Dents, Alum Nails Fail
Joints Show and Fail
Heats Expands/Contracts
Joints Leak, Brittle w/ Age
Rots Band Board Collapses
COMPONENTS & LIFE SPANS

ALL COMPONENTS HAVE DIFFERENT LIFESPANS

WE ACCEPT THE NEED TO FIX A LEAKY SUN ROOF

WE BALK AT THE NEED TO FIX A LEAKY HOUSE ROOF

THE OLDER A HOUSE GETS THE MORE MAINTENANCE IT REQUIRES
UNTIL..... MAINTENANCE BECOMES ALMOST CONTINUOUS

NEW PRODUCTS COBBLED ON OLD HOUSES

“MAKING IT FIT”

ENLARGING EXISTING TO ACCOMMODATE NEW

FINDING THE UNEXPECTED

PLUS- WE KEEP FINDING NEW THINGS WE WANT IN HOUSES

BUT WHY NOW? NEVER HAD SO MUCH MAINTENANCE BEFORE!
WHY ARE MAINTENANCE & RENOVATION PROJECTS GROWING?

#1: Entropy- AKA Varying Component Lifespans

#2: Longer Stay at the Same House

#3: Changing Lifestyles & Working From Home

#4: Efficiencies- we want it cheaper, faster,

#5: Regulations and Building Code Updates
#1 ENTROPY
THE GENERAL TREND OF THE UNIVERSE TOWARD DEATH AND DISORDER. —JAMES R. NEWMAN

HOUSES ARE NO EXCEPTION— JOE CROSS

"I said from the very beginning, I don't want a big house, I don't want big grounds, I don't want the trouble with the maintenance and all of that."

Nancy Reagan

“Our summer cottage in Newport is frightfully expensive.”

Alice Vanderbilt

“No man who owns his own house and lot can be a Communist. He has too much to do”

William Levitt
1952
#2 AGING IN PLACE

Mobility rates age 65+

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990-1995</td>
<td>16.8%</td>
</tr>
<tr>
<td>2010</td>
<td>5.4%</td>
</tr>
<tr>
<td>2016</td>
<td></td>
</tr>
</tbody>
</table>

US Census Mobility Rates

Translation:
We are outliving the lifecycle of components of our homes
- Roofing
- Wood rot
- Windows
#3 CHANGING LIFESTYLES

## Changing Lifestyles
- Family Rooms
- Dining Room
- Master Closets
- Porches / Decks
- Media Rooms
- Entertainment Kitchens
- Fitness Rooms
- Sun Rooms, Hot Tubs

## Internet Based Workforce
- Libraries
- Home Offices
- His Office / Her Office

## Multi-generational living
- Extra Bedroom
- In-House Suites

## Cost
- A fraction of the cost of new

Does anyone remember
- Parlors
- Receiving Rooms
- Sleeping Porches
- Tea Rooms
- Mud Rooms
EFFICIENCIES- CHEAPER FASTER

Environmental Awareness

Less Pollution

Lower Operating Costs

Improved Products

Longer Lifespans

Less Maintenance with Greater Performance

New Products

Things we didn’t know we couldn’t live without

Multi-functional products
REGULATIONS & BUILDING CODE UPDATES

Local & State

Building code updates every two years

Building Mechanical Fire
Electrical Plumbing

Local Ordinances

Site & Drainage Chesapeake Bay Tree Buffers

Federal

Lead Paint Asbestos OSHA
Wetlands Fish & Wildlife
WHERE TO FIND WHAT YOU WANT...

CSI CONSTRUCTION SPECIFICATIONS INSTITUTE

01 GENERAL CONDITIONS
02 EXISTING CONDITIONS
03 CONCRETE
04 MASONRY
05 METALS
06 WOOD, PLASTICS & COMPOSITES
07 THERMAL & MOISTURE PROTECTION
08 OPENINGS
09 FINISHES
10 SPECIALTIES
11 EQUIPMENT
12 FURNISHINGS
13 SPECIAL CONSTRUCTION
14 CONVEYING EQUIPMENT
15 FIRE SUPPRESSION
16 PLUMBING
17 HEATING VENTILATING & AIR COND.
18 INTEGRATED AUTOMATION
19 ELECTRICAL
20 COMMUNICATIONS
21 ELECTRONIC SAFETY & SECURITY
22 EARTHWORK
23 EXTERIOR IMPROVEMENTS
24 UTILITIES
25 TRANSPORTATION
26 MATERIALS PROCESSING & HANDLING
27 ELECTRICAL POWER GENERATION

SWEETS.CONSTRUCTION.com
(The Products Bible)
RESIDENTIAL CONSTRUCTION

END OF SESSION #1

Questions?

INSTRUCTOR - JOE CROSS
RESIDENTIAL CONSTRUCTION

SINGLE FAMILY
MULTI FAMILY
RENOVATION
REMODELING
MAINTENANCE

INSTRUCTOR- JOE CROSS
ELEMENTS OF MAINTENANCE

Existing Conditions
FROM THE GROUND UP: SOIL

Dirt’s Dirt, Isn’t it?

- O horizon (loose and partly decayed organic matter)
- A horizon (mineral matter mixed with some humus)
- E horizon (light colored zone of leaching)
- B horizon (accumulation of clay from above)
- C horizon (partially altered parent material)
- unweathered parent material

How to Use:

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).
2. Note the number of the map sheet and turn to that sheet.
3. Locate your area of interest on the map sheet.
4. List the map unit symbols that are in your area.

Symbols:
- 27C
- 56B
- 131B
- 134A
- 148B
- 151C

JC & York Co - it’s a marble cake
Elements of Maintenance

Existing Conditions

Foundation & Soil Profile - What you can’t see

Assumed Soil Bearing Capacity 2,500 psf

Lot Clearing & Fill
- Varies by type & compaction
- 1,000-4,000 psi

Clay Lens
- Varies by moisture
- 100-12,000 psi

Consolidated Earth
- 2,000-12,000 psi

Unconsolidated Silt
- 800 psi

Footer

Foundation Wall

Original Surface
Elements of Footers

Concrete (Footings, Slabs, Driveways and Flat Work)

Follow the PISS Rule:
Put In Some Steel
Concrete is strong but very brittle

Masonry:
Brick, Concrete Block (CMU) & Stone
Costly, mostly footers, fireplaces and brick veneer

Concrete Strength
Varies according to the amount of Water or cement added from 50 psi to 18,000 psi. Standard mix for residential use is 2,500 psi

Cement
A powder of alumina, silica, lime, iron oxide, and magnesium oxide burned together in a kiln and finely pulverized and used as an ingredient of mortar and concrete;

Concrete
A composite material composed of coarse aggregate bonded with a fluid cement that hardens. Most concretes are lime
ELEMENTS OF FRAMING: OLD VS. NEW

METALS
- Steel Beams
- Pipe Columns
- Angle Iron Lintels

WOOD

PLASTICS & COMPOSITS
- Original Platform
- Framing System

INSULATED CONCRETE FORMS (I C F)
- Insulated Concrete Forms (I C F)
- Wood Trusses Now
- Truss Joists Now
- LVL Beams Now
- Metal Ties Now
- Rigid Steel or Composite Corners Now
- Lateral Corner bracing by Structural Sheathing Now
- OSB Insulated Sheathing Now
- Building Wrap Now
- Composite T&G Sub-Floor
- Why You Need A Pro
Insulating Concrete Forms (ICFs) are a type of construction material that is formed by hollowed foam blocks that are stacked along the exterior walls of a building, reinforced with steel rebar, and then filled with concrete. The ICFs insulate the concrete, using some of the best insulating materials like Expanded Polystyrene (EPS) and create a resilient wall that provides energy efficiency, noise reduction, and strength to the overall structure.

Most ICF companies manufacture insulated concrete forms in 4”, 6”, 8” and 10” cavity widths and in several shapes.
ELEMENTS OF FRAMING

FRAMING

Material Revolution-
Engineered Lumber
Wood Composites
Steel Studs
Wall Panels

Span
2 x 10 SYP  17'-4"
Wood Floor Truss  25'
Less Deflection
ELEMENTS OF DECKS

Treated Wood- Not so simple anymore

http://preservedwood.org/TechResources/SmartphoneApp.aspx
THERMAL & MOISTURE PROTECTION

Roofing
- Asphalt Type & Weight
- Metal - "Galvalume"
- Sheet Membranes
- Slope

Flashing
- Plumbing Vent Stocks
- Counter Flashing

Insulation
- Granular/Batt/Foam
- Air Stops
- Thermal Bridging

Caulking is for Boats
Sealants are for Construction

http://www.finehomebuilding.com/2004/05/01/making-sense-of-caulks-and-sealants
## CONTROL OF MOISTURE

A Special Cross News Bulletin.... MOISTURE LEVELS AFFECT All THINGS!!

### Moisture of Wood By Temperature & Humidity

<table>
<thead>
<tr>
<th>Temp</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
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<tbody>
<tr>
<td>30</td>
<td>6.3</td>
<td>7.9</td>
<td>9.5</td>
<td>11.3</td>
<td>13.5</td>
<td>16.5</td>
<td>21</td>
</tr>
<tr>
<td>40</td>
<td>6.3</td>
<td>7.9</td>
<td>9.5</td>
<td>11.0</td>
<td>13.5</td>
<td>16.5</td>
<td>21</td>
</tr>
<tr>
<td>50</td>
<td>6.2</td>
<td>7.9</td>
<td>9.5</td>
<td>11.0</td>
<td>13.5</td>
<td>16.5</td>
<td>21</td>
</tr>
<tr>
<td>60</td>
<td>6.2</td>
<td>7.8</td>
<td>9.4</td>
<td>11.0</td>
<td>13.3</td>
<td>16.2</td>
<td>20.7</td>
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<tr>
<td>70</td>
<td>6.2</td>
<td>7.7</td>
<td>9.2</td>
<td>11.0</td>
<td>13.1</td>
<td>16</td>
<td>20.5</td>
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<tr>
<td>80</td>
<td>6.1</td>
<td>7.6</td>
<td>9.1</td>
<td>10.0</td>
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<td>15.7</td>
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<td>90</td>
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<td>5.8</td>
<td>7.2</td>
<td>8.7</td>
<td>10.0</td>
<td>12.3</td>
<td>15.1</td>
<td>19.5</td>
</tr>
</tbody>
</table>

A 2% change in Humidity can expand hardwoods 1/32”

Kiln dried lumber delivered to a Virginia site will vary from 8%-18% +

Moisture Meters are **ESSENTIAL** to Quality Residential Construction
# Elements of Windows

Openings – Doors & Windows

## Energy Star.gov

## WHAT MAKES A WINDOW ENERGY-EFFICIENT?

1. **QUALITY FRAME MATERIALS**
   - A variety of durable, low-maintenance framing materials reduce heat transfer and help insulate better.

2. **LOW “E” Coated Glass**
   - Special coatings reflect infrared light, keeping heat inside in winter and outside in summer. They also reflect damaging ultraviolet light, which helps protect interior furnishings from fading.

3. **Argon Fill**
   - Some energy-efficient windows have argon, krypton, or other gases between the panes. These odorless, colorless, non-toxic gases insulate better than regular air.

4. **Multiple Panes**
   - Two panes of glass, with an air- or gas-filled space in the middle, insulate much better than a single pane of glass. Some ENERGY STAR qualified windows include three or more panes for even greater energy-efficiency, increased impact resistance, and sound insulation.

5. **Insulated Frame**
   - spacer

## Windows

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>U-FACTOR $^1$</th>
<th>SHGC $^2$</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>≤0.27</td>
<td>Any</td>
<td>Prescriptive</td>
</tr>
<tr>
<td></td>
<td>≥0.28</td>
<td>≥0.32</td>
<td>Equivalent</td>
</tr>
<tr>
<td></td>
<td>≥0.29</td>
<td>≥0.37</td>
<td>Energy</td>
</tr>
<tr>
<td></td>
<td>≥0.30</td>
<td>≥0.42</td>
<td>Performance</td>
</tr>
<tr>
<td>North Central</td>
<td>≤0.30</td>
<td>≤0.40</td>
<td></td>
</tr>
<tr>
<td>South Central</td>
<td>≤0.30</td>
<td>≤0.25</td>
<td></td>
</tr>
<tr>
<td>Southern</td>
<td>≤0.40</td>
<td>≤0.25</td>
<td></td>
</tr>
</tbody>
</table>

$^1$ In units of Btu/ft²°F

$^2$ Solar Heat Gain Coefficient

## Skylights

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>U-FACTOR $^1$</th>
<th>SHGC $^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>≤0.50</td>
<td>Any</td>
</tr>
<tr>
<td>North Central</td>
<td>≤0.53</td>
<td>≤0.35</td>
</tr>
<tr>
<td>South Central</td>
<td>≤0.53</td>
<td>≤0.28</td>
</tr>
<tr>
<td>Southern</td>
<td>≤0.60</td>
<td>≤0.28</td>
</tr>
</tbody>
</table>

**Potential Savings**

- Tax Deductions
- 15% + Energy Save

Air Leakage ≤ 0.3 cfm/ft²
Elements of Maintenance

Finishes, Specialties, Equipment & Furnishings

The sky is not the limit, only the beginning....

Zsa Zsa went home to find decorations for her new house. I’m not saying she went overboard, but when she returned, her shopping spree had lifted Hungry out of its post war depression. ..... Bob Hope.

“To infinity and beyond” (sign in a Va. Beach decorator’s shop)

Molded/extruded
Plastic Trim & Decorations

Wood, Laminate & Composite Floors

Dimensionally Stable
Machine Acrylic Finish
Easy to Install – Hard on Knees

WHY??
ELEMENTS OF MAINTENANCE

INTERIORS & FINISHES

DRYWALL
  TYPES
  THICKNESSES

FINISH WOODS & MOLDINGS
  FINGER-JOINTED
  PLASTIC
  HARDWOODS

PAINTS & FINISHES
  ENCAPSULATE
  LOW VOLATILITY

CLOSETS & DRESSING ROOMS

TILE
  THIN-SET
  THICK-SET
  COMMERCIAL

CABINETS - THE REVOLUTION
  MODULAR
  PRE-FINISHED
  OODLES OF FEATURES

FLOORING - ANYTHING GOES ANYWHERE
  (REMEMBER THE TRANSITION STRIP)
ELEMENTS OF MAINTENANCE

Plumbing - Distribution

Copper vs. Cross-Linked Polyethylene (PEX & XLPE)

**Copper** - Rigid, Expensive, Skilled Labor and Proven. Bursts on freezing, right angles, more joints.

**Flexible** - Flexible, Inexpensive, easy to run, requires little training, degrades in sunlight, fewer joints, higher pressures, expands on freezing.

Plumbing – Hot Water Supply

**Tanks** vs. **Tankless**

**Tanks** - Lower material & labor costs, Limited volume.

**Tankless** - Greater cost, Continuous volume

**Popular in Europe and Japan because:**
Fewer bathrooms and water fixture units
220 volt electrical system (vs. US 110 volt)

**Unusually Large Water Bills & Leaks**
What Happened?
A FEW WORDS ABOUT SOLAR ENERGY

Efficiency and Effectiveness depends on Tree Cover

Payback is usually greater than ten years

The new standards are poised to hike construction costs by $25,000 to $30,000 (about half of which is directly due to solar), but the self-produced energy is estimated to save owners $50,000 to $60,000 in operating costs over the solar technology's expected 25-year lifespan. (Engadget)

Residential Solar Mandate and the Investment Tax Credit

Beginning in 2020, all new homes built in California must have solar, prompting new questions about who’s eligible to take advantage of the solar Investment Tax Credit (ITC). While the specifics will depend on your situation, the solar ITC will generally go to whoever owns the system. If a homeowner buys a newly built home with solar and owns the system outright, the homeowner is eligible for the ITC the year that they move into the house. If the homeowners leases the solar system or purchases electricity from the system through a power purchase agreement (PPA), then the ITC is claimed by the company that leases the system or offers the PPA.
ELEMENTS OF MAINTENANCE

HVAC- Heating, Ventilation, Air Conditioning

DESIGN REVOLUTION

OLD

AMOUNT OF COOLING
(GROSSLY SIMPLIFIED)

+ GEOGRAPHIC LOCATION

+ TOTAL CUBIC FEET IN HOUSE

= TONS OF AC

OLD AIR VOLUME

NO. BEDRMS X 150 CFM
LIV RM & KIT @ 240 CFM
BATHS @ 100 CFM

TO A TOTAL OF 1,800 CFM
(BECAUSE THAT WAS A STANDARD AIR HANDLER)

NEW

MANY FACTORS

• WINDOW GLASS/RM
• ORIENTATION OF RM
• SIZE OF RM
• TREE COVERAGE ON LOT
• CHIMNEY(S)
• CAN LIGHTS COVERED
• GAS OR ELECTRIC RANGE
• SIZE OF AIR VENTS
• LENGTH FROM SOURCE
• ETC.
## ELEMENTS OF MAINTENANCE

### HVAC - Heating, Ventilation, Air Conditioning

### DESIGN REVOLUTION

<table>
<thead>
<tr>
<th>OLD</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMOUNT OF COOLING</strong>&lt;br&gt;(GROSSLY SIMPLIFIED)&lt;br&gt; + GEOGRAPHIC LOCATION&lt;br&gt; + TOTAL CUBIC FEET IN HOUSE&lt;br&gt; = TONS OF AC</td>
<td><strong>MANY FACTORS</strong>&lt;br&gt;• WINDOW GLASS/RM&lt;br&gt;• ORIENTATION OF RM&lt;br&gt;• SIZE OF RM&lt;br&gt;• TREE COVERAGE ON LOT&lt;br&gt;• CHIMNEY(S)&lt;br&gt;• CAN LIGHTS COVERED&lt;br&gt;• GAS OR ELECTRIC RANGE&lt;br&gt;• SIZE OF AIR VENTS&lt;br&gt;• LENGTH FROM SOURCE&lt;br&gt;• ETC.</td>
</tr>
</tbody>
</table>

### OLD AIR VOLUME

- No. BEDRMS X 150 CFM
- LIV RM & KIT @ 240 CFM
- BATHS @ 100 CFM

To a total of **1,800 CFM**

(BECAUSE THAT WAS A STANDARD AIR HANDLER)
ELEMENTS OF MAINTENANCE

HVAC- Heating, Ventilation, Air Conditioning

Heat Pumps
Air Sourced
Ground Sourced

Perfectly Clear?
Oh, Sorry!
Let’s go to the cartoon......
ELEMENTS OF MAINTENANCE

HVAC- Heating, Ventilation, Air Conditioning

Let’s Watch the Video.............

https://www.youtube.com/watch?v=14MmsNPtrn6U&t=13s
ELEMENTS OF MAINTENANCE

HVAC - Continued

SEER RATINGS
(Seasonal Energy Efficiency Ratings)
- 1980: 6
- 1985: 7
- 1991: 8
- 2005: 12
- 2013: 13
- 2017: 17

FILTERS -
CHANGE WHEN YOU SWITCH FROM
HEATING TO COOLING CYCLES (2X / YR)

WARRANTIES & HOW THEY WORK
NEW WRINKLES

PROGRAMMABLE THERMOSTATS

Reasons You can fix your HVAC
1. You completely understand the previous video
2. You have a Mechanical Eng degree

Reasons You can’t fix your HVAC
1. It will void any warranty
2. It’s high voltage
3. You can’t buy the fried control board or leaked refrigerant gas

Residential Construction Systems and Maintenance

Christopher Wren Association Lifelong Learning 2018
ELEMENTS OF MAINTENANCE

ELECTRICAL -

AMOUNT OF SERVICE

1950'S     50 AMPS
1960'S     150 AMPS
1970'S     200 AMPS
1990'S     400 AMPS

SERVICE DEPENDS ON NUMBER OF BREAKER SLOTS IN PANEL BOX

Breakers & Mini-breakers

WIRE
COPPER VS. ALUMINUM

JUNCTION BOXES
PLASTIC VS. METAL

USUAL ELECTRICAL ISSUES
CRITTERS
DEAD OUTLETs
LOOSE WIRES IN OUTLETS
Ohm’s Law / Watt’s Law  

Description and practical example:

Ohm’s Law states the relationship between voltage, current, and resistance. Given the relationship between these three elements, once you know any two of them, it is possible to calculate the third. Watt’s Law is similarly useful in figuring out the relationship between power, voltage, and current.

Electrical properties:
- Electromotive Potential, measured in Volts, is represented by V (or E)
- Current, measured in Amperes, is represented with the letter I
- Resistance, measured in Ohms, is represented by R (or the Greek letter Ω)
- Power, measured in watts, is represented by the letter W

According to Ohm’s Law:
- Volts = Current multiplied by Resistance \[ V = I \times R \]
- Current = Volts divided by Resistance \[ I = V / R \]
- Resistance = Volts divided by Current \[ R = V / I \]

According to Watt’s Law:
- Power = Volts multiplied by Current \[ P = V \times I \]
- Power = Current squared times Resistance \[ P = I^2 \times R \]

Real world example:
Suppose you wanted to figure out how many 500-watt lighting instruments you could plug into a circuit without blowing a fuse.

First, you would need to know how much current can be drawn through the circuit. Most homes have 15 amp circuits installed. At MassArt, most of the circuits are on 20 amp circuit breakers. So the total power available would be:

\[ W = V \times I \]  
\[ (\text{Watts} = \text{Volts} \times \text{Amps}) \]

or \[ 110 \times 20 \]

We multiply the volts times the amps (which are known quantities) and see that:

\[ 110 \times 20 \text{amps} = 2200 \text{ watts} \]

So whatever we plug into our circuit has to be less than 2200 watts, because that’s all the power available in this circuit.

Answer: You could safely plug four 500-watt lights into the circuit (or two 1000-watt lights) with a 200 watt safety margin.

Low voltage (read LED’s) changes everything

Reasons You shouldn’t design circuits & loads:

YOU CAN’T / WON’T DO THE MATH

START-UP AMPS
SMART HOUSES - THE FUTURE IS HERE

............And there’s an app for it

For Lighting
For Security
For Climate Control
For home inventories
For monitoring equipment
Smart Outlets

Through your phone
computer
voice
NEW PRODUCTS

LED
(LIGHT EMITTING DIODE)

Ceiling Flood
Strings
Ceiling Panel

LOW ENERGY * PROGRAMMABLE * NO HEAT
FLEXABLE – DURABLE – INEXPENSIVE
COMMON RESIDENTIAL PROBLEMS

THE BIG THREE
1. MOISTURE
2. CRITTERS
3. LIFE SPANS

SOLUTIONS

HIGHER CRAWL SPACES
CRAWL SPACE FANS
CUT BACK/REMOVE TREES
POSITIVE CRAWL SPACE DRAINAGE
POKE HOLE PLASTIC “CUPS”
POWER WASH SIDING DURING LOW HUMIDITY

MOISTURE

PRECIP 1990-2017 AVER 50”/YR
REL HUMID SUM 1990-2017 AVER 78%
ALL ORGANICS SOAK WATER INCLUDING INSECTS & RODENTS
MOLD STARTS GROWING IN MEDIA WITH AT LEAST 18% MOISTURE
WOOD ROT STARTS AT 22% MOISTURE
AC DUCTS CONDENSE MOISTURE AT ABOUT 1 PINT/HR/10’ RUN
AFFECTS MOSTLY CRAWL SPACES, DECKS, SIDING AND TRIM

RESIDENTIAL CONSTRUCTION TRENDS - WHY YOU NEED A PRO

RESIDENTIAL CONSTRUCTION TRENDS - WHY YOU NEED A PRO
END OF SESSION #2

Questions?

INSTRUCTOR- JOE CROSS
RESIDENTIAL CONSTRUCTION

SINGLE FAMILY
MULTI FAMILY
RENOVATION
REMODELING
MAINTENANCE

INSTRUCTOR - JOE CROSS
COMMON PROBLEMS

THE BIG THREE

MOISTURE
CRITTERS
LIFE SPANS

INSECTS
(TERMITES & ROACHES)

RODENTS
(SQUIRRELS/RATS/MICE)

ALL LOVE ATTICS FOR NESTS

BIRDS
(WRENS/FINCHES)

FERAL CATS
(DON’T FEED)

RABBITS
(DRAW OTHERS)

LOVE DAMP CRAWLSPACES

TUNNELS
COMMON PROBLEMS

THE BIG THREE

MOISTURE

CRITTERS

LIFE SPANS

“Your use of our product may alter its life expectancy and the provided warranty.”

(Old Salesman’s disclaimer)

Go on, Go on, You saw the lady with a mustache. To see the bearded lady, you have to pay more. Quality pays you know.

WC Fields

DEPENDS ON

• QUALITY OF MATERIALS
• PERIODIC MAINTENANCE
• LOCAL ENVIRONMENT
• USAGE

WARRANTIES:

• UNLICENSED – NONE
• LICENSED- 1 yr AFTER COMPL
• EQUIPMENT PASS-THRU VARIES

EVERY ENGINEERED PRODUCT HAS A DESIGNED LIFESPAN

MOST PROVIDE A WARRANTY TO END USER FOR A PORTION OF LIFESPAN USED
COMMON PROBLEMS

THE LESser TWO

INCOMPATIBLE PRODUCTS

CONTRACTOR ERROR

Products are designed for wide application, but not every application

Conflicting local and federal rules can result in less optimal results

Local tradesmen may not follow the manufacturers instructions

Products can be used in unintended applications that don’t work.
COMMON PROBLEMS

THE LESSER TWO

INCOMPATIBLE PRODUCTS
CONTRACTOR ERROR

Lack of product knowledge and training

“Git-er-dun” philosophy

Inability to think through problems

Time of completion trumps quality

Lack of coordination between trades
COMMON PROBLEMS

FINALLY- EVERYTHING IS A SYSTEM

Designed and engineered as a system
Installed and serviced by trained and authorized representatives
For more and more specific applications
Forcing the local trades to specialize

Chimney Sweeps
Foundation Repairs
Plumbers who specialize in Water Heaters, Disposals & Clogs, Sinks & Faucets

Decks & Patios
Insulation
Moisture
COMMON PROBLEMS

A WORD ABOUT THE BUILDING CODE

Dates at least back to the Code of Hammurabi
US - City of Baltimore 1859, Chicago Fire 1871
Hurricane Andrew - Florida

“IT MEETS CODE, IT PASSES”


THE BUILDING CODE IS A MINIMUM STANDARD

ONE STEP LESS IN ANY AREA AND THE HOUSE IS CONDEMned FROM HABITATION

Yea!! Our house got a D-
COMMON PROBLEMS
BUILDING PERMITS AND CODE INSPECTIONS

**FACT:** Most Va. Localities require a building permit form any replacement

**FACT:** Many repair men don’t have a license capable of pulling a permit

**FACT:** Any homeowner can pull a building permit

**FACT:** The permit holder is responsible for inspections & meeting code

You take out the permit and the locality holds you responsible for meeting permit requirements
### COMMON PROBLEMS

### REVIEWS AND CODE INSPECTIONS

#### USUAL REVIEW & APPROVALS
- Site Plan
- Erosion & Sedimentation Control Plan
- Storm water Management Plan
- Architectural & HOA approvals

#### USUAL INSPECTIONS

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<th>Rough-In</th>
<th>Complete</th>
<th>Final</th>
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<tr>
<td>Site Plan &amp; E/S</td>
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DOMINION WILL NOT SET METER AND ENERGIZE HOUSE WITHOUT

**Certificate Of Occupancy**

CALL MISS UTILITY

Homeowners & Contractors
Request a Ticket Here!

Call Before You Dig

Va811.com
Dial 811 in Virginia

RESIDENTIAL CONSTRUCTION TRENDS - WHY YOU NEED A PRO

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RESIDENTIAL CONSTRUCTION TRENDS - WHY YOU NEED A PRO
COMMON PROBLEMS

A WORD ABOUT HOME INSPECTORS

The have their place in finding:

- Gross flaws in plain sight
- Symptoms
- Items that previously met code (but do not now).

They have their limitations in

- Using a check-off template method
- The amount of time they spend.
- Looking behind the symptoms
- Understanding system problems

ALWAYS ORDER A FULL REPORT

A STATE LICENSE IN ANY AREA IS NO GUARANTEE
CONTRACTING 101

LEVELS OF SERVICE

HANDYMAN

UNLICENSED CONTRACTOR

TRADESMAN-MAN. REP.

LICENSED BUT NO INSURANCE CLASS “B’ OR “C” LICENSE

LICENSED CLASS “A”

LICENSES

NO BUS. LICENSE

BUS. LICENSE

MAYBE

INSURANCE

NO INSURANCE

GEN. LIABILITY

GEN. LIABILITY

GEN. LIABILITY

GEN. LIABILITY

WORKMAN’S COMP
INDUSTRY TRENDS

“WHICH MODEL TO FOLLOW?”

HOUSING INDUSTRY IS FOLLOWING THE AUTO INDUSTRY

EUROPEAN MODEL

LE CORBUSIER

"The house is a machine for living in".

CAR & HOUSING REPAIR INCREASINGLY REQUIRE A PRO
CONTRACTING 101

TYPES OF CONTRACTS

ORAL

WRITTEN- INFORMAL

ESTIMATE/QUOTE SHEET

WRITTEN SEMI-FORMAL

WRITTEN FORMAL

ELEMENTS OF CONSTRUCTION CONTRACTS

REQUIRED

LEGALLY COMPETENT PARTIES

MUTUAL AGREEMENT

CONSIDERATION

LEGAL PURPOSE

PROTECTIVE

FULL WORK DESCRIPTION

SPECIFICATION OF PRODUCTS

METHODS OF INSTALLATION

TIME REQUIRED & ANY PENALTY

WORK BE FULLY COMPLETE

STANDARD OF QUALITY EXPECTED

Disclaimer: I am not an attorney- always seek legal advice
CONTRACTING 101

METHODS OF CONTRACTING

- FIXED FEE
- COST PLUS
- COMPETITIVE BID
- OPEN BOOK & FEE FOR SERVICES
- DESIGN-BUILD
- HYBRIDS

PROS & CONS (OR TRYING TO CON THE PRO)

- YOU KNOW COST
- YOU DON'T GET SAVINGS
- YOU KNOW COSTS
- YOU DON'T GET REBATES
- PROJECT MAY TAKE LONGER
- SEMI-FIXED PRICE
- CHANGE ORDERS
- REQUIRES DETAILED DOCUMENTS
- YOU KNOW COST
- REQUIRES AN ACCOUNTANT'S MIND
- FEWER CHANGE ORDERS
- LONGER PLANNING PHASE

Disclaimer: I am not an attorney—always seek legal advice
CONTRACTING 101

ADMINISTRATION

BASIC CONSTRUCTION BUSINESS TENENTS:

1. Use other people’s money
2. Get as much as you can upfront
3. Add profit to everything
4. Use the next job to pay for the last job, if you have to

SMALL CONTRACTOR PRACTICES

1. Ask for 50% as an advance for materials
2. Ask for frequent payments
3. Promise anything - there’s always an excuse
4. Always work on the job nearest a billing point
5. As long as it looks good and passes inspection, it’s quality.

SMALL CONTRACTOR REALITIES

1. Chronically under capitalized - cash basis
2. Chronically bad business people
3. Little understanding of accounting
4. Chronically understaffed
5. May have supplier liens against past work
6. Usual and customary to trade is not quality

RISE OF THE FRANCHISE

One Hour Serve Pro
Michael & Son Mr. Electric Mr. Sparky
CONTRACTING 101
LIENS & LIEN WAIVERS

MECHANIC’S LIENS

1. A lien by an involved party against a project, usually in residential projects, a claim for unpaid labor and/or materials
2. Seek an attorney’s help

MECHANIC’S LIEN WAIVER FORM

A legal document signed by all owed money to a project that they are paid or will waive future payment for past work via a mechanics lien. Must be executed for each draw to protect against a lien.

MECHANIC’S LIEN WAIVER

When in an owner/contractor agreement, it prohibits the contractor from filing a lien on that work.

When in a contractor’s agreement with a sub or supplier, it prohibits subs and suppliers from filing a lien- extremely rare in residential construction.
INDUSTRY TRENDS

CONSOLIDATION
MORE EXPENSIVE
WIDENING AFFORDABILITY / COST GAP
SMALLER LOTS & HOMES
FEWER LIFETIME MOVES
MORE STANDARDIZATION
MORE CUSTOMIZATION
ENERGY EFFICIENCY
MORE SOLAR
AIR BNB
NAHB LOSES POTENCY
END OF SESSION #3
Questions?

INSTRUCTOR - JOE CROSS