Wisconsin Contractors Institute

DWELLING CONTRACTORS' ROLE IN AFFORDABLE HOUSING

Course Number 23718
3 CE Hours

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WHY IS AFFORDABLE HOUSING IMPORTANT FOR CONTRACTORS?

Affordable housing is definitely a hot topic. There is usually at least one story about affordable housing in every news cycle.

WHY IS AFFORDABLE HOUSING SO IMPORTANT?

It isn't just about homeless people living in tents or under bridges. It's also about families with children living in apartments working multiple jobs to save enough for a down payment to buy a house of their own.

Since most Americans build their wealth via home ownership, housing is key to reducing poverty passed from generation to generation. Moreover, children growing up in stable homes are more likely to succeed in school and become assets to their communities and to society overall. However, it is estimated that there's a shortage of 5,500,000 homes.

One contributing factor to the shortage is outdated zoning rules that allow for either large apartment buildings or single-family homes on big lots and not much in between. This results in what is called the "missing middle" of more affordable town homes and smaller homes that are clustered together.

As ***responsible citizens*** we can educate ourselves about the plight of many of our neighbors who are in need of more affordable housing and we can help elect lawmakers who will pass zoning laws to help address those needs.

As ***contractors***, we can't rezone the towns and cities where we build, but we can control ***what*** we build, ***how*** we build, and ***where*** we build.

This course will explore solutions to the housing crisis through the design and construction of housing units and the communities into which they are organized.

Course Outcomes:

After completion of this course, construction professionals should be able to:

1. Define what affordable housing is and recognize the need to build houses people can afford.
2. Identify methods of construction that make building houses more economical (short term affordable) and efficient (long term affordable).
3. Identify alternatives to single-family detached housing.

FINAL EXAM QUESTIONS:

1. **Since many Americans build wealth via _____ ownership, housing can reduce poverty passed from generation to generation.**
   A. Home
   B. Boat
   C. Automobile
   D. Furniture

2. **Contractors can't rezone towns and cities where they build, but they can control:**
   A. What they build, when they build, where they build
   B. What they build, how they build, where they build
   C. When they build, how they build, where they build
   D. When they build, why they build, where they build

DESIGN: WHAT WE BUILD

Multi-Story Single Family

Multi-story houses have a smaller "footprint" and therefore require less property. Since multi-story houses combined several stories under a single roof, less material is required. For instance, in a two-story house, the floor system of the second story serves as the ceiling for the first story and the foundation and roof required is half the size of a single-story house of the same square footage. On average, a two-story house cost 20% less than a one-story house of the same square footage.

Multi-story homes also require less energy to heat and cool. Compared to a one-story home with the same square footage, a two-story home will save on utility bills. A one-story home must provide plumbing and wiring on a more spread out, horizontal plane. It takes more time and energy to move electricity from one side of the home to the other.

In a two-story home with the same square footage, plumbing and electrical wires will flow vertically down throughout the home. This cuts costs because the piping and cords have much less distance to travel. This general rule of thumb also goes for heating and cooling. Unlike one story homes, two story homes offer a more centralized water heater and HVAC. Also, in the winter, heat is more likely to be captured by the second story and less likely to escape.

There are some negative aspects to multi-story houses, however. One important long-range strategy for affordable housing is Universal Design. Universal design is the process of creating products that are accessible to people with a wide range of abilities, disabilities, and other characteristics. Disabilities can result from birth issues, disease, accident, and aging. When considering Universal Design relating to affordable housing, the primary concern is disability because of aging. Designing homes to accommodate disabilities makes it possible to "age-in-place", eliminating the need for extensive remodeling as occupants age or the need to move to another place. Multi-story residences require stairs for vertical navigation which makes it difficult or impossible for people with certain disabilities. Elevators are helpful, but expensive and unreliable in the event of power outages.

Multi-Story Multi-Family

Multi-story multi-family share the same benefits as multi-story single-family housing in that they occupy less property. For the same reasons as described in multi-story single family construction, less material is required.

Multi-family residences such as apartments, condominiums, and townhouses share common walls. Common walls cannot accommodate windows which reduces the access to daylight. It also limits cross ventilation. A vital consideration in the design of multi-story multi-family buildings is egress: the ability to exit under normal usage or in the case of fire or some other emergency the need to evacuate the building. Depending on the layout, elevators and fire escapes may be required.

Multi-Use Spaces Within Individual Homes

Another money saver when designing residences is multi-use spaces, sometimes referred to "open plans". The popularity of open planning comes and goes. Sometimes it is trendy, but in the past 15 years, the introduction of widescreen TVs have certainly encouraged the design of open plan multi-use spaces—probably forever. A major economic advantage to multi-use spaces is that it allows for less square footage by the overlap of space function resulting in the need for less material.

The short-term affordability advantage is the requirement of less material. The long-term affordability advantage is the reduced volume of space that will need to be maintained and air-conditioned over the lifespan of the home. Another major benefit of an open floor plan is that it allows the natural light from windows to penetrate deeper into the interior space. Natural light not only reduces electrical usage but is proven to have positive health effects including greater Vitamin D absorption preventing bone loss and reducing the risk of heart disease, weight gain, and various cancers. Natural light also helps prevent potential depression that is the result of seasonal affective disorder. Proper sunlight exposure is also necessary for healthy sleep. It is much easier to design effective artificial lighting in open plans.

Additionally, open floor plans allow for better air flow from both from HVAC and from any open windows. The primary change that occurs when using open planning is the elimination of hallways, which are only used to circulate from one space to another. And of course, where there are fewer individual rooms, there are fewer interior walls to build. An important benefit to open plans that is not necessarily economic is the encouragement of fellowship and community.

However, the benefit of community also has a downside: privacy is sacrificed. Private spaces are especially important to families with children and with the increasing number of intergenerational homes.

A footnote about multigenerational homes:

In 2021, Generations United issued a publication titled 'Family Matters: Multigenerational Living is on the Rise and Here to Stay' that reported that the number of Americans living in a multigenerational household with three or more generations has nearly quadrupled over the past decade, with a dramatic increase of 271% from 2011 to 2021. That means that more than 1 out of 4 Americans now live in a multigenerational home. This is actually a very good thing when considering solutions to affordable housing and the care of aging adults.

Dimensions Are Crucial

If we want to be optimal in the design of homes, it is crucial to recognize that materials come in standard sizes. Plywood was introduced into the United States in 1865 and in 1928, the first standard-sized 4 feet by 8 feet plywood sheets began to be used as a general building material. This worked well with the already established standard of placing studs at 16 inches on center which was originally determined by the allowable span of lathe boards used for wall plastering. Alternative spacing of 12 inches, 19.2 inches, and 24 inches are also used, all of which are complete divisions of 96 inches.

Designing rooms whose dimensions fit standard floor covering roll widths is also wise. When incorporating Universal Design into a residence for aging-in-place, it is important to know the sizes of hallways and doorways established by the American Disabilities Act (ADA). ADA has also established standards for the accessibility of bathrooms and kitchens.

Aging-In-Place Design Features

Aging-in-place refers to older individuals staying at home as they age, rather than moving to some sort of senior living community or facility. It is an important part of affordable housing strategy. When designing and building for aging-in-place, there are several essential design considerations. Older adults lack the balance they once had when they were younger, so it is important to provide safe flooring. Flooring should be skid free and, if possible soft to cushion in the event of falls. Handrails are expected on stairways and ramps, but are also very useful in hallways. Where level access is not possible, ramps should be provided. In the bathroom, grab bars should be installed in walk in showers and at toilets according to ADA specifications. Arthritis and lack of hand strength make it difficult for older persons to operate doorknobs or ball type faucets, so lever handles should be used. In the kitchen and the bathroom, under counter drawer cabinets are accessible where standard base cabinets and wall cabinets would be difficult to use. Lighting should be bright and switches should be conveniently located when entering or exiting a room or space.

FINAL EXAM QUESTIONS:

3. **Multi-story construction for affordable housing has which of the following advantages?**
   A. Occupies less property.
   B. Provides elevators for residents.
   C. Requires more building material.
   D. Requires fire sprinklers.

4. **On average, a two-story house costs ____ less than a one-story of the same square footage.**
   A. 10%
   B. 20%
   C. 30%
   D. 40%

5. **True or false: multi-story single family homes require more energy to heat and cool.**
   A. True
   B. False

6. **_____ is the process of creating products that are accessible to people with a wide range of abilities, disabilities, and other characteristics.**
   A. Universal Design
   B. Global Standard
   C. American Codebook
   D. Designer Choice

7. **Multi-use spaces offer which of the following advantages?**
   A. Greater privacy for occupants
   B. Creates single-use hallways
   C. Reduces interior walls
   D. Increases square footage

8. **True or false: A major advantage to multi-use space is that it allows for less square footage by the overlap of space function resulting in the need for less material.**
   A. True
   B. False

9. **A short-term affordability advantage in multi-use spaces within individual homes is:**
   A. Increased volume of space
   B. Requires more material to build
   C. Requires less material to build
   D. Reduced energy bills over lifespan of the home

10. **A long-term affordability advantage in multi-use spaces within individual homes is:**
    A. Increased volume of space
    B. Requires less material to build
    C. Increased energy bills over lifespan of the home
    D. Reduced volume of space that will need to be maintained and air-conditioned over the lifespan of the home

11. **Benefits of open floor plans and increased natural lighting include:**
    A. More light penetrates deeper into the interior space
    B. Reduces electrical usage
    C. Facilitates healthy sleep in occupants
    D. All of the above

12. **Recognition of standard dimensions in building is important because of which of the following?**
    A. Varying material sizes
    B. The US is converting to the metric system
    C. Standardization of fireplaces
    D. The need for accessible spaces

13. **Which of the following is a disadvantage of multi-story single family buildings?**
    A. More difficult to navigate, such as stairs
    B. Occupies less property
    C. Requires less material
    D. Requires less energy to heat and cool

14. **Aging in place refers to older individuals staying at home as they age. Which of the following are important considerations for aging in place?**
    A. Slick flooring
    B. Ramps
    C. Stairways
    D. Multiple floors

15. **Which of the following is NOT considered a multi-family residence?**
    A. Townhouse
    B. Condominium
    C. Tiny home
    D. Apartment

16. **A vital consideration in the design of multi-story, multi-family buildings is _____: the ability to exit under normal usage or in the case of emergency.**
    A. Egress
    B. Ventilation
    C. Exit Signage
    D. Infrastructure

17. **Although multi-stories have many advantages, what is one major disadvantage?**
    A. Extra cost to build
    B. Less adaptive to universal design (aging-in-place)
    C. More dangerous to build
    D. Greater engineering costs

18. **True or false: The number of Americans living in multigenerational households with three or more generations has nearly quadrupled over the past decade.**

A. True

B. False

METHODS OF CONSTRUCTION: HOW WE BUILD, PART 1

Up to this point we've been considering design strategies to make homes more affordable in both the short term and the long term. Now we want to look at some tactics of how we can build houses that are more affordable. Let's first look at foundations, the lowly foundation! We don't usually give it much thought. We know how important the foundation of a building is, but as builders, aren't we always in a hurry to get the foundation out of the ground so we can start building the real building? After all, when the building is complete, no one will even notice the foundation, which is mostly underground anyway. When we consider innovative building methods, we don't usually think there is much you can do with a foundation, so most foundations for houses are usually a footing and some type of masonry walls. But if we're going to make houses more affordable, we're going to have to consider some other ways we can build, even foundations.

Historical Foundations

You might have traveled to historical sites in Europe where houses had a foundation made of stone.

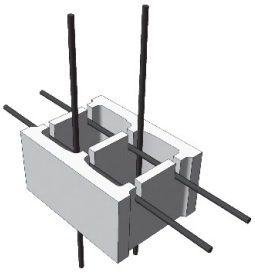
Often the stones that were gathered from the clearing of the land would serve as the stones for the foundation. The smaller stones were the base or the footing for the foundation. The larger stones were used for the vertical walls of the foundation. These types of foundations have been built for thousands of years. Even the great cathedrals of Europe were built on foundations such as these.

Traditional Foundations

This type of foundation, the ***masonry foundation wall***, is an excellent choice where a crawlspace is desired. One of the greatest advantages of a crawl space is that it is a convenient space for plumbing, electrical, and mechanical systems. Since it is a free volume, very little extra planning is required for the plumbing piping, the ductwork for HVAC systems and the electrical wiring. Post-installation servicing of MPE is also much easier. Another advantage to crawl spaces is that the floor system can be well insulated.

Conventional wisdom has been that crawlspaces needed to be ventilated. The purpose for ventilation was to keep air circulating to keep the air under the house dry. As it happens, in most cases, the foundation vents introduce moist air into the crawlspace. Warm moist air entering a cool crawl space will drop its moisture, which will condense on walls, pipes, ducts, and floor joists making conditions favorable for mold, corrosion, and rot. Debates among code writers have continued for decades over whether to vent crawl spaces or not.

Often masonry foundations are overbuilt for what is needed to support the house. For instance, the default use of 8 inch CMUs where 6 inch CMUs would suffice results in unnecessary expense. An engineer's fee to design an optimum foundation would be well worth the savings in the cost of the foundation.



A hybrid of CMU and reinforced concrete is the ***Ivany block foundation***, as pictured above. Ivany blocks are concrete blocks formed with notches to receive horizontal reinforcing bars and cells to receive vertical reinforcing bars and poured concrete. The resulting wall is similar in performance to a poured reinforced concrete wall but without the need for the placing and removal of forms.

Monolithic slabs are foundation systems poured as one unit and consists of a concrete slab (floor) with thickened portions of the slab around the perimeter and under interior load bearing walls which serve as footings. The footing sections are reinforced with reinforcing steel. This type of foundation is popular in southern regions where the ground does not freeze. National builders often use this type of foundation / floor system because of its simplicity, cost savings, and reduced likelihood of call backs. Even if the natural terrain of a site does not easily accommodate a monolithic slab, extensive grading is often done to flatten the site.

Since much of the waste plumbing is under the slab, special care must be taken to ensure that stub ups are accurately placed. Sometimes HVAC ducting is also placed under the slab. HVAC air ducts located under concrete slab floors are especially problematic. Collapsed ductwork that can occur during construction can result in inadequate airflow. Even if the ductwork survives, many environmental problems can occur under slab ducts such as condensation, flooding, odors, mold, insects, and radon emissions. Despite the potential drawbacks, a slab is usually the most inexpensive solution for the foundation / floor phase of any building.

Nontraditional Foundations

Precast foundation walls are made of high-strength concrete panels that are manufactured off site. In addition to the continuous vertical concrete component, each panel has regularly spaced solid concrete studs for load-bearing support and a built-in concrete footing. Because the footing is incorporated into the panel, there is no need for a traditional formed or excavated concrete footing. Panels often include rigid insulation where the basement will be used as heated space. The studs can also be wood or steel to receive finished wall materials such as drywall. These studs can also accommodate plumbing and wiring as in conventionally framed walls.

Although the construction of a foundation using precast foundation walls is relatively simple in concept, the process requires meticulous preparation and skilled installation of the panels. Preparing the gravel base, which is usually 4 to 12 inches thick, should be done in coordination with a soils engineer. The gravel base or "subfooting" should be compacted and graded level. The panels are placed with a crane and are bolted together, and all joints are caulked with a urethane sealant. Some companies coat the exterior side of the panel eliminating the need for further waterproofing, although some state codes require additional waterproofing, nonetheless. After the panels are in place and secured, the basement slab is poured to anchor the bottom of the panels. Back filling should not occur until the floor joists are installed above the foundation to brace the tops of the panels.

The advantages of precast foundation walls include more accurate and better quality controlled manufacture of the foundation walls. Since the concrete is usually 5,000psi, the panels can be thinner and lighter than a poured concrete foundation. The walls are erected in a fraction of the time of block, Ivany, or cast-in-place concrete and can be erected even in inclement weather. The design of the panels accommodates the installation of piping and wiring, as is the installation of finished walls.

Insulated Concrete Forms (ICFs) are similar in some respects to Ivany blocks in that they are individual units stacked in such a way to be filled with concrete resulting in a sort of cast-in-place concrete wall. The difference is that in ICF construction the blocks are not concrete, but polystyrene insulation material. Like cast-in-place concrete, the forms must be held in place by tensile connectors. In ICFs the connectors are usually plastic and can also serve as fastening points for drywall or other wall finishing materials. Unlike cast-in-place forms which are removed after the concrete has set, ICFs remain in place and serve as insulation for the wall, both on the exterior and the interior.

Forms can be delivered as preassembled blocks with connectors already installed or flat-packed panels that must be assembled with the connectors on site. Some preassembled blocks use hinged connectors to allow for more convenient packing and shipping. The foam most often used for ICFs is expanded polystyrene (EPS). The connectors that separate the two layers of forming material can be plastic or metal. The joints between individual forms can feature interlocking teeth or a tongue and groove configuration molded into the forming material, or simple butt jointed seams. Block sizes are usually 16 inches high by 48 inches long. The cavities are commonly six or eight inches wide but can be customized according to engineered requirements.

Autoclaved Aerated Concrete has been around for approximately 100 years and has been used extensively in Europe, Asia, and the Middle East, but to date has had limited use in the United States.

Unlike most other concrete materials, AAC is produced using no aggregate larger than sand. When AAC is mixed and cast in forms, several chemical reactions take place that gives AAC its light weight, since 80% of the volume of an AAC block is air. The finished product is solid but still soft. It is placed in an autoclave chamber which is a steam pressure hardening process. This gives AAC its high strength and other unique properties.

Some of the advantages of AAC are:

- Improved thermal efficiency.
- Superior fire resistance.
- Lighter weight saves cost and energy in transportation and labor expense.
- Environmentally friendly: There is a decrease of 50% of greenhouse gas emissions.
- Non-toxic: There are no toxic gases or other toxic substances in autoclaved aerated concrete.

The biggest disadvantage is that AAC is brittle in nature and needs to be handled more carefully than clay bricks to avoid breakage.

Permanent Wood Foundations are built with pressure-treated 2X lumber and sheathed with pressure-treated plywood. The size of the studs as well as their spacing and thickness of the sheathing are dependent on the height of the wall, the vertical loads of the upper stories, and the horizontal pressure of the backfill. Wood foundations that sit on gravel or sand must have a footing plate that is wider than the wall stud / plate size and may be pre-attached to the framed wall or staked to the footing gravel or sand. When a poured concrete footing is employed, no footing plate is required. The bottom plate of the framed wall is bolted to the concrete footing. Plywood recommended for the PWF system is all-veneer APA-Rated plywood sheathing, Exposure 1 marked APA Series V-600 or Exterior marked APA Series V-611, and produced according to U.S. Product Standards PS1, PS2 or APA Standard PRP-108. All fasteners need to be hot dipped galvanized if above grade and stainless steel if below grade. The specifications must be determined by a qualified engineer. Permanent wood foundations may be built on site or built off site and transported to site for installation.

Like precast concrete foundation, before a wood foundation is backfilled, the top of the wall must be supported laterally by the floor system. The bottom of the wall must be supported by a cast in place concrete slab or by a pressure treated wood framed floor system. Wood foundations are generally placed on footings of crushed stone (1/2" maximum), gravel (3/4" maximum), coarse sand (1/16" minimum) or poured concrete. In crawl space construction, the interior base of the foundation wall should be backfilled before installing the floor system. Once the floor system is in place, the exterior side of the foundation may be backfilled.

Wiring and plumbing may be routed in the vertical spaces between the studs, but studs, plates and any required blocking may not be cut or drilled, however top plates may be drilled for electrical wiring. When installing insulation in below grade walls, a 2" space must be provided between the bottom end of the insulation and the bottom plate. Permanent wood foundations can also be designed to support brick veneer exteriors.

Pier and beam foundations are not always "houses on stilts". Where poor soil, not flooding, is the issue, houses can be built much closer to the grade. Piers can be posts on footings, driven pilings, or helical piers. Pier and beam foundations are also useful on sloping sites. Any sort of conventional footing and foundation that is installed on a slope is bound to slide over time just because gravity will always be exerting forces to pull it down the grade. Helical piers can be screwed deep into the hillside and piers can be attached avoiding the sliding forces of footings and block or concrete foundation walls.

FINAL EXAM QUESTIONS:

19. One of the greatest advantages of a crawl space is that it is a convenient space for:

A. Plumbing
B. Electrical
C. Mechanical Systems
D. All of the above

20. Which of the following statements accurately describes the potential cost-saving strategy regarding masonry foundations?

A. The default use of 6 inch CMUs is often not enough to support the house even though it saves money.

B. Overbuilding masonry foundations is essential to ensure the structural integrity of the house, regardless of the additional costs incurred.

C. The default use of 8 inch CMUs is preferred to guarantee the stability and longevity of masonry foundations, despite potential cost overruns.

D. Hiring an engineer to design an optimum foundation is advised as it can lead to significant savings in the cost of the foundation, despite the initial expense.

21. Which of the following is the most economical solution to foundation/floor assembly?

A. Concrete block

B. Monolithic slab on grade

C. Precast concrete foundations

D. Encapsulated crawlspace

22. Which of the following statements most accurately describes the Ivany block foundation?

A. Ivany blocks consist solely of reinforced concrete, offering a cost-effective alternative to traditional concrete block foundations.

B. Ivany blocks are concrete blocks with specialized features, including notches for horizontal reinforcing bars and cells for vertical reinforcing bars and poured concrete, resulting in a performance similar to poured reinforced concrete walls, without the requirement for formwork.

C. Ivany blocks are standard concrete blocks with no unique characteristics, suitable only for basic foundation construction purposes.

D. Ivany blocks are formed by stacking concrete blocks without any reinforcement, making them a suitable choice for lightweight construction projects.

23. Which of the following are considered traditional foundations?

A. Precast foundations

B. Masonry foundation walls

C. Permanent wood foundations

D. Pier and beam foundations

24. Which of these is NOT a trait of a monolithic slab?

A. Poured as one unit

B. Thickened portions of the slab around the perimeter and under interior load bearing walls

C. Contains high-strength concrete panels that are manufactured off site

D. Has footing sections that are reinforced with reinforcing steel

25. In what region of the United States are monolithic slabs most popular, due to ground conditions?

A. Northern

B. Midwest

C. Western

D. Southern

26. True or false: In spite of the potential drawbacks, a slab is usually the most inexpensive solution for the foundation or floor phase of any building.

A. True

B. False

27. Permanent treated wooden foundations are which of the following?

A. Illegal

B. Cannot be placed below grade

C. Cannot support masonry veneers

D. None of the above

28. Which of the following is NOT a reason that builders often choose a monolithic slab?

A. Need for crawlspace

B. Simplicity

C. Cost savings

D. Reduced likelihood of call backs

29. _____ foundation walls are made of high-strength concrete panels that are manufactured off site.

A. Monolithic

B. Masonry

C. Precast

D. Permanent wood

30. True or false: The advantages of precast foundation walls include more accurate and better quality controlled manufacture of the foundation walls.

A. True

B. False

31. Which of the following is a disadvantage of Autoclaved Aerated Concrete?

A. Superior fire resistance

B. Requires careful handling

C. Lighter weight

D. Environmentally friendly

32. Which of the following statements is true?

A. The bottom wall doesn't need to be supported in a wood foundation.

B. Wood foundations are generally placed on footings of crushed stone, glass, or clay.

C. In crawl space construction, the interior base of the foundation does not need backfill before installing the floor system.

D. Before a wood foundation is backfilled, the top wall must be supported laterally by the floor system.

33. What type of foundation is commonly chosen for poor soil or areas prone to flooding?

A. Monolithic slab

B. Pier and beam foundations

C. Insulated concrete forms

D. Masonry foundation

METHODS OF CONSTRUCTION: HOW WE BUILD, PART 2

The next area to investigate on how we can make houses more affordable is *framing*. Framing offers the most likely phase of construction where money can be saved by innovative practices. Unfortunately, many contractors are reluctant to try new methods of framing because it would require furthering their own education as well as training their carpenters. In this section we will look at different approaches to framing as well as some alternatives to traditional framing.

Framing

Framing can be wood or steel, but because the preponderance of residential construction is wood framing, we will concentrate our considerations on wood framing. The three main types of wood framing used for residential building are: Western or platform framing, balloon framing, and braced framing.

Western or Platform Framing is a system of framing in which the floor system of one story sits on the wall assembly of the story beneath it.

Balloon Framing, sometimes called Chicago framing, is a system of framing in which the vertical elements of the exterior walls, i.e. studs, extend the full height of the structure from the soleplate to the roof plate. Floor joists are fastened to the studs either by being nailed or screwed to the sides of the studs or by sitting on a ledger that has been let into the studs.

Braced Framing, or Post and Beam Framing, is a system of framing in which girts are mortised into solid corner posts which are full frame height. Intermediate studs are single story height and, once installed, are diagonally braced. Braced framing is considered ***Heavy Framing***, whereas balloon and platform framing are considered ***Light Framing,*** due to the use of smaller and more numerous components. Historically, braced framing was replaced by balloon framing, and balloon framing has been replaced by platform framing except in certain cases such as stairwells on exterior walls and multi-story height walls where balloon framing must still be employed.

In the 1960s, a version of platform framing was proposed called ***Advance Framing or Optimum Value Engineering (OVE)***. Its intent was to reduce the amount of lumber used in framing. The purpose was to reduce costs and improve the energy efficiency of wall assemblies by reducing thermal bridges and allowing better insulation. Some of the methods of this technique include:

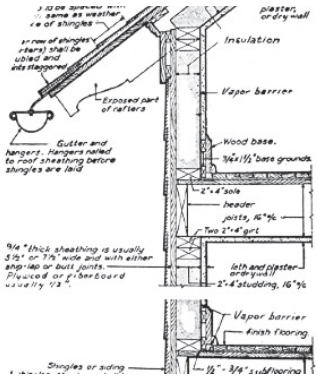
- Framing on wider centers such as 24". This saves studs and increases the amount of insulation in the wall.
- Inline framing where studs line up over joists and joists and rafters line up over studs. Where wall studs are 2x6 on 24" O.C. and in line with joists and rafters, this is sometimes referred to as ***Arkansas Framing***.
- The use of two stud corners, which reduces the amount of studs and allows insulation to be installed in corners.
- Single stud jambs, which prevent the bulking up of jack studs and cripple studs at window openings, reducing the number of studs and consequent thermal bridging.
- Right-sized insulated headers including no headers in non-bearing walls.
- Eliminating studs at intersections with interior partitions.

Although Advanced Framing has been around for over fifty years, it has not gained widespread acceptance. The International Residential Code recognizes some, but not all aspects of Advanced Framing, and areas with high wind loads or seismic zones will not allow some of the details. Even if you are building in an area amenable to using Advanced Framing, don't expect your local building inspector to sign off on the framing without an engineer's letter.

Building Efficient Walls

A seemingly simple element, the wall, has proven to be quite complex. Of all the advances in building science, knowledge of how a wall works has proven to be the most enigmatic. Astonishingly, it has taken literally thousands of years to understand and learn from the mistakes humans have made in the building of walls. Each generation of builders learned what previous builders did before them and contributed their own ideas on how to improve on the methods and materials.

The function of a wall is two-fold – support and enclosure. The functional requirements for walls as an enclosure component are weather resistance, fire resistance, heat insulation, acoustical insulation, privacy, and security. The need for strength and the need for insulation against the elements are often competing issues and a balanced compromise must be achieved. Focusing on weather resistance and heat insulation, the wall must be designed and built to handle four major types of infiltration – water, air, vapor, and thermal.



Traditionally, the typical wall section looked something like image above.

Notice especially that the exterior cladding serves as the sole control layer. This particular section doesn't even specify roofing felt over

the sheathing and under the siding. Roofing felt (asphalt impregnated felt) has been used for centuries as a moisture barrier on walls.

Alternative weather resistant barriers (WRB) to roofing felt have become popular since the introduction of Tyvek® in 1967. Tyvek is a nonwoven product consisting of spun bond olefin fiber. It resists liquid, but it allows the passage of water vapor. It is thin, but not easily ripped, making it useful for other applications such as mailing envelopes and personal protective equipment (PPE) suits. Similar house wraps are also available which are less expensive, but also less effective. Typar®, another leading house wrap, has lower vapor permeability than Tyvek®, but has better water holdout. It is also five times more tear resistant. Typar's superior water holdout makes it a better WRB when used in a rainscreen system.

In the traditional wall section, a vapor barrier is indicated under the drywall or plaster layer. In the late 1970s codes required this vapor barrier. It could be achieved by facing the craft paper side of batt insulation toward the conditioned space or preferable by applying a continuous envelope of polyethylene plastic sheeting over the insulation, just under the drywall. This practice has continued for years if not decades. The original idea was that it would prevent water vapor created inside the house from bathing, cooking perspiring, etc. from entering the structure, i.e. the framing of the wall, after it had permeated the drywall, plaster, or wall paneling. However, it does not. There are too many electrical receptacles, switches, lighting fixtures, mechanical penetrations that allow moisture into the wall structure. In fact, the interior vapor barrier prevents moisture that does get into the wall structure from being able to migrate into the house where it can be processed by the mechanical system.

Some sort of approved house wrap is required in most scenarios. Also required is a means of draining any water that does enter the assembly. Water in the assembly may be present by water actively entering the assembly or by the condensation of water vapor that has entered the assembly. Water may exit the assembly by liquid drainage or by vapor evaporation.

Within the last ten years or so, a new approach has been developed using moisture resistive sheathing. The MRS becomes a combination of structural sheathing, air barrier, and water barrier and eliminates the need for a house wrap. The most well-known is Zip System® by Huber Engineered Woods. The system includes structural OSB wall and roof panels with resin-impregnated overlays that are bonded to the outside face of the panel. The roofing panels have the added featured of a high friction, gritty texture to improve traction. Important to the success of the system are the tapes that are used to seal the seams between panels and window and door openings and any other penetrations. The tapes have a patented adhesive that when properly applied and rolled, form a molecular bond to the substratum surface. The resulting perm rating is that of an OSB panel covered with Typar® housewrap. Debate continues as to the cost effectiveness vis-à-vis conventional OSB and house wrap, but it is certainly gaining in popularity.

Wood Alternatives

Cold-formed steel framing is a cost-effective option for low-rise and mid-rise building projects. It refers to light-frame construction where the vertical and horizontal structural elements are a system of cold-formed steel framing members. The framing members are typically spaced at 16 or 24 inches on center depending on the loads and coverings.

Vertical wall members are typically channel studs, which fit into channel track sections at the top and bottom and fastened with self-tapping screws. Similar configurations are used for floor joist and rafter assemblies. Floor and roof trusses are also available for cold-formed steel framing applications.

A ***Structural Insulated Panel (SIP)*** is a sandwich structured composite building component, consisting of a core of rigid insulation sandwiched between two layers of structural board. The structural board is usually OSB, however, the board can be plywood, cement, sheet metal, or magnesia. The insulating core can be expanded or extruded polystyrene, polyisocyanurate, or polyurethane foam. In theory, SIPs share the same structural properties as an I-beam or I-column, with the structural board acting as the flanges and the rigid insulation core acting as a web. As a composite assembly, SIPs incorporate several standard components used in building such as studs, insulation, vapor barrier and air barrier. SIPs can be used as exterior walls, roofs, floors and foundations.

The advantages of building with SIPs are numerous. The whole-wall R values are much greater than a conventionally framed and insulated wall of the same R-value insulation, due to the reduction of thermal breaks. For instance, a 2x6 wall framed 24 inches on-center with plywood sheathing, drywall, and 5.5-inch batts has a whole-wall R-value of 13.7. The same wall built with 6-inch OSB SIPs has a whole-wall R-value of 21.6, a 58% increase. The panels are built in environmentally controlled facilities which ensures superior quality control. Manufacturers of SIPs claim that field erection of SIP structures is simpler and requires less skilled labor, but that is a dubious claim, since manipulation and connection of large, thick panels presents a new set of challenges, and if panels are not properly connected, air infiltration problems can occur, resulting in future failures of the panels. Connection to foundations and to interior partitions can also be quite complicated. While drywall and carpentry trades enjoy the benefits SIPs provide for their trades, installation of the MEP trades present challenges that conventional construction does not.

FINAL EXAM QUESTIONS:

34. OVE stands for:

A. Overall Vertical Egress
B. Order Versus Equipment
C. Optimum Value Engineering
D. One Variable Expression

35. The function of a wall as an enclosure includes which of the following?

A. Weather Resistance
B. Style of the house
C. Number of windows
D. Support for the roof

36. Which of the following is a function of walls?

A. Square footage
B. Support
C. Plumbing
D. Exposure to elements

37. The primary types of wood framing used for residential building include:

A. Western or platform framing
B. Balloon framing
C. Braced framing
D. All of the above

38. **Braced framing is considered _____ framing, whereas balloon and platform framing are considered to be light framing.**
    A. Heavy
    B. Lightweight
    C. Deep
    D. Wide

39. **Which of the following is NOT a primary function of a wall?**
    A. Decoration
    B. Weather resistance
    C. Heat insulation
    D. Acoustical insulation

40. **Which type of framing is a system of framing in which the floor system of one story sits on the wall assembly of the story beneath it?**
    A. Western or platform framing
    B. Balloon framing
    C. Braced framing
    D. Advance framing

41. **Which type of framing is a system of framing in which girts are mortised into solid corner posts which are full frame height?**
    A. Western or platform framing
    B. Balloon framing
    C. Braced framing
    D. Advance framing

42. **True or false: Advance Framing, or Optimum Value Engineering (OVE) was intended to increase the amount of lumber used in framing.**
    A. True
    B. False

43. **Which of the following is a type of infiltration that walls are built to handle?**
    A. Vapor
    B. Thermal
    C. Water
    D. All of the above

44. **Which of the following methods was commonly used to create a vapor barrier in traditional wall sections in the 1970s?**
    A. Facing the craft paper side of batt insulation toward the exterior space
    B. Applying a continuous envelope of polyethylene plastic sheeting over the insulation, under the drywall
    C. Spraying a layer of sealant over the drywall
    D. Installing a layer of mesh between the insulation and drywall

45. **Which of the following innovations has emerged in the last decade as a comprehensive solution for moisture resistance in wall and roof systems?**
    A. Application of additional layers of plastic sheeting over traditional sheathing
    B. Integration of moisture resistive sheathing (MRS) combining structural, air barrier, and water barrier properties, exemplified by products like Zip System®
    C. Enhanced application of special mesh between structural panels to prevent moisture infiltration
    D. Utilization of specialized sealants

46. **True or false: Cold-formed steel framing is a cost-effective option for Low-rise and mid-rise building projects.**
    A. True
    B. False

SOURCING MATERIALS AND OFF-SITE CONSTRUCTION

The previous sections examined how to use materials in various methods of construction. Next is a look at the materials themselves and how to save money in the sourcing and procurement of those materials. This section will also discuss the rapidly growing method of construction and that is off-site construction: building portions of or whole sections of a building at an off-site location and having them delivered to the building site.

Sourcing Materials

When building affordable housing it is important to pay strict attention to material costs. Building good working relationships with material suppliers is essential. Most suppliers have tiered pricing for customers, usually giving the best pricing to contractors, especially those who request such pricing.

When sourcing materials, it is important to continue to periodically obtain competitive bids in writing on materials rather than relying on a single supplier, even if you consider that supplier to be trustworthy and reliable. Company A may have the lowest prices one week, but Company B might beat their pricing the following week.

Another tool that uses Artificial Intelligence and is available to contractors in today's digital age is DigiBuild. DigiBuild, which employs ChatGPT, has automated the job of canvassing suppliers to find materials. What used to take humans hundreds of labor hours has been reduced to a matter of seconds.

It can also be productive to visit the supplier and choose the materials you want to purchase rather than let the supplier choose them for you. Leaving the selection to others may result in a higher percentage of inferior or even unusable material.

As every builder knows, tons of usable materials are discarded every day ending up in dumpsters and landfills. With some effort, these unused materials can be harvested to be used in affordable housing. Builders that are finishing projects may welcome the opportunity for someone to pick up and remove materials that will otherwise be thrown away. Some social media platforms like Craig's List and Amazon Marketplace often advertise building materials for sale. Re-use centers like Habitat for Humanity Restores® and Goodwill Industries are well stocked with both used and new materials and there are some wholesalers who buy train cars and shipping

containers of materials and sell them at greatly reduced prices. Big box stores like Lowes, Home Depot, and Best Buy always have Scratch & Dent appliances and products that are great bargains.

Off-Site Construction

Panelized construction means walls, floors, ceilings, and roof components are built in a climate-controlled factory and delivered to the work site, where they are assembled. This process allows for better quality components to be built more safely, quickly, and accurately and without the delays that inclement weather can sometimes cause with site-built conditions.

Whereas panelized construction is the prefabrication of components, modular construction is the off-site prefabrication of entire rooms or sections of a building which are then transported to the site where they are assembled. Like panelized construction the modular construction process allows for better quality components to be built more safely, quickly, and accurately and without the delays that inclement weather can sometimes cause with site-built conditions.

FINAL EXAM QUESTIONS:

47. When building affordable housing, it is important to pay strict attention to material _____.

A. Advertising
B. Trends
C. Sizing
D. Costs

48. Which of the following is NOT a tactic in sourcing affordable materials?

A. Obtaining written quotes
B. Wait 90 days to pay
C. Checking social media markets
D. Checking re-use stores

49. Fill in the blank: _____ is the prefabrication of components.

A. Modular construction
B. Manufactured homes
C. Panelized construction
D. Zoning

50. Fill in the blank: _____ is the off-site prefabrication of entire rooms or sections of a building which are then transported to the site where they are assembled.

A. Modular construction
B. Manufactured homes
C. Panelized construction
D. Zoning

51. Which of the following applies to precast concrete foundation walls?

A. Manufactured on-site
B. Installed on traditional concrete footings
C. Prone to leak groundwater
D. Accommodate the installation of piping and wiring

52. Which of the following isa tool that uses artificial intelligence to help find suppliers of materials?

A. ChatGPT
B. AI Supplier
C. Google
D. DigiBuild

53. True or false: It can be productive to visit the supplier and choose the materials you want to purchase rather than let the supplier choose them for you, because they may select inferior or unusable material.

A. True
B. False

54. When sourcing materials, which is NOT important to do?

A. Identify possible suppliers.
B. Only rely on a single supplier.
C. Use reclaimed materials when possible.
D. Obtain multiple written quotes.

55. Which of the following are potential resources for sourcing affordable materials?

A. Re-use centers
B. Scratch & Dent sections
C. Online marketplaces
D. All of the above

56. Modular homes are produced in _____ that are entire rooms built off-site and assembled on-site.

A. Panels
B. Units
C. Modules
D. Containers

57. What defines panelized construction in the context of building?

A. Construction of walls, floors, and ceilings using prefabricated components delivered to the site
B. Using advanced 3D printing technology to construct building components
C. Erecting structural panels made entirely of glass for enhanced aesthetics
D. Assembling building components directly on-site without prefabrication

58. What distinguishes modular construction from panelized construction in building processes?

A. Modular construction involves the prefabrication of entire rooms or sections of a building, while panelized construction focuses on individual components such as walls and floors.

B. Modular construction relies on 3D printing technology for on-site assembly, whereas panelized construction uses traditional building methods.

C. Both panelized and modular construction are primarily used for residential projects rather than commercial.

D. Modular construction and panelized materials are specialized lightweight materials that are generally a lower quality than traditional construction

59. Which of the following is an advantage of off-site construction?

A. Materials must be transported to the site

B. Inclement weather affects the project less than site-built construction

C. Requires special logistics for installation

D. Overall cost often similar to traditional construction

BUILDING FOR ENERGY EFFICIENCY

Building for energy efficiency is usually more expensive and seems to be contrary to our purpose of building more affordable housing, but affordability is not just a short-term objective. When it comes to energy efficiency, an upfront investment can reap years of savings down the road. In this section, both materials and methods to save energy will be examined.

While short term affordability is the primary consideration, long term affordability should not be overlooked. Consider this quote by Benjamin Franklin: "The bitterness of poor quality remains long after the sweetness of low price is forgotten."

When applying this principle to building, we find that the sweetness of the initial low price results in the bitterness of higher utility bills for the life of the building as well as poorer environmental conditions for the inhabitants.

Although the typical crawlspace is usually vented because it is cheaper to build, the IRC does allow for non-vented crawlspaces with certain specifications. This is important for humid regions.

In ***unventilated crawlspaces***:

Mechanically circulating air is established between the upper conditioned area of the home and crawlspace. The air-circulating device must move at least 1 cubic foot of air per 50 square feet of crawlspace area. The crawlspace floor area must be completely sealed with a vapor-retarding material. This means lapping the edges of the vapor retarder up against the inner foundation walls, overlapping separate sheets by at least six inches, and sealing up those seams.

All crawlspace walls must be insulated to appropriate R-values for the regional climate. Another term for this type of crawl space is "encapsulated". Encapsulated crawlspaces are superior to vented crawlspaces in several ways:

- The elimination of conditions that result in mold, mildew, metal corrosion and wood rot.
- An encapsulated crawlspace also provides a more suitable environment for the placement mechanical equipment.
- Because the air in the crawlspace is conditioned it is a more suitable environment for the mechanical equipment and heating and cooling are more efficient.
- Because the crawlspace is sealed the prevention of potential rodent and insect infestations is increased, however there must be a 3-inch termite inspection gap at the top of each pier and along the interior perimeter of the foundation walls.

The ***attic*** is a space that is not usually conditioned. Attics get cold in the winter, and hot in the summer. On a hot summer day, an attic can reach a temperature of 150-160º F. Usually, insulation is placed in the ceiling joists to insulate the living space below from the attic space above. In the summer the hot air will want to move down to the living space, because warm always moves to the cold to try to reach equilibrium. This is true for air, water, or any material. In the winter, the warmer air in the living space will move toward the colder attic space. So, we try to control this phenomenon with insulation.

Temperature control is not the only battle here. There is also the important issue of moisture. Just as moisture was extremely important in foundation and wall design, so it is in roof/attic design as well. Moisture enters roof assemblies and attics several ways. We're all familiar with roof leaks. It's the bane of any builder's existence. But moisture also enters the roof and attic as vapor from outside air and from moisture in the living space migrating through openings in the ceiling, especially in the winter when the warm air in the house is moving toward the colder attic space. The very best way to solve the temperature as well as the moisture problems is through the use of ventilation.

Much like the encapsulated crawlspace being an alternative to the vented one, a non-vented attic can be a beneficial alternative to a ventilated attic. It is the preferred type of attic where HVAC equipment is installed in the attic, since HVAC equipment that is installed in a vented attic is in constant battle with the unconditioned air, especially in the summer when vented attics can reach very high temperatures.

According to the EPA, residential HVAC ducts leak around 20-30%. The best place for HVAC equipment and all of the ducts would be inside the space that it is heating and cooling. The system would not have to work nearly so hard and any leakage of the ducts would contribute to the conditioning of the living space rather than cooling or heating the attic.

Fiberglass Insulation works by limiting conductive heat transfer in the space that it occupies. Warmer air naturally moves towards a cooler space. The air trapped between the fibrous strands in fiberglass doesn't move and creates still air, effectively eliminating convection and conduction and insulating the space. Fiberglass is made from 50-80% recycled materials, is also a good acoustical insulator and has a life span of about 100 years.

Cellulose Insulation is composed of recycled wood and paper, primarily used newspapers. Like fiberglass, cellulose is an excellent thermal and acoustical insulator. Some tests have shown that cellulose is a better thermal insulator than fiberglass of the same R value. Cellulose is also less expensive than fiberglass. Unlike fiberglass, cellulose is always installed in loose form. The advantage of loose form insulation is that it can settle in nooks and crannies where fiberglass batts cannot. Forcing fiberglass into tight spaces reduces its efficacy. The disadvantage of loose form insulation is that it can settle over time, creating voids that are spaces that are no longer insulated. Cellulose is treated with boric acid to discourage pests and vermin and with fire retardants to reduce flammability. If cellulose is exposed to moisture, it is prone to absorb the moisture, and, while it may not encourage mold growth, it can cause rot and mold on materials that it is in contact with. The life span of cellulose is 20-30 years.

Rockwool Insulation is a rock-based mineral fiber insulation comprised of basalt, a volcanic rock, and recycled slag, a by-product of the steel and copper industries. The minerals are melted and spun into fibers. Prior to 1960, rockwool also often contained asbestos. Rockwool repels water, so R-value is not affected in the presence of moisture. In addition to being fire resistant, it is also completely resistant to rot, mildew, mold, and bacterial growth. There is some concern that the dust and loose fibers from rockwool can be irritants to eyes, skin, and respiratory systems. The life span of rockwool is equivalent to the materials it is comprised of – rocks!

Sprayed Foam Insulations are highly effective ways to insulate although they come with initially higher costs. Sprayed foam insulation is either open cell or closed cell. Open cell foam is full of cells that aren't completely enclosed. This makes the foam softer and more flexible. Closed cell foam is made up of cells that are completely closed. Closed cell foam is more rigid, stable, and resistant to air and moisture than open cell foam. Open cell foams have an R-value of around 3.5 per inch. Closed cell foams have R values of almost twice that of open cell ranging from 5.0 to 7.0 per inch. Closed cell foam is designed to expand to about 1″ of thickness when sprayed. Open cell foam is designed to expand to 3″ of thickness. Open cell foam can expand into spaces that closed cell foam cannot. Closed cell foam is waterproof and can serve as a vapor barrier against moisture and active water. This feature can be useful in interior damp-proofing of existing basements.

When it comes to energy efficiency for HVAC in affordable housing, the most important consideration is *where* the system is located. To save cost in initial construction, contractors usually install HVAC systems in attics or crawlspaces. The ideal location is within the actual condition space, but this entails building a mechanical room in the heated square footage, which increases cost. Alternatively, the crawlspace can be encapsulated, or the attic can be insulated. Both options also increase the initial cost, but the long-term savings in efficiency of heating and cooling and equipment longevity result in significant long-term cost savings.

FINAL EXAM QUESTIONS:

60. True or false: Building for energy efficiency is usually more expensive.

A. True

B. False

61. Building for energy efficiency is important because:

A. It costs less short term.

B. It saves money over the long term.

C. It is required by law.

D. None of the above.

62. In unventilated crawlspaces, what is a requirement regarding air circulation and vapor retarder installation?

A. Air circulation must be established solely through natural means, without mechanical devices

B. Air circulation must be maintained at a rate of 1 cubic foot per 50 square feet of crawlspace area using mechanical devices

C. The vapor retarder should only cover the ground surface without lapping the edges against the inner foundation walls

D. Seams between separate sheets of the vapor retarder do not need to be sealed if they overlap by at least four inches

63. All crawlspace walls must insulated to appropriate R-values for the regional climate. Another term for this type of crawl space is _____.

A. Circulated

B. Conditioned

C. Sealed

D. Encapsulated

64. True or false: Encapsulated crawlspaces are considered inferior to vented crawlspaces.

A. True

B. False

65. Which of the following is NOT an accurate statement about encapsulated crawlspaces compared to vented crawlspaces?

A. Mold, mildew, metal corrosion, and wood rot is less likely

B. Heating and cooling are more efficient

C. It is a less suitable environment for mechanical equipment

D. There must a 3-inch termite inspection gap at the top of each pier

66. The preferred location for HVAC equipment is:

A. A vented crawlspace

B. A vented attic space

C. Within the condition envelope

D. On the roof

67. _____ insulation works by limiting conductive heat transfer in the space that it occupies. The air remains trapped between the fibrous strands in this type of insulation.

A. Cellulose
B. Fiberglass
C. Rockwool
D. Sprayed foam

68. When it comes to energy efficiency for HVAC in affordable housing, the most important consideration is the _____ of the system.

A. Location
B. Age
C. Material
D. Cost

69. On a hot summer day, an attic can reach maximum temperatures of:

A. 120-130º F
B. 130-140º F
C. 140-150º F
D. 150-160º F

70. Which of the following is NOT true about Rockwool insulation?

A. Often contained asbestos prior to 1960
B. Absorbs moisture
C. Can be irritating to eyes, skin, and respiratory systems.
D. Resistant to mold and bacterial growth.

71. "The bitterness of poor quality remains long after the sweetness of low price is forgotten." is attributed to which of the following?

A. Mark Twain
B. John F. Kennedy
C. Abraham Lincoln
D. Benjamin Franklin

72. Although building for energy efficiency can increase the initial cost, it results in which of the following?

A. Short-term affordability
B. Tax credits
C. Long-term affordability
D. None of the above

73. Which of the following is TRUE about attics?

A. Attics are prone to extreme temperatures.
B. Attics never experience moisture infiltration.
C. Attics are very good spaces to install HVAC equipment.
D. Attics are ideal for storage of items needing temperature regulation.

74. According to the EPA, residential HVAC ducts leak around _____.

A. 10-20%
B. 20-30%
C. 30-40%
D. 40-50%

75. Cellulose insulation is composed of:

A. Recycled wood and paper
B. Fiberglass
C. Rock-based mineral fiber
D. Foam

76. Which type of insulation is considered an excellent thermal and acoustical insulator?

A. Fiberglass insulation
B. Cellulose insulation
C. Rockwood insulation
D. Sprayed foam insulation

77. Which of the following are TRUE about sprayed foam insulations?

A. Effective insulation and initially much cheaper.
B. Closed cell foam is softer and more flexible.
C. Open cell foam is waterproof and useful for damp-proofing.
D. Open-cell foam can expand into spaces that closed-cell cannot.

TYPES OF HOUSING UNITS

When most people hear the term "affordable housing" they imagine little single-family boxes shoddily built with cheap materials. But there is a great variety of types of housing that fall under the category of "affordable". The final section of this study of affordable housing concludes with a look at different types of housing units.

Renovation of Existing Houses

Sometimes in our search for solutions to the affordable housing dilemma, the answer is in plain sight: houses that already exist. According to the National Association of Realtors, the median age of a home in the U.S. is 39 years old, and more than 50% of houses in the U.S. were built before 1980. As Baby Boomers enter the twilight of their lives, the homes that they are leaving to enter alternative accommodations are often available at attractive prices. Even with the additional costs of renovations, these homes are

suitable options for affordable housing. According to the National Association of Home Builders, Americans spent $427 billion on home improvement projects in 2022.

Affordable Single-Family Homes

The dominant housing trend of the last century was an exodus from cities to suburbs. The American Dream consisted of a married couple in a detached house with a white picket fence around a private yard, a family, and a nice car or maybe even two. Although that has changed for many, there are still a large number of families who are raising children who still pine for individual homes in neighborhoods where they feel safe and where children can walk or bike to school and play in local parks in the afternoons and on weekends. The demand for these types of homes is great, but so are the prices. The gentrification of these neighborhoods is forcing out longtime residents who, even though they own their homes, can no longer afford to pay the increased property taxes. The cost of land, the cost of labor and materials to build have changed the 20th century dream into a 21st century mirage. Affordable single-family homes are only affordable in modern times with the help of programs like Habitat for Humanity, or FHA and USDA programs for lower income and rural homebuyers.

Multi-Generational Housing

Multigenerational housing is gaining in popularity and is considered a newer phenomenon, but for most of the history of the United States, multigenerational housing has been the norm rather than the exception. This was due to two major factors: a rural agrarian economy and an urban immigrant society.

A typical rural farmhouse would include grandparents, their children, and grandchildren. The younger members of the household would work on the farm and care for the elderly when they could no longer work. This arrangement continued as the generations cycled. This condition persisted until the beginning of the twentieth century when children began moving away from the farm. Some moved from the east to the west, others into urban centers. This left elders to live alone or to move into institutional housing. The introduction of the Social Security Act in 1935 as well as the increasing availability of automobiles facilitated leaving the care of elders to others with the promise of visiting them from time to time.

Immigrants arriving from Europe usually settled in cities where factories and industrial businesses offered employment. They sought housing that was familiar and where extended families lived in the same building just as they had done in their European homelands. A typical arrangement would be a "three decker" house where a nuclear family could own a building where they would live and rent out the other two stories, usually to other members of their extended family. This was an excellent way to live, but unfortunately, this type of housing became associated with immigrants, and anti-immigrant sentiment influenced municipal leaders to enact zoning laws that prohibited building this type of housing. Over time, these three-deckers were demolished and replaced with single family dwellings.

By the end of the nineteenth century, multigenerational housing began to decline in popularity, primarily because of the trend of elderly parents living separately from their children. Those who were able-bodied lived in their own residences, those who were infirm or disabled ended up in retirement, assisted living, or nursing homes. Children leaving home at an earlier age also contributed to a downward trend in multigenerational housing. By 1980, only 12% of the US population were living in multigenerational homes, the lowest in national history.

However, the trend has reversed for several reasons. The primary reason has been the need for care for the elderly. People are living longer, and the cost of healthcare has necessitated families taking care of their own. The flip side of this equation is that multigenerational homes provide built-in childcare. Another related reason for multigenerational housing is simple economics. The U.S Bureau of Labor Statistics reported that 18.5 percent of youth between 16 and 24 were unemployed in July 2020. This was an increase of 9.4 percentage points from the year prior.

Multigenerational housing does not work for every family, but for many it is a wonderful solution to affordable housing. What are some of the considerations when planning to build multigenerational housing? Who will live there and what will their personal needs be? Older residents will need easy access without the need for stairs. They will also need special bathroom accommodations including grab bars, walk-in showers, and ADA height toilets. If they do not have their own kitchen, they may need to be close to the common kitchen. Couples will want more private quarters and teenagers will want their own rooms and privacy. Depending on the family, there may be common spaces, such as dining areas, living areas, or a common kitchen. Some families may want totally autonomous apartments. In almost all cases, private entrances are a good idea. Location is also an important factor, especially for those who are unable to drive, such as the young and the aged. Local parks, shops, hospital facilities, and public transportation should be convenient.

The Missing Middle of Housing

To address the growing demand for housing, some municipalities are relaxing or ending single-family zoning to allow for multi-family buildings, usually apartment buildings that increase the density often taxing the streets and parking available. Neighborhoods that were once rows of houses with lawns and tree lined streets became asphalt jungles of banal towers. Due to traditional zoning theories, the options for housing tended to be limited to single-family or large apartment buildings. There seemed to be something "missing" in between.

Missing Middle Housing types include smaller multi-unit buildings such as duplexes, fourplexes, townhouses, and work/live buildings. The scale of these sorts of buildings can fit into older existing residential neighborhoods without destroying walkability and local retail.

Another viable missing middle option is smaller cottage type homes clustered around a common courtyard. This allows residents to occupy single family or smaller multigenerational homes that occupy a fraction of the land area that a traditional neighborhood would require. Also, much like multi-use spaces in individual homes, exterior courtyards encourage the development of community among the neighborhood residents.

There is growing interest in a type of smaller compact dwelling in the U.S., sometimes called "Tiny Homes". According to the 2018

International Residential Code, a tiny house is "a dwelling unit with a maximum of 400 square ft of floor area, excluding lofts." These units are self-contained living quarters with all the necessary amenities. However, if any of the amenities that are required for a dwelling unit are not present then a tiny home would be considered an accessory structure and must be placed on the same lot as a primary structure per the 2018 International Residential Code. Accessory Dwelling Units or ADUs are growing in popularity, especially as Baby Boomers, and now their children, are taking on the role of caring for elderly parents. The ADU affords the parent a degree of independence while providing the needed proximity for the caregivers. In addition to providing housing for family accommodations, ADUs can also be used as rental properties for additional income for homeowners.

FINAL EXAM QUESTIONS:

78. In addition to providing housing for family accommodations, accessory dwelling units can also be used as rental properties for additional _____ for homeowners.

A. Work
B. Land
C. Fellowship
D. Income

79. According to the National Association of Realtors, the median age of a home in the U.S. is ___ years.

A. 29
B. 16
C. 39
D. 42

80. By the end of the nineteenth century, _____ housing began to decline in popularity, primarily because of the trend of elderly parents living separately from their children.

A. Multigenerational
B. Single family
C. Multi-level
D. Single-level

81. Multigenerational housing is becoming more popular in modern society because:

A. People are living longer
B. The cost of healthcare has increased
C. The elderly need in-home care
D. All of the above

82. Which of the following is NOT considered the "missing middle" of housing?

A. Townhouses
B. Large apartment buildings
C. Duplexes
D. Smaller, multi-unit buildings in general

83. Gentrification is which of the following?

A. The aging of the general population.
B. Wealthier people leaving poorer neighborhoods.
C. Displacing current inhabitants of neighborhoods by making taxes higher.
D. Increasing density by building more multifamily housing.

84. Residential buildings that are not detached single-family or large apartment buildings are called what?

A. Hybrid homes
B. Missing middle housing
C. Urban renewal
D. Gentrified neighborhoods

85. What is one obvious solution to affordable housing through renovation?

A. Shopping centers
B. Homeless shelters
C. Existing houses
D. Empty hotels

86. Which of the following does NOT contribute to the affordability of multi-use spaces?

A. Reducing total square footage.
B. Eliminating single-use hallways.
C. Reducing the number of interior walls.
D. Reducing privacy.

87. What was the dominant housing trend of the last century?

A. Exodus from the country to the cities
B. Exodus from cities to suburbs
C. Exodus from single-family houses to apartments
D. Exodus from single-family houses to condominiums

88. Which of the following options is NOT associated with ADUs?

A. Additional Domestic Units.
B. Accessory Dwelling Units.
C. A dwelling unit located within the principal detached dwelling or a separate accessory structure.
D. Growing in popularity, especially as Baby Boomers are taking on the role of caring for their parents.

89. According to the 2018 International Residential Code, a _____ is "a dwelling unit with a maximum of 400 square feet of floor area, excluding lofts."

A. Tiny home

B. Commercial building

C. Residential property

D. Storage Unit

90. True or false: In addition to providing housing for family accommodations, ADUs can also be used as rental properties for additional income for homeowners.

A. True

B. False

CONCLUSION

The average household size dropped from 3.67 in 1940 to 2.53 in 2016 (US Census data). The bottom line of this statistic is that average American families don't really need large homes anymore. Needing smaller homes is one step toward affordability. Other steps that can be taken are attention to design using muti-use spaces, multi-story buildings (where universal design is not a concern), and optimal dimensioning in room and building sizes for material use efficiency and accessibility (where universal design is a concern for aging-in-place). Rethinking traditional foundation specifications and using non-traditional framing materials and techniques can result in immediate cost savings. Building for energy efficiency, though sometimes more costly in the short term, can reap significant long-term savings.

Finally, in some cases we need to abandon the legacy idea of one family in one house on one lot. Clustered single-family and multi-family and other missing middle housing configurations such as duplexes, triplexes, quadplexes and attached townhomes can often afford more satisfying living arrangements than a single-family detached home can. In the ongoing quest to find ways and means to construct more affordable houses, let's not forget that these *houses* that we will build will become someone's *home*, so we should never sacrifice the dignity of the residents just to save a dollar.