Alternative Building Systems: Design Issues and Options

A VARIETY of alternative building systems can be employed to make a structure more environmentally friendly to construct and more energy efficient to operate. Some are obviously unique, while others appear traditional. Determining the best choice for your client takes some research.

Objective:

Identify appropriate applications for various alternative building system options.

Key Terms:

Earthship
formaldehyde
insulated concrete form (ICF)
structural insulated panel (SIP)
zeroHouse

Appropriate Applications for Alternative Building Systems

Alternative building systems can use new building materials to create structures that range in appearance from conventional to avant-garde. To determine the best choice for your customer, focus on long-term satisfaction. The keys to long-term satisfaction with a building include ease of operation and maintenance; comfort; appearance; and cost of operation and maintenance.

MAINTAINING TRADITIONAL APPEARANCES

Some alternatives to wood framing are insulated concrete forms, structural insulated panels, and metal framing. These are designed for environmental and energy efficiency while still maintaining traditional appearances.

Insulated Concrete Forms

An **insulated concrete form (ICF)** is two panels of expanded polystyrene with spacers. This construction option provides strong structures capable of withstanding earthquakes and hurricanes and offers reduced energy costs, sound reduction, reduced labor costs, fire retardation, and mold and insect resistance.

Construction costs are usually 5 to 10 percent higher than with conventional building techniques. This is mitigated by lower labor and energy costs. You should provide your customer with a comparison of both construction and operations costs with traditional and ICF construction.

A major constraint of buildings using ICFs is that renovation can be difficult and expensive. It is advised, therefore, that you install conduit or a channel for use as an open wiring chase.

Structural Insulated Panels

A **structural insulated panel** (SIP) is two pieces of oriented strand board with a piece of rigid foam plastic insulation between them. SIPs boast reduced labor and energy costs.

While material costs are 5 to 10 percent higher than with conventional building techniques, the reduction in material waste and labor cost results in similar overall construction costs.

Indoor air quality is a concern because many panels use formaldehyde as an adhesive. **Formaldehyde** is a colorless organic compound that has a significant odor and is known to be detrimental to human health. Choose formaldehyde-free panels to ensure that your customer's indoor air quality is not adversely affected.

Metal Framing

Metal framing is considered by some to be an environmentally friendly choice because metal can be recycled. Also, steel is impervious to fire and termites. The residential construction industry has been slow to adopt steel construction because of the steep learning curve and the need for different tools.

A major concern is energy efficiency. Steel is a good conductor, making it a poor insulator. You must take special care to insulate well so that the metal cannot draw conditioned air from the building.

FIGURE 1. Steel framing requires special tools.

THE DIFFERENCE IS OBVIOUS

More avant-garde framing techniques and materials are also available. Sometimes the final result is visibly different. Therefore, zoning and homeowner associations should be considered. Also, it is important that the structure perform in a manner that provides the residents with comfort, cost effectiveness, and safety.

FURTHER EXPLORATION...

ONLINE CONNECTION: Earthship Mansion

Watch this YouTube video about Dennis Weaver's Earthship home: http://www.youtube.com/watch?v=Po6VVF1jW24&feature=related.

How many design features can you list that are environmentally friendly? Do you think more houses like this one should be built? Would you like to live in a house like Dennis Weaver's?

Earthship

Dennis Weaver's house is known as an **Earthship**, a distinctive type of passive solar home made with natural and recycled materials. Earth-filled tires are standard fare for Earthship Biotecture of New Mexico.

A client interested in an Earthship home needs to investigate several factors. First, zoning and building codes may not allow the construction techniques used for an Earthship. Second, lenders may not be willing to finance the structure. Finally, resale could take a longer time because an Earthship home requires a unique buyer. Therefore, most Earthship owners should plan to stay in their homes for many years.

The cost of building an Earthship home is comparable to that of building a traditional home. Labor is the most expensive component, because it takes a substantial amount of time to pound the earth into the used tires. The cost to operate the home is significantly less because there are few utilities. There is concern, however, about the maintenance required. The walls must be replastered every year so that fumes associated with the degradation of the tires do not affect indoor air quality.

FIGURE 2. Earth is pounded into used tires to create the building material for Earthship homes.

zeroHouse

The **zeroHouse** is a prefabricated house resting on a unique foundational system that touches the ground at only four points. The zeroHouse is designed to be capable of being off the grid and often capable of selling power back to the grid.

Just as with the Earthship house, zoning and financing must be considered. Further, the cost per square foot of a zeroHouse is significantly more than that of a traditional building. Current costs are $350,000 for a 650-square-foot structure with an additional 250 square feet of covered exterior decks.

The cost to live in and operate a zeroHouse is the selling point. The systems are designed to provide all the power and water for the structure. Further, concern about resale is reduced because the zeroHouse can be easily moved.

Summary:

A variety of alternative building systems can be employed to make a structure more environmentally friendly to construct and more energy efficient to operate.

Three that are designed for environmental and energy efficiency while still maintaining traditional appearances are insulated concrete forms, structural insulated panels, and metal framing.

More avant-garde framing techniques and materials are also available. Sometimes the final result is visibly different. An Earthship is a distinctive type of passive solar home made with natural and recycled materials. The zeroHouse is a prefabricated house resting on a unique foundational system that touches the ground at only four points.

Checking Your Knowledge:

1. Describe five alternative building systems.
2. Discuss the pros and cons of each system.
3. What is an Earthship?
4. What is the zeroHouse?

Expanding Your Knowledge:

Explain how to determine the best building system option for your client.

Web Links:

Earthship Pros and Cons
http://www.archinia.com/about-us/publications/216-earthship-pros-and-cons.html

Alternative Building System—SIP
http://ubuildit.com/blog/building-products/barriers/alternative-building-system-sip-what-the-heck-is-that-read-on/

Manufactured Systems
http://www.greenhomebuilding.com/manufactured_systems.htm