Wood Brings the Savings Home

Offers Maximum Value for Mid-rise Senior, Student and Affordable Housing

WoodWorks

The need for senior, student and affordable housing has been cited as one of the country's great challenges.

Applewood Pointe

Drs. Julian and Raye Richardson Apartments

The number of American seniors is growing dramatically—to the point that there are now more people age 65 and older than at any other period in US history. At the same time, a record number of young people attended American colleges and universities in 2012, stretching the housing capabilities of cash-strapped educational institutions. And lack of affordable housing, particularly in urban areas, increasingly impacts communities in ways that include safety and public health.

Because budget is always a consideration for mid-rise housing, a growing number of institutions, developers and architects are choosing wood-frame construction, which provides notable cost savings as well as other advantages, including speed of construction, safety, durability, aesthetics and environmental performance.

Mid-rise Wood Housing Meets Code Requirements

The *International Building Code* (IBC) permits wood-frame construction for five stories and more in building Group R occupancies that include student and affordable housing, as well as housing for seniors living independently who fit the requirements of I-1 occupancy. IBC Section 509 (2009 code) allows five- or six-story wood-frame structures over one level of a podium-type structure, typically concrete. These 'five-over-one' and 'six-over-one' buildings are treated in the code as two distinct structures, separated by a 3-hour, fire-resistance-rated horizontal assembly. The IBC and *California Building Code* (CBC) both allow designers to consider these buildings as two different structures for the purposes of determining building height, area limitations and continuity of fire walls; codes also allow designers to use a two-stage analysis for structural design.

Multi-story residential wood construction is generally categorized as Type III or V, although Type IV, also known as Heavy Timber construction, can also be used. While Table 503 of the IBC lists allowable building heights and floor areas for different construction types, there are provisions in Sections 504 and 506 for increases. For most occupancy groups, IBC Section 504.2 permits increases to the allowable height (and number of stories) and 506.3 permits increases to the allowable floor area when approved automatic sprinkler systems are used in accordance with the National Fire Protection Association (NFPA) 13 Standard.

For example, while the IBC allows Type III-A construction for Residential Group R to be four stories and 65 feet high and a Type V-A building can be three stories and 50 feet in height for both Group R and I-1 occupancies, Section 903.2 requires buildings with these uses to be equipped with an approved sprinkler system. When protected by automatic sprinklers in accordance with NFPA 13 (not NFPA 13R), Types III-A and V-A residential buildings may be five stories (85 feet) and four stories (70 feet), respectively. Height is calculated from the grade plane and stories are calculated from the top of the 3-hour-rated horizontal assembly. In addition, IBC Section 505 states that mezzanines are not included when calculating the allowable number of stories for a building. Therefore, a mezzanine acting as a loft or penthouse could add to the allowable number of stories as long as the height limit is not exceeded.

Wood Costs Less

Many designers of mid-rise housing projects use wood-frame construction because they find it to be less expensive than a comparable steel or concrete structure. Wood works particularly well for mid-rise residential projects because it offers a high percentage of leasable square footage at a relatively low cost.

Roger Johnson of JSSH Architects, Inc. said his firm never considered anything other than wood framing for their 123,964-square-foot senior housing project in Roseville, Minnesota. "Applewood Pointe of Langton Lake was built using wood for a base cost of less than $80 per square foot, and that was with a quality contractor," he said. "That's a hard price to beat. Cost is important to us; we build affordable housing for seniors, so everything we do is wood frame."

The Drs. Julian and Raye Richardson Apartments is a five-story wood-frame affordable housing project in San Francisco. "Wood frame is a cost-effective way to build here in California; contractors are very familiar with wood," said project architect Amit Price Patel with David Baker Architects. "Based on our experience with wood systems, we never considered anything else for this project."

After completing the first building in a multi-phase student housing project for Illinois State University, Eileen Schoeb from OKW Architects in Chicago said they switched from a hybrid steel-wood system to an all-wood system for the second

STUDENT HOUSING

Spartan Village, Phase I, located adjacent to the University of North Carolina at Greensboro, provides 800 new student beds in 1-4 bedroom apartments. After comparing costs of a wood-framed system to metal studs, cold-form metal framing and long-span concrete deck as an alternative system, the project's owner and architects chose wood because of the significant cost savings and because wood framing helped speed construction on the huge project.

Project: Spartan Village, Phase I – Student Housing • University of North Carolina at Greensboro
Completion: 2013
Cost: $44 million (construction cost)
Architect: Lord, Aeck & Sargent Architecture • Chapel Hill, NC; TFF Architects & Planners • Greensboro, NC
Structural Engineer: Stewart Engineering • Raleigh, NC
Construction Manager: Samet/Barton Malow/SRS, Inc., A Joint Venture Company • Greensboro, NC
Owner/Developer: Capital Facilities Foundation • Greensboro, NC
Owner's Representative: EDC • Midlothian, VA; UNCG Housing and Residence Life • Greensboro, NC
Size: Four buildings, total 385,000 square feet
Structure: Four stories of wood (Type V-A)

Spartan Village Phase I

SENIOR HOUSING

Applewood Pointe offers independent living for seniors with a variety of mobility needs, from those who are in mechanized wheelchairs to those "who can still pole vault." Wood framing was chosen for this project because it offered flexibility, affordability and speedy construction. Construction schedule for the 48-unit, four-story structure was very tight; the project was completed in just 11 months. Wall panels were assembled off site, then trucked in and lifted into place—in the middle of a Minnesota winter.

Project:	Applewood Pointe of Langton Lake • Roseville, MN
Completion:	2011
Cost:	$8.7 million
Architect:	JSSH Architects, Inc. • Minnetonka, MN
Structural Engineer:	Blanchard Engineering • Richfield, MN
Contractor:	Weis Builders • Minneapolis, MN
Owner/Developer:	United Properties Residential LLC • Bloomington, MN
Size:	123,964 square feet
Structure:	Four stories of wood (Type V-A) over a one-story concrete parking garage

building. "Because the structure had so many openings, the metal studs for the first building, Flats on Main, needed to be 12-gauge, but they were heavy and it was difficult for the crews to screw and attach our finishes. So the contractor encouraged us to switch to wood bearing walls for Flats on Osage, the second building. As a result, it ended up being a more economical project."

Cost savings was also the primary reason architects used wood for Spartan Village Phase I, a student housing project for the University of North Carolina at Greensboro (UNCG). "We compared a wood-frame system to an alternative system using metal studs, cold-form metal framing and long-span concrete deck," said Raymond Hunt of EDC's Development Management group. "We assumed that wood framing would be a little less expensive, but actually found it gave us significant cost advantages. We saved $15 per square foot—which, for a 385,000-square-foot project, is a lot of savings."

Time is Money

When it comes to schedules, added Hunt, "there are two times of the year you can open a new residence hall—August and August. Seriously, though, when building student housing, you have no choice. Student housing projects simply *must* be done on time."

Regardless of whether the structure uses traditional wood framing, panelized products, engineered wood or prefabricated assemblies, wood construction is usually faster than steel or concrete. Wood products are readily available and can often be delivered to the jobsite more quickly than other building materials. And most communities have a large pool of skilled tradespeople with wood framing experience, which minimizes construction delays and keeps labor costs competitive.

Applewood Pointe, the senior housing project in Minnesota, was built adjacent to a wetlands area and park. "It was a tight site without much room to work, so we had the wood wall panels assembled off site, trucked in and lifted into place," said

Johnson. "The process went quickly and smoothly. Because there is so much demand for senior housing, our goal is to get these projects completed as quickly as possible. Wood helps us do that."

While Schoeb said their initial reasons for changing from a hybrid steel-framed student housing structure for Flats on Main to an all-wood frame for Flats on Osage was economy, speed of construction was also a factor. "We were on a tight schedule, and Midwest winter building conditions are easier to deal with when you're using wood; metal studs are difficult to work with when they are cold. We panelized the interior wood walls for Flats on Main, which helped speed things along, and then switched to using all-wood panels for Flats on Osage."

By simplifying design, savvy designers can amplify the economic advantage of wood construction. "We chose wood for the UNCG Spartan Village student housing project because it was cost effective," said Lauren Rockart with Lord, Aeck & Sargent Architecture. "But the fact that the building is laid out repetitively from floor to floor made it very easy to design and build. Because the load-bearing walls are stacked, they also double as shear walls. Units are sized so that we could span from exterior wall to corridor using standard trusses. Our floor-to-floor heights are also based on standard stud sizes. All of these design elements work well with both wood-frame design and student housing units."

Welcome to the Neighborhood

Much of the new student, affordable and senior housing developed today is being added to existing urban neighborhoods. Wood works well for these developments, for several reasons. Multi-story wood-framed structures meet residential code requirements and adhere to required safety and structural performance guidelines for urban infill buildings. Plus, infill real estate often carries a premium price, so developers often find the economic advantage of building five or six stories using wood over a podium-type structure to be the only way a project can work financially. City planning and building departments are also motivated to support multi-story wood-frame construction in order to entice developers to build on these urban infill lots.

Continuity of design with the surrounding neighborhood is also a consideration. For example, most affordable housing projects today look like anything but. Architects use innovative building designs to win over middle- and even upper-class neighbors who might otherwise be wary of having affordable housing added down the block. Many high-end apartment and condominium complexes are already being constructed using wood, so wood lends itself well to buildings that integrate into the surrounding neighborhood, avoiding an 'institutional look.'

If it is directly associated with a university, student housing is increasingly being treated as an extension of the institution itself, so it has to reflect the same quality and environmental objectives as other campus buildings. At the same time, these institutions are increasingly using mixed-use, urban-infill student housing projects to add vital businesses to surrounding neighborhoods.

Before they built Spartan Village at UNCG, the site was occupied by industrial buildings and single-family homes, many of which were vacant or in poor condition. "Spartan Village creates a new neighborhood that sets the tone for future mixed-use development in this area," said Rockart. "We worked closely with the University, city planners and surrounding neighborhood

STUDENT HOUSING

The first phase of this mixed-use development (Flats on Main, a 28-unit apartment complex) featured wood for the interior partitions and the floor and roof framing systems, but the engineer chose heavy 12-gauge steel studs for the walls. Because the contractor overwhelmingly favored the ease of construction of the wood partitions, the second phase of the project (Flats on Osage) eliminated the steel studs and used wood framing throughout.

Projects:	Flats on Main and Flats on Osage Student housing for Illinois State University • Normal, IL
Completion:	Flats on Main: 2011 • Flats on Osage: 2013
Cost:	$6.2 million
Architect:	OKW Architects • Chicago, IL
Structural Engineer:	Larson Engineering • Chicago, IL
Contractor:	Johnston Contractors, Inc. • Bloomington, IL
Owner/Developer:	Tartan Realty • Chicago, IL
Size:	Flats on Main: 48,327 square feet Flats on Osage: 66,915 square feet
Structure:	Flats on Main: Four stories of hybrid construction (metal and wood framing, Type III-B) over a one-story steel frame podium Flats on Osage: Four residential floors comprised entirely of wood framing (Type V-A) over a concrete podium

Spartan Village Phase I

to transition from higher density student housing to the lower density single-family homes in the area. That's part of the reason we incorporated step-down features in our design, and why we added some porch elements that help these buildings look more residential."

Wood for Quality and Durability

Wood was used as the primary structural material for the Drs. Julian and Raye Richardson Apartments, the affordable housing project in San Francisco, because the cost efficiency of wood framing compared favorably with concrete and steel. But Price Patel stressed that their use of wood was also a statement of quality and durability.

"Some people have the initial impression that affordable housing needs to be done cheaply," he said. "I strongly believe that affordable housing should be considered a public building so you want to make it the best it can be. We've found that we can often do better design for affordable housing projects because there's a set budget, whereas market-rate projects often try to push the bottom line down. Usually, both the City and the owner of an affordable housing project are looking for a structure that will last a long time; these are not projects that will be flipped to someone else."

In residential structures, wood is often left exposed for aesthetics, as it was in this affordable housing project. Price Patel added, "We chose wood for warmth, texture and the range of colors you can get from it. People have very positive associations with wood. It is also durable in that it can take nicks and scratches and still weather well over time. We have a number of disabled residents in wheelchairs, which means this is a heavily-used building. Wood holds up well in the common areas."

Rockart added that she sees a delicate balance between creating a building that feels institutional versus creating a residential complex that is durable and easy to maintain, particularly for student housing. "With Spartan Village, we paid a lot of attention to detail on the exteriors, in the proportions of the openings, for example. While it is a high-density student housing development, we wanted to make sure it still feels like a residence rather than a big commercial complex. Wood helps us meet that goal because traditional framing methods associated with wood help bring residential scale to large multi-family developments."

Acoustics, Fire and Seismic

The Drs. Julian and Raye Richardson Apartments met CBC requirements for acoustics by using staggered stud party walls between the units, and by using an acoustic sealant on all junctions between drywall and plywood. In some cases, they used resilient channels on the wood framing to help deaden the noise; fiberglass batt insulation within the wood-frame walls also contributed.

For sound control in the Applewood Pointe senior housing project in Minnesota, JSSH Architects used a unique system consisting of two 2x4 walls. "Within the two walls, we actually used 7/16-inch oriented strand board (OSB) as a shear wall," said Johnson. "So, these walls of sheathing, which run perpendicular to the long axis of the building, also stiffen the structure, which provides extra lateral protection."

All new mid-rise residential structures are required to be fully sprinklered, regardless of the framing system. Fire-retardant-treated lumber can be used, but it is not necessarily required for residential mid-rise applications. And while fire safety is always important, it poses an additional challenge with populations that may have mobility issues. For the senior housing project in Minnesota, Johnson said they designed stairwells to serve as areas of refuge. "The stairwells have 2-hour fire ratings with double sheet-rocked wood-framed walls. They're designed as stand-alone, self-supporting shafts; wood-framing works well for this," he said.

And, because wood-frame structures are lighter weight and have more repetition and ductility than structures built with concrete and steel, they are very effective at resisting lateral forces such as seismic loads—a feature that was especially important for the affordable housing project in San Francisco.

Spartan Village Phase I

Natural Advantages

Regardless of whether the structure is for senior, student or affordable housing, long-term operating costs count as much as upfront costs of the initial construction. For example, energy-efficient structures can help save owners or residents 15 to 25 percent or more on heating bills. It's easy and inexpensive to insulate—or even super insulate—wood-frame structures.

Universities are increasingly requiring that new projects be built to meet Leadership in Energy and Environmental Design (LEED) or other environmental certifications, hoping their commitment to the environment will help attract like-minded students. Wood is the only major building material that grows naturally and is both renewable and sustainable. Life cycle assessment studies also show that wood structures have less embodied energy than buildings made from steel or concrete, and a lighter carbon footprint.

David Baker Architects used reclaimed elm and cypress in common areas of the Drs. Julian and Raye Richardson Apartments to reinforce the green philosophy of the building. The project achieved GreenPoint Rated certification by using wood materials, including engineered joists and glulam beams in addition to the recycled wood materials. The building surpassed California's strict energy standards by 15 percent.

Wood Rises to the Top

There are many similarities in the criteria for senior, student and affordable housing. Universities compete for top student talent by offering attractive, affordable housing options. Cities and social service agencies want to build durable, accessible structures. Senior housing is trying to meet burgeoning demand.

"Most goals are developer-driven, though," said Schoeb. "These structures are built to generate revenue. Therefore, both square footage and efficiency are very important, which is why wood works so well."

Price Patel said that using wood for the affordable housing project in San Francisco allowed them to build a cost-effective, durable building that will serve the owner and residents well over the long term. "Because this is such a heavily subsidized public project, we needed to make sure it was a high quality building, which will help improve neighborhood relations and reduce costs to the City in the long run."

When asked what other architects should know about using wood for mid-rise housing projects, Schoeb answered, "It's a great way to meet budget. Many people don't think of using wood for this type of project. However, there are now a lot people in the market who are excited because wood makes many of these projects finally affordable to build."

AFFORDABLE HOUSING

Designed to provide permanent residences for low-income, formerly homeless adults, this five-story project consists of 120 studio apartments. The architect used wood as the primary structural material because of its relative cost savings compared with concrete and steel. Wood was also left exposed throughout the interiors to add warmth, variety and texture to the common spaces. This classic mixed-use urban infill project achieved GreenPoint Rated certification, and was a 2012 WoodWorks Wood Design Award winner.

Project: Drs. Julian and Raye Richardson Apartments • San Francisco, CA
Completion: 2011
Cost: $26.8 million
Architect: David Baker Architects • San Francisco, CA
Structural Engineer: Structural Design Engineers • San Francisco, CA
Contractor: Cahill Contractors • San Francisco, CA
Owner/Developer: Mercy Housing California • San Francisco, CA
Community Housing Partnership • San Francisco, CA
Size: 65,419 square feet
Structure: Four stories of wood (Type V-A) over one story of concrete

woodworks.org

Carbon Benefits

Wood lowers a building's carbon footprint in two ways. It continues to store carbon absorbed during the tree's growing cycle, keeping it out of the atmosphere for the lifetime of the building—longer if the wood is reclaimed and reused or manufactured into other products. When used in place of fossil fuel-intensive materials such as steel and concrete, it also results in 'avoided' greenhouse gas emissions.

Drs. Julian and Raye Richardson Apartments

- **Volume of wood used:** 45,429 cubic feet
- **US and Canadian forests grow this much wood in:** 4 minutes
- **Carbon stored in the wood:** 1,014 metric tons of CO_2
- **Avoided greenhouse gas emissions:** 2,156 metric tons of CO_2
- **TOTAL POTENTIAL CARBON BENEFIT:** 3,170 metric tons of CO_2

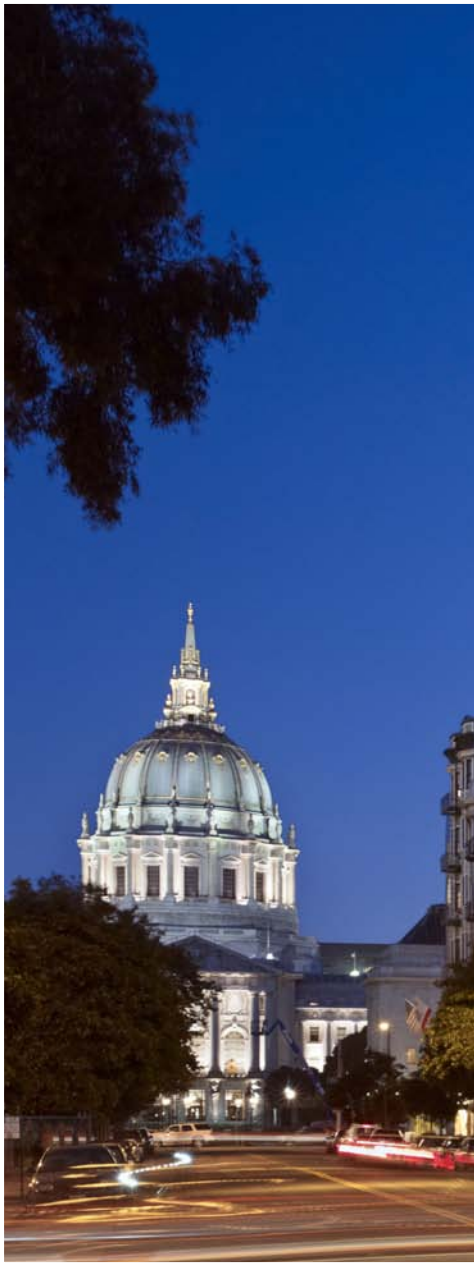
EQUIVALENT TO:

- **606 cars off the road for a year**
- **Energy to operate a home for 269 years**

Source: US EPA

Estimated by the Wood Carbon Calculator for Buildings, based on research by Sarthre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations. Note: CO_2 on this chart refers to CO_2 equivalent.

Use the carbon calculator to estimate the carbon benefits of wood buildings. Visit **woodworks.org**.



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