Structural Systems and Design Considerations for Low-Rise Generational Specific Housing Buildings

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ABSTRACT

Each day, approximately 10,000 people from the "baby boomer" generation turn 65 years old. Coupled with the expected population growth the DC-Baltimore region, there is a need for both traditional housing, and generational specific housing--but a stagnant economy has made supplying more housing a complicated endeavor. While low building costs have always been a priority, a hyper competitive marketplace has forced developers to differentiate their properties by adding environmentally friendly and sustainable building features, more amenities, and other building characteristics that don't necessarily contribute to cost efficiency. The onus is placed on the design team to select the most efficient structural system to mitigate the impact of more costly building features. For housing projects less than 10 stories in height, the most efficient structural system is not always obvious, particularly with so many viable options available. The aim of this paper is to explore the design considerations and nuances for generational specific housing, and to present several of the structural systems used for both multi-family and generational specific housing buildings.

DEFINING THE TERMS OF SENIOR LIVING

The term Senior Living generally applies to housing specifically targeted for people aged 55 years and older where the housing facility provides some level of assistance with daily life activities. The types of housing vary from Independent Living, where the emphasis is on a a transition to a low-maintenance lifestyle, to Assisted Living, which serves the need for both basic housing and medical care. Senior Living facilities can vary from individual apartments and free-standing homes to multi-story buildings with hundreds of occupants. The terms related to Senior Living vary as widely as the types of available facilities and can mean different things to different people and it is important to differentiate the technical facts from colloquial speech. Below is a brief glossary of terms related to Senior Living:

Independent Living (IL): IL housing is for seniors aged 55 years and older that includes anything from multi-unit apartments to detached houses. Residents live independently; however, there is an emphasis on recreational activities and amenities. IL facilities often include recreation centers where seniors can connect with peers and participate in arts&crafts, take classes, watch movies etc. Some also include amenities for sports and physical activities such as swimming, tennis, or golf. IL is commonly referred to as a Retirement Home or an Active Adult community. Recent years have seen denser, urban, transit oriented IL developments, and often times catering to more financially secure seniors seeking a more urban setting.

From a building design perspective, IL varies very little from traditional multi-generational mixed-use developments with an emphasis on mobility, ease of living, opportunities for social interaction, and increasing demand on proximity to mass transit and an urban lifestyle.

Assisted Living (AL): Assisted Living is housing for seniors with the need for some assistance with day-to-day activities but not around the clock care. AL housing typically includes private living quarters, meals, on-call assistance, and housekeeping. Residents can exercise as much independence as they want with the knowledge that personal care and support services are available if they need them. AL is generally regarded as a step below skilled nursing.

AL housing is the link between IL to housing with continual nursing care and typically has smaller unit sizes, basic kitchens and is located on the floors below the IL units in the building.

Nursing Care: Nursing Care (NC) facilities are for residents that require 24 hour nursing care and assistance with continuous assistance with activities of daily living. Nursing homes are typically licensed by the state of residence and cater to those with special needs such as Alzheimer (AZ) patients. Nursing facilities are also referred to as Skilled Nursing Facilities (SNF) or Convalescent Homes.

The design of nursing/SNF/AZ housing is centered on the ability to administer nursing care to the occupant. Nursing care units are generally located on the lowest levels of a mixed-use building to provide the easiest access for both care givers and residents.

Building Amenities: Features of the building that add to the comfort of the tenants such as convenience stores, coffee shops, fitness centers, pools, community rooms, etc.

Mixed-Use Development: Mixed-use developments are buildings that typically blend combinations of residential, commercial, cultural, institutional, or industrial uses. These developments aim to take maximum advantage of building code requirements (number of stories, fire rating and separation of uses etc.) while providing a place for tenants to work, dine, shop etc. in addition to a place to live.

IMPACT OF FAIR HOUSING ON SENIOR LIVING

In April 1968 the United States Congress passed the federal Fair Housing Act (FHA) with support from President Lyndon B. Johnson. The original purpose of the Fair Housing Act as to protect buyers and renters from discrimination based on race, color, religion, sex, or national origin. Although not directly aimed at seniors, the Fair Housing Act laid the groundwork for future legislation that made it easier for seniors to find housing without age discrimination.

The influence of the FHA was extended in 1988 when provisions were added to protect persons with disabilities and familial status. The Fair Housing Act is enforced by the US Department of Housing and Urban Development (HUD) and its subsidiary branches (Office of Fair Housing and Equal Opportunity and the Office of General Counsel), making it one of United States' largest federal civil rights agencies.

The Americans with Disabilities Act (ADA), a federal law passed in 1990, further impacted the design of Senior Living facilities by prohibiting discrimination in public accommodations (lobbies, rental offices, terraces etc) based on disability, however it does not apply to individual apartments.

The FHA's nondiscrimination requirements apply to all dwellings such as houses, condominiums, and apartments and are understood to apply to all Independent Living, Assisted Living facilities in the United States.

NATIONAL POPULATION TRENDS

According to the US Census Bureau (Vincent & Velkoff, 2010), the United States is projected to experience a rapid growth in its older population. The baby boomer generation, generally regarded as those born between 1946 and 1964, begin crossing into this age category in the early 2000's and have a major impact on this trend. The Bureau estimates that by 2050 there will be over 88 million Americans aged 65 and older which is more than double the estimated amount of 40 million in 2010. Nearly 1 in 5 Americans are projected to be over the age of 65 by 2030.

The impact of this population shift will be important to both public and private interest groups. In addition to the impact on federal programs such as Medicare and Social Security, private sector decision-makers including senior living real estate developers will play a pivotal role in shaping the living environment of America's aging population.

POPULATION TRENDS IN MARYLAND AND SUBURBAN DC

Based on statistics from the US Administration on Aging (USAoA), the western states (from Texas through Washington state) saw the greatest percentage increase in persons aged 65 and older between 2000 and 2011. The exception is the Mid-

Atlantic region including Maryland and Virginia which saw an increase of 20% to 28% of people 65 years and older. Interestingly, the vast majority of people 65 years and older lived in metropolitan areas in 2011 (81%), adding emphasis to the idea that people seeking IL housing are looking increasingly in urban areas with a mix of nearby transit and amenities.

While Maryland has a below average percentage of overall population above age 65, the US Census data from 2000 supports the notion that the majority of elder citizens live in urban areas or counties surrounding Baltimore and Washington DC.

% Total of MD Population age 60+, 2000

1. Baltimore County: 17.52%
2. Montgomery County: 16.31%
3. Baltimore City: 13.85%
4. Prince George's County: 11.31%

State Average: 4.12%

The trend of a population increase of older citizens is projected to continue in Maryland's most populated jurisdictions.

Projected % Change of MD Population age 60+, 2000 - 2030

1. Prince George's County: 155%
2. Montgomery County: 129%
3. Baltimore County: 63%
4. Baltimore City: 25%

State Average: 111%

The data are clear in that the number of older Marylanders is increasing rapidly. It is expected that the percentage of aged 60+ will be 25% statewide by 2030, while the number of people over the age of 85 is expected to rise by almost 200% by 2030.

While the population projections seem to point to an inordinate number of seniors seeking generation specific housing in the coming decades, it's important to note that only a small percentage of seniors actually seek senior-specific housing. According to Building Design + Construction (Fabris, 2013), only 5% - 8% of seniors opt for this type of housing.

While the senior housing market felt the same pains as the rest of the housing market during the recession, the positive demographic trends point to a bright future for the market. Advances in health and technology may keep seniors in the current living situation under the care of family or friends as opposed to seeking to take the major step of moving to a senior-only facility. So despite what seems to be an overabundance of baby boomers heading toward their 60's, the proverbial

sweet spot for a transition to the senior living lifestyle, perhaps it is not guaranteed that the same percentages of seniors will make the transition. Status quo may not be sufficient any longer. Developers of senior housing must stay ahead of the demand and provide state-of-the-art facilities with unique features that appeal to today's seniors, and those features are predicated on location, amenities, and quality.

RESPONSE BY THE REAL ESTATE INDUSTRY

The trend toward an aging population in the United States is not lost on the Real Estate development community as developers are looking to capitalize on the opportunity with acquisitions of existing properties and development of new ones. The Senior Housing market felt the same bruises as the real estate industry as a whole through the recession. The last few years have seen a major turnaround in activity and that trend looks to continue. According to CoStar Group, public REITs have invested $54 billion in cash for properties in the last 12 months. Of the 25 most active REITs, one in five was a health care related entity (including both senior housing and medical office) accounting for over one-third of total spending. The result is that prices for the most desirable properties are being driven upwards and the market is becoming more competitive (Heschmeyer, 2013). Low interest rates are also a driver for acqusitions and refinancing that can be a source of capital for renovations and expansions for senior housing operators.

According to a report from Marcus & Millichap's National Senior Housings Group, the senior housing sector is moving toward efficiency and consolidation. Senior housing operators with few properties are looking to sell to well-capped buyers who are scouring the country for the right deals, especially value-add opportunities. CoStar notes that the sales volume of senior multi-family properties increased by 35% to $1.59 billion in the first half of 2013. From a design perspective, it puts even more emphasis producing a building with the right mix of modern amenities in a desirable location.

URBAN AND MIXED USE SENIOR HOUSING

In the past decade and in particular since the recession, developments in the DC and Baltimore metro areas are focused on density, accessibility to mass transit, and walkability. John McIlwain of the Urban Land Institute illustrates this point further in his report “Housing in America: The Next Decade” (2010) where he predicts a period of reurbanization, growth of major cities, and a decline in suburban homeownership.

Young professionals and families with young children are not the only workforce sector that is beginning to favor the city over the suburbs. While some seniors may be tethered to their homes due to underwater mortgages, others that are free to move are bucking the trend of flocking to the Sun Belt and are choosing to move closer to the cities where they live in order to stay closer to their children and

grandchildren. Seniors, in particular empty-nesters that seek a maintenance free yet active and social lifestyle, are attracted to multi-family senior housing developments in urban settings. Some, including Mel Gamzon, President of the Senior Housing Global Advisors, say that "Multi-family mixed-use interegenerational housing is the future of the industry. There are huge opportunities in intergenerational housing models." (Ecker, 2013).

Senior Housing, IL in particular, has always been community and socially oriented but that may not be enough to beckon the 'newer' seniors, in particular the active 55-62 age bracket, from their homes. These active seniors seek opportunities for fitness, wellness, and preventative health maintenance not just in close proximity to where they live but in the same building.

WHAT TENANTS WANT – A SENIOR LIVING WISH LIST

The current real estate climate suggests that Senior Housing is a safe investment, a fact illustrated by the torrid pace that REITs are soaking up properties. The population trends suggest that demand for senior housing will only increase, perhaps significantly, in coming decades. Does this mean that senior housing is a sure thing, and that 'if you build it, they will come"? Peter Fabris from BD+C cautions against this line of thinking not only for developers but for A/E design professionals. He notes that today's seniors "have a definite mindset of what they want" from their retirement housing. What exactly do these potential occupants want? And which ones impact the design and construction of the facility? According to Fabris:

1. Unique or Distinctive Amenities – Building amenities can be the difference between a marginally successful 90% occupied building and a wildly successful 98% occupied one. Not every property is blessed with attractive natural features. Those properties lacking an attractive natural setting rely on interior common spaces for an edge. Not just dining rooms and card tables but wood working, arts and crafts, spas, and wellness centers.
2. Design That Overcomes Preconceptions – The design, both of the interior living spaces and the facade, must overcome the stark and clinical look of the facilities of old. If a standard market-rate multi-family development incorporates high-end finishes and articulation that enables it to add value to the community, then a senior development should be no different.
3. Diversity in Unit Mix Flexibility of Spaces – Seniors prefer to age in place and are naturally reluctant to move to apartments as their health situation changes. Room size and layout should reflect the flexibility that seniors with ever-changing health situations need. This is especially important for developments with Memory Care (or AZ) units to accommodate those with cognitive

disabilities. These spaces require very specific design features including those for physical safety and personal security.

4. Sustainability – Like the public at-large, seniors want to know and understand how their housing affects the environment. Sustainability efforts may not be on the forefront of the project however sustainable designs are increasingly part of the day-to-day fabric of design and should be marketed as such.

BUILDING CODE ANALYSIS

The International Building Code (IBC) is the primary driver of how large a building can be. This paper focuses on Occupancy Groups R-2 and R-4, which are defined in IBC Section 310.
Used in conjunction with the requirements of Chapter 6, Table 503 in IBC establishes the allowable building areas and heights based on Occupancy Group and Type of Construction.
The zone highlighted in Image 3 shows the large range of allowable building heights and areas for Occupancy Groups R-2 and R-4. When the height of a building exceeds about ten stories, the choices in structural systems become very limited—generally speaking, the options are either cast-in-place concrete or structural steel, with the ultimate choice strongly influenced by the geographical location of the project. But when the building height is less than ten stories, the most appropriate and cost effective structural system is more opaque. This paper will explore four distinct structural systems suitable for mid-rise housing buildings: Stick-Framed Wood (Type 3 Construction), The Infinity System, Non-Proprietary Deck-on-Studs, and Hambro.

STICK-FRAMED WOOD (TYPE 3 CONSTRUCTION)

Type 3 construction has been used in the Southeast United States for some time, and recently has been widely adopted in the mid-Atlantic region, particularly the Washington, DC metropolitan area. Type 3 wood construction is most clearly distinguished from the more conventional Type 5 wood construction in two ways: the allowable building height and the construction of the exterior walls.

The primary advantage of Type 3 construction is that it affords developers the opportunity to build a five-story building, while still taking advantage of the low-costs associated with wood construction. Section 504.2 in IBC permits an increase in the allowable heights outlined in Table 503 provided that an adequate sprinkler system is installed—the result being a five story, wood-framed , Type 3A building with a total allowable building height of 85 feet.

However, the nuances of Type 3 construction—particularly the requirements that the exterior walls must be constructed of noncombustible materials, and that the

exterior bearing walls must have a two-hour fire rating—partially offset the cost savings generally associated with wood stick framed construction.

Stick-framed Type 3 buildings are generally framed with open-web wood trusses or engineered i-joists supported on wood stud bearing walls—the exterior walls are constructed with FRT lumber while the interior walls are constructed with non-treated lumber. Although not common, cold formed steel studs are also an option for the exterior walls. It must be noted that steel studs will not shrink, while the interior wood walls will shrink—the result is a sloped floor that could be problematic if not accounted for during the design process.

Type 3 buildings are typically light and the design of the lateral force resisting system is governed by wind loads. The lateral forces on the building are generally resisted with structural-panel wood shear walls or CMU shear walls—or a combination of both. Unit demising walls are the best options for shear walls as they are long, uninterrupted, and have enough dead load to mitigate the formation of net uplift at the ends of the walls. It is good practice to avoid using interior bearing walls as shear walls as these walls are subject to damage by tenants, and are typically interrupted with openings.

The additional height of Type 3 buildings can pose a challenge with respect to the lateral system when compared to Type 5 buildings—lateral resistance is rarely an issue for the latter. When designing the lateral force resisting system, one of the goals is to minimize the need for atypical wall constructions by using the minimum sheathing required to meet the needs of the architect. The fire rating requirements for demising walls mandate that at least one layer of 5/8" gypsum wall board (GWB) sheathing be provided on each side of the wall. It is common that GWB alone is insufficient to meet the shear requirements of the wall—in this case, a layer of OSB may be added to the wall construction. This atypical wall construction not only creates atypical units with reduced area, but also can be a coordination problem during construction. When OSB is required at the lower level shear walls, mobilizing the shear capacity of the interior bearing walls may ultimately be the better option.

While the design of the building superstructure is relatively straightforward, the details associated with Type 3 construction present unique challenges—namely, separating the floor framing from the rated and non-combustible building envelope. The details shown in Figures 1 and 2 illustrate two ways to handle exterior bearing wall conditions, the major difference compared to Type 5 construction being the use of ledgers in lieu of traditional platform framing. There are a myriad of options available for supporting the floors from the exterior

walls—Images 6 and 7 are just two of many—with the ultimate direction often driven by the preference of the contractor.

Some contractors prefer to keep the same wall construction around the perimeter of the building—i.e., maintaining the two hour rating for all exterior walls. However, it is worth noting that a very small percentage of the exterior wall may actually qualify as a "bearing wall" (a bearing wall is defined by IBC as a wall that supports no more than 100 pounds per linear foot in addition to it's own weight). Locating the first truss close to the exterior wall can limit the amount of load accumulation in that wall, thus rendering the wall "non-bearing", and non-bearing exterior walls in Type 3 construction only require a 1 hour rating.

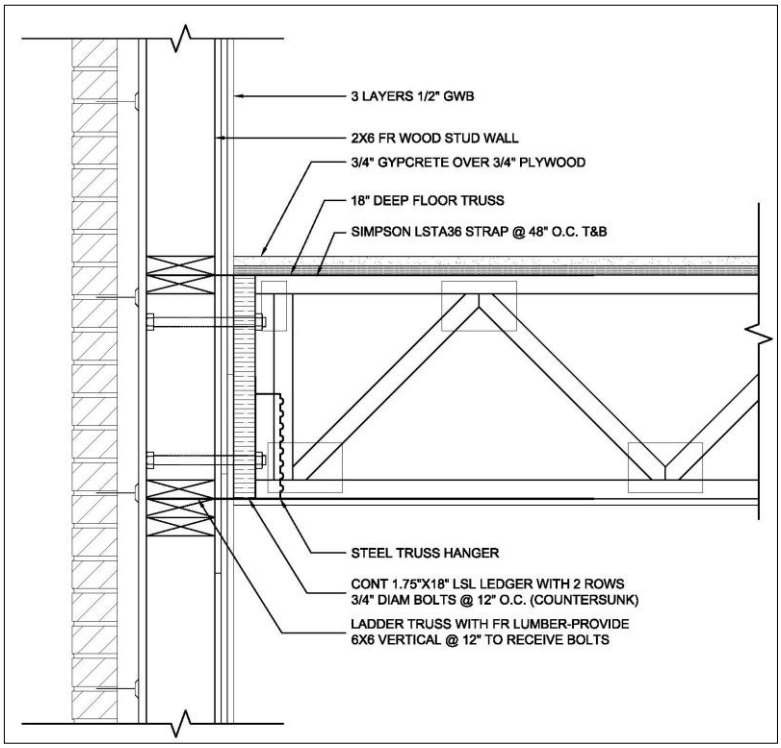

Figure 1: Type 3 Detail at Exterior Bearing Wall

Shrinkage of the frame is a concern for any wood structure, but this concern is exacerbated in Type 3 construction because of the additional building height. The total accumulated shrinkage can approach 2", so engineers and architects have to be conscious of this matter when detailing exterior wall openings, particularly for buildings with brick facades (the brick will expand while the wood frame will shrink which can result in gaps in the building facade). Engineers can mitigate the amount of shrinkage in the exterior frame by limiting the number of plates in the walls; however, doing so may require balloon framing for interior walls to minimize the amount of floor tilt due to differential shrinkage.

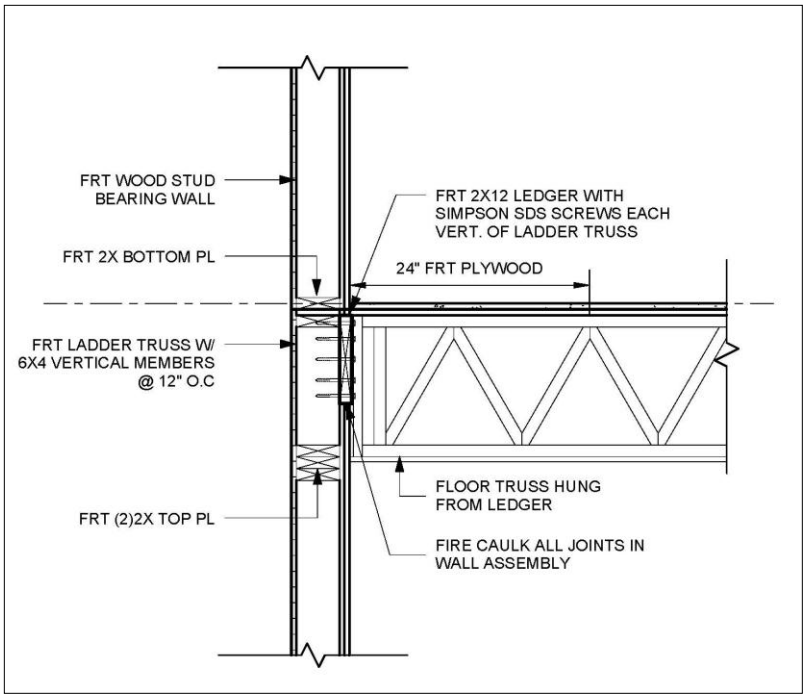

Figure 2: Type 3 Detail at Exterior Bearing Wall

THE INFINITY SYSTEM

The Infinity System is a Type 1 or Type 2 proprietary structural system widely used for all types of housing projects that uses the Epicore floor system. The Epicore floor system employs proprietary metal deck produced by Epic Metals to support a concrete slab with typical span ranges on the order of 20 feet for a 6 inch deep slab. The floors are typically supported on metal stud bearing walls that are pre-engineered and prefabricated. The Infinity System offers a turnkey solution to developers—Infinity Structures will design, fabricate, and install the system, although the onus is generally placed on the structural engineer of record to design the floor slabs. The turnkey nature of the Infinity System offers obvious benefits to developers and the costs of the system are generally competitive with a cast-in-place concrete structure for buildings up to about 9 stories.

The height of an Infinity building is limited by the capacity of the bearing walls, which are typically 6 inches wide. The Infinity system is very heavy compared to Type 3 or Type 5 wood buildings and the accumulation of the higher loads at the bottom of the building result in closely-spaced, heavy gage steel studs. It is imperative that the bearing walls align vertically throughout the building—offset bearing walls create load transfer conditions which usually require structural steel framing and significantly reduce the efficiency of the system. Infinity is particularly well suited to modular-type buildings with repetitive floor plans.

It is important to note that the floors require temporary shoring until the concrete slab has cured. While not a major design consideration, the shoring does present problems for the contractor with respect to sequencing the work as the shoring is an impediment to the installation of the building mechanical systems.

Strapped metal stud shear walls can be used to brace Infinity buildings against lateral loads, but are generally only effective up to 4 or 5 stories—beyond these heights, cast-in-place concrete shear walls or structural steel braced frames are generally advisable (note that while CMU walls are also an option, their low seismic response modification coefficient render them largely ineffective for taller buildings). The weight of Infinity buildings results in much higher seismic forces compared to wood structures—the result being a more complicated lateral design and analysis. The lateral system is one of the most important aspects of an Infinity building and must be investigated early by the structural engineer—the costs of structural steel braced frames and cast-in-place concrete shear walls are generally not included in preliminary cost estimates for the Infinity system, but must be considered by the developer when comparing different options for the structural system.

For mixed-use projects, the housing component is commonly located on a cast-in-place concrete podium constructed over street level retail or parking. Heavy bearing wall systems like Infinity have a significant impact on the cost of the podium structure. As the residential building approaches the practical limits of the system, a tighter column spacing for the podium—or a post-tensioned podium—is required to support the loads of the residential construction. Tighter column spacing has a significant impact on the use of the building below the podium, and thus is another component of the structure that must be investigated early in the design process by the structural engineer.

NONPROPRIETARY DECK-ON-STUDS

Nonproprietary deck-on-studs systems are an alternative to the Infinity system. These systems employ conventional, “off the shelf” metal deck to support a concrete floor slab. Non-proprietary systems can offer more flexibility with regard to deck and slab thickness combinations—standard dovetail deck with 6” of concrete can be used with temporary shoring to provide a virtually identical system to Infinity, or a thicker slab with heavy gage conventional ribbed deck can be used to avoid the need for temporary shoring.

The generic nature of this system has the obvious benefit of encouraging competition among builders, but requires more effort from the structural engineer to design the system components. It is worth noting that there are companies that will install these systems in a turnkey fashion (i.e. design, fabricate, and install the

system components) similar to Infinity, but there are generally slight differences in their relative scope of services, which makes direct cost comparisons a cumbersome endeavor.

Outside of the generic nature of the system components and the responsibilities of the structural engineer, the nonproprietary deck-on-studs systems are virtually identical to Infinity from an engineering perspective. These systems have the same issues with respect to the design of the lateral force resisting system, are best suited for modular-type buildings, and have the same impacts on the design of a podium structure for mixed-use buildings.

HAMBRO

Hambro is a proprietary structural system that uses composite steel joists and a thin concrete slab supported on either metal stud bearing walls or a structural steel frame. Hambro is able to achieve longer spans compared to Infinity or other thin-slab systems and provides relatively superior acoustic performance. When Hambro floors are supported on a structural steel frame, the practical height restrictions mentioned for systems supported on bearing walls are virtually eliminated.

Hambro's longer spans are achieved at the cost of a much deeper structure. Assuming static ceiling height requirements relative to system comparisons, a deeper structure results in a taller building, leading to increased building skin costs, potentially larger lateral forces, etc. The open-web nature of Hambro joists allows the building systems to pass through the floor plenum, eliminating much of the need for dropped ceilings and providing more flexibility with respect to field coordination.

Although the Hambro system is lighter than Infinity or or other thin-slab systems, it is still much heavier than wood-framed structures and the impacts on the transfer structure for mixed-use projects must be considered. Furthermore, the relative weight of the system also requires careful consideration of the lateral system to determine how the building will be braced against lateral forces.

Even more so than Infinity and other deck-on-studs systems, the Hambro system is sensitive to the repetition of floor plans between levels—variations in bearing wall or column locations can result in transfer conditions which can be very costly, and nonorthogonal building shapes and wall configurations require different joists lengths which can significantly impact the efficiency of the system. Decks, balconies, terraces, and other areas that require a drop on the floor elevation can also be problematic in a Hambro building and should be carefully considered by the design team early in the design process—these areas can result in latent costs that may not be captured in preliminary price estimates.

IMPACT OF MULTIGENERATIONAL SENIOR HOUSING ON STRUCTURAL DESIGN

The successful model for the future of senior housing appears to be defined. It's urban and dense. It has cutting-edge amenities that would be attractive to people of all ages not just seniors. It enables occupants to enjoy a fulfilled, healthy, and social lifestyle sometimes without walking outside the building, or at most a short walk to a nearby Town Center. With competition for urban land becoming increasingly fierce, and the options for senior housing increasing by the month, the question is then: can the modern senior housing development be built affordably?

Below is a list of some of the design challenges for mixed-use multi-generational senior living:

Alignment of Bearing Walls: The typical layout of a low rise multi-family building includes vertically stacked unit demising walls on all levels. The design is incredibly efficient since the load path is continuous to the bottom of the residential levels and has no need for expensive transfer framing. A secondary benefit to stacked demising walls is that the bearing walls can be used as shear walls to resist lateral loads from wind and earthquake. The load(s) from the floor framing effectively weigh-down the walls down therefore eliminating the need for expensive hold-down hardware at the ends of the walls.

The demising walls at multi-generational buildings do not align vertically since the distribution of units changes every couple of levels. Typically these buildings have AZ/Memory Care units on the lower levels, AL units in the middle levels, and IL on the upper levels. Each of these unit types have different widths and layouts, forcing the floor framing to span from corridor wall to exterior wall. The spans in this direction are typically longer, requiring stronger and more expensive floor framing. There is added cost for framing around the window and door opening since they are in a load bearing wall, and the benefit of the shear walls no longer applies.

Accessibility of Balconies: Balconies are somewhat of a standard for multi-family housing units especially those that can take advantage of favorable views or weather. The same can be said for balconies at IL units. AL units are also trending toward larger units with 9 foot ceilings, walk-in closets, and balconies. AZ/Memory Care units have little to no functional need for balconies aside from keeping a uniform appearance on the façade as the floors above.

This condition can be problematic for the structure for a few reasons. If the floor joists run corridor to exterior wall as described above, then the walls surrounding the balconies often become bearing walls. The load(s) from those bearing walls require expensive transfer framing or the introduction of posts/columns in to the space when the building transitions from floors with balconies (AL) to floors

without balconies (AZ). This is a condition that is somewhat unique to multi-generational housing serving seniors of different needs groups.

Coordination with Structured Parking: Suburban multi-family developments are able to take advantage of the availability of land by proving surface parking for the tenants and visitors. Urban multi-family developments often times do not have this luxury due to relative scarcity of land. In most cases the building is constructed tight to property lines on three sides. Couple this with the need for parking for mixed-use tenants and the result is structured parking. Most structured parking is located below the retail/amenity level of the building, and in the DC suburbs it's typically located below grade. In most cases the building from the foundation level to the retail-to-residential transition (aka the "transfer podium") is constructed with cast in place concrete. The challenge then becomes coordinating column locations that work both for the parking level below the retail, for the retail spaces at the 1st Floor, and for the edge of the housing building above. Although not an uncommon issue, it is one that is unique to mixed-use developments that have multiple uses stacked one on top of the other.

CONCLUSION

As the need for housing—generational specific housing in particular—continues to increase, it will become crucial for building designers to understand the various needs and wants of the building's occupants. Ensuring that these needs are accommodated can have significant impacts on the structure of the building, making proper selection of the structural system paramount. Therefore, having a firm understanding of all of the systems available for the project is the first step in ensuring that the needs of the project are satisfied.

REFERENCES

1. Senior Housing and Care Glossary of Terms (2013) Retrieved from http://www.seniorhousingnet.com/care-selection/glossary.aspx?source=web.

2. Vincent, G. K. and V. A. Velkoff (2010), The Next Four Decades, The Older Population in the United States: 2010 to 2050, Current Population Reports, P25-1138, U.S. Census Bureau, Washington, DC.

3. Fabris, P. (2013), 8 Trends Shaping Today's Senior Housing, Building Design + Construction http://www.bdcnetwork.com/8-trends-shaping-today%E2%80%99s-senior-housing .

4. Ecker, E. (2013), Is Mixed-Use, Multi-Gen Housing the Future of Senior Living?, Senior Housing News http://seniorhousingnews.com/2013/07/10/is-mixed-use-multi-gen-housing-the-future-of-senior-living/.

5. *Currin, D. (2013), Lot Lines: Aging Population Drives Trends*, The Journal Record http://journalrecord.com/2013/09/19/lot-lines-aging-population-drives-trends-opinion/ .

6. Heschmeyer, M. (2013), 25 REITs Likely to Buy Your Property in 2013, CoStar Group, http://www.costar.com/News/Article/25-REITs-Most-Likely-To-Buy-Your-Property-in-2013/148748.