

More for Less?

An Inquiry into Design
and Construction
Strategies for
Addressing Multifamily
Housing Costs

Hannah Hoyt
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Foundation Communities' Cardinal Points Apartments is a 120-unit affordable multifamily project in Austin, Texas. The team prioritized environmental performance, selecting healthy, high-performing materials. See more about how Foundation Communities' works on projects on page 43. →



Photo Credit: Andrea Calo for Foundation Communities

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Executive Summary

How can developers, architects and contractors address multifamily housing costs through design and construction decisions?

Demand for multifamily housing, especially affordable and middle-income rental housing, is rising as the nation continues to add new households. However, overall housing production remains below needed levels given household growth. Many new multifamily units are renting at prices that are prohibitive for middle- and low-income renters. The need for more affordable multifamily housing is clear, but developers, architects and contractors face rising construction and land costs as they build multifamily housing.

During over 30 interviews in Summer 2019, developers, architects, contractors and policy makers described the challenges of increasing multifamily housing production. They noted the need for significant policy changes, from more federal support for housing, to local zoning changes to encourage housing production and job training programs to address labor shortages in the trades. However, they also acknowledged the slow pace of these policy changes. In practice, multifamily project teams often face significant budget gaps, scrambling to reduce costs while still building quality housing.

Given that persistent challenge, this report focuses on the design and construction decisions that are within the day-to-day control of the project team, asking: how

can developers, architects and contractors address multifamily housing costs through design and construction decisions? Or, phrased differently, what are the limits of cost reduction through design and construction decisions? What parts of the multifamily puzzle can only be addressed through policy or financing changes?

These multifamily experts shared strategies (and some experimental ideas) for addressing cost increases and anticipating cost challenges. These interviewees also shared cautionary tales, pointing out unpredictable parts of their projects and places where rash cost-cutting can compromise building quality or environmental performance.

Their strategies, organized by land costs, soft costs and hard costs, are not silver bullets but they aim to provide a starting point for project teams as they build high-quality, cost-efficient multifamily housing. These strategies focus on increasing the efficiency and predictability of multifamily construction with the aim of helping project teams identify cost savings that can be reinvested in their buildings or passed on to tenants. While the report focuses on strategies that developers, designers and construction firms can deploy in their current multifamily projects, it also notes how select municipal, state and federal policies impact multifamily project teams.

This report draws on interviews with 30 individuals who work in multifamily housing policy, development, architecture & construction in cities and towns across the United States. More information on these interviews can be found on page 13.

What is multifamily housing? And why does it cost so much?

How is multifamily housing defined?

The definition of multifamily varies. Census data groups multifamily projects in bands (2 units, 3-4 units, 5-9 units, 20-29 units, 30-49 units, 50+ units). Freddie Mac multifamily lending is for projects with 5 or more units, while its single-family business takes on properties with 1-4 units.¹

The “XS House” designed by ISA in Philadelphia fits 7 units on a narrow 11’ wide site. See page 37 for more. →



Image Source: Sam Oberter for ISA, Callahan Ward

Multifamily housing refers to buildings with at least two units. It makes up 26 percent of the nation’s overall housing supply. 87 percent of residents living in multifamily properties live in rental units.²

Demand for multifamily housing is growing. The story is well told. America’s households are changing: roommates, inter-generational families and older adults aging in place are reshaping the traditional conception of households. Households are growing; nationwide, 1.2 million new households were formed each year between 2016-2018. Given that growth, the Joint Center for Housing Studies estimates that annual construction should be about 1.5 million units per year, 260,000 more units than the 1.24 million units built in 2018.³

Vacancies are down, rents are rising and cost-burden is high. The consequences of this gap in supply are familiar to anyone working to make housing more affordable. Rental vacancy rates are at the lowest levels since the mid 1980s; overall vacancy rates are at their lowest since 1994. Rents have been growing steadily for over 7 years; over this time period, the CPI for rents has risen four times faster than the cost of all other goods. Nearly half of renter households remain housing-cost burdened.⁴

Costs to build housing are rising. Land costs, especially in some metropolitan

areas, are prohibitively expensive. Skilled construction workers are scarce, leading to unpredictable labor costs. Well-intended regulations are adding new costs to already tight pro-formas. Few design elements are standardized and project teams change frequently, making it hard to carry lessons learned from one multifamily project to another. While many architects, developers and contractors are eager to explore new materials or building processes (such as pre-fabrication, cross laminated timber, or integrated project delivery) that might reduce costs or save time, tight margins and short timelines limit effective experimentation.

And the multifamily housing that is being built is too expensive for many renters.

As construction costs rise and more high-income renters enter the multifamily market, new multifamily units are built at prices or sizes that are misaligned with the needs of low- and middle-income renters. This change comes at a time when the nation is losing low-rent units.

Affordable housing developers are especially impacted. Affordable housing developers are competing for increasingly scarce funding. Tight budgets sometimes pit priorities that are important to affordable housing developers—notably supporting local labor and investing in environmental performance—against the immediate need for more housing at a lower price point.

Putting in low quality finishes is not going to save a project significant money.

Architect interview

Addressing these challenges requires new policy, development and construction strategies to produce multifamily housing.

Multifamily housing should be designed for the long-term, driven by environmental and social goals of affordability, quality of life and environmental performance. The following strategies, drawn from developer, architect and contractor interviews, illustrate how project teams try to achieve these goals as they contend with rising housing costs.

Their strategies are no substitute for needed policy changes, but they reflect the reality that many project teams face immediate pressure to control costs as they build multifamily housing. These strategies resist the ambition to find a technological or policy panacea (micro-units, cross-laminated timber, accessory dwelling units) that often dominates design and planning discourse.

By compiling these strategies in one place, the report aims to provide a starting point for project planning. Some will be relevant to a project, others will not, but, taken together, they reflect the learning and insights of experienced multifamily practitioners considering cost and quality throughout the construction process.

Types of Costs →

Land Costs / Cost of purchasing the land, 10-20% of total costs.

Soft Costs / All costs besides land and hard costs, includes design, engineering, financing and permit costs, 20-30% of total costs.

Hard Costs / Cost of labor and materials for construction, includes four primary categories: substructure and site prep, shell and structure, interiors and services, 50-70% of costs.

Strategies

Strategies are organized in six categories that comprise the major multifamily project costs: land costs, soft costs and hard costs.

Land Costs

- 1 / Focus site selection process on scale and constructability.
- 2 / Develop on oddly-shaped lots or scattered sites.
- 3 / Renovate, convert or co-locate housing with existing buildings.

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Soft Costs

- 4 / Engage general contractors earlier and as partners in the design process.
- 5 / Share more information with subcontractors to produce more accurate cost-estimating.
- 6 / Provide more information on site conditions in public RFP processes.

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Hard Costs / Substructure & Site Prep

- 7 / Run site prep concurrent to RFP process.
- 8 / Design to reduce foundation depth and complexity.
- 9 / Reduce or remove structured parking.

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Hard Costs / Shell & Structure

- 10 / Make a massing with a few big moves, rather than many small moves.
- 11 / Simplify facades, while still creating variation through materials.
- 12 / Let the structural grid guide plans and limit long-span spaces.
- 13 / Investigate new techniques & materials.

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Hard Costs / Interiors

- 14 / Design unit layout and dimensions for flexibility and efficiency.
- 15 / Specify materials for health, durability and cost.
- 16 / Rotate and mirror to create variation with repetitive unit and building plans.

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Hard Costs / Services

- 17 / Stack, standardize and simplify: conveying, kitchens and bathrooms.
- 18 / Invest upfront in building energy and water performance to encourage long-term savings.

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Interviewees noted key considerations that guide their thinking about multifamily construction and costs.

You can't really control costs until the project is out of the ground.

Developer interview

There are no silver bullets. There is no single strategy to reduce cost of multifamily housing. Significant federal and local policy changes are needed to encourage more affordable and middle-income construction. Yet, because the pace of change at both the federal and local level is slow, many project teams must contend with rising costs through design and construction decisions.

Solutions vary by city and region. Market conditions in U.S. cities vary dramatically—land costs, labor markets and zoning constraints ensure that no single solution will be relevant across cities. For example, higher labor costs in some cities may justify the high cost of off-site construction, while the same construction techniques would not make sense in markets with lower labor costs.

Time is money. Developers, architects and contractors across the country repeated the maxim that “time is money.” Reducing time spent on design, approvals and construction

means that projects can generate rental revenue more quickly. A shorter timeline also means fewer months of interest on costly construction loans.

Design quality and efficiency are complimentary. This report discusses design quality and cost, arguing that reducing costs is not inimical to producing high-quality buildings. Rather, a focus on building efficiency can enable greater control over costs, allowing project teams to spend more on features that would improve their buildings’ design and performance.

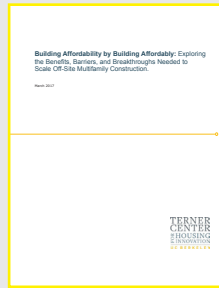
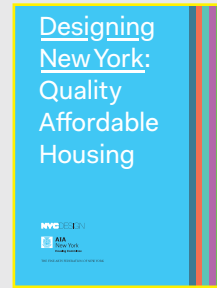
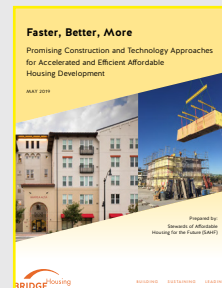
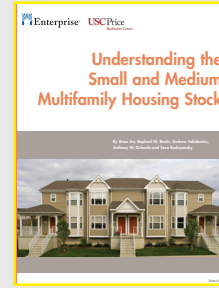
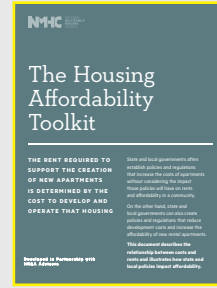
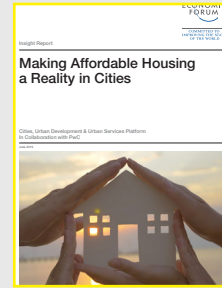
Non-profit developers are balancing multiple, often competing objectives. Many non-profit developers have broad economic and community development objectives. While they strive to maximize affordability, they are also also are trying to support community planning, provide job training and jobs for local residents, create healthier living situations, and reduce energy costs. At times, these efforts compliment

their affordability goals, but there are cases in which these objectives are at odds, forcing difficult trade-offs.

Climate considerations are changing and will continue to change the way we talk about affordability. Energy demand, especially for cooling, is poised to increase as temperatures rise and communities contend with more frequent and intense storm events. The economic argument for up-front investment in building performance is increasingly clear, but more efforts to track lifecycle costs are needed.

Multifamily housing is predominantly rental housing. 87 percent of residents living in multifamily properties live in rental units, so in focusing on multifamily housing, this paper (and many of the interviewees) concentrates on rental housing.⁵ Traditionally rental housing does not provide the same long-term affordability or wealth building as home ownership, so encouraging models for multifamily home ownership is incumbent upon policymakers and developers.

“It is really easy to suggest prefabrication but that doesn’t mean it makes sense for the project.”
Contractor interview



A selection of reports consulted to inform the research. →

Literature Review. Existing literature on multifamily housing design, construction and policy set the stage for this research. This research clusters around a few primary topics. (1) Policy and context-setting reports that describe the current landscape of multifamily housing and make recommendations for policy changes at the federal, state and municipal level to support affordability. (2) Deep dives that focus on a

single intervention (e.g. accessory dwelling units) or construction technique (e.g. modular) that project teams could consider as part of their cost-reduction strategies and (3) Design guidelines that provide precedents of and advocate for high-quality affordable housing. All of these categories informed the work in this report.

Interview Approach. This report draws on interviews with over 30 individuals who work in housing policy, development, architecture and construction in cities and towns across the United States. The insights they shared from their projects provided the foundation of this report. Many emphasized that policy changes should be the primary levers for addressing housing costs, but agreed that the reality of day-to-day practice means that project teams are constantly considering costs in individual projects.

Interviews were conducted with individuals from a variety of professions and organizations, including: 13 developers (7 of whom are affordable housing developers in the NeighborWorks network), 11 architects, 7 policy experts (with expertise in municipal housing policy, housing economics and healthy materials), and 5 construction experts.

→ Page 88 for a full list of interviews.

Interview Questions

Interviews were unscripted but generally included a discussion of the following questions:

- For a multi-family housing project, what are the key decision points that drive cost? Which costs are largest? Which costs are hardest to predict? Which costs are hardest to control?
- What strategies has your team employed to control or reduce costs on multifamily projects? Have these strategies performed as anticipated? Why or why not?
- Are there strategies (e.g. construction approaches, design methods, team structures, review processes) that your team is interested in trying, but has not tried? What is holding your team back?
- Has your team participated in projects that use pre-fabricated elements or off-site construction? For what type of project (# units, region, developer experience, labor and policy context)? Were there cost or time savings? Lessons learned?
- Has your team participated in projects that invested up-front in higher-cost, higher-quality materials or systems? How did your team balance budget and long-term investments?

Context

Triplex, tower, garden apartment. Over a quarter of the nation's housing units are in multifamily buildings.⁶ Demand for multifamily housing is growing, but new construction is not keeping pace, driving vacancies down and rents up. Shortages in the construction labor market, rising material costs and increased land prices in many cities make it harder to produce new housing, especially multifamily housing, that is affordable. In real terms, wages for low- and middle-income Americans have barely budged since the late 1970s.⁷ Insufficient supply, rising costs and stagnant incomes have made a larger share of America's multifamily housing unaffordable for low- and middle-income renters. This context section discusses these challenges and describes the primary multifamily costs and housing types.

Demand is growing, especially for smaller, rental housing.

Household growth is picking up...

The nation added 21M new households since 2000, including 11M new renter households.⁸

Over a third of households are renting...

While the number of renter households fell slightly in 2018, 36 percent of households rent, an increase from 33 percent in 2000.⁹

And households continue to get smaller.

63 percent of all households have only 1 or 2 members in 2018. This represents an increase from 59 percent in 2000 and 41 percent in 1960. Today the average household size is 2.53, down slightly from 2.62 in 2000 and 3.33 in 1960.¹⁰

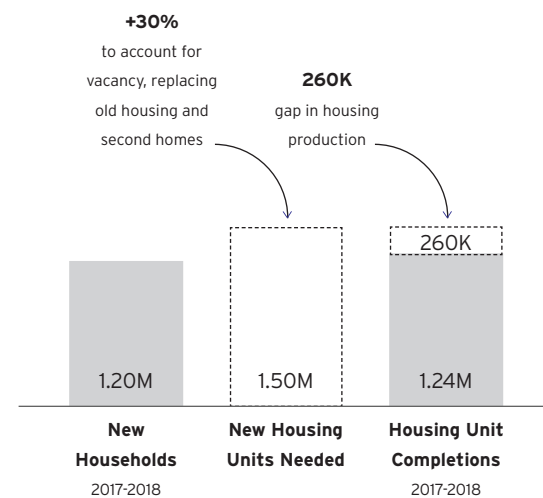


Fig. 1. Gap in housing production based on household growth, 2017-2018. →

Source: Joint Center for Housing Studies, State of the Nation's Housing Report, 2019.

Housing construction is just keeping pace with household growth...

Multifamily production has bounced back from post-recession lows...

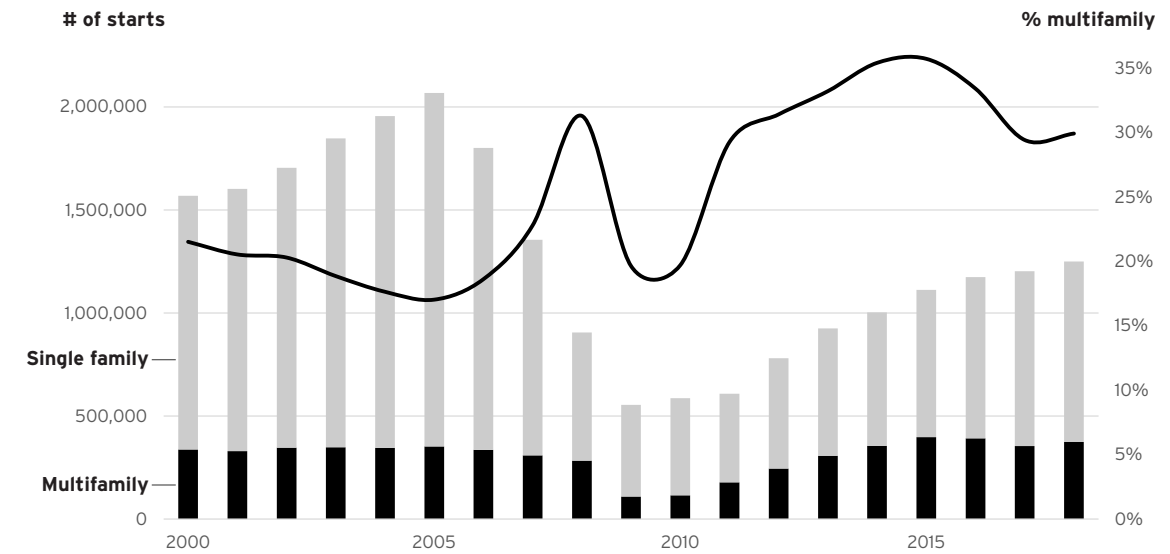
374,000 multifamily units were started in 2018. Multifamily units represent 30 percent of overall housing starts in 2018, up from about 20 percent in the years leading up to the recession. However, in absolute terms, multifamily construction starts are similar to levels seen in the early 2000s and well below peak multifamily production levels in the mid- to late-1980s.¹¹ **See Fig. 2. →**

But is not sufficient to meet demand...

To meet growing demand from new households and account for normal vacancy and obsolescence, housing production should be outpacing household formation by about 30 percent. Since 2011, production has tracked with household formation, creating a gap between demand and supply.¹² **See Fig. 3. →**

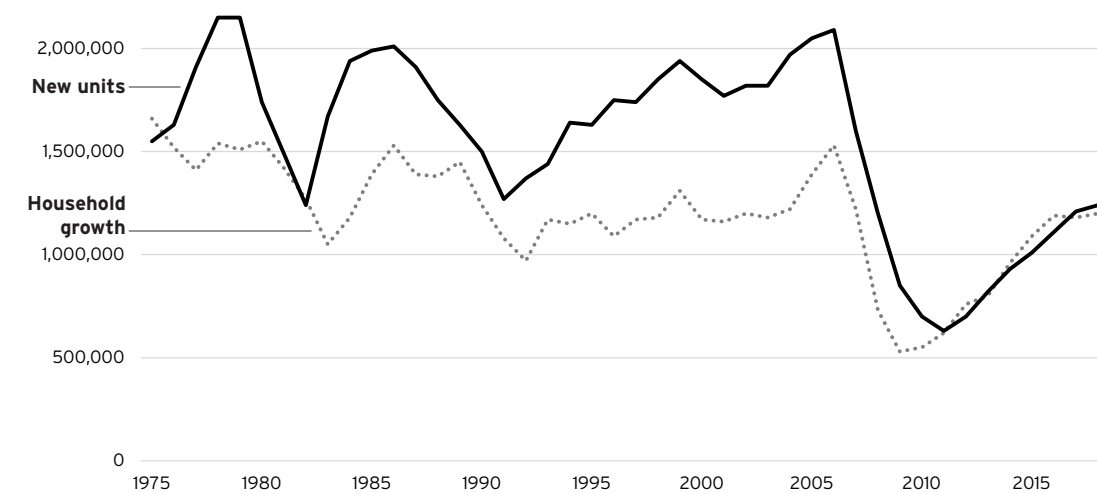
And much of the housing that is being produced is too expensive...

More high-income households are renting. 26.5 percent of renter households have incomes above \$75,000, up from 19 percent on average from 1980 to 2010.¹³ The addition of high-income renters, coupled with rising construction costs, means that more multifamily housing is targeting these high-income households, while middle-market housing is increasingly hard to build.¹⁴



Source: U.S. Census Bureau, New Privately Owned Housing Units Started, excluding manufactured, 2000-2018.

← Fig. 2. Housing starts, multifamily and single-family, 2000-2018.



Source: Joint Center for Housing Studies, State of the Nation's Housing Report, 2019.

← Fig. 3. Household growth and completion and placement of new units, 1975-2018.

Labor costs are changing so quickly that the cost estimates we do in the early phases of the project are far below final budget numbers.

Developer interview

...as construction costs increase, fueled by...

Land costs...

Land price increases are widespread, but have been particularly significant in fast-growing, coastal metro regions where the high cost of land often reflects highly-constrained zoning that limits density, rather than an actual lack of land.¹⁵

76 percent increase in land value between 2000 and 2016, almost twice the rate of inflation.¹⁶

Material prices...

The price of materials used for multifamily construction increased 3.3 percent from January 2018-January 2019, twice the rate that the Bureau of Labor Statistics' Consumer Price Index increased over the same time period (1.6 percent).¹⁷ While material prices are generally more consistent nationwide than land or labor costs, uncertainty related to tariffs and oil prices mean that contractors are often increasing bids to account for uncertainty in future material and transportation costs.¹⁸

The cost of materials is rising twice as fast as inflation.

Labor shortages...

Demand for skilled construction labor is growing, but there are not enough workers to keep up with demand. Contractors and developers nationwide identified the cost and availability of workers as primary concerns. These labor shortages are particularly challenging in high-cost metro regions which lack affordable places for construction workers to live, but desperately need new housing construction to bring down housing costs.

5.1 percent unemployment rate in the construction trades (the lowest since 2000).¹⁹

...and well-intended regulations.

Additionally, a range of local and state level regulations (from impact fees to permit costs to required infrastructure investments) are adding costs and extending construction timelines. When governments add costs to development, these costs typically get passed on to renters or buyers with a markup. While many of these fees produce important services and public goods, onerous regulations can impose a significant burden, especially on smaller-scale projects and affordable or middle-income housing.²⁰

\$10-70K, per unit cost of local development fees for a multifamily building in California. These fees are typically passed on to the buyer or renter at a markup.²¹



Image Credit: SounderBruce / Flickr / Creative Commons

← Wood frame residential floors are constructed atop a concrete ground floor in a typical mid-rise multifamily project.

Slow permitting extends project timelines.

"The Legislative Analyst's Office found that California's coastal metros take about two and a half months longer, on average, to issue a building permit than in a typical California inland community or the typical U.S. metro (seven months compared to four and a half months)."²³

What is the impact of fees on housing costs?

When the public sector imposes fees on a project, these fees typically get passed on to renters or owners in the form of increased costs. However, determining the extent to which fees increase as they get passed on to residents is difficult and varies from region to region. A literature review of fees in the San Francisco Bay Area by the Bay Area Economic Council found that "impact fees raise the price of new housing by about 166 percent the amount of the fee," while the City of Portland, Oregon estimated that "government fees" added an average of 13 percent to total housing development costs.²²

It seems like we should be able to align investments in building performance with operational savings, but developers and operators are often different. Developer interview

Housing has become less affordable for many renters...

Vacancies are down...

The national vacancy rate for rental housing decreased to 6.8 percent in 2019, its lowest level since 1985.²⁴

Rents are rising...

Rents are increasing at twice the rate of inflation, climbing nationwide at a 3.6 percent annual rate in early 2019.²⁵ Additionally, the US. lost 4 million low-rent (less than \$800/month) units since 2011, including 1 million units in 2017 alone.²⁶

and incomes for lower and middle-income households are stagnant.

While rent has increased for all housing types, income increases have mostly accrued to high-income households.²⁷ “Since 2000, incomes have fallen for the bottom 40 percent of American households, while the middle 20 percent experienced almost no real household income growth.”²⁸

Many renter households are housing-cost burdened...

Nearly half (48.7 percent) of renter households pay 30 percent or more of their income to rent, the standard definition of housing-cost burden.²⁹ Low- and middle-income households making between \$15,000 and \$75,000 saw increases in housing-cost burden between 2011 and 2018.³⁰

And rising energy demand may exacerbate existing disparities in energy spending.

Climate changes, namely higher temperatures and more frequent and intense heat waves, are poised to make energy demand higher and exacerbate existing discrepancies in energy spending by household income. Low-income households living in multifamily housing currently spend 5 percent of their household income on energy bills, more than 3 times the energy burden of households that are not low-income (1.5 percent).³¹

Image Source: Will Crocker for OJT



← OJT Architects “starter home” project includes 12 houses on a dense site in New Orleans. See more on page 70.

The “missing middle” or challenge of providing middle-income housing.

While cost increases impact all multifamily projects, many projects for low-income households (typically below 60% AMI) have access to subsidies or incentive programs, such as low-income housing tax credits (LIHTC) that fill some funding gaps.

By contrast, there are few incentives for building middle-income housing, particularly for households with incomes above the reach of LIHTC, but below prevailing levels required to afford market-rate rents. This middle-income band is often defined as households with income between 80-120 percent of AMI.

However, the upper boundary of “middle-income” varies by city. In more

expensive cities, prevailing market-rate rents could be “unaffordable” (causing housing-cost burden by costing over 30 percent of monthly income) for households above 120 percent AMI, while in other cities the gap between subsidized affordable housing and market-rate rents is smaller.

For example, in San Francisco County (which is coterminous with the city of San Francisco), the 2017 median household income was \$96,265. With an average rent of \$4,457 for a two-bedroom, a family would need an annual income of \$178,267 or 185 percent AMI to afford monthly rent. By contrast, in Cook County, Illinois, which includes Chicago, the average two-bedroom rent of \$1,662 is affordable at 95 percent AMI given median household income of \$69,839.³²

Why does so much multifamily housing look similar?

The horizontal building separation allowance (IBC 510.2) permits the stacking of Type V wood construction over a Type I steel or concrete podium if there is a fire barrier separating the two construction types. This provision enabled the proliferation of the now-ubiquitous 5-over-1 (or 4-over-2 etc....) in which less costly stick-built residential apartments sit atop a steel or concrete podium that includes commercial space or parking.

Multifamily housing takes a few forms..

Material costs, building codes, zoning regulations and financing requirements strongly influence multifamily housing types. Multifamily typically adopts a few building forms: small infill projects with a single stair, mid-rise construction that packs dozens of units into double-loaded corridors or tall towers with central cores.

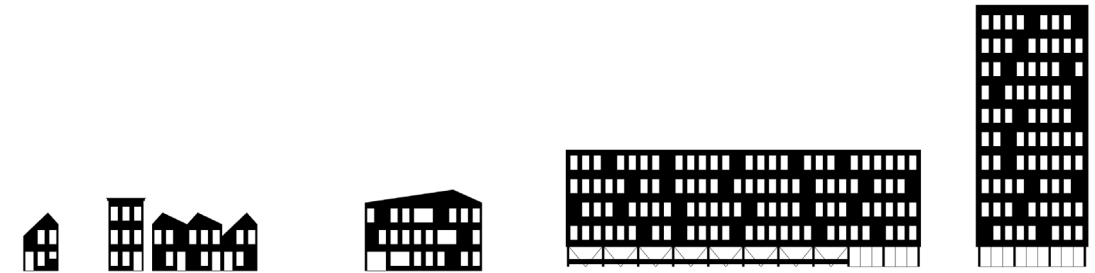
Construction Types

The International Building Code (IBC) establishes five primary construction types. The building's materials determine the construction type, which in turn informs the maximum number of floors and area of the building. Reading these regulations closely clarifies why some housing types have become ubiquitous and illustrates opportunities for exploring new or hybrid types that could deliver housing at feasible price-points.

Changes in the IBC, notably the anticipated addition of tall mass timber to the 2021 code which will enable wood construction to reach new heights of 18 stories, will continue to influence multifamily construction.

Most multifamily housing is comprised of the following construction types:

- Type I & II: Entire structure made of non-combustible materials (e.g. concrete, steel, masonry). Type II buildings are less fire resistant.
- Type III: Exterior walls made of non-combustible materials. Floors, roof and structure made of other permitted materials (e.g. wood).
- Type V: Any materials permitted by code. Typical for single-family residential and mid-rise residential.³³



	Infill	Low-rise	Mid-rise	High-rise
Names	Duplex, two, three or four-family, garden, walk-up	3-over-1	5-over-1, 5-over-2, 4-over-2	Tower
Construction type	Typically wood	Typically wood	Wood on concrete or steel podium	Concrete or steel
# of Floors	3 stories, up to 6 in older buildings	1-3 stories	4-7 stories	Unlimited by IBC, dictated by zoning, usually 12 + stories
# of Units	~1-4 units	~5-50 units	~50-200 units	~4-20+ units/floor
Circulation	Typically single stair, no corridor	Typically double-loaded corridor, multiple stair, sometimes elevator	Typically double-loaded corridor, multiple stairs and egress, elevator	Typically smaller floor plate, double-loaded corridor, elevator, egress stairs
Location	Rural, suburban, urban	Rural, suburban, urban	Suburban, urban	Urban
Cost PSF	Varied	\$150-225	\$175-250	\$225-400+

Multifamily housing is changing...

More units are located in larger buildings

Since 2000, the share of units has shifted towards larger buildings. In 2000, only 14 percent of new units were located in buildings with over 50 units. By 2017, 52 percent of new units were in larger, 50+ unit buildings. The share of units in 30-49 unit buildings also increased, while the share in buildings with fewer than 29 units decreased significantly. In line with unit count increases, building heights have also increased—over half of multifamily buildings are over 4 stories, up from just 14 percent in 2000. 8 percent of new multifamily units were in townhouses in 2000. Today townhouses only represent 1 percent of new units, as multifamily buildings with fewer units decrease.³⁴ See Fig. 4. →

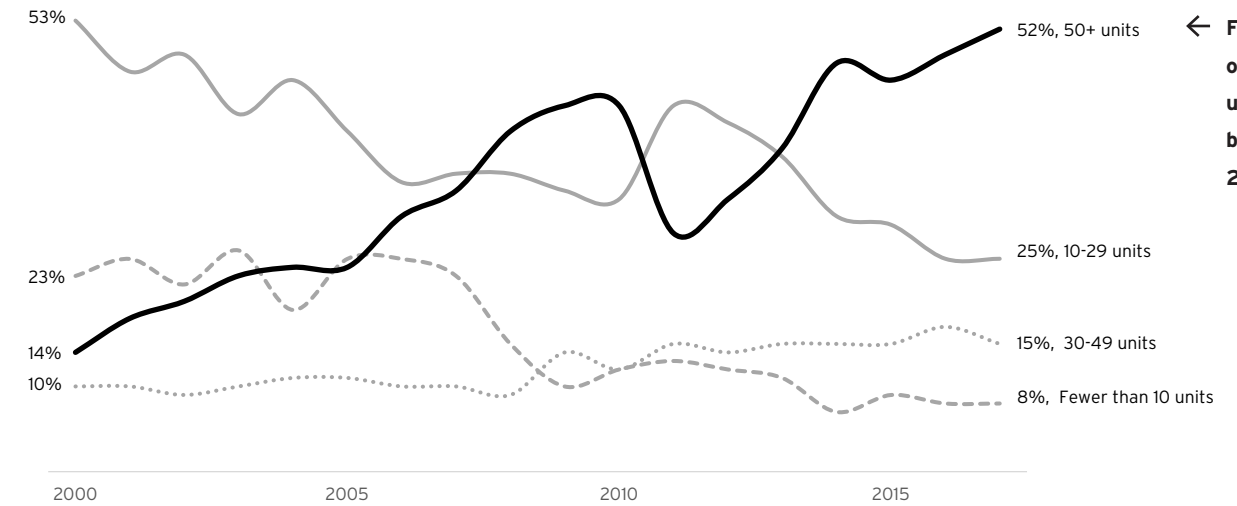
The one bedroom has become the dominant new unit type.

One-bedroom units have overtaken two-bedroom units as the most common unit type

delivered in new multifamily construction. Studios comprise a slightly larger share of new units, while family-sized units (two- and three-bedroom units) represent a smaller share of new units. These changes are a reflection of new, wealthier renters (often retirees or young professionals) entering the multifamily market and seeking smaller units. As these new renters dictate new market trends, family-size units that are critical to low and middle-income renters are increasingly scarce.³⁵ See Fig. 5. →

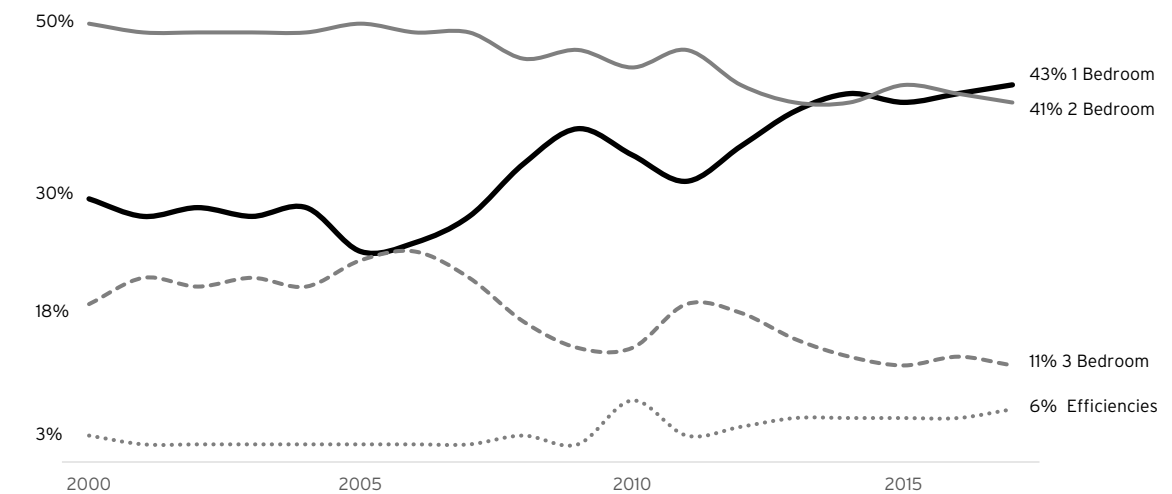
Unit sizes are increasing.

While unit sizes in many major metros are small, overall multifamily units are getting larger. This increase in size is largely attributable to increases in the size of for-sale units in multifamily properties, which are significantly larger than for-rent units (1,088 SF median size for rental units compared to 1,494 SF for for-sale units). However, both for-rent and for-sale unit sizes have increased since 2000, 7 percent and 17 percent respectively.³⁶



← Fig. 4. Share of multifamily units completed by building size, 2000-2018.

Source: U.S. Census Bureau, Residential Construction Survey, 2018, Characteristics of New Housing, units per building.



← Fig. 5. Share of multifamily units completed by number of bedrooms, 2000-2018.

Source: U.S. Census Bureau, Residential Construction Survey, 2018, Characteristics of New Housing, units per building, bedrooms

We are looking for sites that can take a least 80 to 100 units because many soft costs and costs related to mobilizing construction resources (e.g. a crane) are fixed. Developer interview

The land hunt is the biggest decision. We can typically only afford highly-constrained sites.
Developer interview

What are the components of cost?

Cost breakdowns for multifamily project budgets vary significantly based on region and project type (e.g. mid-rise, high-rise), size and site. The following breakdown is an approximation of how major costs might be divided in a mid-sized multifamily project.

Land Costs, 10-20 percent.

Land cost represents the cost of purchasing the land. The share of total costs that land cost represents ranges significantly based on the local market conditions, the development capacity of the site and the availability of subsidized land for affordable housing. In dense cities with highly restrictive zoning (for example, San Francisco or Boston), land costs can represent a larger share of construction costs. The site’s development capacity reflects its zoning (e.g. uses, FAR, setbacks) as well as its physical characteristics (e.g. lot dimensions and grade). Timing the acquisition of land has significant bearing on the feasibility of many projects, especially for affordable or middle-income housing.

Soft Costs, 20-30 percent.

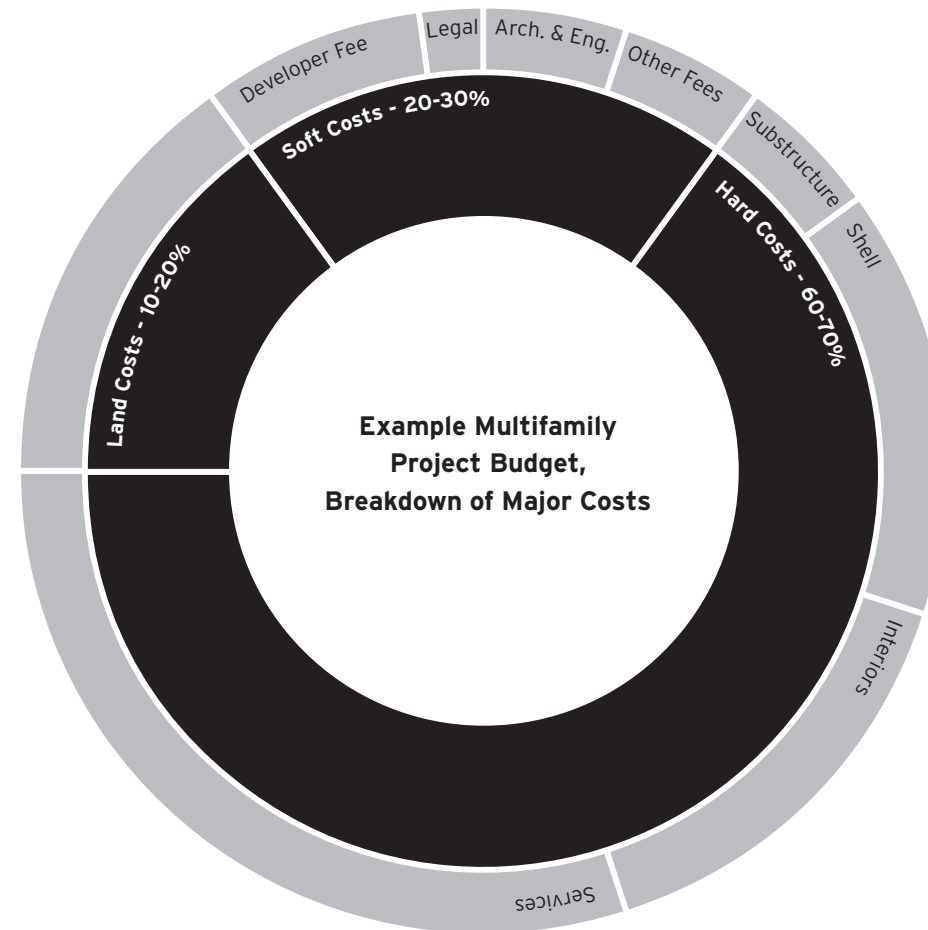
Soft costs are everything besides the labor and materials needed to construct the building. Soft costs include developer profit, contractor fees, design costs for architecture and engineering, and costs related to financing, entitlement and permits. If a project is proceeding as-of-right, soft costs may be lower than if a project

requires discretionary approvals, which typically necessitate additional studies and negotiation. Soft costs include financing costs, such as interest on construction loans, and marketing costs. Financing affordable housing projects requires the coordination of a range of debt and equity funding sources, which often necessitates significant spending on legal, accounting or syndication fees.³⁷

Hard Costs, 60-70 percent

Hard costs are comprised of the labor and materials for construction. Regional variation in material costs is limited, but labor costs vary significantly between metros. Labor costs are also increasing quickly, especially in expensive coastal cities.³⁸ Hard costs form the bulk of the project budget and can be roughly categorized as:

- **Substructure and site preparation**, which includes preparing the site for construction by grading and excavating it, as well as foundation, below-grade structure and slab.
- **Shell and structure**, which includes the superstructure, exterior enclosure, exterior doors and windows and the roof.
- **Interiors**, which include interior walls, partitions, interior doors and windows, stairs, fittings and finishes.
- **Services**, which include elevators, mechanical systems, electrical systems, and plumbing.



← Fig. 6. Example Multifamily Project Budget. Cost-breakdowns vary significantly by project type and location. This hypothetical budget is based on several sources. Overall land-hard-soft cost proportion is based on the Government Accountability Office’s survey of LIHTC projects and the State of California’s data on affordable housing costs. The breakdown of hard costs is based on R.S. Means data for multifamily housing. Interview conversations also included discussions of project costs.³⁹

Sources: R.S. Means, U.S. Government Accountability Office, State of California Department of Housing and Community Development. See citation 39 for details.

Which project characteristics drive costs?

Isolating how affordable and middle-income housing follow to or diverge from these trends is difficult. Affordable developers often have less choice about land because of costs or because the public sector has selected a specific site for new housing, so opportunities to build larger projects may be out of a developer’s control. Additionally, many affordable projects have specific requirements for unit size and mix, so the multifamily market push toward one-bedroom units is likely less relevant in affordable housing.

A recent survey of affordable housing projects by the U.S. Government Accountability Office (GAO) set out to determine the relationship between project characteristics and costs. The GAO gathered data on new construction and renovation projects that used the 9 percent tax credit through the LIHTC program. The projects were completed in 12 jurisdictions nationwide between 2011 and 2015.

The GAO found that the average per-unit cost for new affordable housing was \$222K in 2015, which may be understated because

land was free or discounted for some projects.⁴⁰ The median per-unit cost increased by about 7 percent between 2011 and 2015, outpacing inflation over the same time period (~5.3 percent). Per-unit costs were significantly higher in some areas, reaching over \$600,000 in some projects in California.

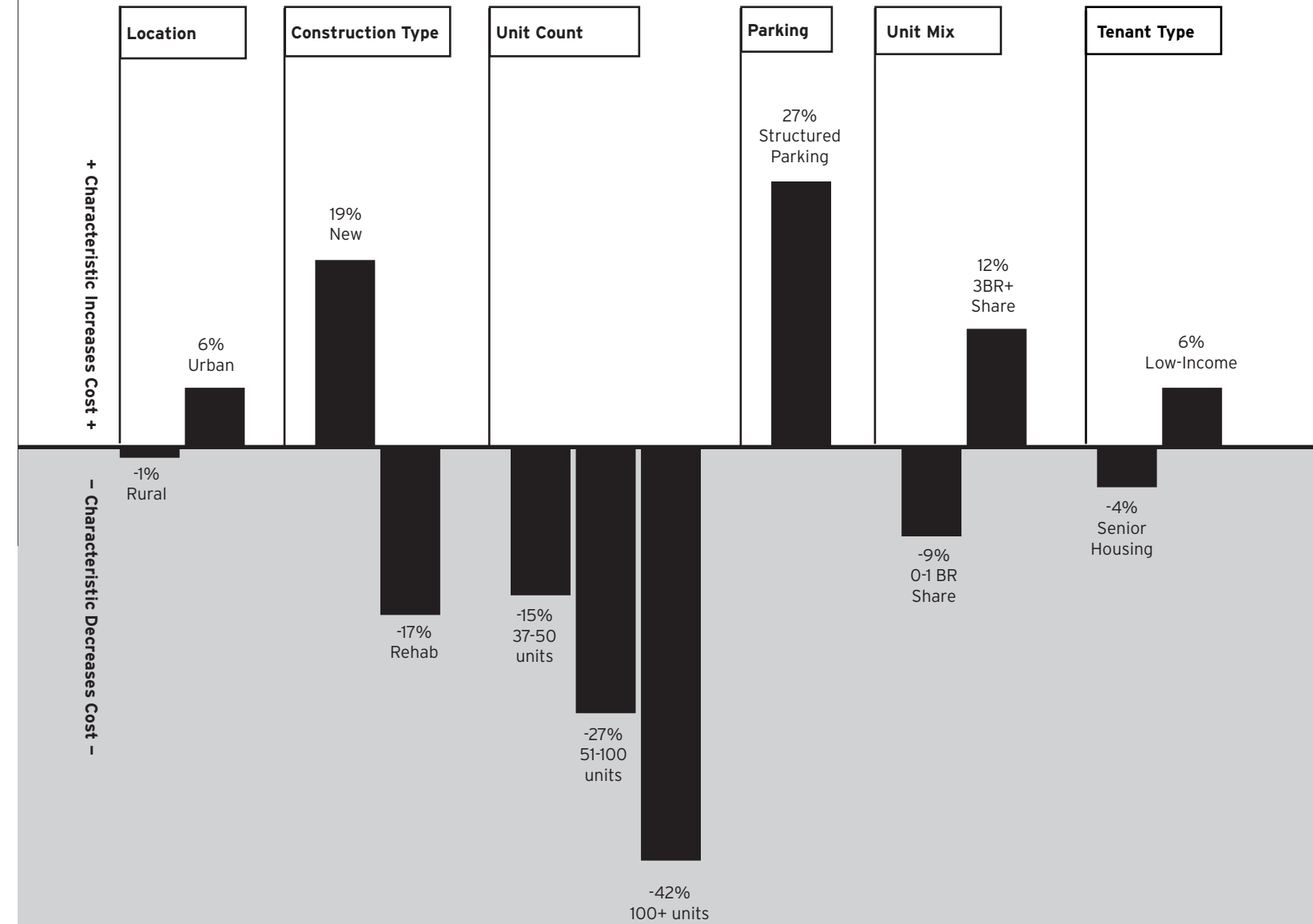
The report noted that costs for affordable housing may be higher for a variety of reasons, including:

- LIHTC project developers have longer time horizons for building performance and therefore may invest in more durable (and expensive) construction materials with the goal of reducing replacement and operating costs;
- Local requirements for additional building services, such as community facilities, may add costs to affordable housing;
- Developer profit comes through developer fees, which are part of upfront soft costs, rather than rental income generated by operating the property;
- LIHTC financing is complicated and slow, often resulting in higher soft costs.⁴¹

Unit mixes and minimum sizes are usually prescribed and not open for discussion. Developer interview

Significant on site requirements such as stormwater management or community uses add costs and design constraints. Developer interview

Fig. 7. Impact of Project Characteristics on Median Unit Costs for LIHTC Projects



Sources: Government Accountability Office, 2018 LIHTC Report. % change relative to median unit cost of \$204,000 for 1,849 new and rehab LIHTC-funded projects from 2011-2015., see citation 39 for details.

Strategies

Interviews with developers, architects and contractors yielded a set of strategies (and some experimental ideas) for responding to rising multifamily housing costs. These strategies are organized by the primary components of a multifamily project: (1) land costs, (2) soft costs and hard costs. Within hard costs, the strategies are divided in four categories: (3) site preparation and substructure, (4) shell and structure, (5) interiors and (6) services. These strategies are no replacement for substantive policy changes, but they reflect the reality that teams building multifamily housing, especially affordable multifamily housing, are often pressed to reduce costs. By sharing strategies, the report aims to help project teams address cost challenges, so they can achieve project priorities.

Land Costs

Strategies

- 1 / Focus site selection process on scale and constructability.
- 2 / Develop on oddly-shaped lots or scattered sites.
- 3 / Renovate, convert or co-locate housing with existing buildings.

Developers seek strategies to use land more efficiently as land costs increase at often unpredictable rates.

They are pursuing two basic approaches to land acquisition to reduce overall costs. The first approach seeks out easily buildable land, accepting higher upfront land costs for the potential of lower construction costs enabled by flat, regular sites that have space for larger buildings. However, high land costs often make this approach prohibitive for affordable and middle-income housing projects. An alternative approach seeks more constrained sites that have lower land costs, with the hope that clever design and construction solutions can overcome site challenges. In both cases, understanding the tradeoffs and inherent limitations in a given piece of land is critical to lowering land costs or leveraging land costs to produce other cost savings.

From an operations standpoint, it costs almost as much for us to operate a 30-40 unit building as it does a 100-unit building, so we are looking for sites that can accommodate larger projects. Developer interview



Image Credit: © brizmaker

1 / Focus site selection process on scale and constructability.

Affordable housing developers typically seek sites where they can deliver projects that benefit from economies of scale. This requires a constant weighing of tradeoffs between site size, cost and ease of construction. How many units can fit on one site? Does the steep grade of one site require a complicated foundation that will reduce any land cost savings? All sites have constraints or challenges; finding out what these issues are upfront, rather than being caught off guard by site issues is key to evaluating sites.

Interviewees encouraged organizations to develop standard processes for site evaluation. Many interviewees also encouraged spending more upfront on site analysis to get a more comprehensive understanding of site issues.

Codifying site evaluation processes is critical to transferring lessons learned on one project to the next, even as project teams change. A set of initial questions for evaluating sites are included in the box at right. These questions are not exhaustive. Rather, they represent areas of inquiry that a project team should consider as they embark on site evaluation.⁴²

Site Evaluation Criteria

Interviewees noted major topics that should be considered as part of a consistent site evaluation process. Their questions surface both standard information and potential challenges.

- Size** How many units can the site accommodate given depth, width and FAR?
- Regulations** Are there public right-of-ways, setbacks or other zoning requirements that significantly constrain the building massing?
- Soil** What is the bearing capacity of the soil? Is the site contaminated or in need of remediation?
- Site clearance** Is the site clear or do existing structures need to be demolished?
- Grade** Is the site flat? What type of foundation will the site require?
- Utilities** Are the utilities right-sized for the project?
- Staging** Does the project require a crane for construction and is there room for it?
- Adjacent uses** Is the site adjacent to specific uses that may make coordination more challenging? (E.g. school, transit)

Larger buildings have lower per-unit costs. Larger projects benefit from economies of scale. Per-unit costs in buildings with 100+ units are \$85,000 less than in buildings with fewer than 37 units.⁴³

Units on urban sites have a slight cost premium. Urban projects typically have a cost premium of \$13,000/unit, which could in part be due to more complex sites and adjacent uses, as well as the fact that many urban buildings are taller.⁴⁴

Competitions encourage building on small lots.

Recent competitions, including the City of New York's Department of Housing Preservation and Development's "Big Ideas for Small Lots" competition and the Disruptive Design competition in Chicago explored strategies for small and irregular lots.

2 / Develop on oddly-shaped lots or scattered sites.

In dense urban areas where land (or buildable FAR) is scarce, developers often have to accept more constrained sites that have higher soft and construction costs. These sites might have irregular shapes or steep grades or be scattered as a series of small infill sites. The opportunity for dealing with these irregular sites lies in becoming an expert about a specific type of irregularity (for example, narrow sites or sites with a steep grade) and leveraging lessons learned from one project to subsequent projects.

Design Precedent Identifying non-conforming lots in New Orleans

In its research and design work, OJT Architects proposed that small, irregular lots in New Orleans could be sites for small starter homes that would be affordable to middle-income homeowners. Using municipal zoning and property data, they identified non-conforming lots—sites that are zoned for residential use, but do not meet all the minimum criteria for residential redevelopment (for example, minimum lot size). Working with developers, they built a series of small infill projects that turned several of these sites into housing. OJT is applying this methodology to other cities, seeking out underutilized lot types, such as leftover areas around larger residential development sites, parking areas or steeply graded sites.⁴⁵

Policy Precedents Leveraging vacant, City-owned lots in Boston

The City of Boston's Neighborhood Homes Initiative identified 250 small, vacant, City-owned properties for disposition for affordable housing. Boston pre-approved a set of model home designs developers can use to build housing on the parcels, reducing design costs and ensuring that development proceeds swiftly.⁴⁶



Image Source: Sam Oberter for ISA, Callahan Ward

← Exterior view, section and plan of the "XS House" in Philadelphia.

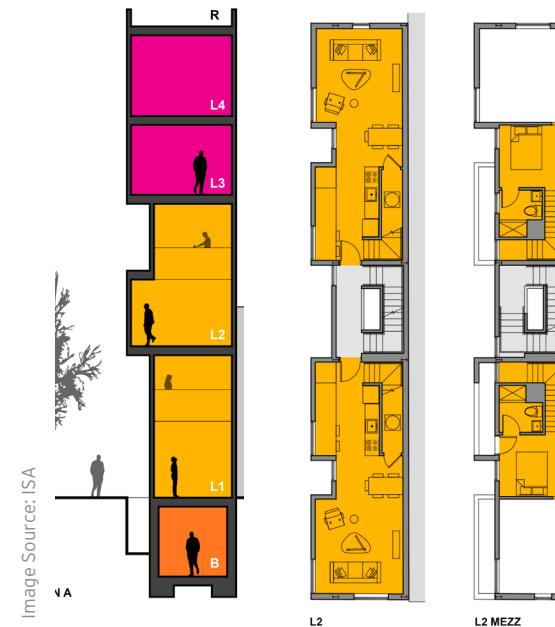


Image Source: ISA

Design Precedent Designing for narrow lots in Philadelphia
Close reading of the building and zoning code can produce insights about maximizing occupiable space on highly constrained parcels. In Philadelphia, ISA designed the XS House, which stacks seven apartments on a narrow 11' x 93' site. Mezzanines create additional living area, without adding to the overall building area or number of floors. A single, central stair limits the amount of space dedicated to circulation and provides access to the seven apartments.⁴⁷

3 / Renovate, convert or co-locate housing with existing buildings

In select cases, renovation or addition to an existing building may provide cost savings, particularly by reducing spending on site preparation and substructure. Careful study of the existing structure is required to evaluate these opportunities and determine whether the hard cost savings outweigh complexity of working with an existing structure. For example, some older one-to-two story concrete or steel (Type I) commercial or industrial buildings could serve as podiums for wood (Type V) construction, thereby reducing some below-grade excavation and foundation work.

Policy Precedent Adding housing to existing or new public buildings

Low-density public buildings such as fire stations or libraries can also be successful neighbors or ground floors for housing. West End Square 50 is a 9-story mixed-use development in Washington D.C. that houses a fire station and 55 units of affordable and supportive housing, where a single-story fire station once stood.⁴⁸

Policy Precedent Encouraging single-family infill and conversions in Minneapolis

Minneapolis' recent zoning change to eliminate single-family zoning and permit duplex and triplex development is poised to usher new types of infill density to the city. Additionally, the regulation could encourage conversions of single-family housing stock to small multifamily projects. In both cases, exploration of new housing models for scattered low-rise housing is likely.⁴⁹

Design Precedent → Building over existing structure in Boston

1047 Commonwealth Avenue is a microunit project in Boston designed by French 2D / Neshamkin French Architects. Five floors of microunits sit above a former car showroom. While the podium needed to be strengthened to support the microunit construction, reusing the podium limited complicated and unpredictable below ground site prep. Additionally, the narrow structural grid of the car showroom (~13' bays) was well-suited to the dimensions of the micro-unit program, so the structural system could be highly efficient.⁵⁰



Image Credit: Edua Wilde Photography, for French2D / Neshamkin French Architects

← Exterior view, and ground floor plan of 1047 Commonwealth Avenue Microhousing project in Boston.

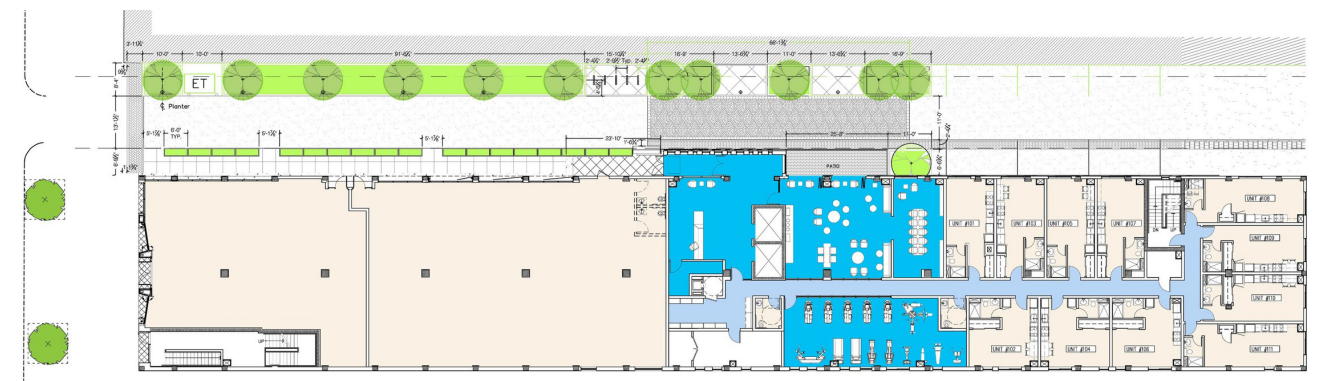


Image Credit: French2D / Neshamkin French Architects

Soft Costs

Strategies

- 4 /** Engage general contractors earlier and as partners in the design process.
- 5 /** Share more information with subcontractors to produce more accurate cost-estimating.
- 6 /** Provide more information on site conditions in public RFP processes.

We try to bring everyone, from the executive director to the sub-contractors to the table at the start of the process to set priorities and get everyone on board.

Developer interview

Soft costs, which include architecture and engineering services, impact fees, required studies, exactions, permits and financing costs, comprise 20-30 percent of total project costs. The predictability and magnitude of these costs varies significantly from city to city. Affordable housing projects often have higher costs due to the complexity of financing.

Encouraging as-of-right zoning and carefully calibrating fees are among the most powerful tools a city has to reduce soft costs. Yet, because zoning changes require significant political mobilization, they take a long time to enact. Therefore, for project teams, controlling soft costs typically means investing in efforts to reduce time and increase predictability. Better integration of design and construction teams, frequent collaboration with trusted partners, better information sharing to produce more accurate cost estimates: these are the strategies that are within the purview of the project team considering soft costs.

We've worked with the same design and construction team on about five projects now; we are building a language of unit types, details and material specifications that we can build on during each project. Contractor interview

4 / Engage general contractors earlier and as partners in the design process

In traditional design-bid-build project delivery, a contractor provides a preliminary cost estimate after schematic design. Construction bidding then occurs after construction documents are developed, often setting in motion a value engineering process that requires changes to the design.

This process poses challenges for multifamily developers, especially affordable multifamily developers. First, in a competitive market, demand for general contractors and subcontractors is high. There is limited incentive for construction firms to deliver accurate early estimates because competitive bidding processes mean that some projects have to go to the lowest bidder, even if developers may have concerns about the quality of work or the accuracy of the estimate. Second, month-to-month escalation of construction costs can cause accurate early cost estimates to be well under final construction bids.

Industry-wide there are a variety of project delivery strategies that seek to disrupt the traditional design-bid-build models.

Developers, architects and contractors interviewed identified a range of project structures they are testing, with the goal of increasing project efficiency and reducing timelines.

These range from legal agreements that establish performance standards and grounds for profit sharing to more informal efforts to bring construction teams to the table earlier in the project. Some developers are bringing general contractor functions in house. Others are working with a construction manager at risk, who is at the table from the start helping to guide the design process. Other collaborations are done more informally. Many developers in the NeighborWorks network and outside noted the efficiencies that come through repeat work with the same construction and design teams.

Development Precedent

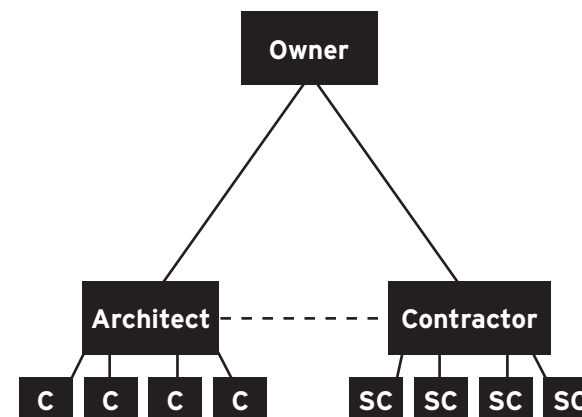
Working with a "construction manager at risk"

At Foundation Communities in Austin, two project managers co-lead each project, one with expertise in finance and one with design/construction expertise. Foundation Communities includes a Construction Manager at Risk (CMAR) in their design process which helps make construction costs, schedules and constructability more predictable. Following a competitive RFP process, the CMAR joins Foundation Communities and their full design team at weekly meetings to provide feedback and anticipate areas where costs may pose issues by providing frequent cost estimates. The CMAR provides a timeline and Guaranteed Maximum Price (GMP) based on subcontractor bids. The CMAR is then responsible for delivering the project for that price and schedule, providing Foundation Communities with clear and predictable costs. In the event that the CMAR is unable to deliver at the GMP, Foundation Communities can bid the job competitively.⁵²

Development Precedent

Encouraging accurate cost estimates

For an affordable housing project in metro Boston, non-profit developer Preservation of Affordable Housing (POAH) has set up an incentive for accurate cost estimating. POAH selects a pre-construction general contractor through an RFP process; this contractor is involved in the design process to flag constructability issues and cost impacts. Following standard project timelines, POAH works with the pre-construction GC to develop an initial control budget after the design development phase of work. Then, following the development of construction documents, the GC provides a final control budget. If that estimate is within 1-2 percent of their earlier estimate and all other criteria of the RFP are met, the pre-construction GC will have priority on the award even if other bids come in lower during the competitive bidding process. This provision allows POAH to partner closely with a construction firm that it trusts and encourages accurate, open book cost estimating early in the project.⁵¹



← Project structure for a construction manager at risk contract. C indicates consultant, SC indicates subcontractor.

Regulations, particularly around energy performance, are changing rapidly, so we often find ourselves asking subcontractors to learn something new on the project, which always drives bids higher. Developer interview

5 / Share more information with subcontractors to produce more accurate cost-estimating

For affordable housing teams taking on new building systems or energy targets, subcontracting estimates are often costly and unpredictable. Labor shortages are acute in many trades, so few staff are available to do the detailed due diligence needed to produce accurate cost estimates at early stages of a project. Additionally, the rapid pace of regulatory change, particularly in terms of energy performance, means that subcontracting teams are often learning new systems on the job and add this training time to their fees.

Prioritizing clear and simple drawing sets that subcontractors can easily bid on and identifying ways for design and engineering teams to share information with subcontractors can help to clarify the scope of work and ideally lead to more accurate cost estimates.

Development Precedent Supporting subcontractors in learning new skills

Preservation of Affordable Housing (POAH) is developing a set of upcoming high-performance affordable housing projects in the Chicago, Boston and Metro D.C. areas. These projects will be constructed over a multi-year period, offering an opportunity for subcontracting teams to install similar systems on multiple projects. POAH has hosted open presentations where design and engineering teams present information on the building to interested subcontractors, answering questions before subcontractors submit bids, with the aim that this information sharing will yield more accurate cost estimates.⁵³



Image Credit: Author

← Site excavation occurring for a mixed-use, residential high-rise.

6 / Provide more information on site conditions in public RFP processes

Many local governments are encouraging affordable housing by offering publicly-owned land via the RFP process. Interviewees noted that governments may be able to receive more accurate bids if they provide clear and comprehensive site information. Making more comprehensive geotechnical information available to RFP respondents (e.g. title reporting, Phase 1 environmental review, geotechnical surveys that use sub-surface soil borings to determine the soil, rock and groundwater conditions and characterize neighboring foundation conditions) will enable developers and subcontractors to estimate fees and bid on projects more accurately.

How are due-diligence tasks typically distributed between the public and private sector?

Enterprise’s 2017 paper on “Public Benefit from Publicly Owned Parcels” notes that there is “not a consensus on which due-diligence tasks should be conducted in advance by the [public sector],” however, “high levels of pre-solicitation due diligence can reduce uncertainty and increase the quality of development proposals.”⁵⁴ In particular, having an understanding of the magnitude of costly activities such as environmental remediation can lead to more accurate proposals.

Hard Costs Substructure & Site Prep

Strategies

7 / Run site prep concurrent to RFP process.

8 / Design to reduce foundation depth and complexity.

9 / Reduce or remove structured parking.

You can't control costs until you get out of the ground.

Contractor interview

Site prep and substructure are costly and often unpredictable hard costs. Site prep includes the costs of preparing the land for development. Depending on the site conditions, this includes: clearing the site, addressing soil contaminants, leveling the site, excavating, installing drainage and right-sizing utility hookups. Substructural work includes the foundation. The type and depth of foundation depends on building footprint, loads and soil type. Generally, the less deep and the more regular (i.e. rectangular) a foundation, the less costly it is to build.

While developers and contractors alike commented that it was challenging to control costs until a project is out of the ground, they noted that reducing (or eliminating) structured parking, simplifying foundations and reducing time by conducting site prep alongside other tasks, can help to control costs.

7 / Run site prep concurrent to RFP process

Site prep is an unpredictable phase of project delivery, often subject to time and cost overruns. In traditional project timelines, site prep is the first phase of work and precedes construction. Delays in site prep can throw project schedules off, particularly in weather-sensitive climates like the Northeast or Midwest.

Strategies to conduct site prep concurrent with RFP processes or off-site construction could reduce overall construction timelines. In some cases, cities could lead site remediation or preparation efforts during an RFP process. Developers could also pursue off-site construction strategies that enable construction work to occur at the same time as the site is prepared. For some larger projects, there may be opportunities for a developer to contract foundation work separately from above-grade building construction, so that site excavation can occur while design and engineering teams finalize construction documents for the above-grade building.

8 / Design to reduce foundation depth and complexity

Site soil conditions (grade, soil bearing capacity, soil type) and loads (dead, live, wind, seismic) from the building dictate what type of foundation system a building requires. While the foundation type is generally non-negotiable given these conditions, a site selection process that includes a geotechnical survey can help to estimate costs accurately. In general, sites with soil that has a higher bearing capacity mean that foundations can be less deep. Less deep foundations translates to less digging and less foundation materials, thereby reducing both materials and costs. Additionally, identifying sites that do not require pilings, stepped foundations and retaining walls can help to reduce costs.

Design Precedent

Simplifying foundation work.

REACH, a NeighborWorks network member based in Portland, Oregon, has been working with Walsh Construction and Ankrom Moisan Architects on a series of affordable multifamily projects in the Portland, Oregon area. In their ongoing multifamily projects in Portland, they have a specific focus on cost-efficient design and construction. With site prep and substructure costs in mind, they prioritize flat sites and rectangular massings that simplify their foundation work whenever possible.⁵⁷

→ Read more about this collaboration on page 58 & 66.



Image Credit: Bernheimer Architecture

← Site excavation and foundation process for 1490 Southern Boulevard, an 80-unit senior housing project in the Bronx. The 9-story building is adjacent to an elevated subway line.

Type A Real Estate Advisers is developing the building, which is designed by Bernheimer Architects, for NYC's Department of Housing, Preservation and Development.

Structured parking has a significant impact on unit costs. A single spot of structured parking in an affordable housing development is estimated to add ~\$56,000 in per-unit costs.⁵⁵ And, due to local zoning requirements, parking is often oversupplied in dense, urban areas. In a survey of multifamily housing in metro Boston, only 74 percent of multifamily residential parking spots were utilized.⁵⁶

9 / Reduce structured parking

Constructing structured parking, particularly below-grade or multi-level structured parking adds significant costs. A single unit of structured parking can add more than \$50,000 to per-unit costs. Costs increase significantly when parking is underground or multilevel because of the costs of digging deeper and the demands that parking places on building structure. While not within an individual project team's control, policies to reduce required parking are critical to reducing the impact of parking costs on affordable housing. Shifting from minimum parking requirements to maximum parking requirements, eliminating or reducing parking requirements on TOD sites, or centralizing off-site parking can help to reduce the amount of parking that must be built on site.

Policy Precedent

Encouraging transit-oriented affordable housing in Los Angeles.

Los Angeles' Transit Oriented Communities (TOC) Affordable Housing Incentive Program encourages affordable housing development in the vicinity of transit by providing a tier-based incentive system (including increases in FAR and dwelling unit increases and decreases in parking reductions) for affordable housing projects within a half-mile radius of a major transit stop (a rail station or intersection of two or more bus routes). Incentives increase depending on the number of units and the share of low-, very-low, and extremely low-income households in the project.⁵⁸

Design Precedent

Reducing structured parking on a TOD site in Boston.

Metromark is a mixed-use, mixed-income, 283-unit housing development adjacent to a rail stop in the Jamaica Plain neighborhood of Boston developed by the Brennan Group and the John M. Corcoran Company and designed by Utile. The project was permitted through the City of Boston's Large Project Review process, which allows the local community to weigh in on project design, including parking.

With local support for transit-oriented development, the project secured a parking ratio of .6 parking spaces per dwelling unit, a significant decrease from the typical 1.5 parking ratio for similar buildings in the area. With this lower parking ratio, the project team was able to keep all parking at grade, avoiding more costly multi-level or underground parking. Mindful of the site's prominent urban location, the design team reduced the visibility of the parking by wrapping the parking in small-footprint retail spaces and residential units.⁵⁹



Image Credit: Utile

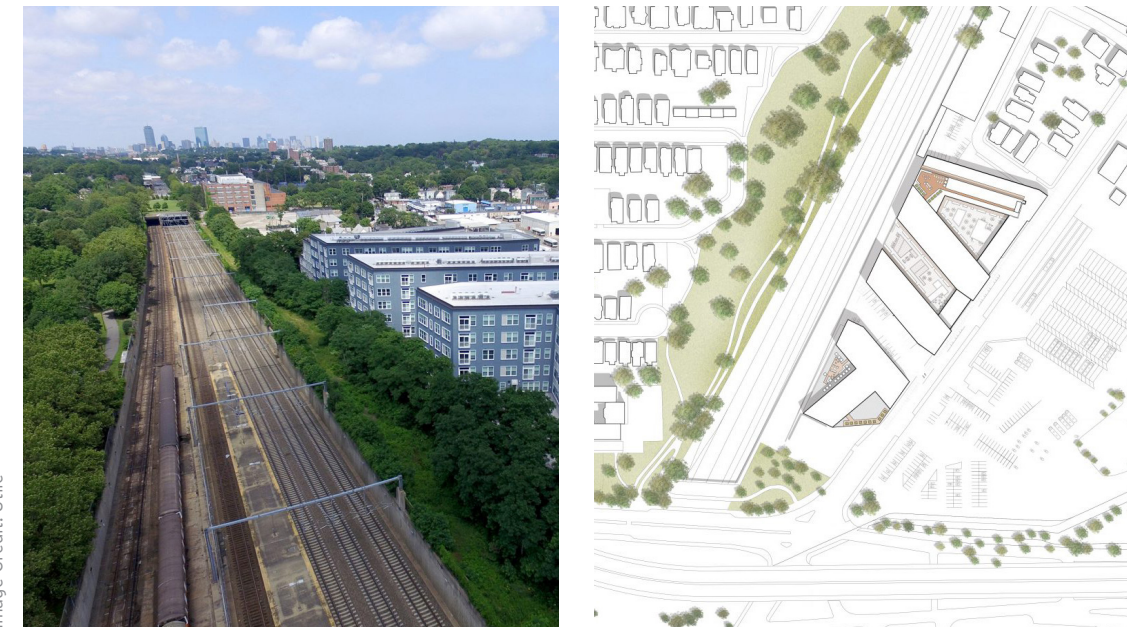


Image Credit: Utile

← Entrance and courtyard at Metromark in Boston. Aerial view of Metromark's location next to train line and site plan.

Hard Costs

Shell & Structure

Strategies

10 / Make a massing with a few big moves, rather than many small moves.

11 / Simplify facades, while still creating variation through materials.

12 / Let the structural grid guide plans and limit long-span spaces.

13 / Investigate new techniques and materials.

Structure and shell, the envelope of a building, which includes its exterior walls, windows and doors, represent 15-20 percent of costs. The cost of a building's structure varies significantly based on construction type, which is dictated by building height, code, soil type, and local construction market labor.

In all multifamily housing, the facade plays multiple roles that must be balanced in the design phase. The facade is the public identity of the building; it hints at life behind the windows. The facade brings in light and keeps out water. It is the biggest thermal barrier in a building, defining how air moves in and out of a building and driving spending on heating and cooling. As such, there are rarely excesses that can be removed from facade or structure to reduce costs. Instead, focusing on economy of form and selection of materials offer the greatest opportunities for balancing costs and performance objectives.

10 / Make a massing with a few big moves, rather than many small moves

Housing design guidelines often call for “engaging” facades, requiring a mix of materials or encouraging bays, small folds or other forms of layering to create variation. While the ambition behind these guidelines is valid, a highly manipulated facade can add length and creates corners where more thermal bridging can occur.

Guidelines can be more expansive in their definition of an “engaging” facade. Design teams can consider pairing simple, regular facades with a few big moves (a welcoming entrance, an angled exterior wall) in place of a series of small moves. Reducing the number of corners or folds in a facade reduces facade complexity and length, which, in turn, can help reduce costs.

Design Precedent

Focusing on the front facade in Brooklyn

At Navy Green in Brooklyn, Curtis+Ginsburg designed 97 units of supportive housing as part of a larger, 400+ unit, mixed-income redevelopment project led by L+M (market-rate developer) and IMPACCT (supportive housing developer). The big move—a double-height entry framed by a large canopy that projects out of the building—creates a clear and inviting entrance. Scattered portrait and landscape windows and different tones of red corrugated metal panels create variation on the otherwise flat facade. The project uses typical block and plank construction, but by rotating the blocks to be perpendicular to the street-facing facade the facade does not have to be load bearing and windows can be placed flexibly.⁶⁰



Image Credit: Kenny Polyak

← Exterior view of Navy Green in Brooklyn showing facade materials and double-height entry.

Designing the facade is a financial puzzle. We know the budget and we mix and match materials until we have the right amount of facade covered at the right pricepoint. Architect interview

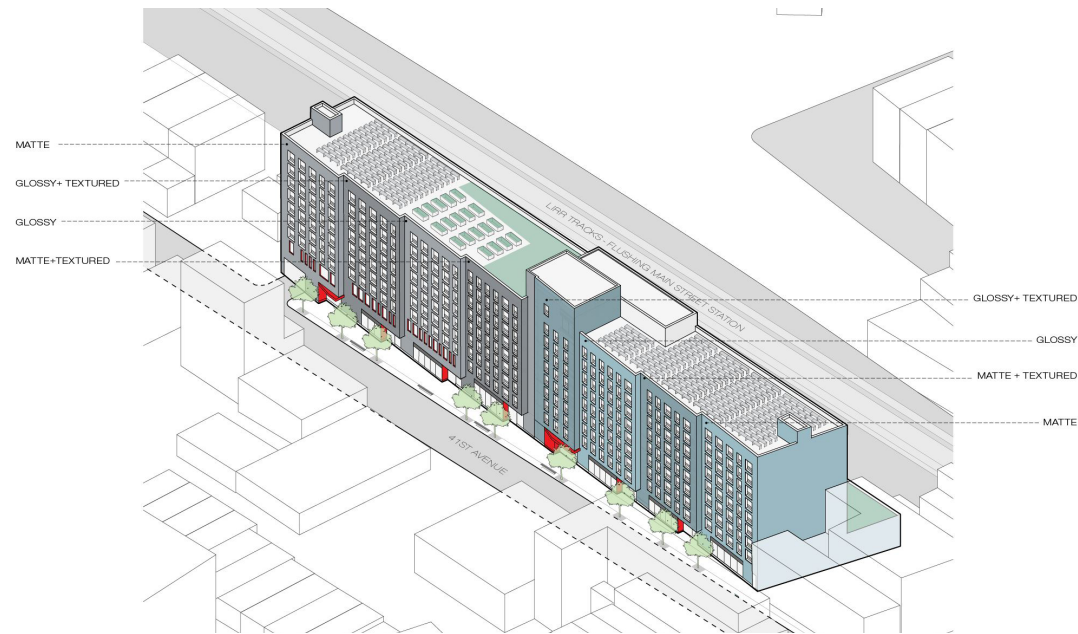


Image Credit: Bernheimer Architects

11 / Simplify facades, while still creating variation through materials

Facade materials need to be durable, visually appealing and support environmental objectives. For many projects, mixing higher and lower-cost facade materials can create dynamic facades that have an overall price that is feasible for the project budget. In some projects, materials not typically associated with residential construction, such as corrugated metals have created cost savings. In others, a lower-cost facade material is used for most of the facade, while the ground floor or another key element has a different material.

Design Precedent

Mixing materials for housing in Queens
 One Flushing, a 230-unit affordable housing project in Queens, developed by Monadnock, HANAC, and AAFE and designed by Bernheimer Architecture, divides a 400-foot long massing into a sawtooth of eight facades. Slight changes in brick tone and texture differentiate volumes and break up the facade. The sawtooth creates additional depth and space in units facing the facade, enabling a range of unit types (studio, one-, two- and three-bedroom units) on the street-facing facade.⁶¹



Image Credit: Frank Ouldeman (left), Bernheimer Architects (right)



← Plan, diagram and photos showing the use of different brick colors and textures on the facade of One Flushing.

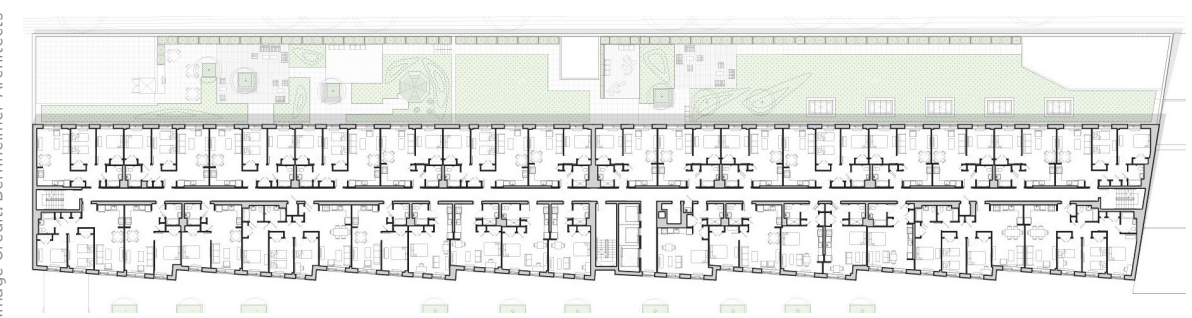


Image Credit: Bernheimer Architects

Floor plan showing use of efficient units to create overall massing (left). One bedroom unit plan showing structural grid (right).



Image Credit: Ankrom Moisan Architects (left), Walsh Construction Co. right

12 / Let the structural grid guide plans and limit long-span spaces

Regardless of facade materials, the structural system and its spacing will set the grid for window and entry layout if the facade structure is load-bearing. The grid dimensions will vary depending on the structural system—for example, block and plank or stud walls laid out with advanced framing—but in all systems the structural grid will dictate placement of walls, doors and windows. In particular, aligning windows so that loads can be transferred directly to the ground and limiting long-span spaces or cantilevers that require additional structure will limit cost increases.

**Design Precedent
Designing an efficient structural grid for unit layout**

REACH, Walsh Construction and Ankrom Moisan Architects worked together on a “Cost Efficient Design and Construction” initiative in which they optimized unit plans for efficiency and livability. As part of this initiative they laid out units on a 2’ structural grid that enabled advanced framing techniques. This approach to framing means that fewer materials are wasted as dimensions are calibrated to off-the-shelf components. Windows are placed in line with this 2’ structural module, minimizing framing materials, and units are stacked, allowing loads to be transferred directly to the foundation. The 2’ module also lends itself to producing floor plans that can be easily configured for the narrow truck beds used to transport modular units.⁶²

Image Credit: Waugh Thistelton



13 / Investigate new techniques and materials, such as off-site construction and CLT

Alternative timber products (cross laminated timber (CLT), dowel laminated timber (DLT), glulam etc.) are not yet widely used in the U.S., for multifamily housing. However, the 2021 version of the International Building Code is anticipated to permit the use of mass timber in taller buildings. Examples from other countries suggest that using alternative timber products could shorten construction timelines (because they allows for more prefabrication); reduce interior finish costs (because wood can double as structure and surface) and improve environmental performance (because timber stores CO₂ and can be harvested sustainably and locally). Given current costs, however, innovation in the market-rate housing sector may precede significant use of alternative timber products in affordable housing.⁶³

**Design Precedent
Experimenting with CLT modular in London**

Waugh Thistelton (architect) and Swan Housing (non-profit developer) are building Watts Grove, the UK’s first mid-rise CLT modular scheme, which is engineered in Swan Housing’s modular factory. The development, which is 100 percent affordable, includes 65 apartments that will be delivered to the site with kitchens, bathrooms, finishes and fittings. Construction time is anticipated to be 50 percent of a traditional construction process and costs are expected to 10 percent below a conventionally-built development.⁶⁴

← Exterior rendering and drawing showing CLT modules that will form Watts Grove, a 6-story apartment building in London.



Offsite construction promises big benefits: higher-quality construction, reduced timelines and lower costs. Yet, offsite construction for multifamily housing is not widespread. What is holding it back? And what will it take for it to be a compelling alternative?

The following questions and insights came up when discussing why developers, architects and contractors interviewed for this report have—and have not—used off-site construction methods, especially modular construction. Their experiences are not comprehensive, but they offer a sample of the challenges and opportunities of offsite construction, especially for affordable and middle-income housing.⁶⁵

What are the savings, really?

While modular companies promise construction cost decreases, many developers are less optimistic about realizing these savings, especially on their first few modular projects. Developers’ interest in modular typically stems from decreasing time and increasing quality, though several developers noted that even these benefits can be hard to achieve.

Is there are market in our region?

Offsite construction is a regional business and some regional markets are more developed than others. The transportation costs of moving modular a long distance can quickly eliminate any construction cost savings, so simply switching to another firm is not feasible. This challenge cuts both ways; a consistent stream of projects is necessary to sustain a modular builder in a region.



Image Credit: © brizmaker

← **Structural insulated panels (SIPs) are pre-fabricated panels that sandwich insulation and sheathing to form walls. SIPs are highly customizable and are an energy efficient alternative to onsite framing.**

What is offsite construction?
 Offsite construction includes both modular (three dimensional) and flat-packed (two dimensional) components that are fabricated offsite, transported by truck to site and erected on site. Offsite construction is not new (window units and doors have been assembled offsite for decades) and is widely used in other countries. Currently 15 percent of housing in Japan and 10 percent of housing in Germany utilizes offsite construction, compared with just 3 percent in the U.S. Other countries, such as Finland, Norway and Sweden have robust offsite construction industries with nearly half of housing produced offsite.⁶⁶



Image Credit: © Ilyaska

Do we have room for staging?

Off-site construction, especially modular, requires staging and space for a crane adjacent to the construction site, which can be challenging to come by in dense, urban settings. Several developers noted that flat-packed elements, such as SIPs (structural insulated panels), are easier to integrate into traditional onsite construction.

Does modular make sense for our unit mix?

Joining modular units is more complicated than simply stacking closed units. As such, building types that use discreet modules (such as SROs, studios, dorms or hotels) are particularly well-suited to modular construction. 1, 2- or 3-bedroom units can be constructed using modules; however, multiple modules must be combined to make these units. As a result, one side of the module must be open during transport and on-site interior connections must be made between modules.

Why is everything still custom?

Many developers noted that modular continues to be used as a “custom” rather than a standard solution. Rather than picking and choosing from a range of modular options, developers are working with architects to design the building before passing the drawings to a modular manufacturer who then redraws the project and determines how to fabricate it offsite.

Can we design so the unit can be built either onsite or offsite?

Without knowing whether modular or onsite construction will be cheaper, some design and development teams are pursuing a parallel modular / conventional design process in which they design a unit that could be built conventionally or fabricated off-site. This approach leads to additional work (and corresponding costs), but insulates developers from concerns about unpredictable modular providers. Many developers have witnessed closures of modular factories and are wary of proprietary modular designs that can only be built by an individual fabricator.

Is modular an efficient use of materials?

Double thickness floors, walls and ceilings are required to make the module, but are duplicative and may cut into interior room heights. Several fabricators are exploring modules that reduce duplication, but this is not standard for modular.

How will labor react?

Many developers are wary of offsite construction because they are concerned that construction trade unions will not look favorably on projects that shift some work to factory settings where workers either are not unionized or belong to other unions. Even in non-union projects, dividing scope between site work and offsite construction is new territory for most general contractors and subcontractors.



Image Credit: BRIDGE Housing



Image Credit: BRIDGE Housing

← BRIDGE Housing worked with Cannon Constructors, Guerdon Modular and Ankrom Moisan Architects to build 85 low-income senior apartments in San Leandro, California. The project used 109 modules, which were put in place by a crane (top image) to build the four-story building. Turning to modular allowed the team to compress the design and building permitting process, a significant benefit in the Bay Area region where project teams are contending with high labor and land costs.

Hard Costs

Interiors

Strategies

14 / Design unit layout and dimensions for flexibility and efficiency.

15 / Specify materials for health, durability and cost.

16 / Rotate and mirror to create variation with repetitive unit and building plans.

In small footprint units, making sure that the ceilings are the right height can go along way in making a generous, desirable space for living.
Architect interview

The unit plan is the foundation for an efficient residential building. Most projects leverage a set of standard unit plans to generate design and construction efficiencies. The ideas for unit efficiency are rarely ground-breaking, but, when deployed across a building, can have a significant effect. Small changes—reducing in-unit circulation space in favor of flexible space, sharing some apartment amenities in common areas, or creating healthier material specifications—can make more livable and efficient units.

Many developers also noted that interiors are often an area of short-sighted cost-cutting. Finishes, often the first item to get cut or downgraded, are a small part of overall project budgets. Downgrading these reduces durability and environmental quality without providing serious cost savings.

REACH, Walsh →
Construction and Ankrom Moisan built a full-scale mock-up of the revised unit to test dimensions and experience.



Image Credit: Walsh Construction Co.

14 / Design unit layout and dimensions for flexibility and efficiency

A series of small moves can combine to make more efficient units. Within units, areas that have multiple uses can replace space dedicated to circulation. Studios and one-bedroom units can be planned without entry halls or hallways. Spaces should be flexible; furniture, rather than walls, can be used to differentiate spaces. Kitchens and bathrooms can be as minimal as possible, provided they meet accessibility requirements. Doors and walls can be reserved for separating spaces that require privacy, such as bathrooms and bedrooms. When possible, the number of interior corners can be reduced to simplify framing.

Evaluating the amenities (e.g. laundry, storage space) provided in unit versus those shared by the whole development may also surface opportunities for reducing in-unit space. Conventions for affordable multifamily projects typically follow prevailing market norms, so what’s in and what’s out of the unit will be based on regional expectations and guidelines regarding minimum and maximum unit size. For example, having common rather than in-unit storage space can enable more transitional living; a resident aging in place may rent extra storage, while a group of young roommates may not need storage beyond basic apartment closets.

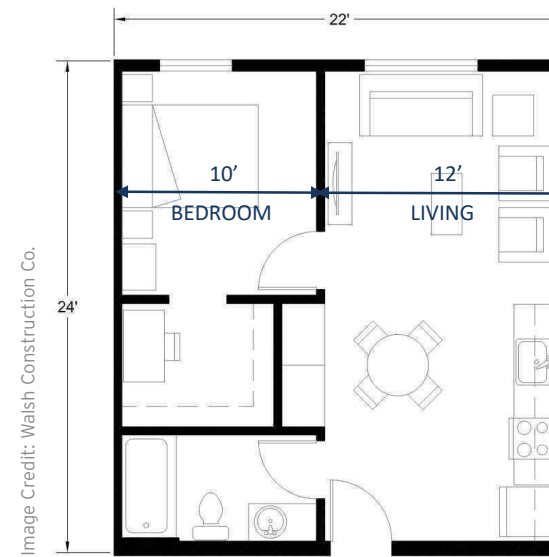
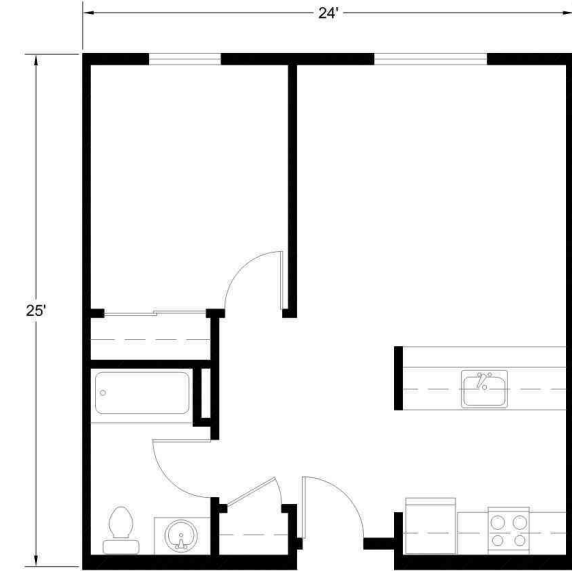


Image Credit: Walsh Construction Co.



← REACH, Walsh Construction and Ankrom Moisan revised the standard one bedroom unit (right) to make it more efficient (left) by adjusting the overall unit width and depth and reducing dedicated circulation space.

← **Design Precedent**

Making small changes to improve units

As part of REACH, Walsh Construction and Ankrom Moisan Architects “Cost Efficient Design and Construction Initiative,” the team tested a series of small unit changes through a full-scale unit mockup. One of the changes they tested was a change to unit dimensions. Making a small change to unit dimensions can reverberate across the building. For example, in a conventional double-loaded corridor building, adjusting the unit width by two feet reduces the per-unit facade area by ~20 square feet and the hallway space by ~10 square feet. With more efficient unit dimensions, the site can accommodate more units.⁶⁷

Design Precedent

Creating standard unit plans

The Southwest Minnesota Housing Partnership has pursued a strategy of “modular in design but not construction” as it develops a set of standard 1, 2, and 3 bedroom units. These units designs are being repeated in several buildings, giving the SWMHP and their partner design teams the ease of consistent specification and construction. A fully modular, off-site construction strategy would likely be cost prohibitive for SWMHP, so this approach affords them some benefits of repeat design at an affordable price.⁶⁸

15 / Specify materials for health, durability and cost

Architects specify hundreds of products for each project, balancing durability, health and cost considerations as they evaluate materials. Often, however, they rely on tried-and-true specifications, even if other healthier materials might have similar costs. As design teams evaluate the spatial efficiencies of their projects, they can also revise their standard specifications to adopt healthy materials at similar costs.

Many standard finishes have a healthier alternative at the same price point. If you can take the time to spec it once, it can become part of the standard repertoire for housing projects. Architect interview

Design Precedent

Selecting healthy materials in Minnesota

At Dublin Crossing, a 50-unit affordable workforce housing development in Mankato, Minnesota, CommonBond Communities worked with HomeFree, an initiative of the Healthy Building Network, to review and update their standard flooring, interior paint, countertops, cabinetry, doors, drywall and insulation specifications. They focused in particular on flooring, piloting a healthier linoleum product in common areas, and specifying materials with Health Product Declarations (a standard specification for reporting the contents and health information of building products). By testing out the flooring, the facilities team was able to gain experience with the new product and reduce the number of cleaning products used in their projects.⁶⁹



Image Credit: CommonBond Communities

← Kitchen and exterior of Dublin Crossing in Mankato, Minnesota.

Learning from healthy building resources. Living Building Challenge's "Declare Database" and the Healthy Building Network's Specification Guidelines are important resources evaluating the health impacts of different products used in residential buildings.

22nd and Main, → a proposed housing project in Louisville repeats the same building plan, rotating it to create a varied street front facade.



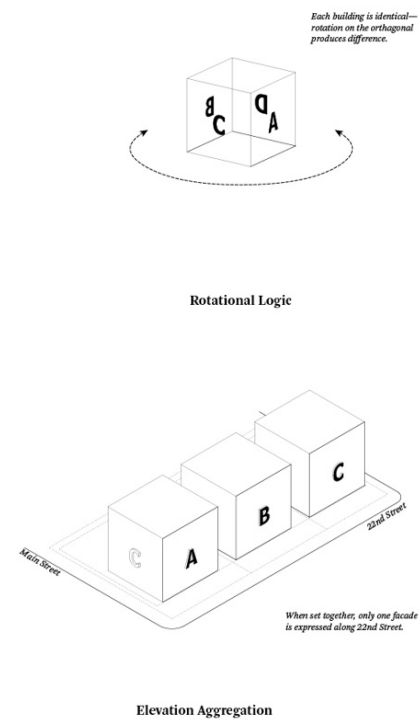
16 / Rotate and mirror to create variation with repetitive unit and building plans

Efficiency can also be generated through the reuse of designs. Repetition, rotation and mirroring can be used at the building or unit scale to create variation without adding new designs and corresponding costs.

Design Precedent

Rotate & repeat to create variation

For a proposed multifamily housing project in Louisville, Kentucky, OJT Architects designed a single four-unit building that they rotated and repeated three times to form the overall development. Combined, the buildings produced a distinct face on each side of the block, while providing the benefits of a standard drawing set and repeated construction process. They deployed a similar tactic in their veterans housing project in New Orleans, repeating and rotating three floor plans and two different building types to create a varied site plan.⁷⁰



← Bastion is a 100-unit mixed-use housing development in New Orleans serving veterans. A set of standard rectangular homes with asymmetrical pitched roofs and front porches are scattered across the site, creating a varied complex while using a limited set of building designs.



Hard Costs Services

Strategies

17 / Stack, standardize and simplify: conveying, kitchens and bathrooms.

18 / Invest upfront in building energy and water performance to encourage long-term savings.

All of the decisions on building systems have to be made together because they bear on each other. Figuring out the puzzle, especially with high-performance buildings is the challenge. Contractor interview

Elevators, mechanical, electrical and plumbing services are among the most costly elements of a multifamily building. Common practices of stacking and standardizing plumbing and designing buildings that need fewer elevators can reduce costs. Ultimately though, selecting systems always requires a tradeoff between cost, quality and environmental performance; the challenge is finding an appropriate set of systems given project costs and priorities.

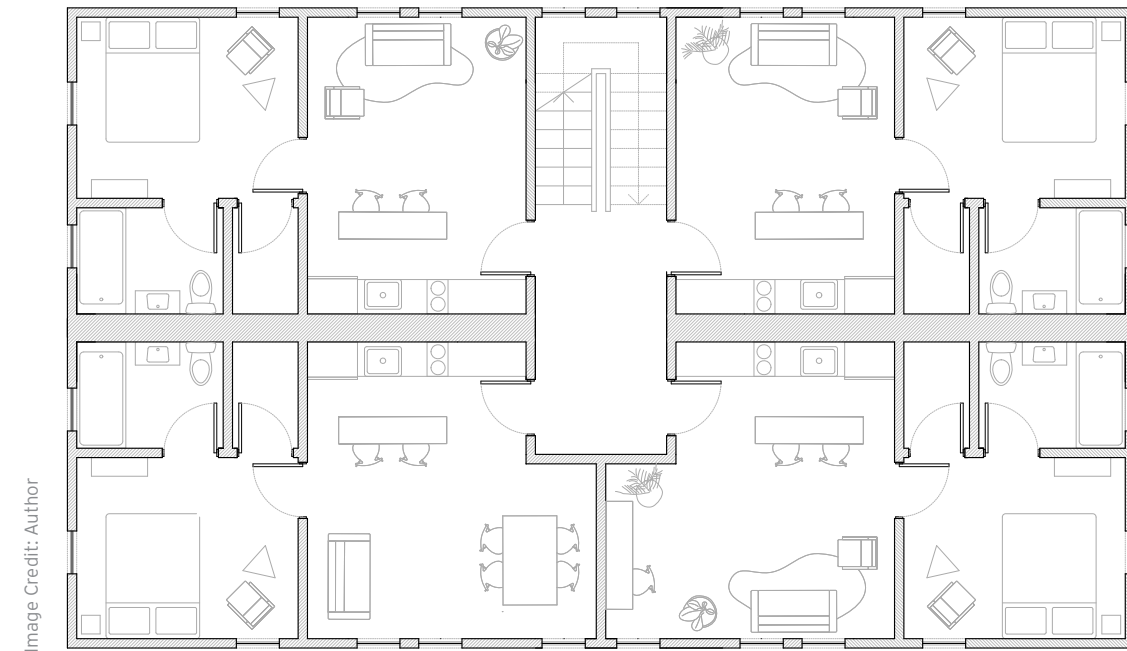
The implication of these choices extends beyond initial capital costs, influencing tenant health, quality of life, operating costs and tenant utility costs. Spurred by mission, regulatory incentives (particularly in state Qualified Action Plans used to allocate Low Income Housing Tax Credits) and rating programs (such as LEED, Passive House or Living Building Challenge), many multifamily housing developers are pursuing green building performance standards that cost more upfront, but have potential to reduce long-term operating costs.

**17 / Stack, standardize and simplify:
conveying, kitchens and bathrooms.**

While not groundbreaking, adhering to basic best practices for plumbing and conveying layout can help to control costs. When designing a unit, stacking “wet” (kitchens and bathrooms) walls vertically and placing them back to back reduces plumbing complexity and cost.

Elevators are dictated by code and are a significant line item on the project budget. As such, understanding the point at which an elevator is required (typically above 3 stories and over 12 units) is important. In many cases, the benefits of building a larger project with elevators will outweigh the costs of the elevators, but in some low-density small projects it may be possible to reduce or eliminate elevators, while still creating an accessible building.

Some smaller buildings, such as townhouses, or single-stair buildings, can be built without elevators. For example, in a single-stair building, four units surround a single, central stair. Ground floor units are accessible and there are no more than three floors, enabling a 12-unit building where most of the space is dedicated to living, rather than circulation.



← Floor plan for a single stair building, showing four one-bedroom units around a central stair and landing.

We're good at building really tight buildings; we're not as good at operating them. Developer interview

18 / Invest upfront in energy and water systems to encourage long-term savings

As both developers and operators, many affordable housing non-profits are interested in making upfront investments in high-performance envelopes, HVAC and plumbing systems that have potential to reduce long-term operating costs. Additionally, state affordable housing programs often encourage investments in energy performance through the scoring systems used to allocate LIHTC.⁷¹ However, data on both the initial cost premium of higher-performance buildings and the long-term cost savings of these investments is limited and is usually case-by-case, making it challenging for developers to make the case for upfront investment.

The cost increase attributable to using higher-performance systems ranges; several developers estimated a cost premium of 3-5 percent for high-performance projects. Some of this premium is for materials, but some of it is for consultant fees for studies and certifications needed to build higher-performance buildings. Additionally, while many developers track building performance after occupancy, performance data needs to be paired with education programs for both facility managers and residents as they adjust to the new requirements of living in these buildings.

We need to make sure the walls are installed correctly. Doing the basics right will go a long way for overall building performance. Architect interview

Design Precedent

Building high-performance housing and tracking progress in Minneapolis.

Aeon's The Rose in Minneapolis was the first multifamily affordable housing development to pursue Living Building Challenge (LBC) when it registered for LBC in 2011. The Rose's project team at Aeon and MSRDesign focused on improving energy performance, reducing water use and using healthy materials. The team has been tracking performance of the 90-unit building since occupancy to compare actual performance to estimated performance during the LBC process.

Energy use is half of the code-mandated levels, but is not as low as modeling predicted. In part this is attributable to a complicated HVAC system and the challenges of tenant education about living in green buildings, given that it is a rental property with turnover. The project has, however, come close to achieving its water use targets which are less than half of comparable multifamily projects in the region. The successes and challenges of the Rose affirm both the potential for savings and the increased knowledge needed to successfully operate (and live in) high-performance buildings.⁷²



Image Credit: Google Maps

← Exterior view of the Rose, a Living Building Challenge certified housing project in Minneapolis.

Conclusion



Photo Credit: Andrea Calo for Foundation Communities

While there are no silver bullets for addressing costs in multifamily construction, certain ideas came up repeatedly in the 30+ interviews that form the foundation of this report. These insights do not fit neatly in a single part of the budget, but rather reflect the type of team needed to deliver high-quality, environmentally-responsible, affordable multifamily projects.

Get the whole team on board. Bringing a project team together at the outset of a project to affirm goals of quality of life, environmental performance and affordability can help ensure that the team keeps these priorities in mind as they deal with the issues and pressures that emerge as projects evolve.

Reduce time. The sentiment that “time is money” echoed through the interviews. Decisions to save time, whether through repeated collaboration with trusted partners or partial off-site fabrication, are often among the most powerful ways to reduce cost without compromising quality.

Anticipate the unknowns. Many interviewees encouraged careful spending early in a project to reduce (often costly) errors later in construction. For example, additional geotechnical analysis or third-party plan review came up as areas where early spending lets teams anticipate future issues.

Work at scale. There are nearly as many components to design and specify in a 20-unit building as there are in a 100-unit building and many of the costs to operate these buildings are fixed, regardless of the number of units. Consequently, finding the optimal building size given the local market and developer/operator’s capacity, is critical to spending efficiently.

Start with the unit. Building efficiency begins with the unit. Getting the dimensions right in the unit creates efficiencies throughout the building and improves quality of life for residents.

Decide what’s custom and what’s standard. Identify the signature elements of a project, whether an entryway or an energy system, and prioritize these elements as the design gets refined.

Reduce structured parking. When possible, reducing structured parking is one of the most powerful levers for reducing costs. The opportunity to reduce parking, of course, is only relevant in certain markets, but parking requirements should be a top advocacy issue for multifamily developers.

Repeat, revise and share. Finally, for project teams working on affordable and multifamily housing, encouraging information sharing is critical to reducing costs and advocating for important policy changes, particularly on topics of energy and environmental performance.

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