Production-Built Homes: The Cost Advantages of Smart Growth
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Introduction

This white paper compares the cost efficiencies of housing components, construction and design techniques, and other construction issues that apply to production-built, single-family, detached housing units in smart growth communities (also called traditional neighborhood development or TND) and conventional suburban development (CSD). The findings are provided in a comparative context with respect to cost efficiencies for those production builders considering building in smart growth communities.

There is a perception that smart growth houses cost more to build than conventional suburban houses. This is inaccurate because the comparison is often between a custom-built house in a TND and a production-built house in a CSD. This paper is a comparison between production-built houses—smart growth houses on the one hand, conventional suburban houses on the other.[1] The starting premise for the analysis is that when production building techniques are used (i.e., stock plans, stock materials, stock components, etc.), the two types of houses should cost roughly the same. This paper then takes a more detailed look at the construction elements in each type of house, from foundation to finishings, and describes cost efficiencies found in each type. Differences emerge in this more detailed view. The overall analysis finds that smart growth houses are either cost neutral or more cost efficient than conventional suburban houses when the elements that influence construction costs are examined closely. The primary difference in cost efficiency between the two house types is found in their overall design.

Based on interviews and discussions with architects, builders, engineers, and developers, the study identifies the various components and techniques of home building in the two types of developments that can be compared, and attempts to help production builders better understand the differences between the two approaches, including cost issues. While almost all of the design and construction techniques are either cost neutral or more cost efficient in favor of the smart growth house, materials and labor costs will vary from market to market. In the end, the intent of this paper is to give production builders a starting point for the comparisons they will need to make their own business decisions.

This paper will not address other elements that play a role in building and selling homes in a subdivision or neighborhood, such as labor costs, materials costs, the how and why of the neighborhood design elements (e.g., street widths, creating a center, building orientation), infrastructure costs, phasing the project, and marketing. Other issues such as the entitlement process, community visioning, and zoning are not part of this project. The paper is limited to the mechanics and process of production-built housing in order to help

[1] For those unfamiliar with examples of production-built smart growth houses, sample marketing sheets are found in the appendix.

production builders understand how and where they might gain a competitive advantage in their market by introducing smart growth products into their business line.

Definitions of terms

A house in a master-planned, smart growth community is defined for this paper as a detached, single-family dwelling unit located in a traditional neighborhood development (TND). A traditional neighborhood development typically includes a variety of housing types (e.g., detached and attached houses on varying lot sizes, for-sale and rental property) often on the same street and block. A mix of nonresidential uses, such as retail, office, and other commercial and civic buildings, is also included in these developments. Additionally, open space amenities such as parks, plazas, squares, trails, and other outdoor recreational space are provided. Housing units, nonresidential buildings, and open spaces are placed on a network of interconnected streets and blocks arranged around the geographic or commercial center of the project. Streets are narrow and provide on-street parking, and blocks are small and often provide an alley down the center to access rear-loaded garages. A TND typically connects to the neighborhoods that border it, if they exist.

A smart growth house is typically simple in design, often has its narrow side facing the street, is placed on a small lot,[2] and may include a side- or alley-loaded garage. Front-loaded garages are less common; when they do appear, they are usually recessed from the front side of the home. Smart growth houses are not meant to be "islands" within a subdivision, delivering curb appeal on their individual merits. Rather, each unit is viewed as a piece of the whole that contributes to the overall design of the street and neighborhood—as is the case in many traditional neighborhoods across the United States.

A house in a master-planned suburban community is defined for this paper as a detached, single-family dwelling unit located in a conventional suburban development (CSD). A conventional suburban development includes housing and may include retail, other commercial and civic uses, and active and passive green spaces. A mix of housing types is usually offered; these are separated from one another based on size and price point and arranged in subdivisions of pods on cul-de-sacs and looped streets. Residential uses and nonresidential uses are separated from each other. Nonresidential uses, when provided, are separate from the residential program, and often further separated according to each commercial use by roads, parking, or green-space buffers. Streets are wide and do not offer on-street parking. Cul-de-sac streets and looped streets are placed on large blocks, often linked to arterial roads by collector roads.

A conventional suburban house is often complex in its exterior design and rooflines (multiple rooflines are common), horizontally scaled (wider and shallower), placed on a larger lot than its smart growth counterpart (typically +/- 20,000 square feet[3]), and usually includes a front-loaded garage. A conventional house's exterior complexity exists in part to

[2] Ford, Jonathan, and William Gietema, Jr**., "**A Comparative Analysis of Infrastructure Costs in Smart Growth and Conventional Suburban Communities**,"** Jan. 31, 2007. http://www.epa.gov/smartgrowth/sg_business.htm

[3] *Ibid*.

draw the eye away from the front-loading garage doors and create curb appeal. CSD houses are generally designed to be viewed and judged (and sold) individually, based on their specific features, both interior and exterior.

Housing components comparison: the production builder context

Production builders erect houses in large volumes by using stock plans, standard materials, and standard components like doors and windows. This repetition of a limited number of models allows for streamlined construction processes. Economies of scale and cost savings can be reached in the purchasing of materials, components, and scheduling trade contractors.[4] From a vertical construction perspective, this method is applicable to both smart growth and conventional suburban housing units.

The remainder of this paper discusses some of the key elements of home construction, design, construction process, and technique that factor into a production builder's system for building a smart growth house and a conventional suburban house. This paper's analysis begins with the footprint; moves to design factors, components, and materials used in construction; and ends with factors such as porches versus decks, garages, and setbacks. For each comparison there is a general discussion of how the design characteristic or construction technique is used in each house type, followed by a conclusion that outlines the differences between the two and how these differences could affect construction costs.

1. *Site planning*

Conventional Suburban House

Currently, most code and zoning variances present few or no hurdles for a conventional suburban production builder. Lot layout, utility configuration, hookups, and engineering needs are usually a "known quantity" (i.e., most production builders have built in this format for years); there are fewer surprises—and, therefore, fewer unforeseen expenditures—at this stage. Site-specific challenges, such as trees or topography, can be removed to create a "clean slate" on which to plan and develop.

This is not to say that conventional suburban development is an entirely simple affair. Significant hurdles exist that can make it quite difficult to get a suburban master-planned community approved. Large CSD master-planned communities can require neighborhood approvals and proffers, impact fees, new schools, variances or some rezoning, and environmental and/or economic impact reports.

Smart Growth House

The traditional neighborhood development site and its interaction with the house require more thought and attention during its planning phase. Planning typically puts more care

[4] See the discussion of production builders in Witold Rybczynski, *Last Harvest: How a Cornfield Became New Daleville*, Scribner: New York, 2007, pp. 171-173 and 201-202.

into the consideration of lot layout, utility configuration, hookups, alley placement, and engineering needs, on a lot-by-lot basis. Because of the extra time spent in planning, additional costs usually are incurred, primarily in the form of extra planning time and time spent securing code or zoning variances as required by the municipality.[5]

Conclusion

√ **Site planning: Cost efficiency for the conventional suburban house**

Due to the current state of subdivision ordinances and other development regulations at the local level, site planning usually is more cost efficient for a CSD house.

2. *Footprint size and configuration*

Conventional Suburban House

Typically, conventional suburban houses are one story. A larger, single-family, detached, conventional house will generally have a larger footprint and require a wider lot with more attendant infrastructure costs attributable to the unit itself.[6] Most conventional houses have front-loaded garages. In an effort to downplay the large garage door(s), many conventional house designs include extra bump-outs, bays, corners, etc., to create visual interest. The corresponding irregular footprint costs more to build than a simple square or rectangle shape. Further, the larger a house's footprint, the more complicated and complex it is due to reinforcing and technical issues that exist.

Smart Growth House

Relative to conventional suburban houses, more smart growth houses are two stories. Where this happens, smart growth houses of equal square footage to conventional houses will incur lower costs during the excavation and foundation phases of construction, because the footprint and foundation are smaller. Square footage is gained by building up rather than out. It follows, then, that the foundation or slab for a two-story house does not cost as much as the foundation or slab for a one-story house.[7] By extension, two-story houses also carry lower roofing costs because the under-roof square footage is stacked beneath the roof, rather than spread out in one level beneath it.

Conclusion

√ **Footprint size and configuration: Cost efficiency for the smart growth house**

[5] Author interview with Kevin Klinkenberg, July 12, 2007.
[6] A more in-depth examination of infrastructure costs in TNDs and CSDs can be found in "Smart Growth Infrastructure Cost Comparison," Jonathan Ford, P.E., and William Gietema, Jr., Jan. 31, 2007.
[7] Author interviews with Kevin Klinkenberg, *op. cit.*; John R. Anderson, May 5, 2007; and Caron Looney, August 30, 2007.

The smart growth house footprint size and configuration usually are more cost efficient than the conventional house. Smart growth houses are more likely to have second stories, and the footprint can be as much as half the size of a conventional suburban house with the same square footage.

3. *Foundation*[8]

Conventional Suburban House

A monolithic slab—a simple concrete pad—is the least costly foundation currently available in any conventional suburban house. But in parts of the United States with any significant topography, the building site must be graded flat in order to pour a slab; this adds to overall costs.[9] In addition, conventional suburban houses may incorporate poured-in-place, stem-wall foundations.

Smart Growth House

The monolithic slab is used on lots in TNDs, but it is used less often because the slab does not allow the builder to efficiently raise the first floor off the ground. In TNDs, where a sense of community is promoted by placing the homes' entrances close to the sidewalk and street and efficiencies are realized with smaller lots, it is important to raise a home's first floor off the ground by 18 inches to two feet. This elevation gives the resident more privacy by separating the first floor of the home from the street grade.

Conclusion

- √ **Slab foundations: Cost efficiency for the smart growth house**
- √ **Stem-wall foundation: Cost-neutral element**

In general, foundation costs are neutral across the two housing types. A monolithic slab is the cheapest foundation currently available to production builders. Grade changes in topography usually add cost to slab construction. Slabs require more grading than a stem-wall foundation. This would be the case in either a CSD or TND. The size of the foundation affects costs. Generally speaking, conventional houses are single story and the foundations are larger. Smart growth houses are often two stories, which can allow the foundation to be as much as half the size of a similarly sized, single-story, conventional house.

Stem-wall foundations—i.e., poured-in-place foundation walls—use more material to construct and are more costly than slab foundations. As discussed above, stem-wall foundations are used in both conventional and smart growth houses. If a builder is saving

[8] There are many issues that determine which type of foundation a builder will use—geography, home design, soil type, topography, and water table, to mention a few. This section is a summary conclusion of the two different types of foundations.

[9] Klinkenberg, Kevin, *op.cit.*; Looney, Carson, *op. cit.*

money on foundation construction because a smart growth house is two stories (allowing the foundation to be half the size), some of the savings can be invested in a stem wall foundation.

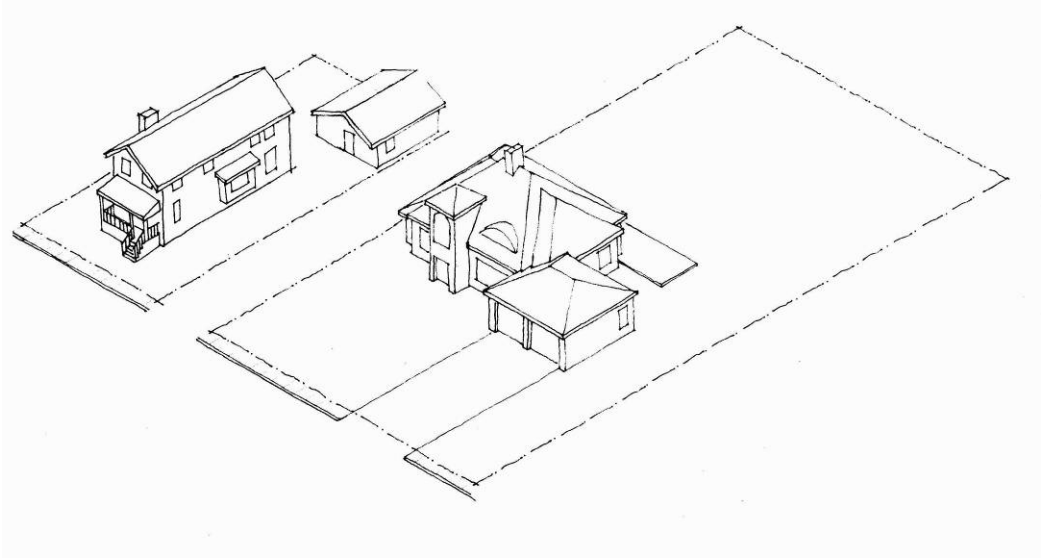

Figure 1: *Two sketches of production-built houses: a two-story unit and lot typical of a house in a smart growth community (left) and a one-story unit and lot typical of a house in a conventional suburban community (right). Both houses, each to scale, comprise approximately 2,000 square feet of living space and have two-car garages. (Illustration: U.S. EPA)*

4. *Exterior corners and roof pitches*

Conventional Suburban House

One popular design strategy for CSD houses is to draw attention away from a front-loaded garage with multiple rooflines, steep roof pitches, bump-outs, and/or large, eye-catching entry features (see Figures 1 and 2). Each exterior corner increases labor and material costs. Angles created by roof pitch and wall intersections increase costs; curved foyers and other similar entry features also add to the bottom line. These features and their costs create a ripple effect that often influences the foundation design and its cost. In addition, the typical wide CSD house requires longer roof trusses, adding to the cost of the roof component.[10]

Smart Growth House

Smart growth houses are generally simple in exterior design, with fewer added design features like bump-outs and multiple roof lines (see Figures 1 and 2). A simple, well-proportioned exterior design adds to the community's streetscape, rather than seeking to make an individual design statement. The form is usually straightforward—square or rectangular—and roof lines are uncomplicated with less dramatic roof pitches. And again,

[10] Looney, Carson, *op. cit.*; Anderson, R. John, *op. cit.*

a two-story smart growth house with the same square footage as a one-story conventional house will incur lower costs in roof trusses because the spans are smaller.[11]

Conclusion

√ **Exterior corners: Cost efficiency for the smart growth house**
√ **Roof pitches: Cost-neutral element**

Because of design differences, construction components such as corners and roof spans are more cost efficient in the smart growth house than in the conventional suburban house.

Roof *pitches*, however, are arguably more cost-neutral. Generally, costs increase with steeper roof pitches.[12] The roof pitch in any particular house will depend on the particular design the production builder chooses to use.

5. *Windows and doors*

Conventional Suburban House

Although the builders of production-built conventional houses often use standard-size, factory-built windows, they also are likely to include nonstandard windows to increase "curb appeal," which helps to sell an individual house. Oversized or complex window configurations are used to admit additional light or increase views and to balance the façade with the large garage door that is a common feature of a conventional house. If nonstandard windows are used, in addition to product costs, delivery delays and installation challenges can become factors that can add to a production builder's costs.

Smart Growth House

Typically, a smart growth house design calls for simpler, vertically scaled windows that often are available as standard models. The idea of "curb appeal" is based not so much on the appearance of individual houses, but rather how the form and siting of many houses work together as building blocks to create an appealing streetscape.

Because of this simplified approach, custom windows are chosen less often. This can lead to a generally lower cost of windows for a production-built, smart growth house.

Conclusion

√ **Windows: cost efficiency for the smart growth house**
√ **Doors: cost-neutral element**

[11] Klinkenberg, Kevin, *op. cit.*; Looney, Carson, *op. cit.*; and author interview with Tim Busse, September 9, 2007.
[12] Busse, Tim, *op. cit.*; Klinkenberg, Kevin, *op. cit.*

Generally speaking, any house-construction component that can be purchased as a standard model will save money. Interviews with builders and architects suggested that smart growth houses are more apt to use standard-model components than conventional houses; therefore, windows for a smart growth house will usually be more cost effective. It should also be noted that the term "standard model" is given to any window model that a window manufacturer has in its "published and priced" window line. If a production builder orders enough units of a new or custom window design, the manufacturer may choose to include that window in its regular production schedule; hence, it would become a standard model and the price per unit would likely decrease, due to efficiencies gained by its joining the regular production schedule.

The point here is that the window manufacturer decides what a "standard" model is; the term has nothing to do with how many units a production builder orders in a year. In the end, if a builder is able to buy in bulk, the unit prices, even on "nonstandard" windows, may drop.

Doors appear to be cost neutral in smart growth and conventional comparisons, although some builders have insisted that doors tend to be more costly in a conventional house because these houses usually have grander entrances (e.g., double doors, transoms) to mitigate the impact of the front-loaded garages; those entrances, subsequently, often include more elaborate and costly front doors. With these exceptions, an appropriately scaled front door is usually included in both housing types, as are other exterior and interior doors.

6. *Ceiling heights*

Conventional Suburban House

Production-built conventional houses can have ceilings in excess of 8 feet. It is not uncommon for conventional houses to include a two-story entry foyer. A two-story foyer can add framing and gypsum board costs for the production builder. This design element requires additional scaffolding, increased labor to accommodate more complex framing, and material and labor increases to cut gypsum board sheets to the appropriate lengths.

Smart Growth House

Traditional design tends to promote taller ceiling heights to emphasize vertical proportions, but is more often than not designed without two-story entries. More and more, architectural firms are designing smart growth homes with 9-foot standard ceiling heights. Ceilings of this height—or any "nonstandard" height—would add to gypsum board material and labor costs, since the sheets would need to be cut to accommodate a 9-foot-high wall. These costs would approximate the additional costs of a two-story foyer and living room in a conventional house. In addition, gypsum board is becoming increasingly available to production builders in a variety of dimensions.[13]

[13] Looney, Carson, *op. cit.*

Conclusion

√ **Ceiling heights: Cost efficiency for the smart growth house**

While ceiling height *can* be a cost-neutral design element, two-story entry foyers are more common in conventional houses, making it a significant cost factor. Smart growth houses usually aren't saddled with this extra cost. Production builders might consider analyzing the actual cost of their ceiling heights, as well as the design philosophy used to justify them. Cost efficiencies might be gained by scaling back the height of, say, an entry, and creating that "wow" factor through other design techniques.

It should be noted that gypsum board manufacturers now provide their product in 4-feet by 8-, 9-, or 12-feet dimensions, which makes a 9-foot ceiling's total cost very close to that of an 8-foot ceiling.

7. *Decks and porches, and exterior details*

Conventional Suburban House

Decks are more often associated with conventional suburban houses. Decks, like porches, vary widely in size, configuration (e.g., built-in seating, number of staircases), materials, and elevation (e.g., some are stepped or raised to conform to topography). Building a deck is typically less expensive than building a front porch.

Smart Growth House

Porches have been more closely associated with smart growth houses than with conventional houses. With a front porch, the smart growth house will incur more costs than a similarly sized conventional house due to additional materials and labor costs. Front-entry elements such as stoops, entry porches, full-width porches, and wraparound porches can fluctuate widely, with many choices and costs associated with them. Porches are popular features in TNDs, but they are not an inherent or a required component necessary to the construction of a smart growth house. Porches are valuable in some streetscapes and locations and have value if they're usable rather than simply decorative. Indeed, some remodeling strategies encourage adding a front porch to increase a home's resale value, stating it will recoup 90 percent of its initial cost.[14]

Conclusion

√ **Decks and porches, and exterior details: Cost-neutral element**

Exterior details such as keystones, trim, and shutters are cost neutral. They can be included in both conventional and smart growth houses—neither holds claim to any specific architectural ornament—with little cost variation between the two. If a builder chooses to

[14] DeZube, Dona, "Top 15 Home Updates," undated, HGTV.com, accessed December 11, 2007. http://www.hgtv.com/home-improvement/top-15-home-updates/index.html

include any of these features, that builder will pay the local market rate for the materials and labor. The cost difference arises when materials and execution are factors. For example, an 8-foot-deep porch with stone column supports and accurately executed capitals will cost more in materials and labor than a 5-foot-deep porch with painted, 4-inch by 4-inch columns, whether this porch is attached to a smart growth or a conventional house.[15] However, decks, like porches, are add-ons and not an inherent component of the production-built house. Therefore, these features are cost neutral.

8. *Quality of materials and finishes*

Discussion and conclusions

√ Quality of materials and finishes: cost-neutral element

Quality of materials and finishes can add to or subtract from construction costs, but neither are specifically inherent to either conventional suburban houses or smart growth houses. Builder upgrades and incentives for the exterior and interior of a house, whether conventional or smart growth, often are added by builders in response to local market knowledge about buyer tastes and preferences. The costs for these upgrades are real, but they are not necessary components of production-built houses, conventional or smart growth.[16] Builders also may offer buyer incentives, again based on market conditions. Buyer upgrades are typically net-positive transactions for builders.

Another cost factor related to the quality of the materials and finishing associated with certain production units relates to the marketing and branding of the community. A project's master developer may require builders to adhere to design guidelines and materials specifications. These requirements will vary by community and project and are not inherent to the basic construction of a conventional or smart growth house.

Often, cost efficiencies can be gained by offering several different elevations with a single floor plan. Both conventional and smart growth houses take advantage of this strategy, but the general consensus is that the elevations in conventional house plans get changed but usually don't look significantly different from one another.[17] Smart growth houses typically offer fewer floor plans with a greater variety of front-elevation options.[18]

Here, the comparison moves into the realm of perceived value. Production builders—whether involved with smart growth or conventional home construction—can create cost efficiencies by designing one floor plan and tweaking the front elevation design repeatedly to create four, six, ten, or more "different" models. In this regard, the topic is cost neutral. There is no rule or custom that says conventional or smart growth home builders need five, ten, or 20 iterative front-elevation plans, nor is there evidence that such varieties have higher associated costs. The number of plans is a market-based decision based on the

[15] Klinkenberg, Kevin, *op. cit.*; Busse, Tim *op. cit.*; Looney, Carson *op. cit.*; Anderson, R. John, *op. cit.*
[16] Anderson, R. John *op. cit.*; Klinkenberg, Kevin, *op. cit.*
[17] Klinkenberg, Kevin, *op. cit.*
[18] Looney, Carson, *op. cit.*

builder's clientele or the master developer's design guidelines. The associated cost is not built into the base model of a house.

9. *360º architecture versus 90º architecture*

Conventional Suburban House

At issue here is the practice of "360º architecture" versus "90º architecture"—that is, whether a house's exterior trim, shutters, and cladding are equally executed on all sides. Conventional houses are more likely to be dressed up on their front elevations with high-quality cladding, such as brick, then finished on their remaining sides with a lower-quality product. Aside from the aesthetic drawbacks to this approach, it is certainly true that a conventional house with such an exterior finish would cost less to build than one with brick—or even fiber-cement siding—on all four elevations.[19]

Another issue is the adaptation of a stock plan to conform to corner lots. CSD subdivisions typically have fewer corner lots, so production builders' plan inventories are typically skewed toward non-corner-lot house plans.[20] When a corner lot appears in a conventional subdivision, the builder must change the plan so that more windows are on the street side, because two elevations must have visual interest. This takes time and money to accomplish.

Smart Growth House

The ideal approach would be to choose an exterior cladding material that complements the house's architecture—cedar or fiber-cement lap siding is an acceptable choice for most Craftsman-style houses, for example—and install it on all four façades. More often than not, this will make the costs for exterior cladding slightly higher for a smart growth house compared to a similarly sized conventional house. For production builders, however, the stock plan will not require the highest quality finishing for all sides of the house. While it may be ideal to have the highest quality finishing on all four sides, it is not necessary for a smart growth house.

TNDs have more blocks with corner lots than CSD developments. To account for the frequency of corner lots, stock plans for production-built smart growth houses provide a 360º design. The builder still must address the issue of cladding.

Conclusion:

√ 360º architecture versus 90º architecture: Cost-neutral element

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[19] Klinkenberg, Kevin, *op. cit.*; Looney, Carson, *op. cit.*

[20] Many standard, production-built houses are designed with the intent of having one side face the street. In *Last Harvest*, Rybczynski noted the difficulty one national builder had in adapting its standard plan on a corner lot where two sides of the house faced the street; see Rybczynski, pp. 200-201. TNDs typically have more corner lots than typical CSDs. See Ford, *op. cit.*

In the final measure, this is another element that is usually cost neutral to both smart growth and conventional houses. Although 360º architecture is ideal in TNDs, it is hardly the standard. Several well-executed TNDs, such as King Farm and Lakelands in Maryland, do not strictly follow the 360º strategy; some high-end, production CSD subdivisions do follow it. In many respects, these decisions are market based, affected by buyer upgrades, market expectation of a builder's clientele, or the master developer's design standards governing the master-planned community.

10. *Interiors*

Discussion and conclusions

√ Interiors: Cost-neutral element

Many of the same considerations for house exteriors carry into the interiors. Neither smart growth nor conventional houses have cornered the market on quality or material choices; this is a cost-neutral category and is based on how much an individual builder wants to invest during the construction phase. Interiors are a matter of upgrades and customer choice, regardless of housing type.[21]

11. *Garage configuration*

Figure 2: *Drawn to scale, this elevation of street frontage shows how smart growth (left) and conventional suburban (right) housing prototypes address their respective garages and streetscapes. (Illustration: U.S. EPA)*

Conventional Suburban House

Since conventional houses typically prioritize the automobile, front-loaded garages (see Figure 2.) are the rule rather than the exception. The garage is usually either flush with or extended forward from the front edge of the house. This requires a driveway of some length to the street. Depending on the setback of the house, the driveway cost can be significant. Driveway width must also be factored in: Depending on the number of garage bays, the width of the driveway could be substantial. This additional cost can trickle down to curb and sidewalk costs, which can be passed from the land developer to the builder and finally to the home buyer. When sidewalks are not included, money is saved in hard costs

[21] Klinkenberg, Kevin, *op. cit.*

while negatively affecting quality of life and even property values by removing an amenity.

Smart Growth House

Since smart growth houses typically accommodate—rather than prioritize—the automobile, their garages are usually side or alley loaded (see Figures 1, 2, and 3). When topography or property boundaries "force" a front-loaded garage, it is usually recessed from the front edge of the house (a 20-foot recession is the general rule of thumb, although some planning firms use an 8-foot recession to reduce the amount of impervious surface and the cost of paving, while reducing the likelihood of homeowners parking in front of their garages).[22]

Conclusion

√ Garage configuration: Cost efficiency for the smart growth house

Depending on where the garage is located in relation to the house and the street, driveway costs can shift regardless of the house type. Generally speaking, though, the smart growth house's garage is more cost efficient than the conventional house. Alley-loaded garages, which are more common in TNDs, can all but remove the cost of a front-loaded driveway from the equation. Alleys are, essentially, groups of "driveways" that are placed behind—and shared by—the houses (see Figure 3). If an alley is about as wide as two cars placed side by side (roughly the width of a driveway serving a two-car, front-loaded garage) but shared by the house behind it, the alley cost per TND unit could conceivably be roughly half that of a comparable number of conventional suburban driveways.

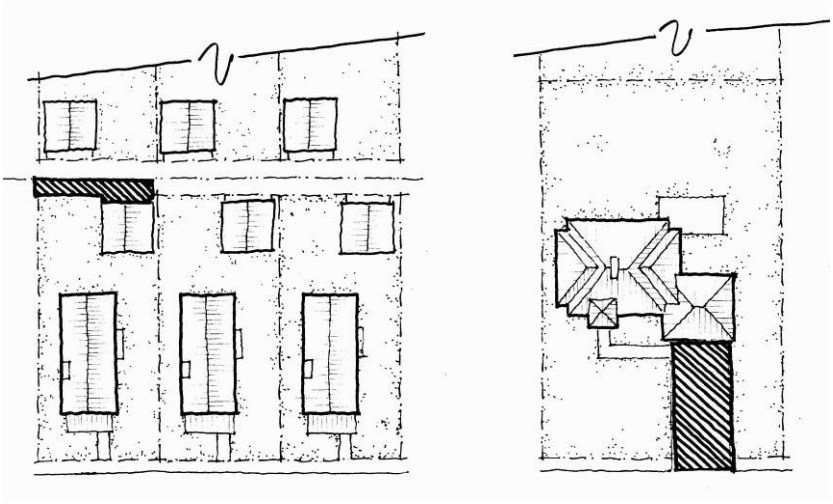

Figure 3: *Plan addressing access for two-car garages: The conventional suburban driveway (right) is twice the size of the alley segment apportioned to each smart growth lot (left). (Illustration: U.S. EPA)*

[22] Author interview with Cecily Bedwell, December 11, 2007.

Conventional suburban homes typically provide for garages and driveways that can accommodate 3 and sometimes even 4 cars. These are costs that a production builder in a TND need not bear because on-street parking is provided.

12. *Garage: attached versus detached*

Discussion and conclusions

√ **Garage: attached versus detached: Cost efficiency for the conventional suburban house**

Attached garages are typically more cost-efficient to build, regardless of house type, because one or more walls are shared with the primary structure, and roof truss lines are more easily extended. The construction issues for attached garages aren't different enough to warrant detailed analysis. It's reasonable to conclude that attached garages are more often used part of a conventional suburban house.

Detached garages are more often built in TNDs. They require construction of an extra wall and an extra roof component, because they do not share these components with the main residential structure. Issues of design and transition from the garage to the house come into play, as do construction sequence concerns. Occasionally, one must build a detached garage after the house is built so as not to interfere with delivery of construction materials if the alley is to be used for that purpose.[23]

Detached garages are more flexible when dealing with topography. Steep sites often are a challenge for attached garages, especially if the lots are smaller and cannot easily accommodate a spread-out footprint without excessive, costly grading work. Detached garages can be built on a different grade from the main residential structure house, which may remove the need for additional grading.

[23] Anderson, R. John, *op. cit.*; Klinkenberg, Kevin, *op. cit.*; Busse, Tim, *op. cit.*; Bedwell, Cecily, *op. cit.*

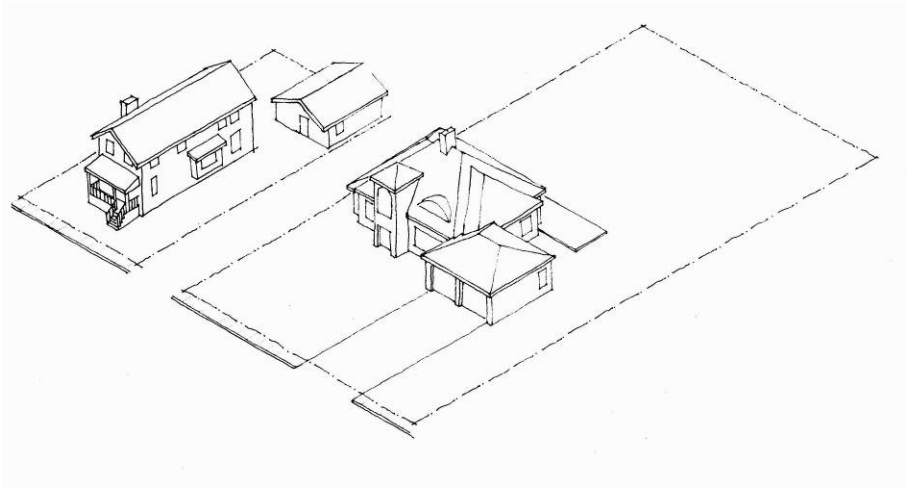

Figure 4: *Axonometric sketches showing similarly sized smart growth (left) and conventional suburban (right) houses and their setbacks from the street. (Illustration: U.S. EPA)*

13. *Setbacks*

Conventional Suburban House

Typically, local subdivision ordinances require minimum setbacks in CSDs. A setback is the minimum distance between the street and the front edge of the house. Setbacks are a major determining factor in the character of a street (see Figure 4). They also determine the length of a driveway and, therefore, have cost consequences for builders. At the furthest extreme, conventional houses with three- and four-car garages can have driveways that are as wide as they are long, requiring large concrete pours that significantly add to bottom-line construction costs.

The difference between a 15-foot setback and a 25-foot setback is significant. Larger setbacks leave less buildable area on the lot. In most CSDs, lots that are 60 feet by 120 feet have 15-foot setbacks. Larger lots—for example, 100 feet by 160 feet—have 25-foot setbacks. Builders can choose to place the house farther back than the minimum setback, depending on the neighborhood character he/she is trying to achieve. In general, conventional suburban houses are set back further from the street than comparable houses in TNDs.

Smart Growth House

In TNDs, build-to lines and alley-loaded garages are used to help define the street and create neighborhood character in the community. A "build-to" line is the specific distance from the curb at which the builder must site the front of the house. Houses are built to this line in order to create streets that are attractive and inviting to residents and allow safe, convenient interactions between neighbors (see Figure 4). Often, porches are allowed to encroach on the build-to line.

In a TND, an alley often is used to access the garage. The cost of paving the alley is typically rolled into the cost of the lot, while the cost for the driveway that services the garage from the alley is carried by the builder. Alley-loaded garages with short driveways cost less than alley-loaded garages with longer driveways. Similarly, larger setbacks shrink the buildable portion of the lot.[24] Large setbacks of alley-loaded garages are not typical in TNDs. Three-foot setbacks are more common, intended to reduce paving and to avoid homeowners' parking on the driveways or aprons, which would block movement through the alley.

Conclusion

√ **Setbacks: Cost efficiency for the smart growth house**

CSDs operate with minimum setbacks; TNDs operate with build-to lines. It appears that the TND approach is more cost effective, since it pulls the houses closer to the street and eliminates the driveway, instead using alley-loaded garages with shorter driveway stubs accessing them.

Production builders can calculate site-specific figures by determining if the total square footage of pavement is reduced by incorporating alleys versus long front driveways. This figure will depend on the depth of the setbacks and should factor in the typically narrower street widths found in TNDs. Costs carried by the developer upfront (and passed on to the builders) and the cost carried directly by the builder(s) should also be considered. The developer may carry the cost of the streets and alleys—creating potentially more upfront costs—and the builder may carry the cost of the driveway.

14. *Floor area and design*

Conventional Suburban House

Because of their approach to design and "curb appeal," conventional houses become more costly to build per square foot as their square footage increases. Larger conventional houses are more complicated: more corners are added, along with more rooflines, more foundation protrusions, rounded stairs, three- or four-car garages, and more steel to carry the structural load.[25]

Smart Growth House

A smart growth house typically retains its simpler design as it grows in size. "Bells and whistles," such as foundation protrusions, complex rooflines, bays, and bumpouts, are restrained; architectural balance and compatibility with neighboring houses is paramount. Because of this difference in design, the smart growth house accommodates its growth better, both in ease of construction and overall cost per square foot.[26]

[24] Klinkenberg, Kevin, *op. cit.*
[25] *Ibid.*
[26] Looney, Carson, *op. cit.*; Klinkenberg, Kevin, *op. cit.*

Conclusion

√ Floor area and design: Cost efficiency for the smart growth house

Because a TND house typically retains its design simplicity as its square footage grows, it is more cost effective in this category.

15. *Systems and operational approach*

Discussion and conclusion

√ Systems approach and operations: Cost-neutral element

Large-scale efficiencies, streamlined scheduling, and increased training opportunities are the primary cost-saving elements associated with production builders. When it comes to issues of systems and operations, there is little difference between the challenges that face production builders of conventional and smart growth houses. When a production builder owns a specific project—whether that project is a CSD or a TND—and is the only builder on the site, all elements of coordination and construction are on a single timeline and more easily controlled.[27]

TND projects often have more than one builder working on the same block. This complicates coordination of the construction tradespeople, but it doesn't seem to be a critical issue during the construction phase itself and so is viewed as cost neutral when compared to CSD projects. More often, scheduling-related problems surface before construction begins in earnest, while utilities are being installed and builders are beginning construction on houses (see the Site Planning section above).[28]

The challenge of multiple builders working on the same project is not unique to TNDs. It is not uncommon for more than one production builder to work in a larger development of either type (though in a CSD, multiple builders are typically not working on the same block or street). When this happens, the same coordination issues arise. Builders of smart growth houses need to be a little more proactive and organized on the front end before construction begins. Once the infrastructure is in, the lots are purchased, and the house construction begins, there is little difference between the issues facing production builders for either house type.[29]

Final conclusions and summary

The construction techniques and issues that determine costs for production-built smart growth and conventional suburban houses are, at their core, nearly identical. Production-built smart growth houses need not cost more than conventional suburban houses. This

[27] Klinkenberg, Kevin, *op. cit.*
[28] Anderson, R. John, *op. cit.*
[29] Klinkenberg, Kevin, *op. cit.*; Anderson, R. John, *op. cit.*

paper shows that construction issues and design techniques in production-built smart growth houses can be cost competitive for the production builder. In most cases, the construction issues and design techniques discussed in this paper are either cost-neutral elements or cost efficient for the smart growth house. Smart growth houses tend to have additional costs associated with their pre-construction site planning and preparation. Conventional suburban houses have additional costs associated with their scale and massing. In addition, other cost-neutral elements include add-ons, upgrades, and other material finishes that apply to both conventional suburban and smart growth houses. These additional features are market based and will vary according to local consumer preference.

The summary table below lists the design components and other construction issues related to production-built houses and compares the two housing types.

Cost Efficiencies of Production Home Construction Elements

Construction Element	Cost Neutral	Smart Growth	Conventional
Site planning			√
Footprint size and configuration		√	
Foundation - Slab		√	
Foundation - Stem-wall	√		
Exterior corners		√	
Roof pitches	√		
Exterior doors	√		
Exterior windows		√	
Ceiling heights		√	
Decks and porches	√		
Exterior details	√		
Quality of materials and finishes	√		
Front elevation variety		√	
360º versus 90º architecture	√		
Interiors	√		
Garage configuration		√	
Garage: attached versus detached			√
Setbacks ("build-to lines")		√	
Floor area and design		√	
Systems approach	√		

This paper is the first research into the construction comparisons between smart growth and conventional suburban housing with a perspective on construction cost efficiency. Those in the housing and architecture industries and those in academia are encouraged to build upon this work. At this time, production builders might consider the conclusions gained from this research:

- Houses in smart growth communities are not inherently more expensive to build than houses in conventional suburban communities.
- In almost all cases, the smart growth product is either cost neutral or more cost efficient than production-built, conventional suburban units.

- Higher-quality materials, upgrades, and add-ons can make a TND house more expensive to build than a CSD house; the converse also is true.
- Higher-quality materials, upgrades, and add-ons are market-based additions that are a function of buyer's choice, builder's enticement, master developer's branding specifications, or any combination thereof.

Jason Miller is the former editor of *New Towns, TNDhomes.com,* and *TND Series Vols. I-III*, a collection of stock home plan volumes for traditional neighborhood developments. He is co-author of the forthcoming *Pocket Neighborhoods: Creating small-scale community in a large-scale world* (Taunton Press, 2010). He is a senior account manager for Purdie Rogers, a Seattle-based public relations, advertising, and marketing firm that specializes in green building products and new urban neighborhoods. He writes frequently on New Urbanism and conventional suburban development practices and provides educational, marketing, and public relations materials for new urban neighborhoods nationwide.

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- Brian Cirillo, principal, Magnolia Florida, Orlando, Florida
- John Corgan, president, Mitchell & Best Homebuilders, LLC, Rockville, Maryland
- Eric Englund, editorial supervisor, Houseplans, St. Paul, Minnesota
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- Robin Redd, Looney Ricks Kiss, Memphis, Tennessee

Appendix

The following pages contain sample marketing sheets of production-built, single-family, detached houses designed for smart growth communities. As in conventional suburban communities, models come in a variety of sizes and configurations.

These marketing sheets have been provided for educational purposes only. No part of these pages may be used, reproduced, or modified for commercial or any other non-educational purposes.

First Floor Plan - 929 Sq. Ft.

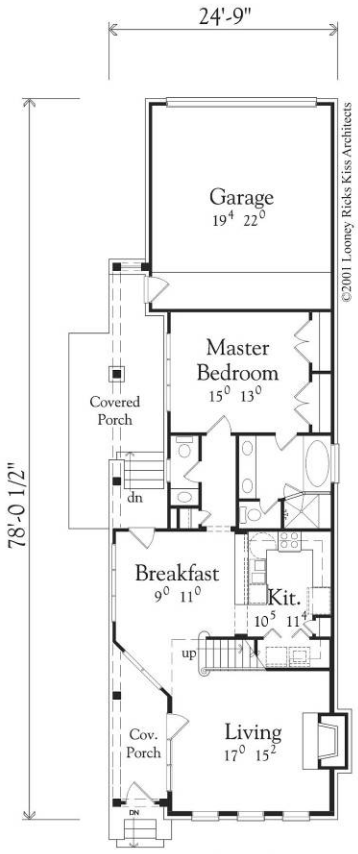
Second Floor Plan - 1,015 Sq. Ft.

LRK
Looney Ricks Kiss

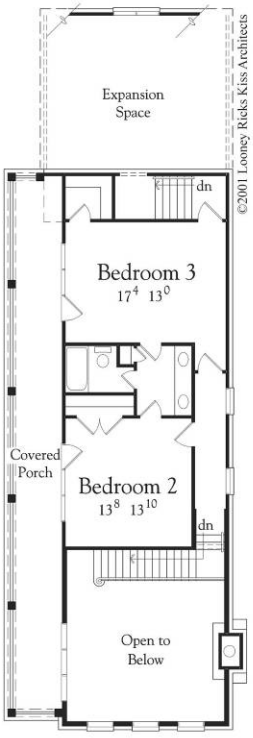
175 Toyota Plaza, Suite 600
Memphis, Tennessee 38103
Telephone 901 521 1440
Fax 901 525 2760
Internet www.lrk.com

Memphis Nashville Princeton Celebration
Rosemary Beach Dallas Jacksonville Boulder Baton Rouge
Architecture • Planning • Interiors • Research
Graphic Design • Urban Design • Landscape Architecture

Plan Number	0S.00284.LR
Sq. Ft.	1,944
Width	41'-10"
Depth	49'- 5 1/2"



First Floor Plan



Second Floor Plan

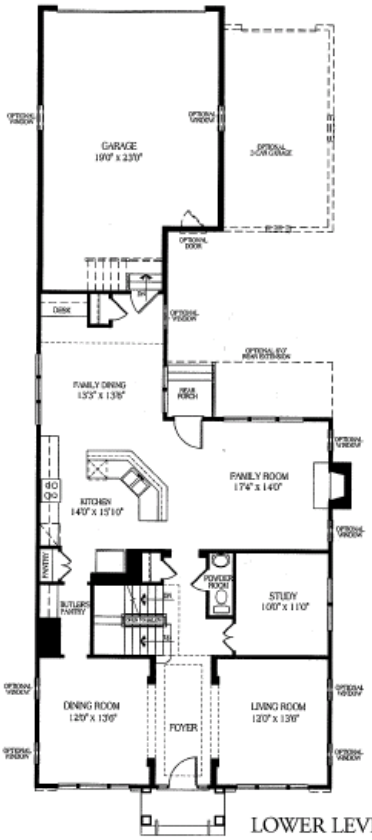
LRK
Looney Ricks Kiss

175 Toyota Plaza, Suite 600
Memphis, Tennessee 38103
Telephone 901 521 1440
Fax 901 525 2760
Internet www.lrk.com

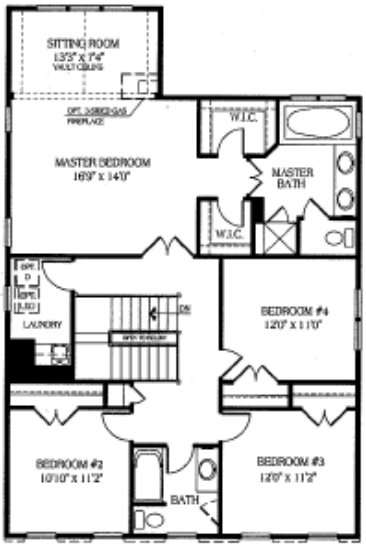
Memphis Nashville Princeton Celebration
Rosemary Beach Dallas Jacksonville Boulder Baton Rouge
Architecture • Planning • Interiors • Research
Graphic Design • Urban Design • Landscape Architecture

Plan Number	0S.95089.LR
Sq. Ft.	1,740
Width	24′-9″
Depth	78′-0½″

The Hartford



LOWER LEVEL PLAN
(Elevation A)



UPPER LEVEL PLAN
(Elevation A)

Elevation 'C'
Shown With Some Optional Features

Elevation 'B'
Shown With Some Optional Features

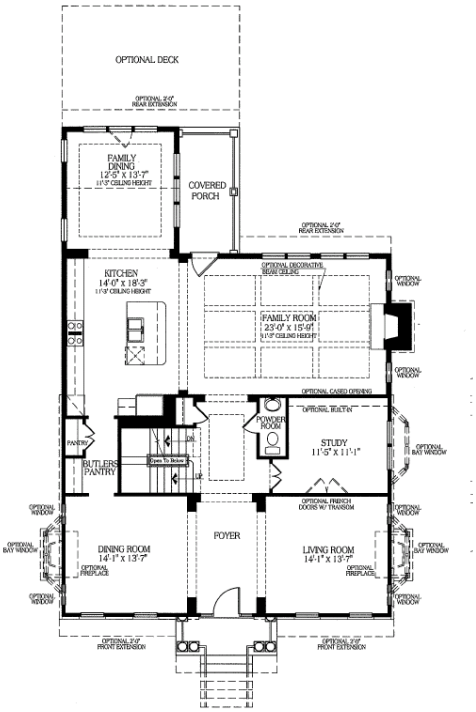
Elevation 'D'
Shown With Some Optional Features

Mitchell & Best℠

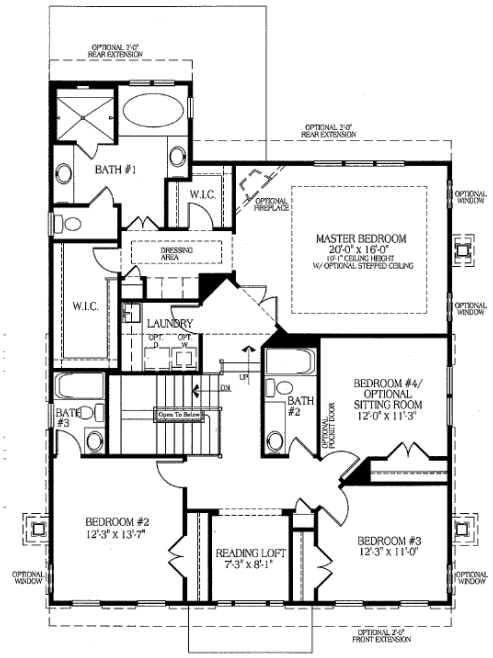
All dimensions are approximate and accuracy cannot be guaranteed. Plan dimensions, elevations and features are subject to change without notice or obligation. These inserts are for illustrative purposes only. Certain options, as shown, may not be available on all elevations and on every homesite. See Sales Manager for details.

Photo shown with some optional features. Basement plan not shown due to space limitations of this paper.

The Hamilton III



LOWER LEVEL PLAN
(Elevation A)



UPPER LEVEL PLAN
(Elevation A)

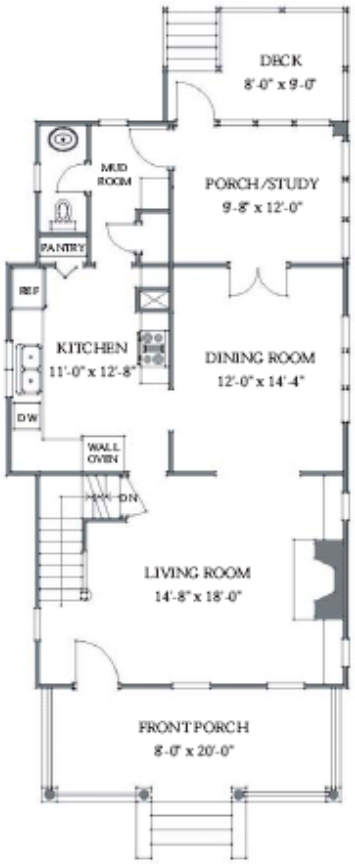
Mitchell & Best℠

All dimensions are approximate and accuracy cannot be guaranteed. Plan dimensions, elevations and features are subject to change without notice or obligation. These inserts are for illustrative purposes only. Certain options, as shown, may not be available on all elevations and on every homesite. See Sales Manager for details.

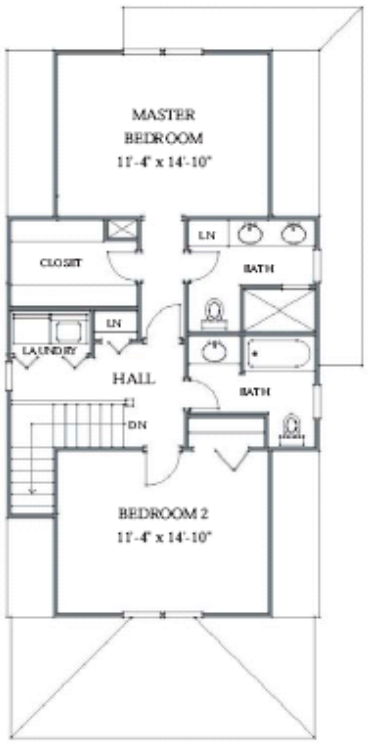
Photo shown with some optional features. Basement plan not shown due to space limitations of this paper.

180° URBAN DESIGN + Architecture

The Susan

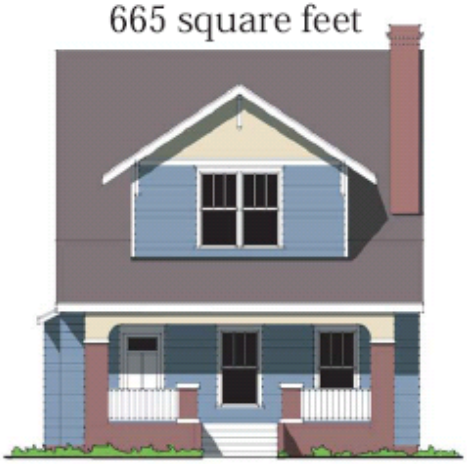


First Floor Plan
873 square feet



Second Floor Plan
665 square feet

1538 sq. ft.
2 bedrooms
2 1/2 baths
Basement: Y
Width: 24'
Depth: 40'
Id. 02-116

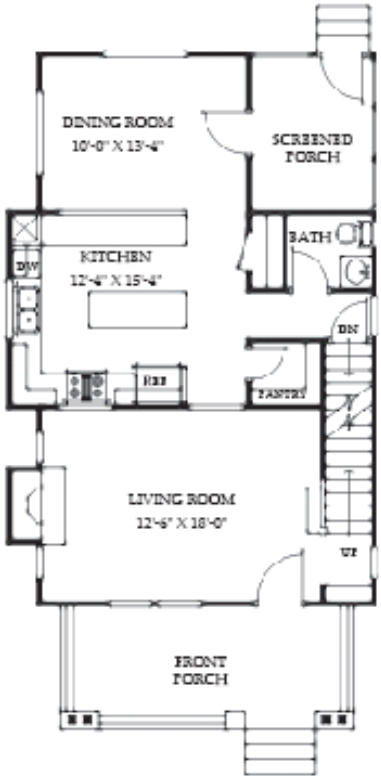


Significant modification may be required if building within 5 mile radius of 3rd & High View Drive, Lee's Summit, MO. This is an artist's rendering. The final set of construction documents may have been updated from this conceptual plan. 180 Degrees Design Studio, LLC reserves the right to make any alterations.

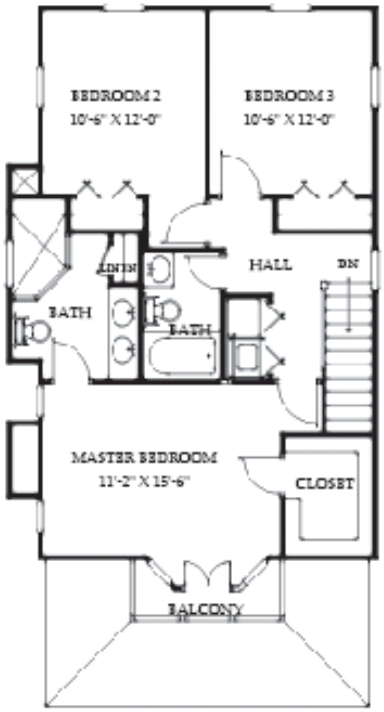
KANSAS CITY, MISSOURI PHONE: 816-531-9695 FAX: 816-531-9695 www.180DEG.COM

180° URBAN DESIGN + Architecture

The Kenneth



First Floor Plan
711 square feet



Second Floor Plan
764 square feet

Significant modification may be required if building within 5 mile radius of 17th & Jefferson, Kearney, MO. This is an artist's rendering. The final set of construction documents may have been updated from this conceptual plan. 180 Degrees Design Studio, LLC reserves the right to make any alterations.

1475 sq. ft.
3 bedrooms
2 1/2 baths
Basement: Y
Width: 23'6"
Depth: 37'
i.d. 03-114

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