GOING MOD

Reducing Housing Costs in Philadelphia with Modular Construction

Since 2004, the When We Fix It Coalition, a group of nonprofit and for-profit builders, architects, engineers, environmental groups and others who seek increased investment in the city, have worked to bring down the cost of construction in Philadelphia.

Most of their efforts have been directed at the costs attributable to obtaining permits and approvals from the city of Philadelphia. In partnership with the city, the coalition's successes in this area include the passage of a referendum to form a Zoning Code Commission to reform the city's zoning code, the creation of the city's first comprehensive electronic zoning map, the production of the first development review guide to set down city requirements in a single document, and many other key reforms to improve the investment environment.

A joint publication of

BUILDING INDUSTRY ASSOCIATION
of Philadelphia

FixItPhilly

Coalition members include the following:
Building Industry Association of Philadelphia
10,000 Friends of Pennsylvania
American Institute of Architects, Philadelphia Chapter
Central Philadelphia Development Corporation
Housing Alliance of Pennsylvania
Local Initiatives Support Corporation Philadelphia
Pennsylvania Environmental Council
Philadelphia Association of Community Development Corporations
The Reinvestment Fund
ULI Philadelphia

The Community Design Collaborative and the American Planning Association, Pennsylvania chapter, join the coalition in releasing this report.

We gratefully acknowledge the William Penn Foundation for funding this report.

GOING MOD

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EXECUTIVE SUMMARY
GOING MODULAR

Philadelphia's high construction costs compromise the city's ability to meet the housing needs of residents, attract investment and redevelop abandoned land.

Philadelphia's construction costs are the fourth highest of any major city in the nation and 18 percent above the national average for all United States communities. The city's house values—the price for which homes can be sold—are the third lowest of any major city in the nation and are 40 percent below the national average. As a result, construction costs often exceed the prices of new homes. This makes government subsidy a prerequisite for home building in most Philadelphia neighborhoods to fill the gap between building costs and the sales price of a home. High labor costs, 39 percent above the national average, drive the construction industry's out-of-scale cost structure. These labor costs make up over half the total cost of an average project in Philadelphia.

Modular single-family-home construction significantly lowers the cost to build a new home in Philadelphia.

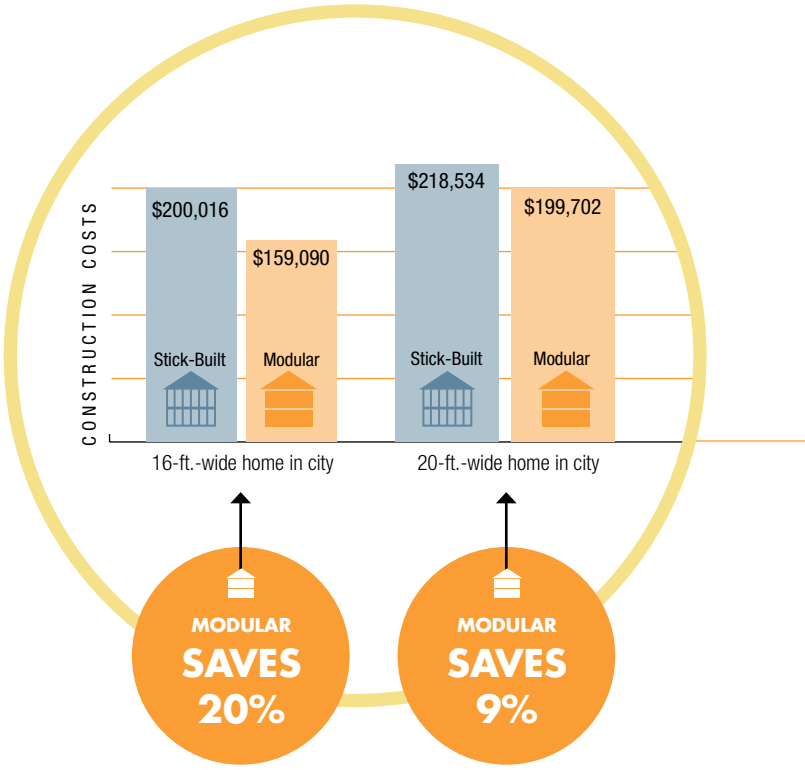
Modular construction requires much of the house to be built off site in a modular factory and then shipped to the site, placed on a foundation and finished by workers on site, who complete the facade and make all necessary utility connections.

A detailed cost comparison found that, on average, an owner or developer saved 20 percent of total project costs by building a 16-foot-wide x 40-foot-long rowhome in the city using modular versus stick-built construction. Average savings for the modular construction of a 20-foot-wide x 40-foot-long home in the city were 9 percent.

In addition, modular home construction offers speed, durability and environmental-sustainability benefits.

Stick-built construction, however, offers the advantages of more design flexibility and a greater use of local labor. A full picture of the pros and cons of each method is included within the report in order to help for-profit and nonprofit developers choose the best construction method for individual projects.

Modular home construction means that limited public subsidy dollars can go further; the adoption of modular home building for 16-foot-wide rowhomes in Philadelphia can mean an immediate annual increase of 20 percent in the volume of publicly subsidized housing built each year, thus providing decent, safe and sanitary housing for many more low- and moderate-income families and reducing the number of families and individuals who become homeless each year.



This report was commissioned by the When We Fix It Coalition.

The coalition is a group of nonprofit and for-profit organizations in the city of Philadelphia dedicated since 2004 to lowering construction costs and achieving consistency and fairness in the city's development review process.

To complete a price comparison between modular and stick-built construction, the coalition issued a Request for Information (RFI) in the fall of 2009 to four construction contracting firms that build single-family homes in the city and its surrounding suburbs and that have a reputation for quality work. Each firm was asked to provide an accurate bid to build a 16-foot-wide rowhome/townhouse and a 20-foot-wide rowhome/townhouse using modular and stick-built construction on two identical sites—one in the city and one in the suburbs. The RFIs, the responsive bids, the architectural plans and the detailed specifications are included in the appendix to this report. Firms were told to assume that union labor would be used in the city, per industry custom. For the smaller home, a 16-foot-wide x 40-foot-long size was selected because it is fairly standard for workforce housing in the city and can be completed with a single modular "box" from the factory per floor. A 20-foot-wide x 40-foot-long size was selected for the suburban home, both because it reflects the size of a small marketable suburban home and because it requires the construction and fastening of two "boxes" per floor, which adds substantial cost.

Philadelphia must find ways to reduce the cost of building new homes in the city.

Modular technology offers the opportunity to lower the cost of a single-family house in Philadelphia by an average of $22 per square foot. Homes are high quality, durable, and environmentally sustainable. Through the process described in this report, the When We Fix It Coalition found that replacing stick-built with modular construction would result in savings of 20 cents on the dollar for 16-foot-wide homes and 9 cents on the dollar for 20-foot-wide homes. While these numbers are not sufficient to close the market gap between the high cost to build in Philadelphia and the city's low market values, they do offer substantial help in making the numbers work. Modular homes are high quality, durable and environmentally sustainable. The savings created by using modular construction, along with the city's very successful property-tax-abatement program for residential construction, make viable the construction of much-needed middle-class housing, as well as low-income and luxury housing. With recent census estimates showing that Philadelphia finally stopped its 60-year pattern of population decline and is open to growth, competitively priced housing becomes even more important to achieving Mayor Nutter's promise to attract 75,000 new city residents over the next decade.

REPLACING STICK-BUILT WITH MODULAR CONSTRUCTION WOULD **SAVE 20 CENTS ON THE DOLLAR** FOR 16-FOOT-WIDE HOMES, or

$32 PER SQUARE FOOT.

"Recessions are times for innovation and reeducation of the way the building industry works to make it more competitive and give people new options."

Brian Phillips of Interface Studio Architects LLC

INTRODUCTION

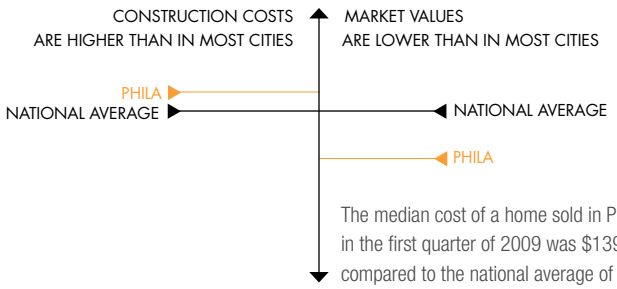
During much of its recent history, Philadelphia's combination of low property values and high construction costs has made new residential housing prohibitively expensive to build. This has been a significant factor in the absence of quality housing for low- and moderate-income residents and in the loss of middle-income residents over the last five decades.

This report examines whether the technologies offered by modular housing, which is built off site in modules for later assembly on site, present an opportunity to significantly lower the costs of new house construction in Philadelphia. It also analyzes what conditions must be in place for modular construction to offer advantages over stick-built construction and compares modular versus stick-built construction with respect to durability, speed, environmental sustainability and other factors. The report concludes with recommended next steps to bring savings to Philadelphia homebuyers.

Construction costs in the city of Philadelphia are 18 percent higher than the national average, while home market values are 40 percent lower than the national average.[1]

As a result, the cost to build a new house in Philadelphia often exceeds the sales price that buyers are able and willing to pay for a new home.[2] In fact, the only major cities in the United States with higher construction costs are Boston, New York and San Francisco, each of which has significantly higher housing prices to support the elevated building costs.[3] To date, the city has filled the significant market gap created by low property values and high construction costs for affordable housing with government subsidy. As a result, housing built for low-income households dominated the Philadelphia housing market for decades, making up 60 percent of all new single-family homes as recently as 2002.[4]

PHILADELPHIA MARKET VALUES ARE TOO LOW TO COVER ITS HIGH CONSTRUCTION COSTS, DETERRING INVESTMENT IN MANY NEIGHBORHOODS



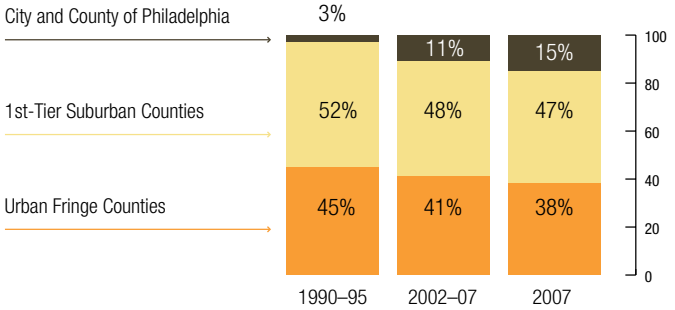
The median cost of a home sold in Philadelphia in the first quarter of 2009 was $139,000, compared to the national average of $175,500.[5]

Philadelphia's share of regional residential development has grown due to rising market values & tax abatements.

By 2007, the city's decision to provide tax abatements for residential construction made it possible for residential developers to invest in the city for the first time in years, building new luxury and workforce housing. In 2007, the total number of homes built in the city increased by 600 percent, with only 8 percent of total new homes being subsidized affordable housing. Even with this huge increase, Philadelphia's housing production still lagged behind that of the surrounding suburbs and other large cities across the country. [6]

In 2000, the city expanded an existing ten-year property-tax-abatement program that had been limited only to renovation to include new construction of any type, including housing. The abatement has been credited with allowing private-sector development of workforce and middle-class housing in the city from 2000 to 2008, after decades of disinvestment. [7]

PHILADELPHIA'S SMALL SHARE OF THE REGION'S RESIDENTIAL BUILDING PERMITS HAS GROWN



Philadelphia's Share of Total Residential Building Permits in the Region (Phila-Camden-Wilmington, PA-NJ-DE-MD)

High labor costs make it impossible to construct a house in Philadelphia at a regionally competitive price.

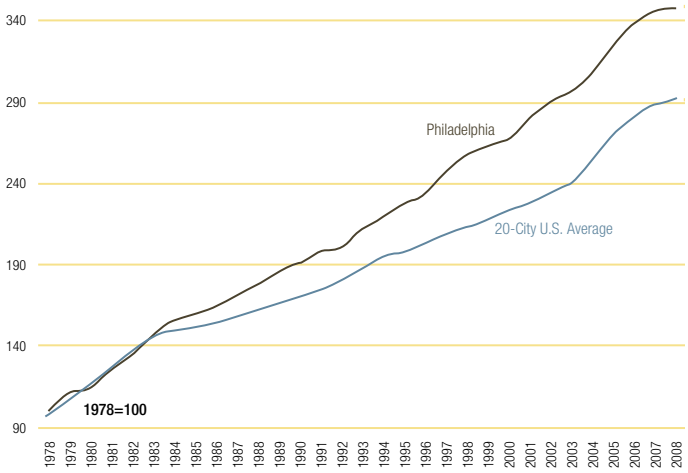
Philadelphia's high labor costs caused one major national builder to build its first and only modular homes in the United States in 2008. Initial calculations showed that the company could not produce their usual home products for a profit in Philadelphia. Modular-construction savings allowed them to build to their standards at a profit.[8]

Labor costs drive Philadelphia's high construction costs. The cost of construction labor in Philadelphia is 39 percent above the national average, and labor accounts for 45 percent to 60 percent of a project's cost.[9] While union labor is required by custom in the city, labor in the surrounding suburbs is not so constrained. As a result, the cost to build a house in the city is significantly higher than the cost to build the same house in the surrounding Pennsylvania and New Jersey suburbs. Despite the uncompetitive position in which this places Philadelphia, the city has not achieved comprehensive cost reductions in housing construction labor in the past two decades.[10] As a result, this report seeks to find a method to lower the labor costs required to build a house in the city through technical advances and the use of modular-construction techniques.

Importantly, in 2009 the Building Industry Association of Philadelphia's Labor Committee achieved a landmark agreement with the Carpenter's Local 1073 that effectively reduces the costs associated with the work performed by the carpenters by 34 percent on private market housing.

PHILADELPHIA CONSTRUCTION COSTS HIGHER THAN 20 PEER CITIES

From 1983 to 2008, Philadelphia's construction costs grew 17% faster than those in other cities, material costs increased 85% and labor costs increased by 170%.[11]



In 2010, there is an overwhelming need to create competitive building conditions in Philadelphia.

Development spurred by the residential new-construction tax abatement screeched to a halt in 2008 due to the recession. High construction costs, dropping property values, shrinking credit, growing unemployment and declining income growth make this a critical time in which to address the issue of how to make the city's housing market more robust.

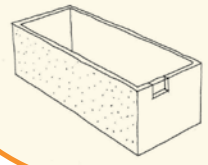
This report is offered with the hope of helping builders innovate during this recession, as well as during the next market upturn.

MODULAR HOME CONSTRUCTION 101

The Basics: How Modular Construction Differs from Stick-Built Construction

Stick-Built Construction

Foundation

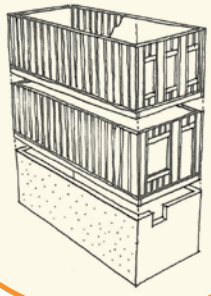


Constructed in the field
- Poured-in-place concrete
- Concrete masonry units
- Panelized systems

Can build on top of foundations or slab on grade.

Coordinate site work and utility connections.

Framing of the Walls and Floors



Constructed in the field
- Most materials delivered directly to the site
- Field-assembled by carpenters
- Linear process—one floor after another
- Sheathing is field applied

MEP-related items
- Fabricated and installed on site by related trades—plumbers, electricians, sheet-metal workers
- Process follows framing
- Fabricated and installed on site by related trades—requires incremental sign-offs by building inspectors

Facade and Interior Finishes

Facade
- Front and rear facades constructed in the field
- Facades and roof are installed following the framing on the walls and floors
- Steps and sidewalks are usually poured or constructed after facade work is underway or completed

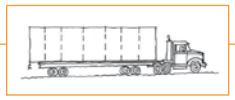
Interior Finishes
- Interior finishes such as kitchens, bathrooms, finished drywall and flooring are constructed and installed in the field and by a process determined by the framing of the home
- Final utility connections are done in the field

Stick-built construction is the standard practice in the Philadelphia region.

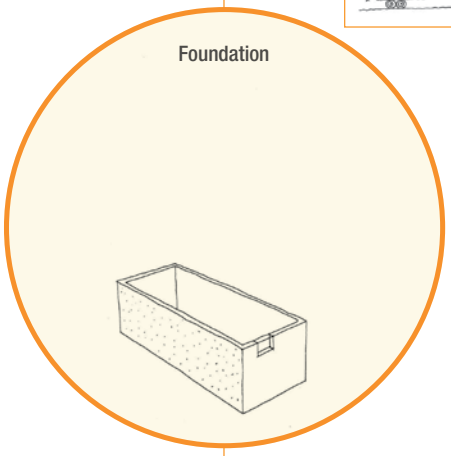
About 97 percent of the 1.2 million annual new housing starts in the United States are stick built.[12] The stick-built method for framing a house has been used since the 1800s and has more or less remained the same. When a single-family house is built using stick-built construction, the house is constructed on site outdoors by several work crews, who build the foundation, do the framing and install plumbing, electrical and other systems in accordance with an architect's plans. Often, these work crews are subcontractors hired for a single aspect of the project.

The homes are constructed out of lumber and other materials that are cut and fastened together into walls and roof trusses, then finished on the interior with drywall and on the exterior with siding, stucco or brick. While the home is typically completely assembled on site, prefabricated panels or roof trusses are used more and more often to save cost and time. Stick-built homes must conform to local building codes.

Modular Construction



Foundation

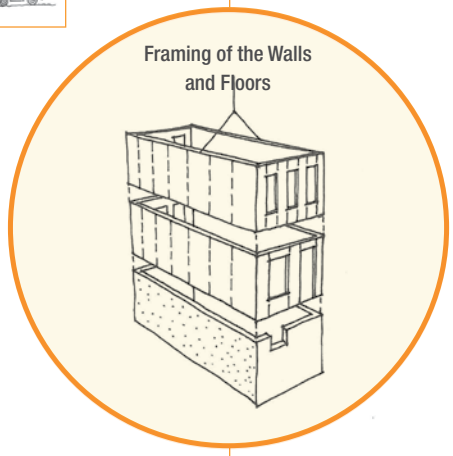


Constructed in the field
- Poured-in-place concrete
- Concrete masonry units
- Panelized systems

Minimum requirement of a foundation with a 30" crawl space.

Coordinate site work and utility connections.

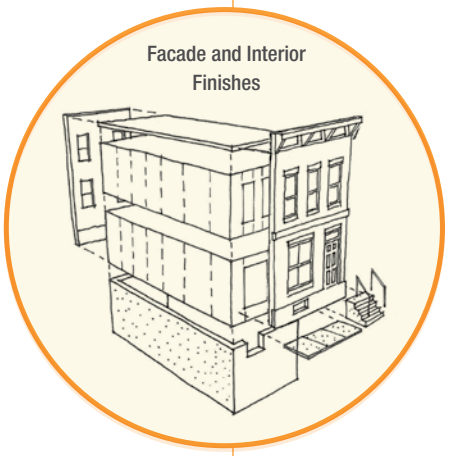
Framing of the Walls and Floors



Built within the factory
- Product delivered to the site by truck
- Boxes set by modular manufacturer
- Boxes are manually connected to the foundation in the field
- Factory-set levels of quality controls
- Exterior sheathing already installed

MEP-related items
- Most MPE-related items come assembled in the box
- Minor connections and hook-ups required in the field

Facade and Interior Finishes



Facade
- Front and rear facades constructed in the field
- Facades and roof are installed following the setting of the boxes
- Steps and sidewalks are usually poured or constructed after facade work is underway or completed

Interior Finishes
- Interior finishes such as kitchens, bathrooms, finished drywall and flooring are constructed in the factory and delivered within the boxes
- Final finishing and minor touch-up is required after boxes are set in place
- Final utility connections are done in the field

The maximum width of a modular unit that can be conveyed on a state highway in Pennsylvania is 16 feet. The maximum height is 14 feet 6 inches, including the height of the trailer. The maximum length feasible for modules is 80 feet. As a result of the height limit, indoor ceiling heights for modular homes cannot exceed 9 feet 6 inches.

Using modular-construction methods, the majority of the house is built in an indoor, factory setting and then shipped to the site.

Three percent of single-family homes nationally are built using modular construction.[13] In the rainy, snowy Northeast, this percentage climbs to 11 percent.[14] With several major national homebuilders starting to use modular construction, including Warren Buffett and his i-house produced by a Berkshire Hathaway subsidiary, Clayton Homes, many experts forecast that modular construction will increase its share of the market.[15]

When building with modular methods, workers assemble the frame, roof, drywall and flooring inside a factory, in accordance with an architect's plan. Several modular factories are located within a two-hour drive of Philadelphia. The module, also referred to as the box, is constructed in the factory using the same materials as those used for stick-built housing. Windows, cabinets, flooring, carpeting, walls, doors and lighting fixtures are installed inside the factory. Upon completion, the box or boxes are encased in house wrap (such as Tyvek) and shipped by truck to the site.

"The Arbours at Eagle Pointe," Westrum Development Company

The primary restriction placed on this type of construction is the 16-foot maximum width allowed for any modular unit that must be transported on a state or federal highway. When the completed home will be larger than 16 feet wide, more than one box must be shipped, set onto a permanent foundation using an 80- to 160-ton crane and fastened together to create the home. The thickness of the structure is doubled along the "marriage line" where the boxes meet. The onsite crew fastens the boxes together, as though attaching Lego pieces, using big wrenches and huge bolts. This process is called the set.

Most modular manufacturers provide a rough set—that is, they place the box or boxes by crane onto the foundation and seal the home—and give the responsibility for the finish work to the builder or contractor hired by the owner (including installation of HVAC equipment, interior and exterior finishes for mate walls[16] and floors, utility hook-ups, drywall touchups, painting, porch and deck construction, garages and brick work.)

Finish work also includes the building of the foundation that the modular boxes will be set on, even though this work takes place at the beginning of the process. Finish work typically costs about 25 percent of total construction and is performed over the course of one or two months.[17]

Modular homes can be built in accordance with any architectural plan, but if cost is an issue, the factory's standard designs with modified floor plans are typically used. Developers and users agree that the final product is indistinguishable from its stick-built counterpart.[18] Modular units are inspected while in the factory to ensure that they meet national International Building Code standards, and they are inspected again on site to ensure that they conform to local building codes, which in Philadelphia is the International Building Code as well.[19]

The Pennsylvania Supreme Court has held that municipalities cannot prohibit modular housing or, without a strong reason, treat it differently than housing built on site.[20]

Modular homes are *not* the same as mobile or trailer homes. Modular homes are built with the same materials and using the same techniques as stick-built homes, although in an indoor, factory environment. Modular homes are indistinguishable from stick-built homes once they have been built. For the purposes of this study, smaller homes referred to as rowhomes or townhouses were examined, but modular methods can be used to build any type of home design.

“At first I was skeptical that a house made up of boxes from a factory could create a house with as high quality a design as a traditional stick-built home, but it can. With good architectural design, modular homes are indistinguishable from stick built and can be significantly less expensive to build.”

Matthew Koenig, AIA, JKR Partners LLC

COST COMPARISON: MODULAR PROVIDES SUBSTANTIAL SAVINGS

In fall 2009, the When We Fix It Coalition hired two locally respected developers to issue an RFI to four contracting firms requesting bids to build identical homes using modular or stick-built construction methods. (A full description of the methodology employed for this study is included on pages 24 to 25.)

In brief, a detailed RFI supported by complete sets of architectural plans developed by JKR Partners LLC was issued for two home designs—a 16-foot-wide rowhome/townhouse and a 20-foot-wide rowhome/townhouse. All companies were asked to provide bids for the construction of homes with identical specifications and comparable requirements regarding the quality of finishes, fixtures, doors, walls, carpeting, electrical systems, plumbing and HVAC. The bids were for single-family homes to be constructed on identical lots in the city and in an area suburb.

Bids were requested for eight homes, described below. Three contractors provided estimated costs for each of the eight home types requested. One contractor provided estimated costs for the four homes located in Philadelphia only, due to inadequate experience in the suburbs.

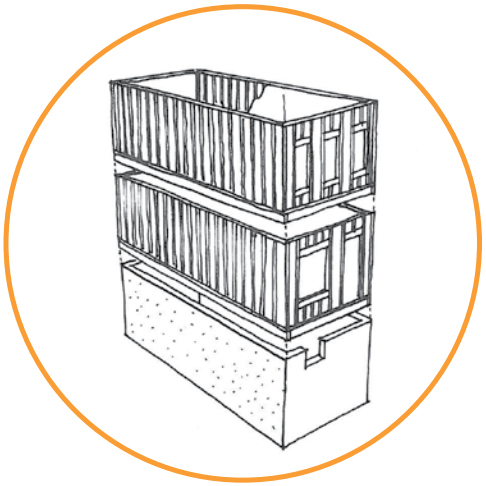
Bids were also requested from manufacturers to build the modules that will make up the house, transport them and set them onsite. The modular boxes were to be transported with completed kitchens and bathrooms as detailed in the architectural plans. Bids were requested from two respected Southeast Pennsylvania factories. Neither of these modular manufacturers ran union shops. Their bids came in fairly close to one another, with the 16-foot modular home bids at $84,522 and $90,266 and the 20-foot modular home bids at $111,939 and $130,737. The average cost for the work of these modular manufacturers was then added to the contracting firms' bids to finish the houses in order to arrive at the total cost of construction for a modular 16-foot house and a 20-foot house.

The width of the homes was selected for two reasons. First, as mentioned earlier, a 16 x 40-foot rowhome is fairly standard for workforce housing in the city, while a 20 x 40-foot house is a small but marketable housing product in the suburbs. Second, a 16-foot-wide house can be built using only one modular box from the factory, while a 20-foot-wide house requires the construction and fastening of two modular boxes, which increases the costs of building and setting the larger house using modular. None of the total estimated construction costs included site improvements.[21]

These are the eight homes for which bids were requested:

1. A 16-foot townhouse or rowhome on a specific urban site in Philadelphia, using stick-built construction;
2. A 16-foot townhouse or rowhome on a specific urban site in Philadelphia, using modular construction;
3. A 20-foot townhouse or rowhome on a specific urban site in Philadelphia, using stick-built construction;
4. A 20-foot townhouse or rowhome on a specific urban site in Philadelphia, using modular construction;
5. A 16-foot townhouse or rowhome on a specified suburban site, using stick-built construction;
6. A 16-foot townhouse or rowhome on a specified suburban site, using modular construction;
7. A 20-foot townhouse or rowhome on a specified suburban site, using stick-built construction; and
8. A 20-foot townhouse or rowhome on a specified suburban site, using modular construction.

COST COMPARISON:
THE FINDINGS



SITE BUILT

16' Stick Built - Urban

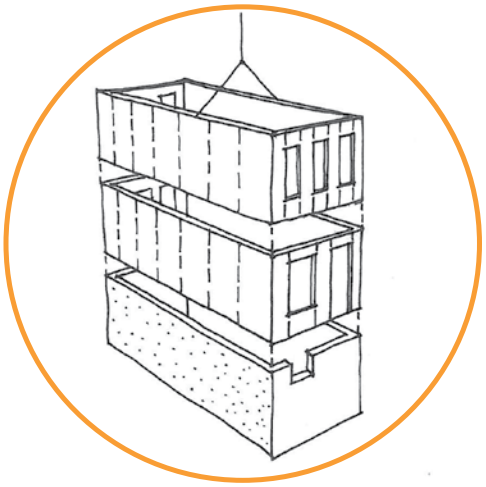
BID BREAKDOWN

	Cost	$ Per Sq. Foot
Contractor 1	$205,503	$161
Contractor 2	$259,156	$202
Contractor 3	$156,199	$122
Contractor 4	$179,205	$140

AVERAGE

Average Cost with No Site Work	$200,016	$156

Modular construction significantly lowers the cost of construction in the city.



MODULAR

16' Modular - Urban

AVERAGE

	Cost	$ Per Sq. Foot
Average Cost with No Site Work	$159,090	$124

BID BREAKDOWN

	Modular Vendor 1	Modular Vendor 2
Modular Vendor Cost of Box	$84,522	$90,266
Contractor 1 Finish Costs + Box	$158,798	$164,542
Contractor 2 Finish Costs + Box	$190,956	$196,700
Contractor 3 Finish Costs + Box	$121,267	$127,011
Contractor 4 Finish Costs + Box	$153,852	$159,596

20’ Stick Built - Urban		16’ Stick Built - Suburban		20’ Stick Built - Suburban	
Cost	$ Per Sq. Foot	Cost	$ Per Sq. Foot	Cost	$ Per Sq. Foot
$220,953	$138	-	-	-	-
$275,919	$172	$206,045	$161	$218,184	$136
$180,122	$113	$141,668	$111	$163,798	$102
$197,140	$123	$144,925	$113	$159,505	$100
$218,534	**$137**	$164,213	**$128**	$180,496	**$113**

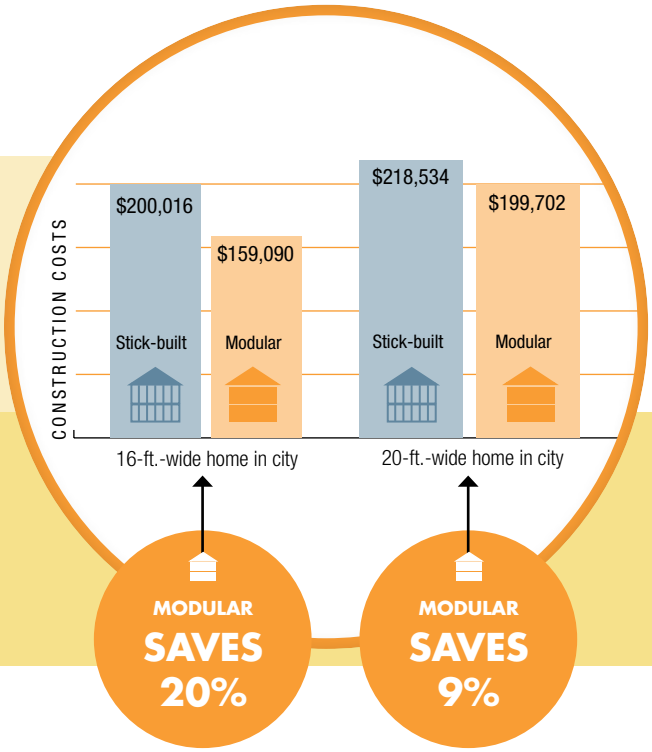
20’ Modular - Urban		16’ Modular - Suburban		20’ Modular - Suburban	
Cost	$ Per Sq. Foot	Cost	$ Per Sq. Foot	Cost	$ Per Sq. Foot
$199,702	**$125**	$135,698	**$106**	$178,939	**$112**

Modular Vendor 1	**Modular Vendor 2**	**Modular Vendor 1**	**Modular Vendor 2**	**Modular Vendor 1**	**Modular Vendor 2**
$111,939	$130,737	$72,864	$82,558	$105,821	$129,789
$192,730	$211,528	-	-	-	-
$226,430	$245,228	$148,365	$161,705	$192,907	$217,675
$154,528	$173,326	$108,652	$121,992	$143,009	$167,777
$187,523	$206,321	$130,068	$143,408	$163,748	$188,516

COST COMPARISON: ANALYSIS

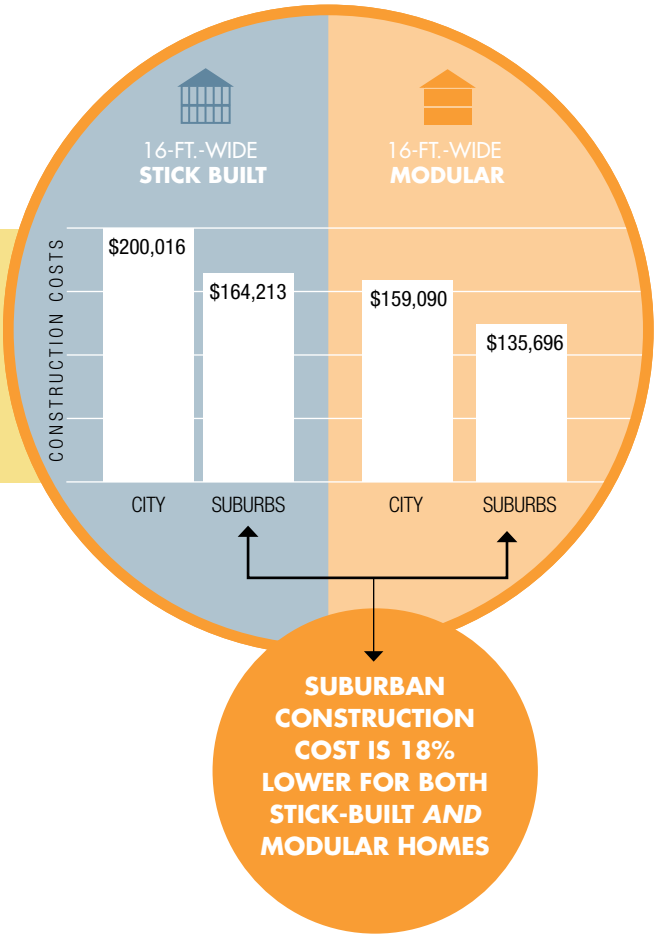
1 Modular construction significantly lowers the cost of construction in the city.

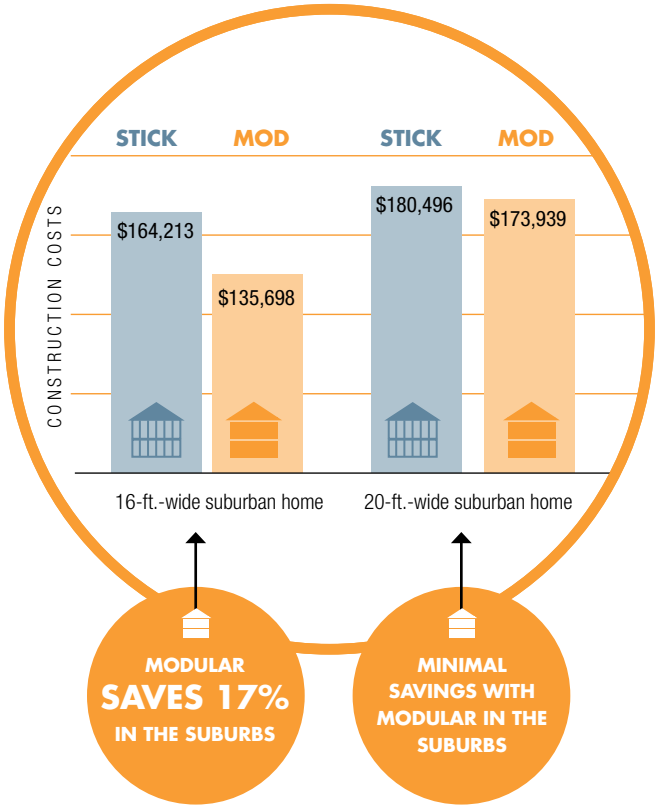
The average cost savings for building a 16-foot-wide rowhome using modular construction in Philadelphia were 20 percent, reducing the cost by $32 per square foot. The average cost savings for a 20-foot-wide rowhome using modular construction in Philadelphia were 9 percent, reducing the cost by $12 per square foot.



2 Constructing a house in Philadelphia costs substantially more than building an identical house in the suburbs.

For bids based on stick-built construction, building a house in the city was estimated to cost an average of $37,000 more than the building of an identical house in the suburbs. For bids based on modular-construction methods for building the same homes, the cost of the boxes was identical between city and suburb, but the on-site finish costs were an average of $24,000 higher in Philadelphia. This price difference puts Philadelphia at a significant regional disadvantage in terms of attracting residents who prefer new homes.





3 Modular only provides cost savings in the suburbs when a single modular box is used per floor.

This study found that modular's primary cost benefits come from reducing labor costs, and in the suburbs labor costs are already competitive. That said, if a 16-foot-wide townhouse were a viable product in the suburbs, there would be substantial savings of more than 17 percent compared to the cost of stick-built construction. The reality, however, is that a 16 x 40-foot house is too small to be attractive in current suburban markets. For the 20-foot-wide house no savings were achieved from using modular-construction techniques, according to the cost comparison.[22]

4 The four contractors' bids differed significantly for both stick-built and modular construction.

The estimated prices in their bids to build the same house using the same construction method differed in some cases by over $80,000. (See bids on pages 14 to 15 and 38 to 45.) Several developers interviewed for this report said that they find significant price differences to be typical when they solicit bids. This makes it extremely important for any new homeowner or nonprofit or for-profit developer to shop around to obtain the most competitive price.

5 High finish costs charged by contractors lacking modular-construction experience or by those who prefer stick-built construction can significantly reduce modular construction's cost efficiencies.

At present, many union contractors in Philadelphia are not motivated to give good prices for finish and set work. Others are carving out this market niche for themselves with the understanding that participating in more projects makes good sense, even if their role in each is smaller. As the New Kensington Community Development Corporation wrote in 2008, "the initial costs savings produced by modular construction may be reduced by an increase in labor expenses" when union laborers complete finish work. Several building industry members interviewed said that union contractors have bid well over 25 percent of project cost to finish the house on the site. We found this to be the case, though estimated finish costs differed substantially from firm to firm. The lowest bid to finish a 16-foot-wide modular home was $44,045. The highest to finish the same home was $115,324—a rather startling difference in estimated price to connect utilities, attach the facade and complete a home that had so far costed $71,279. There are ways to reduce the cost of finishing a modular home; one developer told us that he uses his first modular unit on every project as a test case. Whenever the plumbing or electrical contractors identify a component that raises finish costs, he has these components changed on later versions of the unit coming out of the factory.[23]

> "One of the biggest challenges to the integration of prefab and modular by CDCs [Community Development Corporations] and housing agencies is related to perceived union labor issues. The reduction of work completed on site may threaten union workers, although should not be a deal-breaker."

The weeHouse - Modular Housing for Kensington, New Kensington Community Development Corporation (2009)

MODULAR CONSTRUCTION CAN ALSO OFFER ADDITIONAL SAVINGS IN AREAS THAT WERE NOT CAPTURED BY OUR COST COMPARISON.

$$$$$

Construction financing costs and other soft costs are lower.

Construction financing is lower for modular because the construction cycle time is 50 percent or less of the time required to construct a stick-built home. This shorter financing period results in lower financing costs and fewer draws from the bank, as higher-interest construction loans can be converted into final mortgages within weeks rather than months. Builders' risk insurance can be lower, as well, due to the shortened construction timeframe.[24]

Overhead is lower.

For the developer using modular-construction methods, site supervision is less intensive for the period before the box is delivered, and this saves money.[25] Modular may also reduce staffing needs. For instance, the site may not require a full-time accountant to pay regular bills, since 60 to 70 percent of the bills are taken care of in a single payment to the modular manufacturer. Finally, architect fees may be reduced because, when working in partnership with a modular manufacturer, the home's architect will create the layout and design for the house, but the factory's staff will produce the drawings and wall sections, and then review them with the architect to fully document the final product.

Modular costs are fixed.

The risk of extra charges, backcharges and surprise costs is typically eliminated in modular construction because a detailed contract is developed between the general contractor or developer and the manufacturer. One local developer who has bought modular boxes and accompanying services for eight or nine years reports that he has never had a backcharge or a surprise cost.[26] Developers also noted that it is important to carefully negotiate the terms of the contract between the manufacturer and the general contractor or developer. Standard modular contracts tend to ask for high deposits and initial payments, but developers report that negotiated terms have allowed them to pay 80 percent or more of the total cost after the boxes were built and set.

Modular units can be paid for as needed.

Once plans are completed, a developer can order a few modular units at a time and set them as they sell, committing to each group of units as the market allows rather than building an entire project and hoping sales will occur. It is important to note, however, that starting and stopping construction repeatedly will entail additional cost.

SPEED & SUSTAINABILITY

In a city of high-cost construction, cost is the key factor when choosing between the two construction methods. But other important advantages and disadvantages to modular-construction methods can also be considered by nonprofit and for-profit developers.

Stick-built construction provides greater design flexibility.

Architects who have used both modular and stick built attest to the fact that using stick-built construction methods allows them to imagine and create any style of home. Modular housing, made up of rectangular units, does not allow for the same level of creativity from the ground up.[27] Factories will customize home designs in accordance with architectural plans, but to achieve savings through the use of modular, the plans must stick fairly closely to traditional floor plans.

Modular construction delivers speed.

Modular projects typically go up in one-third to one-half of the time it takes to complete a stick-built home, regardless of location. One developer who has built in Philadelphia using both methods stated that in his experience, modular saves two months off the time it would take to build a stick-built house.[28] In part, this time savings is explained by the assembly-line mode of building, which is unaffected by weather delays.[29] When there is high demand for new homes, as occurred from 2005 to 2008, the ability to construct them more quickly allows developers to keep up with demand and quickly meet customers' needs.

Modular homes' appraisals, financing, insurance, rents, appreciation and resale values are similar to those of stick-built homes.

A well-built modular home will have the same longevity as its stick-built counterpart, increasing in value over time.[30]

Modular construction lowers the risk of theft and vandalism.

Developers report lower rates of theft and vandalism on modular sites, since fewer materials need to be stored on site. Also, modular houses can be locked and secured as soon as they are put into place on the building site.

MODULAR VERSUS STICK-BUILT CONSTRUCTION: WHICH DELIVERS?

	Modular	Stick Built
DESIGN FLEXIBILITY		✓
SPEED	✓	
VALUE OVER TIME	✓	✓
THEFT REDUCTION	✓	
DURABILITY	✓	
ENVIRONMENTAL BENEFITS	✓	
FAMILIARITY		✓
LOCAL WORKFORCE		✓
TRANSPORTATION COSTS		✓

Modular homes have the same or greater durability.

Modular construction uses more materials than stick-built construction: several manufacturers estimate that anywhere from 10 to 25 percent more materials are used in a modular home in order to make it strong enough for highway transport. For example, 2 x 6 lumber is typically used to build a modular home instead of 2 x 4 lumber, which is standard for stick built. This offers greater strength as well as two extra inches of insulation.[31] Drywall and sheathing are both nailed and glued to every framing member on a modular box in order to allow it to withstand shipping, which includes the potential for exposure to high winds, as well as the box being lifted by a crane.[32] After Hurricane Andrew hit in 1992, FEMA's Mitigation Assessment Team conducted a study to see how various building types weathered the storm. The team concluded that "overall, relatively minimal structural damage was noted in modular housing developments. The module-to-module combination of the units appears to have provided an inherently rigid system that performed much better than conventional residential framing."[33]

City of Philadelphia development-review agencies are comfortable with modular and stick-built construction.

Although many building industry leaders mentioned that in years past, inspectors were uncomfortable with modular construction, all agreed that today, the city inspectors and plan examiners are equally confident with both construction methods. The one difference in how the homes are examined is that modular homes must pass rigorous inspection at two points in the process. The first takes place in the factory, where third-party inspectors inspect and approve the manufacturing process and the construction of each unit. The second occurs when city inspectors inspect the home once it has been set and finished. Because the modular sections are inspected and certified in the factory, less city inspector time must be dedicated to ensuring their quality and safety. City inspectors are able to limit their inspection to checking the foundation, the joining of modular units and party walls, any final installation of siding or roofing, and site utility connections.

Transportation of modular units requires skill and knowledge.

Modular construction requires the modular manufacturer or developer to evaluate whether road conditions, highways, bridge heights, street widths and other factors will permit transport of the large boxes to the building site. Modular builders who were interviewed had very different perceptions about the ease of obtaining permits to move the modular units through traffic: while some said that it involves numerous government agencies and large amounts of paperwork, others who are accustomed to government paperwork reported that the transportation permitting process is nothing unusual.[34] Some developers voiced concern that truck and crane access is not feasible on urban in-fill lots, while others have brought in cranes even on small lots off of narrow Philadelphia alleys.[35]

More local workers are employed to construct stick-built housing.

Modular manufacturing employs its labor at the factory. At this time, there are no modular factories located in Philadelphia; therefore, the jobs will not be located in Philadelphia. There is no available data that shows how many Philadelphians are employed in nearby modular factories. However, a 2009 mayoral report looking at local and minority participation in construction found that a substantial number of construction workers in the city are not Philadelphia residents.[36] If more builders chose modular housing methods, it would create an inducement for factories to open in or near the city—helping Philadelphia to create new jobs and to achieve many of its sustainability objectives by reducing the carbon footprint of home construction.[37]

Modular construction requires the hiring of a general contractor, just like stick-built does, to avoid issues regarding liability.

Leaders of Philadelphia CDCs have reported that when considering modular construction, liability is a major concern. Their fear is that the modular manufacturer will not be considered liable for building defects that might be said to have occurred during set and finish. Nationally, there are reports of conflicts between the manufacturer and the on-site builder, with both trying to shift legal responsibility onto the other.[38] The solution, and the general practice in many communities, is to hire a general contractor who will buy the box, set and finish it and take on liability for any failure, regardless of whether they intend to seek compensation from the manufacturer.[39]

> "[T]here are . . . several basic principles intrinsic to the modular-construction process that make it more eco-friendly than conventional construction. They spend significantly less on-site time . . . which notably minimizes the overall impact on a site. And . . . modular-construction methods and materials allow a building to be more readily "deconstructed" and moved to another location should the need arise, so complete building reuse or recycling is an integral part of the design technology."

"External Issues and Trends Affecting Architects, Architectural Firms, and the AIA," American Institute of Architects, February 2008
http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aiab046303.pdf

Experts agree that a home built using either stick-built or modular construction can be environmentally sustainable and energy efficient.

THERE ARE SOME GREEN FEATURES THAT FAVOR MODULAR.[40]

Modular building provides shorter site disturbance during the construction process.[41] The modular structure is constructed off site simultaneously with foundation and other site work, thereby reducing the time and impact on the surrounding site and reducing the number of vehicles and equipment needed at the site. Completing construction in a far shorter time offers significant benefits to the community, as well. Neighbors experience fewer trucks, less noise and minimal dust and debris compared to stick built.

Modular can create a more uniformly airtight building. With site-built construction, the wood expands and contracts as it is being built, which may affect the feasibility of creating an airtight structure. In addition, some experts have found that the delegation of the work to different subtrades may cause similar problems: for instance, a worker may inadvertently tear holes in a vapor barrier on the inside of a wall designed to prevent moisture damage.[42] This is far less likely to happen in the indoor environment of a factory, where a single team works full time together on the houses. To achieve airtightness, however, a modular home must be accurately set and sealed, and whether this is accomplished effectively depends on the experience and skills of the crew involved.

Modular building is more easily deconstructed and the materials are more easily reused.[43] If the need for a modular home on a particular site disappears, the modular building can be disassembled and the modules relocated or refurbished for their next use. The entire building can be recycled, in some cases.

Modular construction presents fewer indoor air-quality issues due to less material exposure to inclement weather. Because the modular structure is substantially completed in a factory-controlled setting using dry materials, the potential for high levels of moisture being trapped in the new construction is eliminated, and the home is less prone to mold. This advantage is lost if the modular units are stored outdoors at the factory after completion, or left sitting in the rain on site for days before being set or finished.[44]

RECOMMENDATIONS

Educate developers, contractors and potential owners about modular single-family construction.

Builders of single family homes have been slow to adopt new technical approaches to construction or to use innovative products. As the New Kensington Community Development Corporation (NKCDC) found in 2008, "[T]here is a general lack of knowledge within the Philadelphia development community with regard to modular construction. At present, inexperience is a primary limitation to developing, building and investing in this method."[45]

The When We Fix It Coalition, the Building Industry Association and other key players in new construction should provide a series of trainings and open houses to educate building professionals about modular construction. Architects, contractors and builders need good information well in advance of their next residential new construction project in order to select the most appropriate construction method. The current building slump provides the perfect opportunity to get builders in a room and familiarize them with the benefits of new technologies.

Attract a modular factory to the city or near its borders to further reduce the costs of modular.

Modular builders in the state are currently limited to shipping boxes no wider than 16 feet on state highways. One builder has found a way around these restrictions in New York City—by shipping exclusively on local roads and obtaining an agreement with the city that allows the transportation of wider boxes. New York City, in order to bring down the cost of constructing affordable housing, has authorized the shipping of 18- and 20-foot-wide boxes on local roads between midnight and 4:00 a.m. This allows for larger homes to be built using a single box.[46]

Capsys Corporation, located in the Brooklyn Navy Yard, transports modules of 20 feet wide and up to 45 feet long in the early morning hours on local roads. Capsys has found that the 20-foot width of the modules allows just one module to constitute a single floor and reduces the number of plumbing, heating and electrical connections that must be made in the on-site finish process. Capsys obtains permits through the New York City Department of Transportation, and the city provides a police escort; the streets are not closed. Engineers hired by Capsys are responsible for performing thorough surveys of the entire transport route in advance and submitting them to the city.

As modular construction takes over a greater percentage of total building in the city, Philadelphia certainly could offer the same arrangement to a new or existing local modular company in order to lower costs further. Having a manufacturer in or nearer to Philadelphia's borders would allow for the training and hiring of more Philadelphia workers, particularly minority workers, who currently are underrepresented on union construction-site crews.

CONCLUSION

Too often, Philadelphia fails to keep and attract residents and businesses because of regionally uncompetitive taxes, costs and fees.

In the residential construction area, high labor costs that are 18 percent above the national average raise the cost of building a new home in the city by more than $35,000 over the cost of an identical stick-built house in the suburbs. This higher cost presents a tremendous obstacle to building affordable and middle-class housing in the city for residents, refreshing Philadelphia's aging housing stock and redeveloping abandoned land.

After decades of fruitless efforts to lower the cost of union housing-construction labor to a competitive level, this report looks to technology to help make new, single-family-home construction viable in the city without the need of substantial subsidy by the city, state or federal governments.

The analysis provided in this report shows conclusively that the cost to build single-family homes can be meaningfully reduced by using modular construction. Savings of 20 cents or 9 cents on the dollar are not sufficient to close the market gap between the high cost to build in Philadelphia and the city's low market values, but these savings do offer substantial help in making new housing construction viable in the city of Philadelphia.

APPENDIX

METHODOLOGY

Many factors contribute to the cost of building a house, including land, site development, labor, materials, utility hook-ups, permits and all the overhead costs of equipping and operating a building company. The goals for this analysis are to keep as many of these factors as constant as possible and to determine whether the cost of construction of an identical house on an identical site varies significantly depending upon whether modular or stick-built construction methods are used.

The coalition hired AMC Delancey Group, Inc. and RMR Real Estate Advisors, Inc. as consultants to obtain accurate, objective cost estimates for each aspect of building a house with either stick-built or modular construction. AMC Delancey Group and RMR Real Estate Advisors selected four contractors based upon their past work in residential construction and their reputation for reasonable pricing that reflects the general market. AMC Delancey Group and RMR Real Estate Advisors issued an RFI requesting cost estimates in writing as part of a complete bid package. Contractors were informed that their bids would be used for the purposes of a study but were strongly encouraged to provide the most accurate pricing possible due to the report's audience. Initially, two firms were asked to bid for each location and type of construction. This created a significant range of prices. In October and November 2009, two additional building firms were asked to respond to the identical RFI in order to offer a fuller representation of the range of prices for constructing a home using the two methods.

Matt Koenig at JKR Partners LLC in Philadelphia furnished architectural plans and specifications for the two house designs. (These are included in the Architectural Plans section of the appendix.) The 16-foot-wide and 20-foot-wide homes were designed to be attractive, functional and affordable. Both home designs offer a two-floor home with a brick facade. Each contains a full-service kitchen, three bedrooms, one bathroom and an optional powder room. In addition to the plans, each contractor received elevations, site details, a materials list and a narrative description.

The bids assumed that 12 houses would be built, allowing the product to benefit from some economies of scale. Contractors were told that their bids should reflect the customary use of union labor in the city of Philadelphia.

Each of the four contractors furnished bids for constructing one rowhome/townhouse that was 16 feet wide and one that was 20 feet wide using stick-build construction and the same using modular methods. Three contractors provided bids for both a suburban and an urban location. One did not provide cost estimates for the suburban location due to a lack of past experience in the suburbs. For the purpose of this study, the suburban and urban locations were assumed to be identical.

Specifically, the scope asserted the following assumptions:

1. The urban and suburban sites are identical in size, dimensions and configuration.

2. All utilities are immediately available to the site, with no off-site requirements for infrastructure improvements.

3. Sites do not require any demolition and are flat, and the indigenous soil is suitable for foundations and backfill. There are no underground obstructions or contaminants in the soil, with no requirements for export or import or any soil exchange. There are no sheeting, shoring or underpinning requirements for adjacent roads or structures.

4. The sites are accessible to all construction activities, with no requirements for off-site staging, special permits for access into the site or street/sidewalk closure permits.

5. In order to avoid urban versus suburban charges for utility company backcharges, water and sewer connection permits, wastewater discharge permits, etcetera, estimates will be predicated on not including these fees.

5. Contractor shall assume houses front on existing public streets, with no requirement to repair/replace front sidewalks, and shall assume surface parking for two vehicles immediately behind the home, with connecting sidewalk. Contractor shall use a landscape/hardscape allowance of $2500 per home.

6. The bid is for an interior attached house unit. Contractors are asked to estimate separately the added cost to build an end unit.

Each contractor received a cost-breakdown sheet and a qualifications form in order to provide a detailed cost estimate for each aspect of construction of the homes. The same sheet needed to be completed for each house at each location using modular and stick-built methods. (See the Cost Breakdown Sheet in the appendix.)

For modular construction, two price estimates were obtained from local modular firms for the box or boxes, and these prices included the cost to set the boxes on the permanent foundation at the site. Neither of the two modular manufacturers used for the purposes of this study were union shops. The contractor was responsible for "finishing" the house. Contractor finishing obligations were spelled out in the scope as follows:

a. Exterior siding and trim
b. Foundations, basements and waterproofing
c. Gutters and downspouts
d. Utility extensions and connections to public service
e. Exterior painting
f. Site work, landscaping and exterior pavements

In order to provide a single cost number for the construction of a modular home, the cost of the box and set were added to the finish costs. The costs cited in this report do not include site work.[47]

All questions posed by contractors were answered in a written supplement to the RFI in order to assure that each contractor's bids were based upon the same assumptions regarding design specifications, materials and code compliance. (See the Request for Information Supplement, page 37, in the appendix.)

Request for Information (RFI)

1. Background/Introduction: About the BIA of Philadelphia

Established in 1937, the Building Industry Association of Philadelphia has become a leader in the real-estate development industry by addressing significant business-related issues. The BIA of Philadelphia is recognized as the leading organization in its industry for providing local and regional information and advice from policy makers and elected officials. Many BIA members hold positions of influence on various boards and commissions, and others have been deeply involved in helping to craft policies in the city of Philadelphia.

Objectives of this study directly coincide with many ongoing goals of the BIA:

- Educating members through reports addressing important industry topics as well as sponsoring forums, including the BIA's Annual Housing Conference
- Working with the housing agencies and neighborhood Community Development Corporations to promote skilled and competent minority workers
- Educating BIA members and members of city government about the benefits of sustainable building techniques and practices
- Expanding the market for all housing, paying particular attention to policies that promote middle-income housing
- Promoting housing affordability by reducing construction costs
- Working with city government and agencies to remove barriers to re-investment in the neighborhoods

2. Glossary of Terms and Definitions

Client: NeighborhoodsNow and/or the Building Industry Association of Philadelphia ("BIA").

Consultant: Any of the following consulting entities participating in the research and development of this RFI and ultimate reports to Client: AMC Delancey Group, Inc.; JKR Partners; May 8 Consulting; and RMR Real Estate Advisors.

Contractor: Any of the general contractors, construction managers or modular housing manufacturers responding to this RFI.

Report: Any draft or final report emanating from Consultant related to this RFI.

RFI: The Request for Information ('RFI") comprising this document, along with all attachments and exhibits.

3. Purpose and Objectives

Consultant is currently conducting market research for Client. This RFI is part of this market research effort. This RFI requests industry input on a number of topics and issues that are reflected in Attachment 1. Consultant will use the information collected to develop a report or reports to be potentially released in the near future to Client and/or the public.

4. RFI Response Instructions

Contractors should review the RFI and use best efforts to diligently base their responses on the information provided. When responding, Contractors must utilize the format provided in Attachment 3 in the RFI documents and exercise care in furnishing all information requested in the particular format requirements. Responses are due to Paul J. Commito of AMC Delancey Group, Inc. via email at "pcommito@amcdelancey.com" not later than 5:00 pm (EDT) on 25 September 2009. Late responses, failure to use the requested format, and incomplete information may render the Contractor's response "Non-Responsive."Attachments 1 to 3 are provided to assist Contractors in developing their response.

5. Milestone Schedule

The table below reflects the milestone schedule. Contractors should note that this schedule is subject to change upon prior written notice.

Event	Target Completion Date
Release of RFI Package	8 September 2009
Receipt of Contractor Responses	25 September 2009
Analysis of Contractor Responses	6 October 2009
Internal Distribution of Data Compilation	13 October 2009
Draft Report	20 October 2009
Final Report	30 October 2009

6. Disclaimer

This RFI does not constitute a solicitation for proposals or the authority to enter into negotiations to award any contract. This RFI is for research and reporting purposes only and shall not be considered as a request for proposal or as an obligation on the part of the Client or Consultant to acquire any products or services. Unless specifically agreed upon to the contrary, no entitlement to payment of direct or indirect costs or charges by the Client or Consultant will arise as a result of Contractor submission of responses to this RFI or the use of such information by Client or Consultant. Responses to this RFI will not be returned. Whatever information is provided in response to this RFI may be used to assess tradeoffs and alternatives available for determining the contents of any reports produced based wholly or in part on the information furnished. Any data, material and the like, in whole or in part, that is submitted may be used as part of any private or public dissemination of information, but specific Contractor submitted documentation will be safeguarded as proprietary. By the Contractor submitting a response to this RFI, Contractor agrees to the use of its company name in any draft or final reports generated by the Client or Consultant.

7. Attachments

A. Narrative Description of Scope of Study

B. Plans and Specifications

C. Response Format / Cost Breakdown Sheet and Qualifications

Narrative Description of Scope of Study

Cost Comparison of Site-Built and Modular Construction

The goal of this study is to obtain accurate, objective cost estimates for each aspect of building a townhome as either site-built or modular construction. AMC Delancey Group, Inc. and RMR Real Estate Advisors, Inc. (Consultant) will obtain cost estimates in writing as part of a complete bid package. Contractors asked to bid will be selected based upon past work in residential construction and a reputation for reasonable pricing that reflects the general market.

1. Consultant will describe two generic sites—one urban, one suburban. The goal is to ensure that both the urban and suburban sites share basic attributes and do not provide any unique challenges that would raise the cost to build at either location. Consultant will provide May 8 Consulting with the generic descriptions of these sites for the purposes of writing the report and will furnish the same description to the contractors asked to bid.

2. Consultant will identify two (2) union and two (2) non-union contractors for each site, each of whom would bid as both stick-built and for finishing the boxes. Consultant will identify two modular manufacturers to bid on providing a 16-ft.-wide and 20-ft.-wide box for the two locations. The designs for these homes will be based on a 16-ft. and 20-ft. home design by JKR Partners. Consultant will work with Matt Koenig at JKR Partners to ensure specifications are complete for these two home designs.

3. Consultant will request bids and will ensure that they have at least two complete and credible bids for each size home and for each mode of construction for the urban and suburban locations. Consultant will request bids from contractors for the same two home designs for generic sites in the city and suburbs. Consultant will provide May 8 Consulting with the plans and specifications, which will be furnished to the contractors asked to bid.

4. Based on general industry practices, it will be assumed that union labor must be used in the city of Philadelphia and non-union labor will be used at the suburban location.

5. Consultants will receive the bids by September 25 and provide analysis of the bids by October 6, 2009.

6. Consultant will perform a de-scoping and valuation analysis to make certain that a “level playing field” is established and “apples to apples” estimates are being utilized. Where bids are incomplete and consultants must obtain supplemental information by phone, accurate notes of these conversations will be kept and will be used to provide footnotes to the information to ensure continuity and accuracy.

7. Consultant will determine average absolute pricing and pricing per square foot for the two product types in both environments. Consultant will provide an analysis of what aspects or stages of the construction process caused the differences in pricing.

8. Consultant will ask for bids with the understanding that it will be used for purposes of a BIA study, but contractors will be strongly encouraged to provide the most accurate pricing reasonably feasible due to the report’s audience and potential real benefits to the contractors via public relations.

9. Final bids and analysis will be provided to May 8 Consulting no later than October 13, 2009.

16-FT. UNIT PLAN

STRUCTURAL NOTES

FRAMING NOTES

1. ALL LUMBER SHALL BE S4S AND GRADE STAMPED. MOISTURE CONTENT NOT TO EXCEED 19 PERCENT IN ALL SIZES 2" OR LESS IN THICKNESS.
2. FOR EXPOSED LUMBER APPLY GRADE STAMPS TO ENDS OR BACK OF EACH PIECE OR OMIT GRADE STAMPS AND PROVIDE CERTIFICATE OF GRADE COMPLIANCE.
3. LIGHT FRAMING AND STUDS - HEM-FIR, STANDARD OR BETTER.
4. JOISTS AND RAFTERS - HEM-FIR NO. 2 OR BETTER. Fb: 1200 psi E: 1,500,000psi
5. POSTS, BEAMS & TIMBERS - HEM-FIR NO. 1.
6. EXPOSED FRAMING LUMBER - HAND SELECT APPEARANCE GRADE MATERIAL.
7. ALL MISCELLANEOUS LUMBER SHALL BE HEM-FIR, STANDARD OR BETTER UNLESS OTHERWISE NOTED.
8. ROOF SHEATHING SHALL BE 1/2" CDX (PI 24/0) WITH 10d COMMON NAILS @ MAX. 6" O.C. AT ALL END SUPPORTS.
9. PROVIDE SOLID BLOCKING AT ALL BEARING WALLS.
10. ROOF TRUSSES SHALL BE PER MANUFACTURER'S SPECIFICATIONS.
11. ALL WOOD IN CONTACT WITH CONCRETE OR CMU SHALL BE PRESSURE TREATED WITH PRESERVATIVES PER AWPB LP-2.
12. PROVIDE PLYWOOD SHEATHING 48" OUT IN BOTH DIRECTIONS FROM ALL OUTSIDE CORNERS OF EXTERIOR WALL FRAMING.

MISCELLANEOUS MATERIALS

1. GYPSUM SHEATHING SHALL BE 1/2" GRADE W.
2. FIBERBOARD SHEATHING SHALL BE 1/2" "HOMASOTE" 440.
3. METAL HANGERS AND ANCHORS SHALL BE "SIMPSON" AS SHOWN ON THE DRAWINGS.
4. NAILING SHALL BE PER BOCA 1993, TABLE 2305.2.

TYPICAL HEADERS

1. DOUBLE 2x8 HEADERS OVER ALL OPENINGS IN INTERIOR NON-BEARING WALLS

PARTITION TYPES

A — 4" BRICK VENEER WITH 1" AIR SPACE OVER ½" EXTERIOR TYPE 'X' SHEATHING ON 2x6 WOOD STUD WITH BATT. INSULATION 16" O.C. WITH ½" G.W.B. ON INTERIOR SIDE.

B — VINYL SIDING ON ½" EXTERIOR TYPE 'X' SHEATING OVER 2x6 WOOD STUD WITH BATT INSULATION @ 16" O.C. WITH ½" GYPSUM WALL BOARD, USE MOISTURE RESISTANT GYPSUM WALLBOARD IN WET AREAS.

C — MARRIAGE WALL @ CENTER
½" TYPE 'X' G.W.B. OVER 2x3 WOOD STUD OVER 1" AIRSPACE OVER 2x3 WOOD STUD ON ½" TYPE 'X' G.W.B. USE MOISTURE RESISTANT GYPSUM WALLBOARD IN WET AREAS.

D — 4" SHOULDICE VENEER WITH 1" AIR SPACE OVER 8" CMU BLOCK

E — INTERIOR WALL
½" G.W.B. ON 2x4 WOOD STUD W/ BATT. INSULATION
(AT WET LOCATION USE ½" MOISTURE RESISANT GYPSUM WALL BOARD)

FOUNDATION NOTES

FOUNDATION

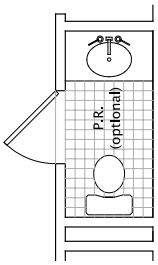
1. BOTTOM OF FOUNDATION IS ASSUMED TO BEAR ON SOIL CAPABLE OF SUPPORTING 3000 PSF.
2. BOTTOM OF ALL FOOTINGS MUST BE INSPECTED AND APPROVED BY A REGISTERED SOILS ENGINEER BEFORE PLACING ANY CONCRETE. APPROVAL IN WRITING MUST INDICATE THE SOIL IS ADEQUATE TO SAFELY SUSTAIN SPECIFIED SOIL BEARING PRESSURE.
3. BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE MINIMUM THREE FEET BELOW EXTERIOR FINISH GRADE.
4. ALL DIMENSIONS ARE TO FACE OF CMU UNLESS NOTED OTHERWISE.

CONCRETE

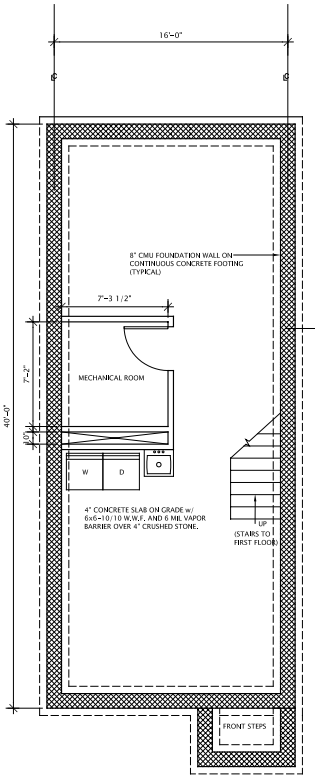
1. ALL CONCRETE SHALL BE REDI-MIX. HAVE A MINIMUM COMPRESSIVE STRETNGTH OF 3000 PSI AT 28 DAYS. HAVE A MINIMUM OF 500 LBS. OF CEMENT PER CUBIC YARD. SLUMP (AT POINT OF CONCRETE PLACEMENT) SHALL BE 3 INCH MINIMUM AND 6 INCH MAXIMUM. CONCRETE EXPOSED TO WEATHER SHALL HAVE 4 PERCENT AIR ENTRAINMENT. ALL CONCRETE SHALL HAVE A MAXIMUM WATER-CEMENT RATIO OF 0.45 BY WEIGHT. SUBMIT MIX DESIGNS FOR REVIEW.
2. ALL CONCRETE WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE ACI BUILDING CODE (ACI 318). THE ACI DETAILING MANUAL (ACI 315), AND THE SPECIFICATIONS FOR STRUCTURAL CONCRETE OR BUILDINGS (ACI 301).
3. ALL REINFORCING STEEL SHALL BE MANUFACTURED FROM HIGH STRENGTH BILLET STEEL CONFORMING TO ASTM DESIGNATION A615 GRADE 60. WWF SHALL COMPLY WITH ASTM A185.
4. LAP ALL BARS MINIMUM 40 DIAMETERS. LAP WWF A MINIMUM OF 6 INCHES.

MASONRY

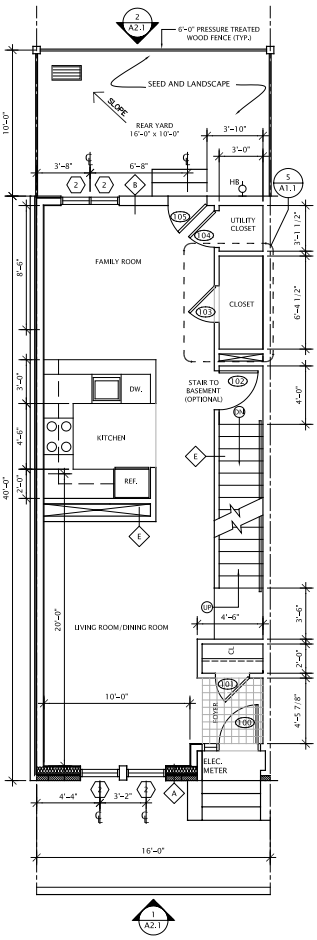
1. MASONRY UNITS SHALL BE TYPE N-1 ASTM C90 SOLID OR ASTM C90 HOLLOW GROUTED SOLID BELOW GRADE, ASTM C90 SOLID ABOVE GRADE WITH MINIMUM COMPRESSIVE STRENGTH OF 1800 PSI.
2. ALL MORTAR SHALL BE ASTM C270 TYPE S WITH A MINIMUM COMPRESSIVE STRENGTH OF 1800 PSI AT 28 DAYS. EXCEPT IVANY BLOCK SHALL BE LAID USING ASTM C270 TYPE M MORTAR WITH A MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI AT 28 DAYS.
3. GROUT SHALL BE A HIGH SLUMP MIX IN ACCORDANCE WITH ASTM SPECIFICATION C476 AVING A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI.
4. ALL CONCRETE MASONRY SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE "BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES ACI 530-88/ASCE 5-88" AND "SPECIFICATIONS FOR MASONRY STRUCTURES ACI 530.1-88/ASCE 6-88."
5. PROVIDE HOT-DIPPED GALVANIZED TRUSS TYPE HORIZONTAL JOINT REINFORCEMENT. MIN. 9 GA. AT 16" ON CENTER VERTICAL IN ALL MASONRY WALLS.



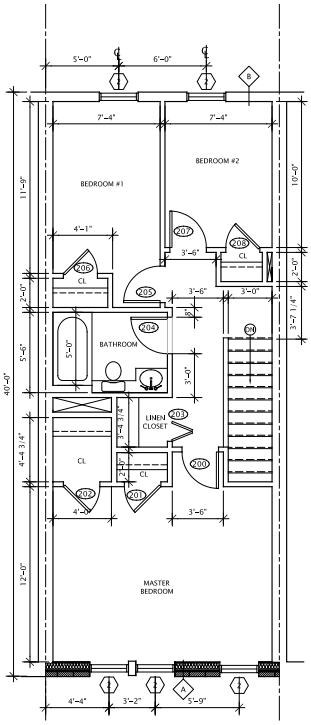
5 A1.1 OPTIONAL POWDER ROOM IN CLOSET
SCALE: 1/2" = 1'-0"



1 A1.1 BASEMENT FOUNDATION 16'-0" UNIT
SCALE: 1/4" = 1'-0"



1 A1.1 FIRST FLOOR 16'-0" UNIT
SCALE: 1/4" = 1'-0"



2 A1.1 SECOND FLOOR 16'-0" UNIT
SCALE: 1/4" = 1'-0"

DOOR SCHEDULE

DOOR NO.	ROOM NAME	TYPE	MATERIAL	WIDTH	HEIGHT	THICKNESS	HARDWARE	REMARKS
100	FRONT ENTRY	A	MHHC	2'-8"	7'-0"	1 3/8"		
101	CLOSET	D		2'-4"	6'-8"			
102	BASEMENT	B		2'-8"	6'-8"			
103	POWDER ROOM	C		2'-6"	6'-8"			
104	W/D	C		2'-6"	6'-8"			
105	REAR ENTRY	A		2'-8"	7'-0"			
200	BEDROOM	C		2'-6"	6'-8"			
201	BEDROOM CLOSET	C		2'-6"	6'-8"			
202	BEDROOM CLOSET	C		2'-6"	6'-8"			
203	WASHER/DRYER	E		3'-0"	6'-8"			
204	BATHROOM	C		2'-6"	6'-8"			
205	BEDROOM	C		2'-6"	6'-8"			
206	BEDROOM CLOSET	D		2'-4"	6'-8"			
207	BEDROOM	C		2'-6"	6'-8"			
208	BEDROOM CLOSET	D		2'-4"	6'-8"			

MHHC = MOULDED HARDBOARD HOLLOW CORE

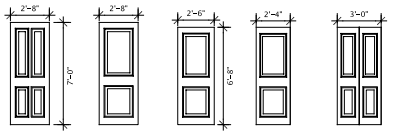
HARDWARE

1. LOCKSET BY SCHLAGE 1 1/2 PAIR HINGES BY STANLEY

   * FRONT DOOR TO RECEIVE MAIL SLOT AND PEEPHOLE

2. PRIVACY SET BY SCHLAGE 1 1/2 PAIR HINGES BY STANLEY
3. LATCH SET BY SCHLAGE 1 1/2 PAIR HINGES BY STANLEY

DOOR TYPES



A	B	C	D	E
4 PANEL EXTERIOR WOOD DOOR	2 PANEL MOLDED HARDBOARD HOLLOW CORE	2 PANEL MOLDED HARDBOARD HOLLOW CORE	2 PANEL MOLDED HARDBOARD HOLLOW CORE	2 PANEL MOLDED HARDBOARD HOLLOW CORE BI FOLD DOOR (LOUVERS OPTIONAL)

NOTE: ALL DOORS AND FRAMES ARE PAINTED

OUTLINE SPECIFICATIONS

BASE STRUCTURE

FLOOR SYSTEM
FIRST FLOOR SYSTEM INCLUDES DOUBLE 2"X1.0" PERIMETER JOIST AND TRIPLE 2" X 10" CENTER JOIST AT MATING WALL.
SECOND FLOOR SYSTEM CONSISTS OF DOUBLE 2" X 10" PERIMETER JOIST AND DOUBLE 2" X 10" CENTER JOIST AT MATING WALLS.
FLOOR JOISTS ARE 16" O/C.
FLOOR DECKING IS ONE LAYER OF 7/16" OSB AND ONE LAYER OF 1/2" WESTERN FIR PLYWOOD.
FACTORY INSTALLED CONSTRUCTION ADHESIVE IS USED ON PLYWOOD LAYERS.
JOHNS MANVILLE FORMALDEHYDE-UREA FREE W/25% RECYCLED CONTENT R-19 KRAFT FACED FLOOR INSULATION SHIPPED LOOSE.

WALL AND CEILING SYSTEMS
EXTERIOR WALLS ARE 2" X 6" WSPF @ 16" O/C: SINGLE BOTTOM AND DOUBLE TOP PLATE.
JOHNS MANSVILLE FORMALDEHYDE-UREA FREE W/25% RECYCLED CONTENT R-19 KRAFT FACED INSULATION PROVIDED IN EXTERIOR WALL APPLICATIONS.
WALL SHEATHING 7/16" ZIP WALL.
2" X 10" BLOCKS AT ALL EXTERIOR WINDOWS AND DOORS AND ALL BATHROOM ACCESSORIES.
INTERIOR WALLS ARE 2" X 4" WSPF STUDS @ 16" O/C.
INTERIOR WALLS AND CEILINGS ARE COVERED IN 1/2" USG SHEETROCK AND PRIMED WITH TWO COATS OF SHERWIN WILLIAMS MASTERHIDE MODERATE WHITE FLAT PAINT.
JOHNS MANVILLE FORMALDEHYDE-UREA FREE W/25% RECYCLED CONTENT R-41 INSULATION PROVIDED IN TOP FLOOR CEILING APPLICATION
5/8" TYPE XDRYWALL ON FIRE RATED WALLS, AND 5/8" TYPE C DRYWALL ON FIRE RATED CEILINGS.
TWO 2" PVC UTILITY CHASES TO RUN PIPING, ELECTRIC AND AUDIO/VIDEO.
INTERIOR BASE MOLDING AND DOOR CASEMENT TRIM WILL BE PAINTED WITH SHERWIN WILLIAMS MASTERHIDE MODERATE WHITE SEMI GLOSS PAINT.

EXTERIOR
7/16" ZIP WALL APPLIED TO ALL EXTERIOR WALLS.

ROOF SYSTEM
ROOF SYSTEM INCLUDES 2" X 6" SYP RAFTERS AND CEILING JOIST, 16" O/C.
ROOF DECK CONSISTS OF 1/2" ZIP WALL ROOF SYSTEM.

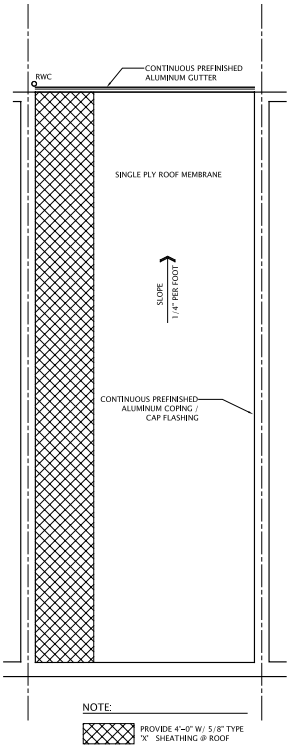
ELECTRICAL
110 VOLT OUTLETS PROVIDED TO MEET CODE REQUIREMENTS. EXTRA OUTLETS CAN BE ORDERED AS REQUIRED.
EMT CONDUIT THROUGHOUT.
PASS & SEYMOUR TOGGLE WALL SWITCHES AND WIRING BY CODE.
PASS & SEYMOUR DUPLEX/LA RECEPTACLES.
WESTINGHOUSE CUTLER HAMMER 200 AMP PANEL WITH 40 CIRCUITS.
BRK CO/SMOKE DETECTOR HARDWIRED WITH BATTERY BACKUP.
ARC FAULT BEDROOM AND SMOKE DETECTOR CIRCUITS.
GFI WITH WHILE IN USE COVER @ FRONT AND REAR DOOR.
FRONT DOOR CHIME.
WHITE COVER PLATES.

PLUMBING
ROUGH-IN PLUMBING IN ACCORDANCE TO PLAN TO INCLUDE: SINK DRAINS AND SUPPLY LINES, TUB/SHOWER DRAINS AND SUPPLIESWATER CLOSET DRAINS AND SUPPLY LINE. PVC ROOF VENTS FOR PLUMBING AS REQUIRED.
COPPER WATER SUPPLY SYSTEM.
OATEY ICEMAKER WATERLINE TO REFRIGERATOR.

GENERAL
FULL SET OF SEALED CONSTRUCTION DRAWINGS TO INCLUDE ALL FLOOR PLANS, ELEVATIONS AND DETAILS TO BUILD THE HOUSE.
INTERMODULAR CONNECTIONS.

OPTIONS	DESCRIPTION
WALL AND CEILING	
FIRE WALLS	ONE HOUR FIRE RATING ON EXTERIOR WALLS AND CEILINGS
ROOF SYSTEM	
SHINGLES	OWENS CORNING 30 YR ARCHITECTURAL ONYX BLACK
WINDOWS	
WINDOWS	SILVERLINE BY ANDERSEN 2900 SERIES SH VINYL GBG 2 OVER 2 GRILLE PATTERN WHITE
DOORS	
EXTERIOR	THERMA TRU 1 PANEL 1/2 LITE
EXTERIOR	ADA UNITS ONLY WILL COME WITH A THERMA TRU STAINLESS STEEL SILL
INTERIOR	MASONITE 2 PANEL SQ TOP MOLDED SMOOTH HOLLOW CORE
HARDWARE EXTERIOR	KWIKSET COVE KNOB – SATIN NICKLE
HARDWARE EXTERIOR	KWIKSET 600 SERIES – DEADBOLT
HARDWARE INTERIOR	KWIKSET COVE KNOB – SATIN NICKLE
INTERIOR TRIM	
BASE MOULDING	1X 6 MDF
WINDOW/DOOR CASEMENT	1 X4 MDF
CABINETRY	
KITCHEN	BASE/WALL MERRILAT ESSENTIALS – MILLBRIDGE II OAK
BATHROOM	MERRILAT ESSENTIALS – MILLBRIDGE II OAK
COUNTER TOPS	
FORMICA COUNTER TOPS	KITCHENS – FORMICA
BATHROOM COUNTER TOPS	BATHROOMS – CULTURED MARBLE
BATH ACCESSORIES	
BATH MIRROR	FERGUSON BATH MIRROR
BATH ACCESSORIES	KOHLER CORALAIS K13430 POLISHED CHROME TOWEL BAR
BATH ACCESSORIES	KOHLER CORALAIS K13434 POLISHED CHROME TOILET PAPER HOLDER
HANDICAP BARS	ADA UNITS ONLY – MOEN CSI R8718W GRAB BARS
BATH FAN/LIGHT	BROAN QTXE080 BATH FAN
ELECTRICAL	
LIGHTING	THOMAS LIGHTING -- PL326-BL CHROME – BEDROOMS, HALL, DIN. RM
LIGHTING	THOMAS LIGHTING -- SL7213-4 CHROME – BEDROOMS
LIGHTING	THOMAS LIGHTING -- FWL2324B – KITCHEN, LAUNDRY ROOM
PLUMBING	
WATERHEATER - TANKLESS	RINNAI 7.5 GAL. INT. TANKLESS WATER HEATER - NATURAL GAS
TOILET	STERLING BY KOHLER ROCKSTON 12" 402027 WATER SENSE TOILET
KITCHEN SINK	STERLING BY KOHLER MIDDLETON 14708
TUB/SHOWER	STERLING BY KOHLERADVANTAGE SMOOTH WALL TUB/SHOWER 61030110
SHOWER-POLIRED BASE	ADA UNIT ONLY – STERLING BY KOHLER OC-5-63/62060103
FAUCETS - KITCHEN SINK	KOHLER CORALAIS K-15172-PCP
FAUCETS - BATHROOM SINK	KOHLER CORALAIS K-15198-PCP
FLOOR COVERING	
HARDWOOD	LAMINATE TARKETT - TREK FLOORING OR EQUIVALENT
CERAMIC TILE	
FLOOR	DAL 6 X 6 WHITE IN BATHS AND POWDERROOMS
STAIR PACKAGE	
STRINGERS	PINE STRINGERS
RISERS	PINE RISERS PAINTED WHITE
TREADS	OAK TREADS
RAILS & POSTS	OAK RAILS
APPLIANCES	
WASHER	WHIRPOOL DUET WFW83005W
STACKABLE UNIT	WHIRLPOOL DUET STACKING COMPONENT 8541503/49971
DISHWASHER	WHIRLPOOL DU8500WPQ
DISPOSAL	INSINKERATOR BADGER V
GAS RANGE	WHIRLPOOL 30 INCH GAS RANGE - WFG114SVB
REFRIGERATOR	WHIRLPOOL 18.2 CU. FT. TOP MOUNT REFRIGERATOR ET8WTKXKB

NOTE: YELLOW FLEX GAS LINE FOR RANGE AND HOT WATER HEATER WILL BE DIRECT DROPPED TO THE CRAWL SPACE FOR ONSITE CONNECTION BY BUILDER.



4 / A1.1 ROOF PLAN 16'-0" UNIT
SCALE: 1/4" = 1'-0"

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SUITE 200
PHILADELPHIA, PA 19107
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16'-0" x 40'-0"
UNIT PLAN

DATE: 09.01.2009

DRAWN BY: MJK \ MM

FILE:

REVISIONS:

0

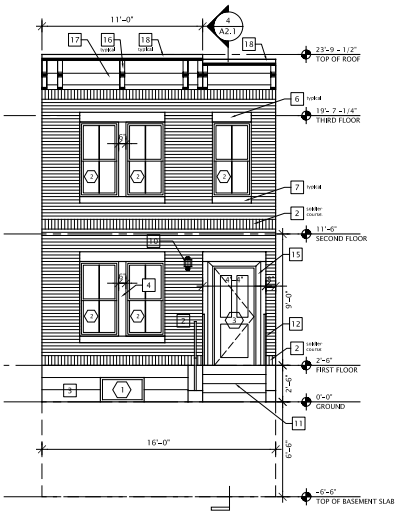
A1.1

PRICING SET
NOT FOR CONSTRUCTION

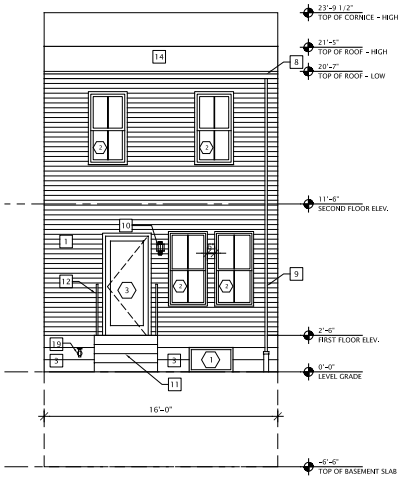
APPENDIX

DESIGN SPECIFICATIONS, ARCHITECTURAL PLANS

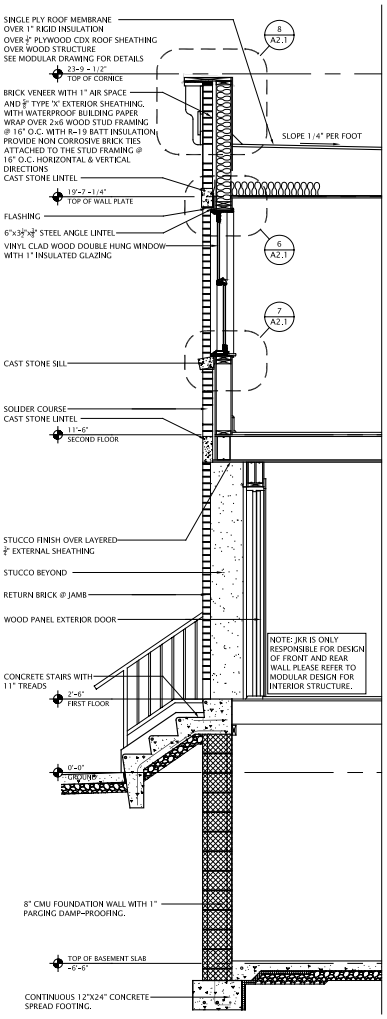
16-FT. UNIT PLAN



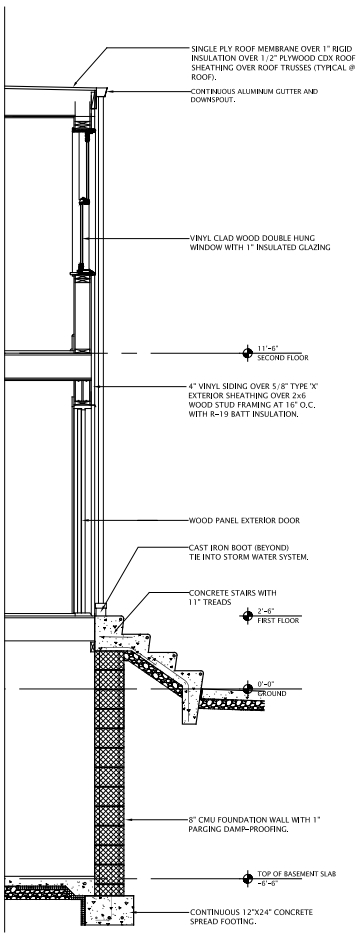
1 A2.1 TYPICAL UNIT – FRONT ELEVATION
SCALE: 1/4" = 1'-0"



2 A2.1 TYPICAL UNIT – REAR ELEVATION
SCALE: 1/4" = 1'-0"

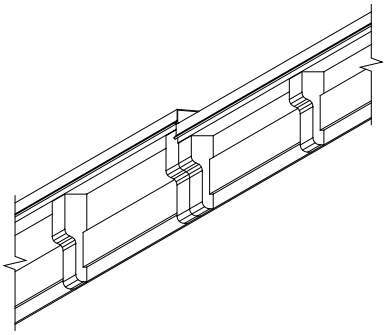


4 A2.1 WALL SECTION THRU FRONT FACADE
SCALE: 1/2" = 1'-0"

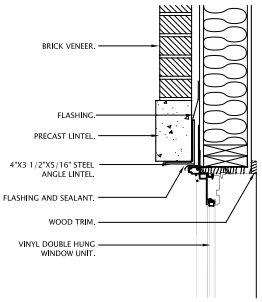


5 A2.1 WALL SECTION THRU REAR FACADE
SCALE: 1/2" = 1'-0"

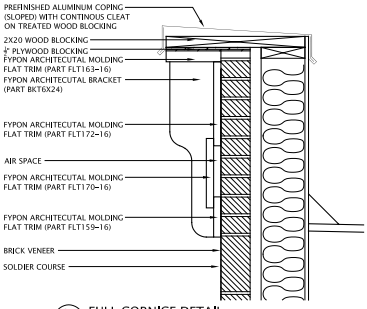
3 / A2.1 SIDE ELEVATION OF END UNIT (IF NECESSARY)
SCALE: 1/4" = 1'-0" 16'-0" UNITS EACH



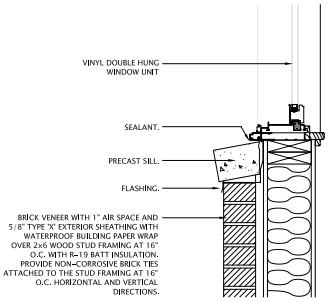
9 / A2.1 AXON OF FIBERGLASS CORNICE
SCALE: 3/4" = 1'-0"



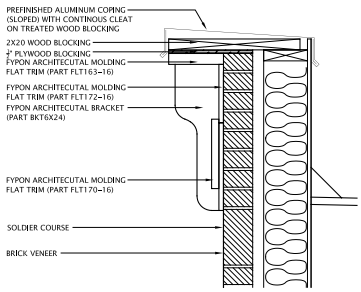
6 / A2.1 WINDOW HEAD DETAIL
SCALE: 1-1/2" = 1'-0"



8A / A2.1 FULL CORNICE DETAIL
SCALE: 1-1/2" = 1'-0"



7 / A2.1 WINDOW SILL DETAIL
SCALE: 1-1/2" = 1'-0"



8B / A2.1 SMALL CORNICE DETAIL
SCALE: 1-1/2" = 1'-0"

MATERIAL KEY

1. 4" VINYL SIDING -DOUBLE CLAPBOARD
2. 4" COMMON FACE BRICK. STANDARD COLOR AND PATTERN.
3. 4" THICKNESS SMOOTH TEXTURE CAST STONE - BY SHOULDICE
4. PAINTED WOOD DIVIDER
5. WEATHERPROOF CONVENIENCE OUTLET
6. CAST STONE LINTEL - ALL LINTELS TO BE SIMILAR.
7. CAST STONE SILL
8. 4" CONTINUOUS ENAMELED ALUMINUM GUTTER
9. ENAMELED ALUMINUM DOWNSPOUT W/ PAINTED CAST IRON BOOT CONNECT TO UNDERGROUND STORM SEWER -COLOR
10. EXTERIOR WEATHERPROOF LIGHT FIXTURE BY PROGRESS OR SIMILAR.
11. POURED IN PLACE CONCRETE STAIR
12. WROUGHT IRON METAL RAILING SYSTEM
13. CONTINUOUS ENAMELED ALUMINUM MOLDING-.032 COLOR
14. SINGLE-PLY ROOF MEMBRANE SYSTEM OVER 1" RIGID INSULATION OVER ½" PLYWOOD SHEATHING
15. ALUMINUM CLAD WOOD TRIM
16. FYPON - BRACKET - DECORATIVE PART (BKT-6X24)
17. FYPON - ARCH. MOULDING FLAT TRIM - PART (FLT172-16)
18. ALUMINUM COPING (TYPICAL) OVER SOLID WOOD PLATE.
19. HOSE BIB - TYPICAL

GENERAL NOTES

1. ALL RWC'S SHALL EXTEND W/ CAST IRON BOOT BELOW GRADE AND CONNECT TO STORM WATER PIPE SYSTEM PER SITEWORK DRAWINGS.
2. AT ALL SINGLE ROOF AREAS PROVIDE WATERPROOF ICE AND WATER SHIELD MEMBRANE AT LOWER 2 FT. ABOVE EAVE AND ALL VALLEYS.

WINDOW SCHEDULE

TYPE	DIMENSIONS WIDTH	DIMENSIONS HEIGHT	PRODUCT DESCRIPTION	REMARKS
1 ☆	R. O. 2'-9"	R. O. 1'-0"	AWNING STYLE VINYL CLAD - INSULATED GLASS WINDOW BY SILVERLINE BY ANDERSEN 2900 SERIES	BASEMENT
2	R. O. 2'-8"	R. O. 5'-0"	VINYL DOUBLE HUNG INSULATED GLASS WINDOW BY SILVERLINE BY ANDERSEN 2900 SERIES SH VINYL GBG 2 OVER2 GRILLE PATTERN - STANDARD COLOR	TYPICAL WINDOW -
3	R. O. 3'-0"	R. O. 7'-0"	VINYL - STORM DOOR WILL FULL GLASS PANEL.	DOOR (F&R)

☆ DENOTES EGRESS SIZE WINDOW

MANUFACTURER: PRICE - SILVERLINE BY ANDERSEN - 2900 SERIES
EXTERIOR COLORS: WHITE
INTERIOR : FACTORY PRIMED, PAINTED.

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PHILADELPHIA, PA 19107
215.923.8171
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16'-0" x 40'-0"
ELEVATIONS & DETAILS

DATE: 09.01.2009
DRAWN BY: MJK \ MM
FILE:
REVISIONS:

A2.1

PRICING SET
NOT FOR CONSTRUCTION

20-FT. UNIT PLAN

STRUCTURAL NOTES

FRAMING NOTES

1. ALL LUMBER SHALL BE S4S AND GRADE STAMPED. MOISTURE CONTENT NOT TO EXCEED 19 PERCENT IN ALL SIZES 2" OR LESS IN THICKNESS.
2. FOR EXPOSED LUMBER APPLY GRADE STAMPS TO ENDS OR BACK OF EACH PIECE OR OMIT GRADE STAMPS AND PROVIDE CERTIFICATE OF GRADE COMPLIANCE.
3. LIGHT FRAMING AND STUDS - HEM-FIR, STANDARD OR BETTER.
4. JOISTS AND RAFTERS - HEM-FIR NO. 2 OR BETTER. Fb: 1200 psi E: 1,500,000psi
5. POSTS, BEAMS & TIMBERS - HEM-FIR NO. 1.
6. EXPOSED FRAMING LUMBER - HAND SELECT APPEARANCE GRADE MATERIAL.
7. ALL MISCELLANEOUS LUMBER SHALL BE HEM-FIR, STANDARD OR BETTER UNLESS OTHERWISE NOTED.
8. ROOF SHEATHING SHALL BE 1/2" CDX (PI 24/0) WITH 10d COMMON NAILS @ MAX. 6" O.C. AT ALL END SUPPORTS.
9. PROVIDE SOLID BLOCKING AT ALL BEARING WALLS.
10. ROOF TRUSSES SHALL BE PER MANUFACTURER'S SPECIFICATIONS.
11. ALL WOOD IN CONTACT WITH CONCRETE OR CMU SHALL BE PRESSURE TREATED WITH PRESERVATIVES PER AWPB LP-2.
12. PROVIDE PLYWOOD SHEATHING 48" OUT IN BOTH DIRECTIONS FROM ALL OUTSIDE CORNERS OF EXTERIOR WALL FRAMING.

MISCELLANEOUS MATERIALS

1. GYPSUM SHEATHING SHALL BE 1/2" GRADE W.
2. FIBERBOARD SHEATHING SHALL BE 1/2" "HOMASOTE" 440.
3. METAL HANGERS AND ANCHORS SHALL BE "SIMPSON" AS SHOWN ON THE DRAWINGS.
4. NAILING SHALL BE PER BOCA 1993, TABLE 2305.2.

TYPICAL HEADERS

1. DOUBLE 2x8 HEADERS OVER ALL OPENINGS IN INTERIOR NON-BEARING WALLS

PARTITION TYPES

A1 — 4" BRICK VENEER WITH 1" AIR SPACE OVER ½" EXTERIOR TYPE 'X' SHEATHING ON 2x6 WOOD STUD WITH BATT. INSULATION 16" O.C. WITH ½" G.W.B. ON INTERIOR SIDE.

A1 — VINYL SIDING ON ½" EXTERIOR TYPE 'X' SHEATING OVER 2x6 WOOD STUD WITH BATT INSULATION @ 16" O.C. WITH ½" GYPSUM WALL BOARD. USE MOISTURE RESISTANT GYPSUM WALLBOARD IN WET AREAS.

C1 — MARRIAGE WALL @ CENTER
½" TYPE 'X' G.W.B. OVER 2x3 WOOD STUD OVER 1" AIRSPACE OVER 2x3 WOOD STUD ON ½" TYPE 'X' G.W.B. USE MOISTURE RESISTANT GYPSUM WALLBAORD IN WET AREAS.

D1 — 4" SHOULDICE VENEER WITH 1" AIR SPACE OVER 8" CMU BLOCK

E1 — INTERIOR WALL
½" G.W.B. ON 2X4 WOOD STUD W/ BATT. INSULATION
(AT WET LOCATION USE ½" MOISTURE RESISANT GYPSUM WALL BOARD)

FOUNDATION NOTES

FOUNDATION

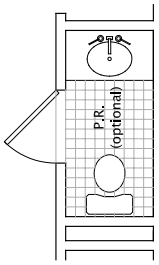
1. BOTTOM OF FOUNDATION IS ASSUMED TO BEAR ON SOIL CAPABLE OF SUPPORTING 3000 PSF.
2. BOTTOM OF ALL FOOTINGS MUST BE INSPECTED AND APPROVED BY A REGISTERED SOILS ENGINEER BEFORE PLACEING ANY CONCRETE. APPROVAL IN WRITING MUST INDICATE THE SOIL IS ADEQUATE TO SAFELY SUSTAIN SPECIFIED SOIL BEARING PRESSURE.
3. BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE MINIMUM THREE FEET BELOW EXTERIOR FINISH GRADE.
4. ALL DIMENSIONS ARE TO FACE OF CMU UNLESS NOTED OTHERWISE.

CONCRETE

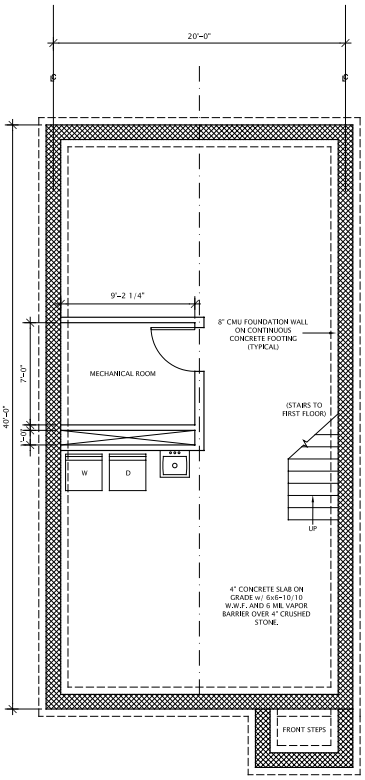
1. ALL CONCRETE SHALL BE REDI-MIX. HAVE A MINIMUM COMPRESSIVE STRETNGTH OF 3000 PSI AT 28 DAYS. HAVE A MINIMUM OF 500 LBS. OF CEMENT PER CUBIC YARD. SLUMP (AT POINT OF CONCRETE PLACEMENT) SHALL BE 3 INCH MINIMUM AND 6 INCH MAXIMUM. CONCRETE EXPOSED TO WEATHER SHALL HAVE 4 PERCENT AIR ENTRAINMENT. ALL CONCRETE SHALL HAVE A MAXIMUM WATER-CEMENT RATIO OF 0.45 BY WEIGHT. SUBMIT MIX DESIGNS FOR REVIEW.
2. ALL CONCRETE WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE ACI BUILDING CODE (ACI 318). THE ACI DETAILING MANUAL (ACI 315), AND THE SPECIFICATIONS FOR STRUCTURAL CONCRETE OR BUILDINGS (ACI 301).
3. ALL REINFORCING STEEL SHALL BE MANUFACTURED FROM HIGH STRENGTH BILLET STEEL CONFORMING TO ASTM DESIGNATION A615 GRADE 60. WWF SHALL COMPLY WITH ASTM A185.
4. LAP ALL BARS MINIMUM 40 DIAMETERS. LAP WWF A MINIMUM OF 6 INCHES.

MASONRY

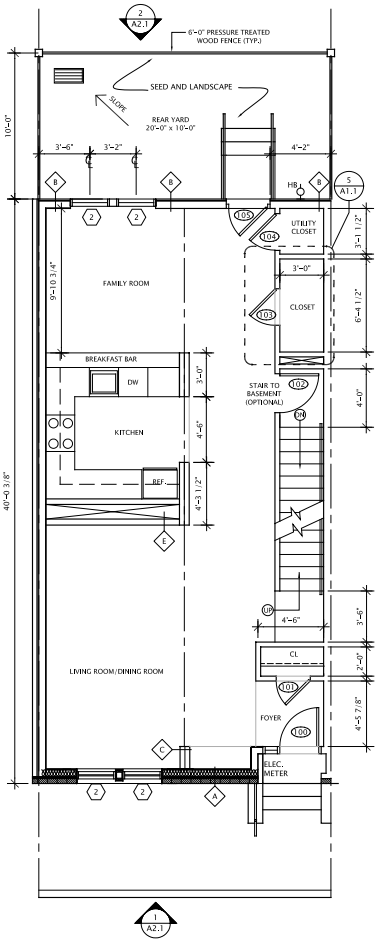
1. MASONRY UNITS SHALL BE TYPE N-1 ASTM C90 SOLID OR ASTM C90 HOLLOW GROUTED SOLID BELOW GRADE. ASTM C90 SOLID ABOVE GRADE WITH MINIMUM COMPRESSIVE STRENGTH OF 1800 PSI.
2. ALL MORTAR SHALL BE ASTM C270 TYPE S WITH A MINIMUM COMPRESSIVE STRENGTH OF 1800 PSI AT 28 DAYS. EXCEPT IVANY BLOCK SHALL BE LAID USING ASTM C270 TYPE M MORTAR WITH A MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI AT 28 DAYS.
3. GROUT SHALL BE A HIGH SLUMP MIX IN ACCORDANCE WITH ASTM SPECIFICATION C476 AVING A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI.
4. ALL CONCRETE MASONRY SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE "BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES ACI 530-88/ASCE 5-88" AND "SPECIFICATIONS FOR MASONRY STRUCTURES ACI 530.1-88/ASCE 6-88."
5. PROVIDE HOT-DIPPED GALVANIZED TRUSS TYPE HORIZONTAL JOINT REINFORCEMENT. MIN. 9 GA. AT 16" ON CENTER VERTICAL IN ALL MASONRY WALLS.



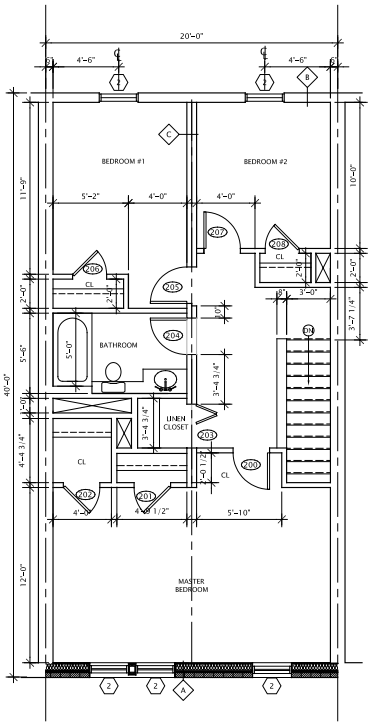
5 / A1.1 OPTIONAL POWDER ROOM IN CLOSET
SCALE: 1/2" = 1'-0"



1 BASEMENT FOUNDATION 20'-0" UNIT



1 FIRST FLOOR 20'-0" UNIT



2 SECOND FLOOR 20'-0" UNIT

DOOR SCHEDULE

DOOR NO.	ROOM NAME	TYPE	MATERIAL	WIDTH	HEIGHT	THICKNESS	HARDWARE	REMARKS
100	FRONT ENTRY	A	MHHC	2'-8"	7'-0"	1 3/8"		
101	CLOSET	D		2'-4"	6'-8"			
102	BASEMENT	B		2'-8"	6'-8"			
103	POWDER ROOM	C		2'-6"	6'-8"			
104	W/D	C		2'-6"	6'-8"			
105	REAR ENTRY	A		2'-8"	7'-0"			
200	BEDROOM	C		2'-6"	6'-8"			
201	BEDROOM CLOSET	C		2'-6"	6'-8"			
202	BEDROOM CLOSET	C		2'-6"	6'-8"			
203	WASHER/DRYER	E		3'-0"	6'-8"			
204	BATHROOM	C		2'-6"	6'-8"			
205	BEDROOM	C		2'-6"	6'-8"			
206	BEDROOM CLOSET	D		2'-4"	6'-8"			
207	BEDROOM	C		2'-6"	6'-8"			
208	BEDROOM CLOSET	D		2'-4"	6'-8"			

MHHC – MOULDED HARDBOARD HOLLOW CORE

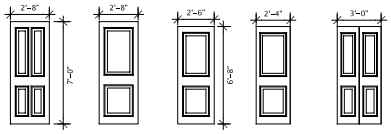
HARDWARE

1. LOCKSET BY SCHLAGE 1 1/2 PAIR HINGES BY STANLEY

   * FRONT DOOR TO RECEIVE MAIL SLOT AND PEEPHOLE

2. PRIVACY SET BY SCHLAGE 1 1/2 PAIR HINGES BY STANLEY
3. LATCH SET BY SCHLAGE 1 1/2 PAIR HINGES BY STANLEY

DOOR TYPES



A	B	C	D	E
4 PANEL EXTERIOR WOOD DOOR	2 PANEL MOLDED HARDBOARD HOLLOW CORE	2 PANEL MOLDED HARDBOARD HOLLOW CORE	2 PANEL MOLDED HARDBOARD HOLLOW CORE	2 PANEL MOLDED HARDBOARD HOLLOW CORE BI-FOLD DOOR (LOUVERS OPTIONAL)

NOTE: ALL DOORS AND FRAMES ARE PAINTED

OUTLINE SPECIFICATIONS

BASE STRUCTURE

FLOOR SYSTEM
- FIRST FLOOR SYSTEM INCLUDES DOUBLE 2"X10" PERIMETER JOIST AND TRIPLE 2" X 10" CENTER JOIST AT MATING WALL.
- SECOND FLOOR SYSTEM CONSISTS OF DOUBLE 2" X 10" PERIMETER JOIST AND DOUBLE 2" X 10" CENTER JOIST AT MATING WALLS.
- FLOOR JOISTS ARE 16" O/C.
- FLOOR DECKING IS ONE LAYER OF 7/16" OSB AND ONE LAYER OF 1/2" WESTERN FIR PLYWOOD.
- FACTORY INSTALLED CONSTRUCTION ADHESIVE IS USED ON PLYWOOD LAYERS.
- JOHNS MANVILLE FORMALDEHYDE-UREA FREE W/25% RECYCLED CONTENT R-19 KRAFT FACED FLOOR INSULATION SHIPPED LOOSE.

WALL AND CEILING SYSTEMS
- EXTERIOR WALLS ARE 2" X 6" WSPF @ 16" O/C: SINGLE BOTTOM AND DOUBLE TOP PLATE.
- JOHNS MANSVILLE FORMALDEHYDE-UREA FREE W/25% RECYCLED CONTENT R-19 KRAFT FACED INSULATION PROVIDED IN EXTERIOR WALL APPLICATIONS.
- WALL SHEATHING: 7/16" ZIP WALL.
- 2" X 10" BLOCKS AT ALL EXTERIOR WINDOWS AND DOORS AND ALL BATHROOM ACCESSORIES.
- INTERIOR WALLS ARE 2" X 4" WSPF STUDS @ 16" O/C.
- INTERIOR WALLS AND CEILINGS ARE COVERED IN 1/2" USG SHEETROCK AND PRIMED WITH TWO COATS OF SHERWIN WILLIAMS MASTERHIDE MODERATE WHITE FLAT PAINT.
- JOHNS MANVILLE FORMALDEHYDE-UREA FREE W/25% RECYCLED CONTENT R-41 INSULATION PROVIDED IN TOP FLOOR CEILING APPLICATION
- 5/8" TYPE X DRYWALL ON FIRE RATED WALLS, AND 5/8" TYPE C DRYWALL ON FIRE RATED CEILINGS.
- TWO 2" PVC UTILITY CHASES TO RUN PIPING, ELECTRIC AND AUDIO/VIDEO.
- INTERIOR BASE MOLDING AND DOOR CASEMENT TRIM WILL BE PAINTED WITH SHERWIN WILLIAMS MASTERHIDE MODERATE WHITE SEMI GLOSS PAINT.

EXTERIOR
- 7/16" ZIP WALL APPLIED TO ALL EXTERIOR WALLS.

ROOF SYSTEM
- ROOF SYSTEM INCLUDES 2" X 6" SYP RAFTERS AND CEILING JOIST, 16" O/C.
- ROOF DECK CONSISTS OF 1/2" ZIP WALL ROOF SYSTEM.

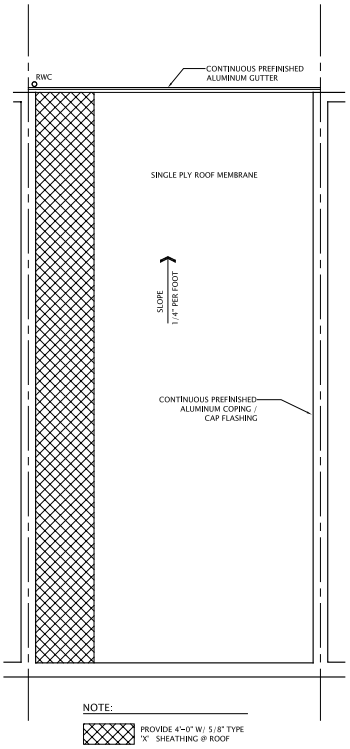
ELECTRICAL
- 110 VOLT OUTLETS PROVIDED TO MEET CODE REQUIREMENTS. EXTRA OUTLETS CAN BE ORDERED AS REQUIRED.
- EMT CONDUIT THROUGHOUT.
- PASS & SEYMOUR TOGGLE WALL SWITCHES AND WIRING BY CODE.
- PASS & SEYMOUR DUPLEX/LA RECEPTACLES.
- WESTINGHOUSE CUTLER HAMMER 200 AMP PANEL WITH 40 CIRCUITS.
- BRK CO/SMOKE DETECTOR HARDWIRED WITH BATTERY BACKUP.
- ARC FAULT BEDROOM AND SMOKE DETECTOR CIRCUITS.
- GFI WITH WHILE IN USE COVER @ FRONT AND REAR DOOR.
- FRONT DOOR CHIME.
- WHITE COVER PLATES.

PLUMBING
- ROUGH-IN PLUMBING IN ACCORDANCE TO PLAN TO INCLUDE: SINK DRAINS AND SUPPLY LINES, TUB/SHOWER DRAINS AND SUPPLIESWATER CLOSET DRAINS AND SUPPLY LINE, PVC ROOF VENTS FOR PLUMBING AS REQUIRED.
- COPPER WATER SUPPLY SYSTEM.
- OATEY ICEMAKER WATERLINE TO REFRIGERATOR.

GENERAL
- FULL SET OF SEALED CONSTRUCTION DRAWINGS TO INCLUDE ALL FLOOR PLANS, ELEVATIONS AND DETAILS TO BUILD THE HOUSE.
- INTERMODULAR CONNECTIONS.

OPTIONS	DESCRIPTION
WALL AND CEILING	
FIRE WALLS	ONE HOUR FIRE RATING ON EXTERIOR WALLS AND CEILINGS
ROOF SYSTEM	
SHINGLES	OWENS CORNING 30 YR ARCHITECTURAL ONYX BLACK
WINDOWS	
WINDOWS	SILVERLINE BY ANDERSEN 2900 SERIES SH VINYL GBG 2 OVER 2 GRILLE PATTERN WHITE
DOORS	
EXTERIOR	THERMA TRU 1 PANEL 1/2 LITE
EXTERIOR	ADA UNITS ONLY WILL COME WITH A THERMA TRU STAINLESS STEEL SILL
INTERIOR	MASONITE 2 PANEL SQ TOP MOLDED SMOOTH HOLLOW CORE
HARDWARE EXTERIOR	KWIKSET COVE KNOB – SATIN NICKLE
HARDWARE EXTERIOR	KWIKSET 600 SERIES – DEADBOLT
HARDWARE INTERIOR	KWIKSET COVE KNOB – SATIN NICKLE
INTERIOR TRIM	
BASE MOULDING	1X 6 MDF
WINDOW/DOOR CASEMENT	1 X4 MDF
CABINETRY	
KITCHEN	BASE/WALL MERRILAT ESSENTIALS – MILLBRIDGE II OAK
BATHROOM	MERRILAT ESSENTIALS – MILLBRIDGE II OAK
COUNTER TOPS	
FORMICA COUNTER TOPS	KITCHENS – FORMICA
BATHROOM COUNTER TOPS	BATHROOMS – CULTURED MARBLE
BATH ACCESSORIES	
BATH MIRROR	FERGUSON BATH MIRROR
BATH ACCESSORIES	KOHLER CORALAS K13430 POLISHED CHROME TOWEL BAR
BATH ACCESSORIES	KOHLER CORALAS K13434 POLISHED CHROME TOILET PAPER HOLDER
HANDICAP BARS	ADA UNITS ONLY – MOEN CSI 8871.8W GRAB BARS
BATH FAN/LIGHT	BROAN QTXE080 BATH FAN
ELECTRICAL	
LIGHTING	THOMAS LIGHTING – PL326-BL CHROME – BEDROOMS, HALL, DIN, RM
LIGHTING	THOMAS LIGHTING – SL7213-4 CHROME – BEDROOMS
LIGHTING	THOMAS LIGHTING – FWL232-EB – KITCHEN, LAUNDRY ROOM
PLUMBING	
WATERHEATER - TANKLESS	RINNAI 7.5 GAL. INT. TANKLESS WATER HEATER - NATURAL GAS
TOILET	STERLING BY KOHLER ROCKSTON 12" 402027 WATER SENSE TOILET
KITCHEN SINK	STERLING BY KOHLER MIDDLETON 14708
TUB/SHOWER	STERLING BY KOHLERADVANTAGE SMOOTH WALL TUB/SHOWER 61030110
SHOWER-POURED BASE	ADA UNIT ONLY -- STERLING BY KOHLER OC-1-63/62060103
FAUCETS - KITCHEN SINK	KOHLER CORALAS K-15172-4-CP
FAUCETS - BATHROOM SINK	KOHLER CORALAS K-15198-4-CP
FLOOR COVERING	
HARDWOOD	LAMINATE TARKETT - TREK FLOORING OR EQUIVALENT
CERAMIC TILE	
FLOOR	DAL 6 X 6 WHITE IN BATHS AND POWDERROOMS
STAIR PACKAGE	
STRINGERS	PINE STRINGERS
RISERS	PINE RISERS PAINTED WHITE
TREADS	OAK TREADS
RAILS & POSTS	OAK RAILS
APPLIANCES	
WASHER	WHIRLPOOL DUET WFW83005W
STACKABLE UNIT	WHIRLPOOL DUET STACKING COMPONENT 8541503/49971
DISHWASHER	WHIRLPOOL DU8505WPQ
DISPOSAL	INSINKERATOR BADGER V
GAS RANGE	WHIRLPOOL 30 INCH GAS RANGE - WFG114SVB
REFRIGERATOR	WHILRPOOL 18.2 CU. FT. TOP MOUNT REFRIGERATOR - ETBWTKXKB

NOTE: YELLOW FLEX GAS LINE FOR RANGE AND HOT WATER HEATER WILL BE DIRECT DROPPED TO THE CRAWL SPACE FOR ONSITE CONNECTION BY BUILDER.



NOTE:

PROVIDE 4'-0" W/ 5/8" TYPE "X" SHEATHING @ ROOF

4 / A1.1 ROOF PLAN 20'-0" UNIT
SCALE: 1/4" = 1'-0"

JKR PARTNERS LLC
ARCHITECTS • DESIGNERS
1128 WALNUT STREET
SUITE 200
PHILADELPHIA, PA 19107
215.928.9331
JKRPARTNERS.COM

20'-0" x 40'-0"
UNIT PLAN

DATE: 09.01.2009

DRAWN BY: MJK \ MM

FILE:

REVISIONS:

0

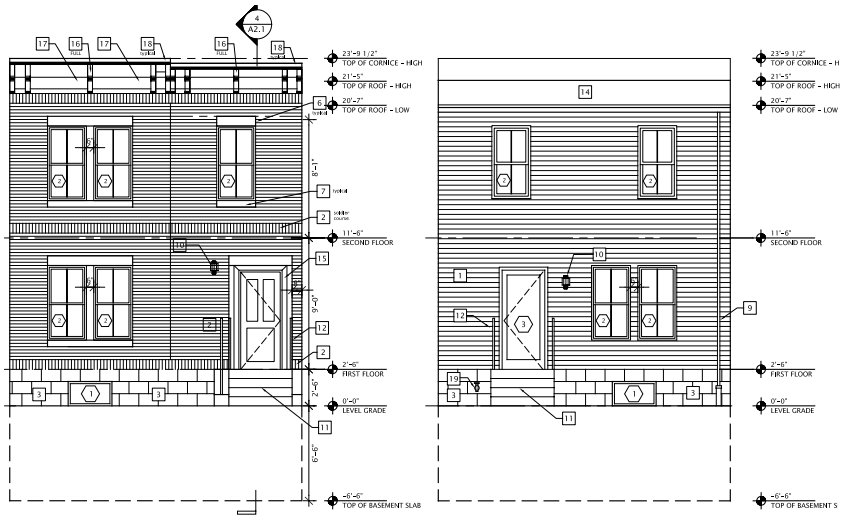
A1.1

PRICING SET
NOT FOR CONSTRUCTION

APPENDIX

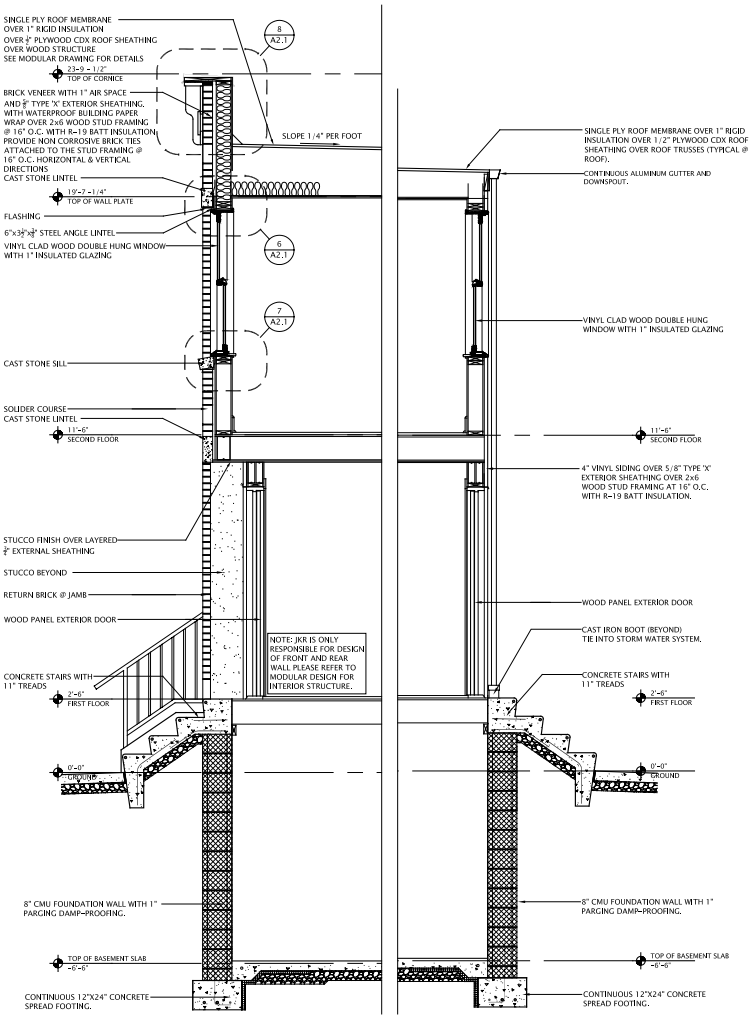
DESIGN SPECIFICATIONS, ARCHITECTURAL PLANS

20-FT. UNIT PLAN



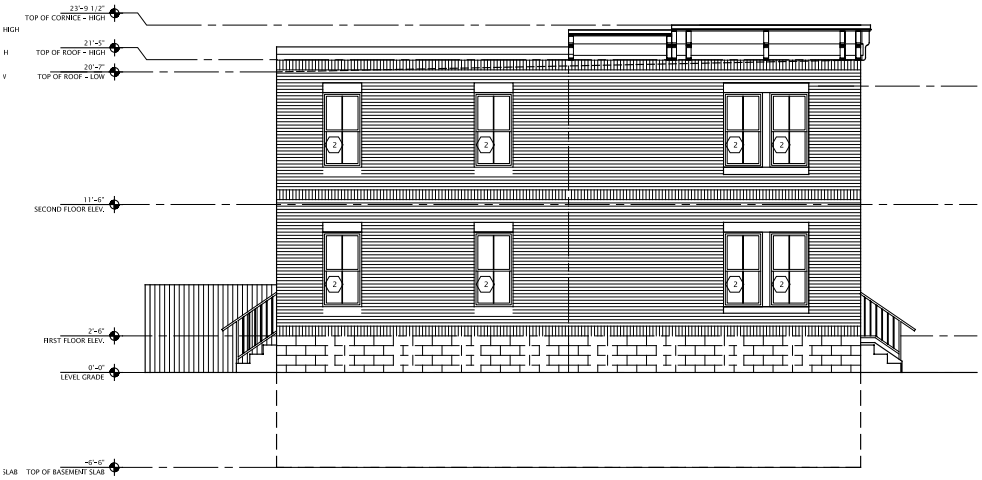
1 A2.1 TYPICAL UNIT – FRONT ELEVATION
SCALE: 1/4" = 1'-0" 16'-0" UNIT

2 A2.1 TYPICAL UNIT – REAR ELEVATION
SCALE: 1/4" = 1'-0" 16'-0" UNIT

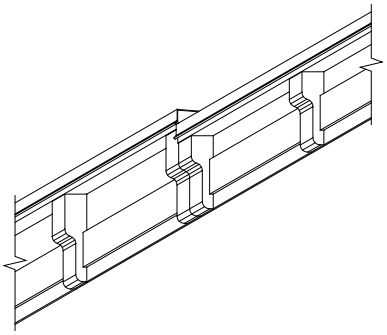


4 A2.1 WALL SECTION THRU FRONT FACADE
SCALE: 1/2" = 1'-0" 16'-0" UNITS EACH

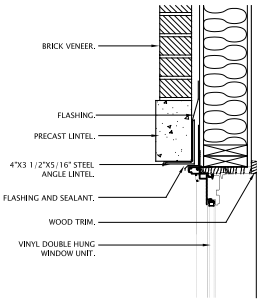
5 A2.1 WALL SECTION THRU REAR FACADE
SCALE: 1/2" = 1'-0" 16'-0" UNITS EACH



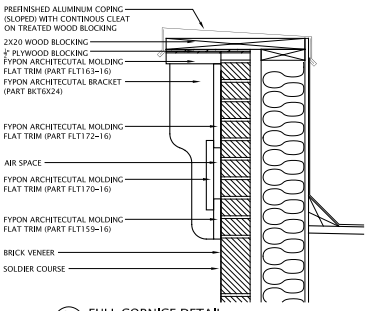
3 / A2.1 SIDE ELEVATION OF END UNIT (IF NECESSARY)
SCALE: 1/4" = 1'-0" 16'-0" UNITS EACH



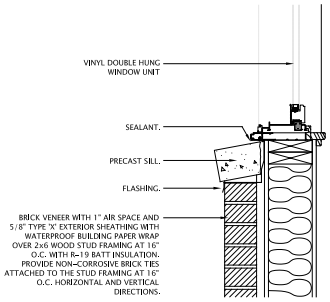
9 / A2.1 AXON OF FIBERGLASS CORNICE
SCALE: 3/4" = 1'-0" 16'-0" UNITS EACH



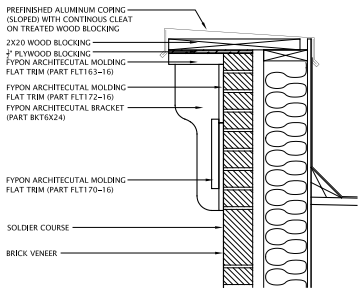
6 / A2.1 WINDOW HEAD DETAIL
SCALE: 1-1/2" = 1'-0" 16'-0" UNITS EACH



8A / A2.1 FULL CORNICE DETAIL
SCALE: 1-1/2" = 1'-0" 16'-0" UNITS EACH



7 / A2.1 WINDOW SILL DETAIL
SCALE: 1-1/2" = 1'-0" 16'-0" UNITS EACH



8B / A2.1 SMALL CORNICE DETAIL
SCALE: 1-1/2" = 1'-0" 16'-0" UNITS EACH

MATERIAL KEY

1. 4" VINYL SIDING -DOUBLE CLAPBOARD
2. 4" COMMON FACE BRICK. STANDARD COLOR AND PATTERN.
3. 4" THICKNESS SMOOTH TEXTURE CAST STONE - BY SHOULDICE
4. PAINTED WOOD DIVIDER
5. WEATHERPROOF CONVENIENCE OUTLET
6. CAST STONE LINTEL - ALL LINTELS TO BE SIMILAR.
7. CAST STONE SILL
8. 4" CONTINUOUS ENAMELED ALUMINUM GUTTER
9. ENAMELED ALUMINUM DOWNSPOUT W/ PAINTED CAST IRON BOOT CONNECT TO UNDERGROUND STORM SEWER -COLOR
10. EXTERIOR WEATHERPROOF LIGHT FIXTURE BY PROGRESS OR SIMILAR.
11. POURED IN PLACE CONCRETE STAIR
12. WROUGHT IRON METAL RAILING SYSTEM
13. CONTINUOUS ENAMELED ALUMINUM MOLDING-.032 COLOR
14. SINGLE-PLY ROOF MEMBRANE SYSTEM OVER 1" RIGID INSULATION OVER ½" PLYWOOD SHEATHING
15. ALUMINUM CLAD WOOD TRIM
16. FYPON - BRACKET - DECORATIVE PART (BKT-6X24)
17. FYPON - ARCH. MOULDING FLAT TRIM - PART (FLT172-16)
18. ALUMINUM COPING (TYPICAL) OVER SOLID WOOD PLATE.
19. HOSE BIB - TYPICAL

GENERAL NOTES

1. ALL RWC'S SHALL EXTEND W/ CAST IRON BOOT BELOW GRADE AND CONNECT TO STORM WATER PIPE SYSTEM PER SITEWORK DRAWINGS.
2. AT ALL SINGLE ROOF AREAS PROVIDE WATERPROOF ICE AND WATER SHIELD MEMBRANE AT LOWER 2 FT. ABOVE EAVE AND ALL VALLEYS.

WINDOW SCHEDULE

TYPE	DIMENSIONS WIDTH	DIMENSIONS HEIGHT	PRODUCT DESCRIPTION	REMARKS
1 ☆	R. O. 2'-9"	R. O. 1'-0"	AWNING STYLE VINYL CLAD - INSULATED GLASS WINDOW BY SILVERLINE BY ANDERSEN 2900 SERIES	BASEMENT
2	R. O. 2'-8"	R. O. 5'-0"	VINYL DOUBLE HUNG INSULATED GLASS WINDOW BY SILVERLINE BY ANDERSEN 2900 SERIES SH VINYL GBG 2 OVER2 GRILLE PATTERN - STANDARD COLOR	TYPICAL WINDOW -
3	R. O. 3'-0"	R. O. 7'-0"	VINYL - STORM DOOR WILL FULL GLASS PANEL.	DOOR (F&R)

☆ DENOTES EGRESS SIZE WINDOW

MANUFACTURER: PRICE - SILVERLINE BY ANDERSEN - 2900 SERIES
EXTERIOR COLORS: WHITE
INTERIOR : FACTORY PRIMED, PAINTED.

JKR PARTNERS LLC
ARCHITECTS • DESIGNERS
1128 WALNUT STREET
SUITE 200
PHILADELPHIA, PA 19107
215.923.8171
JKRPARTNERS.COM

20'-0" x 40'-0"
ELEVATIONS & DETAILS

DATE: 09.01.2009
DRAWN BY: MJK \ MM
FILE:
REVISIONS:

A2.1

PRICING SET
NOT FOR CONSTRUCTION

COST BREAKDOWN

i.	General Conditions	$_____
ii.	Site Improvements	$_____
iii.	Foundation Work	$_____
iv.	Masonry Work	$_____
v.	Framing & Rough Carpentry	$_____
vi.	Exterior Siding	$_____
vii.	Roofing	$_____
viii.	Doors & Windows	$_____
ix.	Interior Finishes	
	1. Drywall & Paint	_____
	2. Trim	_____
	3. Flooring	_____
	4. Cabinets & Countertops	_____
	5. Appliances	_____
	6. Other	_____
	Sub-Total Finishes	$_____
x.	Sprinklers (Complete)	$_____
xi.	Plumbing Work (Complete)	$_____
xii.	HVAC Work (Complete)	$_____
xiii.	Electrical Work (Complete)	$_____
	TOTAL	$_____

Generic Site Description

Construction estimates shall be based on the following set of assumptions for site improvements:

1. The urban and suburban sites are identical in size, dimensions, and configuration.
2. All utilities are immediately available to the site, with no off-site requirements for infrastructure improvements.
3. Sites do not require any demolition and are flat, and the indigenous soil is suitable for foundations and backfill. There are no underground obstructions or contaminants in the soil, with no requirements for export, import, or any soil exchange. There are no sheeting, shoring, or underpinning requirements for adjacent roads or structures.
4. The sites are accessible to all construction activities, with no requirements for off-site staging, special permits for access into the site or street/sidewalk closure permits.
5. In order to avoid urban versus suburban charges for utility company backcharges, water and sewer connection permits, wastewater discharge permits, etc., estimates will be predicated on not including these fees.
6. Contractor shall assume townhomes front on existing public streets, with no requirement to repair/replace front sidewalks; and shall assume surface parking for two vehicles immediately behind the townhome, with connecting sidewalk. Contractor shall use a landscape/hardscape allowance of $2500 per home.

Vertical Construction

Construction estimates shall be based on the following set of assumptions for vertical construction:

1. Contractor must use the same sheet for both site-built and modular construction cost breakdowns.
2. To facilitate analysis, the plans have been drafted with a modular orientation. However, for site-built applications, Contractor is encouraged to make normal and customary changes (2x4 framing v. 2x6; substitute standard mate-wall construction detail; etc.) provided Contractor documents such change(s) and resulting cost impact (i.e., deduct alternate of $XXX.xx).
3. Contractor shall price parapet and fiberglass cornice as an "Add Alternate." Standard shall be termination of brick soldier course at cornice with typical metal coping.
4. Contractor shall use side elevation with brick (see 3/A2.1) for standard pricing and provide "Deduct Alternates" for both stucco and vinyl side elevations.
5. On modular applications, Contractor obligations shall be as follows:
   a. Exterior siding and trim
   b. Foundations, basements, and waterproofing
   c. Gutters and downspouts
   d. Utility extensions and connections to public service
   e. Exterior painting
   f. Site work, landscaping and exterior pavements
6. Other than Item 5 above, Contractor shall assume that modular manufacturer will deliver, set, and make all inter-modular connections. However, Contractor shall provide on this qualifications sheet break-out pricing for the following:

Delivery of Modular Units	$_____
Setting of Modular Units	$_____
Crane Service	$_____
Inter-Modular Connections	$_____

RFI for BIA Study

Follow-Up Clarifications

1. **Q:** What is the HVAC scope desired for these units?

   A: HVAC is design-build based on typical workforce housing specification: single zone, air-to-air split system, with gas-fired heating and electric cooling.

2. **Q:** Should we factor in an economy of scale in our pricing?

   A: Yes—assume 6 units for each product type of 16' and 20' wide townhomes.

3. **Q:** Are we to price a single end unit or a middle unit?

   A: Please price interior unit and provide the additional cost for the end unit.

4. **Q:** Are we to assume all floor to be wood as no carpet is specified, except at the powder room?

   A: Please assume carpeting in bedrooms, and carry $15/yd. for material only.

5. **Q:** Please confirm for the roofing that we should use the single ply membrane and not the shingle product noted.

   A: Due to flat roof, you may use single ply membrane, modified bitumen, or other roofing system appropriate to these roofing conditions.

6. **Q:** Is the attic required to receive a dry sprinkler system?

   A: Please price base house without sprinkler system and provide an add alternate for sprinkler, but do not include sprinkler in the attic or interstitial space of the home.

7. **Q:** Please confirm the exterior walls are to have a 1-hour fire rating.

   A: Correct.

8. **Q:** Please provide the demising partition rating/design for the unit demising wall.

   A: 1-hour for the entire demising wall assembly.

9. **Q:** For the foundation walls, please confirm we can substitute concrete in lieu of masonry.

   A: Yes, feel free to substitute concrete in lieu of masonry, whichever is more economical.

As a supplement to the RFI, please provide the time difference, in weeks, for site-built versus modular construction, assuming no delays under either scenario due to weather, lack of availability of materials, and all subcontractors, vendors, and material suppliers hitting their schedules.

16′ SITE BUILT - URBAN	Bid 1	Bid 2	Bid 3	Bid 4
General Conditions	23,449	44,349	17,190	31,773
Foundation Work	9,232	46,254	16,427	9,647
Masonry Work	25,899	in 3 above	7,250	21,744
Framing & Rough Carpentry	34,485	77,550	18,500	41,542
Exterior Siding	1,315	2,000	1,500	1,900
Roofing	4,714	5,440	3,250	4,694
Doors & Windows	2,288	6,930	9,207	6,635
Interior Finishes				
Drywall & Paint	19,326	20,708	14,330	13,438
Trim	8,870	2,650	7,586	2,146
Flooring	11,017	6,330	9,120	6,013
Cabinets/Countertops	3,278	4,350	9,975	5,065
Appliances	3,272	3,680	4,165	2,650
Other	151	935	3,500	545
Sprinklers		0	0	
Plumbing Work	21,376	12,580	6,963	9,375
HVAC Work	18,087	13,600	9,750	9,000
Electrical Work	13,483	11,800	5,375	13,038
Fee	*incl.*	*incl.*	*12,111*	*incl.*
TOTAL	214,734	293,806	163,499	205,892
Total Adjustments*	5,261	0	0	0
TOTAL w/out Site Work	**205,503**	**259,156**	**156,199**	**179,205**
Per Square Foot Cost	172	230	128	161
Site Improvements	14,492	34,650	7,300	26,687
TOTAL with Site Work	**219,995**	**293,806**	**163,499**	**205,892**
Per Square Foot Cost	161	202	122	140
Add/Deduct Alternates				
Add Sprinkler		4,800	2,672	3,800
Add Parapet & Fiberglass Cornice Detail		4,300	4,275	2,585
Change from interior unit to end unit	37,833	30,000	16,232	20,000
Delete brick exterior side elevation, replace w/ Stucco			-9,100	
Delete brick exterior side elevation, replace w/ Vinyl			-10,900	

* After the written bid was submitted, a cost adjustment was made by this bidder based on an improved understanding of the scope requirements.

20′ SITE BUILT - URBAN	Bid 1	Bid 2	Bid 3	Bid 4
General Conditions	23,449	45,313	17,190	31,773
Foundation Work	9,969	50,451	19,810	11,237
Masonry Work	31,233	in 3 above	8,765	24,660
Framing & Rough Carpentry	36,339	83,920	20,750	48,150
Exterior Siding	1,644	2,400	1,750	2,200
Roofing	5,591	3,508	4,188	5,470
Doors & Windows	2,288	6,930	9,203	6,635
Interior Finishes		-		
Drywall & Paint	21,518	21,700	18,053	14,831
Trim	9,188	2,700	8,250	2,291
Flooring	13,730	7,650	11,400	7,763
Cabinets & Countertops	3,934	4,350	11,850	5,975
Appliances	3,272	3,680	4,165	2,650
Other	151	935	3,500	545
Sprinklers	-	-	0	0
Plumbing Work	21,376	12,580	6,963	9,450
HVAC Work	18,087	14,100	14,625	9,000
Electrical Work	13,703	12,600	5,738	14,510
Fee	*incl.*	*incl.*	*13,922*	*incl.*
TOTAL	229,964	311,119	187,947	224,601
Total Adjustments*	5,481	0	0	0
TOTAL w/out Site Work	**220,953**	**275,919**	**180,122**	**197,140**
Per Square Foot Cost	138	172	113	123
Site Improvements	14,492	35,200	7,825	27,461
TOTAL with Site Work	**235,445**	**311,119**	**187,947**	**224,601**
Per Square Foot Cost	147	194	117	140
Add/Deduct Alternates				
Add Sprinkler		4,800	3,980	4,800
Add Parapet & Fiberglass Cornice Detail		5,100	4,575	2,750
Change from interior unit to end unit	37,833	30,000	16,232	20,000
Delete brick exterior side elevation, replace w/ Stucco			-9,100	-7,385
Delete brick exterior side elevation, replace w/ Vinyl			-10,900	-8,846

* After the written bid was submitted, a cost adjustment was made by this bidder based on an improved understanding of the scope requirements.

16′ SITE BUILT - SUBURBAN	Bid 1*	Bid 2	Bid 3	Bid 4 No Site
General Conditions	NA	40,816	15,590	24,853
Foundation Work	NA	33,923	14,814	7,885
Masonry Work	NA	in 3 above	6,300	15,280
Framing & Rough Carpentry	NA	63,890	16,500	34,246
Exterior Siding	NA	1,350	1,120	1,750
Roofing	NA	3,540	3,000	4,262
Doors & Windows	NA	6,930	8,828	5,910
Interior Finishes				
Drywall & Paint	NA	12,986	12,805	9,970
Trim	NA	2,650	6,586	1,924
Flooring	NA	4,675	8,320	5,375
Cabinets & Countertops	NA	4,350	9,450	4,605
Appliances	NA	3,680	4,165	2,650
Other	NA	935	3,000	545
Sprinklers	NA	-	0	0
Plumbing Work	NA	8,500	6,490	7,525
HVAC Work	NA	8,700	9,000	7,200
Electrical Work	NA	9,120	4,725	10,945
Fee	NA	-	10,975	incl.
TOTAL	NA	230,315	148,168	169,075
Total Adjustments	NA	0	0	0
TOTAL w/out Site Work	**NA**	**206,045**	**141,668**	**144,925**
Per Square Foot Cost	NA	161	111	113
Site Improvements	NA	24,270	6,500	24,150
TOTAL with Site Work	**NA**	**230,315**	**148,168**	**169,075**
Per Square Foot Cost	NA	180	116	132
Add/Deduct Alternates				
Add Sprinkler	NA	4,800	2,244	2,850
Add Parapet & Fiberglass Cornice Detail	NA	3,200	3,800	2,200
Change from interior unit to end unit	NA	21,600	14,428	15,200
Delete brick exterior side elevation, replace w/ Stucco	NA	-	-8,800	-8,353
Delete brick exterior side elevation, replace w/ Vinyl	NA	-	-10,350	-9,824

*Contractor 1 declined to provide bids for suburban locations.

20′ SITE BUILT - SUBURBAN	Bid 1*	Bid 2	Bid 3	Bid 4 No Site
General Conditions	NA	41,506	15,590	24,853
Foundation Work	NA	37,011	17,815	9,213
Masonry Work	NA	in 3 above	8,000	17,420
Framing & Rough Carpentry	NA	68,510	18,500	39,556
Exterior Siding	NA	1,600	1,400	2,020
Roofing	NA	4,150	3,850	4,950
Doors & Windows	NA	6,930	8,828	5,910
Interior Finishes				
Drywall & Paint	NA	14,427	16,082	10,966
Trim	NA	2,700	7,200	2,049
Flooring	NA	5,585	10,400	6,938
Cabinets & Countertops	NA	4,350	11,250	5,425
Appliances	NA	3,680	4,165	2,650
Other	NA	935	3,000	545
Sprinklers	NA	-	0	0
Plumbing Work	NA	8,700	6,490	7,585
HVAC Work	NA	8,900	13,500	7,200
Electrical Work	NA	9,200	5,050	12,225
Fee	NA	incl.	12,678	incl.
TOTAL	NA	242,704	171,148	184,339
Total Adjustments	NA	0	0	0
TOTAL w/out Site Work	**NA**	**218,184**	**163,798**	**159,505**
Per Square Foot Cost	NA	136	102	100
Site Improvements	NA	24,520	7,350	24,834
TOTAL with Site Work	**NA**	**242,704**	**171,148**	**184,339**
Per Square Foot Cost	NA	152	107	115
Add/Deduct Alternates				
Add Sprinkler	NA	6,000	3,337	3,600
Add Parapet & Fiberglass Cornice Detail	NA	4,000	4,100	2,425
Change from interior unit to end unit	NA	21,600	14,428	15,200
Delete brick exterior side elevation, replace w/ Stucco	NA	-	-8,800	-8,353
Delete brick exterior side elevation, replace w/ Vinyl	NA	-	-10,350	-9,824

*Contractor 1 declined to provide bids for suburban locations.

16' MODULAR - URBAN	Bid 1*	Bid 2	Bid 3	Bid 4	Modular Vendor 1	Modular Vendor 2
General Conditions	16,123	-	3,915	19,532	0	
Foundation Work	9,232	46,254	16,427	9,647	0	
Masonry Work	25,899	in 3 above	7,250	21,744	800	
Framing & Rough Carpentry	419	12,800	0	2,675	1,950	
Exterior Siding	1,315	2,000	1,500	1,900	655	
Roofing	789	5,440	900	4,694	250	
Doors & Windows	-	200	0	650	0	
Interior Finishes			875		500	
Drywall & Paint	0	9,420	0	0	250	
Trim	0	500	0	0	0	
Flooring	0	5,340	0	0	0	
Cabinets & Countertops	0	0	0	0	0	
Appliances	0	0	0	0	0	
Other	0	0	0	0	0	
Sprinklers	-	-	0	0	0	
Plumbing Work	9,866	4,200	1,450	1,250	2,940	
HVAC Work	-	-	0	7,500	4,300	
Electrical Work	6,577	7,400	1,165	7,238	2,950	
Sub-Total	-	-	-	-	61,864	70,473
Fee	incl.	incl.	3,263	incl.	incl.	incl.
TOTAL	84,712	115,324	44,045	103,517	76,459	70,473
Total Adjustments*	4,056	12,880	0	-7,500	0	12,083
Subtotal (no site improvements)	74,276	106,434	36,745	69,330		
Site Improvements	**14,492**	**21,770**	**7,300**	**26,687**	**0**	
TOTAL	**88,768**	**128,204**	**44,045**	**96,017**	**76,459**	**82,556**
				Transportation	incl.	3,229
				Set Crew	2,263	741
				Crane Service	3,000	3,150
				Intermod Connections	2,800	590
				Modular Total	**84,522**	**90,266**
				Per Square Foot Cost	**66**	**71**
Grand Totals (Contractor + Mod Vendor 1)	**173,290**	**212,726**	**128,567**	**180,539**		
Per Square Foot Cost	**135**	**166**	**100**	**141**		
Grand Totals (Contractor + Mod Vendor 2)	**179,034**	**218,470**	**134,311**	**186,283**		
Per Square Foot Cost	**140**	**171**	**105**	**146**		
Add/Deduct Alternates						
Add Sprinkler		4,800	1,114	960	1,120	7,900
Add Parapet and Fiberglass Cornice Detail		4,300	4,275	2,200		
Change from interior unit to end unit	33,036	30,000	14,550	15,200		
Delete brick exterior side elevation, replace w/ Stucco		-	-9,100	-8,711		
Delete brick exterior side elevation, replace w/ Vinyl		-	-10,900	-10,433		

* After the written bid was submitted, a cost adjustment was made by this bidder based on an improved understanding of the scope requirements.

20′ MODULAR - URBAN

	Bid 1*	Bid 2	Bid 3	Bid 4	Modular Vendor 1	Modular Vendor 2
General Conditions	16,123	-	3,915	19,532	0	
Foundation Work	9,969	50,451	19,810	11,237	0	
Masonry Work	31,233	in 3 above	8,765	24,660	0	
Framing & Rough Carpentry	446	13,770	0	2,675	800	
Exterior Siding	1,644	2,400	1,750	2,200	2,790	
Roofing	877	6,610	1,025	5,470	775	
Doors & Windows	-	200	0	650	750	
Interior Finishes		-	975		0	
Drywall & Paint	0	9,420	0	0	1,900	
Trim	0	500	0	0	775	
Flooring	0	6,660	0	0	0	
Cabinets & Countertops	0	-	0	0	0	
Appliances	0	-	0	0	0	
Other	0	-	0	0	0	
Sprinklers	-	-	0	0	0	0
Plumbing Work	9,866	4,200	1,450	1,250	2,940	
HVAC Work	-	-	0	7,500	4,750	
Electrical Work	6,577	7,400	1,165	7,910	3,100	
Sub-Total	-	-			85,296	102,570
Fee	incl.	incl.	3,734	incl.	incl.	incl.
TOTAL	91,227	123,931	50,414	110,559	103,876	102,570
Total Adjustments*	4,056	12,880	0	-7,500	0	14,933
Subtotal (no site improvements)	80,791	114,491	42,589	75,584		
Site Improvements	14,492	22,320	7,825	27,475	0	
TOTAL	**95,283**	**136,811**	**50,414**	**103,059**	**103,876**	**117,503**
			Transportation		-	6,458
			Set Crew		2,263	1,264
			Crane Service		3,000	4,550
			Intermod Connections		2,800	962
			Modular Total		**111,939**	**130,737**
			Per Square Foot Cost		**70**	**82**
Grand Totals (Contractor + Mod Vendor 1)	**207,222**	**248,750**	**162,353**	**214,998**		
Per Square Foot Cost	**130**	**155**	**101**	**134**		
Grand Totals (Contractor + Mod Vendor 2)	**226,020**	**267,548**	**181,151**	**233,796**		
Per Square Foot Cost	**141**	**167**	**113**	**146**		
Add/Deduct Alternates						
Add Sprinkler		4,800	1,856	1,600	1,120	8,784
Add Parapet and Fiberglass Cornice Detail		5,100	4,275	2,750		
Change from interior unit to end unit	33,036	30,000	14,550	20,000		
Delete brick exterior side elevation, replace w/ Stucco		-	-9,100	-6,620		
Delete brick exterior side elevation, replace w/ Vinyl		-	-10,900	-7,930		

* After the written bid was submitted, a cost adjustment was made by this bidder based on an improved understanding of the scope requirements.

16′ MODULAR - SUBURBAN	Bid 1*	Bid 2	Bid 3	Bid 4	Modular Vendor 1	Modular Vendor 2
General Conditions	NA	-	3,650	15,299		
Foundation Work	NA	33,923	14,814	7,885	0	
Masonry Work	NA	in 3 above	6,300	15,280	0	
Framing & Rough Carpentry	NA	10,940	0	1,775	800	
Exterior Siding	NA	1,350	1,120	1,750	1,400	
Roofing	NA	3,540	800	4,262	400	
Doors & Windows	NA	200	0	650	250	
Interior Finishes	NA		700		0	
Drywall & Paint	NA	6,620	0	0	500	
Trim	NA	500	0	0	250	
Flooring	NA	3,685	0	0	0	
Cabinets & Countertops	NA	-	0	0	0	
Appliances	NA	-	0	0	0	
Other	NA	-	0	0	0	
Sprinklers	NA	-	0		0	
Plumbing Work	NA	2,700	1,100	1,000	1,800	
HVAC Work	NA	-	-	6,000	3,800	
Electrical Work	NA	4,580	965	5,840	1,800	
Sub-Total	NA	-			61,864	70,473
Fee	NA	incl.	2,876	incl.	incl.	incl.
TOTAL	NA	88,308	38,825	83,891	72,864	70,473
Total Adjustments**	NA	4,000	0	-6,000	0	12,083
Subtotal (no site improvements)	NA	72,038	32,325	53,741		
Site Improvements	NA	20,270	6,500	24,150	0	
TOTAL	**NA**	**92,308**	**38,825**	**77,891**	**72,864**	**82,556**
				Transportation	incl.	3,229
				Set Crew	1,863	654
				Crane Service	1,600	2,700
				Intermod Connections	incl.	528
				Modular Total	**76,327**	**89,667**
				Per Square Foot Cost	**60**	**70**
Grand Totals (Contractor + Mod Vendor 1)	NA	**168,635**	**115,152**	**154,218**		
Per Square Foot Cost	NA	**132**	**90**	**120**		
Grand Totals (Contractor + Mod Vendor 2)	NA	**181,795**	**128,492**	**167,558**		
Per Square Foot Cost	NA	**142**	**100**	**131**		
Add/Deduct Alternates						
Add Sprinkler		4,800	1,056	960	750	7,900
Add Parapet and Fiberglass Cornice Detail	NA	3,200	3,800	2,200		
Change from interior unit to end unit	NA	21,600	12,800	15,200		
Delete brick exterior side elevation, replace w/ Stucco	NA	-	-8,800	-7,411		
Delete brick exterior side elevation, replace w/ Vinyl	NA	-	-10,350	-8,716		

*Contractor 1 declined to provide bids for suburban locations.

** After the written bid was submitted, a cost adjustment was made by this bidder based on an improved understanding of the scope requirements.

20′ MODULAR - SUBURBAN

	Bid 1*	Bid 2	Bid 3	Bid 4	Modular Vendor 1	Modular Vendor 2
General Conditions	NA	-	3,650	15,299	0	
Foundation Work	NA	37,011	17,815	9,213	0	
Masonry Work	NA	in 3 above	8,000	17,420	0	
Framing & Rough Carpentry	NA	11,400	0	1,775	800	
Exterior Siding	NA	1,600	1,400	2,020	2,200	
Roofing	NA	4,150	900	4,950	500	
Doors & Windows	NA	200	0	650	750	
Interior Finishes	NA		800		0	
Drywall & Paint	NA	6,620	0	0	1,900	2,850
Trim	NA	500	0	0	775	
Flooring	NA	4,595	0	0	0	
Cabinets & Countertops	NA	-	0	0	0	
Appliances	NA	-	0	0	0	
Other	NA	-	0	0	0	
Sprinklers	NA	-	0	0	0	
Plumbing Work	NA	2,700	1,100	1,000	1,800	
HVAC Work	NA	-	0	6,000	4,200	12,083
Electrical Work	NA	4,580	965	6,400	1,950	
Sub-Total	NA	-			85,296	102,570
Fee	NA	incl.	3,358	incl.	incl.	incl.
TOTAL	NA	94,026	45,338	89,575	100,171	102,570
Total Adjustments**	NA	14,530	0	-6,000	0	14,933
Subtotal (no site improvements)	NA	87,886	37,988	58,727		
Site Improvements	NA	20,670	7,350	24,848	0	
TOTAL	**NA**	**108,556**	**45,338**	**83,575**	**100,171**	**117,503**
			Transportation		incl.	6,458
			Set Crew		3,000	1,090
			Crane Service		1,850	3,900
			Intermod Connections		incl.	838
			Modular Total		**105,021**	**129,789**
			Per Square Foot Cost		**66**	**81**

Grand Totals (Contractor + Mod Vendor 1)	**NA**	**213,577**	**150,359**	**188,596**		
Per Square Foot Cost	**NA**	**133**	**94**	**118**		
Grand Totals (Contractor + Mod Vendor 2)	**NA**	**238,345**	**175,127**	**213,364**		
Per Square Foot Cost	**NA**	**149**	**109**	**133**		

Add/Deduct Alternates

Add Sprinkler	NA	6,000	1,320	1,200	750	8,784
Add Parapet and Fiberglass Cornice Detail	NA	4,000	4,100	2,425		
Change from interior unit to end unit	NA	21,600	12,800	15,200		
Delete brick exterior side elevation, replace w/ Stucco	NA	-	-8,800	-7,411		
Delete brick exterior side elevation, replace w/ Vinyl	NA	-	-10,350	-8,716		

*Contractor 1 declined to provide bids for suburban locations.

** After the written bid was submitted, a cost adjustment was made by this bidder based on an improved understanding of the scope requirements.

APPENDIX

REFERENCES

1 The average costs per square foot are derived from the cost-comparison analysis of a 16-foot-wide home and a 20-foot-wide home using modular construction methods rather than stick built.

2 Kevin C. Gillen Ph.D., Econsult, and Ira Goldstein, Ph.D., The Reinvestment Fund, "Empirical Results from the Women's Community Revitalization Program Barriers-to-Affordability Study Presentation to WCRP" (2007). Data based on 2005 American Community Survey, Census NAHB, and RS Means data. http://beta.phila.gov/philagov/taxpolicy/PDFs/empiricalResultsWRCPBarriersToAffordability.pdf

3 Philadelphia's average household income is also well below the national average. As a result, it is a far better solution to the disparity between high construction costs and low market values to lower the cost to build rather than to raise home sales prices beyond the reach of Philadelphians.

4 Gillen and Goldstein, *Empirical Results*.

5 Alan Mallach, "A Strategic Approach to Building Affordable Housing in Philadelphia," Women's Community Revitalization Project (February 2009, http://www.williampennfoundation.org/news_keywords3559/news_keywords_show.htm?doc_id=832362 The number of subsidized units represents all homeowner units subsidized by the city. The figures were provided by the Philadelphia Office of Housing and Community Development on May 20, 2008.

6 Ibid. Total homeowner new construction single-family units data are provided by Econsult Corporation and are based upon Philadelphia Board of Revision of Taxes 2006 property tax data. (These numbers do not include condominium units in multifamily buildings.)

7 Kevin C. Gillen, Ph.D., Econsult, "Philadelphia's Ten-Year Tax Abatement: Updated Statistics on the Size and Distribution of Abated Properties in Philadelphia," Building Industry Association (August 2008), http://www.econsult.com/articles/041609_Abatement.pdf

8 Building Industry Association: Analysis of Inclusionary Zoning Bill # 071005-A, Econsult Corporation (May 8, 2008), http://www.biaofphiladelphia.com/pdf/IZ-Report-Final-2008.pdf

9 Building Industry Association: Analysis of Inclusionary Zoning Bill # 071005-A, Econsult Corporation (May 8, 2008), http://www.biaofphiladelphia.com/pdf/IZ-Report-Final-2008.pdf; Theresa Agovino, "Construction Unions Agree to Cut Labor Costs: Building Contractors and Unions Have Reached an Agreement to Slice Labor Costs, but the Long-Sought Deal Falls Well Short of Developers' Goals," Crain's New York Business.com (April 24, 2009).

10 Other union towns have successfully lowered costs. In late April 2009, New York City construction unions agreed to take action to modify their terms in order to make construction more affordable in the city and allow stalled projects to continue. The deal covers 25 different unions. While few were willing to cut their members' pay, they did agree to change work rules, which union leaders state will result in savings on construction projects of 15 to 20 percent and which builders say will more likely result in savings of 3 to 8 percent. Agreed-upon work-rule changes included unions agreeing to work an eight-hour day instead of a seven-hour day. They have also agreed to honor a common list of holidays. Agovino, "Construction Unions Agree"; ibid., "NYC Construction Unions Ink Cost-Cutting Pact," Crain's New York Business.com (May 29, 2009).

11 The builder did use union labor for set and finish. Interview with Chris Gillen, vice president of Beazer Homes (May 18, 2009).

12 U.S. Census Bureau Construction Statistics for New Residential Construction, The 2008 Annual Housing Units Authorized by Building Permits Data (2008), citing statistics from 1996 to 2007.

13 Ibid.

14 Barry Rehfeld, "Even Some Contractors Are Choosing Modular Homes," *New York Times* (September 30, 2006), citing 2005 data.

15 Justin Moresco, "Four Green Building Trends to Watch in 2010," Earth2Tech.com (December 23, 2009), http://earth2tech.com/2009/12/23/4-green-building-trends-to-watch-in-2010/ downloaded December 29, 2009.

16 When assembling two units, you need a mate wall. This mate wall does not have to occur where two equally sized modular units meet. For example, when building a 22-foot-wide townhouse, there is no reason that the mate wall has to occur at 11 feet. The mate wall is a stud wall that is about five inches thick. This support wall will be about 3 inches wider than a typical wall. Interview with Scott Miller, Miller Purdy Architects (May 18, 2009).

17 Mullens, M., and M. Kelley, "Lean Homebuilding Using Modular Technology," *Housing and Society*, 31(1), 41-54, 2004; Mullens, M., and M. Kelley, "Lean Homebuilding Using Modular Technology," *NAHB International Builders Show: Conference Proceedings*, Las Vegas, published by Michigan State University, East Lansing, MI (January 2003), p. 2.

18 Naomi Cytron, "Some Assembly Required: Using Manufactured Housing in Affordable Housing Development," *Federal Reserve Bank of San Francisco Community Investments* (September 2005).

19 The passage of Bill 090841 amended the Philadelphia Building Construction and Occupancy Code by adopting the 2009 edition of certain International Codes on December 17, 2009.

20 Geiger v. Zoning Hearing Bd. of the Twp. of N. Whitehall, 510 Pa. 231 (1986); Trumbauer v. Zoning Hearing Bd., 73 Pa. D. & C.2d 20 (Pa. Com. Pl. 1975); and Anstine v. Zoning Bd. of Adjustment of York Twp., 411 Pa. 33, 37 (1963).

21 Our simple definition of site work for the purpose of this report includes clearing and grubbing, earthwork, underground utilities (including separate house utilities to within a few feet of the foundation), curbing, paving, sidewalks, landscape and hardscape. The decision to omit site work from the cost of building the homes is based on a belief that the cost of the home construction should represent the actual vertical construction cost, or hard cost, and should not include the horizontal, or site work, portion of construction. Excluding site work should help the developer clearly isolate project costs and simplify the comparative cost process. Costs with site work included are identified in the summary chart on pages 38 to 45.

22 Developers are using modular-construction methods for larger homes in the suburbs and making a profit.

23 Interview with David Perlman, Philadelphia Residential Development Company (May 18, 2009).

24 Peter J. Cameron and Nadia G. DiCarlo, "Piecing Together Modular: Understanding the Benefits and Limitations of Modular Construction Methods for Multifamily Development," Massachusetts Institute of Technology Thesis in Satisfaction of a Master of Science in Real Estate (September 2007), http://dspace.mit.edu/bitstream/handle/1721.1/42038/228657327.pdf?sequence=1

25 Murdock, James, "Modular Makes a Comeback," *Multi-Housing News* 40, no. 3 (March 2005), pp. 1–27.

26 Interview with David Perlman, Philadelphia Residential Development Company (May 18, 2009).

27 In fact, modular companies offer to design homes for free, but this is done without a professional architect. Most of the design constraints come at the beginning of the process. Once they are understood, many different types of designs are possible. Interview with Scott Miller, Miller Purdy Architects (May 18, 2009.)

28 Interview with David Perlman, Philadelphia Residential Development Company (May 18, 2009).

29 It is important to note, however, that modular homes often fail to be completed by the agreed-upon schedule. According to a 2006 study by J. D. Power and Associates of modular homes built in 2005, "[O]nly 35 percent of modular homebuyers reported the home was ready for move-in by the date originally promised." Thayer Long, "J. D. Power and Associates Surveys Modular Customer Satisfaction," *Building Systems Magazine*, March-April 2007, http://www.modularcouncil.org/mc/pub_mod/default.asp?id=14&article=192

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32 Matthew Power, "Made to Order," *Builder Magazine* (February 2002), http://www.builderonline.com/sales/made-to-order.aspx

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34 Cameron and DiCarlo, "Piecing Together Modular."

35 Interview with Nic Darling, partner, PostGreen (March 24, 2009); interview with David Perlman, Philadelphia Residential Development Company (May 18, 2009); interview with Scott Miller, Miller Purdy Architects (May 18, 2009.)

36 "Mayor's Advisory Commission on Construction Industry Diversity Report and Recommendations" (March 2009), http://www.econsult.com/articles/031609_MACCID_Exec_Sum.pdf

37 A carbon footprint is is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide.

38 "Modular System Design Test and Evaluation Results, prepared by The Hickory Consortium, Building America Initiative," submitted to National Renewable Energy Laboratory (April 18, 2002).

39 Shelley Christiansen, "Modular Houses Barge in," *Martha's Vineyard Magazine* (Summer 2008), http://www.mvmagazine.com/2008/home_and_garden_spring-summer/modular.php

40 These advantages will be markedly increased when modular builders routinely begin to offer upgraded materials and environmentally preferred products.

41 Telephone interview with Brian Phillips, Interface Studio Architects LLC, Philadelphia (May 2009). Phillips points out that shorter site disruption can be especially helpful in dense urban settings.

42 Suzanne Morphet, "Local Prefab among 25 Selected for New Book," *Vancouver Sun* (November 14, 2009); interview with David Johnston, green building expert at WhatsWorking.com (June 3, 2009), http://www.vancouversun.com/business/Local+prefab+among+selected+book+book/2222641/story.html

43 Lifecycle Construction Resource Guide, Environmental Protection Agency (February 2008), http://www.lifecyclebuilding.org/files/Lifecycle%20Construction%20Resource%20Guide.pdf

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