

The Ghost Houses: Dimensions of an Urban Infill Project

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That certain lot or parcel of land known and described as Lot No. Twenty four otherwise known as Lot "K" in R.M. Bearden's Addition to said City, lying in the northeast corner of Gill and Stuart Streets (formerly Morgan and Pond Streets) and thus bounded: Beginning at a stake, the Northeast corner of Stuart and Gill Streets; thence easterly with the northern side of Gill Street one hundred and forty two feet more or less to an alley; thence Northerly with Western line of said alley fifty feet to a stake; thence westerly parallel to Gill St., one hundred and forty two feet more or less to Stuart St; thence southerly on Stuart Street fifty feet to the beginning.

Indenture made 24th day of August, 1908 between seller and buyer exchanging property for note of \$500.¹

The Ghost Houses project began with curiosity about shallow depressions on either side of our home in Knoxville, Tennessee. Documentation confirmed the existence of three structures built simultaneously on the parcel shortly after 1910. Interestingly, materials used in their construction were allegedly salvaged from a nearby school or post office. Census data describes three houses occupied intermittently by short and long-term renters, and their immediate and extended families. At times the site accommodated six households and as many as 16 residents when all three houses were inhabited as duplexes. Other census years found all structures vacant or a sole unit occupied by one lone family.² (fig. 1) The three structures of nearly identical massing, distribution of space, materiality, and detail endured through the late 1980's when, following decades of disinvestment in inner-city neighborhoods, two of the three vacant structures were condemned and demolished. The third structure was renovated, in part using the re-salvaged remains of those demolished, and let as a duplex by its new owner.

Shortly after purchasing the property, we re-

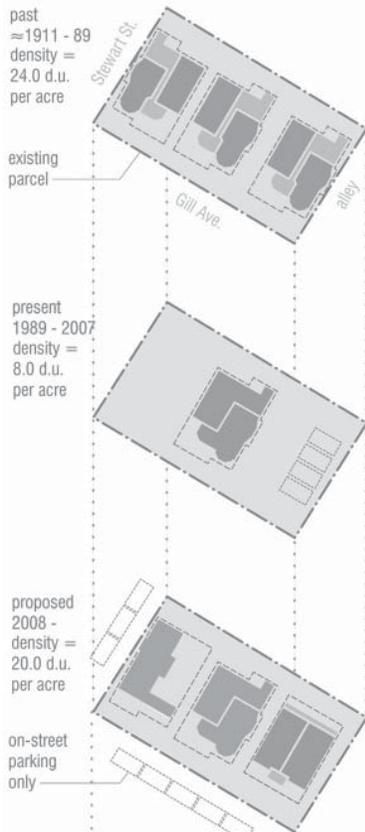
searched the site's history and were inspired to re-develop the parcel and participate in the revitalization of our inner-ring urban neighborhood. We encountered obstacles from the outset, however, in the form of inappropriate zoning ordinances that require dimensions aligned with suburban, green field development patterns - namely minimum lot size, maximum lot coverage, minimum set-backs from property lines, and maximum dwelling units per acre. The application of these dimensions to the proposed site not only prohibits construction of the two new structures we proposed but also theoretically prohibits the existing structure as currently positioned. (Fig. 1) We quickly recognized that the regulatory dimensions constraining our vision for the site were meaningless but the site's historical dimensions - both literal and figural - would unlock the potential of the project and capture public support and garner regulatory approvals. Thus, the Ghost Houses project was born.

PLANNING DIMENSIONS

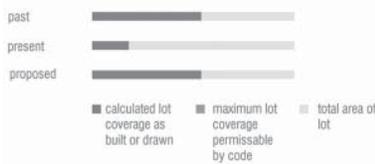
The Ghost Houses project derives its name from an appropriation of literal dimensions devoid of stylistic encumbrances. New designs assume the massing and siting of the invisible structures that now exist only within the memory of those that recall them or in ephemera that affirms their prior existence. (Fig. 2) Sources include oral histories, newspaper articles, city directories, archival maps, legal deeds, and federal census records. These documents were critical to addressing apprehensive neighbors' and regulators' concern about the consequences of increased density (of structures and inhabitants) and a program that included multi-family rental units (rather than exclusively owner-occupied, single-family resi-

actual parcel dimensions as exist/ed

The diagrams below illustrate the historic parcel and structures as they have changed over time. The proposed diagram (bottom left) reflects the intended site arrangement for the Ghost Houses project.

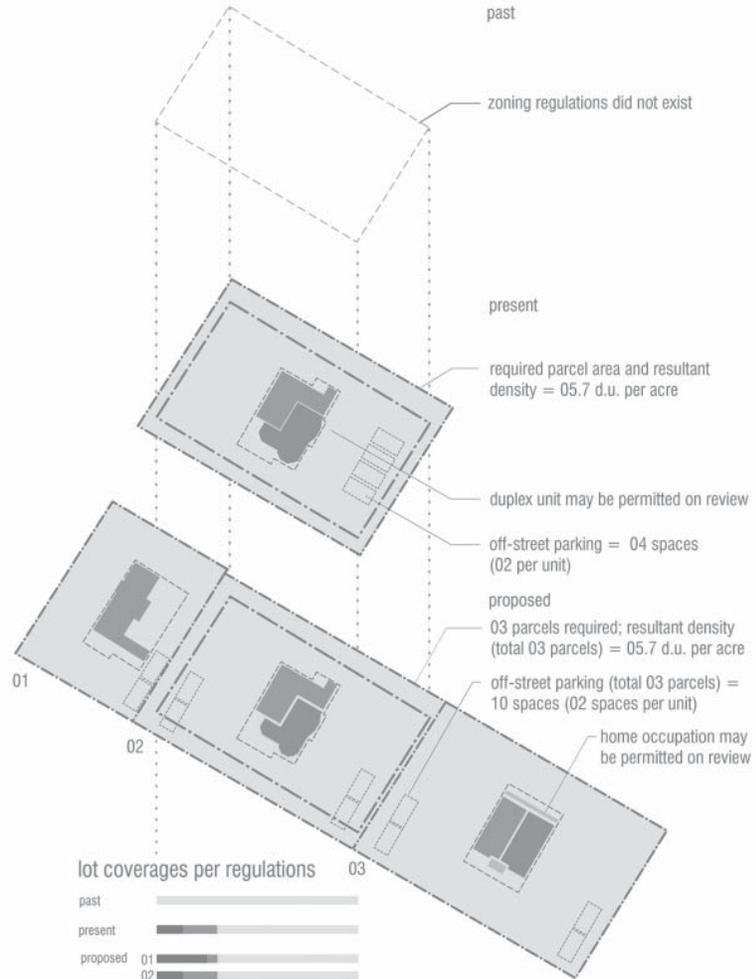


lot coverages as exist/ed



regulated parcel dimensions as zoned

The diagrams below illustrate the land areas and number of parcels required by zoning regulations in order to re-develop the site in accordance with the historic pattern of structures and dwelling units.



lot coverages per regulations



Source: Zoning Ordinance for Knoxville, Tennessee as amended through June 19, 2007

| Sheet, Avenue, Road, etc. | PLACE OF ABODE | | | NAME | RELATION | TENURE | PERSONAL DESCRIPTION | | | | | CITIZENSHIP | | | EDUCATION | | | | NATIVITY AND MOTHER TONGUE | | | | | | OCCUPATION | | | | |
|---------------------------|----------------------------|---|---|--|--|---------------------|---|---|--|------------------|---------------|----------------------|--------------------------------------|--|---|---|--|--|--|--|-------------------------------------|---------------------------------|--------------------------|---------------|---------------------------|--|--|--|-------------------------|
| | House number or farm, etc. | Number of dwelling house in order of visitation | Number of family in order of visitation | | | | of each person whose place of abode on January 1st, 1919 was in this family. Include every person living on January 1, 1919. Count children born since January 1, 1919. | Relationship of this person to the head of the family | Home owned or rented if owned, fee or mortgage | Sex | Color or race | Age at last birthday | Single, married, widowed or divorced | Year of immigration to the United States | Naturalized or alien if naturalized, year of naturalization | Attended school Any time since Sept 1, 1919 | Whether able to read | Whether able to write | Place of birth | Mother tongue | Place of birth | Mother tongue | Place of birth | Mother tongue | Whether able to speak Eng | Trade, profession, or particular kind of work done | Industry business, or establishment in which at work | Employer, salary or wage worker, or working on own account | Number of farm schedule |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | |
| West 68 Street | 207 | 79 | 94 | Dirk, William A. Maia Mae Katie Fielden, William | Head Wife Daughter Daughter Grandson | R | M F F M | W W W W | 30 54 25 18 6 | M D S S | | | | | Yes Yes Yes Yes | Yes Yes Yes Yes | Tennessee Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee Tennessee | Yes none none none | Butcher none none none | Meat Market | W | | | | | |
| | 209 | 80 | 95 | Nelson, Harry A. Mary Louise | Head Wife Daughter | R | M F F | W W W | 30 22 18/12 | M M S | | | | | Yes Yes Yes | Yes Yes Yes | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Yes none none | Lineman none none | Telegraph Co. | W | | | | | |
| | | | 96 | Adams, William Ada Lee Kenneth D. | Head Wife Son | R | M F M | W W W | 30 24 12/12 | M S S | | | | | Yes Yes Yes | Yes Yes Yes | Tennessee Tennessee Tennessee | Georgia Tennessee Tennessee | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Yes none none | Toolmaker none none | Machine Shop | W | | | | | |
| | | 211 | 81 | 97 | Cowan, Crud B. Tisa Donald C. | Head Wife Son | R | M F M | W W W | 32 26 5 | M M S | | | | | Yes Yes Yes | Yes Yes Yes | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Tennessee Tennessee Tennessee | Yes none none | Engine ? none none | Sou. Railway | W | | | | |
| | | | 98 | McCamy, Haris Ada | Head Wife | R | M F | W W | 41 36 | M M | | | | | Yes Yes | Yes Yes | Tennessee Tennessee | Tennessee Tennessee | Tennessee Tennessee | Tennessee Tennessee | Tennessee Tennessee | Yes none | Carpenter none | House | W | | | | |

Fig. 1. Planning dimensions and census data (illustrations by curb)

dences). The necessity for relief from off-street parking requirements created further skepticism. The site's historic omission of this 'amenity' however, persuaded neighbors and officials to once again entertain the possibility of demand for enhanced public transit - reminiscent of the street-car system that gave rise to neighborhoods like this one.

Appropriate dimensions thus originate in the site and context, and resonate with specific meaning as opposed to abstract generalization. Following the project's rejection when viewed first through the dimensions outlined in local zoning ordinances, we sought to re-frame the proposal by assessing its historic dimensions - both literal and metaphorical. The approach garnered the support and assistance of the municipality's Historic Zoning Commission, Metropolitan Planning Commission and Board of Zoning Appeals, the city's elected Council Members, and various neighborhood associations. Signs advertising public hearings on historic 'appropriateness,' re-zoning petitions, use-on-review proposals, and variance requests were repeatedly staked to and removed from the site. Initial objectors opted to support, or at least accept, the proposed redevelopment plan, and with it assumed traditionally unpopular increases in density, decreases in off-street parking allowances, and provisions for affordable rental housing. Though these issues invariably illicit opposition from neighboring property owners, their eventual acceptance indicates the promise of new regulatory measures, those informed by the "knowledge of how [places'] historic cultural landscapes have evolved" and how this might "help to establish priorities for current interventions."³ Meaningful regulations and associated dimensions would thus emphasize the context of evolution rather than preservation - of both the past and the status quo.

ARCHITECTURAL DIMENSIONS

*"No matter where one cuts open each house, the period itself has been imprinted."*⁴

Adoption of the dimensions embedded within the historical site and massing produced fixed volumes in which to develop spatial strategies to accommodate and reflect contemporary modes of inhabitation. Within similar envelopes, the two



Fig. 2. Upper left, Photograph of three historic houses on site prior to demolition. Upper right and bottom, Photomontages of proposed redevelopment of site. (photographs, illustrations by curb)

structures develop divergent approaches to a new single-family dwelling and a new two-family dwelling with a studio/work space. These in turn differ from that of the original (but modified) house, a duplex.

A plan of the existing house discovered in a file at the city's department of code violations reveals a pattern of use obscured by its current configuration - shared use of an entry vestibule and central hall linking a common kitchen and bathroom.⁵ Two rooms with a fireplace between them are located on either side of the common hall. This layout provides flexibility for inhabitation by one or two families - a pattern confirmed by federal census data (but currently forbidden by the local zoning ordinance). An egalitarian plan is in this case the driver of spatial division and not the volume. In fact, the volume beneath the generous roof form is not experienced from within at all, negated by the flat, albeit high, ceilings. The roof form with its steep slopes and elegant proportions, does not however exclusively offer protection from the elements, but contributes significantly to compositional and symbolic aims. Amidst occupation by two families, the dwelling's untapped volume raises temporal questions surrounding the shifting value placed upon public expression versus private spatial needs or desires. (Fig. 3, B.01 and B.02)

The proposed two-family dwelling can be understood to some extent as an inverse of these conditions. Its design maximizes every square inch of

leasable space by manipulating the section within a constrained volume. The constrained volume establishes the massing of both new structures, and primary floor, eave, and ridge elevations. These constraints inform the transformation of side-by-side dwelling units such that perceptually large and bright spaces are possible despite limited floor area. The resultant section produces one large, high room with lower and upper mezzanines to the rear. Sliding panels permit private use of the mezzanines as sleeping or work areas. An office/studio occupies the volume above the units and beneath the roof form. Access to this studio is via a rear stair around which storage and mechanical needs are met through the manipulation of interstitial space. High skylights and low vents discreetly provide light, air and views to the otherwise ensconced office/studio. (Fig. 3, C.01 and C.02)

The spatial strategy for the proposed single-family dwelling originated with the opinion that the internal space enclosed by the prescribed volume exceeded quantities needed by a single family. Thus, from the outset, a large percentage of the inherited volume was allocated as external space. The approach to interior and exterior space within and around the given massing would then create conditions of balance between the two. Furthermore, this spatial balance would inform the approach to inhabitation and environmental systems that leverage qualitative and quantitative relationships to nature within an existing urban site. The western half of the ground floor is devoted to interior living space and the eastern half to outdoor living space. The thick, western wall buffers internal spaces from the public street and the intense sun. The eastern wall is semi-transparent with further enclosure provided by the landscape and adjacent structure. Floor-to-ceiling operable glazing and placement of the galley kitchen obfuscate the threshold between the two halves, as does the overhead floating ceiling. The ceiling is created by a sleeping loft centered under the hip roof and open to both interior and exterior living spaces. The manipulation of space and the inclusion of an entry vestibule, a sun porch, a light/air/water chimney, and a thermal labyrinth and mass walls create a system to passively heat, cool and ventilate the rooms thereby providing the comforts associated with modern living without the environmental tolls. Their inclusion and

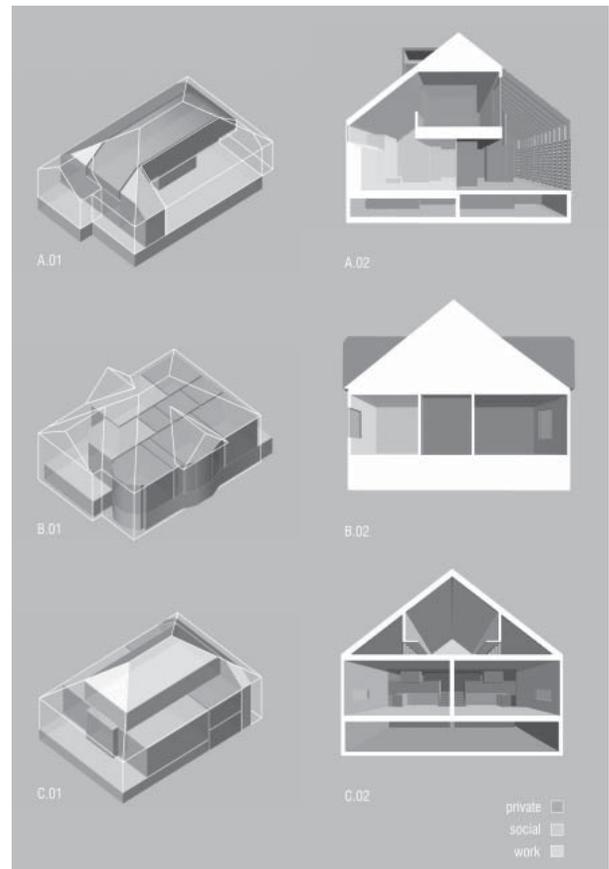


Fig. 3. Composition of program within typical volumes. Left column, A.01 – proposed single-family residence, B.01 – existing two-family residence, C.01 – proposed two-family residence with office/studio. Spatial relationships within typical cross section. Right column, A.02 – proposed single-family residence, B.02 – existing two-family residence, C.02 – proposed two-family residence with office/studio (illustrations by curb)

the emphasis on symbiotic interior/exterior conditions synthesize contemporary environmental and spatial demands within the appropriated and dimensionally constrained shell. (Fig. 3, A.01 and A.02)

Historic neighborhood review boards traditionally exert minimal control over the dimensions of internal space, its materiality, or its uses. The three designs detailed above point to the diverse modes of inhabitation that are possible within the constraints of historical site plans and building envelopes. The flexibility to invent within these dimensions creates unique and unanticipated environments. Unfortunately, the same cannot generally be said of the exterior expression. Neighborhood

boards consistently draft and adopt design guidelines with arcane and prescriptive dimensions - extent of overhangs, percentage of allowable wall openings, and ratios for acceptable roof slope rise and run. The Ghost Houses project confronts these and other dimensional constraints to explore their environmental, spatial, technological, and sociocultural implications.

TECHNOLOGICAL DIMENSIONS

Both proposed structures adopt stick framing, a tradition of residential construction in the United States and likewise the construction system used to build the historic house. The approach to framing the proposed structures, however, differs considerably from traditional models. Optimized Framing principles and Computer Numeric Controlled (CNC) milling technology are integral to the design and construction of the Ghost Houses. The impact of these strategies can be measured quantitatively and their influence experienced qualitatively. (Fig. 4)

The decision to use Optimized Framing techniques reflect the Ghost Houses' approach to framing not simply as structure but furthermore as a central player in the performance of the envelope. The design rigorously aligns conventional 2x framing at 24" increments from floor to wall to roof. This eliminates the use of double top plates in walls. Headers are appropriately sized for

actual load conditions and factory-made engineered-wood insulated headers specified. The use of clips at openings, corners, and wall intersections further reduces the number of studs. Optimized Framing thus minimizes resource use and maximizes thermal benefits. Coupled with insulated sheathing, a pronounced improvement in R-value is achieved, reducing thermal bridges and increasing cavities for insulation. "Every stick or skin of wood (which has an R-value of about 1 per inch) you can take out and replace with cavity or sheet insulation (with R-3.5+ per inch) represents more than a three-fold improvement in resistance to heat loss or gain."⁶

To ensure efficient layout, material usage, and minimal waste all framing is designed and modeled using Building Information Modeling software. The 3-dimensional framing model is sent

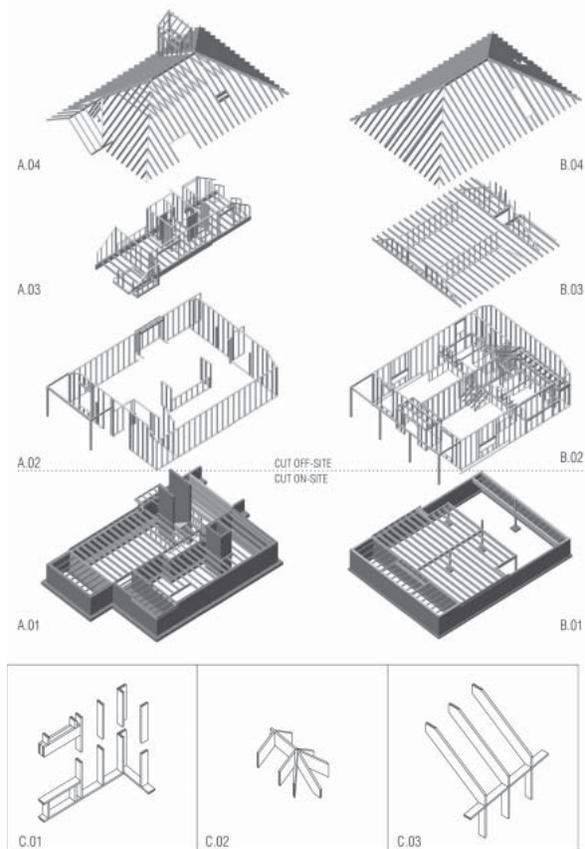


Fig. 4. Exploded axonometric of CNC milled stick frame (A.01 – B.04, Top), optimized framing corner detail (C.01), CNC milled roof framing at hip (C.02), alignments of rafters and studs in optimized framing (C.03), Bottom. (illustrations by curb)

electronically to the timber mill. There, digital files are used to generate a lumber list and member layouts that optimize material resource use and minimize material waste. The three-dimensional files provide further labor, and therefore economic, efficiencies. A CNC saw is digitally guided to make compound cuts - such as those where the hip ridge, jack rafters, and common rafters meet - and to mass-produce repetitive cuts - such as birdsmouth notches where walls and rafters meet. As a further convenience and efficiency, sill plates are notched 1/4" deep at 24" centers to guide the placement of studs thereby eliminating on-site measurement. The framing is bundled into kits, delivered to the site, laid out on the site-framed floor platform, and erected within a matter of days.⁷ Dimensionally tight infill sites and neighbors within close proximity - both atypical of large green field developments - make pre-cut framing

packages even more desirable.

The value of wide-spread incorporation of Optimized Framing and digital technologies can be measured in part against research statistics indicating "that 87.7% of the 1.7 million homes built in the US in 1999 were stick framed, that a "typical" home consumes just over 13,100 board feet of framing lumber (about 3/4 of an acre of a forest) and that the wood scrap pile for the construction of the "typical home is pushing 2 tons."⁸ The project's adoption of these technologies, coupled with a reduction in home size from the US median and inclusion of semi-attached duplex units, point to measurable efficiencies in material resource use which compound efficiencies inherent in the land-use pattern.

The response of building code officials and builders to these rational but unconventional systems remains to be seen, and their outcomes merit future analysis. Post-occupancy monitoring of environmental performance is also anticipated and will contribute further measurable data to inform future constructions and their dimensional implications.

CONCLUSION

"Buildings come out best when they emerge logically and honestly from their immediate material, process, and cultural contexts."⁹

After fourteen months, the Ghost Houses are a near reality, with construction set to commence in January of 2008. The success in securing our neighbors' and municipality's approval affirms that it is possible to operate creatively within regulatory constraints. Furthermore, the process reveals the Architect's unique capacity for abstraction and synthesis, and her ability to communicate the implications of this synthesis to laypeople and municipal officials – both verbally and visually.

Several examples demonstrate the application of these skills to the Ghost Houses. One such instance involved the telling of site's history as one more complex than can be explained by its physical existence or appearance. To do so, we examined and presented the site as a reflection of its continually evolving context. The occupancy, density, and transportation patterns prevalent at the

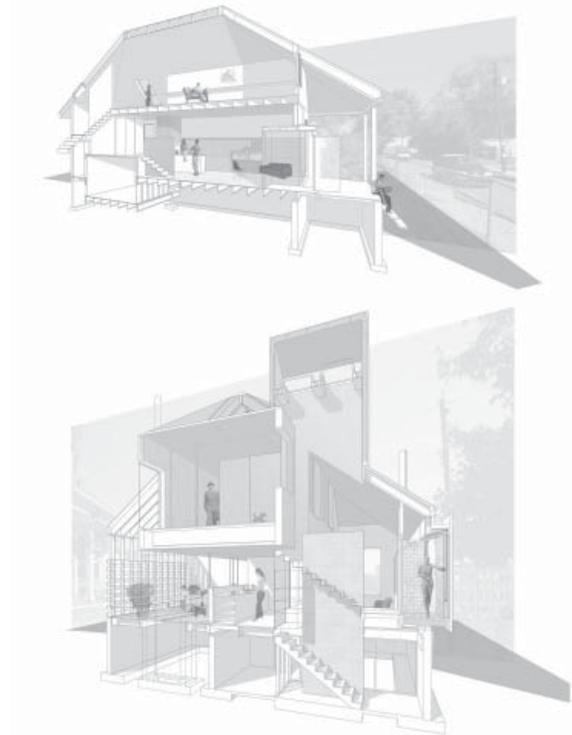


Fig. 5. Section perspective through one dwelling within the two family house, top. Exploitation of the appropriated cross section produces one large, high social room with private lower and upper mezzanines to the rear. An office/studio is ensconced between the dwellings and the hip roof, and discreet openings and translucent roof panels offer light, air, and views. Section perspective through the light and air chimney within the single family residence, bottom. The plywood-lined sleeping loft hovers above the indoor and outdoor living spaces. Sliding panels and doors permit the loft to open onto both of these spaces. (illustrations by curb)

time of the original, for instance, were compared to those implicit in governing zoning ordinances and also to the alternatives proposed by the design. In this way we sought to capture the spirit of inhabitation and all that it entails, then to offer our vision for dwelling on the property. Our vision considers the contemporary social and ecological imperatives of the time. Likewise it reflects an individual desire for a live/work home in the city - but not in a loft or historic house; an interest in cycling in lieu of driving; and financial and social goals related to affordable rental housing.

Another approach involved the use of history as a political tool. For the general public, the past retains an automatic legitimacy, one that is earned

and unearned, advantageous and limiting. The past thus served as an instrumental precedent for closely spaced rental housing. Photographs of the historic development and the remaining duplex present an appealing form and expression despite a use that has grown to be viewed as a threat to adjacent property values. The imagery helped to garner support for infill from neighbors, review boards and historic zoning commissioners, but also generated debate over aesthetic appropriateness. Again, it was necessary to communicate abstract principles regarding spatial relationships from the past that were employed to generate compatibility in lieu of applied aesthetics and imitation of the precedent. The adoption of footprints, setbacks, roof forms and aspects of the material palette, in our opinion, necessitated compromise by architect/client and advocates for surface historicism.

Places speak and architects are uniquely trained to pose critical questions as to the value of past, present and future existences. When these questions lead to solutions that are beneficial to the public but in conflict with accepted regulations, it is crucial the Architect apply her skills to challenge those practices. The Ghost Houses magnify the artificiality and obsolescence of many such practices - out-of-date planning principles, ill-informed and unnecessarily prescriptive design guidelines, and entrenched construction methods and regulations, to begin. Until the units and methods of measure are reformed, profound change in the physical landscape will remain impossible. Small, experimental projects like the Ghost Houses that challenge broader spatial practices are necessary to conceptualize and anticipate the potential nature and dimension of growth that lie ahead.

ACKNOWLEDGEMENTS

The author wishes to thank the following individuals for their assistance with this project: Brad Raines, Ann Bennett, Tom Brechko, Ken Pruitt, and Tom Reynolds.

ENDNOTES

1. Legal description noted on Indenture (Deed of Trust) made the 24th of August, 1908 between Carrie P. Kirk and Hugh M. Johnston. P. 121 copied from W.B. 224, Knox County, Tennessee Register of Deeds.
2. US Federal Census Data for Knox County, Tennessee District 2, September 01, 1920, for parcel located

at 207/209/211 W. Gill Street. Copy of microfilm obtained from Knox County Historical Society, Knoxville, Tennessee.

3. Delores Hayden, *Building Suburbia: Green Fields and Urban Growth, 1820 - 2000* (United States: Vintage Books, 2003): 235

4. Hiroshi Matsukuma, "The Appeal of a Vernacular Modernism" *The Japan Architect*, Vol. 22 (Summer 1996-2):08

5. Floor Plan 'A' found in a file on the property identified as 101-105-109 Gill Avenue. File held by the City of Knoxville's Department of Code Violations.

6. Peter Yost and Ann Edminster, "Optimizing Wood Framing," http://www.buildingscienceconsulting.com/resources/articles/optimizing_wood_framing.pdf : 03 (Originally appeared in the May 2003 issue of *Building Safety Journal*.)

7. Information regarding the CNC milling refers to Hundegger K2 technology and was supplied by Sauter Timber LLC, Rockwood, Tennessee.

8. Yost and Edminster: 01

9. Mark Anderson and Peter Anderson, *Prefab Prototypes - Site Specific Design for Offsite Construction* (Princeton Architectural Press, 2006): 09

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Jessie Bond, "'Nightmare' homes on Gill get new renovating owner," *Knoxville Journal*, March 04, 1988.

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