

PREFABRICATION IN THE DESIGN OF HOUSING AT FOREST HILLS GARDENS IN NEW YORK, 1909-19

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A VISION OF TECHNOLOGY AND "THE ART OF CONSTRUCTION"

Just after the turn of the century and prior to the first World War, the Board of Directors of the Russell Sage Foundation, a newly formed philanthropic trust, committed funds to support the development of an experimental housing project which would eventually become the acclaimed community of Forest Hills Gardens.¹ Located on Long Island, but within the New York City Borough of Queens, Forest Hills Gardens was intended to provide affordable homes for working class families.² Although it did not succeed in this goal, Forest Hills Gardens has been viewed, throughout the 20th century, as a milestone in the history of American urban planning and design.³ Credit is generally given to the architect Grosvenor Atterbury who, between 1909 and 1919, supervised the project and designed the great majority of its buildings. In fact, the planning work was done by the Olmsted Brothers, a firm of landscape architects succeeding their parent, Frederick Law Olmsted.⁴ As early as 1912, the professional press noted Atterbury's objection to the use of the word "model" in association with the undertaking at Forest Hills. He is quoted as saying:

It is unfortunate that the somewhat misleading term "model" must be applied to such an eminently practical scheme as this development of the Russell Sage Foundation, for the reason that there is a kind of subtle odium which attaches to "model" things of almost any kind, even when they are neither charitable nor philanthropic—a slightly sanctimonious atmosphere that is debilitating rather than stimulative of success.⁵

Atterbury's reluctance to acknowledge the philanthropic basis of the project is perplexing. To some extent, his rejection of charitable involvement may be explained by the procedure used to finance the Forest Hills development: it was structured as a business venture—a "limited dividend company"—expected to return a minimum profit of three per cent.⁶ But issues of profit do not fully explain Atterbury's dislike of labelling Forest Hills Gardens a "model" community.

At the time of his involvement with the Forest Hills venture, Atterbury enjoyed a reputation as a prominent American architect. Born in Detroit in 1869, he was a graduate of Yale University, attended the School of Architecture at Columbia, and ultimately studied at the Beaux Arts in Paris; he had begun practicing around 1895.⁷ Working out of New York City, Atterbury participated in the echelons of high society: he knew and was involved with prominent philanthropists and accepted commissions for charitable work from these clients.⁸ Designs for

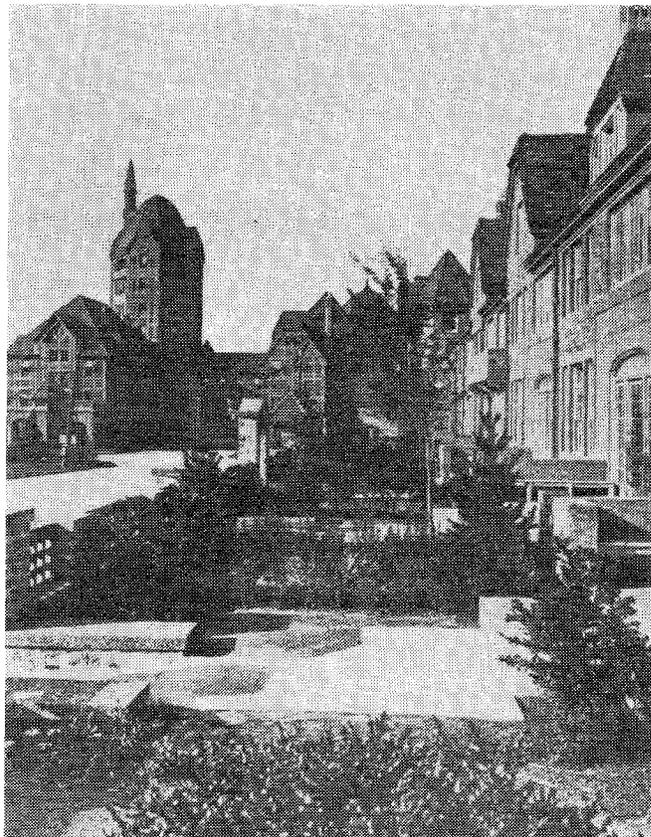


Figure 1: Forest Hills Gardens. Group VI Townhouses on the Greenway, 1912. Source: *Brickbuilder* 21, n. 12 (December 1912), Pl. 161.

"model tenements"—urban, walk-up dwellings for the poor—were credited to Atterbury and published in contemporary journals coincident with the first years of work at Forest Hills.⁹

The change in Atterbury's point of view may be explained by a speech in which he addressed the Fifth National Housing Conference in Providence, Rhode Island. The speech, published in the November 22, 1916 issue of the *American Architect*, was entitled "How to Get Low Cost Houses: The Real Housing Problem and the Art of Construction." Observing "by far the greatest sum spent in this country to-day is in domestic work," Atterbury argued that, by contrast to innovation in commercial building, traditional methods used in residential construction were wasteful and "disorganized."¹⁰ Viewing design as insufficient, Atterbury insisted that the problem could be resolved only within the realm of technology:



Figure 2: Forest Hills Gardens. Group III Townhouses, Detail and Plans, 1912. Source: *Brickbuilder* 21, n. 12 (December 1912), Pl. 158.

*As one of the first to begin talking about the practical solution of the housing problem, model tenements and model towns, some fifteen years ago, it was quite proper that I should be among the first to stop talking about it and devote myself to an effort to find some practical constructive solution...*¹¹

By directing his own energies toward the search for technological improvement, Atterbury hoped to demonstrate that the individual house, like the newly invented automobile, could become affordable to working families. He believed that the technology he proposed would automatically resolve the issue of design: "What we are trying to produce is not only obvious economy in material structure, but also in skilled expert service—such as is available now only to the rich man in the building of his home."¹²

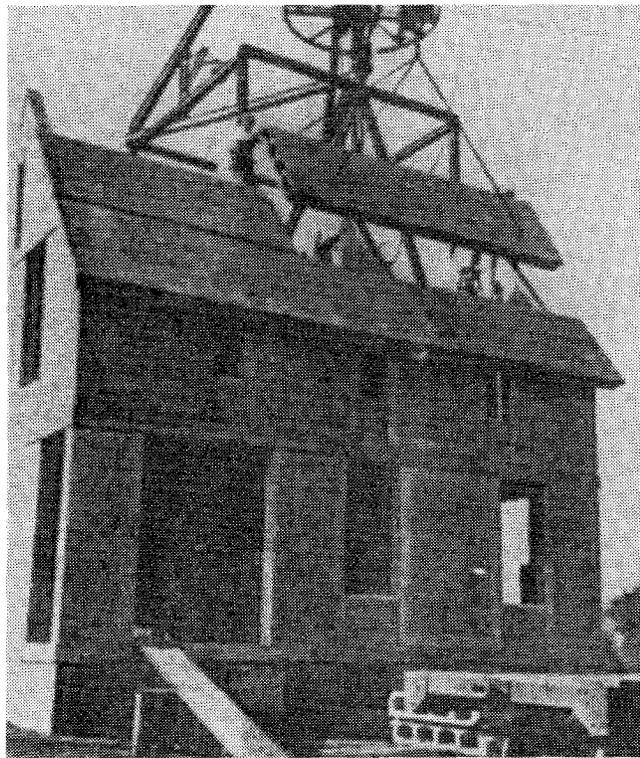


Figure 3: Sewaren, New Jersey. Pre-Cast Construction, 1910. Source: Grosvenor Atterbury, *Economic Production of Workingmen's Homes* (January 1930), p. 18.

FIRST PHASE OF CONSTRUCTION, 1909-12

Atterbury's involvement with the Russell Sage Foundation dated from its inception in 1907, when the trust was formed by Sage's elderly widow Olivia. In that year, Atterbury approached the Board of Directors with a request to support his experiments in devising a system of prefabrication for the construction of small homes.¹³ Relying on his own funds and with the assistance of others, Atterbury had set up a demonstration site in Sewaren, New Jersey. In January 1908, the trustees approved a grant of \$32,000 that allowed Atterbury to continue his experimental work.¹⁴

The trustee's decision to purchase land outside the urban limits of the city and proceed with a housing development in Queens occurred early in 1909 and was seemingly independent of the enterprise at Sewaren. A limited dividend partnership, the Sage Foundation Homes Company, was immediately formed to pursue the venture. Edward Bouton was chosen as the general manager of the project. The Olmsted firm, which had done the planning for Bouton's successful development of Roland Park outside Baltimore, were contracted to work on the layout of the scheme. Atterbury, meanwhile, was hired to design the actual buildings that would be constructed.¹⁵

Although Atterbury's interest in technology can be traced to the early years of his practice,¹⁶ the work he produced during the first decade of the century was quite varied. In his efforts to address the needs of a conservative clientele, his design was usually styled in a traditional manner.¹⁷

A first phase of construction, inviting public reaction and comment, was completed at Forest Hills in December 1912.¹⁸ Development had focused on the village center, "Station Square," and included a commuter station elevated to accom-

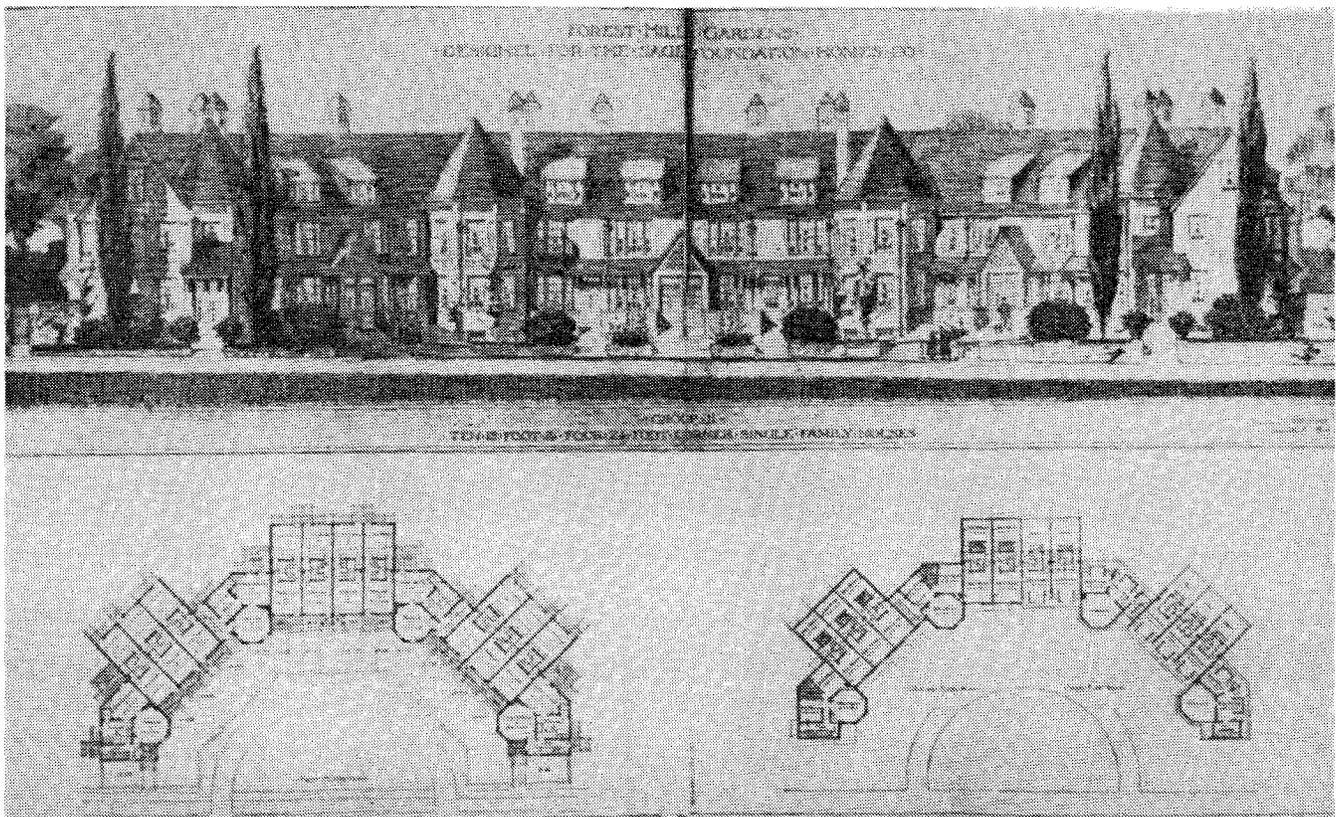


Figure 4: Forest Hills Gardens. Group II Townhouses, Rendering and Plans, 1912. Source: Forest Hills Gardens (New York: Sage Homes Company, 1913).

modate the railroad embankment, a hotel complex divided into five parts, two apartment buildings, and a set of three residential duplexes. Also of significance was an elongated segment, "The Greenway," which served as a transition between the commercial area and the residential interior.¹⁹ The Greenway was flanked by two rows of townhouses, referred to in design documents as "Group VI A" and "Group VI B."²⁰

Despite the overlap between his research at Sewaren and the project in Queens, Atterbury limited his technical experiments during this first phase of construction at Forest Hills. He was selective, if not actually cautious, about introducing innovations. All the buildings were erected on traditional foundations of poured concrete. The hotel tower was framed entirely in steel; lower-storied buildings were structured using hollow terra cotta blocks reinforced with steel rods and poured concrete, along with concrete piers and girders. In general, floors were constructed of concrete beams and terra-cotta blocks. With the exception of the townhouses, roofs were framed in steel and covered with a cement slab reinforced with metal lath and embedded with nailing strips to receive tiles.²¹

At this stage of construction, techniques of prefabrication were limited to window jambs, lintels, sills, cornices, and gable trimmings. A number of decorative gratings were among the castings. Despite their status as a minor element, they are striking through their repetition and versatility. In general, filler pieces were devised so that individual molds could produce similarly shaped units of differing sizes.²² The exterior facades of the buildings rely extensively on brick infill: the project is enhanced both by the design of the coursing and skill in laying the brick.²³ Atterbury's talent for choosing and co-ordinating materials, especially with regard to texture and color, contrib-

uted to the persuasive effect of this initial round of construction.²⁴

Among the technical innovations of this phase was the recycling of broken roof tiles for use as an aggregate in cement stucco. The technique was also applied to concrete casting. In both instances, washing the exterior surfaces with acid removed excess cement and served to effectively expose the aggregate.²⁵ These innovations were possible due to Atterbury's success in convincing the trustees to build a factory on the site at Forest Hills. The factory enabled the crushing and mixing of the concrete as well as the formulation of precast members that were used at this stage.²⁶

A comparison of the townhouses on the Greenway (Group VI) with the commercial buildings of Station Square indicates the extent to which the buildings at Forest Hills are tied together by a vocabulary of stylized elements, even at this stage of construction. The recurring shallow arch is effective in uniting the buildings in Station Square with the Greenway townhouses. Also characteristic is the method of working and resolving the trabeated forms of the upper storey and the repetition of masonry patterns. The consistency of pitched roofs and square-browed gables also proves a unifying factor.

Although Station Square and the Greenway form the heart of this first phase of development, the character of the project overall was established through selective development within the residential interior. Housing types ranged from the parti-wall townhouses introduced along the Greenway to free-standing, single-family homes. The middle scope of this hierarchy included a variety of "detached" and "semi-detached" groupings. Although a few other architects contributed, most of the buildings realized were designed by Atterbury or his firm.²⁷

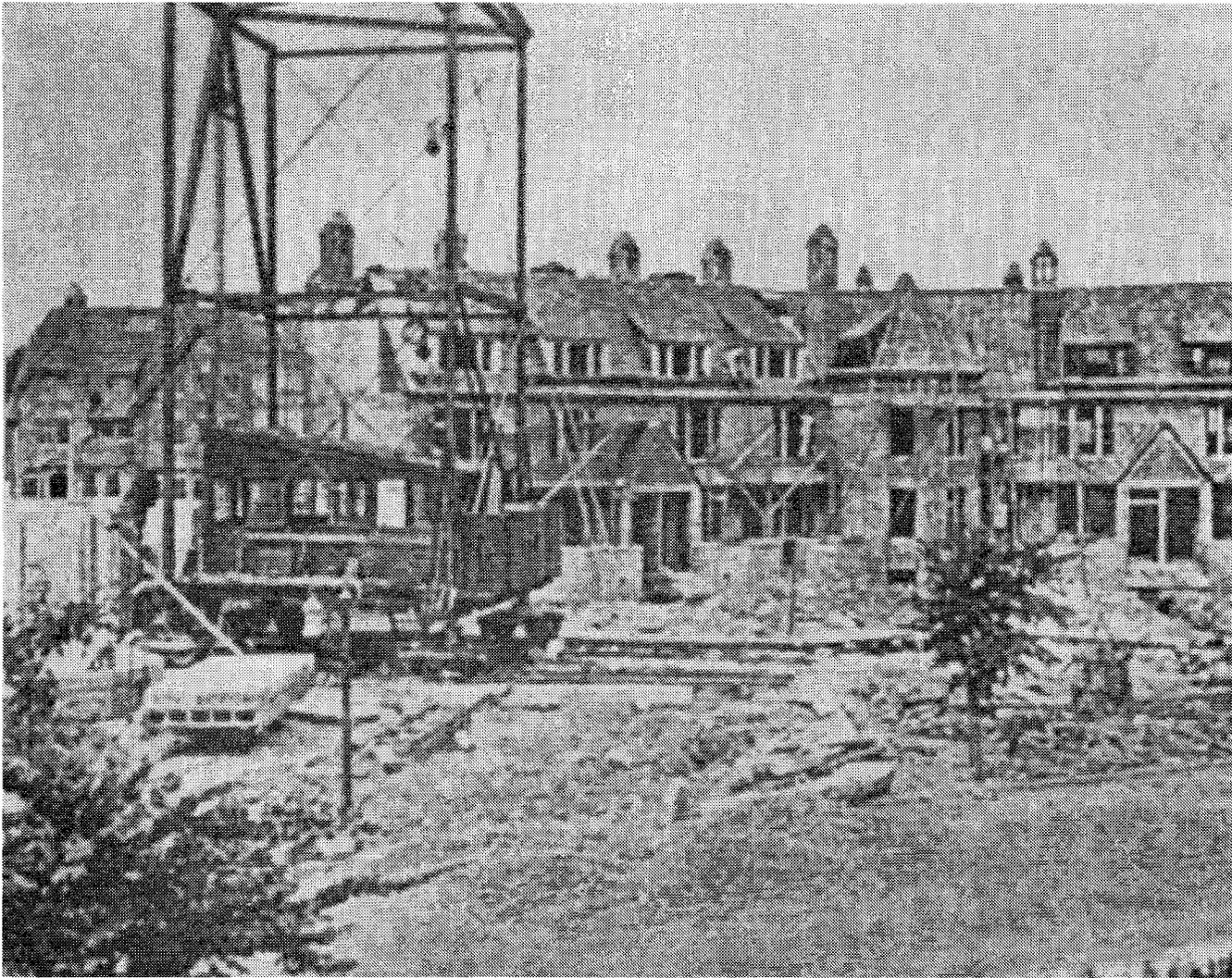


Figure 5: Forest Hills Gardens. Group II Townhouses, Under Construction, 1913. Source: Grosvenor Atterbury, *Economic Production of Workingmen's Homes* (January 1930), p. 25.

While Group III and Group VI townhouses share the technique of applying stucco over terra cotta blocks, Group III is notable for its pronounced display of the repetitive, flat arch.²⁸ Aside from Group III's Gothic appearance, its parti-wall facades present a more direct expression of syntax, a kind of ultimate logic of the pieces. But despite this more rational articulation, Group III ultimately proves less appealing than the townhouses on the Greenway. Whereas Group XI and two single family houses, I-F-50 and I-F-51, abandon the use of structural clay blocks and stucco and are built entirely out of brick, several of the established motifs of the other constructions are present in their design and execution.

Although in many ways this phase of construction appeared successful, according to one essential criterion it had failed: the cost of even the most modest townhouse exceeded the means of the average working class family.²⁹

SECOND PHASE OF CONSTRUCTION 1913-14(17?)

The end of the 1912 building season, culminating with the publicity and review of the project in December, marked the end of the first phase of development at Forest Hills

Gardens. From 1913 on, efforts turned toward filling the numerous residential sites. The Sage Foundation Homes Company issued a monograph of the project that documented site clearance and construction and showcased the completed work. The publication also featured proposals for numerous dwelling types.³⁰ Photographs accompanied plans of buildings already constructed; often renderings were included. The book conveyed the sense of a successful undertaking, fully conceived and well on its way to completion.

Less advertised was Atterbury's conversion of the factory to full-scale production of houses based on the system of prefabrication he had developed through his experiments in Sewaren, New Jersey.³¹ Public discussion does not reveal whether this shift in methods of construction at Forest Hills Gardens had always been intended or was conceived as an expedient to counteract the high cost of construction in the first phase. Alternately, the introduction of the new system may simply be a tribute to Atterbury's powers of persuasion in dealing with his client.

Although Atterbury's work at Sewaren had begun in 1904, by his own account construction did not take place until after 1907 when, he claimed, "the first years of survey and

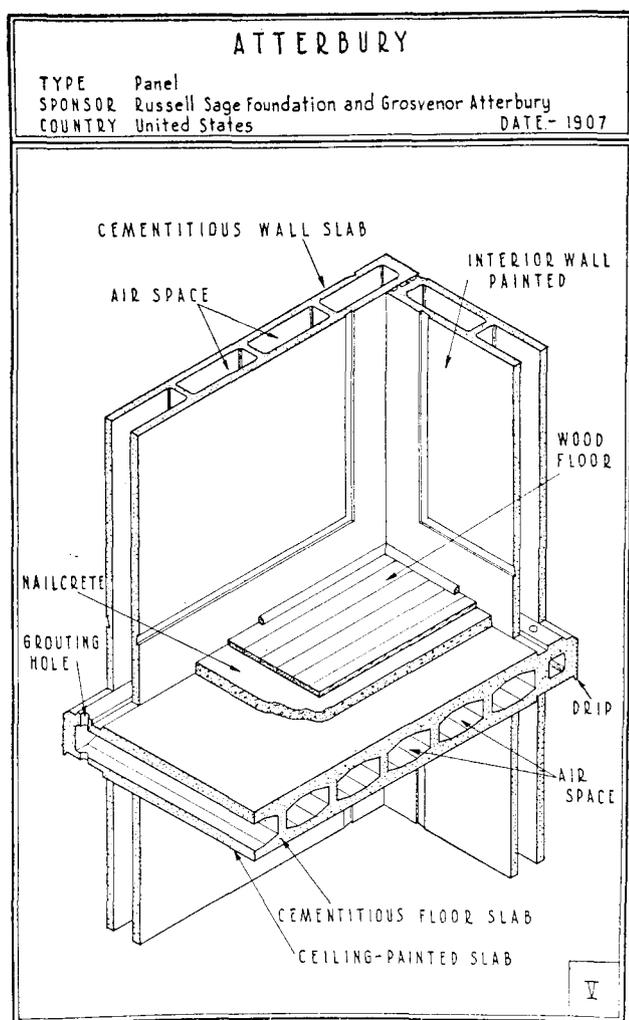


Figure 6: Diagram of the Atterbury System of Pre-Cast Concrete Construction. Source: Albert Farwell Bemis, *The Evolving House: Rational Design* (Cambridge: MIT, 1936), v. 3, p. 350.

elimination were completed.³² Progress accelerated following the grant Atterbury received from the Sage Foundation; between 1908 and 1910 two houses were erected. Both were made entirely of pre-cast concrete sections, but differences in the form of the structural members led to alternate methods of assembly. Whereas one technique involved large-scale slats set in horizontal layers, the other—which was ultimately chosen for adaptation and development at Forest Hills—minimized horizontal joints by utilizing one-story panels separated by window and door openings.³³

Construction of the Sewaren Houses required an electric crane supported by a 40-foot derrick mounted on railroad “trucks.” Concrete sections were transported to the site on flatbed rail cars.³⁴ Both the derrick and the rail system connecting each residential site to the concrete factory were installed at Forest Hills and used in construction from 1913 on.³⁵

Among the first of the buildings erected in 1913 was a series of townhouses known as “Group II.”³⁶ The plan was configured to form a segmented curve whose inside angles were marked by four turrets. The entire structure incorporated ten 13-foot wide and four 24-foot wide party-wall homes; the turrets

identified the locations of the four larger dwelling units.³⁷ The construction of the Group II townhouses, like the cottages at Sewaren, was based solely on the assembly of elements precast within the concrete factory. The only exceptions were doors and windows (although frames were included in the castings). Wooden floors were nailed to a surface screeded onto the concrete. Interior surfaces, including partitions that were wholly internal to the structure, were exposed concrete finished only by painting. Panels involving interior walls were detailed to simulate decorative wood trim normally applied to plaster as a means of proportioning the horizontal and vertical surfaces of a room.³⁸

By comparison to Group II, the Group III townhouses which had been completed during the prior year had formed a linear configuration including ten 17-foot wide dwellings, and there were no special units comparable to the turreted homes of Group II.³⁹ Although the turret had actually appeared as a formal element prior to this phase of construction, its high-profile use in the Group II ensemble was probably meant to diffuse criticism that “standardization”—which was the intent of the prefabrication process—would necessarily lead to dullness of design.⁴⁰ In contrast to the turret’s inclusion, the flattened arch which had served as a signature motif in the earlier phase is absent in Group II. A familiar form that has found a permanent role among the new cast of players is the ubiquitous chimney.⁴¹ Another minor but repetitive form is the attic dormer; it has acquired a simplified character as a flapped, awning-styled opening. The grate castings which were an effective result of the earlier trials have here evolved into the decorative gable ends of the entry porches and also serve as banding under the eaves of the turret walls. A significant carry-over is the use of aggregate whose color and texture is enhanced by an acid wash. This technique, combined with the surface relief formed within the panels, serves as a substitute for the infilled lattice patterns of earlier constructions.

THIRD PHASE OF CONSTRUCTION 1914(17?)–1919

Atterbury was motivated by the belief that machine technology could replace costly and unreliable hand labor and minimize the difficulties of co-ordinating trades on the site. Moreover, factory operation would bring an end to seasonal fluctuations in productivity.⁴² Because an effective manufacturing process was essential to the success of his endeavor, Atterbury’s energies were drawn into the design and management of the concrete facility and the technology upon which the castings were dependent.⁴³

In the design of houses both at Sewaren and Forest Hills, the number of required molds was kept to a maximum of six or seven.⁴⁴ Foundations as well as walls were pre-cast. Walls were eight feet in height, spanning between window and door openings, and nine inches in width. They were hollow—1 1/2” of concrete on each side separated by a 6’ air space—and ribbed. The floor slabs were also hollow; Atterbury experimented with the thickness of the castings in an effort to eliminate the need for steel reinforcing in spans up to 14 feet. He also developed a substance called “nailcrete” which could be set in the mold. With its use, wood flooring could be nailed directly to the precast slabs. Floor panels were designed to lock over wall sections and overhang them slightly. This connection allowed for the location of weep holes which would drain any water that might penetrate the wall; stylistically, it also created a pronounced



Figure 8: Forest Hills Gardens. Group 48 Townhouses, Erected in 1918. Source: Grosvenor Atterbury, *Economic Production of Workingmen's Homes* (January 1930), p. 35.

2. Glenn, Brandt, and Andrews do not recognize low-cost housing as a goal of the project; observing that the Forest Hills development "failed to provide low-cost housing for working people," David C. Hammack and Stanton Wheeler, *Social Science in the Making: Essays on the Russell Sage Foundation, 1907-1972*, (New York: Russell Sage Foundation, 1994), p. 18, seem to admit that it was.
3. Norman T. Newton, *Design on the Land* (Boston: Harvard University Press, 1971), describes the Forest Hills project within its historical context, pp. 474-78.
4. Newton, himself a landscape architect, clarifies the role of the Olmsted Brothers; the work of the Olmsted firm is also acknowledged by Glenn, Brandt, and Andrews.
5. Atterbury's remarks serve as the lead quotation for an article in the December 1912 issue of *Brickbuilder* (21, no. 12), "Forest Hills Gardens, Long Island: An Example of Collective Planning, Development, and Control," p.317
6. The letter of gift which accompanied Mrs. Sage's foundation of the trust authorized the use of principal to fund "activities maintained for the improvement of social or living conditions" with the stipulation that such projects would "produce an annual income of not less than three percent," Glenn, Brandt, and Andrews, appendix A, p.668. See also Hammack and Wheeler, pp.17-18.
7. To some extent, details of Atterbury's life can be gleaned from the publication of his work and speeches (the first of his published designs appeared in the June 12, 1897 issue, no. 1120, of *American Architect and Building News*). A brief biography accompanied the article "Concrete—Forerunner to the Movement," part of a series on prefabrication developed by *Architectural Forum* (see 78: February 1943, p.69); also relevant is Atterbury's obituary, printed in the October 19, 1956 issue of the *New York Times*.
8. In a speech published at the end of his career, Atterbury reminisced about his relationship with Henry Phipps, see "The Scientific Approach to the Problem of Economic Construction," *Journal of the American Institute of Architects* 2, (September 1944), pp.143-44.
9. Plans and photographs of "Rogers Model Dwellings," a tenement on West 44th Street in New York, appear in *American Architect* 104, no. 1975 (October 29, 1913)
10. Grosvenor Atterbury, "How to Get Low Cost Houses: The Real Housing Problem and the Art of Construction," *The American Architect* 110, no. 2135 (November 22, 1916), p.318.
11. *Ibid.*, p.320
12. *Ibid.*, p.319.
13. In "Scientific Approach to Economic Construction," Atterbury refers to the "program" he submitted in 1907 for 'Researches in the Economic Production of Workingmen's Homes' and identifies a lengthy quotation, p. 140, as the text of the original proposal.
14. Glenn, Brandt, and Andrews list the grant, "For pioneering experiments in prefabricated housing," see appendix D, p. 687.
15. The bulk of this information is included in the account of Glenn, Brandt, and Andrews and is also summarized by Newton; Bouton's prior relationship with the Olmsteads is revealed in Newton's discussion of the development of Roland Park, pp.468-71 16. According to Albert Farwell Bemis, *The Evolving House: Rational Design* (Cambridge: MIT, 1936), vol. 3, p.349, in 1902 Atterbury "began an investigation of current construction methods the world overp Atterbury would later mention a revelatory trip to Cincinnati, sometime around 1903 or 1904, see "Scientific Approach to Economic Construction," p.144
17. A privately published "Architectural Catalog" (New York, April 1918) demonstrates the diversity of Atterbury's practice; his traditional interpretations are patterned in the work chosen for publication by the trade journals.
18. Photographic plates first appeared in the October 30, 1912 issue of *American Architect* (102, no. 1923). In December 1912, two articles were published simultaneously in *Brickbuilder*: "Forest Hills: Collective Planning," pp.317-18, and W.F. Anderson, "Forest Hills Gardens—Building Construction," pp.319-20; plates 155-64 of the same issue featured photographic views of the project and plans of some of the individual buildings.
19. For a plan see *Brickbuilder*: "Forest Hills: Collective Planning," p.318; or Newton, pp. 475, 477
20. Anderson, "Forest Hills—Building Construction," pp.319-320
21. *Ibid.*, p.319
22. *Ibid.*, p.320
23. *Ibid.*, p.319
24. Anderson draws attention to this aspect of the project which is also apparent through visual analysis.

25. Anderson explicitly discusses the role of the aggregate and even provides formulas for different mixtures: "Forest Hills—Building Construction," pp.319-320; Bemis, p. 351, attributes the successful development of the process to Atterbury's collaboration in 1909 with 'Professor Pellew' of Columbia University.
26. Anderson, "Forest Hills—Building Construction," p.320
27. Evidence for the extent of completion is found by comparing published sources: in particular, *Brickbuilder*, p.318 and plates 155-64, with a private publication of the Sage Foundation Homes Company, *Forest Hills Gardens* (New York, 1913)
28. Comparison is based on contemporary photographs along with photographic documentation and plans of Group III and photographs of Group VI in *Brickbuilder*, p.320 and plates 158, 161; a rendering, plans, and photographs of Group III are also included in Sage Foundation Homes, *Forest Hills Gardens*.
29. *Brickbuilder*, "Forest Hills: Collective Planning," p. 317, states this contemporaneously.
30. Sage Foundation Homes, *Forest Hills Gardens*.
31. A private publication authored by Atterbury, *Economic Production of Workingmen's Homes: 1904-25* (January 1930), provides photographic evidence for the transition, pp.20-21 ff. See also Bemis, p.352; *Architectural Forum*, "Concrete," p. 69; and Richard Sheppard, *Prefabrication in Building* (London: Architectural Press, 1946), p.47
32. *Ibid.*, p.12
33. *Ibid.*, pp.14-19 (documentation is in the form of photographs supported by descriptive captions); Atterbury refers to the construction at Sewaren as the "Third Demonstration," images are dated 1910.
34. Bemis mentions the "trucks" and also "derricks," p.352; Atterbury describes the machinery in the caption of a photograph, *Economic Production of Workingmen's Homes*, p.24
35. A review of available photographs suggests that only one crane existed, see *Economic Production of Workingmen's Homes*, pp. 15-28, 34. There is no evidence that any construction occurred in New Jersey after 1913.
36. See *Economic Production of Workingmen's Homes* (documentation is in the form of photographs supported by descriptive captions): Atterbury identifies this construction, p.13, as "Group 2" but refers to it most frequently as the "Fourth Demonstration," pp.22-26
37. A rendering and plans of the structure are labelled "Group II" in Sage Homes, *Forest Hills Gardens*.
38. Bemis, pp.352-53; see also *Architectural Forum*, "Concrete," p. 70, and Sheppard, p.47. A striking photograph of the interior occurs in *Economic Production of Workingmen's Homes*, p.26
39. Comparison is based on contemporary photographs along with photographic documentation and plans of Group III in *Brickbuilder*, plate 158; Sage Foundation Homes, *Forest Hills Garden* includes a rendering and plans of Group II as well as a rendering, plans, and photographs of Group III.
40. Atterbury's concern for the relationship between standardization and aesthetic quality is frequently expressed in *Economic Production of Workingmen's Homes*—in particular, see p.13. Returning to the question of aesthetics in "Bricks without Brains: A Challenge to Science and the Factory-Made House," *Architecture* 73, no. 4 (April 1936), pp. 194-96, he developed an argument that foreshadows principles later articulated by Elizabeth Plater-Zyberk, Andres Duany, Peter Calthorpe, and other proponents of "New Urbanism."
41. For a photograph of chimneys laid out in the storage yard, see *Economic Production of Workingmen's Homes*, p.21
42. He states these goals explicitly in *Economic Production of Workingmen's Homes*, p.11
43. This is the impression given by Bemis; *Architectural Forum*, "Concrete," p. 71, discusses Atterbury's continued efforts to improve the technology of the process.
44. *Economic Production of Workingmen's Homes*, p.13
45. A comparison of diagrams prepared by Bemis, p. 350, and *Architectural Forum*, "Concrete," p. 70, reveals slight differences which are informative. For textual information see Bemis, p.352-53, Sheppard, p.47; and *Architectural Forum*, "Concrete," p. 70-71. The *Architectural Forum* series was also published in book form: Bruce, Alfred and Harold Sandbank, *A History of Prefabrication* (Raritan, N.J.: John B. Pierce Foundation, 1945)
46. *Economic Production of Workingmen's Homes*, p.30
47. *Architectural Forum*, "Concrete," p.71, raises the issue of "expensive molds" but does not discuss the cause.
48. Atterbury admits that "our plant and its production was very small and inefficient," *Economic Production of Workingmen's Homes*, p.29
49. See *Economic Production of Workingmen's Homes*, pp.12, 30-31, 34; also "Bricks without Brains," p.194
50. *Economic Production of Workingmen's Homes*, p.12
51. The disadvantages are briefly discussed to in *Architectural Forum*, "Concrete," p. 71; despite his many retrospective discussions, Atterbury himself did not acknowledge this problem.
52. *Economic Production of Workingmen's Homes*, p.13
53. *Economic Production of Workingmen's Homes*, pp.27-28, 34, 35 (documentation is in the form of photographs supported by descriptive captions) Atterbury refers to this group as the "Fifth Demonstration;" he does not explain the lapse of five years between the construction of Group II and Group 48.
54. Atterbury's stated goal was "the standardization of structural elements to the maximum degree compatible with flexibility of design," *Economic Production of Workingmen's Homes*, p.11
55. The documentation includes a set of plans: Sage Foundation Homes, *Forest Hills Gardens*.
56. *Economic Production of Workingmen's Homes*, p.13.
57. Atterbury reported that the continuation of his research through 1925 was financed by a handful of "public spirited" investors who formed a group called the "Standardized Housing Corporation," see *Economic Production of Workingmen's Homes*, p.6
58. Concerning Mrs. Sage's death, see Glenn, Brandt, and Andrews, pp. 267-70; Bemis describes the sale of the factory, p.351
59. Group 56 is documented by a single photograph following the opening pages of *Economic Production of Workingmen's Homes*; Atterbury's caption labels the grouping as the "Seventh Demonstration."
60. Bemis, p.351
61. *Economic Production of Workingmen's Homes*, p.29
62. For further information relative to the divestiture, see Glenn, Brandt, and Andrews, pp.272-73