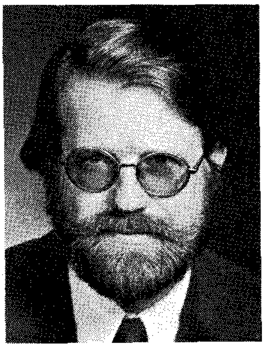
Precast Concrete Housing: The Youngstown Project



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The potential for innovation inherent in reinforced concrete as a building material was recognized early. Many builders experimented with the new material and explored ways in which its unique properties could be advantageously exploited. Particularly interesting were many of the early experiments that dealt with the precasting of concrete building elements.

There is not always a continuous line of development, however, from early experiments in the area to our current precast concrete industry. Many innovative ideas were developed to the extent that they were field tested, only to then fall by the wayside to await rediscovery at a much later date.

A good case in point is the development of housing systems made of precast building elements. The past 20 years have seen a flurry of such systems, some successful and some not. Most were developed as if there were no previous experiments at doing the same thing. Not fully appreciating previous experiments is unfortunate, since many of the more successful innovations in the use of precast elements to build housing are to be found in some of the earliest examples of precast systems. A good example is a housing project in Youngstown, Ohio.

The Youngstown project does not represent the first precasting experiment in the United States, but it is among the more significant. A stable using precast concrete elements was built in Brooklyn, New York, in 1900 and was followed by a warehouse built in West Rutland, Vermont, in 1905.[1] A significant building using a precast floor and roof system was constructed in Reading, Pennsylvania, in 1905.[1] In other countries, an important initial attempt at precasting apartment units was made in 1904 in Liverpool, England, by City Engineer John A. Brodie.[2]

Further significant developments in the United States include the precast

The author brings to light an early and highly innovative use of precast concrete in the construction of housing. Built about 60 years ago, much of this housing project is still in use today.

building constructed in 1907 in New Village, New York, by the Edison Portland Cement Company. Ernest Ransome developed the so-called "Ransome Unit System" and applied it to a four-story building in Beverly, Massachusetts, in 1911.[1] Between 1910 and 1918 Grosvenor Atterbury used a hollow-core panel system he had developed earlier in the construction of a large number of housing units in Forest Hills, Long Island.[3]

The Unit Construction Company of St. Louis, Missouri, which later did the Youngstown project, began producing precast industrial buildings around 1910 using the "Unit Structural Concrete Method." John E. Conzelman, an engineer and designer for the firm, took out a large number of patents related to precasting in the period from 1910 to 1916.[1] A five-story building built in 1911 for the National Lead Company in St. Louis, Missouri, was among the firms more notable buildings.[1]

The Youngstown project thus had its predecessors, but none matched the success of the Youngstown System. Many of the specific innovations introduced by the builders marked significant improvements over earlier experiments. The project is still worth reviewing as a model of a highly successful method of building housing. The project is still existent.

Construction of the Youngstown Project

In May of 1916, the directors of the Youngstown Sheet and Tube Company appropriated $250,000 for the construction of housing for the employees of the plant. The decision to build housing was not necessarily an exercise in altruism, for in 1916 a series of worker riots took place in Youngstown because of dissatisfaction with working and living conditions. Large portions of the city were burned down. The state militia had to be called in to quell the riots. In the aftermath, the directors of the plant acted to improve the lot of their workers.

The Buckeye Land Company, a subsidiary of the plant, handled the building of various tracts of homes and apartments. From construction time until completion in 1920, 281 units of housing were built in East Youngstown. The project was constructed in two phases with the first consisting of 146 units.

Three different types of dwelling unit plans were used in the project. One consisted of a unit accommodating one family only, another housing two families, and another sheltering three families. These different one, two, and three-family types were combined into rows consisting of several units. All of the apartments contained four rooms, with the exception of the middle apart-

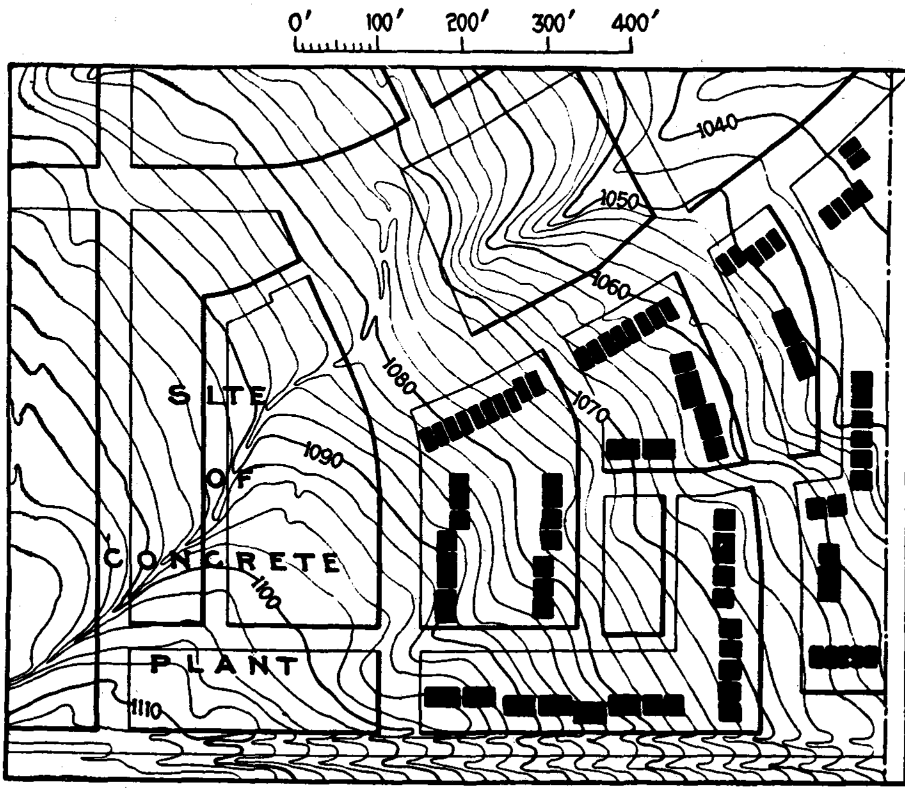

Fig. 1. Site plan showing location of housing project in relation to concrete plant.

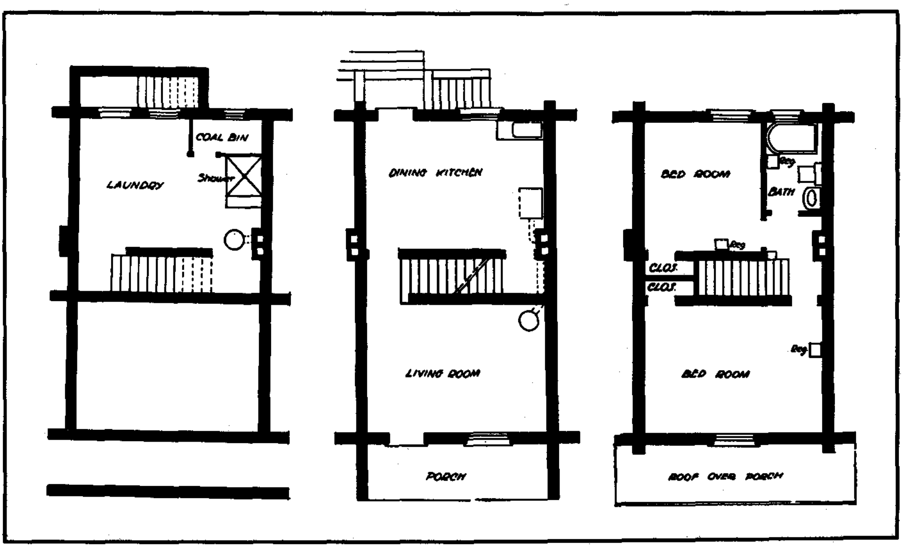

Fig. 2. Basement, first and second floor plans for typical 16-ft (5 m) frontage house.

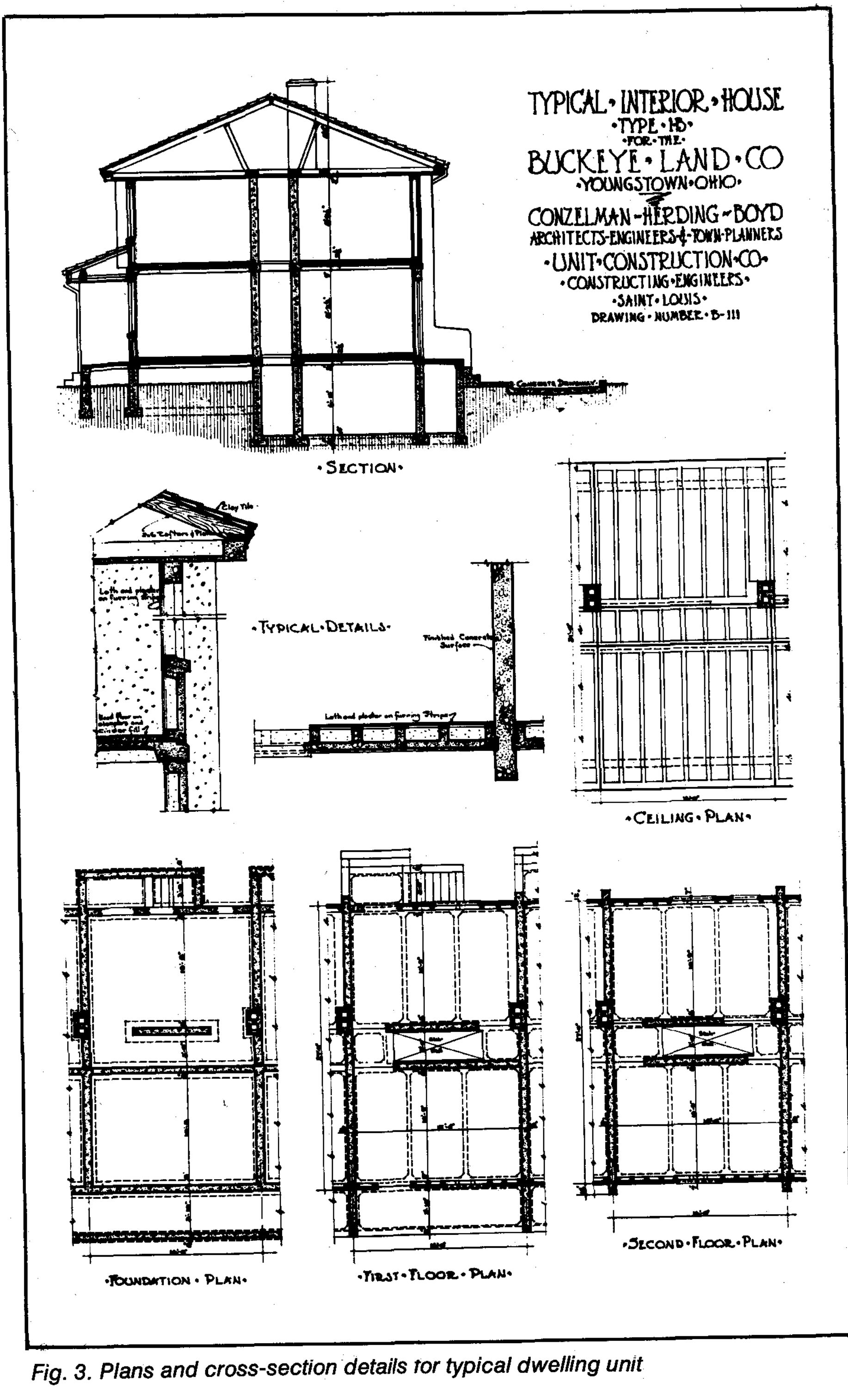

Fig. 3. Plans and cross-section details for typical dwelling unit

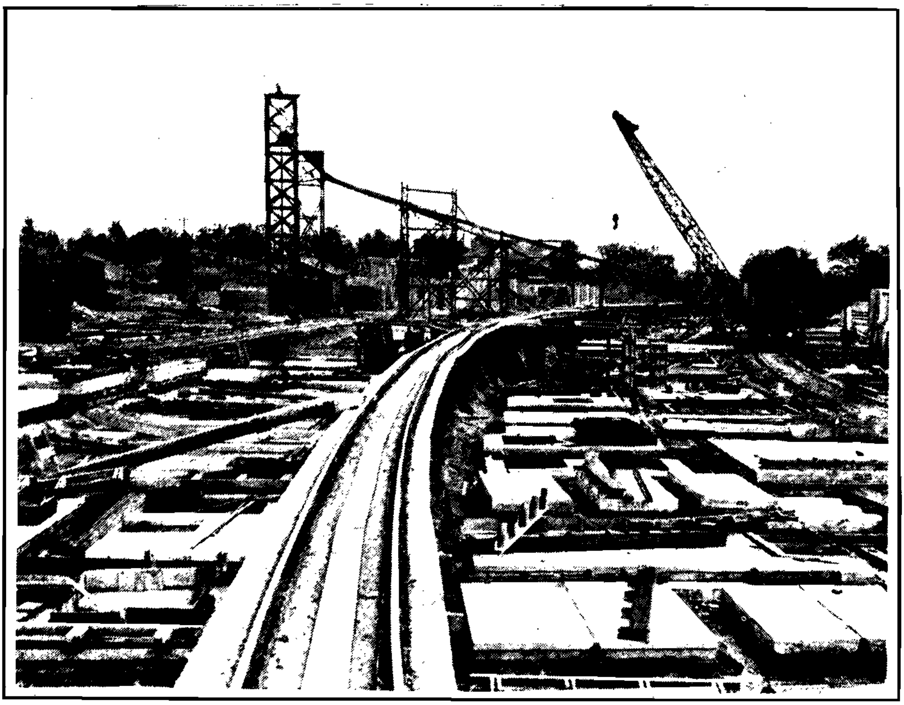

Fig. 4. General view of casting yard. Note the trestle track running from the central concrete plant through the yard.

Fig. 5. Concrete was chuted from a sidegate car on the trestle track into wood or concrete forms.

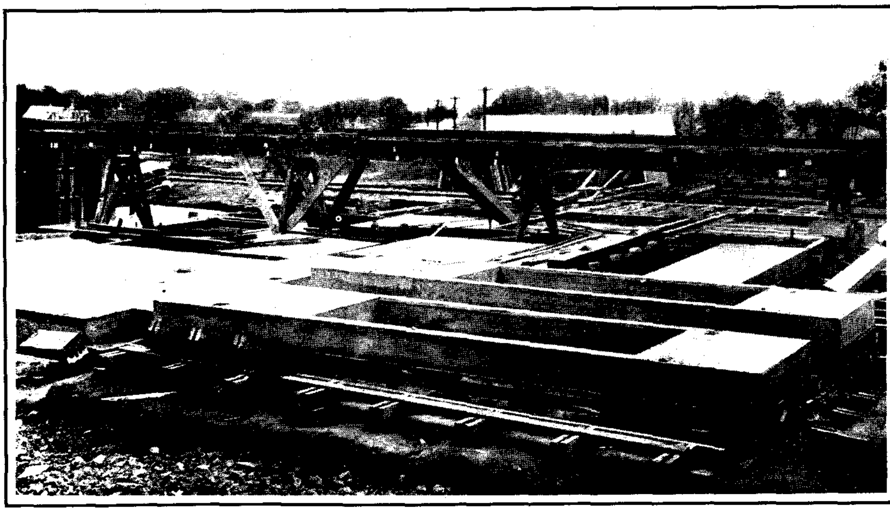

Fig. 6. Cast floor slabs with stairwell openings.

ments of the three-family houses, which consisted of three rooms each.

Each unit had a cellar which contained an individual laundry facility and shower for each family. There was a separate entrance to the cellar which allowed the inhabiting workers, who often returned from Youngstown mills in a rather dirty and grimy state, to use the cellar facilities to clean up before going up into the living area. All in all, the dwelling units were rather sensitively designed in view of their day and purpose.

These dwelling units were built using what was termed at the time the "unit method" of construction.[4] This type of construction was patented by the contractors, the Unit Construction Company of St. Louis, and had been used extensively in the railway field for small bridges, railings, trainsheds, and also for warehouse roofs and elevators. Conzelman, Herding and Boyd were the architects and landscape architects for the project.

The dwelling units were erected from large, precast concrete wall and floor units. One wall unit was sufficient for an entire side wall, one story high, of a single house. A floor unit typically covered the entire floor of one room. Entire structures were made of these units, including the interior partitions, with the exception of the roof and the gabled roof portion (which was built up above the second story ceiling slab, in wood frame with a stucco surface). Also, the foundation walls, 8 in. (203 mm) thick, were cast in place in the usual way.

The accompanying figures show details of the floor and roof units. The exterior wall slabs were made a total of 7 in. (178 mm) deep with a wall thickness of 3 in. (76 mm) and a series of 4-in. (102 mm) projecting ribs at 16 in. (406 mm) on center. When the interior was finished with lath and plaster on furring strips, a useful insulating air space was formed. Interior walls were made hollow by using granulated slag cores.

The window and door openings were cast in the wall slabs, but the window sills were cast separately. After the sills were placed, wooden door and window frames were fitted.

Floor units were also ribbed as shown in the drawings. Special floor units were developed to be used around stairwells.

The roof design was of timber framing with 1-in. (25.4 mm) plank sheathing, to

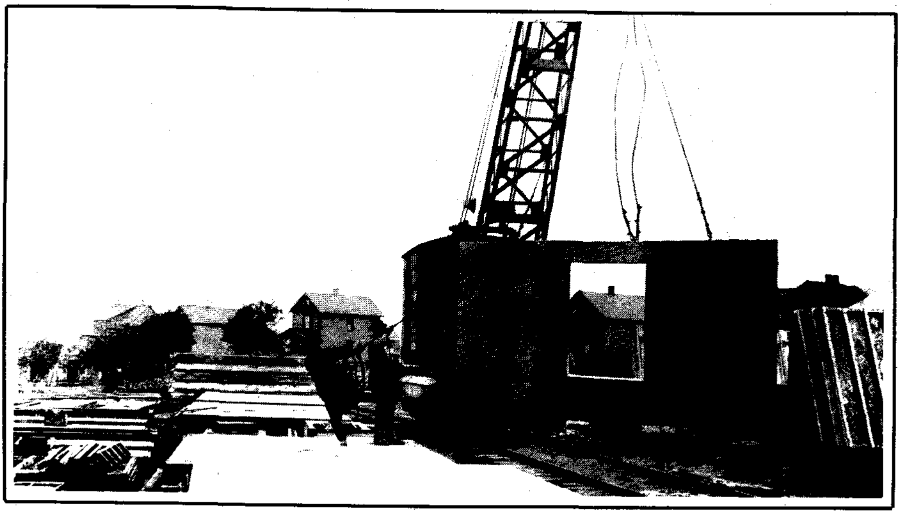

Fig. 7. Handling wall slabs. Note that a locomotive crane on a standard railroad track handled cast units.

which a red tile roof was attached. The gable ends were made with triangular concrete slabs. Chimneys were made of precast units one story high.

Because of the unevenness of the site, the houses could not be built at the same elevation. In order to standardize construction as much as possible, a uniform step between units in each row of houses was established. It was found that by adopting a uniform difference in elevation of 3 ft ($\approx$ 1 m) between floors of adjoining houses, all the buildings could be fitted to the site with very little grading. This stepping was also felt by the architects to be important in reducing

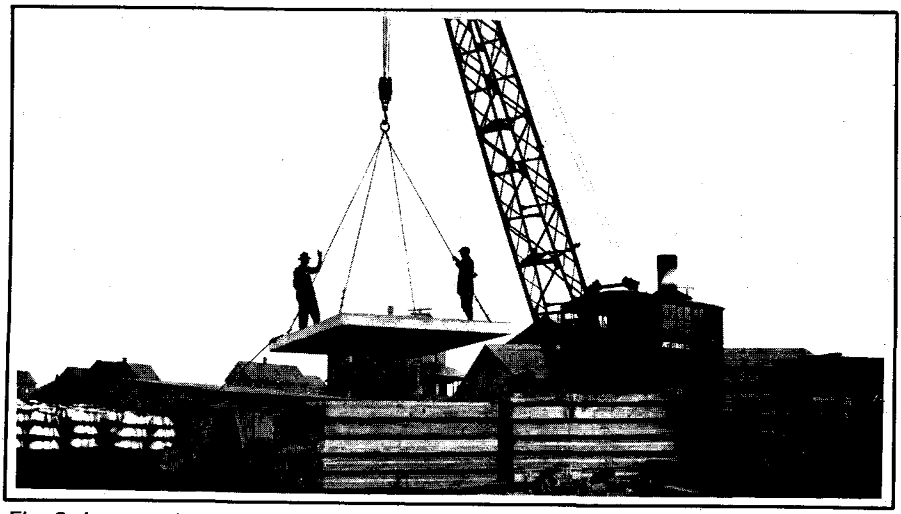

Fig. 8. Locomotive crane storing floor slabs in the casting yard.

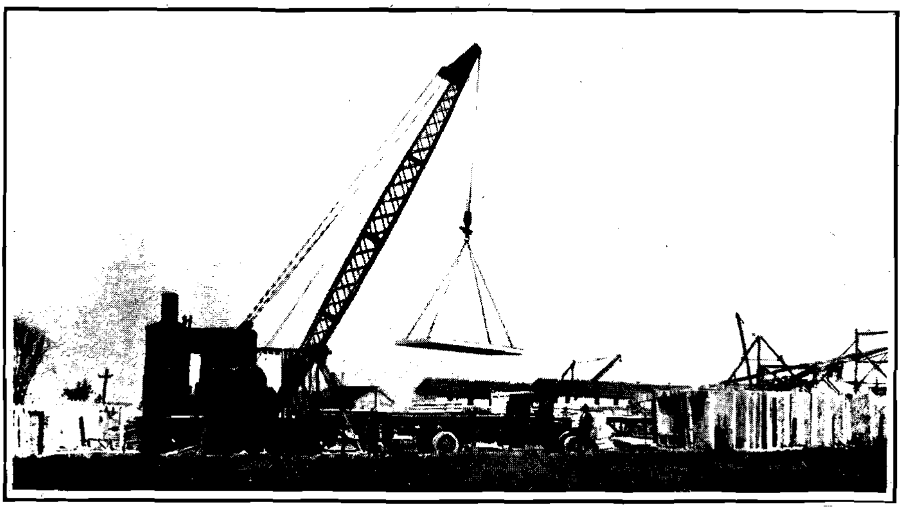

Fig. 9. The locomotive crane was also used to transfer cast units to trucks for transportation to the job site.

what was perceived to be the danger of monotony in the completed project.

The various precast building components were made in a special casting yard situated up a hill from the housing site. A trestle track was set up to run through the yard. Concrete was chuted by gravity from a sidegate car on the trestle track into horizontal concrete or timber molds placed adjacent to the track.

Uphill from the molds, on the side toward the street by which materials were received and near the middle of the yard, was located a central concrete plant. The concrete made by the plant used crushed slag from the Youngstown mills for aggregate. The plant itself consisted of a two-bag batch mixer supplied with material by a car on a narrow-gauge railroad track which ran beneath bins into which trucks dumped sand and crushed slag through gratings.

As the ground rose several feet along the length of these bins behind the mixer, it was possible to put the narrow-gauge track into a cut, construct bins on top of it, and still drive motor trucks from the ground over the bins without having to climb up a ramp. Sand, slag, and cement were supplied by three motor trucks which worked 10 hours a day.

Parallel to the trestle and located on the uphill side was a standard-gauge track for a locomotive crane which stacked and handled the slabs. The units when cast weighed from ½ to 6 tons each. The locomotive crane loaded these units onto trucks which transported them to the job site where they were later handled by a movable hoist.

For the first phase of the project, consisting of housing for 146 families, work was started in the casting yard on the single-family and three-family houses. An estimated 150 concrete beds and 100 timber beds were required to keep the mixer plant going on slabs for these two types. Two men handled, filled, and emptied the concrete car on the trestle. Five or six men worked on the larger forms and did the finishing. After the concrete had set, the side forms were stripped and match marks painted on the edges of the concrete. The slabs were allowed to set from 2 days to a week, depending on the weather, and

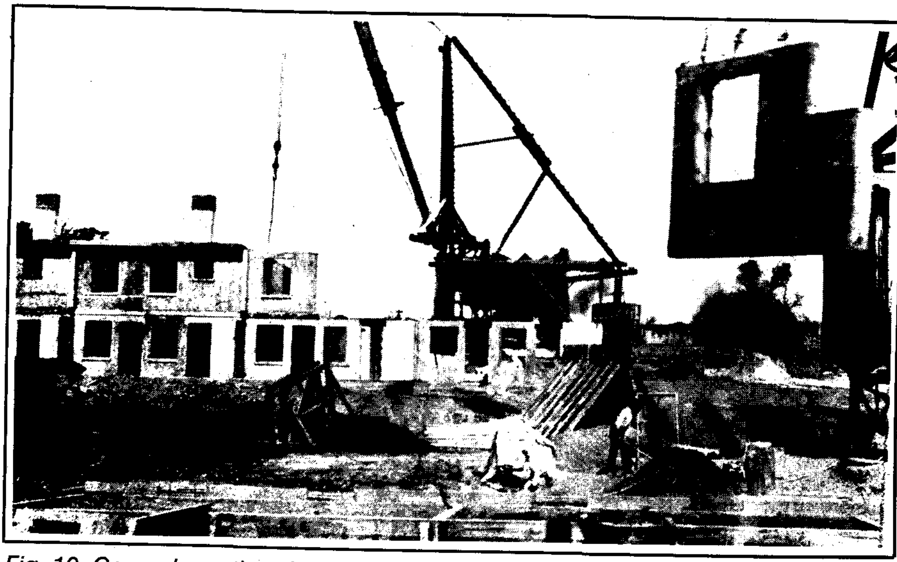

Fig. 10. General erection view. Note that two stiffleg derricks are in use.

then raised from the beds and stacked on edge with others of the same type.

The lifting was done with wire rope slings and hooks, which were hooked into eye bolts and embedded in the concrete. The heads of these bolts were inside the form. Recesses were cast around them large enough to permit slipping the hoisting hook. The floor slabs had four such rings so that they could be suspended level. The wall slabs had rings only in the top edge. The lighter pieces, e.g., the chimneys and the window ledges, were set by hand and lifted in bundles with a sling.

The large wall slabs were normally carried to the job site in a vertical position. They were loaded onto a car with wooden wheels and upright standards wide enough to hold four or five sections. This car was hauled by a truck onto which slabs and small sections were also loaded.

The slabs were unloaded and placed in cement mortar by a stiffleg derrick mounted on three columns. Wood-stave tanks filled with dirt for counterweight were attached to the back pair of columns. The entire rig weighed about 100 tons. The foot of each of these columns rested on a casting containing four rollers. The entire casting could rotate at will with respect to the column. This feature made it possible to turn the derrick on a short radius. The boom was telescoping, and its length could be varied from 50 to 84 ft ($\approx$ 15 to 25 m). The entire rig was patented.

The Project Then and Now

There is little doubt that the Youngstown project was very innovative, both in terms of the quality of housing provided and the way it was built. The construction process was a good example of the custom fitting of a highly mechanized approach to building to a specific job site. A good balance was achieved between a form of industrialized building and traditional on-site construction. The economy of the project was undoubtedly attributable to this balance and to specific factors such as the way the casting yard was set up in relation to the job site. The way the slopes

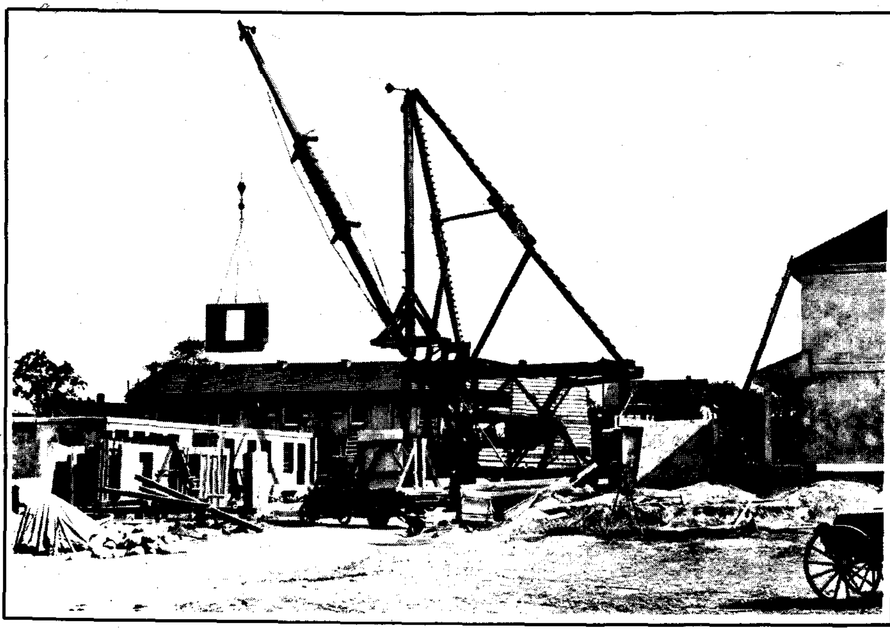

Fig. 11. A special stiffleg derrick capable of turning on a short radius was used to erect cast units on the site.

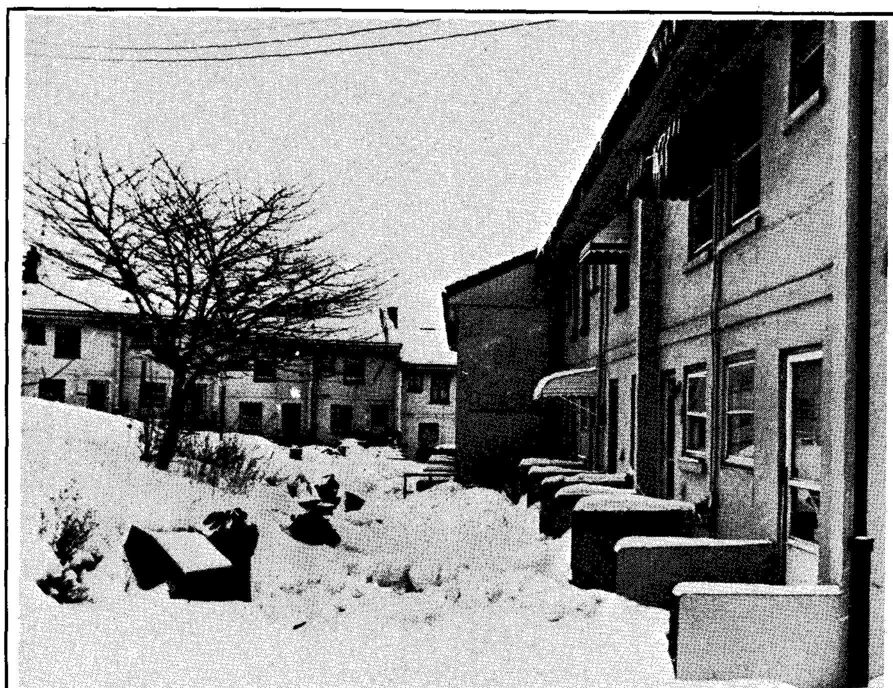

Fig. 12. The Youngstown housing project today.

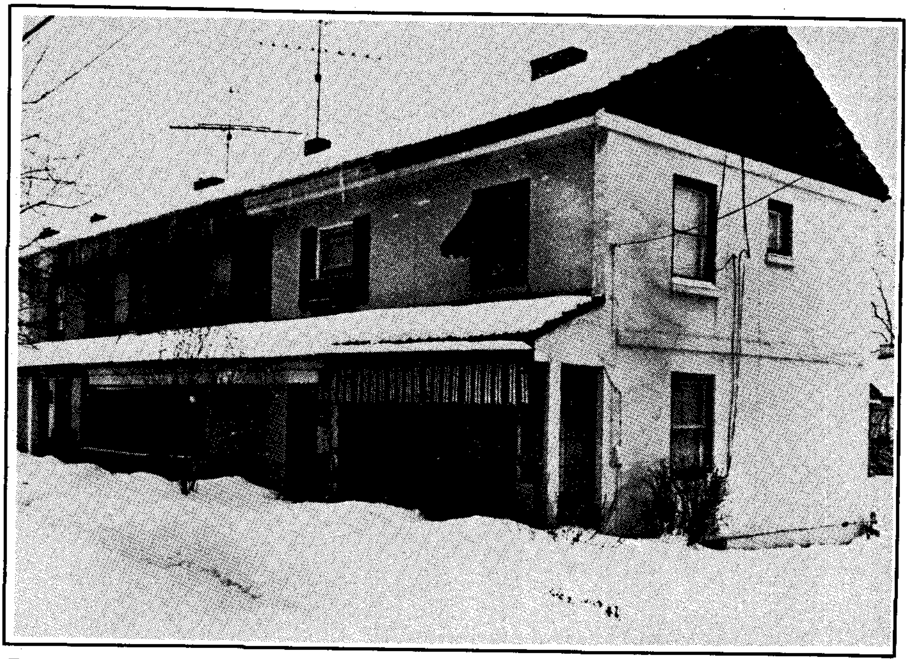

Fig. 13. Another view of the Youngstown housing project today.

present on the casting yard were used to advantage, for example, is admirable.

The Youngstown project was widely regarded by many at the time as an example of future building practices. The project architects and landscape architects presented the project at the 1920 national meeting of the American Institute of Architects.[5] As is well known, however, few comparably successful developments in the field occurred during the period between the two world wars.

Today the Youngstown project still stands. Many of the buildings have been painted different colors and personalized in other ways. Several of the units have been converted to condominiums. Others have been vandalized and are scheduled to be torn down. It is evident, however, that at least some vestiges of this unique early use of precast concrete will remain for some time to come.

Acknowledgment

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