SUPERIOR ELEVATOR
(Cargill Superior Elevator)
874 Ohio Street
Buffalo
Erie County
New York

HAER No. NY-253

WRITTEN HISTORICAL AND DESCRIPTIVE DATA
PHOTOGRAPHS

Historic American Engineering Record
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

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(Cargill Superior Elevator)
HAER No. NY-253

Location: 874 Ohio St., Buffalo, Erie County, New York

Date: Elevator "A": building permit application November 19, 1914; approved November 31, 1914; completed by early summer 1915
Elevator "B": building permit application February 3, 1923; approved February 23, 1923
Elevator "C": building permit application February 11, 1925; approved March 17, 1925

Designer: Elevator "A": H. R. Wait, Monarch Engineering, A. E. Baxter, Resident Engineer
Elevator "B": H. R. Wait, Monarch Engineering Co, Supervising Engineer A. E. Baxter Engineering Co.;
Elevator "C": T. D. Budd, James Stewart & Co., Supervising Engineer A. E. Baxter Engineering Co.

Builder: Elevators "A" & "B": Monarch Engineering Co.
Elevator "C": James Stewart & Co.

Status: Derelict

Significance: The grain elevators of Buffalo comprise the most outstanding collection of extant grain elevators in the United States, and collectively represent the variety of construction materials, building forms, and technological innovations that revolutionized the handling of grain in this country.

Project Information: The documentation of Buffalo's grain elevators was prepared by the Historic American Engineering Record (HAER), National Park Service, in 1990 and 1991. The project was co-sponsored by the Industrial Heritage Committee, Inc., of Buffalo, Lorraine Pierro, President, with the cooperation of The Pillsbury Company, Mark Norton, Plant Manager, Walter Dutka, Senior Mechanical Engineer, and with the valuable assistance of Henry Baxter, Henry Wollenberg, and Jerry Malloy. The HAER documentation was prepared under the supervision of Robert Kapsch, Chief, HABS/HAER, and Eric DeLony, Chief and Principal Architect, HAER. The project was managed by Robbyn Jackson, Architect, HAER, and the team consisted of: Craig Strong, Supervising Architect; Todd Croteau, Christopher

Payne, Patricia Reese, architects; Thomas Leary, Supervising Historian; John Healey, and Elizabeth Sholes, historians. Large-format photography was done by Jet Lowe, HAER photographer.

Historians: Thomas E. Leary, John R. Healey, Elizabeth C. Sholes, 1990-1991

This is one in a series of HAER reports for the Buffalo Grain Elevator Project. HAER No. NY-239, "Buffalo Grain Elevators," contains an overview history of the elevators. The following elevators have separate reports:

NY-240 Great Northern Elevator
NY-241 Standard Elevator
NY-242 Wollenberg Grain & Seed Elevator
NY-243 Concrete-Central Elevator
NY-244 Washburn Crosby Elevator
NY-245 Connecting Terminal Elevator
NY-246 Spencer Kellogg Elevator
NY-247 Cooperative Grange League Federation
NY-248 Electric Elevator
NY-249 American Elevator
NY-250 Perot Elevator
NY-251 Lake & Rail Elevator
NY-252 Marine "A" Elevator
NY-253 Superior Elevator
NY-254 Saskatchewan Cooperative Elevator
NY-256 Urban Elevator
NY-257 H-O Oats Elevator
NY-258 Kreiner Malting Elevator
NY-259 Meyer Malting Elevator
NY-260 Eastern States Elevator

In addition, the Appendix of HAER No. NY-239 contains brief notations on the following elevators:

Buffalo Cereal Elevator
Cloverleaf Milling Co. Elevator
Dakota Elevator
Dellwood Elevator
Great Eastern Elevator
Iron Elevator
John Kam Malting Elevator
Monarch Elevator
Pratt Foods Elevator
Ralston Purina Elevator
Riverside Malting Elevator

The Superior Elevator complex was developed by the locally based Husted Milling Company. The company established operations at an inland site along the tracks of the New York Central Railroad, where it built a wood crib-binned elevator and mill in 1899. Among the elevator's novel features were concrete bin flooring and a cupola of structural steel supported independently of the crib work. Husted Milling employed all-concrete construction at an early date. The company's second concrete elevator, commissioned in 1907, was the third concrete-binned elevator built in Buffalo. Designed by the James McDonald Company, it was the first in Buffalo to feature outerspace bins, which in this case were accommodated behind straight curtain walls rather than convex quarter walls. In 1912 an explosion destroyed much of the building and claimed thirty-two lives.[1]

At this point, under the presidency of G. M. Husted, the company appears to have taken the opportunity to re-establish its operations on the Buffalo River and concentrate on the transfer elevating and grain re-conditioning business. The original site was purchased by the Ralston Purina Company, which commissioned the A. E. Baxter Company to rebuild the 1907 concrete elevator and add a new concrete house featuring non-cylindrical bins. This building was noteworthy for its all-concrete slip-formed workhouse, apparently the first in Buffalo. The Ralston Purina Complex was demolished in the early 1980s.

Almost immediately after the explosion, the Husted Company commissioned the Monarch Engineering Company to design a reinforced concrete elevator on the new Buffalo River site. Although the original plans are dated 1912, the elevator was not completed until the summer of 1915. It was the first concrete elevator in Buffalo built over the winter/spring period, rather than the more favorable summer building season. The project suffered from financial problems, including delays in insurance payments and the sale of the remains of the original complex to Ralston Purina. During the elevator's construction, the operating company changed to the Superior Elevating Company under the presidency of E. M. Husted.

The design, the work of Monarch Engineering's design engineer H. R. Wait, appears to have been the prototype for what became a standard Monarch design from 1914 (Connecting Terminal) to the mid-1930s (Perot Malting). With the exception of the Wheeler Elevator (1908), the Meyer Malt Elevator (1914) and the Dellwood "B" Elevator (1915), all Monarch's Buffalo works were built to this design. Like the Wait-designed Wheeler Elevator, they featured quarter wall outerspace bins, although Wait introduced spread main bins connected by link walls to increase capacity. Initially link walls were quite short, only 1'-4" long

at Superior "A", but by the 1930s wall lengths had increased considerably; those at the Perot Elevator were 5'-6". Wait also abandoned the basement beam design that he employed at the Wheeler Elevator, substituting a full bin slab above the basement pillars.

Above the bins, the early standardized Wait elevators were something of a hybrid. Unlike the retrograde open-topped bins of the Wheeler Elevator, these featured a bin floor of book tiles. Structural steel was employed above the bin floor for gallery and workhouse. The steel work was usually clad in corrugated iron, although ferro-enclave plaster walls were employed in the early elevators including Connecting Terminal and Superior "A". The elevator featured a standard workhouse design that incorporated cylindrical steel garner bins supported by a steel ring girder in a similar fashion to the main bins of the Great Northern Elevator.

The basement works were constructed using conventional fixed form techniques and the bins were constructed using slip forms raised by the Metcalf type jacking system featuring threaded jacking rods. The construction cost of Superior "A", an estimated $317,800, provided storage at 21 cents per bushel of capacity. This figure was to alter little in subsequent Monarch elevators.

The main storage unit of the elevator measures 320' x 67'-4". A 100' x 22' cleaner house abuts the landward side of the storage unit in the vicinity of the workhouse, and a separate drier house, measuring 35' x 30', adjoins the western end of the mainhouse.

The elevator has a storage capacity of 1,500,000 bushels. The three parallel, non-interlocking rows of fourteen cylindrical main bins are 19'-6" in inner diameter and spread both longitudinally and transversely on 22'-6" centers. The bins are connected by link walls measuring 1'-4" x 1'-4" and rise to a height of 95' above the bin slab. The northwest corner bin is horizontally sub-divided to provide an upper shipping bin. Two bins at the western end of the building are also horizontally sub-divided into upper and lower bins which feed and receive grain to the adjoining drier house.

The main bins enclosing twenty-six interspace bins arranged in two parallel rows of thirteen bins have a capacity of 23,000 bushels. These bins are larger than the typical interspaces of the time; eight, rather than four, wall units form four segments of the adjoining main bins and of the four connecting link walls. The capacity of both rows of interspaces below the workhouse is reduced, as they also accommodate the elevator legs enclosed in

slip-formed concrete casings. Twenty-eight outerspace bins occupy all available locations. Those along the length of the building have outer walls formed of convex walling to the same radius as the main bins and extend over one-sixth of their circumference. The rear wall is formed by the link wall, and the two side walls are formed by segments of the adjoining main bin walls. The bins along the side walls have straight outer walls that give them a slightly greater capacity. The outerspaces have a capacity of between 3,000 and 4,000 bushels. There are ten or twelve rectangular bins in the cleaner house. The cleaners and clippers are at an intermediate level within this structure. The upper bins supply the machinery, and the lower bins receive the conditioned grain. There is a sacking floor below these bins.

Although the proportions of the concrete and the details of bin reinforcing in Superior are not known, both probably resemble Concrete-Central, the construction of which began the same year. The bins are covered by a bin floor of book tiles. The tiles are placed between steel I-beams on 25" centers and supported by similar beams placed transversely on 6' centers. Wire mesh laid above the tiles is covered by a mortar screen. The hoppering for all bins consists of inclined mortar slabs on slag concrete placed upon the bin slab. In the main and interspace bins, the hoppering leads to conical steel draw-off spouts set into the bin slab. Only the center row of main bins and the interspace bins discharge centrally. The outer main bins discharge through smaller conical steel spouts placed toward the inside of the bins. The outerspaces discharge through small steel plate spouts set close to the link wall. A single inclined mortar slab feeds the outerspace draw-off spouts.

The bins are supported by a 14" thick bin slab raised above the basement works on six longitudinal rows of basement pillars. The bin slab is reinforced by a longitudinal, transverse and diagonal grid of trussed bars that passes over each column head. Each set of reinforcing is comprised of groups of five bars spaced on approximately 12" centers. The draw-off spouts are between the groups of reinforcing bars. Alternate bays are occupied by draw-off spouts within the area of bin slab above any one aisle. The center row of bins discharges centrally to conveyors in the center aisle. The draw-off spouts for the interspaces are in the adjoining aisles. In order to provide for the draw-off spouts in these three inner aisles, diagonal reinforcing is only placed in every other bay. The outer row of main bins discharges through relatively smaller draw-off spouts located above the outer aisle but near the center line of the elevator. The outerspaces discharge through very small spouts in alternate bays above the outer aisle of the basement. These arrangements allow diagonal bin slab reinforcing in every bay above the outermost aisles of the basement.

The bin slab is supported on basement pillars, providing a full basement with 13' headroom. Transversely, six pillars divide the basement into five longitudinal aisles. The longitudinal pillars are on 11'-3" centers and the transverse ones on 11'-3" centers, with the exception of the 3'-8" outermost aisle pillars. The outer row of bracket-headed pillars measures 5' x 2' and forms part of the exterior basement walling. The area between the pillars is infilled with concrete panels and above half height features an elongated window that extends the full length of the bay. These exterior pillars are below the point of intersection of the main bin walls and the outerspace quarter walls. The 3'-6" square inner pillars have inverted pyramid heads. Four columns are located below every main bin. The pillars are reinforced with 1" square verticals placed close to the pillar surfaces. The outer pillars have twelve such bars and the inner pillars ten. The bars are bound by loops of 1/2" square bar on 12" centers. The pillars are 18' long and rise directly from the foundation slab. The pillar footings are not stepped. A slag concrete fill is placed above the foundation slab and between the lower part of the pillars to a depth of 3'-10". A 4" thick floor slab sits on the slag concrete.

The elevator is built on wood piles extending to rock. In the area underlying the square pillars, the piles are on 2'-2" centers and arranged in longitudinal and transverse strips of three intersecting below each pillar. The transverse row of piles does not continue below the outermost aisle of the basement, but is again present below the outermost rectangular pillars. Here it is supplemented by intermediately placed piles which combine to give a spacing of 13". The piles are capped by a 2'-6" thick reinforced concrete foundation slab. The slab is not continuous but reflects the geometry of the piles below. It consists of longitudinal and transverse components that intersect below the foot of every interior pillar to produce a rectangular grid. Although the longitudinal component is absent below the outermost row of pillars, the transverse members extend below it.

The foundation slab is reinforced by an upper and lower system of bars. The lower system is comprised of discrete units of reinforcement centered about each pillar footing. Two 11' long non-trussed 1-1/4" bars are laid longitudinally and transversely over the pile heads. Immediately below the pillars, they are supplemented by an additional pair of 6' long, 1" square, non-trussed bars arranged longitudinally and transversely beside the longer bars. Below the outer pillars, two 11' long square bars are laid longitudinally across each pile head. Transversely, five 1-1/4" bars are placed about the center line of the pillars and single 1" square bars are laid above the outer row of piling. The continuous upper system ties all column footings both longitudinally and transversely and consists of two

1-1/4", non-trussed, square bars about the center line of the footings.

The bin floor is covered by a single-story gallery of structural steel extending the full width of the building. The gallery has a concrete roof and was apparently originally clad in 2" ferro-enclave plastered walls. At some later date, these were replaced by the present corrugated iron cladding. At the western end of the building is a substantial workhouse measuring 160' x 25'.

The workhouse, of structural steel with concrete floor and roof, originally had walls of ferro-enclave plaster, but these are now of corrugated iron. The workhouse design was virtually standardized by Monarch Engineering; Connecting Terminal and Concrete-Central are almost identical in design, with component parts of similar materials and dimensions. The workhouse rises 78'-10" above the bin floor to a total height of 189' above the basement floor slab. It has two overall floors--a scale floor 29' above the bin floor and a head floor at the top of the structure.

The building's six cylindrical steel garner bins are 16'-6" in diameter and provide 2,000 bushels of storage. The garner bins are supported within the structure on an external steel ring girder, supported in turn by steel pillars bearing on transverse beams. These arrangements are very similar to those employed in supporting the main bins of the Great Northern Elevator. The six 2,000-bushel cylindrical scale hoppers located below the garners are supported by a similar method.

A three-track car shed of steel and corrugated iron abuts the south side of the elevator and lies against the cleaner house. A fourth rail track passes through the basement of the cleaner house. The cleaner house consists of 6 x 1 bays measuring 100' x 22' and rising 110' to bin floor height except where the gallery extends across it on the west end. The building, of concrete construction to bin floor level, contains six upper and six lower rectangular cleaner bins of approximately 20' x 15'. The upper bins are 25' deep and the lower 20' deep. A cleaner floor is at an intermediate height of approximately 55' between the upper and lower bins. The upper feed bins supply the clipping and cleaner machinery, and the lower bins receive from the same. The lower bins spout to a sacking floor at second-story level.

The basement is occupied by a single-track railroad loading bay. As originally constructed, the elevator was only equipped with a single movable marine tower. In 1917 Monarch engineered a second

moveable tower at a cost of $22,000. The present easternmost tower appears to be the original structure of 1914.

The Superior "B" Elevator occupies a site immediately to the west of Superior "A." Both "A" and "B" houses are linked to form a continuous unit with integrated basements and bin floors. Because of the broad sweep of the Buffalo River in the vicinity of the junction of the houses, the same alignments can not be maintained. As a consequence, the bin arrangements at the western end of the "B" House must both meet the bin line of the original elevator and establish the 22° change in alignment necessary to accommodate the remainder of the "B" House on the available land. As the marine towers could not negotiate such a bend in their track, the new facility was served entirely by the existing elevating machinery associated with "A" House.

The elevator was built by Monarch Engineering of Buffalo to the design of Chief Engineer H. R. Wait in 1923. Although corresponding to the standard Wait pattern, the elevator shows several evolutionary developments in comparison to its earlier neighbor. Apparently the first elevator in Buffalo to employ mushroom-headed basement columns, rather than pyramid-headed pillars, the elevator has slightly larger main bins and link walls lengthened to provide greater storage volumes in inter- and outerspaces. The longitudinal link walls between the outer bin rows are shifted toward the center line of the building and curved inward to produce enlarged outerspace bins. The bin slab and hoppering design has been altered so that all bins discharge centrally. The book tile bin floor has been abandoned in favor of a concrete floor incorporated monolithically into the structure of the bin walls. The elevator, built at an estimated cost of $275,000, provides storage at a cost of 25 cents per bushel.

The elevator measures 205' x 69'-4" and has a capacity of 1,000,000 bushels stored in twenty-five cylindrical main bins, seventeen interspace bins, seventeen outerspace bins, and a single bin that is two-thirds of a cylinder. The main bin block consists of three parallel non-interlocking rows of seven bins. The bins are 20' in inner diameter and spread longitudinally and transversely on 24' centers with link wall connections. The bins rise to a height of 95' above the bin slab. The two westernmost bins of the riverside bin row are horizontally subdivided to provide upper shipping bins. All transverse link walls and the central longitudinal link wall are straight and 2'-8" long.

The longitudinal link walls connecting the outer rows of main bins are shifted toward the center line of the structure and curved to a radius of 6' to present a convex face to the interspace. By this means, the capacity of the outerspaces is

enlarged. Two rows of six interspace bins occupy the interstices between the main bins. The easternmost interspaces are slightly smaller as they have two curved link walls. The westernmost interspaces are larger and terminate against a straight link wall positioned toward the outside of the bin line. There are fourteen outerspace bins with conventional convex exterior walls built to the radius of the main bins and extending to one-sixth of their circumference.

The bin arrangements at the junction and change of angle between "A" and "B" houses is rather more complex. There are four main bins in this area, one of which is truncated and only two-thirds of a cylinder, three outerspace bins resembling those of the main block, three interspace bins of varying configurations, and two interspaces formed at the junction of the two houses. The bins, arranged to maintain the alignment of Superior "A", are placed transversely against the end wall of the "A" House on centers corresponding to those of the original elevator. To achieve this end, the bins are similar to those of Superior "A", with inner diameters of 19'-6" and spread transversely on 22'-6" centers. The fourth bin is in the riverside bin row at the intersection of the "A" and "B" lines. An outerspace bin with curved inner link walls and conventional exterior quarter walls is on either side of this bin. The two-thirds main bin is aligned with the center bin row of the main block of "B" House and is truncated by it.

An outerspace bin with curved link walls and conventional outer quarter walling is located between the landward bin row at the change of alignment. Three interspace bins are arranged about the truncated main bin. Two additional interspaces are in interstices created at the junction of the "A" and "B" houses. Their volume is reduced by the presence of the former outerspace bins of the end wall of "A" House. Outerspace bins are absent at the junction of the two houses.

The bin walls are 8" thick and the link walls are 1'-6". The vertical reinforcing is the same as that used by Monarch Engineering in its Concrete-Central Elevator, suggesting a high degree of standardization in the designs of H. R. Wait. The exact arrangement of jacking rods is not known, but it may be assumed that they were of the threaded pattern preferred by Monarch. A single jacking rod was probably placed between the ordinary verticals mentioned below. Single ordinary verticals are within the bin walls at the intersection of the main bin with both the outerspace quarter wall and the curved link wall. Two ordinary verticals are in the bin wall at the point of intersection between the main bin wall and the straight link walls. The ordinary verticals are 15' lengths of 1/2" square bar.

The horizontal reinforcing consists of ninety-four tank bands of graduated, deformed rectangular bar at a regular coursing interval of 12". Each band consists of three 26' long bars lapped and wired together to form a complete circle. The outerspace quarter walling and the curved inner link walls are reinforced with ninety-four courses of 1" x 1/4" bar at intervals that coincide with those of the main bins. Each course is a single bar. These bars are bent at the ends to hook about the verticals at the point of intersection with the main bin. The direction of the bend is reversed at every course so that successive bends pass to either side of the verticals. Additional contact anchors are not employed at these wall intersections. The straight link walls are reinforced by twin link bars of 1/2" square steel. The bars are hooked about the verticals provided at the point of intersection.

The bins are supported by a 14" thick bin slab raised on columns to form a full basement with 13'-10" headroom. Bin hoppering is provided by a hopper fill of slag concrete placed on the bin slab and faced with a conical mortar hopper slab. All main and interspace bins discharge centrally through conical steel draw-off spouts set into the bin slab. The hoppering is angled at 50°. The outerspace hoppering is not conical but consists of an inclined mortar slab placed on slag concrete hopper fill.

The bin slab is reinforced by a grid of longitudinal, transverse and diagonal bars which pass over, and intersect above, every column head. Each group includes five square bars placed on 12" centers. In each group of five, three straight bars alternate with two trussed bars. The apertures for the draw-off spouts are between the groups of reinforcing rods; however, in contrast to Superior "A", the placement of groups of diagonal bars at every available location results in every other set of diagonals being interrupted by a draw-off spout.

The basement arrangements follow the usual Wait pattern. Five longitudinal aisles separate the six rows of basement pillars and columns. Mushroom-headed columns are used in the inner four rows. The 4' diameter columns widen to 8'-6" at the head and are spaced equidistantly on 12' centers. The exterior row is formed of 5' x 2' rectangular pillars with bracketed heads placed longitudinally on 12'-6" centers to coincide with the position of the inner columns. They are located 14'-2" from the adjoining row of columns to create an outer aisle that is wider than the inner aisles. The exterior pillars are below the point of intersection of the outerspace quarter walls and the main bins. The basement walling is formed by 6" thick monolithic concrete panels placed between the exterior pillars. Elongated windows are at half height between the pillars of every bay. The

main bins are supported by the interior columns at four points. These columns rise 18'-4" from the foundation slab. Unlike the pillars of Superior "A", the columns of "B" House have stepped footings. The area between the columns is infilled with 4'-2" of slag concrete placed upon the foundation slab, and a 4" floor slab is placed on this fill. This slab is reinforced by a diagonal network of 1-1/4" square bars that pass through the base of every column at floor level.

In contrast to the grid foundation slab employed at Superior "A", the elevator is built on a 2'-6" thick overall foundation slab. The entire foundation area is piled on 2' centers with the exception of the area below the outer pillars, which is supported by groups of piles arranged on 12" centers. The foundation slab is reinforced by a lower diagonal system of 1-1/4" square non-trussed bars and is composed of twin sets of bars that intersect below the column footings to form a diagonal grid.

The upper reinforcing is discrete mats of reinforcing centered below each column footing in longitudinal and transverse bars. Two 11' long, 1-1/4" square bars pass over the head of each pile. Toward the center of the mat, these bars are supplemented by an additional paired set of 6' long, 1" bars, which also pass over all pile heads. The exterior pillars are supported on a grill of eleven 1-1/4" bars placed on 2" centers longitudinally, and ten 1" square bars twinned and placed above every other pile head. The bins are capped by a 4" thick monolithic concrete bin slab of reinforced wire mesh that rests on transverse steel I-beams. A 10' high single-story structural steel and corrugated iron gallery spans the width of the bin floor and extends the full length of the building. It has a concrete slab roof.

Superior "C" Elevator lies immediately to the east of Superior "B" and maintains the same alignment but is structurally separated from the earlier parts of the elevator. The bin floor is maintained at the same height, and a broad bridge provides a continuous gallery between the two houses. The elevator was built during the 1925 construction season by the James Stewart Company with A. E. Baxter Engineering as supervising engineer. The design was by James Stewart's Chief Engineer, T. D. Budd, and appears to have been covered by the text of his 1921 patent, although in detail it differs from the accompanying patent drawings. The elevator is of the bin wall basement design with the bin hoppers raised internally within the bin cylinders. Rather than supporting the hoppers on an annular steel "compression ring" braced by pilasters incorporated into the bin wall, the hopper bottoms are supported by an annular concrete ring girder raised on radially arranged freestanding concrete pillars.

The Superior was the first elevator in Buffalo to employ such an arrangement, which would become a hallmark of A. E. Baxter's work in Buffalo over the next two decades. In the same year, 1925, Budd was also involved in the construction of the Marine "A" Elevator which was executed according to the patent drawings.

The Budd design provided an elevator that could be slip formed from the foundation slab upward yet included a roomy basement. All loads were transferred in direct compression to the foundation slab either via the bin walls or basement pillars. The foundation slab alone needed reinforcing to withstand the bending moments that could be created between bins in differing loading conditions. The design economized materials by eliminating the need for an expensive conventionally constructed basement, while the concentration of foundation loads about the bin walls permitted construction on inexpensive ring foundations. The elevator was raised in a single lift using Folwell Sinks patent jacks. It was completed at an estimated cost of $250,000, providing storage at a unit cost of 22 cents per bushel.

The building measures 247' x 82', and its storage capacity of 1,098,371 bushels is housed in fourteen main bins and twelve interspace bins. The main bins are arranged in two parallel non-interlocking rows placed in tangential contact. The area of tangential wall thickening extends 5'-6" to either side of the center line. The bin walls rise 114' from the foundation slab to the bin floor; however, as hopper bottoms are raised within the bin cylinders, the walls extend at full width for only 100'-6".

The four bins at the western end of the house are slightly shallower, as the hopper bottoms are raised higher in the bin walls to accommodate the rise of the basement conveyors to "B" House. Here the shallowest bin extends for 94' at full width. As the bins are in tangential contact, a relatively large main bin diameter of 34'-3-1/2" is required to produce a usefully large interspace bin. The capacity of the average main bin is 73,282 bushels. The two western bins closest to "B" House have a capacity of 67,156 bushels and the next two are of 72,810 bushel capacity. A fixed marine tower is accommodated between the two easternmost bins of the riverside bin row, which are truncated to three-quarter bins by straight walls to enclose the space accommodating the elevating machinery. These bins have a capacity of 63,898 bushels. The single row of six interspace bins between the main bin rows has a capacity of 18,018 bushels with the exception of the easternmost interspace, also truncated by the fixed marine tower, which has a capacity of 13,987 bushels.

As in most bin wall basement elevators with bins arranged in non-interlocking parallel rows, outerspace bins are absent. The

additional storage offered by outerspaces installed between non-spread bins was not considered worthwhile. Volumes of both interspaces and outerspaces could have been increased by spreading the bins longitudinally. However, the location of the link walls would have been coincident with the line of basement conveyors. Moving the basement conveyors would require bin draw-offs to be located non-centrally with the undesirable effect of greatly increasing bin wall stresses during draw-off. Eventually, bin wall basement designs came to feature transversely spaced bins engineered to increase interspace volumes, as in GLF "C" of 1936 and Eastern States of 1934 and 1945. The solution to the problem of creating worthwhile outerspaces in this type of elevator appears to have been found in the design of the Standard Annex of 1941. Here the bins are spread longitudinally and the link walls moved inward to extend to the foundation slab without interrupting the basement conveyor systems. An additional strut wall is introduced into this design to strengthen the tie between main bins and outerspaces.

The bin walls are 12" thick for the first 8' above the foundation slab and 9" from this point to the bin floor. The minimum thickness within the tangential contact is also 9". The bin walls are constructed uniformly of 1:2:5 proportioned concrete. Re-rolled rail is used for all reinforcing in the bin walls except for the contact anchors and jacking rods, which are of structural grade, hard, new billet steel. All bars are deformed. The vertical reinforcing consists of twelve 1" round jacking rods on 9'-3" centers about the circumference of the bin walling. These are located at the point of tangential contact and at two intermediate locations between these points. Twenty-four ordinary verticals of 1/2" round rod are placed between the jacking rods. The ordinary verticals between every jacking rod provide a uniform spacing of 3' between the vertical elements of the bin wall reinforcing system. The verticals are 2-1/2" from the exterior surface of the bin walls and the horizontals are wired to the outside of them so that there is a minimum concrete cover of 1" over the steel.

The lowest 10' of bin wall below the ring girder is not subject to grain wall pressures and consequently bears low levels of tensile stress. The placement of horizontal steel in this area is not known. This area of the wall is subject to the highest compressive forces and, rather than altering the proportioning of concrete, the thickness of the bin wall is increased. There are 173 discrete tank bands of graduated diameter at varying course intervals above the base of the ring girder. The lowest 138 courses to a height of 80' above the foundation slab are of 3/4" rod placed uniformly at a 6" course interval. Above this point the coursing interval doubles to 12", and to allow for this large change the rod size increases for the next thirteen bands to a

height of 93'. The bands of adjacent bins overlap at the point of tangential contact where they pass to either side of the shared jacking rod. Single contact anchors are placed at the extremities of the contact wall thickening and are bent about the verticals within this area of the bin wall.

The main bins bottoms are supported by an annular concrete ring girder immediately inside the bin wall but structurally independent of it. The 5' x 5'-6" girder is reinforced by twenty-seven non-trussed reinforcing bars; thirteen placed close to the base of the girder, thirteen close to its upper side and one in the side. It also incorporates a series of metal straps riveted to the hopper bottom. The ring girder, supported by eight free-standing concrete pillars, is arranged radially at 45° intervals. The 10' high, 3'-9" x 1' pillars are reinforced by eight verticals on 9" centers and nine horizontal bands at 12" intervals. The hopper bottoms extend the width of the bin and rest within the ring girder. They slope at an angle of 35° and their upper sections of 1/4" plate are reduced to 3/16" plate toward the base of the cone.

The basement walls are pierced by longitudinal conveyor passages and transverse personnel passages, both of which are within the area of tangential wall thickening. Communication to the basement interspaces is afforded by additional diagonally placed personnel passages. The elevator is built on wood piles placed on 2'-3" centers in a broad ring that extends below the bin walls and the basement pillars. The piling is continuous below the interspaces, and the piles are capped by an overall foundation slab. Above the piles, the slab is 2'-6" thick, but it thins to 1' below the central area of the main bins where piles are absent. The reinforcing details of the foundation slab are not known. A 6" mortar screen floor is above the foundation slab.

The concrete bin floor is monolithically incorporated into the bin walls. A single-story concrete gallery spans two-thirds of the width of the bin floor and extends the length of the building. A slip-formed concrete workhouse is located at the western end of the structure. The elevating leg is positioned in the space between the new unit and "B" House. The workhouse extends to a height of 175'-6" above the foundation slab and measures 18' x 31'. It incorporates a single 2,500-bushel concrete garner bin with nine draw-off spouts. The area between the two easternmost bins of the riverside row incorporates a fixed marine tower that extends beyond the gallery to a height of 153' above the basement slab. The part of the tower extending across the quayside is of structural steel clad in corrugated iron.

BUSINESS HISTORY

The massive Cargill Superior Elevator, geographically the next to last elevator upstream on the Buffalo River, had its genesis in a small local company. In 1896 Buffalo businessman Edwin M. Husted and six other people (including Edith Husted) incorporated Husted Milling and Elevator to extend their existing business of buying and selling grain, feed, hay and similar commodities. The new company furthered the marketing operations by purporting to engage in "milling, elevating, transferring, and storing" those same wares.[2]

Husted, a lifelong Buffalo resident, left the Normal School (now Buffalo State College) in 1880 to work in a railroad office. Three years later, he entered a canning business in suburban Orchard Park and finally, in 1889, joined his father's small Buffalo flour, feed, and milling business.[3] The Husted Milling and Elevator Company was considerably larger than Husted Senior's original operations. The capital stock of the new enterprise was established at $175,000. Although half the capital was paid within the first month, the company had only subscribed $147,000 of the authorized amount a year later. Nevertheless, that was a tidy nest egg with which to begin business.[4]

In June, 1900, Husted Milling took out its first mortgage with Buffalo Savings Bank for $50,000 to be secured by 2.46 acres of land on Prenatt Street (later known as Elk Street), the site of the company's original feed operations. It began expansion in 1907 by purchasing the Nickel Plate Transfer Elevator next to the Husted Elevator site; Husted was at 839 Elk (as the street was then named), and the Nickel Plate was at 845 Elk. This elevator acquisition put Husted Milling in command of an important railroad-based transfer facility, and Husted's faith in its potential was reflected in the new incorporation standards. The Nickel Plate was endowed with $100,000 in authorized capital, although only $10,000 was paid in at the start. A major owner and director himself, Husted was able to attract other Buffalo businessmen to participate in the venture. Among the new investors and directors were Riley Pratt, President of Pratt & Company, a grain dealership of which Husted was a director, and J. Henry Metcalf, a local attorney. The remaining directors were drawn from Husted Milling & Elevator, clearly indicating the tight inter-relationship between the two businesses.[5]

As plans for the Nickel Plate were developing, Husted Milling and Elevator had prospered sufficiently to assume a second bank loan on the original Elk Street property. This second debt presumably underwrote the purchase and development of the Nickel Plate property. In the seven years between mortgages,

the company had retired half of the original lien, increased the paid-in capital on the Husted Company to $173,000, and become affluent enough to be granted a second mortgage of $50,000, also taken from Buffalo Savings Bank.[6] In August, 1907, Husted Milling and Elevator petitioned to change its name to Husted Milling Company. On September 26, the Nickel Plate filed notice that $50,000, or one-half the authorized capital, had been paid into the corporate funds. Nickel Plate announced in July that a large issue of new stock shares would be made available September 30th, a decree that may have excited further interest from investors. Although no corporate records exist to document company fortunes for either Husted or Nickel Plate over the next several years, Edwin Husted's personal prosperity indicates that the companies fared very well.[7]

In 1913, the Elk Street complex caught fire and exploded, leaving the Husted companies operating in name only. In 1914, no doubt propelled by desperation, the company embarked on several momentous changes. The Nickel Plate Elevator Company changed its name to Superior Elevator Inc. in April; the next month Husted Milling acquired lots 62 and 63 of the Buffalo Creek Indian Reservation from the Buffalo Creek Railroad and its lessees, the Erie Railroad and the Lehigh Valley Railroad. In November Husted's companies acquired a $250,000 mortgage from Bankers Trust Company secured by the new properties. Two weeks later, Superior Elevator Inc. absorbed Husted Milling in a mutually satisfactory merger. On December 15, 1914, Superior officially became the surviving company, and Husted disappeared as a corporate entity. The new Superior Elevator directors were the same as those running Husted that year: Edwin Husted, Clifford Husted, Pratt, Thomas O'Brien, and A. T. Safford.[8]

Husted purchased the Buffalo Creek Railroad lots for two reasons. Both of the company's first two elevators were landlocked, and the lots were on the river, giving the site access to new means of transportation via lake bulk carriers. Second, the Buffalo Creek Railroad had the best tracking facilities in the city to serve whatever facility Husted developed. Even before the property was secured in September, 1914, Husted and his fellow directors were developing plans for a massive elevator complex to be known as the Superior Elevator. A contract was issued February 26, 1914, to Monarch Engineering for the design and construction of one of the most structurally advanced elevators of the day. The building permit was obtained in April of 1914. The company's optimism was laudable, since direct ownership of the property itself was not definite for at least another five months. Once again, Husted's optimism was well-founded; by June, 1915, the Superior Grain Elevator was in full operation and already renowned for its innovations.[9]

Edwin Husted remained actively involved in the day-to-day operations of Superior Elevator until his retirement from the company in 1925. During the early years of operation, the company prospered, increasing its capital stock from $200,000 to $1.3 million. In 1925, when Husted retired from direct control, the company changed its name once again and established Premier Elevator Corporation. The operating purposes of Premier were extended to include not only grain handling, milling and storage, but also business in paper trading--the lending and exchange of money, futures, and receipts. Premier was a manifestation of Superior's role in the 1920s movement away from active, productive business to speculation. Never designed to function, Premier was a straw company existing only to raise money and to pass on new business activities without the incumbrances of past debts or current operating obligations. Because it was a "paper" operation, Premier's common stock had no par value and the preferred stock was worth only $8.00. Premier lasted less than one day, being reincorporated once again as Superior Elevator Corporation.

As this dodge indicates, financial problems existed for the first Superior Elevator Company in the weakened agricultural markets of the 1920s. The quick turnover in identity appears to have been a means of evading creditors without the cumbersome process of filing bankruptcy and of establishing a speculative arm that might otherwise have been considered too risky for the operating company with its current debts and liabilities. A new company circumvented objections that might have been made by the State of New York and would-be creditors.[10]

Superior's corporate identity fiddle did little good. The new Superior Elevator quickly overextended itself, particularly in its "subsidiary" Premier. Superior had to reduce the number of shares available for sale in Premier since it could not afford to pay dividends. However, the reduction also meant a diminution in capital generation. With less capital coming in, Superior Elevator had little choice but to use Premier as the lender of record to take out two additional mortgages on the elevator, one for $500,000 from Marine Trust Company and another for $2.1 million from Buffalo Trust Company. The monies in hand, Premier was quickly dissolved. The banks were not thrilled, but were caught in the convolutions of a corporation floating a long paper trail in an effort to stay alive. Marine Trust saw the handwriting on the wall, sold the mortgage to Liberty Bank and took leave of Superior Elevator completely.[11]

Superior Elevator's financial convolutions were an effort to finance a large expansion of the elevator itself. Proposals for additional capacity had been projected since March, 1925, when blueprints and permits were filed with the city. The annex was

finally built, increasing Superior's capacity to 3.75 million bushels, making the elevator one of Buffalo's largest. In 1927, the company took out a third mortgage from Community National Bank of Buffalo for an additional $500,000 secured by "the usual property." This was the straw that broke Superior's back. The first $50,000 installment on the loan was due January, 1929. The company could not sustain such a financial burden.[12]

Corporate identity changed once again when a certificate of incorporation for yet another company, Superior Forwarding Company, Inc. was drawn in April, 1929. Like its predecessors, this company was limited to "storage, wharfage, warehousing, elevating, transferring, and forwarding..." of grain and other related commodities. The company was to be capitalized with 1,000 shares of preferred stock carrying a $100 par value and 1,000 shares of common stock with no par value at all. Capital was to equal the sum of all issued preferred shares and $1.00 for each share of common. This decision opened the company to potentially serious undercapitalization, but it was in conformity with the Stock Corporation Law of the late 1920s. All of the directors who signed on to the company only for the purpose of incorporating it were "cutouts" masking the real owners and future directors. They all came from Syracuse, and none had been with Superior Elevator in any of its many forms.[13]

Through these creditable front people, the company was able to secure another mortgage on the Superior Elevator, but the mortgage was to be used as collateral to underwrite the principal and interest on bonds that the company wished to issue. Clearly the new Superior Forwarding Company was, like its predecessors, more concerned with paper trading than grain elevating. It is not clear why the mortgage did not generate sufficient money for the company; one can only presume that the bond issues were to generate far more through inflation of value than the mortgage itself could supply. This effort came two months after the collapse of the stock market and the beginning of the Great Depression, which revealed the futility of such paper empires overextended with loans and devoid of productive substance.[14]

Even more tragic, the bonds were to help complete payment on the elevator itself. Previous financial deals had fallen apart, and the Superior Elevator was placed on the auction block August 30, 1929. Superior Forwarding, the only bidder, did not have the money needed to pay old creditors who had finally caught up with Superior; the name changes had not insulated the company permanently from its obligations. In an effort to retain its property, Superior Forwarding had bid $2.35 million for its own property based on an outstanding first mortgage of $2.15 million and $150,000 in back taxes. The auction was ordered by Liberty

Bank, the mortgage holder and trustee for the bondholders.[15] The reorganization was a legal fiction that permitted stockholders to retain control over the elevator while evading direct responsibility to their old creditors. The auction and new mortgage gave the company breathing room on payment schedules in the bad times of the 1920s agricultural depression.

The Superior Forwarding Company was, however, nearly as short- lived as Premier. Incorporated in April, 1929, it was dissolved October 31, 1930. Two months later the company was again reincarnated, this time as Superior Elevator & Forwarding Corporation. It was established to build, maintain, and operate grain elevators and to mill, receive, and store all kinds of grain. It would also operate wharfage, docks, and watercraft. Such lofty ambitions masked a more modest reality. The state incorporation charter directed the company not to use its own funds or property for the purchase of its own capital stock. Clearly the days of rampant speculation were being legally curtailed.[16]

Now that Superior was national in scope, its stock was finally made public and traded on the New York Stock Exchange. Some directors of the new company were still from Buffalo, but others came from throughout the country. Of the Buffalo directors the key player was Edward H. Letchworth, a partner in Kenefick, Cooke, Mitchell, Bass & Letchworth, the corporation's legal counsel. Letchworth was a prominent western New York name with historic ties to manufacturing, railroads, and finance. Despite the obvious but not illegal conflict of interest, Edwin Letchworth was also the administrator of the Kellogg family trust, the wealth of which emanated from the well-being of the Spencer Kellogg Grain Elevator further down the Buffalo River.[17]

Another Buffalo director was Thomas C. O'Brien, formerly a grain shipper and a director of both the old Nickel Plate and Husted Milling & Elevator. O'Brien had been affiliated with the irresponsible versions of the Superior corporation but, as an old Husted associate, he may have been introduced to the "new" Superior board of directors as a representative of continuity. He came with other conflicts, however, since he was also tied to the Abell family concerns embodied in the Marine Elevator, where he had been a director for three years until 1930. Between 1927 and 1930 O'Brien withdrew from Superior to avoid a flagrantly illegal interlocking relationship in direct violation of the 1914 Clayton Act. He left Marine in 1930 to resume his role with SE&F, thereby once again avoiding legal complications that could stem from an overtly conflicting relationship between the two elevators.

Because the company was publicly traded on the stock exchange, local control over Superior was no longer guaranteed. Superior President Albert Beringer and Director Paul W. Fisher were both from New York. Director Donald G. Sherwin hailed from San Francisco and Eric A. Pearson was from Philadelphia. With widely distributed stock and stockholders to consider, the company could no longer wheel and deal with impunity; public accountability was now, at least nominally, the watchword.[18] The fragility of the new company was reflected in an unusual proviso in the incorporation agreement. In Article 12, the incorporators issued a disclaimer as to the conflicts engendered by any director's having an interest in any other corporation that might hold controlling interest over the stock of Superior Elevating & Forwarding. They also declared that no conflict of interest could be charged against a director who belonged to any other corporation engaged in similar trade with common contracts.[19] The disclaimer was not legally binding since the Clayton Act could not simply be ignored. It was clearly there to protect the company from O'Brien's complicated history with the old Superior companies, as well as with Marine, and also to insulate the company from criticism with respect to Letchworth's alliance with the Kelloggs.

Despite Superior's unsavory economic history, Superior Elevator & Forwarding encountered very few difficulties raising capital. In January, 1931, the corporation obtained a $500,000 first mortgage from Marine Trust. The terms were stiff--the entire principal and interest were due and payable in 1935--but the directors were undeterred by the strictures. The same day, January 14, 1931, they obtained a twenty-year, 6 percent mortgage for $1,050,000. Both mortgages were secured by the elevator and its real estate. The mortgages were to pay for the conveyance of the elevator from the former companies to Superior Elevator & Forwarding.[20]

In years past, the railroads had sold SE&F's precursors various subsidiary land parcels abutting the lots containing the elevator. The railroads then re-leased the rights-of-way for their own continued use. In 1929 those conveyances had been withdrawn by the railroads, and in 1931, when the lands were re-acquired by Superior Elevator & Forwarding, it was not through sale but merely through lease. SE&F had the same debt burdens and obligations as previous companies but the abuses of fiduciary and operating trust propagated by SE&F's corporate antecedents left the new company with far less control over the property and the bank accounts.[21]

Despite all of its handicaps--the $1.55 million debt, the restrictions on its operations, and a doubtful economic

reputation--Superior Elevator & Forwarding plunged full tilt into the game of Depression-era corporate acquisitions. In early 1932, SE&F took control over two key Buffalo grain elevators, the Dakota and the Great Eastern, through a foreclosure action. The purchase cost of an additional $1.25 million was still an excellent price; the Dakota alone had been valued at $2 million in 1924. The procurement nearly doubled Superior's indebtedness at a time when business was unreliable at best.[22]

In March, 1937, Superior modified the 1931 indenture made with Marine Trust. Despite evidence of further trouble brewing, SE&F directors organized a separate company later in October, 1937, creating Superior Grain Corporation which had essentially the same purposes as SF&E and all of the predecessors. Superior Grain's capital was authorized at $50,000, and the articles of incorporation carried the same clauses allowing directors of the new company to be on the boards of other similar corporations.[23] The authorization was critical to Superior Grain's operation since four of the first seven Superior Grain directors had ties to SE&F. Homer A. Woods, Albert Beringer, and Edward Letchworth were directly associated with the boards of both firms, while H. Kenneth Haller was an attorney of Letchworth's law firm and maintained indirect ties to SE&F and to Spencer Kellogg family interests.[24]

Like its predecessor, Superior Grain embarked on expansion programs. The company's leasing of a third elevator, the Canadian Pool Elevator on Buffalo's outer harbor, was followed by a similar arrangement with the Connecting Terminal Elevator at the mouth of the Buffalo River. By 1941, Superior Grain had a capacity of 4 million bushels. While the new company was doing relatively well, the prosperity of SE&F was far from assured.[25] In Spring of 1939, Superior Elevator & Forwarding had sold the flagship elevator, the Superior, to Cargill, Inc. This huge, international grain trader based in Minnesota was interested in expanding its eastern operating bases. Cargill's procurement (not consummated until 1941) did not immediately spell the demise of SE&F, however; the company continued another seven years, although it appears to have become more of a passive investment firm than an active grain operator. In October, 1946, SE&F finally filed its certificate of dissolution, thereby ending fifty years of corporate history.[26]

When the Superior Elevator passed into Cargill's control, it opened a new era in Buffalo's grain trade. Cargill represented the largest outside corporation engaged in Buffalo-based grain trading that had operated in western New York to this date. Cargill was interested in buying, moving, storing, and shipping grain rather than in any form of milling or other processing.

The company had no real commitment to Buffalo per se; Cargill always sought to maximize profits through low costs on both its grain purchases and on its facilities and transportation.

Buffalo was not an inexpensive transfer point for Cargill's grain shipments but was an attractive site for an interim period because of favorable locational factors that tied together Great Lakes shipping and rail lines. Situated at the farthest eastern end of the lakes, Buffalo would "do" for Cargill at least during the war years, when the great demand for exports kept grain demand and prices high. With a maximum thirty-hour turn-around from unloading to delivery at the docks in New York City harbor, Buffalo was the optimum delivery point for grain transfer.[27]

Cargill came to Buffalo after seventy-five years of growth and development elsewhere. The company began in 1865 as a very modest rural grain storing operation. Westward agricultural development was given an enormous impetus in 1862, when the Homestead Act granted or sold tracts of land to settlers and companies promising to develop them. The largest grants were made to the railroads that sold parcels to prospective farmers. The railroads needed grain traffic to support their revenues, and farmers needed the railroads to ship grain to urban markets; it was a symbiotic, though frequently hostile, relationship. Grain collection and distribution, however, became the crucial mediating link in the flow of produce between farm and market.[28]

William Cargill was the son of a Wisconsin farmer who had migrated westward from Scotland. The elder Cargill, a sea captain, had sold his shipping interests just before the 1857 Panic and used the proceeds to acquire land in the United States. As an adult, William relocated to Conover, Iowa, where he became a partial owner of a small wooden grain elevator. The endeavor was successful, and William and his brothers, watching the western rail expansion patterns, decided to follow the rail lines and establish more elevators to collect and distribute the bounty of the vast grain fields. In quick succession, the Cargills opened elevators in Iowa, Wisconsin, and Minnesota.

The Cargill brothers were underwritten financially by banks eager for the interest income on their profitable developments. Their support primarily came from smaller midwestern banks, and Will established a useful alliance with Milwaukee banker Robert Elliott who enjoyed a particularly fruitful business with the new grain traders. The Cargills were sufficiently stable economically not only to survive the Panic of 1873, but also to capitalize on other traders' misfortunes, buying out distressed warehouse and elevator operations at bargain prices.[29]

In 1874 Will Cargill moved to LaCrosse, Wisconsin, where he established the company's headquarters and his own grand residence. Here Cargill developed the system of integration that ultimately made Cargill, Inc. so lucrative. The company tied all stages of grain handling together--from country elevators to lakeside transfer depots for Great Lakes Shipping. To make this possible, the Cargills developed friendly relations with the railroads who gave them preferential rates and blocked competitors. The Cargill brothers worked closely with the Northwestern Railroad and the Green Bay & Western. These two lines built Cargill its desired spur to the port of Green Bay, Wisconsin, where the company's depot was then located. In addition the Cargills worked closely with James J. Hill's Great Northern Railroad, which took both the rail line and Cargill into the northern plains states.[30]

Will Cargill's LaCrosse mansion was directly across the street from that of another wealthy Scottish Presbyterian family, the MacMillans. Will's daughter married John Hugh MacMillan who joined his father-in-law in the Cargill enterprises. By the 1880s the Cargill company and one other LaCrosse firm controlled five out of nine bushels of capacity on all of the southern Minnesota rail lines. Fifteen years later, Cargill and two other companies, Peavey and Northern Grain, controlled virtually all grain storage at Duluth, Minnesota, at the head of the Great Lakes. The Cargill brothers had consequently risen to national prominence, sitting on the boards of various railroads serving their grain empire. Before the turn of the century, the Cargills already exercised enormous control over America's grain trade.

In 1909 William Cargill died intestate but extremely wealthy. His son, William, Junior, had invested unwisely in a failed Montana irrigation project and a railroad that went nowhere. Due to young William's indiscretions, enormous bills in his father's name were outstanding all over the west. At the elder Cargill's death, creditors descended on the family and business demanding payment, but no one had the authority to settle the debts until probate could be cleared. For seven years, the Cargill Company was on the verge of bankruptcy, its lands and other property sold to appease creditors, and the family itself was torn apart in a feud between John MacMillan and his less capable brothers-in-law. Because of MacMillan's superior command of the company's operations, the Cargills lost control, although some family members retained a beneficial if not directing interest in the company. William, Jr. was bought out for cash, railroad bonds, and notes worth $250,000. MacMillan became president of Cargill Elevator and, despite the feud, kept the company solvent and growing. By 1916 the crisis was over and the Cargill empire was worth more than $4 million.[31]

After World War I, the Cargills were bested by a sharp Buffalo wheat broker who leased space in the company's own elevators and sold spring wheat to New York exporters more cheaply than the Cargills themselves. In response, the Cargills decided to move into eastern markets to secure their own deals and prices. By 1922 MacMillan established a sales office in New York that expanded the integrated purchasing, transport, and sales network to the Atlantic seaboard. Cargill Elevator also established foreign-based purchasing networks in South America to obtain grain for sale in both the United States and other countries. To simplify access to European markets, Cargill organized sales offices in Europe.

In 1930 Cargill incorporated in Delaware, the state offering the most advantages to corporations seeking to do business nationally. The incorporators of the "new" Cargill, all from Wilmington, were merely signatories of convenience masking the real ownership and direction of the company. The company, now known as Cargill, Inc., remained closely controlled, operating as a private joint-stock corporation with the majority of shares still owned by MacMillan and Cargill family members.[32]

Since Cargill, Inc., was not publicly traded, the company was not legally required to publish income and profit data. Therefore, no one outside the company will ever really know how well Cargill fared during the agricultural and general depressions of the 1920s and 1930s. The overt evidence, however, indicates that the company held its own during this period. In the 1930s Cargill invested heavily in the company's primary operations, building and acquiring new elevators, developing barge transport systems along the Mississippi River, and taking leases on still other elevators it chose not to acquire outright. Among the latter was the giant 7.5-million-bushel Albany, New York, elevator on the Hudson River. This elevator, built to Cargill's specifications but publicly owned, saved Cargill all of the capital costs while meeting the company's needs. By the mid-1930s, Cargill was powerful enough to move into the key Chicago commodities market; in the process it forced out the old trading giant, Rosenbaum Grain Co., and soon became Chicago's largest grain merchant.[33]

Under the MacMillan family control, Cargill was operated as a methodical, if cutthroat, trading operation. The company was never involved in speculation such as gambling on price futures. Rather, it endeavored to dominate the grain trade through absolute control over points of purchase and of storage and through superior ownership of distribution, transport, and marketing outlets. Cargill preferred the steady if unspectacular returns on its capital that could be obtained through monopoly, rather than the higher but far more uncertain yields that might

be garnered through price competition.

Despite Cargill's conservatism, the company ran afoul of the Chicago Board of Trade in 1937, when it employed its overwhelming dominance of purchasing power to corner the market and surpass one of the BOT's primary speculators, Dan Rice. Cargill had not done anything overtly criminal, but the BOT, hospitable to only its familiar would-be monopolists, decried the "outsider" activities of the "upstart" Cargill. In 1938 the BOT filed suit against Cargill charging the company had manipulated corn prices. Cargill retaliated with a countersuit, accusing the BOT of violations of the Sherman Antitrust Act and demanding that the federal government clean up the commodity exchange. Cargill lost and was excluded from trading in the Chicago market which was increasingly becoming the national price and sales market. Nevertheless, Cargill ultimately won the economic battle. It dissolved the Chicago subsidiary which had the seat on the Board of Trade; the BOT relinquished its efforts to keep Cargill out of the grain market all together.

Despite exclusion from the primary market, Cargill still controlled huge quantities of grain. The company needed to move its abundant supplies quickly and as cheaply as possible. With no access to the BOT by which to dispose of the surplus and with an enlarged desire to continue grain trade dominance, Cargill needed to cut costs and, more important, move grain toward export outlets rapidly. These factors underlay Cargill's interest in Buffalo as a site for a new transfer elevator.[34]

From the beginning of its presence in Buffalo, Cargill made it clear that it regarded the area's elevators as stopgap measures. It perceived Buffalo as having too high wages, due to the presence of strong unions whose negotiating strengths Cargill also disliked. In addition, the company asserted that New York's taxes were too high. Cargill did not appear to find these same factors objectionable in the state-run Oswego elevator or in Albany; the price breaks offered there through capital-cost absorption apparently outweighed Cargill's articulated dislike of the labor and tax factors in Buffalo. The advantages Buffalo offered Cargill included the holding capacity to hoard grain until prices improved, preferential rail rates to eastern port cities and rapid turn-around delivery time to New York.[35]

Cargill bought the Superior in Spring, 1939, and assumed full control May 31. Since Cargill's impetus to purchase the elevator was to gain improved access to the export market, the advent of World War II gave an enormous boost to Superior's strategic location within the company's plans. Any plans Cargill had to make a killing overseas, however, were tempered by the

intervention of wartime rationing. Cargill predictably protested government regulation of supplies and prices, but it also discovered numerous ways to diversify and expand business using wartime demands as a springboard.

At this point, the company became a shipbuilder not only for its own needs, but also for the armed services. This activity was a logical extension of its existing barge-building operation, and during the war Cargill built eighteen tankers and four other vessels for the military. Its ship building facilities were located both in Albany and in Minnesota. After the war, the company's prominence in shipping became apparent within the domestic sector; Cargill either owned or leased 35 percent of all space on Great Lakes ships.[36]

The postwar agricultural boom in the United States resulted from the devastation of farming in war-torn countries abroad and from the fortuitous bumper crop seasons of the late 1940s. Cargill was superbly positioned to capitalize on both the surplus and the export opportunities since it had terminal offices in nineteen cities and controlled 60 to 70 million bushels of terminal elevator space nationally, including nearly 12 million bushels of capacity in Buffalo, 3.7 million of which was available from the Superior Elevator alone.[37]

Cargill's command of capacity backfired on the company in 1946. The Federal Office of Price Administration, which continued to exercise price rationing controls for some time after the end of the war, asked the Chicago Board of Trade to cancel all futures contracts. Although the BOT refused, it did limit trade in futures to the old, regulated price ceilings on 85 million bushels--bushels Cargill had hoped to sell at new, higher prices. Cargill was caught with 6 million bushels that the company claimed it had bought to be sold and delivered on fixed contracts at specified flat prices. The perpetuation of lower prices undercut Cargill's profit margin and could not be offset later by higher prices since the company did not (and, as an outcast from the BOT, could not) engage in future speculation. Its profit margin was narrow because earning was generated by volume not price hikes. By the company's calculations, the loss on the 1946 deal was 1/2 cent on each sales dollar, a substantial sum for the giant trader.[38]

Such setbacks were difficult but only temporary. On the whole, the company grew rapidly and steadily. In 1955 its net worth was $40 billion but by 1965 it had grown to $100 billion. Annual sales in the same decade soared from $800 million to nearly $2 billion. If it had been publicly traded, that sales figure would have made Cargill the nation's sixth largest

corporation.[39]

Part of Cargill's expansion came from the diversification program it began during the 1950s. The company's grain barges were returning empty from trips to Gulf ports. Since the company had always hauled non-agricultural commodities in return voyages on its ships, it was only logical to apply the same tactic to Mississippi River barge traffic. Cargill began hauling rock salt for other companies, then decided to develop its own Louisiana salt mine, finally retailing salt outright. To build its own barges more inexpensively, the company bought North Star Steel Company and another small steel maker to supply its barge-building needs. The company diversified within its agriculturally based activities as well, entering turkey processing, grain milling, corn syrup manufacturing, soybean processing, and other such fields. To cap the whole enterprise, it also began an insurance business.[40]

Grain trading and shipping continued to dominate Cargill's expansion plans and daily operations. Part of what sustained the company's interest in and prompted its continued reliance upon Buffalo elevators, such as the Superior, was Public Law 480 passed in 1954. The other factor was the creation of the Commodity Credit Corporation. Public Law 480 helped the United States government dispose of the postwar agricultural glut by opening new markets for private grain sales. Foreign aid involved "whetting the appetite" of less-developed countries for food stuffs previously unattainable economically and supplying those newly created market needs with American surplus grains. In addition, the CCC became the nexus through which excess American grain production was purchased by the government with federal dollars to keep national farm commodity prices high. The CCC became the source through which private companies such as Cargill contracted to store those surpluses for a fee, also paid for by the government.[41]

Cargill was America's chief beneficiary of both Public Law 480 and of the CCC business. From 1958 to 1958 Cargill received more than $76 million for storage of surplus alone. Along with a handful of other large dealers, Cargill was allowed to buy government grain at its own discretion. In 1966 Congressional hearings revealed that the grain merchants manipulated CCC reserves by buying them from the CCC in such quantities that they created "shortages" which in turn engendered rising prices. The companies then benefitted by reselling the grain at much higher prices, even though the initial purchase from the farmer had been through the CCC with tax dollars. U. S. consumers were thus paying several times over for the same grain, and farmers were receiving price supports below the new "market" value of the commodities. That was not enough for Cargill, however. Through

its governmental lobbyist, William Pearce, Cargill lobbied for a reduction in CCC subsidies to farmers. The price per bushel would drop to keep Cargill's purchases from CCC lower. Theoretically, other price supports programs would compensate for the amounts purchased through the CCC for export and for Cargill.[42]

Cargill expanded rapidly to handle the enormous volume of grain storage and shipping that Public Law 480 and the CCC generated for the company. In one year, 1963-1964, the company sold $1.5 billion in CCC exports. The company had so constructed its diversified empire that, through foreign subsidiaries in other grain producing nations, the company got the lion's share of the massive export to the Soviet Union in the mid-1960s. Although Cargill was limited by federal regulation to a maximum of 25 percent of the total of U.S. government-subsidized exports, it also generated 20 percent of all Canadian grain sales.[43]

In the mid-1960s Cargill controlled a huge number of country elevators ranging from 30,000 to 500,000 bushels in capacity. Its twenty-five sub-terminal elevators of 500,000 to 1 million bushels in capacity collected grain from both Cargill elevators and those of other companies. Finally, Cargill controlled forty-five terminal elevators of up to 20 million bushels in capacity. These megaliths were located at major transit crossroads such as Buffalo and, like the Superior Elevator, were crucial links to Cargill's handling of massive volumes of export and domestic grain.[44] The Superior Elevator had an important but uncertain position within Cargill's plans. In July, 1963, it was announced that Cargill was set to reopen the facility after a seventeen-month shutdown. The catalyst for the reopening was a new 10.9-million-bushel CCC allotment of surplus grain to Buffalo. Superior, as it turned out, would receive none of the bounty; Cargill reserved the elevator for its own commercial grain reserves.[45]

The reopening illustrates a key feature in Cargill's cost considerations. The company had hoped to renegotiate minimum crew size to staff the Superior but encountered resistance from the union. Cargill was not comfortable with unions, either in its own facilities or in other industries. It worried about the growing power of the Teamsters Union in trucking and the bargaining strength of independent truckers. The reason for this antipathy was simple: aspects of the integrated structure of grain movement and storage that fell under the control or influence of well-organized outsiders threatened Cargill's capacity to freely cut costs to retain its profit margins and growth rates. In the trucking dispute, Cargill was able to pressure the Interstate Commerce Commission to restructure

trucking rates and regulations and thereby provide it with rate breaks. The company was less successful with the grain handlers' unions.[46]

A second issue that Cargill could not control also began to affect the company's interest in the economic viability of the Superior and other Buffalo grain elevators. Between 1963 and 1966, Buffalo allowed the erosion of its preferential rail rates to eastern port cities. With improvements to the St. Lawrence River having created an unimpeded seaway open to Atlantic shipping in 1959, Cargill could abandon its western New York operations except for winter storage when the Seaway was closed. With the loss of low rail rates, even winter storage became too costly; it was no longer beneficial for Cargill to trade short delivery time to New York City for increased costs. Cargill then developed a simple means to by-pass Buffalo outright, regardless of season. It arranged to rent entire trains and rights-of-way, giving it a rail linkage at low cost to transport grain directly from the Midwest to New York without stopping in Buffalo. The Rent-a-Train (RAT) system gave Cargill the final reason it needed to abandon the Superior and other elevators.[47]

By the 1970s the Superior Elevator was moribund. Initially, the company could not sell it and refused to pay taxes on the idle facility. The elevator was put up for auction in 1982, when Cargill re-acquired the property for substantially less than it owed the city and county. Despite the financial windfall, it did not reactivate the facility. In 1985 Cargill finally did find a buyer for the elevator--the Bauer Corporation of Ft. Collins, Colorado--which never ran the facility even after obtaining an excellent price and receiving tax-exempt status from the city. From the beginning of Bauer's involvement, the purpose of the acquisition was unclear; Bauer had no specific business purpose stated in its own articles of incorporation.[48] Once again, the Superior Elevator, always troubled by a turbulent pattern of ownership and mismanagement, lies abandoned.

MATERIALS HANDLING: HISTORY AND DESCRIPTION

Receiving by Water

In any analysis of Buffalo's grain elevators, the process of unloading boats should be considered significant and unique. At the new Superior, cargoes from deep-draft lake carriers navigating the Buffalo River were initially handled by a single mobile marine tower with a rated capacity of 25,000 bu./hr. Monarch Engineering, the prolific firm of local elevator

builders, was responsible for the mechanical engineering of the vessel unloading apparatus, as well as the overall design of the elevator. The Superior job appears to have been Monarch's first movable marine tower; the previous project at the Wheeler Elevator had included a fixed marine leg. However, Monarch's chief designer, Harry R. Wait, had also accumulated substantial expertise concerning movable marine towers during his tenure with the Steel Storage and Elevator Construction Company.

The 1914 tower at Superior consisted of the usual structural steel framework with concrete floors and a corrugated iron sheathing. It traveled over a concrete dock with a piling foundation; the concrete extended down to 1' below mean low water. The marine tower was self-propelled and rolled on twenty pairs of car wheels. The tower's original machinery included weighing apparatus and a lofter leg for re-elevation of instore grain, as well as the marine leg for raising grain out of lake vessels. In the unloading sequence, grain was carried up in buckets on the endless belt of the marine leg and discharged over the head pulley into a 1,000-bushel upper garner. Weighing was carried on through a 400-bushel instore scale, discharging into a lower garner. Grain was then spouted from that receptacle into the boot of the tower's own lofter leg to be carried back up to the level of the storage bins.

An unusual feature of the 1914 Superior marine tower was the dump tank by which small quantities of re-elevated grain could be diverted back to the boot of the lofter rather than being spouted into the house. The function of this by-pass may have been to provide a means of storing grain for brief periods while a tripper on a horizontal instore conveyor belt was being moved to another bin. Re-elevated grain exited the marine tower into a series of V-hoppers over the bin floor gallery that could distribute to certain storage tanks without moving the tower itself. From these collecting points, grain could also be discharged onto the upper conveyors for transport to more remote sections of the elevator that lay beyond the reach of direct spouting.

The arrangements for driving the machinery in the 1914 marine tower were comparable to the composite techniques used in other contemporary Monarch projects at the Connecting Terminal and Concrete elevators. The marine leg itself was driven by a 75 hp motor mounted at the crosshead. A 100 hp motor, located on the bin floor level of the tower, powered the marine lofter via rope drive and spur/pinion reduction gears. A 50 hp motor on the tower's first floor drove the marine leg hoist winch and pusher arm mechanisms, the tower mover winch, and the ship shovels through a complicated series of indirect connections among ropes, tension pulleys and countershafts. Specifications for the

original marine leg and lofter elevating capacities, bucket dimensions and bucket spacing remain undetermined, as does the status of existing conditions. A second marine tower of comparable design was added in 1917.

Monarch Engineering provided no additional marine elevating capacity when the second phase of storage bins was added at Superior in 1923. However, during the third phase of construction two years later, James Stewart & Company installed a new fixed marine leg with a capacity of 30,000 bu./hr. Webster Manufacturing Company furnished the machinery, which was housed in a structural steel tower with concrete floors and roof covered in corrugated galvanized iron. The fixed leg was situated at the east end of the expanded elevator, the dock for the two movable towers being at the opposite end.

The belt on the Stewart leg was 34" wide and consisted of seven-ply, 32-oz. canvas with vulcanized rubber covering. Carried on this belt were two staggered rows of 15" x 8", 8" deep buckets spaced on 11" centers. A 150 hp at 720 rpm motor drove the marine leg. It was initially contemplated that power would be transmitted to the headshaft through a Link-Belt double reduction silent chain; however, in the event the contemplated chain drive proved unsatisfactory, T. D. Budd of Stewart's authorized replacing it with double spur reduction gears. The starter for the marine leg motor was located on the shovel floor of the tower. The crosshead carrying the motor was mounted on vertical guides such that the leg's overall length of travel as it extended down into a vessel's hold was 70'; when the leg reached its lowest point of descent, the center line of the head pulley was aligned 2' in from the dock face.

Grain elevated from boats discharged into an upper garner with a double-acting gate was weighed by an instore hopper scale and discharged into a lower garner. Original specifications for these units were for 600 bushels, 500 bushels and 800 bushels respectively; as built, some sources indicate that all had capacities of 800 bushels. The elevating rate of the marine tower lofter was equivalent to that of the marine leg at 30,000 bu./hr. The belt on the lofter leg was 60" in width and carried four staggered rows of 14" x 8", 8" deep Buffalo buckets on 13" centers. A 200 hp at 720 rpm motor drove the marine leg through a flexible coupling and helical reduction gears. The starter for the marine lofter motor was located on the bin floor with a pushbutton stop on the tower's scale floor.

Other machinery functions in the Stewart tower were also powered by individual motors instead of the indirect rope drives employed by Monarch for its mobile marine towers a decade earlier. A 30 hp at 720 rpm constant-speed squirrel cage motor

drove the marine leg pusher arm via two leather belts for direct or reverse motions and the hoist winch countershaft through Link-Belt silent chain. A 100 hp at 720/360 hp motor powered the four-drum ship shovel set by flexible coupling and helical gear reduction; the two-speed motor provided fast or slow rates of rope travel (750/375 rpm) for power shovel operations down in the hold.

By the mid-1950s only the two movable marine towers remained in service. Their nominal capacity had declined to 15,000 bu./hr. per leg. In 1971, when the elevator was inactive, the comparable estimate was 12,000 bu./hr. Both marine towers remain extant, though disheveled. The machinery in the 1925 stationary leg has been scrapped.

Receiving by Rail

The Superior Elevator's relatively remote upstream location on a sharp bend of the Buffalo River was determined, in part, by the accessibility of nearby rail connections. Disputes among competing railroads owning property on the outer harbor had retarded development of sites that would have presented fewer obstacles to navigation. Avoiding congestion in the more developed switching district toward the mouth of the river was another factor in the Husted interest's choice of location.

In 1914 four parallel tracks entered the car shed on the south (land) side of the elevator. Aligned along the two outer tracks were six pits for receiving grain emptied from boxcars by means of power shovels. A motorized car puller spotted the boxcars over the track grates. Three transverse conveyors running through tunnels carried instore grain beneath the track shed and into the workhouse for elevation. Three lofter legs were available for raising grain to the top of the workhouse where the scales were located. Each lofter was driven by a 75 hp at 300 rpm motor via ropes running in grooved pulleys to countershafts with spur-and-pinion reduction gearing. From each leg, grain could be discharged at the head pulley into flanking 2,000-bushel garners above 2,000-bushel Buffalo hopper scales; six sets of each were arranged longitudinally.

Below the scales, distribution arrangements were similar to the means provided later by Monarch at Concrete-Central. Turnheads below the scale hoppers could be rotated to reach groups of four distributing hoppers leading to the storage bins via fixed spouting, the bin floor conveyors, the loading spouts or the grain conditioning equipment. Approximately thirty of the ninety-eight bins in the 1914 mainhouse, cleaner house and drier building--including an undetermined number of the forty-two

25,000-bushel principal storage tanks--were accessible through direct spouting from the workhouse so that no conveyors had to be used for distribution to those points.

In the elevator's early years of operation, between seventy-five and 100 cars could be unloaded in the course of ten hours through this sequence of operations. During the 1920s and 1930s, published rail receiving capacity averaged 7,000 bu./hr. or four cars per hour in actual practice (compared with a projected maximum level of ten cars per hour initially). In 1971 the estimated carhandling rate had fallen to three per hour with only three of the receiving pits still available for service.

Instore Distribution

Grain received through the 1914 and 1917 marine towers reached storage via direct spouting from the external V-hoppers or by means of the belt conveyors running longitudinally through the cupola over the bins. In the first phase of construction, three such belts were installed, each 42" wide and equipped with self-propelled trippers for discharging grain at desired points. As in the case of Concrete-Central, marine receipts were presumably transferred directly over to the land side of the elevator for loading out to rail cars. Rail receipts elevated through the workhouse also traveled on these belts to reach bins beyond the limits of the fixed spouting system radiating from the quadruple sets of distributing hoppers previously noted. The hourly carrying capacity and other specifications relevant to the performance of the bin floor belts remain undetermined.

As no details of the equipment installed in the 1923 addition have surfaced, it may be conjectured that Monarch Engineering provided storage conveyors of comparable capacity and arrangement. In the 1925 phase, a pair of 48" reversible belts with four-pulley trippers took grain received by both water and rail, delivering to bins throughout all three sections of the house as part of a continuous upper horizontal materials handling system. Located in a typical low cupola over the bins, the 1925 conveyors were composed of four-ply rubber-covered cotton duck and were driven by 60 hp at 720 rpm motors through flexible couplings and helical gears. Stewart-type automatic take-ups were provided to compensate for any slackening in the belts that would reduce their efficiency. Ball bearings were specified to cut friction loss. The bin floor belts in the James Stewart phase could also be loaded from a new shipping leg interposed between the 1923 and 1925 houses.

Grain Conditioning and Dust Control

In 1914 the Superior was furnished with equipment for cleaning wheat and oats. This machinery was housed in an adjacent reinforced concrete cleaner house, located in the vicinity of the track shed. Six bins over the cleaners were filled by grain from cars or storage via one of the quadruple distributing hoppers in the workhouse; marine receipts usually required cleaning less frequently, but it presumably was possible to send grain directly to the cleaner house via certain V-hoppers and bypass spouting. On the cleaner floor beneath the upper bins stood two receiving separators with aggregate cleaning capacity of up to 10,000 bu./hr. and two Monitor oat clippers rated at 3,600 bu./hr. A third clipper appears to have been added by the early 1920s. After grain had been cleaned it could be re-elevated back to the main house via a short jack leg or dropped via a distributing floor into a set of six bins beneath the cleaners. These lower bins supplied a bagging floor where cleaned grain could be sacked and weighed on Richardson automatic scales prior to being loaded into rail cars. It was also possible to spout grain from the lower cleaner bins back to the boot of one of the shipping legs for re-elevation.

Instore grain received damp was conditioned in a separate fireproof building at the west end of the site. Bins with a capacity of 4,000 bushels held grain routed directly from the receiving scales or the marine tower. The daily capacity of the No. 8 Hess Drier and Cooler was rated at 35,000 bushels. It featured double heating chambers delivering air to the grain from both sides. An outside leg elevated dried grain for delivery via spouting to the storage bins of the mainhouse. The drier house equipment could also be used in tempering grain that had become overheated in storage. The Superior also once contained a 1,000 bu./hr. oat bleacher. Grain was delivered via spouting to the bleacher from the upper portions of two horizontally subdivided bins and was subsequently returned to the lower portions of the same tanks. Bleaching operations were discontinued by the early 1950s.

Dust was originally collected through a Day sweeper system and delivered to a dust packer on the bagging floor. Dust with little recyclable value was sacked and subsequently shipped out. Other features included vents and related provisions for minimizing or containing dust generated at such points as belt loading hoppers and elevator leg boots. Of course, these precautions antedated the disastrous Santa Fe Elevator explosion at Chicago in 1920 that stimulated demands for even more stringent and comprehensive dust control policies throughout the North American grain trade.

Shipping via Water and Rail

To reclaim grain from its assorted storage tanks, the Superior was originally equipped with two 36" belts running longitudinally through the raised basement beneath the bins to the workhouse lofter legs. Hourly carrying capacity and other specifications remain undetermined. Approximately half the storage bins could also spout directly to the house lofters. All six house legs could be utilized for shipping out, though three were specifically designated for such duty. As in the case of the car receiving legs, power was obtained from 75 hp at 300 rpm motors, and grain was elevated to 2,000-bushel garner-scale sets. In 1914 loading out to the track shed was accomplished by means of three car spouts at a maximum rate of 300 cars over a ten-hour period; cars were loaded on the two inside tracks. Shipments to boats or barges were handled through two dock spouts at an overall rate of 25,000 bu./hr.

Shipping conveyors for the storage bins in the 1923 annex may have been continuous with the basement belts in the 1914 house, though the two sections intersected at an obtuse angle. However, the same conditions did not prevail in the 1925 James Stewart & Co. addition, where the 42" belts ran in tunnels through the bottoms of the tanks rather than in a raised basement. Grain carried on the 1925 belts had to be raised (presumably via jack legs) to compensate for the difference in levels. Each of the six new interstitial bins could spout to either shipping belt. Two of the large 1925 circular bins spouted directly to the boot of the new lofter. Grain moving in the opposite direction (roughly west to east) also reached this leg from storage in the pre-existing groups of tanks.

The new shipping leg was intended to improve Superior's rail car loading capacity. Capable of raising 15,000 bu./hr., this lofter was driven by a 100 hp at 720 rpm motor through a flexible coupling and helical reduction gearing. Grain was elevated to a new headhouse equipped with a 2,500-bushel garner and a 2,000-bushel hopper scale. Garner construction featured concrete sides and steel bottoms. The scale was a solid-lever, floor-type model capable of weighing up to 120,000 lbs. at a single draft. A turnhead below the scale directed its discharge to bin floor belts or shipping facilities. Grain was loaded out from the new headhouse through two new cars spouts that terminated in the usual bifurcated Sandmeyer attachment. Cars were loaded under a canopy on the south side of the elevator near the junction of the 1923 and 1925 additions. A two-drum car puller with a 50 hp variable-speed motor was originally specified for spotting cars on the new shipping tracks; sources differ as to whether this machine was ever actually installed.

For a time the new arrangements more than doubled Superior's overall rail loading capacity to 52,000 bu./hr. However, the hourly rate at which cars could be filled declined steadily--perhaps partially reflecting the advent of larger rolling stock--to 24 as of 1948, 22.5 in 1952, and 17 in 1956. By 1971 listed rail loading capacity using four tracks was 22,000 bu./hr. from a total of five spouts, three for boxcars and two for hopper cars. Rates for loading out to boats or barges remained relatively constant at 25,000-35,000 bu./hr. over Superior's five decades of full-scale operation. A third dock spout appears to have been added at some point. By the time it closed, Superior's dock spouts were inactive. During the elevator's latter stages of activity, provision had been made for delivering 6,000 bu./hr. to trucks via a single loading spout.

ENDNOTES

1. The following paragraphs are based on information from a variety of sources including building permits, plans and contracts housed in Buffalo City Hall. Surviving original plans were inspected courtesy of Henry Baxter. Further details of the elevator's construction may be found in the Northwestern Miller, 102 (2 June 1915): 580 and the American Elevator & Grain Trade, 41 (15 August 1922): 95; 33 (15 May 1915): 734. The completed "C" House is described in the Grain Dealers Journal, Special Plans Book 5 (1942), 163 and the American Elevator & Grain Trade, 44 (15 March 1926): 551.

2. Erie County Clerk (ECC), Corporations, Husted Milling & Elevator, Box 6925-1. Certificate of Incorporation, January 29, 1896. All Erie County Clerk documents are listed by date of document origin, not by date of filing, unless otherwise noted.

3. Buffalo City Directory, 1894; Buffalo Evening News, 17 April 1926, p. 4.

4. ECC, Corporations, Husted Milling and Elevator, Box 6925-1; Certificate of Payment, February 13, 1896; Annual Report, January 1, 1897.

5. ECC, Corporations, Husted Milling and Elevator, Box 6925-1, Consent to Mortgage, January 31, 1900; Nickel Plate Elevator, Box 6925-1, Certificate of Incorporation, July 6, 1907; Buffalo City Directory, 1895, 1896, 1900, 1907; Buffalo Commercial, July 9, 1907, 13.

6. ECC, Corporations, Husted Milling and Elevator, Box 6925-1, Consent to Mortgage, July 6, 1907.

7. ECC, Corporations, Husted Milling and Elevator, Box 6925-1, Order Changing Name, August 26, 1907; Certificate of Increase of Capital Stock, July 15, 1907 (filed September 30, 1907); Nickel Plate Elevator, Certificate of Payment, September 28, 1907.

8. Buffalo Courier-Express, 17 April 1926, p. 4; Erie County Clerk, Corporation, Nickel Plate Elevator, Box 6925-1. Change of Corporate Name, May 11, 1914; Husted Milling Company, Box 6925-1, Consent to Mortgage, November 4, 1914; Certificate of Merger, November 17, 1914; Change of Name to Superior Elevator, December 15, 1914; Election of Directors, February 2, 1915; Deeds, Liber 1295, September 29, 1914, pp. 56-8; Buffalo City Directory, 1914.

9. Buffalo City Hall, Permits and Plans, Superior Elevator, Permit #41511, April 1, 1914; Northwestern Miller (2 June 1915): 580.

10. Buffalo Courier-Express, 17 April 1926, p. 4; ECC, Corporations, Superior Elevator, Inc., Box 6925-1, Increase in Capital Stock, November 22, 1922; Change of Name (filed October 1, 1925); Premier Elevator Corporation, Box 8843, Certificate of Incorporation, September 30, 1925; Certificate of Name Change (to Superior Elevator Corporation), September 30, 1925; "Agricultural Depression," New Republic, 55 (6 June 1928): 62-4 and (12 June 1928): 90-2; "In Defense of the Grain Speculator," Literary Digest, 85 (18 April 1925): 82.

11. ECC, Corporations, Premier Elevator Corporation, Box 8843, Certificate to Reduce Shares, October 2, 1925; Consent to Mortgage (Marine Trust Co.), October 6, 1925; Consent to Mortgage (Buffalo Trust Company, October 19, 1925; Resolution of Board (filed October 30, 1925).

12. Buffalo City Hall, Permits and Plans, Superior Elevator Company, Permit #89789, March 27, 1925; ECC, Corporations, Superior Elevator Corporation, Box 8843, Consent to Mortgage, September 13, 1927; Deeds, Liber 1769, August 24, 1925; p. 395.

13. ECC, Corporations, Superior Forwarding Company, Inc., Box 17587, Certificate of Incorporation, April 19, 1929; Moody's Industrials, 1931.

14. ECC, Corporations, Superior Forwarding Company, Inc., Box 17587, Consent to Mortgage, December 30, 1929.

15. Northwestern Miller (11 September 1929); ECC, Deeds, Liber 2101, January 1, 1931, pp. 450-52, cf. Mortgage, Liber 1922, October 7, 1922, p. 152.

16. ECC, Corporations, Superior Elevator and Forwarding Corp., Box 18733, Certificate of Incorporation, December 30, 1930.

17. ECC, Corporations, Superior Elevating and Forwarding Corp., Box 18733, Certificate of Incorporation, December 30, 1930; Buffalo City Directory, 1930.

18. Moody's Industrials, 1931; Buffalo City Directory, 1916, 1923, 1929, 1930, 1932.

19. ECC, Corporations, Superior Elevator & Forwarding Corporation, Box 18733, Certificate of Incorporation, December 30, 1930.

20. ECC, Corporations, Superior Elevator & Forwarding Corporation, Box 18733, Consent to Mortgage (Marine Trust), January 14, 1931; Consent to Mortgage (lender unspecified), January 14, 1931; Mortgages, Liber 2330, January 1, 1931, p. 311.

21. ECC, Deeds, Liber 2101, January 14, 1931, pp. 450-52; Liber 2182, November 4, 1931, pp. 80-84.

22. Northwestern Miller (29 June 1932).

23. ECC, Corporations, Superior Elevator & Forwarding Corporation, Box 18733, Certificate of Consent to Mortgage, March 4, 1937; Superior Grain Corporation, Box 21826, Certificate of Incorporation, October 1, 1937.

24. ECC, Corporations, Superior Elevator & Forwarding Corporation, Box 18733, Annual Reports, 1927-32; Superior Grain Corporation, Box 21826, Certificate of Incorporation, January 25, 1931, Buffalo City Directory, 1937, 1938.

25. Buffalo Courier-Express, 25 May 1941, Sec. 5, p. 2.

26. ECC, Corporations, Superior Elevator & Forwarding, Certificate of Dissolution, October 3, 1946; Deeds, Liber 4009, January 15, 1941, p. 580; Buffalo and Erie County Public Library (BECPL), Scrapbooks, "Harbor," Vol. 3, p. 30.

27. BECPL, Scrapbooks, "Harbor," vol. 3, p. 30; Buffalo Live Wire, 1924.

28. Dan Morgan, Merchants of Grain (New York: Penguin Books, 1971), 89; Roger Burbach and Patricia Flynn, Agribusiness in the Americas (New York: Monthly Review Press, 1980), 232; C. Knick Harley, "Oligopoly Agreement and the Timing of American Railroad Construction," Journal of Economic History, 42 (December, 1982): 801-804.

29. Morgan, Merchants of Grain, 89-90; Milton Moskowitz, Everybody's Business (New York: Harper & Row, 1980), 87.

30. Morgan, Merchants of Grain, 90, 94; "A Two-Billion Dollar Company Lives by the Cent," Fortune (December, 1965), 168.

31. Morgan, Merchants of Grain, 93, 124; "A Two-Billion Dollar Company...," 168.

32. Morgan, Merchants of Grain, 125; ECC, Corporations, Cargill, Inc., Box 26634, July 18, 1930. This is a copy of the original Delaware incorporation sent to Erie County, New York when Cargill, Inc. began doing business in Buffalo in the late 1930s.

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33. Morgan, Merchants of Grain, 125-6; Burbach and Flynn, Agribusiness in the Americas, 234.

34. Morgan, Merchants of Grain, 126; "The Grain Traders," Fortune (August, 1949): 83, 106; Burbach and Flynn, Agribusiness in the Americas, 234-35; "Cargill Reaps New Harvest," Business Week (16 April 1949): 65-68; "Cargill, Inc. Sues," Business Week (1 June 1946): 57-8, 110.

35. BECPL, Scrapbook, "Industry," Vol. 5, p. 94.

36. Courier-Express, 17 May 1939, p. 7; Burbach and Flynn, Agribusiness in the Americas, 235; Morgan, Merchants of Grain, 140.

37. "Cargill, Inc. Sues," Business Week (1 June 1946), 57-8; BECPL, Scrapbook, "Industry," vol. 5, p. 84.

38. "Cargill, Inc. Sues," Business Week (1 June 1946), 57-8; "A Two-Billion Dollar Company...," Fortune (December, 1965), 167.

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42. Burbach and Flynn, Agribusiness in the Americas, 237-8; Morgan, Merchants of Grain, 148-9.

43. "A Big Grain Trader Needs More than Grain," Business Week (4 January 1964), 70-4.

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APPENDIX

Elevator "A"

Cost:	$317,800
Foundation:	Wooden piles capped by concrete foundation slab, rubble infill above foundation slab to depth of 4'-6" supports 4" reinforced floor slab
Basement:	Full height (13'-10") at grade; four rows of 3'-6" square pyramid headed longitudinal pillars, together with outer rows of rectangular bracketed pillars support 14" bin slab; four columns located beneath each main bin with outer columns located beneath intersection of main & 1/4 bins; all pillars spaced equidistantly; exterior basement walls straight with monolithic concrete panels, between outer pillars; elongated windows between pillars above 1/2 height
Hopper:	Mortar slab on slag concrete above bin slab Draw-off via central conical steel hopper set in bin slab
Bins:	Capacity 1,500,000 bushels Main bins 14 x 3 in parallel rows, cylindrical 19'-6" in diameter on 22'-6" centers, 95' high (above bin slab); NW corner main bin subdivided horizontally for loading to boats Interspace bins 13 x 2 28 outerspace bins, convex 1/4 circle outer wall, except on side elevations where the walls are straight-sided Square bins occur above and below cleaners in cleaning house and above driers in drier house Non-tangential, link wall contacts between bins, link walls 16" x 16" Bin Wall thickness 8" Reinforcing probably similar to that of Concrete-Central

Bin Floor:	Book tile on I-beams
Gallery/ Headhouse:	Structural steel, concrete roof, ferro enclave 2" plastered walls
Marine Tower:	Movable, structural steel, corrugated iron clad

REFERENCES: Surviving original plans inspected courtesy of Henry Baxter. City building permits give dates and the City Plans Book for 1914 costs of construction. Further details of construction, may be found in Northwestern Miller, 102 (2 June 1915): 580 and American Elevator & Grain Trade, 41 (15 August 1922): 95 and 33 (15 May 1915): 734.

Elevator "B"

Cost:	$275,000
Foundation:	Wooden piles capped by 2'-6" foundation slab Slab reinforced with lower 1-1/4" diagonal tie bars & upper grid of 1" & 1-1/4" bars beneath each column footing; column footings rise in a step from the foundation slab; all bars are straight; floor slab 4" thick reinforced with diagonal bars and laid on top of 4'-6" of slag filling above foundation slab
Basement:	Full height (13'-10"), 2/3 above grade, four longitudinal rows of mushroom-headed columns Columns are 4' in diameter with heads widening to 8'-6" diameter, two outer longitudinal rows of 5' x 2' rectangular bracketed pillars; Four columns/pillars below each main bin, Pillars are located below the intersection of main and 1/4 walling; pillars & columns support 14" bin slab; bin slab reinforced by bars linking column heads longitudinally, transversely, and diagonally; each set of links consists of 5 bars, 3 straight and two trussed beneath each main bin; exterior basement walls straight with 6" monolithic concrete panels infilling between

outer pillars; elongated window at half height to full width of the panel

Hoppers: Mortar slab on slag concrete above bin slab
Central draw-off via conical steel hopper set into bin slab

Bins: Capacity 1,100,000 bushels
Main bins 7 x 3 in parallel rows, 4 at angled junction with House "A," cylindrical 20' in diameter on 24' centers, 95' high (above bin slab); 2 bins at NE end of building horizontally divided to load boats
Interspace bins 6 x 2, 4 asymmetrical bins between the 4 whole bins that fit into the junction between "A" & "B" houses; arrangement consists of one inner bin with 3 interspace bins around it
17 outerspace bins; conventional convex 1/4 circle outer wall; inner wall is curved to a radius of 7'-6" inside the center line of the bins
Non-tangential link wall contacts between bins; transverse and center longitudinal link walls are straight and connect the bins at their closest points; these links are 2'-8" long and 1'-6" wide; the longitudinal link walls between the outerspace bins are curved inwards and located inside the point of closest contact between main bins; these two features create a larger outerspace bin
Bin wall thickness 8"
Vertical reinforcement; jacking rods located at the intersection of exterior and interior outerspace walls; outerspace interior & exterior walls have two 1/2" verticals, in 15' lengths; straight link walls have 4, 1/2" verticals, in 15' lengths; location of remaining verticals unknown
Horizontal reinforcement wired to outside of verticals, of smooth rectangular bar; main bin reinforcement is graduated in equally spaced courses of 12"; quarter wall and curved link walls reinforcement is uniformly of
1" x 1/4" smooth bar; coursed as the main bins At their ends they are bent about a main bin vertical; the direction of the bend is reversed at every course, spreading the load between two main wall verticals; the

	intersection of main & 1/4 walls is filleted and accommodates a 1/2" square anchor bar, which hooks around adjacent jacking rods in main & 1/4 walls; link walls are reinforced with double 1/2" square contact bars at every course; the ends of the contact bars are bent about the main tank verticals
Bin Floor:	Concrete slab on I-beams, with wire reinforced concrete
Gallery:	Structural steel clad in corrugated iron, concrete roof

REFERENCES: Surviving original plans inspected courtesy of Henry Baxter provide much of the above information. City building permits give dates and the City Plans Book for 1914 construction costs.

Elevator "C"

Cost:	$250,000
Foundation:	Wooden piles capped by 3' slab; bin walls rise directly from slab
Basement:	Enclosed within bin walls, 2/3 above grade Eight free standing radially arranged pillars (3'-9" x 1' x 10') support circular concrete ring girder; ring girder 5' deep and 6' wide Bin walls pierced by conveyor and man openings between bins
Hoppers:	Conical steel to full width of bins, supported on concrete ring girder
Bins:	Capacity 1,098,371 bushels Main bins 7 x 2 in parallel rows, cylindrical 33'-6½" in diameter, height 115'-6" from foundation slab, 100'-6" from top of ring girder Interspace bins 6 x 1, of conventional form No outerspace bins

Tangential intersection between all bins, 11' long
Bin wall thickness 12" for first 7'-6", 9" to full height, 9" at intersections
Vertical reinforcing, 12 1" round jacking rods
24 1/2" round vertical rods, spaced equally about circumferences; verticals centered 2-1/2" from exterior face of wall; all deformed re-rolled rail rods, except jacking rods which are plain, new billet steel of structural grade
Horizontal reinforcing, all round rods, wired to outside of verticals, all deformed, re-rolled rail, except contact anchors & stirrups which are of new billet steel of structural grade; tank bands vary in diameter and course spacing; within the contact wall they overlap and share a common vertical; contact anchors are bent about verticals

Bin Floor: Monolithic concrete on I-beams

Gallery: Monolithic concrete

Workhouse: Monolithic concrete with concrete garner hoppers

REFERENCES: Army Engineer microfiche housed in Buffalo City Hall provides copies of the original contract and plans. Additional plans were inspected courtesy of Henry Baxter. Dates are from city building permits and costs from the City Plans Book for 1925. The completed house is described in Grain Dealers Journal, Special Plans Book 5, (1942): 163 and in American Elevator & Grain Trade, 44 (15 March 1926): 551.