CONCRETE-CENTRAL ELEVATOR
175 Buffalo River
Buffalo
Erie County
New York

HAER No. NY-243

WRITTEN HISTORICAL AND DESCRIPTIVE DATA
PHOTOGRAPHS
REDUCED COPIES OF MEASURED DRAWINGS

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

CONCRETE-CENTRAL ELEVATOR
HAER No. NY-243

Location: 175 Buffalo River, Buffalo, Erie County, New York

Date: Elevator "A": building permit application February 6, 1915; approved April 9, 1915; completed August, 1915
Elevator "B": building permit application January 14, 1916
Elevators "C/D/E": building permit application December 7, 1916; completed November, 1917

Designer: H. R. Wait, Monarch Engineering

Builder: Monarch Engineering

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 Concrete-Central elevating complex, measuring 960' x 72' and capable of storing 4,500,000 bushels of grain in 268 bins, was the largest transfer elevator in the world upon its completion in 1917. The complex lies between the Buffalo River and the tracks of the former New York Central Railroad. This site, the farthest upstream of any elevator, was apparently provided by the railroad, which seems to have been a prominent influence throughout its construction. Although apparently operated by the Eastern Grain Mill and Elevating Corporation, half of the elevator was built for the Central Elevating Corporation and was for some time known as the Central Elevator. The building's unified design was the work of H. R. Wait, the engineer of the Monarch Engineering Company of Buffalo responsible for its construction. The elevator is the third example of Wait's early standardized designs in Buffalo and differs only in small details from the Connecting Terminal and Superior "A" elevators built in 1914 and early 1915.[1]

The elevator has a full basement with columns supporting the overall bin slab on which the bins are constructed. It was built from 1915 to 1917 in three successive years of construction. The original "A" House, built in 1915, lies below the northerly section of the workhouse and extends northward beyond it. The "B" House, built in 1916, lies to the north of "A" House and is the northern terminus of the complex. The "C" House lies below the southerly section of the workhouse and extends southward beyond it. The "D" and "E" houses are still farther south. The "C," "D" and "E" houses were all built in 1917. The basement works were constructed by conventional fixed form techniques. The bins were built using slip forms lifted by yokes which bore on threaded jacking rods. The concrete was poured in 6" lifts.

The complex consisted of two distinct elevators divided about the center of the workhouse. The northern elevator, "A" and "B" houses, was known as the Concrete Elevator, while the southern range of houses was designated Central Elevator. Evidence of this subdivision may be seen in the early lettering on the workhouse. The north and south sections of the workhouse carry the words "Concrete" and "Central," which formed "Concrete-Central" on the riverside elevation and "Central-Concrete" on the landward side. At a later date this side was also changed to Concrete-Central.

The building permit for Concrete Elevator's "A" House was made in 1915, but plans for a "proposed 1 million bushel elevator for the Eastern Grain Company" date from 1914. The Eastern Grain Company transformed itself into the Eastern Grain Elevator & Mill Company in January of 1915. The structure was completed by August of that year, and the plant was operational by October.

Built at a estimated cost of $226,700, the elevator provided storage at 21 cents per bushel.

"A" House measures 212' x 72' and has a capacity of 1,050,000 bushels stored in twenty-seven main cylindrical bins, sixteen interspace bins and twenty outerspace bins. The main bins are arranged in three parallel rows of nine bins. These have an inner diameter of 20' and are spread on 24' centers with link wall contacts. The link walls are 2'-8" long. The southwest corner bin is sub-divided horizontally to provide an upper boat loading bin. The main bins have a capacity of 26,000 bushels. The capacity of the interspace bins occupying the interstices between the main bins is extended by link walls. The two rows of eight interspace bins have a capacity of 16,000 bushels. The three interspace bins below the workhouse have less capacity, as they also accommodate the elevator legs between the double longitudinal link walls. The twenty outerspace bins occupy all available spaces between the exterior main bin walls. Like the main bins, these have convex outer walls built to the diameter and equal to one-sixth of their circumference. The outerspace bins have a capacity of 4,200 bushels and rise to a height of 95' above the bin slab.

The bins are composed of 1:2:4 concrete and have a wall thickness of 8". The link walls are 1'-6" thick except beneath the workhouse, where the transverse walls are 2'-6", and the longitudinal link walls on either side of the elevating legs are 8" thick. The vertical reinforcement consists of eight 1" threaded jacking rods and eight 1/2" square verticals. The jacking rods are positioned on 8' centers at link wall intersections and at intermediate positions. On the outer wall, an intermediate position is close to the point of intersection between main and quarter (outerspace) bin walls. Ordinary verticals are placed between jacking rods at 4' intervals. The quarter walls each have two jacking rods and two verticals. The rods are close to the point of intersection with the main bin wall, and the verticals are positioned between them on 4' centers. The link walls have two ordinary verticals in 4' lapped lengths near the intersection with the main bin wall. The jacking system allowed the employment of long lengths of threaded rod. Verticals were placed in the middle of the bin wall.

The horizontal reinforcement is wired to the outside of the verticals and is of smooth (non-deformed) rectangular bar. Main bin reinforcement is graduated in equally spaced 12" courses bent about the main wall verticals--an ordinary one and a jacking rod--closest to the point of intersection. The direction of the bend is reversed at every course, spreading the load between these two verticals. The intersection of main and outerspace walls is filleted and accommodates an anchor bar of 1/2" square bar. The

anchor bar connects and is bent about the main bin and quarter wall jacking rods located close to the point of intersection. The link walls connecting the main bins are reinforced with double 1/2" square contact bars at every course. The ends of the contact bars are bent about the jacking rods located at the point of intersection.

The hoppering is provided by slag concrete placed on the bin slab and finished with an angled 4" mortar slab. Draw-off is via conical steel spouts set into the bin slab. The two basement conveyors are located in the bays below the interspace bins. The central main bins spout to either of the sets of basement conveyors; however the draw-off from the outer rows of bins is closer to the inside wall of the bins to maintain the spouting angle to the basement conveyors. The interspace bins discharge centrally to the conveyors below, while the outerspace bins discharge close to the link wall. Hoppering in these bins consists of a single inclined mortar slab.

The elevator's full height basement provides 13'-10" headroom below the bin slab and lies above ground level. The bin slab is supported by outer rows of 24" x 60" bracketed pillars incorporated into the exterior wall, and four inner rows of 3'-6" square pyramid-headed pillars. The pillars extend from the foundation slab to the bin slab over a height of 18'-10", the lower 5' of which lies below floor level. The pillars are arranged equidistantly on 12' centers and are placed beneath main bin walls at the point farthest from the link contacts. The outer pillars are located beneath the intersection of main and exterior outerspace walls. The square pillars are reinforced by twelve 1" deformed rods bound by hoops on 12" centers. The columns were designed to be loaded to 400 tons. The bin slab is 14" thick and is reinforced by roughened bars which link the pillar heads longitudinally, transversely, and diagonally. Each set of links consists of five bars, three straight and two trussed. The exterior wall is 6" thick monolithic concrete panels which infill between the outer row of pillars. Above half height, there are elongated windows to the full width of the panel. All concrete within the basement is of 1:2:4 mix.

The elevator is on wood piles of long leaf yellow pine driven to rock. The piles are distributed on 2'-4" centers below most of the elevator. Four additional piles are placed immediately below the inner columns to give a diagonal pile spacing of 1'-2". The piling interval increases to 5' towards the outside of the outer aisles, but is concentrated below the exterior row of pillars on diagonal 1'-2" centers. The arrangements are designed so that no pile bears more than twelve tons. The piles are capped by a 2'-6" thick foundation slab. The slab is reinforced with a lower grid of 1-1/4" diagonal tie bars.

Two tie bars link the area immediately below the center of the pillar footings.

The upper reinforcing system is made up of a longitudinal and transverse grid of 1" and 1-1/4" bars centered upon and extending beyond each pillar footing. The reinforcing extends over a block of 5 x 5 piles about each column footing. Two 11' long 1-1/4" bars are located longitudinally and transversely over each pile head. They are supplemented by two 6' long 1" bars placed similarly over the block of 3 x 3 piles below the pillar footing. A 4'-6" thick "slab filling" of slag concrete is above the foundation slab between the column footings, and a 4" thick floor slab lies on the slab filling. The floor slab is reinforced with a network of 1-1/4" diagonal bars. Two such bars run close to the sides of the pillars. All foundation bars are straight and of roughened or twisted square steel.

The bin floor is of 3" deep, 24" square book tiles laid on longitudinal T-section steel supported by the main transverse I-beams. The I-beams show as corbel details at the top of the bins. The book tiles are covered in a 1" mortar screen reinforced with No. 19 woven wire mesh. The bin floor does not follow the bin line, but extends beyond it to form a straight eave. The bin floor is protected by an overall single-story gallery of structural steel with concrete slab roof and corrugated iron walls. The structural steel workhouse at the southern end of the elevator rises 77' above the bin floor to a total height of 187'. The workhouse is 4 x 1 bays and contains three sets of 2,000-bushel garner hoppers and 2,000-bushel scale hoppers, all cylindrical and of steel plate. The garner hoppers are supported by an annular ring girder in a manner similar to the bins of the Great Northern Elevator. The workhouse has only two floors--a combined distribution and scale floor immediately above the bin gallery and a machinery floor at the head of the structure. The intervening free space is occupied by the hoppers.

The elevator was equipped with two movable marine towers to the standard Monarch Engineering design. The towers had internal re-elevating equipment and thus extended above the elevator gallery to a height of 150'. As originally built, a double-track railroad loading shed of structural steel and corrugated iron abutted the east side of the elevator below the workhouse. The "B" House was added to the north of the original elevator in 1916. The elevator was built by Monarch Engineering to the design of H. R. Wait at an estimated cost of $176,000, providing storage at a cost of 18 cents per bushel. When completed, the new elevator became part of the Concrete Elevator, operated and apparently owned directly by the Eastern Grain Mill & Elevating Company; however, the earliest plans, numbered contract eighty-one, are for the "proposed Central Elevator." The Central

Elevator was built a year later and to the south rather than the north of the original elevator. Although it was commissioned by the Central Elevator Corporation, the building application for the 1916 phase of construction was made in the name of the "leasees," Eastern Grain. The second and later set of working plans, numbered 81A, are for the "extension to the Concrete Elevator."

The elevator has a capacity 950,000 bushels stored in twenty-four main bins, fifteen interspace bins and eighteen outerspace bins. The design dimensioning and structural elements of the elevator are analogous to those of the original building. The precise details of the plan differ to accommodate for the sharp bend in the Buffalo River that determines the northern boundary of the site. The building is 72'-9" wide and the eastern and western elevations measure 205'-4" and 150'-8". The northern elevation occupies a diagonal following the river line. The bins are arranged in three rows that correspond to those of the original elevator. These bins also have an inner diameter of 20'.

As the river truncates the northern end of the elevator on the diagonal, the number of bins in each row differs; the easternmost row has nine whole bins, the central row eight, and the westernmost row seven. The block of 3 x 5 main bins closest to the original elevator is spread in both directions on 24' centers. If the entire elevator had been built with longitudinally spread bins, then the required number of whole bins could not have been accommodated within the space available between the river line and the original elevator. Therefore, longitudinal bin spacing is reduced to 22' and the remaining main bins have tangential longitudinal contacts and are only spread transversely. The contact thickening extends for 1'-6" on either side of the center line and has a minimum thickness of 16".

The elevator has eight interspace bins between the central and eastern row of main bins. Three of these bins are slightly smaller due to the tangential bin contacts in the northernmost main bins. There are seven interspace bins between the central and western row of main bins, two of which are slightly reduced in capacity due to the tangential contacts in the northernmost main bins.

Included in the above are the two interspace bins created at the junction of the extension and the original elevator. These are also of reduced capacity, as part of the space between the main bins of the extension and original elevator is occupied by the outerspace bins of the original elevator. There are eight outerspace bins along the eastern elevation. The outerspace bin is absent at the junction between the extension and original

elevator. Four of the bins are slightly smaller due to the tangential contacts between main bins in the northern part of the elevator. There are six outerspaces along the western elevation. An interspace is absent at the junction of the two houses, while two are of reduced capacity due to the tangential contacts between the main bins in the northern part of the building. There are two outerspace bins of large capacity between the three main bins of the northwestern end wall.

The addition of a bin to each successive row produces an end wall where the main bins step out to the east. An enlarged outerspace, resembling that found between interlocking rows of cylindrical bins, is created between the main bins of the end wall. The rear wall of these outerspaces is not formed by a link wall at the point of closest contact between the bins; rather, the bin extends back to the wall of an interior main bin. The exterior convex wall is built to, and extends over, one-third the circumference of the main bins. These outerspace bins are horizontally sub-divided to create an upper shipping bin for the loading of boats.

The Central Elevator, or Concrete-Central houses "C," "D" and "E" were built in 1917. The complex measures 442' x 72' and extends southward from the original elevator, following the same building line. The west elevation faces the Buffalo River, and a shallow bend in the river truncates the bin line to form a diagonal southwesterly side elevation. The building permit application was made in 1916, and the elevator was operational by November of the next year. The elevator was built for the Central Elevating Corporation by the Monarch Engineering Company of Buffalo to the in-house design of H. R. Wait, company engineer. The dimensioning and structural elements of the elevator are the same as those used in houses "A" and "B." The elevator was built in two lifts of 288' x 72' and 244' x 72'. The basement works were built using conventional form work, and the bins were slip formed using the Metcalf system of yoke jacking nut which acts upon threaded jacking rods. The elevator, built at an estimated cost of $475,000, provided storage at 19 cents per bushel.

The elevator had a total storage capacity of 2,500,000 bushels. The first lift of bins measuring 288' x 72' was designated as "C" House, while the southernmost block measuring 244' x 72' was divided into "D" and "E" houses. "C" House is rectangular in plan and accommodates thirty-six main bins, twenty-four interspace bins and twenty-two outerspace bins. The simple bin plan consists of three rows of twelve cylindrical bins that are coincident with and dimensionally the same as those of the original house. In addition to the two rows of eleven interspace bins within the interstices between the bins of this

house, there are two interspaces at the junction with the original elevator. These bins are of smaller volume, as part of the interstitial space is occupied by the outerspace bins of the original elevator.

Four elevating legs are placed on the center line of the building between the five northernmost rows of bins. As in the original elevator, these are between double link walls so that the eight interspace bins adjoining the elevator legs are of reduced capacity. There are eleven outerspace bins of conventional form on both the east and west elevations. Outerspaces are absent at the junction between houses.

The more complex arrangement of bins in "D" and "E" houses results from the need to maximize storage capacity as the river line begins to truncate the structure. Further complications are caused by the presence of the elevating leg of the southern workhouse. The main bins are laid out in three rows coincident with those of "C" House. The easterly row has ten main bins, the central row nine and the westerly row eight. The block of 3 x 7 main bins closest to "C" House, designated "D" House, is of conventional arrangement and both dimensionally and structurally analogous to the bins of "C" House. Within their interstices, they accommodate two rows of seven interspace bins, including two interspace bins within the interstices created at the junction between houses "C" and "D." There are twelve outerspace bins, six each on east and west elevations. Outerspaces are absent at the junction between houses "C" and "D."

The "D" House has a total of forty-seven bins--twenty-one main bins, fourteen interspace bins, and twelve outerspace bins. The "E" House refers to the bins lying between the regularly arranged bins and the diagonal end wall of the elevator and below the southern workhouse. It consists of the three southernmost bins of the eastern row of main bins, the two southernmost bins of the central bin row and the last bin of the western row. The junction between "D" and "E" houses is made by the standard link wall connections and provides two interspace and two outerspace bins of conventional design and standard dimension. The bins are spread longitudinally on 34' centers but remain spread transversely on the 24' centers. The main bins are arranged in rows which coincide with those of the rest of the complex, although the additional degree of spreading permits a whole cylindrical bin of 20' diameter to be placed between the main bins.

The resulting configuration produces a bin plan that externally resembles rows of interlocking cylindrical bins 20' in inner diameter. The interspaces occupy the area between the interlocking bins but are divided in half as the transverse link

wall is retained. The outerspaces are considerably enlarged, as there is no longitudinal link wall and the rear wall of the outerspace is formed by a segment of interlocking main bin wall. In practice, this basic geometry is considerably modified by the diagonal cut of the end wall and the presence of the elevating leg of the southern workhouse. The eastern elevation accommodates two enlarged outerspace bins. The southwest, diagonal elevation is composed of the terminal bins of the three continuous rows of main bins. Two interlocking bins are placed between these three bins to form an exterior wall which appears as convex half-segments of main bin wall. Only the southernmost of these interlocking bins is complete. The others are truncated by the presence of the elevating leg.

Both of the interlocking bins along the southwest elevation are vertically divided to create an outside bin for boat loading. The presence of the elevating leg, placed between the two bins of the central row, truncates these bins into two-third cylinders. The wall line of the elevating leg is extended into the adjoining interlocking space to form a bin with three straight walls and a segmental wall one-third the circumference of a main bin. The remaining area is occupied by four small interspace bins.

In summary, "E" House is comprised of five complete main bins--one vertically subdivided, one with two straight walls and a half-segmental wall, one with three straight walls and a third segmental wall and two that are two-third cylinders. There are also two enlarged outerspace bins, two standard outerspace bins, and four half interspace bins. The "C," "D" and "E" houses have book tile bin floors of similar specification to those of the other two houses. The bin floors are protected by a single-story gallery of structural steel clad in corrugated iron with concrete slab roofs. There are no internal partitions in the gallery which provides a continuous open space over the entire length of the building.

The northern part of "C" House features a large steel and corrugated iron workhouse that occupies an analogous position to the workhouse of the original elevator. The 5 x 1 bay structure rises 77' above the bin floor and abuts the original workhouse to form a continuous and unified structure nine bays long. The internal arrangements are analogous to those of the original workhouse, containing four 2,000-bushel cylindrical garner hopper bins and four 2,000-bushel scale hopper bins. The garner hoppers are supported on annular steel ring girders. Above "E" House is a relatively small southern workhouse with only one set of garner and scale hoppers. Its primary function was to re-elevate grain unloaded at the fixed marine tower to the south of this house.

Several other works undertaken in 1917 essentially completed

the complex as it is seen today. The tracks for the marine towers extend along the western elevation of "C" and "D" houses, and an additional movable marine tower similar to the two original towers was added. Unloading capacity was increased further by the construction of a fixed marine tower. The tower is isolated from the main elevator, lying about 100 yards to the south of "E" House. It consists of a square concrete tower, which together with the cylindrical fixed concrete tower at Washburn Crosby, is the only example of concrete marine tower construction in Buffalo. The tower does not have re-elevating equipment; grain was transferred by a sub-basement conveyor tunnel to "E" House to be re-elevated by the machinery in the southern workhouse.

Originally, no provision was made for the reconditioning of grain, as it was thought that the drying and cleaning facilities at the Eastern Grain-owned Iron Elevator would suffice. By 1917, these arrangements were both inadequate and inconvenient. A drier and cleaner house was added at the north end of "B" House abutting the eastern wall of bins. The building is of concrete frame construction with brick panel infill and contains a single rectangular drier bin of 15,000 bushel capacity. A small, low workhouse was added between the elevator and the drier house to re-elevate conditioned grain to the bin floor. The railroad loading and unloading facilities were also substantially increased, the original double-track shed being incorporated into a new quadruple-track shed which extended along both "A" and "C" houses in the area below their combined workhouses.

BUSINESS HISTORY

The history of Concrete-Central Grain Elevator is inextricably bound to the family histories of the men who founded and built it. As part of Eastern Grain Mill & Elevator Co., Concrete-Central was originally constructed under the aegis of several smaller grain trading operations, all of which were owned by a group of men led by Nisbet Grammer and John J. Rammacher. In its various incarnations, Eastern Grain Mill & Elevator lasted over a quarter century and became the largest grain trading and handling corporation east of Chicago. Over the years, the firm owned or operated seven Buffalo grain elevators but built only the massive Concrete-Central.

The Eastern Grain Mill & Elevator Corporation began modestly with the founding of the Iron Elevator and Transfer Company incorporated in Buffalo November 13, 1900. Its ostensible purpose was to erect elevators and handle grain "and other merchandise." The company's initial authorized capital was a modest $100,000, privately held among a limited number of partners represented by four directors, two from Chicago and two,

Treasurer George W. Bartlett and Thomas E. Ferguson, from Buffalo.[2]

By 1906, however, the company's ownership was reorganized. Elevator manager Nisbet Grammer had been catapulted to company president, presumably as a reward for his careful oversight of the elevator's reconstruction after a disastrous fire in 1901. By 1908 Grammer had control of the company holdings by owning the majority of stock shares.[3] Two years later, in 1910, Grammer and Rammacher founded Eastern Grain Company, a similar corporation with the same general purposes as those of the Iron Elevator Company. However, Eastern Grain had a more overt goal of not only handling grain and operating elevators but also acting as commodity brokers and real estate developers and trading in intangible property such as promissory notes and bills of exchange.

Perhaps fearing charges of conflict of interest from the Iron Elevator owners, neither Nisbet nor Rammacher were founding directors of the new Eastern Grain enterprise; instead the three incorporators were John Croover, a chauffeur; George Klahs, a bookkeeper, and F. A. Parker (actually Fanny A. Parker), a stenographer. The use of "cut outs" as nominal incorporators was not uncommon before 1918, when ownership interests were obscured for various reasons. Between 1910 and 1914 both Grammer and Rammacher remained "silent partners" in this new enterprise.[4]

In January, 1914, a third company was formed. The Eastern Milling Corporation was organized to fulfill purposes similar but not identical to those of Eastern Grain. This new venture was openly incorporated by Grammer and Rammacher along with Frank J. Maurer, who at the time was also an Eastern Grain employee. The Eastern Milling was incorporated just as the Clayton Act was implemented outlawing interlocking directorships between and among theoretically competing companies. Grammer and Rammacher may have taken care to designate the new company's operating goals as sufficiently different from those of Eastern Grain to avoid apparent conflicts of interest. The latter did not have a mandate to engage in milling thus rendering it distinct from the new company.[5]

In August of 1914, Grammer, Rammacher, and Maurer created Eastern Grain, Mill & Elevator Corporation (EGM&E) and openly engaged in all of the business activities of its smaller predecessors. The new company, however, declared itself to have only $1,000 in capital stock to be issued in ten shares of $100 each. Four months later, in December, 1914, EGM&E increased its capital to $340,000. The stock was sold in 3,400 shares of $100 each but the original ten shares were the only ones outstanding. Grammer owned eight shares and Rammacher and Maurer owned one

share each. One week later, stockholders of all the companies voted to consolidate Iron Elevator, Eastern Grain, Eastern Milling, and Eastern Grain, Mill & Elevator under EGM&E control. By January, 1915, the fiction of distinct corporation was resolved once and for all with the creation of one large holding and operating company.[6]

By August, 1915, however, an additional venture was formed by Grammer and Rammacher along with a new partner, Norman B. Macpherson. Macpherson's ties to EGM&E would last for over two decades and extend through several of the company's numerous ventures. The new business was named the Central Elevator Corporation and was capitalized at $300,000. Its operating purposes were virtually identical to those of EGM&E, so the reason for the separate corporate identity is not entirely clear. The company probably spread the mortgage and capital liability among other fictitious entities. As Central Elevator lasted for thirteen years and was to play a critical role in the direct property development of Concrete-Central Elevator, it may have been developed to protect existing capital and to secure a fresh infusion of financing to underwrite the company's expansion program.[7]

The appearance of Concrete-Central Elevator on the Buffalo River occurred in three stages, 1915, 1916, and 1917. The lack of publicity attending its gestation and birth was probably due to the general public information blackout concerning all major building projects during World War I. Despite the fact that the elevator was in private hands, it was of governmental interest, as were all other terminal and transfer elevators of the time.

A critical link in the foreign and domestic food distribution chain, Buffalo's new elevator was considered as much a national security factor as would a munitions plant. The nation feared foreign sabotage on one hand and labor-farmer unrest on the other. In 1917, New York Stock Exchange President Herbert C. Hoover asked elevator owners to guard their property against crop destruction threats from cash-poor farmers and their "I.W.W. allies" and from a wave of incendiary fires that had already swept midwest elevators. Hoover's request implied that the latter events were the result of spies and saboteurs.[8]

Three separate permits were filed, one in 1915 and two in 1916, to begin construction on the original elevator and its two extensions. EGM&E built the first two parts, the original elevator and its extension.[9] The third permit for the second extension was filed by the Central Elevator Corporation.[10] The precise operating agreements between the two companies are unclear, but since the ownership of Central and EGMM&E were

virtually identical, close cooperation may reasonably be inferred. The ownership of the Concrete-Central Elevator property was even more complex than the bifurcated ownership of the structure. The origins of the real estate transactions derived directly from Nisbet Grammer's family history rather than from impersonal corporate exchanges.

Grammer's father was Capt. George J. Grammer, a vice president of the New York Central Railroad and the man in line for the rail line's presidency at the time of his death in 1907.[11] Nisbet Grammer's 1908 ascendence to ownership of the Iron Elevator may well have been enabled by a substantial inheritance, but, more important, was a legacy of alliances and friendships with his father's railroad colleagues that directly affected the establishment of Concrete-Central.

In October, 1913, the New York Central & Hudson Railroad (later shortened to the NYCRR), mortgaged a tract of land along the Buffalo River in Township 10, Range 8 of the Buffalo Creek Reservation. The mortgage was registered in Erie County and issued by Guaranty Trust Co., the J. P. Morgan investment bank. In June, 1915, a supplement was added to the mortgage to include the Lake Shore and Michigan Southern Railroad property adjoining the existing lots which together were held exclusively by the New York Central.[12] Newspaper reports from 1914 stating that EGM&E was to build its new elevator on lands purchased from the New York Central Railroad were not entirely accurate.

In December, 1916, some of the NYCRR lands were leased to Central Elevator Corporation, and on May 15, 1917, an encumbered sale of two lots was made. The restrictive proviso in the deed notes that the conveyance was solely for the purpose of "handling grain"; if the property were abandoned for more than ninety days or the grain handling business ended, the property would revert to the railroad at the same rate per square foot as that originally paid and without payment to Eastern Grain or Central Elevator for any additional buildings or structures.[13] At the time Concrete-Central Elevator was built (1915-1917), the land upon which all three sections rested was either owned or controlled by the railroad, not by the two elevator companies.

Grammer unquestionably obtained a toe hold on the desirable riverside location through his NYCRR linkages with his father's old friends. But, since 1917 was a very poor year for the grain trade, even these paternal relations could not garner him or his companies outright control over such valuable property. NYCRR officials could hardly be faulted for their unwillingness to risk an outright sale of their rights-of-way for the first-ever venture of their old partner's untested son.

EGM&E and Central Elevator did not consolidate their control over the elevator real estate for another decade. On December 7, 1927, Central Elevator finally purchased parcels 1-3 of lot 61, which they had been leasing for eleven years. In a separate transaction the same day, EGM&E was released from the railroad's restrictive covenants to gain unfettered control of the property parcels they had owned. Ten days later, December 17, 1927, Central Elevator sold its portion of the land and, implicitly, the part of the elevator under its control, to EGM&E. Having served Grammer and Rammacher primarily as a property holding company that was no longer needed, Central Elevator Corporation was dissolved twenty-four days later, January 10, 1928.[14]

When EGM&E consolidation was first recorded, the company's capitalization reflected the owners' ambitious expansion program, soaring from the original $340,000 to $1 million. Stock in the member companies was converted to EGM&E stock and, although the company remained private, stock was presumably sold to a somewhat wider range of investors. The new company first issued two classes of stock--half preferred with a guaranteed 7 percent annual return, and half common with no assured dividend. Both sold for $100 per share. The new company added two additional directors, George J. Grammer and Norman Clement, the latter an officer of Marine Trust Company (now Marine Midland, a global banking company) and a local property developer.[15]

The company's expansion lived up to the original partners' greatest expectations. Capitalization soared from $2 million in 1916 to $3 million in 1919 and $5 million in 1922. The number of stockholders who authorized the 1922 expansion was less than fifty individuals or estates, indicating that EGM&E remained tightly controlled and largely family dominated. In 1924 capital increased to $6 million, and three years later, to $7 million. Clearly the rapidity of company growth validated stockholders' authorization of risk-taking and reflected a solid profitability throughout the 1920s.[16]

Having established its own ground as elevator operators and, by extension, grain traders, the company began leasing or buying existing elevators in the Buffalo area. In 1919-1920 it leased the Evans Elevator (no longer extant) and in 1921 developed a separate company, Island Warehouse, that acquired the Mutual Elevator, once known as the Great Northern. Shortly thereafter, Island Warehouse sold out to flour milling giant Pillsbury, but Island Warehouse remained an active subsidiary of the Minneapolis corporation. EGM&E leased two other elevators in the 1920s and in 1929 created the Nisbet Elevator Corporation, named for Grammer's maternal family line. Nisbet bought the brand new Standard Elevator built by Hecker-Jones-Jewell, a New York City

firm that had just been acquired by the diversified conglomerate, the Gold Dust Corporation.[17]

In late 1922 EGM&E entered an entirely new field related to its existing business. It formed two alliances with Armour Grain Company, a subsidiary of Armour & Company, the huge Chicago meat packing business. These combined ventures brought EGM&E into the ranks of the national grain trading ventures. The first operation, Eastern Steamship Company, was formed by agreement between the two grain merchants December 22, 1922, and officially incorporated October 23, 1923. The directors for Eastern Steamship were all drawn from EGM&E with the company capitalized at $1 million. The company bought its first lake vessel one week before it was chartered, and the day after official incorporation it purchased three more lake vessels from Republic Transportation. The following year, Eastern Steamship purchased six new canal-sized steamers with a total capacity of 1.6 million bushels from English and Scottish naval yards. By this time the company had expanded its fleet to ten large lake carriers.[18]

Eastern Steamship had a second dimension which was crucial to its survival in international grain trading. In addition to its domestic operations, the company opened Eastern Steamship Ltd., a Canadian corporation based out of Port Colborne, Ontario. This expansion was important to both EGM&E and Armour for two reasons. First, Armour and Company was part of a 1920 Supreme Court consent decree barring the company from all activities unrelated to meat packing. The company was given until 1925 to divest itself of non-meat packing holdings. Armour's involvement in Eastern Steamship was obscured by both the EGM&E dominance of operations and by the Canadian incorporation which was not covered in the consent decree.

Second, both companies needed a Canadian base for shipping since in 1922 the Canadian government was expressing great reluctance to permit U.S. ships to enter the Canadian coastal trade on Canada's side of the Great Lakes. Having a Canadian wing of operations for Eastern Steamship could prove enormously beneficial in bypassing Canadian government regulations. Between 1923 and 1926, the fleet was expanded to twenty-one "Montreal-type" boats and four large lakers which could ply the St. Lawrence as far as Montreal. A brief fling into a new subsidiary, Grammer Steamship Co., added another laker. The company did extremely well through the 1920s because it was managed by Boland & Cornelius, the large, successful Buffalo shipping line, but it fell on hard times during the North American agricultural and general depression of the early 1930s. The company was formally dissolved in 1932, although the ships were retained and presumably used until after Grammer's death

three years later.[19]

In 1925, Eastern Grain Milling & Elevator and Armour formed a second joint venture to operate Great Lakes elevators. They became the Lake Elevator Corporation, with EGM&E serving as the dominant "public" partner and Armour as the "silent" partner. The new company operated two 1-million-bushel Buffalo-based elevators, the Export Elevator and the Connecting Terminal and a third elevator in Erie, Pennsylvania.[20] In March of 1929, Eastern Grain Mill & Elevator Corporation voted to change its name to Eastern Grain Elevator Corporation. The change was a reflection of the simple fact that the company never had, and likely never would, actively engage in flour milling or other forms of grain processing. What the new name did not reflect was the breadth of the company's expansion and growth as a leading grain trading as well as storing operation.[21] The next month, EGM&E purchased Buffalo's 2-million-bushel Electric Elevator. With Concrete-Central as the company's primary facility, the company owned four elevators and 10,000,000 bushels of capacity, making EGM&E the largest grain handling company east of Chicago in the 1920s.

Despite its competitive advantages, the general decline of grain receipts during that period took its toll on the company's fortunes. By 1934-1935, a brief glimmer of improvement portended great things to come. Rammacher negotiated the largest cash corn sale ever made in the United States by purchasing 2.75 million bushels to be stored in Concrete-Central and the Nisbet. He then sold the entire lot to Farmers' National Grain Corporation in Chicago for $2.75 million. Despite this coup and the general agricultural upturn in 1935 and 1936, disaster befell Eastern Grain Mill and Elevator.[22]

The company was rocked by the untimely death of its foremost leader, Nisbet Grammer, who suffered a heart attack in April, 1935. The company's vote to reduce its capital and number of shares the next year was followed by two more such moves in 1937. The third reduction brought the company's capitalization down to $1 million. A progressive cashing out by Grammer's heirs and estate and poor business conditions in general contributed to the decline in value.

In 1938 Rammacher also died, a victim of injuries suffered in a horse riding accident while at his summer home in Ontario, Canada. Since the stock ownership and daily business control had been so tightly dominated by the two original partners, there was insufficient slack for other stockholders or managers to continue the company's operations beyond the wishes of the heirs. With both families seeking to liquidate assets as quickly as possible, most of the elevators, ships, and other assets were

divested rapidly. The only survivor, Concrete-Central, carried the company fortunes until 1944 when it was sold to Continental Grain. In 1945 Eastern Grain was finally liquidated, closing an important chapter in both the local and national grain trading history.[23]

Continental Grain is still one of the nation's top two grain trading firms and one of the top five traders in the world. Continental's international headquarters was based in New York City during World War II but the company's origins date back to nineteenth-century Belgium, where Simon Fribourg parlayed his modest grain trading business into an empire. In 1848, a year that brought social and political revolutions to Europe, food shortages were rampant in many countries. Simon's son, Michel, saw many of his fellow Belgians in the throes of imminent starvation. Carrying bags or trunks of gold (the story varies), Michel embarked on a dangerous trek to Bessarabia to buy wheat for Belgian millers and importers. The supply of grain he brought back alleviated his fellow citizens' suffering. By the Franco-Prussian war of 1870, the Fribourg family was not only trading grain as major European brokers but also building its own flour mills in Belgium and Luxembourg.[24]

During World War I, the company relocated its headquarters to Paris where it prospered during the inter-war years. In 1926 Continental Grain established American operations, registering as a Delaware corporation with three U.S. subscribers holding ten of the available 10,000 shares.[25] The Fribourgs' American operations were not initially lucrative for the same reasons that affected domestic corporations. The 1920s farm depression was compounded by the global depression of the 1930s. The liquidity of the Fribourg empire, however, enabled Continental Grain to pursue trans-Atlantic and other international business while waiting for the U.S. market to recover, and to take advantage of the occasional buy-out to establish and retain a secure toehold in the American commodities operations. In 1933, Jules Fribourg made the single largest purchase of surplus American wheat ever negotiated (1 million tons), and the Federal Farm Board did not forget the Belgian's largesse.[26]

The Fribourgs weathered the early years of Hitler's rise to power, but, as a prominent Jewish mercantile family, were forced to flee Paris after the German occupation in 1940. At this point the company relocated to New York City where, in 1944, fifth generation scion Michel Fribourg assumed control at age twenty. While he learned the business, operations were directed by his father's international associates--William Schilthius, originally from the Netherlands, German-born Julius Mayer, and American Eugene Bissell.

Under their "regency," then under young Michele's direct guidance, Continental's U.S. operation blossomed. In less than two decades, Continental grew to rival domestic giant Cargill, Inc. in both the international and domestic grain trade. By the 1960s, Continental controlled 25 percent of the international trade and 20 to 25 percent of the U.S. domestic export grain shipping and exchange. Continental based its operations on a chain of inter-related facilities that moved and consolidated grain from the countryside to the market. The company owned a large string of country elevators, over a dozen large-capacity riverside transfer elevators including Concrete-Central, and eight massive overseas export elevators located in major port cities, six in the United States, two in Canada. Continental also leased hundreds of railroad cars and owned sixty-five river barges and twenty-five lakers and "salties" with 500,000-ton capacities.[27] Continental's objective was "to gain control of the transportation and logistics of the grain flow from the country to its export elevators." It was so effective that it automatically required and obtained the majority of railroad cars, thus putting smaller companies at a significant disadvantage.[28]

The Fribourg/Continental Grain holdings were extended into other operations as well. Since Michel Fribourg owns 90 percent of the company, the two interests are virtually indistinguishable. By 1970 Continental had at least 100 companies under its control. It bought out the west-coast baker, Arnold and its Oroweat line, Hilbun Chicken processing, Wayne feeds, and other merchant and consumer lines. In 1965 Continental bought Allied Mills, which in 1970 acquired the agricultural products division of Quaker Oats. Continental's U.S. operations were matched by similar acquisitions in Europe and Latin America.

During the 1960s, Fribourg publicly revealed his banking and financial interests. When he saw the growing trend toward large bank takeovers, he divested himself of his holdings in two small banks in Paris and Zurich, retaining only a 35 percent interest in a finance company in Lausanne, Switzerland. Unfortunately, that holding was tied to extremely unstable real estate transactions, and it failed when its use of Eurodollars to finance mortgage payments proved impossible. When the finance company declared bankruptcy in 1970, a number of the other stockholders personally blamed Fribourg.[29] That particular failure, however, proved a comparatively small blot on Continental's overall performance. Continental's acquisition of the Concrete-Central Grain Elevator in 1944 was one of the first acts of the grain trading firm once it was based in New York City. The purchase represented the entree of, not the first but

certainly one of the largest, grain traders into Buffalo elevating circles.

Although the purchase was consummated in December, 1944, Continental Grain did not secure the $500,000 mortgage for the property from Chicago's Continental Illinois Bank until three months later in March, 1945. At this point Michel Fribourg was himself firmly in command at the grain company.[30] Clearly he and Continental had expectations of growth and expansion at the site beyond operation of the elevator alone. Not only did Continental acquire the physical plant, "...the grain elevator having a capacity of approximately four 250,000 bushels," and Allied facilities, but also all of adjoining Lot 187, slightly over four acres, and a portion of Lot 186. Both of these properties were purchased from Alexander Davidson. The company built a garage and repair shop and made minor alterations to the elevator between 1949 and 1950, but otherwise it did not expand the property or enlarge the elevator's operations. Instead, corporate strategy diverted capital in ways that did not tie investment directly to Buffalo. Expanded storage space was achieved by chartering lake vessels and using them as floating warehouses on the Buffalo River.[31]

Continental owned Concrete-Central for over twenty-two years until early 1967. The value of the large transfer elevator to Continental's marketing and distribution strategies survived the 1959 opening of the St. Lawrence Seaway, since Buffalo's utility as a bulk storage operation, especially for winter periods, remained consistent with Continental's receipts. As one of the top two grain traders in America, Continental was well placed to capture a lion's share of the post-World War II government-surplus grain trade, particularly that destined for export. Continental dominated both the Soviet and Japanese trading operation to which was consigned the Commodity Credit Corporation surpluses; but the European market continued to command 30 percent or better of Continental's overall trade from CCC reserves. Concrete-Central remained a key fixture in the company's delivery and storage patterns, since it could be used to retain supplies during abundant harvests and keep sufficient shortages in play to avoid flooding the export market and thereby reducing prices. Winter reserves could be shipped during the cold months via rail or were available in early spring to be shipped immediately out the St. Lawrence at the earliest moment of spring Seaway opening, giving Continental a major strategic advantage over shippers having to wait for supplies from the upper lakes.[32]

Between 1963 and 1966, however, several events occurred that changed Continental's focus from the enduring utility of

Concrete- Central to the corporation's own plans. First, a crisis was caused by the sudden unavailability of grain from the Commodity Credit Corporation. Then, the 1964 loss of preferential rail rates from Buffalo to the east coast came on top of the 1963 increase in demurrage fees that railroads charged elevators for waiting time during loading and unloading.

The fight to restore preferential rates from Buffalo ended decisively in 1966 when, rather than reviving lower tariffs from the city eastward, the Traffic Executives Association of the Eastern Railroads moved to include feed ingredients as well as regular grains in the higher haulage rates.[33] These external factors combined with a number of internal changes within Continental itself. In 1966 Continental embarked on its first real corporate diversification plan, and the elevator in Buffalo must have seemed more attractive as a potential source of capital from its sale than as an operating entity which now had insufficient grain receipts and increased haulage fees for rail-born exports. By June, 1967, the company decided that it would sell its inactive elevator, now a white elephant within the corporate scheme of things.[34]

Continental quickly found a buyer, the newly-formed Buffalo Grain Elevator Company, which provided the ready money it needed. The elevator was still idle, and the outer lots, 187 and 186, had been sold in 1960 to George J. Schnatz of Kenmore, New York, who had no apparent interest in elevator development. In any case, those lots were unavailable in 1967 as a source of further cash. The sale to Buffalo Grain was adequate, but just to hedge its bets Continental wrote into the sale a lease-back deal with Buffalo Grain wherein the grain merchant company would use Concrete-Central on a rental basis should CCC grain supplies and improved freight rates make the trading scenario more lucrative. In 1968 Continental announced that it would reopen Concrete-Central provided those factors were in place.[35]

Buffalo Grain Elevator does not appear to have run Concrete-Central at all. Incorporated solely to "buy, sell, and deal in real estate," it was not a grain company but a property trader. Grain was stored in the elevator as late as 1973, but on whose behalf and by what concern is not entirely clear. The presumption that the grain was CCC stores held for Continental cannot be confirmed. The property went into city receivership for $175,000 in back taxes and was placed for auction with the city treasurer on October 24, 1973. At the time of sale, the identified parties acting on behalf of Buffalo Grain Elevator Corporation were L. M. Smith and G. L. Wilhelm, both of Albany. In 1975, when Buffalo Grain Elevator was officially dissolved, the primary actors in the company were Arnold B. Gardner and

Edwin H. Kavinoky, both senior partners of Kavinoky, Cook, Hepp, Sandler, Gardner & Wisbaum, a prominent Buffalo law firm. The two men were serving respectively as vice president-secretary and president-treasurer. The bankruptcy and corporate dissolution left Concrete-Central utterly abandoned as a derelict property under only the city's control.[36]

In its final days Concrete-Central was stripped of much of its machinery, both by scavengers illegally trying to obtain scrapping rights and by vandals. Over $250,000 worth of equipment and office furniture was removed, leaving only a building shell and odd pieces of equipment. The building itself fell into disrepair, and before the city acted to remove the first-floor stairway, a young boy was killed in a fall from the roof.[37] No one has taken responsibility for the once-majestic structure, and it remains in disrepair, untended to this day.

MATERIALS HANDLING: HISTORY AND DESCRIPTION

Receiving by Water

The Concrete Elevator, the first phase in Eastern Grain, Mill & Elevator Company's overall construction project, began handling cargoes during the autumn of 1915. At that time the new facility was equipped with two movable marine towers. A solid concrete dock on a piling foundation supported these ungainly structures. The electrically-propelled towers were mounted on twenty pairs of car wheels. For unloading through the various hatches of lake vessels, the marine towers could be operated as close together as 48' or as far apart as 192' on centers. Each tower was capable of delivering grain either to storage bins by direct spouting or to conveyor belts on the bin floor of the elevator for further distribution. Use of the distributing belts rather than direct spouting avoided the loss of time involved in shifting either the towers or the vessel, but also entailed some restriction of other transfer functions. The nominal unloading capacity of each marine leg was rated at 24,000 bu./hr.; early operations indicated that an overall level of 50,000 bu./hr. could be sustained for extended periods. During one forty-hour stretch, a total of 1,070,000 bushels was unloaded, an hourly average of 26,750 bushels including cleanup time at three vessels.

The addition of the Central Elevator in 1917, which more than doubled the storage capacity built during the two previous construction phases, also resulted in doubling marine receiving capability. A third movable tower was added at dockside and a fixed tower provided south of the main house. The latter

structure was designed primarily for handling odd lot cargoes, presumably shipments that could be unloaded through a single hatch or without excessive shifting of the vessel. Conventional practice involved operation of the three marine legs in one or two boats. The movable towers commanded an overall 750' length of travel along the dock. It was, however, feasible to accommodate three lakers simultaneously along the river frontage of the complex by stationing two marine towers at one vessel with the remaining movable tower at a second ship while using the fixed leg to handle a third boat. As the number of marine legs multiplied, nominal hourly unloading rates remained at the level of 20,000-25,000 bushels per individual leg. While in actual practice maximum unloading capacity per leg occasionally reached 35,000 bu./hr. on the dip, the average dropped to only 18,000 bu./hr. when operating in conjunction with the ship shovels and scooper gangs. During the 1919 shipping season two of the legs elevated 526,380 bushels of oats from a vessel over a 13 1/2-hour period, an hourly average of 19,495 bushels per leg.

The marine towers were constructed of structural steel and originally covered with corrugated iron. They stood approximately 157'-6" in height. Each tower functioned as a self-contained unit for elevating, weighing and re-elevating cargoes. The legs carried grain up out of vessels in a double row of 12" x 8" buckets, mounted on a 26", seven-ply belt. A 75 hp at 715 rpm motor located at the crosshead drove each marine leg through reduction gearing. The marine legs were counterbalanced with sixteen-ton cast-iron weights connected to the crosshead by steel cables; when these weights were released the entire leg assembly of head and boot pulleys, framing, belt, buckets, motor and crosshead descended gradually along guides out of the tower and into the hold, assisted by a mechanical pusher. A 50 hp at 480 rpm motor, located on the first floor of the tower, powered the vertical-screw pusher arm as well as several other functions through a complicated series of rope and gear drives whose composite design revealed the transitional nature of the original engineering. The rope drives, with accompanying tensioners, passed up through the tower to countershafts on three different levels. The pusher was driven from the scale floor. Other rope drives transmitted power to the hoist winch that lifted the marine leg out of the vessel and to the winches for the ship shovels. The hoist was operated through spur-and-pinion gearing and the pusher by a worm-and-nut arrangement through spur gears. The same 50 hp motor also drove the first-floor winch that moved the towers along the dock. This complex rope drive power transmission system is no longer extant; individual motors were later substituted to drive each function directly, a practice generally adopted in Buffalo elevators during the 1920s.

Each marine leg elevated grain to its own 1,000 bushel upper

garner which in turn discharged into a 400 bushel receiving scale. The upper garner featured a 48" rotary gate, the scale hopper a 24" counterweighted dump gate. Following instore weighing, grain then descended by gravity through a 1,000 bushel lower garner to the Buffalo-pattern boot of the marine tower lofter leg for re-elevation to the storage house. The tower lofters featured a double row of 16" x 8" x 34" V-buckets and were driven by 100 hp at 480 rpm motors located at bin floor level, through a rope-driven countershaft with spur-and-pinion reduction gearing to the headshafts. The original capacity of the tower lofters equalled that of the marine leg. Grain discharged at the head pulley was delivered to the bin floor through rooftop V-hoppers either directly into storage bins or onto the distributing conveyors; it could also be routed to the grain conditioning department.

The square stationary tower at the south end of the dock functioned in the same general manner as the movable legs, though no lofter was necessary for reelevation. A 48" horizontal belt housed in a tunnel conveyed grain at a rate of 25,000 bu./hr. to a lofter and headhouse located at the south end of the elevator proper. The capacity of the instore scale associated with the fixed marine leg was 1,000 bushels, reflecting the smaller amounts of grain ordinarily handled via this route. Hourly marine unloading rates at Concrete-Central remained constant at a nominal level of 25,000 bushels per leg through the 1960s. As of 1971, after Continental Grain had disposed of its interest in the elevator, the three functional legs were each rated at 15,000 bu./hr. The leg in the fixed tower had presumably been taken out of service by then.

Receiving by Rail

Because of close association with New York Central interests, the Eastern Grain group anticipated handling substantial quantities of all-rail grain and sited its new elevator accordingly. Monarch Engineering designed extensive apparatus for unloading cars and transferring their contents into Concrete-Central for conditioning, storage or shipment.

As of 1915 rail receiving equipment was housed in a steel car shed on the east side of the original Concrete Elevator. Three tracks, each with space for thirty-two cars, entered the shed from the nearby New York Central yards. Two of these tracks were equipped for receiving grain from boxcars. A three-drum car puller, driven by a 35 hp motor at 480 rpm, was used in spotting cars over a pair of double track hoppers with interlocking grates. Men operating two sets of double Clark-Beatty power shovels cleared grain from inside the cars. The power shovels were driven from a 20 hp motor at 480 rpm. A pair of 36"

receiving conveyors connected the car pits with the receiving lofters in the workhouse. These transverse conveyors were driven by 10 hp motors at 715 rpm and rated at 12,000 bu./hr. At this stage of development sixty cars could be unloaded over a ten-hour period.

By the time all phases of construction had been completed the car shed had been enlarged to cover five tracks with a proportional augmentation of rail receiving machinery. A dozen cars could be unloaded simultaneously at six groups of double receiving pits. A total of four transverse conveyors carried grain from the car pits to the receiving legs. Approximately eighteen cars per hour could be handled in this fashion. During the 1920s and 1930s Concrete-Central's rail unloading capacity remained steady at eighteen to twenty cars per hour, equivalent to 36,000-40,000 bushels of grain. By 1971 only four receiving pits remained in service at the car shed. These pits and power shovels were capable of unloading seven cars per hour. Car dumpers for more rapid handling were never installed at Concrete-Central.

Instore Distribution: Vertical and Horizontal Handling

Grain received through the mobile marine towers could be routed to a number of destinations: the storage bins via spouting or belts; the grain conditioning department via conveyor; or immediate transfer to water or rail shipping facilities. Rail receipts followed many of the same paths. To accomplish these coordinated movements in an efficient manner, Concrete-Central featured an impressive array of elevating and conveying equipment.

When the first section of the Concrete Elevator opened for business, the spouting system fed by the marine towers was capable of reaching all the storage bins, though it is unlikely that either tower had access to the entire house via this mode from any given position on the dock. Marine receipts could be discharged by means of switch gates into the lines of distributors on either the dock or track side of the elevator for immediate delivery to loading spouts. As of 1915, two 42" conveyors on the bin floor distributed instore grain received through the rooftop V-hoppers. Adjustable belt concentrators and travelling loading hoppers contained the spread of dust as grain was fed onto the conveyors. These belts were reversible and were equipped with self-propelled trippers for discharging grain at the desired point. Each conveyor was driven by a 20 hp motor at 715 rpm and had a carrying capacity of 20,000 bu./hr.

With the expansion of the original elevator in 1916-1917, belt arrangements on the bin floor became more elaborate.

Although four distributing conveyors were apparently installed, the only section where four longitudinal belts remain in today is in the northernmost section of the Concrete Elevator, completed in 1916. The fourth belt in this area actually serviced the drier leg. Of the three extant distribution belts, the one on the west (river) side features different trippers and rail mounts from the other two. The bin floor belts are divided at the workhouse legs between the Concrete and Central elevator sections.

The transverse belts from the car pits delivered grain through tunnels to the boots of the house receiving legs. Though all seven internal workhouse lofters could be pressed into service for shipping, differences in features and distinctions in nomenclature suggest that these legs were intended to serve particular functions on most occasions. In the workhouse of the Concrete Elevator, two of the three lofters specialized in receiving. Two out of four legs in the adjacent Central Elevator were likewise denominated as receiving legs. A single row of 20" x 8" V-buckets was attached to each belt. The receiving legs were driven at the head pulley through spur-and-pinion gearing by a 75 hp at 285 rpm motor. Each leg had a rated capacity of 12,000 bu./hr.

For each of the seven lofting legs the headhouse contained a set of steel garners and hopper scales. Turnhead spouts on the head (top) floor of the workhouse diverted the flow of grain into either of the flanking garners. The capacity of both garners and scales was 2,000 bushels. The outlet from each garner was a 48' rotary gate; the scape hopper outlets consisted of 33' rotary gates with independently-supported cast-iron turnheads. The scales featured trussed levers with recording beams and could weigh up to 120,000 lbs. in a single draft. Underneath each scale a grouping of four distributing hoppers directed grain to bins, belts, conditioners or loading spouts.

Grain Conditioning

The Concrete Elevator initially handled a considerable amount of waterborne grain that had previously undergone cleaning at the western lakehead. The Grammer-Rammacher interests also operated the Iron Elevator which was furnished with a complete battery of machinery for conditioning all-rail grain. Therefore, as of 1915, equipment for cleaning grain at the Concrete site was rather modest, consisting of only a single aspirating separator. However, the completed Concrete-Central complex ultimately featured greater cleaning and drying capability. All the conditioning equipment was located in the drier house on the land (east) side at the north end of the elevator. The bin floor belts delivered grain from the headhouse instore scales or the marine tower distribution route to a 15,000-bushel bin above the drier.

The No. 8 Hess Drier, similar to units installed at the Iron and Superior elevators, had a rated capacity of 20,000 bushels per day.[38] Hoppers under the drier discharged into a 500-bushel scale. Once the dried grain had been weighed it was delivered to a separate leg by a conveyor powered by an electric motor with chain drive.

At Concrete-Central power transmission through chain drive was used only in the drier house where noise reduction associated with more costly gear drives may have been considered less of a priority or the consequences of sparking and explosion less disastrous. Grain cleaning equipment in the drier house consisted of two No. 11 Monitor oat clippers with 2,000 bushel hourly capacity, one No. 11 double Monitor Warehouse and Elevator Separator with 4,500 bushel hourly capacity, and one Monitor Northwestern Separator with 500-1,000 bushel hourly capacity. The Monitor line was produced by the Huntley Mfg. Co., then of Silver Creek, New York. This conditioning equipment remained in place through the 1930s, along with a 12,000 bu./hr. blower. As of 1971 the drier, clipper, and cleaner were still considered available for service.

Shipping by Rail and Water

Movement of grain out of storage required use of the basement shipping belts, house lofters, outstore scales, distribution spouts or bin floor belts, and car or dock spouts. The two lower conveyors were 36" wide and rated at 15,000 bu./hr. These belts were not reversible--that is, they ran constantly in the direction of the workhouse--and featured two-pulley trippers for discharge into the boot of the appropriate shipping leg. As was the case with the upper conveyors, the basement belts were driven by 20 hp at 715 rpm motors with spur-and-pinion gear drives. Certain storage bins could spout directly to the elevator boots; thus the conveyors were not required for that part of the cycle. Three of the seven house legs were particularly designated for outstore deliveries. These lofters featured double rows of 12" x 8" V-buckets and were driven through reduction gearing at the head pulleys by 100 hp at 285 rpm motors. The shipping legs were rated at 15,000 bu./hr.

Following elevation and outstore weighing through the 2,000-bushel garner-scale sets in the headhouse, grain passing through the distribution turnspouts could be directed into car spouts leading to the track shed. Cars could also be loaded from the marine towers by direct transfer at the bin floor level without passing through either the headhouse scales or the storage bins. By 1920 a total of ten loading spouts descended to five tracks. Under certain circumstances when no grain was being received through the headhouse, it was possible to load seven boxcars

2. Erie County Clerk (ECC), Corporations, Eastern Grain & Elevator (Iron Elevator and Transfer), Box 4344, Certificate of Incorporation, November 13, 1900. All Erie County Clerk documents are listed by date of document origin, not by date of filing, unless otherwise noted.

3. ECC, Corporations, Eastern Grain & Elevator, Box 4344, Certificate of Reduction of Directors, July 5, 1906; Buffalo Evening News, April 22, 1935, pp. S-1, Grammer obituary.

4. ECC, Corporations, Eastern Grain & Elevator (Eastern Grain Company), Box 4344, Certificate of Incorporation, April 5, 1910; Buffalo City Directory (BCD), 1910; Grace Rammacher de la Plante, "Major Buffalo Grain Elevators in the Early 20th Century," TS, n.d., 1 p.; George Berle and Adolph Means, The Modern Corporation and Private Property, 2nd ed. (New York: Harcourt, Brace & World, 1968), 204-12.

5. ECC, Corporations, Eastern Grain & Elevator (Eastern Milling), Box 4344, Certificate of Incorporation, January 30, 1914; BCD 1914; E. S. Herman, Corporate Control, Corporate Power (New York: Cambridge University Press, 1981), 200-02. The grain companies were actually too small to be covered individually by the Clayton Act, but there was a general national reduction in centralized control of companies immediately following the implementation of this anti-trust regulatory act.

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Who Was Who in New York, 1929.

APPENDIX

Elevator "A"

Cost:	$226,700
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 pillar footing; 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") 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 pillars located beneath each main bin with outer pillars located beneath intersection of main and 1/4 walls; all pillars spaced equidistantly; bin slab reinforced by bars linking pillar heads longitudinally, transversely, and diagonally; each set of links consists of 5 bars, 3 straight and 2 trussed; exterior basement walls straight with 6" monolithic concrete panels between outer pillars; elongated windows are above 1/2 height to full width of panel
Hoppers:	Mortar slab on slag concrete above bin slab Central or near central draw-off, via conical steel hopper set into bin slab
Bins:	Capacity 1,050,000 bushels Main bins 9 x 3 in parallel rows, cylindrical 20' in diameter on 24' centers; 95' high (above bin slab); SW corner bin horizontally divided to load boats Interspace bins 8 x 2 20 outerspace bins; convex 1/4 circle outer walls Non-tangential link wall contacts between bins, 2'-8" long, 1'-6" wide (transverse links below workhouse 2'-6" wide) Bin wall thickness 8" Vertical reinforcement, 8 1" jacking rods,

and 8 1/2" square verticals equally spaced Jacking rods positioned at link wall and quarter wall intersections; quarter walls (outer) have two jacking rods and two verticals; link walls have 2 ordinary verticals; all verticals in 4' lengths Verticals placed in center of bin wall Horizontal reinforcement of smooth rectangular bar wired to outside of verticals; main bin reinforcement graduated in equally spaced courses of 12"; 1/4 wall reinforcement is uniformly of 1" x 1/4" smooth bar, coursed as the main bins and bent about the main wall verticals; the direction of the bend is reversed at every course, spreading the load between two main wall verticals; the intersection of main and 1/4 walls is filleted and accommodates a 1/2" square anchor bar bent about adjacent jacking rods in main and 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: Book tiles on I-beams covered with wire reinforced concrete

Gallery & Workhouse: Structural steel, clad in corrugated iron, concrete roof

REFERENCES: Army Engineers microfiche of the original plans and contract are housed in Buffalo City Hall. City planning permits give dates and the City Plans Book for 1915 costs. The American Elevator & Grain Trade, 34 (15 November 1915): 321 provides details of the completed structure.

Elevator "B"

Cost: $176,000

Foundation: Wooden piles capped by 2'-6" foundation slab Slab reinforced with lower 1-1/4" diagonal tie bars and upper grid of 1" and 1-1/4" bars beneath each pillar footing; 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") 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 pillars located beneath each main bin, with outer pillars located beneath intersection of main and 1/4 walls; all pillars spaced equidistantly; bin slab reinforced by bars linking pillar heads longitudinally, transversely, and diagonally; each set of links consists of 5 bars, 3 straight and 2 trussed; exterior basement walls straight with 6" monolithic concrete panels between outer pillars; elongated windows above 1/2 height to the full width of the panel

Hoppers: Mortar slab on slag concrete above bin slab, central or near central draw-off, via conical steel hopper set into bin slab

Bins: Capacity 950,000 bushels
Main bins 7 x 3; 3 additional bins form diagonal north end elevation; all in parallel rows, cylindrical 20' in diameter on 24' centers. 956' high (above bin slab)
Interspace bins 7 x 2, and 1 between three end bins
16 outerspace bins, convex 1/4 circle outer walls and 2 convex 1/3 circle outer walls accommodated in diagonal end elevation of building; bins horizontally sub-divided for boat loading; 5 x 3 block adjacent to House "A" on 24' centers with link walls 2'-8" long, 1'-6" wide; remainder on 22' centers with link walls 8" long and 3' wide; wall thickness 8"; vertical reinforcement, 8 1" jacking rods, and 8 1/2" square verticals equally spaced; jacking rods at link wall and quarter wall intersections; quarter walls (outer) have two jacking rods and two verticals; link walls have two ordinary verticals; all verticals in 4' lengths
Verticals located centrally within the wall
Horizontal reinforcement of smooth rectangular bar wired to outside of verticals; main bin reinforcement graduated in equally spaced courses of 12"; quarter wall reinforcement uniformly 1" x 1/4" smooth bar, coursed as the main bins; bent about a

conventional parallel rows. The main bins were placed in three interlocking rows. Interspaces of conventional shape, though with their axis rotated through 45°, occupied the space between four main bins. As the outer main bins had to be spread to accommodate the interlocking inner row of main bins, a larger than usual outerspace bin was formed. The exterior outerspace wall was of conventional convex form.

A section of the inner main bin walling provided the rear wall of the outerspace bins. T. D. Budd, the designer of Marine "A", employed this geometry as a convenient means of installing outerspace bins in a bin wall basement elevator. As the contact walls were set diagonally, they did not coincide with the line of basement conveyors, and the outerspace bins could conveniently be spouted to the conveyor serving the outer row of main bins. The John Metcalf Company specialized in the interlocking bin arrangement; however, its elevators were characterized by concave outerspace walls, as in the Grand Trunk Pacific Elevator, Fort William, Canada. No elevators were built to this style in Buffalo, and the only examples of concave quarter walls occur in the Washburn Crosby complex, where outerspace bins are accommodated within irregular main bin geometries. The H-O Oats Elevator (1931) deployed interlocking bins as a means of creating usefully sized outerspaces where the main bins were particularly narrow (15'). The use of diagonal link walls in this structure further increased the capacity of both inter- and outerspace bins.

Reinforcing in the exterior walls of the outerspace bins followed the pattern established in the main bins. Verticals were placed on centers similar to those in the exterior walls of the main bins and included at least one jacking rod. Horizontals were coursed at the same interval as the main bin. The difference in lateral pressure with height in the outerspace bins was usually small enough for bar/rod size to be standardized. The Kellogg Elevator employed square bars, and the earlier Wait-designed elevators used 1" x 1/4" flats. Both Saskatchewan and Lake & Rail used 1/2" rounds of intermediate grade, new billet steel for all horizontals.

The outerspace rods were only graduated with height in the relatively larger bins of Marine "A", Perot Annex and Standard Annex. Quarter wall horizontals were never lapped as a single rod extended throughout one course. The quarter wall bands were tied to the main bin bands by various means. In the Kellogg Elevator they were bent into short tangs that hooked over the main bin bands. Where flats were used, in the early Wait designs for example, they were bent about the single vertical close to the point of intersection, the direction of the bend alternating with

height to the full width of the panel

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

Bins: Capacity 2,500,000 bushels
Main bins 20 x 3, 4 at end diagonal wall in parallel rows, cylindrical, 20' in diameter on 24' centers; 95' high (above bin slab) SW corner bin horizontally divided to load boats
Interspace bins 20 x 2, 5 within end bins
39 outerspace bins, convex 1/4 circle outer wall; 1 1/2 circle outer wall accommodated within diagonal end elevation of building
Non-tangential link wall contacts between bins; 2'-8" long, 1'-6" wide (transverse links below workhouse 2'-6" wide)
Wall thickness 8"
Vertical reinforcement: 8 1" jacking rods and 8 1/2" square verticals equally spaced
Jacking rods at link wall, and quarter wall intersections; quarter walls (outer) have two jacking rods and two verticals; link walls have two ordinary verticals; all verticals are in 4' lengths and located centrally within the wall
Horizontal reinforcement of smooth rectangular bar wired to outside of verticals
Main bin reinforcement is graduated in equally spaced courses of 12"; quarter wall reinforcement uniformly 1" x 1/4" smooth bar, coursed as the main bins; bent about a main bin vertical at the ends; direction of the bend is reversed at every course, spreading the load between two main wall verticals; the intersection of main and 1/4 walls is filleted and accommodates a 1/2" square anchor bar which bends about adjacent jacking rods in main and 1/4 walls; link walls reinforced with double 1/2" square contact bars at every course; ends of the contact bars bent about main tank verticals

Bin Floor: Book tiles on I-beams covered with wire
Reinforced concrete

Gallery & Workhouse: Structural steel clad in corrugated iron
Concrete roof

Marine Tower: Fixed, concrete, square isolated structure

REFERENCES: The original plans have been lost. City planning permits give dates, City Plans Book for 1916 costs. Much of the above information has been derived from the original control room bin board now in the keeping of the Buffalo Industrial Heritage Committee. As bin volumes are comparable to those in the "A" & "B" houses, it is assumed that bin dimensions are analogous and that reinforcing practice has remained unaltered. The American Elevator & Grain Trade, 38 (15 February 1920): 641, gives an account of the completed structure.

ADDENDUM TO:
CONCRETE-CENTRAL ELEVATOR
175 Buffalo River
Buffalo
Erie County
New York

HAER NY-243
HAER NY,15-BUF,28-

COLOR TRANSPARENCIES

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001