SASKATCHEWAN COOPERATIVE ELEVATOR
(Pool Elevator)
1489 Fuhrmann Blvd.
Buffalo
Erie County
New York

HAER No. NY-254

HAER
NY
15-BUF
43-

WRITTEN HISTORICAL AND DESCRIPTIVE DATA
PHOTOGRAPHS

Historic American Engineering Record
National Park Service
U.S. Department of The Interior
P.O. Box 37127
Washington, D.C. 20013-7127

HAER
NY
15-BUF,
43-

HISTORIC AMERICAN ENGINEERING RECORD

SASKATCHEWAN COOPERATIVE ELEVATOR
(Pool Elevator)
HAER No. NY-254

Location: 1489 Fuhrmann Blvd., Buffalo, Erie County, New York

Date: Mainhouse: building permit application May 5, 1925; approved June 9, 1925; opened December, 1925
Annex: building permit issued May 26, 1926

Designer: C. D. Howe

Builder: Mainhouse: Monarch Engineering Co.
Annex: unknown

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 Saskatchewan Elevator, the only Buffalo elevator located on the lakeshore, occupies land reclaimed specifically for the purpose. Although preparation of the site was expensive, the location permitted access to the deepest part of the lake. The building permit for the mainhouse was approved in June of 1925, and the first grain was received six months later.[1]

Both mainhouse and annex are fixed formed, while the workhouse is slip formed. The manipulation of the slip forms was complicated; the forms had to be wider for the basement columns to produce the wall thickening that occurs above the columns in the lower part of the bin walls. Once the forms had risen above the height of the hoppering, this work would have stopped for two or three days so that the hopper fill could be placed upon the bin slab. While stationary, the forms were narrowed by the insertion of fillers into 18" wide sections above the columns.

The workhouse forms were placed for use in the construction of pillars, beams, curtain walls and garner bin walls. Their purpose at a particular height was determined by the "chokes" which directed concrete only to those areas of the form where it was required. For example, a single piece of form work would be choked in order to limit the concrete supply to those areas requiring pillars. On reaching a particular height, the chokes were removed, and the entire length of the form received concrete for the construction of a beam or wall. In any one place, the forms were built to the width of the thickest member constructed above this point. Fillers were added to the forms to reduce their width in the construction of thinner members. In the case of garner bin walls or curtain walls built above beams, fillers were added so the specified thickness of concrete might be placed. Where the workhouse narrows with height, above the distribution floor for example, the form work used for the construction of the distribution floor would be "cut off" and left behind while the forms for the remainder of the structure continued to be raised.

The forms were raised by "clamp jacks" to the Folwell Sinks design in which the jack rods passed through and were clamped within a hollow jacking tube. The tube was raised by a jacking nut attached to the form yokes. Concrete was supplied by a batch mixer and was placed within twenty minutes of mixing. The estimated cost of construction was $800. Using this figure, the cost of providing a bushel of storage is 72 cents, at least three times greater than comparable contemporary facilities. However, these costs probably included those for the reclamation of the site.

The mainhouse's capacity of 1,1100,000 bushels is stored in thirty-three main cylindrical bins, two of which are subdivided vertically to provide four quarter bins, twenty interspace bins, and twenty-four outerspace bins. There is also one complete cylindrical bin vertically subdivided into two quarter bins. The capacity of the main bins is 23,000 bushels. The main bins are arranged in three parallel non-interlocking rows of eleven. The bins have an inner diameter of 20'-6" and are spread longitudinally and transversely on 24' centers with connections made by 2'-4" long link walls.

The central bin along the eastern elevation and the second most easterly bin of the northern elevation are subdivided vertically; half the bins accommodate a stairway, while the remainder are divided into two quarter-sized bins. The interstices between the main bins are occupied by two rows of ten interspace bins. Three elevator legs occupy the space between the four most easterly bins of the central row of main bins. The elevator legs are between double link walls which extend into six adjacent interspace bins, reducing their capacity. Between every external main bin, there are outerspace bins with convex external walls built to the same radius as, and extending over one-sixth the circumference of, the main bins. These bins extend to a height of 85' above the bin slab.

The bin walls are composed of 1:2:4 concrete and are designed to bear 2,500 psi of compressive load. The bin wall thickness is 7", though the lower 12' of bin wall immediately above the basement column heads thickens to 18". The link walls are 8" wide, except below the workhouse where they are 2'-4" square. The reinforcing steel of the bins has an ultimate strength of 55-65,000 psi, and an elastic limit of 25,000 psi. The vertical reinforcement is provided exclusively by 1/2" round jacking rods of new billet steel. Twelve such rods are on 5' centers placed equidistantly about the circumference of the main bins. The positioning of the rods does not coincide with the point of intersection of link walls. The jacking rods do not appear to be supplemented by a system of ordinary verticals. The jacking rods are centered 2-3/4" from the outer wall surface and the horizontal tank bands are wired to them.

The Saskatchewan is the only elevator in Buffalo employing a system of horizontal reinforcement of standardized size with variable coursing intervals. The main bins and outerspace "quarter" walls are reinforced with 1/2" rods of re-rolled steel. The individual main tank bands consist of three 24'-8" long rods curved around a template and wired together with a 2'-1" lap. The outerspace quarter walls are of a single pre-curved 13'-8" rod hooked over the main bin tank bands. The coursing interval provides the densest concentration of reinforcing material towards the base of the bin.

The 164 courses of tank bands are on centers that increase in diameter as height increases; these range from the lowest seventy-three courses at a height of 30'-5" on 5" centers to five courses on 10" centers at a height of 72'-4" and culminate in the twelve courses on 12" centers located below the intersection of main bin wall and outerspace quarter wall. The columns, designed to carry a load of 400 tons, are reinforced with thirty-two 1" vertical rods placed 2" from the surface and bound by fourteen horizontal hoops of 1/2" rod on 12" centers. The outer wall pillars are reinforced with nineteen 3/4" vertical rods bound by a similar arrangement of hoops. Monolithic concrete panels between the pillars form the exterior basement wall. Elongated windows occupy the full panel width above half height.

The basement columns and beams support a 12" thick continuous bin slab. The slab is not supported by beams, but reinforced by groups of five transverse and five longitudinal rods placed over and between the column tops on 18" centers. The lower system is composed of straight, discontinuous rods that run from column to column. The upper system is trussed in an unconventional manner. Rather than a system of individual bars that span the columns and are bent to form a truss, all the bars in the bin slab have only one bend; any one bar is only trussed up over a single column head. The bend is located just beyond the column head, and in any one line of reinforcing bars, all the bends are located on one side of the columns. In the adjacent lines of reinforcing, all bends are on the opposite side of the column. This system produces a trussed span between columns and a doubled network of rods over the mushrooms. The rod sizes used in the bin slab vary according to the predicted loading conditions. The bin slab above the inner aisles is designed to carry a total load of 137,000 lbs. and a moment of 370,000 lbs. The bin slab above the two outer aisles is designed to carry a total load of 104,000 lbs. and a moment of 335,000 lbs.

The elevator is built on 2,786 wooden piles driven to rock. The piles are placed on 2'-3" grid, such that twenty-one piles are below most columns, a figure which increases to twenty-five piles below those columns under the workhouse. The piling arrangements are designed so that no pile carries more than 20 tons. The piles are capped by a 1'-6" thick reinforced concrete foundation slab designed to bear moments of 520,000 lbs.--39,600 lbs. of tension and 60 psi of shear. The slab is composed of concrete and reinforced with an upper, middle and lower system of steel rods. The lower system consists of a grid of straight, continuous 3/4" round rods on 2'-3" centers so as to cross every pile. Above the grid is a trussed system running both transversely and longitudinally on 4" centers.

The trussing is accomplished in an unconventional manner and is similar to that used in the bin slab. It is formed of individual rods, not tied together and each with a single bend. The bend is placed so that it will be below the outer part of the stepped column footing. The upper part extends into the next footing, while the lower part of the rod extends to the bend of the next individual bar. In any one line of rods, all are laid in this fashion. The rods in the line of bars 4" away are laid with the bends below the opposite side of the footing to build up a trussed system. Straight-top rods are also laid longitudinally at 4" intervals. The load of the columns is spread by stepped column footings rising in two 1'-2" deep steps; the lower footing occupies an area 7'-8" square and the upper step provides a 5'-8" square landing for the columns. A filling of slag concrete is placed to a depth of 3' above the foundation slab between the column footings. This slab filling supports a 6" floor slab reinforced transversely, longitudinally and diagonally by groups of straight 1/2" round bars. Six such bars run longitudinally and transversely on 12" centers above the column footings, while five bars are arranged on 10" centers to form the diagonal grid that also passes over the column heads.

The bins are capped by a 6" thick concrete bin floor incorporated monolithically into the bin structure. The arrangement of supporting I-beams is unusual. Rather than single beams placed across the width of the structure, the outer bins have two I-beams on diagonals; the central row of bins has more conventionally arranged transverse beams. The bin floor is reinforced with 1/2" rods spaced so their density increases towards the center of the bins. Those over the outer bin rows are arranged in a longitudinal and transverse grid, while those above the inner bin row are arranged on a diagonal grid. The bin floor is protected by a single-story overall gallery of reinforced concrete pillar, beam and slab construction. The pillars are located above the link walls of the bins. The inner pillars measure 16" square and the outer pillars 2'-3" x 12". Both are reinforced with four 3/4" vertical rods bound by a spiral. The outer pillars are rectangular and infilled with monolithically constructed concrete curtain walls featuring elongated windows between all pillars.

At the eastern end of the building, a workhouse rises 87' above the bin floor to a total height of 185'-6". The workhouse is of slip formed reinforced concrete and incorporates monolithic concrete garner bins. The 98' x 25' structure is located on the center line of the elevator, and is 4 x 1 bays with the exception of the lower story, which extends the width of the gallery on the north side. Above the bin floor, the workhouse provides a 12'-6" high distribution floor, a 20' high scale floor, a 17'-5" high work floor, and a 15'-9" deep garner.

The three concrete garners each have nine discharge spouts supported by a network of hopper beams. The workhouse has exterior walls devoid of pier and panel features and is characterized by sets of elongated windows on every story. The distribution, workhouse and scale floors are lit along their entire lengths, the scale floor only at its ends. This pattern of workhouse fenestration, a hallmark of C. D. Howe designs, also appears in the Saskatchewan No. 7 Elevator (1928). The structural pillars and beams are set on 24' centers, and the pillars are placed above the link walls of the bin. The dimensions of and reinforcing within the pillars decrease with height. The verticals are bound by spiral steel. The columns support beams that span the bays. Those supporting the distribution floor are 2' or 2'-3" deep and 12" wide, while scale floor beams are 3' deep and 24" wide. The garners are supported by 2'-9" deep beams of either 1'-2" or 2' width, and the machinery floor is supported on 2'-9" deep beams of 1'-4" width.

A quadruple-track railroad loading and unloading shed abuts the north side of the elevator below the workhouse. The elevator is equipped with two Monarch designed and built movable marine towers of structural steel with corrugated iron cladding. The annex, constructed in 1926, was also designed by C. D. Howe and appears to be identical in form and structure to the mainhouse. The builder of the annex is not known. The estimated cost of construction was $300,000, providing storage at a cost of 33 cents per bushel. Although a more realistic figure than that given for the mainhouse, it is still 50 percent more expensive than comparable storage units. The additional costs reflect the complexities of slab construction.

The annex has a capacity of 900,000 bushels, accommodated in twenty-seven main bins, eighteen interspace bins and eighteen outerspace bins. The main bins are arranged in three parallel non-interlocking rows of nine bins. They are 20'-6" in inner diameter and are spread on 24' centers. The interstices are occupied by interspace bins of conventional form in two rows of nine bins. The interspace bins occupying the junction between mainhouse and annex are of reduced volume, as the interstices are partly occupied by the outerspace bins. Eighteen outerspaces are utilized for storage and feature outerspace pocket bins of conventional form. Outerspace bins are absent at the junction between the two houses. The bin floor is protected by an extension to the single-story galley. Because it has no elevating capacity, the annex lacks a headhouse. The dock and marine leg tracks extend along the length of the annex.

BUSINESS HISTORY

The only grain elevator located on Buffalo's outer harbor was also the first built by a farmer's cooperative and the only surviving elevator that began with non-U.S. ownership. The original owner of the large facility was Saskatchewan Cooperative Elevator Company. The Co-op was an outgrowth of the Canadian grange movement, a response to increasingly national and international market pricing over which farmers had no control. The first locus of market forces was usually the local or "country" grain elevator, often owned by merchants or railroads who, in cooperation with large boards of trade, set prices to their own advantage. Several reactions arose in response to the vast, unpredictable fluctuations in prices. These political responses included the "granger" or cooperative movement. The Saskatchewan Cooperative was a comparatively recent Canadian outgrowth of farmer activism incorporated in 1911 by large groups of farmers to buy, own, and operate 450 local elevators in Saskatchewan and Manitoba. Within a decade, the co-op decided to acquire large terminal elevator sites to increase its leverage over the grain markets. One of these elevators was in Port Arthur, Ontario, the other in Buffalo.[2]

The co-operative was incorporated in Erie County in the autumn of 1922. It was established through five men, all nominally the acting directors and incorporators who were based in Buffalo, Rochester, Dunkirk, and Silver Creek. The actual beneficial owners of the new corporation, however, were the thousands of western Canadian wheat farmers who collectively owned the co-op.[3] Two years after establishing their business in Buffalo, cooperative members declared their intention to construct a large, 1.1 million-bushel transfer elevator on twelve acres of Buffalo's outer harbor bought from the Lehigh Valley Railroad. The co-op had already acquired grain trading subsidiaries--Saskatchewan Cooperative Export Co., James Stewart & Co., Ltd., and James Stewart Grain Corp., the latter based in New York City. Construction on the elevator was completed in late 1925, and the new facility opened early in December of that year. In May, 1926, the Saskatchewan Elevator set some impressive records as it unloaded 372,000 bushels in eleven hours, while simultaneously loading 164,000 bushels onto rail cars for shipment to New York City in six and one-half hours. It was one of the fastest grain facilities for materials handling in Buffalo.[4]

The Cooperative did not survive for long. In April, 1926, a new farmers' cooperative was formed in Saskatchewan amalgamating the Saskatchewan Cooperative Wheat Producers and other Canadian co-ops. The new collective organization represented 138,000 Canadian wheat farmers who united to secure control over their own burgeoning production. The Pool was incorporated August 25, 1923, with $100,000 in capital divided into 100,000 shares. Farmers were only charged basic costs for handling grain, no profit, and were therefore paid the price of grain at nearly full value. Any profits from further sales were divided among the members and paid regularly over the year. The Pool bought out the co-op for $15 million. By 1930 Saskatchewan Cooperative was liquidated. After the takeover, the new Pool owned 926 country elevators, four terminal elevators including the site in Buffalo, and created a large export operation called Canadian Wheat Producers.

The farmers' impulse to expand their control over production lay in the dramatic growth in grain production; Canada increased its output by seven times in twenty years, while the population only doubled. The farmers were determined to govern the price of the 225 million bushels they produced by controlling the distribution, storage, and sales of their own product. In 1926 alone, 50 million bushels were handled at the outer harbor elevator, over 1/3 of the 134 million bushels of Canadian wheat handled in Buffalo that year.[5]

Because the elevator was sold from one cooperative to the next so quickly after completion, it was known both as the Saskatchewan Co-op and the Saskatchewan Pool. The latter name, however, shortened to "the Pool," tended to persist. The co-op was a welcome addition to the economies of both Buffalo and Canada, and, in the latter country, escaped the onus usually attributed to pools which were generally associated with trusts, monopolies, combines, and cartels. The fact that the Canadian Wheat Pool was producer-owned and operated made all the difference; its purpose was to sustain farmers, not exploit them, and even advocates for private grain traders such as the Northwestern Miller sought to give the Pool a fair chance to succeed.[6]

The cooperative owned the elevator until 1945 but turned over daily operations to Superior Grain Corporation, an offshoot of the Superior Elevator. Superior Grain took over control of the Pool Elevator in 1939 under the direction of Charles M. Kennedy, a Buffalo lawyer and grain trader who was on the board of Superior Elevator. In 1945 Kennedy and other Superior Grain associates formed the Pool Elevator Company in order to purchase the Canadian elevator.[7]

In January, 1952, the elevator changed hands again. Pillsbury Mills bought the elevator for an undisclosed amount, although the post-war value was set at $1 million. Unlike Pillsbury's first elevator, the Great Northern, the Pool was to be used for a "grain merchandising operation," indicating that

Pillsbury was considering entering the general domestic and export grain trade in Buffalo as well as handling grain for its own cereal and flour milling.[8] The Pool Elevator was a highly desirable transfer facility with a holding capacity of 2.1 million bushels in 135 bins. Grain buyers could store any amounts they desired, and space at the Pool was not widely used by the government's Commodity Credit Corporation export program. Private storage was in such demand that private dealers arranged with Pillsbury to have first call on the elevator's 20-million-bushel-per-year handling capacity.

The elevator had excellent deep-draft vessel capacity for unloading and was served well by the Lehigh Valley Railroad connecting to other lines and to eastern ports. In 1951 alone, thirty-two ships unloaded during the shipping season. The two lakeside marine legs could siphon off 250,000 bushels every eight hours. Numerous boxcars were subsequently loaded on a track that could accommodate fifty-two cars at a time. The Pool could load 100 cars per day, each with a 200,000-bushel capacity. Virtually all receipts and shipments were in bulk, and the elevator handled a wide variety of wheat, oats, barley, and other grains.[9]

Despite the enormous vitality of the Pool's resources, Pillsbury closed it in 1962. More than any other "captive" elevator in Buffalo--elevators serving a specific grain company's storage needs--the multi-customer Pool was deeply affected by the 1959 opening of the St. Lawrence Seaway. Because the Buffalo elevators could be by-passed outright via the Seaway, fewer customers each year saw value in unloading grain to an elevator and reloading to rail cars bound for eastern ports. Only grain companies with massive holdings requiring winter storage or with the reserve capacity to await better prices still found Buffalo's terminal elevators useful. One company with such needs, Cargill, Inc., bought the Pool Elevator from Pillsbury in April, 1964, and planned to open it immediately. Cargill found the waterfront Pool a more attractive facility for storage than the comparable up-river Superior Elevator, which it closed to open the Pool. The Pool's rapid handling capacity, deep-dredge dockfront and small crew size were appealing to money-conscious Cargill.[10]

Cargill eventually left Buffalo, abandoning both of its remaining elevators, the Electric and the Pool. As it had done with both the Electric and the Superior, Cargill allowed the Pool to stand idle and to become delinquent in property tax payments. Upon default, the city of Buffalo placed the Pool on the auction block, where it was bought by the sole bidder--Cargill, Inc. The sum Cargill bid was considerably less than the taxes the grain trader owed.[11]

The following year Cargill, Inc. sold the Pool to South End Marina Corporation owned by Buffalo resident, Fred Langdon. Today the elevator is stripped of all its grain handling and transfer equipment and serves as winter boat storage for the marina associates. Despite its loss of glory as a grain handling facility, the Pool's majestic exterior stands as a prominent landmark on Buffalo's outer harbor, its silhouette a reminder of recent days of glory within the once-burgeoning Buffalo grain trade.

MATERIALS HANDLING: HISTORY AND DESCRIPTION

Subcontractors for elevator machinery and equipment under the Canadian engineering firm of C. D. Howe & Co. also included firms from the United States. For example, the Oldman-Magee Boiler Works of Buffalo fabricated the receiving hoods for the marine towers, garners and scale hoppers. The Morse Chain Co. supplied the silent chain drives used in conjunction with sixteen of the electric motors. Farrel Foundry & Machine Co. manufactured the reduction gear units installed on the marine leg and house lofter leg power trains. The twenty-nine major electric motors were of General Electric make, as was the transformer equipment which stepped three-phase 25-cycle 2,200-volt current down to 440, 220 or 110 volts for driving motors or lighting purposes. A more novel use of electricity involved heating; 5,000-watt units were installed in the offices of the foreman and the weighmaster as well as in the substation room to ward off the discomforts associated with an exposed lakefront location in wintertime. Once capable of transshipping as many as 20,000,000 bushels of grain per year, the elevator has been inactive for an extended period and is currently being used for marina storage. The marine towers and the marine shipping gallery have been dismantled. The headhouse and car shed remain extant, but the machinery associated with them has been extensively cannibalized.

Receiving by Water

During the mid-1920s vessels bringing grain down from the head of the lakes were unloaded by a pair of mobile marine towers operating on the 269' x 35' concrete dock along the south side of the elevator. The dock was extended to the inland side during the 1951 navigation season. Each marine tower housed equipment for raising grain from ships, weighing the cargo and reelevating it to the top of the tower for distribution within the elevator proper. The nominal peak capacity of the marine legs was 30,000 bu./hr. The Monarch Engineering Co. of Buffalo subcontracted the erection of the towers as Job No. 185.

The marine towers themselves consisted of structural steel framework with concrete floors and were originally sheathed in corrugated iron. Each tower stood 158' high and measured 32' x 22'. The towers were mounted on twenty pairs of car wheels and ran along the dock on four parallel rails. To guard against the possibility of toppling due to high lakefront winds, the towers were secured to the elevator by rolling anchors with a special clamp that was electrically interlocked with the tower mover motors. To prevent the towers from being blown off the ends of the dock they were also equipped with rail clamps and wheel brakes; concrete bumpers blocked the ends of the tracks. Each marine tower could be propelled along the dock at a maximum rate of 18' per minute by a 20 hp slip ring, crane-type motor, operating at 490 rpm with worm and spur gear reduction.

The marine leg within each tower measured 96' in length. A 28" rubber belt carried two parallel rows of 13" x 8", 8" deep Buffalo buckets spaced on 10" centers. The crosshead carrying the head pulley and its driving motor was balanced by a 48,000 lb. counterweight as the leg moved up and down within the vessel's hold. Sets of power ship shovels manned by scoopers shifted grain within each hold to the vicinity of the leg's boot pulley. As the buckets carrying grain traveled up and over the head pulley they discharged their load into an apron hopper and thence into an upper garner prior to weighing. Instore shipments from each marine leg were weighed in a 500-bushel hopper scale with plain beams and 42" rotary valves. Once recorded, each draft in the scale descended by gravity to a drop-gate lower garner and thence to the boot of the marine lofter leg for reelevation from the base of the marine tower to the top.

The marine lofter within each tower was 142' long with a 38" belt carrying a double row of 18" x 8", 8" deep Buffalo buckets on 13" centers. Elevating capacity of the marine lofters in terms of bushels per hour remains undetermined. At the head of the lofter leg grain discharged through the marine tower's traveling spout into ten V-hoppers, each with two stationary turnheads, which collected the flow for distribution to bins or storage conveyors within the elevator.

An independent electric motor drove each functional component of the marine unloading process. A 100 hp motor powered each marine leg through double spur gearing, reducing the speed of the head pulley from 725 to 36 rpm. The pusher and hoist for controlling the position of the leg within the vessel's hold were both operated by a 50 hp motor located on the second floor of the marine tower. Power was transmitted to the screw-type pusher via bevel gear, worm gear and a nut revolving at 133 rpm; the crosshead originally was lifted by rope or belt drive. The set of ship shovels for each tower ran off a 50 hp motor, also situated on the second floor. Power for the shovels was transmitted through rope drive to a countershaft; reduction gears downshifted operating speed from 100 rpm on the countershaft to 71 rpm on the shaft that carried four 24" drums made of maple lagging. These drums were engaged and disengaged by the scooper gangs through friction clutches activated by thrust screws and counterweighted lever arms. The Jacob Schmahl Company supplied the ship shovels.

The marine tower lofter leg motor was rated at 125 rpm with double speed reduction through herringbone gears and silent chain drive from 725 to 33 rpm. Each leg was also equipped with a Webster friction clutch and Gemlo backstop. The motors driving the marine legs and lofters were controlled from the third floor of each tower with floor mounted starters.

Its marine tower equipment enabled the Saskatchewan Elevator to efficiently handle cargoes from the largest lakers, including Canada Steamship Lines Lemoyne, a new 633' x 70'-3" giant that loaded a record grain cargo of 518,000 bushels at Fort William in 1926.[12] During its first year of operation, the elevator and its crews accomplished the noteworthy feat of unloading 372,000 bushels of wheat from the steamer Shenango in eleven hours, an overall rate for each leg of approximately 16,500 bu./hr. including shoveling and clean-up. The maximum operating rate of each marine leg on the dip remained constant at 30,000 bu./hr. until the 1960s, when capacity was downgraded to 25,000 bu./hr. Vessel unloadings averaged fifty per year during times of peak demand; thirty-two grain boats docked at the Pool in 1951.

Receiving By Rail

Grain arriving in rail cars was unloaded in a track shed on the north side of the elevator. Two of the four entering tracks were laid over a double receiving pit into which grain was emptied by men operating Clark-Beatty automatic power shovels driven by a 15 hp motor. A pair of car pullers with 50 hp motors positioned cars over the receiving pits; the drive train from these motors consisted of silent chains and spur gears. Each unit featured 450' pulling and back haul cables for each track to minimize manual labor in shifting cars. The receiving hoppers discharged onto a 36" receiving belt powered by a 7 1/2 hp motor; the conveyor transferred grain to the elevator's internal house lofter legs. This layout enabled the Saskatchewan to unload rail cars at the relatively rapid rate of 12 per hour, equivalent to approximately 20,000 bushels. No car dumper was ever installed since the volume of rail receipts apparently did not warrant such investment during the years when the elevator was active.

Instore Handling: Horizontal Transfer and Vertical Distribution

Grain received through the marine towers reached certain storage bins directly through the rooftop V-hoppers and cupola turnheads. To access more distant bins without the necessity of moving the marine towers, grain was spouted via the turnheads onto one of the two 42" reversible conveyor belts which ran the length of the bin floor. A 30 hp motor drove each distribution belt. Four-pulley self-propelled trippers discharged grain into bins at any point along the conveyors.

Rail shipments unloaded through the car pits and receiving belt were elevated for instore weighing in the headhouse at the east (inshore) end of the elevator. The house lofter legs also doubled as shipping legs when loading out to cars or vessels. Two lofters were installed when the Saskatchewan opened in 1925, and a third leg was added upon construction of the west (outshore) storage annex the following year. The lofters were rated at 20,000 bu./hr. and carried a staggered double row of 14" x 8", 8" deep Webster special buckets on a 30" seven-ply belt. A 100 hp motor at the head floor drove each leg through helical single reduction gears and silent chains. Other features of the house lofters included Webster friction clutches and Gemlo backstops, as on the marine legs, plus the Edmonds & Norrell patented automatic takeup.

The lofters discharged into 3,000-bushel concrete garners with concrete bottoms which accumulated grain for weighing in 2,500-bushel hopper scales with type registering beams and suspended bearings. There were four hopper bins per scale, and the units were capable of weighing up to 150,000 lbs. per draft. Below the scales instore grain could be distributed via the spouting system to bins, belts or cleaning machines. Saskatchewan apparently was not equipped with conditioning units at the outset since the Wheat Pool's elevators at the Canadian lakehead possessed extensive cleaning and grading plants. However, cleaning and drying equipment of undetermined type and capacity had been installed by the late 1930s, presumably to handle grain received mainly by rail. The elevator was also capable of bagging small quantities of grain for special orders, though the vast majority of shipments were in bulk.

Shipping by Water

A substantial portion of the grain shipped through Buffalo by the Canadian Wheat Pool was destined for Montreal. To expedite the process of transhipment to Welland Canal steamers at the new outer harbor terminal, C. D. Howe & Co. designed facilities unique among local waterfront elevators. Along with the usual shipping bins and dock spouts, a belt gallery was provided for carrying outstore grain away from the workhouse. This procedure was also used when loading craft transiting the New York State Barge Canal. Such an arrangement permitted vessels to be filled more rapidly by two spouts at a common location, if desired, while still grouping both the marine shipping bins and the carloading facilities near the workhouse. This routing dispensed with the more cumbersome process of using the bin floor belts for dispatching grain to remote shipping bins within the elevator.

The slip that accommodated the 260' Welland canallers or the steel tow barges was located on the north side of the elevator. Initially dredged to accommodate vessels drawing up to 18', the canal slip was 70' wide; the dock extended along approximately 1100' of the 1400' north shoreline of the property.

Grain to be shipped out was discharged from storage bins onto two 36" basement conveyor belts driven by 20 hp motors. The spouting arrangement enabled grain from the center row of circular bins to be directed to either conveyor. These belts delivered to the boots of the house lofter legs for reelevation and weighing out. Two of the three scales in the headhouse were capable of spouting directly to the boat loading bins via the turnheads on the distribution floor. These bins supplied a pair of 36" shipping belts housed in the gallery over the track shed. The shipping belts were powered by 10 hp motors and delivered to vessels through two dock spouts.

Initial vessel loading rates were given as 30,000 bu./hr. to ships and 25,000 bu./hr. to barges. Addition of a third dock spout during the mid-1930s raised the elevator's marine loading capacity to approximately 35,000 bu./hr. This nominal rate remained constant until the mid-1960s when under Cargill's ownership two spouts were taken out of service; the remaining spout was listed as capable of delivering 25,000 bu./hr. Shipments via the Barge Canal had virtually ended by the early 1950s.

Shipping by Rail

The process of moving grain from storage into rail cars involved a sequence from the basement shipping belts through the house lofters, garners, scales and distribution spouts to the carloading spouts. Each of the three scales eventually installed in the headhouse was arranged to supply any of the four car spouts in the track shed. In May of 1926, 164,000 bushels of wheat were loaded in 6 1/2 hours for rail shipment to New York--a rate equivalent to approximately 25,000 bu./hr. The nominal maximum carloading capacity of the Saskatchewan was originally

40-45,000 bu./hr., equivalent to filling 240 boxcars during a ten-hour period. By the early 1950s, loading 100 cars with 200,000 bushels was considered a noteworthy performance. Published rail loading rates per ten hours fell to 120 in the mid-1950s and fifty-two by the mid-1960s.

ENDNOTES

1. The following paragraphs are based on information from a variety of sources including plans, building permits and contracts housed in Buffalo City Hall. Contemporary accounts of the elevator appear in the Grain Dealers Journal, Special Plans Book, 5 (1942), 142; American Elevator & Grain Dealer, 41 (15 May 1926), 671; The Buffalo Journal of Commerce (November, 1927), 10 and the Northwestern Miller (16 December 1925). Mr E. Hennessey has described the construction of the mainhouse in a personal conversation.

2. Trevor J. O. Dick, "Productivity Change and Grain Farm Practice on the Canadian Prairie, 1900-1930," Journal of Economic History 40 (March, 1980), 105-10; Robert A. McGuire, "Economic Causes of Late-Nineteenth Century Agrarian Unrest: New Evidence," Journal of Economic History, 41 (December, 1981), 835-52; Moody's Industrials, 1926.

3. Erie County Clerk (ECC), Corporations, Saskatchewan Co-operative Elevator Company, Certificate of Incorporation, October 26, 1922, Box 12,320. All Erie County Clerk documents are listed by date of document origin, not by date of filing, unless otherwise noted.

4. Northwestern Miller, October 22, 1924, p. 336; December 16, 1925, n.p., June 2, 1926, p.880; Buffalo Live Wire, XV (November, 1924), 13, 16.

5. Northwestern Miller, April 14, 1926, p. 153; August 25, 1923, n.p.; "Buffalo's Pool Elevator," Buffalo Journal of Commerce XVIII (November, 1927), 10-12; Moody's Industrials, 1926, see especially p. 2514; 1931, p. 3175; ECC, Corporations, Saskatchewan Co-Operative Elevator Company, Certificate of Dissolution, December 16, 1930, Box 16996.

6. Northwestern Miller, 10 September 1930, 829.

7. Buffalo and Erie County Public Library (BECPL), Scrapbooks, "Industry," v. 6, p. 112.

8. Buffalo Courier-Express, 30 January 1952, p. 21; Buffalo Evening News, 29 January 1952, p. 28.

9. Buffalo Courier-Express, 2 March 1952, Sec. 4, p. 20.

10. Buffalo Evening News, 28 April 1964, p. 23.

11. ECC, Deeds, Liber 7004, May 6, 1964, p. 319; Liber 9137, June 30, 1982 (in settlement of In Rem Action 8, E-9043, ser. no. 612), pp. 271-72; Liber 9232, June 13, 1983, pp. 529-30.

12. Paul G. Wiening, Reflections: Stories of the Great Lakes (St. Catherines, ON: Stonehouse Publications, 1990), 137.

SOURCES

American Elevator & Grain Dealer, 41 (15 May 1926), 671.

Buffalo Courier-Express, 30 January 1952, p. 21; 2 March 1952, Sec. 4, p. 20.

Buffalo & Erie County Public Library, Local History Scrapbooks, "Industry," Vol. 6, p. 112 and Vol. 7, pp. 203-204 (Buffalo Courier-Express, 2 March 1952).

Buffalo Evening News, 29 January 1952, p. 28; 28 April 1964, p. 23.

Buffalo Journal of Commerce, (November 1927), 10.

Buffalo Live Wire, 15 (November 1924), 13, 16.

"Buffalo's Pool Elevator," Buffalo Journal of Commerce, 18/11 (November, 1927): 10-12.

Building Permits & Plans, 301 City Hall
#92047 (25 June 1925)
[#1835z] (25 May 1926)

Dick, Trevor J. O. "Productivity Change and Grain Farm Practice on the Canadian Prairie, 1900-1930," Journal of Economic History 40 (March 1980), 105-10.

Erie County Clerk, Records, Erie County, NY.

Grain Dealers Journal, Special Plans Book, 5 (1942), 142.

Green's Marine Directory of the Great Lakes [title and publication data varies]
30th ed. (1938), 323.
32nd ed. (1940), 299.
34th ed. (1942), 344.
40th ed. (1948), 340.
44th ed. (1952), 340.
48th ed. (1956), 349.
53rd ed. (1961), 327.
57th ed. (1965), 154.

McGuire, Robert A. "Economic Causes of Late-Nineteenth Century Agrarian Unrest: New Evidence," Journal of Economic History, 41 (December 1981), 835-52.

"Modern Fire-Proof Elevator at Buffalo," [Grain Dealers Journal], Grain Elevators of North America, 5th ed. (Chicago: Grain and Feed Journals Consolidated, 1942), 142-144.

Moody's Industrials, 1926.

Northwestern Miller, 25 August 1923; 22 October 1924; 16 December 1925; 14 April 1926, 153; 2 June 1926, 880; 10 September 1930, 829.

Plans, Fred Langdon, South End Marina, Buffalo, NY.

War Department, Corps of Engineers, U.S. Army and United States Shipping Board, [Transportation Series #1] Transportation on the Great Lakes (Washington: Government Printing Office, 1930), 223.

War Department, Corps of Engineers, United States Army, [Transportation Series #1] Transportation on the Great Lakes (Washington: Government Printing Office, 1937), 246.

Wiening, Paul G. Reflections: Stories of the Great Lakes. St. Catherines, ON: Stonehouse Publications, 1990.

APPENDIX

Mainhouse

Cost: $800.000

Foundation: Wooden piles capped by 1'-6" foundation slab reinforced by lower grid of straight and continuous round rods on 2'-3" centers so as to cross every pile; a trussed system formed of individual rods which are not tied together runs both transversely and longitudinally on 4" centers; each rod has one bend placed below the outer part of the stepped column footing; the upper part of the rod extends into the next footing, while the lower part of the rod extends to the bend of the next individual bar; all the bars in any one section are laid in this fashion; in the next section, 4" away, all the bars are laid with the bends below the opposite side of the footing, building a trussed system; additionally, straight top rods laid longitudinally at 4" intervals Column footings rise in two steps from the foundation slab; a 3' deep slag filling lies over the foundation slab and supports a 6" floor slab; the floor slab is reinforced transversely, longitudinally & diagonally by straight 1/2" round bars

Basement: Full height (13'-6") at grade; four longitudinal rows of 4' diameter mushroom-headed columns; two outer rows of 3'-9" x 2'-6" pillars support a 12 " bin slab; all columns spaced equidistantly, four columns below every main bin; the outer pillars lie below the point of intersection of the main and 1/4 bin walls; each column has 32 1" verticals placed 2" from the surface and 14 horizontal hoops of 1/2" rod at 12" intervals The bin slab is reinforced by groups of 5 transverse and longitudinal rods placed over and between the column tops; all bars are discontinuous; the lower system is straight and runs from column to column; the upper system is trussed in a similar fashion to that in the basement slab; all bars have only one bend located just beyond the column head;

in any one section all bends are located on one side of the column, while in the next section all are located on the opposite side of the column; this system produces a trussed span between columns and a doubled network of rods over the mushrooms; all rods are of deformed new billet steel; exterior basement walls are straight monolithic concrete panels with infilling between outer pillars. Elongated windows occupy the full panel width above half height

Hoppers: Mortar slab on slag concrete above bin slab; central draw-off via flat plate steel hopper set into bin slab

Bins: Capacity 1,100,000 bushels
Main bins 11 x 3 in parallel rows; cylindrical 20'-6" in diameter on 24' centers; 95' high (above bin slab); 2 bins sub-divided vertically to form 2 bins, elevator and stair shafts
Interspace bins 10 x 2
24 outerspace bins, convex 1/4 circle outer wall
Non-tangential link wall contacts between bins; link walls 2'-4" x 8", except below headhouse where they are 2'-4" square
Wall thickness 7", 18" thick for first 12' above bin slab
Vertical reinforcement of new billet steel; 1/2" round jacking rods, 12 per main bin, 1 per outerspace 1/4 wall; jacking rods may be supplemented by further verticals; verticals centered 2" from outer wall surface
Horizontal reinforcement, all wired to outside of verticals; main and quarter bins re-rolled rail all 1/2" round rod, coursed at various intervals; link and anchor rods of new billet steel 1/2" in diameter coursed as main bins; both contact anchors are hooped over

Bin Floor: Concrete slab on I-beams

Gallery: Monolithic concrete, with elongated windows between all pillars

Headhouse: Monolithic, incorporating concrete garners
Internal pillars to give smooth exterior

	surface; lit by elongated windows on all floors
Marine Towers:	Movable, structural steel with corrugated iron cladding

REFERENCES: Original plans and contracts provide much of the above information. City Building Permits provide the dates and City Plans Book 1925 the costs. Additional information is provided in Grain Dealers Journal, Special Plans Book 5 (1942): 142, American Elevator & Grain Dealer, 41 (15 May 1926): 671, Buffalo Journal of Commerce (November, 1927): 10 and Northwestern Miller (16 December 1925).

Annex

Cost:	$300.000
Foundation:	Wooden piles capped by 1'-6" foundation slab Slab reinforced by lower grid of straight and continuous round rods, on 2'-3" centers so as to cross every pile; a trussed system formed of individual rods which are not tied together runs both transversely and longitudinally on 4" centers above grid; each rod has only one bend placed so that it will be below the outer part of the stepped column footing; the upper part of the rod extends into the next footing, while the lower part of the rod extends to the bend of the next individual bar; all the bars in any one section are laid in this fashion. In the next section, 4" away, all the bars are laid with the bends below the opposite side of the footing, building a trussed system; Additionally, straight top rods laid longitudinally at 4" intervals; column footings rise in two steps from the foundation slab; a 3' deep slag filling lies over the foundation slab and supports a 6" floor slab reinforced transversely, longitudinally & diagonally by straight 1/2" round bars.

Basement:	Full height (13'-6") at grade, Four longitudinal rows of 4' diameter, mushroom-headed columns; two outer rows of 3'-9" x 2'-6" pillars support a 12 " bin slab; all columns spaced equidistantly, four columns below every main bin; the outer columns lie below the point of intersection of the main and 1/4 bin walls; each column has 32 1" verticals placed 2" from the surface, and 14 horizontal hoops of 1/2" rod at 12" intervals The bin slab is reinforced by groups of 5 transverse and 5 longitudinal rods spanning the 8'-6" tops of the columns; all bars discontinuous; the lower system is straight and runs from column to column; the upper system is trussed in a similar fashion to that of the basement slab; all bars have only one bend located just beyond the column head; in any one section all bends are located on one side of the column, while in the next section all are located on the opposite side of the column; this system produces a trussed span between columns and a doubled network of rods over the mushrooms; all rods of deformed new billet steel; exterior basement walls are straight, monolithic concrete panels with infilling between outer pillars; elongated windows occupy the full panel width above half height
Hoppers:	Mortar slab on slag concrete above bin slab, central draw-off via flat plate steel hopper set into bin slab
Bins:	Capacity 900,000 bushels Main bins 9 x 3 in parallel rows; cylindrical 20'-6" in diameter on 24' centers; 95' high (above bin slab) Interspace bins 8 x 2 18 outerspace bins, convex 1/4 circle outer wall Non-tangential link wall contacts between bins; link walls 2'-4" long, and 8" wide. Wall thickness 7", but 18" thick for first 12' Vertical reinforcement of new billet steel; 1/2" round jacking rods, 12 per main bin, 1 per outerspace 1/4 wall; jacking rods may have been supplemented by further verticals

	Horizontal reinforcement, all wired to outside of verticals; main and quarter bins re-rolled rail all 1/2" round rod, coursed at varying intervals, diminishing upward; link and contact anchor rods of new billet steel of 1/2" diameter coursed as main bins; the link and contact anchors are hooked over the horizontal bands
Bin Floor:	Concrete slab on I-beams
Gallery:	Monolithic concrete; lit by elongated windows between every pillar

REFERENCES: Original plans provide much of the above information. City Building Permits provide the dates and the City Plans Book for 1926 the costs.