NPS Form 10-900-b OMB No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places
Multiple Property Documentation Form

This form is used for documenting multiple property groups relating to one or several historic contexts. See instructions in How to Complete the *Multiple Property Documentation Form* (National Register Bulletin 16B). Complete each item by entering the requested information. For additional space, use continuation sheets (Form 10-900-a). Use a typewriter, word processor, or computer to complete all items.

☒ New Submission ☐ Amended Submission

A. Name of Multiple Property Listing

Historic and Architectural Resources of the Buffalo Grain and Materials Elevator Multiple Property Submission

B. Associated Historic Contexts

(Name each associated historic context, identifying theme, geographical area, and chronological period for each.)

Part I: The Development of Buffalo as a National Center of the Transshipment of Grain Prior to 1860
Part II: Increased Grain Trade and the Evolution of Grain Elevator Design, 1860's-1890's
Part III: 1890's to 1930's: The Evolution of the Modern Elevator
Part IV: The Decline of Buffalo as a Grain Transshipment Port after 1959

C. Form Prepared by

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D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR part 60 and the secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation. (☐ See continuation sheet for additional comments)

Signature and title of certifying official SHPO Date 3/18/03

State or Federal agency and bureau

Buffalo Grain and Materials Elevator Multiple Submission
Name of Multiple Property Listing

New York
State

I hereby certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper

Date of Action

Buffalo Grain and Materials Elevator Multiple Property Submission — New York
Name of Multiple Property Listing — State

Table of Contents for Written Narrative

Provide the following information on continuation sheets. Cite the letter and the title before each section of the narrative. Assign page numbers according to the instructions for continuation sheets in *How to complete the Multiple Property Documentation Form* (National Register Bulletin 16B). Fill in page numbers for each section in the space below.

Primary location of additional data:

- ☒ State Historic Preservation Office
- ☐ Other State agency
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- ☐ Local Government
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Name of Repository: Historic American Engineering Record, National Park Service, U. S. Department of The Interior, P. O. box 37127, Washington, D. C. 20013-7127. Buffalo Grain Elevators, Buffalo, Erie County, N.Y. HAER No. NY-239-NY-260.

E. Statement of Historic Contexts

Introduction

The Historic and Architectural Resources of the Buffalo Grain Elevator Multiple Property Submission include eighteen significant properties. The nominated resources illustrate the distinctive features of the architectural and historical development of grain transshipment at the port of Buffalo during the first half of the twentieth century. During this period, Buffalo had the nation's largest capacity for the storage of grain in over thirty concrete grain elevators located along the inner and outer harbors on the Buffalo River and Lake Erie. The concrete grain elevator represented the culmination of fifty years of development in grain elevator design. Joseph Dart built the first wooden elevator in Buffalo in 1842. Late nineteenth-century tile and steel elevators paved the way for the mammoth reinforced concrete elevators, the first of which went up in Buffalo in 1906. The last one constructed here was erected in 1954. This nomination includes Buffalo's sole surviving steel elevator.

Part I: The Development of Buffalo as a National Center of the Transshipment of Grain Prior to 1860

The American Grain Trade before the Opening of the Erie Canal

Wheat was one of the first agricultural products planted by European colonists in the New World. In colonial times it not only was a staple of life but also became an item of internal and foreign trade. By the time of the American Revolution, there existed a "bread belt" in the Middle and Southern colonies that extended northward into New York's Hudson Valley and westward into the Mohawk Valley. Much of the corn, wheat, and rye that was grown fed homeland consumption, but some was shipped abroad, mainly through Philadelphia, to the West Indies and Europe. In 1765, Philadelphia, which was the leading commercial port in colonial America and the continent's most prosperous city, exported over 360,000 bushels of wheat. In the same period, nearly 110,000 bushels of American wheat began its journey to foreign ports from New York City.[1] From these small beginnings, grain was destined to become the premier American agricultural crop.

The westward movement of population accelerated after the Revolution, as "pioneers" moved into the territory beyond the Appalachians. Settlers put much of this newly cultivated land to raising grain. In 1800, the Appalachians from Virginia to central New York marked the western boundary of American civilization. Before the middle of the century, the line had moved to the Mississippi River. By the time of the Civil War, the future great Mid-Western plains grain-growing regions of Minnesota, Wisconsin, and Lower Michigan were under cultivation.

Raising grain on the frontier was one thing, getting it to market was another. Yet despite the slow and lengthy routes the products were forced to follow from farm to market trade in grain and flour from recently cultivated western lands became a flourishing business in the new republic. During the Revolution and just after, a considerable amount of the wheat raised in Western Pennsylvania began to be shipped to Pittsburgh and

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aul Emmett Sweeney, *Locational Economics and the Grain Trade and Flour Milling Industry of Buffalo* (unpublished Ph.D. dissertation, Dept. of Economics, University of Buffalo, 1942), p. 73.

then down the Ohio to the Mississippi to New Orleans. By the time of the Louisiana Purchase in 1803, New Orleans had become the most important trading center for wheat, corn, and flour from the new farmland in the Ohio Valley and Kentucky. New Orleans would remain a major transshipment point for the export of western grain to Europe until the opening of the Erie Canal in 1825.

Even Western New Yorkers depended on New Orleans for marketing their grain. Grain (and other goods) bound for New York City from the western part of the state often went first south to New Orleans. There it was placed on ocean-going vessels that carried it to its final East Coast destination. This voyage of 3000 miles proved less expensive than the $100 per ton cost (a sum three times the value of the grain) of overland transportation.[2] As one can imagine, the transport of grain from the upper Mississippi region to New Orleans was long and arduous. Loaded onto barges manned by the "flatboatmen" celebrated in the paintings of George Caleb Bingham, barrels of grain and flour made their way down the Ohio to the Mississippi and then southward to New Orleans. The journey was fraught with the dangers of shifting channels and other vagaries of wilderness river travel. And the return trip back north, against the current, could take up to three months. Frequently, a barge owner at the end of his journey, rather than face an upriver trip, would sell his boat in New Orleans and take passage on a ship to Philadelphia or Baltimore. There he would purchase manufactured goods and a wagon to carry him home over an increasingly reliable network of interior roads. Such a round trip could take as long as six months. But from the late eighteenth century until 1825, many residents of the new western lands carried on this cycle of transport, which had more in common with the Roman world than with modern life.

Such journeys, however, became less and less difficult during the first half of the nineteenth century as road building came to supplement river travel in the country's interior. Important early westward roads and turnpikes were constructed between Philadelphia and Pittsburgh, across the Cumberland Gap to Kentucky, and from Baltimore to Wheeling. In some cases, new highways allowed northern farmers to bypass the shipment of grain to either Philadelphia or New Orleans. One such exception to the southerly movement of grain took place in New York. Much of the grain from the fertile Genesee Valley—one of the nation's principal wheat growing areas--went east to Albany via the Mohawk Valley Road. From there, boats carried it down the Hudson to New York City. Such trade contributed to the increased importance of New York City as a grain port.

Concurrent with road building, another factor that would figure prominently in later grain transportation came into existence. Steamboat service began on the Ohio-Mississippi route in 1811, when the first paddle wheeler left Pittsburgh for New Orleans. By 1820, steamboat freight and passenger service, an aspect of the American experience immortalized in the writings of Samuel Clemens, began competing seriously with flatboat traffic. By the end of the 1840s, it had completely replaced the older form of water transport. Steamboats also began plying the waters of the Great Lakes in the 1820s. These new types of large vessels were destined to play a significant role in the success of Buffalo as grain port after the opening of the Erie Canal. Conditions were ripe for a major improvement.

Opening of the Erie Canal in 1825

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[2] *Ibid.*, p. 87.

When the Erie Canal was opened in 1825 with Buffalo as its western terminus, the course of grain transshipment from the west to the east altered drastically. Located where the Niagara River flows out of Lake Erie toward Lake Ontario, Buffalo stood at the easternmost point of navigation on four of the Great Lakes and at the westernmost point of the new canal. (Niagara Falls, some fourteen miles down river from Buffalo, precluded a navigable link between Lake Erie and Lake Ontario and the direct access the latter would have afforded to the Atlantic via the St. Lawrence River.) Henceforth, grain would move across the western Great Lakes to Buffalo, where, unloaded and transferred to canal boats, it was carried eastward 363 miles via the canal to Albany. It was then placed on vessels for the 150-mile journey down the Hudson to New York City. There it could be exported to European and other world markets. What had once been a three-thousand-mile journey was now reduced to 450 miles.

In 1825, Buffalo was a middling village of 2400 people, barely rebuilt after having been burned by the British during the War of 1812. The town did not even produce its own flour; the nearest gristmill operated eleven miles away in Williamsville. At the beginning of its existence, the canal carried more passengers than goods,
for it immediately became the vital water level link in a new highway of immigration to the West from the Eastern Seaboard. But local leaders also saw Buffalo's potential as a commercial port as well as a place of human transit. By creating a large harbor out of the sand-clogged mouth of the Buffalo River (a process begun in 1819 by farsighted Mayor Samuel Wilkinson) and protecting it from the often turbulent open waters of Lake Erie by means of a breakwater, the city prepared itself to accommodate increasing lake traffic. But by 1830, the transshipment of wheat from the West to New York City via the canal had become significant. In 1831, over 57,000 barrels of flour and more than 173, 000 bushels of wheat passed through Buffalo on their way east. These figures steadily increased, and in 1846 more flour and wheat were shipped through Buffalo than through New Orleans. The United States Bureau of Statistics reported that for the year 1860 the "bulk of produce of the Ohio Valley had been diverted to the lakes and Atlantic seaboard; but probably one fifth of it found its way to New Orleans."[3] And the expense of moving goods had come down dramatically since pre-canal days; it now cost only $15 to carry a ton of grain from Buffalo to New York City (including canal tolls). By the time of the Civil War, Buffalo, which also benefited from the construction in the 1830s and 1840s of a network of smaller canals in Pennsylvania and the Great Lakes region of which the Erie Canal became the hub, was handling over 7,000,000 barrels of wheat and flour annually.[4] This, despite the fact that cold weather closed the harbor and canal during the winter months. By the time that Buffalo's mayor Grover Cleveland became president in the mid 1880s, the *Buffalo Express* avowed that "Buffalo has long been known as the City of Grain Elevators."[5]

Grain transshipment also stimulated other wheat-related businesses in Buffalo. An active grain market developed here as the city grew into a center of grain traffic. In 1855, the newly formed Board of Trade and Commerce proudly proclaimed that "Buffalo is now universally acknowledged to be the greatest grain market on the Continent, not even excepting the City of New York."[6]

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[3] *Ibid.*, p. 99.
[4] *Ibid.*, pp. 92-93.
Great Elevator Enterprise," *Buffalo Express*, November 7, 1886, p. 3.
[5] *Ibid.*, p. 93.

Indirectly, the construction of the Erie Canal also stimulated a nascent flour milling industry at nearby Black Rock, a community some three miles down the Niagara River from Buffalo. By drawing water from the Black Rock harbor, engineers were able to create here what, in effect, was an extended millrace. This waterpower became available for manufacturing in 1824, but it was not until the following decade that significant flourmills were constructed along its banks. "Black Rock, has already, by aid of her inexhaustible water power," touted a local newspaper at the time, "become the great flour market of the lakes, and is hereafter to be the principal wheat market of the west."[7] By 1839, lake vessels loaded with grain sailed down river and docked at the Black Rock harbor, where, by means of newly invented machinery, their cargoes could be unloaded in less than a day. Predictions of Black Rock's future as a major milling center, however, proved overly optimistic, and during the last half of the nineteenth century the area saw little expansion beyond the initial spurt of mill construction. Niagara water power proved unreliable (there were years when, due to low lake and river levels, milling had to be suspended), economic recessions took a heavy toll on development plans, and local millers experienced difficulty in obtaining high quality wheat. In the words of Peter Sweeney, the historian of the grain trade in Buffalo, during the period from 1853 to 1907 "Buffalo milling made no sustained advances and at the end its position was not markedly better than at the beginning."[8] Flour milling, which after the opening of the Erie Canal swelled into the premier industry at neighboring Rochester, did not come into its own in Buffalo until after the mid 1890s when hydroelectric power from Niagara Falls began to be transmitted to the city.

The Development of the Railroads

Together with the historic transformation of marine travel by steam power, the early nineteenth century saw the same force recast terrestrial movement. In addition to the Erie Canal and the steamboat, the railroad revolutionized the transportation of goods, including grain, in the early nineteenth century. Indeed, almost from the beginning of its existence, the Erie Canal faced competition from the new railroad industry. Rail beds began to be constructed parallel to the Erie Canal in the early 1830s. At first, competition was small because early roads were built with iron rails that could sustain only relatively light loads. Furthermore, the early roads had no terminals for loading and stowing grain and other goods. But with the introduction of steel rails and the steady improvement of trackside facilities, railroads began first supplementing and then drawing away business from the canal. Rail travel was faster, and unlike the canal, the railroads could run all year round; they did not shut down when winter ice closed the lakes-canal route.

By the middle of the century, when a number of lines had been absorbed into the New York Central, the rail link between New York and Buffalo was consolidated. The railroad had grown into a major player in the transportation of passengers and goods between the Atlantic seaboard and the Great Lakes region. "This great route almost equaling in importance the Erie Canal," stated a Buffalo business journal in 1854, "and to which it already proves a formidable rival . . . has been yearly extending its operations until it now forms one of the most reliable channels of commerce between the produce of the west and the manufacturers and markets of the east."[9] Other roads, such as the Pennsylvania Railroad and the Baltimore and Ohio also built trunk lines to

[7] *Buffalo Commercial Advertiser*, April 12, 1839, p.2, quoted in Sweeney, p. 239.
[8] Sweeney, p. 241.
[9] *Ibid.*, p. 104.

Buffalo from the older ports of Philadelphia and Baltimore. By the middle of the 1880s, twenty different railways started or ended at Buffalo.

Railroads eventually tightened their grip on grain transportation by investing in lake steamboat lines as subsidiaries and by building warehouse facilities and storage elevators on the Buffalo waterfront. Already in the mid-1850s, the New York Central had erected between Ohio Street and the Buffalo River what it touted as the largest depot in the world. This facility allowed trains to receive grain and other freight directly from lake vessels docked in the harbor. The road was also by then connected to the two largest grain elevators on the Buffalo waterfront. In 1855, railroads carried twice the amount of flour from Buffalo that moved on the canal and by the end of the decade they threatened the very existence of the canal as a grain route.[10]

Another spurt of railway development came in the 1880s, by which time the International Railway Bridge over the Niagara River to Canada had been constructed at Buffalo. During that decade the city made generous land grants to railroads to encourage their expansion here. Six different routes connected the city to New York, including the New York Central, Lehigh Valley, and Delaware, Lackawanna and Western lines. The transfer yards on the east side of town grew to the largest in the world and new terminal facilities greatly increased storage and warehouse capacity. The Lehigh Valley line alone created a terminal and ship canal at the Tifft farm that added two miles of dock space to the existing waterfront.

Joseph Dart and Robert Dunbar and the Development of the Wooden Grain Elevator and Marine Leg Conveyer System for Unloading Grain from Lake Freighters

As Buffalo's harbor became port of call to more and more vessels arriving to unload grain, it was perhaps inevitable that invention would be applied to the laborious process of transferring grain from lake vessels to canal boats. At first, men, chiefly Irish immigrants, carried barrels by hand. Not only was this backbreaking work, but the slow pace was a weak link in the chain of improved efficiency of movement represented by the steamboat and locomotive. When the first bulk shipment of grain (some 1600 bushels) arrived in Buffalo aboard the *Osceola*, it took a week for longshoremen to unload the cargo.[11]

It was Buffalo entrepreneur Joseph Dart (1799-1879) and engineer Robert Dunbar who applied the new technology of the age to the handling of grain. Dart had come to Buffalo from his native Connecticut in 1821 and set himself up in the hat and fur business. Dart, whom contemporaries described as a "methodical and industrious man,"[12] had an eye for good business opportunities. As the grain trade began to develop in Buffalo after the opening of the Erie Canal, he turned his sights on this growing industry. "It seemed to me," he said, "as I reflected on the amazing extent of the grain producing regions of the Prairie West, and the favorable position of Buffalo for receiving their products, that the eastward movements of grain through this port would soon exceed anything the boldest imagination had conceived."[13] In 1842, Dart built the first steam-powered grain elevator. (It is probably more than coincidence that the first shipments of anthracite coal from northeastern Pennsylvania arrived in Buffalo via the canal in the same year that Dart built his elevator. Thereafter, the coal

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[10] *Ibid.*
[11] Michael N. Vogel and Paul F. Redding, *Maritime Buffalo*, Buffalo: Western New York Heritage Institute, 1990, p. 25.
'Death of Joseph Dart," *Buffalo Express*, September 29, 1879, p. 4.
[13] Joseph Dart, "The Grain Elevators of Buffalo," *Publications of the Buffalo Historical Society*, I(1879), p. 399.

that fueled Buffalo's many steam-powered industries came in a steady flow by the waterway and later by rail.) In 1843, when the schooner *Philadelphia* unloaded the first bulk shipment of grain at the **Dart Elevator**, it took only hours to lift the wheat from the hold.[14] The man who made it possible was thirty-year-old engineer, Robert Dunbar, the unsung pioneer of grain elevator construction. Born in Scotland in 1812, Dunbar arrived in Buffalo in 1834, after having studied mechanical engineering in Canada. At the time of his death in 1890, Dunbar was eulogized as "the father of the great grain elevator system." His inventions had made possible "all the present improvements of elevators," proclaimed the *Buffalo Commercial Advertiser*.[15] In addition to the **Dart Elevator**, Dunbar designed nearly all of the elevators that by the 1880s crowded together along the shores of the Buffalo River. The **Evans** (1865), **Watson**, **Merchants**, **Reed**, **Wilkinson** (1863), **Wells**, and **Bennett**[16] elevators are now long vanished and known to us only in photographs, yet they were the first landmarks of the new age of grain transshipment in North America. The taciturn Dunbar—a contemporary described him as a man of "a singularly retiring and undemonstrative disposition"[17]—enjoyed an international reputation for his remarkable accomplishments in Buffalo. Jobs for constructing elevators came to him from as far away as Odessa, Liverpool, and elsewhere in Europe and Canada.

Dunbar became associated with Dart in his grain elevator enterprise after having erected in nearby Black Rock at least one water-powered flourmill that utilized a new mechanized system for handling grain and flour. In 1842, the two men undertook to erect the 50 by 100 foot **Dart Elevator** on a site near the mouth of the Buffalo harbor at the junction with a small subsidiary waterway called the Evans Ship Canal. (A bronze plaque placed there by the Buffalo and Erie County Historical Society presently marks the location.) By means of a steam-powered vertical conveyer belt made of leather or canvas and equipped with buckets, Dart could unload grain directly from the hulls of a lake vessel moored alongside his storage elevator. Inside the ship, men who before this had carried barrels on their backs from boat to dock now shoveled grain into the conveyor belt buckets. They were the first generation of "scoopers," as the laborers—more often than not Irish immigrants or their descendents--who unloaded the lake vessel cargoes in this way came to be called. (Locals skeptical of Dart's investment in the new technology taunted him with the jest that "Irishmen's backs the cheapest elevators.") The grain they scooped was carried up this so-called loose leg to a scale where it was weighed before being distributed to large storage bins. There, grain would be stored until sold. At that moment, it would be drawn off through the bottom, raised again to the scale by means of a "stiff leg" conveyer system that occupied a fixed position within the elevator house. Finally, the grain "spouted" down into a waiting canal barge moored where the arriving lake vessel had docked. The process involved the forces of steam power to lift the grain and gravity to spout it. Thus was born a new building type. An early observer defined it as "a collection of elevating, weighing and distributing machinery, placed in and over a building made to fit its size and requirements, this building being a collection of boxes, or bins, of greater or lesser size and depth, fitted for the receipt of grain at the top and for discharging the same through openings in the bottom."[18]

The most innovative feature of the **Dart Elevator** was the long, vertical conveyer system that replaced human labor as the means of unloading grain from lake vessels. Housed in a tall wooden sleeve, the conveyer

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[14] Vogel and Redding, p. 24.
[15] "Famous Inventor: The Death of Mr. Robert Dunbar," *Buffalo Commercial*, September 18, 1890, p. 6.
[16] Dunbar's Bennett Elevator replaced his earlier Dart Elevator.
Ibid.
[18] E. P. Overmire, "Modern Fireproof Grain Elevators," *The Northwestern Miller*, 56(November 18,1893), p. 1103.

could be canted outward at the bottom of the elevator structure and lowered directly into the hold of a waiting boat. When not in use, this loose leg conveyer belt was retracted by means of a steam engine to its original vertical position inside the elevator. A hood or cupola, some twenty feet in height, on the roof of the structure provided the extra room needed to store it upright. It was the most distinctive external feature of Dart's elevator and those that followed its example. At first this pioneer "marine leg," as these boat-to-elevator devices came to be called was equipped with two-quart buckets 28 inches apart. Dunbar's original system was able to raise 600 bushels an hour, ten times the amount human workmen had been able to carry. Soon, however, with improvements, the capacity of the marine leg rose to 2000 bushels an hour and the elevator's storage capacity increased from 55,000 bushels to over 110,000 bushels. Dart and Dunbar owed a serious debt in their invention to miller Oliver Evans, who earlier had devised a similar conveyer system to handle flour and grain in his milling operation in Philadelphia.

While the mechanization of grain handling that went on inside the early elevators represented the application of new ideas to an age-old industry, the materials and methods used to construct the first elevators were not new. Wood, a plentiful material in the Great Lakes basin, allowed for quick and inexpensive construction. (Dart also involved himself in the burgeoning Western New York lumber trade.) Heavy timber frames sustained these early structures that contained rectangular storage bins built on the traditional crib system. In order to support the enormous weight of the stored grain (100,000 bushels weighs about 3000 tons), and because these elevators were located on mud and sand adjacent to the river, it was necessary to erect them on pilings. Typically, closely spaced log piles were driven deep into the soft earth to form a solid foundation on which the elevator could be raised. A basement course of stone or brick was laid on the pilings to a height of about 16 feet, above which rose a framed superstructure of oak, elm or beech. The internal bins were supported on a series of posts, struts, and girders.[19] With their exteriors covered with boarding, the first elevators resembled enormous sheds or barns. Their tall, ungainly proportions and steeply sloping roofs evoked a decidedly Medieval appearance. Perhaps this is what attracted H. H. Richardson to them, for the great Romanesque revival architect, who had projects in Buffalo in the late 1860s and early 1870s, nurtured a keen desire to design a grain elevator.

Despite their old-fashioned look, the new Buffalo elevators increased the speed with which grain could be transferred from boat to barge and made it possible to store safely large of amounts of grain at the site. Dart and Dunbar provided the third element necessary together with motorized lake and rail transportation that brought the age-old grain industry into symmetry with vastly expanded scale of modern life. By 1860, the **Dart Elevator** had spawned ten similar structures on the Buffalo waterfront and given the city a storage capacity of over one-and-a-half-million bushels. With an addition of sixteen more elevators by the end of the Civil War, Buffalo surpassed the grain commerce of London, Odessa, and Rotterdam to become the world's largest grain port. Without the invention of the versatile and efficient elevator, this meteoric rise would have been impossible.

"Grain elevators make ideal structures for the storage of grain," writes industrial historian Henry H. Baxter, whose ancestors designed many of Buffalo's later elevators. "In the elevator's bins, grain can be kept

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A description of early elevator construction is found in A. P. Boller, rain Elevators, Cleaners, and Dryers," *Journal of the Franklin Institute*, 52(July 1866), pp. 4-5.

dry, cool, free from vermin, and safe from pilferage. Moreover, elevators make it possible to weigh and sample grain to determine the quality, quantity, and grade as a basis of payment."[20] In addition, Buffalo's early elevator operators developed the ability to dry and clean the grain they received here sometimes in less than optimal condition. Often the grain in ship holds became wet during the lake voyage. In order to prevent damp grain from spoiling, it needed to be dried before being put into storage. Dunbar's **Reed Elevator** had a typical drying facility (called a Marsh dryer) attached to it. The marine leg lifted the grain from the hold to a large metal surface some 800 feet square that was perforated with tiny holes. As the moist grain was raked across this surface it was dried by a blast of hot air from below. The grain was then drawn through a current of cold air to cool it before being shunted into a storage bin. A system for cleaning grain shipments of chaff and other impurities involved dropping the grain into a large cylinder and drawing off the lighter chaff that rose in the air by means of a steam-powered exhaust fan. A combination drying and cleaning system invented by Buffalonian George Clark was put into operation in the middle of the 1860s in a separate building adjoining the large **Richmond Elevator**.[21]

Part II: Increased Grain Trade and the Evolution of Grain Elevator Design, 1860s-1890s

The Post-Civil War Era, 1865-1890: The Decline and Rise of Buffalo as a Center of Grain Transshipment

By 1860, the breadbasket of America had moved from the Ohio Valley to embrace the entire Great Lakes basin. New York and Pennsylvania bordered this vast expanse of wheat production on the east, Iowa and Missouri on the west, and Wisconsin and Michigan on the north. (Corn production had taken over the area to the south, including Illinois, Ohio and Tennessee.) Much of the grain produced in these areas now found its way north across the Great Lakes to Buffalo. By 1860, American vessels on the lakes totaled over 450,000 tons of carrying capacity. From Buffalo, the grain of the lakes basin traveled by canal or railroad to the Eastern Seaboard. In 1861, Buffalo, which before 1825 had shipped local grain to market via the Ohio and Mississippi to New Orleans, was home to twenty seven grain elevators and did an annual grain business that totaled more than 50,000,000 bushels.[22] The busiest time of the year for the port was from the middle of September, when the grain harvest began, until the middle of November when the lake traffic ceased due to ice and cold weather.

From the time of the Civil War to the closing of the American frontier in 1890, Buffalo experienced declining and rising fortunes as a center of grain and flour transshipment. Buffalo's fortunes were in large measure determined by developments in national transportation patterns and the shift of the nation's main wheat growing region from the Mid West to the Northwest. From the middle of the 1860s to the middle of the 1870s, Buffalo maintained a strategic point in the movement of grain from the West to the Atlantic seaboard. But rivalries between the ever growing railroads and the lake vessels for the transport of grain eastward soon threatened the role of the city as a major point of transfer of grain from lake vessels to canal and rail transport. In the ten years between 1875 and 1885, Buffalo was severely affected by the diversion of western grain shipments to railroads from lake steamers. During this period Midwestern railroads were able to siphon off a major portion of the grain transport business from the lake steamers. This was made possible by the consolidation of shorter lines into through lines, the laying of steel rails that permitted heavier loads to be

[20] Henry Baxter, *Grain Elevators*, Buffalo: Buffalo and Erie County Historical Society, 1980, p. 4.
Boller, pp. 9-11.
[22] *Ibid.*, pp. 105-106.

carried than before by bigger engines, the construction of terminal facilities and railroad grain elevators and the manipulation of transshipment fees. Shipping by rail became attractive to farmers because it was faster and cheaper than by boat and they could avoid transshipment charges because trains went directly to ports, bypassing Buffalo. By 1872, ninety-nine per cent of the flour and sixty-seven per cent of the grain shipped eastward from the Midwest went by rail rather than over the lakes.[23] Insurance costs were also much lower to shippers and they could be assured that their grain would not be subject to heating the way it was on slower moving vessels and canal boats. At the same time, the shipment of grain on the Erie Canal steadily declined. Chicago surpassed Buffalo as the leading center of Great Lakes grain trade during this dark period for Buffalo. From 1868 to 1875, Buffalo accounted for over half of the grain that arrived in New York City; after 1875, this amount was reduced to less than thirty per cent.[24] To many observers, Buffalo seemed doomed to shrink into insignificance in the landscape of the American grain trade.

But the situation turned around dramatically after the middle of the 1880s. Buffalo was given a new lease on life as a result of the expansion of the hard spring wheat belt across Minnesota and the Dakotas. This major agricultural phenomenon (which was matched by a similar growth of grain farming in Kansas and Nebraska) was to restore the city to its position as the strategic transfer point in the westward to eastward movement of grain and flour. These new grain fields of the Northwest were west of Lake Superior and far to the north of the central Midwestern rail system that was centered on Chicago. At the head of Lake Superior, Duluth now became the great collection point of grain for this new region as well as a major flour-milling center. To get their products to markets, shippers restored wheat and flour traffic on the lakes. The journey by steamer from Duluth at the head of lakes navigation to Buffalo at the foot was about the same distance as from Duluth to Chicago. In addition, new rail lines in Minnesota allowed millers and grain shippers to bypass the congested freight yards of Chicago and to shorten the distance to Atlantic ports by placing grain cargo on lake freighters bound for Buffalo at Gladstone. "The ascendancy of the Northwest," observes Sweeney, "put Chicago off, and Duluth on, the direct line between the wheat areas and the Eastern markets; it also produced adjustments in the location of flour milling industry which passed the leadership in place and traffic from the Chicago lake and rail routes to the Duluth-Superior lake route."[25]

As a result of these geographic shifts, Buffalo was back in business. By 1893, Buffalo handled two-thirds of the grain and over fifty per cent of the flour moving eastward from the thriving Lake Superior region.[26] Moreover, by century's end, Buffalo enjoyed a stronger position than ever before in the advancing saga of west-to-east transport of grain and flour. In actual volume, this meant that 128 million bushels passed through the port in 1891; by 1898 this amount had nearly doubled to 221 million bushels.[27] In 1885, a reporter informed the readers of *Harper's Monthly Magazine* of the marvel of Buffalo's nearly mammoth grain elevators. They formed "an elephantine procession a mile long, with a combined storage capacity of 9,250,000 bushels and a transfer capacity of 3,102,000 bushels, or, in other words, the power of receiving lake vessels and transferring to

[23] Sweeney, p. 119.
[24] *Ibid.*, p. 129.
[25] *Ibid.*, p. 127. Chicago remained the primary market for corn and oats, which were mainly grown south of Lake Superior in the central Midwestern corn belt.
Ibid., p. 130.
[27] *Ibid.*

canal-boats and cars daily 3,000,000 bushels of wheat, a rate unequaled by any port in the country."[28] Optimistically facing the new century, Buffalo's extraordinary collection of thirty four grain elevators, in the words of industrial historians Thomas Leary and Elizabeth Sholes, "could unload, weigh, sort, and transfer huge amounts of grain from and to ships, or into storage for local use or for future transport to hungry Eastern cities."[29]

The Decline of the Erie Canal

Despite the boost that Lake Superior grain trade gave to the port of Buffalo, it had little effect in arresting the decline of the Erie Canal. Already during the Civil War, the volume of wheat and flour shipped from Buffalo to New York City via the canal began to fall off. And after the war, the amount declined precipitously from a high of ninety-six per cent in 1868 to a mere twelve per cent in 1898. Closed by cold weather in winter, often impassable due to repairs, and generally plagued by mismanagement, the canal fell victim to the superior advantages of speed, reliability, and economy offer by the railroads. New York and Midwestern rail companies experienced great expansion after the War. They now began to erect terminal facilities and even their own grain elevators which served as intermediaries between rail lines and railroad-owned steamboat companies. To capture business away from the canal (and from each other), they would guarantee shippers through freight rates and unbroken shipment from western grain fields to the East Coast. They were also not above practicing rate discrimination to garner business from competitors. Under these circumstances, by the time it was fifty years old, the Erie Canal—that glorious enterprise that had bestowed the gift of prosperity on Buffalo--was doomed to obsolescence as a feature in the booming eastward transport of grain from America's heartland to the Atlantic seaboard. By the end of the nineteenth century, rail cars had replaced canal boats on the land side of Buffalo's many grain elevators. "To win the heart of this queen city today," wrote an observer in the mid 1880s,"you must court her in the role of a railway king."[30]

By the 1890s, railroads were also delivering grain to Buffalo elevators, in competition with lake steamers. In fact, so much grain arrived by train that there were often 1000 cars waiting to be unloaded in Buffalo's freight yards. Often, it took over two months for a boxcar to be unloaded. By 1885, the situation had become so bad that it posed a threat to Buffalo's position as a grain depot; railroads began to divert grain shipments to other places rather than have their rolling stock mothballed for long periods here. Led by S. F. Sherman, the Buffalo grain transshipment industry took significant measures to improve the situation. In 1886, two new large elevators, the **Lake Shore** and the **International**, were constructed expressly with rail freight service in mind. The **International Elevator** was the first important elevator to go up outside of the Buffalo harbor area. It was erected on a site along the Niagara River served by the new Belt Line railroad and near the International Railroad bridge. A tall, narrow structure with a 1700-foot-long track side loading dock, as well as an internal rail loading dock, the **International Elevator** stood between the railroad and the Erie Canal. With a daily capacity of 320,000 bushels, it received grain from Canada's Union Pacific Railroad and the Grand Trunk and

[28] "The City of Buffalo,"*Harper's New Monthly Magazine*, 71(July 1885), p. 194.
Thomas E. Leary and Elizabeth Sholes, *Buffalo's Waterfront*, Charleston: Arcadia Publishing, 1997, p.23.
[30] "City of Buffalo," p. 196.

Michigan Central roads. It could transfer this grain to canal boats or to the cars of seven other eastward bound rail lines.[31]

To unload boxcars filled with grain, handlers developed a system of mechanized shovels. In 1891, a writer in the *Scientific American* visited Buffalo and described this process, which employed a large shovel or scraper suspended from a rope, as follows: "The rope is attached to steam apparatus by which it is taken in at the proper time, as if on a windlass. The operative draws the shovel back into the car of grain and holds it nearly vertical and pressed down into the grain. The rope draws along the shovel with the grain in front of it and a number of bushels are delivered at each stroke. In this way a couple of men can very quickly empty a car." The men who worked these shovels were comparable to the scoopers who unloaded the hulls of grain freighters. And like their marine counterparts, the boxcar laborers were under pressure to maintain a brisk pace. "The movement of the shovels," observed the *Scientific American* reporter, "succeeds one another with sufficient rapidity to keep the men in active movement."[32]

Lake transport also underwent significant changes during the post-Civil War period. Chief among them was the shift from wooden hulled ships to steel-hulled vessels. The *Spokane*, the first such steamer on the Great Lakes, went into service in 1886. It heralded a new fleet of vessels that could carry increased loads of raw materials, including grain, iron ore, and coal. The new freighters also called for improvements to Buffalo's harbor facilities. Docks and slips were enlarged to accommodate their greater size and the enlarged quantities of their cargoes.

In the middle of the 1880s a major expansion of Buffalo's port facilities was undertaken. A 4000' breakwater was constructed about a half mile from the shoreline, beyond the Buffalo River. By 1903, several miles of new lakeshore dockage had been created behind the breakwater. This area came to be called the Outer Harbor, while the original port facilities that lay inland along the Buffalo River henceforth were known as the Inner Harbor. With this new anchorage in view (and that provided in the Erie Basin, which the city had created in the 1850s behind an earlier breakwater), Buffalo, by now commonly referred to as the Queen City of the Lakes, would soon, claimed a contemporary, "rival the traffic of the river Mersey and vie with that of Liverpool in number of docks and warehouses,"[33]

Advances in Grain Elevator Design, 1860-1890

Dart and Dunbar had established the grain elevator as the structure essential to Buffalo's success as a grain transshipment port. In 1861, the British novelist Anthony Trollope visited the Queen City and recorded his impressions of the flourishing grain trade he saw there. "As ugly a monster as has been yet produced," said Trollope, of the elevators that crowded the busy Buffalo waterfront. He likened them to dinosaurs with "great hungering stomachs and huge unsatisfied maws."[34] Yet he admired the efficiency with which these modern-day industrial brutes processed enormous amounts of grain (which, in English parlance, he referred to as "corn.")

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[31] A detailed account of the International and the Lake Shore (which was located on the Buffalo waterfront) is found in "Great Elevator Enterprise," *Buffalo Express*, November 7, 1886,p. 3.
[32] *Scientific American*, quoted in Leary and Sholes, p. 38.
'City of Buffalo," p. 194.
[34] Anthony Trollope, *North America*, Philadelphia: Lippincot, 1862, vol. I, p. 181.

Trollope found especially fascinating the operation of unloading grain from a lake steamer and depositing it into the hold of a waiting canal barge moored alongside. After observing the performance of the loose leg—which he compared to an elephant's trunk or a mosquito's proboscis that is thrust "into the very vitals and bowels of the ship"—Trollope went inside an elevator. His careful description of the inner workings of these extraordinary structures is the best first-hand account we have of how these early elevators functioned.

> Thus the troughs [the loose leg conveyer belts], as they ascend, are kept full, and when they reach the upper building they empty themselves into a shoot, over which a porter stands guard, moderating the shoot by a door, which the weight of his finger can open and close. Through this doorway the corn runs into a measure and is weighed. By measures of forty bushels each, the table is kept. There stands the apparatus, with the figures plainly marked, over against the porter's eye' and as the sum mounts nearly up to forty bushels he closes the door till the grains run thinly through, hardly a handful at a time, so that the balance is exactly struck. The teller standing by marks down his figure, and the record is made. The exact porter touches the string of another door, and the forty bushels of corn run out at the bottom of the measure, disappear down another shoot, slanting also toward the water, and deposit themselves in the canal boat. The transit of the bushels of corn from the larger vessel to the smaller will have taken less than a minute, and the cost that transit will have been—a farthing.
>
> And these rivers of corn are running through these buildings night and day. The secret of all the motion and arrangement consists, of course, in elevation. The corn is lifted up; and then lifted up can move itself, and arrange itself, and weigh itself, and load itself.[35]

Trollope also remarked on how the grain arrived in Buffalo loose, in bulk, not in sacks. "We in England," he said, "are not accustomed to see wheat traveling in this open, unguarded, and plebian manner. Wheat with us is aristocratic, and travels always in its private carriage."[36]

After the Civil War, Robert Dunbar continued to design and build elevators on the Buffalo waterfront. He constantly made improvements over those Trollope had known. By the middle of the 1880s, the largest elevators could stow 1,000,000 bushels of grain and elevate stores from boats to bins at a rate of 19,000 bushels an hour. A significant development that made such speed possible and which actually changed the outward form that later elevators would take was the introduction of horizontal transfer systems to move grain to the internal storage bins. The horizontal conveyor system allowed grain to be distributed to bins some distance from a fixed elevator leg. The heads of elevating legs and related weighing equipment were housed in a tall cupola or monitor (often containing windows to light the interior) that ran the length of the structure above the storage bins. And economy dictated that the bins now be lined up in straight rows so that "grain might be distributed to them from the least number of horizontal conveyers."[37] Thus, the long, lateral form of the twentieth-century concrete elevator, with stacks of silos lined up beneath an upper "headhouse" began to replace the tall, vertical shed form of the earliest elevators.

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[35] *Ibid.*, 181-182.
Ibid., 182.
[37] HAER, p.5.

Conveyor belts also were added to the basement level of elevators, which eliminated the need for elevating legs down the length of the structure. By means of this innovation, grain being removed from a bin "could be spouted onto the basement conveying system and taken to some convenient point in the house where elevator legs were located. Fewer legs were required per unit of storage as outgoing grain from any bin could be directed to a single elevator leg."[38] Now elevating legs could be grouped at one end of the elevator only, in a "workhouse." From the workhouse, a "headhouse" or low gallery extended across the top of the elevator and housed the bin floor conveyor system. This headhouse replaced the tall cupola of older elevators. The now demolished **Lake Shore Elevator**, erected in 1886, was regarded as the first fully evolved example of this forward-looking system. At the same time, the loose leg became housed in a tower that nearly stood separate from the elevator itself. From this, soon developed the "marine leg tower," a moveable structure set on wheels housing loose legs that could be moved along the length of the elevator to unload grain from waiting vessels moored alongside. By 1894, four of these moveable marine towers were working parts of Buffalo elevators.

"It was my felicity to catch a grain steamer and an elevator emptying that same steamer," wrote Rudyard Kipling during a visit to Buffalo in the late 1880s. His colorful description of the operation of these mighty new marine towers continued:

> She was laden with wheat in bulk from stem to stern, thirteen feet deep lay the clean, red wheat. . . . They maneuvered the fore-hatch of that steamer directly under an elevator . . . 150 feet high. Then they let down into that fore-hatch a trunk, as if it had been the trunk of an elephant . . . And the trunk had a steel nose to it and contained endless chains of steel buckets.
>
> The captain swore, raising his eyes to heaven and a gruff voice answered him from the place he swore at. Certain machinery, also in the firmament, began to clack and the glittering, steel-shod nose of the trunk burrowed into the wheat and the wheat quivered and sunk upon the instant as water sinks when the siphon sucks, because the steel buckets within the trunk were flying upon their endless round, carrying away each of its appointed morsels of wheat.
>
> The elevator was a Persian well wheel—a wheel squashed out thin and cased in a pipe, a wheel driven not by bullocks, but by much horse-power, licking up the grain at the rate of thousands of bushels the hour. And the wheat sunk into the fore-hatch . . . till the brown timbers of the bulkheads showed bare. Then men jumped down through the clouds of golden dust and shoveled the wheat furiously around the nose of the trunk and got a steam shovel of glittering steel and made that shovel also, till there remained of the grain not more than a horse leaves in the fold of his nose bag.[39]

By the early 1890s, Buffalo's wooden elevators had evolved away from Dart's barn-like structure to a form that, internally, anticipated the classic concrete elevators that would soon replace them. The elongated arrangement of rows of bins, the vertical workhouse at one end, the low headhouse extending across the top of the row of bins, and the moveable marine leg tower already were characteristics of Buffalo grain elevators erected by the early 1890s. With Dunbar's **Bennett Elevator** specifically in mind, architectural historian Henry-

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[38] *Ibid.*

Rudyard Kipling, "Buffalo's Wheat Elevators," (1889), reprinted in Carl Carmer, *The Tavern Lamps are Burning: Literary Journeys Through Six Regions and Four Centuries of New York State*, New York: McKay Co., Inc., 1964, pp. 429-430.

Russell Hitchcock observed that while "the battle of styles was fought out uptown and downtown, Dunbar continued to build great elevators along the lake front. . .. Their vast, unornamented surfaces, bold cantilevers and clearly organized functional forms suggest architectural possibilities for America which even Sullivan hardly grasped."[40]

The marine towers of late nineteenth-century elevators might be said to have been anticipated by Arunah B. Nimbs's invention of the floating elevator. Nimbs, a Buffalo entrepreneur inspired by the **Dart Elevator**, built the first of these curious structures in 1866, thus adding another chapter to the unique history of grain transshipment on the Buffalo waterfront. Nimbs's wooden floating elevators, and others built following his example, could hold up to 5000 bushels of grain. They were seldom used, however, to store grain for any length of time. Rather these floating elevators, which, like their stationary sisters, were equipped with steam-powered marine legs and conveyor systems, were used to transfer grain from one ship to another or, in some cases, to unload grain from vessels calling at stationary elevators and mills that lacked their own mechanical grain moving equipment. According to historians Thomas Leary and Elizabeth Sholes, the huge C. and J. M. Horton floating elevator could handle 72,000 bushels of grain each day, an amount that rivaled the efficiency of some of the city's larger stationary elevators.[41] The heyday of these unusual and picturesque structures, however, was short lived. Few if any apparently survived into the twentieth century.

Part III: 1890s to 1930s: The Evolution of the Modern Elevator

Buffalo's Leading Position in the Wheat Trade, 1890 to 1929

"It is evident that, considering both primary and secondary markets," says grain trade historian Peter Sweeney, "Buffalo was the leading wheat market of the United States" for the first three decades of the twentieth century.[42] The establishment of the wheat growing in the Northwest and the pattern of grain shipment from that region to Buffalo accounted this success. Grain receipts continued to increase during the boom years of the 1920s, after which a long and steady decline set in. In 1900, the city handled 111,000,000 bushels of wheat; by 1928 the quantity had risen to 280,000,000 bushels. However, after 1944 a precipitous decline in grain receipts took place. The reasons were complex, but the drying up of the grain trade here was due to such factors as the rise of Pacific coasts ports, such as Seattle, Tacoma, and Portland in the United States and Vancouver in British Columbia, the improvement of the Welland Canal and the Oswego Canal, which allowed more and more traffic to bypass Buffalo by taking the St. Lawrence River route to Montreal, and the general decrease in grain production as demand fell off during the Depression. But the period from 1890 to 1940 might well be considered the city's golden age of commercial supremacy in the grain transshipment industry.

At the same time, the upgrading of the Erie Canal into the New York State Barge Canal made canal transport once again a viable alternative to rail transport between Buffalo and New York City. During the 1930s, more grain actually moved on the canal than did on the rail lines. Railroads, however, continued to carry grain to places other than New York City over lines that extended fan-like from Buffalo to the East Coast.

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[40] Henry-Russell Hitchcock, *Buffalo Architecture*, unpublished exhibition text, Buffalo: Albright Art Gallery, 1940.
Thomas E. Leary and Elizabeth C. Sholes, *Buffalo's Waterfront*, Charleston: Arcadia Publishing, 1997, p. 37.
[42] *Ibid.*, p. 131.

Paralleling the robust trade in grain was a rise in the amount of flour milled at Buffalo. The upward trend began at the turn of the century and continued, with a brief setback during World War I, until it reached a peak in the 1930s. By this time, Buffalo surpassed Minneapolis as the nation's center of flour making.[43] The reasons for Buffalo's ascendancy were several. Among the leading ones were the slower rate of population increase in the Northwest, which reduced consumer demand, and the increase nationally of the number of large commercial bakeries, which caused a reduction in home baking. These mechanized bakeries required less and less of high quality Northwestern flour, which had been the staple of America's kitchen bakers. But perhaps the most important factor working in Buffalo's favor was economic. "Flour milled in Buffalo," explains Sweeney, "from wheat received by lake from Duluth and shipped by rail to New York had a five-cent rate advantage per hundred pounds over flour milled at Minneapolis and shipped rail-lake-rail through Duluth and Buffalo to New York. This advantage had a markedly stimulating effect on Buffalo milling."[44] In other words, it was cheaper for shippers to send grain directly from Duluth to Buffalo for milling and then to New York for export than to send it first to Minneapolis for milling and then to Buffalo for transshipment to New York. Finally, under an agreement with the Canadian government, much Canadian wheat was milled "in bond" in Buffalo. This arrangement provided for the rebate of tariff duties on Canadian grain imported to the United States if, after milling here, it was exported directly to foreign markets.

All of this economic activity called for expanded grain storage facilities at Buffalo and the construction of large-scale flour milling facilities. Engineers met the challenge by literally reinventing the grain elevator. Most of the older wooden elevators were now replaced by ones utilizing new designs and materials. The concrete bins of the new age of elevators greatly improved these structure's fireproof safety and expanded their storage capacity significantly. Just as the period 1890 to 1930 was a golden age of grain trade and flour milling in Buffalo, it was also a golden age of grain elevator construction. In 1931, Buffalo possessed thirty-eight elevators with a total capacity of more than 47,000,000 bushels of grain. And the world took notice, especially the leading lights of the international architectural profession who were forging a new design esthetic for the modern era. Many marveled at Buffalo's extraordinary waterfront lined with mammoth concrete silos that foreshadowed an architecture of austere functionalism. Those like Walter Gropius, Bruno Taut, Le Corbusier, and Erich Mendelsohn drew lessons that helped change the course of modern architecture.

The Search for Fireproof Construction

Nearly all the elevators erected in Buffalo before the 1890s were made of wood. While this made for relatively inexpensive and quick construction, it also possessed many limitations as well. The biggest drawback to timber was its flammability. The early elevators often fell pray to destruction by fire. When the **Eastern Elevator** went up in Buffalo in 1895, it contained eight million board feet of timber. Four years later, all of it was destroyed in a grand conflagration. Combustion might suddenly occur from overheated grain or from grain dust explosions that occurred especially when grain was being loaded into or unloaded from the elevator. There were also threats from the exterior causes, chiefly sparks and hot cinders from locomotives, for elevators were located close to railroads. Cladding the exteriors of the elevators with corrugated metal sheets appears to have done little to prevent fires started by passing trains. Dunbar's **Reed Elevator**, which was described as "the most complete elevator in all its appointments in Buffalo" when it went into operation in 1862, was probably the first

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Ibid., p. 279.
[44] *Ibid.*, p. 315.

to have employed corrugated iron to protect its marine tower; the rest of the exterior and the roof wore a shield of slate.[45] Boilers needed to generate steam for steam-powered machinery also posed a serious fire hazard. In addition to being easily ignited, timber elevators were prone to settle under the weight of a full load of grain, and rodents and other vermin had little trouble infiltrating their interiors. For all of these reasons, insurance costs for such structures were quite high, a fact that was another incentive for entrepreneurs to search for new materials and construction techniques.

Writing in 1902 in the *Northwestern Miller*, a leading grain industry periodical, E. S. Rollins explained the relationship between insurance and grain elevator economy. Saving on insurance costs, he said, could represent the difference between profitability and loss to an elevator operator, especially in slow economic times. Rollins offered this example:

> Now a fire-proof plant of 1,500,000 bushels capacity would cost $195,000, against $150,000 for the wooden, but would save $13,875 per year on insurance. This is a very good saving, and would pay the difference in the cost of construction in less than four years. Moreover, this saving amounts to over seven per cent per year on the total cost of the fire-proof plant. This means that a company might build a fire-proof elevator, borrow the money with which to pay for it, and pay the interest on the bonds with what would be saved on insurance. More than this could be done, in fact, for money can be borrowed at 5 per cent yearly, and as the fire-proof house would be a net savings of 7 per cent yearly on its cost, there would be a net saving of 2 per cent per year.[46]

The Steel Bin Elevator

In the 1890s, engineers in Buffalo and elsewhere began to explore seriously the use of new, fireproof materials in the construction of grain elevators. Experiments with fireproof materials centered on steel, tile, and concrete. (By this time, most elevators, even timber ones, rested on concrete pier foundations.) The search eventually led to the revision of the elevator as it had been known up until that time. The first experiments with fireproof construction were made using metal technology. Already in 1861, an elevator with cast iron bins twelve feet in diameter and fifty feet in depth was built on the Brooklyn, New York, waterfront. Later in the same decade, steel bins were used for the first time in an elevator that went up at Philadelphia. It appears that the first attempt to construct a fully fireproof, non-timber elevator in Buffalo was the **Plympton Elevator**. Erected in 1868, it was built of iron and steel components, including cylindrical metal bins, rather than with the rectangular bins of timber framed elevators. It also had an attached workhouse made of brick and iron. The high cost of construction, however, seems to have discouraged imitators of the Plympton, which went down in the early 1890s. Ironically, this was just at the dawn of a new age of metal elevator construction.

During the last decade of the nineteenth century steel emerged as an important building material. Its most well known application was to the development of the metal-framed skyscraper, the building type that

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[45] Boller, p. 7. Another failed attempt at fireproof construction was tried at the City Elevator (put up in 1850). It was built with exterior brick walls and interior brick walls that isolated the wooden bins in compartments. However, this elevator fell prey to fire in the middle of the 1860s.)

[46] E. S. Rollins, "A Revolution in the Elevator Business," *The Northwester Miller*, 53(April 23, 1902), p. 825.

changed the look of America's cities. Designers also saw steel as a material that could be used in the construction of grain elevators to render them virtually fireproof. With improved methods of industrial production, steel became an economical alternative to timber. This was especially true since timber prices begun to rise in the 1890s. And investors might recuperate the cost of a steel elevator compared to a timber one solely on the reduced premiums that insurance companies charged for metal construction. In this shift from wood to steel for elevator construction, Buffalo played a major role.

The pioneering examples of steel bin grain elevator construction in Buffalo were the **Electric Elevator** and the **Great Northern Elevator**. Both of these elevators, which went into operation in 1897, also marked the switch from steam to electrical powered machinery. (Electricity had become available from the Adams Power Plant in Niagara Falls in November 1896. These two giant elevators represented some of the earliest applications anywhere of electrical energy to industrial use.) The **Electric Elevator** (demolished in 1984) stood adjacent to the Buffalo River and consisted of steel bins resting on concrete foundations with a tall, corrugated iron workhouse at the wharf end and a steel-frame horizontal transfer system for the distribution of grain above the bins. The bins, which had hemispherical bottoms to facilitate the flow of grain, rested above basement conveyor belts that carried grain to and fro below grade. The most striking feature of the **Electric Elevator's** appearance to the eyes of people familiar with its wooden ancestors would have been its cylindrical bins standing completely exposed to view. For unlike earlier timber grain elevators, the Electric had no structure sheltering its bins from the elements. Exposed bins and machinery would become common practice for many later elevator builders. And the bin design itself departed from the rectangular shape of previous timber crib bins. Cylindrical bins, it was thought, were stronger than rectangular ones and were less likely to suffer damage when grain was emptied quickly from them. Both of these aspects of the **Electric's** design—exposed bins and cylindrical silos—had their limitations in the minds of elevator engineers, but their use here definitely marked a new stage in elevator design and construction. "An experimental and transitional building of unusual form," Reyner Banham, the architectural historian who was the first to study Buffalo's grain elevators, declared of the bygone **Electric.**[47]

The **Great Northern Elevator** would have looked less radical in its outward appearance to its contemporaries than did the **Electric Elevator.** In its shed-like form, it resembles the shape of primitive wooden elevators. Its 99-foot-tall steel bins are sheltered inside a vast, 300'-long structure of brick curtain walls equivalent in height to a ten-story building. Its designers, bridge architect Max Toltz and elevator engineer D. A. Robinson (both of whom were employees of the Great Northern Railroad that built the elevator[48]), thought that by enclosing the metal bins they were better protecting the grain being stored in them from the extremes of cold and heat. To shield the grain from summertime temperatures was especially important in order to prevent it from overheating and sprouting. The horizontal conveyer system for distributing and weighing incoming and outgoing grain was housed in a four-story-high, corrugated iron headhouse atop the elevator. When this elevator was still in operation, Banham, who I remember as a man who could see drama and poetry in all architecture, described the inside of the headhouse as "almost cathedral-like: long, lit by ranks of industrial

[47] Reyner Banham, *A Concrete Atlantis: U. S. Industrial Building and European Modern Architecture, 1900-1925,* Cambridge, MA: MIT Press, 1986, p. 127.

[48] According to the assistant engineer on the project, R. H. Folwell, the president of the railroad himself, J. P. Hill, decided that the elevator would be built of steel rather than wood. For a detailed description of its construction see Folwell's "A Steel Structure," *The Weekly Northwestern Miller*, 45(February 4, 1898), 175-179.

windows in the corrugated roofing on either side, filled with a golden-gray atmosphere of flying grain dust sliced by low shafts of sunlight." His description continued:

> The space is laced lengthwise by flat rubber belt conveyors loaded with grain and laced diagonally by more movable chutes for directing the flow of grain. Weigh bins over the heads of the main bins measure the flow, batch by batch, as it goes from bin to bin. The whole is monitored by men who watch steelyards connected to the weigh bins and mounted on desks whose legs are in the form of cast-iron Doric columns . . . [49]

The internal arrangement of the **Great Northern Elevator** differs considerably from that of the **Electric Elevator**. The **Great Northern's** bins, which are formed of plates of steel riveted and welded together, stand on steel pillars several feet above the concrete floor of the elevator. (Another set of steel I-beams supports the headhouse and the upper level conveyor system.) Some of the bins could hold 70,000 bushels of wheat while others were subdivided horizontally to accommodate lesser amounts of grain from smaller shipments. (This is a feature of the **Great Northern** that looks forward to the design of later concrete elevator design.) But the use of cylindrical bins resulted in about a twenty per cent loss of storage space over the old rectangular bin system. The engineers mitigated this problem by introducing eighteen narrower bins between the forty-eight main bins. (Later, additional bins of smaller diameter yet were added between the main bins and the outer walls.) Thus, the final storage capacity of the **Great Northern** reached ninety per cent of the available ground space.

After the **Electric** and the **Great Northern**, a number of steel elevators went up on the Buffalo waterfront. These included the **Great Eastern Elevator** (1901), the **Iron Elevator** (1902), the **Monarch Elevator** (1905), and the **Dakota** (1901). (Other than the **Great Northern**, none of these steel elevators survives.) The most spectacular of the group was the **Dakota**, which replaced an earlier timber elevator destroyed by fire and lasted until the 1960s. Its tall, exposed steel bins and very large headhouse attracted attention of the early modern German architect Walter Gropius, who published a photograph of it in his essay, *The Development of Modern Industrial Architecture*.

Steel, however, proved to be less satisfactory that originally envisioned as a fireproof material. Fire, of course, would not burn the metal, but heat generated by a grain fire could cause severe structural damage to the bins and the steel support structure. A fire in a steel elevator in Fort William, Ontario, in the early twentieth century demonstrated how vulnerable to heat steel could be. The Fort William fire became so intense that the steel bins and other components actually melted. "Steel is an ideal material for constructive purposes," observed engineering writer E. P. Overmire at the time, "but it requires expensive fireproofing to render it safe from internal, as well as external, attacks from fire." Demonstrating an industry-wide change of heart, the owners of the destroyed Fort William rebuilt their elevator in wood, convinced, said Overmire, "that wood will not be more easily destroyed than was the steelwork."[50] The last steel elevator to go up in Buffalo during the period of significance was an addition made in 1922 to the **Kellogg Elevator**. By then, reinforced concrete had become universally recognized as the superior material for elevator construction in Buffalo and elsewhere.

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[49] *Ibid.*, p. 121.
[50] Overmire, "Modern Fireproof Grain Elevators," p. 1103-1104.

The Ceramic Tile Elevator

During the first decade of the twentieth century, industrial engineers also experimented with ceramic tile in an effort to make their elevators fireproof. As early as the middle of the 1890s, Ernest V. Johnson (who was the son of the designer of the earlier iron **Plympton Elevator**) patented a practical system of tile bin construction that was used by the Barnett-Record Company of Minneapolis, a builder of many tile elevators. Some bins were constructed on a rectangular plan, but most ceramic bins were cylindrical with internal steel bands for reinforcement. Those built by the Barnett-Record Company also captured the space between the bins for storage by constructing linking walls of arched tiles reinforced by metal tie rods. This innovation would be important for the later design of concrete elevators, which would usually adopt this practice of reducing wasted space by linking cylindrical bins with intermediate walls.

There were several advantages to ceramic tile bins. Not only were they completely fireproof and heat resistant, but their hollow walls were better than steel at insulating grain from the extremes of heat and cold. For this reason, tile silos did not need to be protected from the weather by an enclosing structure; the cylinders could be left exposed to the elements. And the lighter weight of ceramic bins reduced the load that foundations were required to bear. Although many tile elevators were built in the Midwest, Canada, and at East Coast ports, they made little impact on Buffalo's grain storage industry. Only two were constructed in Buffalo: the 150,000 bushel **Washburn Crosby "A" Elevator**, which consists of tile tanks eighty feet tall and twenty feet in diameter erected in 1903 according to the Barnett-Record Company patented system (these bins are now part of the General Mills complex)[51] and the 100,000 bushel **Maritime Milling Elevator** (now demolished).

Despite tile elevators' many advantages, when compared to concrete elevators, which were becoming practicable at about the same time, tile structures were expensive to build and maintain. The large number of mortar joints needing to be dressed slowed the process of construction and afterward required constant vigilance to prevent leaks. And because tiles were normally produced in pre-fabricated sizes geared for large bins, it was often difficult to obtain materials with which to build smaller elevators. "Tile bins introduced at the turn of the century," states the Historic American Engineering Record, "were already considered obsolescent by 1913."[52] Nonetheless, architectural historian Reyner Banham regarded their exposed, unadorned silos as an important step toward the great concrete elevators of the early twentieth century. In his eyes, the tile-bin system represented "an intermediary between the primitive phase of cylindrical bin construction and the classic concrete phase that was to ensue so soon after."[53] Reflecting upon the German art historian Wilhelm Worringer's theory of an American "ultimate Metaphysic of Form," Banham declared that he found evidence of it "in the sight of these grudging, lowering shapes crouched under a leaden winter sky, unlovable but compelling respect." They were "the Protestant work ethic monumentalized," he asserted.[54]

The age of the steel and tile elevators marked an important chapter in the history grain elevator construction. Developments during this period passed on an important legacy to the age of reinforced concrete elevators that was to follow. First, because of the complex problems involved in building with steel, the highly

[51] These were only storage bins related to the adjacent Frontier Elevator; they had no marine legs.
[52] HAER, p. 12.
[53] Banham, p. 134.
[54] *Ibid.*, p. 136.

trained modern structural engineer now took charge of elevator construction. Second, the cylindrical shape became the standard form for bins. (This allowed individual bin sizes to exceed the 15,000-bushel capacity of timber crib bins.) And third, engineers were required to scientifically study and understand the physical properties of grain when at rest and when in motion.

Experiments in the early twentieth century by various engineers revealed that static grain in storage bins acted like a semi-liquid, exerting less lateral pressure on the bin walls than vertical pressure on the bottom. These pressures were related to the ratio of the diameter of the bin to its height, but after three times the diameter had been reached, vertical pressure increased very little. Thus, it seemed safe to build taller bins than ever before. Physicists also came to understand that vertical pressure was influenced by the angle of friction of the grain and that no excess pressures were created when the grain was moving during draw off, if the outlet were in the center of the bin bottom. All of this newly discovered arcane knowledge would be essential to engineers designing the grand concrete elevators that were soon to go up along the Buffalo waterfront.

The Concrete Grain Elevators of the Early Twentieth Century

The search for a durable and economical method of constructing grain elevators culminated in the early twentieth century when reinforced concrete became the standard material with which these huge structures were built. (Steel bins, however, proved highly practical and remained in common use throughout the twentieth century.) The development represented the climax of an evolutionary process that had gone through wood, steel, and tile elevator design. During the nineteenth century, engineers had selectively applied concrete to foundations and floors of wood, steel, and tile elevators. "The era of the true concrete elevator," states the Historic American Engineering Record, "is defined by the application of reinforced concrete to the construction of storage bins."[55] And the Buffalo waterfront came to possess the world's most impressive array of these monuments of early modern engineering.

Concrete had been used to construct grain silos in Europe as early as the 1890s. The Belgian elevator engineer Francois Hennebique enjoyed a wide reputation for his work with concrete. The **Waever's Mill Granery** at Swansea in Wales was also well-known internationally. Built on a rectangular plan, it contained one hundred, seven-foot-square bins, sixty-six feet deep. In the middle of the 1890s, Minneapolis grain dealer F. H. Peavey sent his engineer, C. F. Haglin, to Europe to study Belgian, Welch, and other developments there in concrete grain elevator construction. Haglin learned a lot about reinforced concrete from his trip and in 1899 erected at Minneapolis the first reinforced concrete bin elevator in the United States. Known as "**Peavey's Folly**," it consisted of a single cylindrical concrete bin. While it shared material with its European counterparts, **Peavey's Folly** cylindrical design (the legacy of American experiments with steel and tile elevator design) made a radical departure from the rectangular "warehouse" system of Trans-Atlantic grain storage facilities. (The silo system was better-suited to the American method of moving grain in bulk rather than in sacks, which was common practice in Europe.) It was the unassuming prototype of the characteristic American concrete grain silos that avant-garde European architects would come to admire at Buffalo and at other grain centers in the

[55] HAER, p. 66.

United States. Indeed, one can say that Haglin's **Peavey's Folly** not only revolutionized the construction of grain elevators, but even influenced the course of modern architecture.[56]

Haglin also introduced an innovative system of concrete construction that would be widely imitated. Dispensing with full scaffolding, he substituted a type of formwork called "slip form" that consisted of two rings held apart by sturdy yokes. Once the concrete that had been poured into the formwork had set, the two rings were raised to the next level by means of jacks. Vertical "jacking rods" built into the system of steel reinforcements in the concrete allowed for the steady rise of the slip form until the full height of the silo was reached. Thus the entire silo would "grow" as the concrete set and the formwork moved upward. **Peavey's Folly**, which had a diameter of twenty feet, rose in this manner to a height of 124' with walls twelve inches thick at the base and only five inches thick at the top. This clever method of construction, which would be used extensively in Buffalo, was first employed to erect an actual commercial elevator in 1900. In that year, Haglin built the **Peavey Elevator** at Duluth. And like later concrete elevators at Buffalo, connecting walls linked the tangential cylindrical bins to create interspace storage bins.[57]

The many advantages of concrete for grain elevator construction accounted for the near universal adoption of this method of construction for large elevators by the second decade of the twentieth century. As the Portland Cement Association pointed out in 1917, concrete furnished the surest form of fireproofing for elevators and mill buildings. Perhaps the best proof of that fact, stated the Association, was that "no insurance need be carried on the structure, as it cannot burn."[58] Concrete silos also could be counted on to preserve the grain from damp. In fact, they were so reliably waterproof that manufacturers of Portland cement, a material far more easily ruined by wetness than grain (which could be dried), had adopted the cylindrical concrete grain bin to store this important building material. Concrete also provided unexcelled protection against rodents. And because it would not rot, it also insured stored grain against the ravishes of insects, which, if they did happen to infest a bin could be easily destroyed by fumigation in the airtight atmosphere. Furthermore, concrete basement tunnels for moving grain were watertight and permanent. "The concrete cylinder elevator," stated Reyner Banham, is still so omnipresent because it represented an almost excessively good investment when first built. If it was solidly enough made to carry its load, maintain an equable thermal environment, and resist fire for long enough to amortize the original investment, then it had to be well enough made to last more or less forever—and be well enough made to be extremely costly to demolish."[59]

With improved mixtures of concrete and the adoption of the practice of slip forming, concrete also came to be used to construct the headhouses, workhouses and overhead galleries as well as the grain bins themselves. In earlier days, these elements were built with structural steel and clad with corrugated iron. The **Washburn Crosby C2 Elevator** of 1913 was the first in Buffalo to employ a concrete gallery; A. E. Baxter's **Ralston Purina** workhouse of 1917 had the first workhouse and headhouse constructed of concrete in Buffalo. These were built quickly by the slip forming method that engineers employed to raise the cylindrical bins. Indeed, speed of construction was another important positive aspect of concrete grain elevator construction. "The timetable for the construction of an elevator," states the Historic American Engineering Record, "was usually

[56] Peavey's Folly, which was never enlarged beyond its single silo, still stands and is listed on the National Register of Historic Places.
[57] For a detailed description of the construction process, see HAER, pp.15-39.
Concrete Grain Bins and Elevators. Chicago: Portland Cement Association, 1917, p. 6.
[59] Banham, p. 174.

extremely tight. Slip forming began only when spring was far enough advance, yet the promoters expected the building to be operational by autumn to received the first of that year's crop and ensure that storage was full at the close of the navigation season in mid-December."[60] By the 1920s, it was common for engineers to erect elevators, headhouses, and workhouses of concrete. (Marine legs, which were mobile, were erected on steel frames and covered with corrugated iron plates.) It is from this period that Buffalo's classic, concrete elevators date.[61]

Harry R. Wait designed many of Buffalo's concrete grain elevators. Following the lead of Haglin's work in Minnesota, Wait refined and improved the type, grouping many tall silos together to form the characteristic unadorned corrugated exterior that distinguished the modern elevator from its shed-like predecessors. The largest and finest example of his work is the abandoned **Concrete Central Elevator** of 1915-1917. It shares one of the innovations for which he was known, the raised basement. Grain stored in the great concrete bins fell through funnel-like steel bottoms into a system of conveyor belts. The ground floors of Wait's elevators were impressive open spaces overshadowed by the immense steel bottoms of the numerous bins. Of the twelve-foot-high, window-lit basement of the **Concrete Central Elevator**, Reyner Banham (who wrongly attributed **Concrete Central** to A. E. Baxter) remarked that it "was palatial in size compared with what was customary in the trade."[62] Other designers, however, rarely imitated Wait's generous basement workspaces. The now-abandoned **Marine A** of 1925, notes Banham, "put the bins on foundations some six feet below grade level and pierce[d] their walls at the bottom to allow the conveyors to pass through."[63]

As the twentieth century progressed, industrial engineers like A. E. Baxter transformed the meandering Buffalo River into a striking corridor of monumental concrete elevators. The story begins in 1906, when the **American Elevator (present Peavey Elevator)**, the first concrete elevator erected on the Buffalo waterfront and the first anywhere to be constructed by continuously pouring concrete into slip forms, went up.[64] It effectively ends in 1954, when the **Connecting Terminal Annex** was constructed. Between these years, some forty-two concrete elevator projects (some of these were additions to existing elevators) were undertaken along banks of the Buffalo River and on the shores of the outer harbor.[65] Various improvements to the harbor district's infrastructure also followed to accommodate rail, lake vessel, and truck access to the area. (The present tower driven lift bridge at Ohio Street was built in 1962. A bridge first spanned the Buffalo River at Michigan Avenue in 1873; the current vertical lift bridge there dates from 1960 but replicates an earlier bridge put up in 1933.) Today, some seventeen elevators remain, including Baxter's handsome **Standard** and **Concrete Central**. Of this number, several are still in use for storing grain or other materials.

The Influence on Modern Architecture

[60] HAER, p. 48.
[61] HAER, p. 66.
[62] Banham, p. 156.
[63] *Ibid.*
HAER, "American Elevator, HAER No. NY-249," p. 3.
[65] For a complete list of concrete elevators erected in Buffalo, including dates and capacities, see HAER, pp. 70-72.

Together with their significance as monuments of early industrial engineering, Buffalo's grain elevators came to play an indirect role in the evolution of modern architecture.[66] Beginning with the German architect Walter Gropius's essay on modern architecture in the *Jahrbuch des Deutschen Werkbundes* of 1913, Buffalo's grain elevators appeared in publications by advanced European architects. They praised them as examples of modern functional design uncluttered by ornament, picturesque composition, or historical references. Gropius illustrated his remarks with photographs of the **Washburn-Crosby** complex and the **Dakota Elevator**. A few years later, Erich Mendelsohn, another influential German architect, published his photographic essay *Amerika: Bilderbuch eines Architeckten*. Among other powerful images of new industrial architecture, it featured views of several elevators Mendelsohn had seen on a recent trip to Buffalo. And in 1927, the great French modernist, Le Corbusier, declared in *Towards a New Architecture*: "Thus we have the American grain elevator and factories, the magnificent FIRST FRUITS of the new age. THE AMERICAN ENGINEERS OVERWHELM WITH THEIR CALCULATIONS OUR EXPIRING ARCHITECTURE."[67] To back up his claim he featured a photograph of Buffalo's exposed-steel-bin **Dakota Elevator**. Writing for an English-speaking audience, Bruno Taut called attention to the Wait's great **Concrete Central Elevator** in his widely circulated *Modern Architecture*. Perhaps Walter Curt Behrendt spoke for all of these men, when, in 1927 he wrote in his *Der Sieg des Neuen Baustils*:

> To do justice, it is necessary to say, and this will probably surprise the reader, that it was the example of America that gave the impulse to the German architects when they first tried to clarify the problem of structure. To be sure, this impulse did not originate in the skyscraper . . . but the simple structures of industrial building such as grain elevators and big silos . . . These examples of modern engineering, designed for practical use only, and obviously without any decorative assistance from an architect, made a deep impression by their simple structure reduced to basic forms of geometry such as cubes and cylinders. They were conceived as patterns exemplifying once more the essence of the pure form of use, gaining its impressive effect from its bare structure.[68]

Part IV: The Decline of Buffalo as a Grain Transshipment Port after 1959

Most historians agree that Buffalo's golden age as a world port of grain transshipment came to en end with the opening of the St. Lawrence Seaway.[69] In 1959, when President Eisenhower and Queen Elizabeth celebrated the opening of the Seaway, no Buffalo business leaders were there to cheer them. It now became possible to load grain in Upper Great Lakes ports such as Duluth, Chicago, or Detroit directly onto ocean-going vessels. By taking the expanded Welland Canal from Lake Erie to Lake Ontario and from there following the St. Lawrence to Montreal, these vessels had direct access to the Atlantic. There was no longer any need to unload grain at

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[66] For a full discussion of the importance of America's grain elevators and factories to the modern movement in architecture known as the International Style, see Banham, chapter 3, "Modernism and Americanism," pp. 181-253.
[67] Quoted in Banham, p. 224.
[68] *Ibid.* pp. 230-231.
[69] Navigational improvements on the Mississippi River also contributed to Buffalo's decline, as more and more Mid-Western grain began moving south again to New Orleans. Furthermore, in the 1970s, the Interstate Commerce Commission revised the artificially low rates that it had maintained for decades for shipping grain by lake vessels. This had the effect of making it cheaper to ship grain by rail than by water from the Mid-West to the East Coast.

Buffalo and put it onto canal boats or railroad cars for surface shipment to East Coast ports. "With no reason for ships bound either for the ocean from the West or from the ocean to the West to ever come to Buffalo," observes historian Mark Goldman, "the city sat bypassed at the end of a long dead-end street."[70] Gradually, during the 1960's-1980s the storage capacity of many grain elevators became superfluous and their operation, usually controlled by out-of-town ownership, was shut down. Milling also slowed during the last decades of the twentieth century, but, nonetheless, managed to survive as a significant local industry into the present century.

When in 1986 Reyner Banham published *Concrete Atlantis*, the book that called international attention once again to Buffalo's important legacy of concrete grain elevators, he cast his prose decidedly in the past tense. Many of the structures he wrote about had already disappeared. But a significant number endured, even if unused. "In such spectacular urban scenes as the view down the Buffalo River toward the Ohio Street bridge," wrote Banham, " . . . one can see that the combination of assured durability and long-sustained functional relevance has given concrete elevators a monumental longevity."[71]

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[70] Mark Goldman, *High Hopes: The Rise and Decline of Buffalo, New York*. Albany: SUNY Press, 1983, p. 271.
[71] Banham, pp. 175-177.

F. Associated Property Type

The Buffalo Grain Elevator Multiple Property Submission includes one property type: the grain elevator, 1842-1954. There are four subsets to this property type: the wooden grain elevator; the steel grain elevator; the ceramic tile grain elevator; and the reinforced concrete grain elevator.

Description

The property type is the primary property type and is found in the city of Buffalo, New York. Eighteen properties of this type are included in the submission. Sixteen of these are located along the Buffalo River in the so-called Inner Harbor: one is located on Lake Erie in the Outer Harbor; and one is located along a railroad line in east Buffalo.

The period within which the grain elevator type developed is defined as 1842-1956, the century during which Buffalo became the most important port in the United States for the transshipment of grain from Midwestern farms to East Coast markets. The world's first grain elevator was built in Buffalo in 1842. The properties included under this property type were built to store grain for later shipment East or for flour milling at Buffalo and represent the evolution of the building type from the primitive shed-like wooden type through the great concrete silos of the early twentieth century. The elevators fall into four categories: the wooden, shed type elevator with rectangular bins; the cylindrical steel bin elevator enclosed in a shed-like masonry structure; the ceramic tile exposed silo elevator; and the exposed silo reinforced concrete elevator. The eighteen properties have not been significantly altered. Much of the industrial landscape of waterways, docks, and rail lines is also intact from the period of significance.

The architectural styles of the Buffalo Grain Elevators differ, but they have similarities in scale, siting, materials, and plan. They also represent a shared desire on the part of industrial engineers to built permanent, fire-proof storage facilities for the ever increasing bulk handling of grain. Two chief sorts of elevator design represented in the submission are the shed type and the multiple silo type. There was little or no attempt by grain elevator designers to impart architectural style or decoration to their structures.

Almost all of the grain elevator properties enjoy a consistent geographic relationship with Buffalo's harbor, which is located on Lake Erie near the mouth of the Niagara River. The harbor is divided into the older Inner Harbor (begun in 1820), which lines the Buffalo River and the City Ship Canal (dredged in 1850), and the newer Outer Harbor, which is directly on the lakeshore behind a long breakwater constructed beginning in the 1870s. Each waterfront grain elevator is oriented toward the water to allow for lake vessels to unload grain by means of marine legs. Roads, bridges and railroad lines also give access the elevators. The three inland elevator is built along a rail line. The historic character of the waterfront grain elevator district is intact, and some of the elevators are still in use. Others are abandoned. All of the elevators retain important characteristics of location and setting that define their type.

The companies that constructed Buffalo's grain elevators employed engineers who specialized in elevator design. Some designers, such as Robert Dunbar, who built the first elevator in 1842, and Alfred E. Baxter, who

designed a number of reinforced concrete elevators in the twentieth century, were local residents who achieved international reputations for their work. Among these were Allan H. Baxter of A. E. Baxter Engineering. Harry R. Wait of Monarch Engineering Company, and T. D. Budd of the James Stewart Corporation. Other designers, such as Max Toltz, engineer with the Great Northern Railroad, and Ernest V. Johnson of the Barnett-Record Company, were from out of town. The names of the designers for nearly all of the extant elevators are known through historic public documents, architectural drawings, or plaques on the structures. Much of this information was thoroughly inventoried in 1998 by the Historic American Engineering Record, National Park Service, U.S. Department of Interior.

The Buffalo grain elevators were situated near to one another along the waterfront and were designed to make the most of the property footprint for storage. All were of considerable size; the later, concrete elevators were among the largest structures, in terms of volume, that existed anywhere in the early twentieth century.

The Buffalo grain elevators situated along the Buffalo River remain on relatively large parcels of land and share a similarity in siting and relation to the river and railroad. They compare in size with concrete elevators in places like Minneapolis, Port Arthur (the present Thunder Bay), and Duluth, but form a grouping unrivaled elsewhere. The designs utilize the forms, materials, details, and general concepts of function and massing common to these types of late-nineteenth and early-twentieth-century grain storage structures. With the exception of the single shed-like wooden elevator (which has rectangular bins) and the sole surviving steel elevator, they are characterized by tall, multiple cylindrical bins or silos that rise above concrete foundations and have attached workhouses, headhouses (long galleries above the bins for distributing grain to the bins), and, in many cases, metal marine legs (used to unload grain from lake vessels). With the exception of the two shed elevators, the bins of the ceramic and concrete elevators are expressed clearly in the elevations of these structures and form their characteristic design feature.

Significance

The Buffalo grain elevators are significant under Criterion A as architecture and engineering that is associated with events that have made a significant contribution to the broad patterns of our history. They stand as monuments to the great age of grain transshipment from the Midwest to the East. This phenomenon began in earnest in the 1820s with the opening of the Erie Canal, which joined Buffalo to New York City by way of a fast and safe water level route. It lasted until the late 1950s, when the St. Lawrence Seaway was opened, allowing ocean-going vessels direct access to Midwestern grain ports. The importance of Buffalo to this process arose with the opening of the Erie Canal in 1825 and was expanded with the development of the railroad beginning in the 1840s. At the easternmost point of Great Lakes navigation, Buffalo became the point where grain was transferred from lake vessels to canal boats or railroad cars to be shipped to New York and other East Coast ports. From there, much of it was sent abroad.

The Buffalo grain elevators are also significant under Criterion C, for they embody the distinctive characteristics of the grain elevator type and methods of construction (including timber frame, ceramic tile, steel, and slip form reinforced concrete). The functional simplicity and mammoth scale of these structures impressed early modern architects in Europe. Pioneers of modern design such as Walter Gropius, Erich Mendelsohn, and Le Corbusier were familiar with Buffalo's grain elevators and used them as examples in their

writings to promote their theories of a new architecture for a mass society that avoided historical references and celebrated function. Indirectly, they contributed to the evolution of the International Style.

Registration Requirements

A Buffalo grain elevator is eligible for listing on the National Register if it substantially retains each of the following definitive characteristics of the property type:

The elevator must have been constructed between 1842 and 1954 and must retain a high level of integrity to its period of significance. They sub types that might be found are: the timber frame elevator with rectangular storage bins; the cylindrical steel bin elevator with protective masonry enclosing structure; the exposed cylindrical steel bin elevator; the exposed cylindrical ceramic tile bin elevator; and the exposed reinforced concrete multiple silo elevator.

Waterfront location on the Inner Harbor or Outer Harbor or an inland location on a railroad line.

G. Geographical Data

The geographical area of the multiple property submission includes the corporate limits of the City of Buffalo, Erie County, New York.

H. Summary of Identification and Evaluation Methods

The multiple property submission of Buffalo Grain Elevators was based primarily on data collected by the Historic American Engineering Record, National Park Service, U.S. Department of Interior in 1998 and on historical research in primary and secondary sources. The evaluation of this material and a survey of the actually existing structures led to the recommendation for nomination to the National Register of the eighteen extant grain elevators in Buffalo.

No attempt was made to identify or evaluate properties whose primary significance was archaeological.

Buffalo Grain and Materials Elevator Multiple Property List

Great Northern Elevator, 250 Ganson Street

Standard Elevator, 1 St. Clair Street

Wollenberg Grain and Seed Elevator, 133 Goodyear Avenue

Concrete-Central Elevator, 175 Buffalo River

Washburn Crosby Elevator, 54 South Michigan Avenue

Connecting Terminal Elevator, 100 Fuhrmann Boulevard

Spencer Kellogg Elevator, 389 Ganson Street

Cooperative Grange League Federation, 385 Ganson Street

Electric Elevator, 40 Childs Street

American Elevator, 87 Childs Street

Perot Elevator, 100 Childs Street

Lake and Rail Elevator, 120 Childs Street

Marine "A" Elevator, 105 Childs Street

Superior Elevator, 874 Ohio Street

Saskatchewan Cooperative Elevator, 1489 Fuhrmann Boulevard

H-O Oats Elevator, 54 Fulton Street

Kreiner Malting Elevator, 50 Elk Street

Meyer Malting Elevator, 1314 Niagara Street

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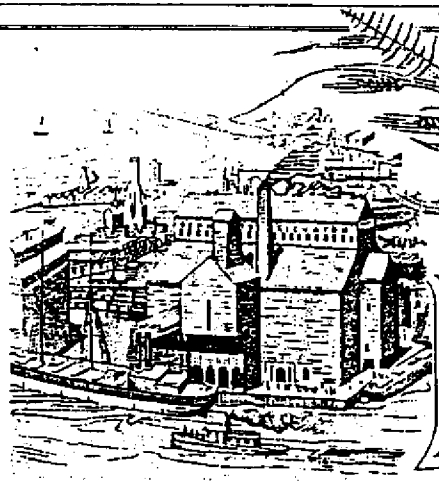
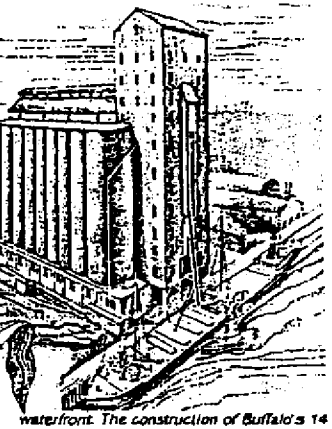
THE GRAIN ELEVATORS

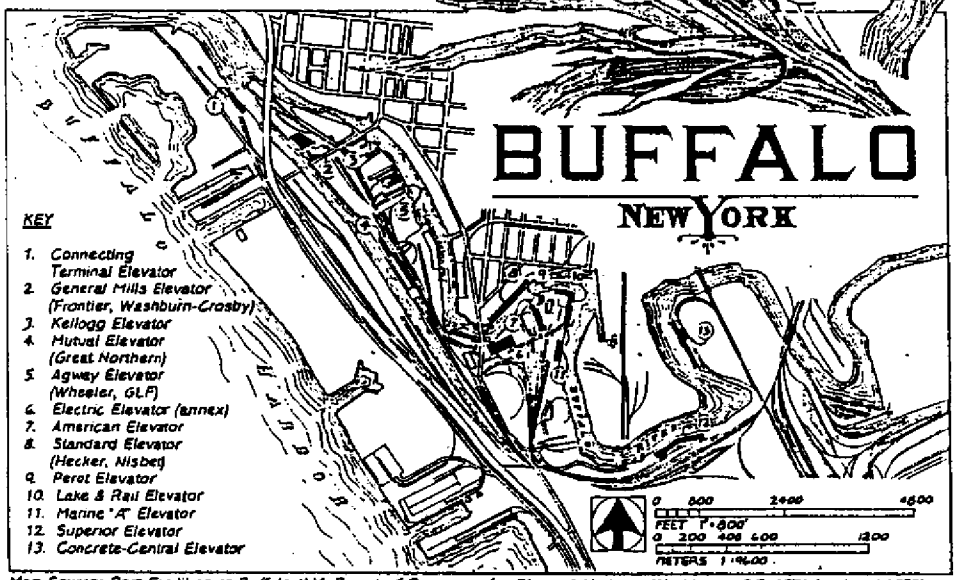




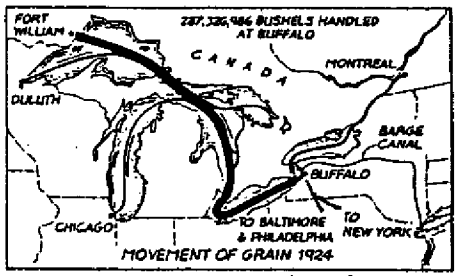
Fortuitous geography, local engineering ingenuity, and American business acumen were to combine to assure Buffalo a pivotal role in the forwarding of grain to national and international markets. After the opening of the Erie Canal in 1825, transshipment of grain between Great Lakes vessels and other carriers stimulated the city's growth as a major inland port. Storing and handling large volumes of bulk grain required significant innovations in structural engineering and materials handling.

Prior to 1842 all transshipment was manual. In that year Buffalo merchant Joseph Dart built the world's 1st grain transfer elevator. Dart's steam-powered wooden elevator, with innovative "marine leg," established enduring principles of grain handling on the Buffalo waterfront where subsequent evolution refined the versatility, speed and safety of handling. By 1894, at the time of construction of Buffalo's largest wooden elevator, the Eastern elevator plant was capable of receiving, shipping, storing, mixing, weighing and conditioning grain at considerable rates with many operations being carried out simultaneously. Yet within 5 years, like many of its smaller predecessors, the Eastern was destroyed by fire.

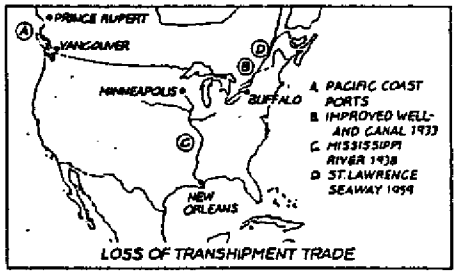
The frequent loss of elevators to fire and explosion prompted a search during the 1890s for safer building materials, construction methods, and drive systems. In Buffalo the Great Northern & Electric Elevators pioneered the use of electric drive, and employed novel steel storage bins in pursuit of the "fireproof" elevator. Both steel and tile proved to be transitional materials, soon to be superseded by reinforced concrete bins. Pioneered in Europe in the 1890s, techniques in concrete bin construction were refined in America after the turn of the century. American innovations in slip-forming construction methods permitted rapid and economic erection of tall cylindrical bins in long interlocking rows. Within 2 years of the construction of the first-slip formed elevator, Buffalo had adopted this construction method; the American Elevator of 1906 displayed a form of industrial architecture that came to characterize the Buffalo waterfront. The construction of Buffalo's 14 waterfront concrete elevator complexes culminated in the provision of 60m bushels peak port storage capacity by 1943.



Map Source: Port Facilities at Buffalo N.Y. Board of Engineers for Rivers & Harbors, Washington DC. 1971 (updated 1990)



Map source: U.S. Army & Shipping Board, Transportation on the Great Lakes 1926.



Map source: Hammond World Atlas

By 1924, Buffalo could claim to lead the world in the volume of grain handled: shipments reached over 300,000,000 bushels in 1928, 45% being transferred to rail, 27% to the Welland Canal, 14% to the Barge Canal, while 17% was retained to supply the growing milling trade. However by the 1930s Buffalo's strategic position in the grain trade began to falter as U.S. and Canadian grain began to bypass the port's transfer elevators. Traffic was diverted to Pacific Coast Ports, the improved Welland Canal, the Mississippi River, and the St. Lawrence Seaway. During the 1960s & 1970s many of Buffalo's elevators closed; however as the Nation's largest flour milling center, 17.5m bushels of elevator capacity remains active in this trade.

The Buffalo Grain Elevators Recording Project is part of The Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial sites in the U.S. The National Park Service, Department of the Interior administers the HAER program. The Industrial Heritage Committee Inc. Lorraine Pierro, President, and the Historic American Engineering Record, Dr. Robert J. Kapsch, Chief HABS/HAER, co-sponsored the Buffalo Grain Elevators Project, with the co-operation of The Pillsbury Company Mark Norton, plant manager; Walter Dutka, Snr. Mechanical Engineer, with the assistance of Henry Baxter, Henry Wollenberg, and Jerry Malloy.

The field team was under the direction of Eric DeLony, Chief and Principal Architect, HAER, and the project management of Robbyn Jackson, Architect, HAER; and 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.

Craig Strong, 1991

BUFFALO GRAIN ELEVATORS