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tools, freight and mine cars, wheels and axles, nails, staples, cable, nuts, bolts, gears, brass, and bronze.<sup>12</sup> "The Steel" was among the leaders of manufactured products in the nation and, as documented in company records, built 1121 merchant and navel vessels, hundreds of major bridges including the Golden Gate and George Washington bridges and hundreds of major skyscrapers throughout the nation and the world.<sup>13</sup>

Bethlehem Steel's dominance in the world market peaked in the 1960s. After a steady decline, the company went into bankruptcy in the late 1990s and recently has been sold as part of the reorganization of the company's debts. Although The Bethlehem Works project proposes to reuse a portion of the site for cultural, educational, entertainment and retail development –including the National Museum of Industrial History in affiliation with the Smithsonian Institution – uncertainty currently surrounds the future preservation and development of the site.

Bethlehem Steel Company is considered the second largest steel maker in the country following only Pittsburgh-based U.S. Steel. U.S. Steel was founded in 1901 and like Bethlehem Steel, grew from humble roots by the acquisition of competitors into one of the nation's largest corporations. While there were many competitors to these steel giants throughout the 19<sup>th</sup> and 20<sup>th</sup> centuries such as Midvale Steel, Phoenix Steel, Homestead Steel, etc., these and other regional steel producers were mostly absorbed by the two companies in the 20<sup>th</sup> century and became plants or divisions of the two companies.<sup>14</sup>

Within the Bethlehem Steel Company, the Bethlehem Plant has retained the status of "home plant" since the founding of the company in 1857. Within the national organizational structure of the Bethlehem Steel Company, the Bethlehem Plant is most significant as the first plant, the first plant to roll wide-flange beams, the pioneer in alloy and tool steels, and the largest steel specialty plant in the company. By the mid 20<sup>th</sup> century, the Bethlehem Plant was organized into operating divisions including the Coke Ovens, Blast Furnaces, Alloy and Tool Steel, Saucon and Manufacturing.<sup>15</sup> (See Figure 1). The 1700-acre site is often described as three main plants with several divisions within each plant: (See Figure 5)

- The Coke Ovens, occupying the eastern section of the site, was the location at which bituminous coal was processed by super heating into coke, the primary fuel used to melt the ore. This plant developed over time from the early 20<sup>th</sup> century to mid century and contains massive kilns and ancillary buildings as well as material storage.
- The Saucon Plant occupies the central portion of the site and was primarily dedicated to the production and manufacturing of structural steel such as plates, rails and wide-flanged beams. This plant was the direct result of Charles Schwab's 1907 introduction of the wide-flanged beams and the early shift into the

<sup>12</sup> Bethlehem Steel Company Booklet 1813, page20.

<sup>13</sup> See *Bethlehem Steel Review*.

<sup>14</sup> See Bethlehem Steel Company Booklet 1813, page20, HAER PA-168, and [www.ussteel.com/corp/about](http://www.ussteel.com/corp/about).

<sup>15</sup> See Bethlehem Steel Company, Bethlehem Plant, Organization and Operations Manual and Figure 1.

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structural steel market. The buildings are typically steel beam and truss construction with corrugated metal sheathing.

- The Lehigh Plant occupies the western half of the site and preserves the earliest surviving stone structures from the 19<sup>th</sup> century, the enormous blast furnaces that furnished the molten steel for both production plants, the Alloy and Tool Steel Division, which included the Mill #2 Annex, and various manufacturing facilities related to specialty steels. Red brick walls with structural steel beams and trusses supporting metal sawtooth roofs typically characterized the furnaces, mills and shops. Buildings built after the 1940s typically were built with sheet piling (corrugated steel) hung on a steel frame.<sup>16</sup>

While the Lehigh Plant contained several divisions, the largest division which housed the most sophisticated and specialized mills of the entire Bethlehem Plant was within the Alloy and Tool Steel Division. This division contained more area under roof than any other division and revolutionized the metal cutting industry creating one of Bethlehem Steels most important product lines.<sup>17</sup> (See Figures 2, 6) According to Charles Martin, Chief Engineer of the Bethlehem Plant, the Alloy and Tool Steel Division originally was scattered throughout the entire Lehigh Plant. In response to the growing awareness of the possibility of a protracted war in Europe in the mid 1930s, the directors called for an immediate increase in mill capacity and efficiency. This resulted in the consolidation and expansion of the Alloy and Tool Steel Division to the western end of the Lehigh Plant.

A Sanborn fire insurance map from 1933 documents that the Lehigh plant and the Steel's property terminated several blocks to the east of the New Street Bridge. The land to the east of the plant contained residential and light industrial property along with a Lehigh Valley Railroad freight house. (See Figure 8) By 1940, Bethlehem Steel had purchased the land up to and beyond the New Street Bridge and began to construct massive new buildings to consolidate the operations of the Alloy and Tool Steel Division. (See Figures 8, 9).

The 1940 updates to the insurance maps also document that the Lehigh Valley Railroad maintained a large freight house at the corner of W. 2<sup>nd</sup> Street and Union Station Plaza into 1940 and had recently constructed a small freight station to the west along the river. By mid 1940 the large Lehigh Valley Railroad freight house was demolished for the construction of the Annex and the smaller Lehigh Valley freight station to the northwest of the Annex was retained in place with the new Annex building abutting the existing freight station. The Lehigh Valley Railroad maintained ownership of the freight station as part of its operation to service the Bethlehem Steel Plant. (See Figure 8)

<sup>16</sup> Interviews with Charles Martin, Chief Engineer, Bethlehem Plant and Lance Metz, various dates.

<sup>17</sup> Interviews with Charles Martin, various dates.

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The Mill #2 Annex was originally called the Lehigh Plant Mill #2 Building West of New Street.<sup>18</sup> This facility was specifically constructed as part of the Alloy and Tool Steel Division on the opposite side of New Street, to the west of the Mill #2 (See Figure 9).<sup>19</sup> Additionally, the 1940 Sanborn map update depicts a new building abutting the freight house to the west. This new building is the first half of Mill #2 Annex, the subject building of this nomination. The freight house was torn down in the second half of 1940 and the Annex was extended to its current footprint covering nearly an entire square block.

Bays 1, 2, and 3 (eastern half) were built in early 1940 and immediately put into use as Bays 4, 5, and 6 (western section) were under construction in the later half of the same year (Figure 8).<sup>20</sup> The brick wall that now divides the building in half was the original western exterior wall of the eastern section. As built, there were at least two 8-10 ton cranes per bay, and sometimes three. The cranes used in the Annex were "old" 1920s era cranes that were likely salvaged from other on-site operations and were originally built by Bethlehem Steel in their crane building shop. These "old-style" cranes featured open platform cages with primitive manual controls. Crane operators stood on this open platform at the crane level far above the ground-level work stations. They stood in between controllers that let off significant heat created by the current running the motors. In contemporary, "new" cranes of the 1940s, the operator sat in a closed cab with greater protection and more modern operating apparatus that required less current.<sup>21</sup>

Bethlehem Steel's in-house engineers designed the buildings of the Bethlehem Plant including the Annex, using standard systems and materials from their large archive of stock designs and materials. In effect, engineers could assemble a building for any use – exterior envelope, structural system, and materials – by picking and choosing from a number of approved designs that had advanced over time. The Annex is typical of Bethlehem Steel buildings from the 1930 – 1940 period in that the brick walls are self supporting but do not support the roof trusses or crane rails, The rails and roof trusses are supported on a tripartite arrangement of H-beams with two piers supporting the sawtooth monitor roof and one supporting the crane rail. One of the more interesting architectural features of this building – the banks of large steel windows – were designed by in-house engineers and therefore unique to Bethlehem Steel's mid-twentieth century buildings. While crane systems are not unique to twentieth century industrial facilities, the cranes and related catwalk network are site-specific systems designed to serve the needs of this particular building. Despite the use of Bethlehem Steel's stock designs, the building's form, scale, large metal windows, stark exterior lines, and overall general style is similar to traditional mid-twentieth century industrial buildings.

<sup>18</sup> Original architectural blueprints refer to the building as Lehigh Plant Mill #2 West of New Street; however, as this name is lengthy and was only used for a short period of time, Lehigh Plant Mill #2 Annex was chosen for the use in the National Register listing. A former Bethlehem Steel employee interviewed for this research and post-1945 Bethlehem Steel blueprints refer to this building as the Mill #2 annex.

<sup>19</sup> Interview with Donald Young, September 11, 2003.

<sup>20</sup> Architectural blueprints, various pages, 1940.

<sup>21</sup> Young, September 11, 2003.

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With the construction of the Annex, the Alloy and Tool Steel Division was now essentially complete and fully operational to accommodate the surge in production during World War II. Despite all of the new construction, the Division also continued to rely on several older structures, primarily the massive electric furnace adjacent to Machine Shop # 2 within the eastern portion of the Lehigh Plant. This building was constructed in the 1890s as an open hearth furnace and converted to electric to support the Alloy and Tool Steel Division. (See Figure 4). Specially refined ingots produced in the blast furnaces were melted in the electric furnace, combined with alloys and further refined. At various stages in production, scientific analysis and treatment of the steel was undertaken to determine and adjust the chemical and physical properties of the product. From the furnace, the alloy steel was sent to the processing mills beginning with the 35" roller mill where it would be broken down into smaller units such as billets (intermediate size stock) and blooms (small size stock). From here, the billets and blooms would be sent to other mills such as the 22" mill, 18" mill, 12" and 9" mills within the plant to be shaped into desired sizes and shapes. Hammer shops, forges, rolling and other mills would shape and refine the steel as needed (See Figure 4). Along the way, a series of treatments such as hardening, tempering, annealing, normalizing and surface finishing of the steel would take place as required to achieve the desired physical properties of the steel according to its intended usage.<sup>22</sup> Final products of the production facility included tool and alloy steel in round, rectangular, square and hexagonal bar stock. This stock would then be milled into tools and other special shapes by customers or within the manufacturing facilities of the Bethlehem Plant.

The mills and furnaces of the Alloy and Tool Steel Division on the other side of New Street were connected to the Annex by two sets of tracks – a narrow gauge that carried materials within all three of the Bethlehem Plant plants and a standard gauge rail that shipped products outside of the facility.<sup>23</sup> Virtually all materials produced in the Alloy and Tool Steel Division were processed through Mill #2 Annex on their way to regional and in-house finishing mills. (See Figure 3, Material Flow Chart).

The Mill #2 Annex housed the departments responsible for intermediate and final surface preparation of billets and blooms and other semi-finished steel before sending the materials to shaping and finishing mills.<sup>24</sup> The Annex was the only billet/bloom preparation/finishing facility within the Alloy and Tool Steel Division of the Bethlehem Plant because its purpose related directly to the manufacture of specialty steel. The Annex provided an essential treatment of the steel where scale and other surface impurities were removed prior to the hammering, rolling and other shaping and processing of the steel. Without this step, impurities and defects would be inherent within the steel products. Steel product was also finished and shipped to world markets from the Annex.

<sup>22</sup> Bethlehem Steel Company, Bethlehem Plant, Organization and Operations Manual, page 133.

<sup>23</sup> Architectural blueprints, various pages, 1940.

<sup>24</sup> Architectural blueprints, Young, September 11, 2003. Billets and blooms are both semi-finished rolled steel products; billets typically have a cross-section dimension of 6 inches square or less and a bloom will have a cross-section dimension of 8 inches square or more.

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The process of surface preparation is as follows: The ingot is made into a billet or bloom at the blooming, or rolling, mill. The mills on the east side of the New Street bridge housed this step. If the inspector felt that the surface required additional preparation, the materials were sent by train on the narrow-gauge rail into the Annex (near the center of the building). Employees often referred to this spur as the "New Street and 6 Bay Railroad". Depending on the nature of the surface defect, the billets/blooms were unloaded into the appropriate bays and handled by the large cranes. Once surface preparation was completed, material was loaded onto rail cars positioned on the standard gauge track at the north end of the building and sent to in-house finishing mills or to outside customers for finishing. If the surface did not need additional preparation, the semi-finished product was sent to a finishing mill for final rolling or off site for various customers.<sup>25</sup>

There were primarily 4 ways to clean up billet/bloom surfaces, and these were all housed in the Annex<sup>26</sup>:

- Bay #1, eastern-most bay: Scarfing  
Scarfing (aka wash scarfing) technique used to remove widespread, shallow surface cracks. Gangs of scarfers ran wide-nozzle tipped torches that "washed" (not cut) surface to remove cracks.
- Bay #1: Chipping  
Surface defects chipped off with hand-held pneumatic chipping hammers; for deeper, less sporadic cracks
- Bay #2: Billeteers  
Surface prepared using a horizontal milling machine with a cutting tool fashioned to resemble a heavy hand chipper. Not used for extensive surface preparation, only where defects seen by naked eye
- Bay #3: Grinding  
Large air- and electric-powered grinders used to grind-out surface defects and small-scale hand grinding.

Bay 4 housed maintenance facilities for the Annex operations areas and the shipping bays. Bays #5 and #6 were used for shipping and warehousing.<sup>27</sup> An office, tool room, first aid room, and meeting rooms were housed in the two-story brick enclosure in the southeastern corner of the facility.<sup>28</sup>

Throughout the next forty years, Bethlehem Steel made few physical and programmatic changes to the building. In the 1960s, the building was transitioned into more warehouse versus manufacturing space, and in 1964 a rolling steel door was added to the west façade.<sup>29</sup> The cranes and other industrial apparatus were left in place.

<sup>25</sup> Young, September 11, 2003.

<sup>26</sup> Young, September 11, 2003.

<sup>27</sup> Young, September 11, 2003.

<sup>28</sup> Architectural blueprints, 1940.

<sup>29</sup> Architectural blueprints, 1964.

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As the Bethlehem Steel Corporation began its long course of financial challenges in the 1980s, the Annex was sold to a private enterprise in 1986. It has since been used as a storage and warehouse space.

In 1997, the entire Bethlehem Steel facility closed due to bankruptcy. It is currently under the control of the International Steel Group and closed to the public. The Annex is currently undergoing rehabilitation using the National Park Service's Investment Tax Credit program.

### Criterion A Significance

Lehigh Plant Mill #2 Annex is one of the only two significant buildings remaining from the Alloy and Tool Steel Division of the Bethlehem Plant. At its peak of operation, it functioned in a critical capacity in the production and manufacture of specialty steel. As noted in PHMC's 1999 determination of eligibility report, "The Bethlehem Plant played a pioneer role in the development of continuously-rolled structural steel shapes and the development of the armor plate industry." Within the Bethlehem facility, the Alloy and Tool Division developed a product and created an industry that propelled Bethlehem Steel to the heights of the industry and opened the doors for the development of modern manufacturing.

As shown in Figure 7, nearly the entire complex of buildings that comprised the Alloy and Tool Steel Division was demolished in the 1980s to make way for commercial development. This has led to the Annex becoming isolated from the remaining buildings of the Lehigh Plant. With the erection in the 1990s of modern office buildings and an ice skating rink between the main plant and the Annex, considerable modern intrusions further separate the building from a proposed Bethlehem Steel Historic District. The only significant buildings remaining to represent the Alloy and Tool Steel Division complex are the Electric Furnace adjacent to Machine Shop #2 and the Annex. The Electric Furnace preserves the history and physical surroundings of the beginning stage in the production of specialty steels at the Bethlehem Plant. It is here that ingots were melted and combined with other metals to form specific alloys. However, the Electric Furnace also served other divisions of the Lehigh Plant as well as the Alloy and Tool Steel Division.

The Annex represents important intermediate and final processing and finishing of all alloy and tool steel at the Bethlehem Plant. The size, scale and industrial character of the Annex are similar to the rolling mills, furnaces, forges and other buildings that once made up the Alloy and Tool Steel Division of the Lehigh Plant. Because the Electric Furnace was originally constructed as an open-hearth furnace in the 1890s, the Annex is the only significant surviving building of the division as redesigned in the consolidation of the Alloy and Tool Steel Division in the late 1930s and early 1940s.

Because of Mill #2 Annex's role in the industrial history of Bethlehem Steel, specifically, and Northampton County, generally, it survives as a significant artifact in the history of steel manufacturing. It remains an important architectural record of the history of steel making in general and specifically of the Alloy and Tool Steel Division of Bethlehem Steel. Though separated by several blocks of newly created open space and

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modern buildings, the Mill #2 Annex continues to contribute to the history and understanding of one of the most significant industrial operations in American history.

### Criterion C Significance

The architecture of the Lehigh Plant Mill #2 Annex reflects both traditional mid-twentieth century industrial designs and institutional designs created by Bethlehem Steel engineers. Its clean lines, rounded corner at the junction of the main facades, and lack of ornamentation are indicative of the Modern style influences at the local level. Its use and function rather than architectural style influence the Annex's interior design. The large open floor plan is flexible and allowed the building to be used for a variety of purposes and procedures, ensuring its usefulness. Its banks of steel sash and large sawtooth monitors allow for as much natural light and fresh air as possible for the well-being of its workers. The Mill #2 Annex shares these common characteristics with other local and regional examples including several other similar buildings in the Lehigh Valley such as the 1890s Phoenix Silk Mills at 3<sup>rd</sup> and Hamilton streets in Allentown.

While Mill #2 Annex's general style is similar to other local and regional industrial buildings from this era, it is unique to Bethlehem Steel in that it was constructed entirely from designs and elements that originated at Bethlehem Steel for Bethlehem Steel. For example, the unique windows that line the facades were designed and produced by Bethlehem Steel as opposed to the far more common usage of "off the shelf" industrial designs from national suppliers. The unusual horizontal orientation and fully automated operation of the sashes defines the windows as Bethlehem Steel from the late 1930/early 1940s era. Also important to the architectural uniqueness of this building type is the structural design of the envelope. Early buildings of the company were constructed with massive stone walls supporting cast iron trusses in an effort to create a fireproof building. By the 1890s cast iron columns with brick infill panels replaced stone and iron construction. The use of the newly developed H-beam with brick infill panels defined the system in the early 20<sup>th</sup> century to the 1930s. By the mid 1930s, self supporting brick walls with internal three part H-beam piers supporting the roof trusses and crane rails was the norm. And after the early 1940s, corrugated metal hung on H-beam piers were universally embraced at the Bethlehem Plant.<sup>30</sup>

The Annex survives in an excellent state of preservation with only minor and minimal alterations since its original construction in 1940. It is also the last surviving building constructed as part of the pre war expansion and consolidation of the Alloy and Tool Steel Division. Its design is unique to the Bethlehem Steel Company and represents a significant contribution to the understanding of the development of the Bethlehem Steel Plant in general and the Alloy and Tool Steel Division in particular.

<sup>30</sup>Interviews with Lance Metz, various dates.

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## Verbal Boundary Description:

The National Register boundary follows the 4.5317 acre lot defined by West 2<sup>nd</sup> Street to the south, New Street Bridge to the east, the former PB&NE rail lines and Lehigh River to the north, and Union Station Plaza to the west. The entire boundary covers one tax parcel, P6/2/2A, and the tax parcel is the same as the building footprint. The small two-story building attached to the mill at its northwestern corner is not part of the historic resource being nominated, and is situated on its own tax parcel.

## Boundary Justification:

The boundary for the Bethlehem Steel Lehigh Plant Mill #2 encompasses the entire building that occupies one entire block. This lot has historically been associated with the building since its construction in 1940.