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THE BIG 'RE-BOOTT'

WRITTEN BY | ROBERT J. VERRIER, FAIA, NCARB

Adaptive Reuse of the Boott Mills Complex Breathes New Life into a New England City

Can an entire town be retrofitted? New England's small industrial cities have offered an opportunity to test the premise. Many have foundered during the past few decades; as mills and factories are shuttered, local economies suffer and urban blight and decay set in. Likewise, property values fall, reducing municipal revenues and leaving local governments hamstrung.

Lowell, Mass., is a perfect example. The town is the setting of the recent film "The Fighter", in which a working class fam-

ily copes with hard times and one son's struggle with drug addiction. Lowell's beating heart was for many years Boott Mills, a cotton and textile campus occupying a large and prominent spot on the Merrimack River just two blocks from the city's downtown. Its Italianate structures date as far back as 1835.

After years of decline, however, manufacturing ceased in 1958, and the entire campus and its 1,000 or so windows went dark. To many, it seemed like a fatal blow to Lowell. But thanks to developers with vision, crucial tax incentives for historic preservation, and modern retrofitting strategies and methods, Lowell has emerged as one of many gateway cities in the Northeast enjoying a rebirth. The restoration and adaptive reuse of the mill buildings themselves are cornerstones of this multi-decade project. While it is a useful model for preserving industrial buildings as part of a larger urban revitalization strategy, it also is unique in several important ways.

Early Challenges

In some ways, Lowell was lucky. Boott Mills' dormant campus escaped fire (many abandoned mills and factories do not), and in the late 1970s the campus became a major component of the Lowell National



Historical Park, a U.S. National Park Service (NPS) site. The park includes a museum on Boott Mills' campus dedicated to its story of the industrial revolution; construction spanning seven decades; and the famed "Lowell Mill Girls", a group of laborers who eventually formed the nation's first women's workers union.

NPS' presence presented its own challenges to developers, though, as a premium had been placed on the historical significance of the complex. The gabled roofs, clock tower, smokestack and other brick façades needed to be fastidiously preserved as part of the redevelopment.

Phase One of Boott Mills required a comprehensive rehabilitation strategy for these iconic features to accommodate conversion to multifamily housing. Boston-based WinnDevelopment led a project team that included environmental and community groups and NPS itself. The developers selected The Architectural Team (TAT), Chelsea, Mass., in 2003 to spearhead the exterior restoration and fit-outs of five mill buildings (see the site plan, page 64) for 154 units of rental apartments, under the direction of project manager Nick Kane, AIA.

The structures on the campus had been damaged by a window-shattering gas



PHOTO: LOWELL DEPARTMENT OF PLANNING AND DEVELOPMENT

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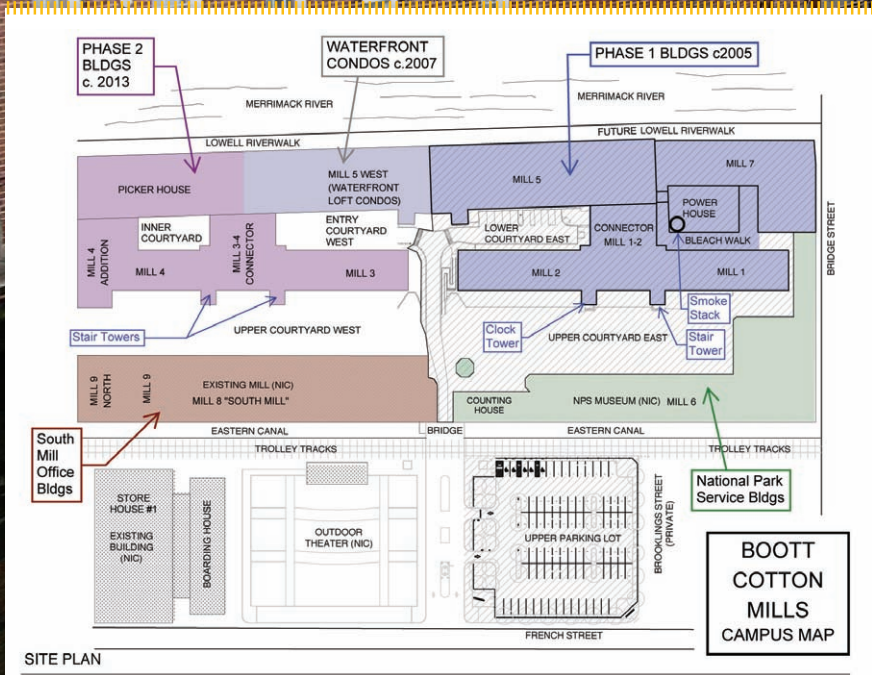
explosion across the river and lightning strikes to the smokestack, as well as the usual forces of time and weather. Plastic and wood used to replace blown-in windows failed to repel moisture, eventually leading to rot and deterioration. Simultaneously, the 25-year-old roof timbers suffered ongoing decay and infestation by wood-eating

microorganisms. TAT's design plan would have to address making enormous factory buildings habitable and preserving iconic architectural features.

TAT's surveys revealed the buildings' first-floor levels were 11 inches below the 100-year flood plain, an issue most mills share because they were built along rivers



PHOTO: KIRK KITTELL



SITE PLAN

1:100

Phase One of the Boot Mills project began in 2003 and included the exterior restoration and fit-outs of five mill buildings for 154 units of rental apartments. The phase was completed in 2005. Phase Two, which was completed in December 2013 and took just under three years, not only increased the numbers of rental units, but also incorporated 45,000 square feet of commercial space.

PHOTO: JOHN SCHRANTZ

in a time when flood plains were not widely understood. The remedy called for a structural fill, compacted to raise the floors with a new finish concrete slab on top.

The foundation, which incorporates sluiceways for canals once used to power milling equipment, had been ravaged by water damage. This undermined entire masonry walls. The preservation of the iconic clock tower, for example, required its complete removal from the building while the walls beneath were disassembled and rebuilt. The restored clock was then craned back into place. Also, once structural repairs were made, the team was able to install a low-head hydro turbine to harness the natural movement of the waters through the canal, which produces electricity for the grid.

Adding to the sustainability of the project's energy profile, the team installed a cost-effective, energy-efficient co-generation boiler plant system that simultaneously produces heat and hot water for the apartments and electricity for the common spaces, utilizing a single fuel source.

Boott Mills' beautiful brickwork presented an enormous challenge. For example, lightning had struck the 200-foot chimney, the construction of which included decorative work with bricks placed at 45-degree angles. Masons had to clean and replace the bricks while hoisted by crane into a precarious position high above the factory roof. The masonry was cleaned with a gentle wash, an old historical method used to preserve color and integrity, rather than sandblasting or harsh chemicals.

For the brick façade, the team tested the lime mortar and replicated its composition (the sand-to-lime ratio, at least). Then, to attain the crisp look of the original masonry, the weathered, rounded corners of the brick exterior had to be addressed. The team used tuckpoint method to fill up to 1/4 inch of each joint, achieving a uniform thickness across all joints in the façade, recreating the look of new brick.

Meanwhile, the design and construction team replaced 40 percent of the beams and floor decking in the mill buildings. After a year of design and development and 19 months of construction, the team completed Phase One in November 2005.

To Marry History and Development

Throughout the project, TAT and the development team worked closely with the Lowell Historic Board (LHB). The team brought its plans for Phase Two to LHB early on, knowing the body to be diligent and thorough. Phase One had been so well received, LHB told the team to consider it a template for future work. However, the team's planning would be complicated somewhat by the development of 39 condominium units—the Waterfront Lofts—within a building on the Boott Mills campus by an unrelated design and construction team. The lofts project proceeded without comprehensive attention to historic views of the buildings, light fixtures, and details of windows and doors—issues that TAT would have to remedy as an addendum to Phase Two while the condo units remained occupied.

WinnDevelopment, now joined by co-developer Rees-Larkin Development LLC, Boston, planned for Phase Two to not only increase the numbers of rental units (all 154 from Phase One were by then occupied), but also broaden the portfolio of unit types and rent values. Plans to incorporate 45,000 square feet of commercial space qualified the project for a "new markets" tax credit that drove this phase financially. The scope of the second phase included five conjoined mill structures, considered one single structure under applicable building codes, plus remedies for the Waterfront Lofts building.

More challenges cropped up: All construction operations had to take place within the narrow confines determined by the river and adjacent canals. Also, there would be even greater scrutiny than with most historical projects because the NPS offices and museum face the project buildings. Exacting work to restore the façades and windows had been completed under NPS direction 20 years previously, and those details would need to remain undisturbed by the new construction.

The team also had to shore up the mill structures for seismic and wind-uplift requirements. For example, the team built girdles around the exteriors of the walls using a steel angle bolted to the top of every beam. Tens of thousands of square feet of

Retrofit Materials >>

CO-GENERATION BOILER PLANT //

Aegis Energy Services,
www.aegisenergyservices.com

HISTORIC-REPLICA ALUMINUM WINDOWS IN APARTMENTS //

ER Lewin Inc., www.erlewin.com

COMMERCIAL WOOD-REPLICA WINDOWS //

North Atlantic Corp., Somerset, Mass.,
www.northatlanticcorp.com

ROOFTOP ENERGY-RECOVERY-VENTILATION UNITS //

Renewaire, www.renewaire.com, and
AnnexAir, www.annexair.com

BRICK-RESTORATION // EnviroKlean

EK cleaner and Heavy Duty Paint Stripper D, in select areas, from
Prosoco Inc., www.prosoco.com

BRICK MORTAR // Saint-Astier Natural

Hydraulic Lime, mixed with local sand
blends, www.limes.us

MECHANICALLY ATTACHED 60-MIL REINFORCED EPDM AND TWO LAYERS OF 3.25-INCH POLYISOCYANURATE //

Firestone Building Products, firestonebpco.com

SPRAY FOAM ON WINDOW AND DOOR PENETRATIONS //

Soudal, www.soudalusa.com

SPRAY FOAM ON INSIDE OF EXTERIOR WALLS //

Icynene, www.icynene.com

CELLULOSE INSULATION ON INTERIOR DEMISING WALLS //

GreenFiber, www.greenfiber.com

GYPSUM CONCRETE //

Gyp-Crete from Maxxon,
www.maxxon.com

ACOUSTIC UNDERLAYMENT FOR FLOORING //


Acousti-Mat 3 from Maxxon

FLOORING // Concrete Connections line in Steel Structure color in bathrooms and Keystones in Urban Putty color in kitchens from Daltile, www.daltile.com

STOREFRONT WINDOWS //

EFCO, www.efcocorp.com



 The team was able to install a low-head hydro turbine to harness the natural movement of the waters through the canal, which produces electricity for the grid.



PHOTOS: JOHN SCHRANTZ

open mill floor and defunct office space were completely gutted down to the base structure to make room for the construction of market-rate residences. Common spaces and amenities already in place for the condominiums had to be adapted and, in a few cases, fully reconstructed to make them work for the combined 117 units.

Getting It Right

TAT worked closely with mechanical engineers to develop strategies for effective system interactions. By designing corridor spaces with long areas of exposed brick and intentionally lower ambient temperatures, reduced energy consumption offset the loss of heat through uninsulated walls. And, of course, historic accuracy was a priority. The roof structure underside was exposed, which necessitated insulation on top, so the perimeter details specified reduced the visible thickness of the insulation without changing the existing proportions of the cornice trim profiles. Likewise, a previously installed cooling tower visible on the roof of one structure had to be moved behind a chimney, along with other HVAC equipment, to restore the original, historic profile of the building.

Thermal strategies incorporated insulation behind drywall finishes in bedrooms (to retain heat overnight) while maintaining the desirable exposed brick in living spaces. High-performing fenestration was installed everywhere. For sound attenuation, concrete, gypsum concrete and leveling material were all considered. TAT elected 3/4- or 1-inch gypsum concrete (depending on the location) on top of an acoustic underlayment, providing a high Sound Transmission Class between floors.

Wherever possible, the team salvaged original stairways. The main wooden stair tower connecting the three commercial floors was retained, and original "Boott Cotton Mills" cast-iron treads were found, restored and reinstalled. Steel fire-escape towers outboard of the façade could not be brought up to code but were deemed historically significant to the look of the building. They were refurbished to retain historic reference, but public access is prohibited.

For the commercial spaces, a minimum amount of build-out was completed as the tenants were yet to be determined. But the

façades were required to be fully restored, regardless. Existing wood window frames were repaired in place. Window openings in the commercial portion that had been blocked were reopened and received historic-replica wood frames.

Because the residential windows required features, such as interior screens and child-protection mechanisms, retrofitting the existing, deteriorated wood windows was not an option. The apartments received historic-replica aluminum window frames approved by NPS and LHB. Nevertheless, residential tenants enjoy significant historical detail. Three of the units in particular incorporate an original internal stairwell as a dramatic feature in the living rooms. The "winder" stair was cleaned, repaired, railings modified, and made into a presentable and usable element while the floors were infilled to separate the stack of apartments.

Mills Reborn


Phase Two began with an 18-month design and development process and was completed after 15 months of construction in December 2013. Boott Mills' rebirth has had a dramatic impact on the city, beyond the atmosphere and symbolism of seeing lights in the windows once more. The Merrimack, long the focus of the town and currently undergoing cleanup efforts, is drawing attention once again among those seeking recreation and reflection. Lowell's Riverwalk, which was rarely trod in the past, is now bookended by a new minor-league ballpark to the north and Boott Mills to the south, making it a newly popular pedestrian path.

Meanwhile the new apartments, which opened in December 2013, are above 50 percent occupied as of this writing, which is high considering the tough holiday season. All stakeholders have been effusive about the results, including the condominium owners who were in place throughout Phase Two. Future plans for the campus include fit-outs of 15,000 square feet of commercial space through the spring of 2014 and another 20,000 to 25,000 square feet left to be fit-out at a later date.

As for Lowell, the city is building a 100-space parking lot across the street in anticipation of tenancy in the commercial portion. And Lowell is already enjoying the revenue from the taxes associated with the

newly desirable property, giving it the funds needed to make other city improvements.

Lowell has become a rich, vibrant gateway city, thanks in large part to successful adaptive reuse and historic preservation of an underused facility. Not all defunct mill properties can be so effectively transformed, but most of them are worth exploring the option. And the strategic use of historic preservation and rehabilitation tax credits can make the idea tempting for savvy developers.

There is power in adapting old mills, and Lowell stands as proof. 

Retrofit Team >>

ARCHITECT // The Architectural Team, Chelsea, Mass., www.architecturalteam.com

DEVELOPER // WinnDevelopment, Boston, www.winncompanies.com

Apartments at Boott Mills (Phase One)

GENERAL CONTRACTOR // Consigli Construction, Milford, Mass., www.consigli.com

ELECTRICAL ENGINEER // Sam Zax Associates, Braintree, Mass., (781) 303-1700

CIVIL ENGINEER // Nobis Engineering Inc., Lowell, Mass., www.nobisengineering.com

MEP // Dubin Engineers, Quincy, Mass., (617) 376-8877

STRUCTURAL // Chaloff Consulting Engineers, Boston, and DM Berg Consultants, Needham, Mass., (781) 444-5156

Boott Mills West (Phase Two)

CO-DEVELOPERS // WinnDevelopment and Rees-Larkin Development LLC, Boston, jon@rees-larkindevelopment.com

GENERAL CONTRACTOR // Keith Construction Inc., Canton, Mass., www.keithconstruction.net

ELECTRICAL ENGINEER // SwiftCurrent Engineering, Yarmouth, Maine, swiftcurrenteng.com

CIVIL ENGINEER // Nobis Engineering

M-P-FP ENGINEER // Petersen Engineering Inc., Portsmouth, N.H., www.petersenengineering.com

STRUCTURAL // Odeh Engineers, North Providence, R.I., www.odehengineers.com

For a list of subcontractors integral to Phases One and Two, visit www.refitmagazine.com/boott-mills.