

Chapter 2

The Origins of Heavy Timber Construction

While it has been clearly established what heavy timber construction is, that is to say its design features and structural requirements have been transcribed, it is pertinent to explain how and why the construction type came into being. The origins of heavy timber construction are a multi-dimensional tale, an extraordinary saga that parallels the very history of the United States itself. The construction type truly manifested itself as the physical embodiment of the nation's rise from a veritable small-scale post-colonial status to undisputable industrial juggernaut.

Within a few short decades, the United States catapulted from relative obscurity on the global scale to a great nation marked by industrial ingenuity and enterprise,¹ and at the forefront of this rapid evolution was heavy timber construction. In order to fully appreciate why heavy timber construction rose to prominence, it is necessary to chronicle the development of the nation itself in the mid-nineteenth century. Economic development in the United States, or its Industrial Revolution, did not take place largely until just after 1820.² The great wave of industrial growth emanated from the great East Coast urban centers of New York, Boston, Philadelphia, and Baltimore. Within two decades, each of these cities possessed nearby industrial satellite cities. New York City had Paterson, New Jersey. Boston had Lowell, Massachusetts. Philadelphia had Reading, Pennsylvania, and Baltimore had Wilmington, Delaware.³

It was in these urban centers where large swaths of the nation's population resided. They were localities that flowed with capital and markets hungry for goods. By 1840, these eastern cities controlled approximately one-quarter of the United States' total manufacturing. From 1828 to 1860, the United States saw its GDP

¹ 'The State of the Manufacturing Trades.' *Scientific American*, XXV.13 (1871), p. 200.

² David R. Meyer, 'The Roots of American Industrialization, 1790–1860.' *Economic History Services*, (2003).

³ Meyer, 2003.

grow by an annual average of 4.6%.⁴ During this period, one of the primary mechanisms for the profound expansion of the United States economy took place, the establishment of an extensive rail network.⁵ Quickly, capital flowed into the rail lines from a variety of sources based out of these urban centers. In fact, between 1830 and 1839, investment in the nation's rail network increased at an average annual rate in excess of 31%.⁶

The establishment of a modernized and efficient transportation network in the form of railroads, which were not dependent upon waterways or animal power, allowed for goods produced in the nation's manufacturing centers to reach distant markets. In short order, the East Coast manufacturing centers were able to capitalize on the sudden increase in the size of markets and the resultant increase in demand. Within a few years, industry exploded, with one Lowell-based company, Merrimack Manufacturing Company, which was an 1823 upstart, posting average annual profits of 24% during the period from 1825 to 1845.⁷ From 1805 to 1811, the aforementioned urban centers largely collected in the New York and southern New England area exceeded the national per capita patent filings by a threefold margin.⁸ By 1860, this geographic area was producing over half of the nation's patents while possessing only one-fifth of the nation's population.⁹

To physically house this type of uncharted industrial and economic growth, suitable buildings were required. Early American industrial buildings were not entirely dissimilar from those in Europe. However, American mills and industrial buildings featured one stark contrast; instead of exterior walls filled with brick, stone, or wattle and daub, they were instead clad with clapboards.¹⁰ In the United States, the great abundance of wood made it far more economical, if not more risky, to build in timber. However, this relatively lightweight construction method, and the exceptionally combustible nature of early manufacturing itself, led to fires being commonplace.¹¹ In the early-nineteenth century, post-and-beam construction, a precursor to heavy timber, emerged as a common building form for industrial buildings, a form that would better combat fire. This old world construction type featured masonry exterior walls, heavy timber beams and columns, and often 2-in.-thick timber floors sometimes covered in a 1-in. layer of mortar.¹²

⁴Rui M. Pereira and William J. Hausman, *Railroads and Economic Growth in the Antebellum United States*, (Williamsburg: College of William and Mary, 2014), p. 5.

⁵Pereira, p. 5.

⁶Pereira, p. 5.

⁷Meyer Weinberg, 'Rise of the Capitalist Class, 1790–1865.' *New History*, (2002).

⁸Kenneth L. Sokoloff, 'Invention, Innovation, and Manufacturing Productivity Growth in the Antebellum Northeast.' *American Economic Growth and Standards of Living before the Civil War*, (Chicago: University of Chicago, 1992), p. 352.

⁹Sokoloff, p. 352.

¹⁰Randolph Langenbach, *Better than Steel? (Part 2): Tall Wooden Factories and the Invention of "Slow-Burning" Heavy Timber Construction*, (Oakland: Conservation tech Consulting, 2010).

¹¹Langenbach, 2010.

¹²Langenbach, 2010.

In 1835, an American building revolution took place in the form of the standardization of heavy timber construction. Leading up to that historic year, a number of fires had utterly decimated New England's textile mills, with flames routinely preying on the highly combustible contents and relatively lightweight construction of said structures. So commonplace were the destructive blazes that insurance companies refused to insure mills and factories, with the Monmouth Mutual Fire Insurance Company flatly stating, "Mills and Factories are rejected altogether..."¹³ In the wake of these circumstances, a group of Rhode Island mill owners formed an organization which later became known as the Associated Factory Mutual Fire Insurance Companies and changed American architecture forever.¹⁴

Their summit in 1835 led to a standardized design for mill construction. The recommended design harnessed both the available resources, but utilized elements known for their proven fire-resistant qualities and for permanence.¹⁵ With the official launch of the heavy timber construction type, it did not take long for the design to find widespread use in a variety of industries and occupancy types. Over the type's early years, the original recommended design was adjusted as necessary when issues arose that required a deviation in order to increase performance.¹⁶

By 1840, it appears that the heavy timber construction type had been truly standardized and streamlined. That year, the superintendent of mills in York, Maine, James Montgomery, commented on New England's mills, stating:

Though the Mills in this country are not so high as those in Great Britain, they are generally very strong and durable. Instead of joists for supporting the floors, there are large beams about 14 inches by 12, extending across from side to side, having each end fastened to the side wall by a bolt and wall plate: these beams are about five feet apart, and supported in the centre by wooden pillars, with a double floor above. The under floor consists of planks three inches thick; the upper floor of one inch board. Some have the planks dressed on the under-side, others have them lathed and plastered: the floor being in all four inches thick, is very strong and stiff. The average thickness of the side walls may be from twenty to twenty-four inches, and they are generally built of bricks. There are very few stone walls, free stone being scarce in this country.¹⁷

As heavy timber proliferated across the upper Eastern Seaboard, alternative fire-resistant building technologies were well known, but appear to have been largely avoided. As early as the 1850s, discussion about the use of iron for structural purposes had become common; however, there were great fears that cast-iron columns would fail under severe strains,¹⁸ and when used in industrial occupancies with heavy fire loads and subsequently subjected to the intense heat of such a fire, the

¹³ 'Monmouth Mutual Fire Insurance Company.' *Maine Farmer and Journal of the Useful Arts*, 7.51 (1839), p. 403.

¹⁴ C. E. Paul, *Heavy Timber Mill Construction Buildings*, (Chicago: Engineering Bureau, National Lumber Manufacturers Assoc., 1916), p. 6.

¹⁵ Paul, p. 6.

¹⁶ Paul, p. 6.

¹⁷ Langenbach, 2010.

¹⁸ 'Fire-Proof Buildings.' *Circular*, 3.116 (1854), p. 462.

iron members would rapidly fail.¹⁹ Moreover, it was common knowledge that hardwoods, such as oak, provided excellent strength and flexibility.²⁰ As such, an argument can be made that the adherence to heavy timber construction, even in the face of other building systems, could be due to both the widespread availability of suitable timbers²¹ and heavy timber's proven performance under fire conditions.

Soon after its inception, heavy timber construction began to dominate New England cities as it slowly swept down the Eastern Seaboard. Providence, Rhode Island, the effective birthplace of the construction type, was one of the great pioneering cities that erected heavy timber buildings to bear the weight of its industrial growth. Coinciding with heavy timber's rise to dominance, Providence had its population triple between 1830 and 1865 and later doubling between the years of 1865 and 1880.²² Providence's industrial growth initially started in 1811 when cotton was the primary trade; however, over the next few decades, the city's industry had diversified to the point it was labeled by one observer stating, "Providence manufactures everything from a carpet-tack to a locomotive."²³ Perhaps there was no better structural example of Providence's diversified nature than the Heaton and Cowing Mill (Fig. 2.1). This milling complex originally built in 1832, with additions through the 1980s, features a wide array of successive building design systems, including heavy timber.²⁴

In Massachusetts, two great industrial centers, Woonsocket and Brockton, stand as excellent exhibitors of heavy timber construction. From 1835 to 1867, Woonsocket populated itself with numerous heavy timber textile mills, with a preference for stone over brick for the load-bearing walls. Most of these mills were relatively small, on average ranging from two to four stories tall and often of long and narrow rectangular shapes in order to capture the maximum amount of natural light.²⁵ In Brockton, the great rise in the construction of heavy timber structures did not largely take place until the 1850s and 1860s, when a great increase in the city's immigrant population fed a local economy primed to launch. However, the great surviving heavy timber buildings dated after 1870 (Fig. 2.2) are common in the city and feature a typically utilitarian appearance with broad gabled roofs and ranging in height from three to five stories.²⁶

¹⁹ 'Fire-Proof Structures.' *Flag of Our Union*, 12.26 (1857), p. 205.

²⁰ 'The Builder's Manual.' *Mechanics' Magazine, and Journal of the Mechanics' Institute*, 1837, p. 198.

²¹ Winston Wallace Clement, *Standardization in the Lumber Industry: Trade Journals, Builder's Guides and the American Home*, (Philadelphia: University of Pennsylvania, 2014), p. 19.

²² Richard E. Greenwood, 'Providence One Hundred Years Ago—The Industrial Heyday.' *City of Providence City Archives*, (2011).

²³ Greenwood, 2011.

²⁴ Edward Connors, *National Register of Historic Places Registration Form—Heaton & Cowing Mill*, (Riverside: Edward Connors and Associates, 2012), pp. 3–5.

²⁵ 'History of Fire and Fire Protection in Nineteenth Century Woonsocket.' *City of Woonsocket*, Woonsocket Fire Department.

²⁶ *MHC Reconnaissance Survey Town Report Brockton*, (Boston: Massachusetts Historical Commission, 1981), pp. 1, 14



Fig. 2.1 Heaton and Cowing Mill in Providence, Rhode Island (Photograph courtesy of Ned Connors)



Fig. 2.2 The W. L. Douglas Shoe Company in Brockton, Massachusetts, in the 1940s (Photograph by Jack Delano, courtesy of the Library of Congress)

As the nineteenth century progressed, so too did heavy timber's gradual migration southward. One of the great pockets of East Coast heavy timber construction was Paterson, New Jersey. Here, most of the mill and industrial heavy timber buildings were of heavy timber construction expressly built for utility rather than elegance. These buildings are considerably more plain than those existing in other localities. Paterson embodies the region's adherence to the construction type and a proven belief in the type's performance.²⁷ In 1871, a fire ripped through the city's Franklin Mill. Initial news reports stated that the fire had ostensibly been burning for quite some time before it was discovered, allowing for the development of quite an inferno. However, the blaze was kept to one wing of the mill, and its nearby exposure, the Hope Mill, was able to withstand the radiant heat.²⁸

Toward the middle of the nineteenth century, heavy timber construction made its way into the American South. The patterns of heavy timber proliferation throughout the South tend to, like the North, follow its general economic development timeline. The South as a whole did not really start dramatically investing in its economy, that is to say by far its most dominant industry of cotton, until about 1840. In the short window between 1840 and 1860, the South had doubled its capital investment in cotton manufacturing.²⁹ Such a dramatic increase by virtue necessitated a resultant increase in infrastructure. To that end, heavy timber made its way through the American South.

To be certain, cotton has often caught the eye of many historians as the dominant industry of the American South, particularly the Antebellum South; however, in the second quarter of the nineteenth century, tobacco became a powerful industry in its own right, notably in Virginia³⁰ and North Carolina. Understandably, the American Civil War and resultant Reconstruction period placed a significant damper on building construction in general. However, in North Carolina, the city of Durham in particular, industry and new construction exploded in the 1870s. Cigarettes had become quite popular and the tobacco-producing regions such as Durham prospered.³¹ A striking example of heavy timber construction's application in the South and its adaptation to tobacco production can be seen in Durham's American Tobacco Company Manufacturing Plant (Fig. 2.3). In this massive complex, which saw almost continual additions between 1874 and 1954, 30 buildings are heavy timber,

²⁷Toni Ristau, *Mill Architecture in Paterson, NJ: A Culmination of the Empirical Tradition in Construction*, Proc. of Symposium on Industrial Archaeology, New Jersey, Paterson, (Paterson: Northeast Historical Archaeology, 1975), p. 59

²⁸'Great Fire at Paterson.' *The New York Times*, 14 December 1871, p. 1.

²⁹Edward Pessen, 'How Different from Each Other Were the Antebellum North and South?' *The American Historical Review*, 85.5 (1980), p. 1125.

³⁰Karen Lang-Kummer and A. Rebecca Harrison, *National Register of Historic Places Inventory-Nomination Form: Shockoe Valley and Tobacco Row Historic District*, (Richmond: Virginia Historic Landmarks Commission, 1982), p. 2.

³¹'Cultivation of a Tobacco Empire.' *North Carolina Historic Sites*, North Carolina Department of Cultural Resources Office of Archives & History, (2014).



Fig. 2.3 The Bull Durham Tobacco Company's complex in Durham, North Carolina, in the mid-twentieth century (Photograph by Marion Post Wolcott, courtesy of the Library of Congress)

and while generally built in a simple utilitarian style, in later years newer buildings were adorned with decorative brickwork.³²

While heavy timber construction generally seems to have followed a rather linear trajectory during the early years of its existence, it appears to have abandoned that trend by the middle of the nineteenth century. While it cannot be definitely ascertained as to why heavy timber construction's spread westward arguably progressed significantly faster than it did into the southern reaches of the United States, it can, however, be clearly seen that heavy timber was establishing itself in force in the Midwest, some 1,500 miles from the source, at around the same time it became popular in the South.

³² Claudia R. Brown and M. Ruth Little, *National Register of Historic Places Inventory-Nomination Form: American Tobacco Company Manufacturing Plant*, (Raleigh: North Carolina State Historic Preservation Office, 2000), pp. 6–7.

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