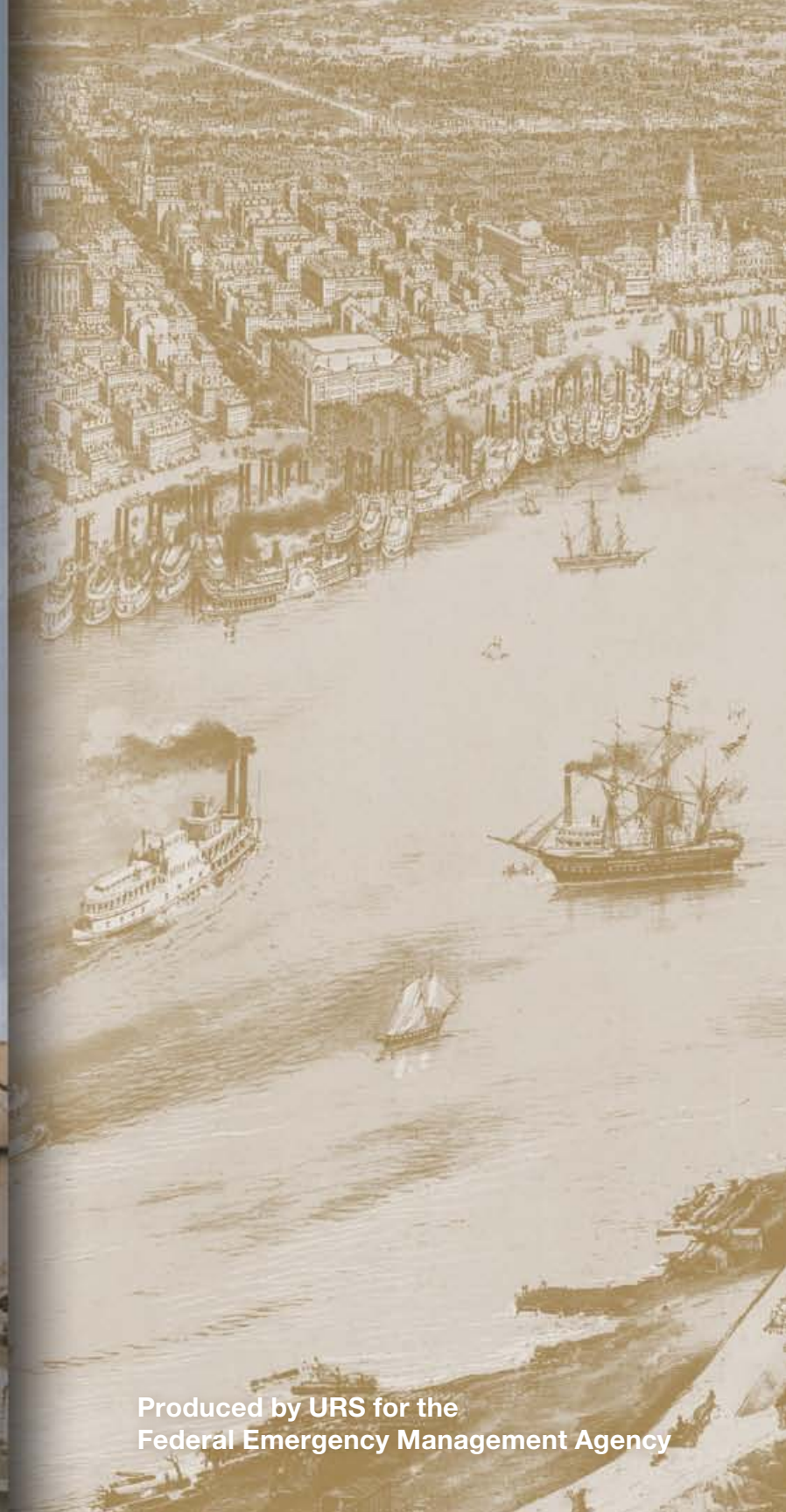


The History of Building Elevation in New Orleans



Produced by URS for the
Federal Emergency Management Agency

The History of Building Elevation in New Orleans



Federal Emergency Management Agency

Department of Homeland Security

500 C Street, SW

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COVER PHOTO: Elevation of a house on wooden cribbing with ground story removed, ca. mid-1950s (courtesy of Abry Bros., Inc.)

COVER MAP: From "Birds' eye view of New-Orleans," drawn from nature on stone by J. Bachman, ca. 1851, Library of Congress Prints and Photographs Division, Washington, D.C.

This booklet was prepared by URS Group, Inc. for the Environmental/Historic Preservation Program of the Federal Emergency Management Agency (FEMA), U.S. Department of Homeland Security, as part of obligations under Section 106 of the National Historic Preservation Act of 1966, as amended. Contributions of staff members working within the Historic Preservation department at FEMA's Louisiana Recovery Office and the Louisiana Division of Historic Preservation are gratefully acknowledged. The following FEMA and URS staff members made material contributions to this document:

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From the first years of European settlement to the present, houses in New Orleans and the coastal parishes of Louisiana have been raised above the ground, either during their initial construction or following flooding or the threat of flooding. The appearance of these houses and the methods of elevating them have changed, but the reasons that prompted their raising have remained the same. Where saturated soils, unpredictable watercourses, and low-lying house sites coexist with rising rivers and the pounding wind and water of storms and hurricanes, safety can often only be achieved by living above, not on, the unpredictable land.

As early as 1719, when New Orleans was a cluster of huts in the yet-to-be gridded or named French Quarter or Vieux Carré, settlers constructed a three-foot-high levee along the Mississippi River. Drawing from the successes and failures of the dwellings erected by native, French, African, and Spanish inhabitants of the Caribbean and the northern coastline of the Gulf, the French, black, and Creole settlers of Louisiana developed the French Creole Plantation House type in the 18th century. This house, with its principal living areas elevated on an aboveground basement, was among the earliest expressions of the raised house type in the region. It was followed late in the 18th and into the 19th century by the Raised Creole Cottage, the Raised (or American) Cottage and, in the 20th century, the Raised Basement House. Though these house types differ in appearance, they were all built in response to the threats of the ever-changing environment in the same fashion: by raising the principal living area at least slightly, and sometimes significantly, off the ground.

A house in New Orleans and low-lying areas of Louisiana did not have to stand far off the ground when first constructed to receive protection. It could always be subsequently elevated. The initial history of the lifting of existing houses, likely executed by local house builders and owners rather than professionals, is absent from historical records. By the mid-19th century, however, professional house raisers appeared in New Orleans: men such as Jeremiah Lincoln, Jacob Lake, John Wagner, and, most notably, John Abry, who a century-and-a-half ago established a house raising and moving firm still operated by his descendants. The number of house elevation firms waxed and waned throughout much of the 20th century. By the late 20th and early 21st century, however, there were record numbers of these companies in the city. These numbers were abetted by the opening of vast areas of New Orleans to development through technological advances in drainage and pumping; the building of houses on slabs on the ground; the depredations of massive hurricanes such as Betsy in 1965 and the horrific Katrina in 2005; and the efforts of the Federal Emergency Management Agency (FEMA), U.S. Department of Homeland Security, to preserve houses, and protect their residents, by drawing from past traditions and elevating them above floodwaters. The efforts of New Orleans' residents over the past 300 years to protect their homes by elevating them, individually and with government assistance, is the subject of the text that follows.

This booklet was written, designed, and produced by URS Group, Inc. (URS) to help the FEMA Environmental/ Historic Preservation Program fulfill its obligations under Section 106 of the National Historic Preservation Act. Contributions of staff members working with the Historic Preservation department at FEMA's Louisiana Recovery Office and the Louisiana Division of Historic Preservation are gratefully acknowledged. Many URS staff members made material contributions to this document. They included Richard Silverman and Marvin Brown, architectural historians and principal authors; architectural historians Michael Verderosa, Mark Edwards, and Carrie Albee, who assisted with editing; Martin Handly and Stephanie Perrault, who wrote a history of New Orleans from which the opening section of this document heavily drew; archaeologists Mark Martinkovic and Jeremy Lazelle; graphic designer Lee-Ann Lyons; and technical editors Ivy Porpotage and Amy Siegel. FEMA staff members who contributed to and carefully reviewed the document included historic preservation specialists Amber Martinez, Gail Lazarus, and Sarah Birtchet; historical architect Ron Reiss; and David Livingtone, FEMA's liaison with the Louisiana State Historic Preservation Office.

Preface

Circumstances and Events that Spurred the Historic Elevation of New Orleans' Buildings

French and Spanish Settlement

In 1708, Bayou St. John, a natural portage from Lake Pontchartrain to the Mississippi River, became the waterfront home of the first settlement in present-day New Orleans.¹ A tiny French fort originally called Fort St. John and later the “Old Spanish Fort” rose on the bayou’s eastern bank near a small settlement of Biloxi Indians.² The first settlers in the New Orleans area established themselves along the natural levees of Bayou St. John and the other drainages that passed between the river and the lake. Their choice of naturally elevated levees indicated that from New Orleans’ very beginning, the placement of buildings was affected by the presence and height of water.

In 1717, France awarded an exclusive charter for trade in its Louisiana Colony to the Western Company, which directed that the colonial capital shift west from Mobile to a spot between Lake Pontchartrain and the Mississippi River. The following

year, Jean Baptiste Le Moyne, Sieur de Bienville, chose a stretch of relatively high ground along the east bank of the Mississippi, adjacent to the established trading route and the Bayou St. John portage, for the new capital.³ He named the city for the Regent of France, Philip II, Duke of Orleans.

The fledgling city of New Orleans initially had no plan. It simply comprised a group of huts clustered near the future intersections of Chartres, Royal, and St. Ann Streets.⁴ In 1721, French engineer Adrien de Pauger debarked in the settlement to refine and implement a city plan (opposite) begun the previous year by Bienville’s chief engineer, Le Blond de la Tour. The plan exemplified the new tenets of 18th-century city planning: it consisted of a rectangle with six rows of blocks and streets at right angles that encompassed 14 squares. Its drainage was laid out to acknowledge the dangers of flooding and demonstrated the central role the control of water had

in the city’s development (above). A modern account of New Orleans’ drainage system notes the attention the two French engineers gave to the movement of water:

Each square was encircled by a ditch, and the whole city was surrounded by a canal. The flow from the ditches around the squares fed into two large ditches, which emptied into the canal. The canal, in turn, emptied into the swamp lying behind the city and stretching to the natural level of Lake Pontchartrain.”⁵

The colony awarded the best lots to settlers with the means and resources to build immediately. Those lots nearest the river were considered prime real estate, as they stood on the highest part of the natural levee, about ten feet above sea level. Even during its very beginnings, New Orleans’ residents understood the value of land elevated above the flood-prone land they had

**PLAN OF
NEW ORLEANS
THE CAPITAL OF
LOUISIANA;**
*with the Disposition of
its Quarters and Canals
as they have been traced
by M^r. de la Tour
in the Year 1720.*

REFERENCES

- A. House of the Intendant
- B. Council of the Capitan Payer
- C. The Jail
- D. Guard Room
- E. Hospital and Convoy of the Cavaliers
- F. Guard House of the Inhabitants
- G. Place where the Windmill Stood

British Fathoms



1720. Published according to Act of Parliament by T. Jefferys at Charles Cross Price 5.

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Map Division
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“Plan of New Orleans the capital of Louisiana; with the disposition of its quarters and canals as they have been traced by Mr. de la Tour in the year 1720.”

Library of Congress, Geography and Map Division, used with permission

chosen to call home. Indeed, in 1719 they had constructed a three-foot-high levee—the first of many—along the Mississippi, acknowledging the supreme importance of elevated or at least protected ground in the city.⁶

In 1722, the capital of the colony was officially transferred from Mobile to New Orleans. The census for that year identified 177 Europeans, the same number of slaves, and 21 Indians in the city.⁷ Father Pierre Charlevoix described New Orleans as “about a hundred huts placed without much order, a large warehouse built of wood and two or three houses that would not grace a French village.”⁸ New Orleans’ first recorded hurricane baptized the brand new capital on September 23–24, 1722. It thrust surges three feet up Bayou St. John and eight feet up the Mississippi. Thirty huts and the city’s hospital were destroyed and ships sank in the harbor. This occurred in spite of the construction of the three-foot-high levee a few years earlier that was intended to protect the settlement from river and tidal overflow.⁹ Ironically, the hurricane’s destructiveness made Pauger’s task of laying out a new city much easier. Many more storms were to damage the city before the century’s end.¹⁰

The following year, the French transferred administration of the colony from the Western Company to the Royal Indian Company. In recognition of the critical importance of flood control, Royal Indian established policies that strongly influenced New Orleans’ built environment. It required those individuals and businesses located adjacent to the back slope of waterways to erect levees for protection against flooding. At that time, only a scattering of buildings stood on the first three rows of the planned streets; the

remainder of the area was uncleared and swampy.¹¹ Still, even at this early period, the emerging city was clearly recognizable as today’s French Quarter. New Orleans grew slowly but steadily. In 1724, it had 380 residents. Two years later, it held 650 white inhabitants, 80 black slaves, and 26 enslaved Indians, all concentrated in the Quarter at the river.

By 1727, 794 white colonists lived in the city along with 144 slaves.¹² Five years later, the white population had dropped to 626, but the total number of black residents had soared to 650.¹³ Maps of mid-18th-century New Orleans suggest that the number of inhabitants and their slaves was increasing, but residential expansion still did not extend beyond the established city limits. Bellin’s 1764 map (opposite) depicts existing mid-18th-century structures, as well as proposed buildings, and an increase in elevated alluvial or batture land along the river in what would become the business district.

Many residents of New Orleans and the colony were displeased, in 1764, when France transferred Louisiana to Spain. When Antonio de Ulloa arrived in Louisiana as the new governor in 1768, he was driven out by the colonists. The following year, Alejandro O’Reilly and 2,000 soldiers took control of Louisiana. During the following four decades of Spanish rule, the population of New Orleans grew significantly. By the last decade of the 18th century, the city had more than 8,000 inhabitants. Increases in population in New Orleans and elsewhere in Louisiana were bolstered by the arrival of several new groups of immigrants. Following the Great Expulsion of 1755, many French-Canadians, who were to be called Acadians or Cajuns,

found their way to Louisiana from northeastern Canada and settled upriver from New Orleans. In response to the abolition of slavery in the French colony of Saint Domingue in 1801 and the creation of the new nation of Haiti in the colony’s stead in 1804, numerous whites, with slaves in tow, abandoned the island of Hispaniola for New Orleans.

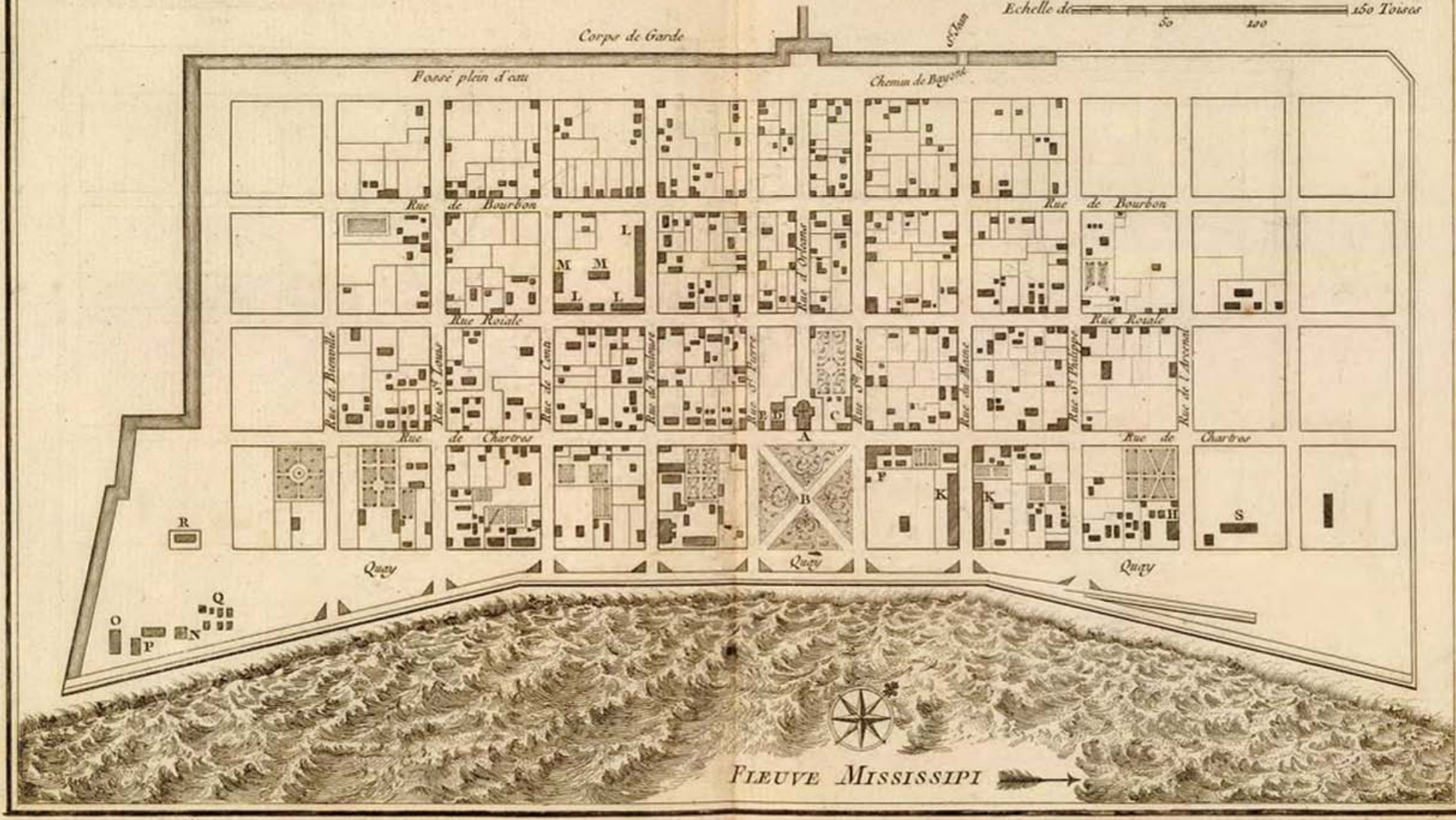
In 1787, Spain also allowed United States citizens to settle in Louisiana, as long as they swore loyalty to the King of Spain and agreed to become Catholic.¹⁴ During the Spanish colonial period, New Orleans’ appearance changed significantly, even though the French boundaries remained in place. The Spanish set oil streetlamps across the city and established the first public market and St. Louis Cemetery. They improved fortifications by erecting new palisades and batteries and adding five new forts.¹⁵

The Spanish also constructed the Carondelet Canal, which extended from a turning basin located at what is now Basin and North Rampart Streets, in the rear or back of town, out to Bayou St. John.¹⁶ The canal’s primary function was the transportation of goods by boat from Lake Pontchartrain through Bayou St. John to the city proper. Secondarily, it provided sewer and storm water drainage, somewhat mitigating the dangers of disease from raw sewage that threatened the city. A municipal system of drains emptied into a ditch outside the city rampart. This ditch could be flushed to some extent via the Carondelet Canal and through other gravity-fed sewer and storm water drainage canals. However, in spite of this rudimentary system and a superabundance of water, New Orleans did not receive

PLAN DE LA NOUVELLE ORLEANS

- | | | | |
|--|-------------------|--|---|
| A. L'Eglise Paroissiale desservie par les Capucins | E. Corps de Garde | K. Magasins du Roi | P. Corps de Garde des Bourgeois |
| B. Place d'Armes | F. Gouvernement | L. Casernes | Q. Cabanes des Negres qui prennent soin du Moulin |
| C. Couvent des Capucins | G. Intendance | M. Foyes du Roi | R. Poudriere |
| D. Prisons | H. Hopital | N. Moulin a vent et a Cheval | S. Nouv ^{le} Maison des Urselines |
| | I. Urselines | O. Hangard de la Marine sous lequel on Construit | |

Echelle de 50 100 150 Toises



Mid-18th-century map of New Orleans.

Louisiana State Museum, used with permission

clean and safe publicly supplied water and sewerage until the 20th century.

A series of disasters punctuated Spanish rule. Hurricanes or powerful tropical storms struck New Orleans in 1776, 1779 (twice), 1780, 1781, 1793, and 1794. The particularly destructive hurricane of August 24, 1780, destroyed crops, leveled buildings, and reportedly sank every vessel afloat on the Mississippi and area lakes.¹⁷

Fire joined water in wreaking havoc late in the century. The great fires of 1788 and 1794 destroyed over 1,000 structures, indelibly changing the city's appearance. Their destructiveness was comparable to the hurricane of 1722 that had allowed for the realization of de Pauger's city plan: they were so devastating they prompted new construction regulations.¹⁸ In his most recent book, Louisiana historian Lawrence N. Powell imagines the appearance of New Orleans, complete with elevated residences, on the eve of the great fire of March 21, 1788:

Most of New Orleans' residential structures were still detached Norman-style cottages, with steeply pitched roofs to shed the rain. Over the years, as a concession to heat and moisture, town builders had raised their foundations off the ground. Residents with means—that is, those who lived near the riverfront—added second stories, girdling them with porticoes, which they shaded by breaking the roof's pitch where it met the wall and extending the shallower slope out to the edge of the street. New Orleans at the time must have looked

*like a French village that had been strained through a Caribbean sieve.*¹⁹

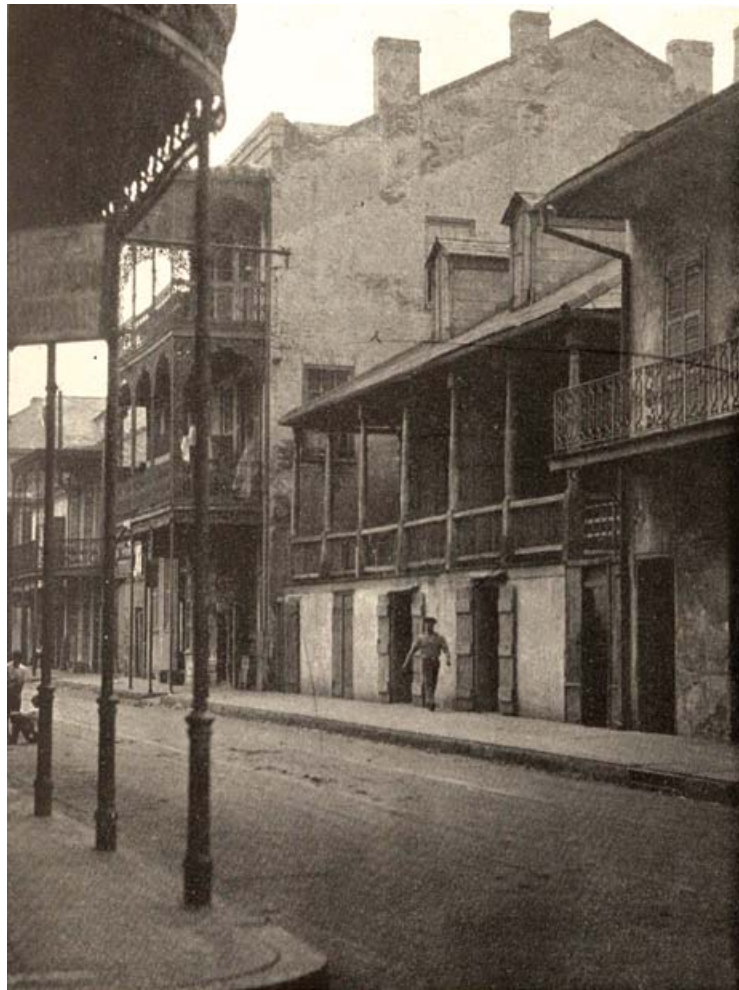
By century's end, Spanish building codes and new housing types—such as Creole cottages and townhouses with courtyards—had begun to reshape the French Quarter and the neighborhoods extending beyond it. In another descriptive paragraph that considers the resting of a typical New Orleans dwelling upon a typical stretch of soggy New Orleans ground, Powell writes:

[T]he signal [Spanish] contribution to an emerging urban aesthetic consisted of the courtyard townhouses that were becoming commonplace between Bourbon Street and the river. Though a few climbed as high as three and sometimes four floors, most hovered around two or two-and-a-half stories, since builders feared that the town's spongy soil couldn't bear the added weight. Almost always the ground level was set aside for commercial use, an arrangement that was the norm in Europe...²⁰

After the fires, as Powell notes, new types of buildings became prevalent, in part because of Spanish architectural traditions and new regulations. Structures grew larger, taller, and safer. Two-story buildings featured brick-cemented timbers and fireproof slate-shingled roofs became the norm. Residences also took on a more Spanish look with secluded, interior courtyards. The French Quarter continues to retain the look of this new fire-driven, Spanish-inflected city. As suggested by

Madame John's Legacy at 632 Dumaine Street in the Quarter (opposite), a rare surviving building reconstructed shortly after the fire, dwellings with raised basements were part of New Orleans' urban residential architecture by the late 18th century.

At the turn of the century, the plantation of Bertrand and Marie Gravier was subdivided into the city's first suburb, Faubourg Ste. Marie (which was Americanized into St. Mary in the early 19th century). Current Howard, Tchoupitoulas, South Rampart, and Common Streets bounded the new neighborhood that is now home to New Orleans' Central Business District.²¹ Still, settlement expanded little beyond the original French grid, although some plantations and several businesses were located along the rare high ground of Bayou Road/Esplanade Road and Bayou St. John. In spite of population pressures, environmental factors kept residential and agricultural expansion in check, as the areas surrounding the old city remained poorly drained, disease-ridden, and in constant danger of flooding.



Madame John's Legacy, reconstructed with raised basement following the Great Fire of 1788.

Library of Congress Prints and Photographs Division, used with permission

American Accession and the 19th Century

The Louisiana Purchase—the 1803 acquisition by the United States of more than 800,000 square miles of land, including Louisiana, from France—inaugurated the Territorial period, a time of tremendous growth in New Orleans. (The French had briefly reclaimed title to their old lands from Spain in 1803 before ceding them to the Americans.) At the time of the grand purchase in 1803, 3,948 whites, 1,335 free blacks, and 2,773 slaves lived within the city.²² The population beyond the city grid had increased as well by this time in the lands that would become Gentilly, Bayou St. John, and the upriver suburbs. The spread of population led to further political division of the region. In 1805, the Americans created Orleans Parish, out of which they soon carved the parishes of St. Bernard and Plaquemines. In 1825, with the creation of Jefferson Parish, they further trimmed the size of the Parish of Orleans.

In 1807, the Federal government gave the City of New Orleans public lands that had originally surrounded the French city, with the provision that a navigation canal be built between the Mississippi River and Lake Pontchartrain. The canal was never dug, but the portion closest to the river became known as Canal Street.²³ New Orleans' population increased steadily throughout the first half of the 19th century, for the first time in new neighborhoods or suburbs—known as the Creole Faubourgs—erected along the river beyond the original city grid.²⁴ The first downriver suburb, Faubourg Marigny, was a great success. Bounded by Franklin and St. Claude avenues, the Mississippi, and the original city, it had been cut out of a

portion of Bernard Marigny's plantation in 1806. The success of the Faubourg Marigny prompted the subdivision of Nouveau Marigny immediately to its north. Low, swampy, poorly drained soils limited the new suburb's success, but developers continued to subdivide plantation lands into lots throughout the first two decades of the 19th century and beyond. A seminal 1807 legal opinion by an American court on land ownership determined that the Federal government, not private individuals, held title to the batture land on the river side of the suburb of St. Mary. The decision also memorialized the critical importance of elevated land to New Orleans' development:

When the first colonists from Europe arrived on the banks of the Mississippi, they had in a manner to conquer the solid earth from the inundations of that river; it was necessary to restrain the waters by dykes or levees sufficient to protect the land against the rage of inundations, especially at the time of periodic swells. Thence the origin of what is called battures in this territory, which are only certain portions of the bed of the river which the Mississippi leaves dry when its waters are low, and covers wholly or in a great measure, in its annual swells.

There has existed from time immemorial, a considerable batture in front of the suburb St. Mary of New-Orleans...

... That batture seems to have been fortunately placed there to favour the building of the City which has risen near it; it may even be said that New Orleans would perhaps never have existed, or that it would have been built but very slowly, but for the aid of that natural depositum of materials placed as it were at its door.²⁵

The first Federal census of the Louisiana territory in 1810 recorded 17,242 residents in New Orleans, which made it the Nation's seventh largest city, and a total of 76,556 residents in the territory. The following year, a territorial convention was held to draft and approve a State constitution. On April 30, 1812, the United States formally admitted Louisiana to the Union and designated New Orleans as the new state's capital.²⁶

Tanesse's 1815 "Plan of the city and suburbs of New Orleans" (opposite) captures the growth and sophistication of the city shortly after Louisiana achieved statehood. It includes images of grand, classical, public and religious architecture and identifies the French Quarter and the city's many suburbs. It also indirectly provides further evidence of the centrality of elevation to development. The only concentration of buildings the map depicts beyond the bounds of the Quarter and the suburbs edging it and the river is found along a road labeled "the Grand Chemin du Bayou St. Jean," which travels north out of the Quarter to the top of the map. This thoroughfare follows the Bayou Road/Esplanade Ridge, a rare extension of high ground in the city beyond the banks of the Mississippi.²⁷

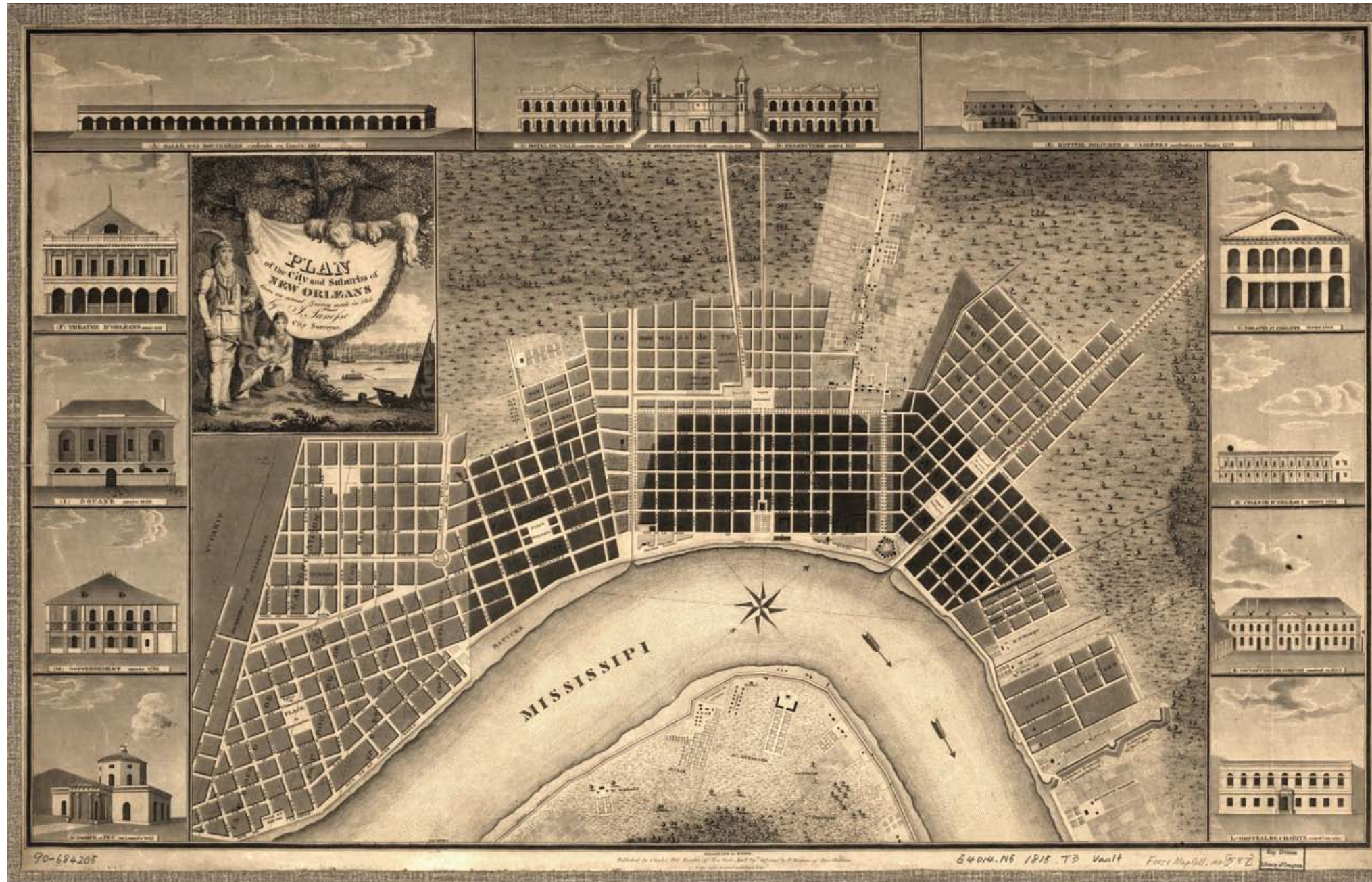
During the early 19th century, the Raised Creole Cottage type became common in New Orleans. The historic Lombard House, which began as a rural dwelling in a portion of Orleans Parish that was subsequently incorporated into the city, was built in about 1810 with a four-room plan elevated above the ground.

The house, which continues to stand on Chartres Street in the Bywater neighborhood, was captured in a photograph in 1930, which shows its sensible elevation, especially considering that the Mississippi was visible from its south-facing façade (below).



1930 image of Joseph Lombard House at 3933 Chartres Street in Bywater, 1826 or earlier.

The Charles L. Franck Studio Collection at The Historic New Orleans Collection, used with permission



Tanesse's 1815 "Plan of the city and suburbs of New Orleans" with the French Quarter, shaded black at the center, flanked by Faubourg Ste. Marie (St. Mary) at the left and the keystone-shaped Faubourg Marigny to right, both also in black.

Library of Congress, Geography and Map Division, used with permission

After the admission of Louisiana into the United States, New Orleans had a stable, extended period of economic, industrial, and population growth. At the onset of this expansion, however, it was drawn into the War of 1812. The Battle of New Orleans, the last engagement between Federal and British forces, took place on January 8, 1815, within the limits of the present-day city of Chalmette, just outside of New Orleans.²⁸ The war had little notable impact on the city, though, which continued to grow.

As had the Spanish and French before them, the Americans had to cope with storms and hurricanes. At least 17 violent storms—in 1800, 1812, 1821, 1831 (twice), 1837, 1856, 1860, 1867, 1871 (three times), 1874, 1875, 1887, 1888, and 1893—damaged New Orleans during the 19th century. The hurricane of August 19–20, 1812, affected almost every building in the city, even those constructed of brick. It destroyed the levee and covered the city with 15 feet of water. A gale on October 5–6, 1837, submerged lower portions of the city and damaged or carried off many buildings. With such destruction, the thought of elevating one's home must always have been on the minds of the city's residents. If the concerns about flooding began to subside with the water, they would have been brought forward yet again with the next storm.

During the antebellum period, new immigrants flocked into a city that was still distinguished by its mixed French and Creole population. Americans from the eastern seaboard arrived in large numbers, joined by immigrants from Germany and Ireland.²⁹ Developers continued to subdivide plantation

properties and added expansive “American suburbs” across from and beyond the French Quarter, the neutral ground of Canal Street, and the Faubourg St. Mary. Those who moved into the new American suburbs tended to be wealthier Anglo citizens in search of a gentrified retreat away from the bustling downtown.

Elevation continued to play a prominent role in development. The new faubourgs were established on the high ground of natural levees to help avoid flooding. Major floods in 1816, 1841, and 1849, however, caused significant damage in those parts of New Orleans that extended beyond the central portion of the old French city.³⁰ Because of the ever-present threat of floods, the city's residents continued to erect raised basement houses during this period, as depicted and discussed in the following section. Commercial and industrial activities also concentrated in the new upriver neighborhoods. The most notable of these was the cotton pressing industry. The largest such endeavor, the Orleans Cotton Press, rose on Front Street opposite the river between Thalia and Terpsichore Streets. As industry continued to move into the area, the wealthier locals again moved further upriver, or uptown, along Prytania and Carondelet Streets. The previously exclusive residences in the area devolved into tenements and businesses and the area became known as the Irish Channel.³¹

By 1830, New Orleans' was the country's fifth most populous city, with more than 46,000 residents. Its population of 102,123 in 1840 was exceeded only by that of New York, Philadelphia, and Baltimore. Demographic changes to the city's black

population through the first half of the 19th century are of particular note. In 1820, the black residents of New Orleans totaled 13,592, divided almost equally between free individuals and slaves. Two decades later, in 1850, the number of black inhabitants had jumped to 28,029, two-thirds of whom were enslaved. On the eve of the Civil War in 1860, the number of African-Americans in New Orleans had dropped slightly, with the ratio of free blacks to slaves nearly balanced, i.e., 10,689 free blacks and 13,385 slaves).³² New Orleans was becoming a multiethnic city, but a certain amount of self- and government-imposed residential segregation was apparent. The State legislature revoked the city's charter in 1836 and created three municipalities, partially along ethnic and color lines, each with its own mayor, council, and public works.³³ The First Municipality encompassed the Creoles living in the old city and the Second Municipality took in the upriver American Sector. The Third Municipality, located downriver of the old city, encompassed Creoles and a large number of free people of color.³⁴

A new government, major flooding events, and population expansion did not necessarily spur municipal drainage and flood control efforts. Rather, drainage was attended to sporadically throughout the Territorial and antebellum periods and the entirety of the 19th century. Results were modest at best. Architect Benjamin Latrobe in 1819 believed the word “mud” best characterized the city. Others focused on mosquitos or sewage.³⁵ There were no building codes that directly addressed the flooding of buildings, though. The decision of if

or how to construct a building that resisted rising waters was in the hands of the individual.

Although New Orleans has experienced numerous inundations both large and small throughout its history, the flood known as the Crevasse of 1849 (right) was more disastrous than any save that which followed Hurricane Katrina. Much of what would become the city and its suburbs in Jefferson Parish was still swampland when the flood struck, but damage was still great.³⁶ The water level of the Mississippi River in 1849 was higher than that of Lake Pontchartrain when it flowed into the city after Katrina. This was particularly evident in areas of Uptown, where higher water levels were recorded in some locations in 1849 than in 2005. Additionally, the flooding of 1849 extended into a significant part of Uptown that remained dry in the aftermath of Katrina.

All of this flooding and an inadequate drainage and maintenance system inevitably damaged New Orleans in ways large and small. Throughout the 19th century, descriptions of the city's many charms were often accompanied by comments on how unsightly it could be as a result of its choked canals, open cesspools, and trash-choked gutters.³⁷ The majority of residents used cypress cisterns or tubs to catch rain runoff from their roofs for drinking water.³⁸ Brick-lined privies were constructed at the rear of residential lots to deal with human waste. They were cleared of waste periodically, usually by digging them out and spreading them with lime.³⁹ In spite of these efforts, the city on the eve of the Civil War was often an unsanitary place. These problems could only have spurred, at the individual if not the municipal level, the development and

Mississippi River flood, May 1849.

Historic New Orleans Collection, used with permission



Elizabeth Lamoisse, watercolor of Canal Street during the Mississippi River flood of 1849, New Orleans.

Louisiana State Museum, used with permission

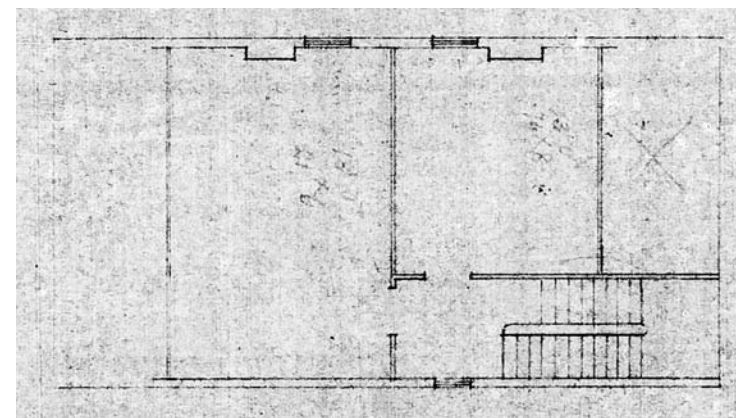
use of various raised housing types and the establishment of enterprises that specialized in the elevation of buildings, as further discussed below. Homeowners often did what they could to provide separation from themselves and the smells and dangers of the ground beneath.

By the mid-19th century, the rooms in raised basements were not confined to commercial use, for some domestic activities took place at the ground level of residences, even if principal living space was located above. A building contract entered into between Eliza R. Spiller Whittermore and John Page on July 25, 1860, describes the appearance and proposed use of the basement of a house to be built on the square bounded by Nayades (now St. Charles Avenue), Sixth, Prytania, and Seventh Streets.⁴⁰ The one-story dwelling was to be of weatherboarded frame with a front gallery complete with cornice, pilasters, railings, and balusters. It was to be raised over a nine-foot-high basement. The contract provided that “The basement under the parlors and cabinet shall be enclosed so as to make a kitchen, washhouse, and store room, the enclosure shall be with pine boards...” Shelves were to be “put up in these apartments when necessary.” The apartments (basement rooms) were to be lit by windows with mitered 10-inch x 14-inch lights (panes of glass) and served by battened doors “properly planed with wrought nails.” Floors were to be laid with pine boards and the bricks, joists, and ceiling were to be whitewashed. Although limited to service rather than commercial functions, this basement was designed to be airy, well-lit, and carefully finished. The house may yet stand at 1535 Seventh Street in the Garden District (top right).



Façade of 1535 Seventh Street, at left, with modern louvers shading basement.

Marvin Brown



Basement floor plan of house designed by architect Hugh Evans, ca. 1884.

The Historic New Orleans Collection, used with permission

Rough floor plans of a house prepared by architect Hugh Evans about 1884, preserved in The Historic New Orleans Collection, include what is likely a similar if simpler basement plan (opposite bottom).⁴¹ The house erected atop the basement was to be relatively narrow, but refined in its architectural treatment. Two-tiered galleries were to bracket the front and rear of its principal block, which was to contain a side-hall, parlor, and dining room at its first story with bedrooms above. A narrower two-story service wing to the rear was to hold a store room, pantry, kitchen, and ironing room at its first story with a bathroom and chambers above. The basement, set only beneath the front block, was to be divided into two unnamed rooms. The full-width front room was to be 21 feet 6 inches x 13 feet. The rear room, narrower because of an interior stair hall, would measure 14 feet 8 inches x 13 feet. The location of the house, if it was indeed built, is not known.

Louisiana seceded from the Union at the onset of the Civil War in January of 1861. Control of the Mississippi River was of vital military importance and the Federal government viewed the capture of New Orleans as one of the keys to this control. Under pressure, the city surrendered early in the conflict without a fight.⁴² Military control proved to be a seminal event in the development of New Orleans' infrastructure. The new military rulers put in place the city's first substantial sanitation regulations. When the Federal forces under General Benjamin Franklin Butler occupied New Orleans, he directed that all cisterns and cesspools be covered.⁴³ He also initiated other public works projects that included the clearing of canals and street gutters. Disease control was the primary impetus for this and subsequent 19th- and early-20th-century drainage

and water projects. General Butler wished to avoid or at least diminish the effects of cholera and yellow fever epidemics. His efforts, even though instituted primarily for the welfare of his own troops rather than that of the citizens of the city, were a success.⁴⁴

Federal rule from the onset of the war led to the emancipation of New Orleans' slaves even as the conflict raged. Following the war's end in 1865, emancipation was accompanied by greater freedom of movement for the city's black population. The Carrollton and Algiers areas that were later to become part of New Orleans saw a large influx of African-American citizens. In 1870, following the annexation of Jefferson City and Algiers, the total population of New Orleans increased to 191,418, 27 percent of whom were black. There was also an influx of Italian immigrants in the latter part of the 19th century.⁴⁵

Public health efforts and the increased mobility of the citizenry did little to reduce the danger and destructiveness of storms, however. On October 3, 1867, high seas and heavy rains from a gale flooded the city yet again. A tropical cyclone brought heavy rain and flooding on June 2–3, 1871, that gave the city the appearance of being submerged (below). The massive hurricane of August 18–20, 1888, flooded almost the entire city. And the Cheniere Caminada Hurricane of October 1–2, 1893—its toll of 2,000 fatalities made it the deadliest in Louisiana's history—yet again inundated the city.⁴⁶

Iberville Street flooding following breach of the Hagan Avenue levee; note two alligators at center foreground (*Frank Leslie's Illustrated Newspaper*, July 1, 1871).

The Historic New Orleans Collection, used with permission



By the time Federal troops withdrew from Louisiana and New Orleans in 1877, the State's economic situation had recovered and the city had reclaimed its position as the most prominent in the South. Cotton brokers and wholesale houses sprang up along the river. During the 1880s, the city introduced electric streetlights, and a few high-rise buildings (reaching seven or eight stories) joined church steeples and ship masts on the skyline.⁴⁷ Although it was no longer among the country's ten largest cities, New Orleans' population had climbed above 242,000 by 1890.

During the latter quarter of the 19th century, facilitated by streetcar lines, the city continued to expand uptown, and downriver as well toward the Ursuline Convent in the Ninth Ward. Although late-19th-century maps depict city streets running all the way to the shores of Lake Pontchartrain, settlement was still restricted to areas of higher ground. Much of the land beyond the French Quarter, the river, and the initial suburbs remained swampy and, therefore, thinly populated.⁴⁸ The city still needed to address its drainage problems to break beyond its limited buildable boundaries.

At the close of the 19th century, several private drainage companies developed canals along with rudimentary pumps. The canals led from those areas already built-up and occupied to Lake Pontchartrain.⁴⁹ An addition to the network, the New

Topographical and drainage map of New Orleans and surroundings.

Historic New Orleans Collection, used with permission



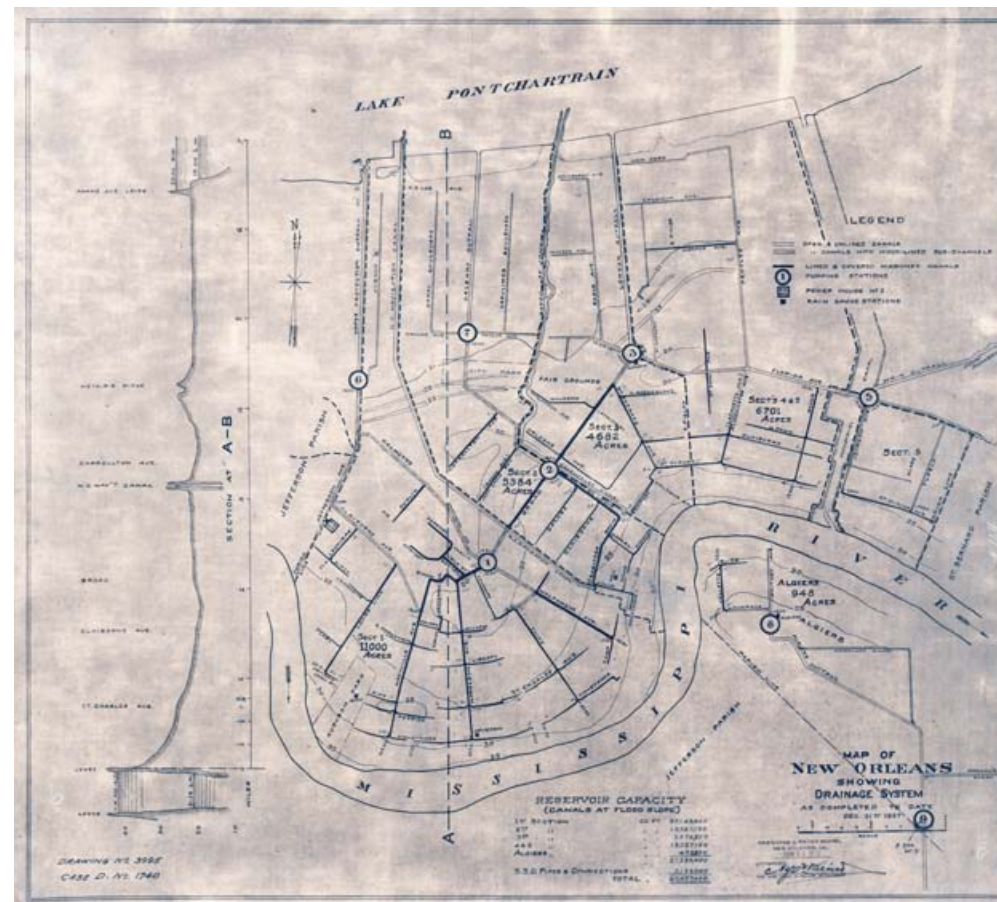
Technological Advances and the 20th century

During the 20th century, New Orleans' population followed a curve up and then down, ending essentially where it had begun. From just over 339,000 in 1910, the population climbed steadily to a high of 627,525 in 1960. It then slowly declined to 484,674 in 2000 and, with the depredations of Hurricane Katrina, plummeted to less than 344,000 in 2010. Partly as a result of population growth and technological advances and partly as

Orleans Canal, was added to the terminus of the Carondelet Canal, which had continued to drain from the rear of the old French city. The New Orleans Canal had been built to help drain the upriver American suburbs, including Faubourgs St. Mary, Solet, Lacourse, and Annunciation. Downriver of the French Quarter, the London Avenue Canal drained the rear of the Esplanade Ridge and Faubourg St. John areas. These two areas were becoming more populated, mainly by wealthier residents who were relocating from the overcrowded old city. The Peoples Canal and the Florida Avenue Canal simply extended along the rear of the Creole Faubourgs (later the Ninth Ward) to the Orleans and St. Bernard Parish lines. Most of the Creole Faubourgs located downriver from the original French city, including the Marigny, Clouet, Montegut, Montreuil, Carraby, and Lesseps, did not have canals that directly drained them. Drainage efforts were concentrated in the old French city areas and the upriver American suburbs. The Creole Faubourgs, occupied by white residents of lower social and economic status, as well as the largest number of free blacks in the city, did not receive the same public services as the wealthier neighborhoods.

Proposals for a citywide drainage system had been made as early as the 1870s. Local businesses and civic associations paid for the installation of pumps and sewer lines in their parts of the city. However, voters did not approve a citywide sewerage, drainage, and waterworks system until 1899. In the following decade, the system increased dramatically from five miles to 350 miles of pipe.⁵⁰ The overall plan, however, was

implemented in stages and took decades to complete.⁵¹ The city decided that the most densely inhabited neighborhoods and areas of business concentrations should receive services first. During the first decade of the 20th century, additional drainage systems were installed within the old French city, Uptown, and the upriver Lafayette and Carrollton areas (below). The city dug a few canals to the rear of the Ninth Ward, as well.



1927 contour map of New Orleans showing proposed drainage canals.

Louisiana State Museum, used with permission

a result of tragedy, the city slowly improved its infrastructure during this period and, for the first time, began to successfully address problems of drainage and flooding.

The early 20th century saw substantial growth in New Orleans' transportation infrastructure.⁵² Most notable was the construction of the vast rail yards of the Illinois Central Railroad and the completion of the Industrial Canal, which joined Lake Pontchartrain with the Mississippi River. Settlement between the established city and Metairie Ridge in Jefferson Parish, as well as between Metairie Ridge and Lake Pontchartrain, however, remained slow to develop. Residences were scattered along the lakefront and the Jefferson Parish line at West End around Spanish Fort, where Bayou St. John and the lake met, and at Milneburg near the terminus of Elysian Fields Avenue. The first house in the Lakeview subdivision was completed in 1905 near the New Basin Canal, while the developers of Gentilly Terrace constructed their first homes on manmade fill in 1908.⁵³ Two decades later, in 1928, the Board of Levee Commissioners of the Orleans Levee Board began a project that took dredge material from Lake Pontchartrain and fashioned a raised shoreline along the lake, further promoting development by lessening the risk of flooding.⁵⁴

The many improvements to drainage and infrastructure in the city during the late 19th and early 20th centuries directly affected the history of the elevation of buildings in New Orleans. Although the newly opened neighborhoods were better drained and more readily accessible than ever before, they were still near sea level and more prone to flooding than the earlier

development that had hugged the city's natural levees and ridges. The need to build a raised house or to elevate a house that was prone to flooding was therefore increased rather than eased by technological advances. Not surprisingly, the city saw a boom in the construction of the new Raised Basement House type, discussed further below, in Mid-City, Broadmoor, Carrollton, and many other of its newly drained neighborhoods.

New Orleans' late-19th- and early-20th-century building and zoning regulations suggest the presence and special character of basements in a city with a long history of Raised Cottage and Raised Basement House types. Reflecting American mores, the city was slow to comprehensively regulate building. Its repeated thrashing by storms and flooding, however, gave it an incentive to regulate that many cities lacked (opposite).

Late-19th-century codes required that a lot be raised higher than the banquette (or sidewalk) out front before a superstructure was erected on it. In 1892, the law mandated that: "All frame dwellings hereafter erected or whose superstructure or frames are hereafter repaired, shall not have the upper portion of their joists less than three feet (3') from the surface of the ground."⁵⁵ The definition changed a few decades later, but elevation above the ground remained important: "All fourth class [wooden frame] buildings hereafter erected shall have [a] foundation of masonry or concrete, plain or reinforced. The footings shall rest on solid original ground and piers and walls carried up nine inches above the finished surface of the ground and damp-proofed with slate or other waterproof material."⁵⁶ With the mid-20th-century advent of construction on concrete slabs,

the building code added a definition for slab foundations: "Top of slab shall not be less than eighteen inches (18') above the highest point of the curb in front of the lot or site."⁵⁷

Early-20th-century laws used a hybridized definition of a basement related but not identical to its common postbellum meaning in drier parts of the country, which considered a basement to be the portion of a building that was wholly or partly below ground level. In 1906, the building laws defined a basement as "That story of a building not more than forty per cent of which is below the grade of the street." They defined a cellar, an exceedingly rare residential commodity in New Orleans, as "That part of a building" more than forty percent below grade."⁵⁸ The reason for choosing the terms "that story" and "that part" becomes apparent in later regulations.

In 1929, New Orleans adopted its first comprehensive zoning code. During the code's three-year development process, the definition of a basement changed to one more akin to the antebellum use of the term and continental European terminology—the lowest story of a building.⁵⁹ The definitions of basement were related to the definition of a story, which was important because the code set uniform story and height requirements for various types of buildings. The proposed zoning code at first defined a basement as "the story nearest to the ground level which if not used for living or business purposes shall not be included as a story for the purpose of height measurement."⁶⁰ At its 34th review meeting in 1928, a subcommittee agreed to substitute a definition similar to



ABOVE: Water submerging Dupre and Baudin Streets in Mid-City during the Great Mississippi Flood of 1927.

The Historic New Orleans Collection, used with permission

LEFT: Wooden houses along a flooded street in New Orleans, last third of 19th century.

New York Public Library, used with permission



that of the building code.⁶¹ The zoning law as adopted in 1929 included this detailed and informative definition:

A basement is that part of a building below the first story of a residence or apartment and may be above or below grade and used for storage, garages for use of occupants of the building, janitor or watchman quarters, or other utilities (exclusive of rooms of habitation or assembly) common for the rest of the building. A basement for the above purpose shall not be counted as a story, provided its height in the clear shall not exceed seven feet six inches (7' 6').⁶²

The definition did not limit the use of basements. It only stated that a basement used for living or assembling was to be considered a story rather than a basement for the purposes of staying within height and story limitations. It suggests traditional non-residential uses of basements in New Orleans—storage, garaging, limited servants' quarters, utilities—and a reasonable height for such functions, not to exceed seven-and-a-half feet. New Orleans' basements continue to be used for the non-residential functions outlined in the 1929 code. Because few residences ever exceeded the height and story limitations of the code—and because seven-and-a-half feet provided adequate if cramped headroom—basements could effectively serve as residential spaces. Even in the face of flooding concerns, New Orleans' basements continue to be used for the non-residential functions outlined in the 1929 code and, occasionally, for living space as well.⁶³

In spite of more sophisticated drainage and levee systems and, eventually, comprehensive zoning, hurricanes and destructive storms—including those of 1901, 1909, 1915, 1922, 1926, 1947, 1948, 1956, 1965, and 1998—persisted in damaging and flooding New Orleans during the 20th century. Levees broke and water flooded the city during the hurricane of August 14–15, 1901. A hurricane of September 9, 1915, damaged nearly every building in the city, even though the ten-foot levee—the sufficiency of which was coming under question—held. Damages in the city hovered around \$5 million and, as a result of failure to heed evacuation calls, 275 people died in its lower-lying areas. A hurricane of August 25–27, 1926, inflicted heavy damage between New Orleans and Baton Rouge.⁶⁴

John Barry, in his definitive history of the Great Mississippi Flood of 1927, notes that during floods in 1912, 1913, and 1922, the Mississippi River came close to overtopping its manmade levees in New Orleans and that the city was largely spared during the 1922 flood when a crevasse (or breach) downriver at the Poydras Plantation happened to relieve the pressure of mounting waters. Many citizens came away from the fortuitous event with the impression that the levees were impregnable. However, as Barry describes in painful detail, the Great Mississippi Flood dispelled any such notions. It covered lower-lying sections of the city primarily occupied by minorities with more than four feet of water. It might have swamped the levees as well, causing much more extensive flooding, if the city had not taken the momentous and controversial step of blowing up the levees downriver at Caernarvon, thereby disastrously inundating much of Plaquemines and St. Bernard Parishes.⁶⁵

To ensure that the levee system around New Orleans would remain structurally sound and avoid further flood threats, a proposal for a spillway system was developed and, in 1927, construction for the Bonne Carre Floodway was begun.⁶⁶ This massive construction project was completed in 1936. (The spillway has only been used twice since opening.) By 1920, additional drainage systems had been installed in Wards Twelve and Thirteen and in the lakefront area. During the 1930s, expansion of the sewerage and water system in the lakefront and New Orleans East areas was undertaken to promote further residential expansion. During that decade, additional drainage was added to Gentilly, New Orleans East, and the Ninth Ward. By the 1940s, drainage projects were concentrated almost solely in the New Orleans East area. The invention of pumps to facilitate these drainage efforts had allowed the construction of homes between the natural levee of the river and the Metairie Ridge during the 1920s. Near the lakeshore, water and sewerage connections, population pressure, and an improved shoreline led to proposals in the 1930s and 1940s for the construction of additional residential areas, along with parks and shopping centers to serve them. One subdivision, Lake Vista, had been completed by the 1940s, and in the following decade the extension of the pumping network had facilitated the beginning of broader development in low, formerly swampy settlements and along still unoccupied portions of the lakeshore.

In association with the desegregation of schools in the 1960s, white flight from New Orleans to surrounding areas began in earnest. The pattern of white flight reflected the original settlement patterns, first upriver, eventually extending into

Jefferson, St. Charles, and St. John the Baptist Parishes, and then to St. Tammany Parish in the 1980s and 1990s.⁶⁷ Also during the 1960s and 1970s, residential expansion and development occurred in New Orleans East, an expansive area east of the Industrial Canal and north of the Intracoastal Waterway.⁶⁸ New Orleans East was touted as a suburban retreat for the upper middle class, much the same way Prytania Street and St. Charles Avenue had been in the 19th century. In 1961, the National Aeronautics and Space Administration took over the Michoud Fabrication Plant in New Orleans East and began the fabrication of engines for the Saturn V rocket, and later the external tanks for the space shuttles, further promoting development in the east.⁶⁹ During the mid-1970s, a new immigrant population arrived, as Vietnamese refugees began to settle in New Orleans East. In the mid-1980s, the demographics shifted again in New Orleans East, due to a recession in the oil and gas industry. By the 1990s, most white residents of the neighborhood had moved across Lake Pontchartrain to Slidell, leaving New Orleans East to minorities.⁷⁰ All of this activity, in association with storms, increased the necessity for improved and expanded flood control.

Storms continued to strike New Orleans in the latter part of the 20th century. Hurricane George on September 19–20, 1947, which submerged Moisant Field on Lake Pontchartrain under two feet of water, highlighted an urgent need for tidal protection levees. In response, the government raised levees along the south shore of the lake to protect Orleans and Jefferson Parishes. Hurricane Flossy on September 24, 1956, propelled water over the eastern sections of the city's seawall,



Gentilly subdivision, above, and Bruxelles and Broad Streets in the Seventh Ward, top right, after Hurricane Betsy, September 1965.

Times-Picayune, used with permission



North Claiborne Avenue after Hurricane Betsy, September 1965.

Times-Picayune, used with permission

flooding two-and-a-half square miles. In 1965, Hurricane Betsy pummeled New Orleans with 110-mile-per-hour winds. The winds drove a storm surge into Lake Pontchartrain, flooding New Orleans East, Gentilly, and the Upper and Lower Ninth Wards. On September 9–10, 1965, a 10-foot storm surge led to flooding that kept the city under water for days. In response to Betsy, the Orleans Levee Board raised the height of the levee to 12 feet.⁷¹

Surprisingly and disastrously, city residents in post-World War II neighborhoods such as Lake Vista and New Orleans East—black or white; rich, poor, or middle-class—built few raised houses, in spite of continued storms and hurricanes and the low elevation of their new neighborhoods. This was due to the overwhelming popularity, in New Orleans and nationally, of houses built on inexpensive concrete slabs that had been poured directly on the ground. The decision of New Orleans' citizens to utilize nationally popular types and methods of construction, in spite of the city's history, was abetted by the faith these residents had in the many 20th-century efforts to avoid and contain flooding. Hurricane Katrina was to call into question the appropriateness of the housing choices made in the last half of the 20th century.



New Approaches and Rediscovering the Past in a New Century

Hurricane Katrina and Modern Elevation

The first decade of the 21st century was even more unkind to the city than the previous centuries. On August 29, 2005, Hurricane Katrina savaged New Orleans. Meteorologist David Roth, in his history of Louisiana's hurricanes, succinctly wrote that the “horrific storm” will “likely be recorded as the worst natural disaster in the history of the United States... producing catastrophic damage and untold casualties in the New Orleans area and along the Mississippi Gulf Coast.”⁷² Although the city did not suffer a direct hit from the hurricane, the storm surge within the lake and through the Mississippi Gulf Outlet caused many levee breaches in the Federal levee protection system. The breaks that led to the greatest damage were at the 17th Street Canal, London Avenue Canal, and the Industrial Canal. Eighty percent of New Orleans was flooded although, yet again, the older, more affluent areas that stood on higher ground saw very little flood damage, and not a single Mississippi River levee was breached.

During the last quarter of the 20th century, New Orleans had become a majority black city, but after Hurricane Katrina, the first people to return were largely the middle class white residents who had the financial means to rebuild their homes and businesses. Even by 2012, many of the city's minority residents had not returned, and swaths of areas formerly

inhabited by them, such as the Lower Ninth Ward, remained largely unpopulated.

Hurricane Katrina was followed almost immediately by Hurricane Rita, which renewed flooding in the Ninth Ward. Between August 31 and September 3, 2008, Hurricane Gustav again sent waters over floodwalls and levees in New Orleans, causing localized flooding.⁷³

Two decades ahead of the depredations of Katrina, engineer James S. Janssen, in a collection of his writings on the construction of New Orleans, commented approvingly on the early and longstanding New Orleans practice of erecting houses “well above ground level.” He stated: “It is false economy of the most blatant form to save possibly a few dollars on construction of a new home or other building by basing it on a concrete slab poured directly on the native soil.” And he identified where this construction often took place and its results, which were beneficial to home raisers if not homeowners:

It took a long time for designers, builders, and home owners in New Orleans to realize the futility of basing buildings on spread footings. Such an approach was feasible when buildings were confined to the high, more solid land along the riverfront or on the sturdy alluvial deposits of Metairie Ridge or Gentilly Terrace. But, when development spread into the low, humus-laden soils of Lakeview, Broadmoor, etc., load distribution was to no avail if the subsoil below the footings consolidated, dried out and shrank as drainage

*improved. Many a building—even those of light construction—had to be jacked up, leveled, repaired, and even demolished. It was a costly lesson in building design. The repair work cost more than piling or some form of deep support would have cost at time of construction.*⁷⁴

Following Katrina, Louisiana cultural geographer Richard Campanella revisited the development of urbanism in New Orleans. He drew a number of lessons from the hurricane, including the following:

Raised houses individualize flood protection. *All structures, particularly residences, should be raised on pilings or piers. This tradition prevailed in New Orleans for over 200 years, only to be abandoned after World War II in favor of cheap concrete slabs poured at grade level. Living at grade places too much faith in flood-control and drainage infrastructure. Building above the grade empowers the individual to play a role in minimizing personal flood damage should other systems fail.*⁷⁵

FEMA reached similar conclusions following the hurricanes and storms of the first decade of the 21st century. After Katrina, FEMA partnered with State and local governments to implement mitigation programs to lessen damage from future flooding events. Particularly significant is the Hazard Mitigation Grant Program (HMGP) program administered by the Louisiana Office of Community Development, which as of 2012 had funded over \$400 million in mitigation grants. As part

of this program, houses are elevated above FEMA's Advisory Base Flood Elevation or demolished and reconstructed above future storm flood levels. This elevation program puts to work the lessons learned from New Orleans' long history of constructing elevated house types or otherwise lifting principal living areas above potential flood waters. FEMA has funded other individual mitigation measures as well that further protect houses by replacing windows and doors with ones that are better able to withstand high winds and airborne debris, elevating exterior utilities, such as heating and air-conditioning equipment, and providing roof tie-downs. The return by means of post-construction elevation to New Orleans' centuries-long tradition of raised houses—spurred by FEMA funding, individual initiative, and a rediscovered respect for natural dangers inherent to living in New Orleans—is discussed further below in the section on modern building elevation design and technology.

FEMA Programs and the Funding of Elevations

Though elevating buildings has been a relatively common activity throughout at least the past 150 years of New Orleans history, recent decades have seen a dramatic upswing in the number of dwellings that have been lifted, shored, or moved. Historically, these activities would have been the financial responsibility of the owner; only those wealthy enough to elevate their buildings were able to do so. Due to the influx of Federal grant money aimed at mitigation of storm and flooding-related damage, this is no longer the case. The Federal

government has introduced a number of programs to bring funding for flood insurance and home elevation to those in need, regardless of the building owner's financial status.⁷⁶

Starting with the introduction of the National Flood Insurance Program (NFIP) in 1968 and continuing through the present with grant programs funded by FEMA, New Orleanians have had access to Federal funding to help protect their homes against future storm and flood damage. The National Flood Insurance Act of 1968 created the NFIP, which is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for complying with State and community floodplain management regulations designed to reduce future flood damages. Prior to 1968, the Federal government reacted to flood-related events by supporting flood-control improvements such as dams and levees. The only Federal funds that were available to the flood victims came in the form of general disaster assistance. After Hurricane Betsy struck the Gulf Coast in 1965, a number of government initiatives led to the development of the NFIP, which strives to better indemnify individuals for flood losses through insurance; reduce future flood damages through State and community floodplain management regulations; and reduce Federal expenditures for disaster assistance and flood control.⁷⁷

In addition to the NFIP, FEMA has developed a number of other mitigation grant programs, including the Pre-Disaster Mitigation (PDM) program, the Flood Mitigation Assistance (FMA) program, the Severe Repetitive Loss (SRL) program,

and the HMGP or Hazard Mitigation Grant Program. The PDM program provides funding to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning, and to implement mitigation projects before the next disaster strikes. The concept behind the PDM is that proactive measures will reduce the risk to life and property, and reduce the need for states, communities, and citizens to rely on post-disaster assistance.

Similarly, the FMA program was developed to proactively addressing potential flood-related damages. Under FMA, money is distributed to states and communities to implement mitigation measures to buildings, homes, and other structures insured under the NFIP. There are three types of grants made available under FMA: Planning Grants to prepare Flood Mitigation Plans; Project Grants to implement measures to reduce flood losses, including relocation of buildings, acquisition of private property, or structural elevation; and Management Cost Grants to help defray the State's costs in administering the FMA program.

The SRL program is meant to supply grant money for buildings insured under the NFIP that have had at least four claim payments, including both the building and its contents, at a minimum of \$5,000 per claim, or a cumulative payment of \$20,000 or more. Property owners who have received at least two separate claim payments for damages incurred to the

building only, where the cumulative payment is more than the market value of the building, are also eligible to apply. Like the other grant programs, this is intended to reduce the risk to life and property and, ultimately, to reduce or eliminate claims under NFIP.

The HMGP provides grants to States and local governments to implement long-term hazard mitigation measures such as elevation of homes, hurricane shutters, etc. Unlike some of the other programs, HMGP is only made available after a major federally declared disaster. In addition to reducing the risk of loss to life and property, this program is intended to implement mitigation measures during the immediate period of recovery following a disaster.

Each of these programs has had a marked presence in New Orleans, particularly following Hurricanes Katrina and Rita in 2005 and Gustav and Ike in 2008. While the other FEMA programs have been in existence in the region for years, they have not offered as much assistance to New Orleans and Louisiana as the HMGP, which has provided funding to Louisiana to mitigate damage to thousands of homes across the State. The majority of property owners who have received Federal funds are in the New Orleans area and much of the house elevation and mitigation activity that has taken place in the city in the years since Hurricanes Katrina and Rita has been made possible by HMPG funding.

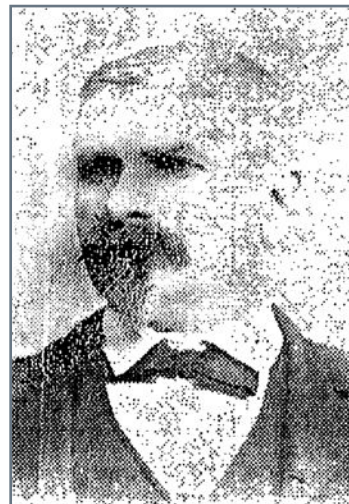
Houses were erected on piers and raised basements from the early years of New Orleans and Louisiana settlement. Some were certainly elevated after they were built, but if any individuals specialized in this practice, their names have not survived in the historical record. During the mid-19th century, according to newspaper advertisements and newly created city directories, firms began to spring up in the city that specialized in raising, leveling (fixing canting floors, not demolishing), shoring, and moving existing houses and other buildings. The oldest such operations identified are those of Jeremiah Lincoln and John G. Abry.

Jeremiah Lincoln (1818–1899) was remembered in his obituary as a man who “had a great deal to do with the paving of the city, and who was one of the best-known house movers and



Jeremiah Lincoln

Times-Picayune, July 19, 1899, used with permission



Emile Abry

Times-Picayune, April 4, 1906, used with permission

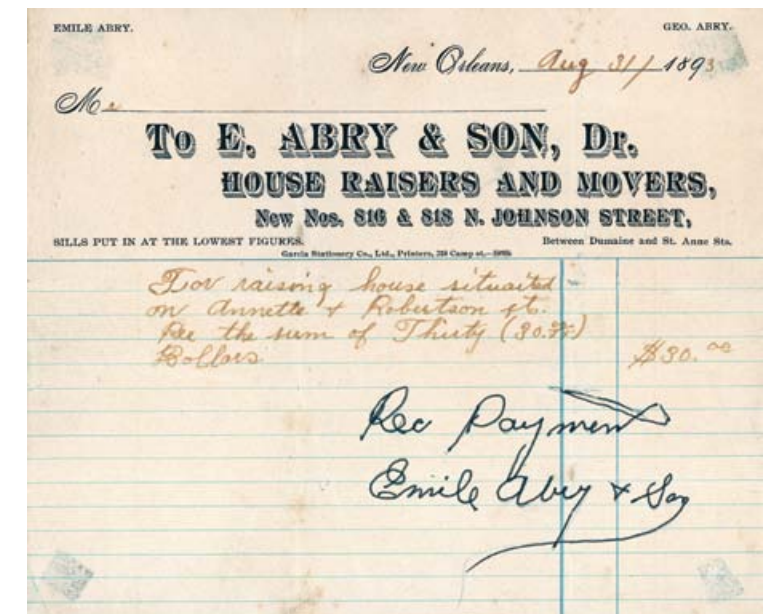
raisers.”⁷⁸ A native of Bath, Maine, he moved to New Orleans in 1847, where he worked as a ship’s mate and a paver and, in 1857, entered into a partnership with a “Mr. Whitney as a house mover and raiser.” After the Civil War he partnered with John H. Reddy, but in 1872 took over sole possession of “J. Lincoln & Co., House Raisers and Movers.”⁷⁹ Upon his death, the business passed to his son, George, who continued to operate it until at least 1907 according to city directories.⁸⁰

John G. Abry, the progenitor of the family business that continues to operate as Abry Brothers, immigrated to New Orleans from Frankfurt, Germany, in 1840 as a “skilled shorer.”⁸¹ Abry Brothers is not only the city’s earliest identified moving and shoring company, but multiple generations later is the oldest such firm still in operation in New Orleans. John Abry first appeared in city directories in 1855 with no listed occupation. Subsequent directories identified him as laboring in various building trades, including those of step maker (1859 and 1860), cistern maker (1861), journeyman carpenter (1868), and carpenter and builder (1870). He identified himself as a house mover in 1875 and in 1879, for the first time, as a house raiser, along with his son, Emile.⁸²

John Abry appeared in city directories up to 1894. That final listing indicated he had passed the torch to Emile, for both were listed individually as house raisers, and Emile for the first time also identified himself as associated with “Emile Abry & Son.”⁸³ An 1893 receipt for elevating a house (right), still in the hands of the Abry family, indicates that at least a year earlier the business had taken on Emile’s name. Emile Abry (ca.

1845–1906) continued to build the firm and began to list it regularly in city directories under the heading “House Raisers and Movers.” His 1906 obituary remembered him as a “pioneer in the moving business in this

New Orleans House Raising and Moving Firms



E. Abry & Son receipt for house elevated on Annette and Robertson in 1893 for \$30.00.

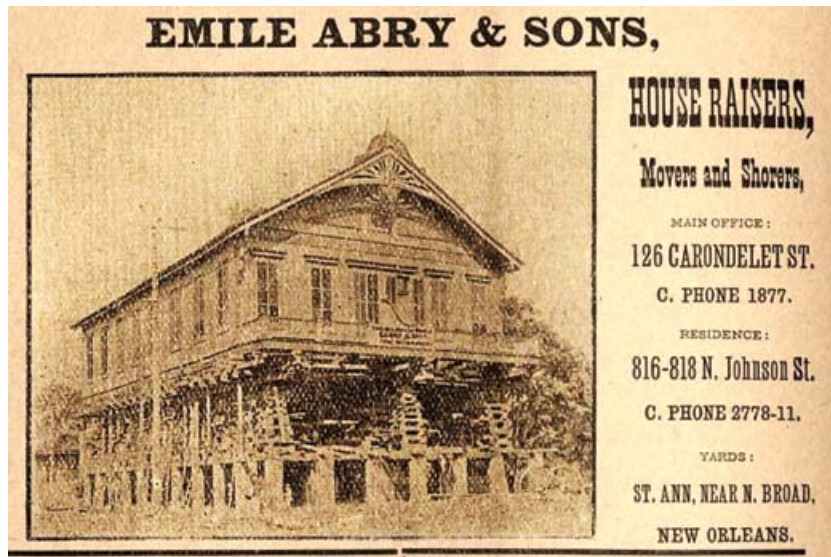
In the possession of Abry Bros., Inc., used with permission

city,” and stated that he was “counted one of the leaders in its prosperous days.” It noted that “Some years ago he turned the fruits of his labor of years over to his sons, who still continue in the trade under the firm name of E. Abry’s Sons.”⁸⁴

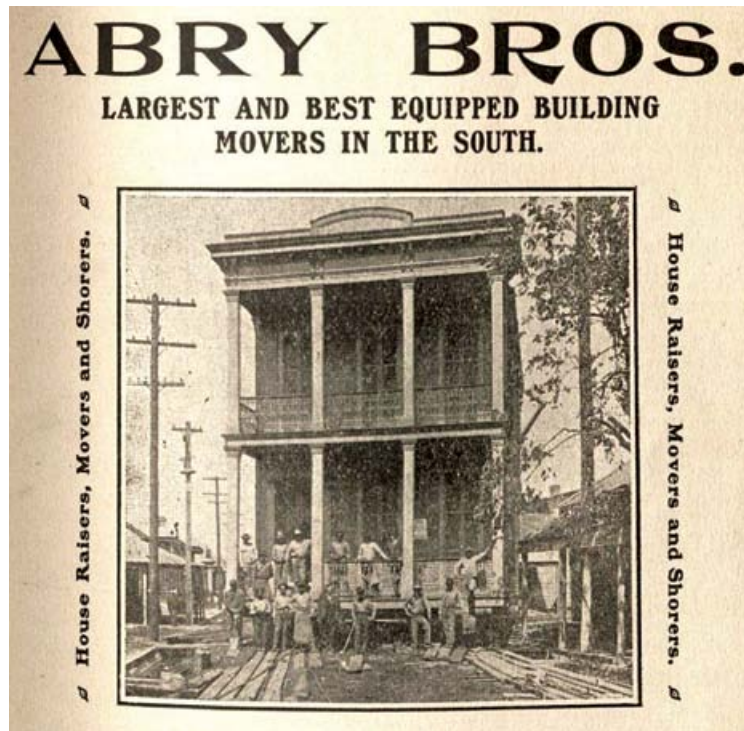
Under the leadership of Emile’s sons, George, John, and Herman, the family business achieved an even higher level of prominence in New Orleans in the early 20th century. The firm—by then simply called “Abry Bros.”—expanded its advertising in city directories and professional publications. At the century’s opening, these ads began to include photographs of buildings raised up on blocks and the slogan “The Largest and Best Equipped Building Movers in the South.”⁸⁵

Text advertisements in the locally produced and now largely lost *Building Review of the South* (August 1919 and September 1919) held the firm out as “House Raisers and Movers.”⁸⁶ The firm’s identification as both house movers and raisers is not surprising, for the two activities required much of the same equipment and skills, and most individuals or firms that did one also did the other.

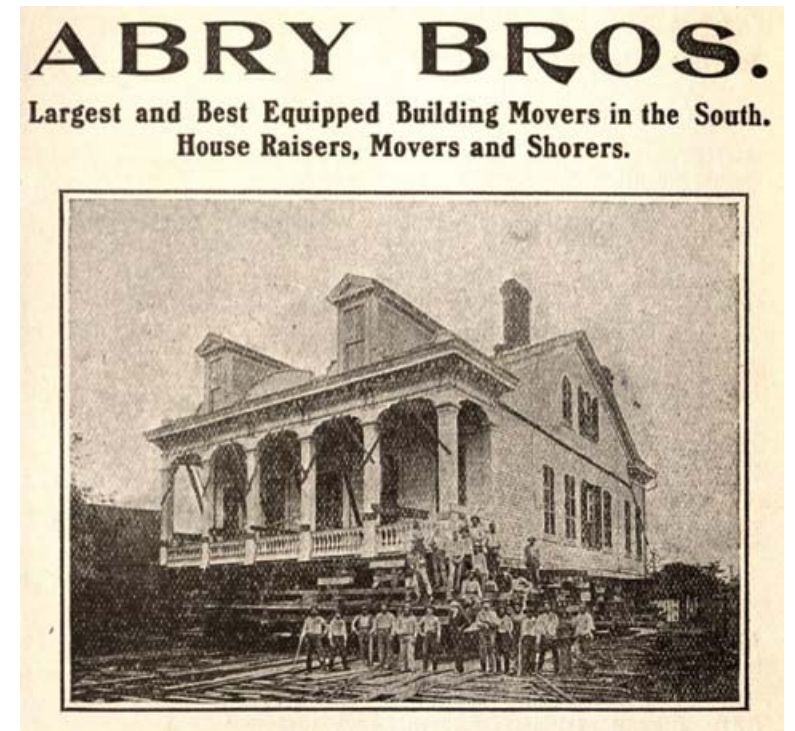
The brothers moved, raised, and shored more than just houses. In 1912, at a cost of \$65,000, they employed 50 men and 800 jackscrews to lift the former Samuel J. Peters School (which no longer stands) four feet high as part of its conversion into a hospital. The brothers told the *Times-Picayune* (August 13, 1912) that the raising of the massive, three-story, masonry building was the largest undertaking of its kind in the city in 30 years.



Abry Bros. advertisement in 1901 City Directory.



Abry Bros. advertisement in 1906 City Directory.



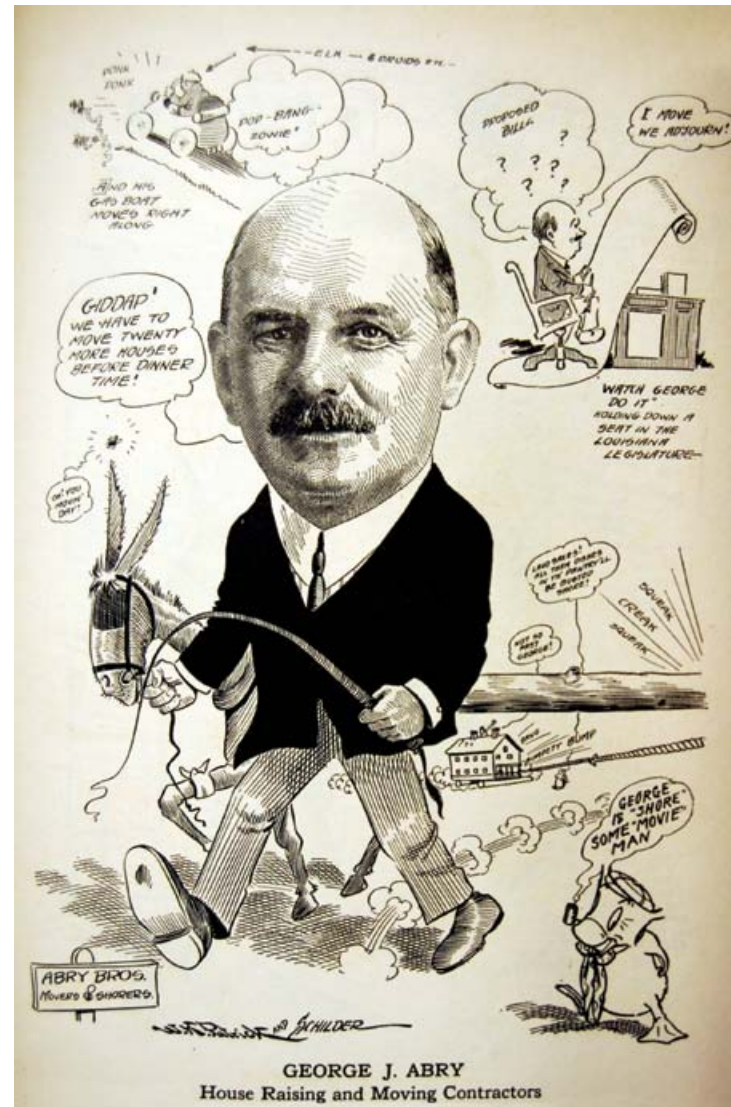
Abry Bros. advertisement in 1907 City Directory.

The paper described the operation:

The method employed in the raising is a novel one. Large grillings are placed in and outside the building, and on these screws are put two feet apart: large timbers are set on top of the screws, and through apertures in the walls large beams are run. At a given signal the men stationed at the screws give them a turn. This is kept up until the building is raised to the required height.⁸⁷

In 1914, Abry Bros. moved two 100-ton bank vaults a block-and-a-half up Camp Street to its intersection with Canal Street.⁸⁸ In 1917, with George Abry in charge, the brothers moved the 54-foot x 119-foot, high-steeped St. Boniface Church from the corner of Galvez and Lapeyrouse Streets to St. Bernard Avenue between Roman and Derbigny Streets in the Seventh Ward. It took the 30-man crew more than two weeks to complete the operation.⁸⁹ Large groups of workmen, such as the crew that moved St. Boniface, may have been assembled as needed. For example, the firm placed a notice in the *Times-Picayune* of November 20, 1912—shortly after it has elevated the Peters School—seeking 25 laborers.⁹⁰

George J. Abry (ca. 1874–1930) achieved prominence beyond the bounds of the firm. He served as treasurer of the New Orleans Contractors & Dealers Exchange (ca. 1908). He earned a bibliographical entry in Chambers' three-volume *A History of Louisiana* and a caricature in Patrick's high-toned *Club Men of*



Caricature of George Abry in Patrick's *Club Men of Louisiana in Caricature*, 1917.

The Roycrofters, used with permission

Louisiana.⁹¹ Outside of the trade, he represented New Orleans' Fifth Ward in the Louisiana legislature from 1912 to 1924.⁹²

In October 1906, Abry wrote an article titled “Modern House Moving and Shoring” in the New Orleans' journal *Architectural Art and its Allies*. It is the only known early account of the profession in the city. He described the ease of attaining estimates for work, the risks involved, and the necessity of long experience, and added:

In following this business there is, on all occasions, a demand on a man for the closest attention, most accurate calculations in loads and strength of material, etc.

There is a line of engineering, a nicety of engineering, that is not covered by any professional engineer in the country, and you could find none who would give you a detailed plan of just where to place your material and what kind of material to use, taking upon himself all responsibility, as in other work. It is a knowledge that can only be gained by a long and varied experience; and the best of all is what you have seen and tried, and not leave too much to fine theory and high ambition.

A great part of the work of to-day is remedying defects of all kinds, growing out of many causes, such as building adjoining, undermining foundations, irregular settle and overload. In such cases it requires experience to know where to take hold. In many instances it is of

financial interest to the owner of a building to have it raised, lowered, moved or shored.

... [B]uildings can now be raised and additional stories built under them, or roofs can be raised and additional stories built on the old walls; fronts can be taken out and new ones put in instead; the walls of adjoining buildings can be shored up while the walls of new buildings are sunk, all of which come under the head of House Moving.⁹³

As George Abry noted, raising and moving could be complex enterprises resulting in various alterations to a building. Photographs of a house now at 1442 Eleonore Street (below) near Audubon Park indicate that in the mid-1950s Abry Bros. elevated it, removed its first story, and moved it to its current site, where they nestled its surviving second story upon a slightly elevated foundation. The reason for downsizing and moving this house is not known.

Abry Bros. continued in business under the hands of brothers John and Herman, and later family descendants, after George's death in 1930. Near mid-century, the firm continued to place ads (opposite left), in newspapers rather than directories, that showed frame and brick houses on blocks.⁹⁴ The firm moved and raised traditional and modern houses and continued to upgrade its equipment. Its first mention of "New Hydraulic equipment" was in a *Times-Picayune* advertisement placed on New Year's Day 1956.⁹⁵



House being prepared for move to 1442 Eleonore Street, December 30, 1955.

Abry Bros., Inc., used with permission



House on wooden cribbing with ground story removed.

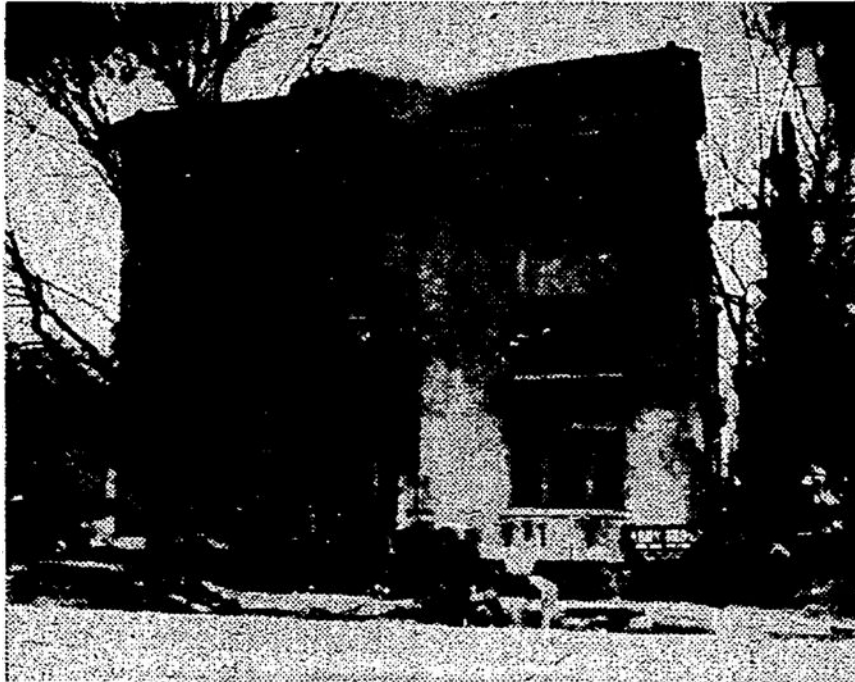
Abry Bros., Inc., used with permission



House at 1442 Eleonore Street, 2012.

Marvin Brown

Abry Raises 3-Story Brick House



The solid brick building containing 35 apartments, measuring 50 feet wide and 116 feet long, was recently raised by Abry brothers, local house raising, moving and shoring firm since 1849. The purpose of raising the building was to build a new foundation, the former one having failed to the point where the house was out of level. While the house was jacked up by the Abry firm a new concrete, steel-reinforced foundation was built. The work was done during the month of February while the 35 apartments were occupied. The occupants were put to no inconvenience, the steam heat from the boiler room was in constant operation, as were the electric, gas, sewer and telephone services. In order to make the structure level again, it had to be jacked up to varied heights at different places so as to cause no rupture. There was no resulting damage to the interior or the plastered walls inside the structure. Here is another example of the experience of Abry Brothers to handle in a most satisfactory manner the most difficult jobs of raising or moving houses and commercial buildings. The actual raising took 25 men 4½ hours. The firm's offices and yards are at 3319 Orleans avenue, the telephone number GAlvez 4718.

Abry Bros. house-raising advertisement.

Times-Picayune, March 30, 1941, used with permission

A small number of individuals and firms other than the Lincolns and Abrys appeared in city directories and newspapers into the 1940s as house raisers, movers, and shorers. A few showed up in the business listings only once or twice. They included Forstall Roach (1905), M.P. O'Neil (1908), Henry Goodrich (1913), Foley & Bird (1915), Morris Lewis (1916), Julius Villio, Jr. (1916), Joseph Husson or Hussong (1916 and 1917), Allen Hays (1917), Emile Heller (1917), Joseph Clark (1925), Camille Guthrie (1928), Acme House Wrecking Co. (1933), Feitel House Wrecking Co. (1933), Southern Construction & Housewrecking Co. (1933), Arrow Building and Repair Service (1940 and 1942), Maurice Hunt (1945 and 1946), and Reynolds Shoring Co. (1945 and 1946).⁹⁶

Others appeared in the listings off and on for relatively extended periods through at least the 1940s. John Wagner and later John Wagner, Jr. were included in the listings from 1896 to at least 1940.⁹⁷ A January 21, 1959, business notice in the *Times-Picayune* declared: "For House Raising, John J. Wagner, the Oldest Established Practical

House Raiser in the State of Louisiana."⁹⁸ Jacob Lockey or Lacky or, most often, Lake is included periodically between 1876 and 1913. Casper Scott is listed from 1902 to 1907. John Woods appeared twice between 1905 and 1912. Joseph Lucius, Lucius and Son, and the Lucius Brothers appear off and on from 1912 through at least 1942. The company placed a half-page ad in the 1940 City Directory listing their various services (below). Another group of siblings, the Norton Brothers, later Norton Shoring, are included in the listings regularly from 1908 through at least 1946. Harold McGee appears four times between 1918 and 1930. Samuel House Wrecking Co. is listed in 1932 and again in 1942.⁹⁹

LUCIUS SHORING COMPANY

R. J. LUCIUS, JR., Mgr.

**HOUSE
RAISERS**



**HOUSE
MOVERS**

Leveling and Foundation Our Specialty
"No Job Too Small or Too Large"

**WE MOVE BRICK BUILDINGS, TANKS, BOILERS,
AND HEAVY MACHINERY**

1734 SPAIN PHONE FRANKLIN 8487

Advertisement for Lucius Shoring, 1940 City Directory, New Orleans.

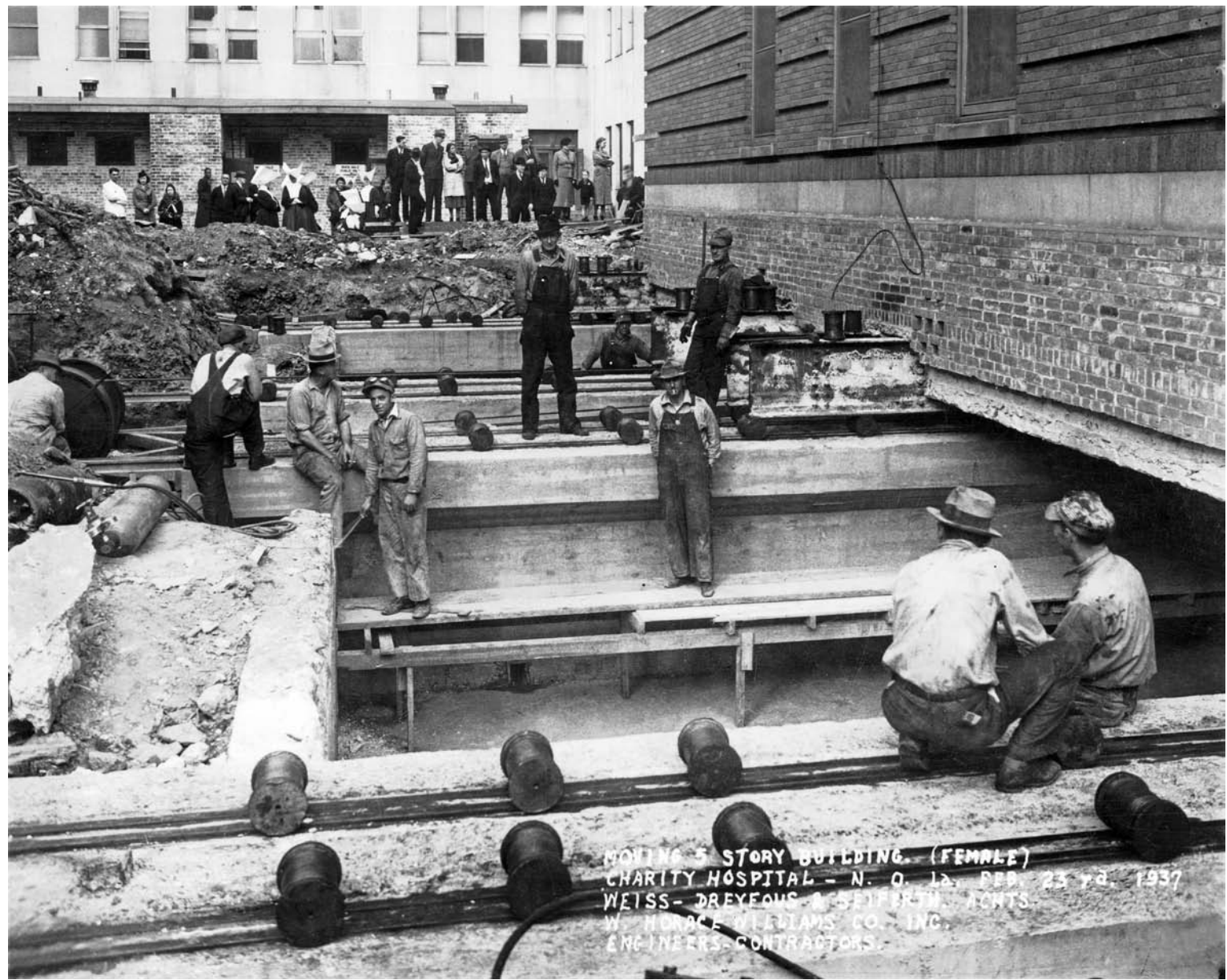
A Depression-era financial scandal indicates that firms that did not hold themselves out primarily as movers, raisers, and shorers occasionally engaged in the business. In 1935, former governor, then Senator Huey P. Long (1893–1935) had a five-story, 49,000-ton, brick building near Charity Hospital in New Orleans (right) hoisted and moved 162 feet to make way for a pharmacy-dental school for Louisiana State University that never materialized. Two years later, the building was shifted back to its original site. The moves were carried out by the engineering and contracting firm of W. Horace Williams Company, Inc., which was not implicated in financial misdealings associated with the moves. Although the company did not advertise itself as movers and raisers, it certainly could do the job. The initial move was completed “without spilling a brick or a piece of cornice,” and the second, on the tracks that had remained in place, apparently went off without a hitch as well.¹⁰⁰

New Orleans city directories indicate that companies primarily in the business of demolishing and/or constructing buildings—such as Feitel, Southern, Arrow, and Samuel—began offering their services as house raisers and movers as well beginning in the 1930s. Conversely, raisers and movers expanded their businesses following World War II, even such stalwarts as Abry Bros. The firm announced in the *Times-Picayune* of January 25, 1962, that they had established a new department committed to home and commercial property remodeling and renovation.¹⁰¹

RIGHT AND OPPOSITE:
Moving of female
ward, Charity
Hospital, May 1, 1935.

Charles Franck, photographers; The
Historic New Orleans Collection,
used with permission





MOVING 5 STORY BUILDING. (FEMALE)
 CHARITY HOSPITAL - N. O. LA. FEB. 23 + 2. 1937
 WEISS - DREYFOUS & SEIFERTH ARCHTS
 W. HORACE WILLIAMS CO. INC.
 ENGINEERS-CONTRACTORS

Companies that specialized in the shoring up of buildings, a process closely related to raising and moving, also offered a variety of services. For example, Norton Shoring began to advertise itself as house movers and raisers in 1930. (Abry Bros. had identified the firm as shorers back in 1921.) Near mid-century, Norton elevated the former First Baptist Church of Gretna (below). An ad for Shorers, Inc. in the *Times-Picayune* of January 19, 1972, stated: “Formerly Lucius Bros. Established 1868, House raisers, movers, foundation work, leveling, sill change.”¹⁰²



First Baptist Church, Gretna, being elevated by Norton Shoring, ca. 1940s.

Charles Franck, photographers; The Historic New Orleans Collection, used with permission

Roubion Shoring Co., incorporated in 1983, changed its name to Roubion Construction, Co. in 1986, which suggested a wider breadth of skills. Even under its shoring name, the company had advertised its abilities to raise, level, install steel beams, and deal with concrete slabs.¹⁰³ Indeed, its Roubion Shoring Co. trucks announced house leveling and raising services (right). Owner Dennis Roubion recalled, during a 2012 interview, that his introduction to the business began at age 12 when he assisted his uncle on a job leveling (bringing to level, not demolishing) a house. Following hurricanes Betsy and Camille in the 1960s, he gained experience moving houses along the Mississippi Gulf Coast. At first he used railroad jacks and cathead jacks to raise homes. When the unified mechanical jacking system came into more common use in the late 20th century, Roubion purchased a unit from Modern Hydraulics in Chicago. Soon thereafter, he elevated his own house on Napoleon Avenue, demonstrating to New Orleanians the success of that system. Roubion traces the family lineage of the business to his great-uncle, Joseph Reynolds, who moved buildings in the 1930s.¹⁰⁴

Following Hurricane Katrina and the availability of government funds to elevate houses, numerous new house-raising firms were established in Louisiana. The continued presence of many in the city reflects the rediscovered importance of elevated houses in New Orleans.



Site photo from Roubion Shoring Company, Inc., ca. 1970s.

Roubion Shoring + Elevation, Inc., used with permission

From the French Creole Plantation House, the French Creole Cottage, and the Shotgun House to the prolific 20th-century Raised Basement House, New Orleans boasts some of the most recognizable and wonderfully embellished architectural types and styles in all of American architecture. This section provides an overview of the variety of principal raised house types developed in southern Louisiana and New Orleans over three centuries. It identifies and highlights the raised house tradition by building type, rather than style. Essentially, “type” is the most basic arrangement of the building’s layout, expressed in the floor plan and massing of structural components, whereas a building’s “style” is determined by the architectural and ornamental details, if any,

applied to the basic structural type. In the context of elevated houses, a residence’s type is more critical than its style, which could be and was applied to various house types over time.

French Creole Plantation House Type

Constructed as plantation houses from the early 18th into the mid-19th century, the French Creole Plantation House type is among the earliest expressions of a raised house type in Louisiana (below). In form, it is a rectangular structure raised on an aboveground-level basement, with the main floor on the second level and storage below. A gallery on the second level

is found on at least two sides and sometimes all four.¹⁰⁵ The design of this house type was largely influenced by the buildings of the West Indies and represents a blending of both French and Spanish colonial influences. The raised basement is a statement as well as a response to a harsh and wet environment, elevating the dwelling in grand European fashion. Perhaps most importantly, though, it is supremely functional. Its advantages include providing ventilation in a hot, rainy, humid climate and lifting principal living areas above periodic flooding. Historic and present day efforts to elevate houses attest to the effectiveness of a raised basement.

Raised House Types of Greater New Orleans

Constructed in the late 1770s, the Pitot House (page 32) is a notable example of the French Creole Plantation House type. One of the few remaining examples of its type in New Orleans and remarkably intact, the house overlooks the waters of Bayou St. John, which saw some of the city’s initial settlement. The dwelling takes its name from one of its early owners, James Pitot, the first democratically elected mayor of the incorporated City of New Orleans.¹⁰⁶ Massive, stucco-covered, brick columns at the first level support a second-level gallery that edges the house’s southwest and southeast elevations. An X-patterned wood balustrade stretches between slender, turned, wooden colonnettes and symmetrically placed chimneys pierce the



Riverlake Plantation, an early- to mid-19th-century French Creole Plantation House in Pointe Coupee Parish.

Frances Benjamin Johnston; Louisiana State Museum, used with permission



LEFT: Southeast side elevation of late-18th-century Pitot House, 1440 Moss Street, New Orleans.

Richard Silverman

RIGHT: 1937 photograph of Madame John's Legacy, 632 Dumaine Street, New Orleans.

Library of Congress, Prints and Photographs Division, used with permission

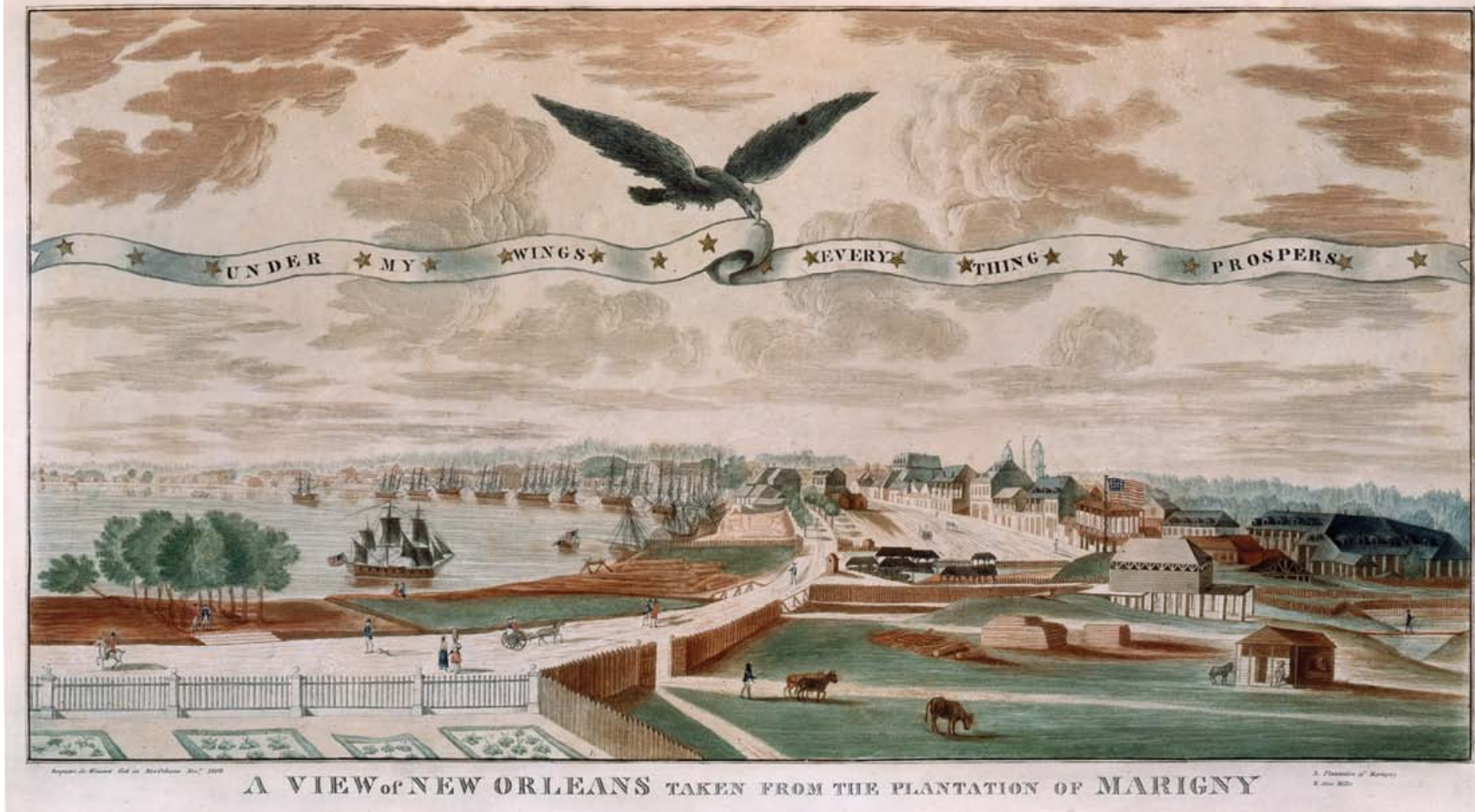


ridge of a broad, double-pitched roof. The house is constructed with brick-between-post or *brique-entre-poteaux* infill covered with stucco.¹⁰⁷ In the French Creole tradition, an all-encompassing “umbrella” hipped roof covers the enclosed core as well as the open-air galleries. Each floor has three large rooms running the width of the house with two adjoining cabinets or small rooms in the rear.¹⁰⁸

Madame John's Legacy (above right), one of the first houses reconstructed in the French Quarter or Vieux Carré in the year following the Great Fire of 1788, represents an early urban adaptation of the French Creole Plantation House type. According to New Orleans architect and historian Lloyd Vogt, the house appears to be a replacement-in-kind of the previous

house on the site and is, thus, likely typical of the urban residences of the period. The walls of the first level are of brick, stuccoed over, while the second level is *brique-entre-poteaux* covered with wide, beaded boards placed horizontally. The first level served as the foundation for the living quarters above and also as a store house and work area for the household. It protected the main, upper, residential level from the threat of flooding. A deep gallery with delicate wooden balusters and slender colonnettes adorns the second level of the northeast façade, and protects it from rain and sun. A high, double-pitched, hipped roof with small dormers tops the dwelling.¹⁰⁹ Madame John's Legacy clearly expresses the importance of the raised basement to early residents of Louisiana and New Orleans, even in an urban setting.

Very few houses akin to Madame John's Legacy survive in the French Quarter, yet at one time many such dwellings filled the older parts of the city.¹¹⁰ As architectural historian Patricia Heintzelman has noted, “The house dates from the time of the walled town when all houses were free standing in the midst of gardens. As this property was gradually sold, various outbuildings were moved or destroyed and others put in their place.”¹¹¹ These early raised buildings are found illustrated in Bouqueto de Woiseri's bird's-eye view of New Orleans, which was created at the time of the Louisiana Purchase (hence the patriotic banner, “Under My Wings Every Thing Prospers” (opposite).



J.L. Bouqueto de Woiseri's ca. 1803 eagle's-eye "A View of New Orleans taken from the Plantation of Marigny." Note the numerous raised basements.

Historic New Orleans Collection, used with permission

Raised Creole Cottage Type

Louisiana geographer and architectural historian Jay Edwards has written of what he calls the third-generation Acadian houses, erected of timber frame primarily between about 1790 and 1850.

By the time the first Acadians arrived, a considerable variety of architectural styles existed in Louisiana. In the city of New Orleans, a dominant French Creole

vernacular style had been established. It consisted of a house one room deep and several rooms wide, with a full-length gallery along the front or, occasionally, completely surrounding the structure. ...

As with Caribbean Creole houses, the early houses of New Orleans were often raised above ground level to enhance through ventilation.¹¹²

Edwards quotes folklorist George F. Reinecke, who wrote in 1901 about the basic, rectangular, timber-frame, gabled-roofed cottages that could still on occasion be found in Acadiana well outside of New Orleans: "These little huts dignified with the name of houses are built on blocks, or piers, twenty or thirty inches above the ground level."¹¹³ The raised Creole house, Edwards concludes, "was far better adapted to Louisiana's tropical climate than the houses of the Acadians (or for that

matter, the buildings designed by French engineers in New Orleans).”¹¹⁴

Among the earlier surviving examples of the Raised Creole Cottage type outside of New Orleans is the refined Maison Olivier in St. Martinville in St. Martin Parish (below). Pierre Olivier Duclozel de Vezin, a wealthy Creole, erected the Maison Olivier about 1815. It is well-maintained within Louisiana’s Longfellow-Evangeline State Historic Site. An equally good if far

more deteriorated example of the form is a house on Highway 405 near the Mississippi River and Nottoway Plantation in the community of White Castle in Iberville Parish, which historian and folklorist Carl Brasseaux photographed in 1975 (below right). The house’s three-part Greek Revival-style entryway suggests that it was built no later than the mid-19th century. The dwelling’s neglect is more typical than Maison Olivier of what has happened to common representatives of the type and it may no longer survive.

BELOW LEFT: Maison Olivier, ca. 1815, St. Martinville, St. Martin Parish.

Louisiana Department of Culture Recreation and Tourism, used with permission

BELOW RIGHT: Raised Creole Cottage on Highway 405 near Nottoway Plantation House in Iberville Parish in 1975.

Carl Brasseaux; Center for Louisiana Studies, University of Louisiana at Lafayette, used with permission



In New Orleans within the Vieux Carré, as Vogt explains, Creole Cottages generally fronted directly on the banquette (sidewalk) and were raised only one or two steps above it. Thus they were not identical to the typical Raised Creole Cottage seen in rural settings. Vogt has described this urban version of the Creole Cottage type (right) as a:

... one and one-half story, gable-ended residence built up to the front property line. Its plan does not use hallways. Creole Cottages are in the early Creole style (1825–1835) and the Greek Revival. Creole cottages were popular in the city from about 1790 to 1850 and likely the most prevalent house type built in New Orleans during the early 1800s. They are found in greatest numbers in the Vieux Carre and Faubourg Marigny, where it was not unusual for a builder to erect an entire row of five or six identical structures.¹¹⁵

The typical plan of such houses consisted of four rooms arranged symmetrically, each approximately 12 to 14 feet square, with two additional small cabinets at the rear outer corners.¹¹⁶ One cabinet generally housed a spiraling staircase to the attic, which was normally used as a sleeping room, while the other was used for storage.

The Francois Cousin House (right) on Bayou Liberty west of Slidell in St. Tammany Parish stands just across Lake Pontchartrain from New Orleans. It was originally a one-and-a-half-story Raised Creole Cottage that—like similar houses in the French Quarter and the Faubourg Marigny—rested on

a basement of limited elevation. Of *brique-entre-poteaux* construction, it was likely erected between 1778 and 1790 by Cousin, a native New Orleanian. A front gallery supported by chamfered columns runs the length of the house. Behind it are two rooms of equal size, with one larger additional room behind, all served by a single central chimney. In the late-19th or early-20th century, an additional three rooms were added to the dwelling's rear, along with side galleries.¹¹⁷ In 2005, the dwelling was flooded with four feet of water from Hurricane Katrina, and again in 2008, to a lesser extent, by Hurricane Ike. Extensive careful work, funded by FEMA, began in December 2009 to elevate it while preserving its historical character-defining form and features. To retain the original context of a Raised Creole Cottage of limited elevation, the house was lifted on piers substantially concealed through the incorporation of a grassy berm.



ABOVE: Row of Creole Cottages, St. Philip Street, in the French Quarter.

Richard Silverman

BELOW: Francois Cousin House in October 2009 before elevation on piers and construction of berm, at left, and after, at right.

FEMA



Raised Cottage Type

Another refined example of an intact Raised Creole Cottage, which from the first stood high off the ground in rural fashion, is the house at 1300 Moss Street (below) on the Bayou St. John in New Orleans' Mid-City neighborhood. Historically (if likely inaccurately) referred to as the Spanish Custom House, it may have been erected by Santiago Laurens about 1784, a date marked on a chimney brick in its unfinished attic.¹¹⁸ Of *brique-entre-poteaux* construction, it makes use of the Raised Creole Cottage form to lift its principal living areas well above anticipated flooding.



Raised Creole Cottage-type dwelling at 1300 Moss Street in New Orleans in 1934.

Richard Koch, Historic American Buildings Survey, used with permission

From the 1830s through the 1870s, the Raised Cottage (interchangeably called American Cottage) type became the most substantial and architecturally significant residential type erected in New Orleans, especially in the expanding Uptown neighborhoods.¹¹⁹ This building type is defined as a raised one-and-one-half story residence characterized by a center hall plan and a roofline incorporating a front gallery. Generally, these houses are set four to five feet above grade level, although some do not rise quite so high. Often stylish as well as functional, they were commonly dressed in New Orleans in one of the two most popular Period Revival styles of the time, either the Greek Revival or the Italianate.



Same dwelling under restoration following Hurricane Katrina.

FEMA

Noteworthy New Orleans examples of the Raised Cottage type built in the Greek Revival-style are the residence at 1525 Louisiana Avenue in the Garden District and the Musgrove-Wilkinson House on Bayou St. John (opposite). The simplicity of the style made it quite adaptable to Raised Cottage type residences, many of which were rising in Uptown New Orleans in the mid-19th century. Generally, the style was an adaptation of temple forms of ancient Greece, resulting in the creation of straightforward, box-like buildings. In New Orleans, architects and carpenters applied heavy moldings, which distinguished the Raised Cottage type from its daintier Federal style predecessors. Most Greek Revival-style buildings have evenly spaced, multi-paned windows and entrances marked by sidelights and rectangular transoms. Columns and pilasters proportioned to imitate ancient classical forms appear on larger Greek Revival houses in the city, particularly in the Garden District.

Following the Civil War, Greek Revival style architecture began to fall from favor in New Orleans, and in its place came the Italianate, a far more architecturally ornate and fanciful style. Raised Cottages and other house types erected during this period in New Orleans featured rooflines with deeper eaves, heavy bracket work, and wide entablatures. Window and door openings, often rounded, could display decorative lintels or heavily molded hooded and arched treatments. In place of the Greek Revival's classical columns, porches could be carried by heavy chamfered wood posts and bracketed cornices. The stylistic exuberance of the Italianate style added a romantic feel to the Raised Cottage type. However, the basic Raised Cottage form remained recognizable despite the Italianate's romantic appliqué.



ABOVE LEFT: 1525 Louisiana Avenue in 2012.

Marvin Brown

ABOVE RIGHT: Raised (American) Cottage, 1525 Louisiana Avenue, Garden District in 1939.

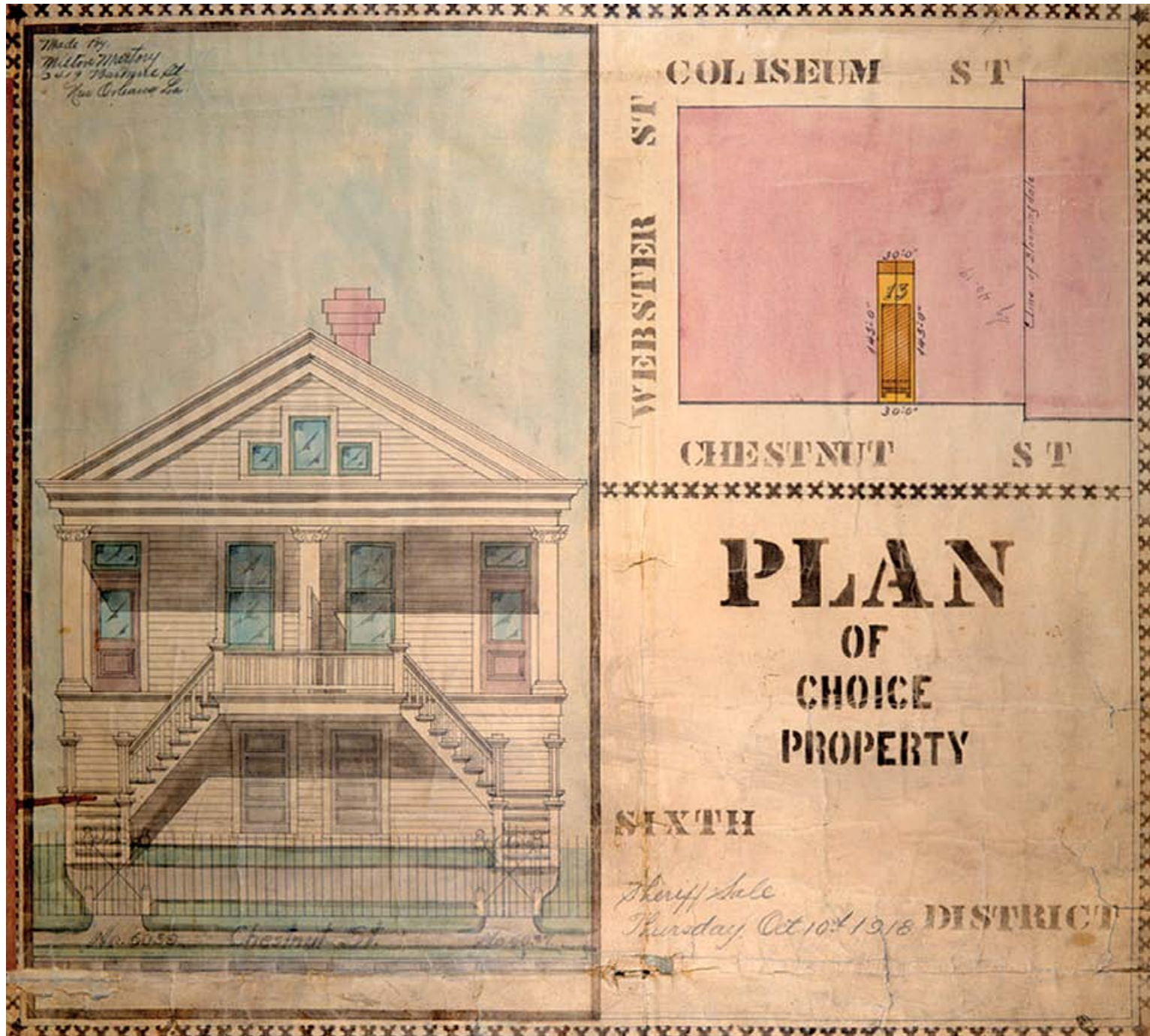
The Charles L. Franck Studio Collection at The Historic New Orleans Collection, used with permission

LEFT: Raised (American) Cottage-type Musgrove-Wilkinson House, 1454 Moss Street on Bayou St. John.

Richard Silverman

Raised Basement House Type

In the early 20th century, a new raised house type—straightforwardly called a Raised Basement House—sprang up in New Orleans and quickly became popular in new neighborhoods such as Broadmoor, Carrollton, and Mid-City. The type's name is believed to have been coined in New Orleans.¹²⁰ The Raised Basement House is characterized by a full-story, aboveground basement topped by a second story that serves as the main living space, and a wide front porch reached by a high flight of stairs fronting the sidewalk or street.¹²¹ Some Raised Basement House examples are monumental, with a particularly high basement and prominent double flight



of stairs (left). Others are more subdued in their architectural treatments. Again, regardless of the popular style applied to it, the type at heart responds to the environment rather than fashion, serving the critical function of elevating living spaces above potential flood waters.

Raised Basement houses are notable for an almost limitless variety of front stair treatments. “Bookended” stair walls help to define and encase the stairs, which can either follow a straight run or break at a mid-height landing. The tops of the stair walls may be sloped at an angle, curved, or stepped. The houses at 4045 Fairmont Street and 3912 Franklin Avenue in New Orleans’ Edgewood Park neighborhood illustrate typical stair treatments (opposite). As these examples and countless others in New Orleans demonstrate, the stairs rose above mere functionality and evolved into a primary, character-defining feature designed in concert with the architectural themes of the house to which they were attached. In many cases, the stairs and stair walls are enhanced by slender, double-height columns (or chamfered posts set on brick or stone piers), urns, tile work, ornamental metal railings, and other features that have become emblematic of the Raised Basement House type at its most ornate.¹²³

1918 rendering of Classical Revival-style Raised Basement house, 6037-6039 Chestnut Street, Uptown.

Plan Book 109, Folio 9, New Orleans Notarial Archives,¹²² used with permission



TOP: Raised Basement bungalow at 4045 Fairmont Street, Edgewood Park.

Richard Silverman

BOTTOM: Raised Basement house in the Mediterranean style, 3912 Franklin Avenue, Edgewood Park.

Richard Silverman



National Register nominations for the Broadmoor, Mid-City, and Uptown New Orleans historic districts bring to light another New Orleans tradition: that of combining the Raised Basement house type with Shotgun-Single and Shotgun-Double forms. The Shotgun at its most basic and common form is the Shotgun-Single—a single-story dwelling, one-room wide and two or more rooms deep, with the roof ridge running perpendicular to the street. Typically, this house has no hall; one walks from one room through to the next or utilizes subsidiary side and rear entrances. The Shotgun Single, with or without a raised basement, has further variants, including the Shotgun Double—two shotguns side-by-side with a party wall and a single roof—and the Camelback, a Shotgun Single or Double with a second-story added above part of the main body towards the rear.¹²⁴ Adding (or incorporating into the original design) a raised basement to a Shotgun allowed those with relatively modest means to take advantage of a type that was not only popular, but that elevated the main living areas of a house above rising waters. A typical example of a Raised Basement Shotgun-Single, with simple Craftsman and Colonial Revival stylistic elements, stands at 2669 Lavender Street in the early-20th-century Edgewood Park neighborhood. Also located nearby in the neighborhood, at 2545–2547 Gladiolus Street, is a typical Raised Basement Shotgun-Double (both shown on page 40).



LEFT: Raised Basement Shotgun Single, 2669 Lavender Street, Edgewood Park.

Richard Silverman



RIGHT: Raised Basement Shotgun Double house with prominent Craftsman-style porch, 2545–2547 Gladiolus Street, Edgewood Park.

Richard Silverman

The Raised Basement type in New Orleans made use of a wide array of architectural styles, individually or in combination with each other, that were popular in the early 20th century. Styles most prolifically appended to the type in the city through World War II include the Craftsman, Classical Revival, Colonial Revival, Spanish Colonial Revival, Tudor Revival, and Mediterranean Revival. Craftsman-style bungalows, introduced in 1909 from California by the developers of Gentilly Terrace, became wildly popular in early-20th century New Orleans, often in association with the Raised Basement type.¹²⁵ They generally featured natural materials, dormers and low-pitched

gable roofs with widely overhanging eaves and exposed rafter ends, and a deeply recessed front porch supported by battered (tapered) posts on brick or stone piers.

The variety of expressions of the Raised Basement House type—and the way it has survived in spite of flooding, changes in taste, and other events that have led to its surface alteration—can be seen in the following series of then-and-now photographs. The first or “then” images were taken on Broad Street near St. Bernard Avenue in 1929 by the New Orleans’ City Planning Commission to help resolve a zoning issue. They are

part of the City Planning Commission Photograph Collection of the New Orleans Public Library. The “now” images date from 2012 (pages 41 through 43).



LEFT: 1740 North Broad Street in 1929.

Louisiana Division/City Archives, New Orleans Public Library, used with permission



RIGHT: 1740 North Broad Street in 2012.

Marvin Brown



LEFT: 1801 North Broad Street in 1929.

Louisiana Division/City Archives, New Orleans Public Library, used with permission



RIGHT: 1801 North Broad Street in 2012.

Marvin Brown

LEFT: 1809 North Broad Street in 1929.

Louisiana Division/City Archives, New Orleans Public Library, used with permission

RIGHT: 1809 North Broad Street in 2012.

Marvin Brown



LEFT: 1815 North Broad Street in 1929.

Louisiana Division/City Archives, New Orleans Public Library, used with permission

RIGHT: 1815 North Broad Street in 2012.

Marvin Brown





LEFT: 1819 North Broad Street in 1929.

Louisiana Division/City Archives, New Orleans Public Library, used with permission



RIGHT: 1819 North Broad Street in 2012.

Marvin Brown



LEFT: 1825 North Broad Street in 1929.

Louisiana Division/City Archives, New Orleans Public Library, used with permission



RIGHT: 1825 North Broad Street in 2012.

Marvin Brown

The use of various raised house types—whether French Creole Plantation House, Raised Creole Cottage, Raised Basement, or other—does not immunize houses from floodwaters, as storms from the 18th century up to and beyond Hurricane Katrina have shown again and again. While raised living areas may remain dry, damage still has often been done. An early-20th-century Raised Basement house at 1219 North Lopez Street illustrates the work (discussed in detail in the following section) that often has to be undertaken to return even a raised house type to its

former condition (below). The post-Katrina photograph of this fine Mission Revival-style dwelling captures substantial efforts to revitalize the house's basement level and the porch above. The basement walls are shored. Wide-flanged steel beams and wooden cribbing are in place at multiple levels. Rusticated cinder blocks are joining historic brickwork. Though laborious, work such as this can return a house to its historic appearance.

Other and Later Elevated Houses

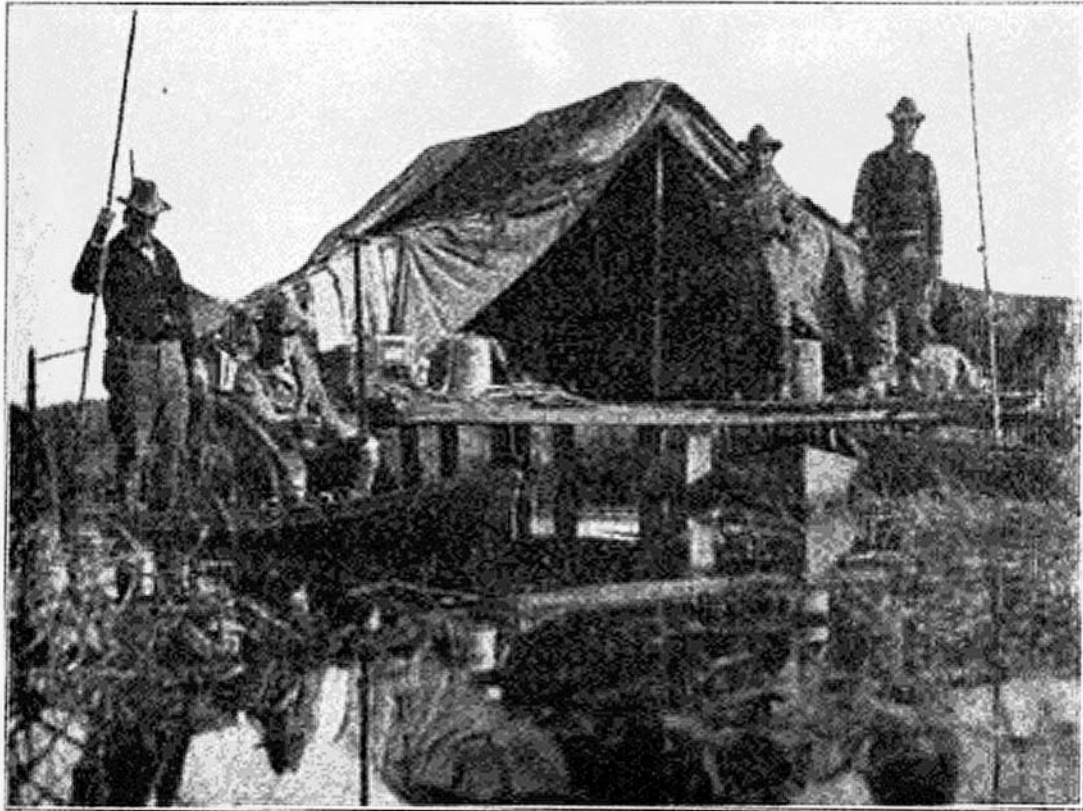
Elevated houses that may not fall within the raised types discussed above were also erected in New Orleans and Louisiana throughout the history of the city and the State. This was inherent in the construction of dwellings in a wet, flood-prone land, regardless of the availability of, or desire to use, any particular house form. Until the advent of sophisticated pumping systems and the planting of houses upon concrete slabs in the mid- and late-20th century, if one wanted a dry, well-ventilated house, one raised it some distance above the ground in one fashion or another.

Elevation occurred as part of construction at dwellings that were temporary and permanent, grand and small, in the city and out in the country, at the hands of individuals and the government. Trappers, by necessity, raised their tents above the marshes they were working (opposite). Residents of lakeside houses in western Louisiana utilized piers to lift their homes above the soggy soil (opposite). Piers were also the choice of riverside dwellers, whether on the banks of the Mississippi in St. Charles Parish or elsewhere along the bayous of southern Louisiana (page 46). (Note that these examples on piers, with the exception of the trappers' tent, could be slotted into the Raised Creole Cottage or Raised Cottage types described above, but the simple use of piers also suggests the most basic and universal means of elevation.)

Raised Basement house at 1219 North Lopez Street undergoing restoration in the aftermath of Hurricane Katrina.

FEMA





A trappers' tent elevated on stilts above the waters of a Louisiana marsh, 1928.

Stanley Clisby Arthur, *Fur Animals of Louisiana*; Louisiana State University Libraries, used with permission

A camp in the marsh, raised above the water by stilts. All transportation is by pirogue (the craft on the left of the picture) which is known as the "fivver" of the marshes.

Alexandre Hebert's "Acadian style house," erected along Lake Arthur in Cameron Parish, ca. 1840.

Center for Louisiana Studies, University of Louisiana at Lafayette, used with permission





Watercolor of Marguerite Delhommer's plantation in St. Charles Parish, drawn by Father Joseph M. Paret in 1859.

Marcel Boyer, *Plantations by the River*, used with permission

Ancienne habitation. M. J. M. Delhommer au St. Charles.

Image described as an Acadian or Cajun cabin raised on piers in an unidentified Louisiana swamp taken by Peter Stackpole of Life magazine in the 1940s.

State Library of Louisiana, used with permission



Sometimes piers alone were not sufficient, as evidenced by elevated houses accompanied by raised walkways—reminiscent of the banquettes that once ran through the French Quarter—that were constructed by the Works Progress Administration near the Atchafalaya Basin east of New Orleans in 1940 (right). Modern examples of elevation found at fishing and hunting cabins in Louisiana’s swamps and along its waterways harken back more to the basic elevation and needs of the trapper’s tent than any identified raised-house types (below).



Elevated houses near the Atchafalaya Basin in 1940.

Works Progress Administration of Louisiana; State Library of Louisiana, used with permission



Raised manufactured house on Bayou Little Caillou, Terrebonne Parish, 2008.

Donald W. Davis; Louisiana State University Libraries, used with permission

Most notably for New Orleans, houses were also elevated after they were constructed. A brick residence constructed in 1833 at 824 Esplanade Avenue, on the downriver edge of the French Quarter, was contracted to be elevated 18 inches as part of other substantial renovations in 1853 (below). A contemporary house just to the southeast in the Quarter at 933–935 Bourbon Street was shifted back on its lot and raised over a new ground floor in the early 20th century (right).

RIGHT: 933–935 Bourbon Street, erected ca. 1830–35 and moved back and raised in the early 20th century.

Marvin Brown

BELOW: 824 Esplanade Avenue, erected in 1833 and lifted 18 inches in 1853.

Marvin Brown





2300 block of A.P.
Tureaud Boulevard,
Seventh Ward, 2012.

Marvin Brown

Among the most striking elevated houses in New Orleans, either raised after construction (left) or newly designed (below and page 50), are those that have followed in the wake of Hurricane Katrina. New post-Katrina designs draw attention to the adaptability and viability of the elevated house in the city. The traditions of architectural type, along with the constraints of geography, continue to influence the appropriateness of, and reflect the necessity for, the raised house in New Orleans.



Post-Katrina house inspired
by the raised basement form,
Bayou St. John, designed by
architect Daniel Samuels.

Richard Silverman



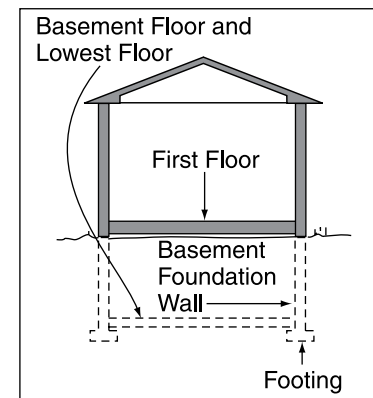
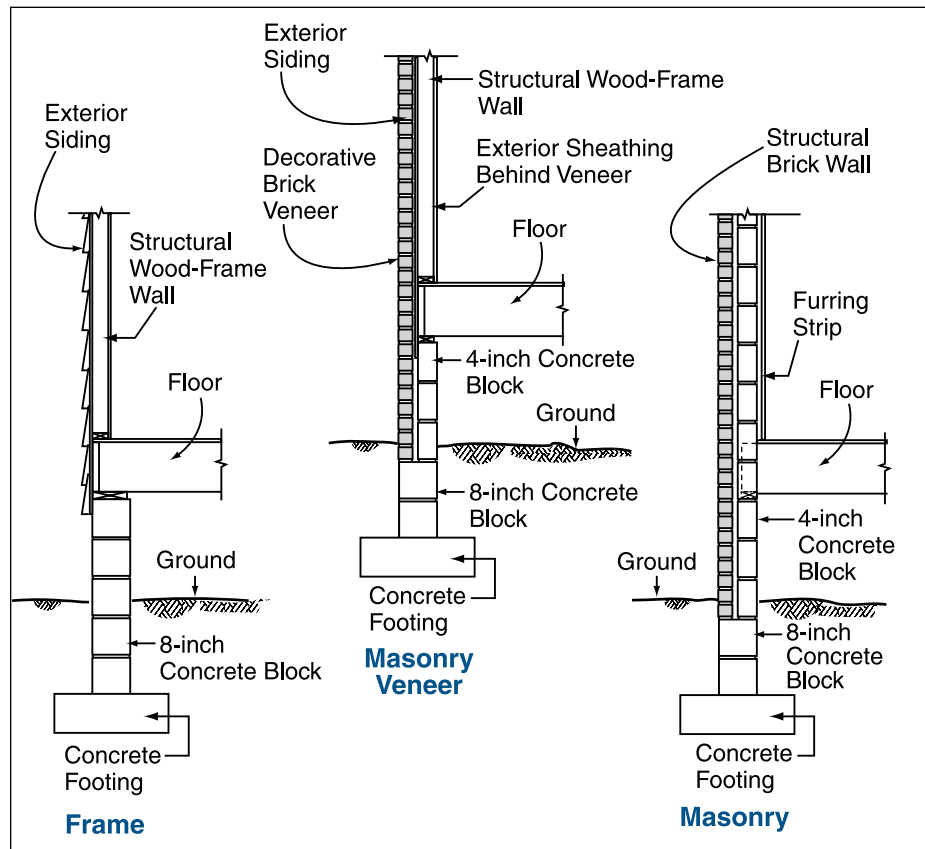
Post-Katrina houses based on locally inspired raised building types, from Build Now promotional materials.
Build Now LLC, used with permission

Common Construction Types

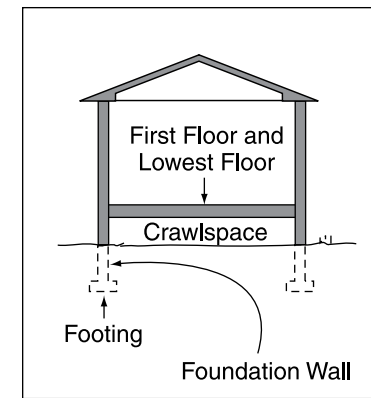
This section illustrates the variety of contemporary elevation techniques and their applications to different house and foundation types. In addition, it explores the evolution of elevation technology in New Orleans, with a focus on mechanical technological advances used by house raising and moving contractors.

The diagram below left illustrates the typical cross-sections of the three most common house construction types encountered: frame, masonry veneer, and masonry. Foundations shown here for all three construction types consist of concrete blocks and a concrete footing. The same construction types are also found on basement and slab-on-grade foundations.

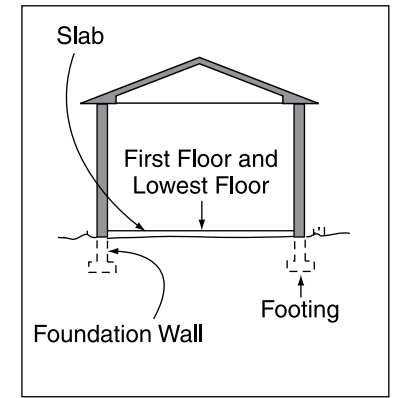
Building Elevation Design and Technology



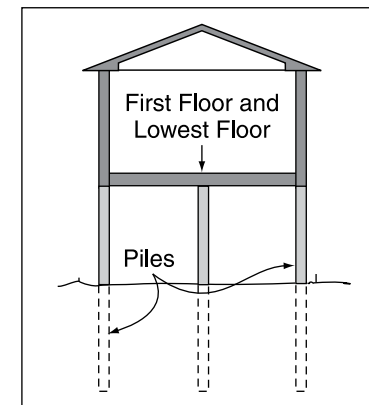
Basement Foundation



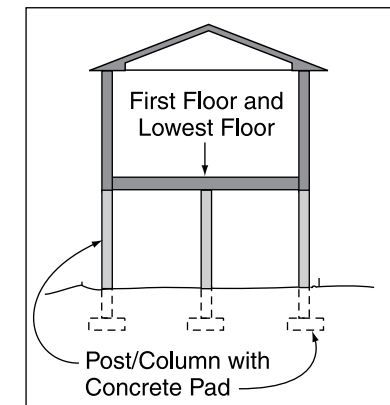
Crawlspace Foundation



Slab-on-Grade Foundation



Open Foundation (Pilings)



Open Foundation (Post/Columns)

LEFT: Wall sections of common construction types.

RIGHT: Diagram of basic home foundation types.

FEMA P-312, 2009

Most homes of these construction types are built on one of two types of foundations: masonry or cast-in-place concrete walls with a crawlspace; or masonry or cast-in-place concrete walls on slab-on-grade. The slab may have a masonry or concrete foundation beneath it or simply a thickened-slab open foundation. Some homes are built on more than one type of foundation. Various combinations of crawlspace and slab-on-grade foundations are common in New Orleans.

Basic Steps in House Elevation

Though many methods vary based on materials, wall construction type, and foundation type, the following sections describe the basic steps in elevating a house.¹²⁶

Disconnect Services and Break Connections

Prior to elevating the house, all utility lines (water, sewer, gas, electric, telephone services, etc.) are to be disconnected (right). The house-raising firm will then “break” all cement, stucco, and structural connections between the house and the foundation so the house is free to lift off of the foundation. Additionally, all wiring and pipes that could be crushed during the lifting process are separated or removed.

Excavate Foundation

Perimeter foundation excavation is required prior to inserting the heavy steel framework that will be used to support the house during lifting. The photo below right illustrates foundation excavation at the historic Rosa Keller Public Library, which was built as a residence in 1917 on the prominent corner of South Broad Street and Napoleon Avenue in New Orleans’ Broadmoor neighborhood. In response to severe flooding in the wake of Hurricane Katrina, the city renovated and expanded the library. This effort, undertaken in 2011 by Roubion Shoring + Elevation, Inc., included elevating the building and replacing its foundation.¹²⁷ As the library is within the National Register-listed Broadmoor Historic District and its elevation was funded by FEMA, it required careful historic preservation planning and coordination.



Disconnection of pipe.

Roubion Shoring + Elevation, Inc., used with permission

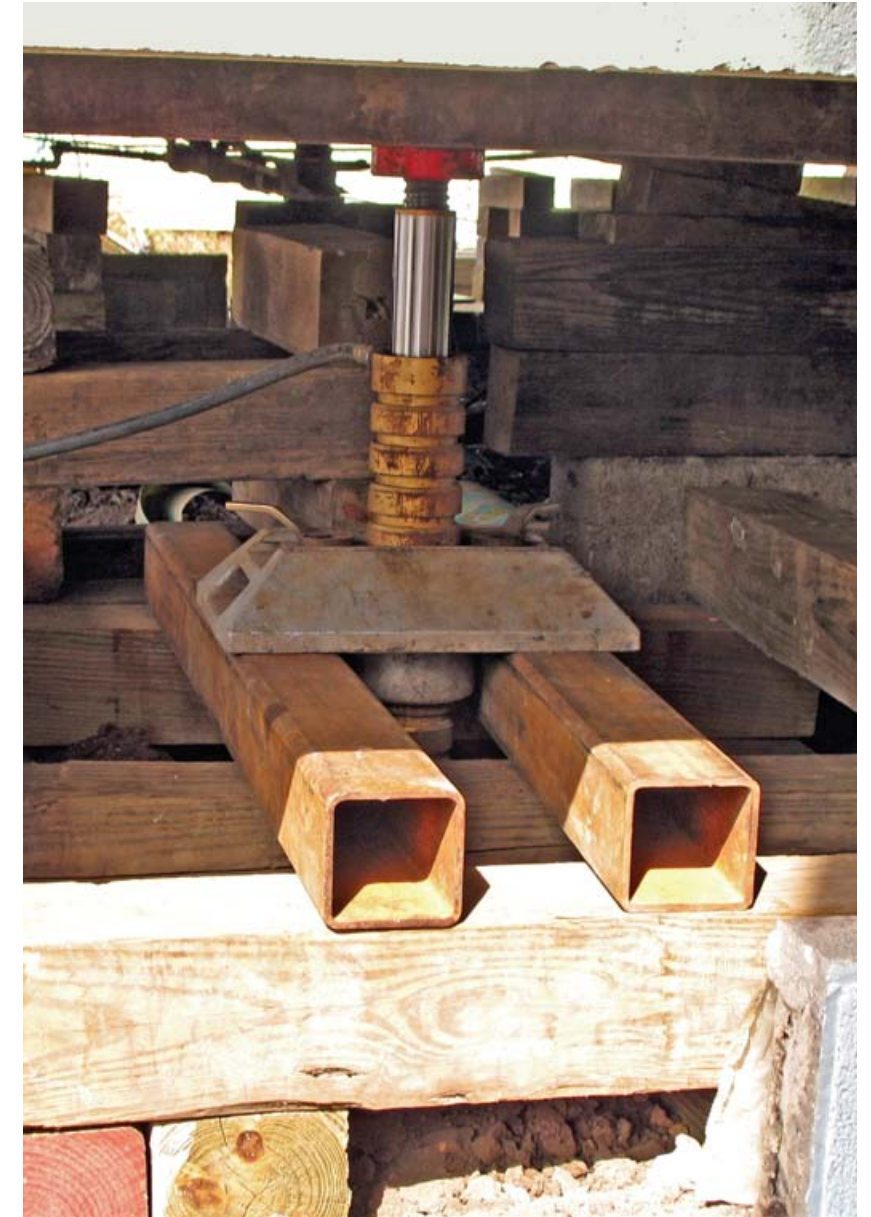
Insert Steel

Steel beams are next inserted beneath the foundation and lined up perpendicular to the floor joists. The photo opposite depicts steel about to be lifted as part of the early-1980s elevation of a house on Rampart Street by Roubion Shoring + Elevation, Inc. The other photos show the hole punched in the house for insertion of a steel beam, and that beam after placement in the hole. For slab-on-grade construction, a trench is dug immediately underneath the concrete slab; the steel beam is then placed against the underside of the concrete slab.



Excavation at Rosa Keller Public Library, Broadmoor neighborhood, 2011.

Roubion Shoring + Elevation, Inc., used with permission



TOP: Early-1980s view of steel used to support a house during elevation project on Rampart Street.

CENTER: Steel beam inserted in hole prior to setting of jacks.

ABOVE: Rampart Street elevation project, with hole to hold steel beam punched into wall left of basement entry.

Roubion Shoring + Elevation, Inc., used with permission

Insert Hydraulic Jacks

After the steel beams have been set, hydraulic jacks or lifts are placed at multiple points beneath the system of beams to minimize the possibility of damaging the house via twisting or differential movement. Before the invention of hydraulic jacks, various forms of manual jacks were used. As each required a human to concurrently physically manipulate the jack, these manual systems inevitably required more manpower, were less efficient, and were significantly more dangerous for the person manning the jack under the buildings being elevated. The photo at right illustrates the placement of the jacks.

Hydraulic jack set beneath the steel beam.

Mark Edwards

Raise House

Once the steel and jacks are set in place, the operator deploys multiple hydraulic jacks to raise the house (right). Each jack stands atop a box cribbing tower of typically 6-inch x 6-inch timbers stacked so as to spread the load below. Because jacks are raising the house a few inches at a time, the jacking process can take several days, with one house raiser operating the jacks from a central control panel, while others monitor the jack points to ensure that the house is level. The operator can raise one jack at a time when needed or all jacks simultaneously. Mechanical screw jacks can also be used to assist, typically at small wings and additions. When all jacks are raised the same amount at the same time, the house will remain level as it rises and the risk of cracking due to stress is lessened. As the house continues to be incrementally raised, wooden cribbing is placed under the I-beams, typically at 12-inch stages.¹²⁸ The photos on this page and opposite left illustrate the raising of the historic Rosa Keller library.

Construct New Foundation

After lifting the house, the crew typically demolishes the old foundation and constructs a new one that meets State and local building codes and other applicable regulations. The type of new foundation system selected is contingent upon multiple factors, such as cost, ease of construction, soil type and stability, and the aesthetic effect desired, particularly for historic buildings.



CLOCKWISE FROM TOP:
View of hydraulic jacks
during house raising.

Mark Edwards

Rosa Keller Public Library
elevation, 2011.

New foundation at Rosa
Keller Public Library, 2011.

Roubion Shoring + Elevation, Inc., used with
permission



Common Elevation Techniques in New Orleans

Seven common elevation techniques are used in New Orleans. The choice of technique depends on a number of factors, including the potential for flooding, regulatory requirements, the desires of the homeowner, and the type of pre-existing foundation.

BELOW: New continuous concrete masonry unit wall, Rosa Keller Public Library, 2011.

Roubion Shoring + Elevation, Inc., used with permission



Technique 1: Elevating by Extending Existing Piers or Walls

One of the most common elevation techniques in the city is to extend the existing foundation to the desired new height. After the building is detached from its foundation and jacked up, the existing foundation is often saved and its walls are extended. The new portions of the walls are usually made of masonry block or cast-in-place concrete. Although in many cases this method is the easiest way to elevate a building, it may involve additional construction modifications or reinforcements. Depending on the size of the house, the amount of elevation, and the magnitude of the structural loads, the footings and foundation walls may need to be modified to ensure the structural stability of the home. Some or all of the original footings also may have to be replaced with larger footings. It may further be necessary to reinforce both the footings and the foundation walls with steel bars.¹²⁹

Daniel Samuels, a New Orleans architect, and his wife, Dr. Nona Epstein, elevated their house prior to Hurricane Katrina by this method: they extended the existing rock-faced concrete block piers an additional three courses, or two feet (right and page 56). The rock-faced block originally supporting the front porch was reused as part of the project. As first built, the 1912 Samuels-Epstein House featured heavy box columns and modillions beneath the eaves. As a component of the elevation, the architect replaced stylistic elements such as the columns, railing, and modillions, to lend the re-designed house loftier proportions better suited to a raised home.¹³⁰



TOP: Samuels-Epstein house, 1450 Moss Street on Bayou St. John, before renovation and elevation, ca. 1991.

ABOVE: Samuels-Epstein house, with the top three courses of rock-faced concrete block added to the existing piers.

Daniel Samuels, Architect, used with permission



Samuels-Epstein house, front elevation drawing.

Daniel Samuels, Architect, used with permission

The long-established elevation and moving firm of Abry Bros., Inc. raised this house. According to Greg and Herman Abry, most dwellings elevated pre-Katrina, such as the Samuels-Epstein House, were raised only two to three feet, in contrast to the sometimes towering heights of post-Katrina elevations. Many residences were already standing on raised basements and owners chose to elevate to create additional habitable space on the lower level, rather than to protect against flooding. Because building elevation was practiced less frequently in pre-Katrina New Orleans, 75 percent of Abry Bros.' work had focused on the more popular leveling of houses that had sagged or gone out of plumb over time. The Samuels-Epstein House is a good example of a privately funded, pre-Katrina house elevation in New Orleans.

RIGHT: Samuels-Epstein house, during renovation and elevation.

Daniel Samuels, Architect, used with permission

BELOW: Same house after completion.

Richard Silverman



Technique 2: Whole House Elevation (Non-Slab)

This technique involves raising the entire house, with floor attached, and building new piers or a foundation wall (opposite). First, steel beams are placed under the floor framing. Next, the house is raised in small increments with hydraulic jacks. Cribbing is placed beneath the steel beams to provide a support for the hydraulic jacks and a safety backup to prevent collapse of the house. This process is repeated until the desired height is reached.

When the required elevation is reached, the original foundation piers are removed and a trench is dug around the perimeter of the house and at other locations where a foundation system of piers will be required. Next, concrete is placed atop steel reinforcing or rebar is laid in the trenches of the foundation system, which creates a steel-reinforced chain wall.

Finally, new piers are built below the raised house. Foundation walls can be constructed below the living space, with vents/openings to accommodate the potential of future flooding. This technique is generally considered the most cost effective for houses that are already partially raised or restored.¹³¹



Technique 3: Elevating on an Open Foundation: Piers, Posts or Columns, and Pilings

Frame, masonry veneer, and masonry houses on basement, crawlspace, and slab-on-grade foundations can also be elevated on open foundations consisting of piers, posts, columns, or pilings. Houses originally constructed on open foundations can also be elevated this way.¹³²

Prior to the elevation process, a house on piers is separated from its existing foundations. Once the house has been raised to the desired height, new masonry piers are built on the existing foundation, if it is adequate. The photos on page 58 show a house located in Mandeville across Lake Pontchartrain from New Orleans that was elevated using this technique. It was lifted approximately one full story and a new concrete slab was poured at ground level below it. The piers were constructed of reinforced concrete masonry units, which later were sheathed in brick veneer for appearance. Because of the dynamic forces associated with flooding and wind, the piers used in this elevation were reinforced with steel.

For houses to be elevated on posts or columns, the uprights are usually set into drilled or excavated holes. Each post or column is either encased in concrete or anchored to a concrete pad. The house elevation process is identical to that described for piers, but the existing foundation must be removed so that the posts or columns and their concrete encasements or pads can be installed.¹³³

Before-and-after views of whole house elevation, with pier-and-beam construction.

Abry Bros., Inc., used with permission



Creole Cottage-style house in Mandeville elevated on cribs (top) and following elevation.

Roubion Shoring + Elevation, Inc., used with permission

Elevating a building on pilings requires a more involved process (below). Pilings are usually driven into the ground or jetted into place with a high-pressure stream of water. They are not supported by concrete footings or pads. Unlike the construction of wall, pier, or post or column foundations, the pile-driving

operation, which requires bulky heavy construction machinery, cannot be carried out under a house that has been lifted on jacks. Instead, the house is usually lifted and moved aside until the pilings have been installed. Because the existing foundation is not used, it must be removed.¹³⁴



Example of a building on pilings.

FEMA

Technique 4: Slab Elevation

Slab elevation entails raising the entire house with the slab floor attached and placing it on a new foundation higher off the ground. First, trenches are dug immediately below the concrete slab. Then, tunnels are excavated under the slab to allow the insertion of steel beams. Steel beams are lowered into the trenches and moved into place beneath the slab through the tunnels. The contractor must also dig holes for the lifting jacks because they have to be placed below the beams. Once the beams and jacks are in place, the lifting process begins.¹³⁵

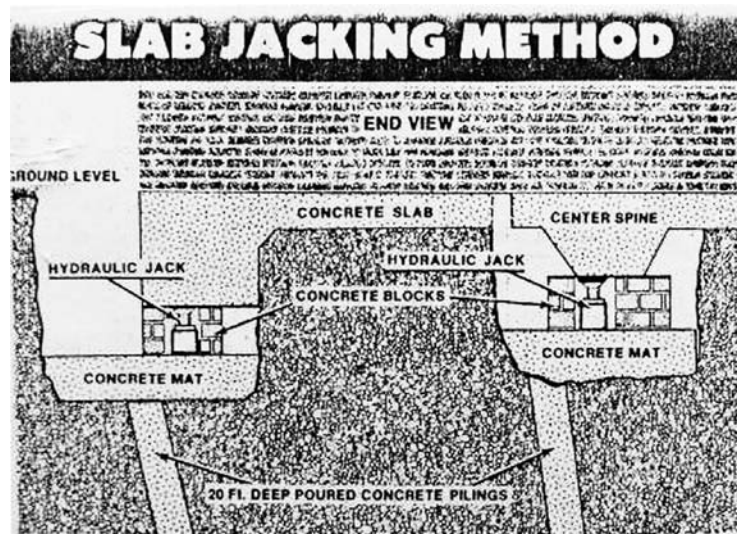


Diagram of a slab jacking method.

Roubion Shoring + Elevation, Inc., used with permission



Slab elevation, before-and-after views.

Abry Bros. Inc., used with permission



If pilings are present beneath the slab, which is common in the New Orleans area, they will be detached from the slab. Next, the house is raised in small increments with hydraulic jacks. Cribbing is placed beneath the steel beams to provide support for the hydraulic jacks and a safety backup to prevent a collapse of the house. This process is repeated until the desired elevation height is reached. Next, rebar is laid in trenches around the house perimeter and other necessary areas and concrete is placed, creating a steel-reinforced chain wall. Finally, a new foundation wall is built below the raised slab, with vents and openings to accommodate potential future flooding, and the house is placed on top of it.¹³⁶

Slab elevation is generally considered the most cost-effective solution for houses that have already undergone interior renovation. House raising companies must be very experienced before attempting a slab elevation because the concrete slab comprises most of the house's weight. Some of the earliest slab elevations in Louisiana were completed in Chalmette after flooding in the early 1980s. Slab elevation was also popularized following the flooding of the Amite River in Denham Springs near Baton Rouge.¹³⁷

Technique 5: Slab Separation

Popular in suburban New Orleans because of the prevalence of ranch houses, this technique lifts the house by detaching the entire structure from the slab foundation (right). Exterior siding must be removed, but may in some cases be reinstalled. The house is braced and beams are placed through it to support it as it is raised. This results in the need to repair interior walls after the elevation.

Because the slab is not lifted, I-beams are inserted through openings cut into the walls of the house above the slab rather than below it. To enable the beams to lift the house, the contractor attaches horizontal wood bracing to the interior and exterior walls at the tops of the openings. When the beams are jacked up, they push against the bracing, which distributes the lifting force equally across the walls. The bracing also supports the walls, which lack the structural stability that would otherwise be provided when the walls and floor are left attached. Without bracing, the walls could twist, bend, or collapse during lifting.

Once braced, the house is raised in small increments with hydraulic jacks. Wooden cribbing is placed beneath the steel beams to provide a support for the hydraulic jacks and to serve as a safety backup to prevent collapse. This process is repeated until the desired elevation height is reached. Piers are constructed for support on top of the existing slab and foundation walls, which provide additional support, and can be constructed with vent openings to allow water to pass through



Slab separation, before-and-after views.

Abry Bros., Inc., used with permission

in the case of flooding. An engineer must inspect the slab beforehand to ensure that it is capable of supporting the point load of the weight of the house on the new piers; elevation firms will look at the dimensions, condition, and materials of the extant slab, as well as the surrounding soils (and any subsidence), to determine if this option of elevation is feasible. The primary advantage of elevating the house without the slab is that the house is lighter and, therefore, easier to lift.¹³⁸

Technique 6: Second-Story Add-On or Elevating by Abandoning a Lower Enclosed Area

The first variant of this technique consists of abandoning the entire lower floor or lower enclosed area of the home and moving the living space to an existing or newly constructed upper story (opposite). The abandoned area beneath the new living space is then used only for parking, building access, or storage. Because this technique leaves the original floor and walls below the Flood Protection Elevation (FPE) exposed to flooding, these techniques, like the others, have their limitations. The portions of the home below the design flood elevation (DFE) will be exposed to flooding and must, therefore, be made of flood damage-resistant materials. The resulting expanded structure is often called a “raised basement” house.¹³⁹ An example of abandoning the lower area, coupled with moving the upper story and setting it on a new foundation, is shown in the sequence of photos on page 26, which trace the history of a house relocated in the mid-1950s to 1442 Eleonore Street near Audubon Park.



Before-and-after views of a second-story conversion.

Louisiana Office of Community Development, used with permission

Technique 7: Wall Extension

The seventh elevation technique, known as wall extension, extends the existing walls of the house upward and raises the lowest floor. With this method, the roof is removed and the structural framing members supporting it are extended upward less than one story. New bricks or other siding material are then added to complete the exterior renovation. As a result of this elevation technique, the lowest floor is raised above its original height. Now set at a level above the flood elevation, vents and openings are installed beneath the first floor to accommodate the possibility of future flooding.¹⁴⁰

For masonry houses on slab-on-grade foundations, two alternative elevation methods are available. One is to remove the roof, extend the walls of the home upward, replace the roof, and build a new, raised floor. The floor can be either a new slab or a new wood-framed floor. For a new slab, fill dirt is placed on top of the old slab and the new slab is built on top. If a new wood-framed floor is built, the space between it and the old slab is left open and becomes a crawlspace (and must be retrofitted with openings to allow floodwaters in that space). The second method is to abandon the entire lower floor, or lower enclosed area, of the home and move the living space to an existing or newly constructed upper story. The abandoned lower floor or enclosed area is then used only for parking, building access, or storage.¹⁴¹

Tools of the Trade: Jacks and Cribbing

This section explores some of the historic and contemporary mechanical equipment that house moving and raising companies have used over the past century.

Cotton Jack

The cotton jacks owned by Abry Bros., Inc. were originally used in the mid-19th century to compress and force cotton bales into the holds of outbound ships plying the Mississippi River. The jacks (below) were acquired by the Abrys in the late 19th century to assist in raising houses. The firm continued to use them into the 1950s.¹⁴²



Late-19th-century cotton jack once used by Abry Bros., Inc. to lift buildings.

Amber Martinez

Screw Jack

A screw jack is a type of jack especially designed to lift heavy weights such as the foundations of houses. An advantage of screw jacks over earlier jacks is that they are self-locking. Therefore, when the rotational force on the screw is removed, it remains motionless where it was left and does not rotate backwards, regardless of how much load it is supporting. Owned by Abry Bros., Inc., the screw jack depicted at right is a particular subtype known as a cathead jack based on its shape.¹⁴³

Railroad Jack

A railroad jack is a very heavy-duty ratchet type of jack designed to raise rail cars (top right). The ratcheting action of the railroad jack allows the user to raise the car in small increments. Because of its extreme lifting capacity and multitude of domestic uses, the railroad jack became widely used in the house raising and house moving businesses. The jacks were able to lift a house off of its foundation and hold it suspended while cribbing was assembled beneath.¹⁴⁴

Hydraulic Crib Jack

Hydraulic crib jacks or hydraulic lifts (far right) are inserted beneath steel beams so they can lift a house off of its foundation. Multiple hydraulic lifts are all connected to a

CLOCKWISE FROM TOP LEFT:
Cathead type screw jack,
ca. 1910s, owned by Abry
Bros., Inc.

Railroad jack, ca. 1915,
owned Abry Bros., Inc.

Hydraulic crib jack with
adjustable base to raise
jack height, ca. 1970s,
used by Abry Bros., Inc.

Hydraulic ram purchased
by Abry Bros., Inc. in 2008.

Light-duty hand
hydraulic bottle
jack acquired by
Abry Bros., Inc.
in 2012 to assist
other jacks and
lighten loads.

Amber Martinez



unified hydraulic jacking system with a power unit and a central control panel (below) that ensures the entire house is raised and lowered while remaining level. The central control panel runs a master hydraulic cylinder, which contains a preset volume of oil. Hoses connect the master cylinder to a series of slave cylinders that are attached to each jack. As the master cylinder evenly distributes oil to the slave cylinders, each jack is raised by exactly the same amount.

Because the system is unified, all the jacks raise and lower at the exact same rate, regardless of how much weight each is supporting. This allows the home to remain level. The control panel also lets the operator make individual adjustments. The unified hydraulic jacking system came into popularity in New Orleans in the early 1970s. Its popularity was widened by building moving trade publications, such as *Modern Hydraulics*.

Early versions of hydraulic lifting technology in New Orleans were used by Abry Bros. beginning about 1956 according to an advertisement the firm placed in the *Times-Picayune* on New Year's Day of that year. In the early 1960s, the firm purchased a hydraulic system from Beerman Precision, a local machinist operation located in the New Orleans' Warehouse District.¹⁴⁵

Cribbing

Cribbing is a temporary wooden structure used to support a building during the process of elevation. Cribbing usually comprises wood blocks, often 6 inches wide x 6 inches deep and 18 inches to 24 inches long. As the house is raised by a hydraulic jack, two sets of wood members are added for every 12 inches in rise. These members are spread apart to form an open box.¹⁴⁶



Modern control panel for unified mechanical jacking system.

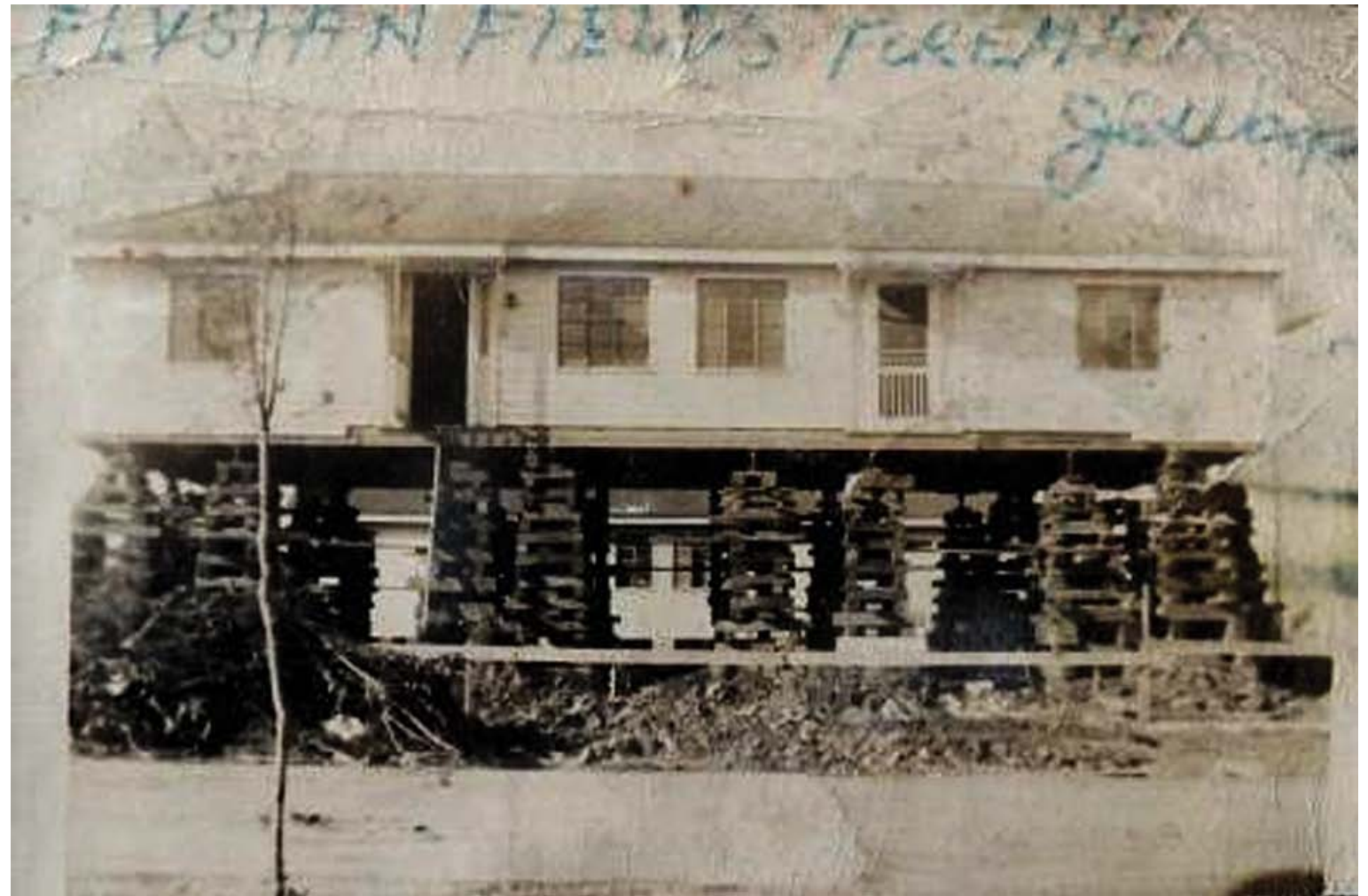
Mark Edwards



Cribbing assembled by Abry Bros. crew, early 1990s.

Abry Bros., Inc., used with permission

Different shapes of cribbing structures are chosen depending on the area available and the designated height the cribbing is to reach. A box crib is the simplest, most stable, and most common method of cribbing (right). It is constructed by arranging two or more sets of matched blocks in a regular log-cabin-style arrangement to form a rising square or rectangular frame. The more blocks on each level, the greater the number of support points and therefore the greater the strength of the crib tower. Other less common configurations are the triangle and the parallelogram crib.



Cribbing under an elevated house on Elysian Fields Avenue, ca. 1960s.

Roubion Shoring + Elevation, Inc.,
used with permission

The cultural prehistory of Louisiana is typically divided into five primary archaeological periods with date ranges that are shared by much of the southeastern United States.¹⁴⁷ These periods in Louisiana are Paleonindian (11,500–8,000 B.C.), Archaic (8,000–800 B.C.), Woodland (800 B.C.–1200 A.D.), Mississippian (1200–1700 A.D.), and Historic (1700 A.D.–present).¹⁴⁸ Louisiana’s Comprehensive Archaeological Plan breaks New Orleans’ prehistoric past into even more detailed periods: the Paleoindian, Archaic, Poverty Point, Tchefuncte, Marksville, Troyville-Coles Creek, Plaquemine, Mississippian, Caddo, and Historic Contact.¹⁴⁹

FEMA’s archaeological investigations within New Orleans since Katrina have unearthed many artifacts from various periods. In association with building elevations, these include diverse 19th- and 20th-century historic materials from multiple domestic sites. The most common artifacts FEMA’s investigations have uncovered are architectural materials such as brick, nails, and window glass. Miscellaneous artifacts, such as coal, clinker, slag, and unidentified iron and other metal fragments, are also quite common. Faunal remains, including animal bone fragments, oyster and clam shells, and kitchen group artifacts, such as historic ceramic and glass container fragments, are also regularly collected. Other typical artifacts encompass a wide range of objects spanning several functional categories (activities, arms, clothing, floral, household, personal, tobacco) that represent domestic activities at sites in New Orleans (left).



Artifacts recovered by FEMA from 344 Audubon Boulevard, New Orleans.

FEMA, 2012

Because almost all elevation projects entail some form of ground disturbance (primarily excavation for removing and constructing foundations) and archaeology is a specialized endeavor requiring detailed technical knowledge, it is important to involve professional archaeologists to help protect archaeological resources. Indeed, when Federal funding, licensing, or permitting is involved and the building is deemed to be historic, the involvement of such professionals is required by law.

Archaeological resources might be disturbed, damaged, or destroyed as a result of a variety of types of ground disturbance, including but not limited to the following:

- Repair and/or removal of piers, pilings or slab foundations
- Placement of new piers and/or pilings
- Creation of a new slab foundation
- Associated onsite construction activities and traffic
- Excavation associated with the disconnection and replacement of mechanical, plumbing, telephone, water, gas, electrical, or other utilities and their associated lines
- Demolition and removal of construction debris
- Construction of new driveway access or sidewalks on the property
- Removal or installation of construction fencing or even new fencing associated with property improvements
- Contractors not following agreed-upon conditions designed to protect archaeological resources
- Unexpected discovery of archaeological resources during construction

Archaeological Concerns

When Federal licenses, permits, or funds are involved, the elevation’s project planner (or project proponent) should determine whether existing archaeological resources are

present for the property subject to elevation. In general practice, professional archaeologists review engineering or architectural plans to determine the scale and nature of ground-disturbing activities that may affect archaeological resources. These professional archaeologists work in concert with local and State historic preservation groups as well as Tribal governments and other interested parties to learn more about the potential for encountering archaeological resources and how to best avoid damaging them. When archaeological resources are present (or likely to be present), archaeologists may conduct additional subsurface investigations to confirm the presence and significance of any archaeological resources (right).

The best way to protect archaeological resources is to avoid them and allow them to remain in place (preservation-in-place). One way of achieving “avoidance” is to find ways to modify the construction means and methods that leave archaeological deposits untouched. Other proactive precautionary measures may include archaeological monitoring of ground-disturbing activities, establishment of work buffer zones, and restrictions on heavy equipment use and construction techniques.

Before any elevation project begins where archaeological resources are of concern and a Federal connection is in place, professional archaeologists should conduct site visits of the building site subject to ground disturbance to assess the recorded archaeological site in relation to the building elevation. If further archaeological investigation is needed, a professional archaeologist may develop a treatment plan designed to protect archaeological deposits. An effective treatment plan will detail



LEFT: FEMA field archaeologists Pam Pyatt and David Gilmour at the Francois Cousin House, St. Tammany Parish.

RIGHT: Tarps and a layer of protective soil are incorporated into construction planning to minimize disturbance of archaeological resources at the Francois Cousin House, St. Tammany Parish.

FEMA, 2009

restrictions or other measures that construction crews will implement, which are designed to avoid disturbance or damage to the archaeological resources.

In the rare cases when archaeological deposits cannot be avoided, professional archaeologists work in concert with local and State preservation officials as well as Tribal governments to compensate appropriately for the loss of any archaeological deposits. Federally sponsored projects require that archaeological concerns be considered early in the planning process for building elevations.

For elevation projects that do not involve a Federal permit, license, or funding, FEMA recommends that the property owner contact a professional archaeologist in the earliest planning stages for the building elevation project. In New Orleans, many houses are located in National Register or locally designated (or locally zoned) historic districts, and for that reason property owners are encouraged to contact local and State historic preservation officials to ensure that archaeological resources are protected throughout the elevation process.

Glossary

Base flood

Flood that has a 1-percent probability of being equaled or exceeded in any given year (formerly known as the 100-year flood).

Base flood elevation (BFE)

Elevation of the 1-percent annual chance flood. This elevation is the basis of the insurance and floodplain management requirements of the National Flood Insurance Program.

Basement

Any area of a building having its floor subgrade (below ground level) on all sides.

Building envelope

The entire exterior surface of a building (including walls, doors, and windows) that encloses or envelopes the space within.

Cast-in-place concrete

Concrete poured into forms at the construction site.

Compaction

In construction, the process by which the density of earth fill is increased so that it will provide a sound base for a building or other structure.

Crawlspace

Type of foundation in which the lowest floor of a home is suspended above the ground on continuous foundation walls.

Cribbing

Cribbing usually consists of a framework of crisscrossed timbers that provides temporary structural support.

Design flood elevation (DFE)

Elevation of the highest flood, including freeboard, that a retrofitting method is intended to protect against.

Elevation

In retrofitting, the process of raising a home or other building so that it is above the height of a given flood.

Fill

Material such as soil, gravel, or stone that is dumped in an area to increase the ground elevation. Fill is usually placed in layers and each layer is compacted (see “Compaction”).

Flood elevation

Height of floodwaters above an elevation datum plane.

Flood Protection Elevation (FPE)

The FPE refers to an elevation 1 foot (minimum) above the 100-year flood plus any stage increase due to the designation of flood fringe areas.

Footing

The base of a foundation, usually made of concrete and may be reinforced with steel bars. Foundation walls are supported on continuous footings; separate foundation members, such as piers, are supported on individual footings.

Freeboard

Freeboard is an additional amount of height included in the building elevation to provide a factor of safety. For example, if you are elevating your home to protect it from the base flood, your DFE should be equal to the BFE plus 1 foot. Freeboard is recommended because of uncertainties regarding expected flood elevations.

Grade beam

In a slab foundation, a support member cast as an integral part of the slab, as opposed to a separate footing.

Jetting

A process in which the hole for the installation of a pile is made by a high-pressure stream of water from a nozzle attached to the bottom of the pile.

Lowest floor

The lowest floor of the lowest enclosed area (including basement). An unfinished or flood-resistant enclosure, usable solely for parking of vehicles, building access, or storage in an area other than a basement area is not considered a building's lowest floor.

Masonry veneer

Nonstructural, decorative, exterior layer of brick, stone, or concrete block added to the walls of a building.

Pier

Vertical support member of masonry or cast-in-place concrete that is designed and constructed to function as an independent structural element in supporting and transmitting both building loads and environmental loads to the ground.

Piling

Vertical support member of wood, steel, or precast concrete that is driven or jetted into the ground and supported primarily by friction between the pilings and the surrounding earth. Pilings often cannot act as independent support units and, therefore, are often braced with connections to other pilings.

Post

Long vertical support member of wood or steel set in holes that are backfilled with compacted material. Posts often cannot act as independent support units and, therefore, are often braced with connections to other posts.

Precast concrete

Concrete materials such as posts, beams, and blocks that are brought to the construction site in finished form.

Reinforcement

Inclusion of steel bars in concrete members and structures to increase their strength.

Retrofitting

Making changes to an existing home or other building to protect it from flooding or other hazards.

Slab-on-grade

Type of foundation in which the lowest floor of the home is formed by a concrete slab that sits directly on the ground. The slab may be supported by independent footings or integral grade beams.

Subgrade

Below the level of the ground surface.

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