

# Toward **Accessible** **Historic** Streetscapes

A Study of New York City's Belgian Block Heritage



Prepared for the Historic Districts Council  
April 2017

## Prepared for



The Historic Districts Council is the advocate for all of New York City's historic neighborhoods, representing over 500 community organizations to ensure the preservation of significant historic neighborhoods, buildings, and public spaces. Learn more at [hdc.org](http://hdc.org).

## Prepared by



**Being Here Landscape Architecture &  
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## INTRODUCTION

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# Place-Defining Pavement for All

### **This report highlights an underappreciated urban asset: historic pavement.**

Asphalt could be anywhere, but whether it's brick, granite, cobblestone, or wood block, an old pavement's texture and scale, the stories it tells about who and where we are—all contribute powerfully to a city's sense of place.

In New York City, the most prevalent historic pavement is called Belgian block. Typically dating to the 19th and early 20th centuries, these rectangular granite stones bring authenticity and a worldly air to the streets and sidewalks of historic districts. Amid the ongoing work of protecting and celebrating civic heritage, paving materials, so often neglected, deserve their due as irreplaceable historic assets. What's under foot matters.

At the same time, cities across the United States are facing competing demands upon historic streets. Neighborhoods once full of factories and warehouses are now centers of loft living and creative industry. Today they must accommodate not horse-drawn carts or railcars but a new influx of local residents and modes of transportation necessary to create a walkable, bikeable, sustainable city of the 21st century.

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*Figure 1: Granite setts in Red Hook, Brooklyn*

As part of this urban evolution, the 1990 Americans with Disabilities Act (ADA) and subsequent regulations mandated that our streets and sidewalks be accessible for all who use them, including those who use wheelchairs, walkers, or canes, or whose mobility otherwise depends on smooth, unobstructed surfaces.

Commissioned by New York City's Historic Districts Council, a citywide advocate for historic neighborhoods, this study examines how to best balance the competing priorities of preservation and accessibility. It focuses on one historic New York City neighborhood, DUMBO, where recent capital improvement projects and routine utility work have significantly impacted its Belgian block streets. The study offers a brief history of New York's Belgian block; details the specific streetscape context of DUMBO; discusses applicable ADA accessibility standards; provides best practices from within New York City and beyond; and offers recommendations to better steward historic streets and advance preservation-minded placemaking.

Making streets from centuries past meet modern-day accessibility standards is not easy. But accessibility and preservation need not be mutually exclusive. Designing streets that are accessible for all is an opportunity to ensure that historic neighborhoods and their place-defining pavements are given the resources they need to endure and inspire for generations to come.

## **A Brief History: New York's Belgian Block Heritage**

Over the past century and a half, the stones in New York City's streets have gone by many names. In this report, we refer to the city's typical, 19th-century granite paving stones as Belgian blocks. These mostly rectangular, tooled granite stones were used as paving materials in cities across America. With the term Belgian block, we distinguish these stones from an earlier paving material, cobblestones, which are untooled, naturally rounded stones that generally predated the use of tooled granite in city pavements. Cobblestones were typically used up to about 1860.

Despite the name Belgian block, it remains unclear to what extent, and during what era, paving stones imported from Belgium may have provided the raw materials for New York City's streets.<sup>1</sup> It is known that the city's early paving stones included a type of six-



*Figure 2: Belgian blocks at the South Street Seaport*

inch-square traprock commonly called "Belgian" block, and said to have first been used in Belgium. This non-granitic, igneous stone block, reportedly sourced from the New Jersey Palisades, was introduced in 1852 and in general use after 1859. None of these paving stones are known to be in use today.<sup>2</sup>

The surviving stone we refer to as Belgian block began to be used in the 1870s.<sup>3</sup> It was most likely sourced from quarries within the United States. By 1877, for example, New York contractors were said to have purchased large quarries in the Northeast for the purpose of providing granite paving blocks to New York City.<sup>4</sup> In 1895, the Commissioner of Public Works reported that all of New York City's granite paving blocks were obtained from quarries on the New England coast.<sup>5</sup> Stones were notably sourced from Maine, including quarries on the island of Vinalhaven.<sup>6</sup>

The existing Belgian block stones in New York City streets today are presumably of this later type quarried in America. Nonetheless, we retain the term Belgian block due to its generally accepted use in referring to granite paving stones, as well as its evocation of the European character that pervaded the city's early streetscapes and continues to contribute a distinctive sense of place today.





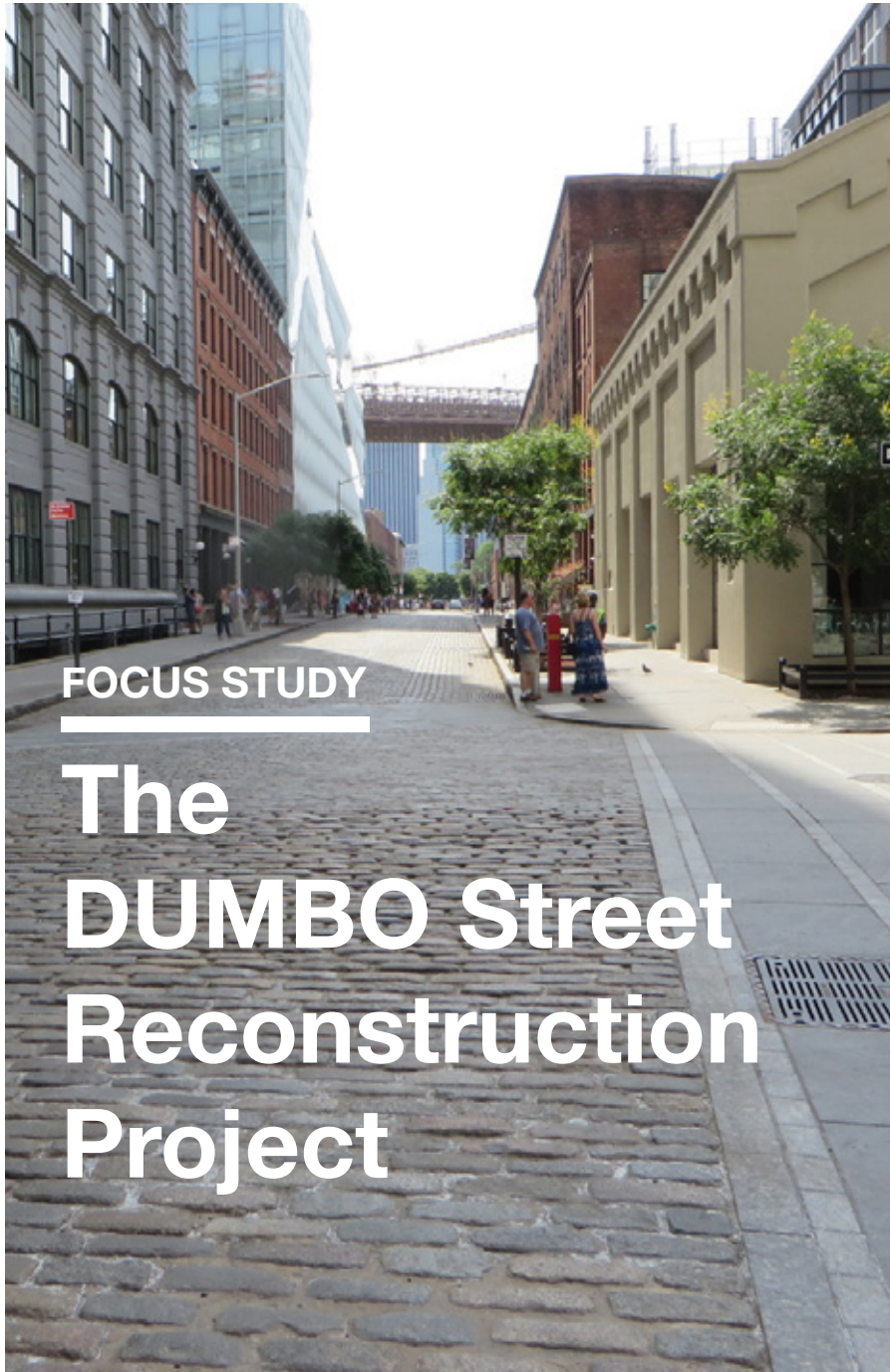
Figure 3: Belgian blocks in the Tribeca North Historic District

Belgian blocks had many virtues as pavements. Especially when laid on concrete foundations, which were used by 1888,<sup>7</sup> Belgian blocks were hard, durable, and offered a much smoother and more regular surface than cobblestones—“a very solid and impervious roadbed,” according to an 1895 report in *The City Record*.<sup>8</sup> Such qualities made them particularly suited for use along waterfronts and other areas with heavy commercial traffic. By 1900, the stones used for such purposes were shaped to a relatively uniform width of between 4 and 5 inches, apparently proportioned to the size of a horseshoe. This allowed horses drawing heavy loads to secure a firm foothold in the joints between blocks.<sup>9</sup>

Despite such advantages, these stone pavements had obvious drawbacks. By 1889, observers were deploring Belgian block’s “abominably rough surface and its propensity to get out of level.”<sup>10</sup> They were difficult to maintain, became slick when wet, and were rued as the noisiest pavement type. Around 1890 asphalt began being extensively used for streetbeds, and within a decade had nearly surpassed granite in miles of Manhattan street coverage.<sup>11</sup>

Still, well into the 20th century, Belgian blocks persisted as a pavement that defined the visual, material, and functional texture of the streetscape in many parts of New York City. In 1949, for example, Manhattan still had 140 miles of granite block streets.<sup>12</sup> Today, citywide, perhaps 15 miles remain. These substantial areas of exposed granite block streetbeds are primarily concentrated in five historic areas: South Street Seaport, Tribeca, SoHo, and Greenwich Village in Manhattan; and Brooklyn’s adjacent Fulton Ferry, DUMBO, and Vinegar Hill districts. Though not in a historic district, granite block streets are also important features of Brooklyn’s Red Hook waterfront neighborhood.

Belgian block was, and remains today, an integral aspect of the city’s historic industrial districts, retained in these places for its superior strength. What *The New York Times* in 1884 called “a differentiation in pavements according to the work they have to do” continues to define the urban environment.<sup>13</sup> These places may no longer be the exclusive home of wharves, warehouses, and factories, but we find in their stones a direct link to a vivid and enriching past.



FOCUS STUDY

# The DUMBO Street Reconstruction Project

**Of all New York City neighborhoods, DUMBO is perhaps most distinctively defined by its Belgian block streets.**

Recalling a time when Brooklyn was the fourth-largest manufacturing center in the United States, the district features an extraordinary collection of 19th- and early-20th-century industrial establishments amid the portals to the Brooklyn and Manhattan bridges. Sugar refiners, coffee roasters, paper box manufacturers, and shoemakers all relied on the transportation of raw materials and finished goods. As part of the area's robust transportation infrastructure, which included docks, freight terminals, railroad lines, and ferry lines on the East River, Belgian block streets connected to more than 90 significant historic buildings that today lie within the DUMBO Historic District, designated by the New York City Landmarks Preservation Commission as a historic district in 2007.

Flanked by the Fulton Ferry Historic District on the west and the Vinegar Hill Historic District on the east, the streetscapes of DUMBO

*Figure 4: Water Street at Main Street*

play a starring role in one of the city's most important waterfront industrial neighborhoods. As noted in the DUMBO Historic District's designation report, the streets within the district were once entirely paved with granite Belgian blocks, which contribute significantly to the area's character.<sup>14</sup> Indicating their special status, the roadbeds themselves are mapped in the designation report, which provides a detailed survey of the Belgian block pavements, along with historic rail tracks, bluestone curbs, sidewalks, and other streetscape elements. The report notes that where streets have been covered with asphalt over time, the asphalt has worn away to reveal a surviving foundation of Belgian blocks underneath.

Today, DUMBO is rapidly evolving to include a diverse mix of residential, office, artist, retail, and industrial uses. As factory and warehouse buildings are renovated and converted, streetscapes form an ever more important link to the district's industrial past. Amid this transformation, DUMBO's Belgian block pavement has been subject to major street reconstruction work that in some cases has altered the historic streetscape fabric.

These events prompted the Historic Districts Council to seek a fuller understanding of whether and how historic Belgian block streets could be made ADA-compliant. The following sections offer a background to the DUMBO street reconstruction project, followed by a detailed analysis of each streetscape element's accessibility considerations.

## **Background: Retrofitting DUMBO's Streets**

Planning and design for a multi-year, multi-phase infrastructure and street reconstruction project in DUMBO dates to the late 1980s. In the intervening years, this long-running project has involved the replacement or repair of water mains, combined sewers, catch basins, hydrants, sidewalks, curbs, and roadway reconstruction, among other elements. The project at various times has involved different lead or sponsoring agencies, regulatory jurisdictions, and review protocols. As a result, DUMBO has become a collection of design and maintenance approaches—with varying historic sensitivity—to creating accessible streetscapes.

The effects of this combination of design and repair practices are clearly seen in successive phases of street reconstruction work.

Around 1988, design concepts for the project's roadbed, crosswalks, and sidewalks were apparently commissioned by the New York City Economic Development Corporation. These were submitted to and approved by the New York City Public Design Commission (PDC), then known as the Art Commission, which typically has jurisdiction over any project built on publicly-owned land.<sup>15</sup> The project was then put on hold until the early 2000s, when it was revived around the same time that DUMBO was designated as a historic district in 2007.

In 2009, the first construction phase commenced. The capital construction project was administered by the New York City Department of Design and Construction (DDC) and advanced with the support of the DUMBO Improvement District, founded in 2006, which has worked closely with city agencies on streetscape improvements.

The Phase One project principally focused on Washington and Water streets and was completed in fall 2011. Drawing on the PDC-approved designs developed in the 1980s, the project reset historic Belgian block within the roadbed on Water Street and in some portions of Washington Street. However, in the center roadbed of Washington Street, the existing Belgian blocks were replaced with a wide strip of new, flat-topped granite blocks treated with a thermal finish to provide slip resistance (Figures 5 & 6).<sup>16</sup> This new granite strip was flanked by historic Belgian blocks reinstalled in the parking lanes on either side.

The installation of the new granite blocks in the Washington Street roadbed has proven to be among the most controversial Phase One elements. With their pinkish color and flat profile, the new thermal blocks do not replicate the historic materials, and the rationale for why new blocks were deemed needed within the roadbed is not clear. In addition, the project removed Belgian blocks from the interior of certain intersections, such as at Front and Washington streets (Figure 7). These alterations were criticized by preservation advocates as adversely affecting the historic character of the streetscape.

Following Phase One, the city commenced work on a new phase of the project under the leadership of the New York City Department of Transportation (NYCDOT). Known as the DUMBO/Vinegar Hill Street and Plaza Reconstruction project, this effort





*Figure 5: Washington Street's new center roadbed pavers (top) with historic Belgian block reset in the parking strip (foreground)*



*Figure 6: Washington Street center roadbed detail*



*Figure 7: Front Street at Washington Street, showing new granite blocks installed within the interior of the intersection*



*Figure 8: Water Street bikeway*

(which incorporates Phases Two and Three) involves sewer and water infrastructure upgrades in DUMBO and Vinegar Hill, reconstruction and restoration of Belgian block roadways, and a large public plaza at the Pearl Street Triangle adjacent to the Manhattan Bridge anchorage. Designed by AECOM, the project at the time of this writing remains in the late stages of design, with construction scheduled to be complete in 2019.

Unlike Phase One, the latter phases fell under the jurisdiction of the Landmarks Preservation Commission (LPC) rather than PDC. The change in jurisdiction was due to two factors: first, the DUMBO Historic District had been designated in 2007. Second, to reduce duplicative regulatory review, projects subject to both PDC and LPC review are now typically assigned to one or the other agency. For work within historic districts, LPC takes jurisdiction. Thus, proposed work in DUMBO following Phase One has been submitted for LPC approval. As of this writing, the full commission had reviewed and approved most project elements, but the agency had not issued a binding approval subject to further dialogue with NYCDOT, principally focused on sidewalks (discussed below).

Due to the historic district designation, DDC's Historic Preservation Office also had a hand in overseeing the development of the project's latter phases. As work commenced on the project, DDC and other agencies reviewed Phase One to evaluate the success of the approaches and materials used.

Representatives at NYCDOT, DDC, and LPC all acknowledged negative community feedback regarding Phase One. In particular, they concur that the use of new thermal granite blocks in the vehicular portion of the Washington Street roadbed was aesthetically unsuccessful. In addition, agencies acknowledge concerns about the Water Street bike lane, defined by historic granite blocks oriented in the direction of travel (Figure 8), as an alteration of the historic fabric that does little to improve rideability. These two elements are reportedly not included in designs for the present project phases.

Instead, a new granite-slab bikeway design was developed following community participation in 2012 and 2013, including three public workshops and a mockup viewing of the proposed bikeway (also discussed below). According to NYCDOT, the project was presented to, and endorsed by, the executive board of Brooklyn Community Board 2 in July 2013.

## DUMBO Streetscapes and ADA Compliance

As the first phases of the DUMBO streetscape project were developed, a number of project elements were designed to meet federal accessibility standards. To better assess the design decisions made, it is important to understand the guidelines and criteria that apply to projects in the public right-of-way.

In the United States, the current federal law governing accessibility is the 2010 *ADA Standards for Accessible Design*, a set of enforceable standards revising the Americans with Disabilities Act of 1990 (ADA). In addition to meeting ADA standards, many municipalities, including New York City and Boston, also seek to meet or exceed standards set forth in the United States Access Board's *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way* (2011). When published as a final rule, these guidelines are expected to become the basis of enforceable standards issued by governmental agencies.

Both ADA and Access Board standards define requirements for accessible routes, which are continuous, unobstructed paths of travel for pedestrians with disabilities. Whereas ADA generally focuses on accessibility within buildings or sites, Access Board guidelines were developed specifically to address the public right-of-way. These guidelines call for accessible routes to be provided within all pedestrian circulation paths located in the public right-of-way. That is, every crosswalk, sidewalk, curb ramp, and other circulation path element must be fully accessible.

Together, ADA and Access Board guidelines constitute widely accepted accessibility best practices. In summary, the key standards defined for paving surfaces are as follows:

- Surfaces should be firm, stable, and slip-resistant (ADA and Access Board)
- Changes in vertical surface level must be 1/4 inch maximum (ADA and Access Board<sup>17</sup>)
- Horizontal surface discontinuities, such as gaps, must be 1/2 inch maximum; while this standard is intended for surfaces with openings such as grates, it can generally be applied to gaps between paving stones (ADA and Access Board)



- The clear width of accessible routes must be a minimum of 3 feet (ADA) or 4 feet (Access Board)
- Surfaces should be smooth, having minimal gaps, rough textures, and vibration-causing features (Access Board)

## Evaluating DUMBO’s Streetscape Elements

Whether the above guidelines can be met through historic streetscape materials depends largely on the properties of the historic unit pavers. While there are many variations in shape, size, and texture, Belgian blocks in New York City broadly seem to be of two basic types. The most common throughout the city are so-called “Manhattan standard” blocks, about 4 by 8 inches, dating from 1912 to 1938. The second type of block, first used in the 1870s, was longer, up to 14 inches, and less regular overall, with rounded tops and generally wider joints between blocks.<sup>18</sup> DUMBO has many of these older, more irregular stones. It is the rough-hewn texture of Belgian blocks, in their mixture of colors, that makes them an attractive pavement material, adding character and dimensionality to the streetscape (Figure 9).

However, the irregular profile of Belgian blocks makes them challenging for accessibility. Because of their undulating shape, they often exceed the 1/4-inch vertical surface discontinuity standard. In addition, because the blocks vary in profile, it is difficult to lay them tightly enough together in such a way that transitions between blocks avoid non-compliant height variations and gaps. Like most historic granite pavements, these blocks are also not slip-resistant, particularly when wet, posing hazards to pedestrians and bicyclists. Due to these properties, most of DUMBO’s Belgian blocks unfortunately cannot meet ADA standards for accessible routes.

It should be noted that Belgian blocks have in some cases been used or proposed for accessible routes in New York City. Generally, the later, “standard”-type blocks are more likely to conform with accessibility guidelines if they are properly installed. For example, in the Gansevoort Market Historic District (discussed in the Appendix), it may be possible to bring existing granite blocks into ADA compliance in certain circumstances, due to the flatter and more uniform properties of the blocks in the Gansevoort district.



Figure 9: DUMBO’s typical Belgian blocks



Figure 10: Harrison Street’s 2011 crosswalk reconstruction in Tribeca

Elsewhere, efforts to meet accessibility standards using historic Belgian blocks have not, in our view, succeeded. On Harrison Street in Tribeca, for example, Belgian blocks were used at a crosswalk at Hudson Street reconstructed in 2011, including an unusual design where blocks ramp up to the curb elevation (Figure 10). While this is a laudable effort to resolve accessibility challenges, the crossing appears not to comply with ADA and Access Board standards due to the gaps between blocks and the varying surface elevations.

Other cities have reached similar conclusions. Both the National Association of City Transportation Officials (NACTO) and the National Trust for Historic Preservation queried their respective networks for this report, seeking information about efforts to meet ADA standards within historic streetscapes. The responses returned no known instance of ADA compliance using historic paving materials in accessible routes. Instead, respondents indicated that ADA standards are being met with modern replacements for historic materials, whether wire-cut brick, sawn granite blocks, or tinted concrete. For example, Cambridge, Massachusetts is eliminating existing cobbles and bricks from crosswalks and streets over time. (In sidewalks, wire-cut bricks will be substituted for historic bricks.) Even within the Minneapolis Warehouse Historic District, for which a sensitive streetscape preservation plan has been developed (discussed in the Appendix), historic pavers are to be removed from the middle of nearly all intersections and from all crosswalks, to be replaced with concrete. Many other cities—including Boston; Portland, Oregon; Washington, D.C.; and Austin, Texas—are also eliminating historic paving materials from paths of pedestrian travel in the public right-of-way to meet accessibility standards.<sup>19</sup>

Beyond existing standards, federal guidelines are expected to become stricter in the future. Research sponsored by the Access Board has resulted in the development of a proposed roughness standard for paving surfaces. This standard, anticipated as part of future Access Board guidelines (and discussed further in the Recommendations), is intended to protect wheelchair users from harmful vibration levels that cause pain and discomfort. Given the irregular profile of DUMBO's existing Belgian blocks, they would be very unlikely to meet such a standard.

Our research suggests that to meet applicable standards, in most cases new paving surfaces will need to be used in accessi-



Figure 11: DUMBO's Phase One crosswalk design

ble routes in DUMBO such as crosswalks and the main travelways of sidewalks. While it is conceivable that accessibility might be achieved through the use of carefully selected and installed historic pavers, as proposed for parts of the Gansevoort district, we have not to date identified feasible strategies for doing so in DUMBO. This is an understandably disappointing conclusion to advocates who would like to see the maximum possible preservation of the district's existing Belgian block streetscapes.

If historic pavers cannot be used, the question becomes what alternative design treatments should be considered for crosswalks, sidewalks, and roadways in the historic district. In the sections below, we take a closer look at the paving materials used and/or proposed for DUMBO's street reconstruction project.

### Crosswalks

Crosswalks constitute the accessible routes across streets at each intersection, creating connections to sidewalks, plazas, and other accessible pathways. The crosswalk developed for Phase One of the DUMBO street reconstruction (Figure 11) was developed by



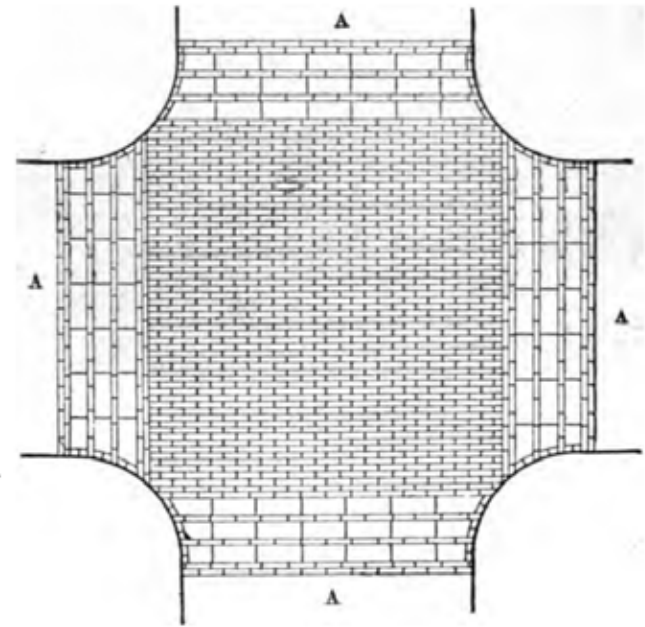


Figure 12: New York City's historic crosswalks (clockwise from top left): Water Street at Fulton Street, Brooklyn, in 1900; 86th Street overlooking the East River, Manhattan, in 1914; a typical 19th-century crosswalk treatment; Broadway at Park Row, Manhattan, in 1894.





*Figure 13: Remaining granite slabs in the DUMBO Historic District (from left): A crosswalk at Plymouth and Adams streets; rails cross a sidewalk at Plymouth Street and Anchorage Place; a three-banded sidewalk at Plymouth and Jay streets; a two-banded sidewalk on Plymouth near Jay Street.*



consulting landscape architects Johansson & Walcavage. Drawing on historic research, the firm created a design using large, rectangular granite pavers separated by rows of smaller granite blocks. Historic photographs (Figure 12) show that this type of crosswalk was used extensively throughout New York City in the 19th and early 20th centuries, including in DUMBO. Indeed, in certain places within the historic district, granite slabs of this type are still extant, notably at intersections along Plymouth Street and within the sidewalk zone on Plymouth and Jay streets (Figure 13).

The typical granite paver crosswalks installed in Phase One of the DUMBO street reconstruction project and also proposed for the present project phases are 11 feet wide. They include four bands of 2 foot x 3 foot x 5 inch deep granite slabs, with a textured surface to provide ADA-compliant slip resistance. Each band of slabs in the crosswalk design is separated by a course of historic granite blocks, with a new, 6-inch-wide granite block header course along the crosswalk's outer edges. LPC has approved this design, and it has become the city's standard crosswalk treatment for use in historic districts, referenced in NYCDOT's *Street Design Manual* (2015).<sup>20</sup>

The design reflects years of experimentation with unit granite block paving in vehicular areas. In particular, NYCDOT analyzed failed granite paver crosswalks in the SoHo-Cast Iron Historic District, where Belgian block streets were reconstructed in the 1980s and 1990s (in some cases using federal highway funds left over from the city's abandoned Westway project). Crosswalks and roadbeds installed in this SoHo project have experienced a range of problems, including unacceptable cracking and movement of larger granite slabs and blocks. Today, the area between Grand and Broome streets is effectively a museum of varying crosswalk treatments (Figure 14), some more successful than others. It is this condition of ad-hoc design approaches and maintenance problems that NYCDOT has sought to remedy with the development of a single new historic crosswalk standard that can be implemented and successfully maintained citywide.

Neighborhood advocates have suggested that less distinctive crosswalk treatments would better harmonize with DUMBO's historic streetscapes. Clearly, the new crosswalks substantially alter the Belgian block fabric, particularly at intersections with irregular geometry, such as at Water and Main streets (Figure 15). It should



Figure 14: Contrasting SoHo crosswalk treatments



Figure 15: Irregular crosswalk geometry at Water and Main streets

also be noted that the absence of crosswalk markings has in some cases been advanced as a traffic-calming measure, lending some merit to the idea that even when using new, ADA-compliant materials, visually subdued crosswalks might be preferred to more seamlessly blend into the historic fabric.<sup>21</sup>

Questions have also been raised about whether crosswalks in DUMBO could be narrower to reduce their visual impact. NACTO's *Urban Street Design Guide* (2013) calls for the crosswalk to be as wide as or wider than the walkway it connects to.<sup>22</sup> Many cities follow a similar guideline, intended in part to allow space within the crosswalk for passing pedestrians. Boston, for example, calls for crosswalks to be at least 10 feet wide, or the width of the approaching sidewalk if it is greater.<sup>23</sup> In DUMBO, sidewalks connecting to the new granite paver crosswalks, such as those at Washington and Front streets, are typically about 13 feet wide, making the 11-foot width appear within a reasonable range. NYCDOT has also made efforts to tailor crosswalk width to the streetscape context: the agency's current proposed design for DUMBO calls for the use of narrower crosswalks where adjoining sidewalks are narrower, using three bands of granite slabs instead of four.

Overall, any strategies to reduce the visibility of crosswalks would conflict with current initiatives to install higher visibility crosswalks. The trend in New York City and other urban centers such as Seattle and Boston is toward higher-visibility crosswalk markings in areas with high pedestrian activity. As part of New York City's Vision Zero initiative to enhance pedestrian safety, adding high-visibility crosswalks to clarify where pedestrians are crossing is an element of safer street design that has helped reduce crashes with injuries.<sup>24</sup> NACTO also recommends high-visibility crosswalk markings due to their tendency to improve motorist-yielding behavior.<sup>25</sup>

In our view, the granite paver crosswalk design used in DUMBO and approved within NYCDOT's *Street Design Manual* as a "distinctive" crosswalk treatment for historic districts citywide appears to achieve a compromise between historic sensitivity, accessibility, maintainability, and contemporary transportation practice, which prioritizes pedestrian safety.



Figure 16: A surviving Belgian block sidewalk on Water Street

### Sidewalks

DUMBO's streetscapes are marked by varying and highly unusual sidewalk conditions. While many sidewalks along the district's most prominent streets have been constructed of concrete, others retain what was likely their original configuration. In some cases, there are no sidewalks at all, with the Belgian block roadbed spanning all the way to the building line. In other places, as the DUMBO designation report notes, Belgian blocks are used for sidewalk paving, a detail not known to appear in any other New York City neighborhood (Figure 16).<sup>26</sup> Still other locations feature a mixture of Belgian blocks with granite and bluestone slabs. Finally, certain sidewalks are crossed by the district's rail line network, which made its way into factory buildings.

ADA standards call for sidewalks in the public right-of-way to provide an accessible route with a minimum clear width of 3 feet. (The Access Board recommends 4 feet.) As discussed above, this portion of the sidewalk must use ADA-compliant pavement materials such as saw-cut granite blocks with a thermal finish; tinted concrete; or other types of accessible unit pavers.



For wider sidewalks, however, the accessible route may not necessarily need to encompass the entire sidewalk width. A distinction is often made between the clear travel path and the furnishing zone of sidewalks. The furnishing zone is the area closest to the curb, which may contain streetscape elements such as plantings, seating, bicycle parking, or decorative treatments. It is possible that historic Belgian block could be used in the furnishing zone of sidewalks in DUMBO, provided that there is sufficient width to create both an accessible route and a furnishing zone. As noted in the Recommendations, however, we stress that the historic pavement condition should be modified as minimally as possible to accommodate the accessible route.

At the time of this writing, NYCDOT, DDC, and LPC were still in dialogue regarding the use of Belgian block in sidewalks. Where sections of DUMBO currently have Belgian block or granite slab sidewalks, according to DDC, NYCDOT is proposing to replace the historic stone with a 5-foot-wide strip of concrete sidewalk, with the furnishing zone given a decorative treatment.

For sections of DUMBO that do not have sidewalks, we encourage the preservation of this unique industrial streetscape to the greatest extent feasible while providing ADA-compliant routes. While the existing Belgian block must generally be replaced with ADA-compliant paving materials within such routes, areas outside of the accessible route could still retain their original historic materials. As noted above, these few streetscape sections are among the rarest remnants of the district's industrial past. Resolving the accessibility challenges for these areas requires carefully detailed design treatments, specific to each block and building, to preserve their special character and historic materials wherever possible.

### **Rail Tracks**

A major feature of DUMBO's streetscape is the system of historic rail tracks known as the Jay Street Connecting Railroad. Built to transport rail cars from East River barges to the area's factories, the railroad carried raw materials and finished goods throughout the district, and in some cases extended into individual buildings (Figures 17 & 18). The tracks' entry into buildings was possible in part because portions of the neighborhood did not have sidewalks, allowing at-grade access to factory floors.



*Figure 17: Rail tracks entering a building on Plymouth Street*



*Figure 18: An attempt at ADA-compliant tracks at 37 Bridge Street*

Inset into the Belgian block paving, the remnants of this rail network are among the most significant and character-defining elements of DUMBO's industrial heritage. Like the High Line in Manhattan, these tracks tell a remarkable story about the district's industrial history and contribute to its unique sense of place. There is widespread agreement within the neighborhood and New York's broader preservation community that they should be preserved wherever possible.

Where they cross accessible routes, these rail tracks pose significant challenges to ADA compliance, due to variations in vertical dimensions as compared to adjacent pavements and variations in horizontal dimensions due to their flangeways—the openings parallel to each rail that permitted the passage of wheel flanges. In addition, the rails are not considered slip-resistant. Because sidewalks are city-owned but generally maintained by the adjacent property owner, NYCDOT has also raised concerns that rails are not considered a pavement, and therefore would not fall under typical agreements requiring owners to maintain sidewalks.

At the time of this writing, according to NYCDOT, all rail tracks will be removed from crosswalks and intersections. (Sidewalks were still under design review.) In the Pearl Street Triangle plaza area, NYCDOT has proposed to replace historic tracks with new tracks that do not have flanges, so as to eliminate the tripping hazard. The tracks would be retained in roadbeds, but flangeways would be filled with asphalt.

In spite of the challenges, it would be feasible to design treatments of rails and adjacent pavements that could meet ADA requirements. Indeed, the 2010 ADA standards permit flangeways of up to 2-1/2 inches at rail track crossings when necessary for the operation of trains across accessible routes.<sup>27</sup> While it is not clear whether this exception would apply to inactive rail tracks, such an allowance should certainly be explored. Because existing conditions in locations where historic tracks and contemporary accessible routes intersect are so varied, design solutions must be adapted to each unique situation. A “toolkit” of available options might include partially filling flangeways to within 1/4 inch of the rail, so that the historic flangeway is still identifiable while meeting the ADA standard limiting change in vertical height.

## **Roadbeds**

As the 2007 DUMBO designation report notes, the “extraordinary amount of original street paving” contributes significantly to the district's special industrial character.<sup>28</sup> Indeed, as discussed above, the roadbeds of DUMBO offer one of the most direct and tangible links to the district's past as a manufacturing center.

The existing Belgian block pavements should be retained and rehabilitated in roadbeds, where there is no requirement for accessible pedestrian routes (excepting crosswalks). Clearly, this effort requires financial and technical resources. Belgian block pavements are considerably more expensive and time-consuming to construct. They require specially trained crews, as well as resource-intensive salvage and storage operations during the reconstruction process. For example, care must be taken when salvaging roadbed materials for reuse. The City of Minneapolis has estimated that a minimum of 30% to 40% paver loss can be expected due to the removal process.<sup>29</sup> A successful rehabilitation project therefore depends on the availability of an adequate amount of salvaged paving materials from DUMBO or elsewhere in the city. In addition, adequate storage and transportation of salvaged pavers must be provided, including a system for identifying the original location of pavers, palletization when moving pavers to another site, and a secure and protected storage facility.

In our opinion, Belgian block roadbeds should be restored even where they are currently covered by asphalt. In certain sections of DUMBO—as in other historic districts in New York City—asphalt pavement has been partially or completely applied over the Belgian block fabric to provide a more uniform road surface or to patch previous utility work. NYCDOT policy should provide for Belgian block roadbeds covered by asphalt in whole or in part to be restored or reconstructed. While careful planning is needed to coordinate such reconstruction with other streetscape projects, the underlying Belgian blocks should be removed, cleaned, reset, and revealed.

As Phase One of the DUMBO reconstruction project showed, the results are worth the effort. Portions of the Water Street roadbed, where Belgian blocks were reset, have generally held up well and show that long-neglected historic pavements can once again contribute to the district's special sense of place.





Figure 19: Phase One intersection with new thermal finish pavers at Front and Washington streets

### Intersections

A related concern regarding DUMBO’s Belgian block streetscapes is the “box” in the center of intersections between crosswalks. As noted above, in the Phase One street reconstruction project, historic Belgian blocks were removed from this area at certain intersections, and replaced with new thermal finish granite pavers (Figure 19). The rationale for this design decision is not entirely clear, since the center of the intersection is not an accessible route. It can be speculated that filling the intersection with thermal finish pavers is considered preferable to carving up the center of the intersection with a jumble of materials where bikeways cross, particularly where two-way streets with bike lanes intersect. Other Phase One intersections were reconstructed with the existing Belgian blocks in a more historically sensitive treatment (Figure 20).

For the current project phases, according to DDC, NYCDOT’s proposed treatment for the interior of intersections is to replace the historic Belgian block with new thermal finish granite pavers as in Phase One, but with a dark gray color similar to the granite cross-



Figure 20: Alternate Phase One treatment retaining historic Belgian blocks within the intersection at Water and Main streets

walk slabs. We believe that closer examination of this treatment is advisable. All opportunities to retain the historic Belgian block in the center of these intersections should be considered to preserve as much historic fabric as possible. In addition, as recommended below, this issue should be discussed as part of an evaluation of citywide policy for historic streetscapes.

### Bicycle Infrastructure

Among the most debated elements of the DUMBO street reconstruction project has been the insertion of new bicycle infrastructure into the existing Belgian block roadbed. On the one hand, city agencies and bicycle advocates have called for a rideable surface on DUMBO’s historic streets, while others have questioned whether the resulting disruption to the historic roadbed fabric was warranted.

This contemporary debate over the need for smooth-surfaced bicycle lanes is by no means new. In 1895, *The New York Times* noted that asphalt bicycle lanes were needed along the city’s “rough and unyielding” granite pavements so that travel might be made



Figure 21: Phase One bikeway detail on Water Street

“easy and safe for the countless riders of the bicycle.”<sup>30</sup>

A compromise solution in Phase One was to use historic Belgian block pavers for the bikeway along Water Street, but to orient the blocks parallel to the curb, running in the direction of bicycle travel (Figure 21). As noted earlier, this solution altered the historic roadbed configuration but did not appear to improve rideability.

For subsequent project phases, NYCDOT has developed a new bikeway design using 2 1/2-foot-wide, 6-inch-thick granite slabs with a thermal finish, separated from the existing Belgian block roadbed by a granite header course (Figure 22). This detail was selected to provide a smooth riding surface and visually distinguish its modern surface from historic paving materials. Such a bikeway would appear to comport with NYCDOT’s *Street Design Manual*, which notes, “Provision must be made for a smooth cycling surface, regardless of whether or not the roadway is part of a designated bike route. DOT and DDC are finalizing a new specification for achieving rideability.”<sup>31</sup> To date, NYCDOT has not confirmed whether this new specification has been released.



Figure 22: A bikeway on Varick Street in Tribeca, similar to the present proposed design for DUMBO’s street reconstruction project

While bikeways are not governed by ADA guidelines (unless they cross an accessible route), they raise similar issues concerning the provision of smooth riding surfaces as part of streetscapes that accommodate all modes of travel. To ensure the appropriate inclusion of such facilities within historic districts, we believe the development and implementation of bikeway designs should be given full public consideration as part of district-wide streetscape planning initiatives (recommended below).

### Utility Repairs

Of all the threats to New York City’s historic Belgian block pavement, routine utility repairs are among the most damaging and discouraging. We note that the challenges of preventing undue harm from utility contractors have long troubled the city. One evocative complaint well describes the problem: An 1887 news article noted that the city’s Department of Public Works “cannot keep a sharp enough lookout on all the people who are authorized under the present system to disturb the pavements after they are laid.”





Figure 23: Asphalt patch and poorly reset Belgian blocks due to utility work in the roadbed

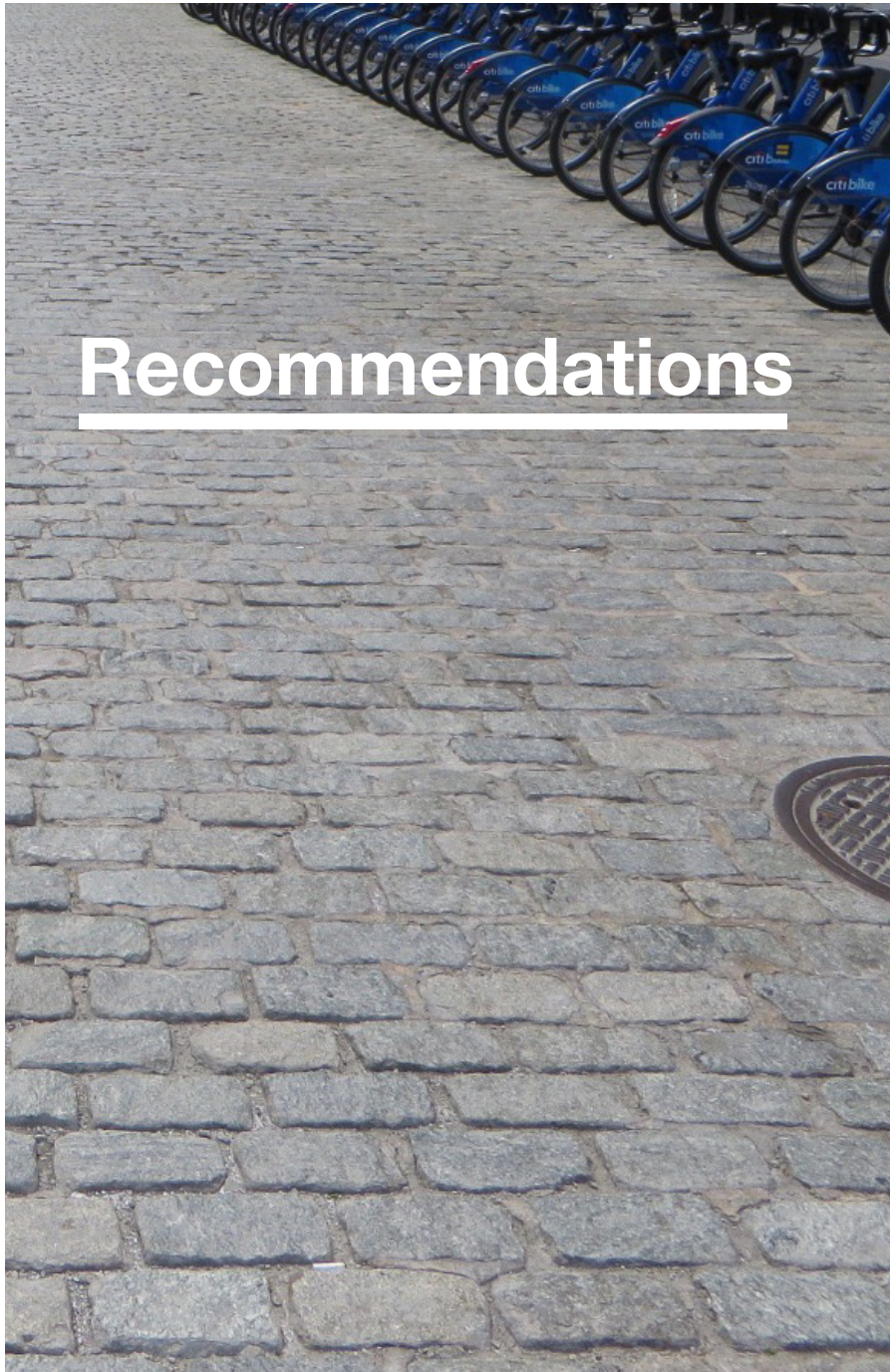
*The gas companies and the steam-heating companies and the horse-car companies and the plumbers and all the other corporations and persons that tear up the streets at their own will and pleasure, are under no practical compulsion to relay the pavements.... The result is that no pavement laid in this city has any chance of subsisting for what may be called its natural life.<sup>32</sup>*

This description is almost entirely apt today. Abundant poorly patched or asphalt-covered utility cuts mar the DUMBO Historic District (Figure 23). In some cases a trencher appears to have been used to cut a line directly through roadbed blocks, a practice that should not be permitted due to the resulting unnecessary damage to the streetscape's historic fabric.

The Rules of the City of New York call for any third party excavating Belgian block in a historic district to restore the paving material in kind. NYCDOT's compliance division, the Highway Inspection and Quality Assurance unit, is responsible for enforcing provisions governing utility work in historic districts. As in the 19th

century, excavations may be made by any number of private utilities, and today also by the city's own Department of Environmental Protection, which has jurisdiction over water and sewer utilities.

Citizens are encouraged to report utility compliance issues to 311. However, DUMBO residents have stated that previous calls to 311 have not been effective, and now as then, the streets reveal a lack of "practical compulsion to relay the pavements." Residents also report that when excavations have occurred for utility repairs, historic materials have been removed and not replaced in kind. There seems to be no agreed-upon and enforced mechanism to require authentic materials to be stockpiled and reinstalled in their original locations or even within the district. Stricter enforcement of regulations requiring the restoration of existing materials in historic districts is clearly needed.



# Recommendations

## 1.

### **Develop Historic Streetscape Design Guidelines to bring state-of-the-art preservation practices to New York City's streets.**

New York City needs a comprehensive approach to historic streetscape design. We recommend the development of Historic Streetscape Design Guidelines that would bring clarity and predictability to interventions in historic streets, which have often been designed and implemented on a case-by-case basis.

The *Street Design Manual* already adopted by NYCDOT outlines street design guidelines, policies, and processes intended to create world-class streets. This document commits NYCDOT to achieving maximum inclusivity and the highest possible aesthetic standards. While it includes some guidance for historic districts—covering the above-discussed granite paver crosswalk as well as granite block in roadways—it does not provide a holistic approach to addressing the special design considerations and contexts of historic streets.

Whether as a new section of the *Street Design Manual* or a standalone document, streetscape design guidelines would offer a blueprint for the preservation of the remaining historic paving

Figure 24: Citi Bike infrastructure on a restored Tribeca streetscape



materials and other infrastructure within historic streetscapes—street surfaces, curbs, sidewalks, street lights, traffic signals, and other elements. The plan would map areas of Belgian block and other special streetscape materials, offering a citywide inventory and perspective on the needs and priorities of historic neighborhoods.

Paramount among the guidelines should be the reuse of original, historic materials wherever possible. While NYCDOT has committed to this principle—stating that the agency supports the use of historic Belgian block, while also meeting legal and ethical obligations to provide accessible routes—historic design guidelines would provide explicit pathways for this to be achieved. They would also provide detailed design standards and best practices for the preservation of historic street materials, with lessons gathered from around the city and the world. For example, the guidelines should detail principles for the selection of materials when original materials cannot be retained, such as the use of high-quality, color-matched stone.

These guidelines should be developed through multi-agency collaboration including NYCDOT, DDC, LPC, PDC, and other relevant agencies, with input from City Council members and a technical advisory committee including neighborhood stakeholders and other preservation and accessibility experts. Having a consensus-based set of principles and standards that can be applied citywide would benefit both agencies and stakeholders in preserving New York’s sense of place.

A starting point for such a document already exists. In the mid-1990s, LPC developed a set of *Proposed Design Guidelines and Rules for Projects Affecting Public Rights-of-Way in Historic Districts*. These guidelines were approved by PDC and NYCDOT, but were not formally adopted. The result of several years of work among agencies and stakeholder groups, the guidelines assert that streetbeds, sidewalks, and other public spaces are integral to the aesthetic character of historic districts. The document’s principles and recommendations, which prioritize the retention and restoration of original or historic materials, should be consulted for valuable insights as new guidelines are developed.

## 2.

### **Create a DUMBO Streetscape Preservation Plan.**

Since 2009, DUMBO has become a testing ground for historic streetscape design, with different approaches, regulatory frameworks, and creative visions applied to different parts of the historic district. This has not served the community well, and has negatively impacted DUMBO’s historic integrity.

To fully preserve and protect its irreplaceable historic fabric, DUMBO needs a comprehensive planning document. In addition to the above-recommended citywide design guidelines, a detailed, block-by-block streetscape preservation plan should be developed for DUMBO, and indeed for each historic district in New York City. Such a plan would apply the Historic Streetscape Design Guidelines to the specific context of each district, resolving at a fine grain strategies for the preservation of significant streetscape elements.

These preservation plans would tailor design solutions to the highly nuanced conditions found among historic districts. For example, the Belgian block in DUMBO varies from street to street, with often distinctive differences in size, shape, color, and orientation. To preserve these special qualities, when blocks are removed, their locations should be noted so that they can be replaced as closely as possible to their original position.

A DUMBO Streetscape Preservation Plan should also reflect appropriate coordination with citywide and district planning initiatives. Those include the Brooklyn Waterfront Greenway, whose 14-mile route for cyclists and pedestrians passes through the area (westbound on York Street and eastbound on Front Street); the Brooklyn Queens Connector streetcar line, currently under study; and designated NYCDOT bicycle routes. Neighborhood advocates have noted that DUMBO would benefit from a transportation master plan to better analyze community priorities as new bicycle and pedestrian infrastructure is created. Such a plan would be especially helpful in the coordination of streetscape preservation initiatives.



Figure 25: Typical Belgian block conditions in New York City (clockwise from top left): Plymouth Street, DUMBO; West 13th Street, Gansevoort Market Historic District; Wooster Street, SoHo; Water Street, DUMBO; Vestry Street, Tribeca; Perry Street, Greenwich Village.



### 3.

#### **Establish a Historic Streets Maintenance Plan and dedicate separate funds to its implementation.**

A look at the Belgian block streets of DUMBO, SoHo, or Greenwich Village reveals streetscapes in urgent need of repair (Figure 25). Not only do these streets require routine maintenance to protect their historic elements from degradation, but the proper care and upkeep of unit pavement and other historic street features is essential for keeping them accessible to all.

As recommended as part of the Minneapolis *Warehouse District Heritage Street Plan*, a Historic Streets Maintenance Plan would provide for the regular and periodic maintenance of historic streets, which have special maintenance needs. Paving experts recommend that unit pavements such as brick or Belgian block be inspected and maintained on at least an annual basis.

To do this requires both human and capital resources. A maintenance plan would help strengthen NYCDOT's internal capacity to manage and maintain historic streetscapes. While the agency does devote a special work crew to maintaining the city's Belgian block, a maintenance plan would ensure that private contractors working in historic streets have the appropriate technical training and skills. And it would creatively seek out diverse funding sources that could contribute to streetscape maintenance and restoration. For example, New York City has in the past restored Belgian block streets using federal highway funds. Other sources suggested for Minneapolis include tax increment financing, tax abatements, special assessments, state transportation revolving loan funds, state historic preservation grants, utility revenues, stormwater grants, and local planning grants.

Maintenance planning should also be coordinated with capital project planning and design. For example, in the northeast climate, subject to freeze/thaw conditions, mortar-set joints will break down over time, particularly rapidly if there are severe winters. Indeed, mortar joints in sections of DUMBO's Phase One project have already shown significant degradation. While we have provided best practices regarding construction details in the Appendix, a thorough study should be undertaken of the optimal materials and design

details for paver installation. In particular, the use of mortar joints and setting beds should be examined and potential alternatives explored that might result in more durable Belgian block pavements with fewer maintenance needs. Designing historic streets to the best possible standards, and keeping them properly maintained, will help ensure their preservation for future generations.

### 4.

#### **Monitor utility work more closely to safeguard historic paving materials.**

Utility work significantly contributes to the degradation of New York City's Belgian block streets. While contractors working in historic districts are required to replace historic materials in kind, this rule has not been adequately observed or enforced, whether through lack of oversight or poorly implemented regulations.

Relevant city agencies, including NYCDOT and LPC, must hold utilities accountable for their work in historic districts by more closely monitoring each excavation project when cuts are made in the roadway. This accountability can be enhanced through more detailed design guidelines that specify approved methods for the excavation, salvage, and storage of Belgian block pavements, as well as construction details and procedures to be followed when excavating and resetting historic blocks.

### 5.

#### **Apply more rigorous methods of analysis to accessible routes.**

Current ADA standards are not defined to a high level of detail, leaving them open to competing interpretations. Different agencies routinely disagree about the correct way to measure pavement properties. This lack of specific guidance in federal rulemaking has made it challenging for agencies, design professionals, and the public to evaluate when and how accessibility standards should be

applied. For instance, of specific concern for this study is the interpretation of trip hazards in paving surfaces. While the rule providing for a 1/4-inch maximum vertical height deviation in a paving surface is clear, in practice, measuring the deviation or roughness of uneven surfaces such as Belgian blocks is not an exact science, leading to uncertainty in evaluating the compliance of historic materials.

More sophisticated methods of analysis are needed to provide better data about pavement surfaces. Such methods, using new digital technologies, are already available. For example, more than a decade of research conducted by the University of Pittsburgh's Human Engineering Research Laboratories has resulted in the development of a set of data collection tools to measure pavement characteristics. Using a mobile device known as PathMeT, mounted with high-resolution instruments, the team can quantitatively compute pathway characteristics such as roughness, level changes, slope, and width.

The results of this research have been surprising, particularly with regard to roughness. For instance, in a 2007 study, unit paving materials such as concrete paving blocks produced less vibration for wheelchair users than standard poured concrete, suggesting that surfaces other than poured concrete should be considered for pedestrian access routes.<sup>33</sup>

The research has led to the creation of a Wheelchair Pathway Roughness Index, defined in a recently published ASTM standard for evaluating surface roughness.<sup>34</sup> By measuring vertical surface deviations over a unit of distance traveled, the standard is expected to set maximum roughness levels for accessible routes, with the aim of minimizing health risks from vibration exposure. The research team has proposed that under 50 mm of vertical deviation per meter of distance traveled would be optimal; between 50 and 100 mm would be marginal; and above 100 mm would be unacceptable.

In addition to high-resolution surface analysis, the PathMeT technology can be combined with a suite of tools allowing users to input photographs of dangerous conditions, and generate "heat maps" displaying pavement conditions across a city.<sup>35</sup> We recommend that NYCDOT and other agencies deploy this type of technology or similar assessment tools to better evaluate ADA compliance and prioritize streetscape improvements.

## 6.

### **Ensure streetscape designs are appropriately reviewed.**

As with all of New York's historic assets, alterations to streetscapes must be reviewed by appropriate agencies and the community. As discussed above, current practice is to designate the Landmarks Preservation Commission as the review agency within historic districts, instead of requiring tandem reviews by LPC and PDC, the entity that would otherwise review projects on public property, including roadbeds and sidewalks.

We believe two aspects of the historic streetscape review process could be improved in ways that would benefit the end products of street reconstruction projects.

First, designs for New York City's historic streetscapes should be reviewed by a panel of professionals who have appropriate training to assess the historic, aesthetic, and technical aspects of a project. LPC is required under the New York City Charter to include among its eleven commission members at least three architects, one historian, one city planner or landscape architect, and one realtor. Because either a city planner or a landscape architect must be on the Commission at any given time, but not necessarily both, LPC review does not always provide the valuable expertise of both professions, which have different emphases in their training and skill sets. We recommend that the Charter be amended to require that composition of the LPC should include both a city planner and a landscape architect.

Second, proposed alterations to streetscapes in historic districts are in some cases reviewed by the full Landmarks Preservation Commission, and in other cases handled by LPC at staff level. In the latter cases, there is little opportunity for public review. We believe that a mechanism is needed that would allow for appropriate public consideration of streetscape designs within historic districts regardless of whether they are reviewed at Commission or staff level. Such a mechanism would ensure that proposed designs for these historic resources, which have such a significant impact on a community's character, receive due public scrutiny.



# 7.

## **Establish New York City as a leader in accessible, preservation-minded placemaking.**

The above recommendations, we believe, will help make New York City a leader in accessible urban design. Belgian block streets are but one example of the many challenges facing the city as it works to build 21st-century urban infrastructure that equitably serves all. By working to better preserve the historic assets that contribute so powerfully to New York’s character and soul, the city can turn accessibility challenges into opportunities that showcase innovation and pioneer sensitive placemaking strategies.

Above all, through a strong emphasis on consultation with the public and the broad preservation community, the steps outlined in this report will provide common ground among the many different stakeholders of New York City’s streets—city agencies, community groups, preservation advocates, bicycle riders, and local residents and businesses. Putting people first in the design process is a good way to ensure our historic streets are built to last.



APPENDIX

# Historic Pavement Best Practices

**The following sections highlight what we have found to be among the most successful strategies for achieving ADA compliance for pavement in historic contexts.**

Please note that all construction details summarized here, if used elsewhere, should be evaluated for appropriateness within local contexts and climate conditions.

## **9TH AVENUE/GANSEVOORT AREA ROADWAY RECONSTRUCTION**

New York City's 9th Avenue/Gansevoort Area Roadway Reconstruction, in the final stages of design as of this writing, overlaps with the boundaries of the Gansevoort Market Historic District. Because of its location partially within the historic district, the Landmarks Preservation Commission has jurisdiction over review for appropriateness, and has approved the project's streetscape design.

The Gansevoort project makes a commendable effort to reuse historic Belgian blocks within accessible routes. According to the project's landscape architect, Ken Smith Workshop, a system has

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*Figure 26: Accessible pavers for Central Park's perimeter*



been devised whereby existing Belgian blocks within the project area are intended to be salvaged, sorted, and graded for reuse according to their dimensions and quality. Rougher Belgian blocks graded as “standard” will be reset in roadways. Smoother blocks graded as “select” will be reset in existing pedestrian areas, and only the smoothest “select prime” blocks will be reset in accessible routes requiring ADA compliance.

The highest quality blocks are intended for certain parts of accessible routes in “amenity zones,” or plaza-like areas of the broad streets that connect ADA-compliant crosswalks to concrete sidewalks. Crosswalks themselves will use the new granite paver design formalized in NYCDOT’s *Street Design Manual* (the same used in Phase One of DUMBO’s street reconstruction).

The Gansevoort salvage method has been possible due to the relatively flatter, more rectangular, and more uniform dimensions of the blocks in this district, which permit a tighter joint and less vertical variation than is achievable with the more domed and irregular blocks in DUMBO.

While enough ADA-complaint Belgian blocks are thought to be available for the designated areas, this method remains to be tested in the field, and it is not clear whether sufficient quantities of accessible-grade block will be successfully salvaged. (The design team has assumed that some blocks, an estimated 17% to 20%, will not be reusable.) In addition, mockups will be constructed to confirm ADA compliance. Should the historic block fail to meet ADA standards, new granite blocks will be substituted (Figure 27).

The detail used for both new or salvaged pavers is as follows:

- 4-1/4 inch x 10 inch x 6 inch deep granite pavers
- 1 inch mortar setting bed
- joints between pavers filled with a dry mortar mixture
- 12 inch concrete subslab
- compacted, crushed aggregate base

The Gansevoort district’s strategy of careful grading and reuse offers a promising approach that could potentially be employed in other historic districts. However, reuse of any blocks within accessible routes is contingent upon finding sufficient quantities that meet the tight ADA smoothness tolerances.



Figure 27: A historic Belgian block from the Gansevoort Market reconstruction project (left), with new, accessible alternatives.

## CENTRAL PARK PERIMETER ACCESSIBLE ROUTES

To provide accessibility at bus stop and seating areas around the Central Park perimeter, the Central Park Conservancy has undertaken to bring pavements in certain areas up to ADA standards. Focusing on sections of Fifth Avenue and Central Park West, the Conservancy has replaced historic Belgian block with new, ADA-compliant granite block in a size and color that corresponds as closely as possible to the historic material (Figures 28 & 29).

The Conservancy selected a type of paver supplied by Cold-spring known as Tumblestone that is created by tumbling pavers against one another to give them a rounded and worn appearance, intended to replicate European stone streets (see Figure 26). The blocks are treated with a thermal finish to provide slip-resistance. A 3/4-inch mortar joint between pavers is recommended to accommodate variation in paver dimensions, but mortar is brought close to the top surface of the blocks to ensure transitions between blocks remain within the ADA-required 1/4 inch. In addition, a mortar setting bed is recommended to help level the blocks vertically.

The installation detail is straightforward:

- 4 inch x 13 inch x 3 inch deep thermal granite pavers
- 3/4-inch-wide mortar joints between pavers,



Figure 28: Central Park's newly accessible seating area on Fifth Avenue



Figure 29: An adjacent bus stop with the Tumblestone pavers

- mortared to within 1/4 inch of the finished grade of the stone
- 1 inch mortar setting bed
- 5 inch reinforced concrete subslab

Note that this detail is not designed for vehicular traffic loads.

## ACCESSIBLE CLAY BRICK PAVEMENTS

Cities with historic brick pavements—Boston, Cambridge, and Bethesda, to name a few—have confronted similar challenges in creating accessible routes. The experiences of brick-industry professionals in developing ADA-compliant pavements offer insights for New York's Belgian block streetscapes.

Many experts believe that historic clay bricks, like Belgian blocks, are not able to meet ADA standards due to their variable dimensions and unacceptable roughness. However, professionally installed, wire-cut brick is widely considered ADA-compliant.<sup>36</sup> To this end, the Brick Industry of America (BIA) has outlined guidelines in a technical note governing accessibility in clay brick pavements.<sup>37</sup> In these guidelines, a key concept is to minimize joint and chamfer widths in unit pavers to control vibration experienced by wheeled devices. For example, the guidelines emphasize selecting pavers that have top surfaces and edges that are planar. To decrease roughness, pavers should have little space between them, have minimal bevel to their edges, and be oriented lengthwise along the path of travel.

These recommendations have relevance for Belgian block as well, in that they discuss recommended tolerances for variations from level over a larger distance, a subject where ADA guidelines lack specific guidance. In particular, the BIA calls for pavements to be constructed within the following tolerances:

- $\pm 3/8$  inch from level over 10 feet, noncumulative
- 1/8 inch maximum vertical lippage (or height variation between pavers) for straight-edged pavers; 1/4 inch maximum vertical lippage for chamfered pavers
- between 1/16 and 3/16 inch width of sand-filled joints
- 1/2 inch maximum width of mortar-filled joints



The BIA also recommends that pavements should be inspected and maintained on a regular basis, but not less than once a year, pointing to the essential role of maintenance in creating and preserving accessible streetscapes.

## THE BETHESDA STREETSCAPE STANDARDS

Other brick-related paving standards can inform the proper construction of granite-block streetscapes. Among the most widely referenced of these are the Bethesda Streetscape Standards, published by the Maryland National Capital Park and Planning Commission.<sup>38</sup> Seeking to create a consistent streetscape treatment of brick pavement within Bethesda's central district, these standards are considered among the best-informed technical guidelines for the use of unit paving materials.

The Bethesda standard calls for the use of new brick pavers (the "Garden Blend" color palette from Pennsylvania-based Watsontown Brick Company) installed to the following specification for areas such as crosswalks that are subject to vehicular travel:

- 4 inch x 8 inch x 2-1/4 inch deep brick pavers set in a herringbone pattern
- joints filled with one part Portland cement to three parts sand
- neoprene-modified asphalt adhesive under pavers
- 3/4 inch bituminous setting bed (7% asphalt cement and 93% fine aggregate)
- 8 inch structural concrete base with #4 rebar at 12 inches on center both ways
- gravel sub-base

While it would need to be adapted to local conditions in other places, this standard has reportedly been successful at weathering freeze-thaw conditions, resisting displacement due to tree roots, and providing reasonable longevity in both vehicular and pedestrian applications.

## THE MINNEAPOLIS WAREHOUSE DISTRICT PLAN

The City of Minneapolis *Warehouse District Heritage Street Plan* (2011) is a rare best-practices model presenting a framework for the preservation, rehabilitation, and reconstruction of historic streets and industrial infrastructure within a historic district.

Much like DUMBO, the Minneapolis Warehouse Historic District has evolved from a commercial and industrial hub of rail yards, warehouses, and factories to a mixed-use district with a growing residential population. And as in DUMBO, the result has been a conflict between the need to create an accessible public right-of-way and the desire to maintain character-defining historic infrastructure.

Developed through a collaborative planning process, the *Warehouse District Heritage Street Plan*, which is now the guiding document for the development of street repair and improvement projects within the district, established that brick, stone, and granite pavers are among the most important features contributing to the district's significance and integrity: "It is critical to preserve the historic infrastructure that exists within the District because it conveys a story, connects us to the past, and reinforces the urban character and quality of life that so many residents choose to call home."<sup>39</sup>

The plan then sets forth a series of recommendations for all "heritage" streets, as well as a detailed, street-by-street analysis offering design recommendations for each street's specific context. To a large extent, the district's brick-paved streets are to be preserved under the plan. The guidelines call for avoiding the use of new bricks within heritage streets and avoiding mixing new unit pavers with any historic bricks. Consequently, prior to the reconstruction of streets, verification of brick quantities must occur to ensure that sufficient quantities are available from existing materials. The plan also includes recommendations for paver removal and cleaning; salvage and storage methods; and snow removal on historic pavements.

On the other hand, to provide ADA-compliant accessible routes, the plan calls for historic pavers to be removed from all crosswalks and from the middle of nearly all intersections. Concrete is to be used in such locations, with ADA-compliant pedestrian ramps.

In addition to implementation recommendations, the Warehouse

District document includes a prioritization plan based on factors such as existing infrastructure and materials conditions, accessibility issues, and historic significance; a phasing plan, taking into account public projects and neighborhood redevelopment opportunities; estimates of capital project and maintenance costs; and potential funding sources.

On the technical side, the Minneapolis plan prescribes an installation detail for brick streets that has reportedly been found to be simple to construct and cost-effective, permitting proper drainage and taking into account severe winter conditions. A similar aggregate base and sand setting bed is recommended for granite paving blocks:

- historic clay pavers
- sand setting bed, 1 inch maximum depth
- class 5 crushed aggregate base, 26 inch depth
- compacted subgrade

Interestingly, the first phase of the DUMBO street reconstruction was among the case studies to inform the *Warehouse District Heritage Street Plan*. The Minneapolis plan could come full circle and in turn inspire a more comprehensive, holistic, and preservation-friendly approach to conserving historic pavements in DUMBO and in other historically-rich districts in New York City.



## REFERENCES

1. While it has often been reported that Belgian blocks were imported to New York as ship ballast, we have not found primary evidence to confirm this practice.
2. *Proposed Design Guidelines and Rules for Projects Affecting Public Rights-of-Way in Historic Districts*, New York City Landmarks Preservation Commission, Revised Draft, June 1993, p. 1. See also George W. Tillson, *Street Pavements and Paving Materials* (New York: John Wiley & Sons, 1901), p. 180.
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7. *Street Pavements and Paving Materials*, p. 10.
8. "Department of Public Works," *The City Record*, p. 768.
9. Mark Treskon, "Excavating Cobblestones: Obsolescence and the Reinterpretation of Stones," paper prepared for the course "Objects, Consumption, Desire," New York University, Spring 2006, p 5. See also Quincy Adams Gillmore, *A Practical Treatise on Roads, Streets, and Pavements* (New York: Van Nostrand, 1876), p. 152.
10. "New York's Pavements," *The New York Times*, June 21, 1889, p. 4.
11. "Many Miles of Pavements: Some Facts Relating to the Streets of the Borough of Manhattan," *The New York Times*, December 25, 1898, p. 21.
12. *Proposed Design Guidelines*, p. 4.
13. "Smooth and Block Pavements," *The New York Times*, April 7, 1884, p. 4.
14. *DUMBO Historic District Designation Report*, New York City Landmarks Preservation Commission, December 18, 2007, p. 18.
15. Since DUMBO was not designated as a historic district until 2007, the 1988 design was not subject to Landmarks Preservation Commission review.
16. While this type of new granite paver is sometimes referred to as "laser-cut," lasers are not ordinarily used to cut granite blocks. Nearly all new granite pavers are mechanically split, or sawn with diamond blades that can achieve face dimension tolerances of  $\pm 1/16$  inch. Source: Randy Huber, Coldspring, personal communication, December 2, 2016.
17. Both sets of standards permit vertical discontinuities between 1/4 and 1/2 inch if such discontinuities are beveled with a slope not steeper than 50%. ADA requires the bevel only in the area between 1/4 and 1/2 inch, while Access Board guidelines require the bevel for the entire discontinuity up to 1/2 inch. This allowance for vertical discontinuities in an accessible route is intended for occasional expansion joints and objects such as utility covers and gratings. See Advisory R302.7.2, *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way*, United States Access Board, July 26, 2011, p. 77.
18. *Proposed Design Guidelines*, pp. 1-2.
19. NACTO correspondence with the authors, September 22, 2016.
20. *Street Design Manual*, New York City Department of Transportation, Second Updated Edition, 2015, p. 124.
21. See David Engwicht, *Mental Speed Bumps: The Smarter Way to Tame Traffic* (Annandale, Australia: Envirobook, 2005).
22. *Urban Street Design Guide*, National Association of City Transportation Officials, October 2013. See <http://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/conventional-crosswalks/>
23. *Boston Complete Streets Design Guidelines*, City of Boston, 2013, p. 172.
24. *Vision Zero Action Plan*, City of New York, 2014, p. 29.
25. See <http://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/conventional-crosswalks/>
26. *DUMBO Historic District Designation Report*, p. 18.
27. *2010 ADA Standards for Accessible Design*, U.S. Department of

- Justice, September 15, 2010, p. 218.
28. *DUMBO Historic District Designation Report*, p. 18.
  29. *Warehouse District Heritage Street Plan*, City of Minneapolis Community Planning & Economic Development, September 31, 2011, p. III-22.
  30. "To Asphalt City Streets," *The New York Times*, October 27, 1895, p. 21.
  31. *Street Design Manual*, p. 129.
  32. "Repairing Pavements," *The New York Times*, December 19, 1887, p. 4.
  33. See <http://www.rehab.research.va.gov/jour/07/44/4/Wolf.html>
  34. See <https://www.astm.org/Standards/E3028.htm>
  35. The PathMeT technology has been licensed to pathVu, a company that provides assessment services for pedestrian pathways and sidewalks. See <http://www.pathvu.com>.
  36. Elizabeth S. Padjen, "The Trouble with Brick," *Landscape Architecture Magazine*, June 2012. See <http://landscapearchitecturemagazine.org/2012/06/05/the-trouble-with-brick/>
  37. The Brick Industry Association, *Technical Notes on Brick Construction*, No. 14E, July 2012.
  38. *Bethesda Streetscape Plan Technical Manual*, The Maryland National Capital Park and Planning Commission, May 2007 Draft, pp. 3 and 13; see also *Bethesda Streetscape Plan Standards*, The Maryland National Capital Park and Planning Commission, Updated Plan, April 1992, pp. 6 and 29.
  39. *Warehouse District Heritage Street Plan*, p. II-9.

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*Figure 12, Bottom Right:* George W. Tillson, *Street Pavements and Paving Materials* (New York: John Wiley & Sons, 1901), p. 193