Street Design Manual

New York City
Department of Transportation

2015
Updated Second Edition

www.nyc.gov/dot

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Updates and addenda to the Street Design Manual will be posted on the Street Design Manual website at www.nyc.gov/streetdesignmanual
Readers may register on the website to receive updates by email.

RIGHT: *Flatiron Plazas, intersection of Broadway and Fifth Avenue, Manhattan*


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Foreword from the Commissioner

I am pleased to present this updated Second Edition of the New York City Street Design Manual, which has become an essential reference for agencies, designers, engineers, and consultants working on our City streets and public spaces. Since its original release in 2009 and its republishing in 2013, the way we think about and design streets has progressed. DOT is working hard to make New York more sustainable, through major efforts like the citywide transition to LED lighting and the expansion of planted areas on medians in our roadways. Superstorm Sandy reinforced the importance of a resilient transportation network, and DOT has been working with its partner agencies to implement best practices. And through both his Vision Zero initiative and emphasis on equity, Mayor de Blasio has focused on the need to make the City's streets safer and more accessible for all New Yorkers, regardless of neighborhood or ability. This update to the Second Edition reflects many of these changes in street design.

As the population grows, it has become increasingly evident that the way we design our streets determines how people interact in our City. When we build spaces that make people of all ability levels feel comfortable and encourage people not only to move through, but to stay, we create a more vibrant public realm, with safety, health and economic benefits for all. Since 2013, DOT has refined some of the treatments featured in the Second Edition of the Street Design Manual. For example, the design of the award-winning CityBench was changed to make it easier to use for older New Yorkers, and public space designs now take into consideration navigation by people with impaired vision.

The lessons from Superstorm Sandy are clear: our street network will impact how the City withstands the next major storm surge—and how quickly it bounces back once it passes. Consideration of resiliency must be integral to our planning process. We must plan for water levels twenty years from now, and build green infrastructure that can absorb and store storm runoff to ease the stress on our sewer systems. As resiliency design measures develop, the Street Design Manual will be a critical resource in bringing them together.

This update continues the Manual's record as a living document. By the time you read this, DOT, our partner agencies, and industry professionals will be working toward publishing a Third Edition of the Manual in 2017—building on the strengths of previous versions and bringing together the latest successes and standards into a playbook ready for a rapidly changing future.

Like our City, the Manual is continuously evolving to serve the needs of our many communities in smarter, stronger and more effective ways.

Polly Trottenberg
Commissioner

Preface

This Updated Second Edition of the *Street Design Manual* infuses the document with a new emphasis on two critical principles, universal design and resiliency, and transmits the latest findings and standards on a broad range of street design elements and processes. It is a digital re-release; pages with new information are noted on the DOT webpage for the *Manual* (**www.nyc.gov/html/dot/html/pedestrians/streetdesignmanual.shtml**), and can be substituted directly into existing copies. Where feasible, DOT recommends saving the paper and referring directly to the digital document.

The update includes new content, based on feedback from users and comprehensive inter- and intra-agency review. Highlights include:

- Expanded focus on considerations and design practices related to universal design principles in chapter introductions and design treatments
- Additional content on resiliency measures in capital project origination section, chapter introductions and design treatments
- Revised Lighting Chapter representing citywide shift to LED streetlights and the adoption of the BUG rating system
- Updated Landscape Chapter reflecting evolution in the city's stormwater management practices since 2013

The following agencies participated in the creation of the *Manual*'s Updated Second Edition: the Departments of Design and Construction (DDC), City Planning (DCP), Environmental Protection (DEP), Parks and Recreation (DPR), and Buildings (DOB), as well as the Economic Development Corporation (EDC), the Landmarks Preservation Commission (LPC), the Public Design Commission (PDC), and the Mayor's Office.

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DCA
New York City Department of Consumer Affairs

DCAS
New York City Department of Citywide Administrative Services

DCP
New York City Department of City Planning

DDC
New York City Department of Design and Construction

DEC
New York State Department of Environmental Conservation

DEP
New York City Department of Environmental Protection

DOB
New York City Department of Buildings

DOHMH
New York City Department of Health and Mental Hygiene

DoITT
New York City Department of Information Technology and Telecommunications

DOT / NYC DOT
New York City Department of Transportation

DPR
New York City Department of Parks and Recreation

DSNY
New York City Department of Sanitation

EDC
New York City Economic Development Corporation

FDNY
New York City Fire Department

FEMA
Federal Emergency Management Agency

FHWA
Federal Highway Administration

LPC
New York City Landmarks Preservation Commission

MOPD
Mayor's Office for People with Disabilities

MOS
Mayor's Office of Sustainability

MTA
Metropolitan Transportation Authority

NYCT
New York City Transit, an MTA agency

NYPD
New York City Police Department

NYS DOT
New York State Department of Transportation

OCPD
Mayor's Office of Capital Project Development

OMB
Mayor's Office of Management and Budget

ORR
Mayor's Office of Recovery and Resiliency

PDC
New York City Public Design Commission

SAPO
The Street Activity Permit Office within the New York City Office of Citywide Event Coordination and Management

SBS
New York City Department of Small Business Services

US ACE
US Army Corps of Engineers

US DOT
US Department of Transportation

Introduction


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Purpose

The *Street Design Manual* is New York City's comprehensive resource on street design guidelines, policies, and processes. It aggregates a broad range of resources—from nationally recognized engineering and design guidelines and standards to federal, state, and local laws, rules, and regulations—to provide information on treatments that are allowed and encouraged on New York City streets. The Manual's intended audience is diverse, consisting of design professionals, city agencies and officials, community groups, and private developers.

The *Street Design Manual* supplements rather than replaces existing engineering and environmental standards, requirements, or guidelines, such as the *Manual on Uniform Traffic Control Devices* (MUTCD), AASHTO *Policy on Geometric Design of Highways and Streets* ("Green Book"), and ADA Standards for Accessible Design. In a city with as many varied and complex conditions as New York, designs must be tailored to the particular needs and opportunities created by the local context, uses, and dimensions of streets. The *Street Design Manual* leaves ample room for choice, and all designs remain subject to case-by-case DOT approval based on established engineering standards and professional judgment, with the safety of all street users being of paramount importance.

ABOVE: *Fulton Street, Brooklyn*

LEFT: *6 ½ Avenue and West 51st Street, Manhattan*

This Manual is New York City's comprehensive resource on street design guidelines, policies, and processes.

Background

Until the early twentieth century, streets served not only as transportation routes but as the front yards and public squares of cities. Horse-drawn carriages, people on foot or horseback, and, later, bicycles and streetcars shared streets with pushcart vendors, outdoor markets, children playing, and neighbors socializing. City streets were vibrant, though plagued by safety, sanitation, and mobility problems.

As Peter Norton explains in his book *Fighting Traffic: The Dawn of the Motor Age in the American City,* when motor vehicles were introduced into this mix, they were not accounted for by the laws, engineering and design practices, and public mores of the time. Pedestrian deaths and injuries from motor vehicle crashes were so frequent that the press across the country routinely vilified motorists, and citizens regularly staged parades commemorating the dead. Some municipalities even contemplated requiring speed controls on engines.

Over the last 15 years, best practices have increasingly favored street designs that support walking, bicycling, and public transit use.

As early as the 1910s, automobile-owners' associations and engineers' groups launched public relations and legislative campaigns to address both the negative public sentiment and the alarming safety problems. They succeeded in getting new laws and

LEFT: *Lower East Side, Manhattan (1910)*
RIGHT: *Ninth Avenue, Manhattan*

engineering standards to improve safety; as a byproduct, motor vehicles were given greater standing in the roadway. By 1930, cultural norms had adjusted to this paradigm shift. Cities prioritized automobile movement for most of the twentieth century. But planners, designers, and engineers have come to recognize that this focus has led to an alarming number of crashes resulting in deaths and serious injuries; unsustainable land-development patterns; a reduction of the number of transportation choices; increased noise, pollution, and greenhouse gases; and a decline in social, civic, physical, and economic activity on streets.

Over the last 15 years, best practices have increasingly sought to address these issues by favoring street designs that support walking, bicycling, public transit, and universal access, as well as motor vehicle use. Practitioners (and the public) have also learned that street infrastructure can yield benefits well beyond mobility: enhanced public health, more pleasant environments, and increased economic activity.

This Manual builds on current thinking about street design, materials, lighting, and project implementation around the world to promote a great public realm. It advocates high-quality, sustainable design and encourages greater mode choice. Also, its creation led to the streamlining of DOT's internal design-review processes, which has made project execution more efficient.

Practitioners (and the public) have learned that investment in high-quality street infrastructure can yield benefits well beyond mobility.

Street Design Policy

Planning and designing streets in accordance with the goals and principles of this section will contribute to a consistent level of quality and functionality for New York City's streets. Along with the project's planning framework, they should be used to resolve conflicting priorities for limited street space.

Goals & Principles

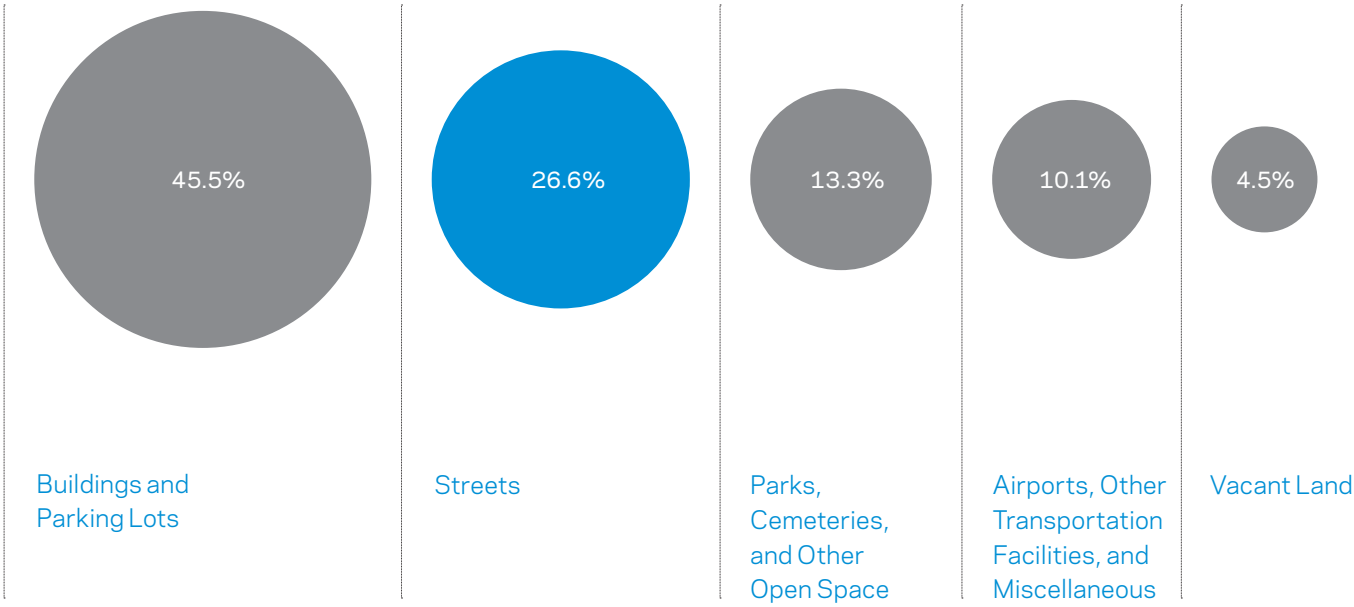
Streets, which take up over a quarter of the city's land area, are a critical part of New York City's infrastructure. The condition of these public spaces has a significant impact on the city's environmental health and on the quality of life for its residents.

DOT's overall goals and principles are:

1. **Design for Safety**
2. **Design to Balance Local Access and Mobility**
3. **Design for Context**
4. **Design Streets as Public Spaces**
5. **Design for Sustainability and Resiliency**
6. **Design for Cost-Effectiveness**

Accordingly, it is the policy of DOT that practitioners adhere to the following goals and principles when designing city streets, all with an eye to achieving maximum inclusivity and the highest possible aesthetic standards.

Percent of New York City Land Area by Use
Streets make up over a quarter of the city's land area. (Source: PlaNYC Sustainable Stormwater Management Plan, 2008)



Operational safety enhancements: Seventh Avenue, Manhattan

Balance of local considerations with through traffic: Delancey Street, Manhattan

Street design to match the context: Eastern Parkway, Brooklyn

1

Design for Safety

The city's efforts to enhance street safety through engineering, education, and enforcement have contributed to a dramatic drop in the number of pedestrian fatalities and serious injuries in the past 10 years. Designing safe streets will continue to be the first priority for DOT.

- **Prioritize safety for all street** users, particularly more vulnerable groups (children, the elderly, those with disabilities) and more vulnerable modes (walking, bicycling).
- **Design local streets for slower** speeds to reduce the number of crashes and to discourage cut-through traffic.
- **Research, test, and evaluate** innovative safety treatments, particularly those successfully adopted in other cities.

2

Design to Balance Local Access and Mobility

Street designs should provide efficient ways to move people and goods and improve the economic vitality of the city, but not at the expense of safety and community needs; street designs should therefore balance access within neighborhoods with mobility through them.

- **Provide safe, accessible,** convenient, and comfortable facilities for walking, bicycling, and transit, particularly on designated routes and at critical network connections.
- **Accommodate truck traffic and** deliveries while minimizing their negative impacts on neighborhoods.
- **Meet or exceed ADA Standards** for Accessible Design.
- **Accommodate emergency-** vehicle access.

3

Design for Context

Streets help define the character of neighborhoods. Except for standard furniture, materials, and lighting, a street's design should interact with the surrounding context, including its history, land uses, and nearby landmarks.

- **Preserve the unique character of** neighborhoods.
- **Support connections to adjacent** land uses by providing gathering spaces and pedestrian access to and from major destinations.
- **Maintain aesthetic consistency** within neighborhoods and corridors.

Streetscape enhancements: Columbus Avenue, Manhattan

Bioswale: Dean Street, Brooklyn

Raised median: Grand Concourse, Bronx

4

Design Streets as Public Spaces

Beyond their use for moving people and goods, streets comprise an extensive network of public open spaces that can facilitate social, civic, and economic interactions.

- **Expand usable public open space** by reallocating underutilized roadway space for pedestrian plazas, expanded sidewalks, corner and mid-block curb extensions, and opportunities for green planted areas.
- **Design streets to encourage** physical activity for all ages and populations by making walking, bicycling, and transit attractive and convenient.
- **Design local streets to be traffic-** calmed environments that encourage walking, bicycling, and recreational activities.
- **Expand the availability of public** seating and bicycle racks.

5

Design for Sustainability and Resiliency

Streets present an extraordinary opportunity to improve the environmental health of the city. Collaborate across agencies in testing, evaluating, and standardizing new materials so that streets are constructed in an environmentally sound way, and respond effectively to more frequent intense storms and catastrophic weather events.

- **Minimize impermeable surfaces** and maximize vegetation on streets. Street designs should use stormwater source controls wherever possible.
- **Utilize resilient materials that** can withstand periodic temporary inundation by both fresh and salt water.
- **Reduce streets' rate of heat** absorption by maximizing tree canopy cover.
- **Minimize the overall lifecycle** energy use and pollution associated with projects, including the extraction, transportation, construction, maintenance, and replacement of materials.

6

Design for Cost-Effectiveness

Reconstruction of city streets requires substantial financial resources. The list of worthy projects competing for a limited pool of funding is extensive. Street designs need to be cost-effective.

- **Consider not only up-front capital** costs, but also full lifecycle costs and benefits; certain options may cost more up front, but may have lower ongoing maintenance and operations costs and/or provide long-term benefits.
- **Design streets to meet the city's** future needs. Because streets are reconstructed infrequently, consideration of future conditions and needs should be part of the planning process.
- **Maintain a clear and consistent** design-review process to streamline project review.
- **Establish well-considered and** clearly defined goals early in project development and focus on meeting those goals throughout planning and design.

Applicability

The policies and guidelines in the *Street Design Manual* are the foundation of designs for all projects that significantly impact public and private streets in New York City. It should be used by agency staff, design professionals, community groups, and other entities involved in the planning and design of streets. DOT will review projects for consistency with the Manual.

Examples of applicable projects include Capital and Expense projects, such as street reconstructions and resurfacings; operational and traffic control treatments; street work associated with new or renovated buildings; and other public or private construction projects that include roadways, sidewalks, and plazas.

The guidance presented in the *Street Design Manual* does not supersede any existing federal, state or city laws, rules, and regulations. All projects remain subject to relevant statutes, such as the Zoning Resolution of the City of New York, City Environmental Quality Review (CEQR), and appropriate reviews and approvals of oversight agencies such as the Public Design Commission (PDC), Landmarks Preservation Commission (LPC), and Office of Management and Budget (OMB).

The Manual provides assistance in four areas:

Tillotson Avenue Step Street, Bronx (Credit: DDC)

Organization

The *Street Design Manual* is structured with six chapters and two appendices. Chapters 2 through 6 contain the bulk of the Manual's design guidance.

Fourth Avenue community workshop: Brooklyn

Operational safety enhancement: Louis Nine Boulevard, Bronx

Concrete pigmented to match adjacent bluestone: Pacific Street, Brooklyn

Chapter 1: Process
How DOT projects are conceived, planned, designed, and implemented.

Chapter 2: Geometry
A "toolbox" of geometric street treatments to enhance safety, mobility, and sustainability.

Chapter 3: Materials
Specific materials with recommendations for use and references to appropriate specifications.

Cobra Head luminaire on Octagonal pole: Pearl Street, Manhattan

CityBenches: Court Street, Brooklyn

Planted median: 253rd Street, Queens

Chapter 4: Lighting
Street and pedestrian lights that meet energy efficiency, technical, and visual quality criteria.

Chapter 5: Furniture
Standard outdoor furniture, including DOT's coordinated street furniture franchise.

Chapter 6: Landscape
General guidelines on plant selection, design, installation, and maintenance for typical applications in the public right-of-way (ROW).

Glossary
Definitions of frequently used terms and abbreviations.

Appendix A: Agency Roles on the City's Streets
Agency responsibilities for particular street operations and infrastructure.

Appendix B: Legal & Design Guidance References
Reference to laws, regulations, and reference sources.

The Planning Framework

The *Street Design Manual* is focused on providing guidance for the design of streets. But the planning framework that establishes the context and priorities for each design, and the ongoing management and operation of streets once built, are also critical steps to create world-class streets (see below). DOT evaluates the costs and effectiveness of design treatments and management strategies to inform future designs and initiatives. This section provides an overview of the larger planning framework for street design. Appendix B includes a number of useful resources for best planning practices for streets.

Street Planning	Street Design	Street Management
Community priorities	Target and design speeds	Speed limit
Land uses and types of users	Alignments and widths	Traffic controls
Demand and usage patterns, major trip generators	Horizontal and vertical geometric elements	One-way or two-way operation
Safety-related needs	One-way or two-way operation	Part-time or full-time access controls
Local vs. through traffic	Public spaces	Curbside regulation
Sidewalks and pedestrian facilities	Accessibility	Maintenance/cleaning
Bus routes, bicycle routes, truck routes, critical connections	Grading and drainage	Public space programming
Driving and building entrance management	Utilities	Short-term operational improvements utilizing temporary materials
Existing environmental and public space conditions	Materials	Enforcement
Neighborhood resiliency	Lighting	
	Furniture	
	Trees, vegetation, and stormwater controls	
	Public art	

At the first public workshop for a plaza, participants share their ideas for the space: Ozone Park, Queens

Planning

Every street is inseparable from its surrounding community and land uses, and also a part of the larger transportation network of the city and region. Streets should be designed with an understanding of their role in both the local and larger planning contexts. The planning of street projects should begin with the setting of clearly defined goals. Projects should seek to address not only pre-existing issues that have been identified by the community or the city, but also policy objectives or other needs of the city and stakeholders. Appropriate stakeholders should be involved in projects from conception to implementation.

Design

The *Street Design Manual's* design guidance includes options for geometric, material, lighting, furnishing, and landscape treatments (Chapters 2–6); in most cases it does not prescribe which specific treatments must be used and in which combination. It also does not dictate which treatment should receive priority when there is a conflict between design alternatives. Rather, it gives users the flexibility to determine which overall design is most appropriate and practical in light of the goals and priorities established through the planning process and the policies enumerated in this Manual. The Design Considerations list in the next section can be a particularly helpful tool for this decision-making process.

Management

Well-functioning, high-quality streets are not just a product of their planning and design — the way a street is operated and managed once built is just as important as its design. For example, curbside regulations and traffic controls (signs, signals, and markings) are a central factor in determining how streets operate and the quality of the public realm. Likewise, access to a street can be limited to pedestrian traffic on certain days or for certain hours, and vehicular traffic can be limited to transit and/or commercial vehicles some or all of the time. Finally, maintenance of street materials, furnishings, and plantings is critical to the long-term success of street designs.

Design Considerations

To define context, set project goals, and help give appropriate thought to the full range of factors that should inform a street's design, refer to this list of design considerations. Projects submitted to DOT for approval will be reviewed with respect to these topic areas.

Street Context

History & Character
Details for the specific project area

Land Use
Predominant land uses and densities within the project area (e.g., light residential, dense commercial), any historic districts or special zoning districts, proximity to transit

Network Role
Role of the street in the neighborhood, city, and regional transportation system

Trip Generators
Trip generators within or proximate to the project area, including prominent landmarks, commercial, cultural and civic institutions, public spaces, and facilities serving people with disabilities

Street Width
Available space and how its allocation will be prioritized

Street Operations

Pedestrians
Pedestrian safety, volumes, comfort and convenience of movement, access or mobility needs of people with disabilities, the elderly, and children, ADA compliance, crash history, important walking connections, and quality of the walking environment

Bicycles
Bicycle safety, volumes, comfort and convenience of movement, existing or proposed bike routes and other important bicycling connections, crash history, and bicycle parking

Motor Vehicles
Motor vehicle safety, volumes, access, crash history, important motor vehicle connections, appropriateness of motor vehicle traffic to street scale (e.g., local vs. through traffic), and ways to reduce the negative impacts of motor vehicle traffic

Transit
Safety, bus routes and operations, subway or other transit station access, and transit usability

Trucks/Freight
Safety, truck routes, volumes, access, mobility, and ways to reduce the negative impacts of truck traffic

Curbside Conditions
Curbside demand and usage patterns within the project area, allocation of space for through movement, meter parking, non-metered parking, loading, deliveries, pedestrian space, and sightlines

Public Space
Opportunities for making streets within the project area better public spaces through such measures as traffic calming, pedestrian seating, appropriate lighting, and art

Street Cuts
Frequency of needed access requiring utility "cuts" into the roadway within the project area, and potential improvement or consolidation of utility infrastructure

Community Goals

Factors various community stakeholders express as important to their health, quality of life, and community character

Greening

Street Trees
Canopy coverage within the project area

Vegetation
Existing plantings within the project area and opportunity sites for other planted areas

Maintenance Partner(s)
Potential and/or committed maintenance partners (e.g., BIDs, DPR) and level of commitment (e.g., watering, weeding, pruning, litter removal, replacements)

Resiliency

Stormwater Control
Stormwater runoff conditions, permeability of underlying soil, stormwater source controls, and durability of infrastructure in recovering from water and saltwater exposure

Drainage
Stormwater flow patterns, groundwater infiltration, catch basins, sewer connections, and waterbody impacts

Flooding
Flooding conditions within the project area, coastal storm surge barriers

Permits
Wetlands or coastline areas within 100 feet of the project area; requirements for New York State Department of Environmental Conservation or the Army Corps of Engineers permits

Public Art

Opportunities for temporary and permanent art installations

Process

1

Introduction

About this Chapter

This chapter describes how DOT projects originate and how they are planned, designed, and implemented, with the exception of work performed on bridges, tunnels, and viaducts, which is managed by DOT's Bridges Division. The chapter includes three case studies: a safety project, the reconstruction of a major roadway, and a plaza project.

Generally, DOT implements two kinds of projects: "Operational" and "Capital." Operational projects usually do not involve sub-surface utility work, drainage, or roadway grading, and they are designed by DOT staff and built either by agency personnel or by a DOT contractor. Capital projects can impact sub-surface conditions and are more comprehensive. They are initiated by DOT and designed by the Department of Design and Construction (DDC) staff or consultants and are built by DDC contractors.

Operational projects are mainly funded by the city's Expense Budget, which pays for day-to-day operating expenditures, while Capital projects are funded largely by the city's Capital Budget, which is generally financed with federal funds and through the sale of bonds.

Information about specific procedures for notification, permitting, approval, and execution of work by developers and utilities can be found in DOT's *Street Works Manual*.

Operational projects usually do not involve sub-surface utility work, drainage, or roadway grading, and they are designed by DOT staff and built either by agency personnel or by a DOT contractor: Grand Army Plaza, Brooklyn

Pipe installation as part of street reconstruction. Capital projects can impact sub-surface conditions and are more comprehensive. They are managed by the Department of Design and Construction (DDC): Second Avenue at East Houston Street, Manhattan

TABLE 1A

	Operational	Capital
Elements	Signals, markings, signs, basic concrete work such as islands or medians, street furniture, landscaping, paint, epoxy gravel. No sub-surface work	No restrictions. Project can include full reconstruction, sub-surface infrastructure upgrades and/or relocation, lighting, permanent streetscape elements, regrading, resurfacing, and green infrastructure. Many streetscape elements that can be Expense-funded can also be Capitally funded
Funding Source	Mostly City Expense funds; some federal and state grants	Mostly city Capital funds; some federal and state grants
Budget	No restrictions	$35,000 minimum
Total Project Timeline	1–2 years	4-7 years
Coordination with DEP	Generally not necessary, except for concrete work, to avoid disruption to DEP infrastructure	Necessary to avoid negative impacts to DEP infrastructure (including right-of-way bioswales and stormwater greenstreets). Enhancements to DEP infrastructure in the same project may be possible, thereby realizing overall efficiencies and cost savings. DEP requirements may affect implementation schedule
Reviews by Other Agencies and Utilities	DOT notifies FDNY if there are potential impacts on its operations. Utilities are consulted as necessary. New York State DOT (NYS DOT) reviews projects funded by the Federal Highway Administration (FHWA), and the Federal Transit Administration (FTA) reviews projects that it funds. For major transportation projects*, DOT consults with FDNY, NYPD, the Mayor's Office for People with Disabilities (MOPD), and SBS. Designs for all works of art and structures† intended for use in a fixed location for more than one year are subject to Public Design Commission (PDC) review‡	OMB, and, if relevant, DPR, FDNY, LPC, NYPD, ORR, and PDC. Utilities also review. DPR, MTA, and Port Authority are consulted as necessary. NYS DOT reviews FHWA-funded projects, and the FTA reviews projects that it funds. Coordination with as many as 40 public agencies and private entities may be required. For major transportation projects*, DOT consults with FDNY, NYPD, the Mayor's Office for People with Disabilities (MOPD), and SBS
Coordinating Agency	DOT	DDC
Useful Life	No requirements	Minimum 5 years
"No-Build" Clause	Additional Operational and/or Capital work can be done at project site post-completion, as needed	No additional Capital work can be performed at project site for at least 5 years. Operational work is allowed
Planning	DOT or its consultant	DOT or its consultant
Design	DOT or its consultant	DDC in-house or consultant, often based upon a conceptual schematic from DOT
Implementation	DOT or its contractor	DDC contractor

* *Major transportation projects are defined by Local Law 90 of 2009 as affecting four or more consecutive blocks or 1,000 consecutive feet (whichever is shorter); a major realignment of the roadway, including either the removal of a vehicular (or travel) lane(s) or full-time removal of a parking lane(s) or the addition of a vehicular lane(s). For further information, see Section 19-101.2 of the New York City Administrative Code.*

† *See the definition of "structures" in Section 854(b) of the New York City Charter.*

‡ *For further information see Section 854(g) of the New York City Charter.*

Community Participation

DOT conducts extensive outreach to communities whenever the agency implements safety enhancement projects or makes changes to the local transportation network. Input from residents and businesses helps DOT take into account the character and needs of specific neighborhoods in the project-development process. While each DOT unit that manages a project is involved in community outreach, the Borough Commissioners are the agency's primary liaison with communities and generally conduct the on-going dialogue.

The Borough Commissioners routinely meet with Community Boards, elected officials, business leaders, and other community stakeholders on issues ranging from full-scale intersection redesign projects to parking regulation adjustments. These meetings can be in community rooms or school auditoriums, in agency or other offices, or on site to review specific traffic concerns. In addition, DOT notifies local elected officials of every large project and presents the project to the affected Community Board(s) before implementation begins.

DOT tailors its community outreach to suit the scope, size, complexity, and magnitude of potential impacts of each project. The outreach process is iterative, as DOT often adjusts and modifies projects based on community feedback. For some projects, as with NYC Plaza Program Capital projects, local community institutions may also be involved as maintenance partners and actively engage the wider community. The Department of Design and Construction (DDC) conducts community outreach for DOT street reconstruction Capital projects, often in coordination with DOT.

DOT Design Reviews and Analyses

Multiple DOT divisions review project designs throughout the planning and design phases of projects. They review designs not only to determine and mitigate negative impacts of projects, but also to identify opportunities to advance the agency's policy goals as enumerated in this Manual and in other DOT publications. Depending on the type of project, DOT divisions consider the following items (some of which overlap with the technical areas addressed by City Environmental Quality Review [CEQR] analyses):

- Safety
- Motor vehicle level of service
- Air quality
- Construction-phase impacts
- Bicycle and pedestrian mobility and access
- Accessibility that meets or exceeds ADA standards
- Network operations
- Parking utilization
- Goods delivery
- Transit access and operations
- Community character
- Public space opportunities
- Street network resiliency
- Stormwater capture and/or filtration
- Plantings
- Aesthetic appeal
- Temporary and permanent art placement
- Community priorities

Motor vehicle level of service (LOS) is a major consideration in developing a project design because of the importance of maintaining traffic flow to the city's economy. DOT therefore treats LOS as a priority.

DOT conducts design and operations analyses as required by federal, state, and local laws, rules, and regulations (including CEQR procedures); for information on the traffic forecasts that inform these analyses, see "Sustainable Street Design" on (2.0.1) in the Geometry chapter. DOT also conducts its analyses according to standard engineering practices and design guidelines and standards (including those described in this Manual). The level of review varies by project.

The public right-of-way (ROW) serves multiple types of users and functions. LOS must therefore always be balanced with other considerations such as safety and community character.

TABLE 1B

Level of Service	*Average Delay in Seconds/Vehicle*	
	Signalized Intersections	*Unsignalized Intersections*
A	⩽ 10.0	⩽ 10.0
B	> 10.0 and ⩽ 20.0	> 10.0 and ⩽ 15.0
C	> 20.0 and ⩽ 35.0	> 15.0 and ⩽ 25.0
D	> 35.0 and ⩽ 55.0	> 25.0 and ⩽ 35.0
E	> 55.0 and ⩽ 80.0	> 35.0 and ⩽ 50.0
F	> 80.0	> 50.0

Level of service (LOS) grades. Traffic engineers and planners use LOS analysis at signalized and unsignalized intersections to measure a project's impact on vehicular traffic. They analyze and compare intersections under existing and "post-build" conditions. Under the CEQR Manual, project designs that worsen LOS to below mid-D in a model require a full environmental impact statement and often mitigation.

Reviews by Other Entities

Other city agencies and public utilities regularly review project designs. The New York City Fire Department (FDNY) reviews any designs—whether Operational or Capital—that might affect its operations. The Department of Environmental Protection (DEP) and public utilities review each Capital project for potential impacts on their infrastructure and for opportunities to fold in enhancements to their infrastructure as part of the project.

Aside from FDNY and DEP, other city agencies review DOT projects as necessary. The Department of Parks and Recreation (DPR) reviews all projects that impact existing trees or propose new trees. The New York City Police Department (NYPD) reviews DOT projects that may have security implications. The Mayor's Office for People with Disabilities (MOPD) reviews Operational projects for consistency with ADA standards.

The Public Design Commission (PDC) reviews some Operational projects, depending on whether the design is intended for use in a fixed location during a period of more than one year. At several stages of design, PDC reviews all Capital projects that feature streetscape treatments whose usage is not standard, as indicated in this Manual. These reviews may require multiple submissions; see Design Development and Review Diagram for more information on PDC reviews and their interplay with typical design phases. The Landmarks Preservation Commission (LPC) reviews all Capital projects—and, under certain circumstances, Operational projects—in historic districts.

Major transportation projects (as defined by Local Law 90 of 2009) require notification to the affected community board(s) and council member(s) as well as consultation with multiple agencies per Section 19-101.2 of the New York City Administrative Code.

See Table 1A for more information on reviews of DOT projects by other entities.

Projects Initiated Outside DOT

While this chapter focuses on projects that originate at DOT, other entities—both public and private—can plan and design projects that affect the ROW. In such cases, DOT works so that the projects meet established criteria—particularly with regard to safety—and provides guidance on meeting other requirements and guidelines, such as those enumerated in CEQR and this Manual.

Project designs must conform to existing contexts or, if other, nearby projects are planned, to future conditions. For instance, a project site might be a segment of an official truck route or of a planned bicycle route, in which case DOT requests that sufficient lane widths be maintained to continue to accommodate trucks, or asks that bike lanes be incorporated into the design.

The New York City Economic Development Corporation (EDC) designs and builds many projects in the ROW. DOT collaborates with EDC on such projects.

Operational Projects

1.1.1 Origination

Operational projects can originate as a result of one or more of the following:

- A DOT citywide safety initiative, such as Safe Streets for Seniors, identifies an area in which to make safety enhancements based on crash data and other factors
- As is the case with the development of a Select Bus Service route and many other projects, a DOT unit leads a citywide or neighborhood-level planning process that identifies modifications
- Another city agency's project, such as a DCP area master plan, creates an opportunity for DOT to make cost-effective enhancements in the course of the project
- Elected officials provide federal or state grants or earmarks to fund a project
- Elected officials, the general public, business improvement districts, other agencies, or community boards request certain treatments or ask DOT to investigate conditions and issues

Several DOT programs use Operational projects to address safety issues and enhance the pedestrian environment: Ft. George Avenue, Manhattan

The New York City Charter mandates that each community board submit to the mayor and the appropriate borough president statements of its expense budget priorities for the fiscal year. This is one mechanism by which a community board can originate a DOT Operational project. Each community board must also submit its capital budget priorities. See Section 230 of the New York City Charter for more information.

1.1.2 Planning & Design

Scoping (1–4 Months)
DOT plans and designs most of its Operational projects rather than engaging a consultant to do so. When it begins to plan a project, agency staff conduct site visits, talk to stakeholders, and collect appropriate information, which typically includes some or all of the following:

- Crash data
- Traffic speeds
- Pedestrian, bicycle, and motor vehicle volumes
- Turning-movement counts
- Parking utilization
- Contextual information, particularly local land uses, parking regulations, bus/truck route information, etc.
- Inventory of existing infrastructure, such as fire hydrants, storm drains, manholes, sidewalks and curbs, curb cuts, etc.
- Relevant demographic data, such as high proportions of elderly New Yorkers and/or people with disabilities

Preliminary design concepts often emerge from initial data collection and information from stakeholders.

Design (6–12 Months)
DOT surveys the project site and creates a base map to establish existing conditions. Agency staff then design enhancements that meet project goals. DOT may collect additional information as the project is developed if other nearby intersections are determined to be in need of modification.

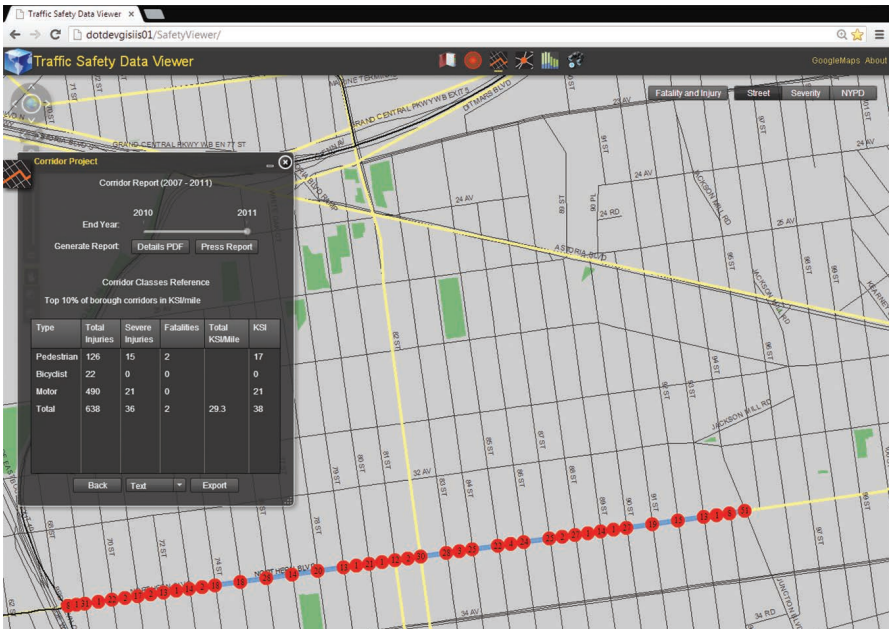
DOT consults with FDNY to address any concerns about the impact of the designs on its operations. The agency also presents the preliminary concepts to the relevant community board and elected officials for input. If the project is a major transportation project, as defined in Local Law 90 of 2009, DOT also consults with NYPD, the Department of Small Business Services, and the Mayor's Office for People with Disabilities. The Department of Sanitation (DSNY) is consulted when a design will clearly impact its operations. Designs for all works of art and structures intended for use in a fixed location for more than one year are subject to PDC review.

In some cases, if DOT contemplates making changes to signal timing or narrowing or removing lanes, the agency uses computer modelling to anticipate future conditions and adjust the plan or make improvements as needed.

1.1.3 Implementation (2–90 Days)

Once a project design is completed, the relevant DOT unit and/or outside contractors implement the project. The work season is usually between mid-April and mid-November.

DOT staff monitor and analyze crash data at the project site for up to three years after implementation. DOT also compares pre- and post-implementation motor vehicle, bicycle, and pedestrian data to determine what impact, if any, the project had on mobility. If issues arise out of this analysis, DOT may revisit the project to make modifications. DOT is increasingly measuring other project-performance indicators as well, such as economic and environmental impacts. Much of these data are available in DOT's annual Sustainable Streets Index report.



DOT's Traffic Safety Data Viewer displays and exports crash data details and summaries for corridors and intersections. Information from the Viewer informs project scoping

Capital Projects

1.2.1 Origination

DOT Capital projects are initiated in any of the following ways:

- DOT identifies structural issues with roadways, bulkheads, retaining walls, or step streets. (This Manual does not cover bridges, tunnels, and viaducts, which are managed by DOT's Bridges division)
- DOT divisions identify safety, mobility, resiliency, or other issues that need Capital enhancements
- DOT citywide initiative, such as the Safe Routes to Schools program, identifies areas in which to make enhancements. Such initiatives can also employ Operational work
- Another agency's project, such as a DEP infrastructure upgrade, creates an opportunity for DOT to incorporate enhancements to the ROW
- The general public or community boards make requests, sometimes obtaining funding from their elected officials or from grants
- Elected officials provide grants and earmarks to fund a project
- The mayor or other elected officials establish priorities to be fulfilled by DOT
- Non-profit organizations with community support apply to DOT's Plaza Program to have public spaces built in under-utilized ROW

1.2.2 Planning & Design

Scoping (3 Months–1 Year)
When a Capital project is proposed, DOT creates an initial project budget and adds the project to the agency's capital plan, which is updated three times per year. The Office of Management and Budget (OMB) must approve the addition of the project to DOT's capital plan before work can begin.

DOT begins research into the project location and visits the site with various agency divisions and other stakeholders to discuss the project scope. The agency then defines the project scope; this process generally takes several months to a year, depending on the project's size and complexity.

Special attention is given to whether the project is located in a flood-vulnerable area, according to the NYC Preliminary FEMA Flood Map (FEMA, 2015). Capital projects in Flood Hazard Zones may involve many additional resiliency considerations from planting selection and salt tolerance to concrete and asphalt thickness. As of December 2015, New York City is developing a set of resiliency-focused design principles for projects in flood-vulnerable areas.

Scoping also considers the impacts of climate change, including projected sea level rise and coastal storm surge. To ensure consistency in these measurements, all elevations are measured in accordance with the North American Vertical Datum of 1988 (NAVD88).

Design Development and Review Diagram

Project Initiation
DOT initiates the project

Preliminary Design
DDC develops schematic designs. DOT (and potentially PDC) are reviewing entities

Final Design
DDC develops construction documents. DOT and PDC review and approve as appropriate.

Scoping | **Draft CPI** | **Introductory Letter** | **Schematic Geometric Design** | **Mass Mailing 1** *40% Final Design* | **Mass Mailing 2** *75% Final Design* | **Mass Mailing 3** *100% Final Design*

The likelihood of PDC review should be determined during scoping. If PDC review is considered probable, its extent should be determined, and the design team should structure its schedule accordingly

PDC Conceptual Review
During Preliminary Design

Necessary for complex or large-scale projects, including those subject to ULURP

PDC Preliminary Review
Beginning of Final Design

This is typically the first time PDC reviews the design. Preliminary review is generally an iterative process that may require multiple submissions

Community Board review is required prior to submission

All necessary interagency coordination should be accomplished prior to submission

Maintenance responsibilities must be identified and addressed prior to submission

Significant design changes after preliminary approval must be submitted for PDC review prior to proceeding to 90% final design

PDC Final Review
90% Final Design

Conditions of Preliminary approval must be resolved

Projects — generally those that are narrow in scope — can be submitted for preliminary and final approval simultaneously, provided they comply with all requirements for both levels of review

All maintenance concerns must be resolved. Outside maintenance partners must commit to responsibilities, as applicable

Note: See the PDC's website at http://www1.nyc.gov/site/designcommission/review/requirements/requirements.page for submission guidelines
Note: If the project affects a landmark or is located in a scenic landmark or historic district, it must be submitted to the Landmarks Preservation Commission

If the project includes non-standard elements, such as distinctive materials or furnishings, OMB reviews and comments on the preliminary project scope and budget. The project is then transferred to the Department of Design and Construction (DDC) for detailed design and implementation (see "Capital Project Initiation") using the Capital Project Initiation form (CPI). The CPI includes:

- Project Purpose/Justification
- Site plan
- Project Scope resulting from scoping process
- Cost Estimate and/or Available Funds
- Funding Sources summary
- Conceptual Design, if applicable
- Other relevant reference materials

Design (1–3 Years)
DDC usually awards a contract or task order to a consultant to design the project. For less complex projects, DDC utilizes in-house staff. DDC and the consultant conduct an analysis of existing conditions, and DDC simultaneously requests that all DOT divisions and other relevant agencies provide information that may have some bearing on the project—e.g., traffic analysis, crash data, environmental studies, etc.—and about other planned or ongoing work occurring in the project area or nearby.

The role of Department of Design and Construction (DDC) is to:
- Perform or contract for and oversee design work, procure construction services, and manage the construction process for DOT's Capital roadway projects
- Coordinate among all stakeholders and manage outreach to communities affected by projects
- Manage Capital street work funded by different city agencies and coordinate Capital programs to minimize conflicts

Schematic Geometric Design
The consultant creates a schematic geometric design—a basic design showing curblines and markings—upon which all DOT divisions comment. Changes in geometry or to the number of moving lanes require further traffic analysis.

Other entities also review project designs. See Table 1.A and REVIEWS BY OTHER ENTITIES (1.0) for more information.

Final Design
Final Design begins the process of creating construction documents. Once DDC and its consultant incorporate all of DOT's comments on the schematic geometric design, the consultant produces the final design in three stages: 40%, 75%, and 100% completion. DDC circulates each set of drawings to all DOT divisions and to the relevant community boards and elected officials—as well as, in some cases, to other agencies and utilities—for their review. At 40% and 75% design, DOT collates and transmits its comments to DDC, and the consultant incorporates the comments into the next design phase. DDC holds "alignment" meetings with the private utilities during final design, as necessary, to avoid conflicts with their infrastructure and so that there is minimal disruption to the construction schedule.

Acquisition/ULURP as Necessary (1–2 Years)
Capital projects sometimes require the acquisition of private property (e.g., to build a new street or widen an existing street) or Uniform Land Use Review Procedure (ULURP) (e.g., to map a new street or change a street's mapped width). Either action often necessitates completion of an environmental impact study. These processes will generally add another year or two to a project's implementation timeline.

1.2.3 Construction (1–2 Years)

Once the design is complete, DDC requests a construction Certificate to Proceed (CP) from OMB and bids out the project to construction management (CM) firms and contractors. OMB typically issues the construction CP before the CMs and contractors respond. Construction can begin when the contract with the selected bidder is finalized with DDC.

Case Studies

Hoyt Avenue at RFK Bridge

Short-Term Project

Operational projects can be effective in saving both time and costs; the enhancements around Hoyt Avenue at the RFK Bridge were implemented quickly, despite some jurisdictional overlap with the MTA. Stakeholders played a formative role in identifying project goals at the outset, thereby avoiding delays during community board design review.

ABOVE: *Columbus Triangle before the project*

LEFT: *One of the enhancements to the pedestrian experience was an expansion of the Columbus Triangle, which is adjacent to the Astoria Boulevard N/Q subway station and which accommodates passengers waiting for the M60 bus*

Purpose

Enhance safety for all users, improve mobility, add landscaping, and create new public space in an area that sees thousands of pedestrians daily.

Location

Astoria, Queens, near where RFK Bridge (formerly the Triboro Bridge) intersects with neighborhood streets and around the Astoria Blvd elevated subway station.

Context

The land uses in the area are generally commercial, with some residential. The Astoria Blvd N/Q elevated subway station is a major pedestrian generator and destination, with many subway riders transferring to the M60 bus here to go to LaGuardia Airport.

The recent construction of a senior center at the intersection of 29th Street and Hoyt Avenue South increased the urgency of the project enhancements.

Project Origination

DOT's Queens Borough Commissioner's office co-hosted a New York Metropolitan Transportation Council (NYMTC) "Walkable Communities" workshop in late March 2009, focused on the project area. Safety was a major concern: the intersection of 31st Street, Hoyt Avenue, and Astoria Boulevard was the highest crash location in northwestern Queens, and, although pedestrian injuries in the area were low, participants nonetheless perceived this multi-segment intersection as dangerous.

Planning & Design

NYMTC's workshop served as an ideal start to the planning and design process: it included stakeholders who could provide local expertise (e.g., members of Queens CB 1, local business owners, and officers from the local precinct), and it generated a comprehensive list of problems that DOT could explore in developing proposed solutions.

DOT conducted site visits, collected data (travel times, vehicle volumes, vehicle turning movement counts, pedestrian and bike counts, crash data, curb regulations, and signal timing), took field measurements, analyzed traffic in computer models — in order to develop a comprehensive proposal. DOT met with MTA Bridges & Tunnels on site to discuss adding a new traffic signal and pedestrian crosswalk at 29th Street where the RFK Bridge exits into the neighborhood. DPR collaborated on planning the addition of trees to new and expanded traffic islands.

DOT then presented its findings and recommendations to elected officials as well as Queens CB 1's Transportation Committee and, as appropriate, made changes to the project design in response to feedback. Queens CB 1's full board then approved the design.

Participants at the NYMTC Walkable Communities workshop in March 2009

Implementation

In early December, 2009, DOT crews laid new concrete, resurfaced roadway segments, installed signals, markings, and signs, and changed signal timing. Some work was done on the MTA's RFK Bridge, and DPR personnel managed the landscaping. All work was completed in five months.

Results

The final design enhanced the pedestrian experience with curb extensions to reduce crossing distances, new and expanded pedestrian spaces, and more convenient transit connections. The project also included the following: new signal phasing and timing throughout the project area; greater travel lane clarity through new markings and signage through intersections; rush hour turn bans off 31st Street; and additional parking spaces on Hoyt Avenue South. New bicycle network connections were also added.

RFK Bridge operations were unaffected, and motor vehicle travel times through the main intersection improved.

West Houston Street

Capital Project

Originally conceived as a series of safety enhancements, the West Houston Street Capital project was expanded to include DEP and MTA sub-surface infrastructure upgrades. The end product was therefore considerably more robust and durable.

ABOVE: *Before its reconstruction, West Houston Street provided minimal protection to crossing pedestrians*

RIGHT: *As part of the project, the medians were expanded to sustain plantings and to provide more protection to pedestrians*

Purpose

Enhance safety, reduce motor vehicle congestion, and replace aging infrastructure.

Location

At its western end, Houston Street serves as the border between SoHo to the south and the West Village to the north. The project includes part of East Houston Street.

Context

Land uses in the corridor vary: there is a mixture of manufacturing with a commercial overlay at the western extent and mixed commercial and residential in the center. Parking is allowed along most of the street. The M21 bus runs along the entire length of Houston Street, and several subway lines stop along the street.

Project Origination

A number of factors led to the project. Houston Street, last rebuilt in the late 1950s, was in need of upgrading. The corridor's crash rate was of concern to DOT, with rear-end crashes involving vehicles turning left off Houston Street being the predominant type of crash. Finally, local elected officials provided funding for new plantings in the median to replace dead trees. DOT determined that widening the median would be necessary to support plantings, and this would also enhance pedestrian safety.

The project enhanced the median landscaping and provided seating where appropriate

Planning & Design

The Capital Project Initiation form (CPI) was drafted in November 2002. DOT and DDC met with Transportation Committees of Community Boards 2 and 3 several times between 2001 and 2004 to present plans for feedback. CB2 passed a resolution in support of the project in 2004.

Several agencies were involved in the project besides DOT: DDC (engineering, design, and construction); DEP (water and sewer); DPR (new park and trees and other plantings); LPC (review); PDC (review); and MTA New York City Transit, which modified portions of Houston Street between Elizabeth Street and Bowery to facilitate a new subway fan plant. DOT transferred necessary funds to the MTA so the work could be performed in advance of the roadway project.

During the planning process, DEP decided to upgrade its water and sewer lines, thereby transforming the project into a full reconstruction. Also, utility companies decided to make enhancements, adding to the project's complexity and cost.

The project design reduced crossing distances with wider sidewalks, wider medians modeled on the Broadway malls, curb extensions, bollards, and pedestrian safety islands. The widened medians made possible the addition of left-turn bays and benches. One eastbound travel lane was removed between Avenue of the Americas and W. Broadway/ LaGuardia. Also, between Avenue of the Americas and Varick Street, a parking lane was removed to widen the narrow south sidewalk.

Implementation

Construction started August 2005 and was completed in June 2009.

Additional water and sewer main work, funded by DEP, increased the cost of the project from $16,067,439 to $31,099,118 and contributed to a longer construction timeline.

Results

Crashes involving injuries within the project area dropped by 24%. Motor vehicle travel times in westbound lanes dropped dramatically during the weekday afternoon peak; travel times in eastbound lanes increased slightly during the weekday afternoon peak, potentially due to ongoing construction on East Houston.

Amenities included a new park at Bedford Triangle, benches on the medians, extensive landscaping and planting of 74 trees throughout the project area, Davit light poles, pigmented-concrete sidewalks, and granite curbs.

Willoughby Plaza

Capital Project

Willoughby Plaza was originally built as an Operational project. This allowed local businesses to experience the street segment as a plaza and to observe the project's impacts in real time. Once it was clear that the change benefitted the area, DOT reconstructed the site to make it permanent.

ABOVE: *Willoughby Plaza after the implementation of Operational enhancements*

LEFT: *Willoughby Plaza post-Capital construction*

Purpose

Enhance pedestrian safety, provide more open space and pedestrian and bicyclist amenities, and address illegal parking on Willoughby Street.

Location

The project site is located in the heart of Downtown Brooklyn, a bustling, mixed-use neighborhood and New York City's third-largest central business district. The project created a permanent plaza on Willoughby Street between the Adams Street East Service Road and Pearl Street, plus about 120 feet along the service road.

Context

The surrounding area is characterized primarily by medium- to high-density commercial and institutional uses and street-level retail. On the north side of Willoughby Street, two- to 13-story buildings house mostly government and educational uses, while on the south side, lower-rise buildings house retail and small offices. C5-4 and C6-4.5 zoning regulations surround the site.

Project Origination

In 2004 EDC and DCP drafted the Downtown Revitalization Plan, which recommends a series of zoning map text changes, new public open spaces, and other actions. This set the stage for more intense development in the area, which led to significantly increased pedestrian volumes on Willoughby Street. DOT created an interim plaza at this site in spring 2006. Willoughby Plaza eventually became a Capital project and was reconstructed in permanent materials. The project budget was $1.8 million.

Planning & Design

Before and after creating the interim plaza on this segment of Willoughby, DOT conducted extensive community outreach and technical analyses, including an Environmental Assessment Study (EAS). This work included a study of the impacts of the closure on traffic operations, pedestrian volumes, and deliveries. Since DOT conducted an EAS for the Operational project, the Capital project did not require an EAS.

The Capital Project Initiation form (CPI) for the permanent plaza was completed in late July 2007. Entities involved in the project, besides DOT, include DDC (engineering, design, and construction), PDC (review), and the MetroTech Business Improvement District (maintenance partner).

DOT engaged local stakeholders throughout the design process via MetroTech BID, which maintains and programs the plaza. The BID was involved in all aspects of the project design. DOT also worked directly with the adjacent property owner.

The design buffered the plaza from the Adams Street East Access Road with a large, contiguous planter. Also, new trees mirrored a line of existing trees in the heart of the plaza. Finally, the design included nearly 200 linear feet of fixed seating, plus opportunity for nearly 200 movable chairs.

The existence of a significant amount of underground vaults and utilities prevented the incorporation of "green" drainage infrastructure into the design.

Willoughby Street before the Operational enhancements

Implementation

Construction began in fall 2011 and was completed in spring 2013.

Results

Administered by the MetroTech BID, Willoughby Plaza provides public seating, concessions, and landscaping and cleaning services for pedestrians visiting the nearby restaurant and retail locations, several of which have opened since the plaza's completion. In addition to acting as a gathering space, the plaza serves as a venue for year-round programming for the community, where activities regularly attract upwards of 100 participants. Events include family-friendly concerts, seasonal activities, and the popular Downtown Brooklyn Nights series, featuring live music, dance lessons, and movies screenings.

Geometry

2

Section	Geometric Treatment	Wide	Limited	Pilot
2.1	**Roadway & Lanes**			
2.1.1	Bike Lane & Path			
2.1.1a	Bike Lane	●		
2.1.1b	Bike Path		●	
2.1.2	Bus Lane & Busway			
2.1.2a	Bus Lane		●	
2.1.2b	Busway		●	
2.1.3	Shared Street			●
2.1.4	Plaza			
2.1.4a	Permanent Plaza		●	
2.1.4b	Interim Plaza	●		
2.2	**Sidewalks & Raised Medians**			
2.2.1	Sidewalk			
2.2.1a	Full Sidewalk	●		
2.2.1b	Ribbon Sidewalk	●		
2.2.2	Curb Extension			
2.2.2a	Curb Extension: Community Facilities	●		
2.2.2b	Curb Extension: Bus Bulb	●		
2.2.2c	Curb Extension: Mid-Block Narrowing	●		
2.2.3	Raised Median	●		
2.2.4	Pedestrian Safety Island	●		
2.2.5	Median Barrier		●	
2.3	**Traffic Calming**			
2.3.1	Lane Narrowing and Lane Removal	●		
2.3.2	Raised Speed Reducer	●		
2.3.2a	Raised Speed Reducer: Speed Cushion			●
2.3.3	Gateway		●	
2.3.4	Raised Crosswalk		●	
2.3.5	Chicane			●
2.3.6	Neighborhood Traffic Circle			●
2.3.7	Roundabout		●	
2.3.8	Raised Intersection			●

Introduction

Streetscape enhancements on Columbus Avenue between West 76th and 77th Streets included CityBenches, planting areas bounded by reused granite pavers, and new tree-bed guards: Manhattan

About this Chapter

The geometric design of streets is integral to their use; for instance, overly wide roadways and corners with large turning radii tend to invite speeding and create an environment that is uncomfortable for pedestrians. Pedestrian ramps improve transitions for users, particularly people with disabilities. Geometry also affects streets' economic, community, and environmental impacts.

This chapter establishes general guidelines for the geometric design of streets as well as a "toolbox" of geometric treatments that may be used to enhance safety, mobility, and sustainability.

The recommendations of this chapter supplement rather than replace existing sources of detailed engineering guidance and do not supersede any existing federal, state, or city laws, rules, and regulations. All projects remain subject to relevant statutes, such as the Zoning Resolution of the City of New York, City Environmental Quality Review (CEQR) and appropriate reviews and approvals of oversight agencies.

Guidance Sources

Guidance on the geometric design and operations of streets and roadways is contained in such sources as *A Policy on Geometric Design of Highways and Streets* (AASHTO, 2011), the *Manual of Uniform Traffic Control Devices* (FHWA, 2003), the *2010 ADA Standards for Accessible Design* (USDOJ, 2010), the *Urban Bikeway Design Guide* (NACTO, 2012), and the *Urban Street Geometric Design Handbook* (ITE, 2008).

Other resources include the *Guide for the Planning, Design, and Operation of Pedestrian Facilities* (AASHTO, 2004), Inclusive Design Guidelines (MOPD, 2010), *Designing Walkable Urban Thoroughfares: Context Sensitive Approach* (ITE, 2010), the *Urban Street Design Guide* (NACTO, 2013), and *New York City's Active Design Guidelines* (2010). Readers should also refer to *DOT's Measuring the Street: New Metrics for 21st Century Streets* (2012) and the *New York City Pedestrian Safety and Action Plan* (2010). For additional references, see Appendix B.

Applicability and Exceptions

All new projects that significantly impact public and private streets should follow these guidelines. DOT approval will be based on site-specific conditions and cost-effective engineering standards and judgment, with the safety and accessibility of all street users being of paramount importance.

Usage Categories

Geometric treatments are divided into three categories: Wide, Limited, and Pilot applications.

Wide

Geometric treatments of this type are in wide use throughout New York City. They constitute the basic set of elements that are typically found on city streets. Designs should incorporate them wherever appropriate. These treatments generally require less intensive review than limited or pilot treatments.

Limited

Geometric treatments of this type are currently in limited use in New York City. While the designs are well-established, their application is contingent on site-specific conditions. These treatments will require more in-depth review of appropriateness and feasibility.

Pilot

Geometric treatments of this type are currently in, at most, limited use in New York City, but have been employed successfully in other US and international cites. Appropriate design criteria are still under development for application in New York City. Proposals for pilot usage of these treatments are encouraged and will be evaluated on a case-by-case basis.

General Guidelines

The following guidelines expand on the general policies and principles outlined in the Introduction, with more detailed information specific to geometric street design.

Sustainable Street Design

Street reconstruction projects are, as a rule, designed to accommodate motor vehicle traffic that is forecasted for a certain year (the "design year") in order to meet requirements of the Clean Air Act; and in many jurisdictions in the United States the forecast invariably calls for growth in motor vehicle traffic. For federally funded projects, the design year is 20 years after the project is completed (the "build year"). In New York City, consideration should be given to recent trends in traffic and mode choice — as documented in DOT's Sustainable Streets Index — and their implication for traffic volumes in future years (e.g., five years after the build year). In most parts of the city, motor vehicle traffic volumes are stable or shrinking, while transit is growing; this is due to New York City's heavy investments in the last two decades in subway, bus, pedestrian, and bicycle infrastructure. These investments have spurred rapid increases in non-auto travel, suggesting that there is a positive relationship between street design and mode choice: streets that prioritize the safety and movement of pedestrians, bus riders, and cyclists equally with the movement of cars will produce more sustainable outcomes.

As the New York State DOT's *Project Development Manual* states, it is understood that, even for a federally funded project, it "…may not always be practicable to…fully accommodate design year traffic, or even to fully address existing traffic congestion." Further, "…traffic forecasts alone do not dictate project scope. Forecasts are only one of many factors (safety needs, mobility needs, environmental issues, community needs, etc.) to be addressed." (See p. 5-2 Design Year Traffic Forecasts section of the *Project Development Manual* for more information: **www.dot.ny.gov/divisions/engineering/design/dqab/dqab-repository/pdmapp5.pdf.**)

Vehicle Target Speed

Streets should be designed with target speeds (see Glossary) and speed limits appropriate to their surrounding uses and desired role in the vehicular network. The citywide speed limit is 25 mph, except where otherwise noted. New York State Vehicle & Traffic Law (VTL) Section 1642(a)(26)(a) currently allows speed limits below 25 mph, and as low as 15 mph in New York City if used in conjunction with traffic-calming measures. Slower target speeds and speed limits should be considered on local streets, residential streets, and alleys; on streets adjacent to schools; in areas with higher populations of seniors or people with disabilities; and on waterfronts, in parks, or in and around other significant pedestrian destinations.

DOT applies design interventions as necessary to slow down fast and aggressive driving. These interventions, known as "traffic-calming" measures, include LANE NARROWING & LANE REMOVAL (2.3.1), SPEED CUSHIONS (2.3.2a), CURB EXTENSIONS (2.2.2), and RAISED CROSSWALKS (2.3.4), and sometimes are intended also to improve pedestrian comfort. As part of its efforts to enhance safety, DOT deploys traffic-calming devices in neighborhoods around schools and in areas with high numbers of crashes involving elderly pedestrians. Community groups can also request certain traffic-calming interventions at specific locations by requesting them from their DOT Borough Commissioners. Some traffic-calming treatments can be designed in such a way as also to enhance the public realm.

Wide roadways like Queens Boulevard can be mitigated with measures such as pedestrian facilities on medians: Queens

Roadway Width, Corner Radii, and Crossing Distance

The roadway—the portion of a street designed, enhanced, or ordinarily used for vehicular travel, exclusive of the sidewalk—should be designed to be the minimum possible width, with the minimum number of lanes, that safely and cost-effectively allows for the desired operations of motor vehicles, buses, and bicyclists. Narrower roadways minimize pedestrian crossing distances, encourage safe driving behavior, and reduce impermeable, heat-absorbing asphalt coverage.

Roadway reconstructions should be designed for traffic volumes expected in the actual build year. Additional consideration should be given to recent trends in traffic and mode choice—as documented in DOT's *Sustainable Streets Index*—and their implication for traffic volumes in future years (e.g., five years after the build year). Excess width should be reallocated to provide walking, transit, and bicycling facilities, public open space, green cover, and/or stormwater source control measures. If financial limitations preclude final implementation of street retrofits (e.g., curbing, streetscaping, etc.), the reallocation of space should still proceed with temporary or least costly approaches such as restriping.

To reduce pedestrian crossing distances further and slow turning vehicles, all roadway corners should be designed with the smallest possible radius that still accommodates the design vehicle and emergency vehicles.

Pedestrian crossing distances should be minimized in all locations utilizing the above methods and other treatments, such as CURB EXTENSIONS (2.2.2) (neckdowns) and RAISED MEDIANS (2.2.3). Sidewalk narrowings and roadway widenings should be avoided.

DOT upgraded the complex intersection of Melrose Avenue, Third Avenue, and East 149th Street – known as the Hub – in 2008: Bronx

Design Vehicles and Emergency Access

The design vehicle (see Glossary) used for geometric street designs, typically a 30-foot-long single-unit truck, should be appropriate to the predominant intended uses of the given street and should not include commercial vehicles larger than New York City's maximum allowable length. In addition, all street designs must consider FDNY, other emergency-vehicle, and sanitation-vehicle-access needs (e.g., for street cleaning and snow clearing).

Complex Intersections

Multi-leg or skewed angle intersections should be redesigned (to the extent possible) to simplify operations and reduce or separate conflicts. This can include the removal of intersection legs and slip lanes that are unimportant to the traffic network, creation of right-angled intersection alignments, and simplified traffic patterns. Resulting pedestrian space should be consolidated into its most usable form to create new public open space and shorter, more direct crossings. The use of slip lanes should generally be avoided unless they produce a conflict-free crosswalk from the island that can provide an important pedestrian-safety enhancement.

Universal Design

Projects must meet or exceed all applicable federal, state, and/or local accessibility standards for facilities and public rights-of-way, including minimum clear path widths, inclusion of ADA-compliant pedestrian ramps and detectable warning strips, and provision of accessible transit facilities.

Drainage

All modifications to street geometry should consider and avoid unintended changes in the direction and disposition of stormwater runoff so as not to create ponding or flooding issues. Minimize impervious paved areas and utilize permeable paving wherever possible. Include planted areas and stormwater source controls within the roadway wherever feasible. Stormwater control within the street network may offer opportunities for resiliency benefits in areas that experience frequent flooding.

Roadways & Lanes

Bike Lane & Path

A dedicated on-street lane or path for bicycles (see Glossary). Bikeways are typically designed as BIKE LANES within the roadway delineated with markings (2.1.1a, also known as Class 2 bike lanes) or as BIKE PATHS physically separated from traffic for most of their length (2.1.1b, also known as Class 1 bike lanes). Another typical design is the shared lane (Class 3 bike lane) described in Table 1. The shared lane is not covered by the Manual. Bikeways in parks, or in other places with heavy pedestrian traffic can also be designated by bike stamps.

ABOVE: *Buffered bike lane: 9th Street, Brooklyn*

LEFT: *Two-way, parking-separated bike path: Prospect Park West, Brooklyn*

Benefits

Provides dedicated space for bicyclists, enhancing safety, comfort, and mobility

Cumulative with other bikeways, provides a comprehensive network of recommended routes for bicyclists, thereby encouraging bicycling

Application

On streets with high current or anticipated bicycle volumes or that offer important linkages to destinations or between routes, or to calm overly-wide roads for cycling circulation

Considerations

Ensure sufficient outreach to people with vision disabilities and facilities serving this population to provide adequate notification of changes during the planning and implementation phases

Design

See Table 1 (following 2.1.1b) for a listing of typical bikeway designs and their respective spatial requirements, ideal applications, and advantages and disadvantages

Create connectivity with adjoining bikeways, bike parking, transit, and commercial or cultural destinations

Utilize permeable paving and/or paving with a high SRI value within BIKE LANE or BIKE PATH

Utilize recycled content in paving materials

BIKE LANE & PATH

Bike Lane

Usage: Wide

A portion of a roadway that has been designated by striping, signs, and pavement markings for the preferential or exclusive use of bicyclists. Also known as a Class 2 bike lane. Physical separation of bike lanes is desirable, but is not always possible due to physical or operational constraints designated by bike stamps.

ABOVE: *Bike lane: 164th Street, Queens*

LEFT: *Bike lane: Montgomery Street, Manhattan*

Benefits

See benefits of BIKE LANES & PATHS (2.1.1)

On-roadway bike lanes that narrow or replace motor vehicle lanes can calm traffic

Considerations

Without physical separation, vehicles can block bike lanes, making enforcement of violations more critical

Application

See application guidance for BIKE LANES & PATHS

Consider using a BIKE PATH (2.1.1b) rather than, or in addition to, a BIKE LANE where street conditions permit (e.g., street width, traffic volume, etc.)

Design

See design guidance for BIKE LANES & PATHS

BIKE LANES should be buffered when possible, typically with 3 feet of channelization

At intersections with complex traffic patterns—or when bike lanes are located immediately adjacent to the curb—bike lanes can be given visual emphasis through the application of green-colored pavement

BIKE LANE & PATH

Bike Path

Usage: Limited

A path intended for the use of bicycles that is physically separated from motorized vehicle traffic by an open space or barrier and either within the roadway or within an independent right-of-way. Also known as a Class 1 bike lane. Physical separation of bikeways can sometimes be preferable on wide or busy streets, on major bike routes, or along long, uninterrupted stretches. Separation can take the form of a painted buffer demarcating the bike lane behind a "floating" parking lane, a narrow curb or raised median, or a wider raised median with landscaping. An alternative form of separation is grade-separation, where the bike path is located at sidewalk grade or in between sidewalk and roadway grade.

Two-way bike path: Grand Army Plaza, Brooklyn

Two-way bike path located outside the sidewalk: Columbia Street, Brooklyn

Benefits

See benefits of BIKE LANES & PATHS (2.1.1)

Offers greatest bicyclist separation from motor vehicle traffic on mid-block sections

Reduces risk of "dooring" (a motor-vehicle occupant opening her door into the path of an oncoming bicyclist)

Reduces or eliminates blocking of the bike lane by motor vehicles and the swerving of bicyclists into mixed traffic

Encourages novice and less confident cyclists to opt for cycling

Considerations

Design consideration must be given to pedestrians with vision/mobility disabilities, emergency-vehicle and paratransit access to adjacent buildings, snow-clearing and street-sweeping needs, and commercial vehicles loading and unloading

Application

Where a BIKE LANE is appropriate and the street is an important bicycle network connection, or has high motor vehicle volumes or speeds or multiple moving lanes, or is along a park, waterfront, or other open space where cross streets and driveways are infrequent

Consider wherever a BIKE LANE is appropriate

Design

See design guidance for BIKE LANES & PATHS (2.1.1)

Care must be given to the design of bike paths at intersections and driveways to maintain visibility of the bicyclist to motorists (and vice-versa) and to reduce the risk of turning conflicts with motor vehicles

In some circumstances (e.g., long paths along open space or waterfront), paths can be designed for shared use by bicyclists, pedestrians, skaters, wheelchair users, and other non-motorized users ("a shared-use path") rather than as a separate bike path and SIDEWALK (2.2.1)

If designed as a shared-use path, provide adequate space appropriate to anticipated volumes of low-speed users (pedestrians) and higher-speed users (bicyclists) so as to provide safe and comfortable accommodation of both and minimize conflicts between the two

Design RAISED MEDIANS that separate bike paths according to the RAISED MEDIAN section (2.2.3)

If a separated bike path uses raised medians, see the CURB-HEIGHT MEDIAN section (6.2.1a) or the RAISED MEDIAN section (6.2.1b) for information on plantings

TABLE 1

Guide to New York City On-Street Bicycle Facilities

Class 1: Bike Path (2.1.2b)

	Signal-Protected Path *9th Avenue, West 59th to 16th Streets, Manhattan*	Protected Path with Mixing Zones *Grand Street, Manhattan*
		
Space Required	**14 feet**	**8 feet**
Parking Loss	**High** 5–6 parking spaces/ turn bay (usually every other block)	**High** 4–5 parking spaces/mixing zone (usually every other block)
Ideal Application	**Commercial Avenues** o Wide one-way multilane street o Excess road space o High-speed vehicular traffic o High potential for motor vehicle intrusion into standard lane	**Commercial Cross-Streets** o One- or two-lane street o Excess road space o Low-speed vehicular traffic for safe mixing zone o High potential for motor vehicle intrusion into standard lane
Advantages	o Full protection for cyclists o Major enhancement to pedestrian safety and comfort	o Protection for cyclists mid-block o Mixing zone to manage turning conflict o Simpler implementation than Signal Protected Path o Signal timing unchanged
Disadvantages	o Space needs o Parking impacts o Signal timing and loading activity increase delays o Cyclist mobility o Complex review and implementation o Turn restrictions may be needed at complex intersections to maintain acceptable operations	o Parking impacts o Cyclist mobility o Unproven (Pilot) o Complex review and implementation o Challenging to regulate floating parking

Class 2: Bike Lane (2.1.2a)		Class 3: Bike Route (Not Included in Manual)	
Buffered Lane *DeKalb Avenue, Brooklyn*	**Standard Lane** *21st Street, Manhattan*	**Shared Lane** *48th Street, Queens*	**Signed Route**
			
8 feet	**5 feet**	**None** A wide (13-foot) travel lane is preferred	**None** A wide (13-foot) travel lane is preferred
Medium-Low Parking typically preserved unless space unavailable. Strict curb regulations sometimes needed	**Medium-Low** Parking typically preserved unless space unavailable. Strict curb regulations sometimes needed	**Low** Parking is typically preserved	**None**
Residential Avenues o Wide multilane street o Excess road space o Low potential for intrusion into bicycle lane	**Residential Cross-Streets** o One- or two-lane street o Excess road space o Low potential for intrusion into bicycle lane	**Narrow Streets** o One- or two-lane street o No excess road space o Connected to other bicycle facilities	**Limited Use** o Interim treatment o Connected to other bicycle facilities o Indicates a preferred bicycle route o Preserves curbside access
o Dedicated cycling space o Buffer zone enhances comfort for cyclists o Preserves curbside access o Simple implementation	o Dedicated roadway space for cycling o Preserves curbside access o Simple implementation	o Clear, easy to follow bicycle route o Heightens driver awareness of cyclists o Preserves curbside access o Simple implementation	o Indicates a preferred bicycle route o Preserves curbside access o Simple implementation
o Vehicular intrusion remains possible o Width tempts motorists to intrude o Perceived as less safe than protected paths	o Vehicular intrusion remains possible o Cyclists have minimal separation from traffic o Perceived as less safe than protected paths	o Does not provide dedicated roadway space for cycling o Cyclists not separated from traffic	o Does not provide dedicated roadway space for cycling o Cyclists not separated from traffic o Sign placement critical, can be challenging

Bus Lane & Busway

A dedicated on-street facility for buses. BUS LANES are delineated within the roadway with markings (2.1.2a) while BUSWAYS are physically separated from traffic for most of their length (2.1.2b). Both facility types can either be designed to run along the median of the street or along the outside (curbside or offset from a parking lane) of the street. Select Bus Service (SBS) is a high-quality bus service operated by MTA New York City Transit that uses several techniques to improve the speed and reliability of bus service, including BUS LANES.

Benefits

Improves bus speeds and reliability by separating buses from potential congestion in mixed traffic and by reducing or eliminating their need to merge in and out of traffic at bus stops

SBS buses operate up to 20% more efficiently than the same bus models operating on other routes, thereby reducing emissions

Provides means for emergency vehicles to bypass traffic

Considerations

If curbside, may result in restriction of curbside parking/loading

Application

Streets with SBS or high bus volumes and moderate to high traffic congestion or excessive road space

Consider on all streets with high bus volumes or existing or planned SBS and adequate space, regardless of congestion

Avoid on streets where the roadway geometry prevents the safe operation of a BUS LANE or BUSWAY in conjunction with other necessary uses of the roadway

Red, curb-aligned, on-street busway with "soft separation" from traffic: First Avenue, Manhattan

Design

BUS LANES AND BUSWAYS can be located immediately adjacent to the curb (curb bus lane or busway), adjacent to the righthand parking lane (offset bus lane), or in the middle of a road with boarding island stations (median bus lane or busway)

ALL BUS LANE AND BUSWAY types can be one or two lanes per direction based on bus volume, operating characteristics, and road width; one lane per direction is a more common treatment

Use an offset bus lane where possible, particularly when parking needs to be maintained; stops can be made at the curb or at BUS BULBS (2.2.2b)

Use a curb-aligned bus lane or busway when right-of-way may be constrained and where parking impacts can be managed

For curb-aligned designs, curbside deliveries can be accommodated with loading windows, lay-bys, and/or reserved commercial loading around the corner

A median BUS LANE or BUSWAY should be considered on two-way streets when sufficient right-of-way is available to accommodate the bus facility and the associated boarding islands, and the operation of the busway (including pedestrian movements) can be safely managed

For median bus lane or busway designs, boarding platforms must be included for bus passengers at bus stops; these islands can also function as PEDESTRIAN SAFETY ISLANDS (2.2.4)

For median bus lane or busway designs, left turns across the bus facility should either be prohibited or provided a protected signal phase

All BUS LANE AND BUSWAY designs can accommodate one or two directions of bus traffic. Special care must be paid to the signalization and design of intersections so as to not introduce turning conflicts

Consider queue-jump lanes for buses where buses need to merge with mixed traffic, where the roadway width reduces (such as at the end of a bus lane, a roadway choke point, or a bridge or tunnel approach), and at turn priority locations

For improved roadway longevity, a concrete roadway should be considered for BUS LANES AND BUSWAYS when conditions permit

Utilize paving with a high SRI value within bus lane or busway unless red-colored pavement is to be used per 2.1.2a

Utilize recycled content in paving materials

BUS LANE & BUSWAY

Bus Lane

Usage: Limited

A portion of a roadway which has been designated by striping, signing, and pavement markings for the preferential or exclusive use of buses. Physical separation of bus lanes is often inadvisable due to physical or operational constraints. Painted lanes, overhead signs, and soft barriers can minimize intrusion of other vehicles. Where land use and street width permit, full or partial physical separation can help enforce the lanes (see 2.1.2b).

Benefits

See benefits of BUS LANES & BUSWAYS (2.1.2)

Considerations

See considerations for BUS LANES & BUSWAYS (2.1.2)

Application

See application guidance for BUS LANES & BUSWAYS (2.1.2)

Design

See design guidance for BUS LANES & BUSWAYS

Red-colored pavement can be considered for bus lanes that operate six or more hours per day

At intersections, the allowance or prohibition of turns from the bus lane should be clear, such as breaking the solid white line where cars can enter to make right turns

Curb-aligned double bus lane: Madison Avenue, Manhattan

Red, curb-aligned bus lane: East Fordham Road, Bronx

BUS LANE & BUSWAY

Busway

Usage: Limited

A physically separated lane reserved for bus traffic. Busways are similar to BUS LANES (2.1.2a) in most respects, however full or partial physical separation (typically through a narrow curb or wider RAISED MEDIAN (2.2.3) further improves bus speeds by minimizing blocking of the bus lane by other vehicles.

ABOVE: *Curb-aligned busway: Paris, France (Note: for illustrative purposes only)*

LEFT: *A short section of separated busway through a busy intersection: Willis Avenue, Bronx*

Benefits

See benefits of BUS LANE & BUSWAY (2.1.2)

Reduces or eliminates blocking of BUS LANE (2.1.2a)

Considerations

Design consideration must be given to emergency vehicle access, deliveries and pick-up/drop-off to adjacent buildings, and to snow-clearing and street-sweeping needs

Attention should be given to accommodation of and navigation by people with vision disabilities

Application

See application guidance for BUS LANES & BUSWAYS

Consider where a BUS LANE is appropriate and the street is a high-volume bus route and has adequate right-of-way to accommodate a busway

Consider wherever a BUS LANE is appropriate

Design

See design guidance for BUS LANES & BUSWAYS

Busways should be designed to allow emergency vehicles to bypass traffic

On routes with multiple tiers of bus service, passing needs (e.g., express buses) should be accommodated

If a median busway design is not separated with a wide median, then the median must widen to provide boarding platforms for bus passengers at bus stops, which must meet ADA standards

Turns across busways need to be controlled for safety; bus-only signals may be needed

Crosswalks , detectable warning strips and traffic control devices should be used to signal transitions between pedestrian space and busways for people with vision disabilities

RAISED MEDIANS used to separate busway should be designed according to the RAISED MEDIAN section

Utilize paving with a high SRI value within busway, for example concrete

For median-separated busway, see the CURB-HEIGHT MEDIAN section (6.2.1a) for information on plantings

Shared Street

Usage: Pilot

Often referred to as a "pedestrian-priority street," a shared street is a low-speed, typically curbless roadway designed as a single surface shared among pedestrians, bicyclists, and low-speed motor vehicles.

Typically employed on low-vehicle-volume and/or high-pedestrian-volume streets, vehicles are slowed to very low speeds through a reduced speed limit, traffic calming, signage, and use of distinctive materials, furnishings, and other visual cues in the roadway that encourage drivers to travel with increased caution. Street users generally negotiate right-of-way cooperatively rather than relying on traffic controls, allowing pedestrians to dominate the street. The entire street thus effectively functions as a public space. Different forms of shared streets can be used in different contexts.

ABOVE: *Shared street: Mainz, Germany (Note: for illustrative purposes only)*

LEFT: *Shared street in a commercial area: Brighton, UK (Credit: Gehl Architects) (Note: for illustrative purposes only)*

Benefits

Allows freer pedestrian movement within walking-oriented areas and to and from surrounding land uses and destinations

Reduces sidewalk crowding on narrow streets

Maintains bicycle, local vehicle, and delivery access while creating an exceptionally pedestrian-oriented street that accommodates recreational and social activities

Allows active land uses to spread into the surrounding street network, fostering a vibrant public realm

Comfortable, attractive environment encourages "staying" activities such as relaxing, shopping, eating, and socializing

Integrated design can incorporate art, street furniture, landscaping, and other innovative and attractive design elements

Encourages partnerships with the community in beautification, maintenance, and programming of street space

Considerations

Attention should be given to accommodation of and navigation by people with vision, hearing, and ambulatory disabilities

May impact street drainage or require catch basin relocation

May require loss of on-street parking

Any community facilities integrated into the design, such as street furniture or public art, will typically necessitate the presence of a maintenance partner and a permit or revocable consent from the city

Coordinate streetscape/utility work to minimize street cuts

Application

Consider on narrower streets (at most two moving lanes) or outer roadways of boulevard-type streets, with little or no through-traffic, and which are not major vehicular or bicyclist through-routes or designated truck routes

Consider on streets adjacent to major pedestrian destinations, where vehicle volumes are low and pedestrian desire lines are diffuse (i.e., pedestrians would like to cross the street in many places)

Consider on local residential streets whose design priority is to allow safe use of street space for recreational activities and green space, in partnership with residents or neighborhood groups

Consider on narrow, alley-type streets

Depending on the specific land uses, width, vehicle and pedestrian volumes, and other access and operational characteristics of the street, a shared street may not be appropriate, in which case consideration should be given to a standard roadway with alternative design options such as traditional traffic calming and/or a mid-block crossing

Consider as an alternative a fully pedestrianized street when pedestrian volumes are high, vehicle volumes are low, and vehicle access is not required during daytime hours

Design

Curbs should not be used, but pedestrian paths of travel alongside vehicle zones with guideways using tactile cues and maximum visual contrast should be included for people with vision disabilities

In the absence of curbs, special attention should be given to providing adequate drainage

Vehicle-free, accessible routes must be provided for the visually impaired

Design should utilize whatever horizontal, vertical, and material treatments are necessary to encourage vehicle speeds that are low (15 mph or lower) throughout, whether or not pedestrians are present

Use GATEWAY (2.3.3) or similar treatments and proper signage at entries to discourage through-traffic, indicate the change in street environment, and slow entering vehicles

Institute a reduced speed limit (New York State VTL Section 1642(a)(26)(a) currently allows as low as 15mph) along with the physical traffic-calming of the shared street

Attractive street materials, furnishings, and other objects within the street can be used to alert drivers and emphasize the pedestrian orientation of the space, subject to permits, maintenance agreements, or revocable consents as required

Include planted areas and stormwater source controls within the roadway wherever possible

Staggered sections of parking or loading zones can be used as a design option to constrict wider streets

Pedestrian-priority zone: Fordham Plaza, Bronx

Shared intersection: Seven Dials, London (Credit: Aaron Naparstek/streetsblog.org) (Note: for illustrative purposes only)

To maintain the streetscape elements required for creating a low-speed environment and fostering a vibrant public space, careful attention must be paid to proper programming and management of the space, with the participation of an active maintenance partner where appropriate

Minimize impervious paved areas and utilize permeable paving wherever possible

Maximize trees and other green cover. See TREE BEDS (6.1) and ROADWAY PLANTINGS (6.2)

Utilize stormwater source controls wherever feasible. See STORMWATER MANAGEMENT PRACTICES (6.6)

Increase SRI value of paved surfaces to reduce urban heat island impact

Utilize recycled content in paving materials

Plaza

An area located fully within the roadway that is designated by DOT for use by pedestrians. The space may contain benches, tables, or other facilities. DOT builds both interim and permanent plazas. Many plazas are built through DOT's Plaza Program, which aims to enhance the public realm. See Chapter 1: PROCESS for more information on how DOT projects are planned, designed, and implemented.

ABOVE: *Fowler Square Plaza (interim), Brooklyn*

LEFT: *Willoughby Plaza (permanent), Brooklyn*

Benefits

Promotes social interaction and builds neighborhood identity

Encourages pedestrian activity and associated health benefits

Catalyzes local economic development

Serves as a venue for a diverse range of community, cultural, and/or commercial events

Enhances safety by narrowing wide roadways and/or normalizing intersections

Considerations

The road segment's relevance to the traffic network

Open-space needs

Surrounding land uses and site appropriateness

Anyone can apply to the Street Activity Permit Office (SAPO) to stage events on DOT plazas. To learn more about the event permitting process, contact SAPO by phone at (212) 788-7567 or visit **www.nyc.gov/cecm**

Advertising is not permitted in plazas

Generally requires a maintenance agreement

Application

Under-utilized, DOT-owned road segments and other city property

Locations with high crash rates

Neighborhoods that support repurposing streets for plazas

Design

Plaza designs should support year-round events and programs

See design guidance for PERMANENT PLAZA (2.1.4a) and INTERIM PLAZA (2.1.4b)

Provide clear paths and tactile cues to accommodate people with disabilities

Furniture should accommodate people with disabilities; for example, providing space for knee clearance for people using mobility devices

PLAZA

Permanent Plaza

Usage: Limited

A plaza built with Capital funds to be maintained and managed by a local not-for-profit organization (Partner) or another entity, such as the Department of Parks & Recreation (DPR). Such a project completely reconstructs the street segment, in whole or in part.

Benefits

See benefits of PLAZA (2.1.4)

Considerations

See considerations for PLAZA (2.1.4)

Application

See application guidance for PLAZA (2.1.4)

Neighborhoods with active not-for-profit organizations that can serve as Partners to maintain and manage plazas

Areas with appropriate adjacent land uses, sufficient population density, proximity to transit, historic sites, significant view corridors

Design

Each permanent plaza is designed to reflect the character and context of its neighborhood. DOT and the Partner conduct a public process to develop an appropriate design that is responsive to the needs of the community

A consultant design team bases its plans on feedback from the public process

Sites smaller than 2,000 square feet are not encouraged

Plazas may include movable and/or formal and informal fixed seating; trees and plants (see TREE BEDS [6.1] and PLAZA PLANTINGS [6.4]); lighting; paving; information and wayfinding signage; subconcessions; public art (temporary and permanent); bicycle parking; and drinking-water fountains

Completed in spring 2013, Willoughby Plaza features new trees and a flexible, open space that lends itself well to a wide range of events and programming, including the art displays shown here: Brooklyn

Incorporate public art where feasible

All permanent public art must be coordinated through the Department of Cultural Affairs (DCA) Percent for Art Program and requires approval by the Public Design Commission (PDC). Permanent art may be completely integrated and functional (e.g., benches, tables, etc.), or it may be stand-alone art (e.g., a sculpture)

Temporary art can be installed as a one-time project or cycled through on a temporary basis at a designated space in the plaza. Temporary art must be coordinated through DOT's Urban Art Program. For guidelines and to apply to the Urban Art Program, visit **www.nyc.gov/urbanart**

Minimize impervious paved areas and utilize permeable paving wherever possible

Incorporate trees and other green cover. See TREE BEDS (6.1) and PLAZA PLANTINGS (6.4)

Utilize stormwater source controls wherever feasible

Increase SRI (solar reflective index) value of paved surfaces to reduce urban heat island impact

Utilize recycled content in paving materials

PLAZA

Interim Plaza

Usage: Wide

A plaza built with interim materials by DOT personnel and on-call contractors. The interim condition often precedes a permanent plaza. This type of plaza can be built quickly, allowing people to use it sooner.

ABOVE: *Putnam Plaza, Brooklyn*

LEFT: *Plazas host multiple special events throughout the year: Corona Plaza, Queens*

Benefits

See benefits of PLAZA (2.1.4)

Catalyzes community support for the space

DOT can study the interim plaza and incorporate its observations and feedback into the eventual capital design of the space

Tests maintenance partner's capacity to maintain and program the plaza

Epoxy gravel or paint creates a more reflective surface, making the space feel safer at night

Cheaper and faster to design and install than a PERMANENT PLAZA

Considerations

See considerations for PLAZA (2.1.4)

Maintenance partner replaces elements over time as needed

Attention should be given to accommodation of and navigation by people with vision disabilities

Application

See application guidance for PLAZA (2.1.4)

Typically the phase prior to a PERMANENT PLAZA (2.1.4a), delivering community benefits quickly, and generating feedback for permanent design

As requested by a community and/or where a safety project provides a public-space opportunity

Design

See design guidance for PLAZA (2.1.4)

Geometry is engineered by DOT and is typically delineated with roadway markings and flexible reflective bollards

Detectable warning strips are required at pedestrian access routes or crossings where the transition from pedestrian space to roadway is flush, and should include high color contrast from the plaza surface

In the absence of a curb, granite blocks are to be placed next to crosswalks when feasible to provide directional guidance for pedestrians with vision disabilities

DOT places edge objects, such as planters, granite blocks and flexible delineators in and around the space to create a consistent boundary and sense of enclosure, and to buffer it from motor vehicle traffic. DOT also applies epoxy gravel or paint to distinguish it visually from the adjacent roadway

DOT and/or Partners provide publicly accessible furniture, such as moveable chairs and tables

Incorporate temporary public art where feasible. See guidance for temporary art in PERMANENT PLAZA (2.1.4a)

Sidewalks & Raised Medians

Sidewalk

That portion of a street, whether paved or unpaved, between the curb lines or the lateral lines of a roadway and the adjacent property lines intended for the use of pedestrians. Where it is not clear which section is intended for the use of pedestrians, the sidewalk will be deemed to be that portion of the street between the building line and the curb. In denser areas a FULL SIDEWALK (2.2.1a) reaching all the way to the curb is used, while in less built-up areas a RIBBON SIDEWALK (2.2.1b), with a vegetated or grass planting strip between the sidewalk and the roadway, can often be used.

Benefits

Provides infrastructure for the most widely used mode of travel in New York City — walking

Creates linkages to transit, connects neighborhood destinations, and allows trip chaining

Support mobility for the majority of New Yorkers

Facilitates straight and unobstructed pedestrian movement, free of vehicle conflicts except at intersections and driveways

With adequate width, can provide space for "staying" activities such as relaxing, shopping, eating, and socializing

Sidewalk with standard paving treatment: 11th Avenue, Manhattan

Considerations

Coordinate streetscape/utility work to minimize street cuts

Application

On both sides of all streets that are 22 feet wide or wider. Exceptions include SHARED STREETS (2.1.4), pedestrian-only, and streets in certain historic districts per LPC

Ribbon sidewalks are appropriate in R1-R6 zoning districts; full sidewalks are used elsewhere

Design

Sidewalks should always be provided on both sides of the street

See SIDEWALKS (3.1) in the Materials chapter for information on options for sidewalk materials

A park's internal path located near a roadway does not substitute for a sidewalk

If the sidewalk is more than 25 feet wide, there should be a clear path adjacent to the building line and an 8-foot clear path adjacent to the curbside furnishing zone

Sidewalks (and planting strip, if applicable) should be as wide as possible appropriate to foot traffic and available street width

Sidewalks must conform to ADA requirements for minimum clear path width and provision of spaces where wheelchair users can pass one another or turn around

Provide an unobstructed clear path of 8 feet or one half the sidewalk width (whichever is greater) in commercial, high-density residential, and transit-adjacent areas

Sidewalks in low-rise residential areas should be at least 5 feet wide

Wherever possible, sidewalk cross-slope should not be greater than 2%

Sidewalks must meet load-bearing, friction, and other requirements per relevant standard specifications and regulations

ADA-compliant pedestrian ramps must be provided at all pedestrian crossings; separate ramps should be used aligned with each crosswalk and be centered on a continuation of the sidewalk

Color of detectable warning strip should contrast with surrounding pavement: dark gray in areas of light pavement and white in areas of dark pavement. See DOT Standard Details of Construction drawing H-1011

The area within 18 inches of the curb should be kept free of all obstructions

New York City Mayor's Executive Order No.22 of 1995 (the "Clear Corner Policy") states that to the maximum extent possible, structures and objects should not be placed in the corner quadrant

For recommended clearances between obstructions, see Revocable Consent Rules (Rules of the City of New York, Title 34, Chapter 7, Section 7-06(c)(5)), DOT Highway Rules (Rules of the City of New York, Title 34, Chapter 2, Section 2-10), DCA's rules regarding newsstands (Rules of the City of New York, Title 6, Chapter 2, Subchapter G), and Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right of Way (US Access Board, 2011)

Include planted areas and stormwater source controls within sidewalks wherever possible when a maintenance partner is identified

If work includes tree planting, consider the location of utility infrastructure, including DEP sewers and water mains

Minimize impervious paved areas and utilize permeable paving wherever possible

Maximize trees and other green cover wherever clearance allows. See TREE BEDS (6.1) and SIDEWALK PLANTINGS (6.3)

Utilize stormwater source controls wherever feasible

Increase SRI value of sidewalk materials to reduce urban heat island impact

Utilize recycled content in paving materials

SIDEWALK

Full Sidewalk

Usage: Wide

A full sidewalk accommodates both pedestrian traffic and a range of street furnishings and fixtures. The area of the sidewalk closest to the curb, where light poles, signs, fire hydrants, waste receptacles, telephone booths, newspaper boxes, etc., are typically located, is referred to as the "furnishing zone."

Benefits

See benefits of SIDEWALK (2.2.1)

Provides increased space for pedestrian movement and improved curbside access as compared to a RIBBON SIDEWALK (2.2.1b)

Application

See application guidance for SIDEWALK (2.2.1)

Design

See design guidance for SIDEWALK (2.2.1)

Full sidewalk: Seventh Avenue, Brooklyn (Credit: DCP)

Sidewalk corner with pedestrian ramps: West 110th Street, Manhattan

SIDEWALK

Ribbon Sidewalk

Usage: Wide

A sidewalk that is separated from the roadway by a continuous, unpaved planting strip. Most existing ribbon sidewalks in the city have a lawn planting strip, more sustainable landscaping options should be utilized whenever possible. Alternatively, planting strips can be designed as pilot STORMWATER MANAGEMENT PRACTICES (6.6.1) to help collect stormwater runoff.

Benefits

See benefits of SIDEWALK (2.2.1)

Provides greater space for tree roots than a FULL SIDEWALK (2.2.1a) with INDIVIDUAL TREE BEDS (6.1.1a), improving long-term tree health

Provides a modest improvement in stormwater detention from the sidewalk and/or roadway as compared to a FULL SIDEWALK

Provides a more attractive streetscape in areas of low- to moderate-density residential land use

Application

Areas within zoning districts R1 through R6

Consider wherever pedestrian volumes can be accommodated and curbside activity is low

Design

See geometric design guidance for SIDEWALK (2.2.1) and materials guidance for SIDEWALKS (3.1)

Ribbon sidewalks should be at least 5 feet wide or as required to match the existing ribbon width in the immediate neighborhood; they should be wider along arterials and collector roads

Ribbon sidewalk with lawn planting strip: Ocean Parkway at Avenue C, Brooklyn

Planting strips adjacent to ribbon sidewalks must be planted with groundcover vegetation for erosion control if a STORMWATER MANAGEMENT PRACTICE (6.6) is not used; herbaceous plant material, preferably native or adapted species, should be used rather than grass wherever possible, as turf absorbs water from tree roots, has little benefit to habitat, and requires the use of pesticides, herbicides, fungicides, and lawnmowers that can potentially damage tree roots

Where there are fire hydrants in the planting strip adjacent to a ribbon sidewalk, a 5-foot-by-5-foot slab of 6-inch-thick concrete on 6-inch, crushed-stone base extending from the curb to the sidewalk is required

Similar considerations apply to other elements, such as lampposts and signal posts

Where feasible, utilize STORMWATER MANAGEMENT PRACTICE (6.6) within planting strip rather than groundcover vegetation alone to better manage stormwater

Curb Extension

An expansion of the curb line into the lane of the roadway adjacent to the curb (typically a parking lane) for a portion of a block either at a corner or mid-block. Also known as neckdowns, curb extensions can enhance pedestrian safety by reducing crossing distances, can relieve sidewalk crowding, and can provide space for functional elements such as seating, plantings, and furniture. In addition, two curb extensions can be located on either side of a street to create a MID-BLOCK NARROWING (2.2.2 c) or at an intersection to create a GATEWAY (2.3.3).

ABOVE: *Curb extension: Seventh Avenue, Manhattan*

RIGHT: *Curb extension: Fifth Avenue, Brooklyn*

Benefits

Calms traffic by physically and visually narrowing the roadway

At a corner, slows turning vehicles and emphasizes the right-of-way of crossing pedestrians

Shortens crossing distance, reducing pedestrian exposure and minimum required signal time for crossing

Improves the ability of crossing pedestrians and drivers to see each other

Makes the crosswalk more apparent to drivers, encouraging them to stop in advance of the crosswalk, and reduces illegal parking within crosswalk

Reinforces lane discipline through intersection, preventing vehicle passing maneuvers in parking lane

Provides additional pedestrian space and reduces crowding, particularly for queuing at crossings and bus stops or when located at a subway entrance or other protrusion

Creates space that may be used to locate street furniture, bike parking, bus stop, public seating, street vendors, etc., potentially reducing sidewalk clutter

Keeps fire hydrant zone clear when located in front of a hydrant

Defines the ends of angle parking

Can discourage truck turns onto streets with No Truck regulations (See Rules of the City of New York, Title 34, Chapter 4, Section 4-13)

Considerations

May impact street drainage or require catch basin relocation

May impact underground utilities

May require loss of curbside parking

May complicate delivery access and garbage removal

May impact snow plows and street sweepers

Application

Only applicable within a curbside parking lane

Corners with marked pedestrian crosswalks in retail districts, directly adjacent to schools, at intersections with demonstrated pedestrian safety issues, on wide streets, or in areas of high foot traffic

At school crosswalks

At mid-block crossings (see MID-BLOCK NARROWING 2.2.2c)

Intersections where a two-way road transitions to oncoming one-way operation so as to block wrong-way traffic from proceeding straight onto the one-way portion (a "blockbuster")

Next to subway entrances or other sidewalk pinch points so as to increase pedestrian walking or queuing space

Near fire hydrants, to keep clear of parked vehicles

Consider at all corners and pedestrian crossings

Consider elongated curb extensions for some or most of a block (i.e., a widened sidewalk with lay-by areas) in areas where a full sidewalk widening would be desirable but some loading, drop-off, or parking access must be maintained

Cannot be used where curbside travel (including bus, bicycle, or general traffic) lane exists, such as those created through peak-period parking restrictions

Feasibility of curb extensions is evaluated based on engineer review of design-vehicle turning movements

Design

Curb extension width is typically two feet less than the width of the parking lane. Minimum curb extension length is typically equal to the full width of the crosswalk, however it can be longer when appropriate or necessary

A fire truck turning zone with a 50-foot outside radius should be maintained clear of physical obstructions (signs, planters, non-flexible bollards, trees)

When a curb extension conflicts with design vehicle turning movements, the curb extension should be reduced in size rather than eliminated wherever possible

At crossings that may have low pedestrian visibility, curb extension should be long enough to "daylight" the crossing, i.e., provide open sight-lines to the pedestrian crossing for approaching motorists; the additional curb extension space can be used to provide plantings (see CURB EXTENSION [6.3.3]) or community facilities such as bicycle parking as long as visibility is not hindered

The design and placement of street furniture, trees, and plantings on a curb extension must not impede pedestrian flow, obstruct clear path, or interfere with "daylighting" the intersection, emergency operations, or sight lines

Pedestrian ramps should be aligned such that they serve as a continuation of the sidewalk, rather than within the radius of the curb extension, to accommodate direct pedestrian path

Curb extension must be designed so as to maintain drainage of stormwater from the gutter and not cause ponding; depending on site-specific grading conditions, this might include properly locating catch basins or utilizing design treatments that channel water through, around, or in

Curb extensions shorten crossing distances. This is especially important for vulnerable users: Fifth Avenue, Brooklyn

between curb extension and the curbline

Where space permits, more functional curb extension designs, such as those with PLANTINGS (6.3), or COMMUNITY FACILITIES (2.2.2a), such as seating or bicycle parking, should be used whenever possible

Vertical elements should be used to alert drivers and snow plow operators to the presence of the curb extension

To reduce the cost and implementation time of curb extension, trench drains can be considered instead of catch-basin relocation if a maintenance partner exists to clean the trench drain

When curb extension is used at a fire hydrant, the length of the curb extension should be equal to or greater than the No Parking zone (typically 15 feet in either direction) and the hydrant should be moved onto the curb extension

Paving on curb extension should match that of the surrounding sidewalks

Locate trees and/or plantings within curb extension where appropriate. See TREE BEDS (6.1) and CURB EXTENSION (6.3.3)

Maximize permeable surface of curb extension

Where feasible, design planted areas within curb extension so as to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

CURB EXTENSION

Curb Extension: Community Facilities

Usage: Wide

A CURB EXTENSION that provides space for community facilities such as bicycle parking, seating, and other street furniture. In areas with inadequate sidewalk width to accommodate needed functional sidewalk elements for the community, the extra space provided by a curb extension can be used for bike parking, seating, public art, gardens, plantings, or trees, alone or in combination. Similarly, all paved curb extensions can also provide space for consolidating basic sidewalk furnishings such as trash cans, newspaper racks, newsstands, and light or signal poles, where foot traffic permits.

ABOVE: *Curb extension with bike parking: North 7th Street, Brooklyn*

RIGHT: *Curb extension with trees and seating: 46th Street, Queens*

Benefits

Provides safety and traffic calming benefits as described in CURB EXTENSION (2.2.2)

Provides space for functional sidewalk elements outside of the sidewalk clear path, freeing sidewalk space for movement

Improves the public realm and creates useful public space, particularly in areas where public open space is in short supply

Allows limited street space to serve multiple functions, thereby increasing the performance of street infrastructure

May encourage mode shift to walking by creating a more comfortable and enjoyable walking environment

Considerations

Permits, revocable consents, and/or maintenance agreements may be required for certain elements

Bike racks must be standard DOT design unless a permit is obtained from DOT

Application

See application guidance for CURB EXTENSION (2.2.2)

Areas without sidewalk crowding where demand exists for the community facilities and a committed partner is willing to maintain any elements that require maintenance, such as seating; a maintenance partner is not needed for a DOT bike rack

Design

See design guidance for CURB EXTENSION (2.2.2)

CURB EXTENSION

Bus Bulb

Usage: Wide

A CURB EXTENSION at a bus stop that avoids the need for buses to pull in and out of the moving lane to pick up and discharge passengers. Bus bulbs may also be designed to better support bus passengers through the inclusion of higher curbs, bus stop shelters, seating, pre-boarding payment equipment, and other bus-supportive facilities.

Benefits

Provides safety and traffic calming benefits as described in CURB EXTENSION (2.2.2)

Speeds bus movement on streets with traffic congestion by eliminating the need for buses to maneuver in and out of the moving lane

Speeds bus movement by reducing the likelihood of bus stops being blocked by stopped vehicles

Discourages non-bus encroachment into bus-only lanes

Can allow faster bus passenger boarding

Can provide comfort and convenience to bus riders through dedicated waiting space and inclusion of bus-related amenities

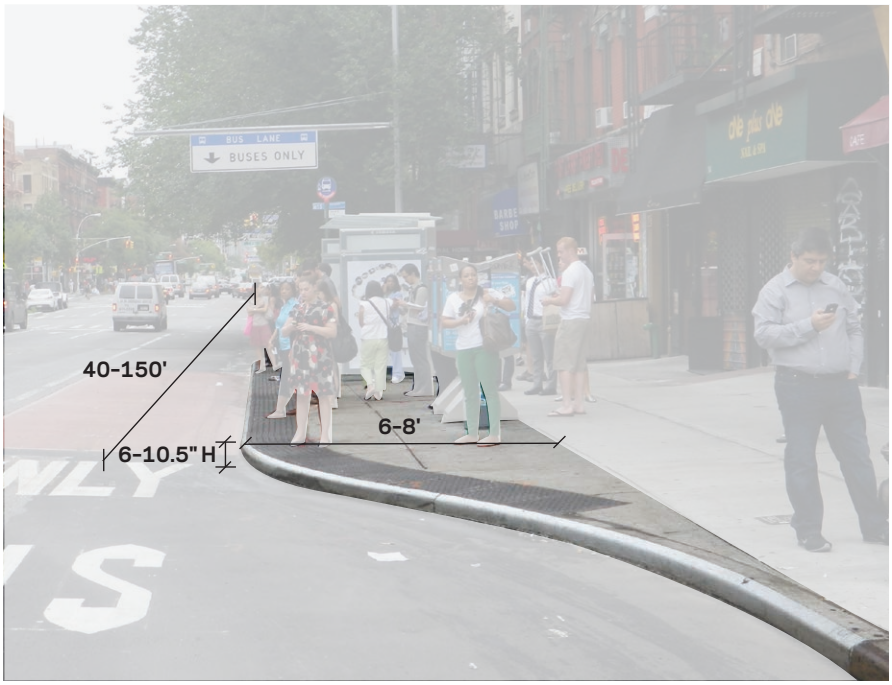
When utilized at a bus stop under an elevated train line, where the bus does not pull over to the sidewalk, provides a safer space for passengers to wait, as many currently stand in the roadway

Allows additional on-street parking as compared to a standard bus stop

Application

See application guidance for CURB EXTENSION (2.2.2)

At bus stops along bus routes where it has been determined by DOT and MTA NYCT that bus bulbs would enhance bus service



Bus bulb: First Avenue, Manhattan

Design

For detailed design guidance, see Select Bus Service Station Design Guidelines (DOT & MTA NYCT, 2009)

See additional design guidance for CURB EXTENSION (2.2.2)

Bus bulbs should be long enough to encompass the front and rear doors of the buses that will be using it, and should extend the length of the bus stop whenever possible

Design BUS BULBS with care to accommodate accessibility needs, taking into account the full range of buses that might be using the stop

A bus bulb under an "El" (elevated subway): Jerome Avenue, Bronx

CURB EXTENSION

Mid-Block Narrowing

Usage: Wide

Two CURB EXTENSIONS that create a pinch point. A mid-block narrowing (also referred to as a "choker") physically or visually constricts the roadway, thereby slowing vehicular traffic or alerting drivers to the presence of a mid-block crossing. The curb extensions themselves can be of any variety, for example with plantings or other functional elements. A mid-block narrowing is equivalent to a GATEWAY (2.3.3) located mid-block.

Mid-block narrowing: West 94th Street, Manhattan
(Note: use of walls is not recommended by this manual)

Benefits

Provides safety and traffic calming benefits as described in CURB EXTENSION (2.2.2)

Calms mid-block traffic speeds, particularly if vertical elements (e.g., bollards, trees, bicycle parking, etc.) are included in CURB EXTENSIONS (2.2.2)

Improves drivers' awareness of presence of crosswalk at mid-block crossing

Provides space for greening, community facilities, bicycle parking, and/or stormwater source control measures

Application

See application guidance for CURB EXTENSION (2.2.2)

Local streets with demonstrated speeding issues and/or a mid-block crossing

At mid-block crossings on two-way streets, it is generally preferable to include a RAISED MEDIAN (2.2.3) or PEDESTRIAN SAFETY ISLAND (2.2.4) rather than or in addition to a mid-block narrowing, when space allows

Design

See design guidance for CURB EXTENSION (2.2.2)

Reduce lane width at mid-block narrowing to impact vehicle speeds; on low-traffic residential streets, mid-block narrowing can be combined with other design treatments, including RAISED CROSSWALKS (2.3.4), RAISED SPEED REDUCERS (2.3.2), or vertical elements for maximum effectiveness

Locate trees and/or plantings within curb extensions of mid-block narrowing where appropriate. See TREE BEDS (6.1) and CURB EXTENSION (6.3.3)

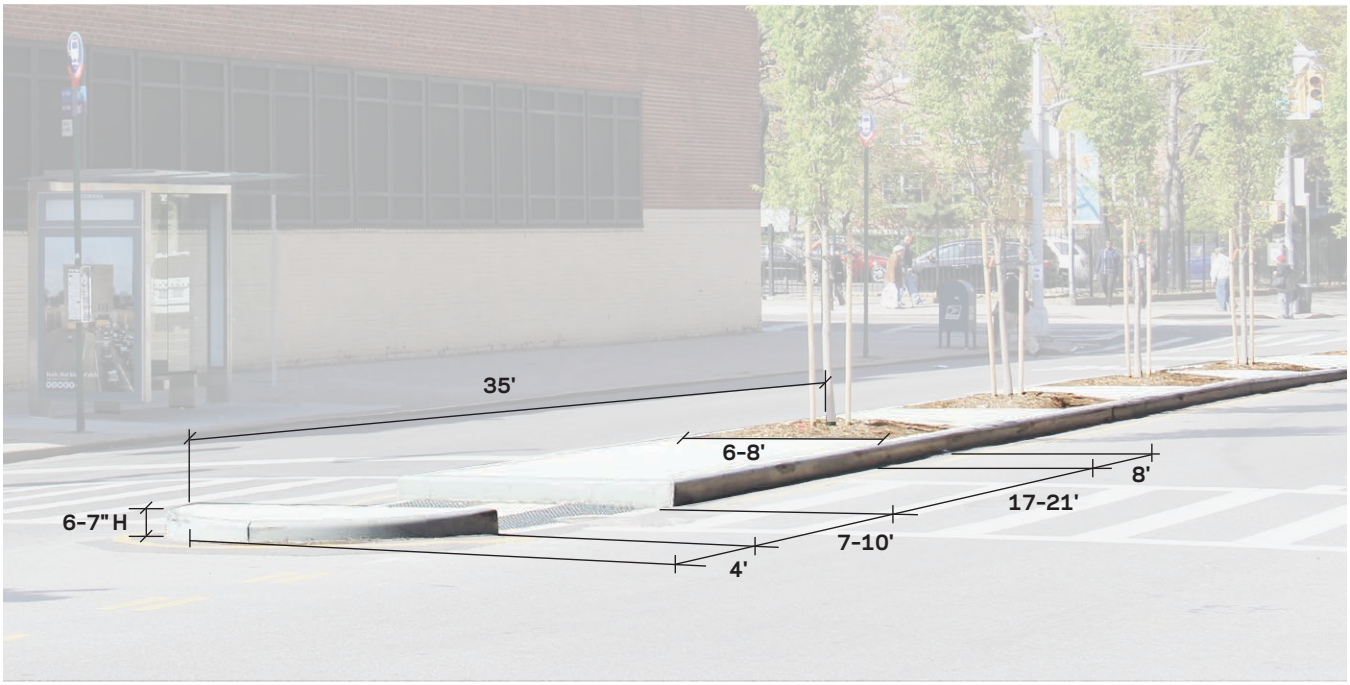
Maximize permeable surface of curb extension with vegetation, permeable paving, or both

Where feasible, design planted areas within mid-block curb extensions so as to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

Raised Median

Usage: Wide

A raised area separating different lanes, traffic directions, or roadways within a street. The raised median can be either curb height (6–7 inches) or, where appropriate, 12–24 inches high. The width as well as design of raised medians can vary widely. They can range from narrow raised concrete islands to tree-lined promenades to intensively landscaped boulevard medians. In contrast to PEDESTRIAN SAFETY ISLAND (2.2.4), raised medians extend for most or all of the street block.



Raised medians can enhance pedestrian safety: Fifth Avenue at East 138th Street, Manhattan

Benefits

Reduces risk of left-turn and vehicle head-on collisions

Calms traffic by narrowing roadway

Enhances pedestrian safety and accessibility by reducing crossing distances and providing refuge for pedestrians to cross road in stages

If designed for walking access, can provide additional pedestrian capacity

Greens and beautifies the streetscape if it incorporates trees and/or plantings. See RAISED MEDIAN (6.2.1)

Improves environmental quality and can incorporate stormwater source controls

Can provide space for a SIDEWALK (2.2.1) and/or SEPARATED BIKE PATH (2.1.1b), particularly as part of a boulevard treatment

Considerations

May impact underground utilities

Design must account for impact of raised median on emergency vehicle movement and access

Landscaping or stormwater source controls require a partner for ongoing maintenance

Changes in traffic circulation resulting from addition of raised median should be understood so as to not force drivers to travel on inappropriate routes or make U-turns

If continuous, raised median may prevent left turns into driveways on opposite side of street

Application

Two-way streets with two or more roadway travel lanes in total

Consider on all two-way multilane streets

On streets of limited width, it may be preferable in some situations to include other treatments (e.g., expanded sidewalks or dedicated transit or bicycle facilities) rather than a raised median if there is not adequate room for all treatments and travel lanes

Design

Raised medians should be wide enough to provide refuge to pedestrians at crossings: 5 feet minimum, 6 feet or greater preferred; when planted, 6 feet minimum. See RAISED MEDIANS (6.2.1)

Raised medians should extend beyond the crosswalk at intersections wherever possible, while accommodating vehicle turning movements; the "nose" of the raised median should include bollards to protect pedestrians from wayward vehicles

Provide a walkable path across the raised median at crossings. When the median is less than 17 feet wide, an 8–10-foot-wide cut-through, flush with the roadway, is appropriate. On medians wider than 17 feet, pedestrian ramps (1:12 grade with 5-foot landing areas) can be used to provide access

Provide a large pedestrian storage area at crossings to permit groups of pedestrians to safely wait to cross

Provide tactile cues for pedestrians with vision disabilities to indicate the border between the pedestrian refuge area and the motorized travel lanes

Median with Greenstreet and sidewalk: Carlton Avenue, Brooklyn

Include street trees, plantings, and unpaved or permeable surfaces wherever safe and feasible, using structural soil where appropriate. See TREE BEDS (6.1), RAISED MEDIAN (6.2.1), and POROUS CONCRETE (3.1.13)

Grade roadways to direct stormwater towards raised medians if the raised medians include stormwater source controls, for example through the use of double or inverted roadway crown

If work includes tree planting, consider the location of utility infrastructure, including DEP sewers and water mains; also consider visibility for motorists, cyclists, and pedestrians

Raised medians must be designed so as to maintain drainage of stormwater and not cause ponding

Locate trees and/or plantings within raised median. See TREE BEDS (6.1) and RAISED MEDIAN (6.2.1)

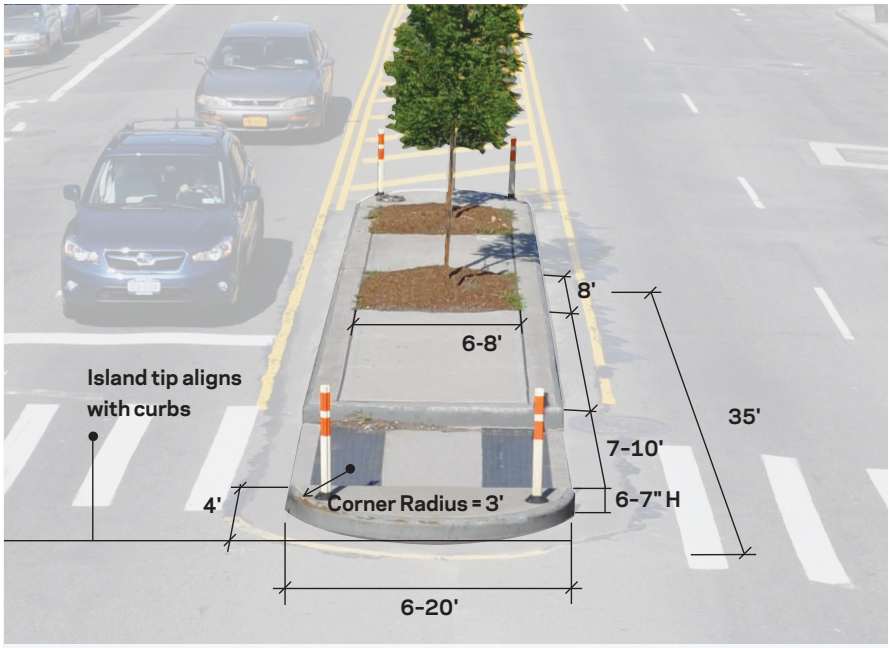
Maximize permeable surface of raised median

Where feasible, design planted areas within raised median so as to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

Pedestrian Safety Island

Usage: Wide

A raised area located at crosswalks that serves as pedestrian refuge separating traffic lanes or directions, particularly on wide roadways. Also known as a "median refuge island" and "Green Refuge Island." Used at pedestrian crossings when a full RAISED MEDIAN is not feasible. A pedestrian safety island confers most of the same benefits as full RAISED MEDIANS at pedestrian crossings. Full RAISED MEDIANS should be used rather than pedestrian safety islands wherever possible.



ABOVE: *Pedestrian safety island: Hillside Avenue, Queens*

LEFT: *Pedestrian safety island: Crotona Avenue, Bronx*

Benefits

Enhances pedestrian safety and accessibility by reducing crossing distances and providing refuge for pedestrians to cross road in stages

Calms traffic, especially left turns and through-movements, by narrowing roadway at intersection

Reduces risk of vehicle left-turn and head-on collisions at intersection

Can green and beautify the streetscape with trees and/or vegetation, potentially including stormwater source controls

Trees increase the visibility of the island, thereby usually improving safety

Considerations

May impact underground utilities

Landscaping or stormwater source controls require a partner for ongoing maintenance

Application

See application guidance for RAISED MEDIAN (2.2.3)

Design

See design guidance for RAISED MEDIAN (2.2.3)

Typical island accommodates two street trees and, where appropriate, bell bollards. See TREE BEDS (6.1) and RAISED MEDIAN (CURB HEIGHT) (6.2.1a)

Median Barrier

Usage: Limited

A RAISED MEDIAN or PEDESTRIAN SAFETY ISLAND extended through an intersection to prevent left turns and through-movements to and from the intersecting street. Pedestrian access can be maintained with pedestrian refuges and bicycle access with gaps in the median. As with typical RAISED MEDIANS, trees or plantings can be included within the median barrier.

Benefits

Reduces or eliminates short-cut and cut-through traffic

When applied consistently to an area, reduces traffic speeds

Can green and beautify the streetscape with trees and/or vegetation, improving environmental quality and potentially incorporating stormwater source controls

Enhances safety at intersection by reducing potential vehicle movements and conflicts, particularly left turns

Reduces risk of vehicle head-on collisions

Reduces risk of motorists running a red light or stop sign when approaching from side street

Calms traffic on side street by requiring turn and on major street by narrowing roadway

Enhances pedestrian safety and accessibility by reducing crossing distances and providing refuge for pedestrians to cross the road in stages

Considerations

May impact street drainage or require catch basin relocation

May impact underground utilities

Emergency vehicle access needs must be accommodated

Landscaping or stormwater source controls require a partner for ongoing maintenance

The raised median on Canal Street extends through the intersection with Washington Street: Manhattan.

If outfitted to capture stormwater, careful consideration must be given to design, overflow control, and plant species

Application

Consider on local streets with speeding or cut-through/short-cutting issues

One-way or two-way local streets at their intersections with two-way collector or arterial roadways

Design

Design traffic diversion devices to impact motor vehicle movement but not bicycle movement; utilize bike channels or similar design strategies to allow passage by bicyclists

Include planted areas and stormwater source controls within traffic diverters wherever possible when a maintenance partner is identified

If work includes tree planting, consider the location of utility infrastructure, including DEP sewers and water mains

Locate trees and/or plantings within diverter when appropriate. See TREE BEDS (6.1) and RAISED MEDIAN (6.2.1)

Maximize permeable surface of diverter. See POROUS CONCRETE (3.1.13)

Design any planted areas within diverter so as to capture stormwater according to current standards

See additional design guidance for RAISED MEDIAN (2.2.3)

Traffic Calming

CURB EXTENSION

Lane Narrowing & Lane Removal

Usage: Wide

Lane Narrowings remove excess width from existing moving lanes without changing the number of moving/traffic lanes. Lane Removals reassign underused traffic lanes to other functions. These design techniques, while not traffic-calming devices, have powerful traffic-calming benefits. Both may be accomplished by adding markings, turning lanes, pedestrian refuge islands, expanded pedestrian space, on-street or separated bicycle lanes, parking, or other functions.

Benefits

Reduces opportunities for speeding and aggressive driving, thereby decreasing the severity and frequency of crashes

Organizes the roadway to provide clearer instruction to drivers, cyclists, and pedestrians

Provides space for pedestrian refuge islands, assigned turn lanes, angle parking, wide parking lanes, bus lanes, bicycle lanes, expanded sidewalks/ pedestrian space, or other uses

Considerations

Traffic conditions must be considered in planning lane removals; detailed analysis may be needed

Commercial loading and other uses should be considered in planning lane narrowing

Planned uses, such as bus lanes or bicycle lanes, should be taken into consideration

Effects of narrowings on turning movements should be tested

Application

Consider lane narrowings on corridors with excessively wide lanes

Multilane corridors with excess capacity (more traffic capacity than traffic volume) are excellent candidates for lane removal

Multi-lane corridors may be good candidates for lane removal in concert with other treatments, such as signal timing changes

Before: After two fatalities occurred at the same intersection in one year, DOT found that the roadway was over capacity: West 6th Street, Brooklyn

After: DOT installed a "road diet" in 2010, resulting in a 25% reduction in crashes

Lane narrowing and removal should be prioritized on corridors with safety or speeding concerns, or where prioritization of non-general traffic is desirable

Design Guidelines

Lane narrowings and removals should result in standard-width lanes

When other treatments are included in a lane narrowing/removal, see specific guidelines for those treatments

Raised Speed Reducer

Usage: Wide

A raised area of a roadway that deflects both the wheels and frame of a traversing vehicle with the purpose of reducing vehicle speeds. The two basic types of raised speed reducers are speed humps and speed tables. Both are typically raised 3 to 4 inches above the level of the roadway, and both have a proven speed-reducing track record in New York City. While a speed hump is relatively short in length (e.g., 13 feet long), a speed table is longer (e.g., 22 to 30 feet long), with a flat section in the middle, sometimes including a RAISED CROSSWALK (2.3.4). SPEED CUSHION (2.3.2a) are a variation of speed humps designed to allow easier emergency vehicle, bus, or truck passage.

Benefits

Compels drivers to travel at speeds no higher than the street's design speed

A speed table can be used to provide a raised mid-block crossing in conjunction with a stop control

Considerations

Impacts emergency vehicle movement

Snow plows must be given advance warning

May generate additional noise

Application

Must be requested by a community, with approval based on a DOT field study of the location using speed survey, geometric, and street operations criteria

Avoid on streets that have any of the following characteristics:

- designated as "local" or "through" truck routes
- on MTA bus routes, tour-bus routes, or routes of any other bus operator
- emergency-vehicle response or snow emergency routes
- Fire Department house located on the block
- more than one moving lane per direction
- wider than 44 feet

Speed hump: Bolton Avenue, Bronx

The location can be investigated by DOT for a "Reduced School Speed Zone" if a speed reducer is not feasible but the street has an 85th percentile speed of 25 mph or higher and is near an eligible school

Design

Space raised speed reducers to maintain desired operating speeds

Appropriate warning signs and roadway markings should accompany raised speed reducers

Locate raised speed reducers in the middle of the roadway, with the gutters kept clear for proper road drainage

Use signage or other methods to alert operators of snow-clearing vehicles to the presence of raised speed reducers

While raised speed reducers (humps, tables, cushions) are an effective method to retrofit existing streets to reduce motor vehicle speeds in lieu of street reconstruction, all newly reconstructed streets should be comprehensively designed to achieve desired speeds, e.g., using appropriate roadway width and alignment, horizontal deflection, traffic controls, trees, and other traffic calming treatments

Utilize recycled content in paving materials

RAISED SPEED REDUCER

Speed Cushion

Usage: Pilot

Narrow speed humps that reduce traffic speeds without causing vertical displacement of vehicles with wide wheel bases (trucks, buses, and emergency vehicles). Wide vehicles can travel over speed cushions at moderate speed after aligning properly, making them potentially appropriate for use on streets with low- to moderate-frequency emergency, truck, or bus routes.

Benefits

See benefits of RAISED SPEED REDUCERS (2.3.2)

Reduces motor vehicle speeds without hampering bus service or most commercial vehicles

Quieter than speed humps on commercial routes

Can be easily removed, relocated, or repositioned

Available as an off-the-shelf product

Considerations

Snow plows must be given advance warning

Application

See application guidance for RAISED SPEED REDUCERS (2.3.2)

Streets that qualify for RAISED SPEED REDUCERS, except for the presence of a truck, bus, or emergency vehicle route

Consider on non-arterial roadways with speeding concerns

Avoid on arterial roadways

Design

See design guidance for RAISED SPEED REDUCERS (2.3.2)

Spacing and dimensions of speed cushions are typically similar to those of other RAISED SPEED REDUCERS

Speed cushions showing impact on typical vehicles: Vancouver, Canada (Credit: Richard Drdul) (Note: for illustrative purposes only)

Speed cushions showing ease of bus passage: Vancouver, Canada (Credit: Richard Drdul) (Note: for illustrative purposes only)

Gateway

Usage: Limited

A combination of traffic-calming and visual measures used at the entrance to a low-speed street to slow entering vehicles and discourage through-traffic. Useful at all roadway transitions to slower-speed environments, gateways are especially suited to entrances to residential side streets and SHARED STREETS. The design elements of a gateway can include CURB EXTENSIONS (2.2.2), a RAISED CROSSWALK (2.3.4) or driveway treatment, a RAISED MEDIAN (2.2.3), landscaping or trees, and community facilities such as seating and public art.

ABOVE: *Gateway at transition from local residential street: Prospect Place, Brooklyn*

LEFT: *Gateway to residential street: West 11th Street at Seventh Avenue South, Manhattan*

Benefits

Decreases vehicular speeds and discourages through-traffic without blocking or prohibiting vehicular access

Demarcates transitions to low-speed, SHARED STREET (2.1.3). or pedestrian-oriented areas

Provides pedestrians with priority movement across the treated leg of the intersection

Considerations

May impact street drainage or require catch basin relocation

May impact underground utilities

May require loss of curbside parking in some cases

Community facilities typically necessitate the presence of a maintenance partner

Many community facilities and sidewalk items require a permit or revocable consent from the city

If gateway includes a RAISED CROSSWALK (2.3.4), snow plows must be given advance warning

Application

Entrances to SHARED STREETS

Consider at entrances to streets with low vehicle volumes or speeds from streets with high vehicle volumes or speeds

Design

Include at a minimum CURB EXTENSIONS (2.2.2) to narrow the roadway; preferably, vertical deflection should also be created using a RAISED CROSSWALK or ramped driveway treatment; if the street is two-way, a RAISED MEDIAN (2.2.3) or PEDESTRIAN SAFETY ISLAND (2.2.4) can be included, space permitting

Other design elements can "narrow" a street visually, including plantings, public art, bicycle parking, and community facilities such as seating

If work includes tree planting, consider the location of utility infrastructure, including DEP sewers and water mains

Where feasible, design planted areas within gateway so as to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

If gateway includes PLANTED CURB EXTENSIONS, see design guidance for PLANTED CURB EXTENSIONS (6.3.3)

Raised Crosswalk

Usage: Limited

A marked pedestrian crosswalk at an intersection or a mid-block location constructed at a higher elevation than the adjacent roadway. A raised crosswalk is essentially a speed table, with the full width of the crosswalk contained within the flat portion of the table, usually 10- to 15-feet wide. It combines the benefits of a RAISED SPEED REDUCER (2.3.2) with enhanced visibility for the pedestrian crossing.

Benefits

Compels drivers to travel at speeds no higher than the street's design speed

Improves drivers' awareness of presence of pedestrian crossing, particularly at mid-block crossing locations

Used at street GATEWAYS (2.3.3), can alert drivers that they are entering a slower-speed, pedestrian-oriented street environment

Allows convenient pedestrian circulation between high foot traffic destinations on opposite sides of a street

Considerations

May impact street drainage or require catch basin relocation

Attention should be given to accommodation of and navigation by people with vision disabilities

Application

Existing stop-controlled crosswalks or other locations where demand exists for a stop-controlled pedestrian crossing that also meet the criteria for RAISED SPEED REDUCERS (2.3.1)

Consider at areas of particularly high pedestrian crossing demand on narrower streets (maximum of two moving lanes), such as locations with pedestrian generators (e.g., major commercial or cultural destinations, transit entrances, parks) on opposite sides of the street

Raised crosswalk: Paris, France
(Note: for illustrative purposes only)

Consider as a more robust option for mid-block crossings

Consider on the outer roadways of multi-lane boulevards at crossings

Avoid on arterial roadways

Design

Appropriate warning signs and roadway markings should accompany raised crosswalk

Use signage or other methods to alert snow-clearing vehicle operators to the presence of raised crosswalk

Detectable warning strips with high color contrast from sidewalk surface should be provided at crosswalk location

Raised crosswalk: London, United Kingdom
(Note: for illustrative purposes only)

Use enhanced, high-visibility street materials to further draw attention to raised crosswalk

See design guidance for RAISED SPEED REDUCERS (2.3.2)

Utilize recycled content in paving materials

Chicane

Usage: Pilot

A serpentine roadway alignment or series of staggered CURB EXTENSIONS to encourage lower driving speeds through horizontal deflection. Chicanes discourage or make it impossible for drivers to drive in a straight line. This can reduce vehicular speeds.

ABOVE: *Chicane at entry to residential neighborhood: San Francisco, California (Credit: SF MTA) (Note: for illustrative purposes only)*

LEFT: *Chicane: Vancouver, Canada (Credit: Richard Drdul) (Note: for illustrative purposes only)*

Benefits

Forces drivers to drive more slowly and with greater awareness, particularly at mid-block locations

Can green and beautify the streetscape with trees and/or vegetation, improving environmental quality and potentially incorporating stormwater source controls

Considerations

May impact street drainage or require catch basin relocation

May impact underground utilities

May require loss of curbside parking

Landscaping or stormwater source controls require a partner for ongoing maintenance

If outfitted to capture stormwater, careful consideration must be given to design, overflow control, and plant species

May impact snow plows and street sweepers

Application

Consider on narrower, low-volume, local streets (maximum of two moving lanes) with demonstrated speeding issues

Avoid on bus routes, truck routes, and major bicycle routes

Design

The simplest and most basic approach to create a chicane is to alternate on-street parking (parallel or angled) from one side to the other; in this case, CURB EXTENSIONS (2.2.2) at the beginning and end of each grouping of parking

If utilizing CURB EXTENSIONS, see CURB EXTENSION section for general design considerations

Use vertical elements to alert drivers and snow plow operators to presence of chicanes

Locate trees and/or plantings within chicane curb extensions when appropriate. See TREE BEDS (6.1) and ROADWAY PLANTINGS (6.2)

Maximize permeable surface of chicane curb extensions

Where feasible, design planted areas within chicane curb extensions to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

Neighborhood Traffic Circle

Usage: Pilot

A round traffic island in the center of a traditional intersection. Primarily applicable to lower-traffic intersections, neighborhood traffic circles can provide many of the advantages of full ROUNDABOUTS, (2.3.7) but using much less space.

Benefits

Reduces speeds and crash rates, particularly when applied consistently to an area

Eliminates possibility of vehicle head-on collisions

Can green and beautify the streetscape with trees and/or vegetation, improving environmental quality

Inclusion of plantings or art within the island creates an attractive focal point for the neighborhood

Considerations

May impact underground utilities

Landscaping requires a partner for ongoing maintenance

Attention should be given to accommodation of and navigation by people with vision and/or ambulatory disabilities

Application

Consider at existing stop-controlled intersections, particularly all-way stops

Consider at intersections of streets with low target speeds (25 mph or below) or low vehicle volumes

ROUNDABOUT (2.3.7) should be used instead at high-volume or large intersections

Neighborhood traffic circle with landscaping: Berkeley, California (Credit: John Allen)
(Note: for illustrative purposes only)

Design

Design speeds for movement around the circle should be 10 to 15 mph; exit speeds should be limited to 15 mph through the circle's design wherever possible

Use signs within the center island and reflective paint on the curb to improve center island visibility

Include street tree(s) wherever possible; include planted areas when a maintenance partner is identified

A protective apron of concrete or textured pavement may be provided around the circle to accommodate wide-turning vehicles; where extreme geometric constraints exist and truck volumes are low, trucks may be accommodated by use of a fully mountable roundabout island

Use small curb radii where right turns are made

Install "Keep Right" or similar signs directing drivers to proceed to the right around the circle through the intersection

If work includes tree planting, consider the location of utility infrastructure, including DEP sewers and water mains

Minimize impervious paved areas and utilize permeable paving wherever possible

Locate trees and/or plantings within neighborhood traffic circle island. See TREE BEDS (6.1) and ROADWAY PLANTINGS (6.2)

Maximize permeable surface of neighborhood traffic circle island

Where feasible, design planted areas within neighborhood traffic circle island so as to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

Roundabout

Usage: Limited

An intersection with circular, one-way (counter-clockwise) traffic around a central circle in which entering traffic yields to traffic already in the roundabout. Roundabouts can vary in size (diameter) and number of lanes and can be designed as unsignalized or signalized intersections. Roundabouts are distinguished from "old-style" traffic circles/rotaries by their rules for yielding and key design features such as horizontal deflection at entries.

Benefits

- Reduces top vehicular speeds at signalized intersections, thereby decreasing the severity of crashes
- Eliminates possibility of vehicle head-on collisions
- Eliminates left turns, a primary cause of crashes
- Enhances pedestrian safety when used at appropriate intersections
- Allows simultaneous movement of crossing vehicular streams, often processing vehicular traffic more efficiently than signalization
- When used in place of a stop- or signal-controlled intersection, may reduce vehicle emissions and travel times by reducing start-and-stop driving
- Reduces need to widen streets approaching intersection to store vehicles under signalized operation
- Can green and beautify the streetscape with trees and/or plantings, improving environmental quality and potentially incorporating stormwater source controls
- Inclusion of public open space, vegetation or art within the roundabout island creates an attractive focal point for the neighborhood

Roundabout with public art in residential neighborhood: Delft, Netherlands
(Note: for illustrative purposes only)

Recently installed roundabout: Intervale Avenue and Dawson Street, Bronx

Considerations

May require increased spatial footprint for intersection, but not approaches

May impact street drainage or require catch basin relocation

May impact underground utilities

May require loss of curbside parking

Landscaping or stormwater source controls require a partner for ongoing maintenance

If outfitted to capture stormwater, careful consideration must be given to design, overflow control, and plant species

Attention should be given to accommodation of and navigation by people with vision and/or ambulatory disabilities

Application

Intersections with 1) no more than 80–90% of volume on the main facility and 2) having at least three approaches, high vehicle-turning volumes or percentages, or speeding issues

Consider at locations with poor safety records, or where signalization has led or may lead to operational issues for pedestrians or bicyclists

As a gateway treatment for low-speed (25 mph speed limit or less) or SHARED STREETS (2.1.3)

Design

Deflection should be created for entering vehicles to reinforce yielding behavior; at two-way legs of the intersection, use splitter islands to provide deflection as well as to allow pedestrians to cross in two segments

Detectable warning strips should be provided at all crosswalk locations with high color contrast from the sidewalk surface

Limit entry and exit speeds through deflection and/or raised crosswalks

Curves should accommodate the design vehicle; use an apron of textured paving around the central island to slow motor vehicle movements while accommodating larger vehicles such as trucks

To improve center island visibility, use reflective signs within the center island and reflective paint on the curb

Include street tree(s) wherever possible; include planted areas and stormwater source controls when a maintenance partner is identified

If work includes tree planting, consider the location of utility infrastructure, including DEP sewers and water mains

Minimize impervious paved areas and utilize permeable paving wherever possible

Locate trees and/or plantings within roundabout islands. See TREE BEDS (6.1) and ROADWAY PLANTINGS (6.2)

Maximize permeable surface of roundabout islands

Where feasible, design planted areas within roundabout islands so as to capture stormwater according to current standards. See STORMWATER MANAGEMENT PRACTICES (6.6)

Raised Intersection

Usage: Pilot

An entire intersection raised above the level of the surrounding roadways. The intersection is typically raised to sidewalk height.

ABOVE: *Raised intersection: London, United Kingdom (Note: for illustrative purposes only)*

LEFT: *Raised intersection: Cambridge, Massachusetts (Credit: Cara Seiderman)*

Benefits

Vertical deflection at entry to intersection encourages reduced vehicle speeds

Improves drivers' awareness of presence of crossings

Visually turns intersection into a pedestrian-oriented zone

Enhances access for people with disabilities

Considerations

May impact street drainage or require catch basin relocation

Snow plows must be given advance warning

Application

Stop-controlled intersections with a high volume of pedestrian crossings and low target vehicle speeds (e.g., 25 mph or below)

Stop-controlled intersections with a history of pedestrian crashes or speeding issues

Stop-controlled intersections where enhancing pedestrian movement is a major goal, such as transit stops or commercial areas

Avoid on truck routes and at other locations where RAISED SPEED REDUCERS (2.3.2) are not appropriate

Design

Slope of entrance ramps for motorized traffic can be steep or shallow, depending on target speeds

Use enhanced, high-visibility street materials to further draw attention to raised intersection

Minimize impervious paved areas and utilize permeable paving wherever possible

Increase SRI value of paved surfaces to reduce urban heat island impact

Utilize recycled content in paving materials

Coordinate streetscape/utility work to minimize street cuts

Materials

3

Introduction

About this Chapter

This chapter identifies materials for sidewalks, curbs, and roadways that are either approved citywide standards or alternatives for specified locations.

Applicability and Exceptions

All projects that significantly impact public and private streets should follow these guidelines. DOT approval will be based on site-specific conditions and cost-effective engineering standards and judgment based on the policies outlined in the Introduction to this Manual, with the safety of all street users being of paramount importance.

Usage Categories

Materials are divided into four usage categories: Standard, Distinctive, Historic, and Pilot.

Standard

Standard materials are required for use in all contexts outside of historic districts, unless DOT and PDC approve a Distinctive treatment. Projects utilizing the Standard materials in the identified contexts will generally only require a permit from DOT.

DOT is responsible for the maintenance of roadways and crosswalks. As such, materials not listed here as Standard are rarely installed in these contexts.

Distinctive

Any material not deemed Standard by DOT will be considered Distinctive and requires review and approval by DOT and the New York City Public Design Commission (PDC). Distinctive materials identified in this chapter are visually appealing and are proven to be durable, and DOT encourages their use in certain circumstances.

All Distinctive sidewalk and curb materials require a maintenance agreement between DOT and the entity proposing the materials (typically the adjacent property owner(s) or a jurisdictional organization). Per Rules of the City of New York Section 2-09(f)(4)(xvi), all approved Distinctive materials must be replaced in kind; however, any changes to existing Distinctive materials must be approved by DOT and PDC prior to their implementation.

The review process for Distinctive sidewalk and curb materials is as follows:

1. Adjacent property owner or jurisdictional organization submits proposal to DOT's Urban Design and Art Unit at udau@dot.nyc.gov. The submission usually comprises architectural drawings, site photographs, project descriptions, and other supporting materials as necessary, and must meet at least one of the following criteria:

- Encompasses an entire block
- Pertains to a streetscape project
- Features a design integral to an adjacent open plaza space, or
- Is compatible with the prevailing material on blocks adjacent to the site for which it is proposed

2. DOT reviews the proposal for consistency with this Manual and for compliance with the criteria listed above. If the proposal does not satisfy these requirements, DOT may require design revisions or reject the proposal. If the proposal is acceptable, DOT submits it to PDC for an initial review

3. PDC reviews the proposal for its aesthetic impact on the streetscape and conformance with the criteria listed above. PDC strongly discourages proposals for piecemeal treatments. For more information on the PDC's guidelines, visit their website at nyc.gov/designcommission

4. If PDC preliminarily approves the proposal, the applicant submits a Sidewalks, Curbs, and Roadways Application (SCARA) to DOT

5. DOT reviews the SCARA. Distinctive materials identified in this chapter will receive an expedited review

6. If the SCARA is approved, DOT and the applicant enter into a maintenance agreement

7. DOT submits proposal to PDC for Final Approval

8. If the proposal receives Final Approval from PDC, the applicant applies for the appropriate DOT construction permits and commences installation of the Distinctive sidewalk and/or curb materials

Historic

Historic materials are standard in historic districts designated by the New York City Landmarks Preservation Commission (LPC) and are subject to its requirements. Historic materials used outside of historic districts are considered Distinctive.

Pilot

Pilot materials exhibit environmentally sustainable properties and are being tested by DOT. It is anticipated that Pilot materials, if successful, will be classified in future editions of this Manual either as Standard or Distinctive.

Specification Sources

The recommendations in this chapter supplement rather than replace existing engineering standards. Readers are directed to the sources noted below, those listed in Appendix B, and any other applicable resources.

Detailed information on the specifications for standard materials is contained in the DOT/DDC Standard Highway Specifications. Typical construction details are provided in the DOT Standard Details of Construction. Information regarding standard procedures and approval requirements is provided in the Instructions for Filing Plans and Guidelines for the Design of Sidewalks, Curbs, Roadways, and Other Infrastructure Components.

The design guidance described here does not supersede any existing federal, state, or local laws, rules, or regulations. All projects remain subject to relevant statutes, such as the Zoning Resolution of the City of New York, City Environmental Quality Review (CEQR), and appropriate reviews and approvals of oversight agencies. When materials are being selected, universal design resources such as the ADA Standards for Accessible Design should be consulted to ensure a maximum degree of accessibility.

Material selection and design for projects in flood-vulnerable areas may involve additional considerations as resiliency best practices continue to develop.

Sidewalk and curb materials not included in this chapter may be proposed, but are generally discouraged and require full engineering and design review by DOT, LPC, or PDC, as well as approvals from other governmental entities. Such materials, if approved, require a maintenance agreement.

Sidewalk Permits

Installation of sidewalks associated with new building construction is coordinated by the Department of Buildings through the Builder's Pavement Plan. For more information on sidewalk permits, reviews, and approvals, see DOT's *Street Works Manual*. For the Instructions for Filing Plans and Guidelines for the Design of Sidewalks, Curbs, Roadways, and Other Infrastructure Components, visit **nyc.gov/streetdesignmanual**. See Section 2-09 of Title 34 of the Rules of the City of New York for requirements related to sidewalk, curb, and roadway work.

Maintenance Agreements

Each treatment in this chapter has a statement indicating whether or not the material requires a maintenance agreement before being installed. This agreement typically requires that the adjacent property owner, installing entity, or some other entity will generally be responsible for maintaining that material and providing appropriate insurance.

Sidewalks

Sidewalks are paths for pedestrians alongside a road (see Glossary). The primary function of a sidewalk is to provide pedestrian movement and access to buildings, parks, and other destinations. Sidewalks also function as sites for loading and unloading vehicles, as public meeting and gathering spaces, as places for outdoor dining, and as venues for commerce or expression. Increasingly frequently, sidewalks can also serve as opportunities to beautify streets with vegetation.

See SIDEWALK (2.2.1) in the Geometry chapter for more information about sidewalks.

The furnishing zone is the area of the sidewalk usually immediately adjacent to the curb where street trees, signs, above-ground utilities, and street furniture are typically located (see Glossary). Furnishing zones provide a physical buffer and a visual transition between the vehicles in the roadway and the pedestrians on the sidewalk, while also affording a clear area for organizing the various elements of street furniture that might otherwise appear cluttered. This area is generally 5 feet wide, or as wide as the tree pits along the blockface.

Furnishing zones are most appropriate on streets with at least moderate levels of both pedestrian and vehicle traffic—usually commercial shopping streets. Furnishing zones are best used when applied to entire blocks or a series of blocks comprising a corridor, rather than to sidewalks in front of individual small properties which would create a "patchwork" effect. Some materials in this chapter are exclusively for use in furnishing zones; all sidewalk materials may be used in furnishing zones.

Issues with pavement heaving due to tree root growth in limited soil volume are common and expensive to repair. Where feasible, use of suspended pavement systems should be considered. Suspended pavement systems can be used with all of the sidewalk materials featured in this section.

All materials listed in this section may be used in PLAZAS (2.1.4) as well.

Unpigmented Concrete

Usage: Standard

Mixture comprised of cement(s), aggregate(s), water, and other chemical admixtures, smoothed and then allowed to harden, forming a solid sidewalk surface.

Benefits

Provides durable sidewalk surface with high friction coefficient

Widely available and cost-effective

Provides solid footing for flush-mounted furniture anchors

Considerations

Difficult to patch in sections where utility cuts or defects occur

Application

Appropriate for sidewalks on all non-commercial and non-historic streets and select commercial streets unless otherwise specified

Adjacent property owners are generally responsible for maintaining this material

Design

Flag size: 5 feet by 5 feet

Joint: "tooled joint" or simulated saw-cut joint-scoring patterns

Typically requires 6-inch gravel base

May require metal reinforcement bars as specified by DOT

Specification source: DOT Standard Specifications Section 2.02, 2.15, 2.22, 3.05, 4.13, item numbers 4.13 AAS (4-inch sidewalk) and 4.13 BAS (7-inch sidewalk)

Detail source: DOT Standard Details of Construction drawing # H-1045

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Typical concrete sidewalk: West Street at 16th Street, Manhattan

Concrete ribbon sidewalk: Rockaway Beach Boulevard, Queens

Pigmented Concrete: Dark

Usage: Standard*

Same mixture as UNPIGMENTED CONCRETE (3.1.1), but with an added pigment for use in high-density commercial districts. This is one of three kinds of pigmented concrete—see also PIGMENTED CONCRETE: BLUESTONE (3.1.2b) and PIGMENTED CONCRETE: GRANITE (3.1.2c).

* Standard only for commercial districts C4-4 through C4-7, C5, and C6, as defined in the Zoning Resolution of the City of New York, per Section 2-09(f)(4) of Title 34 of the Rules of the City of New York

Benefits

See benefits of UNPIGMENTED CONCRETE (3.1.1)

Dark pigmenting visually enhances sidewalk and emphasizes urban character in areas with greatest commercial and retail density

Saw-cut joints provide cleaner look, simulating individually hewn blocks of stone

Considerations

See considerations for UNPIGMENTED CONCRETE (3.1.1)

Application

Standard in commercial districts C4-4 through C4-7, C5 and C6, as defined in the Zoning Resolution of the City of New York, per Section 2-09(f)(4) of Title 34 of the Rules of the City of New York

Adjacent property owners are generally responsible for maintaining this material

Design

See design guidance for UNPIGMENTED CONCRETE (3.1.1)

Specification source: DOT Standard Specifications Section 4.13, item numbers 4.13 CABS (4-inch sidewalk) and 4.13 CBBS (7-inch sidewalk)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Typical dark pigmented concrete sidewalk with simulated saw-cut joint scoring: Broadway at Exchange Place, Manhattan

Pigmented Concrete: Bluestone

Usage: Historic

Same mixture as UNPIGMENTED CONCRETE (3.1.1), but with an added pigment to simulate bluestone flags in historic districts, as per LPC guidelines, or in historic, non-landmarked neighborhoods, as per PDC guidelines. This is one of three kinds of pigmented concrete—see also PIGMENTED CONCRETE: DARK (3.1.2a) and PIGMENTED CONCRETE: GRANITE (3.1.2c).

Benefits

See benefits of UNPIGMENTED CONCRETE (3.1.1)

Reinforces historic character

Saw-cut joints provide cleaner look, simulating individually hewn blocks of stone add to the historic character of this treatment

Considerations

See considerations for UNPIGMENTED CONCRETE (3.1.1)

All sidewalk repair or replacement in historic districts requires written approval from LPC

Application

Appropriate, pending LPC review, in historic districts as replacement of bluestone that is beyond repair, per LPC guidelines

Appropriate, pending PDC review, in historic, non-landmarked neighborhoods as replacement of bluestone that is beyond repair, per PDC guidelines

Adjacent property owners are generally responsible for maintaining this material

Bluestone pavers in the foreground and concrete pigmented to simulate the historic pavers in the background: Hudson Street at Christopher Street, Manhattan

Design

See design guidance for UNPIGMENTED CONCRETE (3.1.1)

Flag size and pigmenting to match existing bluestone flags per LPC or PDC guidelines

Specification source: DOT Standard Specifications Section 4.13, item numbers 4.13 ABS (4-inch sidewalk) and 4.13 BBS (7-inch sidewalk)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Concrete pigmented to simulate bluestone adjacent to a bluestone flag: Pacific Street, Brooklyn

Pigmented Concrete: Granite

Usage: Historic

Same mixture as UNPIGMENTED CONCRETE (3.1.1), but with an added pigment to simulate granite slabs in historic districts, per LPC guidelines, or in historic, non-landmarked neighborhoods, per PDC guidelines. This is one of three kinds of pigmented concrete—see also PIGMENTED CONCRETE: DARK (3.1.2a) and PIGMENTED CONCRETE: BLUESTONE (3.1.2b).

Benefits

See benefits of UNPIGMENTED CONCRETE (3.1.1)

Reinforces historic character

Saw-cut joints provide cleaner look, simulating individually hewn blocks of stone add to the historic character of this treatment

Considerations

See considerations for UNPIGMENTED CONCRETE (3.1.1)

All sidewalk repair or replacement in historic districts requires written approval from LPC

Application

Appropriate, pending LPC review, in historic districts as replacement of granite that is beyond repair, per LPC guidelines

Appropriate, pending PDC review, in historic, non-landmarked neighborhoods as replacement of granite that is beyond repair, per PDC guidelines

Adjacent property owners are generally responsible for maintaining this material

Concrete pigmented to match adjacent granite: Greenwich Street at Barclay Street, Manhattan

Design

See design guidance for UNPIGMENTED CONCRETE (3.1.1)

Flag size and pigmenting to match existing granite slabs per LPC or PDC guidelines

Specification source: DOT Standard Specifications Section 4.13, item numbers 4.13 ABS (4-inch sidewalk) and 4.13 BBS (7-inch sidewalk)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Pigmented Concrete with Exposed Light-Colored Aggregate

Usage: Distinctive

Same mixture as PIGMENTED CONCRETE: DARK (3.1.2a) for commercial districts, but with addition of exposed light-colored pebble-sized aggregate. Joints are scored to simulate saw-cutting.

Benefits

See benefits of PIGMENTED CONCRETE: DARK (3.1.2a)

Exposed aggregate creates a texture and more natural appearance

Exposed aggregate camouflages dirt and gum in high-traffic areas

Considerations

See considerations for PIGMENTED CONCRETE: DARK (3.1.2a)

Application

This material is recommended for commercial areas with high foot traffic

Because this is a Distinctive sidewalk treatment, it is best used when applied to entire blocks, rather than to the sidewalks of individual small properties which would create a "patchwork" effect

Use of this material generally requires a maintenance agreement

Tinted concrete sidewalk with light-colored exposed aggregate (note: this example does not include the required "simulated saw-cut joint" scoring pattern): East 42nd Street at Grand Central Terminal, Manhattan

Design

See design guidance for PIGMENTED CONCRETE: DARK (3.1.2a)

Aggregate: pebble-sized, light in color

Aggregate specification source: DOT Standard Specifications Section 4.13 E, item numbers 4.13 EAGG (4-inch sidewalk), 4.13 EBGG (7-inch sidewalk)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Pigmented Concrete with Silicon Carbide Treatment

Same mixture as PIGMENTED CONCRETE: DARK (3.1.2a) for commercial districts, but treated with silicon carbide to add sparkle.

Usage: Distinctive

Benefits

See benefits of PIGMENTED CONCRETE: DARK (3.1.2a)

Sparkle adds distinction and visual enhancement to pigmented concrete

Increases slip resistance of surface

Considerations

See considerations for PIGMENTED CONCRETE: DARK (3.1.2a)

Application

This material is appropriate for sidewalks in commercial districts

Because this is a Distinctive sidewalk treatment, it is best used when applied to entire blocks, rather than to the sidewalks of individual small properties which would create a "patchwork" effect

Use of this material generally requires a maintenance agreement

Design

See design guidance for PIGMENTED CONCRETE: DARK (3.1.2a)

Silicon carbide specification source: DOT Standard Specifications Section 4.13, item numbers 4.13 CSABS (4-inch sidewalk) and 4.13 CSBBS (7-inch sidewalk)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Pigmented concrete sidewalk with silicon carbide treatment, shown with non-standard flag size: Hanover Square at Pearl Street, Manhattan

Close-up of concrete with silicon carbide treatment: Hanover Square at Pearl Street, Manhattan

Sand-Colored Concrete with Exposed Aggregate

Usage: Distinctive

Sand-colored concrete with multi-colored pebble-sized exposed aggregate. This material is appropriate for sidewalks adjacent to parks.

Benefits

See benefits of PIGMENTED CONCRETE WITH EXPOSED LIGHT-COLORED AGGREGATE (3.1.2d)

Sand color reinforces natural character of open spaces

Considerations

See considerations for PIGMENTED CONCRETE WITH EXPOSED LIGHT-COLORED AGGREGATE (3.1.2d)

Application

This material is appropriate for sidewalks adjacent to waterfronts, parks, and other open spaces

Because this is a Distinctive sidewalk treatment, it is best used when applied to entire blocks, rather than to the sidewalks of individual small properties which would create a "patchwork" effect

Use of this material generally requires a maintenance agreement

Sand-colored concrete sidewalk with exposed aggregate: Prospect Park West, Brooklyn

Design

See design guidance for PIGMENTED CONCRETE WITH EXPOSED LIGHT-COLORED AGGREGATE (3.1.2d)

Pigmenting: sand-colored

Aggregate: pebble-sized, mixed-color river rock

Specification source: DOT Standard Specifications Section 4.13, item number 4.13 ESA (4-inch sidewalk) and 4.13 ESB (7-inch sidewalk)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Concrete with Exposed Glass Aggregate

Concrete into which select surface aggregates (such as colored glass or decorative pebbles) are embedded. Either cast in place or installed in the form of precast unit pavers. This treatment is for use exclusively in the furnishing zone.

Usage: Distinctive

Benefits

Decorative glass adds distinction and visual enhancement to concrete

Increases slip resistance of surface

Precast pavers are relatively easy to reset or replace for utility access and other purposes

Considerations

See considerations of UNPIGMENTED CONCRETE (3.1.1)

Alkaline reaction can degrade structural integrity of the concrete

Unit pavers can become loose over time and will require regular maintenance

DOT requires testing of this material

Application

Cast-in-place should not be used where frequent utility cuts are likely

Use of this material generally requires a maintenance agreement

Design

See design guidance for of UNPIGMENTED CONCRETE (3.1.1)

Slip resistance: minimum 0.60 coefficient of friction wet

Unlimited color and aggregate mix options available

Cast in Place:

- Joint: simulated saw-cut joint scoring
- When poured, may require metal reinforcement bars as specified by DOT

Pavers:

- Pavers should be sand-set for easier installation and greater permeability wherever impermeable installation generates stormwater runoff
- Pavers can be mortar set for stronger structural properties
- Paver size: 8 inches by 8 inches

Specification source: DOT Standard Specifications Section 4.13 EG, item numbers 4.13 EGA (4-inch sidewalk), 4.13 EGB (7-inch sidewalk), and 6.47 EGA8 (pavers)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Sustainability Opportunity: High-SRI coloring

Sustainability Opportunity: Recycled glass or reclaimed aggregates

Poured, cast-in-place concrete with exposed glass aggregate: Manhattan Bridge Plaza, Brooklyn

Concrete pavers with exposed blue and green glass aggregate (shown interspersed with black asphalt pavers): Hudson River Park, Manhattan

Concrete with London Paver Scoring

Usage: Distinctive

Cast-in-place concrete scored to look like London Pavers.

Benefits

See benefits of UNPIGMENTED CONCRETE (3.1.1)

Reinforces civic character of an area

Less expensive than unit pavers

Considerations

Difficult to patch in sections where utility cuts or defects occur

Application

For sidewalks fronting on government buildings and other civic structures such as bridges and memorials

Because this is a Distinctive sidewalk treatment, it is best used when applied to entire blocks, rather than to the sidewalks of individual small properties which would create a "patchwork" effect

Use of this material generally requires a maintenance agreement

Design

Flag size: 18 inches by 36 inches

Requires concrete base

Specification source: DOT Standard Specifications Section 6.06 LP, item number 6.06 LP

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Concrete with London paver scoring: Brooklyn Bridge pedestrian access ramp, Manhattan

Concrete with London paver scoring: Washington, DC

Hexagonal Asphalt Paver

Asphalt pre-cast into hexagonally shaped paver.

Usage: Distinctive

Benefits

Commonly used paver for New York City public spaces conveys park-like character

Interlocking hexagonal shape fits tightly together and resists shifting and buckling

This material is widely available and cost-effective

Dark color hides dirt and stains

Hexagonal pavers are relatively easy to reset or replace, especially for utility access

Asphalt pavers can be recycled

Considerations

Unit pavers can become loose over time and will require regular maintenance

May contribute to heat-island effect

Application

Hexagonal asphalt pavers are appropriate for sidewalks adjacent to parks or plazas

Use of this material generally requires a maintenance agreement — hexagonal asphalt pavers installed by DPR are an exception

Hexagonal asphalt paver sidewalk: Columbus Avenue at West 66th Street, Manhattan

Design

Paver size: 8 inches between parallel sides

Can be sand-set for easier installation or mortar-set for stronger structural properties

Specification source: DOT Standard Highway Specifications Section 3.04 and 6.60, item number 6.60 B

Sustainability Opportunity: High recycled asphalt (RAP) content

Bluestone Flag

Usage: Historic

Historic stone unit paver with subtle variations in color, grain, and surface. The preservation and in-kind replacement of bluestone flags are normally required in new construction projects within historic districts; the installation of new bluestone flags is typically recommended in locations adjacent to existing bluestone.

Benefits

Reinforces historic character

Adds distinction and visual enhancement to sidewalk

Stone conveys connection to natural environment

Considerations

Vulnerable to breakage

Due to the possibility of pavers cracking or becoming uneven, application requires attentive maintenance

All sidewalk repair or replacement in historic districts requires written approval from LPC

Higher up-front cost than concrete

Application

This material is standard in historic districts or other areas with existing bluestone pavers where historic fabric remains intact, per the LPC guidelines

In historic districts, adjacent property owners are generally responsible for maintaining this material

Use of this material outside historic districts generally requires a maintenance agreement

Bluestone flag sidewalk: Perry Street at Bleecker Street, Manhattan

Design

Bluestone: 2.25-inch thick New York State bluestone to match size and color of existing flags

Finish: Natural cleft, with variation in smoothness not exceeding 1/8 inch

Joints: Hand-tight

Specification sources: LPC guidelines, DOT Standard Specifications Section 6.07, item number 6.07 AB

Sustainability Opportunity: Salvaged bluestone

Granite Slab

Usage: Historic

Historic stone paver, with varieties of color, texture, and veining. Can be cut to extremely large sizes to span underground vaults. The preservation and in-kind replacement of granite slabs are normally required in new construction projects within historic districts; the installation of new granite slabs is typically recommended in locations adjacent to existing granite.

Benefits

Reinforces historic character

Adds distinction and visual enhancement to sidewalk

Stone conveys connection to natural environment

Considerations

Not intended to support heavy vehicles when spanning underground vaults

Difficult to repair or patch in sections

All sidewalk repair or replacement in historic districts requires written approval from LPC

Higher up-front cost than concrete

Application

This material is standard in historic districts or other areas with existing granite pavers where historic fabric remains intact, per the LPC guidelines

In historic districts, adjacent property owners are generally responsible for maintaining this material

Use of this material outside historic districts generally requires a maintenance agreement

Granite slab sidewalk: West Broadway at Reade Street, Manhattan

Design

Granite: to match size and color of existing flags, 3-inch minimum thickness

Slip resistance: minimum 0.60 coefficient of friction wet

Specification sources: LPC guidelines, DOT Standard Specifications Section 6.04, item numbers 6.06 NG, 6.06 NGSM (mortar setting bed and joints), and 6.06 NGSS (sand setting bed and joints)

Sustainability Opportunity: Salvaged granite slabs

Granite Block

Usage: Distinctive

Historic smooth-finish granite block unit pavers often referred to as "cobblestones," commonly used throughout New York City in the nineteenth century. This treatment is for use exclusively in the furnishing zone.

Benefits

Visually delineates separation of street uses

Stones convey connection to natural environment

Cobblestones are relatively easy to remove and reset, especially for utility access

Reinforces historic character, where applicable

Considerations

Stones can become loose over time and will require regular maintenance

Can be slippery when wet

Uneven surface can hinder the mobility of pedestrians and people with disabilities

Application

Furnishing zone and around tree beds

Use of this material generally requires a maintenance agreement. Granite blocks installed by DPR around tree beds are an exception

Granite blocks are for use in furnishing zones only: Little West Street, Battery Park City, Manhattan

Design

Should be sand-set for easier installation and greater permeability wherever impermeable installation generates stormwater runoff

Can be mortar-set for stronger structural properties

The area within 18 inches of the curb should be kept free of obstructions

Specification source: DOT Standard Specifications Section 2.06, 6.06

Sustainability Opportunity: Salvaged cobbles

Sustainability Opportunity: Permeable installation

Precast Square Paver

Usage: Distinctive

Precast, square asphalt or concrete pavers. This treatment is for use exclusively in the furnishing zone.

Benefits

This material is widely available and cost-effective

Relatively easy to reset or replace, especially for utility access

Asphalt pavers can be recycled

Considerations

Unit pavers can become loose over time and will require regular maintenance

Application

Furnishing zone

Use of this material generally requires a maintenance agreement

Design

Paver size: 8 inches by 8 inches

Should be sand-set for easier installation and greater permeability wherever impermeable installation generates stormwater runoff

Can be mortar set for stronger structural properties

The area within 18 inches of the curb should be kept free of obstructions

Square asphalt pavers in a funishing zone: Willoughby Street at Duffield Street, Brooklyn

Specification source: DOT Standard Specifications Section 6.06, item numbers 6.6 B (asphalt), 6.06 CSA (concrete with sand joints), 6.06 CSB (concrete with grouted joints), and 6.06 CSC (concrete with sand and grouted joints)

Sustainability Opportunity: High recycled asphalt (RAP) content

Sustainability Opportunity: High-SRI coloring

Permeable Interlocking Concrete Paver (PICP)

Usage: Distinctive*

Permeable Interlocking Concrete Pavers (PICPs) have voids at the joints to allow water to pass through into an open-graded reservoir below.

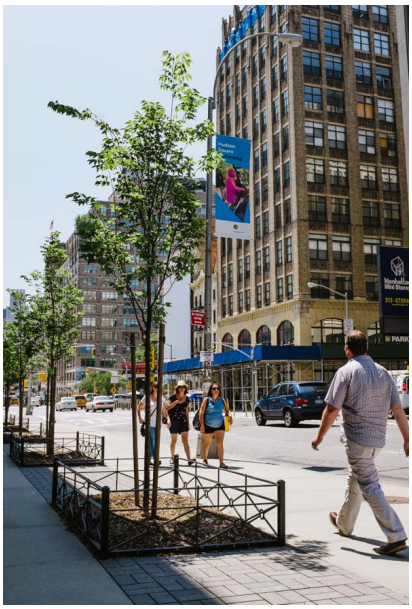
*PICPs have been approved as standard for use on sidewalks at school locations in lieu of a planting strip. (See: Adopted Zoning Text Amendment 26-421, adopted April 30, 2012.) In addition, PDC has approved this treatment for use in the furnishing zone of city sidewalks. In all cases, PICPs are considered a distinctive material, and require a maintenance partner.

Benefits

- Reduces impermeable surface, thereby increasing water infiltration
- Reduces peak sewer discharge during storm events
- Reduces likelihood of ponding and slick or icy conditions
- Helps reduce urban heat-island effect

Considerations

- Not recommended for use where there is water-sensitive subsurface infrastructure
- Only certain soil types are appropriate as sub-bases for infiltration
- Porosity of the pavers can convey harmful chemicals into the soil
- Requires regular maintenance
- Vegetative growth in joints will occur if there is no regular maintenance
- May require vacuuming of surface to restore permeability when joints become clogged
- Sand should not be applied to surface



PICPs above a connected tree bed in Hudson Square, Manhattan (Credit: Hudson Square Business Improvement District)

Application

- Most effective on slopes less than 5%
- Must have adequate sub-surface conditions to detain stormwater and level bottom to allow for uniform infiltration
- Can be proposed for use in parking lane, gutter strip, sidewalk, or plaza area
- Avoid "stormwater hotspots"—sites where there is potential for soil and groundwater contamination
- Use of this material generally requires a maintenance agreement

Design

- ASTM No. 8, 89, or 9 stone is recommend to fill paver joints. Requires open graded stone infiltration bed
- Bottom of infiltration bed should be at least 2 feet above high water table and 2 feet above bedrock
- Sustainability Opportunity: Coat pavers with photocatalytic treatment or high-SRI surface
- Sustainability Opportunity: Manufacture pavers using color additives to increase the SRI or incorporating recycled materials

Porous Concrete

Usage: Pilot

Concrete mixture using minimal cementitious paste to coat the aggregate, and using little or no sand or fine aggregate, leaving substantial void content. This allows water to pass through to an open-graded reservoir underneath.

Porous concrete lets water permeate down to the subsurface soil

Benefits

See benefits of UNPIGMENTED CONCRETE (3.1.1)

Reduces impermeable surface, thereby increasing water infiltration

Reduces peak sewer discharge during storm events

Reduces likelihood of ponding and slick or icy conditions

Helps reduce urban heat-island effect

Considerations

See considerations for UNPIGMENTED CONCRETE (3.1.1)

Pervious concrete has reduced strength compared to conventional concrete applications

Not appropriate for use where there is water-sensitive sub-surface infrastructure

Only certain soil types are appropriate as sub-bases for infiltration

Porosity of the concrete can convey harmful chemicals into the soil

Requires routine vacuuming of surface to restore permeability

Sand should not be applied to surface

Contractors should be certified to install porous concrete

Slump and air content tests are not applicable to pervious concrete

Application

Most effective on slopes less than 5%

Must have adequate sub-surface conditions to detain stormwater and level bottom to allow for uniform infiltration

Can be used to pave an entire sidewalk or just hardscape between CONNECTED TREE BEDS (6.1.1b)

Avoid "stormwater hotspots"—sites where there is potential for soil and groundwater contamination

Not recommended for implementation over significant underground utility corridors

Use of this material generally requires a maintenance agreement

Design

See design guidance for UNPIGMENTED CONCRETE (3.1.1)

Typically an 8- to 24-inch open graded stone infiltration bed is recommended

Generally 4–8 inches thick

Pervious concrete should maintain a 15–25% void content ratio

Bottom of infiltration bed should be at least 2 feet above high water table and 2 feet above bedrock

Rubber Paver

Usage: Pilot

Interlocking sidewalk pavers made of recycled rubber or a rubber/plastic mix.

Benefits

Easy to install and replace

Pavers can be shaped to avoid trees or other objects

Thinner than traditional sidewalk, allowing more room for roots to grow

Permeability of the joints allows stormwater to filter through to tree roots

Permeability helps to reduce the formation of the condensation commonly seen under traditional concrete flags which promotes the aggressive root growth that tends to cause fracturing and upheaval

Considerations

Generates some stormwater runoff

Unit pavers can become uneven over time and require regular maintenance

Application

Appropriate for piloting on sidewalks or plazas with low pedestrian traffic where tree roots may cause the fracturing and upheaval of sidewalk paving

Use of this material generally requires a maintenance agreement

Rubber sidewalk pavers (credit: Rubbersidewalks®)

Design

Recycled rubber must be free of high-risk chemicals or otherwise sealed to prevent contamination of soil

Paver size: 2 feet by 2.5 feet

Various colors available

Sustainability Opportunity: High-SRI coloring

Curbs

A curb is a step where the roadbed meets the sidewalk or other raised pathway (see Glossary). Curbs serve three functions: a visual and physical limit to the vehicular roadbed; a gutter to convey rainwater and detritus from the roadbed and sidewalks to the catch basins at the ends of the street; and aesthetically, curbs add a finished edge to sidewalks and roadbeds.

Unpigmented Concrete

Mixture comprising cement(s), aggregate(s), water, and other chemical admixtures, smoothed and then allowed to harden, forming a solid curb.

Usage: Standard

ABOVE: *Typical untinted concrete curb with steel facing: West 114th Street and Morningside Avenue, Manhattan*

LEFT: *Typical concrete curb: Beach 73rd Street, Queens*

Benefits

This material is widely available and cost effective

Can easily be cast on site to fit curved sidewalk profiles

Cast-in-place curbs are more resistant to displacement than stone alternatives

Considerations

Vulnerable to breakage or crumbling

Application

This material is standard for any street with UNPIGMENTED CONCRETE sidewalks (3.1.1)

DOT generally maintains this material

Design

Size: 6 inches wide on top, 8 inches wide on bottom, 18 inches deep; 7-inch reveal above roadway

Expansion joints of curb should line up with expansion joints of sidewalk

Steel facing should be used on streets where repeated mounting by heavy vehicles may cause damage.

May require metal reinforcement bars as specified by DOT

Concrete curb specification source: DOT Standard Specifications Section 4.08, 3.05

Steel-faced curb specification source: DOT Standard Specifications Section 2.13, 3.05, 4.09

Concrete curb detail source: DOT Standard Details drawing # H-1044

Steel-faced curb detail source: DOT Standard Details drawing # H-1010

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Sustainability Opportunity: Salvaged or recycled steel facing

Pigmented Concrete

Usage: Standard

Same mixture as UNPIGMENTED CONCRETE (3.2.1), but with a pigmented admixture to match the sidewalk. There are three types of pigmented concrete: PIGMENTED CONCRETE: DARK (3.1.2a), BLUESTONE (3.1.2b), and GRANITE (3.1.2c).

Benefits

See benefits of UNPIGMENTED CONCRETE (3.2.1)

Considerations

See considerations for UNPIGMENTED CONCRETE (3.2.1)

Application

See application guidance for PIGMENTED CONCRETE sidewalks (3.1.2a, 3.1.2b, and 3.1.2c)

DOT generally maintains this material

Design

See design guidance for UNPIGMENTED CONCRETE (3.2.1)

See design guidance and specification information for PIGMENTED CONCRETE sidewalks (3.1.2a, 3.1.2b, and 3.1.2c)

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Typical pigmented concrete curb with steel facing: Beaver Street at Hanover Street, Manhattan

Integral Concrete Curb and Gutter

Usage: Distinctive

Concrete curb and gutter precast as single pieces and installed in sections.

Benefits

Easier to install and maintain than cast-in-place alternatives

Can be removed and replaced as needed

Considerations

See considerations for UNPIGMENTED CONCRETE (3.2.1)

Use of this material may require a maintenance agreement

Application

Appropriate for residential areas with low volumes of heavy vehicles

Flood-prone areas

Design

Specification source: DOT Standard Specifications Section 4.08, item number 4.08 CG

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Sustainability Opportunity: Porous concrete where possible

Precast concrete curb and gutter sections laid end-to-end. Photo shows extension in background: Miami Beach, FL (Note: for illustrative purposes only)

Granite

Usage: Distinctive

Granite cut to long sections and laid as curbing. Saw-finishing, achieved by cutting the granite with a stone saw and polishing out saw marks, provides a smooth, clean look. Split finishing, typically achieved by hand-chiseling, exposes the natural cleft of the stone, giving a rough-hewn texture.

Benefits

Reinforces historic character (if applicable)

Adds distinction and visual enhancement to sidewalk

Stone conveys connection to natural environment

Extremely durable and low-maintenance, resists cracking and discoloration

Can be removed and replaced as needed

Considerations

Difficult to patch and must therefore be replaced by section if severely damaged

Much higher material cost than concrete

Application

This material is appropriate for all streets, especially commercial districts, including use in combination with concrete sidewalk

Granite curb is usually required in historic districts, adjacent to individual landmarks, or in areas with existing granite curb where the historic fabric remains intact

DOT generally maintains this material

Split-finish granite curb shown with concrete sidewalk: Houston Street at LaGuardia Place, Manhattan

Saw-finish granite curb shown with historic bluestone sidewalk: Madison Avenue at East 51st Street, Manhattan

Design

Size: 5 inches to 8 inches wide on top, 3 inches of minimum width on bottom, 16 inches deep

Must have lip with batter and rounded edge

Slip resistance at top of curb: minimum 0.60 coefficient of friction when wet

Specification source: DOT Standard Specifications Section 2.12, 4.07

Saw-finish curb detail source: DOT Standard Detail drawing # H-1056

Split-finish curb detail source: DOT Standard Detail drawing # H-1056A

Sustainability Opportunity: Salvaged granite curb

Crosswalks

Crosswalks are areas of roadbed that are delineated to indicate where pedestrians are expected to cross (see Glossary). In certain instances, crosswalks may have patterns or be constructed from materials that further increase their visibility or add character to a neighborhood. This section is intended to include only surface materials approved for creating distinctive crosswalks. It does not include guidance on using standard thermoplastic markings to designate crosswalks for traffic control purposes. For this information, please refer to the most recent version of the federal *Manual on Uniform Traffic Control Devices* (MUTCD).

In addition to the materials listed in this section, all materials listed in the Roadways section (3.4) may also be used in crosswalks, according to the application guidance provided.

Granite Paver

Usage: Historic

Stone unit pavers are known for durability and associated with high-quality traditional streets.

Granite pavers in a crosswalk. This treatment is appropriate for historic districts: Water Street, Brooklyn

Benefits

Visually enhances crosswalk

Creates accessible, smooth crossing surface

Considerations

Due to the possibility of pavers cracking or becoming uneven, and asphalt shoving at the borders, application requires attentive maintenance

Significantly higher cost than a standard asphalt crosswalk

Application

Crosswalks on historic streets or where distinction is desired and there are low volumes of heavy vehicle traffic

Should not be used where frequent utility cuts are likely

Use of this material generally requires a maintenance agreement

Design

Crosswalks generally should comply with MUTCD standards

Paver size: minimum 4 inches for shortest dimension, maximum 30 inches for longest dimension, minimum 5-inch thickness for vehicular roadbed

Pavers that have a ratio of length to width greater than 2:1 should only be used when set in poured concrete because of the likelihood of breakage under heavy-vehicle traffic

Granite must have a textured surface that provides sufficient slip resistance to meet a minimum 0.60 coefficient of friction when wet

Specification source: DOT Standard Specifications Section 6.04

Sustainability Opportunity: Salvaged pavers

Roadways

Roadways represent the paved central portion of the street that allows access to and movement through an area (see Glossary). Most roadways are primarily designed for motor vehicle use.

Asphaltic Concrete

Usage: Standard

Commonly known as asphalt, this material is a mixture of asphalt binder and stone aggregate, usually laid on a concrete base and compacted by a roller to form a smooth and solid road surface.

Benefits

Provides smooth and durable road surface with high friction coefficient

Material is widely available and cost-effective

Impervious quality channels water to the curb on crowned roadways

Dark color hides dirt and stains, creates background for high-contrast markings

Easy to maintain and patch

Can be pigmented or imprinted for varied purposes

Asphalt can be recycled

Typical asphalt roadway: Delancey Street at Forsyth Street, Manhattan

Considerations

Prone to rutting and shoving under high volumes of heavy vehicles

Contributes to heat-island effect

Sends runoff to catch basins, thereby contributing to combined-sewer overflows (CSOs) during large rainstorms

Application

Standard for roadbeds in all neighborhoods unless otherwise specified

Preferred road surface for cycling

DOT generally maintains this material

Design

Minimum 3-inch-thick wearing course, typically

Roadway should be crowned to drain stormwater from the road surface

Typically requires concrete base

Specification source: DOT Standard Specifications Section 2.05, 3.01, 4.01, 4.02

Detail source: DOT Standard Details drawing H-1034 and related

Sustainability Opportunity: High recycled asphalt (RAP) content

Sustainability Opportunity: High-SRI asphalt

Sustainability Opportunity: Porous asphalt in parking lanes

Porous Asphalt

Usage: Pilot

Asphaltic concrete in which the amount of fine particles is kept to a minimum and in which the binder content is low, allowing water to pass through into an open-graded reservoir.

Benefits

See benefits of ASPHALTIC CONCRETE (3.4.1)

Reduces impermeable surface, thereby increasing water infiltration

Exhibits structural properties similar to conventional asphalt

Reduces peak sewer discharge during storm events

Reduces likelihood of ponding and slick or icy road conditions

Helps reduce urban heat-island effect

Voids in between stones allow water to pass through (Note: for demonstration purposes, this example shows a clear resin, not asphalt, to bind the aggregate particles)

Conventional asphalt causes rainwater to pool while porous asphalt allows it to permeate the ground below

Considerations

See considerations for ASPHALTIC CONCRETE (3.4.1)

Not recommended for use where there is water-sensitive sub-surface infrastructure

Only certain soil types are appropriate as sub-bases for infiltration

Porosity of pavement can convey harmful chemicals into the soil

Requires vacuuming of surface to restore permeability when clogged

Sand should not be applied to surface

Application

Can be proposed for use in parking lanes, parking lots, and recreational paths

Most effective on slopes less than 5%

Must have adequate sub-surface conditions to detain stormwater

Avoid "stormwater hotspots"—sites where there is high potential for soil and groundwater contamination

Not recommended for implementation over significant underground utility corridors

Use of this material generally requires a maintenance agreement

Design

Minimum 3-inch-thick wearing course, typically

Roadway should be crowned to drain stormwater from the road surface

Aggregate should be no smaller than 600 µm, or the No. 30 sieve

Asphaltic cement should be 5.75–6.75% bituminous asphalt content by weight

Do not seal coat

Typically, a 12–30-inch open graded stone infiltration bed is recommended.

Bottom of infiltration bed should be at least 2 feet above high water table and 2 feet above bedrock

Consider use in gutter area near pedestrian ramps to reduce ponding

Concrete

Usage: Standard

Mixture comprising cement(s), aggregate(s), water, and other chemical admixtures, poured over metal reinforcement bars, smoothed, and then allowed to harden, forming a solid road surface.

Benefits

Provides durable road surface with high friction coefficient

This material is widely available and cost effective

Resists rutting and shoving that can occur with asphalt

Compared to asphalt, reduces impact of vehicle travel vibrations on sub-surface features and neighboring structures

Considerations

Difficult to replace or patch in sections where utility cuts or defects occur

Noisier than asphalt

Application

Appropriate for roads with high motor vehicle volumes and/or gross weight

Should be used wherever engineering criteria dictates, such as bridges, vaulted roadways, or bus pads

Should not be used where frequent utility cuts are likely

Will be evaluated case-by-case based on engineer review of roadway structure

DOT generally maintains this material

Typical concrete roadbed: West Side Highway, Manhattan

Design

Must have joints to allow for expansion no more than 20 feet apart

May require metal reinforcement bars as specified by DOT

Specification source: DOT Standard Specifications Section 3.05, 4.05

Detail source: DOT Standard Details drawing H-1050

Detail source (bus pad): DOT Standard Details drawings H-1005, H-1005 A

Sustainability Opportunity: Supplementary cementitious materials (SCM)

Typical concrete bus pad: Manhattan Avenue at 114th Street, Manhattan

Granite Block

Usage: Historic

Historic smooth-finish granite block unit pavers often referred to as "cobblestones," commonly used throughout New York City in the nineteenth century.

Typical cobblestone roadway: Jay Street at Hudson Street, Manhattan

Detail of a design to provide rideable cycling surface using a strip of smooth granite pavers among reused granite blocks

Benefits

Reinforces historic character

Calms vehicle traffic

Can visually delineate separation of street uses or modal priorities

Cobblestones are relatively easy to remove and reset, especially for utility access

Considerations

Stones can become loose over time and require intensive, regular maintenance

May generate significant noise from vehicle tires

Uneven surface can hinder pedestrians, cyclists, and people with disabilities; attention must be given to navigation by people with disabilities at crosswalks

See GRANITE PAVER CROSSING (3.3.1)

Can be slippery when wet

Application

Should be used wherever there is existing cobblestone in areas where the historic fabric remains intact

Use of this material is subject to LPC review when used in historic districts with existing cobblestones

May be used to provide visual delineation to separate bike lanes from vehicle lanes or vehicle lanes from pedestrian areas

Can be used to designate areas of the roadbed not intended for regular vehicle travel, such as pedestrian streets or textured gutters, aprons, or medians

DOT generally maintains this material in historic districts, but any third party that excavates it must restore it in kind or as directed by the Commissioner pursuant to Rules of the City of New York, Title 34, Section 2-11(e)(12)(vii)

Use of this material outside of historic districts generally requires a maintenance agreement

Design

Can be sand-set for easier installation and maintenance and for greater permeability, or mortar-set for stronger structural properties

May require concrete base

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

Specification source: DOT Standard Highway Specifications Section 2.06, 6.04

Sustainability Opportunity: Salvaged cobbles

Sustainability Opportunity: Permeable installation

Lighting

4

Introduction

Standard poles can be painted black, brown, or green, and combined with the Helm or Stad luminaire. Such modifications are considered Standard but they typically require a maintenance agreement: West 15th Street, Manhattan.

About this Chapter

This chapter, which constitutes the current DOT Lighting Catalogue, outlines options for both new and replacement street and pedestrian lighting for New York City streets, pedestrian bridges, walkways, bikeways, plazas, and parks. Streetlights currently installed on the street but not included in this chapter are not permitted in new projects. The streetlights herein meet DOT engineering standards and technical requirements for safety and energy efficiency. Most are appropriate for use in a variety of contexts, pending DOT design review; however, with the city's transition to LED streetlights, some luminaires, such as the Helm and Stad, have been discontinued, and will be reconsidered for use if LED lamps become available.

Selection Criteria

DOT uses guidelines established by the Illuminating Engineering Society of North America (IES) to provide sufficient light intensity and uniformity in the ROW to produce a comfortable and safe street environment. In addition to lighting characteristics, the agency considers the design qualities of poles and luminaires with an eye to maintaining an aesthetically consistent and coherent streetscape within each neighborhood. As part of this effort, the agency does not approve block-by-block variations in types of streetlights.

- **Streetlight Components**
  A streetlight comprises three elements: 1) the base (sometimes with a "skirt" that covers the base, for a desired appearance), 2) the pole, and 3) the luminaire, made up of the lamp—i.e., the actual light source—and the fixture, which houses the lamp. The desired aesthetic and engineering outcomes can be achieved by combining poles with a variety of luminaires; acceptable pole-luminaire combinations and options for lamps are described in this chapter.

  In some cases, poles, luminaires, and bases are integral to the streetlights. Such streetlights are called "integrated streetlights."

- **Energy Standards**
  In order to reduce the city's energy use, DOT is phasing in LED lamps for all streetlights and encourages the use of LED fixtures whenever available.

- **Engineering Review**
  In all cases, the suitability of the streetlight for particular street and lighting conditions must be approved by DOT engineers.