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

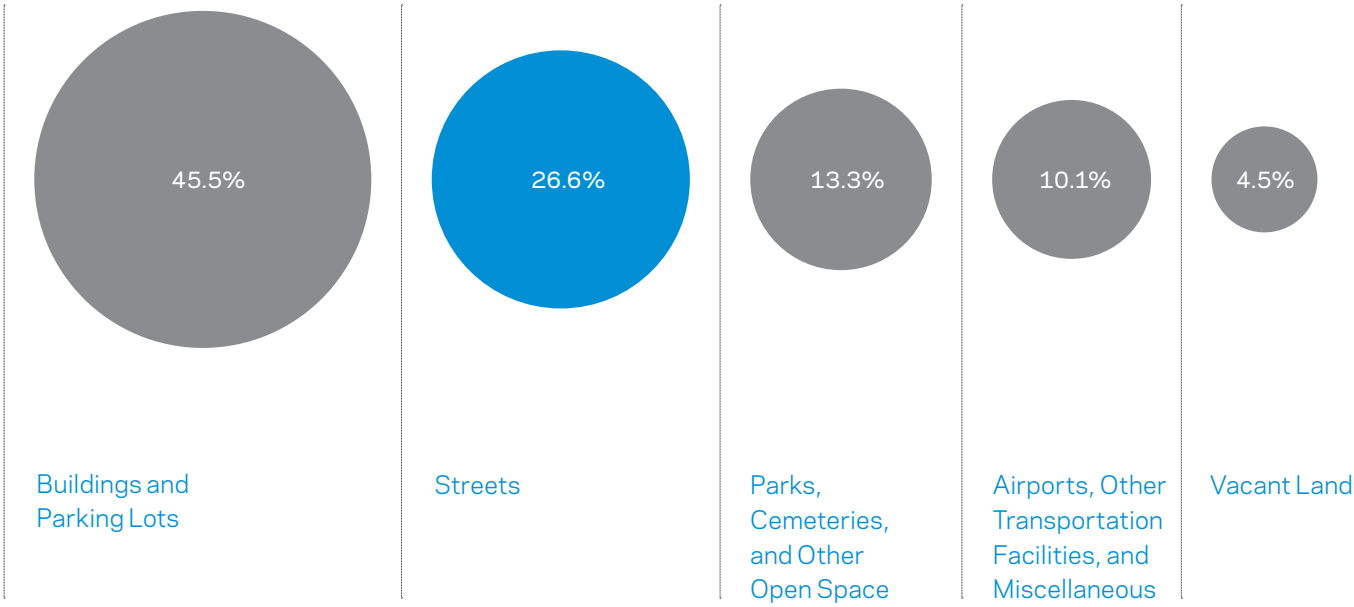
Streets, which take up over a quarter of the city's land area, are a critical part of New York City's infrastructure. The condition of these public spaces has a significant impact on the city's environmental health and on the quality of life for its residents.

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 and Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG).
- **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.

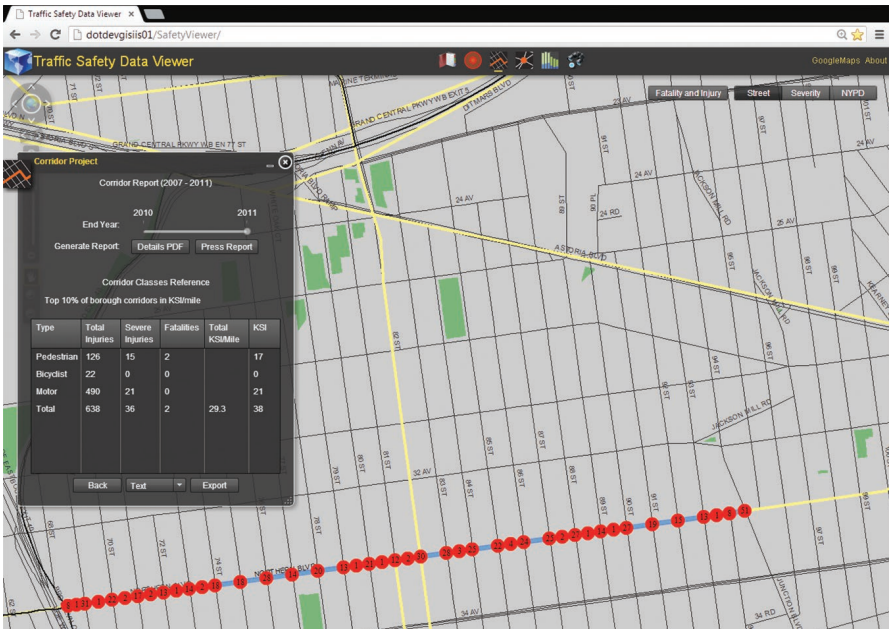
DOT consults with FDNY to address any concerns about the impact of the designs on its operations. The agency also presents the preliminary concepts to the relevant community board and elected officials for input. If the project is a major transportation project, as defined in Local Law 90 of 2009, DOT 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

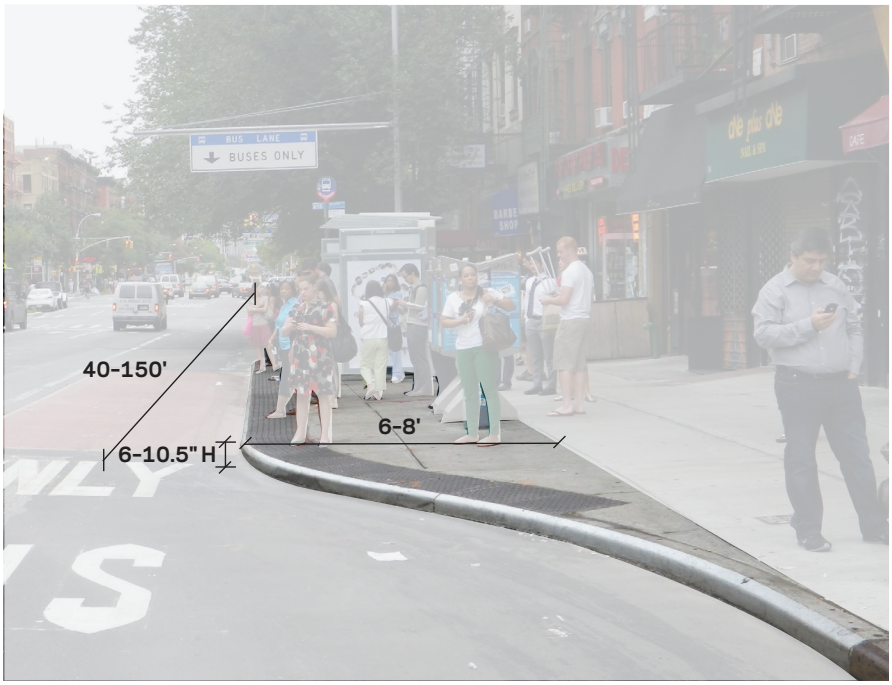
When utilized at a bus stop under an elevated train line, where the bus does not pull over to the sidewalk, provides a safer space for passengers to wait, as many currently stand in the roadway

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)

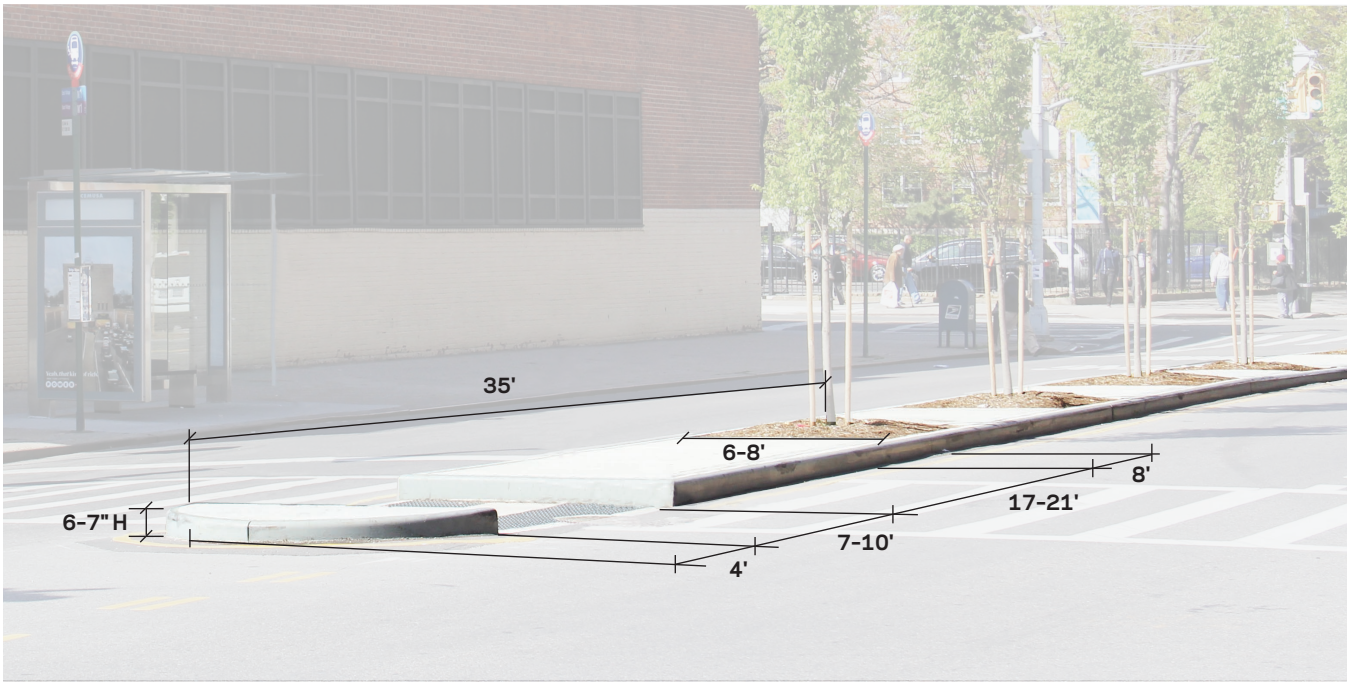
Maximize permeable surface of curb extension with vegetation, permeable paving, or both

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)

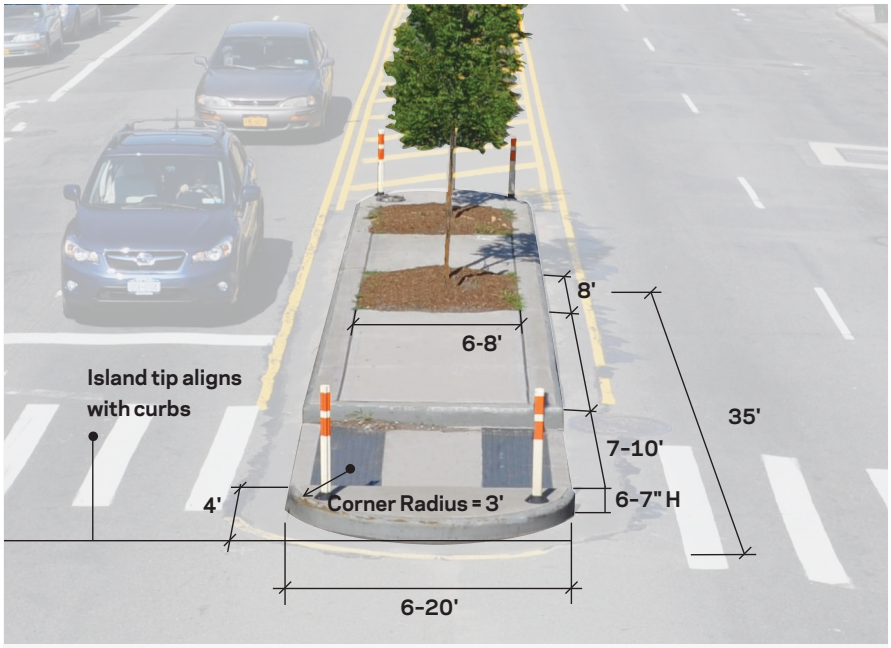
Maximize permeable surface of raised median

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

Usage: Distinctive

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

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

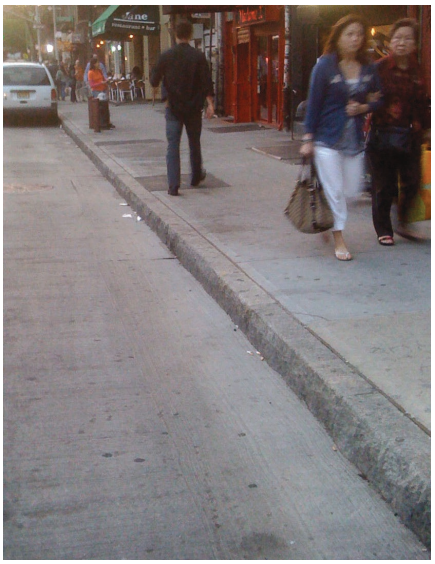
Much higher material cost than concrete

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.

Usage Categories

Streetlights and components are categorized as Standard, Distinctive, Historic, and Pilot. DOT maintains equipment in all four categories, and replaces damaged streetlights in kind. The installation of new streetlights as part of a streetscape project is included in that project's budget and implemented by the project contractor. For any such project, an additional 10% of the total number of streetlights in the project must be purchased; DOT stores these extra streetlights and uses them to replace damaged streetlights in the project area.

- **Standard**
  DOT routinely installs and maintains Standard streetlights. The current Standard cobra head luminaires are the 110W maximum Standard LED Luminaires for wider streets and commercial streets; 78W maximum Standard LED Luminaires for residential streets; and 75W maximum park type Standard LED Luminaires for pedestrian lighting. DOT will maintain and replace existing 100W and 150W HPS Cobra Head luminaires for street lighting and 70W and 100W HPS luminaires for pedestrian lighting, but will be replacing them over time with LED luminaires. For street and pedestrian lighting, the Standard light poles are the Davit, the Round, and the Octagonal. The M-2A and the S-1A signal poles are Standard for use at traffic signal locations.

  With DOT approval, modifications and alternate combinations of components are possible. Poles can be painted black, brown, or green; and alternate treatments for bases can be used. While such modifications are considered Standard, they typically require a maintenance agreement.

- **Distinctive**
  Any streetlights other than those that are listed as Standard or Historic are considered Distinctive; they are installed as part of streetscape projects — in which case they require Public Design Commission (PDC) approval — or as in-kind replacements for damaged streetlights. DOT is responsible for submitting Distinctive streetlight proposals to PDC on behalf of neighborhood associations and other groups that request the treatments. In preparation for these submittals, DOT works closely with applicants to develop consistent streetlighting plans that are sensitive to local contexts. DOT maintains Distinctive streetlight components unless otherwise stipulated in a maintenance agreement.

- **Historic**
  Historic poles can only be used in Landmarks Preservation Commission (LPC) designated historic districts or in neighborhoods with substantial, intact historic fabric — i.e., three or more contiguous blocks. They require approval for use in historic districts, and PDC approval for use in non-designated areas with substantial, intact historic fabric. The Historic streetlights are currently used with only the LED Teardrop and Shielded Teardrop luminaires, with a 150W LED lamp.

  The TBTA pole (4.1.3) is considered Historic when combined with the Teardrop or Shielded Teardrop luminaire. Accordingly, it requires LPC approval in historic districts and PDC approval in non-designated areas with substantial and intact historic fabric.

DOT has transitioned to IES's BUG rating system for streetlighting.

- **Pilot**
  Streetlights in this category are being tested by DOT and are not yet approved for wider use in New York City.

Universal Design

Streetlights and signals at corners must be sited so that they do not obstruct curb ramps, ensuring sufficient access to the sidewalk for all pedestrians, including those using mobility devices. At crossings, the height of Accessible Pedestrian Signals must be reachable by a person using a mobility device, at a preferred height of 42 inches and a maximum height of 48 inches (ADA Accessibility Guides, PROWAG).

Resiliency

Existing foundations at traffic signal locations in certain flood-vulnerable areas will be replaced with coastal storm foundations that incorporate a square concrete pedestal 9 inches in height and 24 inches in width. The 24 inch x 9 inch pedestal will be monolithically poured with the foundation. Raising the base of the traffic signals or street light poles prevents the electrical components of the poles from being submerged in salt water during future flooding events. Additionally, High Density Polyethylene (HDPE) conduit, a more cost-effective material that is not susceptible to corrosion from residual salt water after storm surge events, will replace galvanized steel for all signal and streetlight locations.

Specifications

For design criteria, technical information, finishes, and color specification, refer to DOT's Bureau of Traffic Division of Streetlighting specifications. The latest edition is available for purchase for $50 from the Office of the Agency Chief Contracting Officer, 55 Water Street, Ground Level, New York NY 10041. For further information, call (212) 839-9435.

BUG Ratings

DOT rates luminaires based on IES's BUG Ratings. The BUG (Backlight, Uplight, and Glare) rating describes the types of stray light escaping luminaires, based on zonal lumen calculations for secondary solid angles established by IES TM-15-11. The BUG system takes into account uplight shielding, glare shielding, and backlight shielding. This system replaces the previously-used IES cutoff rating classifications. **DOT recommends fixtures with a B2-U1-G2 BUG rating.**

Lighting Levels & Uniformity

DOT's lighting-levels and uniformity guidelines are based on those established by the IES Roadway Lighting standard RP-8-14. The current edition of the Illuminating Engineering Society of North America's IESNA Lighting Handbook should be referenced for applicable values of illuminance, luminance, contrast and glare criteria, and color temperatures.

All lighting designs must be reviewed and approved by DOT engineers.

	Average Illuminance	Illuminance Uniformity
Roadways		
Collector*	8-12 lux (.74-1.11 footcandles)	4:1
Local**	6-9 lux (.56-.84 footcandles)	6:1
Intersections		
Collector/Collector	16-24 lux (1.49-2.23 footcandles)	4:1
Collector/Local	14-20 lux (1.30-1.86 footcandles)	4:1
Local/Local	12-18 lux (1.11-1.67 footcandles)	4:1
Plazas, Walkways, & Bikeways	5-10 lux (.46-.93 footcandles)	6:1

**Collector roadways serve motor vehicle traffic between major and local roadways — major roadways being those that serve as the principal network for through traffic. DOT's Lighting Division generally classifies avenues and boulevards as collector roadways*
***Local roadways provide direct motor vehicle access to abutting properties. DOT's Lighting Division generally classifies cross streets as local roadways*

Luminaires	Standard Poles			Distinctive Poles	
	Davit	Octagonal	Round	Flatbush	TBTA
Standard LED	●	●	●		
Helm	●	●	●	●	
Stad	●	●	●	●	●
Teardrop				●	●
Shielded Teardrop					●

The table above illustrates what pole-luminaire combinations are allowed, though the Helm and Stad luminaires are only eligible for in-kind replacement. Integrated Streetlights are not included.

Notes and Symbols

CCMH	Compact Ceramic Metal Halide lamping. CCMH is a full-spectrum light that can be installed as part of a streetscape project, and is maintained by DOT.
HDG	Hot Dipped Galvanized Steel
HPS	High-Pressure Sodium
IES	Illuminating Engineering Society of North America
IES Type	IES classification of lighting based on its photometric properties. Five types are relevant to the city's streetlights: I, II, III, IV, and V.
LED	Light-Emitting Diode. DOT is phasing in LEDs that produce white, full-spectrum light.
SS	Standard Streetlight: Standard pole (Davit, Round, or Octagonal), standard luminaire (Standard LED Luminaire), or standard pole and luminaire (Standard LED Luminaire on Round, Octagonal, or Davit)
W	Watts
$	Costs: Shown for each pole or luminaire as a $ symbol, representing relative costs compared to the Standard Streetlight (SS). A scale of one to five $ symbols is used rather than specific monetary amounts because actual costs are subject to change.

Poles

Davit, Round, & Octagonal Poles

Usage: Standard

Each of the Standard poles, combined with the Standard LED Luminaire, constitutes a Standard Streetlight. The Standard poles can also hold other luminaires. The Davit is DOT's preferred Standard pole with the Round and Octagonal used for in-kind replacement.

Applications

Streetlight Pole:
- Streets and highways
- Single and twin mounting

Pedestrian Pole:
- Parks, plazas, esplanades, pedestrian bridges, walkways, and bikeways

Luminaires

Standard LED Luminaire (Standard)

HPS Cobra Head (being replaced by Standard LED Luminaire)

Helm (in-kind replacement only)

Stad (in-kind replacement only)

Material/Color

HDG Steel/silver (street)—black, brown, and green are also allowed but require a maintenance agreement

Aluminum/silver (highway)

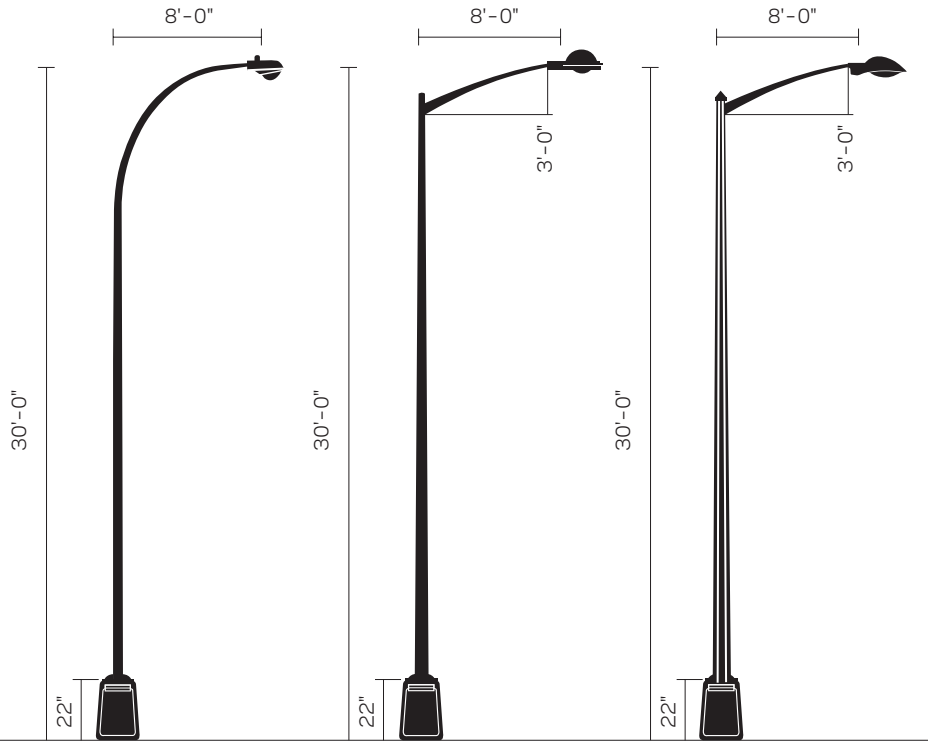
Cost Compared to SS

The Davit, Octagonal, and Round Poles are Standard poles

Octagonal pole with HPS Cobra Head luminaire: Pearl Street, Manhattan

Standard Poles with Various Luminaires

The three luminaires shown here are not being employed in new projects. The Helm and Stad luminaires are eligible for in-kind replacement, and may be considered in the future if versions with LED lamps become available.



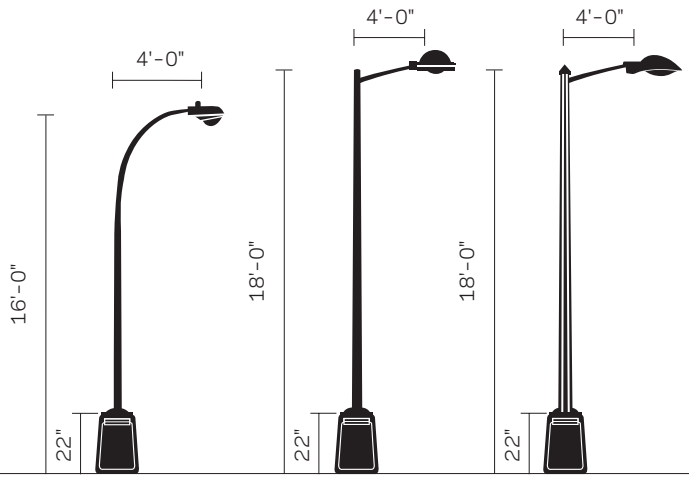
Davit Pole with HPS Cobra Head Luminaire

Round Pole with Stad Luminaire

Octagonal Pole with Helm Luminaire

Standard Pedestrian Poles with Various Luminaires

The three luminaires shown here are not being employed in new projects. The Helm and Stad luminaires are eligible for in-kind replacement, and may be considered in the future if versions with LED lamps become available.



Davit Pole with HPS Cobra Head Luminaire

Round Pole with Stad Luminaire

Octagonal Pole with Helm Luminaire

Flatbush Avenue Pole

The Flatbush Avenue pole was first installed in 1988 on Flatbush Avenue in Brooklyn. Its post-modern design is appropriate for areas with historic character.

Usage: Distinctive

Applications

Commercial and residential streets

Single or twin mounting (center medians)

Streets with roadway width of 36 feet or more

Luminaires

Teardrop (LED) and Shielded Teardrop (LED)

Helm (in-kind replacement only)

Stad (in-kind replacement only)

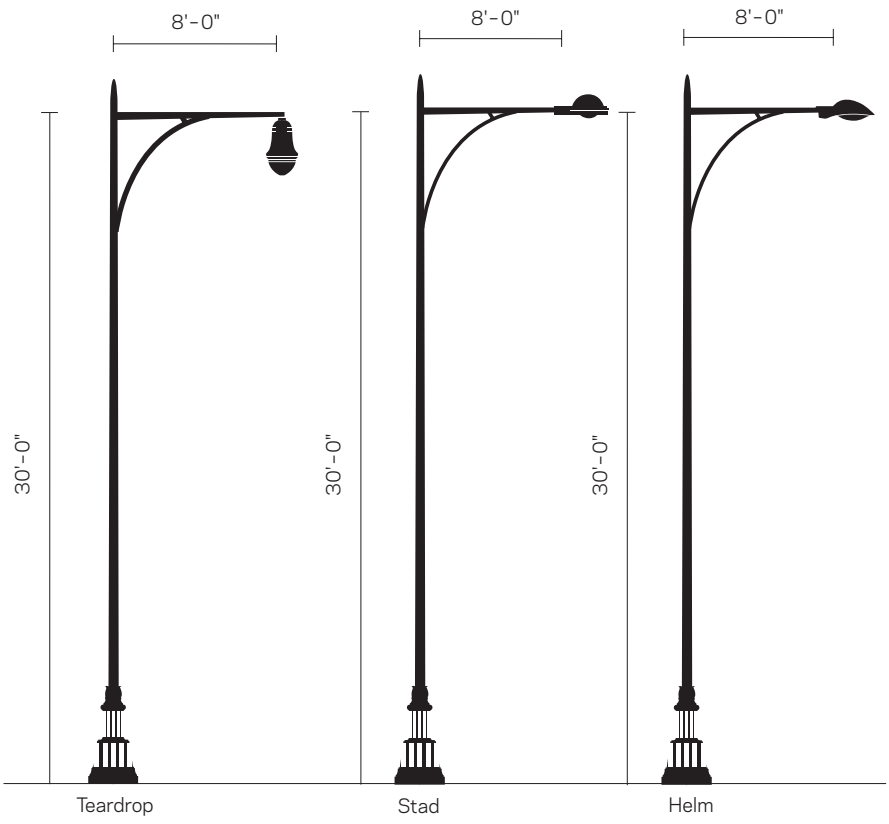
Material/Color

Fabricated steel pole/black, brown, and green

Cost Compared to SS

$$

Flatbush pole and Historic Teardrop luminaire: 49th Street, Queens



Flatbush Avenue Pole with Various Luminaires
The Teardrop (LED) and Shielded Teardrop (LED) are acceptable for combination with the Flatbush Avenue Pole. The Helm and Stad luminaires are eligible for in-kind replacement, and may be considered in the future if versions with LED lamps become available.

TBTA Pole

Usage: Distinctive

The TBTA (Triboro Bridge Tunnel Authority) pole was introduced in the 1950s for mid-twentieth-century bridge construction projects such as the Robert F. Kennedy Bridge (formerly the Triboro Bridge). The TBTA replaced wooden lamp posts that lit parkways during the 1920s and '30s. The Teardrop and Shielded Teardrop luminaires combine with the TBTA pole to produce a historic quality.

Applications

Streetlight Pole:

- Commercial and residential streets
- Single or twin mounting
- Streets with roadway width of 36 feet or more

Pedestrian Pole:

- Parks, plazas, esplanades, pedestrian bridges, walkways, and bikeways

Luminaires

Teardrop (LED) and Shielded Teardrop (LED) (historic districts only)

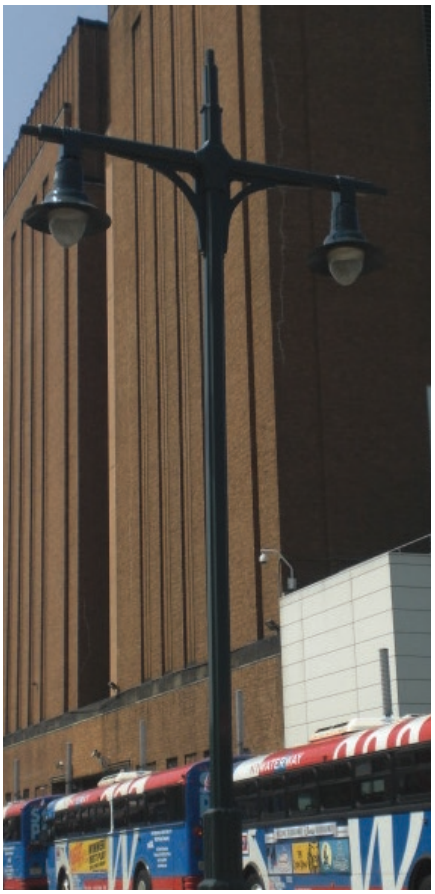
Stad (in-kind replacement only)

Material/Color

Fabricated steel pole/black, brown, and green

Cost Compared to SS

$$$$$

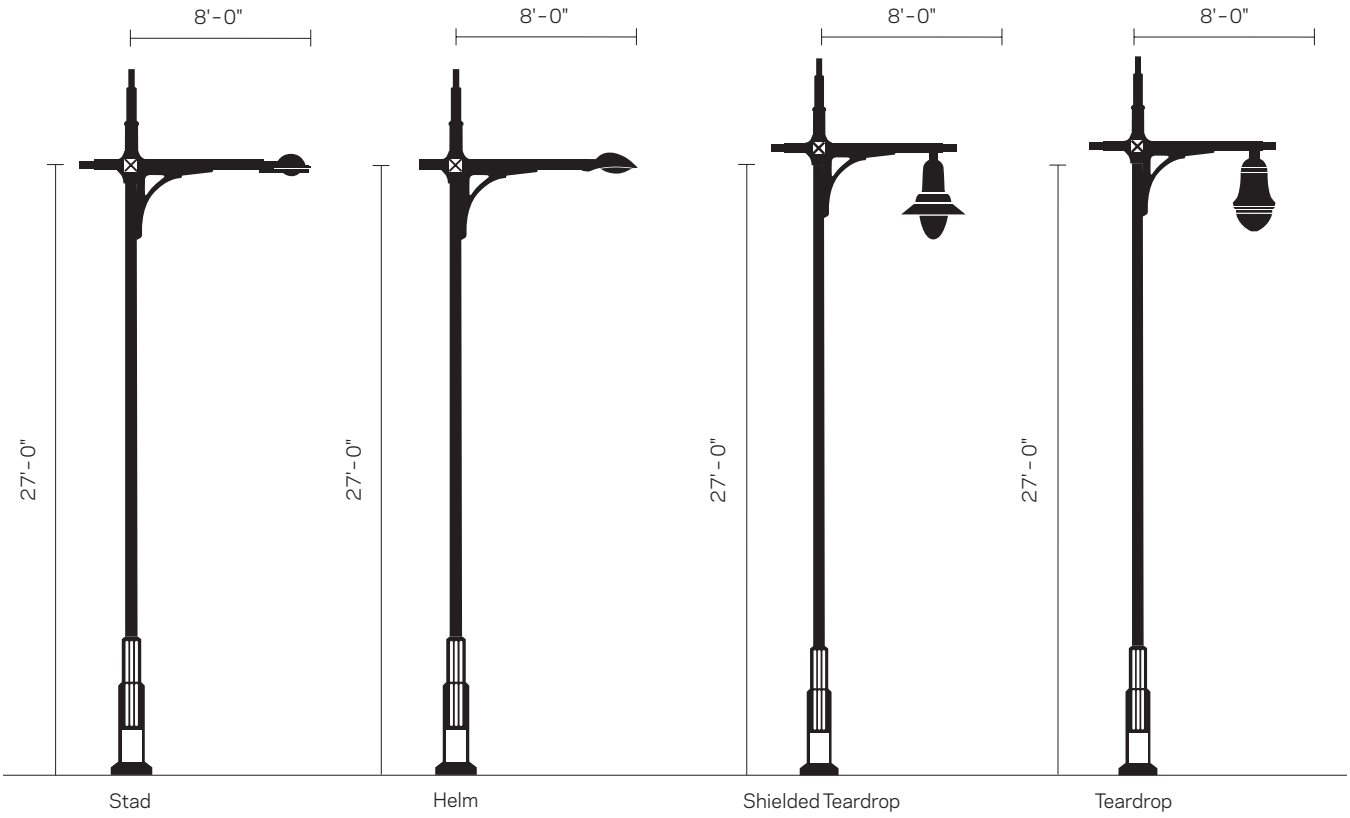


TBTA pole with Historic Shielded Teardrop luminaires: 40th Street, Manhattan

TBTA pole with Historic Shielded Teardrop luminaire: Hudson River Park, Manhattan

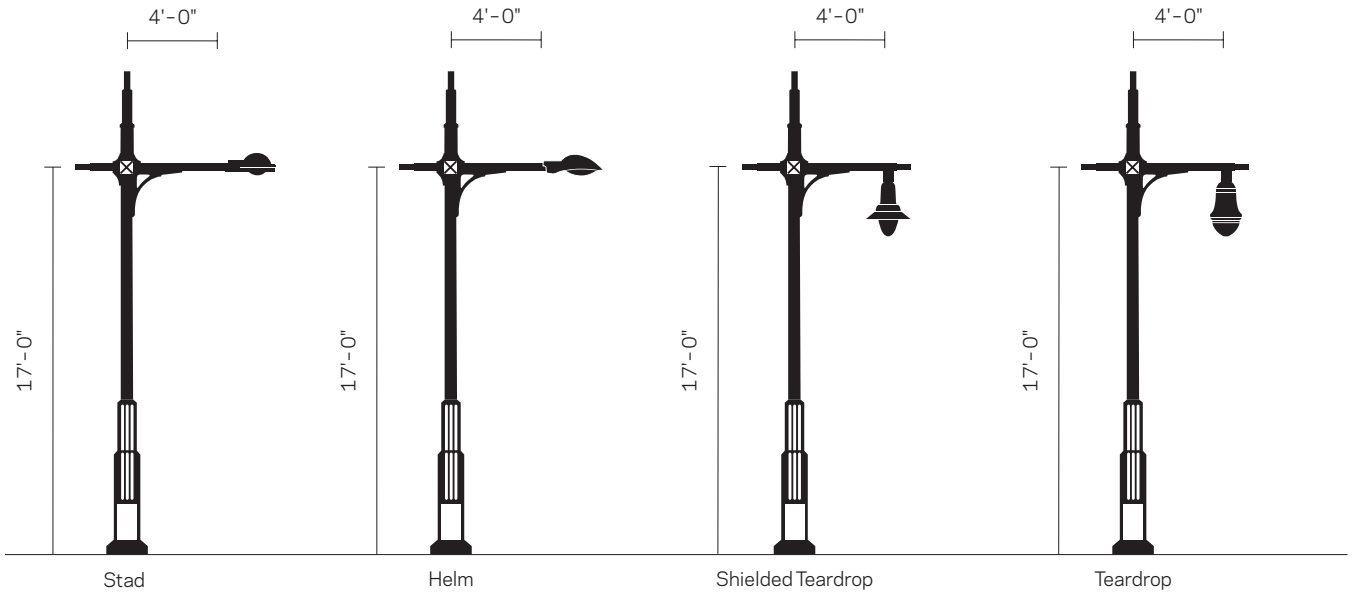
TBTA Pole with Various Luminaires

The Teardrop (LED) and Shielded Teardrop (LED) are acceptable for combination with the TBTA Pole. The Stad and Helm luminaires are eligible for in-kind replacement, and may be considered for new applications if versions with LED lamps become available.



TBTA Pedestrian Pole with Various Luminaires

The Teardrop (LED) and Shielded Teardrop (LED) are acceptable for combination with the TBTA Pedestrian Pole. The Stad and Helm luminaires are eligible for in-kind replacement, and may be considered for new applications if versions with LED lamps become available.



Luminaires

HPS Cobra Head

The HPS Cobra Head luminaire is being phased out and replaced by the Standard LED Luminaire, see STANDARD LED LUMINAIRE **(4.2.2)**

Usage: Discontinued

Applications

Street light: Streets and highways; single or twin mounting

Pedestrian light: Parks, esplanades, pedestrian bridges, walkways, ramps, under elevated trains, and bikeways; single mounting only

Lamp/Optics

Road:
- 100W HPS, IES Type I
- 150W HPS, IES Type II

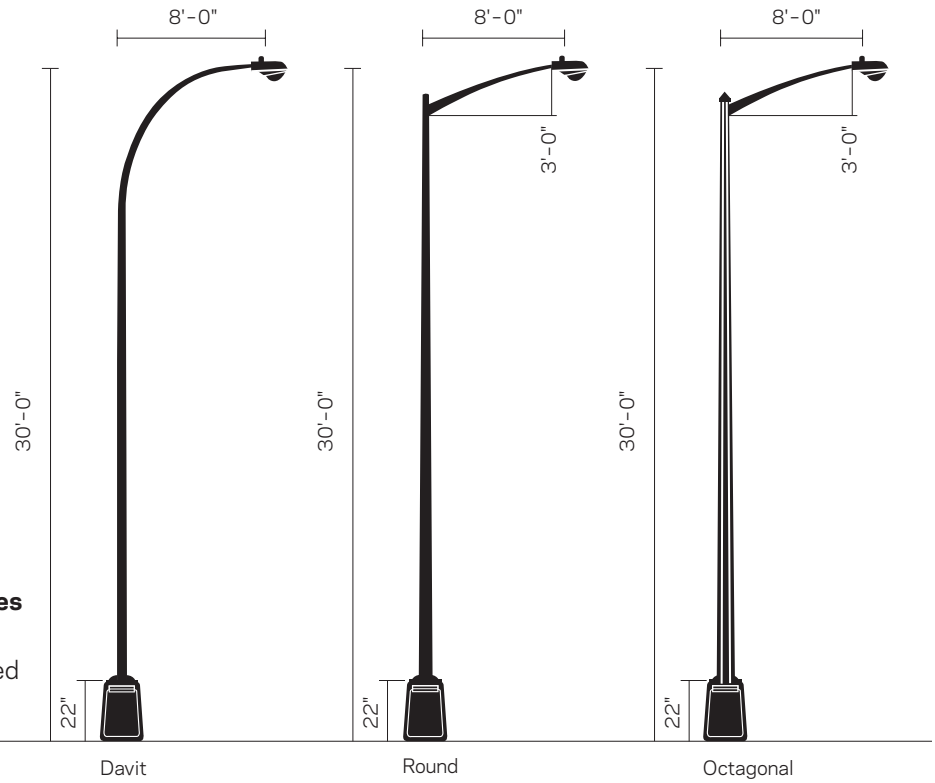
Pedestrian:
- 70W and 100W HPS, IES Type I

Cost Compared to SS

$

HPS Cobra Head luminaire on twin Davit pole: West Houston Street, Manhattan

HPS Cobra Head with Standard Poles
Poles shown here are the standard poles provided, tested, and maintained by DOT.



Standard LED Luminaire

Usage: Standard

DOT is phasing in the 110W and 78W Standard LED Luminaires for wide roadways and residential streets, respectively. Their full-spectrum, white light substantially improves visibility and clarity. The Standard LED Luminaire is considered to have a Cobra Head fixture.

Applications

Street light: Streets and highways; single or twin mounting

Pedestrian light: Parks, esplanades, pedestrian bridges, walkways, ramps, under elevated trains, and bikeways; single mounting only

Lamp/Optics

Wide Roadway/Commercial Area:
- 110W maximum LED
- IES Type I

Residential Street:
- 78W maximum LED
- IES Type I

Pedestrian:
- 75W maximum LED
- IES Type II or III

Cost Compared to SS

The Standard LED Luminaire is the SS

Standard LED Luminaire on Flushing Meadows Pole: Putnam Plaza, Brooklyn

Standard LED Luminaire on green Park Pole: Central Park, Manhattan

Helm Luminaire

Usage: In-Kind Replacement

An LED Helm luminaire is not currently available. The Helm luminaire is no longer permitted for new applications, but may be replaced in kind.

Applications

Commercial districts (in-kind replacement only)

Lamp/Optics

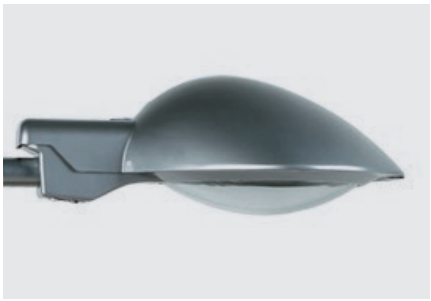
90W and 140W CCMH

Curved sag glass optics

IES Type II or III

Cost Compared to SS

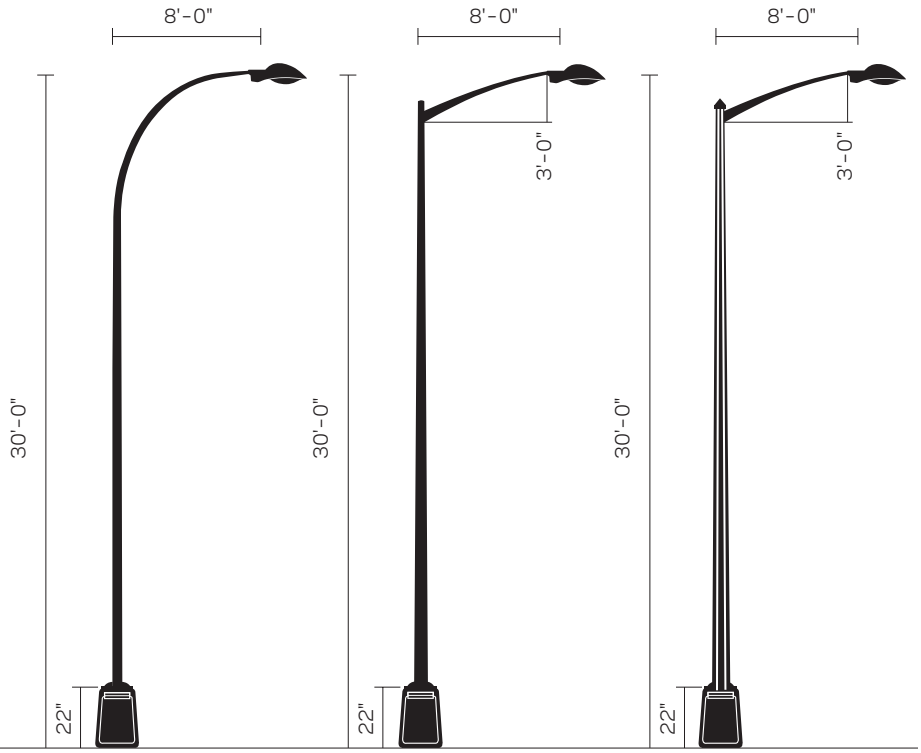
$$$$$



Helm luminaire on Davit pole: Flatbush Avenue, Brooklyn

Helm with Standard Poles
Standard poles are provided and maintained by DOT.

Helm luminaires on standard poles are eligible for in-kind replacement, and may be considered for new applications if a version of the luminaire using LED lamps becomes available.



Helm with Distinctive Poles
Distinctive poles require additional funding.

Helm luminaires on distinctive poles are eligible for in-kind replacement, and may be considered for new applications if a version of the luminaire using LED lamps becomes available.

Stad Luminaire

An LED Stad luminaire is not currently available. The Stad luminaire is no longer permitted for new applications, but may be replaced in kind.

Usage: In-Kind Replacement

Applications

Commercial districts (in-kind replacement only)

Pedestrian luminaires: Parks, plazas, esplanades, pedestrian bridges, walkways, and bikeways (in-kind replacement only)

Single or twin mounting

Lamp/Optics

Road: 90W and 140W CCMH

Pedestrian: 60W and 90W CCMH

Sag or flat lens optics

IES Type II or III

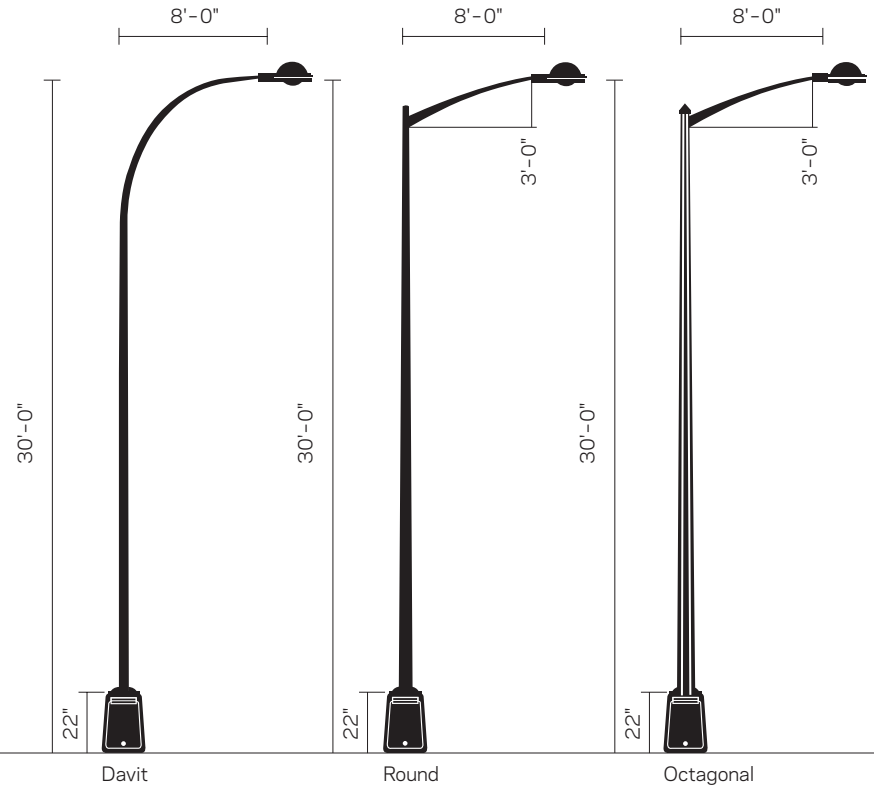
Cost Compared to SS

$$$$

Stad luminaires on TBTA pole: Robert F. Kennedy Bridge, Manhattan

Stad with Standard Poles
Standard poles are provided and maintained by DOT.

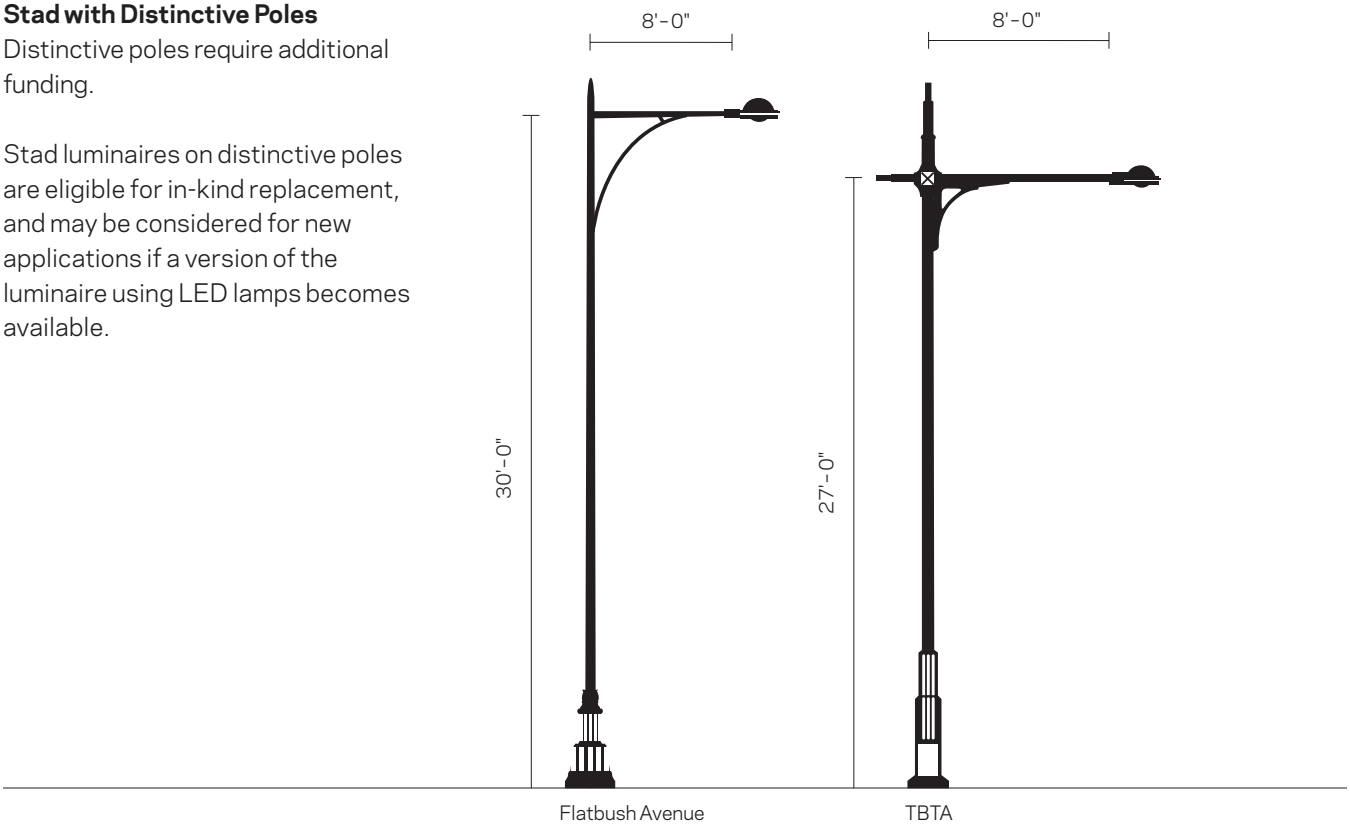
Stad luminaires on standard poles are eligible for in-kind replacement, are eligible for in-kind replacement, and may be considered for new applications if a version of the luminaire using LED lamps becomes available.



Stad with Distinctive Poles

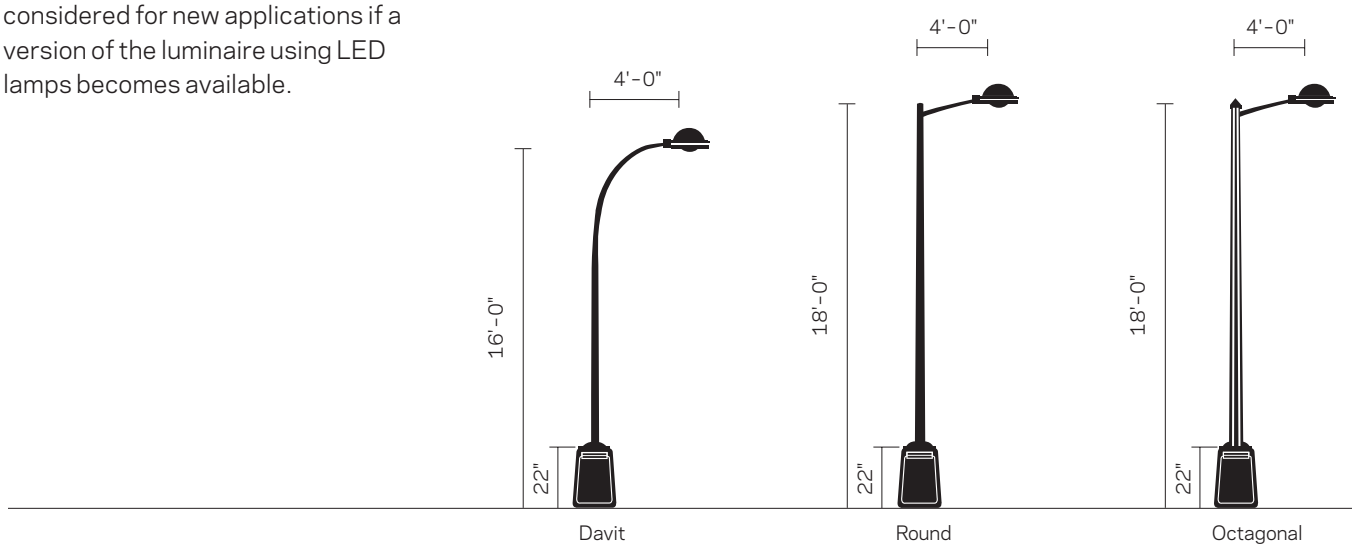
Distinctive poles require additional funding.

Stad luminaires on distinctive poles are eligible for in-kind replacement, and may be considered for new applications if a version of the luminaire using LED lamps becomes available.



Stad with Standard Pedestrian Poles

Stad luminaires on standard pedestrian poles are eligible for in-kind replacement, and may be considered for new applications if a version of the luminaire using LED lamps becomes available.



Teardrop & Shielded Teardrop Luminaires

The Teardrop and Shielded Teardrop luminaires are intended for use in historic districts and are allowed in areas with substantial, intact historic fabric. DOT is replacing existing 250W HPS Teardrops and Shielded Teardrops with 150W and 100W LED versions of these luminaires.

Usage: Historic

Applications

Selected historic districts

Lamp/Optics

150W or 100W LED

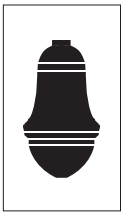
IES Type III or V

Cost Compared to SS

$$$$

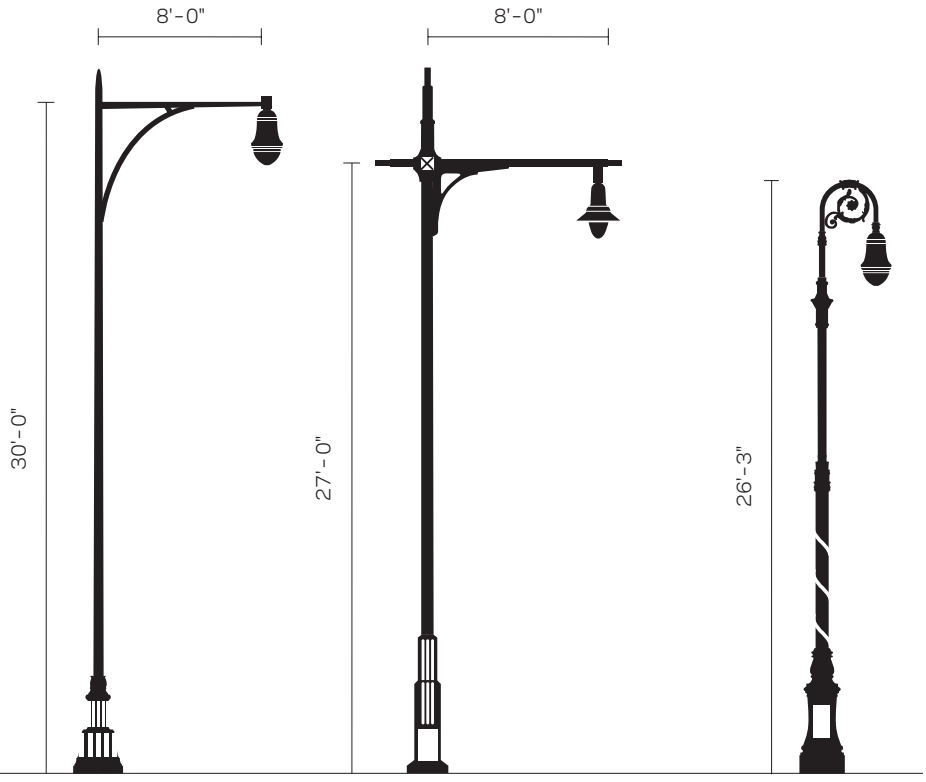
LED Teardrop Luminaire

Historic Luminaires with Various Poles



Teardrop

Shielded Teardrop



Integrated Streetlights

Alliance Luminaire & Pole

The Alliance streetlight was originally introduced in Lower Manhattan by the Downtown Alliance business improvement district. The streetlight is a contemporary alternative to the standard poles with the Standard LED Luminaire, at an additional cost.

Usage: Distinctive

Applications

Commercial districts

Roadways with widths of 36 feet or more

Lamp/Optics

100W and 150W HPS

IES Type II or III

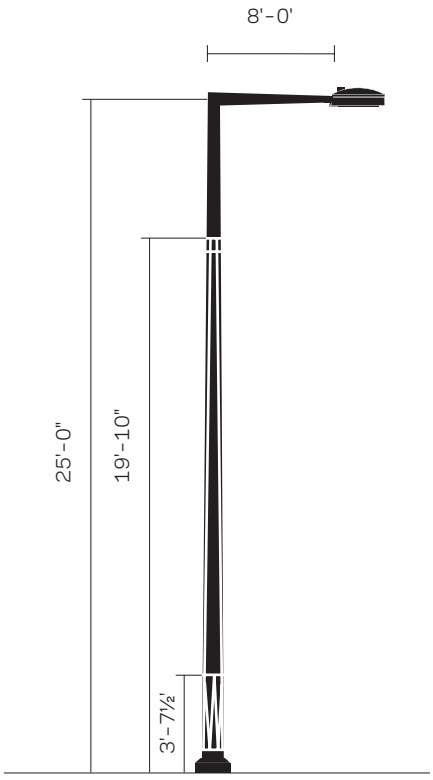
Material/Color

Steel/silver and black

Cost Compared to SS

$$$$$

Alliance luminaire and pole: Murray Street, Manhattan



Alliance Luminaire and Pole

Bishops Crook Luminaire & Pole

Usage: Historic

The Bishops Crook was the first of a number of decorative street lights to be introduced as early as 1900 on narrow city streets. Bracket versions of the Bishops Crook were also attached to the facades of buildings. The reproduction of the Bishops Crook was introduced in 1980 at Madison Avenue and 50th Street outside the Helmsley Palace Hotel (now the New York Palace Hotel).

Applications

Selected historic districts, per LPC approval

Streets with roadway width of 36 feet or less

Lamp/Optics

155W maximum LED Teardrop: IES Type III or V

155W maximum LED Shielded Teardrop: IES Type III or V

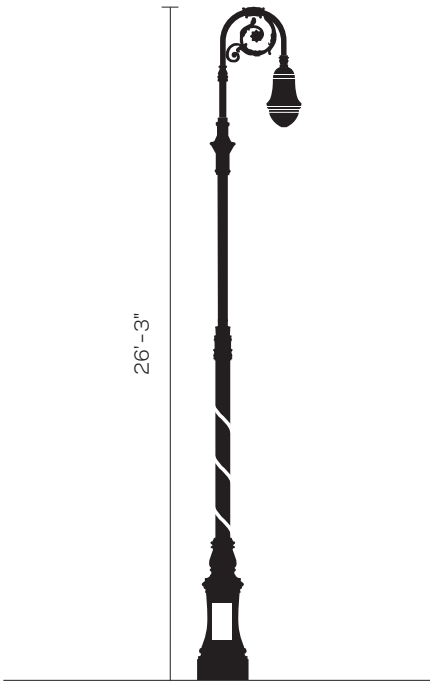
Material/Color

Ductile iron pole/black, brown, and green

Cost Compared to SS

$$$$$

Historic Bishops Crook luminaire and pole: Nassau Street, Manhattan



Bishops Crook Luminaire and Pole

City Light Luminaire & Pole

Usage: Distinctive

An international design competition to develop a new streetlight for New York City was held in 2004. The City Light design was selected as the winning entry. The City Light offers the most contemporary look in DOT's lighting catalogue.

Applications

Commercial or residential districts

Lamp/Optics

100W LED: IES Type II

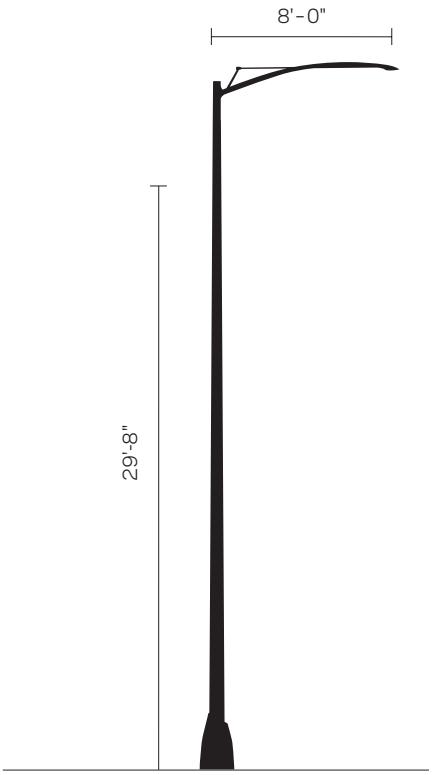
Material/Color

Aluminum/silver

Cost Compared to SS

$$$

City Light luminaire and pole: Warren Street, Manhattan



City Light Luminaire and Pole

Flushing Meadows Luminaire & Pole

Usage: Distinctive

The Flushing Meadows integrated pedestrian light was first installed in 2004 by the Department of Parks and Recreation in Canarsie Park in Brooklyn. The pole is now installed in many city parks, plazas, and along walkways and bikeways. DOT is currently testing this pole with other luminaires for pedestrian plazas.

Applications

Parks, plazas, esplanades, pedestrian bridges, walkways, and bikeways

Lamp/Optics

75W LED

IES Type III or V

Flushing Meadows Head

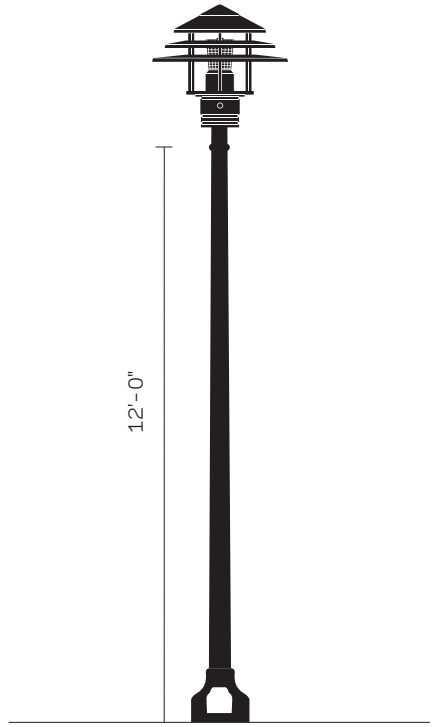
Material/Color

Steel/black, brown, green, and silver

Cost Compared to SS

$$

Flushing Meadows luminaire and pole: 46th Street, Queens



Flushing Meadows Luminaire and Pole

Type B Luminaire & Pole

Usage: Distinctive

The Type B integrated pedestrian light was originally introduced in 1911 by designer Henry Bacon for the Central Park Mall and later installed in other city parks. This version of the fixture was developed in the late twentieth century. Type B luminaires with HPS lamps are being phased out and replaced with LED luminaires. This pole is a more traditional design for pedestrian areas such as parks and plazas.

Applications

Parks, plazas, esplanades, pedestrian bridges, walkways, and bikeways

Lamp/Optics

75W LED

IES Type V

Material/Color

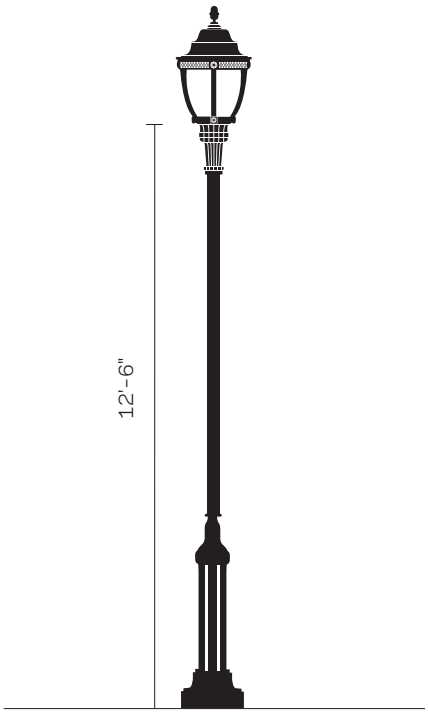
Ductile iron pole/black, brown, or green

Cost Compared to SS

$$

Type B luminaire and pole with LED lamp

Type B luminaire and pole with LED lamp



Type B Luminaire and Pole

Type F Luminaire & Pole

Usage: Historic

The Type F pole, originally known as the Reverse Scroll Bracket, was developed in 1913 and installed on narrow streets downtown on Seventh Avenue. Bracket versions of the Reverse Scroll were also attached to the facades of buildings. The reproduction of the Reverse Scroll was introduced in the late twentieth century as the Type F pole.

Applications

Selected historic districts

Streets with roadway width of 36 feet or less

Single or twin mounting

Lamp/Optics

100W LED Teardrop luminaire

IES Type III or V

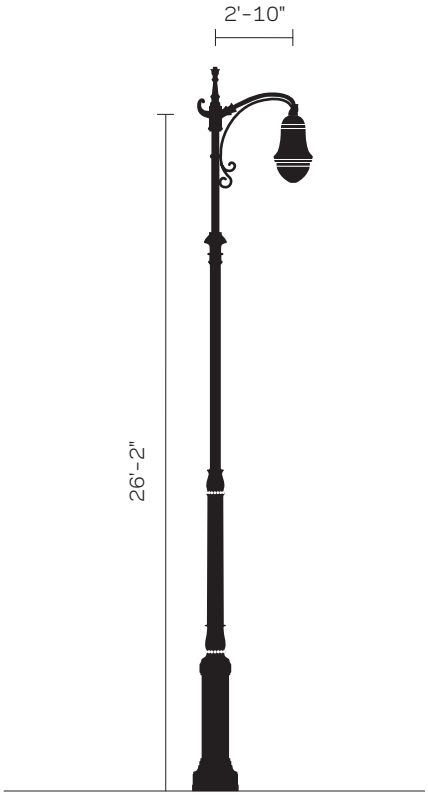
Material/Color

Ductile iron pole/black, brown, and green

Cost Compared to SS

$$$$$

Historic Type F luminaire and pole: East 8th Street, Manhattan



Historic Type F Luminaire and Pole

Type M Luminaire & Pole

Usage: Historic

The Type M pole, originally known as the Mast-Arm post, was introduced in 1908 for wide streets at corners on Broadway north of Columbus Circle and on Seventh Avenue north of Central Park. Bracket versions of the Mast-Arm were also attached to the facades of buildings. The reproduction of the Mast-Arm was introduced in the late twentieth century as the Type M pole.

Applications

Selected historic districts

Streets with roadway width of 36 feet or more

Single or twin mounting

Lamp/Optics

155W maximum LED Teardrop luminaire

IES Type III or V

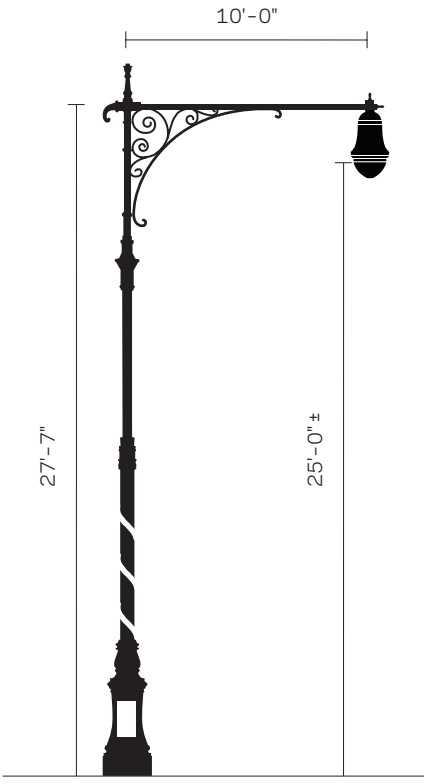
Material/Color

Ductile iron pole/black, brown, and green

Cost Compared to SS

$$$$$

Historic Type M luminaire and pole: West 11th Street, Manhattan



Historic Type M Luminaire and Pole

World's Fair Luminaire & Pole

The World's Fair pedestrian light was first installed in 1964 during the World's Fair held in Flushing Meadows Park in Queens. The pole is now installed in many city parks, in plazas, and along walkways and bikeways.

Usage: Distinctive

Applications

Parks, plazas, esplanades, pedestrian bridges, walkways, and bikeways

Lamp/Optics

Type 2085 fixture

75W LED

100W and 150W HPS

IES Type V

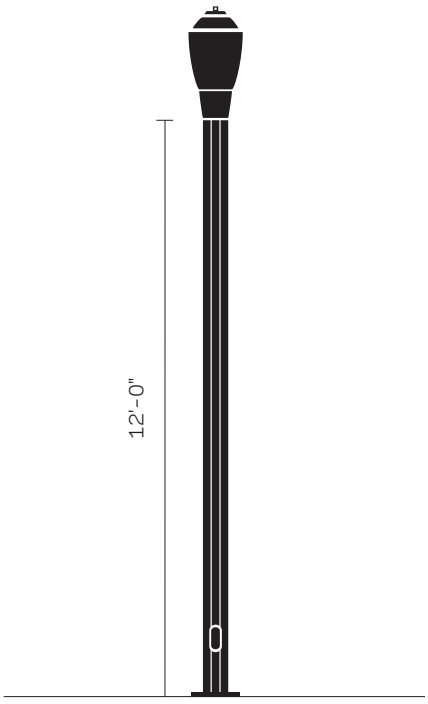
Material/Color

Steel/black, brown, or green

Cost Compared to SS

$

World's Fair luminaire and pole: Battery Park, Manhattan



World's Fair Luminaire and Pole

4.4 Signal Poles

Type M-2A Signal Pole

Usage: Standard

Introduced in 1964 as the M-2, the octagonal M-2A traffic signal pole is standard for use at all traffic signal locations. It can be mounted on a 9-inch concrete cylinder to provide necessary clearance or to avoid moisture in the base. A 5-foot mast-arm extension can be used to bring the signal farther out over the roadway, if necessary.

With a 5-foot 6-inch shaft extension, the M-2A can be used to hold a standard streetlight arm and a luminaire. It can also be made to resemble nearby Bishops Crook, Type F, or Type M poles when paired with the Type M skirt and a matching arm and luminaire.

Type M-2A signal pole with HPS Cobra Head luminaire: Murray Street, Manhattan

Applications

Holds signals and/or signs

Single or double mounting

Two M-2A poles per intersection, diagonally opposite from each other

Sometimes mounted on 9-inch concrete cylinder to provide necessary clearance or avoid moisture in the base

5-foot 6-inch shaft extension provides necessary clearance or holds a luminaire, if necessary

5-foot mast-arm extension to hold signal farther out over the roadway, if necessary

Can be retrofitted to resemble nearby Bishops Crook, Type F, or Type M light poles

Luminaires

Standard LED Luminaire (Standard)

Stad (Distinctive, in-kind replacement only)

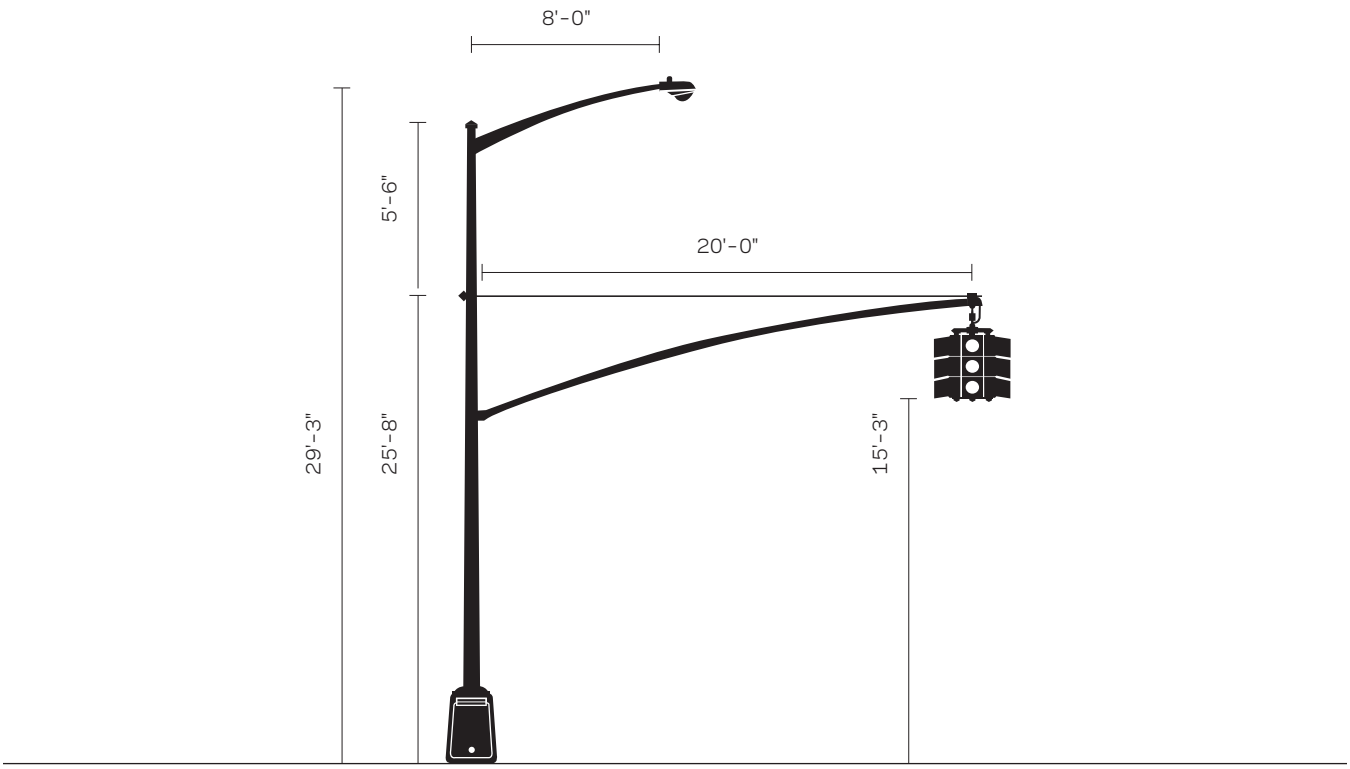
Helm (Distinctive, in-kind replacement only)

Teardrop (Historic)

Material/Color

H.D.G. Steel/silver, black, brown, or green

Type M-2A signal pole with Historic Bishops Crook arm: Foley Square, Manhattan



Type M-2A Signal Pole with HPS Cobra Head Luminaire

Type S-1A Signal Pole

Introduced as the S-1 in 1965, the round S-1A signal pole holds pedestrian signals at corners where an M-2A signal pole or a light pole is not necessary. It also holds traffic signals on medians and traffic islands.

Usage: Standard

Applications

Holds pedestrian and/or traffic signals

Luminaires

This pole does not hold a luminaire

Material/Color

H.D.G. Steel/silver, black, brown, or green

Type S-1A signal pole with a pedestrian signal: Hoyt Street, Brooklyn

Alliance Signal Pole

Usage: Distinctive

The Alliance streetlights were introduced in the Lower Manhattan financial district by the Alliance for Downtown New York business improvement district. The signal pole can be used as a contemporary alternative to the standard M-2A signal pole in conjunction with nearby Alliance streetlights, but at an additional cost.

Applications

Intersections

Lamp/Optics

100W HPS or 150W CCMH

Material/Color

H.D.G. steel/silver and black

Alliance signal pole and luminaire: Murray Street, Manhattan

Furniture

5

Introduction

CityBench on Court Street, Brooklyn.

About this Chapter

A wide range of elements are located on New York City's streets and plazas—everything from bus stop shelters to benches to banners. Some of these items perform utilitarian functions, while others serve as amenities. When well designed and installed in a coordinated manner, they enhance the on-the-street experience for New Yorkers and visitors. Chapter 5 describes the design and siting guidelines for street furniture.

General Guidelines

Clear Path
City regulations mandate that objects on sidewalks leave an unobstructed clear path. Revocable consent rules require that the greater of 8 feet or 50 percent of the sidewalk remain clear; DOT sites bus shelters such that they leave 7-foot clear paths, and newsstands must allow 9.5-foot clear paths. A clear path minimum of 5 feet is required to ensure two wheelchair users are able to pass each other or change direction. Most street furniture should be placed 18 inches from the curb to allow for motor vehicle access. To accommodate pedestrians with vision disabilities adequately, the lowest edge of any ground-level protruding object should be a maximum of 2.25 feet above the sidewalk, and the lowest edge of any suspended protruding object should be a minimum height of 6.7 feet.

Clutter
DOT generally discourages the installation of street furniture and other permanent objects on streets where they may restrict pedestrian circulation and degrade the visual quality of the street.

City policy restricts the placement of movable planters on sidewalks. DOT uses movable planters to delineate pedestrian areas within the roadway, such as interim plazas or sidewalk extensions.

Property Lines
The metes and bounds of private properties, although clearly described in deeds and other real property documents, may not be consistent with existing outdoor structures. As such, property owners must determine the exact locations of their property lines before installing any outdoor furniture by consulting the surveys provided to them upon purchase of their properties or by retaining licensed surveyors to prepare such surveys.

Design
Light poles, signs, seating, bike racks, bus shelters, and other fixed elements play a supporting role on New York City streets. Consistent design of those varied elements is an important consideration in their selection and siting.

Revocable Consents
The city grants a revocable consent to construct and use certain structures on, over, or under its inalienable property — in this case, city roadways and sidewalks. The city retains the right to revoke this consent at any time. For more information on revocable consents, visit www.nyc.gov/html/dot/html/permits/revconif.shtml.

Resiliency
Street furniture and other permanent objects should be constructed using resilient materials that can withstand periodic temporary inundation by both fresh and salt water.

Universal Design
Furniture should be designed to accommodate as wide a range of potential users as possible. Relevant considerations include interface height, amount of force that must be applied, color schemes and level of contrast with surrounding materials, and adjacent clear path.

Additionally, the city has begun installing accessible water fountains across the five boroughs, in order to enhance the comfort and health of all pedestrians using the public realm.

Security Structures
Security structures are fixed objects, such as bollards, installed around the perimeter of a building to reduce blast impacts from vehicle-born explosives. A property owner who wishes to install security structures must apply for a revocable consent from DOT. The application is forwarded to the New York City Police Department's (NYPD) Counterterrorism Division, which reviews security-related information provided by the property owner. If the NYPD determines that security structures are necessary, it works with the property owner's architect/engineer to develop a conceptual plan of an effective security perimeter.

DOT then works with the owner and architect/engineer to develop plans that will provide the security perimeter required by NYPD and will fit in with all other structures that are already in, under, and above the affected streets. DOT then coordinates an expedited interagency review of the plans. Plans are reviewed on a case-by-case basis to confirm that the structures are necessary and effective, have a minimum impact on pedestrian and vehicular traffic, and are aesthetically appropriate.

Art Display Case

DOT partners with local institutions to curate rotating, temporary exhibits in plazas and on large sidewalks around the city.

Description

7 feet-6 inches high x 3 feet-10 inches wide

Displays art on both sides

Siting

Public plazas and wide sidewalks with a limited number of street elements

Sites in close proximity to mass transit, retail, and residential corridors with a high density of foot traffic

Minimum clear path: 8 feet

Minimum of 18 inches from the curb

Installation

Suggestions for display sites can be sent to arts@dot.nyc.gov

DOT is responsible for the installation and removal of art display cases

For More Information

To learn more about the art display case, visit **www.nyc.gov/urbanart**

Art display cases are installed temporarily: Willoughby Plaza, Brooklyn

Automatic Public Toilet (APT)

In response to the lack of public restrooms in New York City, Cemusa, the Coordinated Street Furniture Franchisee, installs automatic public toilets (APTs). These state-of-the-art facilities offer comfort, hygiene, accessibility, and security to the public.

Description

6 feet-7 inches deep x 12 feet wide

Siting

On wide streets, only in commercial, manufacturing, or mixed use districts

On sidewalks or plazas adjacent to property owned or leased by a government agency or public authority, or under the jurisdiction of the Economic Development Corporation (EDC)

On traffic islands or public places bounded on all sides by mapped streets under the jurisdiction of DOT

On or adjacent to parks property or playgrounds, subject to the approval of the Department of Parks and Recreation

Close proximity to water, sewer, and electrical connections

Minimum clear path in front: 8 feet; all other sides: 5 feet

There must be no sub-surface infrastructure in the footprint

Other Clearances:

- 10 feet: fire hydrants, standpipes
- 5 feet: tree trunks, canopies
- 3 feet: streetlights, traffic signal poles
- 2 feet: ventilation, street signs, cellar doors

Madison Avenue at 23rd Street, Manhattan (Credit: Cemusa, Inc.)

Installation

DOT determines where to install APTs

Cemusa installs APTs at DOT's direction

For More Information:

To learn more about the Coordinated Street Furniture Franchise, call 311, visit **nyc.gov/dot**, or email streetfurniture@dot.nyc.gov

Bike Parking Shelter

Bicycle parking shelters enclose four stainless-steel bike racks. The design closely resembles the BUS STOP SHELTER (5.5), using the same high-quality materials. The side panels display the annual NYC Bike Map and public service campaigns.

Description

5 feet x 14 feet—equivalent to the "regular" size BUS STOP SHELTER (5.5)

NYC Bike Map and public service campaigns on side panel; clear glass on back

Siting

Minimum clear path: 7 feet

All shelters must allow a straight unobstructed path of a minimum of 3 feet between the shelter and the curb

Other Clearances:

- 6–8 inches: sub-surface
- 10 feet: fire hydrants, standpipes
- 5 feet: tree trunks, canopies
- 5 feet: tree pits, cellar doors
- 3 feet: streetlights, traffic signal poles
- 2 feet: ventilation, street signs

Installation

DOT determines where to install bike shelters

Cemusa installs bike shelters at DOT's direction

For More Information

To learn more about the Coordinated Street Furniture Franchise, call 311, visit **nyc.gov/dot**, or email streetfurniture@dot.nyc.gov

Jackson Avenue at 50th Avenue, Queens (Credit: Cemusa, Inc.)

Bike Share Station

New York City's bike share system provides access to a network of public bicycles intended for short, one-way trips. By 2017, the system will comprise 700 self-service docking stations for 12,000 bikes, available for use 24 hours a day throughout the year. With a few exceptions, stations hold 15 to 59 bicycle docks. Motivate will own, operate, and maintain the bike share system, with oversight from DOT. The station design complements many of the city's other street furniture elements.

Description

Includes a pedestrian wayfinding map that indicates locations of nearby bike share stations, transit connections, landmarks, etc.

Composed of 4-15 plates (40–150 feet long) with 15 to 59 docks

Three types of modular plates, all of which are 3 feet deep and 10 feet long without bikes:

- Standard: Four docks, approximately 6 feet deep (with bikes)
- Angled: Three docks, approximately 4 feet–6 inches deep (with bikes)
- Double-sided: Six docks, approximately 9 feet deep (with bikes)

Solar-powered and connected to a central computer via existing wireless networks; stations are not wired, trenched, bolted, or fixed into the ground

Plates can be non-contiguous, bridging obstacles such as tree beds with an 8-inch-wide connecting channel

Can be configured in a number of ways, including:

- Linear
- L-shaped (i.e., turning around a corner)
- Back-to-back

Bike share station: Park Avenue at East 42nd Street, Manhattan

Siting

Located in curb lanes of roadways, on sidewalks, in plazas, or on publicly accessible private property

Different siting guidelines apply for each type of location

For More Information

To learn more about bike share stations, visit nyc.gov/bikeshare

Bus Stop Shelter

Bus stop shelters are part of the Coordinated Street Furniture Franchise that was awarded to Cemusa, Inc., in 2006. The award-winning, stainless-steel and glass design provides seating and protection for bus users.

Description

Shelters are configured in five sizes:
- Regular: 5 feet x 14 feet
- Narrow: 3.5 feet x 14 feet
- Short: 5 feet x 10 feet
- Little: 3.5 feet x 10 feet
- Double: 5 feet x 26 feet

Advertising panels on sides; clear glass on back

Siting

Minimum clear path: 7 feet

All shelters must allow a straight unobstructed path of a minimum of 3 feet between the shelter and the curb

Other Clearances:
- 6–8 inches: sub-surface
- 10 feet: fire hydrants, standpipes
- 5 feet: tree trunks, canopies
- 5 feet: tree pits, cellar doors
- 3 feet: streetlights, traffic signal poles
- 2 feet: ventilation, street signs

Installation

Cemusa generally installs bus stop shelters at bus stops that meet clearances, upon request and at DOT's discretion

York Avenue at East 69th Street, Manhattan (Credit: Jennifer Yao)

For More Information

To learn more about the Coordinated Street Furniture Franchise, call 311, visit **nyc.gov/dot**, or email streetfurniture@dot.nyc.gov

CityBench

Through its CityBench program, DOT installs a standard street bench at bus stops without shelters and in commercial areas to support transit use and to encourage walking. In 2014, after analyzing feedback from a wide range of users, DOT updated the design of the arm rests to enhance usability for aging New Yorkers; the seat depth was also slightly decreased to improve comfort. Structural enhancements include more stable footings and a significant reduction in the number of separate pieces, extending the bench's lifespan and reducing its unit cost.

Description

Approximate dimensions: 7.5 feet long x 20.5 inches deep

Styles: backed and backless

Update:

Siting

Locations that meet DOT's strategic objectives—e.g., at bus stops without shelters and Access-A-Ride designated stops, near senior centers, in retail shopping corridors, and near cultural institutions

Benches adjacent and parallel to the building shall be installed no more than 6 inches from the building face

Benches adjacent and parallel to the curb must be placed 18–24 inches from the curb

A bench that is not anchored to the sidewalk shall be placed against the building face during hours that the benefited property is open to the public and shall be stored inside the building when the building is closed

Minimum clear path: 8 feet

Updated CityBench Design with more ergonomic arm rests and seat depth (Credit: Ignacio Ciocchini)

Installation

New Yorkers can request the bench at nyc.gov/Citybench

DOT personnel installs CityBenches

Outside of the CityBench program, a revocable consent is necessary to install a bench on the sidewalk, and a maintenance agreement is required for benches installed in a plaza. For complete regulations regarding revocable consents, including siting requirements, refer to Rules of the City of New York, Title 34, Chapter 7 and on the web at: www.nyc.gov/html/dot/html/permits/revconif.shtml

CityRack

DOT installs CityRacks on sidewalks and, through its Bike Corral program, in clusters in the curbside lane of the roadway. In both cases, installations are driven by requests from the general public and business and property owners. The product of an international design competition held in 2009, the CityRack has been recognized for its combination of function and elegance, and has been added to the permanent collection of the Madsonian Museum of Industrial Design.

Bike corrals include multiple CityRacks: East 9th Street, Manhattan

Description

33.7-inch-diameter, cast-metal circle with a horizontal bar across the center

Bike Corral
- Buffered with reflective flexible delineators and either planters or wheel stops
- Generally takes up one car-parking space
- Planters are planted and cared for by maintenance partners

Siting

Must be installed on city-owned property

Sidewalk:
- 12-foot minimum sidewalk width
- Away from pedestrian flow, usually at the curb, and always away from crosswalks
- If installed at the curb, clearance from the curb must be a minimum of 18 inches
- Must not be installed on pavers, cobblestone, brick, stone/slate slabs, custom/patterned concrete, or metal grates

Bike Corral:
- Curb lane of roadway
- Locations where demand for bike parking outstrips the available sidewalk space

Other Clearances:
- 15 feet: fire hydrants, bus stops, taxi stand or hotel loading zones, franchise structures, subway entrances
- 10 feet: corner quadrants, driveways, building entrances (building line installations only)
- 5 feet: standpipes, above-ground structures (e.g., signs, meters, lights, mailboxes, planters, phones), building entrances (curb installations only)
- 3 feet: tree-bed edges, grates, utility covers

Installation

DOT installs CityRacks

Call 311 or visit **nyc.gov/dot** and fill out the online form to suggest a location for a CityRack

For More Information

For more information visit **www.nyc.gov/html/dot/html/bicyclists/bikerack.shtml**

Mini CityRack

DOT developed the Mini CityRack in 2011 to provide more bike parking cost-effectively and to repurpose parking meter poles that are rendered obsolete by new MuniMeters. The Mini CityRack will be the predominant bike rack on sidewalks.

Description

18-inch-diameter, cast-metal circle

Siting

On existing, retired parking meter poles

Installation

DOT installs Mini CityRacks on parking meter poles as they are retired

For More Information

For more information visit www.nyc.gov/html/dot/html/bicyclists/bikerack.shtml

Mini CityRack

Multirack

A multirack is a newsrack—a self-service newspaper dispenser—designed to hold two or more publications. DOT encourages the use of multiracks in lieu of standard newsracks because they help reduce streetscape clutter. Multiracks require registration with DOT, proof of insurance, and indemnification of the City of New York.

Description

Multiracks cannot exceed 5 feet in height, 7.5 feet in width, and 36 inches in depth

Advertising is not allowed on the outside of the multirack

Siting

Various clearance requirements apply. Section 19-128.1 of Chapter 1 of Title 19 of the Administrative Code of the City of New York (which was amended by Local Law 36 of 2004) together with Section 2-08 of Chapter 2 of Title 34 of the Rules of the City of New York specify how and where a newsrack can be placed as well as the registration and insurance requirements

Installation

Multiracks may be bolted if a DOT permit has been issued for that purpose

For installation on a distinctive sidewalk, written permission from the person or entity responsible for the maintenance of the distinctive sidewalk is required

For More Information

Please contact the Newsrack Unit
55 Water Street, 7th Floor
New York, NY 10041
T: (212) 839-8854
F: (212) 839-8867

Multirack: Lexington Avenue at East 68th Street, Manhattan

Newsstand

Newsstands are part of the Coordinated Street Furniture Franchise. They are fabricated from stainless steel and glass. The product displays can be customized by each operator from a standard kit of parts. All existing newsstands that were licensed by the Department of Consumer Affairs (DCA) as of July 13, 2006, will receive a replacement newsstand at no cost to the licensee.

Description

Newsstands are available in nine sizes:

- 4 x 8 feet, 4 x 10 feet, and 4 x 12 feet
- 5 x 8 feet, 5 x 10 feet, and 5 x 12 feet
- 6 x 8 feet, 6 x 10 feet, and 6 x 12 feet

Siting

Minimum clear path: 9.5 feet

Minimum of 18 inches from the curb

Other Clearances:

- 15 feet: subway entrances, curb cuts
- 10 feet: hydrants
- 5 feet: tree beds, canopies
- 3 feet: streetlights, traffic signal poles
- 2 feet: street signs, manholes, cellar doors, parking meters

For complete siting criteria, refer to DCA rules at: **www.nyc.gov/html/dca/html/licenses/024.shtml**

Installation

Businesses apply to the Department of Consumer Affairs (DCA) for licenses to operate newsstands in specific locations

Cemusa installs new newsstands at locations approved by DCA and PDC

For More Information

To learn more about the Coordinated Street Furniture Franchise, call 311, visit **nyc.gov/dot**, or email streetfurniture@dot.nyc.gov

6th Avenue at 39th Street, Manhattan (Credit: Jennifer Yao)

WalkNYC Wayfinding System

Walking accounts for 31% of all trips in the city and is a component of nearly all travel by public transit and many car journeys. DOT's comprehensive wayfinding system helps visitors and residents alike navigate the city's streets, further encouraging walking. In addition to the Area, Path and Neighborhood signs, DOT is installing Select Bus Service totems with real-time arrival information along current and future routes.

Description

Three map types serve different purposes:

Area:
- The standard size for the WalkNYC system
- Deployed at key intersections and select transit stations
- Panel is 8 feet–5 inches high x 34 inches wide x 5 inches deep

Path:
- Reinforces the Area sign along primary pedestrian routes
- Slender profile is also suited to narrow sidewalks and busy pedestrian areas
- Panel is 8 feet–7 inches high x 18 inches wide x 5 inches deep

Neighborhood:
- Provides a wide view of the surrounding area
- Typically located in plazas and open spaces
- Panel is 8 feet –3 inches high x 4 feet –2 inches wide x 5 inches deep

Select Bus Service:
- Deployed at stations along SBS routes
- Provides real-time SBS bus arrival information
- Includes map of bus route and transfer points
- Panel is 10 feet–1 inch high x 2 feet wide x 5 inches deep

Two maps on each side of the Area and Path maps:
- Focus map displays destinations and services within a 5-minute walk
- Overview map displays destinations and services within a 15-minute walk and is helpful for planning longer journeys using public transit

Maps are "heads-up" – they are oriented according to the direction the user is facing

Siting

Minimum clear path: 8 feet

Minimum 18 inches from the curb

Other Clearances:
- 15 feet: subway entrances
- 10 feet: hydrants, tree beds, phone booths
- Min 5 feet: canopies, street lights, traffic signals, signs, manholes, parking meters, cellar doors, building entrances

Maps are incorporated into bike share and Select Bus Service stations

Installation

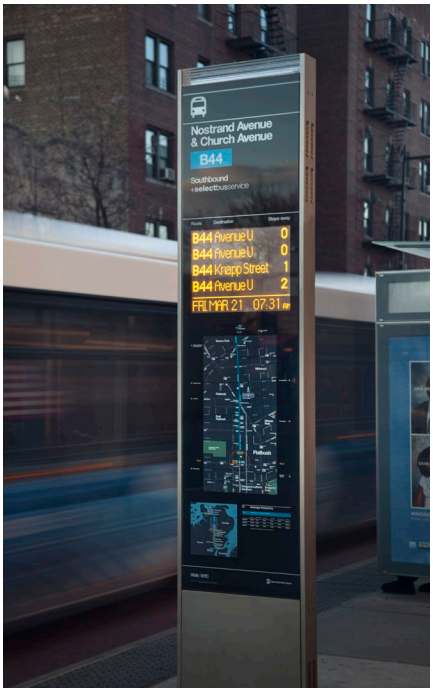
Panels require a 7-inch to 2-foot excavation, depending on sub-surface conditions

DOT is responsible for installation; DDC coordinates installation when it is part of a DDC capital project

For More Information

Visit **www.nyc.gov/walknyc** or email walknyc@dot.nyc.gov.

The local area map: Canal Street, Manhattan



The Select Bus Service Totem: Nostrand Avenue SBS Route at Church Avenue

Waste Receptacle

Among its other responsibilities, the Department of Sanitation (DSNY) services over 25,000 waste receptacles – known as "baskets" – that are placed on thoroughfares citywide. As part of the city's initiative to double the recycling rate to 30 percent by 2017, DSNY has ordered new recycling baskets that are consistent in design with other streetscape furniture. These will reduce the number of regular trash baskets.

Siting

Commercial areas, where they may be emptied as frequently as five times a day

Predominantly residential zones, where they can be serviced on residential refuse routes along with household trash two or three times a week

Sponsor-a-Basket Program

Sponsoring organizations, such as cultural institutions and Business Improvement Districts, can purchase the new receptacle shown at right. With DSNY approval, they may also purchase custom baskets as part of their branding identities. All basket designs must meet DSNY specifications. Sponsored waste baskets may bear the name or logo of the sponsoring organization, but cannot include advertising of any kind. Locations must be submitted for approval along with the Sponsor-a-Basket Letter of Intent.

For More Information

For more information, refer to Sanitation Rules and Regulations at **www.nyc.gov/html/dsny/html/rules_reg/digest.shtml** or in Rules of the City of New York, Title 16

To sponsor a waste receptacle, call 311

Prototype of DSNY's new 44-gallon recycling receptacle. A 32-gallon version is also available

Landscape

6

Introduction

About this Chapter

This chapter provides general guidelines for the selection, design, installation, and maintenance of plantings in the public right-of-way (ROW). It reflects current practices and initiatives such as PlaNYC, MillionTreesNYC, DOT's Plaza Program, and DEP's Green Infrastructure Plan.

The chapter is organized by the location of plantings, except for TREE BEDS (6.1) and STORMWATER MANAGEMENT PRACTICES (6.6) as these should be utilized wherever conditions allow.

Street trees provide significant benefits and should be planted wherever possible: West 95th Street, Manhattan. (Credit: DPR)

Benefits of Plantings in the ROW

Vegetation within the public ROW has been shown to provide significant benefits. Generally, these benefits increase exponentially as the size of the plant increases; this is particularly true for trees.

All plantings:

- capture carbon dioxide and particles from the air
- reduce the urban heat-island effect, decreasing energy costs related to air temperatures
- allow for both passive and active stormwater management
- dampen street noise, providing health and psychological benefits
- provide urban wildlife habitat opportunities
- make streets appear narrower to drivers, thereby causing them to drive slower, and enhancing safety
- create a positive aesthetic that attracts customers to local businesses
- increase the value of adjacent properties
- make streets and neighborhoods more attractive

Guidance Sources

More comprehensive guidance on the planning, design, installation, and maintenance of plantings within New York City is contained in sources such as *High Performance Landscape Guidelines: 21st Century Parks for NYC* (Design Trust for Public Space and DPR, 2011), *High Performance Infrastructure Guidelines* (Design Trust for Public Space and DDC, 2005), *Tree Planting Standards* (DPR, 2012), Standards for Green Infrastructure (DEP, 2016), and the *Sustainable Urban Site Design Manual* (DDC Office of Sustainable Design, 2008).

Other resources include DEP's "NYC Green Infrastructure Program" website, EPA's "National Menu of Best Management Practices," the New York State Stormwater Design Manual, Cornell University Urban Horticulture Institute website, New York Restoration Project and DPR's MillionTreesNYC webpage, and DPR's webpage on Trees and Greenstreets.

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 of all street users being of paramount importance.

Usage Categories

This chapter does not apply usage categories to landscape treatments. Plantings are encouraged wherever site conditions allow and appropriate maintenance can be provided. Plants must always be chosen based on site-specific conditions.

There are certain treatments, noted throughout the chapter, that are considered standard. These treatments will be installed and maintained by the city. Other entities may also pursue these treatments and they will generally require less intensive review. Other treatments may also be pursued, but may require more extensive review depending on the complexity of the project.

Right-of-way projects can provide opportunities for plantings: St. Nicholas and Amsterdam Avenues, Manhattan

Reviews & Approvals

Installation of all plantings within the public ROW must be reviewed and approved by DPR and DOT. A forestry permit from DPR is required to install new trees and for any work being performed within 50 feet of existing trees. Proposed stormwater management landscape treatments within the public ROW must be reviewed and approved by DEP, DPR, and DOT. New plantings may be subject to PDC or LPC review, particularly if they are part of a larger streetscape or open space project within its purview.

Designs for planted areas and green infrastructure within the public ROW are still evolving and being tested. Because these treatments may ultimately be maintained by city agencies, the appropriate agencies must be consulted early in the design process so that all such treatments are technically viable and maintainable.

Maintenance Agreements

DPR is responsible for the maintenance of all trees within the public ROW and of Greenstreets, including select Stormwater Greenstreets. DEP maintains all green infrastructure practices in the ROW (See STORMWATER MANAGEMENT PRACTICES (6.6.1)) with the exception of the DPR Stormwater Greenstreets locations. Other plantings within the public ROW are encouraged but require coordination with appropriate agencies and a maintenance agreement with DOT.

For plantings requiring a maintenance agreement, proposals must be submitted to the appropriate DOT Borough Commissioner. Contact information for DOT Borough Commissioners can be found at **nyc.gov/dotcontact** or by calling 311.

DPR has shifted the focus of its Greenstreets program towards stormwater capture and has updated its criteria for evaluating Greenstreet requests. DPR still builds traditional Greenstreets in any community but only if they come with full independent funding for construction and maintenance. For more information see "Greenstreet Requests" at **www.nycgovparks.org/greening/green-infrastructure**.

General Guidelines

Appropriate plant selection includes a diversity of species with year-round interest: Park Avenue and 97th Street, Manhattan (Credit: Lynden B. Miller)

The following guidelines expand on the general policies and principles outlined in the Introduction, with more information pertaining to landscape planting design, installation, and maintenance.

Project Team

It is recommended that all projects have a consulting arborist (CA), horticulturist, soil specialist, and/or landscape architect on the project team. City and/or state agencies should be involved early on.

Plant Selection

A successful planting design will match plants with existing site conditions and anticipated site use to achieve an aesthetically pleasing, functional, and long-lived landscape. Species selection must be guided by a comprehensive site analysis of the natural and built environment as well as the maintenance plantings are anticipated to need and receive. Plant specification should follow DOT and DPR standards, and, whenever possible, plants should be sourced from a nursery within 200 miles of the project site.

Attention should be given to plants' color, form, foliage, and texture and how those elements can be combined to create year-round interest. Careful consideration should also be given to the forms and heights plants will reach at maturity and how they interact with other design elements, such as seating, signage, signals, and lighting. Avoid species that DPR has determined to be invasive and select plants that are known to compete well with invasive species. Where possible, given site conditions, designers should accommodate the collection of stormwater and select plants that can withstand both periodic inundation and drought. All species selection must be approved by DPR during the review process.

Willow Oaks planted at the same time with different available soil volumes. Note that the trees on the left, which have more soil than the trees on the right, are much larger: Pennsylvania Avenue, Washington, DC (Credit: Urban Horticulture Institute, Cornell University)

Soils

Soils are crucial to plant health and impact plant selection and project implementation. Adhere to the following guidelines:

- Determine soil quality by testing its texture, pH, organic content, permeability, nutrients, and bulk density
- Preserve existing soils that are capable of supporting healthy plants
- Do not work the soil if it is frozen or sodden
- Add organic matter and/or nutrients to poor-quality soils
- Loosen compacted soil (bulk density of >1.4 grams per cubic centimeter) with mechanical tools and/or by integrating compost. (Use pneumatic excavation within tree-protection areas to preserve roots)
- If new soil is required, construction specifications should include detailed information on desired soil characteristics

Soil volume also affects plant health. It is, therefore, important to maximize soil volume and choose plants that grow well in the available soil volume. Where pavement is necessary in close proximity to trees, consider incorporating a suspended pavement system to provide greater rooting volume.

Microclimate

According to the 2012 USDA Hardiness Zone map, most of New York City falls within Zone 7B, with portions of the Bronx and Staten Island within 7A. However, the site-specific environmental conditions such as sun exposure, wind patterns, and precipitation will ultimately create a unique growing environment for plants. This microclimate must be understood in order to select the most appropriate plants.

2013 Asian Longhorned Beetle (ALB) NYC Quarantine Map

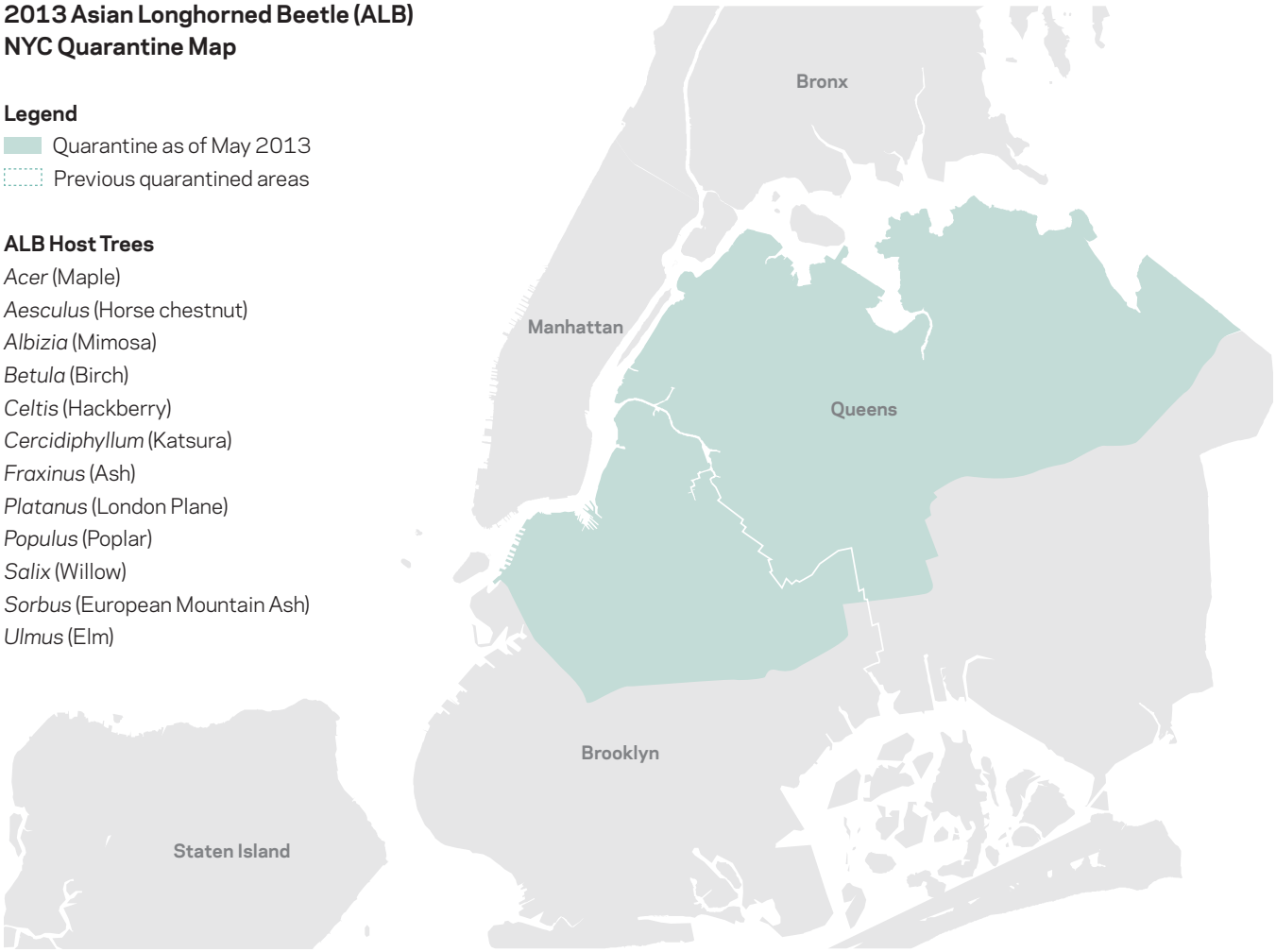
Legend

Quarantine as of May 2013

Previous quarantined areas

ALB Host Trees

Acer (Maple)
Aesculus (Horse chestnut)
Albizia (Mimosa)
Betula (Birch)
Celtis (Hackberry)
Cercidiphyllum (Katsura)
Fraxinus (Ash)
Platanus (London Plane)
Populus (Poplar)
Salix (Willow)
Sorbus (European Mountain Ash)
Ulmus (Elm)



DPR tracks ALB infestation and updates the quarantine map regularly. For more information, visit ***http://www.nycgovparks.org/trees/beetle-alert*** *(Credit: DPR)*

Diseases and Pests

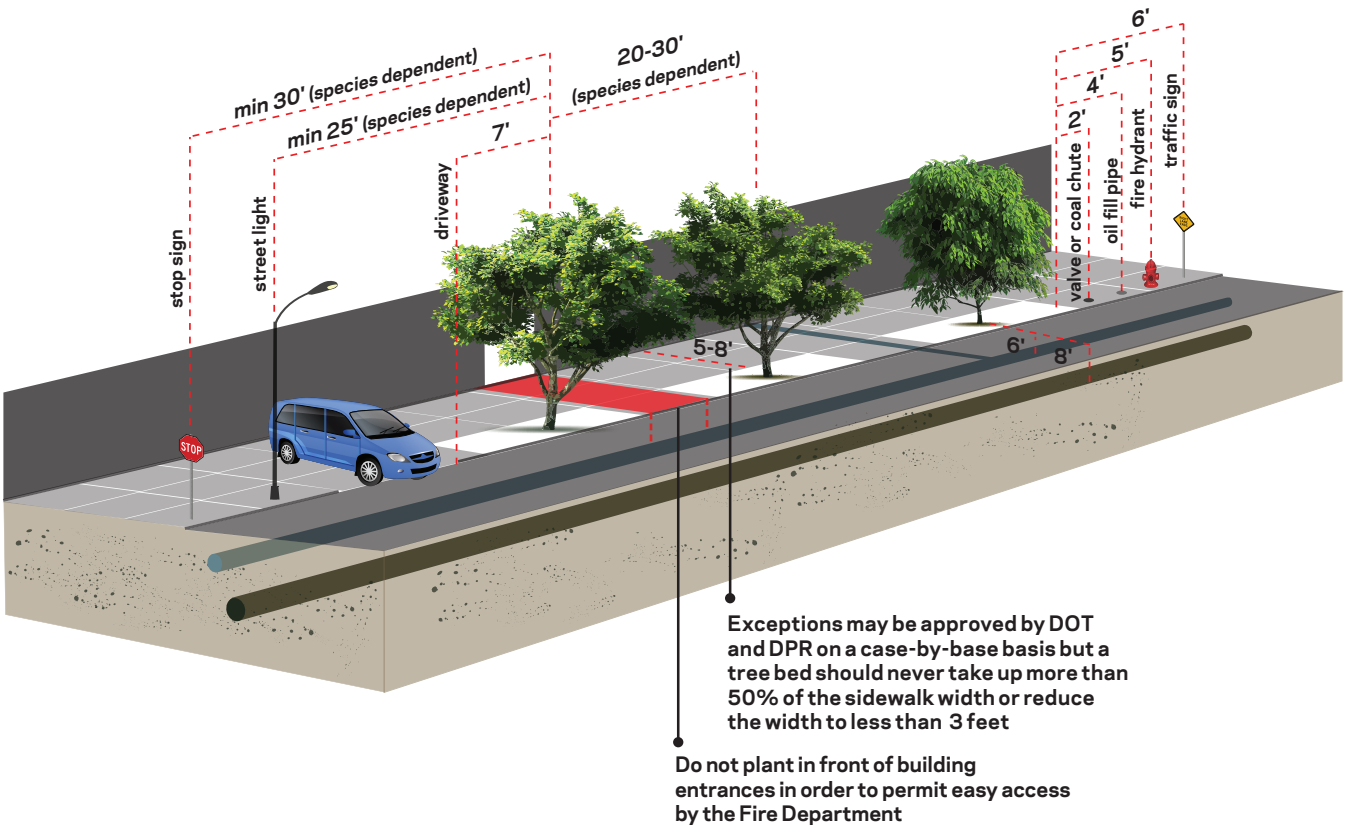
Diseases and pests can pose significant risks to plant health and survival. Plants should be selected that are resistant to common ailments, such as anthracnose (leaf spot), or that can withstand outbreaks.

Several pests affect trees in New York City. The two most damaging are the Asian Longhorned Beetle (ALB) and the Emerald Ash Borer (EAB). ALB (*Anoplophora glabripennis*) is an invasive beetle known to attack several species of trees. Currently the only effective means to control the beetle is to remove infested trees and destroy them by chipping or burning. For more information, visit the USDA's Animal and Plant Health Inspection Service webpage or the USDA's APHIS publication regarding ALB in New York.

EAB (*Agrilus planipennis*) is an invasive beetle that is destroying ash populations across the Northeast and Midwest. As such, ash tree species are no longer being permitted within the city.

Application of pesticides (including herbicides, insecticides, and fungicides) is regulated by the federal EPA as well as New York State Department of Environmental Conservation. Pesticides may only be applied by a NYSDEC Certified Commercial Pesticide Applicator or under the direct supervision of same. Additionally, pesticides applied to property owned or leased by the city must comply with Chapter 12 of Title 17 of the Administrative Code of the City of New York (Local Law 37 of 2005). Note that this law does not apply to private property. For more information on this law, visit the New York City Department of Health and Mental Hygiene webpage (a816-healthpsi.nyc.gov/ll37) **or call 311.**

Clearance Diagram



Spacing/Siting Requirements

In the setting of streets, parkways, and expressways, the placement of trees and other plants has a direct bearing on safety and the cost of maintenance. Plants, excluding tree canopies, in the public ROW should not infringe upon the roadway or sidewalk beyond the planting bed. Ultimately, all plantings must follow MUTCD, AASHTO, NYSDOT, DPR, and DOT design standards and guidelines. (*See Clearance Diagram above.)*

Careful consideration must be given to above- and below-ground constraints; utilities, vaults, and other obstructions may limit the ability to plant. In particular, avoid planting trees directly over DEP water and sewer mains and near steam lines.

Trees and other plantings must not block sight lines at intersections for drivers, cyclists, and pedestrians. At all intersections, trees and any plants that would naturally grow to greater than 2 feet in height must be placed no closer than 35 feet from the curb of the intersecting street and in a manner that does not block the signal or stop sign. (*See Corner Clearance Diagram, right.*) Trees on medians must be set back 35 feet from the curb at the end of the median.

Corner Clearance Diagram

Tree Preservation and Protection

Mature trees should be preserved during construction wherever possible because they provide significantly more benefits than newly planted trees. Such preservation can be complicated and should therefore be guided by a consulting arborist (CA) throughout the project. The following provides general information on how best to approach design with the preservation of existing trees in mind.

Under Section 18-107 of the Administrative Code of the City of New York and Chapter 5 of Title 56 of the Rules and Regulations of the City of New York, all construction work impacting trees within the public ROW must be approved and permitted by DPR. In addition, construction work must follow DPR Tree Preservation Protocols and DPR Forestry Protocol for Planned and Emergency Utility Work. Ultimately, if the removal of a tree is necessary, it must be approved by DPR, and restitution may be required based on a valuation of the trees impacted. This typically involves planting new trees and/or paying a fee to cover the cost of DPR planting the necessary replacement trees.

In order to preserve existing trees, their roots must be protected. Tree roots extend well beyond the visible canopy and are generally within the top three feet of soil. The minimum number of roots a tree needs to survive is called the critical root zone (CRZ) and will be determined by the CA using the International Society of Arboriculture's *Best Management Practices for Managing Trees During Construction* (F. Kite, T. Smiley, 2008). The individual CRZ radii should be incorporated into all phases of design and reflected on a CRZ map. The goal is to preserve as many roots as possible beyond the CRZ through sensitive design and the use of best practices during construction.

DPR is expanding existing tree beds throughout the city to promote tree health and reduce potential trip hazards created by heaving: Devoe Street, Brooklyn (Credit: DPR)

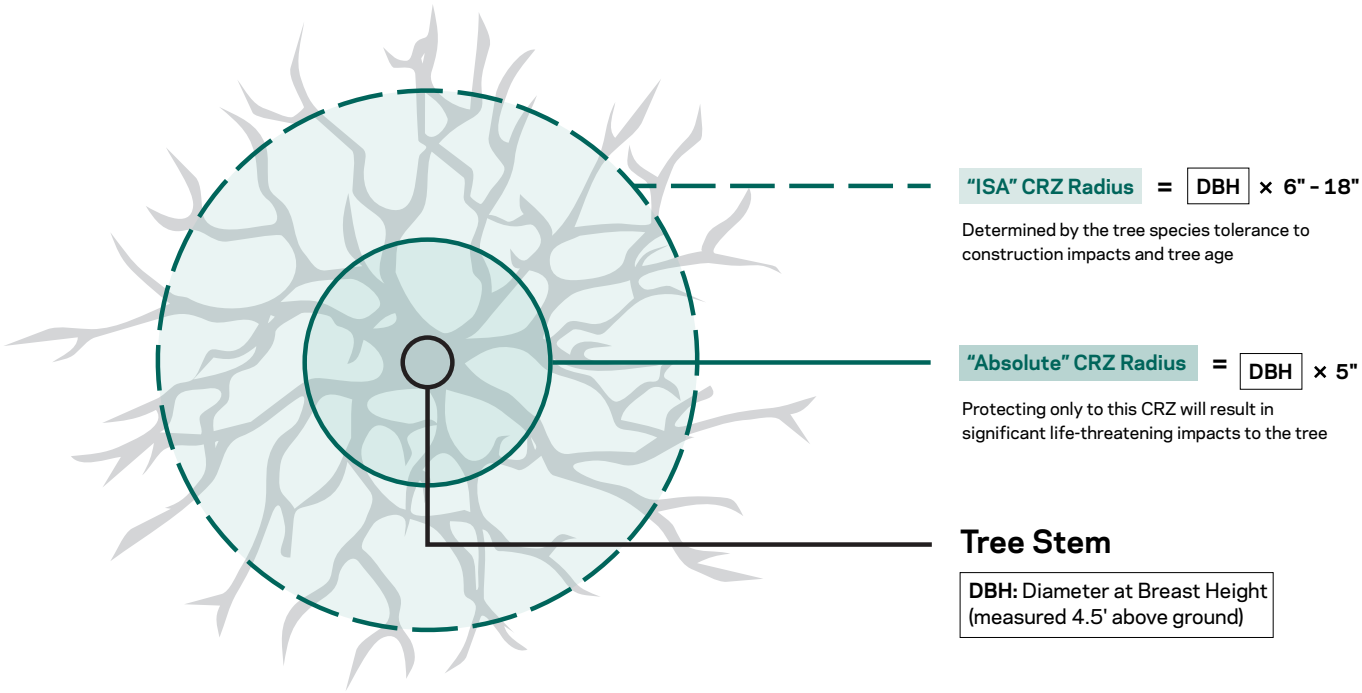
Reconfiguration of a sidewalk to promote tree health (before and after): Aberdeen Road, Queens (Credit: DPR)

1. Scope	2. Inventory and Assess Existing Tree Resources	3. Design with the Tree in Mind	4. Develop Tree Protection Plan	5. Enforce Tree Protection Plan in Construction
Include DPR's Borough Forestry Office in the Scope review to consider potential impacts to trees in siting project scope	Certified Arborist (CA) to inventory and assess all trees within and immediately adjacent to project limit lines	CA to identify potential tree impacts and necessary tree removals All tree removals must be approved by DPR's Borough Forestry Office	CA to advise and review designs for potential tree impacts CA to advise and develop tree protection plan 50% and 90% construction documents reviewed by DPR's Borough Forestry Office	Tree protection implemented and enforced by DPR's Borough Forestry Office and/or CA CA to perform initial inspection and approval of installed tree protection measures CA to supervise all work within and immediately adjacent to Tree Protection Areas

ABOVE: *Root pinning resolves sidewalk heaving while preserving existing trees: Black Locust Triangle, 123rd Street and North Conduit Avenue, Brooklyn (Credit: DPR)*

RIGHT: *Removing soil from around a tree's roots through pneumatic excavation allows for work to be done without damaging the tree:* **LEFT** *– Fort Totten Park, Queens (Credit: DPR);* **RIGHT** *– 235th Street and 119th Avenue, Queens (Credit: Lisa Montana)*

Critical Root Zone Diagram



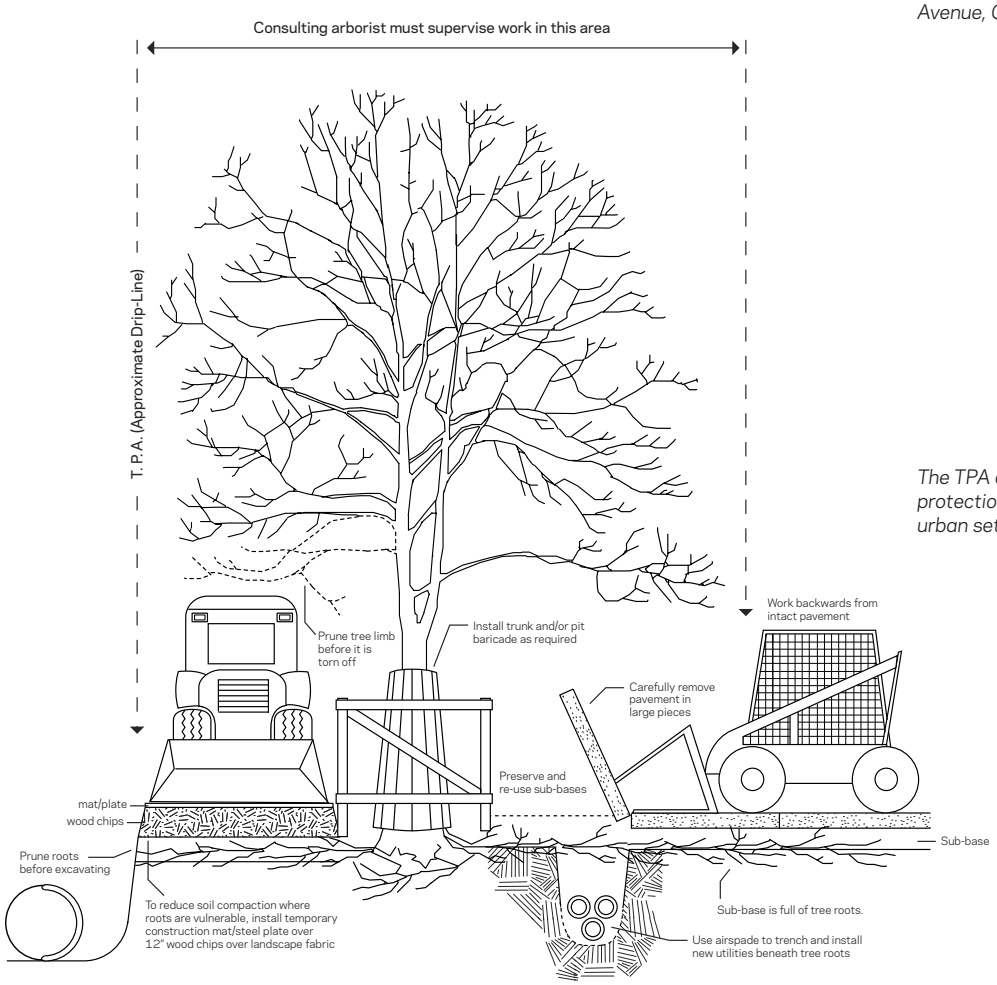
Tree Protection Area

The tree protection area (TPA) is the most important tool used in the preservation of existing trees. Generally, the TPA is developed in coordination with the CA during design and is defined by the canopy drip line of the tree. The TPA will always encompass the CRZ. (*See Tree Protection Area Diagram.)* During construction, the TPA is typically established with a fence or barrier. In circumstances where a majority of roots are growing beneath pavement, special methods should be utilized. (*See diagram*.) No activity, including non-construction-related activities, may occur within the TPA without approval from DPR and supervision by the CA. If construction work must occur within the TPA, the contractor must work with the CA to employ techniques, such as pneumatic excavation (air spading) to expose and preserve the roots in good condition.

TOP: *Tree protection measures during reconstruction of the Allen Street Malls, Manhattan (Credit: DPR)*

BOTTOM: *Typical tree protection area (TPA) in a landscape setting; specialized treatments should be used in urban settings: Conduit Avenue, Queens*

Tree Protection Area Diagram



The TPA diagram provides guidance on tree protection during construction projects in an urban setting

Plant Installation

All plants must be installed per DOT and/or DPR standards. See DPR's Planting Specification Checklist. In addition, contact DigNet or call 811 prior to installation to identify utilities and have them field-verified by proper authorities. The optimal time for planting trees, shrubs, and perennials is during the spring and fall, with some trees restricted to spring planting only. In New York City, this corresponds generally to March 1–May 31, and October 1–December 31, weather permitting. No plants should be installed once the ground has frozen.

Period of Establishment

Newly installed plants require consistent maintenance throughout the growing season in order to become established and thrive. Establishment periods vary, but under a DPR planting permit, the installer is required to water and provide regular care for the first two years.

Another strategy to promote successful establishment of plants is to include a progress payment schedule as part of the landscape portion of the contract. This is a mechanism whereby the landscape portion of the contract is paid in installments throughout the period of establishment only when the contractor performs required tasks such as watering. This incentivizes the contractor to perform regular maintenance instead of just replacing plants that have died at the end of the establishment period.

Combinations of plantings create interesting contrasts of texture and color: New York Botanical Garden, Bronx (Credit: Lynden B. Miller)

Maintenance

Site design and species selection should correspond to the anticipated level of maintenance a planting will receive following installation. Planting areas should be designed to provide sufficient space for personnel to maintain them. Such design considerations may include, among other things, paths within or surrounding the planting areas. The frequency of available maintenance and skill levels of those providing maintenance are important considerations that must be addressed during design.

Maintenance should include an appropriate level of watering, weeding, pruning, cultivating, and waste removal. Repair of minor washouts, mulching, soil replacement, plant replacement and other horticultural operations may also be necessary. Any existing invasive plants that cannot be removed or outbreaks of new invasive species will have to be managed through ongoing maintenance. Selecting plants that are drought tolerant, are disease resistant, compete well, and have the appropriate form at maturity will reduce maintenance needs.

DOT's Adopt-a-Highway program provides opportunities for enhanced plantings and maintenance along limited-access arterials: Belt Parkway and East 12th Street, Brooklyn

Tree Beds

The city strives to build, permit, and manage as diverse an urban ecosystem as possible. A diverse ecosystem is ultimately more resilient and reduces the risk associated with urban forest management and maintenance. Visit DPR's webpage on tree care for more information.

In partnership with the New York Restoration Project, DPR will have planted 220,000 street trees (1,000,000 trees total) by 2017. Visit MillionTreesNYC.org for more information.

Tree Bed

Excavated pits that allow for the planting of street trees and other vegetation within the public ROW. This is a standard treatment that DPR installs and maintains. Other entities are also encouraged to pursue this treatment but require a permit from DOT and DPR.

Tree beds are used extensively all over the city and should be used wherever sidewalks exist if conditions allow. INDIVIDUAL TREE BEDS **(6.1.1a) are currently the only required design, however** CONNECTED TREE BEDS **(6.1.1b) should be used wherever possible to provide improved tree health, and** DEP ROW BIOSWALES **(6.6.1a)—those that take water from the roadway—should be considered wherever DEP Priority CSO Tributary Areas are affected.**

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

For further information on the benefits of trees, see the United States Department of Agriculture's NYC *Municipal Forest Resource Analysis*

Considerations

See GENERAL GUIDELINES (6.0.1)

DOT and DPR permits are required to install trees. The permit holder must maintain and guarantee the tree and bed for two years

DPR contractors will maintain tree beds (individual or connected) planted by DPR for two years after planting, after which each individual property owner is responsible for maintaining the tree-bed(s), while DPR retains responsibility for and jurisdiction over the tree itself; see DPR's webpage on tree-bed care

Street trees along a sidewalk. Spacing is dependent on species. The open tree beds allow for water and air to get to the tree roots: Post Avenue, Manhattan (Credit: DPR)

Design

See GENERAL GUIDELINES (6.0.1)

Meet or exceed minimum size and design requirements of DPR's Tree Planting Standards contingent upon accommodation of pedestrian capacity and sub-surface constraints

An 8-foot clear path should be maintained in areas with high pedestrian traffic and a 5-foot clear path in areas with low pedestrian traffic. Exceptions may be approved by DOT and DPR on a case-by-case basis. In all cases, a tree bed should not take up more than 50% of the total sidewalk width or reduce the sidewalk width to less than 3 feet

Where feasible, use CONNECTED TREE BEDS (6.1.1b) instead of INDIVIDUAL TREE BEDS (6.1.1a) to increase root space and stormwater detention capacity

Diversify street tree species along a block to avoid species blight and plant the largest-canopy species that site conditions allow

Minimum center-to-center distance between trees is 25 feet, depending on tree species and local conditions, and can be as much as 40 feet if the canopy of an existing, neighboring tree is large. Slightly closer spacing may be appropriate if planting in continuous beds or using narrow growing species

Do not remove or add topsoil around the rooting area of established trees; mulch is preferred

Maximize exposed soil to allow more water and air to get to the roots of the tree; if necessary due to high pedestrian traffic, use DPR-approved permeable surface treatments over the tree bed

Tree-bed guards are recommended

Typical tree bed with standard tree-bed guard: Prospect Avenue, Brooklyn

Tree-bed grates that are flush with the sidewalk and vertical tree guards that enclose the tree trunk are not permitted

Do not install any plants within the area of the root ball of a new tree or within 3 feet of the trunk of an established tree

When planting beneath the canopies (within the driplines) of established trees, choose plants in containers no larger than 1 gallon each to minimize damage to trees

Consider the use of a suspended pavement system to increase available root space

Application

The New York City Zoning Resolution requires that one tree be provided for every 25 feet of curb frontage for new developments and major alterations; all other spacing requirements per DPR tree-planting standards still apply

All areas with FULL SIDEWALKS (6.3.1), RAISED MEDIANS (6.2.1), PEDESTRIAN SAFETY ISLANDS (2.2.4), PEDESTRIAN MALLS (6.2.1c), TRIANGLES (6.2.2), and PLAZAS (6.4)

CONNECTED TREE BEDS (6.1.1b) should be utilized as an alternative to INDIVIDUAL TREE BEDS (6.1.1a) wherever feasible

Plants

See Tree-Bed Planting Recommendations (Table 6.A)

TREE BED

Individual Tree Bed

A tree bed within a sidewalk, median, triangle, or plaza, disconnected from other tree beds, where a tree is planted. This is a standard treatment that will be installed and maintained by the city.

Benefits

See benefits of TREE BED (6.1.1)

Considerations

See considerations for TREE BED (6.1.1)

The installation of a tree-bed guard requires a permit from DPR

Application

See application guidance for TREE BED (6.1.1)

Use CONNECTED TREE BEDS (6.1.1b) rather than INDIVIDUAL TREE BEDS (6.1.1a) wherever possible

Design

See design guidance for TREE BED (6.1.1)

Tree-bed sizes may vary depending on site conditions and should be designed to be as large as possible

One of DPR's eleven standard tree-bed guards should be used

Tree-bed guard should be a minimum of 18 inches high, with the lowest horizontal member no more than one inch above the sidewalk, and without any features extending outward beyond the tree bed border

In curbside tree beds, only three-sided tree-bed guards are permitted, with the open side at the curb, 18 inches from the curb face

Tree beds without tree-bed guards must have a flat surface without any tripping hazard and be no more than one inch above or below the adjacent sidewalk surface

Tree bed with standard tree-bed guard. While tree beds may vary in size, larger dimensions allow for more growth: Vanderbilt Avenue, Brooklyn

Plants

See Tree-Bed Planting Recommendations (Table 6A)

TREE BED

Connected Tree Bed

A series of tree beds connected with a continuous trench in order to provide increased root space and stormwater detention. This is a standard treatment that will be installed and maintained by the city.

Benefits

See benefits of TREE BED (6.1.1)

Provides greater space for tree roots than INDIVIDUAL TREE BED (6.1.1a), improving tree health and longevity

In areas where a RIBBON SIDEWALK (2.2.1b) is inappropriate, connected tree beds provide many of the same benefits

Additional soil provides more stormwater detention capacity than INDIVIDUAL TREE BEDS (6.1.1a)

Considerations

See considerations for TREE BED (6.1.1)

Application

See application guidance for TREE BED (6.1.1)

Whenever possible in lieu of INDIVIDUAL TREE BED (6.1.1a)

Consider RIBBON SIDEWALK (2.2.1b) as an alternative in areas of low-to-moderate land use density per its application guidance and zoning requirements

Consider DEP ROW BIOSWALES (6.6.1a) in DEP Priority CSO Tributary Areas where conditions are appropriate

Connected tree beds with permeable-paver-covered trench: Columbia Street, Brooklyn (Credit: DPR)

Design

See design guidance for TREE BED (6.1.1)

The trench of connected tree beds should be left uncovered (and, optionally, landscaped) to improve tree root health

Where pedestrian access is necessary (areas of high foot traffic, limited sidewalk space, or frequent curbside access), pavement can be bridged over the tree-bed trench using a suspended pavement system to increase soil volume

Plants

See Tree-Bed Planting Recommendations (Table 6A)

TABLE 6A

Tree-Bed Planting Recommendations

The DPR list of approved street trees can be found on its website. Tree species should always be selected based on site-specific conditions and approved by DPR.

The following list is a small sampling of perennials and groundcovers that have been successfully used in tree beds in New York City. Large plants or woody shrubs should not be planted in tree beds where there are existing trees. This list is not comprehensive and there is no guarantee that these plants will survive at a specific site. All plants within the public ROW must be selected based on site-specific conditions and approved by DPR.

	Appearance				Tolerances				
	Height	Spread	Characteristics		Drought-Flood		Light	Salt	High pH
Groundcover									
Gaylussacia brachycerra Box Huckleberry	1.5'	3'	MAY JUN		✓		☀ ▶ ◐	◆	–
Rubus calycinoides 'Emerald Carpet' Ornamental Creeping Raspberry	.5'-1'	2'	MAY JUN		✓		☀ ▶ ◐	◆	–
Grasses/Grass-like Plants									
Miscanthus sinensis 'Little Kitten' Little Kitten Eulalia Grass	1"-3"	1'-1.5'	AUG FEB		✓	✓	☀ ▶ ◐	◆	◆
Festuca glaucа 'Elijah Blue' Elijah Blue Fescue	.5'-1'	1'	JUN JUL		✓		☀	◆	◆
Carex morrowii 'Ice Dance' Ice Dance Sedge	.5'-1'	1'-2'	APR JUN		✓	✓	☀ ▶ ◐	◆	–
Perennials									
Echinacea purpurea 'Magnus' PowWow Wildberry Coneflower	2'-2.5'	1'-1.5'	JUN SEP		✓		☀	◆	◆
Heuchera villosa 'Miracle' Miracle Coral Bells	1'-1.5'	1'	JUL		✓	✓	☀ ▶ ◐	◆	◆
Hosta sieboldiana 'Frances Williams' Frances Williams Hosta	2'	3'-4'	JUL			✓	◐ ▶ ☀	◆	–
Lysimachia nummularia 'Goldilocks' Goldilocks Creeping Jenny	4"	1'-3'	JUN JUL			✓	☀ ▶ ◐	◆	◆
Phlox subulata 'Red Wings' Red Wings Creeping Phlox	6"	2'-3'	MAY			✓	☀	◆	◆
Rudbeckia 'City Garden' City Garden Black-Eyed Susan	.5'-1'	1'-1.5'	JUN SEP		✓	✓	☀	◆	◆
Sedum 'Abbeydore' Abbeydore Stonecrop	1.5'		AUG NOV		✓	✓	☀	◆	◆
Tiarella cordifolia 'Brandywine' Foam Flower	1'-1.5'	1'-2'	MAY			✓	◐ ▶ ☀	◆	◆
Bulbs									
Chionodoxa forbesii 'Pink Giant' Pink Giant Glory of the Snow	6"-9"	3"-6"	MAR		✓	✓	☀ ▶ ◐	◆	◆
Crocus vernus Dutch Crocus	6"	4"-6"	MAR APR		✓	✓	☀ ▶ ◐	◆	◆
Galanthus elwesii Giant Snowdrop	9"	6"	FEB MAR		✓	✓	◐ ▶ ☀	–	–
Narcissus 'Mondragon' Mondragon Daffodil	1'-1.5'	.5'-1'	MAR APR		✓	✓	☀ ▶ ◐	◆	◆

* Fall Dig Hazard ^ ALB Host Species Bloom/Showy Flowers Showy Fruit Distinct Foliage Fall Color Distinctive Bark Evergreen

Roadway Plantings

Roadway plantings are trees, shrubs, groundcovers, perennials, and other vegetation located within the roadbed of a street. Generally, plantings are installed within raised medians or triangles that separate or channelize traffic. Roadway plantings must endure various stresses: salt, wind, drought, damage from vehicles, and limited growing space. These all impact plant health and should guide design and plant selection.

Raised Median

A RAISED MEDIAN (2.2.3) that provides an opportunity for planting. Medians can be 6–7 inches high (at curb height) or 12–24 inches high to provide additional growing medium as well as increased protection. Medians allow for various types of plantings due to their different sizes and lengths. Trees are typical; however, careful consideration must be given to the sight lines of drivers, cyclists, and pedestrians. DPR maintains many existing median plantings, pursuant to the Greenstreets agreement between DPR and DOT.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Planted medians increase the traffic-calming effect afforded by MEDIANS (2.2.3)

Considerations

See GENERAL GUIDELINES (6.0.1)

Allow adequate room for trucks and buses to make necessary turns without damaging plant material

Consider environmental and physical stresses plants must withstand, including drought/inundation, sun/shade, heat/cold, wind, road salt, garbage, vehicular damage, and compaction

Consider the lifespan and longevity of species, as plant replacement will be difficult and costly

Typically, plantings are watered via a water truck; however, consider how maintenance workers will access the plantings to perform other regular maintenance activities

Excluding trees, median plantings not covered under the DPR-DOT Greenstreets agreement require a maintenance agreement

Planted median. Low plantings are located near the intersection to allow better visibility. Contrasting colors and texture add interest: Adams Street, Brooklyn (Credit: DPR)

Curb-height median with tree beds. Select narrow species where there is limited space for canopies: Richmond Terrace and Nicholas Street, Staten Island (Credit: DPR)

Design

See GENERAL GUIDELINES (6.0.1)

See RAISED MEDIAN (2.2.3) for geometric design guidance; all medians must include an area, free of vegetation or obstructions, for pedestrians to safely cross at the intersection

Where planting trees, see design guidance for TREE BED (6.1.1)

Planted medians should be a minimum of 7–feet wide to allow for 6 feet of planting space with a 6-inch–wide curb on either side. Exceptions may be approved by DOT and DPR on a case-by-case basis. Where conditions allow, an 18-inch–wide curb around the perimeter of the planting bed is preferred

Provide a minimum 24 inches depth of organic, well-draining soil; 30–36 inches is optimal

Positive drainage below the planting soil is essential. Any impermeable layers of concrete or asphalt must be removed

Where conditions allow, medians should be planted with large-growing canopy trees

Tree spacing should be based on the appropriate mature width of the species chosen and must be approved by DPR

Minimum distance from the curb at the end of the median to the center of the tree trunk is 35 feet

Where truck and bus traffic is heavy, consider using columnar species to reduce damage to plants

Consider planting fewer species to provide continuity and reduce overall maintenance needs; select plants that will provide year-round ornamental interest

Space shrubs and other plants so as to encourage dense, full growth, however, do not overcrowd, which can lead to poor air circulation and encourage the spread of pest and disease problems

Use drought-tolerant, salt-tolerant species that require little to no pruning or deadheading to maintain their shape, size, vitality, and ornamental interest

Plants

See Roadway Planting Recommendations (Table 6B)

RAISED MEDIAN

Curb Height

A median that is raised 6–7 inches above the roadbed and provides adequate width to allow for plantings. RAISED MEDIAN (CURB HEIGHT) are utilized throughout the city. Trees and other ornamental plantings add to the traffic-calming effect provided by medians.

Benefits

See benefits for RAISED MEDIAN (6.2.1)

Considerations

See considerations for RAISED MEDIAN (6.2.1)

Consider underground utility constraints as excavation beneath the roadbed will be necessary to provide adequate soil volume and positive drainage

If the roadway can be regraded to a double crown, consider using the median to capture and detain stormwater; See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Design

See design guidance for RAISED MEDIANS (6.2.1)

Consider the use of a suspended pavement system and CONNECTED TREE BEDS (6.1.1b)

Plantings must not protrude into the roadway; select plants that will grow densely within the planting bed

Plants

See Roadway Planting Recommendations (Table 6B)

Planted curb-height median: 253rd Street and 86th Avenue, Queens (Credit: DPR)

Curb-height median with plantings set back from the curb to allow for easier maintenance: Merrick Boulevard, Queens (Credit: DPR)

RAISED MEDIAN

12–24 Inches

A median, typically constructed of concrete or stone, 12–24 inches above the roadbed that provides above-ground soil volume for plantings. Generally employed where underground constraints prevent planting at grade and/or along high-speed roadways.

Raising medians to over 12 inches helps accommodate tree roots: West Houston Street, Manhattan (Credit: DPR)

Planted raised median: Canal Street, Manhattan (Credit: DPR)

Benefits

See benefits for RAISED MEDIAN (6.2.1)

Considerations

See GENERAL GUIDELINES (6.0.1)

See considerations for RAISED MEDIAN (6.2.1)

Higher medians can encourage higher motor vehicle speeds; therefore, design the median to the minimum height necessary to accommodate appropriate soil depth

Consider visibility in relation to the overall height of mature plantings and the raised median (12 – 24 inches)

Existing trees at potential raised-median sites should be preserved if possible; consider installing the median around the trees to prevent excavation and change of soil grade

Design

See design guidance for RAISED MEDIAN (6.2.1)

Planting beds should be sufficiently wide and deep to provide adequate soil volume for plants: 6 feet minimum soil width (wall to wall) and 24 inches minimum soil depth

Always excavate through the entire roadbed so the bottom of the planting bed is open and will allow positive drainage

The roots of plants will be primarily above ground, and are thus more sensitive to freeze-thaw cycles in the winter. Carefully select species which are cold hardy to at least Zone 6A. For added insulation, provide adequate mulch (2 – 3 inches) at the time of planting and replenish as necessary

For perimeter plantings, choose plants that will not protrude beyond the edge of the raised wall; plants that cascade over the edge of the wall may be acceptable

Plants

See Roadway Planting Recommendations (Table 6B)

RAISED MEDIAN

Pedestrian Mall

A wide median that allows for pedestrian use and circulation in addition to plantings. Pedestrian malls, like the Allen Street Malls or the Park Avenue Mall at East 97th Street in Manhattan, provide a safe area for pedestrian use within the roadway. Typically, these malls are DPR property and are maintained by DPR or by neighborhood groups through a maintenance agreement.

Left: The same pedestrian mall in the summer, with plantings that provide shade while maintaining visual interest: Park Avenue and 97th Street, Manhattan (Credit: Lynden B. Miller)

ABOVE: *Strategic tree and plant selection allows for year-round interest. Early flowering trees and bulbs add color in the spring: Park Avenue and 97th Street, Manhattan (Credit: Lynden B. Miller)*

In the fall, this pedestrian mall features colorful foliage: Park Avenue and 97th Street, Manhattan (Credit: Lynden B. Miller)

Evergreens provide color in the winter: Park Avenue and 97th Street, Manhattan (Credit: Lynden B. Miller)

Benefits

See benefits for RAISED MEDIAN (6.2.1)

Considerations

See considerations for RAISED MEDIAN (6.2.1)

Consider pedestrian and bicycle circulation within the mall

Consider how the planting design will function with other elements, such as seating, lighting, and artwork

Consider the collection of stormwater. See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Plantings, excluding trees, not maintained by DPR require a maintenance agreement

Design

See design guidance for RAISED MEDIAN (6.2.1)

Adequate access should be provided throughout the mall; planting areas should be designed to accommodate necessary circulation

A minimum of 8 feet must be provided for a pedestrian-only path, 8 feet for a two-way bicycle path, and 12–14 feet, depending on the volume of users, for a shared-use path

Plant densely to discourage weed growth and pedestrian access through the plantings

Consider the use of tree-bed guards around planting areas to discourage trampling of plant material

Plants

See Roadway Planting Recommendations (Table 6B)

Triangle

A planted area of any size and shape, not just a triangle, within the public ROW that generally separates and/or channelizes traffic. Typically, existing planted triangles are maintained by DPR (through the Greenstreets agreement between DOT and DPR) or another entity, such as a neighborhood group through a maintenance agreement.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Can incorporate community facilities such as seating or other furnishings to encourage social and recreational activities, depending on its size and capacity of the maintenance partner

Considerations

See GENERAL GUIDELINES (6.0.1)

May impact street drainage or require catch-basin relocation

Safe access to plantings for maintenance workers must be provided

Landscaping or stormwater source controls not covered under the agreements between DPR, DEP, and DOT require a maintenance agreement

Design

See GENERAL GUIDELINES (6.0.1)

Where planting trees, see design guidance for TREE BED (6.1.1)

Design details should be determined on a site-specific basis in consultation with DPR, DOT, and DEP

Consider pedestrian access and circulation; paths should be uninterrupted through triangles

Consider height and width of shrubs, grasses, and perennials at maturity, and, if necessary, keep taller plants towards the interior and use shorter plants along the exterior of triangle plantings. Choose dwarf species where visibility is a concern

Planted triangle. Clear paths are provided for pedestrian circulation: Grand Army Plaza, Brooklyn

Planted triangle. Shorter plants are located near the edge to maintain sightlines: Macombs Road and Grand Avenue, Bronx (Credit: DPR)

Planted triangle: Flushing Avenue and 59th Street, Queens (Credit: DPR)

Plants must not protrude into the roadway; plant densely within the planting bed to discourage weed growth and trampling

Use salt-tolerant, drought-tolerant species for plantings

Consider designing the area to capture stormwater runoff. See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Plants

See Roadway Planting Recommendations (Table 6B)

Street End

The public space at the end of a street abutting a boardwalk or body of water. Pedestrian access to the waterfront or boardwalk must be maintained. In some cases, such as street ends in Greenpoint and Williamsburg in Brooklyn, the area is subject to a Waterfront Access Plan (WAP). This plan is created by DCP and outlines specific concerns regarding design, access, and maintenance.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Provides an opportunity to actively collect and manage stormwater

Considerations

See GENERAL GUIDELINES (6.0.1)

See considerations for TRIANGLE (6.2.2)

Consider physical and environmental stresses when selecting plants; especially if near the coast or a river

If DPR will not maintain plantings, a maintenance agreement will be required

Design

See GENERAL GUIDELINES (6.0.1)

Consult DCP for Waterfront Public Access requirements for adjacent parcels and to allow for coordination with existing or future public access areas and continuous access along the shoreline where appropriate

A minimum 5-foot path for pedestrian access should be provided through a planted area if there is an accessible area beyond the plantings

If a maintenance partner can be identified, consider the use of community amenities, such as street furniture, in conjunction with plantings

Consider the capture of stormwater runoff. See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Street closures can create opportunities for plantings: 73rd Avenue, Queens

Planted area in a street end. These hardy grasses are appropriate for the context; they can tolerate salt and a wide range of soil conditions and provide year-round interest: 73rd Avenue, Queens

Consider the use of a barrier, such as a W-section guide rail or bell bollard, to prevent vehicular access and damage to plantings; all barriers must be reviewed and approved by DOT and any non-standard barriers will require a maintenance agreement

Plants

See Roadway Planting Recommendations (Table 6B)

TABLE 6B

Roadway Planting Recommendations

Trees, shrubs, groundcovers, perennials, and other vegetation located within the roadbed of a street. Generally, plantings are installed within raised medians or triangles that separate or channelize traffic. This list is not comprehensive and there is no guarantee that these plants will survive at a specific site. All plants within the public ROW must be selected based on site-specific conditions and approved by DPR.

Trees

Scientific Name 'Cultivar' Trade Name Common Name	Appearance			Tolerances			
	Height	Shape	Characteristics	Drought-Flood	Light	Salt	High pH
Ulmus 'New Harmony' ^ New Harmony Elm	>40'			✓ ✓		◆	◆
Ginkgo biloba (Fruitless Cultivar Only) Ginkgo	>40'			✓ ✓		◆	◆
Juniperus chinensis 'Keteleeri' * Keteleer Chinese Juniper	15'-40'			✓ ✓		◆	◆
Koelreuteria paniculata Goldenrain Tree	15'-40'		AUG SEP	✓		◆	◆
Prunus serrulata 'Okame' * Okame Cherry	15'-40'		APR	✓		◆	–

Shrubs

	Height	Spread	Characteristics	Drought-Flood	Light	Salt	High pH
Hydrangea paniculata 'DVPinky' Pinky Winky Hydrangea	6'-8'	5'-6'	JUL SEP	✓		◆	◆
Cornus sericea 'Farrow' Arctic Fire Red Twig Dogwood	3'-4'	3'-4'	MAY JUN	✓		◆	◆
Rosa 'Radcor' Rainbow Knock Out Rose	3'-4'	4'-5'	MAY NOV	✓		◆	◆
Abelia x grandiflora 'Rose Creek' Rose Creek Glossy Abelia	<3'	3'-4'	MAY SEP	✓		◆	–
Caryopteris x clandonensis 'Dark Knight' Dark Knight Blue Mist Shrub	<3'	1.5'-2'	JUL SEP	✓		◆	–
Juniperus chinensis var. sargentii 'Glauca' Blue Sargent Juniper	<3'	6'-9'		✓ ✓		◆	◆
Lagerstroemia indica 'Gamad II' Razzle Dazzle Crepe Myrtle	<3'	3'-4'	JUL SEP	✓ ✓		◆	◆
Potentilla fruticosa Shrubby Cinquefoil	<3'	3'-4'	JUN NOV	✓ ✓		◆	◆
Rhus aromatica 'Gro Low' Gro Low Sumac	<3'	6'-8'	APR	✓ ✓		◆	◆
Spiraea x bumalda 'Goldmound' Goldmound Spirea	<3'	3'-4'	MAY	✓ ✓		◆	◆
Yucca filamentosa 'Color Guard' Color Guard Adam's Needle	<3'	2'-3'	JUN SEP	✓ ✓		◆	◆

Perennials

Liriope muscari 'Big Blue' Big Blue Lilyturf	1'-2'	1'-2'	AUG SEP	✓ ✓		◆	◆
Nepeta x 'Walker's Low' Walker's Low Catmint	2'-2.5'	2.5'-3'	AUG SEP	✓ ✓		◆	◆
Perovskia atriplicifolia 'Little Spire' Little Spire Russian Sage	1.5'-2'	1.5'-2'	JUN NOV	✓ ✓		◆	◆
Echinacea purpurea Coneflower	2'-3'	1.5'-2'	JUN AUG	✓ ✓		◆	◆

Grasses/Grass-like Plants

Chionodoxa forbesii 'Pink Giant' Pink Giant Glory of the Snow	3'-5'	1.5'-2.5'	JUN FEB	✓ ✓		◆	◆

Bulbs

Narcissus 'Improved King Alfred' Trumpet Daffodil	1'-2'	.5'-1'	APR MAY	✓ ✓		◆	◆
Allium 'Globemaster' Globemaster Ornamental Onion	1.5'-2.5'	1'-1.5'	JUN	✓ ✓		◆	◆

* Fall Dig Hazard ^ ALB Host Species Bloom/Showy Flowers Showy Fruit Distinct Foliage Fall Color Distinctive Bark Evergreen

Sidewalk Plantings

Sidewalk plantings are trees, shrubs, groundcovers, perennials, and other vegetation located on the sidewalk. Generally, plantings are located within the sidewalk furnishing zone. Sidewalk plantings must endure limited growing space, compaction, salt, and damage from people, animals, and vehicles; these factors should guide plant selection.

Full Sidewalk

Any planting within the furnishing zone of a FULL SIDEWALK (2.2.1a); may include street trees, ornamental plantings, stormwater plantings, or other types of vegetation. Street trees should be planted wherever possible. While DPR is responsible for the maintenance of the city's street trees, other ornamental plantings, such as tree bed plantings, are encouraged but will require a maintenance agreement. DEP ROW BIOSWALES (6.6.1a) are generally installed on sidewalks in DEP Priority CSO Tributary Areas to capture stormwater runoff from the roadway where conditions are appropriate.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Considerations

See GENERAL GUIDELINES (6.0.1)

See considerations for TREE BED (6.1.1)

Adequate access from the street and to building entrances must be maintained

Consider environmental and physical stresses plants must withstand, including drought/inundation, sun/shade, heat/cold, wind, compaction, garbage, and animal damage

Plantings, other than trees, outside the DPR-DOT Greenstreets agreement will require a maintenance agreement

Design

See design guidance for TREE BED (6.1.1) and SIDEWALK (2.2.1)

Meet minimum size and design requirements of DPR's Tree Planting Standards

The New York City Zoning Resolution requires that one tree be provided for every 25 feet of curb frontage for new developments and major alterations

Plantings can be coordinated with benches and other amenities to create a welcoming streetscape: Columbus Avenue at 76th Street, Manhattan

Planted area in front of PS 234. Planted areas adjacent to schools can provide educational opportunities: Greenwich Street at Chambers Street, Manhattan (Credit: Lynden B. Miller)

A wide sidewalk can accommodate more expansive planted areas. Such installations are maintained by private partners or DPR: Greenwich Street at Warren Street, Manhattan

Maximize available soil volume and select plants with appropriate shape, form, and ultimate size to allow proper sight lines for pedestrian, bicycle, and vehicular traffic

Consider the installation of DEP ROW BIOSWALE (6.6.1a)

Plants

See Sidewalk Planting Recommendations (Table 6C)

Ribbon Sidewalk

RIBBON SIDEWALKS allow for planting along the curb. They typically occur in more residential areas with low-volume pedestrian traffic. The planting strip generally consists of trees and turfgrass, but can also provide an opportunity for enhanced ornamental plantings.

Ribbon sidewalk with turf grass and trees. Trees can be very large due to expanded rooting area afforded by adjacent lawns: Bancroft Avenue at Edison Street, Staten Island (Credit: DPR)

Ribbon sidewalk with lawn planting strip and trees. This configuration is common in lower-density residential areas and generally supports larger trees: Ocean Parkway at Avenue C, Brooklyn

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Considerations

See GENERAL GUIDELINES (6.0.1)

May impact underground or overhead utilities

Consider environmental and physical stresses plants must withstand, including drought/inundation, sun/shade, heat/cold, wind, compaction, garbage, and animal damage

Planting strips adjacent to ribbon sidewalks must be planted with groundcover vegetation for erosion control if a STORMWATER MANAGEMENT PRACTICE (6.6.1) solution is not used

The adjacent property owner or other maintenance partner is responsible for maintenance of any plantings other than trees

Design

See design guidance for TREE BED (6.1.1)

Groundcover other than turfgrass is permitted as long as adequate access every 20 feet via walkable vegetation or another accessible surface is provided from the roadway

Consider the capture of stormwater runoff. See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Select low-growing plants that will have year-round ornamental interest

Plants

See Sidewalk Planting Recommendations (Table 6C)

Curb Extension

A CURB EXTENSION that is planted rather than paved.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Considerations

See GENERAL GUIDELINES (6.0.1)

May impact street drainage and require new catch basins

Landscaping or stormwater source controls other than city-maintained ROW Bioswales, Greenstreets and Stormwater Greenstreets require a maintenance agreement

Design

See design guidance for CURB EXTENSION (6.2.1)

If located at a corner, maintain clear access to the crosswalk and the pedestrian ramp

Where possible, pitch sidewalks to direct water into the planting beds. Additionally, consider the capture of stormwater from the roadway. See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Select low-growing plants that will have year-round ornamental interest and not block sight lines. Consider the use of tree-bed guards around planted areas

Plants

See Sidewalk Planting Recommendations (Table 6C)

Curb extension with Greenstreet: Greenwich and Christopher Streets, Manhattan

Curb extension with Greenstreet: West 11th Street at Seventh Avenue South, Manhattan

TABLE 6C

Sidewalk Planting Recommendations

Trees, shrubs, groundcovers, perennials, and other vegetation located on the sidewalk. Generally, plantings are located within the sidewalk furnishing zone; see SIDEWALKS (3.1). This list is intended for wide sidewalks and curb extensions that have ample room for planting. For a small sample of plantings acceptable in tree beds, see TREE BEDS (6.1). This list is not comprehensive and there is no guarantee that these plants will survive at a specific site. All plants within the public ROW must be selected based on site-specific conditions and approved by DPR.

Trees	Appearance								Tolerances				
Scientific Name 'Cultivar' Trade Name Common Name	Height	Shape	Characteristics						Drought-Flood		Light	Salt	High pH
Quercus phellos * Willow Oak	50'-70'								✓			◆	◆
Metasequoia glyptostroboides Dawn Redwood	50'-70'								✓	✓		◆	◆
Zelkova serrata 'Village Green' * Village Green Japanese Zelkova	60'-70'								✓			◆	–
Eucommia ulmoides Hardy Rubber Tree	40'-60'								✓			◆	◆
Cercis canadensis * Eastern Redbud	20'-30'		APR						✓	✓		◆	–
Maackia amurensis Amur Maackia	20'-30'		JUN						✓			–	–
Shrubs		Spread											
Ilex crenata 'Helleri' Heller's Japanese Holly	2'-3'	5'-8'							✓	✓		◆	◆
Jasminum nudiflorum 'Nanum' Compact Winter Flowering Jasmine	2'-3'	3'-4'	FEB MAR						✓			◆	◆
Juniperus chinensis 'Old Gold' Old Gold Juniper	2'-3'	4'-5'							✓	✓		◆	◆
Rosa x 'Noatraum' Flower Carpet Pink™ Flower Carpet Rose	2'-2.5'	3'	MAY SEP						✓	✓		◆	◆
Juniperus conferta 'Blue Pacific' Blue Pacific Shore Juniper	.5'-1'	4'-6'							✓	✓		◆	◆
Grasses/Grass-like Plants													
Miscanthus sinensis 'Adagio' Adagio Eulalia Grass	2'-3'	2'	AUG FEB						✓	✓		◆	◆
Panicum virgatum 'Hot Rod' Hot Rod Switch Grass	3'	2'	AUG SEP						✓	✓		◆	–
Koeleria glauca 'Coolio' Coolio Blue Hair Grass	1'-1.5'	1'-1.5'	MAR JUL						✓			◆	◆
Carex elata 'Aurea' Bowles Golden Sedge	1'-1.5'	1.5'								✓		◆	–
Perennials													
Achillea millefolium 'Pretty Belinda' Pretty Belinda Fernleaf Yarrow	1'-2'	1.5'	JUN JUL						✓			◆	◆
Euphorbia 'Ascot Rainbow' Ascot Rainbow Variegated Spurge	1.5'-2'	1.5'	JUN						✓			◆	◆
Nepeta x faassenii 'Kit Cat' Kit Cat Catmint	1.5'	1'-2'	MAY SEP						✓	✓		◆	◆
Nipponanthemum nipponicum Montauk Daisy	2'-3'	2'-3'	AUG SEP						✓	✓		◆	–
Bulbs													
Allium christophii Star of Persia	1'-2'	.5'-1.5'	MAY						✓	✓		◆	◆

* Fall Dig Hazard ^ ALB Host Species Bloom/Showy Flowers Showy Fruit Distinct Foliage Fall Color Distinctive Bark Evergreen

Plaza Plantings

Although plazas tend to consist mostly of hardscape to facilitate pedestrian circulation, sitting, and programming, plantings can make them more inviting and can help define spaces within them. Plazas allow for more growth potential and greater diversity of plant species than is possible in more constrained areas such as raised medians and tree beds.

See PLAZA (2.1.4) and PERMANENT PLAZA (2.1.4a) for more information on general plaza design.

In-Ground Planting Area

Planting areas within plazas that are level with the surrounding grade. The size and shape of the area may vary, and it is typically employed where there are few underground constraints.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Plants add character to a plaza and provide secondary environmental benefits

Plazas provide more room for planting and allow for a greater diversity of plants

Considerations

See GENERAL GUIDELINES (6.0.1)

Account for existing and proposed pedestrian circulation, especially major desire lines to crosswalks, building entrances, and pedestrian generators such as transit connections

Plazas should maintain a feeling of openness; plantings should not block critical sight lines through the plaza

Proximity to vehicular traffic and pedestrian circulation will impact the size and shape of the planting areas

Positive drainage must be established in all planting areas

Consider how maintenance workers will access the plantings to perform regular maintenance activities; access to a water source for irrigation should be provided

Design

Plantings must be considered in context of the overall plaza design. See PERMANENT PLAZA (2.1.4a) for design guidance

The plantings in this plaza were selected based on the microclimate, which is mostly shady and windy: Hanover Square, Lower Manhattan (Credit: Lynden B. Miller)

Maintain a clear path for any major pedestrian desire lines or defined circulation paths; if the plaza is located in front of a building, provide an additional clear path adjacent to the building

Provide adequate soil volume/rooting area for plantings; a minimum 24-inch depth and 5-foot width of organic, well-draining soil

Design plantings in relation to seating areas or other areas of interest to create or define edges, to add visual interest, to provide shade, and/or to provide other protection for plaza users

Select plants that provide year-round interest; utilize combinations of plants that have contrasting textures, colors, and forms

Plant densely to discourage littering, trampling and other improper uses

Direct stormwater runoff into plantings wherever possible. See STORMWATER MANAGEMENT PRACTICES (6.6.1)

Plaza plantings should provide year-round interest and be appropriate for a given microclimate: Hanover Square, Lower Manhattan (Credit: Lynden B. Miller)

In heavily trafficked areas, consider the use of suspended paving systems to maximize circulation while preventing soil compaction. Consider the use of a tree-bed guard where feasible

Plants

See PLAZA PLANTINGS (6.4): Plaza Planting Recommendations

Raised Planting Area

Any planting area within a plaza that is raised above grade. The size and shape of the area may vary from site to site and is typically employed where there are underground constraints. The majority of the soil volume is contained within the above-ground structure.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0) and IN-GROUND PLANTING AREA (6.4.1)

Above-ground planting structures allow the integration of other design elements such as seating and lighting

Raising planters creates opportunities for planting where there are underground constraints

Raised planters create more substantial barriers from vehicles

Raised planters create protection from winter salt spray

Considerations

See GENERAL GUIDELINES (6.0.1)

See considerations for IN-GROUND PLANTING AREA (6.4.1)

Plant selection should be sensitive to the limited amount of soil available for root growth in a raised planter. Due to the limited soil volume, plants should be more drought-tolerant and will need to be watered more often

Soil is less insulated in raised planting beds; freeze/thaw cycles will be more extreme in winter; select plants that are one to two USDA zones hardier to survive these conditions

Raised plantings along a path can be visually appealing. These plantings provide year-round interest: subway station on Broadway at 96th Street, Manhattan (Credit: Lynden B. Miller)

Design

See design guidance for IN-GROUND PLANTING AREA (6.4.1)

Consider the type of soil that will be used within the raised bed. Specify a soil with good water and nutrient holding capacity.

Raised structures allow for greater variation in topography and a larger variety of seating options

Planting beds, as a general rule, should not exceed 18 inches in height and should maintain visual and physical openness

Raised planting areas can provide additional seating by utilizing the wall of the raised structure as a seat wall; avoid creating long walls that impede pedestrian circulation

Raised plantings in a plaza can help create a sense of enclosure: subway station on Broadway at 96th Street, Manhattan (Credit: Lynden B. Miller)

Plants

See Plaza Planting Recommendations (Table 6D)

TABLE 6D

Plaza Planting Recommendations

The following list provides a small sampling of plants that have been successfully employed in plazas within NYC. This list is not comprehensive and there is no guarantee that these plants will surive at a specific site. All plants within the public ROW must be selected based on site specific conditions and approved by DPR.

Trees

Scientific Name 'Cultivar' Trade Name Common Name	Appearance								Tolerances				
	Height	Shape	Characteristics						Drought-Flood		Light	Salt	High pH
Acer rubrum (and cultivars) ^ * Red Maple	>40'		MAR APR						✓	✓		◆	–
Cornus kousa * Kousa Dogwood	15'-30'		JUN									–	◆
Magnolia x soulangeana * Saucer Magnolia			MAR									–	–
Ilex x aquipernyi 'Meschick' Dragon Lady™ * Dragon Lady Holly	<15'								✓	✓		◆	◆
Malus spp. and cultivars Crabapple			APR MAY						✓	✓		◆	◆

Shrubs

		Spread											
Hibiscus syriacus 'Diana' Diana Rose of Sharron	>8'	4'-6'	JUL SEP						✓	✓		◆	◆
Vitex agnus-castus * Chaste Tree		5'-8'	JUL AUG						✓			◆	◆
Prunus cistena Purple Sand Cherry		5'-8'	APR						✓	✓		◆	◆
Cornus alba 'Elegantissima' Red-Stemmed Variegated Dogwood	3'-8'	3'-5'	MAY JUN							✓		◆	◆
Hydrangea quercifolia Oakleaf Hydrangea		6'-8'	JUL DEC									◆	◆
Prunus laurocerasus 'Otto Luyken' * Otto Luyken Dwarf Cherry Laurel		10'-12'	MAY						✓			◆	◆
Spiraea thunbergii 'Ogon' Mellow Yellow ® Golden Thunberg Spiraea	<3'	3'-5'	APR						✓			◆	◆
Euonymus fortunei 'Coloratus' Purple-Leaf Wintercreeper		1'-3'							✓	✓		◆	◆
Juniperus squamata 'Blue Star' Blue Star Juniper		1'-4'							✓			◆	◆
Rosa Knock Out ® series Knock Out Roses		3'-4'	MAY NOV							✓		◆	◆
Yucca filamentosa 'Color Guard' Color Guard Adam's Needle		2'-3'	JUN SEP						✓	✓		◆	◆
Buxus 'Green Velvet' Green Velvet Dwarf Boxwood		2'-4'							✓			◆	◆

Perennials

Alchemilla mollis Lady's Mantle	1'-1.5'	1.5'-2.5'	MAY JUN							✓		◆	◆
Amsonia hubrichtii Arkansas Blue Star	2'-3'	2'-3'	MAY						✓	✓		◆	◆
Geranium macrorrhizum 'Bevan's Variety' Bevan's Variety Big-Root Geranium	1'	1'-1.5'	MAY						✓			◆	◆
Helleborus x hybridus Lenten Rose	1'-1.5'	1'-1.5'	MAR MAY						✓	✓		◆	◆
Hemerocallis 'Happy Returns' Happy Returns Daylily	1'-1.5'	1'-1.5'	JUN OCT							✓		◆	◆
Liriope muscari 'Big Blue' Big Blue Lilyturf	1'-2'	1'-2'	AUG SEP						✓	✓		◆	◆
Nepeta x 'Walker's Low' Walker's Low Catmint	2'-2.5'	2'-3'	APR SEP						✓	✓		◆	◆
Sedum Autumn Joy Autumn Joy Stonecrop	1.5'-2'	1.5'-2'	AUG NOV						✓	✓		◆	◆

* Fall Dig Hazard ^ ALB Host Species Bloom/Showy Flowers Showy Fruit Distinct Foliage Fall Color Distinctive Bark Evergreen

Limited-Access Arterial Plantings

Landscapes along limited-access arterial highways feature shade and evergreen trees, understory plantings, and turf grass to provide a green buffer for adjacent communities and enhance the natural environment. These areas are typically much larger and allow for a greater diversity of plants than is possible elsewhere. However, irrigation is rarely provided, and plants must tolerate other urban stresses such as wind and salt.

Limited-Access Arterial Plantings

Limited-access arterial highways are high-speed roadways, such as expressways or parkways, with access ramps, no intersections with traffic control, and generally large areas for plantings. The most commonly used ground cover for limited-access arterial highways is turf grass. It has low installation costs, superior ability to control soil erosion, and minimal maintenance requirements. Arterial lawns are mowed about four times during the growing season. No fertilizers or pesticides are used, and there is never supplemental irrigation after establishment.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW (6.0)

Limited-access arterial ROWs often contain large contiguous areas suitable for re-forestation, providing some of the benefits of natural woodland, including corridors for wildlife

Opportunities for greater diversity in trees and other species and preservation of native species where existing conditions are not unduly disturbed

Reduction in glare and a more pleasant experience for motorists

Summer cooling, wind reduction, buffering of negative traffic perceptions, and enhanced aesthetics

Considerations

See GENERAL GUIDELINES (6.0.1)

Planting must comply with DOT design standards and guidelines and NYSDOT guidelines if located within NYSDOT jurisdiction

Limited-access arterial highway landscapes typically receive limited maintenance; there is no weeding or invasive-species removal

Trees should not be planted closer than 20 feet apart to allow for mowing. Space should be provided for maintenance vehicles and crews

Plantings should not create hidden areas that facilitate illegal activities such as dumping or vandalism

Plantings along an access ramp and bridge structure: Belt Parkway at Guy R. Brewer Boulevard, Queens

A diverse array of newly planted trees: BQE at Prospect Street, Brooklyn

Limited-access arterial with various tree species: Hutchinson River Parkway, Bronx

Soil can be highly variable in texture, pH, and depth; compaction is typical and can greatly suppress root growth as well as cause drainage problems

Plants must be able to tolerate various stresses such as reflected heat, salt, drought, wind, and competition from invasive plants

Plants known to be susceptible to insect or disease problems should not be used

The Port Authority of New York and New Jersey prohibits plants with fruit that attracts birds near the airports

Any plantings not maintained by DOT or DPR will require a maintenance agreement; consider DOT's Adopt-a-Highway program for enhanced maintenance

Design

Limited-access arterial highways without curbside safety barriers must maintain 30-foot clear zones (recovery zones) on either side. Access ramps must have clear zones measuring at least 15 feet on either side. All clear zones must be approved by DOT

A minimum of 10 feet behind any safety barrier should be clear of trees and other fixed objects

Arterial landscapes are usually viewed by highway users at fast speeds. Plant large swathes of fewer types of species

Large-growing shade trees should be spaced to promote maximum growth, typical form, and sturdy structure; interplant large trees with smaller understory trees and/or shrubs to increase the density of plantings

A good highway plant palette includes hardy species known to thrive and other plants for diversity and interest

Asphalt mow strips are required around and under objects that mowers cannot pass over

Incorporate STORMWATER MANAGEMENT PRACTICES (6.6.1) where appropriate. Generally, restrictions on space do not apply, so such infrastructure can be much larger

Mulch around trees, without covering the root flare or trunk, to reduce damage from tractor mowers and greatly improve tree health

Plants

See Limited-Access Planting Recommendations (Table 6E)

TABLE 6E

Limited-Access Arterial Planting Recommendations

The following are plants that have been successfully employed along limited-access arterial roadways. This list is not comprehensive and there is no guarantee that these plants will survive at a specific site. All plants within the public ROW must be selected based on site-specific conditions and approved by DOT and DPR. In cases where NYS DOT has jurisdiction, NYS DOT must also approve the plants and overall design.

Trees

Scientific Name 'Cultivar' Trade Name Common Name	Appearance			Tolerances			
	Height	Shape	Characteristics	Drought-Flood	Light	Salt	High pH
Cedrus deodara 'Shalimar' * Shalimar Hardy Deodar Cedar	>40'			✓	✓	◆	◆
Gymnocladus dioicus Kentucky Coffee Tree	>40'		MAY	✓	✓	◆	◆
Liquidambar styraciflua * Sweet Gum	>40'			✓	✓	◆	–
Pinus strobus * Eastern White Pine	>40'			✓		–	–
Quercus alba * White Oak	>40'			✓	✓	◆	–
Quercus phellos * Willow Oak	>40'			✓		◆	–
Styphnolobium (Sophora) japonicum 'Regent' Regent Sophora Tree	>40'		JUL AUG	✓	✓	◆	◆
Tilia tomentosa 'Sterling' * Sterling Silver Linden	>40'		JUN JUL	✓		◆	◆
Zelkova serrata 'Green Vase' * Green Vase Japanese Zelkova	>40'			✓		◆	◆
Ilex 'Nellie R. Stevens' * Nellie R. Stevens Holly	15'-40'			✓	✓	◆	◆
Juniperus chinensis 'Kaizuka' Hollywood Chinese Juniper	15'-40'			✓	✓	◆	◆
Cercis canadensis * Eastern Redbud	<15'		APR	✓	✓	◆	◆
Cornus mas 'Golden Glory' Golden Glory Cornelian Cherry	<15'		MAR APR	✓		◆	◆
Lagerstroemia indica x faurei hybrids * Hybrid Crape Myrtle	<15'		JUL SEP	✓	✓	◆	◆
Malus 'Donald Wyman' Donald Wyman Crabapple	<15'		APR MAY	✓	✓	◆	◆
Syringa reticulata 'Ivory Silk' Ivory Silk Japanese Tree Lilac	<15'		JUN	✓	✓	◆	◆

Shrubs

	Height	Spread									
Viburnum rhytidophyllum * Leatherleaf Viburnum	6'-10'	6'-10'	APR					✓		◆	◆
Forsythia x intermedia cultivars Border Forsythia	8'-10'	10'-12'	APR					✓		◆	◆
Myrica pensylvanica Northern Bayberry	5'-10'	5'-10'						✓	✓	◆	–
Cornus racemosa Gray Dogwood	10'-15'	10'-15'	MAY JUN					✓	✓	◆	◆
Lonicera fragrantissima Winter Honeysuckle	6'-10'	6'-10'	MAR APR					✓		◆	◆

Self-Clinging Vines

Parthenocissus tricuspidata Boston Ivy	30'-50'	5'-10'						✓		◆	◆

Turf Grass

Festuca arundinacea cultivars Turf-type Tall Fescue Grass	3"-4"	3"-4"						✓		◆	◆
Lolium perenne cultivars Turf-type Perennial Rye Grass	3"-4"	3"-4"						✓		◆	–

* Fall Dig Hazard ^ ALB Host Species Bloom/Showy Flowers Showy Fruit Distinct Foliage Fall Color Distinctive Bark Evergreen

Stormwater Management Practices

Stormwater management practices are areas that may be planted with trees, shrubs, groundcovers, grasses, and perennials that are designed to collect and treat stormwater runoff from the city's streets. These treatments are also known as "green infrastructure." Plants are selected for their ability to endure periods of wet weather as well as drought, and in many cases to withstand the impacts of salt, sediment, and contaminants typically found in urban runoff. Using plants and soils to mitigate the impacts of stormwater runoff is an ecologically responsible and economical technique to employ within the public ROW.

The High Performance Infrastructure Guidelines (2005), the DEP Green Infrastructure Plan (2010) and the 2011 Plan Update, and the High Performance Landscape Guidelines (2011) outline strategies for sustainably managing stormwater in New York City.

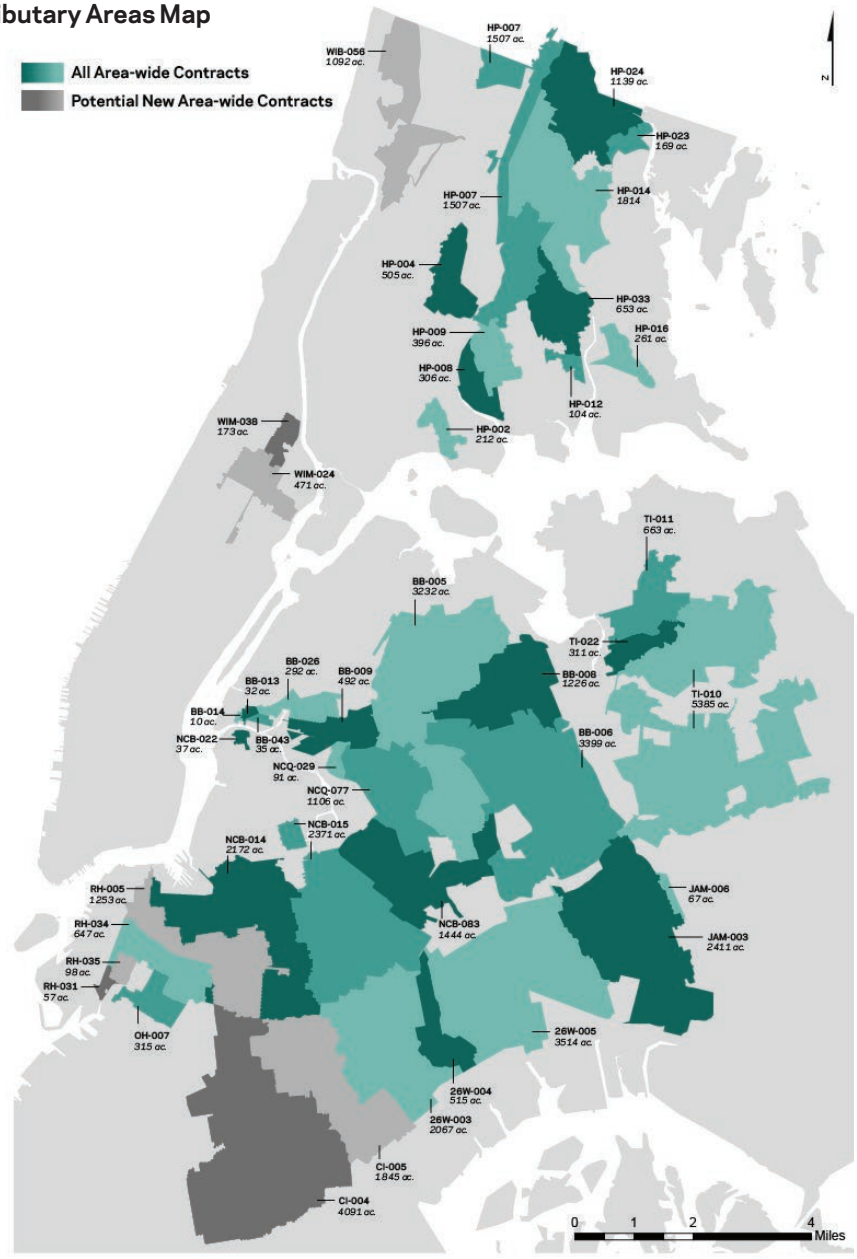
STORMWATER MANAGEMENT PRACTICES (6.6.1) describe general considerations and design principles typical of a green stormwater solution. These treatments can be employed citywide, where appropriate conditions allow.

DEP ROW BIOSWALE (6.6.1a) and STORMWATER GREENSTREET (6.6.1b), along with other DEP ROW Green Infrastructure treatments, are specific city-led strategies for managing stormwater in targeted areas that have the greatest need. These treatments will be built and maintained by the city within priority areas. See DEP Priority CSO Tributary Map. These treatments can be built by private entities but will require a maintenance agreement.

Important Terms (NYS Stormwater Design Manual)

- **Detention:** The temporary storage of storm runoff in a stormwater management practice with the goals of controlling peak discharge rates and providing gravity settling of pollutants
- **Retention:** The amount of precipitation on a drainage area that does not escape as runoff. It is the difference between total precipitation and total runoff

DEP Priority CSO Tributary Areas Map



(Credit DEP)

Stormwater Management Practices

Any area, typically planted, that is specifically designed to capture and treat stormwater runoff from the Right-of-Way (ROW). The primary purpose of these treatments is to reduce stress on the city's combined sewer infrastructure during rain storms. Practices can range from a single tree bed to a bioswale to a rain garden in a triangle or plaza. ROW green infrastructure practices include ROW Bioswales, ROW Stormwater Greenstreets, ROW Rain Gardens, ROW Greenstrips, ROW Permeable Pavement, and ROW Infiltration Basins.

Benefits

See BENEFITS OF PLANTINGS IN THE ROW

Reduced stormwater entering sewers during storms

Can reduce the frequency and intensity of Combined Sewer Overflows (CSOs)

Healthier plants and greater survival rates when appropriate plants are used

Inlet design directs stormwater into DEP ROW Bioswale: Dean Street and 4th Avenue, Brooklyn (Credit: DEP)

DEP ROW Stormwater Greenstreet constructed in the roadway, modifying the street geometry: Powell Street and Belmont Avenue, Brooklyn (Credit: DEP)

Considerations

See GENERAL GUIDELINES (6.0.1)

Designers should consider environmental due diligence to ensure green infrastructure installations will not exacerbate preexisting subsurface contamination, including but not limited to a preliminary review of publicly available local, state, and federal databases.

Designer should reference DEP Office of Green Infrastructure's latest Procedure Governing Limited Geotechnical Investigation for Green Infrastructure Practices and coordinate with DEP on geotechnical results to ensure that stormwater control practices are appropriate for the proposed location

Retrofitting existing plantings may be feasible if there is limited grade change and in situ soils are appropriate; special care must be given to tree roots; existing species must be able to tolerate higher levels of water

Plants should tolerate salts, sediment, contamination, and highly variable levels of water availability

Due to existing grading and/or the crown of the road, stormwater installations along the gutter are ideal for stormwater capture, while installations in the center of the road will not capture significant volumes of water unless the road can be regraded

Leaves, litter, and other material may clog inlets/outlets and could impact overall performance of the STORMWATER MANAGEMENT PRACTICE

STORMWATER MANAGEMENT PRACTICES will require a maintenance agreement

Application

All areas with TREE BEDS (6.1), ROADWAY PLANTINGS (6.2), SIDEWALK PLANTINGS (6.3), PLAZA PLANTINGS (6.4), and LIMITED-ACCESS ARTERIAL PLANTINGS (6.5)

See DEP ROW BIOSWALE (6.6.1a) if in DEP Priority CSO Tributary Areas; see STORMWATER GREENSTREET (6.6.1b)

Installations can be pursued in partnership with DPR, DEP, or another maintenance partner

Unused or under-utilized roadway areas that can be re-purposed to collect stormwater

Design

Use canopy trees, low shrubs, and groundcover to maintain visibility

Maintain an 8-foot clear path in areas with high-volume pedestrian traffic and a 5-foot clear path in areas with low-volume pedestrian traffic

Installations must be sited at the low point of the street or paved ROW area and receive adequate flow

Locate treatments at least 7 feet from any below-ground vaults or basements to prevent water damage to these structures

Stormwater management areas should be sized in relation to the tributary drainage area to handle the volume of water entering into them; consult DEP Office of Green Infrastructure's latest Standards

Select soils that allow more rapid infiltration than typical horticultural soils and resist compaction while still supporting plant material

Direct runoff into planted areas via porous pavement, curb inlets, stormwater inlets with sub-surface pipes, or other methods approved by DEP

Utilize a pre-treatment system such as grates, a vegetative filter, or weirs to filter and collect sediment and floatables into a concentrated area; this system should be easy to clean out and will reduce the frequency of maintenance visits

Water entering the planted area should be detained and allowed to infiltrate into the soil; grade soil as a swale or depress the soil level below the inlet/outlet structures

Use gravel berms or concrete weirs to divide the planting bed and increase water detention and infiltration. This treatment also allows for greater manipulation of grades on steeper slopes while helping to concentrate litter that flows into the system

Overflow must be allowed to flow to an existing catch basin; consider the use of graded outlet structures or overflow drains to direct excess water from larger storms into the sewer system

Plants

See Stormwater Management Practices Planting Recommendations (Table 6F)

DEP ROW Bioswale

The most common type of Stormwater Management Practice, a DEP ROW Bioswale is a planted area located along the curb of a sidewalk, graded to capture stormwater, and planted with an understory of shrubs and herbaceous material. Curb cuts allow for stormwater from the adjacent roadway to enter the planted area and overflow to exit. DEP, together with DOT, DPR, and DDC, developed designs and protocols to site stormwater bioswales within the public ROW. The city will build and maintain DEP ROW BIOSWALES within DEP Priority CSO Tributary Areas, which are areas where CSO volumes are high, combined sewers frequently overflow, and the receiving water bodies need water quality improvements. See DEP Priority CSO Tributary Areas map.

Benefits

See benefits of STORMWATER MANAGEMENT PRACTICES (6.6.1)

Reduced stormwater flows and fewer CSO events in DEP Priority CSO Tributary Areas

Application

DEP Priority CSO Tributary Areas; see DEP Priority CSO Tributary Areas Map

Outside DEP designated areas with a maintenance agreement

Considerations

See considerations for STORMWATER MANAGEMENT PRACTICES (6.6.1)

See considerations for TREE BEDS (6.1.1)

Consider parking regulations; curbside access must be preserved

Consider subsurface conditions

The underlying soils should have adequate infiltration rates

Bedrock or groundwater level should be a minimum of 4 feet from the bottom of any DEP ROW Bioswale

Plants should tolerate salts, sediment, contamination, and highly variable levels of water

DEP, per the three party agreement, will install DEP ROW BIOSWALES within Priority CSO Tributary Areas

DEP ROW BIOSWALES may be installed outside of DEP priority areas but will require a maintenance agreement

Design

DEP ROW BIOSWALES should follow all DEP, DPR, and DOT bioswale siting criteria

Maintain an 8-foot clear path in areas of high-volume pedestrian traffic or heavy curbside activity and a 5-foot clear path in areas of low-volume pedestrian traffic

Install just upstream from existing catch basins to optimize stormwater capture prior to entering the combined sewer system

Soil and design specifications must adhere to DEP standards

Deviations from the latest DEP Standards for Green Infrastructure must be reviewed and approved by DOT, DPR, and DEP on a case-by-case basis

Use of 12 inches of open-graded stone located along the curb serves as a buffer from the roadway and increases infiltration and sediment capture

Typical DEP ROW Bioswale with tree: 62nd Drive and Junction Boulevard, Queens (Credit: DEP)

Stormwater entering DEP ROW Bioswale through inlet and overflow exiting from outlet: Dean Street and 4th Avenue, Brooklyn (Credit: DEP)

Curb cuts at both ends serve as an inlet and outlet for runoff, which slope from flush to the standard 6 – 7-inch reveal; other DEP-approved inlet/outlet structures may be employed based on slopes and runoff velocity

Concrete aprons outside the inlet and outlet direct runoff into and out of the bioswale

An approved DPR tree-bed guard is required to discourage foot traffic. The curb side should be open and fencing set back 18 inches from the curb to allow for people exiting from vehicles

Overflow must be allowed to flow to an existing catch basin; consider the use of graded outlet structures or overflow drains to direct excess water from larger storms into the sewer system

Plants

See Planting Recommendations (Table 6F)

Stormwater Greenstreet

Another common Stormwater Managment Practice, a Stormwater Greenstreet is a planted area within the sidewalk or roadway, which extends beyond the standard street geometry, and collects and treats stormwater runoff. DEP ROW Stormwater Greenstreets and DPR Stormwater Greenstreets are typically larger stormwater management practices installed and maintained by DEP, DPR, or another committed maintenance partner. They can be located anywhere in the city as conditions allow. For examples, visit DEP's webpage on Green Infrastructure.

Benefits

See benefits for STORMWATER MANAGEMENT PRACTICES (6.6.1)

Permit greater water capture than what is typical for a DEP ROW BIOSWALE (6.6.1a) due to generally larger installations

Non-standard geometry (i.e., curb extension) enables the greenstreet to capture water and reduce runoff bypass by allowing water to enter directly while also providing the safety benefits typical of a CURB EXTENSION (2.2.2)

Considerations

See considerations for STORMWATER MANAGEMENT PRACTICES (6.6.1)

Avoid in areas of high foot traffic or curbside activity, including pedestrian desire lines that may be impacted

Within DEP priority areas, the city will construct and maintain STORMWATER GREENSTREETS. Outside of these areas, a maintenance agreement is required

Check dams can separate different levels of a planting area to allow for greater control of slopes and to increase detention: Westbourne Avenue at Bay 25th Street, Queens (Credit: DPR)

DPR has installed treatments of various sizes and shapes throughout the city: Westbourne Avenue at Bay 25th Street, Queens (Credit: DPR)

Water can be collected in a forebay, such as the triangular area shown on the right. This allows sediment and debris to settle before the water continues to the planting area: Westbourne Avenue at Bay 25th Street, Queens (Credit: DPR)

Application

See application guidance for STORMWATER MANAGEMENT PRACTICES (6.6.1)

Design

See design guidance for STORMWATER MANAGEMENT PRACTICES (6.6.1)

Overall dimension will be determined based on the catchment area, and geometries must be approved by DOT; generally, installations follow striped roadbed area or underused roadway width

Catch basins should be located on the downstream side of the overflow or outlet

Plants

See Planting Recommendations (Table 6F)

TABLE 6F

Stormwater Management Practices Planting Recommendations

The following plants have been successfully employed in areas that capture and treat stormwater runoff in New York City. In particular, species listed below can tolerate salts and wide fluctuations in soil moisture. This list is not comprehensive, and there is no guarantee that these plants will survive at a specific site. All plants within the public ROW must be selected based on site-specific conditions and approved by DPR.

Trees

Scientific Name 'Cultivar' Trade Name Common Name	Appearance								Tolerances				
	Height	Shape	Characteristics						Drought-Flood		Light	Salt	High pH
Taxodium distichum 'Shawnee Brave' Shawnee Brave Baldcypress	>40'				✓	✓	✓		✓	✓	☀	◆	–
Gleditsia triacanthos var inermis 'Shademaster' Shademaster Honeylocust						✓			✓	✓	☀	◆	◆
Quercus bicolor * Swamp White Oak						✓			✓	✓	☀▶☀	◆	–
Liquidambar styraciflua * American Sweetgum					✓	✓	✓		✓	✓	☀	◆	–

Shrubs

		Spread											
Aronia melanocarpa Black Chokeberry	3'-6'	3'-6'	MAY	●		✓			✓	✓	☀	◆	◆
Ilex glabra 'Compacta' Compact Inkberry Holly	3'-6'	3'-6'		●				▲		✓	☀▶☀	◆	–
Itea virginica 'Sprich' Little Henry™ Little Henry Sweetspire	3'-5'	3'-5'	JUN			✓				✓	☀▶●	◆	–
Cornus sericea 'Kelseyi' Kelseyi Red Twig Dogwood	2'-3'	2'-3'	JUN	●			✓			✓	☀▶☀	◆	◆

Perennials

Aster 'Wood's Pink' Hardy Aster	1'-1.5'	1.5'-2.5'	AUG SEP							✓	☀▶☀	◆	◆
Echinacea purpurea Coneflower	2'-3'	2'-3'	JUN AUG	●					✓	✓	☀	◆	◆
Epimedium grandiflorum 'Lilafee' Bishop's Hat	1'	1'-1.5'	MAY		✓	✓		▲	✓		☀▶●	◆	◆
Eupatorium dubium 'Baby Joe' Baby Joe Pye Weed	1'-1.5'	1'-1.5'	JUL SEP	●				▲	✓	✓	●▶●	◆	◆
Hemerocallis (Dwarf Varieties) Daylilly	1'-1.5'	1'-1.5'								✓	☀▶☀	◆	◆
Liriope spicata Creeping Lilyturf	1'-2'	1'-2'	AUG SEP		✓			▲	✓	✓	☀▶●	◆	◆
Rudbeckia fulgida Black Eyed Susan	2'-2.5'	2'-2.5'	JUN OCT	●					✓	✓	☀	◆	◆
Solidago (Dwarf Varieties) Goldenrod	1.5'-2'	1.5'-2'	AUG SEP	●					✓	✓	☀	◆	◆

Grasses/Grass-like Plants

Carex morrowii Sedge	1'-1.5'	1.5'-2'	APR JUL	●	✓			▲	✓	✓	●▶●	◆	◆
Carex pennsylvanica Pennsylvania Sedge	.5'-1'	.5'-1'			✓			▲	✓	✓	●▶●	◆	◆
Hakonechloa macra Golden Japanese Forest Grass	2'-2.5'	3'-4'			✓	✓			✓	✓	●▶●	◆	◆
Juncus effusus Common Rush	2'-4'	2'-4'	JUN AUG		✓					✓	☀	◆	◆
Panicum virgatum Switchgrass	3'-6'	2'-3'	JUL FEB	●	✓	✓			✓	✓	☀▶☀	◆	◆

* Fall Dig Hazard ^ ALB Host Species ● Bloom/Showy Flowers ● Showy Fruit ✓ Distinct Foliage ✓ Fall Color ▲ Distinctive Bark ▲ Evergreen

Glossary

Common Terms

A

AASHTO (American Association of State Highway Transportation Officials)
A nonprofit, nonpartisan association representing highway and transportation departments in the fifty states, the District of Columbia, and Puerto Rico, representing all five transportation modes—air, highways, public transportation, rail, and water. AASHTO publishes numerous design guidance publications, including *A Policy on Geometric Design of Highways and Streets* ("Green Book"). www.transportation.org/?siteid=37&pageid=310

Accessibility
The design of facilities and public Rights-of-Way that is easy, safe, and intuitive to use for people with disabilities. Accessible environments provide for a person's ability to independently navigate the space.

ADA (Americans with Disabilities Act)
The Americans with Disabilities Act gives civil rights protections to individuals with disabilities, similar to those rights provided to individuals on the basis of race, color, sex, national origin, age, and religion. It guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, state and local government services, and telecommunications. www.ada.gov

ADT (Average Daily Traffic)
The average number of vehicles to pass a certain point or use a certain roadway per day. Sometimes referred to as VPD (Vehicles Per Day), this is the calculation of the total traffic volume during a given time (in whole days) divided by the number of days in that period. (AASHTO: *A Policy on Geometric Design of Highways and Streets*)

Albedo (Pavement Albedo)
Albedo is the ability of a surface material to reflect incident solar (short wave) radiation. It is expressed on a scale of 0 to 1, where a value of 0.0 indicates that a surface absorbs all solar radiation and an albedo value of 1.0 represents total reflectivity. Light-colored surfaces generally have higher albedos than dark-colored surfaces. Pavements with lower albedo absorb more sunlight and get hotter. Pavements with higher albedo absorb less sunlight and are therefore cooler, mitigating the urban heat island effect www.epa.gov/heatisland/resources/faq.html#7. Conventional asphalt has an albedo in the range 0.04 to 0.12, while concrete has an albedo of around 0.5. (*High Performance Infrastructure Guidelines*) Reflectance is also measured using Solar Reflectance Index (SRI) values.

Arterial Street
The part of the roadway system serving as the principal network of through-traffic flow. The routes connect areas of principal traffic generation and important rural highways entering the cities. (*Institute of Traffic Engineers Traffic Engineering Handbook*)

B

Bicycle
Every two- or three-wheeled device upon which a person or persons may ride, propelled by human power through a belt, a chain, or gears, with such wheels in a tandem or tricycle, except that it shall not include such a device having solid tires and intended for use only on a sidewalk by pre-teenage children. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 102 and Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Bicycle Facilities
A general term denoting improvements and provisions made by public agencies to accommodate or encourage bicycling, including parking and storage facilities, and shared roadways not specifically designated for bicycle use. (AASHTO: *A Policy on Geometric Design of Highways and Streets*)

Bicycle Lane/Bike Lane
A portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicycles. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 102-a)

Bicycle Path/Bike Path
A path physically separated from motorized vehicle traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way and which is intended for the use of bicycles. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 102-b)

Bicycle Route/Bike Route
A bikeway designated by the jurisdiction having authority with appropriate directional and informational route markers, with or without specific bicycle route numbers. Bike routes should establish a continuous routing, but may be a combination of any and all types of bikeways. (AASHTO: *Guide for the Development of Bicycle Facilities*) In New York City, bike routes are set forth in the New York City Cycling Map and come in three main categories: Bicycle Path, Class 1 (bridge, park, or separated on-street path); Bicycle Lane, Class 2 (on-street striped route); and Bicycle Route, Class 3 (on-street signed route).

BID (Business Improvement District)
A not-for-profit corporation made up of property owners and commercial tenants who are dedicated to promoting business development and improving an area's quality of life. BIDs deliver supplemental services such as sanitation and maintenance, public safety and visitor services, marketing and promotional programs, capital improvements, and beautification for the area—all funded by a special assessment paid by property owners within the district. **www.ci.nyc.ny.us/html/sbs/html/neighborhood/bid.shtml**

Bikeway
A generic term for any road, street, path, or way which in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes. (AASHTO: *Guide for the Development of Bicycle Facilities*)

Bioswale
A depressed, planted area designed to convey, capture, and filter stormwater runoff and increase rainwater infiltration. These systems are linear. The term "street swale" is used throughout this Manual. (*Florida Field Guide to Low Impact Development*: **buildgreen.ufl.edu/Fact_sheet_Bioswales_Vegetated_Swales.pdf**)

BMP (Best Management Practices)
Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage, or leaks, sludge or waste disposal, or drainage from raw material storage. **www.epa.gov/npdes/pubs/cgp_appendixa.pdf**

BRT (Bus Rapid Transit)
A flexible, high-performance rapid transit mode that combines a variety of physical, operating, and system elements into a permanently integrated system with a quality image and unique identity. (Levinson et al., *Bus Rapid Transit: Implementation Guidelines, TCRP Report 90-Volume II*)

BRT (Bus Rapid Transit) Route
A road designed to improve the speed, reliability, and overall attractiveness of bus service, and that carries bus lines designated as "Select Bus Service" by MTA NYCT/MTA Bus and/or other services identified as BRT. This also includes roads that are designated for BRT service in the future, through the BRT Master Plan or other planning documents.

C

BUG (Backlight, Uplight, Glare) Rating
The BUG rating system, describes the types of stray light escaping from an outdoor lighting luminaire. The BUG system was developed by the Illuminating Engineering Society (IES) to make comparing and evaluating outdoor luminaires fast, easy and more complete than older systems www.aal.net/content/resources/files/BUG_rating.pdf

Bus
Every motor vehicle having a seating capacity of more than fifteen adults, in addition to the operator, and used for the transportation of persons, and every charter bus, interstate bus, intrastate bus, school bus, and sight-seeing bus, regardless of seating capacity. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Bus Route
A street that carries one or more regularly scheduled local, commuter, or intercity bus lines running on a published schedule.

Busway
A physically separated lane reserved for bus traffic.

Capital Project
A. A project that provides for the construction, reconstruction, acquisition, or installation of a physical public betterment or improvement that would be classified as a capital asset under generally accepted accounting principles for municipalities, or any preliminary studies and surveys relative thereto, or any underwriting or other costs incurred in connection with the financing thereof;
B. The acquisition of property of a permanent nature, including wharf property;
C. The acquisition of any furnishings, machinery, apparatus, or equipment for any public betterment or improvement when such betterment or improvement is first constructed or acquired;
D. Any public betterment involving either a physical improvement or the acquisition of real property for a physical improvement consisting in, including, or affecting (1) streets and parks, (2) bridges and tunnels, (3) receiving basins, inlets, and sewers, including intercepting sewers, plants or structures for the treatment, disposal or filtration of sewage, including grit chambers, sewer tunnels, and all necessary accessories thereof, or (4) the fencing of vacant lots and the filling of sunken lots;
E. Any other project allowed to be financed by the local finance law, with the approval of the mayor and the comptroller;
F. Any combination of the above. (New York City Charter Section 210.1)

Cast-in-Place
Term describing a paving material, such as concrete, that is poured into place on-site and set to harden

CEQR (City Environmental Quality Review)
A process by which agencies of the City of New York review proposed discretionary actions to identify the effects those actions may have on the environment. CEQR is New York City's process for implementing SEQRA (New York State Environmental Quality Review Act), which requires that state and local governmental agencies assess environmental effects of discretionary actions before undertaking, funding, or approving such actions, unless they fall within certain statutory or regulatory exemptions from the requirements for review. www.nyc.gov/html/oec/html/ceqr/ceqrfaq.shtml

Channelization
The separation or regulation of conflicting traffic movements into definite paths of travel by traffic islands or pavement marking to facilitate the orderly movements of both vehicles and pedestrians. (AASHTO: *A Policy on Geometric Design of Highways and Streets*)

Clear Path
A straight unobstructed path for pedestrian circulation on the sidewalk. (Rules of the City of New York, Title 34, Chapter 7, Section 7-06(c)(3)). (See also definition of clear path in DCA's rules and in the ADA.)

Coefficient of Friction
A value between 0 and 1 representing the ratio of the force of resistance between the horizontal motion of a body or object and a surface to the force pushing the body or object down on that surface. Surfaces with lower values, such as ice, are more slippery, while surfaces with higher values, such as concrete, are less slippery.

Collector Street
The collector street system provides both land access and traffic circulation within residential, commercial, and industrial areas. It differs from the arterial system in that facilities on the collector system may penetrate residential neighborhoods, distributing trips from the arterials through the area to the ultimate destination. Conversely, the collector street also collects traffic from local streets in residential neighborhoods and channels it into the arterial system. In the central business district, and in other areas of like development and traffic density, the collector system may include the street grid, which forms a logical entity for traffic circulation. (FHWA: *Functional Classification Guidelines*)

Commercial District
A commercial district, designated by the letter C (C1-2, C3, C4-7, for example), is a zoning district in which commercial uses are allowed and residential uses may also be permitted, as described in the Zoning Resolution of the City of New York. www.nyc.gov/html/dcp/html/subcats/zoning.shtml

Community Facilities
As used in this manual, community facilities are elements of the streetscape that serve useful functions to street users beyond infrastructure and vehicular operations. Examples include street furniture (e.g., bike racks and newsstands), public and café seating, public art, and plantings. Their use is generally authorized through permits, revocable consents, and/or maintenance agreements.

Concession
A grant made by an agency for the private use of city-owned property for which the city receives compensation other than in the form of a fee to cover administrative costs, except that concessions shall not include franchises, revocable consents, and leases. (NYC Charter, Section 362(a); Rules of the City of New York, Title 12)

Controlled-Access Highway
Every highway, street, or roadway in respect to which owners or occupants of abutting lands and other persons have no legal right of access to or from the same except at such points only and in such manner as may be determined by the public authority having jurisdiction over such highway, street, or roadway. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 109)

Crosswalk
A. That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway between the curbs or, in the absence of curbs, between the edges of the traversable roadway; **B.** Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 110)

CSO (Combined Sewer Overflow)
A discharge of excess wastewater from a combined sewer system (sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe) directly into nearby streams, rivers, or other water bodies during periods of heavy rainfall or snowmelt when the wastewater volume exceeds the capacity of the sewer system or treatment plant. cfpub.epa.gov/npdes/home.cfm?program_id=5

Cut-Through Traffic
Traffic using minor roadways, usually residential streets, as shortcuts to avoid congestion on major streets. (*U.S. Traffic Calming Manual, American Planning Association, 2009*)

Curb
A vertical or sloping member along the edge of a roadway clearly defining the pavement edge. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 111)

D

Design Speed
A selected speed used to determine the various geometric design features of the roadway. The assumed design speed should be a logical one with respect to the topography, anticipated operating speed, the adjacent land use, and the functional classification of highway. (AASHTO: *A Policy on Geometric Design of Highways and Streets*)

Design Vehicle
Selected vehicles, with representative weight, dimensions, and operating characteristics, which are used to establish highway design controls for accommodating vehicles of designated classes. (AASHTO: *A Policy on Geometric Design of Highways and Streets*)

Driver
Every person who operates or drives or is in actual physical control of a vehicle. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 113)

Driveway
Every entrance or exit authorized pursuant to applicable law and used by vehicular traffic to or from lands or buildings abutting a highway. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

E

Engineered Soil
A soil designed to achieve specific infiltration standards in a stormwater-capture installation.

F

Flag (sidewalk)
A flat slab of stone used as a paving material. (*American Heritage Dictionary of the English Language*, Fourth Edition)

Franchise
A grant by an agency of a right to occupy or use the inalienable property of the city (usually, streets or sidewalks) to provide a public service. (NYC Charter, Section 362(b))

Friction Coefficient
See "Coefficient of Friction"

Furnishing Zone
A multi-purpose area of the roadside. It serves as a buffer between the pedestrian travel way and the vehicular area of the thoroughfare within the curbs, and it provides space for roadside appurtenances such as street trees, planting strips, street furniture, utility poles, sidewalk cafés, sign poles, signal and electrical cabinets, phone booths, fire hydrants, bicycle racks, and bus stop shelters. (Institute of Transportation Engineers, *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities: An ITE Proposed Recommended Practice*)

G

Gateway
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.

Green Book
See *A Policy on Geometric Design of Highways and Streets*.

Green Infrastructure
An adaptable term used to describe an array of products, technologies, and practices that use natural systems—or engineered systems that mimic natural processes—to enhance overall environmental quality and provide utility services. As a general principal, green infrastructure techniques use soils and vegetation to infiltrate, evapotranspirate, and/or detain stormwater runoff. When used as components of a stormwater management system, green infrastructure practices such as green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition, to effectively retain and infiltrate rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits. water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm

Greenstreet
Paved traffic islands and medians converted into green spaces filled with shade trees, flowering trees, shrubs, and/or groundcover, pursuant to a program established in 1996 and as further referred to in a Master Agreement between DOT and DPR. Many of these installations are designed to capture street and sidewalk runoff to allow for stormwater infiltration, and are referred to as Stormwater Greenstreets. Both DPR and DEP currently construct Stormwater Greenstreets.

H

Highway
The entire width between the boundary lines of every way publicly maintained when any part thereof is open to the use of the public for purposes of vehicular travel. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 118)

High Water Table
The highest level of the groundwater in a given area, taking into account seasonal and periodic storm event fluctuations. This level can vary throughout the boroughs, and needs to be taken into consideration when designing stormwater management practices/green infrastructure.

Historic District
Any area which (1) contains improvements that have a special character or special historical or aesthetic interest or value; and represent one or more periods or styles of architecture typical of one or more eras in the history of the city; and cause such area, by reason of such factors, to constitute a distinct section of the city; and (2) has been designated as a historic district pursuant to Title 25 of the Administration Code of the City of New York. (Administrative Code of the City of New York, Title 25, Chapter 3, Section 25-302(h))

Horizontal Deflection
The horizontal (sideways) movement of moving vehicles compelled through physical and/or visual changes to the roadway alignment, for example a bend in the road.

HPS
A type of lamp which uses sodium gas to produce light. HPS lamps are being replaced by more-efficient LED lamps throughout the city.It is one of the most efficient sources of light.

I

IESNA
The Illuminating Engineering Society of North America is a professional organization of lighting engineers with a commitment to sharing their knowledge and expertise. IESNA has established recommended guidelines regarding levels of illumination for street and pedestrian lighting.

Inclusive Design
See Universal Design.

Intersection
The area contained within the grid created by extending the curblines of two or more streets at the point at which they cross each other. (Rules of the City of New York, Title 34, Chapter 2, Section 2-01)

L

LED
A light-emitting diode converts electricity to light through the movement of electrons. It does not have a filament and is more efficient than incandescent bulbs. It consumes less energy, is more compact, and lasts longer than traditional light sources.

Limited Use Street
A legally mapped street to be temporarily closed to motor vehicles by the Department of Transportation, in accordance with lawfully authorized signs or other traffic control devices. (Rules of the City of New York, Title 34, Chapter 4, Section 4-12(r)(4))

Local Street
The local street system comprises all facilities not on one of the higher systems. It serves primarily to provide direct access to abutting land and access to the higher order systems. It offers the lowest level of mobility and usually contains no bus routes. Service to through-traffic movement usually is deliberately discouraged. (FHWA: *Functional Classification Guidelines*)

Local Traffic
Vehicular traffic whose trip origin and/or destination are in the immediate area of a given street.

LOS (Level of Service)
A methodology for measuring traffic flow based on traveler delay and congestion, defined in the *Highway Capacity Manual* (HCM). Grades from A to F are used, from free flow to traffic jam conditions. Historically used primarily for motor vehicle traffic, LOS methodologies have also been devised for pedestrian, bicyclist, and transit operations.

M

Motor Vehicle
Every vehicle operated or driven upon a public highway which is propelled by any power other than muscular power, except as otherwise provided in Section 125 of the Vehicle and Traffic Law. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

MUTCD (Manual on Uniform Traffic Control Devices)
Defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F. mutcd.fhwa.dot.gov

N

NACTO (National Association of City Transportation Officials)

NACTO is a 501(c)(3) non-profit association that represents large cities on transportation issues of local, regional and national significance, and facilitates the exchange of ideas, data, and best practices. NACTO publishes numerous design guidance publications, including *Urban Street Design Guide*. www.nacto.org/about/

O

Operating Speed

The speed at which drivers are observed operating their vehicles during free-flow conditions. The 85th percentile of the distribution of observed speeds is the most frequently used measure of the operating speed associated with a particular location or geometric feature. (AASHTO: *A Policy on Geometric Design of Highways and Streets*)

P

Park

Parking

The standing of a vehicle, whether occupied or not, otherwise than temporarily for the purpose of and while actually engaged in loading or unloading property or passengers. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Peak Hour(s)

The hour or hours of greatest vehicular traffic volumes on a given street or intersection, usually defined for weekday AM, MD (mid-day) and PM, and Saturday MD peak periods. The peak hours, rather than entire day, are typically analyzed in a traffic analysis.

Pedestrian

Any person afoot or in a wheelchair. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 130)

Plaza

An area designated for use by pedestrians, which may vary in size and shape; which may abut a sidewalk and is located fully within the bed of a roadway; may be at the same level as the roadway or raised above the level of the roadway; may be physically separated from the roadway by curbing, bollards, or other separators; may be treated with special markings and materials; and may contain benches, tables, or other facilities for pedestrian use.

A Policy on Geometric Design of Highways and Streets

Often referred to as the "Green Book," this document is published by AASHTO and contains "design practices in universal use as the standard for highway geometric design." bookstore.transportation.org/item_details.aspx?ID=109

Private Road

Every way or place in private ownership and used for vehicular travel by the owner and those having express or implied permission from the owner, but not by other persons. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 133)

Public Highway

Any highway, road, street, avenue, alley, public place, public driveway, or any other public way. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 134)

R

Rain Garden
A planted depression that captures and absorbs rainwater that would otherwise flow into a storm drain. Infiltration and evapotranspiration are the primary means for water management in these systems. (*Florida Field Guide to Low Impact Development*: buildgreen.ufl.edu/Fact_sheet_Bioretention_Basins_Rain_Gardens.pdf)

Resiliency
The ability of people, the places where they live, and our infrastructure systems—such as transportation and energy—to withstand a stress or shock event, to recover, and emerge even stronger. (One New York)

Restricted Use Street
A legally mapped street to be permanently closed to motor vehicles by the Department of Transportation, and open to use by pedestrians. (Rules of the City of New York, Title 34, Chapter 4, Section 4-12(r)(4))

Revocable Consent
A grant by the city of a right, revocable at will…to an owner of real property or, with the consent of the owner, to a tenant of real property to use adjacent inalienable property (usually, streets or sidewalks) for such purposes as may be permitted by rules of DOT or DoITT. (For full definition see NYC Charter, Section 362(c)(2); Rules of the City of New York, Title 34, Chapter 7, Section 7-01)

Right of Way
The right of one vehicle or pedestrian to proceed in a lawful manner in preference to another vehicle or pedestrian approaching under such circumstances of direction, speed, and proximity as to give rise to danger of collision unless one grants precedence to the other. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 139)

Right-of-Way
A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to transportation purposes. (AASHTO: *Guide for the Development of Bicycle Facilities*)

Road
An open way for the passage of vehicles, persons, or animals on land. (FHWA)

Roadbed
The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulder. (FHWA)

Roadway
That portion of a street designed, improved, or ordinarily used for vehicular travel, exclusive of the shoulder and slope. (Rules of the City of New York, Title 34, Chapter 2, Section 2-01)

S

Scoring (concrete)
Marking the surface of concrete for visual or textural effect. "Tooled joint" scoring refers to concrete sidewalk flag joints finished with a hand-trowelled border. "Simulated saw-cut joint" scoring refers to concrete sidewalk flag joints finished using a spacer to simulate the appearance of joints cut with a masonry saw.

Shared Use Path
A bikeway physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way. Shared use paths may also be used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users. (AASHTO: *Guide for the Development of Bicycle Facilities*)

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. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Simulated Saw-Cut Joint
See scoring (concrete)

Solar Reflectance Index (SRI)
SRI is a value that incorporates both solar reflectance and emittance in a single value to represent a material's temperature in the sun. SRI quantifies how hot a surface would get relative to standard black and standard white surfaces. It is calculated using equations based on previously measured values of solar reflectance and emittance as laid out in the American Society for Testing and Materials Standard E 1980. It is expressed as a fraction (0.0 to 1.0) or percentage (0% to 100%). (United States Environmental Protection Agency: www.epa.gov/heatisld/resources/glossary.htm)

Source Control
Action to prevent pollution where it originates. www.stormwaterauthority.org/glossary.aspx

Source Reduction
The technique of stopping and/or reducing pollutants at their point of generation so that they do not come into contact with stormwater. www.cabmphandbooks.com/Documents/Development/Section_7.pdf

Stand
Standing
The stopping of a vehicle, whether occupied or not, otherwise than temporarily for the purpose of and while actually engaged in receiving or discharging passengers. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 145 and Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Stop
Stopping
Any halting even momentarily of a vehicle, whether occupied or not. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Street

A street, avenue, road, alley, lane, highway, boulevard, concourse, parkway, driveway, culvert, sidewalk, crosswalk, boardwalk, and viaduct, and every class of public road, square and place, except marginal streets. (New York City Charter Section 210.7)

Street Tree
A tree growing in the public right-of-way. These trees provide a range of benefits, from increased property values to stormwater capture and urban heat island mitigation. www.nycgovparks.org/sub_your_park/trees_greenstreets/faq.html

Supplementary Cementitious Materials (SCM)
Industrial by-products such as coal fly ash, granulated blast furnace slag, and silica fume that are used as a partial replacement for portland cement in concrete. (Green In Practice 107—Supplementary Cementitious Materials, Portland Cement Association). SCM's are pre-consumer recycled materials that would otherwise have been disposed of in landfills, providing cost savings to concrete manufacturers and reducing environmental impact caused by averting disposal. (*High Performance Infrastructure Guidelines*).

Swale
See Bioswale

T

Target Speed
The speed at which vehicles should operate on a thoroughfare in a specific context, consistent with the level of multimodal activity generated by adjacent land uses, to provide both mobility for motor vehicles and a safe environment for pedestrians and bicyclists. The target speed is usually the posted speed limit. (ITE *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*)

Through Traffic
Vehicular traffic whose trip origin and destination are not in the immediate area of a given street.

Traffic
Pedestrians, ridden or herded animals, vehicles, bicycles, and other conveyances either singly or together while using any highway for purposes of travel. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 152)

Tooled Joint
See Scoring (concrete)

Traffic Calming
The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users. As opposed to traffic control devices that are regulatory and require enforcement, traffic calming measures are intended to be self-enforcing. (ITE: *Traffic Calming: State of the Practice*, 1999)

Traffic Control Device
All signs, signals, markings, and devices placed or erected by authority of a public body or official having jurisdiction for the purpose of regulating, warning or guiding traffic. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 153)

Transitway
Any roadway or series of roadways designated for the exclusive use of buses or taxis or such other designated high occupancy vehicles as may be permitted, during certain hours of the day, with access to such roadway(s) limited to one block thereof to other vehicles for the purpose of delivery of goods or services or the picking up or dropping off of passengers. (Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

Truck
Except as otherwise specified in the Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b), a truck is defined as any vehicle or combination of vehicles designed for the transportation of property, which has either of the following characteristics two axles, and six tires; or three or more axles. (Rules of the City of New York, Title 34, Chapter 4, Section 4-13(a))

U

Unit Paver
Paving materials that are precast, such as hexagonal asphalt pavers, or individually hewn, such as granite blocks, such that each paver is a single unit that can be removed or replaced.

Universal Design
The process of creating convenient, safe, and accessible spaces for everyone. Accessibility is a critical component of universal design. Also referred to as "Inclusive Design."

Urban Heat Island
Many urban and suburban areas experience elevated temperatures compared to their outlying rural surroundings; this difference in temperature is what constitutes an urban heat island. The annual mean air temperature of a city with one million or more people can be 1.8 to 5.4 degrees F (1 to 3 degrees C) warmer than its surroundings, and on a clear, calm night, this temperature difference can be as much as 22 degrees F (12 degrees C). Even smaller cities and towns will produce heat islands, though the effect often decreases as city size decreases. (US EPA: *Reducing Urban Heat Islands: Compendium of Strategies*)

V

Vehicle
Every device in, upon, or by which any person or property is or may be transported or drawn upon a highway, except devices moved by human power or used exclusively upon stationary rails or tracks. (New York State Vehicle and Traffic Law, Title 1, Article 1, Section 159 and Rules of the City of New York, Title 34, Chapter 4, Section 4-01(b))

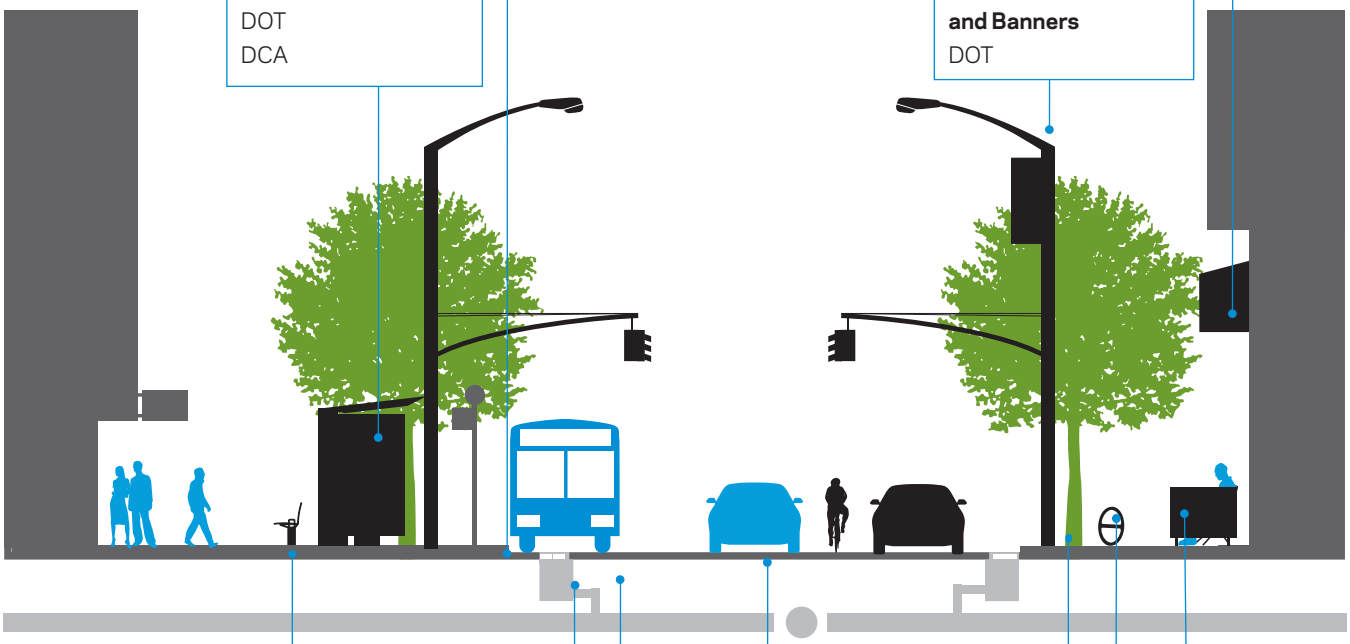
Vertical Deflection
The vertical (upward) displacement of moving vehicles by way of a raising of the roadbed surface, for example with a hump, table, or other raised element.

Appendices

Agency Roles on the City's Streets

This diagram summarizes the roles and responsibilities of city agencies and other entities related to the most visible aspects of the city's streets. It does not include all agencies with street-related roles and is not intended to be a literal representation of appropriate street furniture locations.

An expanded listing follows.



Permits for Construction on Sidewalk or in Roadway
DOT

Coordinated Street Furniture Franchise
DOT
DCA

Façades, Marquees, Awnings, Canopies, and Signage
DOB
DOT

Street Lighting, Traffic Controls, and Banners
DOT

Sidewalk Maintenance and Repair
Property Owners

Sidewalk Permits, Revocable Consents, Vaults, Curb Cuts, Cellar Doors, and Sidewalk Sheds
DOB
DOT

CityBench
DOT

Drainage, Sewers, and Catch Basins
DEP

Roadway Repairs
DOT

Utilities
Utility Companies

Street Tree Permits and Design Standards
DPR

Greenstreets
DPR
DOT

Stormwater Management Practices
DEP
DPR
DOT

Sidewalk Cafés
DCA

CityRack
DOT

The following are agencies, authorities, and other organizations that are frequently involved in the design of streets in New York City. This list is provided as a reference tool, for informational purposes only, and is not an exhaustive list.

Street Planning, Design & Construction

Street Capital Projects

DOT
(initiation, scoping, conceptual design) WDEP
(initiation, scoping) www.nyc.gov/dep

EDC
(initiation, scoping, conceptual design, final design, agency alignment & construction)
www.nycedc.com

DDC
(conceptual design, final design, agency alignment & construction)
www.nyc.gov/ddc

DPR
(parks, greenstreets)
www.nyc.gov/parks

NYS DOT
(state highways within New York City)
www.nysdot.gov

Other city, state, and federal agencies and authorities for individual, typically site-specific projects

Comprehensive Street Planning

DOT
(for most public streets)
www.nyc.gov/dot

DCP
(zoning, private streets, transportation studies)
www.nyc.gov/dcp

NYS DOT
(for state and federal routes)
www.nysdot.gov

Design of Stormwater Best Management Practices/ Source Controls

DDC www.nyc.gov/ddc

DEP www.nyc.gov/dep

DPR www.nyc.gov/parks

DOT www.nyc.gov/dot

Greenstreets

DPR www.nyc.gov/parks

DOT www.nyc.gov/dot

Land Acquisition

DCAS www.nyc.gov/dcas

DDC www.nyc.gov/ddc

SBS www.nyc.gov/sbs

Law Department
www.nyc.gov/law

DCP (ULURP) www.nyc.gov/dcp

Non-Capital Street Projects

DOT (design and implementation)
www.nyc.gov/dot

Universal Design

MOPD (Mayor's Office for People with Disabilities) www.nyc.gov/html/mopd/

Street Tree & Tree- Bed Design Standards

DPR www.nyc.gov/parks

Reviews, Approvals & Permits

Coastal Erosion Permits

NYS DEC www.dec.ny.gov

Construction on Sidewalk or in Roadway, Permits

DOT www.nyc.gov/dot

Curb Cut, Existing Cellar Door, Marquee & Awning Permits

DOB www.nyc.gov/html/dob

Environmental Review (CEQR/SEQRA/NEPA)

Lead agency and involved agencies vary by project

Emergency Vehicle Access Review

FDNY www.nyc.gov/fdny

Historic District Review

LPC www.nyc.gov/landmarks

Light Pole Banner Permits

DOT www.nyc.gov/dot

Newsracks

DOT www.nyc.gov/dot

Review of Works of Art and Structures (as defined in Chapter 37, Section 854 of the NYC Charter)

PDC www.nyc.gov/html/artcom

Revocable Consents

DOT www.nyc.gov/dot

DCA
(sidewalk cafés)
www.nyc.gov/consumers

DoITT
(telecommunications)
www.nyc.gov/doitt

Sewers, Catch Basins & Drainage Approval

DEP
www.nyc.gov/dep

Sidewalk Shed Permits

DOB
www.nyc.gov/html/dob

Sidewalk Work Permits

DOB
(Builder's Pavement Plan)
www.nyc.gov/html/dob

DOT
www.nyc.gov/dot

Special Event/Street Fair Permits

CECM www.nyc.gov/html/cecm/

NYPD www.nyc.gov/nypd

Street Tree Permits (including Tree Guards)

DPR
www.nyc.gov/parks

Street Vendor Permits

DCA
www.nyc.gov/consumers

DOHMH
www.nyc.gov/health

Vaults & Canopies: Permits

DOT
www.nyc.gov/dot

Water Quality Permits/Approvals

NYS DEC
www.dec.ny.gov

DEP
www.nyc.gov/dep

Wetlands Permits

United States Army Corps of Engineers www.usace.army.mil

NYS DEC
www.dec.ny.gov

Operation & Maintenance

Coordinated Street Furniture Franchise (bus stop shelters, newsstands, automatic public toilets, bike shelters)

DOT
www.nyc.gov/dot

DCA
www.nyc.gov/consumers

Greenstreets Maintenance

DPR
www.nyc.gov/parks

Roadway Maintenance and Repair

DOT
www.nyc.gov/dot

Roadway & Retaining Wall Inspection

DOT
www.nyc.gov/dot

DDC
www.nyc.gov/ddc

Sidewalk Maintenance and Repair

Property Owners

DOT
(in certain zoning districts or through prior notice) www.nyc.gov/dot

Street Cleaning, Snow Removal & Litter Removal

DSNY
www.nyc.gov/sanitation

DOT
www.nyc.gov/dot

DPR
www.nyc.gov/parks

BIDs
(Business Improvement Districts)
www.nyc.gov/html/sbs/html/neighborhood/bid.shtml

Street Operations (Street Lighting, Traffic Controls, etc.)

DOT
www.nyc.gov/dot

Supplementary Maintenance & Services, Street Furniture

SBS
www.nyc.gov/html/sbs

BIDs
(Business Improvement Districts)
www.nyc.gov/html/sbs/html/neighborhood/bid.shtml

Tree-Bed Maintenance

DPR
(first two years from planting)
www.nyc.gov/parks

Property owners
(after two years from planting)

Transit (Bus) Operations

MTA NYCT
www.mta.info/nyct

Utilities

DEP
www.nyc.gov/dep

Private Utilities

Empire City Subway
www.empirecitysubway.com

Enforcement

Enforcement of Construction Permits

DOT
www.nyc.gov/dot

Enforcement of Traffic Rules (including parking regulations)

NYPD
www.nyc.gov/nypd

Stoop Line Enforcement

DCA
www.nyc.gov/consumers

Legal & Design Guidance References

The following are laws, rules, regulations, and design guidance documents that may be relevant to the design of streets. This list is provided as a reference tool, for informational purposes only, and is not an exhaustive list. All public and private actions must comply with all applicable laws, rules, and regulations, not solely those listed below.

Federal Laws and Regulations

Code of Federal Regulations (CFR)
www.gpoaccess.gov/cfr/

Manual on Uniform Traffic Control Devices (MUTCD)
www.mutcd.fhwa.dot.gov/

United States Code (USC)
uscode.house.gov

Americans with Disabilities Act (ADA)
www.ada.gov/regs2010/2010ADA Standards/2010ADStandards_prt.pdf

Clean Air Act (CAA)
www.epa.gov/air/caa/

Clean Water Act (CWA)
www.epa.gov/oecaagct/lcwa.html

National Environmental Policy Act (NEPA)
www.epa.gov/Compliance/nepa/

State Laws and Regulations

New York State Code of Rules and Regulations
www.dos.state.ny.us/info/nycrr.htm

New York State Department of Environmental Conservation (Title 6)
www.dos.state.ny.us/info/nycrr.htm
New York State Environmental Quality Review Act (SEQRA)
www.dec.ny.gov/public/357.html

New York State Department of Transportation (Title 17)
www.dos.state.ny.us/info/nycrr.htm

New York State Environmental Conservation Law (ECL)
public.leginfo.state.ny.us/

New York State Highway Law
public.leginfo.state.ny.us/

New York State Transportation Law
public.leginfo.state.ny.us/

New York State Vehicle and Traffic Law (VTL)
public.leginfo.state.ny.us/

Local Laws and Regulations

New York City Charter (2004)
(www.nyc.gov/html/charter/)

City Planning (Chapter 8)

Department of Buildings (Chapter 26)

Department of Citywide Administrative Services (Chapter 35)

Department of Consumer Affairs (Chapter 64)

Department of Design and Construction (Chapter 55)

Department of Environmental Protection (Chapter 57)

Department of Health (Chapter 22)

Department of Parks and Recreation (Chapter 21)

Department of Sanitation (Chapter 31)

Department of Small Business Services (Chapter 56)

Department of Transportation (Chapter 71)

Fire Department (Chapter 19)

Franchises, Revocable Consents, and Concessions (Chapter 14)

Landmarks Preservation Commission (Chapter 74)

Police Department (Chapter 18)

Public Design Commission/Art Commission (Chapter 37)

Administrative Code of the City of New York
24.97.137.100/nyc/AdCode/entered.htm

Budget; Capital Projects (Title 5)
NYC Traffic Rules

Construction and Maintenance (Title 27)

Consumer Affairs (Title 20)

Contracts, Purchases and Franchises (Title 6)

Environmental Protection and Utilities (Title 24)

Local Laws and Regulations (cont.)

Fire Prevention and Control (Title 15)

Health (Title 17)

Housing and Buildings (Title 26)

Land Use (Title 25)

Parks (Title18)

Police (Title 14)

Sanitation (Title 16)

Transportation (Title 19)

Rules of the City of New York 24.97.137.100/nyc/rcny/entered.htm

City Planning (Title 62)

Community Assistance Unit (Tile 50)

Department of Buildings (Title 1)

Department of Citywide Administrative Services (Title 55)

Department of Environmental Protection (Title 15)
Rules Governing the Construction of Private Sewers
Rules Governing the Use of the Water Supply

Department of Consumer Affairs (Title 6)

Department of Health (Title 24)

Department of Parks and Recreation (Title 56)

Department of Sanitation (Title 16)

Department of Small Business Services (Title 66)

Department of Transportation (Title 34)
NYC Traffic Rules (Chapter 4)
NYC Highway Rules (Chapter 2)
Revocable Consents (Chapter 7)

Fire Department (Title 3)

Franchise and Concession Review Committee (Title 12)

Landmarks Preservation Commission (Title 63)

Police Department (Title 38)

Public Design Commission/Art Commission (Title 57)

Zoning Resolution of the City of New York www.nyc.gov/html/dcp/html/subcats/zoning.shtml

City Environmental Quality Review www.nyc.gov/html/oec/html/ceqr/ceqr.shtml

CEQR Technical Manual www.nyc.gov/html/oec/html/ceqr/ceqrpub.shtml

New York City Charter (Chapter 8)

Rules of the City of New York (Title 43 and 62)

National Design Guidance Sources

American Association of State Highway and Transportation officials (AASHTO) www.transportation.org/

A Policy on Geometric Design of Highways and Streets, 6th edition (AASHTO: 2011; www.bookstore.transportation.org/

A Guide for Achieving Flexibility in Highway Design (AASHTO: 2004; bookstore.transportation.org/

Guide for the Planning, Design, and Operation of Pedestrian Facilities (AASHTO: 2004; bookstore.transportation.org/

Guide for the Development of Bicycle Facilities, 4th edition (AASHTO: 2012; bookstore.transportation.org/

American Planning Association (APA)

U.S. Traffic Calming Manual (American Planning Association & American Society of Civil Engineers: 2009)

Federal Highway Administration (FHWA) www.fhwa.dot.gov/

BIKESAFE: Bicycle Countermeasure Selection System (FHWA: 2006; www.bicyclinginfo.org/bikesafe/)

PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System (FHWA: 2004; www.walkinginfo.org/pedsafe/)

Pedestrian Facilities Users Guide (FHWA: 2002; www.trb.org/news/blurb_detail.asp?id=1545)

Designing Sidewalks and Trails for Access (FHWA: 2001; www.fhwa.dot.gov/environment/sidewalks/)

Flexibility in Highway Design (FHWA: 1997; www.fhwa.dot.gov/environment/flex/)

Public Involvement Techniques for Transportation Decision-Making (FHWA/FTA: 1996; www.fhwa.dot.gov/reports/pittd/contents.htm)

MUTCD (Manual on Uniform Traffic Control Devices) mutcd.fhwa.dot.gov/

Institute of Transportation Engineers (ITE) www.ite.org/

Urban Street Geometric Design Handbook (ITE: 2008; www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=TB-018)

National Design Guidance Sources (cont.)

Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities: An ITE Proposed Recommended Practice (ITE: 2006; www.ite.org/css/)

Traffic Calming: State of the Practice (ITE & FHWA: 1999; www.ite.org/traffic/tcstate.asp#tcsop)

The Design and Safety of Pedestrian Facilities (ITE: 1998; www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=RP-026A)

National Association of City Transportation Officials (NACTO)
www.nacto.org

Urban Street Design Guide (NACTO: 2013; www.nacto.org/publication/urban-street-design-guide/)

United States Access Board
www.access-board.gov/

Accessible Public Rights-of-Way: Planning and Designing for Alterations (US Access Board: 2007; www.access-board.gov/prowac/alterations/guide.htm)

ADA and ABA Accessibility Guidelines (US Access Board: 2004; www.access-board.gov/ada-aba/)

The Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (US Access Board: 2002; www.access-board.gov/adaag/html/adaag.htm)

Accessible Rights-of-Way: A Design Guide (US Access Board: 1999; www.access-board.gov/prowac/guide/PROWGuide.htm)

Local Design Guidance Sources

DCP
www.nyc.gov/planning

New York City Bicycle Master Plan (DCP & NYC DOT: 1997; www.nyc.gov/html/dcp/html/bike/mp.shtml)

DDC
www.nyc.gov/ddc

Active Design Guidelines: Promoting Physical Activity and Health in Design (DDC, DOHMH, DOT, DCP & OMB: 2010)

High Performance Infrastructure Guidelines: Best Practices for the Public Right-of-Way (DDC & Design Trust for Public Space: 2005)

Sustainable Urban Sites Design Manual (DDC: 2009; www.nyc.gov/html/ddc/html/desogm/reports.shtml)

DOT
www.nyc.gov/dot

Standard Highway Specifications Volume 1 (DOT: 2009; www.nyc.gov/html/dot/downloads/pdf/standard%20_highway_specs_vol%201.pdf)

Standard Highway Specifications Volume 2 (DOT: 2010; www.nyc.gov/html/ddc/downloads/pdf/pub_intra_std/_DOT/hwy_std_specs_101101_vol_2.pdf)

Standard Details of Construction (DOT: 2010; http://www.nyc.gov/html/ddc/downloads/pdf/pub_intra_std/_DOT/hwy_std_constr_details_100701.pdf)

Street Lighting Specifications and Standard Drawings (DOT: 1992; www.nyc.gov/html/dot/html/about/dotlibrary.shtml#spec)

Instructions for Filing Plans and Guidelines for the Design of Sidewalks, Curbs, Roadways and Other Infrastructure Components www.nyc.gov/html/dot/html/permits/stpermit.shtml#instructions

Specifications for Furnishing All Labor and Material Necessary and Required for the Installation, Removal or Relocation of Street Lighting Equipment in the City of New York (DOT: 1992; www.nyc.gov/html/dot/html/about/dotlibrary.shtml#spec)

Specifications for Furnishing All Labor and Material Necessary and Required for the Installation or Removal of Electrical Traffic Signal Equipment to Control Traffic in the City of New York (DOT: 1995; www.nyc.gov/html/dot/html/about/dotlibrary.shtml#spec)

School Safety Engineering Project: General Mitigation Measures Final Report (DOT: 2004; www.nyc.gov/html/dot/downloads/pdf/schoolsafetymitigation.pdf)

DPR
www.nyc.gov/parks

Tree Planting Standards (DPR: 2014; www.nycgovparks.org/pagefiles/53/Tree-Planting-Standards.pdf)

Tree Guards (DPR; www.nycgovparks.org/trees/tree-care/tree-guards)

Park Design for the 21st Century: High Performance Landscape Guidelines (DPR & the Design Trust for Public Space: 2011)

MOPD
www.nyc.gov/mopd

Inclusive Design Guidelines: New York City (MOPD, International Code Council: 2010)

Landscape Design Guidance Resources

Parks, Plants, and People: Beautifying the Urban Landscape (Lynden B. Miller: 2009)

Trees in the Urban Landscape: Site Assessment, Design, and Installation (Nina L. Bassuk and Peter J. Trowbridge: 2004)

Stormwater Source Control / Best Management Practices (BMP) Design Guidance Sources

PlaNYC Sustainable Stormwater Management Plan (NYC: 2008; **www.nyc.gov/html/planyc2030/html/stormwater/stormwater.shtml**)

State of New York Stormwater Management Design Manual (New York State Department of Environmental Conservation: 2008; **www.dec.ny.gov/chemical/29072.html**)

City of Chicago Stormwater Management Ordinance Manual (Chicago Department of Water Management: 2008)

City of Portland Stormwater Management Manual (Portland Bureau of Environmental Services: 2008; **www.portlandonline.com/bes/index.cfm?c=47952**)

City of Philadelphia Stormwater Management Guidance Manual (Philadelphia Water Department Office of Watersheds: 2008; **www.phillyriverinfo.org/Programs/SubprogramMain.aspx?Id=StormwaterManual**)

Street Planning Resources

Downtown Brooklyn Traffic Calming Study (NYC DOT: 2004; **www.nyc.gov/html/dot/html/motorist/dntnbklyntraf.shtml**)

Project Development & Design Guide (Massachusetts Highway Department: 2006; **www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about**)

San Francisco Better Streets Plan–Draft for Public Review (City and County of San Francisco: June 2008; **www.sfbetterstreets.org**)

Smart Transportation Guidebook: Planning and Designing Highways and Streets that Support Sustainable and Livable Communities (New Jersey DOT/Pennsylvania DOT: 2008; **www.smart-transportation.com/guidebook.html**)

Index

C

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

Z