Getting Started

Lighting creates safe and desirable streetscapes at night and during daytime. Lighting selection can add value and aesthetic character to neighborhoods and commercial districts.
Street lighting is an essential part of the Complete Streets network. Well-designed street lighting enhances the public realm, creates a more hospitable environment, and provides safety and security on roadways, paths, alleys, and stairways. Adequate street lighting promotes active transportation options after dark, especially during the winter months. Lighting design also can help to define neighborhoods or add to historic significance.

### SOME CONSIDERATIONS FOR STREET LIGHTING INCLUDE:

<table>
<thead>
<tr>
<th><strong>HISTORIC LIGHTING</strong></th>
<th>Historically accurate or complementary street light poles and fixtures should be used where appropriate.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOCATION AND SPACING</strong></td>
<td>Street and pedestrian lighting should be installed in the sidewalk furniture zone. Light fixtures should not be located next to tree canopies that may block the light. Lighting should be spaced to minimally assure complete coverage of the pedestrian realm.</td>
</tr>
<tr>
<td><strong>LIGHT COLOR</strong></td>
<td>Light sources should provide a warm, white–color light (yellow–spectrum, not blue).</td>
</tr>
<tr>
<td><strong>LIGHT POLES AND FIXTURES</strong></td>
<td>Design should be coordinated with the design of other streetscape elements and should reflect the history and character of the surrounding neighborhood.</td>
</tr>
<tr>
<td><strong>DARK–SKY COMPLIANT LIGHTING</strong></td>
<td>Where appropriate, dark sky–compliant lighting should be selected to maximize light cast onto the ground and minimize light pollution cast into the sky.</td>
</tr>
<tr>
<td><strong>LIGHTING FOR SAFETY</strong></td>
<td>Lighting placement should prioritize illumination of public gathering areas and public spaces, as well as areas with high incidences of index crimes.</td>
</tr>
</tbody>
</table>
PEDESTRIAN-SCALE LIGHTING 4.1

Pedestrian-scale lighting is essential for creating safe street environments. Conventional street lighting, designed primarily to light the vehicle way, often is inadequate for pedestrian needs, leaving unlit areas and dark shadows on walkways. Pedestrian-scale lighting is especially important in cold-weather climates with long winter nights. Pedestrian-scale lighting illuminates potential tripping hazards, helps to deter crime, and makes pedestrians more visible to drivers. Pedestrian-scale lighting also can illuminate bikeways near walking areas. Retrofits of existing streetlights and new installations should provide lighting on sidewalks and multi-use paths. Pedestrian-scale lighting should be coordinated with building and property owners to include building-mounted lighting for sidewalks, alleys, paths, and stairways where poles would obstruct the pedestrian zone. Land use context should be considered to achieve optimum lighting levels in pedestrian areas, and care must be taken to avoid light trespass into the windows of nearby residential units. Common examples of pedestrian-scale lighting include acorn, globe, and lantern lamps.

VEHICLE-SCALE LIGHTING 4.2

Vehicle-scale lighting is an important element in streetscapes. In certain contexts, pedestrian-scale lighting is sufficient to provide adequate lighting for safe and secure walking, bicycling and driving. On major roadways, however, vehicle-scale lighting is needed to illuminate the travel way. Vehicle-scale lighting should be located in the furnishing zone and should never block the pedestrian way.
In many settings, vehicle-scale lighting is sufficient to light the pedestrian way. In some cases, however, street lighting can be supplemented with pedestrian-scale lighting to create a better multimodal environment. Where feasible, conventional streetlights can be retrofitted by hanging a pedestrian-scale lighting arm from the existing pole at a height of 12 feet to 17 feet. If streetlight spacing is not adequate for pedestrian needs, pedestrian-scale lights can be added between existing streetlight poles.
Going the Distance

This section presents practices for lighting design that go beyond the widely accepted tools listed above. Standards for using these new technologies are in development and need further testing, but limited applications are currently in use.

SOLAR/LED LIGHT FIXTURES 4.4

Solar and LED (light-emitting diode) fixtures are now readily available in most street lamp designs. While the initial investment for these fixtures is usually higher than for traditional technologies, total life-cycle cost should be considered; for example, solar lighting may reduce the need to lay costly new utility conduit. Wherever possible, solar light fixtures should be used for new installations and retrofit projects. If solar is not feasible, LED or other energy-efficient lighting technologies should be used.

IN-PAVEMENT LIGHTING 4.5

In-pavement lighting is one of many new technologies that can be used to illuminate the streetscape. In-street lighting can include simple solar-lamp bricks installed in walkways or crossings, as well as lights placed in the travel way to further delineate bikeways, crosswalks, or vehicle lanes. Examples of in-street lighting include flashing yellow in-roadway lights used to supplement crosswalk markings, and internally illuminated yellow, white, blue or red raised-pavement markers. Although in-street lighting can increase safety in travel ways, they can be difficult to see in daylight and should supplement, not replace, traditional pavement markings.
CUSTOM-DESIGNED LIGHTING 4.6

Custom lighting can be a unifying element of urban design, helping to define a place and give it a unique identity. In districts with distinctive characters, custom lighting designs should be considered to assure a cohesive streetscape design aesthetic.

CATENARY LIGHTING 4.7

Catenary lighting is suspended from wires affixed to poles or buildings. This lighting technique can reduce infrastructure costs, such as installation of utility poles or underground conduit. Catenary lighting can be useful in pedestrian priority areas, cultural districts, and other areas designed for placemaking, giving a ceiling to the “outdoor room” and reducing the need for light poles that can clutter or obstruct the pedestrian way.
### Table 4A Lighting

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Pedestrian Scale</td>
<td>Straight pole</td>
<td>12-17 ft. H</td>
<td>20 ft. to 40 ft.</td>
<td>Lamps, acorn, globe, bollard, historic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arm</td>
<td>6 ft. L</td>
<td>30 ft. to 60 ft.</td>
<td>Width of sidewalk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dual arm</td>
<td>8 ft. L</td>
<td>30 ft. to 60 ft.</td>
<td>Presence of bikeway or on-street parking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Vehicle Scale</td>
<td>Pole</td>
<td>27 ft.-30 ft. H</td>
<td>40 ft. to 80 ft.</td>
<td>Lamps, bollard, historic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arm</td>
<td>6 ft.-8 ft. L</td>
<td>60 ft. to 80 ft.</td>
<td>Lamps, cobra, historic, Width of travel way for arm length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dual arm</td>
<td>8 ft.-16 ft. L</td>
<td>60 ft. to 80 ft.</td>
<td>Median: width of travel way for arm length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3 Combination</td>
<td>Dual arm</td>
<td>4 ft.-12 ft. L</td>
<td>40 ft. to 80 ft.</td>
<td>Ped arm placed at 12 ft.-17 ft. Width of travel way for arm length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 4B Pedestrian Light Levels by Context

<table>
<thead>
<tr>
<th>Land Use Context for Urban, Suburban, and Rural Environments</th>
<th>Light Level</th>
<th>Notes</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>18.75 lx</td>
<td>Note: Light levels are measured in lumens (lx).</td>
<td>Encouraged</td>
</tr>
<tr>
<td>Mixed-use</td>
<td>5.6 lx</td>
<td>Suggested light levels are consistent with</td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>4.3 lx</td>
<td>ANSI/IES RP-0-30 American National</td>
<td></td>
</tr>
<tr>
<td>Single Use (Office/Industrial)</td>
<td>3.2 lx</td>
<td>Standard practice for roadway lighting</td>
<td></td>
</tr>
<tr>
<td>Special Districts</td>
<td>Varies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Getting Started

Street furnishings add comfort, vitality and usefulness to the streetscape environment, prioritizing the needs of pedestrians and encouraging recreation and social interaction in the public space. Street furnishings serve as important tools in urban design, establishing and strengthening neighborhood character and providing visual consistency across the streetscape. Furnishings should be placed in the sidewalk furniture and/or frontage zones. Although utilities serve different functions than traditional furnishings, they are commingled with furnishings in the streetscape and are discussed in this section as well.
PUBLIC SEATING 4.8

Benches and other seating areas are essential elements of the walking environment, providing comfortable places for people to rest, eat, socialize, or read in a public space. A properly sited bench creates a sense of place for the immediate surrounding area. Some considerations for the design and placement of benches include:

- Seating should be located under trees or other shaded areas, with adequate lighting nearby.
- Seating should be oriented toward points of interest, such as adjacent buildings, open spaces, or the street itself. Where sidewalk width permits, seating can be perpendicular to the curb.
- Informal seating areas, such as low planter walls, wide stairways or other architectural elements, may be used as alternatives to freestanding benches. Benches and other seating should be made of durable, high-quality materials and designed in a style that integrates with other streetscape elements and visually complements and reinforces the streetscape design.

REFUSE RECEPTACLES 4.9

Refuse receptacles should accept both trash and recyclables. Where there is a demand, separate receptacles should be provided for recyclable materials. Some considerations for the location of refuse receptacles include:

- Place receptacles near high-activity generators, such as major civic institutions, commercial destinations and transit stops.
- Place receptacles near street corners but outside of the sidewalk pedestrian zone and curb ramps.
- Refuse receptacles should be placed no less than 200 feet apart along commercial streets.
BOLLARDS 4.10

Bollards are short vertical posts primarily used as safety elements to control access and separate pedestrians and/or bicyclists from motor vehicles. Thoughtful design and location of bollards can add visual interest, strengthen street character, and define pedestrian spaces. Bollards can be 4 to 24 inches wide and 3 to 4 feet high, with articulated sides and tops to provide distinct design details and coordinate with other street design elements. Bollards can be permanent or removable; if removable, they should be designed to appear permanent. Some bollards are equipped with electric mechanisms that retract the post completely into the pavement to allow occasional vehicle access to otherwise closed areas. Bollards are commonly placed in the furniture zone.

PARKING STATIONS & METERS 4.11

Parking meters are a standard element in commercial streetscapes; they can be traditional single-space meters, or preferably, consolidated multi-space pay stations. Single-space meters, which can double as bike parking, should be placed at the front end of the individual stalls. Multi-space meters should be placed approximately 150 to 200 feet apart, with signs every 100 feet clearly directing patrons to the meters. If municipalities have sufficient bike parking, they should encourage conversion of single-space meters to multi-space units to reduce visual clutter. The multi-space units should be selected and sited to minimize their impact on the pedestrian zone.
NEWS RACKS 4.12

Most municipalities set out guidelines for news rack placement. Multiple news racks can be consolidated into a standard decorative stand so they visually blend with their surroundings and complement the architectural character. Some additional considerations include:

When news rack doors are open, racks located within the sidewalk furniture or frontage zones should not encroach into the pedestrian zone.

News racks should be placed no closer than 2 feet from adjacent street signs and 4 feet from bike racks.

TRANSIT SHELTERS 4.13

Transit shelters should be provided in any area prioritized for transit, especially in districts that are major regional destinations. Transit shelters should be designed to fully shield waiting passengers from inclement weather; prevailing winds and storm directions must be considered in design and siting. While custom designs can be developed, all designs should meet the specifications of the servicing transit agencies. Generally, shelters should be at least 5 feet deep and long enough to provide space for a minimum of three seats, plus wheelchair accessibility. Bus transit shelters typically are placed in the furniture zone, so patrons can board more readily; if the furniture zone is not wide enough, the frontage zone may be used. Transit shelter placement should never limit the pedestrian way to less than 5 feet.
This section discusses the three primary types of bike parking: on-street, on-sidewalk, and off-street. (A fourth type, covered bike parking, is discussed in the “Going the Distance” section.)

**ON-STREET**

On-street bike parking, sometimes called a “bike corral,” uses an on-street parking space for bike racks. Up to 12 bike racks can be placed in a single motor vehicle space, maximizing the effective customer parking area in business and office districts. On-street bike parking can be considered in areas where sidewalk space is limited or in spaces unusable by motor vehicles, including areas near intersections and crosswalks.

**SIDEWALK**

The best choices for sidewalk bike parking are inverted-U or ring designs, which maximize the potential locking area and can stand alone or be grouped together. Sidewalk bike parking structure designs can be integrated with the design aesthetic of other street furnishings and public art. Sidewalk bike racks should be placed in the frontage or furniture zones, so bicyclists using them do not interfere unduly with building access or the pedestrian zone. Sidewalk bike parking structures can do double duty by substituting for bollards.

**OFF-STREET**

Off-street racks should be located within clear view of a destination’s entranceway, preferably no further than the closest motor vehicle parking space and usually no more than 50 feet from the entrance. Multiple racks in a visible, signed location can be placed up to 100 feet from the entrance. When off-street racks are placed far from entranceways, cyclists tend to ignore them and find closer places to secure their bikes.
UTILITIES 4.15

Telecommunications, electric, street lighting, traffic signal and fiber optic conduits are often located under the sidewalk, with lateral lines extending from utility mains in the public right-of-way to serve adjacent properties. When utilities are being newly installed or retrofitted, care should be taken to improve pedestrian safety, reduce clutter in the streetscape, minimize maintenance conflicts, and maintain – or preferably, expand – adequate planting areas to support tree growth and stormwater infiltration. When placing utilities within the furniture zone, consider the following:

Wherever possible, small utility boxes (such as residential water vaults and meters, gas vaults and valves, and street lighting access,) should be aligned or clustered at the back of the curb to minimize conflicts with existing or potential landscaped areas and tree locations.

Generally, utility boxes are sited in the direction of the pipe. Where possible, utility boxes sited parallel with the curb should be in the sidewalk furniture zone; vaults perpendicular to the curb should be placed between existing or potential street trees or sidewalk landscape locations, such as walkways to parking areas.

Wherever possible, utility lateral lines should not run directly under landscaped areas; instead, they should be placed under driveways and walkways.

If necessary, utility access can be placed in the pedestrian realm under slip-resistant covers that are flush with the pavement.

SURVEILLANCE CAMERAS AND CRIME PREVENTION 4.16

In areas with high incidences of index crime, it may be appropriate to consider use of cameras to deter crime and maintain “eyes on the street.” Cameras should be placed in a prominent, visible location to maximize video capture, but should not become a visual nuisance. Surveillance cameras can be attached to utility poles. Intersections with red-light cameras visible from sidewalks and storefronts do not require additional surveillance cameras for crime prevention.
Going the Distance

This section presents practices for street furnishings that go beyond the tools discussed above. These practices are typically used in special districts, such as downtowns, historic neighborhoods, entertainment districts, or transit areas.

CUSTOM-DESIGNED FURNISHINGS 4.17

Custom designs using high-quality materials and uniform aesthetics can transform chairs, interpretive signage, bike racks and other furnishings into functional art, maximizing their placemaking effects, especially in special districts. Business groups and other private interests may serve as partners in creating and installing distinctive custom-designed furnishings. Custom furnishings can be used in addition to public art to establish, reflect and promote district and neighborhood character.
SIDEWALK DINING 4.18

Outdoor café and restaurant seating adjacent to the sidewalk adds vitality to the street environment and encourages economic development. Ideally, tables and chairs should be placed in the sidewalk frontage or furniture zones directly in front of the restaurant; if those spaces are not adequate, dining areas can be slightly offset. Sidewalk dining areas should not encroach into the pedestrian way. Since the public purpose of allowing restaurants to have dining on the sidewalk is to stimulate activity on the street, municipalities should prohibit restaurants from fully enclosing the dining area. Parklet cafes also can be used as sidewalk dining. If sidewalk space is limited, parking spaces sometimes can be transformed into outdoor dining areas.

STREET VENDOR STANDS 4.19

Street vendor stands, such as flower, magazine, and food vendors, rely on regular pedestrian traffic to sustain their business. Some vendors catering to commuters operate only during daytime work hours; in areas with vibrant nighttime environments, street vendors may operate in the evening as well. Street vendor stand sites should provide at least 6 feet of clear pedestrian passage between the edge of the display area and any other sidewalk elements. In some areas, street vendor stands may be permitted in on-street parking spaces or in off-street parking lots. (Street vendors with stands in private lots generally pay nominal rent to the parking lot operator.) The details and features of stand designs should be coordinated with other street elements and the architectural character of the district.
Covered bike parking addresses the long-term parking needs of bicyclists who frequently park for eight or more hours, such as daily commuters and bicycle tourists, and should be considered in transit-oriented areas and other special districts. Covered bike parking options include bike lockers, vertical bike parking, and bike parking structures.

Bike share systems connect high-use destinations, such as transit stations, public parks, tourism sites and job centers, and can be deployed with bikeways to integrate transit, land use and economic development goals. Stations can be located off-street where public access is provided; where adequate space is available for a clear pedestrian way, bike share stations also can be placed in the sidewalk furniture or frontage zones.
### Table 4C Furnishings

<table>
<thead>
<tr>
<th>Getting Started</th>
<th>Urban Contexts</th>
<th>Suburban Contexts</th>
<th>Rural Contexts</th>
<th>Places: Overlays for Planned Contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public Seating</strong></td>
<td>4 ft. L x 2.5 ft. W x 2 ft. H</td>
<td>Every 1/4 mile min. Place according to pedestrian system design. Suburban: 3 ft. H.</td>
<td>Commercial: Mixed-use Residential: Single use</td>
<td>Pedestrian Priority Areas: Permitted</td>
</tr>
<tr>
<td><strong>Bollards</strong></td>
<td>4 in. to 2 ft. diameter and 3 ft. to 4 ft. H</td>
<td>Place to increase vehicle separation from bicycles and pedestrians.</td>
<td>Commercial: Residential: Single use</td>
<td>Village: Encouraged, Mixed-use: Permitted, Pedestrian Priority Areas: Discouraged</td>
</tr>
<tr>
<td><strong>Parking Stations &amp; Meters</strong></td>
<td>3 ft. H</td>
<td>Stations every 125 ft. to 200 ft. Stations are preferred to remove street clutter; however, need to provide adequate bike parking if removing meters.</td>
<td>Commercial: Residential: Single use</td>
<td>Green Streets: Encouraged, Schools Zones: Permitted, Home Zones: Discouraged</td>
</tr>
<tr>
<td><strong>News Racks</strong></td>
<td>2 ft. L x 1.5 ft. W x 3 ft. H</td>
<td>Place according to pedestrian demand.</td>
<td>Commercial: Residential: Single use</td>
<td>Social Zones: Discouraged</td>
</tr>
<tr>
<td><strong>Trash Shelters</strong></td>
<td>13 ft. L x 4 ft. W</td>
<td>Average dimensions for wheelchair access. Place where space allows along high use transit routes.</td>
<td>Commercial: Residential: Single use</td>
<td>Entertainments: Discouraged, Cultural Districts: Permitted</td>
</tr>
<tr>
<td><strong>Bike Parking</strong></td>
<td>6 ft. L x 2.5 ft. W x 3 ft. H</td>
<td>Place according to demand.</td>
<td>Commercial: Residential: Single use</td>
<td>Schools Zones: Encouraged, Home Zones: Discouraged</td>
</tr>
<tr>
<td><strong>Utilities</strong></td>
<td>Varies</td>
<td>Placement should not block the pedestrian way.</td>
<td>Commercial: Residential: Single use</td>
<td>Pedestrian Priority Areas: Encouraged, Entertainments: Discouraged, Cultural Districts: Required</td>
</tr>
<tr>
<td><strong>Custom Designed Furnishings</strong></td>
<td>Same as conventional design</td>
<td>Same as conventional design</td>
<td>Commercial: Residential: Single use</td>
<td>Social Zones: Discouraged</td>
</tr>
<tr>
<td><strong>Street Vendor Stands</strong></td>
<td>13 ft. L x 4 ft. W</td>
<td>Minimum dimensions Require permits to assure regulation of clear pedestrian way.</td>
<td>Commercial: Residential: Single use</td>
<td>Social Zones: Discouraged</td>
</tr>
<tr>
<td><strong>Covered Bike Parking</strong></td>
<td>Varies according to demand based on transit shelter.</td>
<td>Requires permits to assure regulation of clear pedestrian way.</td>
<td>Commercial: Residential: Single use</td>
<td>Green Streets: Encouraged, Schools Zones: Discouraged, Home Zones: Required</td>
</tr>
<tr>
<td><strong>Bike Share Stations</strong></td>
<td>Varies, similar to covered bike parking</td>
<td>Varies according to demand Should be designed as part of a comprehensive bike share system.</td>
<td>Commercial: Residential: Single use</td>
<td>Social Zones: Discouraged</td>
</tr>
</tbody>
</table>

**Key**
- Encouraged
- Permitted
- Discouraged
- Required
Getting Started

Green infrastructure includes all trees, shrubs, and other understory plantings on both public and private lands. Street trees and landscaping are essential parts of the urbanized ecosystem, enhancing the comfort and safety of people who live and travel along the street.
A healthy urban forest also is a powerful tool for streetwater management and climate control. Leaves and branches catch and slow rain as it falls, allowing it to soak into the ground instead of flowing into storm drains. The plants themselves take up and store large quantities of water that would otherwise further contribute to surface runoff. Part of this moisture then returns to the air through evaporation to help cool the city.

**TREE ROWS & PLANTINGS 4.22**

Trees and other plantings are important elements along sidewalks. In many urbanized settings, however, trees are planted in constricted, unhealthy locations that limit their lifespan and usefulness. To thrive, street trees must have adequate uncompacted soil, water, and air. The location of underground and above ground utilities also must be considered when planting trees and other landscape elements. This section provides guidance for appropriate selecting, siting, planting, and care of street trees.

**TREE SELECTION CRITERIA**

Tree selection for streetscapes should be based on climate, roadway conditions and land use context, and should consider the mature tree’s need for light, water, canopy space and root extension. Most jurisdictions have forestry guidelines detailing which trees may be planted in public spaces. It is best to select native, hardwood trees that are resilient to inclement weather. Multiple species should be used to avoid localized devastation from species-specific diseases and parasites, such as the Emerald Ash Borer. Fruit trees should be avoided in most settings because they require extra maintenance and annual harvesting.
For streetscape design purposes, tree species can generally be grouped by size to allow for initial roadway design placement.

**DESIGN REQUIREMENTS FOR TREE SELECTION:**

**SMALL TREES** can thrive in planters and tree wells. They require a well or furnishing zone at least 4 feet wide, and can thrive with a tree grate on a commercial/mixed-use sidewalk. Small trees include: Dogwood, Prunus, Service Berry, Crabapple, and Fir.

**MEDIUM TREES** generally require a planting area at least 5 to 7 feet wide; they may thrive in large tree planters. Medium trees also thrive in residential tree lawns. Medium trees include: Maple, Cherry, Bradford Pear, Honey Locust, and White Pine.

**LARGE TREES** generally require a tree lawn but can thrive in a planting area at least 7 to 10 feet wide. Large trees are a great choice for residential areas with wide frontage zones and for landscaped medians on roadways. Large trees include: Sycamore, Elm, Chestnut, Red Oak, and Beech.

**PLANTINGS** Native grasses and other plants can help to protect and restore soil conditions in urban environments. Native plants generally have longer root systems and can help process stormwater onsite. Native plantings can be a suitable alternative to traditional lawns. Groundcover choices can include: Bluegrass, Sedum, and Periwinkle.

In all cases, larger trees can be planted in oblong instead of square-shaped wells to fit them into fairly narrow furniture zones.

**ADDITIONAL PRINCIPLES FOR TREE SELECTION AND PLACEMENT:**

Seek and reclaim space for trees. A surprising number of residual spaces suitable for planting can be found on streets between areas required for travel lanes and parking, such as traffic circles, medians, channelization islands and curb extensions.

Select the right tree for the space. In choosing a street tree, consider what canopy, form, and height will maximize benefits over the course of its life. Mature tree height should allow necessary clearances below overhead electrical transmission lines and prevent limbs from overhanging potentially sensitive structures, such as flat roofs. In commercial areas where the visibility of façade-mounted signs is a concern, choose species whose lowest branches are at least 12 to 14 feet above the ground. Select trees with non-aggressive root systems to avoid damaging paving and sidewalks.

Start with good nursery stock and train it well. When installing plant material, choose well-formed plants with complete single leaders and check that boxed trees are not root-bound. Proper watering and pruning every three to four years will allow trees to mature and thrive for many years of service.

Create optimum conditions for growth. Trees will require space for growing branches and for root extension underground. For optimal growth, a typical medium sized street tree requires a clear sidewalk furniture zone at least 6 to 7 feet wide, with uncompacted soil at least 3 feet deep.

Do not subject plants to concentrated levels of pollutants. Trees and other plants should be integrated within streetwater management practices wherever possible, but filtering pollutants from “first flush” rainfalls and street runoff will extend tree life and prevent toxic buildup of street pollutants in tree wells.
Optimally, trees should be placed every 20 to 40 feet and intermingled with street lighting and utilities, but spacing between trees will vary with species and site conditions. In general, tree spacing should be 10% less than mature canopy spread; closer spacing of large trees is encouraged to create an interlaced canopy. Trees planted in groups and groves create a microclimate more favorable for growth, as isolated trees are exposed to heat and desiccation from all sides. On residential streets where lots are 40 or 50 feet wide, at least one tree should be planted on each lot between driveways. Where constraints prevent even spacing of trees, it is preferable to place a tree slightly off the desired rhythm than to leave a gap in the pattern. Trees should not be eliminated to create a uniform pattern.

PARKWAY OR TREE LAWN

In a parkway or tree lawn, (also known as a planting strip, boulevard, or terrace), the entire furniture zone is dedicated to trees and plantings, creating an optimal environment for a healthy tree row. Parkways are most suited to residential streets but also can be found in commercial areas in suburban settings.
TREES AND VEHICLES

Trees have been shown to reduce driving speeds on roadways because they enclose the space and reduce sight distances. Generally, street trees have a positive effect on roadway safety; however, special consideration should be given to sight lines and sight distances for trees placed near intersections and roadway curves, to avoid creating obstructions or blind spots.

TREE PLANTERS

Planters can be submerged into the sidewalk and used to create a tree row in urbanized settings where the entire length of the furniture zone cannot be dedicated to green infrastructure. Planters should be at least 6 feet by 6 feet to allow room for medium-sized trees to mature; larger planter boxes that extend 20 feet to 40 feet in length can support larger tree varieties. Although planters may be the best option to increase biomass and canopy cover in urbanized areas, they provide a confined, compromised environment for trees, so extra care must be taken to promote tree health. Tree grates and guards should be used along streets with heavy pedestrian traffic; in less urban areas with lighter foot traffic, mulch can be used instead of tree grates to protect tree bases.

LANDSCAPE MEDIANS

Landscape medians offer an opportunity to replace a non-functional paved area with green space and expand the green infrastructure in urbanized areas, increasing stormwater retention and CO2 absorption on heavily trafficked corridors and mitigating some of the adverse environmental effects of motor vehicle travel. Many medians 10 to 14 feet wide are suitable for large trees. Other than trees, plantings should not exceed 2 to 3 feet high. Landscape medians should not disrupt pedestrian connectivity and must be designed to maintain pedestrian access to both sides of the street with minimal pedestrian crossing delay.
BIO-SWALEs 4.23

By filtering and harvesting streetwater, sustainable management practices such as bio-swales capture the benefits of stormwater and other streetwater instead of treating it as a liability. A bio-swale is a wide, shallow, relatively flat vegetated ditch that capture and filter rainfall and runoff from adjacent areas. As the captured water moves slowly through the swale, particulates settle out and contaminants are removed by vegetation. Swales can be located adjacent to roadways, sidewalks, or parking areas and should be designed to work in conjunction with the street slope to maximize slowing and filtration of stormwater. Swale systems can be integrated into traffic calming devices, such as chicanes and curb extensions, and also can be placed in landscape medians. Roadway runoff can be directed into swales through flush curbs or small, evenly spaced cuts in raised curbs. Vegetated swales can be landscaped with native plants.

UrbAn rAIr gARDEnS 4.24

Rain gardens are made of native plants and shrubs planted in highly absorbent soil, sited in depressions with flat bottoms and gently sloping sides. Unlike bio-swales, which slowly move water away from the street area, rain gardens reduce or eliminate runoff by holding water in place, filtering out pollutants and recharging the surrounding ground. Rain gardens may have a footprint of any shape. Rain gardens are not ponds or wetlands; runoff captured in a rain garden should drain into the ground within 48 hours. Rain gardens may include overflow systems using pipes or swales to carry away stormwater after very heavy rainfall.

GOGING THE DIstance

This section presents practices for green infrastructure that go beyond the tools listed above. These represent only a few of the many examples of green infrastructure currently in use in urbanized settings to enhance walkability, manage streetwater, create and extend green spaces and promote placemaking. All of these tools can be used in special districts.
Urban agriculture is the practice of farming for food production in an urbanized setting. Typically, this is a private endeavor, undertaken on private land; in some settings, however, property owners may be permitted to plant urban crops in planter beds in the sidewalk furniture zone. Raised planter beds should be placed on streets with adequate southern sun, to maximize the daily growing cycle. There should be adequate space around the planter bed to avoid encroachment into the pedestrian way. Raised planter boxes should be used to protect crops from urban wildlife. Planter beds should include inlets at 8- to 12-foot intervals, to allow access for crop care. Planter beds may include fruit trees if local caretakers take responsibility for harvesting the fruit; trees should be placed to avoid casting shade on nearby plants.
## Table 4D Green Infrastructure

<table>
<thead>
<tr>
<th>Getting Started</th>
<th>Infrastructure</th>
<th>Dimensions</th>
<th>Spacing</th>
<th>Design Considerations</th>
<th>Urban Contexts</th>
<th>Suburban Contexts</th>
<th>Rural Contexts</th>
<th>Places: Overlays for Planned Contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.22</strong> Tree Rows &amp; Landscape Medians</td>
<td>Large Trees</td>
<td>Requires a 7 ft. to 10 ft. wide planting area. Can thrive in smaller width planting areas if they are long enough to provide enough stormwater capture. Low branches provide 12 ft. to 15 ft. clearance from the ground.</td>
<td>20 to 60 ft., one per residential lot, or 10% less than the mature tree canopy. Integrate with street lighting space.</td>
<td>Large trees should be discouraged wherever possible because the full canopies provide substantially more stormwater absorption, shade and CO2 processing than smaller trees. In some contexts large trees may block sightlines, detract from architectural design features, or simply not fit; however, these trees are permitted in all cases at designer's discretion.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.23</strong> Tree Rows &amp; Landscape Medians</td>
<td>Medium Trees</td>
<td>Requires a 5 ft. to 7 ft. wide planting area. Low branches provide 10 ft. to 12 ft. clearance from the ground. Can be planted 6 ft. square wells.</td>
<td>20 to 60 ft., one per residential lot, or 10% less than the mature tree canopy. Integrate with street lighting space.</td>
<td>Medium trees are a suitable substitute for large trees and can be accommodated in most urban environments. When medium trees are required they can be substituted for larger trees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.24</strong> Tree Rows &amp; Landscape Medians</td>
<td>Small Trees</td>
<td>Requires a 4 ft. wide planting area. Low branches provide 3 ft. to 5 ft. clearance from the ground.</td>
<td>20 to 60 ft., one per residential lot, or 10% less than the mature tree canopy. Integrate with street lighting space.</td>
<td>Small trees are encouraged for aesthetic appeal, but they provide minimal shade or stormwater absorption benefits; however, they can live in minimal space and can be used to fill in areas where medium and large trees cannot be planted. When small trees are required they can be substituted for larger trees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plantings</strong></td>
<td>Requires a 2 ft. wide planting area. Continuous where applied.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Going the Distance</strong></td>
<td><strong>4.27</strong> Bioswales</td>
<td>Same as landscape median or furniture zone. Continuous where applied.</td>
<td></td>
<td>Should be considered for stormwater filtration on Green Streets. Swales are continuous along the roadway.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.28</strong> Urban Raingardens</td>
<td>Same as curb extension or curb bulbout. At intersections or midblock curb extensions.</td>
<td>Continuous where applied.</td>
<td></td>
<td>Should be considered for stormwater filtration on Green Streets. Raingardens are suitable when a continuous swale cannot be achieved. They can be any shape and are typically combined with traffic calming infrastructure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.29</strong> Urban Agriculture</td>
<td>Raised planter boxes. 3 ft. to 5 ft. high. 8 ft. to 12 ft. long, 4 ft. to 8 ft. wide. Continuous where applied.</td>
<td>Require permits to use public space for food production.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Getting Started

Streetscape/wayfinding signs provide direction, destination, and/or location information. Signage can range from standard roadway network signs to custom identity signing plans for neighborhoods and districts. Streetscape signs are most appropriate for downtown, commercial, or tourist-oriented locations, or around large institutions. Best practices for wayfinding signs include street signs (for motorists, pedestrians, and bicyclists) and transit signs.
**STREET SIGNS 4.25**

Best practices for street signs are included in the MUTCD. When placing signs for multimodal transportation corridors, the following principles should be considered:

---

**Signs for motor vehicles should also be visible and usable by bicyclists and pedestrians, where appropriate, for example, street name signs should face both directions at intersections of one-way streets, for pedestrian use.**

---

**Pedestrian warning signs are important at unsignalized crossings, to caution drivers to look for people crossing the street.**

---

**Bicycle signs can be used for wayfinding and regulatory purposes, and also help to raise motorists' awareness of bicyclists. Bicycle wayfinding signs should include the destination, distance, and direction. Regulatory signs inform bicyclists, pedestrians and motorists about rules and regulations for safe cycling and shared use. The MUTCD includes specifications for bicycle wayfinding, regulatory, and warning signs.**
TRANSIT SIGNS 4.26

Transit system signs are needed to fully integrate transit into the roadway network and to connect bicyclists, pedestrians and drivers into the system. Signs are necessary to identify transfer points between service lines and other types of transportation. Transit signs generally fall into three categories: Station/Stop Identification, Service Information, and Wayfinding.

STATION/STOP IDENTIFICATION Transit stations and stops need to be clearly marked to show passengers where to wait for service. Pedestrian crossing signs should always be considered at transit stations and stops.

SERVICE INFORMATION Transit stops and stations should include signs and maps showing routes, schedules, and places served by the line. Newer technologies for transportation demand management (TDM) include “bus-tracker,” “next bus,” and “train-tracker” applications integrated into stations and bus shelters.

WAYFINDING Transit agencies should provide wayfinding signs inside the station, to ease connections, as well as within a half-mile of each station. Transit agencies can use wayfinding signs to increase connections to pedestrian and bicycle networks. Bicycle wayfinding signs should include major transit stations as prominent destinations.
INTERPRETIVE SIGNS 4.27

Interpretive signs are designed to promote interaction and engagement between people and streetscape environments. Interpretive signs can identify a district’s name and gateways, announce important events, or display environmental or historical information. Some useful tools for interpretive signing include kiosks, sign stands, historical markers, installations, and banners.

Kiosks in public areas, often combined with gateway signs, can be attractive, useful street features. Kiosks can be used to display maps, bulletin boards, community announcements, and other important information.

Sign stands can be used for temporary purposes or in permanent installations, such as district maps and informative displays. Signs can be placed in vertical, poster-style stands or on floating tables.

Historical markers provide information about people, places, events, or resources of local or national significance. Historical markers are most often used in places listed on the National Register of Historic Places or local historic registries. Historical markers can be placed on freestanding signs, wall plaques, or even boulders.

Installations of public art can include creatively designed interpretive signs that can be informative elements of the streetscape.

Banners can be displayed on custom poles or can hang from existing lighting and utilities. Banners can be used as permanent district markers or rotated to note seasons or significant events.
Figure 4.27b  
BANNERS 
New York, NY

Figure 4.27c  
HISTORICAL MARKERS 
Oak Park, IL

Figure 4.27d  
NEIGHBORHOOD MURALS 
Chicago, IL

Figure 4.27e  
INFORMATIONAL KIOSK 
Chicago, IL

Figure 4.27f  
INFORMATIONAL KIOSK 
Chicago, IL

TABLE 4E SIGNING
### Table 4E Signing

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.25 Street Signs</strong></td>
<td>Vehicular</td>
<td>4 ft. to 6 ft. H</td>
<td>Varies</td>
<td>Place according to MUTCD.</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td></td>
<td>Pedestrian</td>
<td>4 ft. to 6 ft. H</td>
<td>—</td>
<td>Place according to MUTCD.</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td></td>
<td>Bicycle</td>
<td>4 ft. to 6 ft. H</td>
<td>—</td>
<td>Place according to MUTCD.</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td><strong>4.26 Transit Signs</strong></td>
<td>Vehicular</td>
<td>7 ft. H</td>
<td>Place at every bus stop</td>
<td>Place according to Park Development Guidelines.</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td></td>
<td>Pedestrian</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td><strong>4.27 Interpretive Signs</strong></td>
<td>Vehicular</td>
<td>4 ft. to 6 ft. H</td>
<td>Varies</td>
<td>Place to accentuate transportation systems: transit, pedestrian, and bicycle. Place at landmarks like parks, historic sites, or to highlight districts.</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td></td>
<td>Pedestrian</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td></td>
<td>Bicycle</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
</tr>
</tbody>
</table>

### Key
- Encouraged
- Permitted
- Discouraged
- Required
This section includes best practices for textures and markings, focusing on options for material selection beyond the typical use of concrete and asphalt.
PAINT 4.28

Paints can be used creatively to define and repurpose spaces in underutilized areas of the roadway. Paint can be used to create colored bike lanes, to mark bike boulevards, or to block off whole areas and create new public gathering areas. Temporary, wash-away paint can be used in pilot projects to test their impacts on the roadway network. Some roadway paints are not suitable for cold-weather climates; care should be taken to select a product that will not create slipping hazards for bicyclists or pedestrians.
4.29 Tactile & Texture Changes

Tactile and texture changes in the roadway or sidewalk can be used, often in conjunction with signage, to identify potential hazards or define special districts. Texture changes can be created in concrete finishes by using brooms, trowels or stamps; gravel, filler, and dies also can add texture to concrete surfaces. These techniques are frequently used to communicate nearby hazards to people with visual disabilities. Detectable warning strips – plastic surfaces with truncated domes – are required at pedestrian crossings and the edge of transit platforms to indicate transitions to people with impaired vision.

Figure 4.29a
Crossing Texture Changes
Lisbon, Portugal

Figure 4.29b
Transit Tactile Strips
Chicago, IL

Figure 4.29c
Brick Texture Changes
Oak Park, IL
Permeable paving reduces or eliminates direct runoff by absorbing rainfall and allowing it to infiltrate into the soil. By using permeable paving, municipalities can reduce water volumes in existing storm sewer systems and decrease the need for downstream filtration of streetwater. Permeable pavement can be clogged by sediment-laden runoff, so care should be taken to divert flows from landscaped areas away from paved sections. Permeable paving is not smooth, which makes it difficult for bicyclists and wheelchair users to traverse; this should be taken into account in the design. Permeable paving is usually appropriate in high-use parking lanes, which are not frequently used by cyclists and people in wheelchairs.

**BRICK & PAVERS 4.30**

Historic brick and cobble streets convey a sense of place and identity that can add charm and interest to the environmental context. However, these surfaces are often uneven, making them potentially hazardous for bicyclists, people using wheelchairs, and pedestrians with mobility impairments. The needs of all users should be considered when using these materials; new brick and paver materials can be used to create attractive designs that are smooth and traversable.
PLASTICS 4.32

Plastic products can be resilient, strong, and colorful, making them useful for creating placemaking designs in the streetscape. Thermoplastics, which use heat to bond plastics into asphalt and concrete, can be used to mark pavements, decorate crosswalks (along with required white lanes) or to add stencils to roadways and sidewalks. Long-lasting colored plastics are commonly used instead of paints to create colored bike lanes, bike boxes, or bike through-lanes. Recycled plastic (or rubber) sidewalks can be used instead of concrete, allowing for easy replacement of single segments and easy access for maintenance issues, such as tree route trimming and drainage pipe repair. As plastics become more commonly used materials in roadway construction, there will be new opportunities to test various applications.

TABLE 4F TEXTURES AND MARKINGS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.28</td>
<td>Paint</td>
<td>Cost effective tool. Can be used for pilot projects and simple improvements like crosswalks, and bike lanes and markings.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.29</td>
<td>Tactile Pads &amp; Textures</td>
<td>Non-verbal environmental cues can be as effective as signing. Detectable warning strips are required for ADA compliance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.30</td>
<td>Bricks &amp; Pavers</td>
<td>Can be used to enhance aesthetics of districts. Can be used on bus routes and emergency routes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.31</td>
<td>Permeable Paving</td>
<td>Can improve stormwater infiltration. Requires maintenance to retain effective absorption. Can be used on bus routes and emergency routes. Can be difficult for bicyclists.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.32</td>
<td>Plastics</td>
<td>Cost effective if used in combination with resurfacing. Provides an enhanced design aesthetic in districts. Can be used on bus routes and emergency routes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KEY

Encouraged | Permitted | Discouraged | Required