



# Lighting

The City of Milwaukee owns and operates a unique electrical system that is divided into roughly two equal halves. Each half is defined by the voltage of the system. The first half is a fairly conventional system consisting of 240V roadway and pedestrian luminaires and poles commonly found in cities across the country. The other half of the system is a much older, unique electrical system that uses an extensive arrangement of 2200V cabling and transformers to power a special set of light fixtures.

There are trans closures that contain the electrical equipment necessary to supply energy to the lighting systems. Because they are above and not below ground in Milwaukee, they create significant elements in the streetscape. There are also cabinets which house the electrical components needed for the outlet circuitry.



Figure 4-1: Trans closure and davit pole installation in median

## Milwaukee's Electrical System

There must be a clear area around these trans closures, which must meet all National Electrical Code (NEC) and National Electrical Safety Code (NECS) standards. This is an OSHA requirement and cannot be modified.

Because these large, highly visible trans closures and cabinets do create significant elements in the streetscape, they should be given a graphic design, a community-oriented image or civic logos, so they can become more attractive landscape features.

In either system, circuitry is accomplished with the installation of cable, conduit, junction boxes, box outs and other methods which allow for maintenance of the systems after installation. Typically, the conduits extend from pole-to-pole and are installed within the first two feet back from the curb.



Figure 4-2: Trans closure installation improved with community-oriented art

## Lighting Styles

Special care is needed when working in this zone. Streetscape designers must accommodate this zone when designing streetscape improvements.

To accommodate holiday lighting elements, a separate circuit can be provided to supply power to 120 volt outlets mounted on the poles. The power available at each outlet is generally limited to 120 watts (one amp/two amp maximum load per outlet per circuit). The BID will be responsible for the energy consumed, electric company charges, and maintenance (done by the City at BID expense).

Only City of Milwaukee electricians are allowed to install electrical equipment which will be connected to the City's system.



Figure 4-3: Milwaukee Harp Luminaire

## Lighting Styles

In the early part of the 20th century, the City of Milwaukee designed and used as standard lighting, luminaires known as the Milwaukee Harp and the Milwaukee Lantern. Fabricated in various cast metals over the years (aluminum, iron, and steel), the teardrop fixture has been used in single and double combinations and on metal or concrete poles depending on the application in the city.

The Milwaukee Harp is generally used for pedestrian level lighting and can be mounted on steel poles (dark green or black poles and mountings for Harps and Lanterns) or pre-stressed concrete poles (standard gray or black finish for concrete). Due to the added cost, the Double Harp mounting is currently available for use only on Wisconsin Avenue.



Figure 4-4: Double Harp luminaire detail

## Harp Luminaire



Figure 4-5: Harp luminaire on metal pole



Figure 4-6: Harp luminaire on concrete pole

## Harp Luminaire Variations



Figure 4-7: Double Harp Installation with banners

## Milwaukee Lantern



Figure 4-8: Harp luminaire - single davit arm configuration



Figure 4-9: Harp luminaire - double davit configuration

The Milwaukee Lantern is essentially a harp with a yoke removed with the luminaire installed in a pendant configuration at the end of a decorative arm. The lanterns have been designed for use on tall poles (either 13' or 15'), usually concrete, but metal poles have also been used (steel is acceptable, aluminum is no longer used).

The Harp and Lantern luminaires all utilize a high pressure sodium light source in a number of wattages depending on the fixture height and the intended use.

The City designs lighting to meet the current standards established by the Illuminating Engineering Society of North America (IESNA). Spacing criteria is a minimum of 25' between trees and lights, and a minimum of 40' between street light pole and traffic signal face. However, there is no set lighting level or pole spacing because of the wide diversity of streets, layouts, traffic levels, and pedestrian traffic levels.

Each project presents a unique set of design parameters. The City's Lighting Department (within the Department of Public Works), makes the final decision regarding lighting levels and pole spacing.

Exact placement will vary with conditions and streetscape design. For example, Milwaukee Harps (octaflute poles) are typically set back 36" from the face of the curb, except on Highland Avenue they are set back 30", and on Wisconsin Avenue, where the streetscape is more elaborate, they are set back 48".

In order to maintain a consistent "Milwaukee" identification throughout the city, only Harp Luminaires and Milwaukee Lanterns will be allowed for lighting in all future streetscape projects. Harps are typically placed 25' on center, and set back 3' from front of curb.

## Historic Third Ward Fixture



Figure 4-10: Historic Third Ward Luminaire and Pole

Milwaukee's Historic Third Ward has a special fixture reserved for its exclusive use as part of its overall palette of streetscape elements.

This nautical-inspired element is a drop pendant luminaire with an exterior cage over an opalescent glass or plastic dome that covers the light source. This fixture is used primarily in double-luminaire configurations, however, at special locations quad units have been installed. The color of the metal pole and other components matches the other metal streetscape elements in this Business Improvement District and contributes to the area's unique identity.

The City has made special arrangements with the Historic Third Ward BID to stock and maintain these special fixtures. While the City will repair and replace these units, the BID provides the poles and parts to the City directly.



Figure 4-11: Historic Third Ward - Quad Fixture



Figure 4-12: Historic Third Ward Streetscape Lighting

## Standard Poles and Luminaires



Figure 4-13: Davit "cobra" luminaire on concrete pole



Figure 4-14: Double-armed davit "cobra" luminaires on concrete pole

The city also employs a set of standard davit arm fixtures for use in the residential areas of the city. These fixtures are standard "cobra" style luminaires mounted on steel arms on concrete poles.

# Tree and Plant Materials

Tree and plant materials add four-season color, interest, and texture to a streetscape. The goal is to efficiently manage the urban landscape to provide a better quality of life for our citizens and visitors. It is important to consider a number of items to ensure a successful landscape.

## Use and Effect

The intended use of the landscape should be at the forefront of the design process. What is this landscape intended to do? Whether the intent is to control traffic, screen or enhance views, provide a background for an adjacent use, or just to soften the existing streetscape, the intended use and its desired effect must be considered in the choice of plant materials.

Plant heights must also be considered to ensure safety and security in the streetscape. Hybrid varieties, including dwarf and columnar plants, have been developed over the years to create a wide range of choices for the streetscape designer.

## Plant Color

Color is probably the most striking design feature of the landscape. It can attract attention to a single plant or a mass of plants. It can create an atmosphere of warmth or a cooling effect. Two color techniques are generally used in landscape design: background color and accent color.

Background color establishes the basic theme of the landscape, providing a backdrop on which to present a harmonious composition. Accent color serves to emphasize certain features in the landscape.

Color must be used carefully in the composition of the landscape. Light and cool colors (blues and greens) represent a calm, thoughtful landscape. These colors also appear farther away, or recede from the viewer. Bright and warm colors (reds, yellows, oranges) excite people and may guide the viewer through a landscape. These colors appear nearer to, or to advance toward, the viewer.



Figure 4-15: Median plantings with varying textures



Figure 4-16: Mixes of perennial and annual plantings add seasonal color



Figure 4-17: Fall tree color

## Sight Triangles

Sight triangles are a method of quantifying the requirements for determining plant heights in certain conditions. Sight distance triangles are generally based on the design speed of the roadway and may be covered by AASHTO and WisDOT requirements. At intersections where plantings are included, the sight triangles help to determine where plantings of certain heights can be included.

Milwaukee sight triangle requirements vary by zoning classification and intersection type. Within sight triangles, mature plant heights (excluding trees) should not exceed 12-18" in height. In other applications, trees and shrubs should not block a 2.5' - 6'

clear vision zone, above the plantings and below the crown of the trees, so that drivers can see pedestrians and on-coming vehicles. Other opaque elements should not obstruct this clear vision zone.

Curbed planters are often used, and the curb height should be included in any mature plant material height calculations. Median plantings have a special set of sight triangles based on design speeds of the roadway and the various positions of the driver.

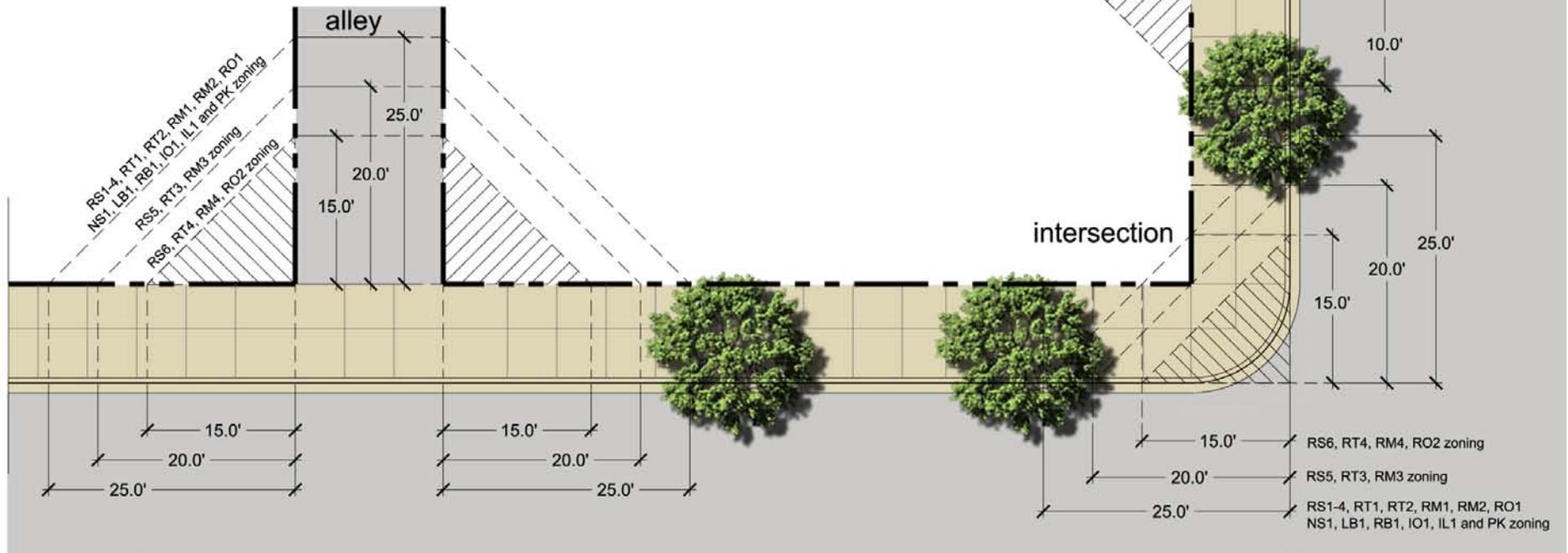


Figure 4-18: Sight triangle

## Plant Maintenance

Maintenance must also be considered in the choice of plant materials. A maintenance free landscape does not exist; all landscapes, even those labeled as low maintenance require some degree of attention to tend to the needs of live plant materials including:

- spring cleanup of prior season's growth
- removal of refuse blown into planting beds
- replacement of damaged or dead plant materials
- periodic tending to plant installations including weeding, pruning and similar activities



Figure 4-19: Trimming landscape areas

## Salt Tolerance

Streetscapes can be some of the harshest environments in which to expect plant materials to survive and given the need to keep streets clear of snow and ice in winter, plant material with a high salt tolerance must be used. The City maintains a list of plant materials that have been successfully used in DPW projects. Adding to this knowledge base is regional research in Milwaukee and other cities on new plants that can be used in these environments.

The availability of water and the presence of underdrainage in medians can help in ensuring the long-term survivability of plantings. Water - manually applied or via an irrigation system - is often used in the early spring to help flush out any salts that may accumulate over the winter snow events. The drainage systems carry this water away to keep the salts from accumulating in the lower soil layers.



Figure 4-20: Salt tolerant plantings can include a wide variety of plants:

Although it is still recommended that salt tolerant plants be used in this environment, other design features can be incorporated into the streetscape to help ensure the survivability of plants in the streetscape. For example, raised salt lips around tree pits, raised planter beds, and "carriage walk" or door swing separations between planter beds and parked cars (approximately two feet), can be used to increase the distance of the plants from the road. Specially designed salt fencing can be installed during the winter to further protect this investment.



Figure 4-21: Ornamental grasses and daylilies

## Planting Soils

Providing the proper planting soils in streetscape projects is very important. Standard topsoil should not be used alone; it must be augmented with materials to increase the drainage characteristics of the soils. A recommended soil mix could include the following:

- 50% topsoil (by volume)
- 30-40% sand (by volume)
- 10-20% organic mulch (by volume)

Nutrient-rich organic material needs to be carefully considered; while providing essential nutrients to the plant materials these nutrient-rich materials can add to salt residue buildup in the soils.

Mulches should also be used after plant installations; hardwood bark mulch for trees and shrubs and a finer material for perennials helps maintain soil moisture content.



Figure 4-22: Installing planting soils

## Drainage

In combination with proper planting soils, proper drainage can help ensure good plant growth. In areas of the city where soils drain freely, providing extra drainage systems is not necessary. Where subsoils do not drain freely and water will accumulate in planters or tree pits, removing the water with underdrains is critical to plant survival.

Underdrains can be constructed of either perforated polyethylene or PVC pipe and connected to the storm sewer system.

One of the most important aspects of landscape maintenance is the availability of water to supplement natural precipitation. In the spring, using irrigation to flush out accumulated salts can greatly help plant materials survive.



Figure 4-23: Underdrain pipe

## Irrigation

Irrigation can be either by automatic irrigation or hand watering. Automatic irrigation consists of underground piping connected to pop-up sprinklers or drip lines located in the planters. These systems are maintained by the City and perform automatically, usually at night. The hand watering method uses quick-couplers with hose bibs. A standard garden hose can be attached to these for manual watering of the planters. The hose bib is a separate piece that is easily installed and removed to prevent undesired use. Although the City maintains the piping, the hose bib may be kept with the Business Improvement District or members of the community who have agreed to take responsibility for maintenance.



Figure 4-24: Median irrigation being tested

# Planters

Streetscape planters come in a wide range of styles and sizes. When placing planters, it is important to consider accessibility. Federally established accessibility guidelines allow a 32" minimum pinch point for a 2' maximum travel distance. Downtown areas with high pedestrian traffic require more accessible passage space than the 32" minimum required by law. In addition to freestanding planters, light standards and other street amenities must comply with this passage requirement.

## Flush Planters

Flush planters have no curb and are placed at the same elevation as the surrounding sidewalk. Flush planters can be installed with or without railings, with turf, or with more intense plantings including groundcover, annuals, perennials, ornamental grasses, and shrubs, or simply mulched. When more intense plantings are used, a railing is recommended to protect the plantings. The best example of a flush planter is a typical turf parkway.

Pedestrian traffic levels must be taken into account when designing flush planters, as they may be used for additional walking space if adequate space is not allocated. In this scenario, railings may be warranted.

## Curbed Planters

Curbed planters can be poured in place or constructed of precast concrete, granite, or other natural stone. These planters, varying in length, are generally 6"-8" in height and may have a variety of profiles, depending on the design intent of the project. The minimum size for planters, as measured from the inside of the planter curbs, is 4' in width and 8-1/2' in length. Planters can be installed with or without railings.

Sidewalk drainage is a key consideration when designing the placement of curbed planters. Sidewalks should be graded so that water on the sidewalk, behind the planter, drains in between the planters to the street.



Figure 4-25: Overly large planters can constrict pedestrian movements



Figure 4-26: Flush or salt lip planters can provide access to parked cars



Figure 4-27: Curbed planters can provide protection to plants

## Free-Standing Planters

Free-standing planters come in a variety of sizes and shapes and can be precast concrete or a synthetic material, such as glass fiber reinforced concrete (GFR). The planters are placed above ground and rest on the sidewalk, adding color and texture in tight areas or where underground conditions, such as utilities and vaults, prevent in-ground planters from being installed. Planters are allowed on hollow sidewalks, provided owners prove the sidewalk is structurally sound.

Caution must be taken to maintain the accessible route when placing free-standing planters. Care should be taken during installation to keep planters level. Planters may be decorated for interest in all seasons, such as pine boughs for winter and forced bulbs for spring.



Figure 4-28: Planters provide seasonal interest.

## Hanging Baskets

Hanging baskets are specially designed hanging flowerpots often constructed of open metal bands and filled with a lightweight planting soil. Hanging baskets add interest and color to a streetscape and are a way to introduce plant materials when there is no room for trees or planters. Hanging baskets are desirable in retail districts, main streets, and neighborhood shopping districts with an intimate scale.

Although hanging baskets are purchased and installed by the City, the sponsoring organization has the ultimate ongoing maintenance responsibility. Both free-standing planters and hanging baskets require constant maintenance and frequent watering. The ability of the community stakeholders or BID to maintain these elements is a critical factor in the decision to include them in the streetscape design.



Figure 4-29: Hanging basket maintenance

## Landscaping and Utilities

Before deciding to install planters and trees, a careful check of underground utilities and above ground utilities or encroachments, such as balconies, awnings, skywalks, etc., must be made.

Large-size utilities, such as a large water main or gas line, must be relocated if trees or in-ground planters are to be installed in the same location. This can add significantly to the cost of a project. If the utilities cannot be moved, landscape designs must be changed to accommodate.



Figure 4-30: Utility boxes and vaults in the landscape

## Railings

Low, ornamental railings add interest and identity to a streetscape, as well as protection from pedestrians and animals, when placed in combination with flush or curbed landscape planters. These railings vary in height from 12"-18". Due to their height and location within the streetscape, railings should not be constructed with pickets extending above the top rail in order to prevent snags or injuries.

The panels of pickets between the posts are secured in place with tamper proof bolts. This allows panels to be removed for access to the planter area for tree stump removal and/or tree planting equipment. In areas where there are existing trees, it is often advisable to install a railing without a curb. Unlike a curb, which has a continuous footing, the railing posts have narrow foundations that do not require tree roots to be removed or cut to accommodate railing installation.



Figure 4-31: Wisconsin Avenue Planter Railings

## Tree Grates

In the past, the City has used cast iron tree grates in the streetscape. However, for cost reasons, the City is moving away from using tree grates unless width restrictions require their use.

Tree grate openings must comply with ADA accessibility guidelines. This means that the slots of the tree grate must not be more than 3/8" wide. This allows tree grates to become part of the ADA's accessible route that must be present in all streetscapes.

Cast or ductile iron tree grates have been used throughout the city for many years. In addition to protecting trees, cast iron tree grates have the benefits of strength, durability, stability, low maintenance, non-flammability, and the ability to be cast in varying thicknesses and patterns. Manufacturers have standard off-the-shelf patterns that can be purchased by contractors and still satisfy DPW requirements. Iron tree grates must have breakout

rings or removable bolted tree rings cast into the grate. This allows the center of the tree grate to literally be broken out or removed to accommodate the growing tree trunk.

Tree grates should also be installed with frames as part of a raised salt lip or edge that frames the tree grate. This slightly raised position of the tree grate helps to keep salt out of the tree planting pit. These salt lips are typically part of the concrete support that surrounds the tree grate. In certain areas of the city, this salt lip has been fabricated in granite.



Figure 4-32: Tree grate with granite salt lip



Figure 4-33: Tree grate with concrete salt lip

# Sidewalk Pavement

Pavements, especially in urban areas, form the floor of the outdoor environment in which people live, work, and play every day. The design of walking surfaces is one of the most important elements for setting the initial mood of the space. A space covered in grass will feel much different than the same space covered in concrete.

Even if the outdoor area is accented with trees, lights, benches, people, and other urban space elements, the ground plane sets the tone for how the space is to be used and how it feels to the user. For the most part, the sidewalks in the City of Milwaukee are constructed with concrete, although a number of areas have concrete walks accented with the addition of other materials, such as pavers or colored concrete.



Figure 4-34: Sidewalk pavements

## Monolithic Sidewalks

Most sidewalks are monolithic, which means that the pavement is constructed with one material, most typically Portland Cement Concrete (P.C.C.). The typical P.C.C. sidewalk constructed in the city has the following characteristics:

- Thickness: 5"
- Strength: minimum 3,500 pounds per square inch
- Not reinforced with wire mesh or rebars
- Broom finished top surface

This type of sidewalk is easy to install and long lasting when installed correctly. Repair of the sidewalk is easily accomplished when properly done.

There are a number of finish variations to P.C.C. sidewalks: scored concrete; stamped pattern concrete, and window pane concrete.



Figure 4-35: Sidewalk pavements

## Scored Concrete

Typically, concrete surfaces are scored into squares or rectangles in order to control cracking in the concrete slabs. Additional scoring can be added to further break up the concrete surface and to add visual interest. This additional scoring can be either hand tooled during initial installation or saw cut after curing of the concrete.

Special attention should be paid to the design of concrete scoring at certain streetscape elements, especially tree grates, planters, and light poles.



Figure 4-36: Scored concrete sidewalk pavements

## Window Pane Finish

Scoring can be combined with wide tooling of the surface to create a window pane effect. This must be done during the final finishing of the concrete. After the concrete surface has been broom finished, the scoring is created using a wide concrete tool that creates a smooth surface on both sides of the score joint. This smooth surface can vary from 2"-3" wide and the resulting surface has a higher level of visual interest.



Figure 4-37: Window pane concrete finish

## Colored Concrete

Colored concrete sidewalks are constructed with Portland Cement Concrete (P.C.C.). The typical colored P.C.C. sidewalk in the city has the following characteristics:

- Thickness: 5"
- Strength: minimum 3,500 pounds per square inch
- Not reinforced with wire mesh or rebars
- Broom finished top surface
- Color can be added integral to the concrete or during the curing process (it is the City's practice to use integral color)

It is important to consider the problem of color matching when future maintenance is required. The new patches may not completely match the original colors.



Figure 4-38: Colored concrete finish

## Stamped Concrete Finish

Stamped concrete was developed to impress a design resembling masonry or a modular material, into a monolithic concrete surface. There are numerous patterns available: brick, cobbles, flagstone, and boardwalks. These are achieved by pressing a metal or rubber master pattern into the freshly poured concrete or during the curing process.

Color may also be added, either integral to the concrete or during the curing process. It is important to consider the challenge of color matching when future maintenance is required. New patches in a stamped or colored concrete surface are very difficult to match to the original surface.



Figure 4-39: Stamped concrete finish

## Detailing and Streetscape Elements

To avoid cracking and increase the longevity of concrete walks, it is important to pay close attention to joint detailing. Each streetscape element poses a different circumstance that must be addressed. Curbed concrete planters should have an expansion joint between the planter curb and the surrounding concrete walk. Similarly, light poles should have an expansion joint between the light pole footing and the surrounding concrete walk.



Figure 4-40: Proper detailing is important in streetscape elements

## Unit Paver Sidewalks

In contrast to monolithic sidewalks, unit paver sidewalks are created using small paving units that form the surface of the sidewalk. Unit pavers have been in use in Milwaukee since the city was constructed. The old, original brick streets that often underlay newer asphalt surfaces were constructed with unit pavers.

Unit pavers are made from a number of materials, including concrete, clay, and stone, and are highly variable in color, finish, and texture. Both maintenance and budgetary constraints must be considered when determining the appropriateness of unit pavers in a streetscape project. The walkability of unit pavers must be considered.



Figure 4-41: Unit paver sidewalks

## Concrete Unit Pavers

Unit pavers must be used as an accent feature and not as the main pavement surface.

These pavers are fabricated from highly compressed, specialized concrete mixes. High quality concrete unit pavers have the following characteristics:

- Very high strength (generally 8,000 pounds per square inch)
- Absorption rates are low (generally four to five percent range) to help prevent spalling
- Smooth finish for walkability
- UV resistant, integral color throughout the paver, however concrete unit pavers tend to fade after three to five years of exposure to sun (depending on quality and color of pavers)

The City of Milwaukee has used Holland Stone paver (4" x 8" x 2-3/8") or Double Holland paver (8" x 8" x 2-3/8") manufactured by Unilock, or an approved equal. The standard color is either a buff/brown blend or a charcoal/natural blend.



Figure 4-42: Concrete unit pavers

## Clay Unit Pavers

Concrete pavers are typically used as an accent feature in streetscape design, not a principal walking or driving surface.

These unit pavers are fabricated from clay that is fired at extremely high temperatures. However, unlike typical building bricks, clay unit pavers are solid and must meet much higher strength requirements due to their exposure to weathering, water, and salt. High quality clay unit pavers have the following characteristics:

- Extremely high strength, often in the range of 10,000-12,000 pounds per square inch
- Low absorption rates (generally in the four to five percent range) to help prevent spalling
- Color will not change because the paver is a fired product

The City of Milwaukee does not have a standardized clay unit paver and new projects must provide samples for approval by DPW for approval. These are typically used as an accent paver.



Figure 4-43: Stamped pattern concrete gives “unit paver” accent in streetscape

## Granite Pavers

Milwaukee has utilized recycled granite pavers in a number of its projects, most notably in the intersections of major streets in the downtown area. These pavers have been salvaged from street reconstruction projects, cleaned, palletted, and stored for re-use in City projects.

These pavers are quarried from actual granite blocks and have a highly variable size and surface characteristic. The cleft finish of a granite paver surface can be relatively rough and may not be appropriate for pedestrian use unless the pavers were sawn to create a consistent walking surface.

It is strongly recommended to limit the use of granite pavers to an accent paver or in conjunction with landscaping in terraces or medians because the high cost of the material.



Figure 4-44: Clay unit paver accent with granite paver edging

## Special Finish Pavers

There are a number of manufacturers of high quality, special finish pavers. These pavers generally are fabricated in a variety of sizes - from 4” squares up to 36” squares- and have highly variable and customizable surface textures and colors. The larger size makes these pavers appropriate for larger sidewalk sections, especially plazas and special interest areas. Special finish pavers can also represent natural stone products such as marble, granite, or other natural local or imported stones. The City of Milwaukee has not selected any particular paver for a standard in its streetscape work.

Depending on the size, special finish pavers may require specialized installation detailing for long term durability.



Figure 4-45: Special finish pavers during installation

## Unit Pavement Construction

For long-term durability, unit pavers must be installed properly and on a base that is appropriate for the intended use of the surface. The City of Milwaukee has installed unit pavers in a wide variety of methods with varying degrees of success. Pavers which have been installed with mortared joints have suffered significant failure, not of the pavers themselves, but of the mortar and setting bed due to the harsh winter climates and application of salts. This system is not recommended for future streetscape installations.

Today, unit pavements are constructed in one of three ways:

- flexible base system
- rigid base system
- hybrid system



Figure 4-46: Unit paver crew in action

## Flexible Base System

In this system, unit pavers are placed on a sand setting bed that is installed on a compacted stone base course. The pavers are vibrated into place which causes the sand to migrate and interlock with the pavers. This system has the following characteristics.

- Initial installation is comparatively easy and inexpensive
- Repairs to subsurface utility systems are easier to access, however repair of the unit paver surface is difficult to achieve to the original grade. Careful attention must be made to meet original compaction levels to prevent uneven settling
- Finished surface of pavement is subject to settling as the subgrade settles. Settlement may occur adjacent to fixed objects (lights, etc.) and adjacent monolithic pavements (sidewalks) and curbing



Figure 4-47: Flexible system with pavers, sand and aggregate base

- This system will require future maintenance to correct settled pavements

This system is commonly used for residential driveways and patios and has been used for streetscapes in the past. However, because of the possibility for settlement, the use of this system should be very limited and used in areas where pedestrians are not expected to be present.

The initial savings created by this system over other systems more often are offset by future costs of resetting pavers that have settled. While it may appear that this system would be easy to make repairs to underground utilities, the new surfaces can fail as the subgrades are frequently more difficult to compact to original densities and will settle over time, which causes uneven settlement in the repaired unit paver surface.



Figure 4-48: Settled unit pavers

## Rigid Base System

In this system, the unit pavers are placed on a bituminous setting bed that is installed on a concrete slab base course. The purpose of using bituminous material in the sand setting bed is to provide a barrier to prevent sand from moving into any cracks that may have developed in the concrete underlayment slab. The concrete slab is installed similar to any sidewalk or driveway slab with a stone base course over a compacted subgrade. This system is typically used in sidewalks, crosswalks and driveways where vehicular traffic is present. The characteristics of this system are as follows:

- This is a comparatively more difficult system to initially install and typically more costly.
- This system is much more resistant to settlement since the bituminous setting bed and concrete underlayment bridges over areas of subgrade that are not fully compacted.



Figure 4-49: Preparing subgrade for underlayment installation



Figure 4-50: Concrete underlayment prepared for new pavers



Figure 4-51: Installing pavers on bituminous setting bed with neoprene tack coat

- This system is outstanding for areas subject to vehicular traffic.
- This system will not require as much future maintenance work to correct settled pavements.
- Repairs to the pavement are often more costly, however, those repairs can last longer.

While the concrete underlayments may appear to create challenges in this system when access to utilities below grade is needed, the replacement concrete is tied into the adjacent concrete slabs and will bridge the excavation. This bridging effect will keep the repaired unit paver surface flush with the original.

The installation of the bituminous setting bed and the pavers is a precision installation which requires specialized knowledge and expertise. Repairs can often be more costly.

## Hybrid Base System

Recently, a hybrid system has emerged that combines the advantages of the sand setting bed in the flexible base system with the concrete underlayment in the rigid base system. This hybrid system uses a sand setting bed with a filter fabric over a concrete underlayment slab and has a number of characteristics:

- This installation of the pavers is nearly identical to the flexible base system, which increases the pool of available installers.
- The costs are in the mid-range between flexible and rigid systems because of the concrete underlayment.
- The filter fabric keeps the sand from flowing out of the setting bed and into the cracks that develop in the concrete underlayments.
- System is tolerant of occasional vehicular traffic.



Figure 4-52: Hybrid Base System - installing pavers on sand over concrete (filter fabric is obscured)

- Repairs to a finished paver system will still require replacing concrete underlayments to help preserve surface integrity.

The hybrid base system can provide a high performance unit pavement system with the ease of installation of the flexible base and the settlement resistance of the rigid base unit paver pavement systems.



Figure 4-53: Installing large slab pavers over sand over concrete with filter fabric

## Balance of Systems

Each unit paver system must be evaluated on the application and function that is intended.

- In areas where vehicular traffic is anticipated - crosswalks, alleys, driveways, etc. - a rigid base (bituminous setting bed) system is recommended.
- In areas where pedestrian traffic dominates, such as sidewalk areas, a hybrid base system is recommended.
- The flexible base system is not recommended except in very limited areas where pedestrians and vehicles are not anticipated.



Figure 4-54: Unit pavers can be used for intricate patterning

## Roadway Pavements

The City of Milwaukee surfaces all of its roads with bituminous asphalt. Concrete roadway pavement is preferred for new construction and reconstruction projects. Refer the DPW Infrastructure for more information.



Figure 4-55: Roadway pavement

## Striping

The City of Milwaukee has standards for striping driving lanes, angle parking spaces, crosswalks, stop bars, and bicycle lanes; generally these follow the requirements of the Manual of Uniform Traffic Control Devices (MUTCD).

While a project is under construction, temporary spray-painted markings may be used. However, the final thermoplastic markings that are applied to bituminous surfaces will be more permanent and long lasting.



Figure 4-56: Standard striping

## Curb and Gutter

Curbs define the edge of the sidewalk area where it meets the street and act as a barrier to prevent vehicular traffic from riding up onto the sidewalk. The gutter is located in the street, adjacent to the curb, and forms the edge of the roadway pavement. The gutter collects water run-off from the street and channels it into the appropriate drainage structures, which are located along its length. The City of Milwaukee installs cast-in-place curb and gutter. The typical curb is 15" deep by 7" wide and tapers into an integral 12" wide gutter.



Figure 4-57: Standard curb & gutter

### Crosswalks - Standard

As discussed in Chapter Three, crosswalks are the legal pedestrian crossings for city streets. DPW uses 4" wide white stripes to delineate crosswalks in standard crosswalk applications. These stripes are periodically renewed when the pavement is resurfaced. Typically, crosswalk stripes are applied using thermoplastic materials.

The city has used various materials in the construction of crosswalks with enhanced surface features and has decided to limit enhanced pavement choices for crosswalks to concrete with the option of using unit pavers as an accent material. The city has had experience with stamped bituminous asphalt texturing, however, the stamped surface does not wear well and the surface coating requires nearly constant renewal due to vehicular traffic.



Figure 4-58: Standard crosswalk

### Crosswalks - Concrete

The first enhancement option for crosswalks is to use concrete with a scored (not stamped) finish. This concrete will be the standard gray color of Portland Cement Concrete (P.C.C.) or be integrally colored concrete with a buff colored finish and scored into a simple grid and banding pattern. The concrete will be as deep as the adjacent pavement system and tied into the adjacent pavements to prevent differential settlement.

This technique provides a good contrast between the driving surface and the crosswalk area. A border stripe should also be applied on each side of the crosswalk in keeping with the Manual of Uniform Traffic Control Devices (MUTCD).



Figure 4-59: Scored concrete crosswalk

### Crosswalks - Unit Pavers

The second enhancement option for crosswalks is to use unit pavers not as the primary walking surface, but as a header or accent material. The City has used pavers in certain intersections with good success. The pavers should be installed on a bituminous setting bed over a heavy duty concrete underlayment. To contain and protect the pavers and to provide a visual band, a concrete header band should be installed on each side of the paver field. All of the concrete elements should be tied into the adjacent concrete pavement underlayments to prevent differential settlement and to prolong the pavement life.

This technique provides a smooth-to-rough contrast between the driving surface and the crosswalk. The "rumble strip" causes drivers to slow down and contributes to pedestrian safety. Given the cost of this enhancement, this technique should be reserved for areas where unit pavers are used on the sidewalks.



Figure 4-60: Stamped pattern concrete crosswalk (unit paver treatment)

## Crosswalks - Historic Third Ward

In parts of the Historic Third Ward close to the Public Market, the crosswalks are constructed using stamped concrete with a boardwalk surface texture and appropriate color. This special finish is currently reserved for those areas inside the boundaries of the Historic Third Ward.



Figure 4-61: Historic Third Ward stamped crosswalk (boardwalk treatment)

## Curb Ramps

Curb ramps provide a connection from the sidewalk to the street for all pedestrians and especially those with mobility challenges such as people in wheelchairs, people pushing strollers, children on bicycles, and delivery services.

Curb ramps are required at all intersections and crosswalks, including mid-block crossings, and should align with the center of the crosswalks. A typical curb ramp consists of the ramp, side flares, approach and a landing. The slope of the ramp must not exceed 8.33 percent, or 1" rise per 1' length. The flares must not exceed 10 percent, although 8.33 percent is preferred whenever possible. The cross slope must not be greater than 2 percent. The preferred width of a curb ramp is 6' and the minimum width is 4' not including the width of the flared sides.



Figure 4-62: Series of curb cuts and curb ramps with detectable warning surfaces

While there are a number of potential curb ramp design configurations, the City prefers two curb ramps per corner that run parallel to the crosswalk and direct pedestrians into the crosswalks.

Care must be taken in the design and construction of curb ramps. Per the Federal requirements, there should be a flat landing at the top of the curb ramp. This can create a challenging grading situation for retrofit situations and most likely would require replacement of the entire sidewalk corner.

In addition, it is often necessary to correct the street pavement grades immediately adjacent to the curb ramps. This is done by milling the surfaces of the street and repaving to create the proper gradients at the curb ramps.



Figure 4-63: Typical curb ramp

## Curb Ramps - Detectable Warning Surfaces

Per Federal ADA requirements, detectable warning surfaces must be applied to all ramps to indicate the interface with the street. This pattern of slightly raised truncated domes is determined by the Federal requirements. The finished detectable surface must be in contrast to the surrounding surface colors.

There are a number of methods to create this pattern, however, an embedded unpainted metal panel is the preferred method. This panel is pressed into the moist concrete and is permanently affixed to the concrete panel. This panel is resistant to freeze/thaw cycles and damage from snow plowing and street cleaning.

In areas where unit pavers are used for the surface of the sidewalk, detectable warning surfaces are created using special unit pavers that create the required pattern. Using unit pavers to create this pattern preserves the integrity of the unit paver design and the construction system by not introducing another paving system into the design.



Figure 4-64: Street milling is sometimes required to fix curb ramps



Figure 4-65: Cast iron detectable warning plate



Figure 4-66: Detectable warning unit pavers

# Street Furniture

Street furniture includes those elements that pedestrians, motorists and bicyclists need in the streetscape including benches, trash receptacles, bicycle racks and other accessory elements. Long term durability and ease of maintenance is of primary concern by the City. Using the criteria of long term maintenance, a limited number of special streetscape furniture elements may be considered. In some cases, DPW may require BIDs to assume maintenance of streetscape elements it deems are beyond its capacity to properly maintain with its limited resources.

It is possible to deviate from the standard palette, at the owner's expense, to help reinforce a particular motif or brand in a BID or historic area of the city. However, unless the BID has made special provision to stock those items, the City will repair or replace items with standard streetscape furniture elements.



Figure 4-67: Coordinated Street Furniture

## Benches

The public realm is like an “outdoor room” in many ways. Benches and other street furniture need to be carefully selected for comfort of the user and still stand up to extreme weather and everyday use. A number of considerations are used in the selection of benches:

- Style: timeless style that can span many periods and architectural styles
- Materials: all steel with a durable powdercoated finish
- Backs and armrests for comfort; intermediate armrests on long benches
- Slatted construction to provide for water drainage and to discourage skateboard grinding



Figure 4-68: Landscape Forms Plainwell Bench (black)

For new streetscape projects the City has chosen a standard bench with several variations for use in the public way: the Landscape Forms Plainwell Bench in wood or cast aluminum, or approved equal.

Either variation of the bench is timeless and works well in nearly every situation. The Plainwell Bench is well-designed for comfort and reflects a historical heritage without an overt look.

These benches were selected for their exceptional strength and durability under the most extreme environmental conditions and their vandal-proof protection against destruction and defacing.

For existing streetscapes, or continuation of previously developed streetscapes, the Victor Stanley RB-28 may continue to be used to maintain continuity in the furnishings.



Figure 4-69: Victor Stanley RB-28

## Trash Receptacles

Like benches, trash receptacles need to be considered carefully for two different users: pedestrians and maintenance personnel. The City standard trash receptacle has the following characteristics:

- 20 gauge cold rolled steel with 4 drainage holes in bottom
- 24 gauge galvanized steel liner measuring 20-3/8 inches square by 33-1/2 inches high
- 55 gallon capacity
- 48 inches high, 21 inch square base
- 2 self closing doors on the hood

Trash receptacle capacity is critical in Milwaukee because most trash receptacles are only serviced once per week. The downtown area trash receptacles are serviced twice per week during the summer to address increased waste from high pedestrian traffic, festivals, and special events. Waste receptacles are usually placed two per block, on opposite corners at intersections.

In special areas of the city, some trash receptacles deviate from the standard. The Historic Third Ward uses a decorative teal green trash receptacle manufactured by Victor Stanley. This trash receptacle only has a 36 gallon capacity with an interior pull out liner. It is fabricated from vertical steel bars with a powdercoated finish.



Figure 4-70: Milwaukee Standard Trash Receptacle



Figure 4-71: Historic 3rd Ward Trash Receptacle

## Ash Urns

With the gradual elimination of indoor smoking, smokers are using the streets more often for smoking breaks and ash urns are now returning as optional site furniture accessories. If they are used, urns are usually placed near building entrances and pedestrian congregation areas like bus stops.

In the past, the City has used the Victor-Stanley Ironsites (S-20) ash urn, or approved equal, in the color black as the standard ash urn.

Due to its limited demand and use, this is no longer considered a standard streetscape element by the City.



Figure 4-72: Victor Stanley S-20 Ash Urn

## Bicycle Racks

Encouraging bicycle traffic begins with providing safe corridors to bicycle riders and proper places where bicycles can be secured against theft.

The basic bicycle rack is a simple inverted U-shape rack that is either direct embedded or bolted to the sidewalk pavement. These racks should be ganged together in groups of three or more, parallel to each other about 24-30 inches apart.

No particular manufacturer is named because of the simple nature of this design. The bicycle racks are fabricated from tubular steel; approximately 2 inches diameter and formed into the U-shape that is approximately 24 inches across and 36 inches high after mounting. Finish should be a black powdercoating.



Figure 4-73: Basic bicycle rack

## Bollards

Bollards are simple streetscape elements that have two primary functions:

- to separate areas without creating full barriers like fencing
- to protect high-value elements from deliberate or accidental vehicle collision damage

For most applications, the City has chosen a simple pipe bollard filled with concrete and set in the ground with 24-36" exposed. The exposed portion is covered with a black polyethylene sleeve and cap to eliminate painting and to absorb minor dings.

Heavier duty cast iron sleeves are also available and are often used in hardened perimeter security projects where the sleeve is installed over a heavily reinforced steel pipe core.

At times a decorative bollard is desirable in a streetscape and many



Figure 4-74: Standard bollards sleeve examples

light pole manufacturers offer bollards as companion pieces to the light pole, or standard elements in a complementary "kit of parts."

In the Historic Third Ward, a precast bollard element has been employed in the streetscape. This bollard design is reserved for this particular district.

The City is currently experimenting with bollards of solar lighting on a small project. If these prove to be durable and low maintenance, they could become a standard element.



Figure 4-75: Decorative bollard

## Parking Meters

The City has been maintaining its stock of standard parking meters as it introduces parking kiosks in certain areas of the city.

The standard parking meter is mounted on a post fabricated from steel pipe and core drilled into the pavement. The post is unpainted. The post is set approximately 12 inches back from the face of curb and centered on parking stall lines.



Figure 4-76: Parking meters

## Parking Kiosks

In recent years, the City has been implementing a parking kiosk system (“Lukes”) that drivers use to pay for parking. The kiosks accept cash and credit cards and can be used for any numbered space in the system. Drivers may also get a parking receipt at the kiosk. The City can check to see if parking spaces are paid for at the kiosk rather than having to check individual parking meters. All kiosks accept payment for any parking space. (A driver can add time to the numbered space where his car is parked using a kiosk located blocks away.)



Figure 4-77: Parking Kiosk

## Parking Space Number Posts

In conjunction with the parking kiosks are the posts that delineate which parking space is assigned to the parking receipt. These posts with a top finial and number plate attached are the same material and size as the standard parking meter post and the entire assembly is painted black with applied number graphics on the post plate.



Figure 4-78: Parking Space Number Post

## Community Identifiers and Branding

Community identifiers are sculptural elements within a streetscape that seek to bring a unique identity to a neighborhood commercial district.

This character can be drawn from many different sources: cultural ethnicity, architectural styles or elements, special cultural or historic institutions, or the general historical background of a neighborhood. Since these elements can initially be expensive, have unique maintenance considerations, and are unique to each BID or community area, separate funding must be identified in order for community identifiers to be included in a streetscape project.

A symbol or idea may be developed via community meetings and design charrette to be used repeatedly in a variety of forms throughout a commercial area, such as:

- Large, single-use elements placed over the street, such as a monumental arch, gateway or portal
- Two flanking elements, columns or markers placed on either side of the street, typically located on the sidewalk
- Smaller, repetitive elements such as fabric banners or permanent pole identifiers
- Pavement medallions
- Pavement treatments along the streetscape
- Custom streetscape elements or modifications to standard streetscape elements to include identity elements, such as medallions placed on railings or unique finishes and colors.

## Identifier Elements

The following represent some of the elements that may be used as community identifiers.

**“Gateways” and Area Markers:** An area marker or gateway is generally a large sculptural element placed either at the end of a streetscape or along a streetscape. These elements serve the purpose of marking the entrance ways and throughways into the commercial/retail district. A variety of structures have been used for existing gateways in the City of Milwaukee, including an interior lit “lighthouse” with bronze community name plaques, large steel vertical elements with the name of the area laser cut into the steel, and large sculptural archways with and without community labels identifying the community area.



Figure 4-79: Historic Third Ward Entry



Figure 4-80: Riverworks Entry Feature

## Identifiers Elements

**Kiosks:** The purpose of a kiosk is to present information about both the commercial/ retail area, as well as map points of interest and highlight local events taking place within the area. The kiosk may present permanent information or include a Plexiglas case that allows change-out of information. The Plexiglas case is only installed when a BID or community group has identified a group to maintain it and oversee the information to be displayed in the case.

**Banners and Pole Identifiers:** Banners are rectangular metal, vinyl, or treated fabric signs that are mounted in flag fashion on one or two sides of the light standards along a streetscape. Although banners can be changed seasonally or for special events, both pole identifiers and banners can represent the unique character of a community group, its individual identities, or commercial members.



Figure 4-81: Decorative Kiosk

When mounted on steel light poles, banners are subject to various criteria, including size limitations and minimum vertical clearance.

**Sidewalk Medallions:** Pavement markers, or sidewalk medallions, are ornamental emblems that are set or stamped into sidewalks along a streetscape, usually at intersection corners. These medallions are typically bronze, tile, or precast concrete and can be logos or other representations of community identity. In some areas, such as the Historic Third Ward, pavement markers indicate street names.

**Public Art:** Public art is another way that districts can distinguish themselves in the streetscape. Care should be taken when designing a streetscape, to create opportunities for both temporary and permanent public art. Public art may complement the history

or culture of an area, or create a new experience or interest for the people in the district.

Funding for public art can be most effective when used to design or select infrastructure, including but not limited to:

- Benches and other forms of seating
- Walls or borders (murals, ghost signs, lettering, insets)
- “Kit of parts” streetscape elements such as tree grates
- Planters and other methods of “greening”
- Landscape enhancements, both natural and hardscape
- Walking surfaces
- Lighting (including the City’s Landmark Lighting Program)



Figure 4-82: Washington Park Banner



Figure 4-83: Freedom Quilt Pavement Medallion

## Identifier Elements

- Transit Shelters
- Signage and signage holders
- Establish an endowment for public art that can fund art for an area over an extended period of time and respond to neighborhood changes

Prior to installing any public art, administrators should consider the following:

- Will the art hold the attention of viewers over many years?
- Will a portion of the funding be set aside for long-term maintenance?
- Will there be funding to hire a public art administrator to facilitate an RFP and/or RFQ?



Figure 4-84: "Engine Co. 10"

**Construction and Maintenance:** The constructability of a design as well as maintenance concerns must be at the forefront of the design process for identifier elements, whether large or small. As ideas for identifiers grow in size and complexity, there is often a direct correlation to increased costs for manufacturing, installing, and maintaining these items.

Although identifiers are often dramatic statements, if they are not designed, located, and constructed properly they can become more of a liability than an asset to the community. Whenever feasible, gateway identifiers should be protected with bollards. Often a community desires to have lighting incorporated into the design of their community identifier. This requires careful design and consideration of maintenance.



Figure 4-85: Sculptural wall mural

All publicly funded designs must be approved by DPW and must either use standard components for ease of maintenance and replacement, or assume the responsibility of providing and maintaining custom or non-standard components.

**Design Standards:** The City of Milwaukee has a review process through the Milwaukee Arts Board (or Public Art Subcommittee) to determine the appropriateness of symbols or identifiers in the public realm because the vast differences in types of identifiers. An identifier can range from a small medallion in the sidewalk pavement to a large gateway structure that spans an entire roadway. Designs will also be reviewed for safety and long term maintenance cost.

Depending on the type of identifier element, proper design standards must be maintained to ensure proper use, maintenance, and safety. For example, placement must not impede the accessible route or headroom heights. When space is tight, communities may decide to place identifier elements on private property. Although the City will help with these efforts, the City's streetscape program will not pay for or install them.

## Private Streetscape Elements

As outdoor dining continues to become more popular, many restaurateurs are bringing their dining areas into the streetscape. In many cities, al fresco dining is allowed in the public right-of-way with certain stipulations and permits (Milwaukee code s.115-32.6). The use of privately-owned corrals that surround the outdoor dining areas has been in response to the requirements of liquor laws in many cities.

The challenge in these private streetscape elements is to balance the needs of the public traversing the streetscape with the desire to stimulate and encourage outdoor activities that bring in business. There have been many instances where the extent of sidewalk cafes have forced pedestrians off the sidewalk and into the street to traverse the streetscape area.

Finding the balance can be a difficult task. Each location is unique and may have different pedestrian movements and volumes as well as physical constraints and limitations.

Providing a clear, unobstructed pathway is a critical component of any sidewalk cafe. In areas with high pedestrian counts, this minimum width could be approximately 6 feet. This would allow two approaching pedestrians to pass each other. In areas where there is lighter pedestrian counts, that minimum width may be able to be reduced to 4 to 5 feet. Where sidewalk cafes are long, a wider width would be more comfortable.

The structures that create the corrals should be carefully examined for safe construction and materials. Steel and wood elements are very common; care must be taken to keep sharp edges and splinters from injuring passing pedestrians or snagging clothing. Overhead structures and lighting elements may require special permit reviews and insurance requirements.



Figure 4-86: Outdoor cafe corral - metal and fabric enclosure



Figure 4-87: Outdoor cafe corral - wood planters and enclosure



Figure 4-88: Outdoor cafe corral - wood and planter enclosure