Chapter 3: Guidelines

Parkways have accommodated multimodal travel since their inception.

Treating a parkway in a way that protects and enhances its historic, scenic and recreational characteristics while providing safe, comfortable and multimodal travel is critical. A considerable degree of flexibility and opportunity for engineer or designer judgment are built into the principles of context sensitive design, established design criteria and current engineering practices, as reflected in the MassHighway *Project Development and Design Guide*. These guidelines illustrate how to take advantage of this flexibility in order to preserve and enhance the character of historic parkways throughout the Commonwealth. These guidelines do not establish new or different geometric design standards or criteria for parkways, nor do they imply that safety and mobility are less important design considerations. Where these guidelines do not provide specific dimensions, refer to the MassHighway *Project Development and Design Guide* or, in turn, sources listed in the Bibliography.

The guidelines are organized into the following categories and sequence, consistent with the MassHighway *Project Development and Design Guide*:

- Alignment
- Cross Section Elements
- Major Structures/Bridges
- Intersections and Curb Cuts
- Stormwater Management/Drainage

MassHighway's *Project Development and Design Guide (2006)* is easy to use and clearly organized. Finding the information relevant to a particular parkway project is straightforward. Appendix F: Table of Cross Reference with Federal Highway Administration Flexibility in Design (1997) and MassHighway Design Guide tabulates the location of information in the three guides.

The guidelines in this chapter are consistent with The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes.[1] The two most frequent treatments are preservation and rehabilitation. A given project may include some elements for which preservation is appropriate and others for which rehabilitation is appropriate instead. For as many elements as possible, these guidelines adhere to the standards for preservation. For those elements where preservation is neither feasible nor appropriate, then at the minimum the guidelines adhere to the standards for rehabilitation.

Preservation treatment is preferred for alignment, vistas, interface of travel way and landscape grading, shoulders, lane number and width, medians, vegetation, curbs, walls, bridges, rotaries, and culverts and swales. For other elements, rehabilitation is the appropriate treatment.

Although preservation is the preferred treatment for these twelve elements, there are situations where straight preservation does not satisfy overall parkway goals. The recently completed Memorial Drive Rehabilitation Project is a good example. Preserving three lanes of eastbound traffic next to the Charles River would have retained the travel way's lane number and width, but would have missed the opportunity to increase riverfront parkland and to accommodate the large number of bicyclists and pedestrians. DCR met overall parkway preservation goals by reducing three lanes to two and increasing the width of the parkland rather than preserving three lanes. This rehabilitation approach was based on an analysis of existing conditions and the resulting design controls.

Preferred Treatment by Element		
Element (as organized in this chapter)	Preservation	Rehabilitation
Alignment	■	
Cross Section Elements		
Vistas from the Travelway	■	
Interface of Travelway and Landscape Grading	■	
Sidewalks and Pathways		■
Shoulders	■	
Lane Number and Width	■	
Pavement Markings		■
Travel Surface		■
Medians	■	
Vegetation	■	
Curbs	■	
Clear Zone		■
Traffic Barriers		■
Walls	■	
Utilities		■
Signage		■
Lighting		■
Major Structures	■	
Intersections and Curb Cuts		
Interface with Municipal Roads and Parkway Terminus Points		■
Traffic Signals		■
Rotaries and Roundabouts	■	
Interface with Public Recreation Facilities		■
Curb Cuts		■
Stormwater Management/Drainage		
Travelway Drainage		■
Stormwater Best Management Practices		■
Culverts and Swales	■	

3.1 ALIGNMENT

Goal

Preserve existing roadway alignment and profile except where alterations are needed for traffic calming.

A sinuous vertical and horizontal alignment combined with magnificent trees.
(VFW Parkway, a Connecting Parkway)

Issues for Alignment

Of all the elements of parkway design, alignment affects the user's experience of the parkway the most. Alignment is the combination of curved and straight segments in the vertical and horizontal dimension. Consistent with the original design intent, every parkway should convey its traffic enjoyably and comfortably as well as safely, whether the traffic is vehicular, cyclist, pedestrian, or a combination.

Most travel ways have curvilinear horizontal and vertical alignments that conform to the landscape. Rises in profile and sweeping curves often provide the traveler with middle and long distance views. Landscape elements and prominent scenic features are frequently close to the pavement edges.

Design speed was not a consideration in the original design of many parkways because travel speeds were slow. Curvilinear alignments enhanced driving for pleasure. With the advent of motorized travel, however, the desire of motorists for faster travel speeds began to conflict with the travel speeds implicit in the degree of curvature of the alignments. On parkways that are major transportation corridors, the

number and higher-than-posted speed of vehicles strain the ability of the curvilinear alignment. Higher travel speeds conflict with the original design intent.

The existing minimum radius dictates the maximum safe travel speed and allows sufficient sight lines for adequate stopping distance. The travel speed should also be compatible with pleasure vehicles. Altering the alignment to attain a higher travel speed significantly affects the historical cross section, its character and original design intent and detracts from shared use of the travelway by bicyclists and pedestrians.

Guidelines for Alignment

- Evaluate measures to improve safety and restore the balance of users in a progressive manner starting with the least intrusive approach. For example: better enforce the existing speed limit, evaluate the need for a change in the speed limit, install warning signs on crest curves, install traffic calming measures such as increased curb reveal up to eight inches, narrower travel lanes and shoulders where safe, elevated intersections or walkways on low-speed roadways, or roundabouts at major intersections if historically appropriate, and implement planning measures to lower the volume of demand by redirecting traffic.

- Where the stopping sight distance (per MassHighway *Project Development and Design Guide,* 3.7) is inadequate for a given speed limit, if above measures do not improve safety sufficiently, remove minor sight obstructions such as tree branches in a way that does not substantially alter roadside character.

- Allow minimal alignment changes only where safety data clearly and overwhelmingly indicate a deficiency directly attributable to the alignment of the travelway.

- Only remove ledge to achieve improved sight lines if based on sound assessment of safety needs and only as a last resort. Minimize ledge removal and match the resulting ledge face to the original slope, texture, and height as much as possible. Preserve or restore native plantings and drainage systems.

- Recognize the value of trees in providing visual clues to drivers on changing horizontal and vertical curves.

- **Internal Park Roads:** In areas where alignment reduces sightlines and visibility, clearly post and enforce lower speeds. If no longer needed for vehicular use, improve alignment as appropriate for a recreational trail.

- **Summit Roads:** Do not alter the alignment, unless safety data indicate a deficiency directly attributable to the alignment and minimal change can correct it. If the alignment has already been altered, use interpretive materials to educate visitors about the Summit Road's original configuration. Whenever possible, preserve the original route as a trail.

- **Estate Roads**: Preserve formal entrance sequences and alignment. Even if these roads are converted for the sole use of pedestrians, cyclists or equestrians, continue to maintain their alignment.

3.2 CROSS SECTION ELEMENTS

Parkway cross sections are often as complex as this Summit Road on Mount Sugarloaf.

The cross section refers to the travelway and its immediate parkland corridor as illustrated in the sections in Chapter 1. The Design Control Report defines the width of the travelway. The following elements are discussed below:

- Vistas from the Travelway
- Interface of Travelway and Landscape Grading
- Sidewalks and Pathways
    - Pedestrians
    - Bicyclists
    - In line skaters
- Shoulders
- Lane Number and Width
- Pavement Markings
- Travelway Surface
- Medians
- Vegetation
- Curbs

- Clear Zone
- Traffic Barriers
    - Traffic Barriers for Safety - Guardrails
    - Traffic Barriers for Control of Access
    - Gates
- Walls
- Utilities
- Signage
- Lighting

3.2.1 Vistas from the Travelway

Scenic vista from Christopher Clark Road at Mount Tom State Reservation in Easthampton

Goal

Preserve and restore positive vistas from the travel way and mitigate negative ones.

Issues for Vistas from the Travelway

The viewshed, where scenic, is a fundamental character-defining feature. Roadside trees often frame special vistas. Over time, designed views of features inside the parkway decline due to poor maintenance, new overhead utility lines, or the growth of invasive vegetation. For example, walls and fences deteriorate or disappear. Overgrown vegetation hides vistas to fields, riverbanks and ponds beyond the parkway. Development of abutting property destroys once attractive views outside the parkway.

Guidelines for Vistas from the Travel Way

- Preserve vistas of natural and historic features such as rivers, ponds, fields, walls, fences and historic buildings. Open, restore and maintain vistas that are overgrown. Preserve publicly owned historic features within the vistas.

- Screen incompatible views that degrade parkway character by managing vegetation, including allowing plant succession where the landscape is wide enough, and planting buffers in narrow corridors.

- Remove invasive vegetation in areas where it blocks historically significant views.

- **Border Roads**: Selectively clear the publicly owned side to improve the woodland character and allow visual access into the parkland.

- **Summit Roads**: Provide unobtrusive overlooks with interpretive markers and parking for no more than five (5) cars.

3.2.2 Interface of Travel way and Landscape Grading

Context-sensitive grading enhances an Internal Park Road

Goal

Preserve and use context-sensitive grading to integrate the travelway into the landscape.

Issues for Interface of Travelway and Landscape Grading

Integrating the alignment of the travel way into the terrain is a character-defining feature. Side slopes as gentle as space and underlying geology permit transition smoothly to existing grades. Where space is constricted, walls retain slopes that are unstable or vulnerable to erosion. Riprap for steep slope stabilization is unusual. So, too, are sharp changes in slope between steep fill embankments or cuts and the adjacent undisturbed terrain. Steep cuts are only present when the underlying bedrock is stable.

Guidelines for Interface of Travelway and Landscape Grading

- Match road profiles to minimize cut and fill sections. Avoid long lateral cut and fill slopes.

- Grade and stabilize subsoil and loam to create smooth transitions from the travel way's side slopes to the natural topography. Involve the landscape architect in both the design and inspection of grading.

- Restore the adjacent topography to its prior natural contours wherever possible.

3.2.3 Sidewalks and Pathways

Goal

Accommodate the safety and comfort of pedestrians, bicyclists and in line skaters within the parkway on an equal level with vehicles without sacrificing character-defining historic features, shade trees and geological features.

People engaged in commuting, active recreation or exercise use parkway sidewalks and pathways. Their needs are an essential concern in parkway design and management. They use bituminous concrete or concrete sidewalks that are parallel to the roadway, separated by a grass strip. They also use less formal pathways, sometimes unpaved, further within the parkland with alignments independent of the travelway alignment. In addition to moving along the length of the travelway, these users also cross the travel way to other destinations. Proper crossing design reduces user conflicts and increases safety. The accommodation of pedestrians, cyclists and in line skaters is discussed below.

Issues for Pedestrians

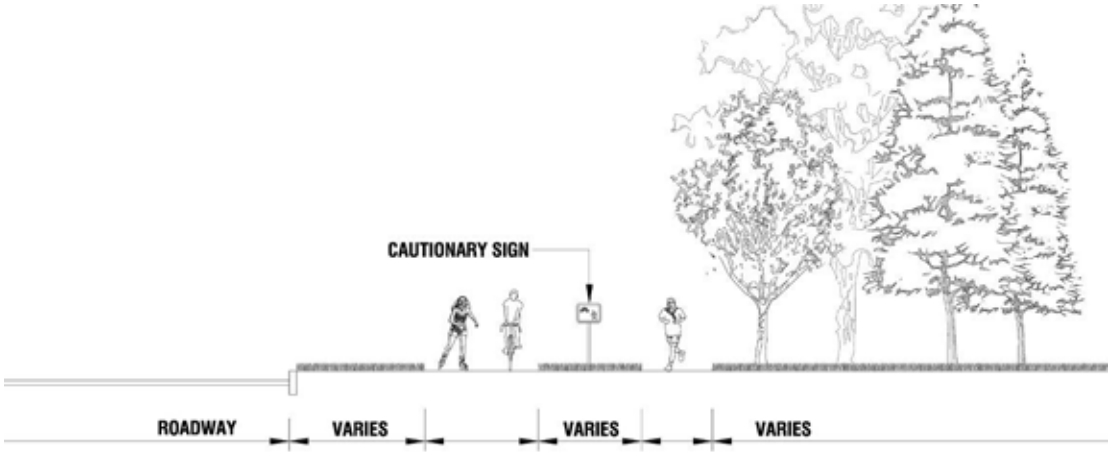
People walking to work, walking for pleasure, jogging, pushing strollers or traveling in wheelchairs, all use parkways. Pedestrian crossings are often far apart from each other. On urban parkways, crossings at uncontrolled locations and at rotaries are not safe. When the historic design does not provide safe crossings, the Design Control Report may support some alterations to improve pedestrian safety.

On popular urban parkways, runners and bicyclists degrade the grass shoulders, compact and erode the soil, damage turf and expose tree roots. Runners prefer grass as a running surface.

Some paths too close to vehicular traffic pose safety risks. Grass strips serve as a visual benefit and separation, improve the safety setback for pedestrians, allow a place for trees and signs and allow for snow storage in winter while keeping the pathway clear.

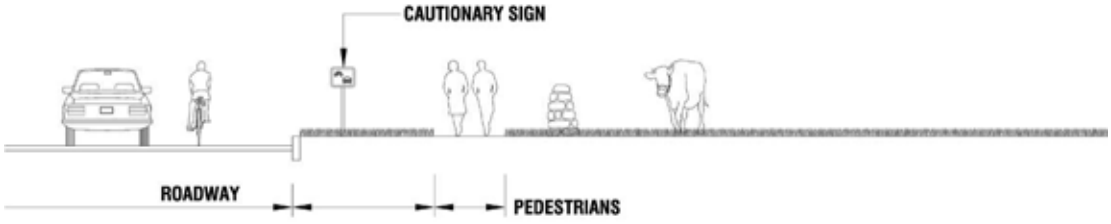
Guidelines for Pedestrians

- Design all walkways in accordance with the Massachusetts Architectural Access Board (MAAB) and Americans With Disabilities Act (ADA) requirements. Consult MassHighway engineering directives on pedestrian accommodation.



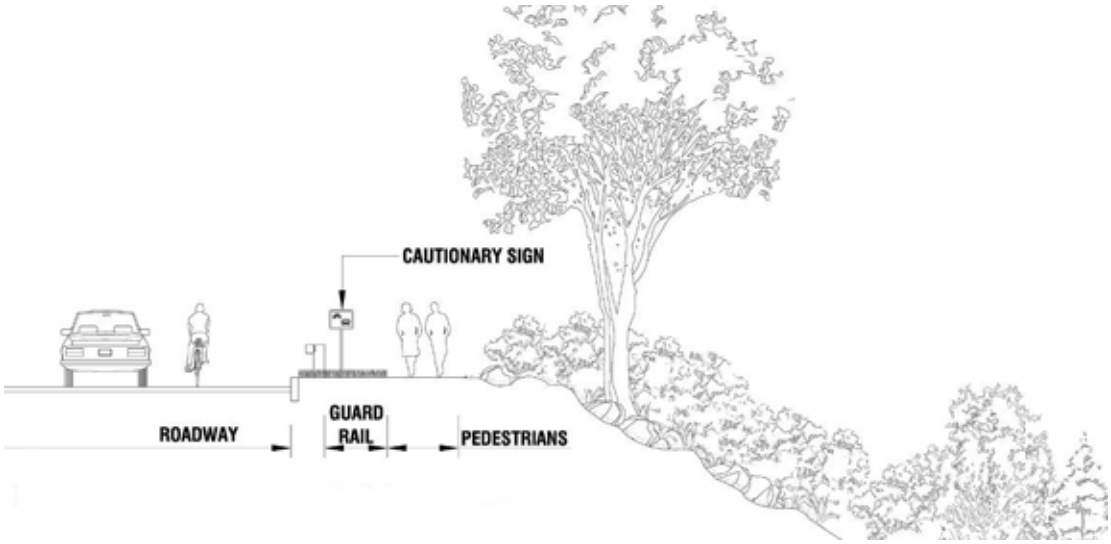
Separate Pathways for Bicyclists and Pedestrians

- In areas of high demand where shared path use is causing unsafe conditions for pedestrians, cyclists and other users, provide, if space allows, a separate pedestrian pathway.



Pedestrian Pathway Only

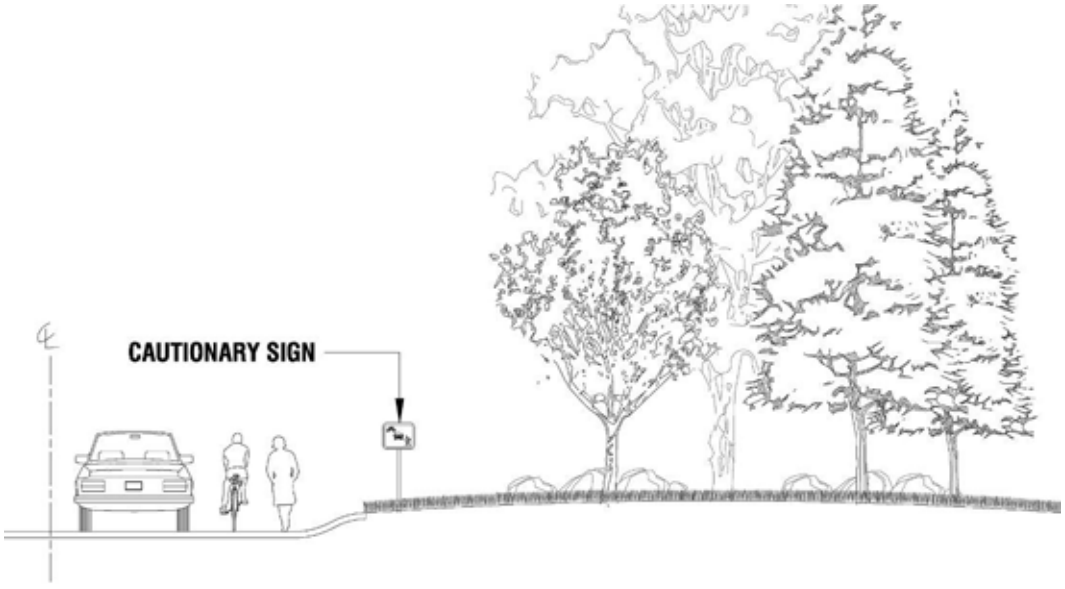
- Where adjacent space allows, locate pathways that run parallel to the roadway at least ten (10) feet back from the immediate edge of the road.



Low-deflection Guardrails Protect Pedestrians

- When a ten foot setback is not feasible, or when the historic alignment of a significant path takes it close to the road, install low-deflection guardrails to protect pedestrians.

- Where improved pedestrian safety is needed and soil compaction and erosion are significant, provide a walking/running surface such as stabilized aggregate to discourage off-path foot traffic.



Shared Roadway for All Users

- When pedestrians share the travelway with vehicles and bicyclists, install warning signs and pavement markings about shared use at regular intervals. If there are wide travel lanes and paved shoulders, delineate a separate cyclist lane on the shoulder.

- Provide safe pedestrian passage across parkways. Retain historic crossing locations. On heavy-traffic parkways with insufficient crosswalks, add crosswalks to provide safe and convenient crossing for pedestrians. Use a consistent system of white crosswalk markings, supplemented where needed with crosswalk warning signs, warning striping, and such traffic calming measures as speed tables. Discourage unauthorized crossings at other locations, preferably with vegetation.

- Consult the MassHighway *Project Development and Design Guide* and publications of the Institute of Traffic Engineers for traffic calming guidance.

- Add pedestrian-actuated crossing signalization if warranted by actual or potential pedestrian crossings. Use signal support, housing and ancillary equipment designed to be as unobtrusive as possible. Paint dark green (Standard Federal Color #14062), to match sign posts and, if controlled by DCR, light poles.

- **Internal Park Roads**: Create a sufficient number of convenient crossing points and discourage or prevent access at other locations by using native vegetation. Use signage and special warning striping or rumble strip paving at pedestrian/horseback rider crossings. Avoid signalization. If there are no paths or sidewalks for bicyclists and/or pedestrians and creating separate facilities creates insurmountable problems, then at a minimum, provide shoulders of sufficient width to accommodate pedestrians and bicyclists. Where insufficient width reduces the safety of cyclists sharing the roadway with motorist, convert underused bridle trails into bicycle trails.

- **Border Roads:** Avoid sidewalks along the travel way. If providing a pathway benefits hikers, runners or horseback riders, provide an unpaved trail. Maintain the appearance of the parkland edge and place a new separate pedestrian trail well back from the travel way. Enhance public use of the parkland by creating and maintaining convenient points of trail access to the recreational amenities.

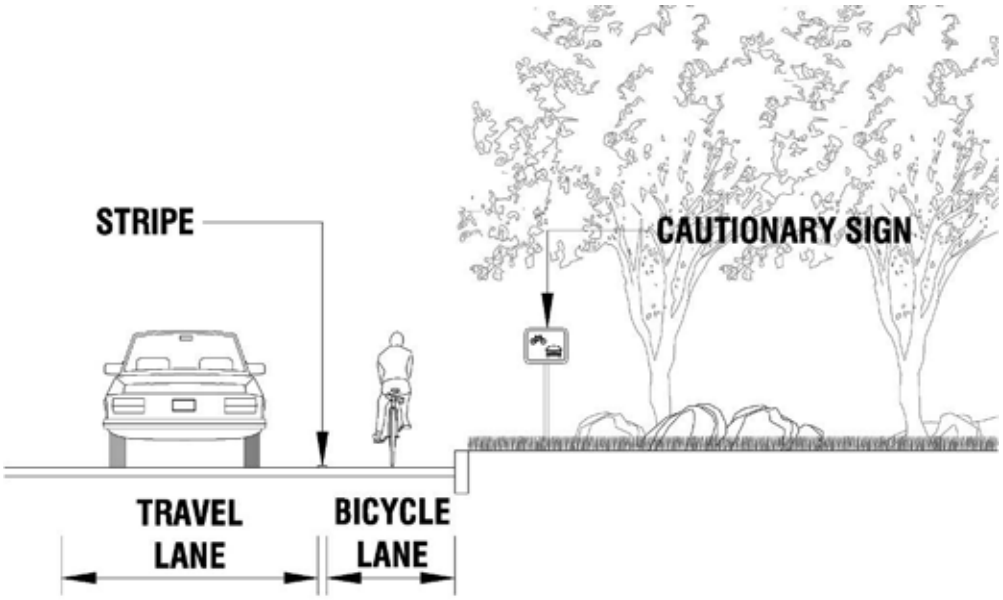
<u>Issues for Bicyclists</u>

Parkways, especially in the urbanized areas of greater Boston, are popular bicycle routes. Although bicycles were popular when parkways were created, there were no dedicated bicycle lanes. Historical documents demonstrate that from the beginning cyclists shared the paved roadway with other users. By law, "Every person operating a bicycle … shall have a right to use all public ways in the commonwealth except . . . express state highways where signs specifically prohibiting bicycles have been posted." (MGL, Chapter 85, Section 11B) DCR acknowledges the right of bicyclists as road users and will provide on-road bicycle accommodations wherever possible.

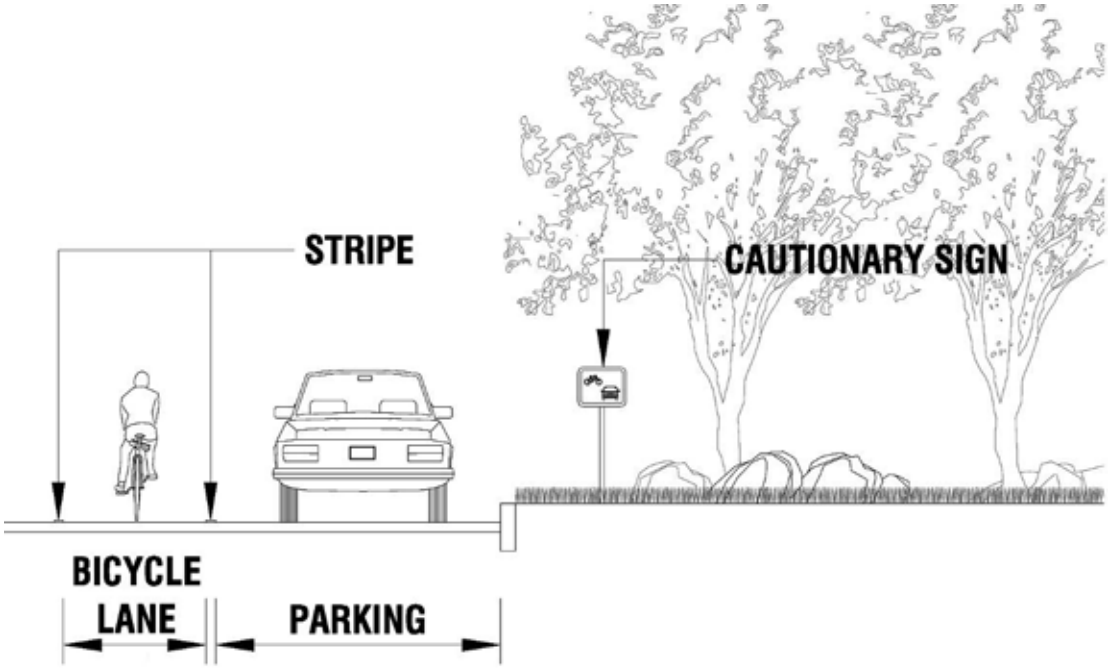
With the advent of heavy traffic, the narrow lanes, curvilinear alignments and rotaries, are increasingly inhospitable to shared use by motor vehicles and bicycles. Shared use of sidewalks and pathways by cyclists and pedestrians raises safety concerns. Consequently, the dual objectives to preserve historic design features and to accommodate bicycle access on parkways can be a source of conflict. There is a range of ways to accommodate safe and efficient travel for cyclists.

Guidelines for Bicyclists

- Design bicycle facilities in accordance with the MassHighway *Project Development and Design Guide***.** Consult MassHighway engineering directives on bicycle accommodation.

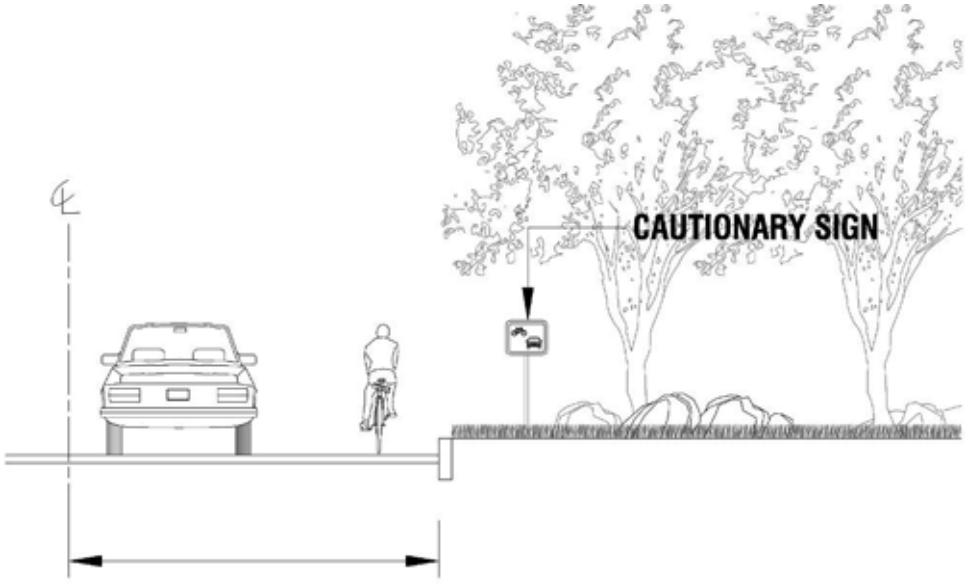


- Where dedicated bicycle lanes are desirable in the travel way, provide a width between four (4) to six (6) feet, with a solid four (4) inch white pavement marking between the travel lane and the bicycle lane. Width will vary based on the setting.



Bicycle Lane Adjacent to Roadway Parking

- Where a bicycle lane is located adjacent to roadside parking, delineate the right side of the bike lane and the left edge of the parking lane with a solid 4-inch white line**.**



Bicycle Accommodation in the Roadway

- Otherwise, provide adequate on-road accommodation either through wide shoulders or wide outside curb lanes, wherever feasible. The optimal shared lane use by bicycles and motorists consists of a fifteen (15) foot minimum lane width from centerline to pavement edge. Install signs and pavement markings to indicate where motorists and bicycles share the roadway.

- If the lane width from centerline to pavement edge is less than fifteen (15) feet, in the Design Controls analysis, evaluate travel speeds and traffic volumes to determine if narrower pavement width will safely accommodate both users. Provide the shoulder with a smooth, clean, even, well-drained travel surface (such as bituminous concrete or cement concrete) and bicycle-safe drainage structure grates.

- In cases where the travel way is too narrow to accommodate a designated bicycle lane and there is no adjacent landscape, provide "share the road" signs.

- Where a dedicated off-road bike path is needed and feasible, integrate it with the landscape yet design it to be separate and clearly distinguishable from pedestrian paths, unless specifically designated as a shared path. Adhere to current bikeway design criteria as described in the *Guide for the Development of Bicycle Facilities, 1999,* American Association of State Highway and Transportation Officials.

- Discourage bicycle use of sidewalks and pedestrian footpaths with signage.

- **Internal Park Roads**: If there are no separate ways for bicyclists, improve conditions for bicyclists on the roadway.

- **Border Roads**: Explore creating dedicated bike lanes, but do not widen the roadway. Where insufficient width is available, create bicycle paths in the parkland. Take advantage of historic bridle paths no longer in use.

- **Ocean Parkways**: Create a shared wider outside lane, add a dedicated bicycle lane if width allows or if shoulder width allows, improve the shoulder. Use multi-use pathway within parkland if space and degree of pedestrian use allow.

- **Summit Roads**: Provide signage indicating shared use by automobiles and bicyclists.

Issues for In Line Skaters

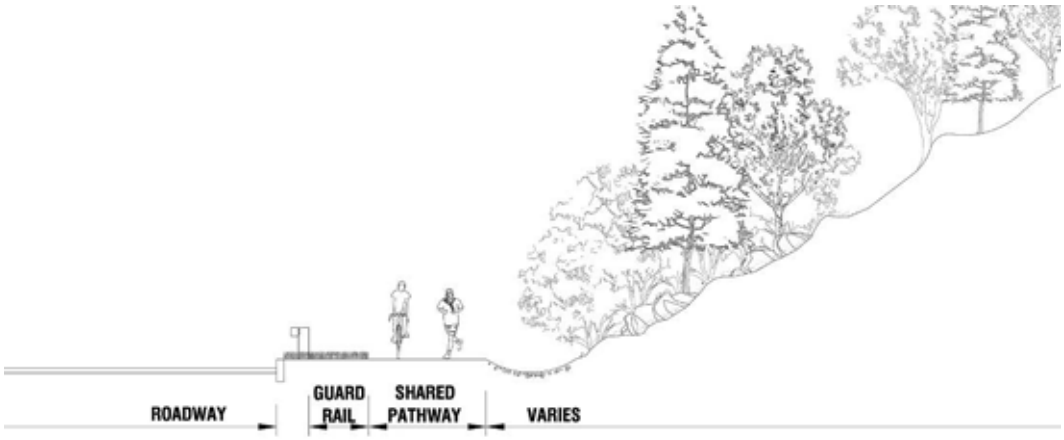
Narrow lanes, curvilinear alignments and rotary intersections can be unsafe for in line skaters and skateboarders. They are more compatible with bicyclists than with pedestrians, because of their speed and preference for pavement. Their presence on roadways and shared pathway can be dangerous.

Guidelines for In Line Skaters

- Follow the conclusions in the Design Control Report about meeting the needs of in line skaters and whether a separate or a shared-use pathway is needed.

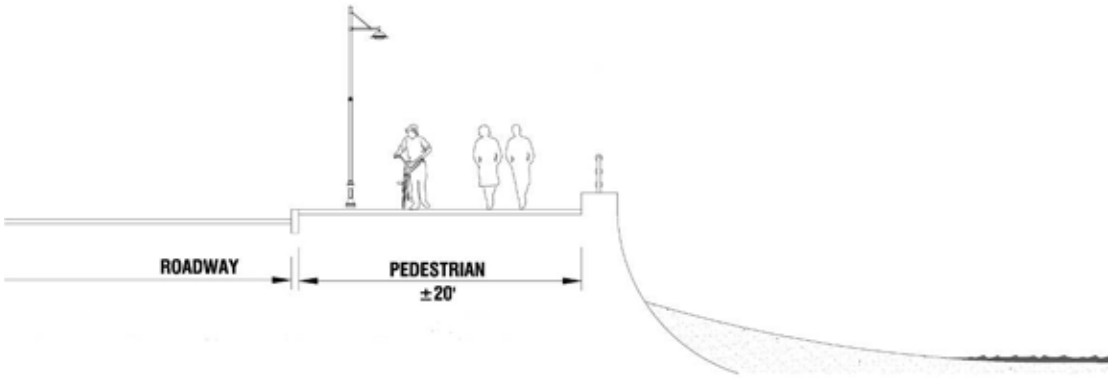
- If the width permits, provide two separate off-roadway trails: a paved trail at least eight (8) feet wide for two-way traffic, for bicyclists/in line skaters and an unpaved trail at least five (5) feet wide with specialized soils for pedestrians/runners.

- If separate off-roadway accommodation is not possible, provide shared paved accommodation at least eight (8) feet wide, set a minimum of ten (10) feet back from the curb and outside the clear zone so as not to require a guardrail, for pedestrians, cyclists and in line skaters.



Shared Pathway Behind Guardrail

- Otherwise, if the historic roadway cross section does not include a curbside sidewalk, provide shared paved off-roadway accommodation, at least eight (8) feet wide, set a minimum of three (3) feet behind a compatibly designed guardrail, for pedestrians, cyclists, and in line skaters.



Pedestrian Pathway at Travel Way Edge

- Base design decisions on level of use and recreational traffic demands. For example, on heavily traveled corridors, 12 feet may be the appropriate width for a shared use path. In some situations, if the corridor width permits, provide two separate off-roadway trails: a paved trail for two way bicycle and

in line skater traffic and an unpaved trail with specialized soils at least five feet wide for pedestrians and runners.

- Balance need for new off-roadway paved trails with the maintenance of green space. Make decisions on a case-by-case basis.

- If the historic cross-section includes a sidewalk, provide cautionary signage indicating shared use of sidewalk.

- Otherwise, provide the following two features: a fifteen (15) feet wide lane within the roadway paving to be shared by motorized vehicles, bicycles, and in line skaters, and an off-roadway unpaved trail at least five (5) feet wide with specialized soils for pedestrians and joggers, set a minimum of ten (10) feet back from the curb if no guardrail, or a minimum of three (3) feet behind a compatibly designed guardrail.

- In all cases provide appropriate cautionary signage indicating proper use of the roadway and pathway or pathways.

3.2.4 Shoulders

Well maintained shoulders on an Internal Park Road in Pittsfield State Forest at Berry Pond Circuit Road

Goal

Preserve the historic configuration of shoulders and avoid any increase in pavement width.

Issues for Shoulders

Shoulders are the useable or graded area between the edge of the travel lane and the curb line or edge of embankment. Shoulders direct surface drainage off the roadway and toward a subsurface drainage system. They serve as "recovery areas", allowing errant vehicles to correct their direction without leaving the roadway or risk hitting roadside obstructions. Shoulders also provide areas for pullovers in an emergency, avoidance maneuvers, bicycle travel, parking, and snow storage. Shoulders may be paved or unpaved and vary in width from less than one foot to 10 feet.

Many early roadways, designed before the automobile, have narrow or minimal shoulders. Current traffic demand can occupy all available width. Consequently, there is no place along the roadway for emergency uses such as speed enforcement or breakdowns. The roadway is unfriendly to cyclists. The perception of speed is heightened and slows down travel speed.

When park visitors pull off the roadway to park or enjoy the view, they damage shoulders, cause erosion and destroy vegetation. Because vegetation at the edge of the roadway is a character-defining feature, these informal pull-off areas are a problem.

For some Internal Park Roads, wide, grassy shoulders also serve as fire breaks and help contain forest fires. On Summit Roads, shoulders are narrow and unpaved, and, in most cases, vegetation grows up to the edge of the travel way. Estate Roads do not have shoulders unless the roadway serves a more formal purpose.

Guidelines for Shoulders

- Change shoulder dimension only if necessary to
  (a) support bicycle use or
  (b) provide police pullovers for speeding motorists.
  In the latter case, identify the least intrusive locations and minimize impact on parkland.

- Where repaving raises the road surface higher than the shoulder, regrade the shoulder to a shallow roadside swale while assuring a safe slope and avoiding erosion, or lower the roadway through full-depth reconstruction.

- Re-vegetate the shoulders using methods that sustain vegetation, while still occasionally supporting the weight of a vehicle. Use the method developed for non-sandy areas at Acadia National Park in Maine: scarify the deteriorated

shoulder to an adequate depth, cover with an aggregate/topsoil mixture, and reseed with a native plant mix.

- When shoulders have inappropriate informal pull-offs, discourage pulling off through signage, plantings and barriers, if necessary. Avoid parking stones, which detract from the character of the landscape.

- When wide shoulders are appropriately used for parking, allow shared shoulder use by cyclists during peak commuter hours, with appropriate signage.

- **Internal Park Roads:** Preserve the historic configuration of shoulders, including the vegetated edge.

- **Border Roads**: Do not add shoulders unless there were shoulders historically and the addition of a shoulder would enhance bicycle safety.

- **Summit Roads:** Preserve the historic configuration of shoulders including the vegetated edge, unless safety data support modifying the shoulder. Discourage informal pull-offs where the shoulder is vulnerable to erosion by installing signage, plantings and appropriate barriers, if necessary. Avoid parking stones. To resist erosion on steep slopes, use coarse locally sourced aggregate instead of finer gravel.

- **Estate Roads**: When historically documented, preserve the shoulder as a component of the historic parkway landscape.

3.2.5 Lane Number and Width

Goal

Preserve original lane number and widths, where feasible. Avoid increasing traffic capacity by increasing the number of lanes or making lanes wider. Avoid any net loss of parkland.

Issues for Lane Number and Width

The number of lanes and lane width are character-defining features that contribute to the parkway experience and have a profound impact on historic character. DCR parkways are not designed to be primary travel routes and should not be substantially modified to accommodate increasing traffic demands.

Most parkway travelways have a maximum of two lanes in each direction. Parkways in rural settings usually have one lane in each direction, and on Summit Roads in steep terrain, a parkway is often a one-lane/one-way loop. Lane width ranges between 9 and 12 feet.

As traffic volumes increase, some roadways are now wider with auxiliary turning lanes that diminish historic parkway character.

Guidelines for Lane Number and Width

- Evaluate existing lane configurations and widths, traffic demand and composition, to assure a safe roadway that enhances all permitted transportation modes and is consistent with parkway purposes, character and context. Keep the number of lanes consistent throughout the various sections of the parkway, and in keeping with the historic context.

- In areas where parkways are over capacity, explore other measures to manage traffic or reduce demand, such as appropriate traffic calming. Refer to the MassHighway *Project Development and Design Guide* for traffic calming information.

- Do not widen or to add turning lanes, transit service areas, or parking lanes for a nominal capacity and safety benefit. The addition of turning lanes has a significant negative impact on the historic parkway, either by displacing parkland next to the road, or by displacing or eliminating the median.

- In cases where the capacity and safety benefit strongly favor the development of auxiliary lanes, identify areas where the added capacity of these lanes may be offset by the reduction of other lanes if they are no longer needed and can be reclaimed for parkland. Document how any capacity enhancement for motor use is consistent with protecting the resource.

- Remove parking or travel lanes to increase space for bicycle use or green space, after assessing its impact on the roadway's historic design and current function.

- Avoid widening lanes that encourage driving above the design speed, with no gain in safety.

- In areas where travel lanes are wider than necessary, narrow them to as little as ten (10) feet to slow traffic and increase safety, reclaim green space, and restore the historic travelway and landscape.

Typical Roadway Lane Widths (feet)		
Parkway Type	Pleasure Vehicles Only	General Traffic (Trucks permitted)
Connecting Parkway	9-10	10-11
Park Border Roads	9-10	10-11
Internal Park Roads	9-10	10-11

- **Internal Park Roads**: Retain one-way loops which follow a specific sequence of views. If a wider travel way is needed for access by lifesaving equipment or other operations, use pull-outs or minimal widening. Do not convert one-way loops to two-way traffic.

- **Ocean Parkways**: Reduce the view-obstructing character of parking wherever possible, remove spaces at particularly important viewpoints and create nearby off-road parking on the landside of the road, with carefully controlled pedestrian crossing facilities. Preserve the relationship between the travel way and the shorefront parkland. Do not widen or add lanes and create a broad "hardscape".

- **Summit Roads:** If safety data support changes to the width of travel lanes in these fundamentally narrow roadways, make only minimal modifications. Distinguish paved swales from the paved roadway to avoid creating the illusion of a wider travel way.

- **Estate Roads**: Preserve the historical roadway width. Where serving as a recreational trail, maintain a single lane with a surface suitable for walking, running, and bicycling, thereby keeping users on the trail and protecting adjacent land. Realign only for an extraordinary environmental benefit such as protecting an endangered species.

3.2.6 Pavement Markings

Clear Pavement Markings on VFW Parkway in West Roxbury

<u>Goal</u>

Mark pavement to promote safe conditions for all parkway users.

Issues for Pavement Markings

Urban parkways are usually marked with double yellow centerlines, white shoulder lines, stop lines and crosswalks. Words, arrows and channelizing markings at intersection islands and rotaries are also common. These required markings maintain safe travel conditions and are intended to be consistently and uniformly applied in accordance with current national safety standards on most parkways, with certain exceptions. The trend towards use of wider longitudinal pavement markings responds to the aging population and the need for increased visibility. Introduced well after many of the parkways were first built, and modified over time, pavement markings are not generally considered to be character-defining features for historic parkways.

Where parkway roadways accommodate not only drivers, but also pedestrians, cyclists and in line skaters, clear pavement marking to delineate safe use is essential.

Guidelines for Pavement Markings

- Design pavement markings to meet the requirements of the ITE *Manual on Uniform Traffic Control Devices.*

- Mark travel lanes with a consistent width (as measured from the center of the centerline to the center of the shoulder line) for consistency within each segment of parkway, as based on an engineering evaluation. Mark shoulders for consistent width as measured from the center of the shoulder line to the edge of pavement or curb.

- For longitudinal pavement markings for centerlines, lane lines and shoulder lines, use lines no greater than four (4) inches wide, except where a six (6) inch width will match widths on adjacent roadways.

- Do not delineate lanes wider than necessary. Excessive width invites fast driving and allocates space for cars that could accommodate bicycle use.

- **Internal Park Roads**: If distinctive single yellow centerlines are present and are considered character-defining, preserve or restore them.

- **Internal Park Roads, Summit Roads,** and **Estate Roads**: Where existing pavement markings are redundant or unnecessary safety measures, remove them. Where safety under certain use and low-visibility weather conditions is an issue, or where pavement width is greater than twenty feet or average daily traffic is greater than 6,000, add centerline and shoulder lines (fog lines) for lane and pavement edge delineation.

3.2.7 Travelway Surface

Unpaved road at Borderland State Park in North Easton is not open to public vehicles and is an enjoyable walking surface.

Goal

Assure a safe properly graded and well-drained surface appropriate to the level of use on the travel way.

Issues for Travelway Surface

The predominant material for most travel ways is bituminous concrete. Until the early twentieth century, unpaved "broken stone", gravel or dirt surfaces were used by bicycles, horses and horse drawn wagons and carriages.

The change from unpaved to paved roadways was a response to changes in vehicular use. During the first two decades of the 20th century, many parkways were used by automobiles and pleasure carriages, with one side of a median paved with bituminous concrete to accommodate two-way automobile traffic and the other side paved with crushed stone for horse-drawn carriages. By the 1930s, dual use ended and bituminous concrete became the norm.

Without periodic maintenance, the bituminous concrete surface deteriorates. If aggregate materials on unpaved road surfaces are not regularly replenished, the crown on the road diminishes and areas of compaction or erosion are created. Resurfacing reduces the height or reveal of curbs and their ability to channel surface drainage, and keep stray vehicles on the road.

Although bituminous concrete is usually the appropriate roadway surface, some non-urban travel ways with light traffic such as Internal Park Roads are still unpaved. Users enjoy these lightly traveled unpaved country roads.

Guidelines for Travel Way Surface

- Follow the DCR paving specification for bituminous concrete.

- Restore adequate curb reveal lost through resurfacing. If curb reveal is below the recommended minimum of six (6) inches, use cold planing. Resurface unpaved roads with aggregate and regrade crowns. Recycle removed bituminous concrete.

- In the Design Control Report, determine the appropriate roadway surface for each historic parkway in light of its historic design and current function. Where possible and desirable for interpretive and visual purposes, remove paving or replace with alternative paving. Evaluate non-bituminous alternatives such as chip seal and resin pavement systems.

- Where the side of the road is curbless and the road edge is deteriorated, reconstruct the pavement. Extend the compacted aggregate base material at least two feet beyond the pavement edge. Grade the finished surface down away from the pavement at a slope of no more than one inch per foot. In addition, determine if subdrains or surface drainage improvements are needed to maintain the integrity of the pavement section and prevent further pavement edge deterioration.

- **Internal Park Roads** and **Vernacular Roads:** If warranted by historic precedent or interpretive goals, remove pavement on a parkway that no longer carries traffic and replace with historically appropriate surfacing.

- **Estate Roads:** For a formal entry road, use treatment appropriate to historic design and current function. Where necessary, retain paved surfaces to support park operations and management. If possible, retain or restore unpaved entry roads to evoke the historic entry experience.

3.2.8 Medians

Median on Woodland Road in Middlesex Fells Reservation in Medford and Stoneham separates travel ways on different alignments.

Goal

Preserve the historic character-defining features of existing medians.

Issues for Medians

The median is an important character-defining feature on many parkways with two lanes in each direction. Mature shade trees in a generous strip of turf of uniform width are bordered by separate travel ways on the same alignment. Far less frequently, parkways in wide corridors may have travel ways on different alignments separated by generous medians of varying width, integrating the travel way into the terrain. Curbs are not always used. Medians combine safety and scenic benefits. Historically, medians separated conflicting modes of travel from each other — trolley lines from vehicles, or pleasure vehicles from general traffic. They are most typical of Connecting Parkways, but also can be found on Border Roads, River Parkways, and Ocean Parkways.

Medians of uniform width vary from ten to thirty feet wide. Some medians as narrow as three feet are paved in concrete or asphalt, since they cannot support trees or be easily mowed. Medians this narrow impart a highway quality that detracts from parkway character.

Particularly in urban contexts, medians provide an amenity that is in short supply—trees and grass. Where the corridor is narrow, a median is wide enough to support

shade trees unifies the parkway. Unfortunately, over the years, many medians have been reduced in width to provide additional travel lanes, especially dedicated turn lanes.

Guidelines for Medians

- Wherever space permits, restore a median wide enough to accommodate two (2) rows of shade trees. If space does not permit two rows, restore a median wide enough to accommodate a single row of shade trees. If the medians never had trees, respect the historic design intent for the median.

- Provide a curb when the median planted with shade trees is too narrow to meet clear zone safety standards, that is, less than seven (7) feet from the curb to the tree trunk (that is, a total median width of fourteen feet).

- If the roadway lane widths or number can be reduced, and historical research supports it, restore the median or add to the width of an existing median. If the median is already over twenty-four (24) feet wide, add to the landscaped shoulders of the roadway instead.

Recommended Treatment for Median by Width	
Median width	**Recommended treatment**
Less than 4 feet	Flush pavers or other material.
4 to 6 feet	Grass, some tree species (too narrow for root spread for most)
6 to 12 feet	Grass, trees, one row or staggered (too narrow for two rows)
12 to 24 feet	Grass, two rows of trees, staggered if rows are less than 15 feet apart.
24 feet and up	Grass, two rows of trees, tree clumps

3.2.9 Vegetation

Trees are often adjacent to the travelway. Estate Road at Maudslay State Park, Newburyport.

Goal

Preserve, protect and restore parkway vegetation according to the original design intent.

Issues for Vegetation

Trees and grass, and in some instances shrubs, perennials and other non-woody species are critical character-defining features. Protection of vegetation is essential to the historic integrity and quality of parkways across the state.

Rows of stately shade trees forming tunnel-like canopies are the glory of many parkways. Trees are often located closer to the pavement edge than would be allowed today on roads with comparable traffic volume. Some planting of inappropriate ornamental small trees has occurred where the historic character calls for large shade trees.

Vegetation occurs both within the travel way cross section and the wider parkway. Farther back from the roadway (but rarely in medians), there is either (1) a designed landscape of trees and shrubs on turf, mostly indigenous species, including evergreens, in a naturalistic or random pattern or (2) a typical Southern New England forest such as along Internal Park Roads and Border Roads.

Areas once groomed are now undergoing natural succession. Although succession increases the ecological and aesthetic quality of the landscape, it also changes the historic character of the parkway. Invasive species alter the species composition even within established forests. Volunteer indigenous and invasive trees and shrubs are common along River Parkways, Border Roads, and Internal Park Roads with limited maintenance. The *Massachusetts Prohibited Plant List* includes approximately 150 invasive species, mostly shrubs and herbaceous species, but also four tree species: Black Locust, Common Buckthorn, Norway Maple, and Tree of Heaven. (Refer to Appendix I: Massachusetts Prohibited Plant List.)

Throughout the urban parkways, particularly along the shoulders, trees suffer from drought stress, car exhaust, deicing salt deposition, mechanical injury by mowers and maintenance trucks, soil compaction by runners and bicyclists, soil loss through erosion, lack of pruning, invasive species competition, and diseases and pests. Lack of pruning poses a safety hazard and block views. Use of a single species increases susceptibility to wholesale loss.

Grass is typical along the Connecting, River and Ocean Parkways and Estate Roads. These areas often become barren patches of soil due to erosion and compaction. Turf shoulders are susceptible to salt damage. The most intensively used turf, particularly along pathways preferred by joggers, is especially subject to compaction.

Historic shrub selections may have been non-native species that are now considered invasive.

Guidelines for Vegetation

- Ensure that the historic character of trees and contributing vegetation is not inadvertently lost or inappropriately altered. Support stewardship and ecological values.

- Wherever the vegetation has deteriorated or is absent—and space permits—plant new historically appropriate vegetation well suited to a historic parkway and if possible, the historic planting plan.

- Select native shade tree and shrub species and varieties (replant historic choices or close substitutes) unless exotic species are consistent with historic exotic landscape. Refer to historic plant lists and planting plans in the Design Control Report.

- Unless the use of a single species is character-defining, select a variety of tree and shrub species for a more robust ecosystem, rather than relying on a single species.

- Protect and care for champion trees. A champion tree is the largest-known species of a native or naturalized tree variety as recorded in the *National Register of Big Trees*. Start a replacement program for lost champion trees.

- Locate new trees so that different species are compatible with one another in stature, form, branching pattern and leaf texture and reinforce parkway character.

- In planting, follow best practices to ensure establishment and survival to maturity; do not place root ball too deeply or bury the trunk flare in excess soil or mulch, and assure regular watering until tree is established.

- On medians or in the green space between the paved roadway and a sidewalk or pathway, provide a width of six (6) feet minimum, optimally at least eight to ten (8–10) feet for healthy tree growth.

- Plant new trees no closer to the curb than five (5) feet to allow for long-term trunk growth. For grass, plant fine-leaved fescues, which require only two mowings per season and are adaptable to inhospitable conditions. Turf coverage will reduce water transpiration and soil compaction of the shoulder zone.

- For special tree row or allee planting, use same species or species of similar height and spread, space trees evenly, optimally no closer than fifteen to twenty (15-20) feet on center, taking into account coordination with light pole spacing.

- In places where vegetation is deteriorated or absent, and space permits, plant new vegetation.

- Replace damaged or dead invasive tree specimens by a native or non-invasive species of similar character.

- Along travel ways once bordered by lawn and now colonized by invasive plants or compacted and eroded, reestablish mowable grass.

- Remove invasive shrub species and replace with native species, if they can be adequately maintained. Monitor removal over a three-year period to ensure that removal is completely successful. Consult the *Massachusetts Prohibited Plant List* (see Appendix I) for tree, shrub and perennial species considered invasive.

- As small ornamental trees planted in place of deciduous shade trees die off, replace with deciduous shade trees.

- **Internal Park Roads**, **Estate Roads**, and **Vernacular Roads**: Use naturalistic turf mix comprising less fine species, mowed at least one (1) inch higher than conventional turf in high use parkland areas, for a less manicured but historically correct look, or wildflower mix if to be mowed only once a year.

- **Internal Park Roads**, **Estate Roads**, and **Vernacular Roads**: Avoid disturbance during construction or maintenance of delineated wetlands, woodland vernal pools, and State-listed Rare Species and Natural Communities identified by the Massachusetts Division of Fisheries and Wildlife (DFW) Natural Heritage and Endangered Species Program (NHESP), the protection of which overrides other goals including opening vistas.

- **Border Roads**: If the side of the parkway opposite the parkland lacks regular street trees, provide them in the public right of way to improve parkway character and discourage private incompatible landscaping on the roadway shoulder.

- **Ocean Parkways**: If absent, along the landside plant salt-resistant tree species to mitigate the visual impact of adjacent development and create a visual cue that the oceanfront parkland extends across the parkway.

- **Summit Roads**: Treat the summit as a historic landscape, integral to the parkway's character. Preserve historic plant materials, layout and vistas. Monitor the summit for overuse and modify the maintenance program as needed to deal with erosion, compaction, drought and other stresses.

- **Estate Roads**: Determine if succession growth is appropriate and desirable for a specific site. Define and manage boundaries of succession growth.

3.2.10 Curbs

An eight-inch curb on the high-traffic VFW Parkway in West Roxbury is compatible with parkway character and helps calm traffic.

Goal

Preserve historic curb if structurally intact.

Issues for Curbs

Curbs delineate the edge of the travel way, control stormwater runoff, define and protect walkways. They also protect roadside and median plantings from wayward vehicle tires, soil erosion and compaction, road salt, oil, fuels and transmission fluid.

There are two types of curbing, vertical curb and mountable curb. Vertical curb is intended to keep vehicles on the road and prevent them from pulling off the road. Vertical curbs protect vegetation. Vertical curb is appropriate for low speed rather than high speed roadways. Therefore, where vertical curb already exists, low speeds are intended. Mountable or sloped curbs come in a number of different shapes and permit vehicles to cross over them.

Although some early Connecting Parkways have curbs only at corners, later Connecting Parkways usually have continuous curbs, and the earlier parkways were retrofitted with them. Where Connecting Parkways still lack them, cars may pull off the road and compact the soil.

A variety of curbs are found on historic parkways, including granite, either sloped or vertical, and quarter-round cement concrete. In the New England weather, granite is the most durable material. The quarter-round cement concrete curb on many former MDC parkways is inset with small (2”-3”) cobblestones. These mountable curbs installed in the 1950s represent the end of the period of historic significance. In some cases, the concrete has failed at the joints, weeds have gained a foothold and accelerated failure. Other segments, however, appear to be in good condition. Another more recent form, though not widely used, is a sloping curb made of three courses of granite pavers set in concrete.

Additional layers of pavement over the years have reduced curb reveal, or vertical exposed curb height. When curb reveal decreases, its ability to contain stormwater, define the road edge for drivers, and protect pedestrians and vegetation diminishes. Roadside erosion is increased.

Internal Park Roads without heavy traffic usually lack curbs, except at some parking areas, significant intersections such as an entrance to an education center, and in steep terrain where gutters are needed for storm drainage.

Guidelines for Curbs

- Where new curb is deemed appropriate, use vertical granite with a six (6) inch reveal, with two exceptions: (1) where driving speeds exceed the design speed for a high-traffic parkway, use vertical curbs with an eight (8) inch reveal, and (2) at access points for maintenance equipment, use sloped granite curb with a four (4) inch reveal. Eight inch curbs calm traffic because they provide “friction.” Drivers are concerned about hitting eight inch curbs so they slow down.

- Where a rock outcrop exists behind vertical curb and cannot be removed, provide a minimum horizontal clearance of 1.5 feet from the face of the curb to the obstruction.

- Restore 6-inch curb reveal either by resetting the curb, if no negative impact to adjacent trees occurs, or by milling the existing pavement and resurfacing to achieve the desired reveal. Reset uneven granite curb, unless doing so damages trees. Replace missing curb along medians and shoulders where new curb would protect vegetation, channel water or improve safety of pedestrians. Assure adequate setting bed and mortar joints throughout.

- Consider various treatment options for the repair or replacement of the pre-cast concrete-and-cobble curb from the 1950s.

- In locations where curb does not exist and the pavement edge is substantially deteriorated, repair the damage and end the cause of the deterioration. Do not install curb unless no other options are feasible.

- **Internal Park Roads, Summit Roads** and **Estate Roads**: Avoid installation of new curbing. Where deemed appropriate to resolve a stormwater or water quality control problem or to protect vegetation or stem erosion, install mountable curbing such as sloped granite whose scale, profile, and material is compatible with the landscape. When routine turning might override the road edge and degrade the roadside landscape, install vertical granite curbing.

3.2.11 Clear Zone

A beautiful character-defining ledge along the Jamaicaway occupies the clear zone.

Goal

Maintain or improve parkway safety and preserve character defining roadside features such as old trees and rock outcrops within the clear zone by respecting the parkway's historic layout.

Issues for Clear Zones

Clear zones are unobstructed, traversable areas at the edge of the roadside where motorists who have driven their vehicles off the road may safely recover control of the vehicle. Many parkways lack clear zones. Magnificent old trees and rock outcrops line the travelway and enhance the parkways. The creation of a clear zone requires removal of all fixed objects such as trees and rocks and grading a traversable slope within a certain distance from the travel lane, a distance dependent on travel speed and traffic volume. Consequently, the design approach to a clear zone is of paramount importance to the maintenance of historic character of parkways.

Most urban parkways are low speed roadways (below 40 mph) and have vertical curbs. These curbs are not recommended where higher travel speed is allowed. Therefore, where vertical curb already exists on a travel way, the speed limit is under 40 mph. Utility poles, signs, trees, rock outcrops, and other fixed objects are and may be located behind the curb on these low speed roadways.

Guidelines for Clear Zones

- Determine if there is any accident history associated with roadside obstacles within the clear zone.

- Only add a recovery area if the accident history is significant, the potential impact on right of way is slight, construction cost is minimal, and the site context is appropriate. Keep increases in clear zone width to an absolute minimum.

- Protect character-defining large trees.

- If certain objects such as light poles or sign posts are required within the clear zone and cannot be removed, design a breakaway or other safety device.

3.2.11 Traffic Barriers

Guardrails and access control barriers include steel beams with a W cross-Section (Type-SS or Thrie Beam), mounted on steel posts at Hampton Ponds State Park, Westfield.

Goals

Minimize the use of guardrails, and where used, minimize their visual intrusion.

Where vehicular access to parklands needs to be controlled, and safety guardrails are not required, provide access barriers compatible with the landscape setting. Design gates to be consistent with one another and compatible with other site furnishings.

Traffic barriers—guardrails, Boston pipe rails, fences and security gates—are prominent features on many parkways. Some post-date the period of historic significance, and are not character-defining features. Guardrails protect motorists from roadside hazards and pedestrians from traffic.

Traffic barriers for safety, for control of access, and security gates are discussed below.

Traffic Barriers for Safety - Guardrails

Guardrail Issues

Modern guardrails, lining one or both sides of the roadway for long distances, block views and impart a highway character. Other types of barriers are also used for relatively short distances.

Guardrails are most common on Connecting Parkways which carry large traffic volumes. The typical design—Type-SS or Thrie Beam galvanized steel or pre-cast concrete barriers ("Jersey barriers") diminish the visual quality and historic integrity of the parkways.

Wooden rustic fences are appropriate to parkways with compelling vistas. Along many Internal Park Roads within the state park system, the CCC constructed guardrails fashioned from wood logs resting on wooden posts, or the state installed three-cable barrier systems mounted on wooden posts. Boston pipe rails are also historic character-defining features found on Connecting Parkways.

The Type-SS or Thrie Beam guardrails and Jersey barriers used today lack the rustic quality of the old log rails. However, the issue here is safety. The log rails and Boston Pipe rails lack the safety features needed for certain speed limits.

Some parkways have barriers with three cables on wood posts and recall slower speeds before World War II (Middlesex Fells, 1934).

The Cor-ten steel guardrail is an alternative because it weathers to a rust-brown, which blends into the winter woods. However, their form is intrusive and rusting steel leaves stubborn stains on the sidewalk and curb.

Typical steel-backed timber guardrail, National Park Service

Steel-backed timber guardrail is closer in appearance to the historic wooden fence guardrail in the urban parkway system. A wood rail backed with a steel plate is supported on timber posts. The steel plate provides the needed tensile strength. The "weak posts" provide the breakaway capability required for the safety of errant drivers. The wood members provide a more rustic appearance than the steel and concrete normally used in barriers. This railing is often used on National Park

Service roads, as well as on the Merritt Parkway in Connecticut. Cost is comparable to the cost of the Thrie Beam. Timber is recommended as the best option from an aesthetic point of view and meets safety standards if steel backed.

Guidelines for Guardrails

- Evaluate the need for guardrails and Jersey barriers, especially if visually intrusive or historically inappropriate. Where guardrails and barriers are unnecessary for safety or access control purposes, remove them or do not use them.

- Where guardrails on roads are needed for safety, use a steel backed timber/weak post system. On a given parkway, use the same design for all guardrails installed for safety purposes. Replace existing Type SS or Thrie Beam guardrails with a steel-backed/weak post system.

- Implement a guardrail replacement program for every parkway treatment project.

- **Internal Park Roads**: Preserve in place original guardrails and stone barriers. If safety requires the replacement of the original, design compatible historic guardrail of appropriate scale, materials and construction. Use all-timber systems or three-cable barrier with wooden posts. On trails and paths, for historic interpretive purposes, install guardrails that replicate the documented historic type, even if they require more maintenance.

- **Border Roads**: Avoid barrier systems, as none have existed historically.

- **Ocean Parkways**: Preserve existing historic barrier systems. If the barriers do not meet current safety needs, exhaust all preservation options, such as internal reinforcement, reconstruction, or addition of materials to the existing barriers before replacing with new materials. Design guardrails to be compatible with the historic barrier system. Do not obstruct water views from the travel way.

- **Estate Roads**: Avoid use of guardrails and barriers. On pedestrian-only routes, do not use crash-proof barriers. Where access control or protection of users from hazardous terrain is necessary, install wood fences. If steep slopes present a hazard to park staff vehicles, install a minimal length of guardrail or other barrier whose design, scale and materials is consistent with the setting and period of historic significance.

Local Roxbury puddingstone harking back to Olmsted controls access on the Jamaicaway in Boston.

Traffic Barriers For Control of Access

Control of Access Issues

Some travelway edges without safety guardrail may require barriers to prevent vehicular trespass to the adjacent land or to channel movements. The placement on the road surface or adjacent ground of loose boulders, stone blocks, granite curbs, concrete Jersey barriers or concrete bollards detracts from parkway character. Wooden bollards are sometimes used as well and are generally less obtrusive, but do not last long.

Guideline for Control of Access

- Select a design that does not exceed the scale, strength and size needed for the specific purpose. Use timber guardrails, wood fences or stone bollards that are appropriate to the historic character of the parkway.

Gates

Gates at Maudslay State Park in Newburyport are a character-defining feature.

Gates Issues

Gates restrict non-employee vehicular access onto some parkland, or restrict off-season or nighttime vehicular access to the parkway itself.

Guidelines for Gates

- Use Shurcliff gate to restrict access in appropriate locations, as needed. Paint metal gates to blend with the landscape.

- Use reflectors instead of bright paint for safety. Avoid decorative gates unless consistent with the historic design of a facility such as a former estate.

3.2.13 Walls

Stone wall on Chickatawbut Road in Blue Hills Reservation, Milton and Quincy probably constructed by the Civilian Conservation Corp between 1933 and 1941.

Goal

Preserve existing historic walls.

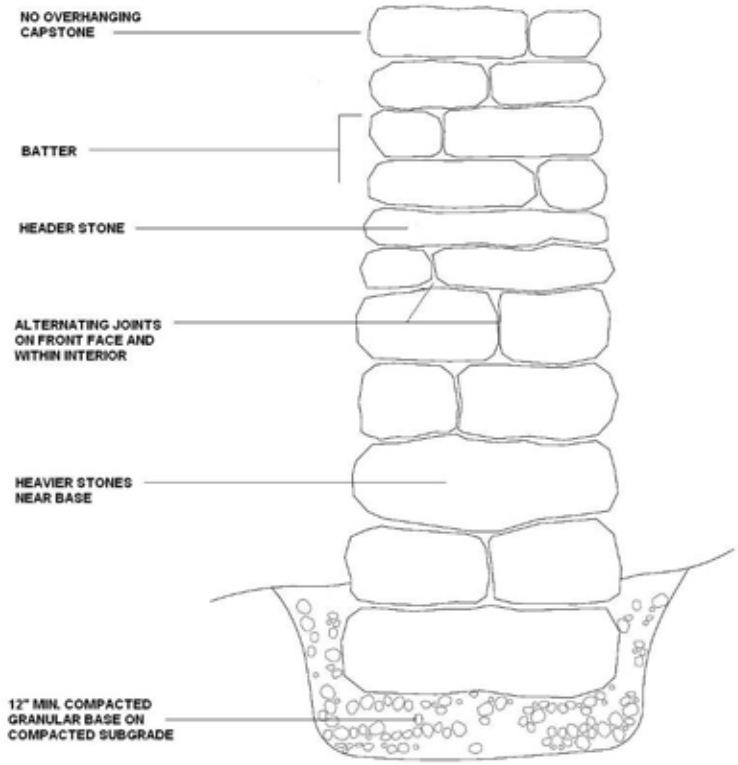
Issues for Walls

Stone walls are character-defining features along many parkways. Pre-cast concrete caps and mortared quarried stones are more prevalent in urban areas; fieldstone walls, both dry-laid and mortared, are more prevalent in rural settings. Most date from the original construction of the parkway or state park roadway.

Stone walls are susceptible to collisions, falling trees, invasion by roots, foot traffic, heaving, and differential thermal or freeze-thaw expansion and contraction. Masonry stone walls are susceptible to the different expansion and contraction rates of stone and mortar. Improper mortaring accelerates moisture damage.

Retaining walls are also constructed of reinforced concrete. Some walls include railings such as the "Boston pattern" railing, as found on Memorial Drive along the Charles River Basin.

Guidelines for Walls



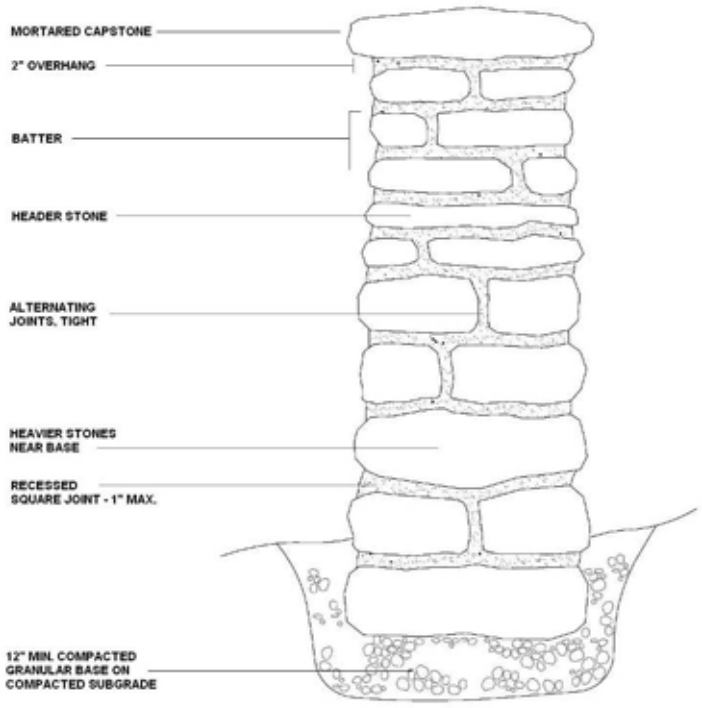
Dry Laid FreestandingWall

- If stone walls require repair or replacement, use stone with the same texture, quality, and size. Match mortar to historic color and joints, recessed to the same dimension as the historic wall. Repair dry-laid walls as dry-laid. Use the best stonemasonry practices. Where traffic and safety considerations permit, dry-lay stone walls, since they are generally less expensive to maintain than masonry stone walls.

- In unusual cases where the original design is significantly more maintenance-intensive than current construction, allow historically acceptable modifications to increase durability. In new construction, such as thick stone veneer over a concrete core, replicate the materials, texture, and quality of the historical stonework to provide the same visual character as the original.

- When rehabilitating a dry-laid wall, investigate the subgrade to assure good drainage and absence of silts. Do not use mortar because it increases internal stresses. The thicker the wall, the less maintenance will be required; good construction will exceed engineering minimum thickness recommendations for retaining walls or high free-standing walls.

- Use local stone, if possible.



Mortared Freestanding Wall

- For mortared stone walls, reduce freeze-thaw damage with natural sands. Match the historic mortar color. Never use premixed mortar-sand combinations. Do *not* assume that locally available sand meets the necessary requirements.

- Replace missing capstones or header stones, to curtail water damage within the wall, with overhang and heavy enough to resist foot traffic. If a mortared wall lacks a capstone, introduce a capstone only if historically compatible. Deflect water away from the wall with a sufficient overhang, avoid thin vertical edge, use recessed joints, control joints, and appropriate unobtrusive flashing. Choose compatible materials. Place control joints at suitable intervals or at a change in the wall support. If the wall did not have a capstone or header stones, use a sealant on top of wall only (used elsewhere it traps moisture).

- For retaining walls, intercept uphill surface drainage by either sloping backfill away from the wall to promote lateral drainage and assure that no runoff pours over the wall or creating an impervious swale along the top of the wall to deflect drainage around the wall or to area drains. If an existing masonry wall without weep holes is rebuilt, introduce weep holes, and assure adequate inward batter, in accordance with standard retaining wall design. Use crushed stone on the upper side to encourage drainage away from the wall.

- If railings on retaining walls need to be replaced, match the appearance and dimensions of the original as closely as possible, consistent with applicable safety standards and codes.

- Remove plants such as small trees that have taken root between the stones to avoid eventual toppling of the wall. Remove graffiti by techniques gentle enough to avoid surface damage. Never use mortar to patch or stabilize dry-laid walls to avoid damage from entrapped internal moisture.

3.2.14 Utilities

Goal

Minimize visual impact of above ground utilities and minimize impact of utility construction and servicing on vegetation.

Issues for Utilities

The clutter of overhead wires diminishes parkway character. Utility poles were added after parkway trees reached maturity. Cable and fiber optic wires now share poles with electric and telephone. Stately tree branches encroach on the wires and require pruning. When trees die, replacement locations are hard to find in some narrow parkway corridors.

Planting smaller species that will not compete with the lines will eventually change the character of historic parkways and is not an appropriate solution. Trees will always require selective pruning in order to co-exist with utility lines. Where this level of maintenance is not practical, underground utilities have the substantial aesthetic benefit of removing wires from the landscape.

Sometimes utility companies pay to use parkland for their utility lines and add many above ground features including fenced in transformers. Utility companies usually conduct all work involving their own facilities. They require access onto the landscape to perform servicing tasks. Policies relating to collaboration between DCR and utility companies are important to the maintenance of historic parkways.

Guidelines for Utilities

- Relocate overhead utility lines as unobtrusively as possible, preferably off the travelway for scenic and safety reasons. Put them underground if feasible.

- Conduct an inventory and survey of utility lines and structures, including location and elevations, and have utility companies and responsible public agencies verify and supplement, as necessary, this information.

- As early as possible in the project, coordinate relocation and accommodation of existing utilities in a parkway in order to avoid increased cost and delay.

- Identify available utility company programs for replacement, abandonment, and expansion of utilities even if such programs are only in the planning stages.

- Identify and assess impacts to existing utilities for the design alternatives being considered during preliminary design.

- In design, take into account clear zone requirements and post-construction periodic utility servicing to avoid utility vehicle damage to trees and soil compaction.

- On plans and in specifications, illustrate and describe all utility work and include information on the work space, work hours, and work duration requirements of the utility companies.

- Throughout the project, maintain and periodically verify complete utility company contact information.

- **Internal Park Roads**: Whenever possible, locate utilities as unobtrusively as possible. Restrict clearings for utility rights-of-way or severe pruning of the trees. Avoid overhead wires, poles and junction boxes as they often require clearing of the right-of-way or pruning of the tree canopy. If utility poles must lie adjacent to the travelway, use wood poles in scale with the surrounding landscape.

3.2.15 Signage

Goal

Provide clear attractive signage to promote user safety and inform users.

Issues for Signage

Signage is important to the function of historic parkways. There are five basic types:

- Regulatory: enhances the safety of motorists and other parkway users—stop, yield signs, no entry, no U turn, one way traffic, load limit, speed limit.
- Warning: also known as public safety signage (typically yellow) provides information about potentially unsafe road conditions ahead, such as sharp bends in the road, merging traffic, and narrowing lane width.
- Guide: also known as wayfinding signage provides information on destinations and their distances, identifies routes numbers, and indicates directional information.
- Identification
- Interpretation

Regulatory, warning and guide signage adheres to national standards. DCR has its own signage serving identification, and interpretive purposes as well. Here DCR has flexibility in its choice of materials and fonts to reinforce parkway character.

Identification signage along the state's historic parkways evokes the special historic character, and places the parkways in a larger system of special roads across the Commonwealth. A signage system that distinguishes these historic parkways from ordinary roads or highways and reflects their history will send a powerful message to the public about their importance.

Guidelines for Signage

- Install regulatory, warning and guide signage.

- Provide warning signage to encourage safer driving and caution where stopping sightlines are blocked or where cyclists and pedestrian share the roadway.

- Avoid or reduce sign clutter. Avoid overly large signs. Do not block views (especially water), and vistas.

- Use alternatives to the standard steel post mounting systems such as posts with darker and less reflective finishes or wooden posts.

- Create a statewide parkway identification signage to distinguish parkways from ordinary roads, and convey that a particular parkway is part of the larger system of parkways across the Commonwealth. Incorporate a simple graphic symbol to distinguish among the parkway types. Choose fonts, symbols, materials, and sign colors and scale to assure system-wide consistency in accordance with the DCR Graphic Design Standards.

- To further distinguish parkway signage from other highway signage, match the color of the back of the sign to that of the front, rather than metallic. Use dark green paint color (Standard Federal Color #14062) for sign poles to match traffic signals, and, if they are controlled by DCR, light poles.

- Provide interpretive pedestrian wayfinding, and recreational signage of consistent, coordinated design at trailheads and adjacent recreational parking areas.

- Install truck exclusion signage on travel ways for Pleasure Vehicles Only, as appropriate.

- **Internal Park Roads**: Develop signage as part of a trail wayfinding and interpretive educational signage system that describes park and archaeological

history. Design scale and materials consistent with the facility and compatible with the historic landscape.

- **Border Roads**: Install signage that identifies the parkland as part of the park system and that locates points of public access.

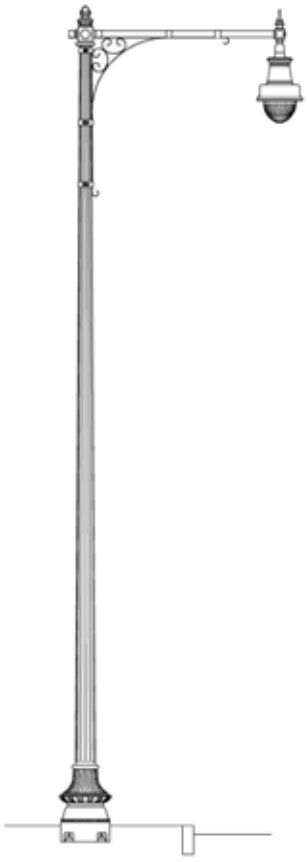
- **River Parkways** and **Ocean Parkways**: Do not place signage that intrudes on ocean, river or long views.

- **Estate Roads**: If closed to public motor vehicles, install interpretive signage to facilitate use as a self-guiding trail.

3.2.16 Lighting

Goals

Where required for safety, maintain minimal safe lighting with consistent, uniform historically compatible fixtures along a parkway.



1907 MDC Boulevard Light

Issues for Lighting

Lighting plays a major role in determining parkway character. Inappropriate travel way lighting can diminish parkway character.

A number of different light fixture designs have been used over the years. The older lights are more compatible with parkway character than the new ones. Some Connecting Parkways originally boasted Welsbach gas or naptha lights, some displaying the name of the parkway. By the 1920s brighter electric lamps were installed. Styles changed frequently until the arrival of the first cobra head fixtures in the 1950s. In the 1970s and 1980s, the shoe box fixture was installed on a concrete, metal pole or wood pole.

Many urban parkways need lights for safe night travel. The most common light—the cobra head on a metal or precast concrete pole —diminishes the historic appearance of the parkway. Wooden poles can be compatible with parkway character, but cannot offset the cobra head effect.

Fortunately, many Internal Park Roads do not have lights or require them. Some are closed at night, others are closed to vehicular traffic.

Responsibility for lighting service and maintenance is often shared between DCR, the community through which it passes, and the utility company. Different interests often control the pole, the fixture, the luminaire, and the wiring. Although DCR may not have control over the choice of fixture now, over the long term it may be able to work with the utility companies to offer a historically compatible, energy efficient fixture that meets these guidelines.

Guidelines for Lighting

- Preserve historic lighting fixtures as character-defining features. If necessary to improve performance, retrofit the lamps with modern fixtures to achieve the intensity and range of illumination required for safety and adjust spacing or locations.

- On parkways where lights are required, provide sufficient and uniform level of illumination.

- Avoid dead spots between fixtures and glare that compromise the vision of the driver or the bicyclist.

- Reduce glare, sky glow, light trespass onto abutting private property**,** and reduce energy waste with fully shielded fixtures, cut-off optics and reflector and flat lens rather than the more commonly used round prismatic lens.

- Avoid amber/yellows of low-pressure sodium (LPS) or high-pressure sodium (HPS) or cool white of metal halide.

- On urban parkways in the metropolitan Boston area, use the 1907 MDC Boulevard light.

- For poles, use either metal with dark green paint color (Standard Federal Color #14062), or dark-stained wood. Avoid light colors or reflective metallic finishes.

- Be consist with design of roadway and pedestrian fixtures on adjacent walkways. For roadway lighting, provide poles no more than twenty (20) feet in height. For pedestrian lighting, provide poles no more than twelve (12) feet in height.

- Locate poles to assure even spacing and alignment with tree rows and if possible traffic signal poles as well. Avoid conflicts with mature street trees.

- Consider lighting along shared use paths that are used by commuting bicyclists and pedestrians.

- **Border Roads** and **Internal Park Roads**: Replace cobra-heads with historically-appropriate or less obtrusive design alternatives.

- **Ocean Parkways**: Preserve historic lighting fixtures. Consider the scale, natural setting, and wind exposure of the landscape. Replace cobra-heads with historically appropriate lights.

- **Summit Roads**: Avoid adding lighting, given that the infrastructure (poles, cables, etc.) and the ambient light detract from the character of the parkway and views to the mountain from its surroundings.

- **Estate Roads**: Do not install lighting, unless lighting fixtures were used in the period of historic significance, in which case match the form of the original as closely as possible.

3.3 MAJOR STRUCTURES

3.3.1 Bridges

Bridge – Historic Blue Hills Parkway

Goals

Preserve historic bridges. Avoid adding pedestrian overpasses.

Issues for Bridges

Beautiful historic bridges carry parkway motorists, pedestrians, and cyclists over other roadways, pathways, rail lines, and waterways. Bridges over the roadway may carry vehicular or rail traffic. On some heavy traffic parkways, pedestrian overpasses traverse the travel way. They do not reinforce parkway character or appeal to pedestrians. New facilities will require extensive ramps to make them handicapped accessible.

Stone arch bridges display the technology and craft of their period. The arch itself is formed by a stone, brick, concrete, or corrugated metal liner. Parallel to the sides of the roadway and below the level of the road surface are walls that retain the embankment. Some arch bridges have parapets extending above the level of the travelway and, in most cases, these are extensions of the retaining walls.

The interior of the structure is usually filled with a granular material topped by the travelway surface or pavement. Some bridges have curbs along the road, paved walkways and grassy embankments. Where the arches extend over waterways, riprap may protect the embankment from scour.

Stone veneer bridges, with stone masking the reinforced concrete structure, were constructed more recently, mostly on urban parkways, but their finishes integrate them well into the historic parkway landscape. These structures usually include concrete barrel arches with stone fascias and solid stone or stone veneer parapets.

With the advent of motorized travel, these structures underwent changes that affected their appearance and longevity. Approaches to bridges were raised to provide a smoother and safer profile. As a result, bridge parapets were partially buried. Consequently, the retaining walls to which the parapets are attached are subject to loading and to moisture associated with the material used to raise the roadway profile. Both of these unanticipated conditions accelerate deterioration.

Appropriate maintenance is essential to preserve these bridges. Fortunately, many of the stone veneer bridges are well designed, low-maintenance and add to parkway character.

Bridges are generally maintained and rehabilitated with a separate report and construction contract under a different process than parkways. Through that process, bridges, including parkway bridges, are subject to current MassHighway and federal criteria for structural integrity and safety, which dictate safe horizontal and vertical alignments and clearances. Because bridges are important character-defining features, the focus here is on the choice of treatment that affects character.

Guidelines for Bridges

- When bridge work is needed, evaluate user requirements to determine the type and extent of structural alterations needed to adapt the structure to current uses in an historically appropriate manner.

- Research the original structure's design and materials prior to implementing any work. Carry out repairs using preservation techniques that match the materials and craftsmanship of the original.

- When alterations are needed, retain or reproduce the appearance of original structure to the greatest extent possible. Identify sources of historically acceptable building materials so that smaller repairs can be performed quickly and satisfactorily.

- Use latest technology to identify and correct the underlying causes of distress at historic bridges, but integrate the work with the original appearance unless hidden.

- For parapets, refer to guidelines on Walls.

- Control the detrimental effects of water at bridge embankments. If necessary, alter roadway drainage to eliminate low points where water can collect either on the bridge deck or in close proximity on the approaches. If necessary, regrade the roadway embankments to divert stormwater runoff from the bridge substructure.

- Avoid new pedestrian overpasses and provide adequate and safe at grade pedestrian crossings wherever possible.

- **Connecting Parkways:** Do not construct new pedestrian overpasses unless both high traffic, pedestrian volumes and safety evaluation support their construction. Design new overpasses to reflect the historic character of the parkway.

3.4 INTERSECTIONS AND CURB CUTS

3.4.1 Interface with Municipal Roads

Parkway terminus points, intersections with municipal roads, traffic signals, rotaries, roundabouts, intersections with non-parkway roads, and with recreational facilities, all affect overall parkway character.

Goal

Enhance parkway character and ensure ease of travel by simplifying the landscape treatment at intersection with municipal roads and parkway terminus points.

Issues for Interfaces with Municipal Roads and for Parkway Terminus Points

Terminus points to the urban parkways often occur at signalized intersections with other busy roadways, while entrance and exit points to the rural parkways usually occur at unsignalized intersections with two-lane rural highways or other roadways.

On urban parkways, the parkway terminus points are often planted with annuals, small shrubs and other inappropriate site elements that do not enhance the parkway character or respect the historic design intent. The confusion at the junction of these busy travelways merits a simple treatment of lawn and trees. On rural highways, the parkway terminus point may be an opportunity for a simple marker to show the transition to the rural highway.

Connecting Parkways and Border Roads provide smooth relatively uninterrupted travel because the number of intersections is restricted mostly to collectors and local roads. These roads convey general traffic including trucks across the parkway. Municipal sidewalks accommodating pedestrians and bicyclists also intersect with parkways. Treatment over the decades has not been consistent. Parkway character is diluted at busy intersections. Traffic controls, signage, lighting, sightlines, and sidewalks are not necessarily consistent with those found elsewhere on the parkway.

Guidelines for Interfaces with Municipal Roads and for Parkway Terminus Points

- Provide consistently spaced and designed pedestrian crossing treatments at interfaces with municipal roads.

- Improve accommodation for bicyclists in these locations so that it is consistent and safe.

- Design the intersections for the safe accommodation of truck cross traffic if the parkway is for pleasure vehicles only. Design intersections so that it is clear that the parkway is for pleasure vehicles only.

- Add shade trees where they do not interfere with required sightlines.

- Add islands or bumpouts, if appropriate. Incorporate landscape if appropriate.

- Remove annuals and other inappropriate site elements that do not enhance the historic parkway character. Remove elements such as the ramped planting at the terminus of the Alewife Brook Parkway at Route 2 and replace with simple grass and shade trees where possible.

- Enhance the parkway's green character, ease maintenance, and facilitate changing direction at parkway terminus points.

- On rural parkways, herald the change to a rural roadway with a simple marker, if desired at similar parkway terminus points. Construct the simple marker with natural materials that are consistent with the particular parkway character. Use these markers sparingly to ease maintenance.

- Avoid visual clutter.

3.4.2 Traffic Signals

Goal

Provide required traffic signals as unobtrusively and sparingly as possible.

Issues for Traffic Signals

Traffic signals have been introduced throughout the parkway system as traffic volumes have increased. The most essential safety and guide signing are appropriate and necessary for the safety and guidance of parkway users. In urban areas, the introduction of traffic signals has in some cases adversely impacted the aesthetics of the parkway corridor, but has also improved safety and access for many users.

Guidelines for Traffic Signals

- Explore all other traffic control features before adding a traffic signal.

- Avoid mast arm mounted signals unless absolutely necessary. Remove unnecessary devices if warranted based on the *Manual on Uniform Traffic Control Devices.*

- Install vehicular traffic signals where needed for safety and capacity reasons. Provide mast arms when necessary to align signal pole with streetlight poles and tree trunks.

- Coat traffic signal equipment and large sign structures with dark green paint color (Standard Federal Color #14062).

- Provide safe and convenient signal phasing and timing for protected pedestrian crossing and bicycle friendly signal loops.

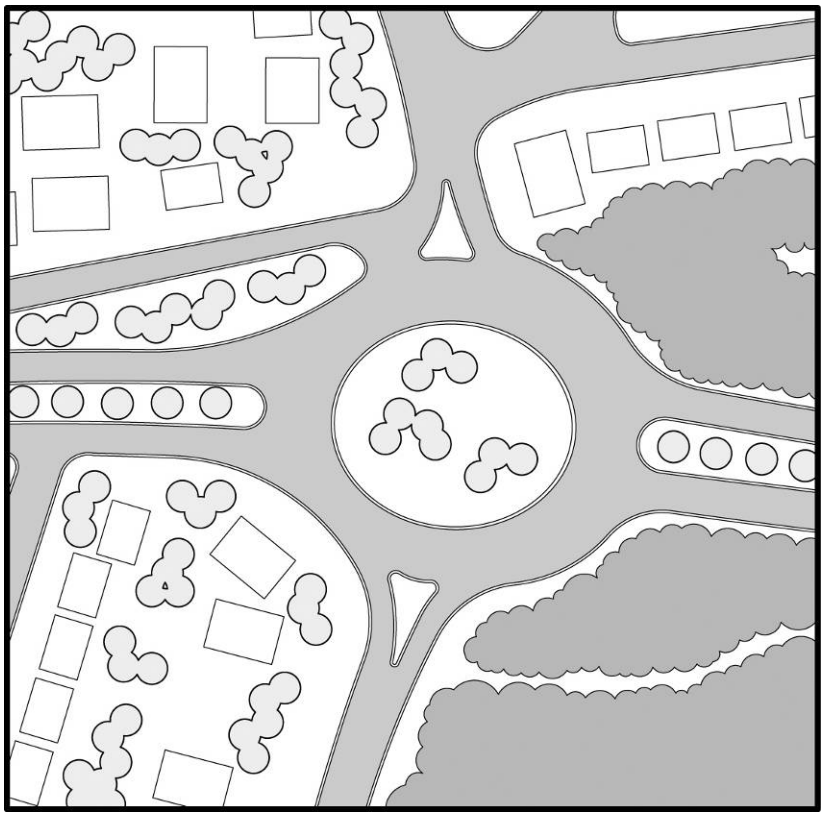
- Install LED traffic lights.

- Facilitate pedestrian crossing on lower-volume parkways with a pedestrian activated signalized crosswalk, where needed.

- Time traffic signals to provide desired parkway operating speed of 30-35 mph.

- Coordinate DCR traffic signals with those that are owned or operated by municipalities.

3.4.3 Rotaries and Roundabouts



Rotaries can be daunting for pedestrians trying to cross the Travel Way.

Goals

Preserve or rehabilitate character-defining rotary/island systems and features as appropriate.

Wherever possible, improve safety for multiple users by redesigning and rehabilitating rotaries as roundabouts.

Issues for Rotaries and Roundabouts

At rotaries, approaching motorists drive around a circular center island in a counterclockwise direction without stopping. There are usually a central island and miters also known as channelization or splitter islands. These islands of trees and shrubs contribute to the historic character and integrity of Connecting Parkways. On most Ocean Parkways, historic rotaries facilitate traffic flow. Rotaries with miters provide refuge for pedestrians. Single island rotaries can be daunting to pedestrians wishing to cross the road.

Roundabouts are smaller, and include miters. The alignments of approaching travel lanes and splitter islands require road users, including cyclists, to slow down or stop in order to enter the intersection. Such designs can be safely combined with pedestrian crossings, and are a recommended rehabilitation treatment of a rotary configuration that is part of a parkway's historic design.

All of the available options can be made safer if combined with traffic calming measures that are appropriate for the parkway including enhanced or raised pedestrian crossings and specific pavement marking improvements.

Guidelines for Rotaries and Roundabouts

- If a rotary is an impediment to pedestrian cross movements, redesign as a roundabout and integrate pedestrian crossings. Refer to the MassHighway *Project Development and Design Guide*.

- Do not change a roundabout to a traffic signal or other control which can aggravate queuing of cars and create bottlenecks during peak hours of use, unless necessary for safety reasons.

- Where historic rotaries are being replaced with modern roundabouts, integrate pedestrian accommodation, including crossings into the design.

- Avoid reduction of the central island diameter of the rotary.

- **Ocean Parkways**: Preserve rotaries with modifications for improved pedestrian safety.

3.4.4 Interface with Public Recreational Facilities

Summit Road at Purgatory Chasm State Reservation in Sutton provides parking for a picnic shelter.

Goal

Preserve and enhance the passive recreational functions of parkways. Minimize impact of active recreational facilities.

Issues

Because Connecting Parkways are recreational spaces, they now have active recreational facilities such as hockey rinks, stadiums, baseball diamonds, basketball and tennis courts, and skateboard parks. In some parkways, these facilities diminish parkway character, reduce space available for passive recreation and block views. Other recreational facilities, such as the picnic shelters built by the CCC along Internal Park Roads, are character-defining features.

Guidelines for Interface with Public Recreational Facilities

- For new facilities, minimize curb cuts by using existing access.
- Screen intrusive facilities such as hockey rinks and swimming pools and their parking with planting. Avoid building such facilities along the parkways. If these facilities do not need to be on the parkway in order to function, relocate them, for example, to an urban lot, and reclaim the parkland for outdoor use.
- For new facilities, minimize curb cuts by using existing access points.
- If additional parking is needed and space is available, choose off-road locations that minimize loss of parkway features.
- Design parking facilities to a high standard.

3.4.5 Curb Cuts

Goal

Avoid adding curb cuts along parkways. Avoid expanding existing curb cuts. Allow no net loss of parkland where a curb cut is allowed or expanded.

Issues for Curb Cuts

DCR usually controls access to abutting private land from parkways to protect resources, enhance the recreational experience, and improve safety. Owners of abutting property continue to seek curb cuts to increase accessibility to their property, and potentially increase property value as well. Curb cuts undermine parkway character by substituting paving for vegetation, and by adding vehicular traffic. Parkways in urban commercial areas already operate at or beyond capacity. Granting permission for curb cuts is detrimental to parkways and sets a bad precedent for the future. Widening an existing curb cut to a commercial property, ostensibly for safety, in fact allows faster speeds rather than calming them. Incremental alterations damage

parkway character. The appearance of certain segments of Revere Beach Parkway is a case in point.

Guidelines for Curb Cuts

- Do not add curb cuts along parkways that are operating at or beyond capacity.
- If a curb cut is to be introduced, mitigate its effect on the landscape by keeping the width to a minimum of ten feet, contributing private property to the parkland equal in area or greater to the square footage of the proposed curb cut, and adding trees and other roadside vegetation.
- Grant permission to expand curb cuts only if there is a clearly demonstrated need and only if equal or greater parkland is added and new trees are planted.
- Do not add more than one driveway to a frontage unless justified by detailed study.
- When a wide expense of undifferentiated asphalt abuts the parkway with no provision for pedestrians, study ways to improve pedestrian accommodation. For example, construct a concrete sidewalk across the driveway.

3.5 STORMWATER MANAGEMENT/DRAINAGE

This section includes guidelines for stormwater management and roadway drainage, best management practices during construction projects, and culverts and swales.

3.5.1 Roadway Drainage

Goal

Preserve or maintain the effective functioning of roadway drainage system, reduce the volume of runoff and improve water quality.

Issues for Travelway Drainage

Stormwater management systems on historic parkways are either closed or open drainage systems. Closed systems consist of catch basins or drop inlets, some with sumps and some without, with drain pipe from these structures either connecting to a larger drainage pipe and manhole network or through the roadway embankment with discharge to a ditch or watercourse. Connecting Parkways, River Parkways and Ocean Parkways usually have closed systems where water is conveyed to catch basins and drain inlets. Newer closed systems can be constructed to recharge drainage back to groundwater depending on drainage catchment area, soil properties and local depth to groundwater.

Open systems consist of swales and ditches, either paved or unpaved, and culverts. Some early Connecting Parkways had cobblestone gutters and no curbs, a system

replaced by curbs within the period of historic significance. The drainage systems of many Internal Park Roads and Border Roads are open. Water is not collected but rather directed off the road surface to culverts, swales, and ditches. Curbing can sometimes be found on parkways with open drainage systems.

Proper design and maintenance of drainage systems are essential to the positive function and character of historic parkways. DCR has performance standards in the Stormwater Management Plan. Low Impact Development (LID) best management practices are important tools.

Maintenance of both drainage structures and the cross-section of the road ensures positive drainage of water off the road. Inadequate treatment of surface drainage on the shoulders of many parkways leads to soil erosion, loss of pavement, and undermining of the roadway subbase.

In addition, drainage systems must comply with current environmental standards. To meet water quality standards for stormwater runoff, the quantity of total suspended solids and other pollutants must be controlled through the design, management, and maintenance of storm water structures. The quantity and quality of storm water runoff are also subject to regulatory control. The standards and methodology for providing compliant drainage systems are described in MassHighway's *Stormwater Handbook for Highways and Bridges.* This publication adheres to the Massachusetts Department of Environmental Protection's policy for stormwater management and it is specifically written for linear drainage systems typical of roadways. The DCR Stormwater Website provides additional references and links to the DCR Storm Water Handbook. It includes construction examples of best management practices for parks and parkways.

<u>Guidelines for Travelway Drainage</u>

- Where alterations to the existing closed drainage system are required, establish the quantity of runoff contributing to various inlet points to the system. Several acceptable methods, properly applied to represent watershed characteristics, are available for determining this number.

- Prior to the design of closed drainage system improvements, thoroughly document existing conditions, with a cleaning and video survey if necessary. If during review of existing systems any unauthorized piped connections (drain or sewer) are discovered, document them and observe whether there is any flow through the connection. Forward any information concerning unauthorized piped connections to the DCR Chief Engineer.

- Continue the use of existing open drainage systems. When appropriately designed and maintained, open systems provide stormwater pollution attenuation and are resilient to high runoff peak flows. Direct runoff to

vegetated infiltration areas, minimize soil disturbance and maximize stabilization of adjacent land.

- For swales, either replace continuous paved surfaces with stone spaced to allow some infiltration or recharge to groundwater, or, if maintenance can be provided, plant low height turf species to allow more storm water to infiltrate to the ground and reduce volume of water to manage and to promote transpiration instead of run-off.

- Mow two times per season to maintain vegetation height and health. Include periodic cleaning to avoid accumulation of litter.

- Where manholes or catch basin will be installed, where possible specify pre-cast concrete manhole and drainage structures instead of brick, which requires more frequent repair and repaving of nearby parkway surfaces, especially in high vehicle traffic areas.

- Where necessary, increase unpaved roadway crowns to allow water in open drainage systems to flow more laterally off the surface into ditches, keeping velocities low and avoiding runoff concentration.

- **Internal Park Roads**: Where waterbars channel water across an unpaved parkway lacking a crown, remove the waterbar and establish a crown.

3.5.2 Stormwater Best Management Practices

Goal
Use best management practices for stormwater.

Issues for Stormwater Best Management Practices
During construction, storm water runoff can erode exposed soils, transport pollutants and degrade local water quality. Stormwater must be managed to reduce the volume of runoff and to prevent the possibility of degradation. To be in compliance with the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System Program (NPDES), soil disturbance greater than one acre requires filing a Notice of Intent with the EPA under the Construction General Permit and preparation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP generally includes the means and methods of controlling soil erosion and water quality degradation and requires periodic inspections of the erosion control measures at the construction site. Copies of the SWPPP should be provided to the local municipal authorities.

Any surface waters within or with hydrological connection to the project site may be considered Massachusetts impaired waterways listed in MA DEP Section 303(d). Massachusetts DEP identifies certain waterways as impaired due to one or more pollutant or stress factors. When construction induces discharges of these pollutants

or amplifies stress factors to receiving waters, site control measures are necessary to improve water quality to manage those pollutants or stresses.

Guidelines for Stormwater Best Management Practices

- Place hay bales and silt fence to reduce sediment loads in storm water discharges, control construction vehicle access and egress, and reduce the tracking of dirt onto adjacent roadways.

- Use appropriate control measures for the site. If storm water leaving the site appears silted or murky, employ additional control measures or treatment improve water quality prior to discharge.

- Where construction activity involves excavation, dewater if the excavation is lower than the level of groundwater and may involve continuous pumping and result in large volumes of water to manage on site.

- Depending on the grade of the site and the adjacent landscape and hydrology, construct a treatment train, or sequence of one or more treatment units to remove suspended solids or other target pollutants prior to discharge from the site, if warranted.

- For the finished project to comply with DCR stormwater management policies and with applicable federal (USEPA and COE) discharge permits, the policy and performance standards of the Massachusetts Wetlands Protection Act and various state regulations governing surface and ground water quality, implement the most "practicable" stormwater management practices. These include post-construction operation and maintenance planning and periodic inspections to ensure that drainage systems are operating properly and that no soil erosion is taking place while vegetation becomes established. Best management practices for stormwater are listed in the DCR Storm Water Management Plan and in the DCR Stormwater Handbook available through the DCR Stormwater website which can be found at http://www.mass.gov/dcr/stewardship/stormwater/index.htm.

- Follow appropriate stormwater Best Management Practices (BMPs) including water quality swales, deep sump catch basins, sediment traps, vegetated filter strips, various configurations of detention/retention basin systems, leaching basins, recharge installations and street sweeping. Where detention of water is necessary to manage stormwater peak flows, consider infiltration/exfiltration galleries constructed underground where soils are suitable (Class A, B or C soils) instead of detention/retention basin systems that detract from historic settings.

- Use design techniques and construction methods to prevent concentrated flow of stormwater. These flows occur along slopes greater than 5%, but can also occur if the surface area is impervious or saturated on slopes of less than 5 %.

- Where construction involves excavation on slopes, install stone check dams installed at the curb line or in the flow path and spaced approximately every 100-feet to reduce run-off velocity and erosion.

- If roadways are designed to have slopes of 5% or greater, use curbing to control storm water and direct it to a collection system.

- Evaluate BMPs to meet the following objectives:

    - control peak runoff rate
    - provide groundwater recharge, where site soils are suitable (Class A, B or C soils) and contain no known hazardous contaminants that could mobilize or migrate in groundwater.
    - maintain acceptable water quality

- Evaluate the effectiveness and practicability of the full range of BMPs by employing a systematic screening process with the following criteria:

    - physical constraints,
    - installation, operational and maintenance requirements,
    - regulatory restrictions,
    - site soils,
    - proximity of installation to critical wetland resource areas and other regulated receiving waters and
    - contribution from land uses with higher potential pollutant loads than roadways.

- Perform backup calculations and documentation in support of the BMP selections in accordance with MassHighway's *Storm Water Handbook for Highways and Bridges*.

3.5.3 Culverts and Swales

Character-defining culvert headwalls deserve preservation.

Goal

Preserve character-defining headwalls, culverts and swales.

Issues for headwalls, culverts and swales

Culverts are covered drainage channels beneath a road that convey surface water runoff from one side to the other. They may or may not tie to the roadway drainage system. They consist of a manufactured metal, concrete or plastic pipe and masonry or concrete headwalls on either side of the roadway embankment. Culverts can be character-defining features, especially if constructed by the CCC.

Swales are shallow ditches with gentle side slopes that are paved, stone lined, or vegetated. Culverts are susceptible to clogging by accumulated debris and headwall root damage. Culverts and swales are susceptible to erosion, often from uncontrolled roadway runoff. When slopes are steep, the culvert and swale drainage system are more susceptible to damage and require increased routine maintenance.

Local drainage may include paved waterways to channel brooks in the vicinity of the travelway. These are not character-defining, and detract from the landscape.

Guidelines for headwalls, culverts and swales

- Where stone headwalls of culverts are character-defining features, do not replace them with concrete unless clad with masonry veneer replicating original character. For mortared headwalls, match the mortar. Do not patch dry masonry with mortar as this accelerates deterioration. Refer also to stone wall guidelines.

- Mark culverts consistently and clearly (but unobtrusively) to assure their inclusion in routine maintenance. For culverts with open basins, introduce a grille to screen debris.

- If surface drainage is spilling over the edge of the travelway onto the headwall from behind, regrade locally to redirect the runoff to a swale or if runoff is excessive to a grate connected directly to the culvert pipe.

- If the culvert pipe is to be replaced and is highly visible, use the same material as the original. For the rare culverts constructed with stone channels, preserve them when possible even if not highly visible.

- Remove paving from paved waterways and restore natural soil and vegetation. Where pavement stabilized the stream bed or banking, place stone pavers, field stones, or synthetic matting covered in stone to stabilize the stream bed and banking. Avoid placement of loam in swales. Loam is high in nutrients and erodes quickly. Use a synthetic mat or vegetation anchor to secure vegetation temporarily until it is established.

- When replacing a culvert over a perennial stream, ACOE regulations (implemented through local conservation commissions) require an appropriately-sized box culvert instead of a piped culvert to allow wildlife passage and improve flood control.

- Design new culverts and swales to minimize erosion by paying close attention to the road grade and other attributes that would slow the rate of runoff.

- **Summit Roads:** Assess the effectiveness and safety of paved swales adjacent to the road. Mark paved swales so that they do not create the illusion of wider travelways. If the road must be widened into the swale, determine whether to change the swale to insure proper drainage into a narrower, deeper swale with underground drainage. Correct cross-slopes to assure proper cross-drainage.

[1] Birnbaum, Charles A., ed., *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes* (Washington, D.C.: U.S. Department of Interior, National Park Service, Cultural Resource Stewardship and Partnerships, Heritage Preservation Services, Historic Landcscape Initiative, 1996), pages 19 and 49. See Appendix K.