CHAPTER FIFTEEN

FLEXIBLE DESIGN PRACTICES

Volume I

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National Standards

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Chapter Fifteen

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Definitions -

NHS – National Highway System

AASHTO – American Association of State Highway Transportation Officials

Green Book – AASHTO – A policy on Geometric Design of Highways and Streets

Traffic Calming - Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non motorized street users.

Local Street – Provides direct driveway access to adjacent properties within residential neighborhoods. Generally, local streets have low speeds and volumes.

Minor Collector – Collects and distributes traffic between local streets and major collectors and/or the arterial system. Minor collectors provide more of a land access function than mobility.

Major Collector – Major collectors emphasize mobility over land access, distributing traffic between major traffic generators or minor collectors and the arterial system.

Minor Arterial – Minor arterials are designed to emphasize mobility over land access, providing access to principal arterials (highways and freeways). They connect cities with adjacent communities and the highway system.

15-1 INTRODUCTION

The Goal of this chapter is to enhance the essence of small, close-knit rural communities in Maine by providing a safe, attractive and comfortable pedestrian environment in a Village while celebrating its unique historic, built and natural features. The challenge is to upgrade road conditions through the Village by meeting Federal Highway System requirements to provide better sight lines and improved vehicular and pedestrian safety while respecting the aesthetic and socio-economic fabric of the community. MaineDOT's technical staff needs to ensure that proposed aesthetic improvements do not interfere with surface drainage patterns, access to underground utilities, and the maximum and minimum grades allowed on roadways. The process is collaborative in nature and draws on time-honored traditions of public meetings, civil discourse and representative democracy. Participation by professionals like artists, landscape architects and others can infuse the process with a creative approach to problem solving and openness to new solutions. A Local Review Committee can provide needed input by overseeing the Project from conceptual design to construction and installation and through to maintenance.

In pursuing this goal, it is important to remember that the full range of the design parameters are available for utilization within AASHTO and the MaineDOT Highway Design Guide.

This "Flexible Design Practices" chapter is not a new design standard. The chapter provides examples of existing design standards and the design exception process. It is intended to provide advice and guidance in complying with Congressional direction that highway design, particularly on the NHS, be flexible and accommodating when sensitive areas are involved such as state highways that run through villages. For projects not on the NHS, Congress has provided that States have the flexibility to develop and apply criteria they consider appropriate. Here in Maine, this has been accomplished with the publication of the MaineDOT Highway Design Guide, Volume II, State Standards (for Maine Non-National Highway System).

Because this "Flexible Design Practices" chapter does not contain any new design criteria, it relies on the criteria provided in the AASHTO "Green Book", the FHWA publication "Flexible Design Practices" and other current design guidelines.

The major thrust of this new chapter is to encourage and foster the development of an attitude toward greater flexibility in the use of specific design policies, procedures and standards. Its goal is to enhance creativity and sensitivity toward the community, historic and cultural values, while providing for user safety and efficiency in highway operations.

Users of this manual are encouraged to share any new solutions you may have found to particular design issues with your colleagues. In addition, if you think the new solution you have found should be included in the future versions of the chapter, please forward your suggestions to the Program Manager of the Highway Program, Maine Department of Transportation, 16 State House Station, Augusta, Maine. In this way, you will be expanding the knowledge base and contributing to successful context sensitive design.

Today's sponsors of transportation improvements consider an extraordinary array of factors. These include not only functionality, safety, and cost but the many concerns of a wide collection of stakeholders, and an extensive range of environmental, cultural, and community issues. This design process succeeds if it has credibility with highway engineers, planners, landscape architects, environmental and historic preservation staff, and the community. It must ring true with all. This means that: those primarily concerned with engineering factors and functionality appreciate the benefits of a broader design context; that designers willingly and openly seek the flexibility necessary to achieve a balanced outcome that respects the imperatives of both technical functionality and context sensitivity; and that planners, landscape architects, environmental staff, and the community have a heightened awareness of the legitimate concerns and constraints with which design engineers must deal.

15-1.1 Understanding Community Needs

Community needs vary widely but typical expressions of local concerns include the following:

- Pavement requires major repair
- Drainage is not functioning
- Traffic volumes are high and cause congestion
- Traffic speeds are too high for the setting
- Crashes are a concern
- Street lacks character and needs improvement in the form of landscaping, street furniture, reduction of overhead utilities, etc.
- Parking is inadequate
- Too few or too many poles and signs
- Visibility or width causes difficulty for pedestrians crossing the street
- Incomplete or inadequate sidewalk network
- Difficult to bicycle on the street
- Lack of lighting raises nighttime safety concerns
- Transit stops are inadequate
- Truck traffic is excessive

Some of these conditions are created by "conventional" street design, others have deeper roots. Currently, some roadway designs say "It's OK to go fast" and a design for higher speeds allows drivers to feel comfortable with their "ownership" of the road but causes other users to feel far less comfortable. The highest expression of this approach is the interstate highway. It uses access controls, clear zones, large curve radii, acceleration and deceleration lanes, large message signs, and other design features to isolate the road, ease driver decision-making, and make it safe and forgiving for the highest speeds. Interstates are targeted towards safety and mobility and are well-designed for these two goals. Local streets, on the other hand, require a completely different set of design considerations: access is paramount, there is no room for clear zones, curve radii are small, acceleration and deceleration lanes are less needed, and signage is scaled down. But, above all, the local street cannot be isolated for the safety of the high speed driver; it must be shared with pedestrians, bicycles, parked cars, delivery trucks, advertising signs, drainage

structures, and every other use made of our main streets. This basic condition shapes the visual and physical character of every local road and nearly all concerns stem from it. Some deeply rooted community concerns stem from roads and traffic but are more often expressions of traditional conflicts in American society. A very basic one is the issue of life safety and mobility versus livability. For example, the director of a nursing home wants to place furniture in a hallway so that the residents can sit and talk, but the fire safety director doesn't want any furniture in the hall because it's a fire hazard. This dilemma springs from differing goals. In Main Street projects, it often takes the form of one group desiring narrow streets and large sidewalks while the fire department insists upon wide streets for mobility and easy access to all structures.

Another is the issue of self-expression versus community values. The business community's desire for parking at the front door, easy access by private automobile, and control of its "turf " or business environment often clashes with the larger community's desire for alternate modes of transportation, less asphalt, and more opportunities for personal communication and beauty. One form the discussion takes on a main street is delivery trucks. Should deliveries be allowed at any time for the convenience of the shipper and the store owner but to the detriment of traffic flow? Or should delivery hours or locations be restricted to the inconvenience of businesses but the benefit of traffic? Whose values should prevail? Still another basic issue is the notion of current desires versus long-term needs. Should the crosswalk be a painted white stripe or stamped concrete? Should the no parking area be designated by a sign or some other technique? Are street trees worth the possible later costs of repairing root damage to sidewalks and sewer lines? This question is the age-old one of balancing the function of the improvement with the form of the improvement.

The last common conflict is tradition versus change. This is the familiar debate about the virtues of the countryside versus the values of the city. It takes many forms along a main street and is reflected in arguments over the "city" solution of a traffic signal when the "old" four-way stop has been working well for fifty years. The same may be said for the "new" ideas of pedestrian nodes or bumpouts, median planters, or narrowed lanes.

There are no technical answers to any of these conflicts. The only avenue to their resolution is building awareness and better perceptions among those trying to address them. The most important questions that arise are not matters of expertise. The challenge is to establish values and priorities and to decide which approaches are legitimate and which are not; in other words, to define the framework and terms of reference within which experts should work. This is a problem for the community, not for the experts themselves. To solve the problem, community members must achieve a better knowledge of those things which form the community environment and how those things are interconnected. This is achieved by going out into the community and talking about what is possible. The key approach is "Our community would function so much better if . . ."

Achieving even the single objective of reducing vehicle speed will require the use of a variety of physical solutions. Achieving the additional objectives of reducing the volume

of traffic, improving the appearance of the street, improving pedestrian accessibility, and reducing auto dependence will require even more changes to the roadway.

15-1.2 But Keep In Mind …

KNOW THE ROOT CAUSE OF THE PROBLEMS
Before applying solutions always identify the problems and their root cause. Sometimes the problems are a result of land use issues. Without the local community resolving the land use issues, through their home rule authority, any transportation solution will just be a bandaid. Realize that flexibility is a two-way street. Match the community's responsiveness with design flexibility.

ANALYZING THE IMPLICATIONS
Remember that improvements are not really improvements if they shift the problem to the next block, make it difficult for businesses to receive goods or customers, or complicate the provision of emergency services. All of the ideas for improvement must be tested. If the solution takes care of the immediate area but creates a problem elsewhere, it is time to rethink the answer.

BICYCLE NEEDS
Bicyclists are becoming a vocal force in the design of roadways and many communities are seeking to support increased levels of bicycle use. Bicycle racks, secure storage, wider travel lanes, separate paths, and safe crossing points are all items that may surface in a local project. MaineDOT's policy is to consider bicycles on all roadway improvement projects and to address bicycle needs where it is reasonable and feasible to do so. Contact the MaineDOT Bike/Pedestrian Coordinator in the Office of Passenger Transportation, 16 State House Sta, Augusta, Maine 04333 for assistance with Bike facilities.

LOCAL ACCESS
Parking and access for businesses, access for delivery vehicles, snow removal, individual driveways, responsibility for sidewalk maintenance, the location of mailboxes, and dozens of other large and small "access" concerns will arise in the course of the project. There are no standard solutions that will apply in every case, there are only examples of how other communities have dealt with the issues and their experience over time with the results. New access points to highways, not in the urban compact, need to be permitted through the appropriate Regional Engineer. For a copy of the rules go to this web address: ftp://ftp.state.me.us/pub/sos/cec/rcn/apa/17/229/229c299.doc

LARGE VEHICLES
Because trucks, buses, and many emergency vehicles have large turning radii, care must be taken when reducing curb radii or installing median islands or roundabouts. If the lane widths or turning movements are too restricted, access could be denied to large vehicles. Unless restricted access is the purpose, all turning radii and lane widths should be checked for their ability to accommodate the necessary vehicles. This can be done on the plan drawings with a "turning template" or in the field with a temporarily marked roadway and actual vehicles.

ENFORCEMENT
A carefully designed road should reduce traffic enforcement needs by maintaining speed limits, clearly identifying parking options, and improving the basic level of safety for pedestrians. A poorly conceived plan could create opportunities for higher speeds, "blind spots" such as fences or shrubs that are difficult for enforcement officials to see behind or gain access to, and confusing parking or access patterns for the local resident. All designs should be studied from a common sense perspective and with the assistance of local public safety officials.

MAINTENANCE
Care and maintenance must be built into the design by thinking about types of materials, longevity, ease of maintenance, life cycle costs, local maintenance capabilities, etc. The aim is to ensure that project character is not altered by future "fixes" such as roadway signs, utility upgrades, tree trimming, or maintenance failures. To preserve the design intent of the project from later changes, the following items must be considered from the beginning.

- Material life
- Access
- Equipment needed
- Replacement cost
- Trash removal
- Landscape care and replacement
- Safety and lighting of spaces
- Coordination with public utilities

TRAFFIC CALMING
The term "traffic calming" is an important component of many highway projects in Maine, especially in communities struggling to 'calm' or slow traffic through their historic villages.

Equally important in this approach to transportation planning are the compatible goals of restoring aesthetic qualities and improving pedestrian safety in village centers. Proven traffic calming methods employed in the streetscape design also plays an important role in traffic calming with enhancements such as lighting, signage and landscaping, which reinforce village character and at the same time, improve aesthetics and human comfort.

Taken together, these initiatives enhance the historic attributes and pedestrian scale of the village and help to keep it a vibrant, satisfying place to live and work, as well as to visit. See the MaineDOT Traffic Calming Policy, Appendix 15-B

TORT LIABILITY

Tort Liability is a real concern for many highway engineers. As a result of concerns about litigation, designers may be tempted to be very conservative in their approaches to highway design and avoid innovative and creative approaches to design problems. The best defense for a design engineer is to present persuasive evidence that the guidelines were not applicable to the circumstances of the project or that the guidelines could not be reasonably met. Designers need to remember that their skills, experience and judgment are still valuable tools that should be applied to solving design problems and that, with reliance on complete and sound documentation, **tort liability concerns need not be an impediment to achieving good road design.**

15-1.3 References

This Report Uses References From:

- A Policy on Geometric Design of Highways and Streets, American Association of State Highway Transportation Officials, 2004 (a.k.a. AASHTO Green Book)
- MaineDOT Highway Design Guide, Volume One, National Standards, December 2004
- MaineDOT Highway Design Guide, Volume Two, State Standards, July 2003
- Roadside Design Guide, AASHTO, 2002
- A Guide to Achieving Flexibility in Highway design, AASHTO, May 2004
- Flexibility in Highway Design, U.S. Dept of Transportation
- Highway Capacity Manual, Transportation Research Board

15-2 FLEXIBILITY IN HIGHWAY DESIGN

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LANE AND SHOULDER WIDTH

DESIGN FEATURE	SOLUTION	REFERENCE
Lane widths of 12ft are desirable on both urban and rural facilities	The use of 11ft lanes are acceptable in urban areas where right-of-way and existing development become stringent controls. Lanes 10ft wide are acceptable on low-speed facilities. Lanes 9ft wide are appropriate on low-volume roads in rural and residential areas.	AASHTO Green Book Pg. 312 Low-volume roads typically have an ADT<400
Lane widths are related to the traffic demands and design speeds. A traveled way width of 24ft is required for arterials with an ADT of 400-1500 and a design speed of 60mph or greater, an ADT of 1500-2000 and a design speed of 55mph or greater, and a DHV over 200 and a design speed of 35mph or greater.	Width of traveled way may remain at 22ft on reconstructed highways where alinement and safety record are satisfactory. Off system highways use State Standard widths.	AASHTO Green Book, Pg. 448 Maine Highway Design Guide, Volume Two.
The width of the shoulder on an added lane should match that of the adjoining two-lane highway.	The width of the abutting shoulder should be a minimum of 4ft wide.	AASHTO Green Book, Pg. 247. MaineDOT Highway Design Guide, Volume One

VERTICAL CLEARANCE

New or reconstructed structures on freeways and arterial systems should provide 16ft clearance over the entire roadway width.	Existing structures can be retained that provide 14.5ft, if allowed by local statute. In highly urbanized areas, a minimum clearance of 14ft may be provided if there is one route with 16ft clearance. Structures should provide additional clearance for future resurfacing of the underpassing road.	AASHTO Green Book, Pg. 447 & 472
The desirable clear height of all grade separation structures above traveled way and shoulders should be 16.5ft. Most states permit the vehicle height, including load, to be between 13.5ft and 14.5ft. Maine permits a vehicle height of 14ft. The clear height of all structures above traveled way and shoulders should be at least 1ft greater than the legal height. Allowance should be made for future resurfacing, for snow or ice accumulation and for occasional slightly over height vehicle.	The recommended minimum clear height of all structures above traveled way and shoulders is 14.5ft.	AASHTO Green Book Pg. 763

HORIZONTAL CLEARANCE

DESIGN FEATURE	SOLUTION	REFERENCE
On urban arterial street sections, a 3ft clearance from curb to face of object is desirable to provide the clearance required for overhang of trucks from striking the object.	Clearance from curb to face of object of 1ft (or wider where possible) should be the minimum.	AASHTO Green Book Pg. 437, 448 & 481

Physical obstructions in or near the roadway should be removed in order to provide the appropriate clear zone.	Where removal is impractical, such objects should be adequately marked by painting or by use of other high-visibility material.	AASHTO Green Book Pg. 295
For a certain design speed and fill slope, there is a recommended clear zone distance.	In one example, the trapezoidal channel design does not conform to recommended gradual slope changes and the recommended clear zone distance is not met. However, if the channel bottom and backslope are free of obstacles, no additional improvement is suggested.	AASHTO Roadside Design Guide, Pg. 3-11
Variable clear zone distances are based on traffic volumes, speeds and roadside geometry.	Clear zones may be limited to 30ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.	AASHTO Roadside Design Guide, Pg. 3-1 & 3-2

CROSS-SECTIONAL ELEMENTS

DESIGN FEATURE	SOLUTION	REFERENCE
Roadways need to be built to the standards for the various functional classifications.	If sufficient right-of-way is not available, reconsider the functional classification, consider lowering the design speed, consider building a 3R project, or request a design exception.*	FHWA publication "Flexibility in Highway Design", Pg. 97
The appropriate number of travel lanes for the level of service desired can be determined using the procedures in the Highway Capacity Manual knowing future projected travel demands.	A community may decide through public involvement that a lower level of service than normally provided is acceptable.	FHWA publication "Flexibility in Highway Design", Pg. 76.

Barriers are needed to minimize the severity of potential accidents involving vehicles leaving the travel way where the consequences of errant vehicles striking a barrier are less than leaving the roadway.	Weathering steel is a low cost option for designers who are trying to "blend" a barrier into the surrounding environment.	FHWA publication "Flexibility in Highway Design", Pg. 94.

HORIZONTAL AND VERTICAL ALINEMENT

DESIGN FEATURE	SOLUTION	REFERENCE
Impact to the surrounding environment should be minimized as much as possible during construction and reconstruction.	Careful attention to detail during the route location and preliminary design phase can minimize the impact on the surrounding environment for example, minor adjustments on one project eliminated the need to acquire any of the adjacent homes and businesses	FHWA publication "Flexibility in Highway Design", Pg. 68.
Efforts should be made to avoid impacting historic districts.	Consider the use of "cut-and-cover" design.	FHWA publication "Flexibility in Highway Design", Pg. 69.
There should be coordination of horizontal and vertical alignment.	Ensure the most effective coordination through the use of multidisciplinary design teams.	FHWA publication "Flexibility in Highway Design", Pg. 71.
Horizontal and vertical geometry's should be designed concurrently as they must be complimentary.	One tool is to use computer-aided design (CAD).	FHWA publication "Flexibility in Highway Design", Pg. 67.

DESIGN SPEED

DESIGN FEATURE	SOLUTION	REFERENCE
Above-minimum design values should be used where feasible, but in view of the numerous constraints often encountered, practical values should be recognized and used.	Develop project under 3R design criteria by adjusting scope of project. Off system roadways use State Standards. Use the design exception process. (App 15-A)	AASHTO Green Book Pg. 68-72. FHWA pubulication "Flexibility in Highway Design", Pg 32-33.

	Look at lowering the posted speed.	MaineDOT Highway Design Guide, Volume One, Chapter 11. MaineDOT Highway Design Guide, Volume II.

LEVEL OF SERVICE

DESIGN FEATURE	SOLUTION	REFERENCE
While the Highway Capacity Manual provides the analytical basis for design calculations and decisions, judgment must be used in the selection of appropriate level of service for the facility under study.	Lesser rates may be used for certain recreational routes or for environmental or land use planning reasons.	Highway Capacity Manual. FHWA publication "Flexibility in Highway Design", Pg. 32-33 AASHTO Green Book Pg. 84

STOPPING SIGHT DISTANCE

DESIGN FEATURE	SOLUTION	REFERENCE
Minimum stopping sight distances are required for various design speeds.	It is permissible to utilize the lowest recommended stopping sight distance in the range of values provided. Consider lowering the design speed for an entire corridor. Use the design exception process. See App 15-A	AASHTO Green Book Pg. 112

SUPERELEVATION

DESIGN FEATURE	SOLUTION	REFERENCE
It is desirable to provide as much superelevation as practical. MaineDOT uses a maximum superelevation rate of 6% on rural roadways and 4% on urban.	Tables in the AASHTO Green Book Chapter III, and IX allows for a range of superelevation rates where a change in design speed or radius can reduce or increase the superelevation rate. Develop project under 3R design criteria by adjusting the scope.	AASHTO Green Book Pg. 132-163, 639-648.

ENTRANCES/DRIVEWAYS

DESIGN FEATURE	SOLUTION	REFERENCE
Directly related to the functional classification of the particular roadway, and whether it is residential or commercial.		

PARKING

DESIGN FEATURE	SOLUTION	REFERENCE
The effect of curb radii on the path of various design vehicles is directly related to the length of parking restrictions.	Consider three-centered curves or an offset simple curve in combination with tapers or spirals to fit the path of the vehicle.	AASHTO Green Book Pg. 593 – 609, Table IX-1, IX-2.

AUXILIARY LANES

DESIGN FEATURE	SOLUTION	REFERENCE
For at-grade intersections, auxiliary lanes desirably should equal that of the through lane.	Auxiliary lanes should be at least 10ft wide.	AASHTO Green Book Pg. 714.
	Auxiliary lane can be the same as, but not less then, the width of the travel lane	MaineDOT Highway Design Guide, Volume One

15-3 ADDITIONAL FEATURES TO CONSIDER:

The following sections, 15-3.1, 15-3.2 and 15-3.3, list project features that will have a major effect on traffic patterns of vehicles, bicycles and pedestrians as well as project cost. These features are identified in the early planning stages of a project when project scoping discussions are taking place between the Bureau of Planning staff and the Communities involved. Cost sharing of the various features is also determined at that stage based on relevance of the feature to the community or to the State. The identified features are listed in the Planning Report and in a community MOA when the project is handed off to the Program who will be the lead unit.

Sometimes these features are identified as important later in the project development stage. Because of the long term effects of these features as well as costs to the project and various cost sharing responsibilities, they should only be added to a project after discussions have taken place between the Program, Planning and the Communities involved.

15-3.1 Improving Pedestrian Accessibility

Sidewalks – Sidewalks are essential in commercial and residential areas. Even with low vehicle speeds, children, seniors, and people with disabilities cannot walk safely without sidewalks. The Americans with Disabilities Act provides the basic standards for minimum width and accessibility. Items to remember are that two people should be able to walk side-by-side: sidewalks that aren't separated from vehicle travel lanes by green strips (or parked cars) should be wider than the standard: and sidewalks next to fences, walls, or buildings should be wider than the standard.

Curb Ramps – These provide a smooth and gradual transition between the sidewalk and the road surface and are designed for access for wheelchairs, walkers, and strollers. The Americans with Disabilities Act provides standards for their location and design including truncated domes to warn pedestrians that they are about to step into approaching traffic.

Marked Crosswalks – Marked crosswalks alert drivers that they are approaching an area of pedestrian activity and alert pedestrians to a safe and accessible crossing. The idea is to incorporate a textured or patterned surface which contrasts with the surrounding roadway. Crosswalks can be marked with stripes, colored concrete or pavers, or stamped asphalt. A crosswalk with texture also serves to slow drivers because of its roughness and noise. Mid-block, as opposed to intersection, crosswalks may be difficult to justify unless accompanied by flashing lights or signs. Another way of making crosswalks more noticeable are embedded lights such as were used in Brunswick on Maine Street. Bump-outs can be used to reduce the length of crosswalks. See Appendix 15-C, Guidelines for Crosswalks for more information.

15-3.2 Features Outside of the Curbs

Features outside the curb need to be located outside of the clear zone so that they are not a danger to vehicular traffic.

For urban arterials, collectors and local streets where curbs are utilized, space for clear zones is generally restricted. A minimum offset distance of 18 inches should be provided beyond the face of the curb, with wider offsets provided where practical. This "operational" offset will generally permit curbside parking and will not have a negative impact on traffic flow. However, since most curbs do not have a significant capacity to redirect vehicles, a minimum clear zone distance commensurate with prevailing traffic volumes and vehicle speeds should be provided where practical.

For clear zone offsets for rural or non-curbed highways see pages 10-7 in Volume I and B-9,10 in Volume II of the MaineDOT Highway Design Guide.

Identification Signs – Non-traffic signs that welcome visitors to a community or district help establish identity and communicate a pride of place. They do not have to be large but within each community should be of a consistent shape, color, and material if more than one is used.

Planters and Banners – Sidewalk planters, hanging planter baskets, and pole banners are an excellent way to add color to the street, divert attention from overhead utilities, identify a special district, or advertise events. Care must be taken not to interfere with pedestrian movement along the sidewalk or add safety distractions for drivers.

Street Furniture – Benches, waste containers, planters, bollards, pedestrian lighting, and kiosks all help create a walkable street environment by "announcing" to the public that they are welcome and their needs have been considered. A number of historic and contemporary styles of benches are available for consideration, including such styles of metal, wood and granite. These amenities should be high-quality, durable, attractive, easily maintained, and placed in such a way that a harmonious design theme is apparent and adjacent structures are complimented.

Landscaping – Most images of healthy communities include treelined streets interspersed with grass and shrubbery. This holds true in commercial as well as residential areas. Apart from their physical beauty, these landscaped areas create a friendly, walkable environment by separating pedestrians from cars and slowing driver speeds. The space required for vegetation varies with the type selected; grass or shrubs will require less room than a deciduous tree. Selecting the proper vegetation is critical – all vegetation should be appropriate for the specific climate where it is to be planted, low maintenance, placed to not uproot curbs or walks, located out of essential sight lines, and selected to not interfere with overhead utility lines.

Gateways - 'Gateways' with signage, landscaping, granite posts and sidewalk markers can alert motorists that they are entering into a village center and should adjust their driving styles accordingly.

Lighting - New, energy efficient, village-scaled lighting fixtures can be used in the village center. New lighting design and engineering of the lighting levels and coverage will result in safer and more consistent illumination than may presently exist. New or existing sidewalks can be sufficiently lit and ensure that pedestrians and schoolchildren will have adequate lighting levels during the dark afternoons of winter and on summer evenings as well.

Lower pole heights (12-14 feet) and softer illumination controlled by either timers or photocells can be provided, and higher poles (16-18 feet) and brighter illumination levels are for locations adjacent to the highway and new sidewalks. As an added benefit, electrical outlets can be installed in the poles around the downtown, facilitating the use of power for special events.

15-3.3 Features Between the Curbs

Bike Lane – This is a portion of the roadway designated by pavement markings and signing for exclusive use by bicycles. A bike lane for one-way movement should be at least five feet wide. A bike lane for two-way traffic should be at least eight feet wide and separated from the vehicle lane with a barrier such as a curb or island. Bike lanes are best provided if the street is commonly used by bicyclists or if it links important bike destinations.

Narrowed Lanes – This is simply a reduction in the width of the travel lane. It is used to reduce vehicle speeds, reduce the crossing distance for pedestrians, increase pedestrian visibility, and to prevent parking too close to an intersection. Typically, low volume streets (i.e. one car or less per minute) do not need wide travel lanes.

Chicanes – A chicane is a series of curb bump-outs or nodes that extend out into the street on alternating sides of the roadway. They may or may not narrow the travel lane but always require the driver to steer from one side of the roadway to the other to negotiate the chicane. They slow traffic, discourage shortcutting, and provide landscaping opportunities.

On-Street Parking – Parking can be allowed on both sides of a roadway or parking zones can be located on alternating sides of a street to create a chicane effect. Both alternatives may reduce vehicle speeds because of "side friction" and potentially reduce the volume of through traffic along a street. Because this measure relies on an effective reduction in traffic lane width for much of its effect, the provision of additional space for bicycles would reduce effectiveness significantly. If streets are wide enough, angled parking increases the total number of parking spaces that can fit within a block and often lowers speeds because the travel lane width is slightly narrowed and drivers are more alert to cars backing into the roadway.

Choker – A set of two curb bump-outs or nodes that extend into the street at an intersection narrowing it to as small as one lane. It causes drivers to slow when entering and exiting the street. The choker is used when there is an unacceptable amount of shortcut traffic, speeding, or a transition is needed from a street in a business area to a street in a residential area.

Bumpouts or Nodes – These features extend the sidewalk into the street. They provide opportunities for landscaping and street furniture, shorten the street crossing distance for pedestrians, protect parked cars from on-coming traffic, and provide better visibility for pedestrians by allowing them to look around parked cars without entering the street. Bumpouts at an intersection prevent parking in a crosswalk or blocking handicapped ramps. They also slow traffic by narrowing the roadway and restricting turning speeds.

Curb Radius Reduction – Reducing the radius of a curb at an intersection can slow drivers who do not completely stop to make a right turn. A reduced radius shortens the pedestrian crossing distance, improves visibility, reduces turning speeds, and may add parking spaces. Always consider the turning radii of trucks, buses, and emergency vehicles when they are heavy users of the intersection.

Full Street Closure – This is a physical barrier that closes the street to vehicles. Pedestrians, bicycles, wheelchairs, and emergency vehicles can be accommodated. A turnaround should be provided at the closure. Use of a full street closure is highly unlikely on a state road, but may be desirable on connecting neighborhood streets if they are used as shortcuts and cause high traffic volumes and pedestrian conflicts.

One-Way Streets – Designating a street for one-way traffic can be used to improve mobility or restrict vehicle access. A one-way street should be paired with another street with traffic flow in the opposite direction and is best used on narrow streets with high volumes where the one-way prohibition is self-enforcing. One-way streets can result in higher speeds and, if not carefully planned, increase traffic through other areas as drivers seek alternate routes.

Partial Street Closure – This is created by a node or curb extension that physically blocks one direction of traffic at an intersection on an otherwise two-way street. It is the equivalent of a Do Not Enter sign but provides landscaping space and a physical barrier. It is used to eliminate cut through traffic.

Pedestrian Refuge Islands – Pedestrian refuges are raised islands in the center of the street at marked, intersection crosswalks. They allow pedestrians faced with a wide street and a short signal sequence, a chance to stop safely before crossing the rest of the street. They also provide an opportunity for landscaping.

Raised Intersections – This measure raises the surface of the roadway from crosswalk to crosswalk as a means of reducing speeds and better defining crosswalk areas. Although they are not used on arterial highways, they can be looked at for use on collector or local streets.

Roundabouts – These are large, raised islands, usually landscaped, designed to lower speeds and improve traffic flow as drivers maneuver through an intersection. Traffic circulates in one direction only and no signals are used. Roundabouts differ from Rotaries in that vehicle speed is greatly reduced as well as vehicle lane weaving.

Traffic Signs – Stop, yield, speed limit, and warning signs require that very specific conditions be present to warrant them. Posting too many can cause unnecessary distractions or cause drivers to disregard the sign's warning.

Speed Humps – These are raised areas of pavement extending completely across the roadway that deflect both the wheels and the frame of a crossing vehicle. They are designed to reduce speeds with the desired speed controlled by the dimensions of the hump and the spacing between them. Although they are not used on arterial highways, they can be looked at for use on collector or local streets.

Medians – These are long, raised islands placed in the center of the roadway. They slow traffic, provide space for landscaping, and give pedestrians a safe place to stop as they cross the street. Placing a median in an existing street typically requires narrowing lane widths, eliminating a travel lane(s) or removing parking. Medians can be especially effective on four-lane roads where they dramatically improve the visual quality of the facility. They limit access to properties by stopping left turn movements and they are a good tool in the right context.

Interrupted Sight Lines – If drivers can see a long way into the distance, their speed increases; if they cannot see a long way ahead, their speed decreases. In certain low speed conditions, interrupting a driver's sight line with chicanes, roundabouts, bumpouts, medians, or crosswalks not only maintains slow speeds but widens a driver's vision so for the shorter distance they are more aware of pedestrians and cyclists.

APPENDIX 15-A

The Design Exception Process

Despite the range of flexibility that exists with respect to virtually all the major road design features, there are situations in which the application of even the minimum criteria would result in unacceptable high costs or major impact on the adjacent environment. For such instances when it is appropriate, the design exception process allows for the use of criteria lower than those specified as minimum acceptable values in the Green Book.

If the Highway project is not on the NHS, the State does not need the FHWA approval for a design exception.

(MaineDOT policy states, approval for design exceptions of the controlling State Standards for off system must come from the Director, Bureau of Project Development.)

For projects on NHS routes, FHWA requires that all exceptions from accepted guidelines and policies on the 13 specific controlling criteria be justified and documented in a manner as stated in FHWA memorandum at http://www.fhwa.dot.gov/legsregs/directives/fapg/0625sup.htm.

The 13 specific controlling criteria are:

1. Design speed
2. Lane width
3. Shoulder width
4. Bridge width
5. Structural capacity
6. Horizontal alinement
7. Vertical alinement
8. Grade
9. Stopping sight distance
10. Cross Slope
11. Superelevation
12. Vertical clearance
13. Horizontal clearance (not including clear zone)

The design exception should be documented and accepted by the Preliminary Design Report (PDR) stage of the MDOT project development process.

APPENDIX 15-B

MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC CALMING POLICY:

The purpose of this policy is to provide guidance to local, regional and State jurisdictions for the application of traffic calming techniques on streets and highways having a Federal functional classification of principle arterial, minor arterial or major collector. Maine's arterial and major collector systems provide a network for the safe and efficient inter-regional movement of people, goods and services between and through major urban centers. Mobility is the prime function of these higher classifications.

Concerns have been raised about the compatibility of traffic calming objectives with the prime mobility function of arterial highways and streets.

For policy purposes, MaineDOT will use the following definition of traffic calming established by the Institute of Transportation Engineers:

> *"Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non motorized street users."*

Traffic calming treatments cover a range of categories and features as indicated in Table 1.

MaineDOT believes that traffic calming, as defined by the Institute of Transportation Engineers, is a valid and useful approach to traffic management on rural highways that are Federally functionally classified as local streets and minor collectors, and on urban roadways classified as local streets and collectors. Consequently, the full range of traffic calming techniques may be considered appropriate for implementation on highways bearing these Federal functional classifications.

Given the fact that the prime function of the higher classifications of arterial highways and streets is to provide mobility for transportation systems users, and given the fact that the objectives of certain traffic calming techniques are incompatible with the mobility function of arterials, MDOT will prohibit vertical changes involving speed humps, speed bumps, or raised intersections, and lateral changes involving chicanes, offset intersections, or lateral shifts in the geometric alignment of highways and streets that are Federally functionally classified within the urban compact areas as arterials. In the rural areas, the restriction prohibiting geometric changes identified above will apply to highways that are Federally functionally classified as major collectors and arterials or any road posted for speeds 45 miles-per-hour and above.

Table 1 displays the effects of this policy on the range of traffic calming categories by Federal functional classification.

Category	***Features***	***Federal Functional Classification***
Vertical changes in street	Speed humps, speed bumps, raised intersections.	Not permitted on arterials within the urban compact. Not permitted on arterials, major collectors or any road posted for speeds 45 mph and above in the rural areas.
Lateral changes in street	Chicanes, offset intersections, lateral shifts.	Not permitted on arterials within the urban compact. Not permitted on arterials, major collectors or any road posted for speeds 45 mph and above in the rural areas.
Constrictions	Narrowings, neckdowns, pinch points, islands.	Eligible treatment for all classifications, determined by the design process.
Narrow pavement widths	Medians, edge treatments.	Eligible treatment for all classifications, determined by the design process.
Entrance features		Eligible treatment for all classifications, determined by the design process.
Circular intersections	Roundabouts, traffic circles.	Eligible treatment for all classifications, determined by the design process.
Small corner radii		Eligible treatment for all classifications, determined by the design process.
Related streetscaping	Surface textures and colors, landscaping, street trees and furniture.	Eligible treatment for all classifications, determined by the design process.

Table 1

Other traffic calming techniques that do not involve the top two categories in the table above may be considered as part of an overall traffic management plan for arterials and major collectors in both the urban compact and rural areas.

POLICY ADDENDUM: Potential exceptions. The Department recognizes that some jurisdictions may feel that an exception to this policy may be justified in certain locations or under special/unique circumstances. Whenever a request is made to the Department for an exception to this policy, four basic levels of traffic management need to be considered and addressed.

Level 1: Establishing (or revising) and enforcing general laws and ordinances pertaining to speed limits, intersection controls, and parking regulations. This strategy should generally be the first used to attempt to address evolving neighborhood concerns.

Level 2: Educating residents to better understand the causes of traffic problems, potential solutions to those problems, and the advantages/disadvantages of implementing various solutions. This strategy should be pursued anytime neighborhood concerns are addressed.

Level 3: Installing traffic control devices that provide specific regulatory, warning, or guide messages to motorists. These should be used judiciously and in conformance with the Manual on Uniform Traffic Control Devices.

Level 4: Installing geometric design features that manage the physical movement of vehicles or pedestrians within the roadway or within a neighborhood. These should be used as a remedial technique **only when the above methods have proved ineffective.**

The Department requires that some level of documentation detailing the efficacy of the steps be submitted before consideration can be given to an exception to the policy.

Also the Department requires that any local or regional jurisdiction that is considering traffic calming within their community or region develop a municipality wide or regionally based traffic calming plan that documents the needs and specifies the areas where traffic calming may be appropriate to address the needs of the community. This municipal/regional plan shall be reviewed and approved by the responsible municipal/regional authority and the Department. Possible exceptions to the policy on arterial traffic calming should be identified in these plans and reviewed on a case-by-case basis for the purposes of identifying the most appropriate treatment to solve the problem. Any proposed treatments must minimize potential conflicts between the objectives of traffic calming and the mobility function of roadways.

A good reference for traffic calming is located at http://www.ite.org/traffic/tcstate.htm. This website includes “Traffic Calming: State of the Practice, ITE/FHWA, August 1999”.

APPENDIX 15-C

State of Maine
Guidelines for Crosswalks

Crosswalks are marked areas where pedestrians can safely cross a roadway. By law in the State of Maine (Title 29-A Subsection 2056,4) any vehicle must yield the right-of-way to a pedestrian who has entered a crosswalk when a traffic control device is not in operation. This law makes it imperative that crosswalk placement, painting and usage be done in a uniform way.

1. All crosswalks shall meet the latest Manual on Uniform Traffic Control Devices (MUTCD) standards. They shall be a minimum of six (6) feet wide and marked with white paint as shown on the attached sheet. Crosswalks shall be painted at least annually and shall be retroreflective for nighttime visibility. Crosswalks should be lighted for nighttime use.

2. All crosswalks shall meet the criteria put forth in the American's with Disabilities Act (ADA).

3. All crosswalks should extend from one safe landing zone to another. A safe landing zone is an area where a pedestrian is safe from vehicle conflict while waiting to cross or when finished crossing. Islands, walkways and sidewalks are typically considered safe landing zones, while road shoulders, driveways (under normal circumstances) and parking areas are not considered safe landing zones. Provisions should be made for winter maintenance of the landing zones, including but not limited to snow and ice removal.

4. Crosswalks shall, to the maximum extent practical, be perpendicular to the highway. No crosswalks shall be constructed more than 30 degrees from perpendicular.

5. Crosswalks shall be installed in areas where the speed limit is 35 mph or less.

6. Crosswalks shall be placed in areas where there is sufficient stopping sight distance for the posted speed limit as set forth in Table 1. Stopping sight distance for the purpose of evaluating a crosswalk shall be measured from a 3.5 foot driver eye height to a 3.5 foot pedestrian height.

Table 1 – Sight Distance

Posted Speed (MPH)	Sight Distance (Feet)
20	155
25	200
30	250
35	305

7. Crosswalks shall have the appropriate signage (W11-2 series from the Manual on Uniform Traffic Control Devices, see attached sheet). These signs shall be black symbol on yellow background or black symbol on fluorescent yellow-green background. Sign colors should not be mixed in any area.

8. Crosswalks should be located a minimum distance of 500 feet apart.

9. No parking shall be allowed within 20 feet of any unsignalized crosswalk and 30 feet at a signalized intersection. Signs should be installed indicating that no parking is allowed.

10. Crosswalks in school zones should have crossing guards for times when school is starting and ending. School crosswalks should be at roadway intersections. Mid-block crossing should only be used when a high concentration of students will be using them, as driver expectation is not to have to stop at a mid-block location.

11. If a municipality proposes a crosswalk on a roadway with more than 1 lane in any direction, they would need to submit a traffic engineering study indicating that the location of the crosswalk would be safe. Placement of such crosswalks shall require approval by the State Traffic Engineer or his/her designee.

12. Prior to installing crosswalks, on State roads or State aid roads towns shall enact traffic ordinances dealing with crosswalks. At a minimum, Items 1 through 11 should be included. Municipalities are entitled to place crosswalks if they are in accordance with these guidelines. If a municipality wants a crosswalk other than as defined in these guidelines, they would need to submit a traffic study indicating that the location of the crosswalk would be safe. Placement of crosswalks other than as specified shall require approval by the State Traffic Engineer or his/her designee.