VERMONT STATE DESIGN STANDARDS

Table of Contents

October 22, 1997 **Page**

List of Tables

1.0 Introduction

1.1 The Purpose of Design Standards *(Back to top of page)*

The following Vermont State Standards for Construction, Reconstruction, and (where specified) Rehabilitation of Roadways and Bridges have been designed with two purposes mind:

> To provide clear technical direction to the designers of transportation projects in Vermont.

> To achieve roadway and bridge designs which provide access, mobility and safety for users, and which are also sensitive to the social and environmental context of Vermont.

These Standards reflect changes to transportation policy on the state and national levels as initiated by the Federal government in the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) legislation, the goals of the 1995 Vermont State Long Range Transportation Plan (LRTP), modifications of the Project Development (Scoping) Process, and inter-agency planning agreements between the Vermont Agency of Transportation (VAOT), the Vermont Agency of Natural Resources (VANR), the Vermont Division for Historic Preservation (VTDHP), and others.

These Standards present the physical design parameters and guidelines of bridges and roadways in Vermont. In some cases they change and in other cases they augment the Standards previously used by the VAOT, and the American Association of State Highway and Transportation Officials (AASHTO). In the following chapters, design standards are organized by roadway functional classification. For each classification geometric values and "Special Design Guidelines" are presented for specific guidance for the design of roadways in sensitive situations.

The Standards have been designed to be flexible and to allow and encourage creative methods to minimize impacts on scenic, historic, archaeological, environmental and other important resources. This will give the VAOT greater ability to conform to State and Federal statutes, rules and regulations, to ensure that projects are designed to fit the Vermont context, to ensure that projects minimize environmental impacts, and to maximize the public benefit of transportation improvement investments. The inclusion of Rehabilitation Projects within these standards is intended to augment both "Preservation" and "3R" Standards which are a separate document. These standards apply in both philosophy and, where specified in detail to those standards.

These Vermont State Standards are based upon the assumption that contextual and situational issues for each project must be identified early in the design process, before geometric values are selected. These issues are then considered at each step throughout the design process. This process will allow for the successful integration of both "quantitative" parameters and "qualitative" issues.

All transportation projects in Vermont must be designed to minimize negative impacts on natural resources, historic, scenic or other community values, while also providing reasonable roadway widths, grades, sight distances, etc. At the same time, roadway improvements have the potential to positively contribute to the local, regional and state-wide economy of Vermont. By providing for the efficient movement of goods and services and by building facilities that provide access to and complement and enhance the State's historic and visual character, the State's economic interests are furthered. In order for this to be accomplished, the design of new transportation facilities in Vermont must balance multiple factors:

> The physical attributes of roadways which are important for user safety.

> The transportation planning policies guiding the region and community.

> The need for access to, and mobility along, a roadway.

> The presence of historic sites and districts.

> The presence of natural resources and environmental factors.

> The social context of the communities within which the facility exists.

> The economic development needs of the community, region, and state.

1.2 How the Standards Were Developed *(Back to top of page)*

The standards presented in this document represent the work of the Vermont Design Standards Committee, established in 1994 as a part of the Long Range Transportation Plan. The group met regularly for over 21 months between April 1994 and January 1996. The meetings were focused on completing recommendations for revised standards based upon input from engineering, planning, and resources perspectives. The Design Standards Committee was comprised of representatives including VAOT staff from the engineering and planning divisions and legal units, the Agency of Natural Resources, the Division of Historic Preservation, Regional Planning Commissions, the Vermont Council on the Arts, the Preservation Trust of Vermont and the Federal Highway Administration. Numerous private citizens, from lay person to professional, also served on the committee.

1.3 Roadway Classification System *(Back to top of page)*

Organization of the standards is based upon the State’s "Functional Classification of Roads and Highways" currently in use by the VAOT. The Classifications include:

> Freeways

    > Principal Arterials

    > Minor Arterials

    > Collectors

    > Local Roads

For each classification, the user is provided with a narrative of the overall description of the classification as well as a series of general objectives and design issues inherent with the need to integrate the roadway design with the Vermont context.

The overriding theme throughout the Standards is the allowance of considerable flexibility in the application of standards to specific projects. For example, Freeways, which are a special class of Arterials, have mobility as the primary functional purpose. As functional classification changes from Arterials, through Collectors, to Local Roads, the emphasis gradually shifts from a mobility orientation to one of land access, and provides for greater flexibility in design.

Proportion of Service

1.4 Project Planning Standards: Linkage to the Project Development Process *(Back to top of page)*

The VAOT is obligated to be responsive to the legal and jurisdictional issues that exist within many roadway and bridge design projects including historical, archaeological, and environmental resources. The Agency has also committed itself through the Transportation Planning Initiative and Long Range Transportation Plan to work closely with local communities and regional planning commissions to consider local and regional issues in the development of roadway and bridge projects. This commitment has developed a public expectation that VAOT projects will balance multiple issues and interests, and address problems and opportunities that may go beyond conventional roadway design and engineering.

The primary tool for achieving responsive roadway and bridge design for a specific project relies initially on a systematic assessment of the community, land use, visual, historical, natural resource and cultural characteristics of the road and its surrounding corridors. Commitments made in the Project Development process need to be carried through the design process. However, in that some VAOT projects do not formally go through Project Development, the Project Development Process or a similar process should be followed to guide decisions made by project designers to anticipate the broad set of considerations that may arise in all types of road and bridge projects, including 3R, Preservation and other project categories.

Being responsive to local issues and the situational context is the responsibility of every VAOT project designer/design team.

1.5 Transportation Design in the Vermont Context *(Back to top of page)*

It is essential that all transportation facilities be designed as part of the total environment. Whatever the type of transportation facility or project, sound planning, engineering, and environmental design principles should be applied. Roads and bridges should be designed to specifically fit into the situational context of the area within which each will be constructed, i.e., city, town, village, suburban and rural areas.

In Vermont, the public has indicated a strong desire for roadway projects to respond to the natural, scenic, and cultural landscape. To provide optimum consideration of these elements, the natural and human "built environment" features in the vicinity of a specific project should be inventoried and analyzed to guide the roadway design development process. The inventory should include: topographical and physical characteristics; natural resources; recreational uses; potential, existing and future residential uses; historical resources; visual and aesthetic resources; landmarks; and existing and potential land uses. The analysis should draw relevant conclusions as to the needs for specific resource protection measures as well as opportunities to integrate those features into the roadway or bridge project at the earliest possible point in the design process. These factors should then be integrated with the geometric standards. The presence of some of these features allow for possible reductions or modifications to the geometric standards through "Special Design Guidelines". Those guidelines are described in this section and Section 1.8. The final design should reflect consideration of all these factors to produce a safe and attractive transportation facility that is compatible with the environment and the character of the community.

All concerned disciplines should collaborate at every stage of the transportation project planning, design, and construction process to realize the maximum potential from the project. The exchange of information and expertise is critical throughout project development. This shall include the full range of highway components or features, such as the roadway (the travel surface itself), the roadside (remainder of the right-of-way, with any natural vegetation and/or plantings), ancillary structures (such as bridges, culverts, and retaining walls), and highway appurtenances (such as fences, signs, lights, and traffic barriers). Community acceptance of a transportation project is often strongly influenced by the visual elements of the project as seen both in views from the project (the road view as seen by users), and view of the project (the road view as seen by project neighbors). All of these components must be properly coordinated with the existing cultural, historical, ecological, physical, and aesthetic considerations.

The following is an outline of design context situations in general categories that describe a range of land use contexts within which roads exist. With each situation, general themes and goals are provided to give the designer an initial framework to address roadway or bridge design in community context. These goals should be confirmed in coordination with local officials and the public, as well as with State and Federal agencies. Many of these goals are specifically derived from Vermont legislation (ACT 200, ACT 250 decisions, etc.) and are an important translation from VAOT, VANR, DCA and other agencies' policies into specific actions.

1.5.1 Large Towns and Cities *(Back to top of page)*

Roadway design projects in Vermont's large towns and cities present complex situations where the needs of through-traffic as well as destination traffic converge. In existing downtowns, the balance between mobility and the economic and cultural issues of "city streets" will need to be addressed. Frequently, road corridors in towns and cities are congested with multiple users (cars, trucks, pedestrians, bikes, etc.). Major corridor projects will continue to be expected to integrate all those users. At the same time, town and city roads function as a complete network; frequently individual problem areas are linked to others nearby and/or more distant contributing conditions.

New and reconstructed roads need to be compatible with the adjacent land uses and reflect the urban characteristics of the location. Elements of roads that should be included in engineering decisions are: preservation or enhancement of on-street parking; new or redefined pedestrian walkways and crossings; pedestrian scale and roadway lighting; coordinated VAOT, public street and other signage; preservation and enhancement of street tree plantings; and landscaping of adjacent public spaces and facilities.

Additionally, roadway projects along existing corridors entering large towns and cities may feature existing strip-development. New projects should be responsive to avoid proliferation of strip-development patterns by integrating roadway design features and land use development regulations. Fringe areas of large towns and cities with strip-developments should incorporate design treatments to reduce curb-cuts, promote safe pedestrian and bicycle traffic and establish urban character with appropriate street trees, lighting, and signage.

Frequently there are conflicts between driver speed, pedestrian safety and economic viability along roadway corridors in Vermont's cities and large towns. Speed control (traffic calming) techniques should be employed to moderate roadway speed. This may be accomplished through the use of visual elements in the street design, by providing channelizing islands or roundabouts, through proper placement and design of pedestrian crossings and through alignment modifications. Both roadway and bridge designs should use visual elements that define urban area gateways where roadway character and land use character changes coincide.

1.5.2 Small Towns and Villages *(Back to top of page)*

Throughout the state, small towns and villages have historically been sited along road corridors. Many of these roads are the "Main Streets" and "Elm Streets" that are the principal public streets that share uses for both through-traffic and local traffic. The identity of individual small town and village centers is an especially important characteristic in Vermont. For aesthetic, as well as safety reasons, it is essential for drivers to reduce speed in small town and village centers. Appropriate design techniques should be used to reinforce this behavior. Pedestrian circulation and on-street parking should be maintained or enhanced. By creative variation of highway alignment and cross-section, driver behavior can be influenced, scenic and community values reinforced, and greater safety achieved.

Small towns and villages in Vermont are of historic significance, minimizing the impacts on the historic character is extremely important. Preservation of this character may include maintaining existing street trees and other landscape features, providing new street trees and landscaping and altering infrastructure including utilities, drainage, and overhead utility lines. Providing curbs should be employed where required to allow preservation of existing streetscape elements and narrower clear zones.

Establishing appropriate road sections should address the difference between the various types of streets commonly found in small towns and villages such as:

> Built-up "Main" streets with on-street parking, sidewalks and commercial blocks.

> Residential "Elm" streets with generous building setbacks, yards and continuous street trees.

> Intersections that include village public spaces with parks, churches, public buildings, etc.

Many of the design objectives of cities and large towns also apply to small towns and villages, but on a smaller scale. Those techniques may be employed in addition to those listed in this section.

1.5.3 Suburban Commercial/Residential Corridors *(Back to top of page)*

Between the 1950s and late 1980s, many Vermont communities experienced commercial growth and development along major road corridors. As that development increased, along with increased population growth and changing patterns of commercial markets in the State, traffic conditions have deteriorated. Frequent turning movements, the use of undefined turning lanes, and the extensive lengths and numbers of curb cuts all combine to create higher levels of congestion with higher accident rates.

Roadway projects along these commercial corridors should be combined with local and regional planning efforts and land use regulations to improve traffic safety and reduce congestion, while still providing access to adjacent properties and improvements to corridor aesthetics.

Design treatment to reduce curb-cuts, promote safe pedestrian and bicycle traffic, preserve or provide new street trees, lighting, and signage should be employed along suburban corridors. Speed control (traffic calming) techniques including: channelizing islands, roundabouts, defined pedestrian crossings, alignment modifications and streetscape designs should be used to moderate roadway speed. Roadways with higher functional classifications through suburban corridors should create or redefine pedestrian walks and crossings and include streetscape elements. These elements may include: pedestrian scale and roadway lighting, coordinated street and other signage, tree plantings and other landscape features. In addition, access from the roadway to major public spaces and facilities should be defined through the use of these elements.

1.5.4 Rural Corridors *(Back to top of page)*

The vast majority of Vermont roads lie within rural corridors. The most prominent rural settings are: agricultural valleys, wooded hillsides and river valleys, and mountainous areas. Each of these situations has implications for roadway design that should be linked to aesthetic, topographical and land use considerations.

Preserving rural quality should be closely integrated with roadway design techniques. The relative location of the road may either enhance or detract from the landscape. Also, the materials and construction techniques employed may have similar positive or negative results. Some of the techniques that may be used to maximize the "fit" between the road and rural landscapes are: alignments that complement the natural topography; avoid bisecting open fields, agricultural lands, critical natural habitats and wetlands by aligning the road to fringe areas; avoiding the placement of guardrail that blocks extensive views and vistas; use of landscape features to blend roadways and bridges into the natural setting; use of locally available materials (stone and plant materials) to blend colors and textures into the setting; and, methods to protect, create and enhance vegetative buffers along shore lines and adjacent to wetlands and important natural habitats. Alternative strategies for slope retention should be employed to minimize visual impacts of crushed stone slopes through the use of more natural appearing treatments. Grading easements or additional right-of-way should be used to allow blending of roadway side slopes with the adjacent landscape. Bridge designs should consider the effects of: intrusion into the State's waterways; visual and public access to waterways; and appropriate pedestrian and bicycle crossings.

1.6 General Use of the Standards *(Back to top of page)*

These Standards present geometric values for the design of roadways and bridges in Vermont. In addition to the flexibility within the geometric values presented throughout these Standards there is a recognition that each project will have its own set of opportunities and constraints. Many of these opportunities and constraints may be addressed within the geometric values built into these Standards. These Standards also include tools for use by the designer to prevent or mitigate impacts to the natural and built environment and to make the best of the opportunities, and to work within the constraints of the project.

These Standards represent a new philosophy that the designers must follow when selecting geometric values for the design of roadways. The designer needs to consider the selection of geometric values in two ways. First, the geometric values included in these Standards may be considered minimum values. Factors which may affect the selection of geometric values need to be considered. Such factors may include: accident histories, design traffic volumes, driver expectancy, percent of truck traffic, future use of the roadway and other corridor characteristics. If the analysis of these factors indicate that a higher geometric value is necessary to provide an acceptable level of safety then the designer should document the use of a higher value.

Second, some projects may require that further consideration be given to easing the geometric values given in these Standards in order to avoid or reduce impact to the natural and built environments. Should such situations become unavoidable then an exception to ease these Standards may be appropriate.

1.7 Use By Municipalities *(Back to top of page)*

The Vermont Design Standards are not intended to apply where communities are using their own funding to perform work on roads and bridges, unless a community chooses to use them as guidance. However, when Federal or State funds are being used, the standards generally apply. Specifically, the Vermont Design Standards apply to all direct or subcontracted transportation work performed in the State of Vermont using Federal funds, where the Vermont Agency of Transportation is responsible for assuring federal eligibility of fund expenditures. For transportation projects using Vermont state funds, where primary responsibility rests with the Agency of Transportation, the Vermont Design Standards apply. For projects within the jurisdiction of Act 140, the standards apply. For other programs using Vermont state funds distributed by formula or by grant, where primary responsibility rests with the municipalities, (eg. the bridge and culvert program and other similar annual grant programs), the municipalities should use the Vermont Design Standards as guidance, at their discretion.

1.8 Special Design Guidelines and Their Role in the Standards
(Back to top of page)

The Special Design Guidelines included with each Functional Classification, are presented to assist the designer in avoiding, minimizing, or mitigating negative impacts upon the environment and other sensitive resources as well as to enhance the design to fit the context of the project site. The Special Design Guidelines note the importance of the individual resources and suggest tools which may be used in the development of a design which recognizes the resource at the proper level of importance. Under various Functional Classification there are guidelines for:

> Historic/Archaeological Resources

> Natural Resources

> Recreational Resources

> Scenic Resources

> Village or City Entrance Considerations

> Economic Vitality Considerations

When such resources (as listed above) are present within a project site, and the use of the tools suggested do not provide an adequate protection of the resources, then the design may be eligible for reductions in geometric values as described in the individual roadway classifications. The decision to pursue reductions in the standards is subject to approval in accordance with the "VAOT Design Exception Policy".

1.9 Design Exceptions ***(Back to top of page)***

These Vermont State Standards reflect the need for transportation projects to provide safe and convenient travel for road users, and at the same time, to fit appropriately within the adjacent natural and built environments. In some instances, the geometric design flexibility provided in these Standards may not be sufficient to adequately protect important resources or values. In such cases, these Vermont State Standards will assist the designer in recognizing and documenting the need for an exception to the Standards, and in proposing mitigation to maintain an appropriate measure of safety. The actual process for obtaining approval for exceptions to the Standards is described in the Agency's "Guidelines for Preparation of Design Exceptions".

Back to Table of Contents

(Back to top of page)

(Back to Prject Development Home Page)

2.0 Freeways

2.1 Basic Geometric Standards

AASHTO design criteria, as presented in the 1990 "Policy on Geometric Design of Highways and Streets" will govern on this class of highways.

2.2 Special Design Guidelines ***(Back to top of page)***

These Special Design Guidelines are presented to assist the designer in avoiding, minimizing, or mitigating negative impacts upon the environment and other sensitive resources as well as to enhance the design to fit the context of the project site. These Special Design Guidelines note the importance of the individual resources and suggest tools which may be used in the development of a design which recognizes the resource at the proper level of importance. Under this Functional Classification there are guidelines for:

> Historic/Archaeological Resources

> Natural Resources

> Recreational Resources

> Scenic Resources

> Village or City Entrance Considerations

> Economic Vitality Considerations

When such resources are present within a project site and the use of the tools suggested do not provide an adequate protection of the resources then the design may be eligible for reductions in geometric values. The decision to pursue reductions in the standards is subject to approval in accordance with the "VAOT Design Exception Policy".

The primary strategy for Freeway projects should be to use alternative roadway alignments to avoid an impact to the resource. Reduction in the size/area of impact, and the utilization of creative design and engineering solutions should be pursued. In certain cases, special design features to enhance the design's integration into the environment are encouraged. These strategies are all described as "common tools" in the following subsection.

2.2.1 Common Tools for Freeways ***(Back to top of page)***

> Alignment modification including: adjustment of horizontal and vertical curves to avoid sensitive areas, to fit topographical features and to protect scenic and visual quality.

> Alterations to typical cross section including:

$ Sideslopes steeper than normal (in combination with additional guardrail)

$ Use of curb and closed drainage systems (elimination of roadside ditching)

$ Retaining walls

> Wetland and wetland buffer restoration/creation

> Wildlife habitat restoration/creation

> Water quality/stream bank, stream buffer, lake buffer creation, restoration, and enhancement

> On and Off - site mitigation

> View/scenic enhancement through vegetation management

> Selection of appropriate guard rail or other roadside barriers to allow visibility through to views or to blend-in with foreground views.

> Use of guardrail to allow preservation of significant features including native and planted vegetation

> Use of grade separation/bridging/elevated structures etc.

> Fencing or Landscaping for screening or earth berm buffers.

> Retrofitting of historical bridges for alternative uses off-the-freeway.

> Integration of historical features in interpretive facilities, rest areas, overlooks, etc.

> Light poles and fixtures should have down shielded luminaires, and be minimized in rural areas or otherwise appropriate for the setting.

> Rest area and truck weighing areas facility design may need special consideration.

> Architectural/Landscape design:

$ lighting

$ use of native materials

$ use of architectural and landscape design details

2.2.2 Historic/Archaeological Considerations *(Back to top of page)*

Freeway construction projects should be designed to avoid historic or archaeological resources wherever possible. This may be in the form of avoiding disturbance of specific sites and structures, historic districts, or areas where the presence of the road conflicts with a historic land use pattern. Where avoidance proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements.

2.2.3 Natural Resources *(Back to top of page)*

Freeway construction projects should be designed to avoid natural resources wherever possible. This may be in the form of avoiding disturbance of specific sites or areas where the presence of the road conflicts with important natural resources. Where avoidance proves unfeasible, every effort should be made to minimize impacts or pursue mitigation strategies and design enhancements to enable the maximum integration of the Freeway with the resource.

All Freeway projects must consider the presence of environmental resources in project planning, design and construction. The following resources are protected by State and Federal law:

> Wetlands

> Lakes and rivers and their shorelines

> Water supplies

> Groundwater protection areas

> Watershed protection areas

> Agricultural districts and farmland

> Floodplains/ways

> Critical wildlife habitat and natural areas

> Rare and endangered species

> Designated "Wild and Scenic Rivers"

> Local conservation districts or zones

> State and Federal forests and wildlife management areas

> Outstanding Resource Waters

2.2.4 Recreational Resources *(Back to top of page)*

Proposed Freeway construction projects should be designed to avoid public recreational facilities wherever possible. Where avoidance proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements to enable the maximum integration of the Freeway with the resource. Examples of Recreational Resources are:

> Federally owned, funded, or managed properties

> State owned, funded, or managed properties

> Locally owned parks and recreational areas

> Privately owned recreational facilities open to the public

> Trails and Greenways

2.2.5 Scenic Roads or Views Considerations *(Back to top of page)*

All Freeway projects should consider scenic and aesthetic issues for projects that possess scenic qualities. Assessment of scenic qualities should be completed in the Project Development Process. This includes, but is not limited to, "Designated Scenic Roads" or "Scenic Byways" as well as other roads with scenic attributes. Techniques for preservation of scenic resources should be employed for both scenic resources seen from the road, as well as views of the road from surrounding areas. The following techniques, in addition to the tools listed above, should be considered where scenic issues are identified in a Freeway project:

> Extension of sideslope grading to round-out cut and fill slopes

> Tree removal or trimming to preserve or enhance views. Selected use of guard rail to allow retention of significant tree groupings and to allow for mitigation and enhancement landscaping within the clear zone.

> Vegetation management in areas where preservation of existing trees serves to provide a visual buffer, frame views, or provide other visual context for the roadway.

> Scenic turnouts should be considered and provided, where demand is apparent.

> Sculpted ledge to afford natural-like clefts and appearance.

> Treatment of bridges, abutments, and retaining walls should de-emphasize structures where prominent long views and vistas are present.

> Consider appropriate sign size and placement to prevent blockage of views.

2.2.6 Village or City Entrance Considerations *(Back to top of page)*

Because Freeways in Vermont do not generally "enter" or pass directly through villages or cities in the usual sense, this issue arises primarily at interchanges where freeway ramps meet other roads in or leading to town centers and other developed areas. The following additional guidelines are appropriate at such locations:

> Consider extending access control on intersecting roads, allow for streetscape treatments and provisions for pedestrians.

> Consider landscaping to define access roads to main public streets and to define public spaces adjacent to Freeway corridors.

> Consider aesthetic treatment of bridges, abutments, retaining walls to emphasize gateways to community entrances and prominent features with "architectural" features and materials.

2.2.7 Economic Vitality Considerations *(Back to top of page)*

Creative design should integrate economic issues where the transportation of goods and services is of significant importance. On those routes within economically important corridors, the following additional guidelines may be appropriate:

> Use appropriate turning radii for large commercial vehicles

> Use appropriate ramp widths for large commercial vehicles

> Consider direct access from large commercial traffic generators to reduce burden on local road system

> Consider rest area facilities or breakdown facilities for trucks

> Consider park and ride facilities at interchanges

> Consider interchanges with other travel modes (air, rail, etc.)

Back to Table of Contents

(Back to top of page)

(Back to Project Development Home Page)

3.0 Principal Arterial Roads and Streets

3.1 Basic Geometric Standards *(Back to top of page)*

Design criteria for Principal Arterial Roads and Streets are summarized below. Other AASHTO design criteria, as presented in the 1990 "Policy on Geometric Design of Highways and Streets" are also applicable where they do not conflict with these standards.

3.2 Level of Service *(Back to top of page)*

Rural Principal Arterials will be designed for a level of service C or better.

Principal Arterials in urban or village areas will generally be designed for a level of service C or better. However, in heavily developed village or urban areas, a reduced level of service such as D or E may be appropriate as judged on a case by case basis. Reference is made in this regard to VAOT's July 25, 1996 Highway Design Level of Service Policy.

3.3 Design Speed *(Back to top of page)*

Rural Principal Arterials are normally designed for speeds of 35 to 55 mph depending on terrain, driver expectancy and other characteristics. When a design speed lower than 35 mph is required, refer to Chapters II, III and IV of the 1990 AASHTO Policy for Design Features.

Principal Arterials in urban or village areas are normally designed for speeds of 30 to 55 mph, and occasionally may be as low as 25 mph.

For rural, village, and urban Principal Arterials, the design speed will be equal to the anticipated posted speed.

Design speeds may be lower than legal speeds. Design speeds as much as 10 miles per hour lower than legal speeds may be used without the requirement of a formal design exception, provided appropriate warnings are posted.

3.4 Sight Distance

3.4.1 Stopping Sight Distance *(Back to top of page)*

Minimum stopping sight distances on rural and urban Principal Arterials will adhere to the values in Table 3.1.

Table 3.1

Minimum Stopping Sight Distance

For Principal Arterials (Wet Pavements)

Rehabilitation, Reconstruction or New Construction

Design Speed (mph)	Stopping Sight Distance (ft)	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
25	150	20	30
30	200	30	40
35	225-250	40-50	50
40	275-325	60-80	60-70
45	325-400	80-120	70-90
50	400-475	110-160	90-110
55	450-550	150-220	100-130

Note: Values at the high end of the range should be used for new construction projects on new location.

3.4.2 Corner Sight Distance *(Back to top of page)*

Corner sight distances for rural and urban principal arterials will meet the minimum requirements of Table 3.2.

Table 3.2

Minimum Corner Sight Distances[a] **For Principal Arterials**	
Design Speed on Main Road (mph)	Corner Sight Distance (ft)
25	275
30	330
35	385
40	440
45	495
50	550
55	605

(a) Corner sight distance is measured from a point on the intersecting road or driveway, at least 15 feet from the edge of traveled way on the main road.

3.5 Lane and Shoulder Widths for Urban and Village Principal Arterials *(Back to top of page)*

Due to the large variations in urban and village settings, no table of values has been given; however, the following guidelines will apply. On urban and village Principal Arterials, lane widths may vary from 10 to 12 feet, and there should be appropriate offsets to curb. The 10-foot widths are appropriate in highly restricted areas having little or no truck traffic. The 11-foot lanes are used extensively for urban and village Principal Arterial street designs. The 12-foot lane widths are generally used on all higher speed, free-flowing Principal Arterials. Under interrupted-flow conditions at low speeds (up to 45 mph), the narrower lane widths are normally adequate and have some advantages. Reduced lane widths allow greater numbers of lanes in restricted right-of-way and facilitate pedestrian crossings because of reduced distance. They are also more economical to construct. An 11-foot lane width is adequate for through lanes, continuous two-way left-turn lanes and a lane adjacent to a painted median. A 10-foot left-turn lane, or a combination lane used for parking, with traffic during peak hours, is also acceptable.

Lane and shoulder widths within Historic Districts should be compatible with the historic character of the District.

Shoulders are desirable on urban and village Principal Arterials, and should be provided where feasible for maneuvering room, space for immobilized vehicles, safety for the pedestrian in areas where sidewalks are not provided, safe accommodation of bicycles, speed-change lanes for vehicles turning into driveways, and storage space for plowed snow. Despite these advantages, the width of shoulders in urban and village areas may be restricted because of available right-of-way, adjacent development and other constraints.

Where shoulders are provided to accommodate disabled vehicles, they must be at least 6 feet wide. Parking lanes require approximately 7 feet of actual street space. The desirable minimum width is 8 feet; however, to provide better clearance and the potential to use the parking lane as a travel lane during peak periods a parking lane width of 10 to 12 feet is desirable.

As an absolute minimum, on limited access principal arterials, where bicycles and pedestrians are prohibited, a 2-foot offset to vertical curb should be provided, and a 1-foot offset to sloped curb. In all cases, drainage grates and drop inlets should be designed so that they do not project into a travel lane. Drainage grates should always be designed bicycle-safe.

3.6 Lane and Shoulder Widths on Rural Principal Arterials

(Back to top of page)

Lane and shoulder widths on rural Principal Arterials will adhere to values in Table 3.3. Note that shoulder widths in this table are considered necessary for adequate safety and service for this class of highway, and may exceed the minimum paved widths needed solely to provide bicycle safety. The required shoulder width beyond that needed to adequately accommodate bicycles as defined in Section 3.14 need not be paved.

Table 3.3

Minimum Width of Lanes and Shoulders

For Two Lane Rural Principal Arterials

Projected Design Traffic Volume	ADT 0-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Lane/Shoulder (ft)[a][b]		
35	11/5	11/6	11/8
40	11/6	11/6	11/8
45	11/6	11/6	11/8
50	11/6	11/8	12/8
55	12/6	12/8	12/8

(a) Width of lane may remain at 11 ft on reconstructed highways where alignment and safety records indicate a

satisfactory condition.

(b) Add 2 ft. to the shoulder width in guard rail areas on principal arterials where the DHV is over 400 vph.

3.7 Bridge Widths and Structural Capacities *(Back to top of page)*

The full width of approach roadways will (normally) be provided across all new bridges on rural Principal Arterials, and the same curb-to-curb width as the street across all new bridges on urban and village Principal Arterials. New bridges should be designed to HS-25 loading capacity.

Bridges to remain in place without treatment should have at least the width of the roadway approach travel way plus 2-foot clearance to face of rail on each side, and should be adequate for State legal loads without posted restrictions.

3.8 Vertical Clearance *(Back to top of page)*

New or reconstructed structures should provide at least 16 feet of vertical clearance over the entire roadway width, including shoulders. Existing structures that provide 14 feet of clearance may be retained. In urban areas, a minimum clearance of 14 feet may be provided if there is an alternate route for trucks that provides a 16-foot clearance. Structures should also provide an additional clearance of 3 inches for future resurfacing of the underpassing road.

Structures over railroads should provide a minimum vertical clearance of 23 feet over both rails, unless otherwise provided in a variance agreement entered into by the VAOT, the railroad and any affected municipality, and approved by the Transportation Board in accordance with 5 VSA, Section 3670. Where "double-stacks" are to be accommodated on the railroad, an absolute minimum vertical clearance of 20.75 feet will be required.

Bridges over rivers and other bodies of water will, where practicable, be designed to pass the 50-year frequency flood with a minimum clearance of 1' between the water surface elevation and the low chord of the bridge. In addition, overtopping of the road should not be permitted during the 50-year flood. Consideration shall also be given to the potential effects of the 100-year flood on upstream and downstream property, the environment, hazards to human life and floodplain management criteria.

3.9 Horizontal Clearance *(Back to top of page)*

A clear unobstructed roadside is highly desirable for motorist safety along rural principal arterials. Clear zone distances for new construction and reconstruction projects on rural principal arterials will normally be based on the values shown in Table 3.4.

Table 3.4

Minimum Clear Zone Distances (in feet from edge of traveled lane)

For Rural Principal Arterials

Design Speed (mph)	Design ADT (VPD)	Fill Slopes		Cut Slopes	
		1:4 or flatter	1:3	1:3	1:4 or flatter
45 or less	Under 750	7	*	7	7
	750-1500	12	*	10	10
	1500-6000	14	*	12	12
	Over 6000	16	*	14	14
50	Under 750	12	*	8	8
	750-1500	16	*	10	12
	1500-6000	20	*	12	14
	Over 6000	24	*	14	18
55	Under 750	14	*	8	10
	750-1500	20	*	10	14
	1500-6000	24	*	14	16
	Over 6000	26	*	16	20

* Since recovery is less likely on the unshielded, traversable 1:3 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of the slope. Determination of the width of the recovery area at the toe of the slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories.

Notes:

1. Selection of a clear zone may or may not provide adequate sight distance. In those cases where inadequate sight distance results, the designer

should specify the need for a sight easement, or otherwise adjust the design to provide needed sight lines.

2. In cut areas without guard rail, it is recommended that the clear zone extend to the back of ditch. This may be wider than the typical clear zone width for the project. The placement of poles or other non-crashworthy features in the ditch is not desirable, as errant vehicles are likely to travel to the bottom of the ditch.

3. The designer may choose to increase the clear zone width on the outside of horizontal curves where accident histories indicate a need, or where specific site investigation shows a definitive accident potential. This may be cost effective where increased banking or other accident countermeasures are not feasible.

Despite the recommendations of Table 3.4, clear zones as narrow as 10 feet may be used on rural principal arterials, without design exception, where necessary to avoid or minimize disturbance of significant historic, archaeological, scenic, natural or other resources.

On uncurbed urban and village principal arterials, clear zones will be the same as for rural areas.

On curbed principal arterial urban and village streets, a 1.5 foot horizontal offset to obstructions from face of curb should be provided. This dimension should be increased to 3 feet near turning radii at intersections with side roads and driveways.

3.10 Alignment *(Back to top of page)*

Horizontal curvature will normally be designed in accordance with recommended AASHTO values for the design speed. However, curves up to 10 mph below the stated design speed may be used, without design exception, where necessary to avoid and/or minimize disturbance of historic, archaeological, scenic, natural or other resources. In addition, horizontal curves within 750 feet of a stop sign may be designed up to 15 mph below the stated design speed without design exception. When curvature sharper than the AASHTO recommended values is used, a post-construction test of those curves will be conducted, and advisory speeds will be posted where appropriate.

3.11 Grades *(Back to top of page)*

Maximum grades on rural and urban Principal Arterials will adhere to the values shown in Tables 3.5 and 3.6. In curbed areas of village and urban streets and on all bridges, grades less than 1 percent should be avoided where possible to promote efficient runoff of storm water.

Table 3.5

Maximum Grades for Rural Principal Arterials

Type of Terrain	Design Speed (mph)		
	35	40-45	50-55
	Maximum Grade (percent)		
Level	6	5	4
Rolling	7	6	5
Mountainous	8	8	7

Table 3.6

Maximum Grades for Urban and Village

Principal Arterials				
Type of Terrain	Design Speed (mph)			
	25	30-35	40-45	50-55
	Maximum Grade (percent)			
Level	9	8	7	6
Rolling	10	9	8	7
Mountainous	12	11	10	9

3.12 Cross-slope *(Back to top of page)*

Two-lane pavements are normally designed with a centerline crown and a parabolic surface with an average cross slope of 2 percent. When drainage is carried across adjacent lanes, the cross slope may be increased from one lane to another. Refer to the VAOT design manual for cross-slope design in various situations.

3.13 Superelevation *(Back to top of page)*

When the use of curves is required on a rural Principal Arterial alignment, a superelevation rate compatible with the design speed must be used. Superelevation of curves on rural Principal Arterials should not exceed 8 percent. Where a side road intersects on the outside of a main road curve, superelevation of the main road curve should be limited to 6 percent or less to prevent operational difficulties for vehicles entering the main road under snowy or icy conditions.

Superelevation is generally not used on low-speed (45 mph or less) curbed urban and village streets. This is to avoid problems with such items as drainage, ice formation, driveways, pedestrian crossings and developed property (Refer to the 1990 AASHTO Policy, Chapter III, for a detailed discussion of design for low-speed urban streets).

3.14 Bicycle and Pedestrian Considerations *(Back to top of page)*

Bicycle and pedestrian traffic may be expected along the sides of most Principal Arterial roads and streets, except those which are designed and posted as limited access facilities. Where bicycles and pedestrians are allowed by law, the roadway should be designed and constructed under the assumption that it will be used by bicyclists and pedestrians. Bicycles require a paved surface; pedestrians, however, may often be adequately accommodated on unpaved roadway shoulders.

In recent decades, highways were not always designed with bicycle and pedestrian travel in mind. There are many ways in which roadway corridors should be improved to more safely accommodate bicycle and pedestrian traffic. Bicycle accommodation within the highway corridor may take four forms: (1) shared use of the highway by bicycles and motor vehicles, (2) designated bicycle route, (3) designated bicycle lane, or (4) a separated bicycle path. Many of the tools listed in section 3.15.1 provide roadways which are safer for bicyclists and pedestrians.

3.14.1 Shared Use of the Highway by Bicycles *(Back to top of page)*

Adequate accommodation of bicycles in rural areas is usually provided by paved shoulders designed to the widths shown in Section 3.6. However, where shoulder width is less than those values, where shoulder paving must be minimized, and in urban or village areas, Tables 3.7, 3.8, and 3.9 provide additional guidance in the selection of appropriate widths of paved areas to safely accommodate bicycles and motor vehicles on the same facility. Note that additional width may be desirable in very high traffic areas or where sight distance is restricted.

Table 3.7

Minimum Width of <u>Paved Shoulder</u> Area to Accommodate Shared Use of <u>Rural Principal Arterial</u> Roadways by Bicycles			
Projected Design Traffic Volume	ADT 0-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Paved Shoulder (ft)[a]		
35	2	2	3
40	2	3	3
45	3	3	3
50	4	4	4
55	5	5	5

(a) Add 1 foot on bridges or where %trucks>10%.

Table 3.8

Minimum Width of <u>Paved Shoulder</u> Area to Accommodate Shared Use of <u>Urban or Village Principal</u> Arterial Streets With Curbing by Bicycles

Projected Design Traffic Volume	ADT 0-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Paved Shoulder (ft)[a][b][c]		
25	2	2	3
30	2	3	4
35	3	3	4
40	3	4	4
45	4	4	4
50	5	5	5
55	6	6	6

(a) Width may be reduced by 1 foot in uncurbed areas.

(b) These recommendations are for areas where there is no adjacent on-street parking. Where parking exists, special consideration must be given to achieve safe accommodation for bicyclists.

(c) For cases where shoulder width adjacent to a curb is less than 5 feet, recessed drainage inlets or curb inlets should be used.

In lieu of a paved shoulder, it is permissible to use a shared-use curb lane of at least the width shown in Table 3.9. When a shared-use lane is employed, a white edge line should be placed within 1 foot of the face of curb to discourage parking. For all shared-use curb lanes, recessed drainage inlets or curb inlets should be used.

Table 3.9

Minimum Width of a Shared Use Curb Lane to Accommodate Shared Use of Urban or Village Principal Arterial Streets by Bicycles

Projected Design Traffic Volume	ADT 0-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Lane (ft)		
25-30	12	13	13
35	13	13	13
40	13	14	14
45	14	14	14
50	15	15	15
55	NR	NR	NR

NR = Not Recommended

3.14.2 Bicycles on Bridges *(Back to top of page)*

Wherever bicycles are to be accommodated on newly constructed bridges, shoulders with a minimum dimension as shown in Tables 3.7, 3.8 and 3.9 in this subsection should be provided between the parapet, rail or barrier and the edge of the nearest travel lane.

3.14.3 Designated Bicycle Routes and Lanes *(Back to top of page)*

Designated bicycle routes or lanes may be appropriate along some principal arterial highways. Because designated routes and lanes will attract bicyclists encompassing a wide range of abilities, special care must be taken to ensure adequate width. Principal concerns for designated bicycle routes and lanes are rider safety and comfort. Because of these concerns, some high speed and/or high volume arterial routes may not be appropriate for designated routes and lanes. In such cases, alternate routes or separate paths for bicycles may be desirable.

3.14.4 Pedestrian Facilities *(Back to top of page)*

Adequate accommodation of pedestrians must be designed for all roadway projects. Depending on the locality and expected frequency of pedestrians, adequate accommodation may range from a graded space alongside a rural road to a sidewalk in a village or city. Projects in urban or village areas shall include consideration of sidewalks and crossing locations. In addition, at the request of a municipality, sidewalks should be considered in other areas of expected pedestrian use such as near schools and recreation areas.

Where pedestrians are accommodated on sidewalks, the design must observe, to the extent possible, current Americans with Disabilities Act Accessibility Guidelines (ADAAG). These guidelines establish acceptable grades, cross-slopes, widths, ramps, surface textures and other facets of pedestrian facility design.

Pedestrian accommodation on combined bicycle/pedestrian paths must also respect the ADAAG to the extent feasible.

Pedestrian accommodation along the shoulders of roadways do not need to comply with ADAAG. However, to the extent that those guidelines can reasonably be achieved, the designer is urged to do so.

3.15 Special Design Guidelines *(Back to top of page)*

These Special Design Guidelines are presented to assist the designer in avoiding, minimizing, or mitigating negative impacts upon the environment and other sensitive resources as well as to enhance the design to fit the context of the project site. These Special Design Guidelines note the importance of the individual resources and suggest tools which may be used in the development of a design which recognizes the resource at the proper level of importance. Under this Functional Classification there are guidelines for:

> Historic/Archaeological Resources

> Natural Resources

> Recreational Resources

> Scenic Resources

> Village or City Entrance Considerations

> Economic Vitality Considerations

When such resources are present within a project site and the use of the tools suggested do not provide an adequate protection of the resources then the design may be eligible for reductions in geometric values. The decision to pursue reductions in the standards is subject to approval in accordance with the "VAOT Design Exception Policy".

The primary strategy for Principal Arterial projects on new alignment should be to use alternative roadway alignments to avoid the impact on the resource. When the project must remain on existing alignment such as a major roadway reconstruction, "Preservation" or "3R" project, bridge repair or replacement, design solutions should be pursued that minimize the extent of the impact. Major tools to be used to avoid sensitive resources include: slope adjustments, clear zone reduction with installation of guard rail and other means which do not reduce the integrity and safety of the design. Reduction in the size/area of impact, and the utilization of creative design and engineering solutions should be pursued. These strategies are described as "common tools" in the following subsection.

3.15.1 Common Tools *(Back to top of page)*

> Alignment modification including: adjustment of horizontal and vertical curves to avoid sensitive areas, to fit topographical features and to protect scenic and visual quality.

> Reduction of Posted Speed.

> Reduction/minimization of lane and shoulder widths

> Reduction/minimization of clear zones

> Reduction of horizontal curves with advisory speed postings.

> Alterations to typical cross section including:

$ Sideslopes steeper than normal (in combination with additional guardrail)

$ Use of curb and closed drainage systems, elimination of roadside ditching

$ Retaining walls

> Wetland and wetland buffer restoration/creation

> Wildlife habitat restoration/creation

> Water quality/stream bank, stream buffer, lake buffer creation, restoration, and enhancement

> On and Off - site mitigation

> View/scenic enhancement through vegetation management and grading of sideslopes

> Selection of appropriate guard rail or other roadside barriers to accomplish visibility through to views or to blend in with foreground views.

> Use of guard rail to allow steeper than 1:4 graded slopes, retaining walls or cribbing

> Use of guard rail to allow preservation of significant features including native and planted vegetation

> Use of grade separation/bridging/elevated structures etc.

> Separation of vehicular/pedestrian facilities.

> Fencing or landscaping for screening or earth berm buffers.

> Retrofitting of historical bridges for alternative uses off-site.

> Integration of historical features in interpretive facilities, overlooks, etc.

> Light poles and fixtures with down shielded luminaires.

> Architectural/Landscape design:

$ street trees

$ use of native materials

$ use of architectural design details

$ pedestrian facilities

$ signage

$ historical design elements

3.15.2 Historic/Archaeological Considerations *(Back to top of page)*

Principal Arterial projects should be designed to avoid historic or archaeological resources wherever possible. This may be in the form of avoiding disturbance of specific sites and structures as well as historic districts or areas where the presence of the road is disturbing to the historic land use and development pattern. Many Principal Arterial roads pass directly through city, town, and village centers and designers must work within these constraints while fitting roadways close to community historic landmarks.

Where Principal Arterials pass through historic town centers an appropriate balance must be struck between the mobility of through traffic and the historic and community values. Since a roadway's design characteristics are a function of the design and posted speeds, consideration should be given to reducing these speed variables. An appropriate response would be to work with local officials in reviewing the tradeoffs between impacts to historic areas and the posted speed.

Providing curbs along Principal Arterials in historic centers will allow improved pedestrian safety as well as a reduction in clear zone requirements to allow preservation and enhancement of historic elements. Where avoidance of historic and community landmarks proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements to enable the maximum integration of the Principal Arterial with the historic area. The following additional design techniques address the potential tools available to designers for Principal Arterials:

> When existing historic bridges are of acceptable structural capacity and meet minimum dimensional criteria, the retrofitting of historical bridges should be considered. Where bridges do not meet these requirements, consideration should be given to use as a single lane of the Principal Arterial accompanied by a new bridge serving opposing traffic.

> When existing historic bridges are structurally deficient, and replacement the only solution, new bridge and approach designs should consider aesthetic treatments consistent with the historical context.

> The inclusion of historic design features which will enhance integration of the design into the historical setting.

3.15.3 Natural Resources *(Back to top of page)*

Principal Arterial construction projects should be designed to avoid natural resources wherever possible. This may be in the form of avoiding the disturbance of specific sites or areas where the presence of the road conflicts with important natural resources. Where avoidance proves unfeasible, every effort should be made to minimize impacts or pursue mitigation strategies and design enhancements to enable the maximum integration of the Principal Arterial with the natural landscape.

All Principal Arterial projects should consider the presence of environmental resources in project planning, design and construction. The following resources are protected by State and Federal law:

> Wetlands, lakes, rivers, streams and their shorelines

> Water supplies

> Groundwater protection areas

> Watershed protection areas

> Agricultural districts and farmland

> Floodplains/ways

> Critical wildlife habitat and natural areas

> Rare and endangered species

> Designated "Wild and Scenic Rivers"

> Local Conservation districts or zones

> State and Federal forests and wildlife management areas

> Outstanding Resource Waters

3.15.4 Recreational Resources *(Back to top of page)*

Principal Arterial projects should be designed to avoid public recreational facilities wherever possible. Where avoidance proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements to enable the maximum integration of the Principal Arterials with the landscape. Examples of Recreational Resources are:

> Federally owned, funded, or managed property

> State owned, funded or managed property

> Locally owned parks and recreational areas

> Privately owned recreational facilities open to the public

> Trails and Greenways

3.15.5 Scenic Roads or Views Considerations *(Back to top of page)*

All Principal Arterial projects should consider scenic and aesthetic issues for projects that possess scenic qualities. Assessment of scenic qualities should be completed in the Project Development Process. This includes, but is not limited to "Designated Scenic Roads" or "Scenic Byways" as well as other roads with scenic attributes. Techniques for preservation of scenic resources should be employed for scenic resources seen from the road, as well as views of the road from surrounding areas. The following techniques should be considered where scenic issues in a Principal Arterial project are identified:

> Extension of sideslope grading to round-out cut and fill slopes

> > Tree removal or trimming to preserve or enhance views. Selected use of guard rail to allow retention of significant tree groupings and to allow for mitigation and enhancement landscaping within the clear zone.

> > Vegetation management in areas where preservation of existing trees serves to provide a visual buffer, frame views, or provide other visual context for the roadway.

> Scenic turnouts should be considered and provided, where demand is apparent.

> Sculpted ledge to afford natural-like clefts and appearance.

> Treatment of bridges, abutments, retaining walls should de-emphasize structures where prominent long views and vistas are present.

> Consider appropriate sign size and placement to prevent blocking of views and to minimize clutter.

3.15.6 Village or City Entrance Considerations *(Back to top of page)*

Many of the Principal Arterials in Vermont enter and pass directly through towns, villages or cities. These Standards are specifically designed to allow greater flexibility and reduce the conflict with the small scale of many of the affected communities along Principal Arterials. The following additional guidelines may be appropriate at such locations:

> Strategies for speed management of through vehicles entering towns, villages and cities should be employed through roadway design, signage and other corridor treatments.

> Use landscaping and other streetscape elements to facilitate the definition of intersections with other local and lower classification roads and to define public spaces adjacent to Principal Arterial corridors. Enhancing the corridor landscape in town and city centers will assist in achieving balance between the presence of the road and preserving the town character.

> Roadway lighting of an appropriate design: luminaire scale should be reduced to urban-pedestrian scale.

> Aesthetic treatment of bridges, abutments, and retaining walls to emphasize community gateways, achieved through prominent "architectural" features and native materials.

3.15.7 Economic Vitality Considerations *(Back to top of page)*

Creative design should integrate economic issues where transportation needs of people, goods and services are significant, and where design of the roadway may affect the vitality of a downtown, commercial or industrial area. In these cases, the following additional guidelines may be appropriate:

> Use appropriate turning radii for large commercial vehicles at appropriate intersections.

> Use lane widths wider than recommended minimums when necessary to accommodate commercial vehicles or anticipated increased traffic volumes.

> Consider truck routes to avoid impacts on downtowns, neighborhoods, and historic districts.

> Retain existing parking, including angle parking, and/or provide additional parking in commercial areas.

> Consider landscaping, lighting, and aesthetic treatments that complement and enhance the commercial identity of a downtown, historic district, shopping district, or recreational area.

> Use appropriate designs for pedestrian and bicycle needs to enhance the vitality of village and urban areas.

> Consider the needs of public transit and intermodal connections, such as bus stops, transfer locations, and park-and-ride lots.

(Back to Table of Contents)

(Back to top of page)

(Back to Project Development Home Page)

4.0 Minor Arterial Roads and Streets

4.1 Basic Geometric Standards *(Back to top of page)*

Design criteria for Minor Arterial roads and streets are summarized below. Other AASHTO design criteria, as presented in the 1990 "Policy on Geometric Design of Highways and Streets" are also applicable where they do not conflict with these standards.

4.2 Level of Service *(Back to top of page)*

Rural Minor Arterials will be designed for a level of service C or better.

Minor Arterials in urban or village areas will generally be designed for a level of service C or better. However, in heavily developed urban areas, reduced level of service criteria such as D or E may be appropriate as judged on a case by case basis. Reference is made in this regard to the VAOT July 25, 1996 Highway Design Level of Service Policy.

4.3 Design Speed *(Back to top of page)*

Rural Minor Arterials are normally designed for speeds of 35 to 55 mph depending on terrain, driver expectancy and other characteristics. When a design speed lower than 35 mph is required, refer to Chapters II, III and IV of the 1990 AASHTO Policy for design features.

Minor Arterials in urban or village areas are normally designed for speeds of 30 to 55 mph, and occasionally may be as low as 25 mph.

For rural, village and urban Minor Arterials, the design speed will normally be equal to the anticipated posted speed. However, lower design and posted speeds may be considered in certain circumstances, such as:

> To avoid and/or minimize impacts to historical, architectural, scenic, natural or other resources.

> To avoid excessive costs of construction.

> To better comply with a town or regional plan.

Design speeds may be lower than legal speeds. Design speeds as much as 10 miles per hour lower than legal speeds may be used without the requirement of a formal design exception, provided appropriate warnings are posted.

4.4 Sight Distance *(Back to top of page)*

4.4.1 Stopping Sight Distance *(Back to top of page)*

Minimum stopping sight distances on rural and urban Minor Arterials will adhere to the values in Table 4.1.

Table 4.1

Minimum Stopping Sight Distance *(Back to top of page)*

For Minor Arterials (Wet Pavements)

Rehabilitation, Reconstruction or New Construction

Design Speed (mph)	Stopping Sight Distance (ft)	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
25	150	20	30
30	200	30	40
35	225-250	40-50	50
40	275-325	60-80	60-70
45	325-400	80-120	70-90
50	400-475	110-160	90-110
55	450-550	150-220	100-130

Note: Values at the high end of the range should be used for new construction projects on new location.

4.4.2 Corner Sight Distance *(Back to top of page)*

Corner sight distances for rural and urban minor arterials will meet the minimum requirements of Table 4.2.

Table 4.2 Minimum Corner Sight Distances[a] For Minor Arterials	
Design Speed on Main Road (mph)	Corner Sight Distance (ft)
25	275
30	330
35	385
40	440
45	495
50	550
55	605

(a) Corner sight distance is measured from a point on the intersecting road or driveway, at least 15 feet from the edge of traveled way on the main road.

4.5 Lane and Shoulder Widths for Urban And Village Minor Arterials

(Back to top of page)

Due to the large variations in urban and village settings, no table of values has been given, however, the following guidelines will apply. On urban and village Minor Arterials, lane widths may vary from 10 to 12 feet, and there should be appropriate offsets to curb. The 10-foot widths are appropriate in highly restricted areas having little or no truck traffic. The 11-foot lanes are used extensively for urban and village Minor Arterial street designs. The 12-foot lane widths are generally used on all higher speed, free-flowing principal Minor Arterials. Under interrupted-flow conditions at low speeds up to 45 mph, the narrower lane widths are normally adequate and have some advantages. Reduced lane widths allow a greater number of lanes in restricted right-of-way areas and facilitate pedestrian crossings because of reduced distance. They are also more economical to construct. An 11-foot lane width is adequate for through lanes, continuous two-way left-turn lanes and a lane adjacent to a painted median. A 10-foot left-turn lane, or a combination lane used for parking, with traffic during peak hours, is also acceptable.

Lane and shoulder widths within historic districts should be compatible with the historic character of the district.

Shoulders are desirable on urban and village Minor Arterials, and should be provided where feasible to facilitate maneuvering, space for immobilized vehicles, safety for the pedestrian in areas where sidewalks are not provided, safe accommodation of bicycles, speed-change lanes for vehicles turning into driveways, and storage space for plowed snow. Despite these advantages, the width of shoulders in urban and village areas may be restricted because of available right-of-way, adjacent development and other constraints.

Where shoulders are provided to accommodate disabled vehicles, they must be at least 6 feet wide. Parking lanes require approximately 7 feet of actual street space. The desirable minimum width is 8 feet, however, to provide better clearance and the potential to use the parking lane as a travel lane during peak periods a parking lane width of 10 to 12 feet is desirable.

As an absolute minimum, where no bicycles are to be accommodated, a 2-foot offset to vertical curb should be provided, and a 1-foot offset to sloped curb. In all cases, drainage grates and drop inlets should be designed so that they do not project into a travel lane. Drainage grates should always be bicycle-safe in design.

4.6 Lane and Shoulder Widths on Rural Minor Arterials
(Back to top of page)

Lane and shoulder widths on rural Minor Arterials will adhere to values in Table 4.3. Note that the shoulder widths in this table are considered necessary for adequate safety and service for this class of highway, and may exceed the minimum paved widths needed solely to provide bicycle safety. The required shoulder width beyond that needed to adequately accommodate bicycles as defined in Section 4.14 need not be paved.

Table 4.3

Minimum Width of Lanes and Shoulders for Two Lane Rural Minor Arterials

Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Lane/Shoulder (ft)			
35	11/3	11/3	11/4	11/5
40	11/4	11/4	11/4	11/5
45	11/4	11/4	11/4	11/5
50	11/4	11/4	11/4	11/5
55	11/4	11/4	11/5	12/5[(a)]

(a) Width of lane may remain at 11 ft on reconstructed highways where alignment and safety records are satisfactory.

Lane and shoulder widths within historic districts should be compatible with the historic character of the district.

4.7 Bridge Widths and Structural Capacities ***(Back to top of page)***

State policy favors the rehabilitation of existing bridges. In choosing between the rehabilitation of an existing bridge and the construction of a new bridge, whether on the existing location or on a new location, the agency shall weigh the following factors:

1. the functional classification of the highway;

2. the load capacity and geometric constraints of the bridge and the availability of alternative routes;

3. the comparative long-term costs, risks, and benefits of rehabilitation and new construction;

4. the requirements of state standards for geometric design;

5. disruption to homes and businesses;

6. environmental impacts;

7. the potential effects of the local and state economies;

8. cost-effectiveness;

9. mobility, including bicycles and pedestrians;

10. safety, as determined by factors such as accident history for motorists, pedestrians, and bicyclists;

11. local or regional plans as interpreted by the adopting entity, and state agency plans;

12. the impact on the historic, scenic, and aesthetic values of the municipality, as interpreted by the municipality, in which the highway is located; and

13. if it is a forest highway under federal jurisdiction.

State policy for the reconstruction of bridges on Minor Arterials favors preservation within existing footprints, in order to ensure compatibility with the Vermont setting and to reduce costs and environmental impacts. Where reconstruction within the existing footprint is not feasible, the full width of approach roadways as shown in Table 4.3 should be provided across all new bridges on rural Minor Arterials, and the same curb-to-curb width as the street across all new and replacement bridges on urban and village Minor Arterials. New bridges should be designed to HS-25 loading capacity.

With regard to a bridge located on a municipal highway, a municipality may request the agency to adhere to one or more of the following guidelines:

1. where feasible, the rehabilitated or replacement bridge shall occupy the same curb-to-curb width or alignment, or both, as the existing bridge or the existing approaches to the existing bridge, or both;

2. unless otherwise required by law, a bridge that does not already carry a sidewalk may be rehabilitated without adding a sidewalk and a replacement bridge may be built without a sidewalk or with a sidewalk on only one side; or

3. in rehabilitating a historically significant bridge, the design of the rehabilitated bridge must retain the bridge’s historic character, to the extent feasible.

Historic bridges in urban, village, or rural historic districts or those in scenic corridors should be considered for design exceptions so that they may remain in place on minor arterials and be considered for future rehabilitation rather than replacement.

4.8 Vertical Clearance *(Back to top of page)*

New or reconstructed structures should provide at least 14 feet of vertical clearance over the entire roadway width, including shoulders plus and additional clearance of 3 inches for future resurfacing of the under passing road.

Structures over railroads should provide a minimum vertical clearance of 23 feet over both rails, unless otherwise provided in a variance agreement entered into by the VAOT, the railroad and any affected municipality, and approved by the Transportation Board in accordance with 5 VSA, Section 3670. Where "double-stacks" are to be accommodated on the railroad, an absolute minimum vertical clearance of 20.75 feet will be required.

Bridges over rivers and other bodies of water will, where practicable, be designed to pass the 50-year frequency flood with a minimum clearance of 1 foot between the water surface elevation and the low chord of the bridge. In addition, overtopping of the road should not be permitted during the 50-year flood. Consideration shall also be given to the potential effects of the 100-year flood on upstream and downstream property, the environment, hazards to human life and floodplain management criteria.

4.9 Horizontal Clearance *(Back to top of page)*

A clear unobstructed roadside is highly desirable for motorist safety along rural minor arterials. Clear zone distances for new construction and reconstruction projects on rural minor arterials will normally be based on the values shown in Table 4.4.

Table 4.4

Minimum Clear Zone Distances (in feet from edge of traveled lane)

For Rural Minor Arterials

Design Speed (mph)	Design ADT (VPD)	Fill Slopes		Cut Slopes	
		1:4 or flatter	1:3	1:3	1:4 or flatter
45 or less	Under 750	7	*	7	7
	750-1500	12	*	10	10
	1500-6000	14	*	12	12
	Over 6000	16	*	14	14
50	Under 750	12	*	8	8
	750-1500	16	*	10	12
	1500-6000	20	*	12	14
	Over 6000	24	*	14	18
55	Under 750	14	*	8	10
	750-1500	20	*	10	14
	1500-6000	24	*	14	16
	Over 6000	26	*	16	20

* Since recovery is less likely on the unshielded, traversable 1:3 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of the slope. Determination of the width of the recovery area at the toe of the slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories.

Notes:

1. Selection of a clear zone may or may not provide adequate sight distance. In those cases where inadequate sight distance results, the designer should specify the need for a sight easement, or otherwise adjust the design to provide needed sight lines.

2. In cut areas without guard rail, it is recommended that the clear zone extend to the back of ditch. This may be wider than the typical clear zone width for the project. The placement of poles or other non-crashworthy features in the ditch is not desirable, as errant vehicles are likely to travel to the bottom of the ditch.

3. The designer may choose to increase the clear zone width on the outside of horizontal curves where accident histories indicate a need, or where specific site investigation shows a definitive accident potential. This may be cost effective where increased banking or other accident countermeasures are not feasible.

Despite the recommendations of Table 4.4, clear zones as narrow as 10 feet may be used on rural minor arterials, without design exception, where necessary to avoid or minimize disturbance of significant historic, archaeological, scenic, natural or other resources. In addition, on low speed (45 mph or less) rural minor arterials, clear zones may be limited to 10 feet, irrespective of the recommendations of Table 4.4.

On uncurbed urban and village minor arterials, clear zones will be the same as for rural areas.

On curbed minor arterial urban and village streets, a 1.5 foot horizontal offset to obstructions from face of curb should be provided. This dimension should be increased to 3 feet near turning radii at intersections with side roads and driveways.

4.10 Alignment *(Back to top of page)*

Horizontal curvature will normally be designed in accordance with recommended AASHTO values for the design speed. However, curves up to 10 mph below the stated design speed may be used, without design exception, where necessary to avoid and/or minimize disturbance of historic, archaeological, scenic, natural or other resources. In addition, horizontal curves within 750 feet of a stop sign may be designed up to 15 mph below the stated design speed without design exception. When curvature sharper than the AASHTO recommended values is used, a post-construction test of those curves will be conducted, and advisory speeds will be posted where appropriate.

4.11 Grades *(Back to top of page)*

Maximum grades on rural and urban Minor Arterials will adhere to the values shown in Tables 4.5 and 4.6. In curbed areas of village and urban streets and on all bridges, grades less than 1 percent should be avoided where possible to promote efficient runoff of storm water.

Table 4.5

Maximum Grades for Rural Minor Arterials

Type of Terrain	Design Speed (mph)		
	35	40-45	50-55
	Maximum Grade (percent)		

Level	6	5	4
Rolling	7	6	5
Mountainous	9	8	7

Table 4.6

Maximum Grades for Urban and Village Minor Arterials

Type of Terrain	Design Speed (mph)			
	25	30-35	40-45	50-55
	Maximum Grade (percent)			
Level	9	8	7	6
Rolling	10	9	8	7
Mountainous	12	11	10	9

4.12 Cross-slope *(Back to top of page)*

Two-lane pavements are normally designed with a centerline crown and a parabolic surface with an average cross slope of 2 percent. When drainage is carried across adjacent lanes, the cross slope may be increased from one lane to another. Refer to the VAOT design manual for cross-slope design in various situations.

4.13 Superelevation *(Back to top of page)*

When the use of curves is required on a rural Minor Arterial alignment, a superelevation rate compatible with the design speed must be used. Superelevation of curves on rural Minor Arterials should not exceed 8 percent. Where a side road intersects on the outside of a main road curve, superelevation of the main road curve should be limited to 6 percent or less to prevent operational difficulties for vehicles entering the main road under snowy or icy conditions.

Superelevation is generally not used on low-speed (45 mph or less) curbed urban and village streets. This is to avoid problems with such items as drainage, ice formation, driveways, pedestrian crossings and developed property. Refer to the 1990 AASHTO Policy, Chapter III, for a detailed discussion of design for low-speed urban streets.

4.14 Bicycle and Pedestrian Considerations *(Back to top of page)*

Bicycles and pedestrian traffic may be expected along the sides of most Minor Arterial roads and streets, except those which are designed and posted as limited access facilities. Where bicycles and pedestrians are allowed by law, the roadway should be designed and constructed under the assumption that it will be used by bicyclists and pedestrians. Bicycles require a paved surface; pedestrians, however, may often be adequately accommodated on unpaved roadway shoulders.

In recent decades, highways were not always designed with bicycle and pedestrian travel in mind. There are many ways in which roadway corridors should be improved to more safely accommodate bicycle and pedestrian traffic. Bicycle accommodation within the highway corridor may take four forms: (1) shared use of the highway by bicycles and motor vehicles, (2) designated bicycle route, (3) designated bicycle lane, or (4) a separated bicycle path. Many of the tools listed in section 4.15.1 provide roadways which are safer for bicyclists and pedestrians.

4.14.1 Shared Use of the Highway by Bicycles *(Back to top of page)*

Adequate accommodation of bicycles in rural areas is usually provided by paved shoulders designed to the widths shown in section 4.6 above. However, where shoulder width is less than those values, where shoulder paving must be minimized and in urban or village areas, Tables 4.7, 4.8 and 4.9 provide additional guidance in the selection of appropriate widths of paved areas to safely accommodate bicycles and motor vehicles on the same facility. Note that additional width may be desirable in very high traffic areas or where sight distance is restricted.

Table 4.7

Minimum Width of Paved Shoulder to Accommodate Shared Use of Rural Minor Arterial Roadways by Bicycles

Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Paved Shoulder (ft)[a]			
35	2	2	2	3
40	2	2	3	3
45	2	3	3	3
50	3	4	4	4
55	3	4	4	4

(a) Add 1 foot on bridges or where % trucks >10%.

Table 4.8

Minimum Width of Paved Shoulders to Accommodate Shared Use of Urban or Village Minor Arterial Streets With Curbing by Bicycles

Projected Design Traffic	ADT	ADT	DHV	DHV

Volume	0-1500	1500-2000	200-400	Over 400
Design Speed (mph)	Width of Paved Shoulder (ft)[a][b][c]			
25	2	2	2	3
30	2	2	3	4
35	2	3	3	4
40	2	3	4	4
45	3	4	4	4
50	4	4	4	4
55	4	4	4	4

(a) Width may be reduced by 1 foot in uncurbed areas.

(b) These recommendations are for areas where there is no adjacent on-street parking. Where parking exists, special consideration must be given to achieve safe accommodation for bicyclists.

(c) For cases where shoulder width adjacent to curb is less than 5 feet, recessed drainage inlets or curb inlets should be used.

In lieu of a paved shoulder, it is permissible to use a shared-use curb lane of at least the width shown in Table 4.9. When a shared-use lane is employed, a white edge line should be placed within 1 foot of the face of curb to discourage parking. For all shared-use curb lanes, recessed drainage inlets or curb inlets should be used.

Table 4.9

Minimum Width of a Shared Use Curb Lane to

Accommodate Shared Use of Urban or Village

Minor Arterial Streets by Bicycles

Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	DHV 200-400	DHV Over 400
Design Speed (mph)	Width of Shared-Use Curb Lane (ft)			
25-30	12	12	13	13
35	12	13	13	13
40	13	13	14	14

45	13	14	14	14
50	14	14	14	14
55	NR	NR	NR	NR

NR = Not Recommended

4.14.2 Bicycles on Bridges *(Back to top of page)*

Wherever bicycles are to be accommodated on newly constructed bridges, shoulders and paved areas with a minimum dimension as shown in Tables 4.7, 4.8 and 4.9 should be provided between the parapet, rail or barrier and the edge of the nearest travel lane.

4.14.3 Designated Bicycle Routes and Lanes *(Back to top of page)*

Designated bicycle routes or lanes may be appropriate along some Minor Arterial highways. Because designated routes and lanes will attract bicyclists encompassing a wide range of abilities, special care must be taken to ensure adequate width. Principal concerns for designated bicycle routes and lanes are rider safety and comfort. Because of these concerns, some high speed and/or high volume arterial routes may not be appropriate for designated routes and lanes. In such cases, alternate routes or separate paths for bicycles may be desirable.

4.14.4 Pedestrian Facilities *(Back to top of page)*

Adequate accommodation of pedestrians must be designed for all roadway projects. Depending on the locality and expected frequency of pedestrians, adequate accommodation may range from a graded space alongside a rural road to a sidewalk in a village or city. Projects in urban or village areas shall include consideration of sidewalks and crossing locations. In addition, at the request of a municipality, sidewalks should be considered in other areas of expected pedestrian use such as near schools and recreation areas.

Where pedestrians are accommodated on sidewalks, the design must observe, to the extent possible, current Americans with Disabilities Act Accessibility Guidelines (ADAAG). These guidelines establish acceptable grades, cross-slopes, widths, ramps, surface textures and other facets of pedestrian facility design.

Pedestrian accommodation on combined bicycle/pedestrian paths must also respect the ADAAG to the extent feasible.

Pedestrian accommodation along the shoulders of roadways do not need to comply with ADAAG. However, to the extent that those guidelines can reasonably be achieved, the designer is urged to do so.

4.15 Special Design Guidelines *(Back to top of page)*

These Special Design Guidelines are presented to assist the designer in avoiding, minimizing, or mitigating negative impacts upon the environment and other sensitive resources as well as to enhance the design to fit the context of the project site. These Special Design Guidelines note the importance of the individual resources and suggest tools which may be used in the development of a design which recognizes the resource at the proper level of importance. Under this Functional Classification there are guidelines for:

> Historic/Archaeological Resources

> Natural Resources

> Recreational Resources

> Scenic Resources

> Village or City Entrance Considerations

> Economic Vitality Considerations

When such resources are present within a project site and the use of the tools suggested do not provide an adequate protection of the resources then the design may be eligible for reductions in geometric values. The decision to pursue reductions in the standards is subject to approval in accordance with the "VAOT Design Exception Policy".

The primary strategy for Minor Arterial projects on new alignment should be to use alternative roadway alignments to avoid the impact on the resource. When the project must remain on existing alignment such as a major roadway reconstruction, "Preservation" or "3R" project, bridge repair or replacement, design solutions should be pursued that minimize the extent of the impact. Reduction in the size/area of impact, and the utilization of creative design and engineering solutions should be pursued. Major tools to be used include the alteration of the proposed cross section and the reduction of design speed within sensitive resource areas. Other strategies are described as "common tools" in the following subsection.

4.15.1 Common Tools ***(Back to top of page)***

> Alignment modification including: adjustment of horizontal and vertical curves to avoid sensitive areas and to fit with topographical features and to protect scenic and visual quality

> Reduction in posted speed

> Reduction/minimization of lane and shoulder widths

> Reduction/minimization of clear zones

> Sharpening of horizontal curves with advisory speed postings

> Alterations to typical cross sections including:

$ Roadside ditches shallower than normal

$ Sideslopes steeper than normal (in combination with additional guardrail)

$ Use of curb and closed drainage systems, elimination of roadside ditching

$ Retaining walls

> Wetland and wetland buffer restoration/creation

> Wildlife habitat restoration/creation

> Water quality/streambank, stream buffer, lake buffer creation, restoration, and enhancement

> On and Off - site mitigation

> View/scenic enhancement through vegetation management and grading of sideslopes

> Selection of appropriate guard rail or other roadside barriers to accomplish visibility through to views or to blend in with foreground views

> Use of guard rail to allow steeper than 1:4 graded slopes, retaining walls or cribbing

> Use of guard rail to allow preservation of significant features including native and planted vegetation

> Use of grade separation/bridging/elevated structures etc.

> Separation of vehicular/pedestrian facilities

> Fencing or landscaping for screening or earth berm buffers

> Retrofitting of historical bridges for alternative uses off-site

> Integration of historical features in interpretive facilities, overlooks, etc.

> Light poles and fixtures with downshielded luminaires

> Architectural/Landscape design:

$ street trees

$ use of native materials

$ use of architectural design details

$ pedestrian facilities

$ signage

$ historical design elements

4.15.2 Historic/Archaeological Considerations *(Back to top of page)*

Minor Arterial construction projects should be designed to avoid historic or archaeological resources wherever possible. This may be in the form of avoiding the disturbance of specific sites and structures as well as historic districts or areas where the presence of the road is disturbing to the historic environment. Many Arterial Roads pass through city, town, and village centers and designers must contend with environmental constraints to fit roadways within historic environments.

Where Minor Arterials pass through historic town centers these standards allow for reduction in lane and shoulder widths as appropriate to avoid the imposition of wide road sections through historically sensitive areas and to preserve, in most cases, the character of the community. Additionally, speed management strategies should be considered to allow the community street networks to safely function with the Minor Arterial system.

Providing curbs along Minor Arterials in historic centers will allow both improved pedestrian safety as well as a reduction in clear zone requirements. Street trees and other urban streetscape elements are essential parts of these roads. Every effort should be made using design enhancements, to integrate the Minor Arterial with the local historic environment.

4.15.3 Natural Resources *(Back to top of page)*

Minor Arterial construction projects should be designed to avoid natural resources wherever possible. This may be in the form of avoiding disturbance of specific sites or areas where the presence of a road conflicts with the natural ecosystem. Where avoidance proves unfeasible, every effort should be made to minimize impacts and pursue mitigation strategies and design enhancements to enable maximum integration of the Minor Arterial with the natural landscape.

All Minor Arterial projects should consider the presence of environmental resources in project planning, design and construction. The following resources are protected by Federal law:

> Wetlands, lakes, rivers and streams and their shorelines

> Water supplies

> Groundwater protection areas

> Watershed protection areas

> Agricultural districts and farmland

> Floodplains/ways

> Critical wildlife habitat and natural areas

> Rare and endangered species

> Designated AWild and Scenic Rivers"

> Local Conservation districts or zones

> State and Federal forests and wildlife management areas

> Outstanding Resource Waters

4.15.4 Recreational Resources *(Back to top of page)*

Minor Arterial projects should be designed to avoid public recreational facilities wherever possible. Where avoidance proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements to enable the maximum integration of the Minor Arterials with the resource. Examples of Recreational Resources include:

> Federally owned, funded, or managed property

> State owned, funded, or managed property

> Locally owned parks and recreational areas

> Privately owned recreational facilities open to the public

> Trails and Greenways

4.15.5 Scenic Roads or Views Considerations *(Back to top of page)*

Minor Arterial projects should consider scenic and aesthetic issues for projects that possess scenic qualities. Assessment of scenic qualities should be completed in the Project Development Process. This includes, but is not limited to "Designated Scenic Roads" or "Scenic Byways" as well as other roads with scenic attributes. Techniques for preservation of scenic resources should be employed for views seen from the road, as well as views of the road from surrounding areas. Given that many of the State's Minor Arterials are tourism routes as well as transportation routes, integrating roadway design with visual and safety issues is very important. Additionally, some of these roads travel through dramatic landscapes where dominance of the road could negatively impact scenic values. The following additional techniques should be considered where scenic views from the highway are identified:

> Selection of guard rail type, where required, should be determined based upon visual assessment and the need for visibility through the guard rail vs. blending of the guard rail with the foreground.

> Tree removal or trimming to preserve or enhance views.

> Vegetation management in areas where preservation of existing trees serves to provide visual buffer, frame views, or provide other visual context for the roadway.

> Scenic turnouts where demand is apparent.

> Sculpted ledge to afford natural-like clefts and appearance.

> Treatment of bridges, abutments, and retaining walls should de-emphasize structures where prominent long views and vistas are present.

> Consider appropriate sign size and placement to prevent blocking of views and to minimize clutter.

> Preservation of historic stone walls and trellises.

4.15.6 Village or City Entrance Considerations *(Back to top of page)*

Many of the Minor Arterials in Vermont enter and pass directly through towns, villages or cities. These standards are specifically designed to allow greater flexibility and reduce the conflict with the small scale of many of the affected communities along Minor Arterials. The following guidelines may be appropriate at such locations:

> Strategies for speed management of through vehicles entering towns, villages and cities should be employed through roadway design, signage and other corridor treatments.

> Use landscaping and other streetscape elements to facilitate the definition of intersections with other local and lower classification roads and to define public spaces adjacent to Minor Arterial corridors. Enhancing the corridor landscape in town and city centers will assist in achieving balance between the presence of the road and preserving town character.

> Roadway lighting of an appropriate design: luminaire scale should be reduced to urban-pedestrian scale.

> Aesthetic treatment of bridges, abutments, and retaining walls to emphasize gateways to community entrances and prominent features with "architectural" features and native materials.

4.15.7 Economic Vitality Considerations *(Back to top of page)*

Creative design should integrate economic issues where transportation needs of people, goods and services are significant, and where design of the roadway may affect the vitality of a downtown, commercial or industrial area. In these cases, the following additional guidelines may be appropriate:

> Use appropriate turning radii for large commercial vehicles at appropriate intersections.

> Use lane widths wider than recommended minimums when necessary to accommodate commercial vehicles or anticipated increased traffic volumes.

> Consider truck routes to avoid impacts on downtowns, neighborhoods, and historic districts.

> Retain existing parking, including angle parking, and/or provide additional parking in commercial areas.

> Consider landscaping, lighting, and aesthetic treatments that complement and enhance the commercial identity of a downtown, historic district, shopping district, or recreational area.

> Use appropriate designs for pedestrian and bicycle needs to enhance the vitality of village and urban areas.

> Consider the needs of public transit and intermodal connections, such as bus stops, transfer locations, and

park-and-ride lots.

.***(Back to top of page)***

(Back to Table of Contents)

(Back to Project Development Home Page)

5.0 Collector Roads and Streets

5.1 Basic Geometric Standards *(Back to top of page)*

Design criteria for rural, urban and village Collectors are summarized below. Other AASHTO design criteria, as presented in the 1990 "Policy on Geometric Design of Highways and Streets" are also applicable where they do not conflict with these Standards.

5.2 Level of Service *(Back to top of page)*

Rural Collector roads should be designed for a level of service C or better. However, level of service D is acceptable, where unusually high traffic volumes exist or where terrain is rolling or mountainous.

Collectors in urban or village areas will generally be designed for a level of service D or better. However, in heavily developed village or urban areas, level of service E may be appropriate as judged on a case by case basis. Reference is made in this regard to the VAOT July 25, 1996 Highway Design Level of Service Policy.

5.3 Design Speed *(Back to top of page)*

Rural Collectors are normally designed for speeds of 25 to 50 mph depending on terrain, driver expectancy and other characteristics.

Collectors in urban or village areas are normally designed for speeds of 25 to 50 mph

For rural, village, and urban Collectors, the design speed will normally be equal to the anticipated posted speed. However, lower design and posted speeds may be considered in certain circumstances:

> To avoid and/or minimize impacts to historical, architectural, scenic, natural or other resources.

> To avoid excessive costs of construction.

> To better comply with a town or regional plan.

Design speeds may be lower than legal speeds. Design speeds as much as 10 miles per hour lower than legal speeds may be used without the requirement of a formal design exception, provided appropriate warnings are posted.

5.4 Sight Distance *(Back to top of page)*

5.4.1 Stopping Sight Distance *(Back to top of page)*

Minimum stopping sight distances on rural and urban Collectors will adhere to the values in Table 5.1

Table 5.1

Minimum Stopping Sight Distance For Collectors (Wet Pavements)

	Rehabilitation, Reconstruction or New Construction		
Design Speed (mph)	Stopping Sight Distance (ft)	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
25	150	20	30
30	200	30	40
35	225	40	50
40	275	60	60
45	325	80	70
50	400	110	90

5.4.2 Corner Sight Distance *(Back to top of page)*

Corner sight distances for rural and urban collectors will meet the minimum requirements of Table 5.2.

Table 5.2

Minimum Corner Sight Distances[a] **For Collectors**	
Design Speed on Main Road (mph)	Corner Sight Distance (ft)
25	275
30	330
35	385
40	440
45	495
50	550
55	605

(a) Corner sight distance is measured from a point on the intersecting road or driveway, at least 15 feet from the edge of traveled way on the main road.

5.5 Lane and Shoulder Widths for Urban Collectors *(Back to top of page)*

On urban and village Collectors, lane widths may vary from 9 to 11 feet, and there should be appropriate offsets to curb. The 9-foot widths are appropriate in highly restricted areas having little or no truck traffic. The 11-foot lane widths are generally used on all higher speed, free-flowing Collectors.

Lane and shoulder widths within Historic Districts should be compatible with the historic character of the District.

Shoulders are desirable on urban and village Collectors, and should be provided where feasible to facilitate maneuvering space for immobilized vehicles, safety for the pedestrian in areas where sidewalks are not provided, safe accommodation of bicycles, speed-change lanes for vehicles turning into driveways, and storage space for plowed snow. Despite these advantages, the width of shoulders in urban and village areas may be restricted because of available right-of-way, adjacent development and other constraints.

Where needed in residential areas, a parallel parking lane of 7 feet may be used. In commercial and industrial areas the desirable parking lane width is 8 feet. Curb offsets are not included in the minimum width of parking lanes noted here. 9 to 11 foot parking lanes should be used when the use of the parking lane during peak periods for through traffic is necessary.

As an absolute minimum, a 2-foot offset to vertical curb should be provided, and a 1-foot offset to sloped curb. In all cases, drainage grates and drop inlets should be designed so that they do not project into a travel lane. Drainage grates should always be bicycle-safe in design.

5.6 Lane and Shoulder Widths on Rural Collectors *(Back to top of page)*

Lane and shoulder widths on rural Collectors will adhere to values in Table 5.3. Note that the shoulder widths in this table are considered necessary for adequate safety and service for this class of highway, and may exceed the minimum paved widths needed solely to provide bicycle safety. The required shoulder width beyond that needed to adequately accommodate bicycles as defined in Section 5.14 need not be paved.

Table 5.3

Minimum Width of Lanes and Shoulders

for Two Lane Rural Collectors

Projected Design Traffic Volume	ADT 0-400	ADT 400-1500	ADT 1500-2000	ADT Over 2000
Design Speed (mph)		Width of Lane/Shoulder (ft)		
25	9/2	9/2	10/3	11/3
30	9/2	9/2	10/3	11/3
35	9/2	9/2	10/3	11/3
40	9/2	9/2	10/3	11/3
45	9/2	9/2	10/3	11/3
50	9/2	10/2	10/3	11/3

5.7 Bridge Widths and Structural Capacities ***(Back to top of page)***

State policy favors the rehabilitation of existing bridges. In choosing between the rehabilitation of an existing bridge and the construction of a new bridge, whether on the existing location or on a new location, the agency shall weigh the following factors:

1. the functional classification of the highway;

2. the load capacity and geometric constraints of the bridge and the availability of alternative routes;

3. the comparative long-term costs, risks, and benefits of rehabilitation and new construction;

4. the requirements of state standards for geometric design;

5. disruption to homes and businesses;

6. environmental impacts;

7. the potential effects of the local and state economies;

8. cost-effectiveness;

9. mobility, including bicycles and pedestrians;

10. safety, as determined by factors such as accident history for motorists, pedestrians, and bicyclists;

11. local or regional plans as interpreted by the adopting entity, and state agency plans;

12. the impact on the historic, scenic, and aesthetic values of the municipality, as interpreted by the municipality, in which the highway is located; and

13. if it is a forest highway under federal jurisdiction.

State policy for the reconstruction of bridges on Collectors favors preservation within existing footprints, in order to ensure compatibility with the Vermont setting and to reduce costs and environmental impacts. Where reconstruction within the existing footprint is not feasible, the full width of approach roadways as shown in Table 5.3 should be provided across all new bridges on rural Collectors, and the same curb-to-curb width as the street across all new and replacement bridges on urban and village Collectors. New bridges should be designed to HS-25 loading capacity.

With regard to a bridge located on a municipal highway, a municipality may request the agency to adhere to one or more of the following guidelines:

1. where feasible, the rehabilitated or replacement bridge shall occupy the same curb-to-curb width or alignment, or both, as the existing bridge or the existing approaches to the existing bridge, or both;

2. unless otherwise required by law, a bridge that does not already carry a sidewalk may be rehabilitated without adding a sidewalk and a replacement bridge may be built without a sidewalk or with a sidewalk on only one side; or

3. in rehabilitating a historically significant bridge, the design of the rehabilitated bridge must retain the bridge's historic character, to the extent feasible.

Historic bridges may be rehabilitated for continued use on collectors if they can be rehabilitated to have a roadway clear width of at least 20 feet and an HS-15 capacity. Other historic bridges may be considered for design exceptions so that they may remain in place on collectors and be considered for future rehabilitation rather than replacement.

Bridges may also be considered for continued use providing they meet the requirements of Table 5.4.

If a historic bridge can be rehabilitated or a replacement bridge is in the same location and has the same profile, a design speed need not be selected.

Table 5.4

Bridges to Remain in Place on Collector Roads and Streets

Current Traffic ADT	Design Loading Structural Capacity	Roadway Clear Width (ft)[(a)]

0-1500	HS-15	20
1500-2000	HS-15	22
Over 2000	HS-15	26

(a) Clear width between curbs or rails, whichever is the lesser, is considered to be at least the same as the roadway

approach traveled way width.

5.8 Vertical Clearance *(Back to top of page)*

New or reconstructed structures should provide at least 14 feet of vertical clearance over the entire roadway width, including shoulders plus an additional clearance of 3 inches for future resurfacing of the under passing roadway.

Structures over railroads should provide a minimum vertical clearance of 23 feet over both rails, unless otherwise provided in a variance agreement entered into by the Agency of Transportation, the railroad and any affected municipality, and approved by the Transportation Board in accordance with 5 VSA, Section 3670. Where "double-stacks" are to be accommodated on the railroad, an absolute minimum vertical clearance of 20.75 feet will be required.

On state highways and their connecting links on Class I town highways, bridges over rivers and other bodies of water should be designed to pass a 50-year frequency flood with a minimum clearance of 1 foot between the water surface elevation and the low chord of the bridge. In addition overtopping of the roadway must not be permitted during the 50-year flood. Consideration shall also be given to the potential effects of the 100-year flood on upstream property, the environment, hazards to human life and floodplain management criteria.

Other town highway bridges over rivers and other bodies of water will, where practicable, be designed to pass the 25-year frequency flood with a minimum clearance of 1 foot between the water surface elevation and the low chord of the bridge. In addition, overtopping of the road should not be permitted during the 25-year flood. Consideration shall also be given to the potential effects of the 100-year flood on upstream and downstream property, the environment, hazards to human life and floodplain management criteria.

5.9 Horizontal Clearance *(Back to top of page)*

A clear unobstructed roadside is highly desirable for motorist safety along rural collectors. Clear zone distances for new construction and reconstruction projects on rural principal arterials will normally be based on the values shown in Table 5.5.

Table 5.5

Minimum Clear Zone Distances (in feet from edge of traveled lane)

For Rural Collectors

Design Speed (mph)	Design ADT (VPD)	Fill Slopes		Cut Slopes	
		1:4 or flatter	1:3	1:3	1:4 or flatter
45 or	Under 750	7	*	7	7
	750-1500	12	*	10	10
	1500-6000	14	*	12	12

less	Over 6000	16	*	14	14
	Under 750	12	*	8	8
	750-1500	16	*	10	12
	1500-6000	20	*	12	14
50	Over 6000	24	*	14	18

* Since recovery is less likely on the unshielded, traversable 1:3 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of the slope. Determination of the width of the recovery area at the toe of the slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories.

Notes:

1. Selection of a clear zone may or may not provide adequate sight distance. In those cases where inadequate sight distance results, the designer should specify the need for a sight easement, or otherwise adjust the design to provide needed sight lines.

2. In cut areas without guard rail, it is recommended that the clear zone extend to the back of ditch. This may be wider than the typical clear zone width for the project. The placement of poles or other non-crashworthy features in the ditch is not desirable, as errant vehicles are likely to travel to the bottom of the ditch.

3. The designer may choose to increase the clear zone width on the outside of horizontal curves where accident histories indicate a need, or where specific site investigation shows a definitive accident potential. This may be cost effective where increased banking or other accident countermeasures are not feasible.

Despite the recommendations of Table 5.5, clear zones as narrow as 10 feet may be used on rural principal arterials, without design exception, where necessary to avoid or minimize disturbance of significant historic, archaeological, scenic, natural or other resources. In addition, on low speed (45 mph or less) rural collectors, clear zones may be limited to 10 feet, irrespective of the recommendations of Table 5.5.

On uncurbed urban and village collectors, clear zones will be the same as for rural areas.

On curbed collector urban and village streets, a 1.5 foot horizontal offset to obstructions from face of curb should be provided. This dimension should be increased to 3 feet near turning radii at intersections with side roads and driveways.

5.10 Alignment *(Back to top of page)*

Horizontal curvature will normally be designed in accordance with recommended AASHTO values for the design speed. However, curves up to 15 mph below the stated design speed may be used, without design exception, where necessary to avoid and/or minimize disturbance of historic, archaeological, scenic, natural or other resources. In addition, horizontal curves within 750 feet of a stop sign may be designed up to 15 mph below the stated design speed without design exception. When curvature sharper than the AASHTO recommended value is used, a post-construction test of those curves will be conducted, and advisory speeds will be posted where appropriate.

5.11 Grades *(Back to top of page)*

Maximum grades on rural and urban Collectors will adhere to the values shown in Tables 5.6 and 5.7. In curbed areas of village and urban streets and on all bridges, grades less than 1 percent should be avoided where possible to promote efficient runoff of storm water.

Table 5.6 **Maximum Grades for Rural Collectors**	
	Design Speed (mph)

Type of Terrain	25	30-35	40-45	50
	Maximum Grade (percent)			
Level	7	7	7	6
Rolling	10	9	8	7
Mountainous	11	10	10	9

Table 5.7

Maximum Grades for Urban and Village Collectors

Type of Terrain	Design Speed (mph)				
	25	30-35	40	45	50
	Maximum Grade (percent)				
Level	9	9	9	8	7
Rolling	12	11	10	9	8
Mountainous	13	12	12	11	10

5.12 Cross-slope *(Back to top of page)*

Two-lane pavements are normally designed with a centerline crown and a parabolic surface with an average cross slope of 2 percent. When drainage is carried across adjacent lanes, the cross slope may be increased from one lane to another. Refer to the VAOT design manual for cross-slope design in various situations.

5.13 Superelevation *(Back to top of page)*

When the use of curves is required on a rural Collector alignment, a superelevation rate compatible with the design speed must be used. Superelevation of curves on rural Collectors should not exceed 8 percent. Where a side road intersects on the outside of a main road curve, superelevation of the main road curve should be limited to 6 percent or less to prevent operational difficulties for vehicles entering the main road under snowy or icy conditions.

Superelevation is generally not used on low-speed (45 mph or less) curbed urban and village streets. This is to avoid problems with such items as drainage, ice formation, driveways, pedestrian crossings and developed property. Refer to the 1990 AASHTO Policy, Chapter III, for a detailed discussion of design for low-speed urban streets.

5.14 Bicycle and Pedestrian Considerations *(Back to top of page)*

Bicycles and pedestrian traffic may be expected along the sides of most Collector roads and streets. Where bicycles and pedestrians are allowed by law, the roadway should be designed and constructed under the assumption that it will be used by bicyclists and pedestrians. Bicycles require a paved surface; pedestrians, however, may often be adequately accommodated on unpaved roadway shoulders.

In recent decades, highways were not always designed with bicycle and pedestrian travel in mind. There are many ways in which roadway corridors should be improved to more safely accommodate bicycle and pedestrian traffic. Bicycle accommodation within the highway corridor may take four forms: (1) shared use of the highway by bicycles and motor vehicles, (2) designated bicycle route, (3) designated bicycle lane, or (4) a separated bicycle path. Many of the tools listed in section 5.15.1 provide roadways which are safer for bicyclists and pedestrians.

5.14.1 Shared Use of the Highway by Bicycles *(Back to top of page)*

Adequate accommodation of bicycles in rural areas is usually provided by paved shoulders designed to the widths shown in Section 5.6 above. However, where shoulders width is less than those values, and where shoulder paving must be minimized and in urban or village areas, Tables 5.8, 5.9 and 5.10 provide additional guidance in the selection of appropriate widths of paved areas to safely accommodate bicycles and motor vehicles on the same facility. Note that additional width may be desirable in very high traffic areas or where sight distance is restricted.

Table 5.8

Minimum Width of Paved Shoulder to Accommodate Shared Use of Rural Collector Roadways by Bicycles

Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	ADT Over 2000
Design Speed (mph)	Width of Paved Shoulder (ft)[a]		
25-30	2	2	2
35-40	2	2	3
45	2	3	3
50	2	3	3

(a) Add 1 foot on bridges or where % trucks >10%.

Table 5.9

Minimum Width of Paved Shoulders to Accommodate Shared Use of Urban or Village Collector Streets With Curbing by Bicycles

Projected Design Traffic Volumes	ADT 0-1500	ADT 1500-2000	ADT >2000
Design Speed (mph)	Width of Paved Shoulder (ft)[a][b][c]		

25	2	2	2
30	2	2	3
35	2	3	3
40	2	3	4
45	3	4	4
50	4	4	4

(a) Width may be reduced by 1 foot in uncurbed areas.

(b) These recommendations are for areas where there is no adjacent on-street parking. Where parking exists, special consideration must be given to achieve safe accommodation for bicyclists.

(c) For cases where shoulder width adjacent to curb is less than 5 feet, recessed drainage inlets or curb inlets should be used.

In lieu of a paved shoulder, it is permissible to use a shared-use curb lane of a least the width shown in Table 5.10. When a shared-use lane is employed, a white edge line should be placed within 1 foot of the face of curb to discourage parking. For all shared-use curb lanes, recessed drainage inlets or curb inlets should be used.

Table 5.10 **Minimum Width of a Shared Use Curb Lane** **to Accommodate Shared Use of Urban or** **Village Collector Streets by Bicycles**			
Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	ADT >2000
Design Speed (mph)	Width of Shared-Use Curb Lane (ft)		
25-30	12	12	13
35	12	13	13
40	13	13	14
45	13	14	14
50	14	14	14

5.14.2 Bicycles on Bridges *(Back to top of page)*

Wherever bicycles are to be accommodated on newly constructed bridges, shoulders with a minimum dimension as shown in Tables 5.8, 5.9 and 5.10 should be provided between the parapet, rail or barrier and the edge of the nearest travel lane.

5.14.3 Designated Bicycle Routes and Lanes *(Back to top of page)*

Designated bicycle routes or lanes may be appropriate along some Collector roads and streets. Because designated routes and lanes will attract bicyclists encompassing a wide range of abilities, special care must be taken to ensure adequate widths. Principal concerns for designated bicycle routes and lanes are rider safety and comfort. Because of these concerns, some high speed and/or high volume collector routes may not be appropriate for designated routes and lanes. In such cases, alternate routes or separate paths for bicycles may be desirable.

5.14.4 Pedestrian Facilities *(Back to top of page)*

Adequate accommodation of pedestrians must be designed for all roadway projects. Depending on the locality and expected frequency of pedestrians, adequate accommodation may range from a graded space alongside a rural road to a sidewalk in a village or city. Projects in urban or village areas shall include consideration of sidewalks and crossing locations. In addition, at the request of a municipality, sidewalks should be considered in other areas of expected pedestrian use such as near schools and recreation areas.

Where pedestrians are accommodated on sidewalks, the design must observe, to the extent possible, current Americans with Disabilities Act Accessibility Guidelines (ADAAG). These guidelines establish acceptable grades, cross-slopes, widths, ramps, surface textures and other facets of pedestrian facility design.

Pedestrian accommodation on combined bicycle/pedestrian paths must also respect the ADAAG to the extent feasible.

Pedestrian accommodation along the shoulders of roadways do not need to comply with ADAAG. However, to the extent that those guidelines can reasonably be achieved, the designer is urged to do so.

5.15 Special Design Guidelines *(Back to top of page)*

These Special Design Guidelines are presented to assist the designer in avoiding, minimizing, or mitigating negative impacts upon the environment and other sensitive resources as well as to enhance the design to fit the context of the project site. These Special Design Guidelines note the importance of the individual resources and suggest tools which may be used in the development of a design which recognizes the resource at the proper level of importance. Under this Functional Classification there are guidelines for:

> Historic/Archaeological Resources

> Natural Resources

> Recreational Resources

> Scenic Resources

> Village or City Entrance Considerations

> Economic Vitality Considerations

When such resources are present within a project site and the use of the tools suggested do not provide an adequate protection of the resources then the design may be eligible for reductions in geometric values. The decision to pursue reductions in the standards is subject to approval in accordance with the "VAOT Design Exception Policy".

The primary strategy for Collector road and street projects on new alignment should be to avoid or minimize the impact on the resource. When the project must remain on existing alignment such as a major roadway reconstruction, "Preservation" or "3R" project, bridge repair or replacement, design solutions should be pursued that minimize the extent of the impact. Collector roads and streets should be designed to allow both local access and mobility and as such should make the most use of tools to avoid impact to sensitive resources. Reduction in the size/area of impact, and the utilization of creative design and engineering solutions should be pursued. The following strategies are described as "common tools" in the following subsection to avoid impact to the resources.

5.15.1 Common Tools *(Back to top of page)*

> Alignment modification including: adjustment of horizontal and vertical curves to avoid sensitive areas and to fit with topographical features

> Reduction in Posted Speed

> Reduction/minimization of lane and shoulder widths

> Reduction/minimization clear zones

> Sharpening of horizontal curves with advisory speed postings

> Alterations to typical cross sections including:

$ Roadside ditches shallower than normal

$ Sideslopes steeper than normal (in combination with additional guardrail)

$ Use of curb and closed drainage systems, elimination of roadside ditching

$ Retaining walls

> Other traffic calming techniques, such as intersection diverters, roundabouts, channelization, speed humps, speed tables, angle points, and gateways.

> Wetland and wetland buffer restoration/creation

> Wildlife habitat restoration/creation

> Water quality/stream bank, stream buffer, lake buffer creation, restoration, and enhancement

> On and Off - site mitigation

> View/scenic enhancement through vegetation management and grading of sideslopes

> Selection of appropriate guard rail or other roadside barriers to accomplish visibility through to views or to blend in with foreground views

> Use of guard rail to allow steeper than 1:4 graded slopes, retaining walls or cribbing

> Use of guard rail to allow preservation of significant features including native and planted vegetation

> Use of grade separation/bridging/elevated structures etc.

> Separation of vehicular/pedestrian facilities

> Fencing or landscaping for screening or earth berm buffers

> Retrofitting of historical bridges for alternative uses off-site

> Integration of historical features in interpretive facilities, overlooks, etc.

> Light poles and fixtures with down shielded luminaires.

> Architectural/Landscape design:

$ street trees

$ use of native materials

$ use of architectural design details

$ pedestrian facilities

$ signage

$ historical design elements

5.15.2 Historic/Archaeological Considerations *(Back to top of page)*

Collector road and street projects should be designed to avoid historic or archaeological resources wherever possible. This may be in the form of avoiding disturbance of specific sites and structures as well as historic districts or areas where the presence of the road is disturbing to the historic land use and development pattern. Designers must contend with environmental constraints to fit new and renovated roadways within historic environments.

Where Collector roads and streets pass through historic town centers, an appropriate response is to work with local officials to reconcile posted speed and historic property conflicts and to apply that resolution to the specific community context. Reduction in lane and shoulder widths may be considered as appropriate to avoid the imposition of wider road sections through historically sensitive areas. Additionally, decisions regarding measures to accomplish speed management should be considered.

Providing curbs along Collector roads and streets in historic areas will allow both improved pedestrian safety as well as reduce in clear zone requirements. Street trees and other urban streetscape elements are essential parts of these roads. Every effort should be made to design enhancements which maximum integration of the Collector road and streets with the historic area.

The following additional design techniques are suggested to designers for Collector roads and streets:

> Alignment modification including horizontal and vertical curves to avoid sensitive areas and blend into topographical features.

> Alterations to typical cross sections including:

$ Roadside ditches shallower than normal

$ Sideslopes steeper than normal

$ Use of curb, and elimination of the roadside ditch

$ Retaining walls

> Landscaping for screening

> Retrofitting of historical bridges should be considered.

> When existing historic bridges are structurally deficient, and replacement the only solution, new bridge and approach designs should consider aesthetic treatments consistent with the historical context.

> The inclusion of historic design features which enhance integration of the design into the historical setting.

5.15.3 Natural Resources *(Back to top of page)*

Collector roads and street construction projects should be designed to avoid natural resources wherever possible. This may be in the form of avoiding disturbance of specific sites or areas where the presence of the road conflicts with natural resources. Where avoidance proves unfeasible, every effort should be made to minimize impacts or pursue mitigation strategies and design enhancements to enable the maximum integration of the Collector Roads and Streets with the resource. Examples of resources included:

> Wetland, lakes, rivers, and streams and their shorelines

> Water supplies

> Groundwater protection areas

> Watershed protection areas

> Agricultural districts and farmland

> Floodplains/ways

> Critical wildlife habitat and natural areas

> Rare and endangered species

> Designated "Wild and Scenic Rivers"

> Local Conservation districts or zones

> State and Federal forests and wildlife management areas

> Outstanding Resource Waters

5.15.4 Recreational Resources *(Back to top of page)*

Collector road and street projects should be designed to avoid public recreational facilities and protect and enhance their use wherever possible. Where avoidance proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements to enable the maximum integration of the Collector road and streets with the resource. Examples of resources include:

> Federally owned, funded, or managed property

> State owned, funded, or managed property

> Locally owned parks and recreational areas

> Privately owned recreational facilities open to the public

> Trails and Greenways

> Federal and State forest and wildlife management areas

5.15.5 Scenic Roads or Views Considerations *(Back to top of page)*

All Collector road and street projects should consider scenic and aesthetic issues for projects that are either designated Scenic Roads or other roads or areas with scenic attributes. Techniques for preservation of scenic resources should be employed for both scenic resources seen from the road, as well as views of the road from surrounding areas. Some of these roads travel through the State's most dramatic landscapes where dominance of the road could negatively impact scenic values. The following additional techniques should be considered where scenic views from the roadway are identified:

> Selection of guard rail type, where required, should be determined based upon visual assessment and the need for visibility through the guardrail vs. blending of the guardrail with the foreground.

> Tree removal or trimming to preserve or enhance views.

> Vegetation management in areas where preservation of existing trees serves to provide visual buffer, frame views, or provide other visual context for the roadway.

> Treatment of bridges, abutments, retaining walls should de-emphasize structures where prominent long views and vistas are present.

> Consider appropriate sign size and placement to prevent blocking of views and to minimize clutter.

> Preservation of old stone walls and tree lines.

5.15.6 Village or City Entrance Considerations *(Back to top of page)*

Many of the Collector roads and streets in Vermont enter and pass through towns, villages or cities. These standards are specifically designed to allow greater flexibility to reduce the conflicts with the small scale of many of the affected communities along Collector roads and streets. The following additional guidelines may be appropriate at such locations:

> Strategies for speed management of vehicles entering towns, villages and cities should be employed through roadway design, signage and overall corridor treatments.

> Coordinated street tree and other landscaping will assist in achieving balance between the presence of the road and preserving town character for pedestrians.

> Roadway lighting of an appropriate design: luminaires scale should be reduced to urban-pedestrian scale.

> Aesthetic treatment of bridges, abutments, retaining walls to emphasize gateways to community entrances and prominent features with "architectural" features and materials.

5.15.7 Economic Vitality Considerations *(Back to top of page)*

Creative design should integrate economic issues where transportation needs of people, goods and services are significant, and where design of the roadway may affect the vitality of a downtown, commercial or industrial area. In these cases, the following additional guidelines may be appropriate:

> Use appropriate turning radii for large commercial vehicles at appropriate intersections.

> Use lane widths wider than recommended minimums when necessary to accommodate commercial vehicles or anticipated increased traffic volumes.

> Consider truck routes to avoid impacts on downtowns, neighborhoods, and historic districts.

> Retain existing parking, including angle parking, and/or provide additional parking in commercial areas.

> Consider landscaping, lighting, and aesthetic treatments that complement and enhance the commercial identity of a downtown, historic district, shopping district, or recreational area.

> Use appropriate designs for pedestrian and bicycle needs to enhance the vitality of village and urban areas.

> Consider the needs of public transit and intermodal connections, such as bus stops, transfer locations, and park-and-ride lots.

(Back to top of page)

(Back toTable of Contents)

(Back to Project Development Home Page)

6.0 Local Roads and Streets

6.1 Basic Geometric Standards *(Back to top of page)*

Design criteria for Local roads and streets are summarized below. Other AASHTO design criteria, as presented in the 1990 "Policy on Geometric Design of Highways and Streets," are also applicable where they do not conflict with these Standards.

6.2 Design Speed *(Back to top of page)*

Rural, urban and village Local Roads and Streets are normally designed for speeds of 25 to 50 mph depending on terrain, driver expectancy and other characteristics. For rural, village, and urban Local Roads, the design speed will normally be equal to the anticipated posted speed. However, lower design and posted speeds may be considered in certain circumstances:

> To avoid and/or minimize impacts to historical, architectural, scenic, natural or other resources.

> To avoid excessive costs of construction.

> To better comply with a town or regional plan.

Design speeds may be lower than legal speeds. Design speeds as much as 10 miles per hour lower than legal speeds may be used without the requirement of a formal design exception, provided appropriate warnings are posted.

6.3 Sight Distance *(Back to top of page)*

6.3.1 Stopping Sight Distance *(Back to top of page)*

Minimum stopping sight distances on rural and urban Local roads and streets will adhere to the values in Table 6.1.

Table 6.1

Minimum Stopping Sight Distance for Local Roads/Streets (Wet Pavements)

	Rehabilitation, Reconstruction or New Construction		
Design Speed (mph)	Stopping Sight Distance (ft)	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
25	150	20	30
30	200	30	40
35	225	40	50
40	275	60	60
45	325	80	70
50	400	110	90

6.3.2 Corner Sight Distance *(Back to top of page)*

Corner sight distances for rural and urban local roads and streets will meet the minimum requirements of Table 6.2.

Table 6.2

Minimum Corner Sight Distances[(a)]

For Local Roads And Streets

Design Speed on Main Road (mph)	Corner Sight Distance (ft)
25	275
30	330
35	385

40	440
45	495
50	550
55	605

(a) Corner sight distance is measured from a point on the intersecting road or driveway, at least 15 feet from the edge of traveled way on the main road.

6.4 Lane and Shoulder Widths for Urban Local Streets *(Back to top of page)*

On urban and village Local streets, lane widths may vary from 7 to 11 feet, and there should be appropriate offsets to curb. The 7 and 8-foot widths may be appropriate in residential areas having very low traffic volume and little or no truck traffic.

Lane and shoulder widths within Historic Districts should be compatible with the historic character of the District. As an absolute minimum, a 2-foot offset to vertical curb is recommended, and a 1-foot offset to sloped curb. In all cases, drainage grates and drop inlets should be designed so that they do not project into a travel lane. Drainage grates should always be bicycle-safe in design.

6.5 Lane and Shoulder Widths on Rural Local Roads *(Back to top of page)*

For new construction, lane and shoulder widths on rural Local roads will adhere to values in Table 6.3. Note that the shoulder widths in this table are considered necessary for adequate safety and service for this class of highway, and may exceed the minimum paved widths needed solely to provide bicycle safety. For reconstruction and rehabilitation the median existing roadway lane and shoulder width within a project area shall be the minimum lane and shoulder widths, with additional shoulder width to accommodate bicycles as outlined under "Bicycle and Pedestrian Considerations" in this chapter.

Table 6.3

Minimum Width of Lanes And Shoulders

for Rural Local Roads

Design Traffic Volume	ADT[(a)] 0-25	ADT 25-50	ADT 50-100	ADT 100-400	ADT 400-1500	ADT 1500-2000	ADT Over 2000
Design Speed (mph)	Width of Lane/Shoulder (ft)						
25	7/0	8/0	9/0	9/2	9/2	10/3	11/3
30	7/0	8/0	9/0	9/2	9/2	10/3	11/3

35	7/0	8/0	9/0	9/2	9/2	10/3	11/3
40	7/0	8/0	9/2	9/2	9/2	10/3	11/3
45	—	—	9/2	9/2	9/2	10/3	11/3
50	—	—	9/2	9/2	10/2	10/3	11/3

(a) Minimum width of 8/0 whenever there is guard rail.

6.6 Bridge Widths and Structural Capacities *(Back to top of page)*

State policy favors the rehabilitation of existing bridges. In choosing between the rehabilitation of an existing bridge and the construction of a new bridge, whether on the existing location or on a new location, the agency shall weigh the following factors:

1. the functional classification of the highway;

2. the load capacity and geometric constraints of the bridge and the availability of alternative routes;

3. the comparative long-term costs, risks, and benefits of rehabilitation and new construction;

4. the requirements of state standards for geometric design;

5. disruption to homes and businesses;

6. environmental impacts;

7. the potential effects of the local and state economies;

8. cost-effectiveness;

9. mobility, including bicycles and pedestrians;

10. safety, as determined by factors such as accident history for motorists, pedestrians, and bicyclists;

11. local or regional plans as interpreted by the adopting entity, and state agency plans;

12. the impact on the historic, scenic, and aesthetic values of the municipality, as interpreted by the municipality, in which the highway is located; and

13. if it is a forest highway under federal jurisdiction.

State policy for the reconstruction of bridges on Local Roads favors preservation within existing footprints, in order to ensure compatibility with the Vermont setting and to reduce costs and environmental impacts. Where reconstruction within the existing footprint is not feasible, the full width of approach roadways as shown in Table 6.3 should be provided across all new bridges on rural Local Roads, and the same curb-to-curb width as the street across all new and replacement bridges on urban and village Local Roads. New bridges should be designed to HS-25 loading capacity.

With regard to a bridge located on a municipal highway, a municipality may request the agency to adhere to one or more of the following guidelines:

1. where feasible, the rehabilitated or replacement bridge shall occupy the same curb-to-curb width or alignment, or both, as the existing bridge or the existing approaches to the existing bridge, or both;

2. unless otherwise required by law, a bridge that does not already carry a sidewalk may be rehabilitated without adding a sidewalk and a replacement bridge may be built without a sidewalk or with a sidewalk on only one side; or

3. in rehabilitating a historically significant bridge, the design of the rehabilitated bridge must retain the bridge's historic character, to the extent feasible.

Where an existing road is to be reconstructed, an existing bridge which fits the proposed alignment and profile may remain in place when its structural capacity in terms of design loading and roadway width are at least equal to the value shown for the applicable traffic volume in Table 6.4.

Historic bridges may be rehabilitated for continued use on local roads if they can be rehabilitated to have a roadway clear width of at least 16 feet and an H-12 capacity. Other historic bridges may be considered for design exceptions so that they may remain in place on local roads and be considered for future rehabilitation rather than replacement.

If a historic bridge can be rehabilitated or a replacement bridge is in the same location and has the same profile, a design speed need not be selected.

Table 6.4

Bridges to Remain in Place on Local Roads and Streets

Current Traffic ADT	Design Loading Structural Capacity	Roadway Clear Width (ft)[(a)]
0-50	H-12	16
50-400	H-15	18
400-2000	H-15	20
Over 2000	H-15	22

(a) Clear width between curbs or rails, whichever is the lesser.

6.7 Vertical Clearance *(Back to top of page)*

New or reconstructed structures should provide at least 14 feet of vertical clearance over the entire roadway width, including shoulders plus an additional clearance of 3 inches for future resurfacing of the under passing road.

Structures over railroads should provide a minimum vertical clearance of 23 feet over both rails, unless otherwise provided in a variance agreement entered into by the Agency of Transportation, the railroad and any affected municipality, and approved by the Transportation Board in accordance with 5 VSA, Section 3670. Where "double-stacks" are to be accommodated on the railroad, an absolute minimum vertical clearance of 20.75 feet will be required.

Town highway bridges over rivers and other bodies of water will, where practicable, be designed to pass the 25-year frequency flood with a minimum clearance of 1 foot between the water surface elevation and the low chord of the bridge. In addition, overtopping of the road must not be permitted during the 25-year flood. Consideration shall also be given to the potential effects of the 100-year flood on upstream property, the environment, hazards to human life and floodplain management criteria.

6.8 Horizontal Clearance *(Back to top of page)*

A clear unobstructed roadside is highly desirable for motorist safety along rural local roads. Clear zone distances for new construction and reconstruction projects on rural local roads will normally be based on the values shown in Table 6.5.

Table 6.5

Minimum Clear Zone Distances (in feet from edge of traveled lane)

For Rural Principal Arterials

Design Speed (mph)	Design ADT (VPD)	Fill Slopes		Cut Slopes	
		1:4 or flatter	1:3	1:3	1:4 or flatter
45 or less	Under 750	7	*	7	7
	750-1500	12	*	10	10
	1500-6000	14	*	12	12
	Over 6000	16	*	14	14
50	Under 750	12	*	8	8
	750-1500	16	*	10	12
	1500-6000	20	*	12	14
	Over 6000	24	*	14	18

* Since recovery is less likely on the unshielded, traversable 1:3 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of the slope. Determination of the width of the recovery area at the toe of the slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories.

Notes:

1. Selection of a clear zone may or may not provide adequate sight distance. In those cases where inadequate sight distance results, the designer should specify the need for a sight easement, or otherwise adjust the design to provide needed sight lines.

2. In cut areas without guard rail, it is recommended that the clear zone extend to the back of ditch. This may be wider than the typical clear zone width for the project. The placement of poles or other non-crashworthy features in the ditch is not desirable, as errant vehicles are likely to travel to the bottom of the ditch.

3. The designer may choose to increase the clear zone width on the outside of horizontal curves where accident histories indicate a need, or where specific site investigation shows a definitive accident potential. This may be cost effective where increased banking or other accident countermeasures are not feasible.

Despite the recommendations of Table 6.5, clear zones as narrow as 5 feet may be used on rural principal arterials, without design exception, where necessary to avoid or minimize disturbance of significant historic, archaeological, scenic, natural or other resources. In addition, on high speed local roads (50 mph or greater) clear zones may be limited to 10 feet, and on low speed (45 mph or less) local roads, clear zones may be limited to 7 feet, irrespective of the recommendations of Table 6.5.

On uncurbed urban and village local roads, the clear zone may be limited to 5 feet where speeds are 35 mph or greater. For speeds less than 35 mph, clearances as for curbed areas will be sufficient.

On curbed local road urban and village streets, a 1.5 foot horizontal offset to obstructions from face of curb should be provided. This dimension should be increased to 3 feet near turning radii at intersections with side roads and driveways.

6.9 Alignment *(Back to top of page)*

Horizontal curvature will normally be designed in accordance with recommended AASHTO values for the design speed. However, curves up to 20 mph below the stated design speed may be used, without design exception, where necessary to avoid and/or minimize disturbance of historic, archaeological, scenic, natural or other resources. In addition, horizontal curves within 750 feet of a stop sign may be designed up to 15 mph below the stated design speed without design exception. When curvature sharper than the AASHTO recommended values is used, a post-construction test of those curves will be conducted, and advisory speeds will be posted where appropriate.

6.10 Grades *(Back to top of page)*

Maximum grades on rural Local roads will adhere to the values shown in Table 6.6.

Table 6.6

Maximum Grades for Rural Local Roads

Type of Terrain	Design Speed (mph)					
	25	30	35	40	45	50
	Maximum Grade (percent)					
Level	7	7	7	7	7	6
Rolling	11	10	10	9	8	8
Mountainous	15	14	13	12	11	10

Grades for local residential streets should be as flat as is consistent with the surrounding terrain. The gradient for local streets should be less than 15 percent. Where grades of 4 percent or steeper are necessary, the drainage design may become critical. On such grades special care must be taken to prevent erosion on slopes and open drainage facilities.

For streets in commercial and industrial areas, gradient design should be less than 8 percent; desirably, it should be less than 5 percent, and flatter gradients should be emphasized.

To provide for proper drainage, the desirable minimum grade that should be used for streets and bridges with outer curbs is one percent.

6.11 Cross-slope *(Back to top of page)*

Two-lane pavements are normally designed with a centerline crown and a parabolic surface with an average cross slope of 2 percent. When drainage is carried across adjacent lanes, the cross slope may be increased from one lane to another. Refer to the VAOT design manual for cross-slope design in various situations.

6.12 Superelevation *(Back to top of page)*

When the use of curves is required on a rural Local road alignment, a superelevation rate compatible with the design speed must be used. Superelevation of curves on rural paved Local roads should not exceed 8 percent and 6 percent on unpaved roads. Where a side road intersects on the outside of a main road curve, superelevation of the main road curve should be limited to 6 percent or less to prevent operational difficulties for vehicles entering the main road under snowy or icy conditions.

Superelevation is generally not used on low-speed (45 mph or less) curbed urban and village streets. This is to avoid problems with such items as drainage, ice formation, driveways, pedestrian crossings and developed property. Refer to the 1990 AASHTO Policy, Chapter III, for a detailed discussion of design for low-speed urban streets.

6.13 Bicycle and Pedestrian Considerations *(Back to top of page)*

Bicycles and pedestrian traffic may be expected along the sides of most local roads and streets. Where bicycles and pedestrians are allowed by law, the roadway should be designed and constructed under the assumption that it will be used by bicyclists and pedestrians. Bicycles require a paved surface; pedestrians, however, may often be adequately accommodated on unpaved roadway shoulders.

In recent decades, highways were not always designed with bicycle and pedestrian travel in mind. There are many ways in which roadway corridors should be improved to more safely accommodate bicycle and pedestrian traffic. Bicycle accommodation within the highway corridor may take four forms: (1) shared use of the highway by bicycles and motor vehicles, (2) designated bicycle route, (3) designated bicycle lane, or (4) a separated bicycle path. Many of the tools listed in section 6.14.1 provide roadways which are safer for bicyclists and pedestrians.

6.13.1 Shared Use of the Highway by Bicycles *(Back to top of page)*

Adequate accommodation of bicycles on paved rural roadways is usually provided by paved shoulders designed to the widths shown in Section 6.5 above. However, where shoulder width is less than those values, on where shoulder paving must be minimized, and in urban or village areas, Tables 6.7, 6.8 and 6.9 provide additional guidance in the selection of appropriate widths of paved areas to safely accommodate bicycles and motor vehicles on the same facility. Note that additional width may be desirable in very high traffic areas or where sight distance is restricted.

Table 6.7

Minimum Width of Paved Shoulder to Accommodate

Shared Use of Paved Rural Local Roadways by Bicycles

Projected Design Traffic Volume	ADT 0-100	ADT 100-1500	ADT 1500-2000	ADT Over 2000
Design Speed (mph)	Width of Paved Shoulder (ft)[a]			
25-30	*	1	1	2
35-40	*	1	2	3
45	*	2	3	3
50	*	2	3	4

(a) Add 1 foot on bridges or where %trucks>10%.

* No special provisions for bicycles.

Table 6.8

Minimum Width of Paved Shoulders to Accommodate Shared Use of Urban or Village Local Streets With Curbing by Bicycles			
Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	ADT >2000
Design Speed (mph)	Width of Paved Shoulder (ft)[(a)(b)(c)]		
25	2	2	2
30	2	2	3
35	2	3	3
40	2	3	4
45	3	4	4
50	4	4	4

(a) Width may be reduced by 1 foot in uncurbed areas.

(b) These recommendations are for areas where there is no adjacent on-street parking. Where parking exists, special consideration must be given to achieve safe accommodation for bicyclists.

(c) For cases where shoulder width adjacent to curb is less than 5 feet, recessed drainage inlets or curb inlets should be used.

In lieu of a paved shoulder, it is permissible to use a shared-use curb lane of at least the width shown in Table 6.9. When a shared-use lane is employed, a white edge line should be placed within 1 foot of the face of curb to discourage parking. For all shared-use curb lanes, recessed drainage inlets or curb inlets should be used.

Table 6.9 **Minimum Width of a Shared Use Curb Lane to Accommodate Shared Use of Urban or Village Local Streets by Bicycles**			
Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	ADT >2000
Design Speed (mph)	Width of Shared-Use Curb Lane (ft)		
25-30	12	12	13
35	12	13	13

40	13	13	14
45	13	14	14
50	14	14	14

6.13.2 Bicycles on Bridges *(Back to top of page)*

Wherever bicycles are to be accommodated on newly constructed bridges, shoulders with a minimum dimension as shown in Tables 6.7, 6.8, and 6.9 should be provided between the parapet, rail or barrier and the edge of the nearest travel lane.

6.13.3 Designated Bicycle Routes and Lanes *(Back to top of page)*

Designated bicycle routes or lanes may be appropriate along local roads and streets. Because designated routes and lanes will attract bicyclists encompassing a wide range of abilities, special care must be taken to ensure adequate widths. Principal concerns for designated bicycle routes and lanes are rider safety and comfort. Because of these concerns, some high speed and/or high volume routes may not be appropriate for designated routes and lanes. In such cases, alternate routes or separate paths for bicycles may be desirable.

6.13.4 Pedestrian Facilities *(Back to top of page)*

Adequate accommodation of pedestrians must be designed for all roadway projects. Depending on the locality and expected frequency of pedestrians, adequate accommodation may range from a graded space alongside a rural road to a sidewalk in a village or city. Projects in urban or village areas shall include consideration of sidewalks and crossing locations. In addition, at the request of a municipality, sidewalks should be considered in other areas of expected pedestrian use such as near schools and recreation areas.

Where pedestrians are accommodated on sidewalks, the design must observe, to the extent possible, current Americans with Disabilities Act Accessibility Guidelines (ADAAG). These guidelines establish acceptable grades, cross-slopes, widths, ramps, surface textures and other facets of pedestrian facility design.

Pedestrian accommodation on combined bicycle/pedestrian paths must also respect the ADAAG to the extent feasible.

Pedestrian accommodation along the shoulders of roadways do not need to comply with ADAAG. However, to the extend that those guidelines can reasonably be achieved, the designer is urged to do so.

6.14 Special Design Guidelines *(Back to top of page)*

These Special Design Guidelines are presented to assist the designer in avoiding, minimizing, or mitigating negative impacts upon the environment and other sensitive resources as well as to enhance the design to fit the context of the project site. These Special Design Guidelines note the importance of the individual resources and suggest tools which may be used in the development of a design which recognizes the resource at the proper level of importance. Under this Functional Classification there are guidelines for:

> Historic/Archaeological Resources

> Natural Resources

> Recreational Resources

> Scenic Resources

When such resources are present within a project site and the use of the tools suggested do not provide an adequate protection of the resources then the design may be eligible for reductions in geometric values. The decision to pursue reductions in the standards is subject to approval in accordance with the "VAOT Design Exception Policy".

The primary strategy for Local Road projects on new alignment should be to use alternative roadway alignments to avoid the impact on the resource. When the project must remain on existing alignment such as roadway reconstruction, "Preservation" or "3R" project, bridge repair or replacement, design solutions should be pursued that minimize the extent of the impact. Local Road projects are intended to provide land access with minimal emphasis on mobility and as such should be treated with the most flexibility when considering design solutions for avoidance of impact to sensitive resources. Reduction in the size/area of impact, and the utilization of creative design and engineering solutions should be pursued to the maximum extent possible. The following "common tools" should be used to reduce impacts to the natural and built environment.

6.14.1 Common Tools *(Back to top of page)*

> One lane (two-way) low volume, low speed roadways

> Alignment modification including: adjustment of horizontal and vertical curves to avoid sensitive areas and to fit with topographical features

> Reduction in posted speed

> Reduction/minimization of lane and shoulder widths

> Reduction/minimization clear zones

> Sharpening of horizontal curves with advisory speed postings

> Alterations to typical cross sections including:

$ Roadside ditches shallower than normal

$ Sideslopes steeper than normal (in combination with additional guardrail)

$ Use of curb and closed drainage systems, elimination of roadside ditching

$ Retaining walls

> Other traffic calming techniques, such as intersection diverters, roundabouts, channelization, speed humps, speed tables, angle points, and gateways.

> Wetland and wetland buffer restoration/creation

> Wildlife habitat restoration/creation

> Water quality/stream bank, stream buffer, lake buffer creation, restoration, and enhancement

> On and Off - site mitigation

> View/scenic enhancement through vegetation management and grading of sideslopes

> Selection of appropriate guard rail or other roadside barriers to accomplish visibility through to views or to blend in with foreground views

> Use of guard rail to allow steeper than 1:4 graded slopes, retaining walls or cribbing

> Use of guard rail to allow preservation of significant features including native and planted vegetation

> Use of grade separation/bridging/elevated structures etc.

> Separation of vehicular/pedestrian facilities

> Fencing or landscaping for screening or earth berm buffers

> Retrofitting of historical bridges for alternative uses off-site

> Integration of historical features in interpretive facilities, overlooks, etc.

> Light poles and fixtures with down shielded luminaires.

> Architectural/Landscape design:

$ street trees

$ use of native materials

$ use of architectural design details

$ pedestrian facilities

$ signage

$ historical design elements

6.14.2 Historic/Archaeological Considerations *(Back to top of page)*

Local road construction projects on new location should be designed to avoid historic or archaeological resources wherever possible. This may be in the form of avoiding disturbance of specific sites and structures as well as historic districts or areas where the presence of the road is disturbing to the historic land use and development pattern.

Reduction in lane and shoulder widths may be considered where appropriate to avoid the imposition of wider road sections through historically sensitive areas. Additionally, decisions regarding measures to accomplish "speed management" should be considered.

Providing curbs along Local Roads in Historic centers will allow both improved pedestrian safety as well as reduced clear zone requirements for street trees and other urban streetscape amenities.

Where avoidance proves unfeasible, every effort should be made to minimize impacts and pursue mitigation strategies and design enhancements to enable the maximum integration of the Local road with the historic area.

The following additional design techniques address the potential tools available to designers for Local roads:

> Alignment modification including horizontal and vertical curves to avoid sensitive areas and blend into topographical features.

> Alterations to typical cross sections including:

$ Roadside ditches shallower than normal

$ Sideslopes steeper than normal

$ Use of curb, and elimination of the roadside ditch

$ Retaining walls

> Selection of appropriate guard rail or other roadside barriers

> Landscaping for screening or earth berm buffers

> Retrofitting of historical bridges should be considered.

> When existing historic bridges are structurally deficient, and replacement the only solution, new bridge and approach designs should consider aesthetic treatments consistent with the historical context.

> The inclusion of design features which enhance integration of the design into the historical setting.

6.14.3 Natural Resources *(Back to top of page)*

Local Road construction projects should be designed to avoid natural resources to the greatest extent possible. This may be in the form of avoiding disturbance of specific sites or areas where the presence of the road conflicts with important natural resources. Where avoidance proves unfeasible, every effort should be made to minimize impacts or pursue mitigation strategies and design enhancements to enable the maximum integration of the Local Road with the resource.

> Wetland, lakes, rivers, and streams and their shorelines

> Water supplies

> Groundwater protection areas

> Watershed protection areas

> Agricultural districts and farmland

> Floodplains/ways

> Critical wildlife habitat and natural areas

> Rare and endangered species

> Designated "Wild and Scenic Rivers"

> Local Conservation districts or zones

> State and Federal forests and wildlife management areas

> Outstanding Resource Waters

6.14.4 Recreational Resources *(Back to top of page)*

Local Road projects should be designed to avoid public rescreational facilities to the maximum extent possible. Where avoidance proves unfeasible, every effort should be made to minimize impacts including mitigation strategies and design enhancements to enable the maximum integration of the Local Roads with the resource.

> Federally owned, funded, or managed property

> State owned, funded, or managed property

> Locally owned parks and recreational areas

> Privately owned recreational facilities open to the public

> Trails and Greenways

6.14.5 Scenic Roads or Views Considerations *(Back to top of page)*

All Local Road projects should consider scenic and aesthetic issues for projects that are either designated Scenic Roads or other roads with scenic attributes. Techniques for preservation of scenic resources should be employed for both scenic resources seen from the road, as well as views of the road from surrounding areas. The following techniques should be considered where scenic views from the highway are identified:

> Selection of guardrail type, where required, should be determined based upon visual assessment and the need for visibility through the guardrail vs. blending of the guardrail with the foreground.

> Tree removal or trimming to preserve or enhance views.

> Vegetation management in areas where preservation of existing trees serves to provide visual buffer, frame views, or provide other visual context for the roadway.

> Treatment of bridges, abutments, retaining walls should de-emphasize structures.

> Consider appropriate sign size and placement to prevent blocking of views and to minimize clutter.

> Preservation of old stone walls and treelines.

(Back to top of page)

(Back to Table of Contents)

(Back to Project Development Home Page)

7.0 Level of Improvement (LOI)

7.1 Introduction *(Back to top of page)*

Level of Improvement (LOI) is a recognition that with limited resources it is not possible to upgrade every road and bridge in Vermont to its ideal engineering condition. The idea was introduced in the 1995 Vermont Long Range Transportation Plan. Under the LOI concept, major transportation projects involving extensive improvements will take place only in major corridors. Other parts of the system will receive less extensive improvements, depending on how heavily they are used, and how important they are to statewide mobility.

7.2 Applicability *(Back to top of page)*

LOI applies to investment in all roads and bridges in Vermont where state or federal funding is involved. The LOI concept will be broadened to become applicable to investment in all modes of transportation in Vermont.

7.3 Classification *(Back to top of page)*

Three major factors are used to classify roadways into LOI investment categories.

Highway Functional Class - LOI differentiates among the following:

- Interstate/Freeway
- Other principal arterials
- Minor arterials - urban
- Minor arterials - rural
- Major collectors
- Urban collectors

Average Daily Traffic - Two different average annual daily traffic (ADT) breakpoints are used, depending on the functional class.

Equivalent Single Axle Loadings - Equivalent single axle loadings (ESALs) during a ten-year period are used to further refine the ADT breakpoints. ESALs serve as a measure of overall truck traffic, to account for significant differences in truck traffic on some Vermont roads which are otherwise similar in classification.

7.4 Investment Categories *(Back to top of page)*

There are three investment categories:

Reconstruction - Applies to those routes or facilities that seek to attain the highest level of mobility and accessibility for the movement of people and goods, while assuring the safety of those who use or reside next to the facility. Includes realignment, relocation, reconstruction, new construction, and major improvements to bring sections of highways or bridges to appropriate Vermont design standards. Types of improvements could include additional lanes, bypasses of town centers or congested locations, operational improvements, and access management strategies. Reconstruction may also include the accommodation of additional modes of transportation via bikeways, sidewalks, paved shoulders, or similar treatment. Reconstruction typically involves the addition of capacity, while rehabilitation projects do not. Reconstruction may also be appropriate to respond to identified safety problems.

Rehabilitation - Involves work on an existing roadway surface or subsurface, or on an existing structure, generally within an established right-of-way (ROW). Under some circumstances minor right-of-way acquisition may be involved. The purpose of rehabilitation projects is to extend the service life of the roadway and/or bridge, provide additional pavement strength, maintain or improve the cross section on existing alignment, increase skid resistance, improve rideability, or enhance safety performance. Examples of rehabilitation improvements include:

- Additional layer(s) of surfacing material to provide additional structural integrity, serviceability, rideability, or skid resistance;
- Work performed on bridge decks, substructure or superstructure elements to render them suitable for additional or extended service;
- Reworking or strengthening the base or subbase via recycling or reworking of existing materials to improve structural integrity, add underdrains, improve shoulders, or widen shoulders;
- Addition of truck climbing lanes, slow-vehicle turn-outs, turning lanes, intersection bypass lanes, or shoulder driving lanes;
- Intersection improvements including signalization and widening; and

The addition or upgrading of safety appurtenances such as guardrail, signing and marking should be considered for inclusion in all projects. Clear zones and drainage should be accommodated to the extent possible without acquisition of additional right-of-way.

Preservation -Sustain as necessary the existing roadway and appurtenances for safe and efficient operation, at the lowest possible capital cost. Certain types of preservation activities may also be appropriate for safety improvements (e.g. improved skid resistant qualities). Mill and fill, seal coats, thin overlays, crack sealing, or other treatments are procedures used to preserve and extend the life of the roadway. Placing membranes on bridge decks is also an example of a preservation treatment. The addition of safety appurtenances such as guardrail, signing, marking, etc. should be included in all projects. Under certain circumstances within an overall system preservation project, rehabilitation improvements may be applied as spot improvements, or in response to specific physical, functional, or safety problems. Additional capacity or realignment would rarely be appropriate on routes designated for preservation.

7.5 LOI Table and Discussion ***(Back to top of page)***

The table shows how the three major factors are used to classify transportation investment into the three investment categories.

Vermont Level of Improvement		Investment Categories		
Functional Class	ADT	Reconstruction	Rehabilitation	Preservation
Interstate/Freeway	all	yes	yes	yes
Other Principal Arterial	all	yes	yes	yes
Urban Minor Arterial	>5,000	yes	yes	yes
Urban Minor Arterial	<5,000	only if ESAL >1.5 million	yes	yes
Rural Minor Arterial	>2,500	yes	yes	yes
Rural Minor Arterial	<2,500	only if ESAL >0.8 million	yes	yes

Major Collector	>2,500	no	yes	yes
Major Collector	<2,500	no	only if ESAL >0.5 million	yes
Urban Collector	all	no	only if ESAL >1.5 million	yes

Discussion of the table

All roads are appropriate candidates for system preservation.

Interstates/Freeways, other principal arterials, and high volume minor arterials in both urban and rural areas are suitable candidates for all three investment categories - reconstruction, rehabilitation, and preservation.

5,000 ADT is used as a breakpoint for urban minor arterials, and 2,500 ADT for major collectors and rural minor arterials. Three different 10-year ESAL levels are also used as breakpoints: 1,500,000 ESALS for urban minor arterials and urban collectors; 800,000 ESALS for rural minor arterials; and 500,000 ESALS for major collectors. The intent of these breakpoints is to separate high-volume roads from low-volume roads in each category, and roads with high levels of truck traffic from those with comparatively low levels.

7.6 Other Factors - Changes to Investment Categories ***(Back to top of page)***

In the vast majority of circumstances, LOI will apply, based on the criteria shown in the table. However, in a small number of instances where unusual conditions apply, investment categories may change, based on a project-specific analysis.

For example, rural major collectors with less than 2,500 ADT and less than 500,000 ESALs are limited to preservation strategies. However, if local land use (for example access to a quarry site) resulted in a high proportion of heavy vehicles, a rehabilitation strategy could be appropriate. Conversely, where a rural major collector with greater than 2,500 ADT closely parallels an interstate highway, preservation may be appropriate even though it is eligible for rehabilitation.

The following criteria apply to investment in unusual conditions:

Continuity - Duplication of function should be avoided: the spacing and relationship of LOI assigned to highways should form a balanced system, ie. closely-spaced parallel highway routes should not be developed to the same level. Isolated segments of highway without logical termini are also undesirable, ie. LOI should be consistent along a given section of route, with changes at sensible locations from a system-wide perspective.

Safety Problems/Accidents - Safety problems, shown by accident experience with a demonstrated relationship to roadway geometry or condition, should receive consideration in the formulation of all project types.

Structural Deterioration - The structural integrity of pavement, bridge, or drainage structures may indicate that rehabilitation may be more appropriate than preservation. In some instances reconstruction may be warranted if it is determined to be more cost effective than rehabilitation.

When upgrading from preservation to rehabilitation, construction on new alignment or with additional capacity is unlikely to be appropriate and will be the chosen alternative only in exceptional circumstances.

Pedestrian/Bicycle Accommodation - State law requires the paving of shoulders where possible in conjunction with other improvement projects. For rehabilitation projects, this consideration should be addressed within the confines of the existing right-of-way.

Land Use - Pre-existing local or regional conditions such as industrial, retail/commercial, or high density residential land use may suggest the need to change the investment category. However, such considerations should be consistent with town and regional plans, consistent with the strategic capital investment policy found in the Long Range Plan, and should not constitute inducement to sprawl or strip development. Requests for this type of consideration should originate and be supported at the town and regional levels.

7.7 Process ***(Back to top of page)***

For "Preservation" projects, an initial determination will be made by the Planning and Programming division. Once the initial determination has been made, the project will be forwarded to the appropriate Agency division for action, via the Secretary's office. The scoping process will not normally be carried forward nor will the project be submitted to the PDT for review.

For "Reconstruction" and "Rehabilitation" projects, determination of acceptable project type will be made during the scoping process, according to the defined categories of functional class, ADT, and ESALs in conjunction with town and regional needs. (If the scoping process determines that "Preservation" is appropriate for a given project, the scoping process will not normally be carried forward from the point where the determination has been made, nor will the project be submitted to the PDT for review: the project will be forwarded via the Secretary's office to the appropriate Agency division for action.)

In the small number of situations where unusual circumstances are thought to apply, the scoping team will evaluate the project in light of the additional factors. Additional information or support for such a determination may be expressed by the affected municipality or regional planning commission. Recommendations will be incorporated as appropriate by the scoping team into the Initial Scoping Report, reviewed by the Project Development Team (PDT), and approved by the Director of Planning.

Final approval of LOI determination will be made by the Agency Secretary. For Preservation projects, this will take place at the time of transmittal of the project to the appropriate Agency division for action. For fully scoped projects, this will be integral with the approval of the final scoping report.

(Back to top of page)

(Back to Table of Contents)

(Back to Project Development Home Page)