

# Table of Contents

**I. Introduction..... 1**

**II. Methodology..... 4**

**III. Workshops..... 6**

**IV. Lincoln Roadway Design Guidelines ..... 7**

    A. General ..... 7

    B. Primary Roadways ..... 7

        Pavement Widths ..... 8

        Pavement Surface ..... 8

        Curbing/Drainage..... 8

        Lateral Clearance..... 9

        Stone Walls ..... 9

        Signage/Striping..... 9

        Cross Section..... 10

        Representative Primary Roadway Example ..... 10

    C. Secondary/Residential Roadways..... 10

        Pavement Widths ..... 11

        Pavement Surface ..... 11

        Drainage ..... 11

        Lateral Clearance..... 11

        Signage/Striping..... 12

        Cross Section..... 12

        Representative Example ..... 12

    D. Low Volume Residential Roadways ..... 12

    E. Specific Design Elements Applicable to All Roadways ..... 13

        Lighting ..... 13

        Traffic Calming ..... 13

        Pavement Surface Traffic Calming Alternatives ..... 14

**Acknowledgement ..... 14**

**Appendices**

- Appendix A Meeting Notes
- Appendix B Guardrail
- Appendix C Crosswalks
- Appendix D Roadway Listing

# Revision Sheet

## Roadway Design Guidelines

### Lincoln, Massachusetts

The Roadway Design Guidelines have been established to have an understanding of the elements of the current roadway network and to develop typical cross sections to serve as guides for future roadway projects. The Guidelines are intended to be a working document that can be revised with policy changes. This revision sheet will document any changes to the Roadway Design Guidelines.

Revision No.	Date	Description
1	February 23, 2000	™ Town Vision Statement (page 2) ™ Bituminous Berm Detail

---

## I. Introduction

In August of 1996, the Town of Lincoln retained Vanasse Hangen Brustlin, Inc. to conduct a Roadway Management Study and to develop Roadway Design Guidelines. The purpose of the study was to identify the condition of the Town's roadway network and project future road conditions, assuming various funding scenarios. By looking at alternative funding levels of annual maintenance improvements, the Town was then able to determine the overall future network conditions of its roadways, e.g., local residential streets, secondary roads, and primary roads. The details of the network level pavement management study are in the companion VHB report: "Roadway Management Study -- Lincoln, MA."

As some of Lincoln's roadway system has deteriorated beyond the point where any type of maintenance activity would be cost affective, some roadways were identified as candidates for reconstruction and major rehabilitation. In the past, previous attempts at roadway rehabilitation and reconstruction to respond to pavement deterioration and safety issues resulted in much local dialogue. While the completed projects address specific pavement and safety needs, they left a final construction that was not in character with the historic nature of the local roadway system of Lincoln. Because of this concern, and in recognition that roadway rehabilitation efforts must be undertaken on the system, the Town retained VHB to conduct a Roadway Guidelines Study in conjunction with the Roadway Management Study. The goal was to determine not only what was required in terms of maintenance options and desirable spending plan, but also to ensure proposed improvements would maintain the character of Lincoln.

This report documents the process undertaken to develop roadway guidelines for the Town. The guidelines present typical cross sections for various types of roadways. These sections are intended to serve as guides for future work on Town roadways, defining elements such as stone walls, roadway width, curbing type, lateral clearances, lighting units, crosswalk type, guardrail, roadside paths, and pedestrian connectivity. The intention is that these elements reflect the character of the town and the desires of the community to maintain that character.

The process undertaken to develop the roadway guidelines in conjunction with the Roadway Management Study consisted of conducting a series of three workshops with a Roadway Planning Committee. The Roadway Planning Committee was made up of representatives from the Board of Selectmen, the executive secretary, the highway superintendent, the planning board, the traffic safety committee and the tree warden. This Committee was supplemented by the pavement engineers, roadway design specialist, and traffic operation engineers experienced in traffic calming from VHB.

Prior to conducting the workshops, VHB, through the pavement management study, assessed existing conditions and documented roadway widths and relative traffic volumes in addition to obtaining information on pavement condition. This information allowed committee members to develop an understanding of roadway network hierarchy or functional classification of streets. A photographic presentation was made of representative roadways within each functional classification during the workshops. The Committee discussed each photo and identified the elements which best represented the character of Lincoln and those which did not. VHB commented on the elements from a structural, safety and service perspective. VHB prepared a summary of those elements which the Committee agreed upon as being representative of the character of Lincoln. (See Appendix A "Meeting Notes") In addition, the Committee also prepared a "vision statement" to guide the future roadway rehabilitation work. That vision statement served as the starting point and the road map for the development of the roadway guidelines. That vision statement is as follows:

Lincoln is a great town that cherishes its rural, agricultural character, its small-town heritage, its open space, and its historical legacy. The Town is committed to:

- ™ Achieving a balance between preserving these values while making reasonable provision for citizens' safety and convenience;
- ™ Fostering economic, racial/ethnic, and age diversity among its citizenry through its educational, housing, and other public policy;
- ™ Excellence in its public educational system, and
- ™ The Town Meeting form of government and the traditions of civic leadership and volunteer public services

Guided by this understanding, we believe that the Town's road system plays a role in sustaining the Town's values and objectives through its transportation and environmental functions. As a transportation network, our roads accommodate multiple pedestrian and vehicular traffic functions while also linking neighborhoods and community facilities. As an environmental network, our roadways are corridors of open space that tie together the many natural and man-made places, which constitutes the town's public image.

Our roads are historic in their alignment and design character, and increased vehicular traffic has caused them to deteriorate. Improvements designed to address current issues must achieve a balance between the multiple requirements of transportation, community linkage, environmental quality, and historic preservation.

Accordingly, we propose the following design guidelines for town roads to guarantee that they reflect the character of the town as they are maintained and reconstructed.

The guidelines should not preclude a critical review of the design elements on a project specific basis, but should provide a foundation for sound engineering decisions. This is particularly true for rehabilitation, restoration and resurfacing type projects where specific elements presented in the guidelines may be unattainable. The following are the guidelines which have been defined for local primary, secondary, and residential streets in Lincoln.

---

## II. Methodology

In August of 1996, the Town of Lincoln retained VHB to conduct a Roadway Management Study. The study consisted of two separate elements. The first was the Pavement Management Study, which determined the condition of each section of paved, town-owned roadways, projected its rate of deterioration based on volume and environmental stresses, and evaluated alternative funding scenarios to address to existing needs in a cost-effective manner, thus reducing the cost of short-lived and expensive, emergency maintenance measures. The purpose of the pavement management portion of the study was to determine needs and identify cost-effective maintenance, rehabilitation and reconstruction projects to address network needs over time.

The development of roadway guidelines was a parallel effort to the pavement management study. The purpose of the roadway guidelines effort was first to understand the elements of the current roadway network which define the character of Lincoln's road system. Secondly, typical cross sections were developed which incorporate those characteristic elements. These cross sections are to serve as guides for the future roadway projects as defined by the pavement management study.

The process undertaken consisted of:

1. Starting the pavement management study to obtain understanding of the existing roadway system.
2. Conducting a series of three workshop meetings with a Roadway Planning Committee. Members of the Roadway Planning Committee were:
  - ↓ Roz Delori -- Selectmen's Representative
  - ↓ Tim Higgins -- Executive Secretary
  - ↓ Vinnie DeAmicis -- Highway Superintendent
  - ↓ Alex MacLean -- Planning Board Representative
  - ↓ Ken Bassett -- Tree Warden
  - ↓ Bob Wolf -- Traffic Committee Representative
3. Presenting the results of the pavement management and the roadway guideline study to the Roadway Planning Committee, selection of a recommended budget to address the town roadway needs, and using the cross sections developed by the Guideline study to assist in the development of project designs.

The following graphic depicts the process and the interaction of the pavement management and guideline development efforts to complete the Roadway Management Study for the Town.

By successfully completing the two elements of the Roadway Management Study the town was able to answer the questions of WHAT needed to be done to address the roadway needs, WHEN it should be done and importantly for the assurance of maintaining the character of the town, HOW it would look when it was completed.

---

### III. Workshops

The first workshop session was held April 30, 1997. The focus of that session was on the major primary roadways in the town as they are most traveled by both residents and through traffic. As such, they are most viewed roadways and have highest speed limit sin the town, zoned at 35 miles per hour. VHB used a series of large, mounted photographic images of portions of this local arterial network to lead a discussion of roadway elements such as pavement width, stone wall construction, striping, signage, lateral clearances to obstructions, distance to roadside paths, guardrail, curbing and drainage options. The intent of the discussion was to identify elements which were felt to be out of character with the Committee's vision for the town roadway system. At the end of the first meeting a consensus was achieved on those roadway elements which should be incorporated in the roadway guidelines for the primary roadways. VHB subsequently researched guardrail treatments for low volume and low speed roadways, options for striping crosswalks, and research on a historic "high hat" lighting unit (the identified standard for roadway lighting). The results of this additional research are included as appendices to this report.

Workshop 2 was held on May 21, 1997 and focused on all the other roadways in town. These roadways are zoned at less than 35 miles per hour and categorized as secondary, residential through or residential dead-end streets. Again, representative photographs of these roadways were used to lead a discussion of the elements which the Committee found most attractive. The first draft of the pavement management study was also presented at the end of this workshop. At the end of the meeting, elements of a typical section for these types of roadways were suggested and a recommended investment plan was selected to address the roadway needs.

Workshop 3 was held on June 11, 1997. The purpose of this final workshop was to discuss the comments on the draft pavement management report and to finalize the elements of the typical cross sections within the roadway guidelines. The meeting notes for the workshops can be found in Appendix A of this report.

The following section presents the results of the discussions which took place at the workshops and defines typical cross sections for local primary and for secondary residential streets in Lincoln.

---

## IV. Lincoln Roadway Design Guidelines

---

### A. General

The visual and functional characteristics of the Lincoln Roadway Systems were identified in the first two workshops. The visual characteristics were classified by the “look and feel” of the roadway. These aesthetic qualities consist of roadside features such as abutting landscapes and stone walls, trees, roadside paths, curbing, etc. Functional characteristics of the roadways were defined by travel speeds and the average daily traffic volumes.

For the purpose of the design guidelines, the roadways have been classified to identify the critical elements that are characteristic of Lincoln’s roadways. The classifications have been blended to complement the intended functionality of the roadways and the desired visual qualities. Lincoln’s roadway network was classified as 1) Primary Roadways consisting of local arterials; and 2) Residential Roadways consisting of secondary, residential through, and residential dead-end streets.

The critical roadway design elements for the two classifications were established during the workshops and consensus was reached for the guidelines for each element. The elements were used to build the roadway cross section for each category. A sample photograph of a Lincoln roadway with the desirable visual characteristics is included as a representative example.

The design guidelines for Lincoln’s Roadways, the Primary and Secondary/Residential, are as follows:

---

### B. Primary Roadways

The Primary Roadways in Lincoln experience the greatest amount of traffic volumes. Primary Roadways provide the greatest opportunity for showcasing the visual experience that is Lincoln. Additionally, there are safety issues to address for higher volumes of vehicles and pedestrian activities. The multi-modal use of these roadways for pedestrians, bicyclists, equestrian riders, and motorists are important features that must be enhanced to provide safe passage and connectivity to various paths and roadways. The Primary Roadways experience traffic volumes greater than 5000 vehicles per day and have average posted speed limit of 30 miles per hour. The Primary Roadways in Lincoln are as follows:

- Bedford Road
- Lincoln Road

- Trapelo Road
- South Great Road (Route 117)
- Concord Road (Route 126)
- Sandy Pond Road (from Baker Bridge Road to Lincoln Road)

As a result of the workshop process, several elements of the Primary Roadways have been identified for incorporation in future projects. This will serve to maintain or enhance the historic visual features and to provide the desired function and safety for vehicles and pedestrians. The critical elements are roadway widths, curbing/drainage, lateral clearance, stone walls, and striping/signage. Following is the summary of the consensus reached during the workshop sessions relative to these roadway elements.

---

## Pavement Widths

Travel Lanes: Two (2) 11-foot lanes; 10-foot lanes through the Historic Center  
Shoulders: Two (2) 1-foot shoulders  
Roadside Paths: Five (5) feet (see “Curbing/Drainage” if clearance from edge of road is less than six feet).

---

## Pavement Surface

Workshop #2 identified the town desire for “rough riding” residential (non-primary) streets to serve as a traffic calming to encourage a self-regulated speeds.

VHB has prepared two surface treatments to address this desire while providing structurally sound and lower maintenance roadways with pothole patched feel. Workshop #3 discussed these treatments.

---

## Curbing/Drainage

Generally, curbing will not be used unless there are site-specific reasons or as defined below:

- Sloped bituminous edging (Cape Cod berm) will be used as needed for containment of roadway runoff.
- Bituminous curbing will be used if the lateral clearance from the edge of road to the edge of a roadside path is less than two (2) feet in areas outside the Historic District.
- Vertical granite curbing will be used if there is no lateral clearance from the edge of road to the edge of a roadside path in the Historic District.
- Sloped granite curbing will be used as required for containment of roadway runoff or for site-specific improvements in the Historic District.

---

## Lateral Clearance

- Minimum clearance for roadside features (trees, walls, utility poles, etc.) is three (3) feet from the edge of pavement to the face of the feature. The three (3) foot clearance is adequate for snow storage.
- Utilities should be placed as the first element off the edge of the roadway, then stone walls, and then pathways.
- Utilities should be placed a uniform distance off the edge of the roadway.
- Roadside paths will preferably be placed behind stone walls and off the right-of-way, visible from the roadway (the paths along Codman Road and Trapelo Road are ideal examples).
- Fences should be out of the right-of-way and back from street layout lines (especially stockade fences) to provide a 225-foot line of sight (sight distance) for 35 mph travel speed.
- Guardrail type will be determined on a project-by-project basis. Guardrail will be used as required for vehicle protection of roadside hazards. See Appendix B for examples of guardrail.

---

## Stone Walls

- Stones will be large, dark-colored and dense, similar to those in New England.
- Stones will be placed loosely, with no sign of mortared joint at the surface. An example of this type of wall is referenced in *Sermons in Stone*, by Susan Alport and referred to as a rubble laid wall (see detail).
- No continuous concrete cap will be used.

---

## Signage/Striping

### State Numbered Primary Roadways:

- Double yellow center striping
- Single white edge (fog) lines
- Crosswalks—use a reflective and high-traction paint (see Appendix C “Crosswalks” for detail)

### Other Primary Roadways:

- Single yellow center striping
- Single white edge (fog) lines
- Crosswalks—use a reflective and high-traction paint (see Appendix C)

### General:

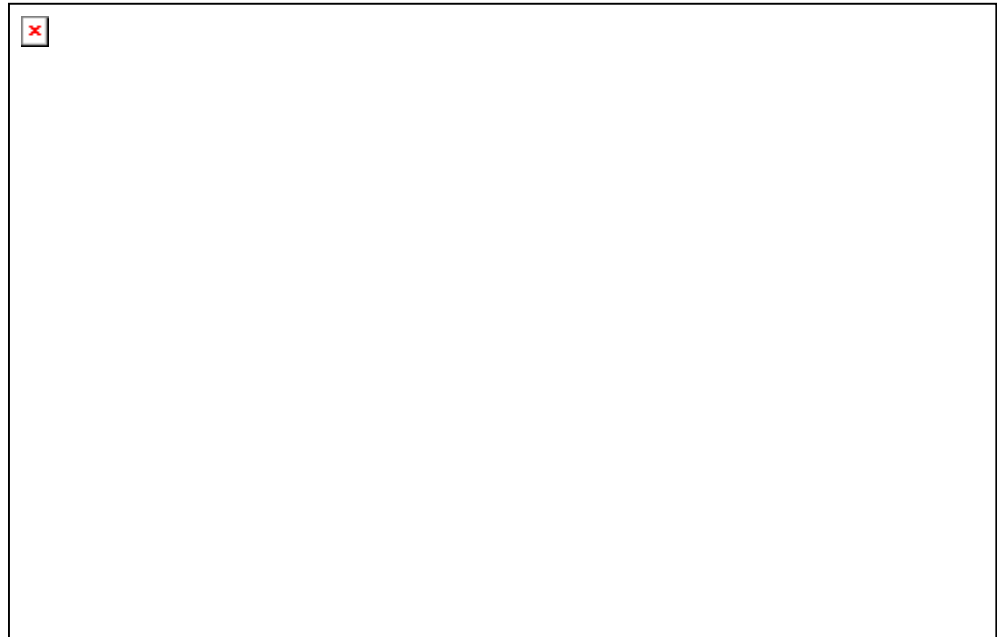
- Sign posts will be green steel.

---

**Cross Section**

See Figure 1 “Primary Roadway Section.”

---

**Representative Primary Roadway Example**

---

**C. Secondary/Residential Roadways**

The Secondary/Residential Roadways in Lincoln are experiencing traffic volumes less than 5000 vehicles per day, with most residential streets less than 1000 vehicles per day. The speed limits are less than 35 miles per hour. This roadway type can be categorized as country residential roadways that highlight the rural feel of Lincoln. These winding roadways often have a deteriorated pavement that controls speed and adds to the visual character. The Secondary/Residential Roadways in Lincoln are as follows:

- |   |   |
|---|---|
| ↗ Baker Bridge Road                                 | ↗ Pierce Hill Road  |
| ↗ Codman Road                                       | ↗ Silver Hill Road  |
| ↗ Lexington Road                                    | ↗ Tower Road  |
| ↗ Old Bedford Road                                  | ↗ Page Road   |
| ↗ Old Sudbury Road                                  | ↗ Weston Road   |
| ↗ Virginia Road (from Old Bedford Road to 700 feet) | ↗ Sandy Pond Road (from Baker Bridge Road to the Concord town line) |

As a result of the workshop process, several elements of the Secondary/Residential Roadways have been identified for incorporation in future projects. This will serve to maintain or enhance the historic visual features and to provide the desired function and safety for vehicles and pedestrians. The critical elements are pavement widths, pavement surface, drainage, lateral clearance, and striping/signage.

---

## Pavement Widths

™ 1,000 to 5,000 vehicles per day:

Travel Lanes: Two (2) 10-foot lanes

Shoulders: No paved shoulders

™ Less than 1,000 vehicles per day:

Maintenance of existing pavement surface only (see next section)

---

## Pavement Surface

Workshop #2 identified the town desire for “rough riding” residential (non-primary) streets to serve as a traffic calming to encourage a self-regulated speed of 25 mph. VHB has prepared two surface treatments to address this desire while providing structurally sound and lower maintenance roadways with pothole-patched feel. Workshop #3 discussed these treatments.

---

## Drainage

- No curbing will be used on the Secondary/Residential Roadways.
- Sloped bituminous edging (Cape Cod berm) will be used as needed for containment of roadway runoff.

---

## Lateral Clearance

- Minimum clearance for roadside features (trees, walls, utility poles, etc.) is three (3) feet from the edge of pavement.
- Roadside paths will preferably be placed behind stone walls and off the right-of-way, visible from the roadway (Codman Road and Trapelo Road paths are ideal examples).
- Existing trees within the minimum 3-foot clear zone will not be removed until they have died. Replacement trees will be located at the 3-foot minimum.
- Fences should be out of the right-of-way and back from street layout lines (especially stockade fences) to provide a 150-foot line of sight (sight distance) for 25 mph travel speeds.

- Guardrail type will be determined on a project by project basis. Guardrail will be used as required for vehicle protection of roadside hazards. See Appendix B for examples of guardrail.

---

## Signage/Striping

Accident history, travel speeds, and the traffic volumes must be considered to determine if striping is necessary. If accidents, speeds, and traffic volumes are low, striping is not recommended. If there are high incidents of accidents or for increased lane definition a single yellow center striping is recommended. For crosswalks, use a reflective, high-traction paint (see Appendix C “Crosswalks” for detail)

---

## Cross Section

See Figure 2, “Secondary/Residential Roadway Section.”

---

## Representative Secondary/Residential Example



---

## D. Low Volume Residential Roadways

During Workshop 2, guidelines for the low-speed/low-volume (less than 1000 vehicles per day) were discussed. It was agreed that these roadways would receive pavement maintenance only. The existing roadways cross section generally will not be modified.

As with the Secondary/Residential Roadways, alternative pavement surface treatments will be considered as a traffic calming technique. The special surface treatment alternatives are discussed in the Pavement Surface Calming Alternatives section.

---

## E. Specific Design Elements Applicable to All Roadways

---

### Lighting

Roadway lighting is generally utilized to increase visibility at critical roadway locations such as intersections, pedestrian use areas, and areas with alignment deficiencies. Also, lighting is used as a crime deterrent.

Roadway lighting is presently used on a limited basis throughout the Town of Lincoln. Because of Lincoln's rural character, lighting will only be considered for replacement of existing lights or for increased safety in isolated cases.

Lighting is warranted for hazardous roadway conditions and areas where pedestrian visibility is a critical safety measure.

- High volume intersections to increase driver visibility and smooth traffic flow
- Intersections with unexpected stop or yield conditions.
- Intersections with pedestrian crosswalks.
- Roadway sections where changes in alignment are not expected or visible.  
Examples include sharp horizontal curves and areas with limited sight distance

### Mounting of Light Fixtures

Lighting fixtures will be mounted on existing utility poles at a maximum height of 24 feet.

### Type of Light Fixture

- Low level lighting similar to existing light fixtures in Lincoln (awaiting results of an ongoing study to determine specific types of low level light fixtures)

---

## Traffic Calming

Traffic calming measures are those design elements that tend to encourage a reduced travel speed or self enforces a travel speed of less than 35 mph. In Lincoln those measures are the reduced lane widths, and consistent lateral clearances to reinforce the 35 mph speed zone on Primary roadways and the 25 mph zone on secondary and

residential streets. Surface treatment is also a means of providing tactile and auditory queues that encourage reduced travel speeds.

---

## Pavement Surface Traffic Calming Alternatives

Traditional calming measures physically alter the geometric of the roadway (i.e., narrowing portions of the roadway over straight sections or placing an island in the center of a busy intersection). Another approach to encourage drivers to travel at slower speeds is to introduce variations into the pavement surface itself. The options that follow alter the pavement surface by applying surface treatments that add texture and a rougher surface, ridges, slight undulations or ripples.

Several surface treatment alternatives will be tested as part of future demonstration projects. These guidelines will be revised accordingly to reflect the preferred alternative.

# Acknowledgments

This project – the conduct of a comprehensive roadway management study and the development of design guidelines for the Town of Lincoln, MA – has been a sustained, iterative, fruitful, and highly successful effort. Along the way, many unique challenges and constraints arose which compelled the project participants to carefully examine a broad range of issues and alternative solutions. VHB project team leaders wish to acknowledge the thoughtful and thought provoking input and feedback provided by the members of the Lincoln Roadway Planning Committee: Rosamond Delori, Selectman’s Representative; Timothy Higgins, Executive Secretary; Vincent DeAmicis, Highway Superintendent; Kenneth Bassett, Tree Warden; Robert Wolf, Traffic Committee Representative; and Alex Maclain, Planning Board Representative.

Further, during this project periodic input was sought from VHB technical specialists on such topics as pavement surface treatment options, traffic calming techniques and roadway lighting alternatives. The VHB project team leaders also wish to recognize their key contributions: Robert Christman, Director of Pavement Services; Pompeo Casale, Senior Transportation Engineer; Heidi Updegraff Richards, Transportation Systems Engineer; Frank Stewart, Engineer; Robert Wyllie, Graphics Specialist; and Charlie Brackett, Transportation Engineer. It has been a pleasure and measure of fun to team with such a well informed and talented group. We look forward to working closely with you all again soon. Thank you.

## VHB Project Team Leaders

James D’Angelo - Principal

Rick Carey - Senior Transportation Engineer

Meryl Ann Mandell - Project Manager

# Appendices



- 
- ™ Appendix A - Meeting Notes
  - ™ Appendix B - Guardrail
  - ™ Appendix C - Crosswalks
  - ™ Appendix D - Roadway Listing

# Appendix A

## Meeting Notes

# Appendix B

## Guardrail

# Appendix C

## Crosswalks

# Appendix D

## Roadway Listing