



## 5 Roadway Construction Standards

### 5.1 General

- A. This Section specifies requirements for a roadway design and construction.
- B. For the purposes of these Standards, streets shall be classified as Local, Collector and Arterial. These classifications are shown in the City Subdivision Rules and Regulations as Residential Access, Residential Subcollector and Primary.
- C. Street design minimum standards for Primary Streets shall conform to the best accepted design practice as recommended by the Institute of Traffic Engineer's Street and Highway Design Manual and the MassDOT Project Development and Design Guide, in consultation with the DPW.
- D. Pavement shall be designed to provide a 20-year life based on soil and traffic conditions. The pavement cross section shall be approved by the City Engineer.
- E. Nothing shall not interfere with the sight distance of the traveled way.
- F. These construction standards need to be met as conditions for acceptance of streets.
- A. As-Built Drawings shall be submitted to the DPW upon completion and acceptance of work.

### 5.2 Roadways

#### 5.2.1 Design

- A. Location, alignment, and street design minimum standards for Residential Subcollector and Residential Access shall conform to the requirements contained in the current edition of the City of Framingham Subdivision Regulations and the following Street Design Minimum Standards.

Street Design Minimum Standards

Characteristic	Street	
	Residential Subcollector	Residential Access
Maximum Grade	6%	8%
Minimum Grade	1%	1%
Maximum Grade of leveling area at approach of Intersections (negative grade required)	2% for 100 feet	2% for 50 feet
Horizontal Alignment: <ul style="list-style-type: none"> <li>• Minimum radius at centerline</li> </ul>	500 feet	200 feet
Vertical Alignment: <ul style="list-style-type: none"> <li>• K - Value</li> </ul>	30 feet per percent Change in grade, 100 feet min.	25 feet per percent Change in grade, 100 feet min.
Width in all Zoning Districts except R-4: <ul style="list-style-type: none"> <li>• Street width (see note 2 below)</li> <li>• Roadway width</li> </ul>	60 feet 28 feet	60 feet 24 feet
Width in all Zoning Districts R-4: <ul style="list-style-type: none"> <li>• Street width (see note 2 below)</li> <li>• Roadway width</li> </ul>	80 feet 26 feet	70 feet 24 feet
Intersections <ul style="list-style-type: none"> <li>• Minimum intersection angle</li> </ul>	70 degrees	70 degrees



<ul style="list-style-type: none"> <li>• Minimum distance between entering streets not Directly opposite each other</li> </ul>	275 feet	275 feet
Minimum radius:	25 feet	20 feet
○ Street sideline	32 feet	27 feet
○ Curb radius	See note 1 below	See note 1below
• Stopping Sight Distance		
Sidewalk Width	5 feet	5 feet
Dead-End Streets		
• Maximum length		500 feet
• Minimum length		225 feet
• Maximum radius of Cul-De-Sac:		
○ Street Sideline Radius		70 feet
• Minimum radius of Cul-De-Sac:		
○ Street Sideline Radius		60 feet
○ Curb Radius		45 feet
○ Island Radius		20 feet

*Note 1. Stopping sight distance, measured 25 feet from the edge of the intersection traveled way, shall be provided. The stopping sight distance requirement shall be calculated using a hypothetical travel speed that is 10 m.p.h greater than the posted or designed speed. A clear sight distance at 3.75 feet above pavement to 0.5 feet above pavement shall be maintained. Landscaping, fencing and other structures may not be sited where they could obstruct the required sight distances or could otherwise jeopardize safety.*

*Note 2. Right-of-way widths in excess of the standard street widths designated in Table 1, above, shall be required where, due to topography, additional width is necessary to provide adequate earth slopes. Such slopes shall not be in excess of four-to-one.*

- B. Property lines at residential street intersections shall be rounded or cut back to provide for a radius of at least 7 feet less than the curb radius.
- C. The maximum grade for cul-de-sacs shall be four percent (4%).
- D. The minimum pavement cross section shall be:
  1. Local Streets: 1.5 inches of Top Course material placed on 2.5 inches of Binder Course material founded on 4 inches of Dense Graded Crushed Stone on 8 inches of Processed Gravel or Dense Graded Crushed Stone. This pavement structure shall be placed on the backfill.
  2. Collector Streets: 2 inches of Top Course material placed on 4 inches of Binder Course material placed in two equal courses founded on 4 inches of Dense Graded Crushed Stone on 8 inches of Processed Gravel or Dense Graded Crushed Stone, with at least 4 inches of natural subbase.
  3. Arterial Streets: 3 inches Modified Top Course material placed in two courses on one 5-inch course of Binder Course material founded on 4 inches of Dense Graded Crushed Stone on 8 inches of Processed Gravel or Dense Graded Crushed Stone with at least 4 inches of natural subbase.

**5.2.2 Clearing (including excavating or stripping poor material)**

- A. All vegetation and debris shall be removed within the Right of Way unless specified by the DPW to remain. Then all muck (peat) and topsoil shall be entirely removed from the Right of Way. All material that does not conform to Special Borrow (MassDOT Standard Spec. M1.02.0) shall be removed to a depth of 16 inches below finish grade. No utilities shall be installed until this requirement is completed.



### 5.2.3 Subgrade

- A. All fill areas within 4 feet of the proposed subgrade shall be filled with Special Borrow except it shall contain no stone larger than 6 inches in greatest dimension and shall be placed and compacted in layers not exceeding 12 inches in depth, compacted measurement.
  - 1. Special borrow for fill shall conform to MassDOT Standard Spec. M1.02.0.
  - 2. Processed gravel for subbase shall conform to MassDOT Standard Spec. M1.03.1.
  - 3. Gravel borrow shall conform to MassDOT Standard Spec. M1.03.0, Type b.
  - 4. Washed crushed stone for subbase shall range in size from  $\frac{3}{4}$  inch to  $1\frac{1}{2}$  inch, conforming to MassDOT Standard Spec. M2.01.4 to M2.01.2 and shall be hard, durable and reasonably free from flat or laminated particles to furnish free draining material.
- B. All cut areas shall be excavated to 16 to 20 inches below finish grade, unless the material meets the standard for Gravel Borrow. Fill areas with a depth 4 feet or greater shall be filled with Special Borrow. All filled areas shall be rough graded and compacted to not less than 95 percent of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T 99, Compaction Test Method C at optimum moisture content.
- C. The subgrade shall be shaped to a true surface conforming to the proposed cross section of the roadway and compacted in accordance with the procedure stated above. All depressions and high spots shall be filled with special borrow or removed and compacted until smooth and satisfactorily compacted. A tolerance of  $\frac{1}{2}$  inch above or below the finish subgrade will be allowed provided that  $\frac{1}{2}$  inch above or below grade is not maintained for a distance longer than 50 feet and that the required grade is maintained in the subgrade. Any portion of the subgrade which is not accessible to a roller shall be compacted with mechanical tampers. The DPW shall approve subgrade construction before sub-base material and pavement is applied.
- D. Before the gravel is spread, the subgrade shall be prepared as noted above and shaped to a true surface conforming to the proposed profile and cross section of the road. Gravel shall be spread and rolled true to lines and grades with an approved three-wheel roller or approved equal, weighing not less than ten (10) tons to yield an 8-inch depth after rolling. All sub-base layers shall be compacted to not less than ninety-five (95) percent of the maximum dry density of the material as determined by the Standard AASHTO T99 compaction test: method C at optimum moisture content. Any depression that appears during or after rolling shall be filled with gravel borrow or dense-graded crushed stone and compact until the surface is true and even. When required by the DPW, samples of the gravel to be used shall be tested for gradation by a sieve analysis and the compacted gravel shall be tested for compaction. All tests shall be paid for by the Contractor.
- E. Dense graded crushed stone shall be placed and compacted to produce a 4-inch layer on top of the gravel sub-base in conformance with MassDOT Standard Spec. Section 402. Dense graded crushed stone for subbase shall conform to MassDOT Standard Spec. M2.01.7.

### 5.2.4 Pavement

- A. Hot Mix Asphalt (HMA) shall conform to MassDOT Standard Section M 3.11.00.
- B. Superpave shall conform to MassDOT Document 00717
- C. The binder course material shall be applied to the prepared sub-base with a  $\frac{3}{8}$ -inch pitch per foot from crown to gutter line. Tack coat shall be required between the binder course and top course as specified in the MassDOT Standard Sections 460 and M3.11.06. Hot Mix Asphalt placement shall conform to MassDOT Standard Section 460.



- D. Pavement shall not be placed on frozen material or when weather conditions predict freezing temperatures. When binder course will be left over winter months, all castings shall be set to surface grade of the binder course of asphalt for the winter season and then reset before the top course of pavement is applied. No permanent asphalt pavement shall be laid after November 15th or before April 1st, unless approved by the DPW.
- E. The setting of granite curbing, the installation of utilities, and any other construction that is required in a street shall be completed before the finish course of bituminous concrete is laid

### 5.2.5 Pavement Markings

- A. To match existing pavement marking applications, pavement markings shall be white or yellow reflectorized thermoplastic, epoxy, or other matching material conforming to MassDOT Standard M7.01. For existing pavement marking applications, pavement markings shall be placed in conformance with MassDOT Standard Section 860
- B. For all new roadway construction, pavement markings shall be white or yellow reflectorized epoxy pavement markings conforming to MassDOT Engineering Directive E-05-003, dated June 16, 2005 and to MassDOT Standard Section 860. New pavement markings shall be placed in conformance with MassDOT Engineering Directive E-05-003, dated June 16, 2005.
- C. Traffic markings must be restored by end of day, either after removal or paving. Temporary markings are allowed.

### 5.2.6 Curbing

- A. Curbing shall be installed in the gutter line of all proposed roadways. Curbing shall be set with a 7-inch reveal.
- B. If constructed in the public right-of-way, the City has standardized on granite curbing. Granite curbing and inlets shall be type VA-4, conforming to the requirements of MassDOT Standard Specifications.
- C. HMA or Bituminous Berm may be used as approved by the DPW. Hot mix asphalt (HMA) curbing shall be type 1, 2, or 3, conforming to the requirements of MassDOT Standard 106.2.0. HMA Berm shall conform to MassDOT Standard Section M3.11.0. HMA Curb shall conform to MassDOT Standard Section M3.12.0. Bituminous Berm shall conform to MassDOT Standard Section 470. Bituminous Curb shall conform to MassDOT Standard Section 501.

## 5.3 Driveways

- A. Driveways and private entrances shall be designed, permitted and constructed to conform to City of Framingham Bylaw (Article VI, Section 8) and MassDOT standards. A plan stamped by a licensed professional engineer is required for commercial and industrial development. The engineer's plan must include calculated safe sight distances in each direction. Construction cannot begin until the plan is approved by the City Engineer.
- B. Residential driveways (not on scenic roads) shall have a minimum width of 12 feet and a maximum width of 20 feet.
- C. Driveway aprons and other sidewalk areas where vehicular traffic may reasonably be expected to occur shall be laid in one course, 6 inches thick, and shall be constructed to the same specifications as sidewalks and meet the proposed sidewalk grades.
- D. Driveways shall be located a minimum of 25 feet from any intersecting street corner radius.



## 5.4 Guard Rail

- A. Guard Rail shall be COR-TEN® with steel or wood posts in conformance with MassDOT Standard M8.07.0. Guard Rail shall be constructed in conformance with MassDOT Standard Section 601. See Construction Details for requirements.

## 5.5 Signs

- A. Proposed sign locations shall be staked in the field for review and approval by the City prior to installation.
- B. Street signs shall use only upper-case white letters with a blue background. Sign dimensions, material, colors, text and post height shall conform to the latest version of the MUTCD.
- C. Traffic signs shall be reflectorized aluminum in conformance with MassDOT Standard Sections 828 and M9.30.0.
- D. Traffic signs shall not be screen printed, with the exception of STOP, YIELD, and DO NOT ENTER signs. All should be of a vandal / graffiti proof type.
- E. Sign orientation to roadway shall follow the latest version of the MUTCD.

## 5.6 Sidewalks

- A. Sidewalks shall be a minimum width of five (5) feet.
- B. Portland Cement Concrete for sidewalks shall conform to the applicable requirements of Section M4 and Section 701 of the MassDOT Standard Specifications. FIBERMESH fibers (100% virgin polypropylene, collated, fibrillated fibers) at a rate of 1.5 lb. per cubic yard of concrete shall be added for reinforcement. Installation shall be per manufacturer's recommendations.
- C. Concrete shall be installed on an 8-inch gravel sub-base prepared in the same manner as for the traveled way with a minimum width of five feet six inches (5'6"). Satisfactory forms shall be installed to assist in securing proper alignment. The concrete walk surface shall be laid in one course to a finished depth of 4 inches. The walk shall have a cross slope of 1.5 percent toward the roadway to provide proper drainage.
- D. Testing of grade shall be done with a 10-foot straight edge placed parallel to the center line of the course; there shall be no deviation from a true surface in excess 1/4 of an inch.
- E. Sidewalks shall be broom finished prior to scoring. The sidewalk slab shall be scored to form 5-foot panels. Traverse preformed expansion joints shall be installed at 30-foot intervals.
- F. Wheelchair ramps shall be 6 inches thick and shall be installed in strict compliance with the current AAB/ADA Rules and Standards. Wheelchair Ramps and brick red Detectable Warning Panels shall be installed in accordance with the "Rules and Regulations of the Architectural Access Board – 521 CMR."
- G. Truncated dome warning panels shall be brick red in color.

## 5.7 Loam and Seed

- A. Side slopes shall be constructed at a maximum slope of 4 feet horizontally to 1 foot vertically (4:1) from the edge of the street side lines to the existing ground surface. Slopes shall be covered with loam, 6 inches in compacted depth, and fertilized, limed and seeded.
- B. The loam grassed areas shall be 6 inches thick. Fertilizer shall be applied to the loam at a rate of 0.2 pounds per square yard and worked into the seed bed with an application of lime, if needed to



achieve the required pH range. As soon as the seed is sown, it shall be covered with a thin layer of loam, rolled and watered. The grass strip shall be seeded at the rate of 3.6 pounds per 100 square yards. Grass shall grow to a satisfactory cover before being accepted by the City.

- C. In locations where erosion is possible, erosion controls shall be in place until the vegetation has substantially rooted. Erosion, gullies and other damage will need to be reseeded as necessary until an adequate growth of grass is achieved
- D. Loam Borrow shall conform to MassDOT Standard Spec. M1.05.0 or shall be the product of a commercial sand and gravel processing facility. It shall be uncontaminated by saltwater, foreign matter, or substances harmful to plant growth. The acidity range of the Loam Borrow shall be pH 5.5 to 7.0.
- E. Fertilizer shall be of a 10-6-4 composition.
- F. Seed composition shall be 60% Red Fescue, 20% Red Top, 20% Kentucky Blue. Seed shall be of the previous year's crop and in no case shall the weed seed content exceed 1% by weight.

## 5.8 Granite Bounds and Monuments

- A. All existing roadway monumentation shall be inventoried and protected. Any and all proposed impacts shall be brought to the attention of the Engineering Division immediately.
- B. The Engineering Division shall be notified immediately if any survey monuments are uncovered, exposed or damaged.
- C. Bounds shall conform to MassDOT Standard Spec.M9/04.8. They shall be 4 feet in length. Granite bounds shall be of sound granite, the top and bottom faces parallel and the front and back shall be straight split. The bounds shall be cut to the dimensions shown on the detail and shall be plain or lettered as indicated on the plans or as directed. The stone shall be pointed on the top and on four sides and for a distance of not less than 6 inches below the top. The top shall be 6 inches square and shall have a drill hole in the center 1.5 inch in depth and 0.5 inch in diameter, with the bottom somewhat flared.
- D. Any damage to roadway monuments prior to acceptance by the City shall be repaired in a manner satisfactory to the DPW and the full cost of such repair shall be paid by the Contractor. Any material used which does not meet the standards of the DPW shall be replaced by the Contractor at no cost to the City. The monumentation shall be replaced, realigned, and/or reset to its intended position and certified as to the correct location by a Massachusetts registered professional land surveyor. All proposed impacts shall immediately be brought to the attention of the Engineering Division. Bounds shall be of granite as directed and shall be set at points designated by the Engineer and in conformity with these specifications. Replacement or new bound installation shall be directly overseen by a Professional Land Surveyor licensed in the Commonwealth of Massachusetts. Surveyor's notes and layout data shall be provided to the Engineering Division.
- E. Bounds shall be set in conformance with MassDOT Standard Specification Section 710. The bounds shall be set at the depth and position as directed, and they shall not project above the ground more than 6 inches after final grading. Bounds located in lawns shall be set with the top of the bound 2 inches below the surface. Bounds located in sidewalks or drives shall be set with the top of the bound flush with the surface. Material for backfilling shall consist of suitable excavated material carefully placed about the bound and thoroughly tamped. When the excavation is in earth not suitable for backfilling, the Contractor shall furnish clean gravel or sand for backfill.
- F. When the bound location falls on solid ledge and the use of a drill steel rod is directed by the Engineer, a 1.5 inch hole shall be drilled to a depth of 18 inches and a drill steel rod as specified under Subsection 710.40 shall be placed in the hole. The rod shall be set so that the hole is on the



bound point. The drill steel rod shall project above the ledge from 1 inch to 2 inches, and shall be grouted with a 1:1 mortar mix.