



# 5 Roadway Construction Standards

## 5.1 Roadway Design

### 5.1.1 General

- A. All plans shall be on 24-inch x 36-inch sheets.
- B. Plan and Profile of sections shall be on separate sheets.
- C. The horizontal scale of the plan and profile shall be the same.
- D. Boring or test pits shall be taken as determined by the DPW. These shall show soil strata and high ground water elevations. Drought conditions shall be noted.
- E. Electric, telephone, cable television and fire alarm cables and ducts shall be placed in the grass strip or sidewalk outside of the traveled way, on the opposite side of the centerline of the street as the water main.
- F. Street light standard locations shall be determined by the DPW and Eversource Electric Company.
- G. DIG SAFE shall be contacted to determine the location of all existing underground utilities prior to any excavation. Call the Framingham Fire Department to mark out their lines.
- H. A note shall be placed on all plans stating "The City of Framingham DPW and Engineering Department shall be notified seventy-two (72) hours in advance of any roadway or municipal service construction. No portion of any utility shall be backfilled until approval for such backfilling is obtained from the DPW. Such approval does not constitute acceptance of such utilities by the City of Framingham."

### 5.1.2 Streets and Roadways

- A. 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.
- B. 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.
- C. Location and alignment shall conform to the requirements contained in the current edition of the City of Framingham Subdivision Regulations.
- D. 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.
- E. The maximum grade for cul-de-sacs shall be four percent (4%).
- F. The pavement cross section 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. 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.
- G. The existing water table shall be located and particular attention given to changes in the present and in the possible future water table caused by the movement of earth and other construction work.

### **5.1.3 Curbing**

- A. Granite curbing shall be type VA-4, conforming to the requirements of MassDOT Standard Specifications.
- B. Hot mix asphalt (HMA) curbing shall be type 1, 2, or 3, conforming to the requirements of MassDOT Standard 106.2.0.

### **5.1.4 Sidewalks**

- A. Sidewalks and wheelchair ramps shall be constructed of Portland cement concrete with fiber mesh or HMA concrete, conforming to the requirements of MassDOT Standard Specifications, with a minimum width of five (5) feet. Wheelchair Ramps (WCR) and brick red Detectable Warning Panels shall be installed in accordance with the "Rules and Regulations of the Architectural Access Board – 521 CMR."

### **5.1.5 Walls or Slopes**

- A. Where walls or slopes must be constructed to properly support the street or adjacent land, such construction must be done in accordance with the specifications set forth in Section 5.2.14.

### **5.1.6 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. Driveways shall be located a minimum of 25 feet from any intersecting street corner radius. For commercial and industrial development, a plan stamped by a licensed professional engineer showing the manner in which the proposed entrance meets these specifications must be submitted to the DPW and approved before such entrance is constructed. The engineer's plan must include calculated safe sight distances in each direction.

### **5.1.7 Protection of Utilities**

- A. A subdivider shall protect all utilities and appurtenances installed under these standards from any and all damage until the ways are accepted by the City. Any damage to these utilities and appurtenances 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 sub-divider. Any material used which does not meet the standards of the DPW shall be replaced by the sub-divider at no cost to the City.



## **5.2 Roadway Materials**

### **5.2.1 Special Borrow**

- A. Special borrow for fill shall conform to MassDOT Standard Spec. M1.02.0.

### **5.2.2 Processed Gravel for Subbase**

- A. Gravel shall conform to MassDOT Standard Spec. M1.03.1.

### **5.2.3 Gravel Borrow**

- A. Gravel shall conform to MassDOT Standard Spec. M1.03.0, Type b.

### **5.2.4 Crushed Stone for Subbase**

- A. Washed crushed stone 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.

### **5.2.5 Dense Graded Crushed Stone for Subbase**

- A. Dense graded crushed stone shall conform to MassDOT Standard Spec. M2.01.7.

### **5.2.6 Loam Borrow**

- A. 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.

### **5.2.7 Fertilizer**

- A. Fertilizer shall be of a 10-6-4 composition.

### **5.2.8 Grass Seed**

- A. 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.

### **5.2.9 Hot Mix Asphalt**

#### **5.2.10 A. Hot Mix Asphalt (HMA) shall conform to MassDOT Standard Section M 3.11.00.Superpave**

- A. Superpave shall conform to MassDOT Document 00717

### **5.2.11 Portland Cement Concrete for Sidewalks**

- A. 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.



### 5.2.12 Granite Curbing

- A. The stones shall conform to MassDOT Standard Spec. M9.04.1 for VA4.

### 5.2.13 Granite Curb Inlets

- A. Curb inlets shall conform to MassDOT Standard Spec. M9.04.5.

### 5.2.14 HMA Berm and Curb

- A. HMA Berm shall conform to MassDOT Standard Section M3.11.0. HMA Curb shall conform to MassDOT Standard Section M3.12.0.

### 5.2.15 Retaining Walls

- A. Walls shall be constructed of cast-in-place, precast reinforced concrete, stone and mortar, or prefabricated block. Prefabricated block retaining walls shall conform to all dimensional requirements as specified by the manufacturer. Methods of concrete construction shall conform to the applicable requirements of Section 901 of the MassDOT Standard Specifications. Cement shall be Portland cement meeting the requirements of ASTM C150. Steel reinforcement shall meet ASTM A615 or A616, whichever is applicable. Reinforcing steel shall be free of rust and dirt. The aggregate shall be crushed stone or screened gravel, and clean hard sand, and shall conform to ASTM C 33 latest revision. Water for concrete shall be clean and free from injurious amounts of mineral and organic substances.

### 5.2.16 Granite Bounds

- A. 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.

### 5.2.17 Guard Rail

- A. Guard Rail shall be COR-TEN® with steel or wood posts in conformance with MassDOT Standard M8.07.0.

### 5.2.18 Pavement Markings

- A. For existing pavement marking applications, pavement markings shall be white or yellow reflectorized thermoplastic, epoxy, or other matching material conforming to MassDOT Standard M7.01.
- 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.

### 5.2.19 Street Signs

- A. 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.



### 5.2.20 Traffic Signs

- A. Traffic Signs shall be reflectorized aluminum in conformance with MassDOT Standard Sections 828 and M9.30.0.
- B. 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.
- C. Sign orientation to roadway shall follow the latest version of the MUTCD.

### 5.2.21 Dust Control

- A. Dust control may be required by the City. The process shall consist of the application of calcium chloride per the approval of the City, to be measured in specified amounts (gallons per square yard for liquid form and pounds per square yard for flake form). The contractor may be required to furnish sprinkler trucks or hoses to wet down surfaces in lieu of applying calcium chloride, if approved in advance by the DPW.

### 5.2.22 Handholes

- A. Handholes shall have minimum internal dimensions of 36 inches length and 36 inches width and internal depth of 24 inches unless otherwise approved by DPW. Handholes shall be designed to meet ASTM C-858 and ACI 318 with AASHTO HS-20 highway loading. Handholes shall be of Quazite® polymer concrete or equal. Handholes shall have 5,000 psi strength after 28 days. Reinforcing steel shall meet ASTM A-615 grade 60 with a minimum of 1-inch of cover provided. Handholes shall be provided with 12-inch by 18-inch knockouts as required.

### 5.2.23 Handhole Frame and Covers

- A. Handhole frame and covers shall be cast iron conforming to the details shown on the drawings. Cast Iron shall be minimum Class 25 conforming to ASTM A48 and as follows:
  - 1. Castings shall be free from scale, lumps, blisters, and sand holes.
  - 2. Frames and covers shall be of cast iron with diamond cover surface design. Machine contract surfaces to prevent rocking.
  - 3. Thoroughly clean and hammer inspect.
  - 4. Capable of meeting or exceeding AASHTO HS-20 loading unless otherwise indicated or specified.
  - 5. Handhole frames and covers include the words "TOF COMMUNICATIONS" written on their tops. Handhole frames and covers shall be East Jordan (EJ) Iron Works catalog no. 8047 with bolted gasketed cover, or equal.

### 5.2.24 Manhole Frame and Covers

- A. Manholes shall have minimum internal dimensions of 36 inches length and 36 inches width and maximum internal depth of 24 inches unless otherwise approved by DPW. Manholes shall be designed to meet ASTM C-858 and ACI 318 with AASHTO HS-20 highway loading. Concrete shall have 5,000 psi strength after 28 days. Reinforcing steel shall meet ASTM A-615 grade 60 with a minimum of 1-inch of cover provided. Handholes shall be provided with 5" knockouts as shown on the drawings and as required.
- B. Manhole? frame and covers shall be cast iron conforming to the details shown on the drawings. Cast Iron shall be minimum Class 25 conforming to ASTM A48 and as follows:



1. Castings shall be free from scale, lumps, blisters, and sand holes.
2. Frames and covers shall be of cast iron with diamond cover surface design. Machine contract surfaces to prevent rocking.
3. Thoroughly clean and hammer inspect.
4. Capable of meeting or exceeding AASHTO HS-20 loading unless otherwise indicated or specified.
5. Manhole frames and covers shall have the words "COF COMMUNICATIONS" written on their tops. Manhole frames and covers shall be East Jordan Iron Works catalog no. 8047 with bolted gasketed cover, or equal.

## 5.3 Roadway Execution

### 5.3.1 General Conditions

- A. Work within public roadways is not permitted between November 15 and April 1, unless special approval is granted by the DPW.  

All street, sidewalk, sewer, water and drain construction and all materials used in such work shall conform to all requirements of the MassDOT Standard Specifications, except as superseded by the City of Framingham standards. All work and materials shall be subject to the inspection and final approval of the DPW.
- B. Clearing of street locations and major changes in the grading of land and streets brought to rough grade with proper compaction shall be completed before the installation of utilities and before the finished street is begun.
- C. 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.
- D. New roadways shall be constructed in conformance with the plans approved by the Planning Board.
- E. Where a subdivision road under construction connects to a public way, a dirt trap shall be constructed, to meet the requirements set forth in the National Pollutant Discharge Elimination Construction Permit requirements. The trap shall be the width of the proposed street, at least 15 feet in length and filled with 6 inches of 2-inch crushed stone. Regular maintenance to remove trapped dirt and to replace stone shall be provided to keep the public way clean.

### 5.3.2 Procedure

- A. It is assumed that under normal conditions work will proceed in accordance with the following schedule. Major shifts in the schedule must be approved by the DPW or their designate. Each step must be approved by the Public Works inspector on the job.
  - a. Clearing and cleaning, including excavating or stripping poor material.
  - b. Earthwork, including necessary cuts and fills.
  - c. Installation of sewer mains.
  - d. Installations of water mains.
  - e. Test water and sewer mains.



- f. Installation of drainage system.
- g. Installation of other underground utilities.
- h. Installation of road sub-drain where conditions warrant.
- i. Installation of sewer services.
- j. Installation of water services.
- k. Preparation of sub-grade surface.
- l. Gravel and dense graded crushed stone approved by City Engineer
- m. Application of gravel and dense graded crushed stone on approved sub-grade.
- n. Compaction testing.
- o. Certification of sub-base grades by Professional Engineer or Surveyor.
- p. Application of roadway binder courses.
- q. Installation of curbing.
- r. Application of gravel in sidewalks.
- s. Slope grading and wall construction.
- t. Regulatory and street signs
- u. Construction of sidewalks.
- v. Guard rails (if required)
- w. Application of asphalt concrete top course for roadway.
- x. Pavement markings
- y. Installation of stone bounds.
- z. Application of loam and seed for lawns and slopes.
- aa. Installation of street lights and street trees.
- bb. Restoration of the public ways as required by the DPW.

### **5.3.3 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.

### **5.3.4 Preparation of 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.

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.

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 1/2 inch above or below the finish subgrade will be allowed provided that 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.

### **5.3.5 Gravel Sub-base**

- A. 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 developer.

### **5.3.6 Dense Graded Crushed Stone**

- A. 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.

### **5.3.7 Hot Mix Asphalt Roadways**

- A. The binder course material shall be applied to the prepared sub-base with a 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. In no case shall any hot mix asphalt be laid until the sub-base has been inspected and approved. Hot Mix Asphalt placement shall conform to MassDOT Standard Section 460. 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.

### **5.3.8 Sidewalks and Driveway Aprons**

- A. 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 cement 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. 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.





- B. In no case shall sidewalks and aprons be laid until the gravel sub-base has been inspected and approved. The City of Framingham DPW shall be notified at least 24 hours prior to any planned sidewalk concrete pour to allow inspection of the gravel sub-base. 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. Sidewalks shall be broom finished prior to scoring. The sidewalk slab shall be scored to form 5-foot panels. Sidewalks shall be 5 feet wide. Traverse preformed expansion joints shall be installed at 30-foot intervals.
- C. Wheelchair ramps shall be 6 inches thick and shall be installed in strict compliance with the current AAB/ADA Rules and Standards.
- D. The loam in the grass strip 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. In locations where erosion is possible, erosion controls shall be in place until the vegetation has substantially rooted (see Section 1.4 for Erosion Control requirements).
- E. Truncated dome warning panels shall be brick red in color.

### 5.3.9 Granite Curbing

- A. Granite curbing shall be installed in the gutter line of all proposed roadways. Curbing shall be set with a 7-inch reveal. Granite Curb Inlets shall be installed at all catch basins. Granite curb and inlets shall be constructed in conformance with MassDOT Standard Specification Section 501, except that cement concrete shall be placed beneath the center section of each curbstone and as backfill in front and behind the curb.
- B. Bituminous Berm shall conform to MassDOT Standard Section 470. Bituminous Curb shall conform to MassDOT Standard Section 501.

### 5.3.10 Retaining Walls

- A. Walls shall be constructed in accordance with Section 5.2.14 in locations designated by the DPW if, in its opinion, such retaining walls are necessary for the public interest and safety, and the protection of abutters and the general public. All retaining walls shall be constructed outside the street lines and shall not interfere with the sight distance of the traveled way. Prefabricated retaining walls shall be constructed in accordance with the manufacturer's specifications. Retaining walls greater than 4 feet in height shall require review and approval of the design by the City Engineer.

### 5.3.11 Slopes

- 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 as described in Section 5.3.8.D. The slopes shall be maintained to repair erosion, gullies and other damage and reseeded as necessary until an adequate growth of grass is achieved.

### 5.3.12 Granite Bounds

- A. An inventory of all existing roadway monumentation shall be taken. All existing roadway monumentation shall remain and be protected. 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.

- B. 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.
- C. 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.

### **5.3.13 Guard Rail**

- A. Guard Rail shall be constructed in conformance with MassDOT Standard Section 601. See Construction Details for requirements.

### **5.3.14 Pavement Markings**

- A. 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 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.

### **5.3.15 Traffic Signs**

- A. Proposed sign locations shall be staked in the field for review and approval by the City prior to installation.

### **5.3.16 Street Signs**

- A. Proposed sign locations shall be staked in the field for review and approval by the City prior to installation.

### **5.3.17 Inspections**

- A. Each step in the construction process shall be inspected and approved by the DPW before the next step shall begin.



### 5.3.18 Handhole Installation

- A. Handholes shall be set on 12-inches of crushed stone bedding and set level. Top of frame on handholes shall set even with finished grade.
- B. Handhole frames shall be set with tops conforming accurately to grade of pavement or finished ground surface or as indicated on drawings. Frames shall be set concentric with top of handhole and on a minimum of 2 courses of red brick and mortar bedding. A full bed of mortar shall be placed so that the space between the top of the brick and mortar and the bottom flange of the frame shall be completely filled and made watertight. Frame shall be grouted as needed to have a smooth transition between the frame and the concrete handhole. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the flange.

## 5.4 References

- A. All materials and execution shall conform to the highest applicable standards. If there is a conflict between other standards, or between other standards and these Design standards, then the most stringent criteria shall be used.
- B. These standards draw and refer to the *Commonwealth of Massachusetts - Massachusetts Highway Department: Standard Specifications for Highways and Bridges* (1995 et seq.) and the *Commonwealth of Massachusetts - Massachusetts Highway Department: Construction and Traffic Standard Details* (1996 et seq.). These two documents are referred to collectively as the MassDOT Standards. In addition to the MassDOT Standards, the City references AASHTO, and ASTM as guidance for the materials and execution of work performed on the City Roadway Infrastructure. The following summarizes select standards applicable to the sections in these Design Standards. This list is not exclusive; other standards may apply. The latest revision of each standard shall be referenced.

| <u>Standard</u> | <u>Title/Subject</u>   |
|-----------------|--|
| AAB             | Architectural Access Board   |
| ADA             | Americans with Disabilities Act  |
| MUTCD           | Manual on Uniform Traffic Control Devices  |
| NA              | Massachusetts Department of Transportation: Standard Specifications for Highways and Bridges   |
| NA              | Massachusetts Department of Transportation: Construction and Traffic Standard Details (1996 et seq.)                                   |
| 521 CMR         | Rules and Regulations of the Architectural Access Board  |
| AASHTO T 99     | Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5-lb Rammer and a 12-in. Drop (Compaction Test Method C) |
| ASTM A615       | Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement   |
| ASTM A616       | Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.  |
| ASTM C33        | Standard Specification for Concrete Aggregates   |
| ASTM C150       | Standard Specification for Portland Cement   |