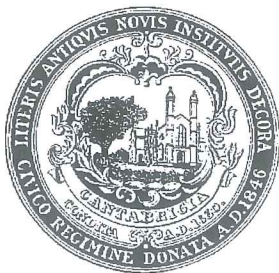


File No 7343

Project Manual

**CHAPTER 90 CONTRACT 20: Massachusetts Avenue,
Richard Avenue, Muller Avenue and Hurlbut Street**



THE WORKS
CAMBRIDGE
DEPARTMENT
OF PUBLIC

**CITY OF CAMBRIDGE
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
JULY 2016**

3. COORDINATION

The Contractor shall designate a contact person and furnish relevant telephone numbers for use by the Cambridge Department of Public Works (DPW) during work hours and during job related emergencies throughout the duration of the contract. In case of an emergency contact after work hours, the Contractor shall respond within one hour to (617) 349-4860/4862 and shall be present, if necessary, at the job-site within three hours of initial contact.

The Contractor shall have a working foreperson on the job site at all times during construction. Names of the Contractor's contact people shall be given to the City prior to start of construction.

The contractor shall provide all on-site communication, including telephones (cell phones). The contractor shall provide two (2) SMART PHONES (Samsung Galaxy S7, Apple Iphone 6s or better) cellular telephones with a minimum of 32gb of internal storage and cellular service (unlimited Voice and Data). Service and software package shall be capable of receiving and responding to City of Cambridge email server wirelessly (Microsoft Exchange Server). The phones must have the capabilities to be used as a wireless hot spot and has a data plan that will support unlimited use. Contractor shall pay all associated fees including and required support services, for the life of the contract.

These items shall be turned over to the Public Works representative prior to the beginning of construction.

4. WORK HOURS

Work hours shall be 7:00 a.m. through 4:00 p.m. Monday through Friday only (except as noted below). No weekend or holiday work shall be allowed except during emergencies and as noted herein.

A list of the City holidays will be supplied by the City upon the awarding of the contract.

The Massachusetts Avenue portion of this contract is part of the MassDOT Complete Streets program. As a required of this program \$250,000 worth of work, including paving, sidewalk, signage and drainage, must be completed and invoiced to the City of Cambridge no later than May 30, 2017. This work cannot commence prior to the City receiving the approval of the Complete Street Grants by MassDOT. The City will notify the Contractor upon approval of the grant and any additional requirements that may arise. If the contractor fails to meet the May 30, 2017 deadline the contractor will be required to pay a \$250,000.00 penalty.

Work on Muller Ave. shall not commence before the start of the 2018 spring construction season. Eversource Gas will be replacing the main and services on Muller Ave. during the 2017 construction season. Close coordination with Eversource gas will be required.

ITEM 102.5

TREE PROTECTION AND MAINTENANCE

EACH

DESCRIPTION

The work to be done under this Item consists of instituting and maintaining positive measures to protect and maintain public and private shade trees within and adjacent to the limits of work.

Public trees are protected by Massachusetts state law, Chapter 87. Section 12 states that a fine of up to five hundred dollars, (\$500.00) per incident of damage to public shade trees can be levied. Each branch broken or improperly pruned, each improper wounding of the trunks of the trees, and each root improperly pruned shall constitute an infraction. Section 12 further provides that anyone who negligently or willfully damages a tree will be liable to the City for all damages.

The Contractor shall take the utmost care to avoid unauthorized, unnecessary or improper wounding of public or private shade trees. Prior to construction, the Contractor shall provide a tree protection and maintenance plan and work schedule. A Massachusetts or International Certified Arborist shall be sub-contracted by the Contractor to provide a protection and maintenance plan and perform specified work. *All plans and schedules shall be subject to review and approval by the City Tree Warden.* **Infraction of Massachusetts state law Chapter 87 or failure to provide a protection plan and work schedule will result in fines or the immediate cancellation of the contract.**

CONSTRUCTION METHODS

Tree protection and maintenance measures shall include the following:

1. Erect and maintain temporary rigid fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. At sidewalk tree pits, the entire perimeter of the tree pit shall be fenced. At a minimum, and only if the Engineer determines that the preceding measures are not feasible, wrap the trunks of all trees with a durable material such as two by four lumber sufficient to protect tree trunks from mechanical damage. Remove fence and wrapping when construction is complete.
2. Trucks and heavy equipment shall not pass over or park on roots of public shade trees; nor shall construction materials, debris, or excavated material be stored within drip line of trees or within tree pits. For occasional or one time access over roots, ½-inch plywood overlapped may be used. Permeable materials such as gravel or wood chips shall be placed over root systems of trees which are not covered by hardscape and over which trucks and heavy equipment must travel during construction operations, when such travel is unavoidable, to prevent soil compaction and root damage. Material shall be replaced as needed.
3. During sidewalk construction adjacent to trees, suitable soil shall be maintained within tree wells. Moist soil or mulch shall also be maintained around surface roots outside of tree wells which may become exposed during construction. Such covering shall be placed as soon as possible after roots are exposed. If roots are

going to be exposed for more than one hour, cover roots with damp burlap. Burlap shall be kept moist until most soil and mulch can be used for permanent cover.

4. Traffic control plans shall be designed in such a way as to direct traffic away from tree trunks and branches.
5. Tunneling shall be the preferred method of excavation adjacent to tree roots to avoid root pruning. If root pruning is unavoidable, a certified arborist shall be onsite to execute or oversee the operation with sufficiently sharpened hand tools and in such a fashion as to have minimum negative impact on tree health and safety.
6. Following construction, existing trees within the project area shall be mulched in accordance with the requirements for new trees, as specified in Section 910.
7. All tree protection and maintenance measures and operations shall be subject to review, approval or change by the City Tree Warden.

COMPENSATION

Tree protection will be measured by the unit each, for each tree provided with protective measures as specified herein.

Payment for work under this items will be at the contract unit price per each and shall include full compensation for all labor, materials, disposal, equipment, tools, and any other incidentals necessary for the satisfactory completion of this work as specified, including furnishing, installing, maintaining, and removing drip line or tree pit fencing, tree wrap, and covering exposed roots with moist burlap, mulch, or soil.

ITEM 102.51 TREE TRIMMING

GENERAL:

The work performed under this Item shall conform to the relevant provisions of Section 100 of the Standard Specifications and the following:

Scope of Work

The work shall consist of the provision of all labor, materials, equipment, and transportation required to complete the pruning of City street trees, in strict accordance with the conditions and specifications of these Contract Documents. The work shall include, but is not necessarily limited to the following:

- Initial site visit and assessment with City representatives
- Securing necessary permits and approvals before commencement of work
- Posting work areas for parking restrictions
- Securing police details, if necessary
- Marking work zones for traffic and pedestrian control
- Providing a schedule of work for City review and approval
- Meeting with City staff on a periodic basis
- Visual assessment of each tree to be pruned
- Determination of pruning objectives
- Pruning cuts
- Wound care

- Wood waste and debris consolidation & disposal
- Site cleanup

Equipment

The following equipment and vehicles shall be considered a minimum requirement in order to be considered a responsible bidder under the terms and conditions of these Contract Documents. All gas- powered equipment and vehicles must be five years old or less.

- Two (2) aerial lift trucks with an articulating boom that have a working height of not less than sixty (60) feet. with Contractor's name painted on each side
- Two (2) chipper dump trucks with a minimum capacity of nine (9) cubic yards, with Contractor's name painted on each side
- Two (2) wood chippers with a capacity for 16" diameter limbs
- All relevant traffic control devices as prescribed by the Manual of Uniform Traffic Control Devices (MUTCD) of the U.S. Department of Transportation

Safety Standards

- Tree pruning shall be performed only by certified arborists or arborist trainees who, through related training or on-the-job experience, or both, are familiar with the practices and hazards of arboriculture and the equipment used in such operations.
- One certified arborist (as defined in the section labeled "Quality Requirements," and as identified in the "Statement of Bidder's Qualifications" of these Contract Documents) must be present at all times as the on-site project manager while tree pruning is performed:
- Tree pruning operations shall comply with the American National Standard for Tree Care Operations— Safety Requirements (ANSI Z133.1), as approved by the American National Standards Institute, and published by the National Arborists Association. Operations shall also comply with applicable Occupational Health and Safety Administration (OSHA) standards.

Pruning Objectives

The pruning operation shall focus on the following types of pruning:

- **Cleaning.** Cleaning shall consist of selective pruning to remove one or more of the following parts— dead, diseased, and/or broken branches. All deadwood that is two (2) inches or greater in diameter shall be removed. Branches with splits, large cavities or any defect that may result in failure shall be reduced, or removed to the trunk if reduction is not feasible.
- **Thinning.** Thinning shall consist of selective pruning to reduce density of live branches. Thinning shall result in an even distribution of branches on individual limbs and throughout the crown.
- **Raising.** Raising shall consist of selective pruning to provide vertical clearance. All branches extending lower than fifteen (15) feet above a public roadway and ten (10) feet above a public sidewalk shall be removed.
- **Reducing.** Reduction shall consist of selective pruning to decrease height and/or spread. Consideration shall be given to the ability of a tree species to tolerate this type of pruning. All branches obstructing park signs, street signs, traffic signs, traffic lights, and park or street lighting shall be removed. Branches shall

be pruned away from all houses and buildings a minimum of five (5) feet, or more if appropriate to the tree shape and structure.

- **Specialty (Young Trees).** For young yet established trees, branches that are rubbing or poorly attached shall be removed. A central leader or leaders as appropriate to the species should be developed. A strong, properly spaced scaffold branch structure should be selected. For newly planted trees, pruning shall be limited to cleaning.

Pruning Practices

- A certified arborist (the on-site project manager) shall visually inspect each tree before commencing work.
- If a condition is observed requiring attention beyond the original scope of work, the condition should be reported to the City within 24 hours. Such conditions may include structural weakness, rot or decay that cannot be corrected by cleaning, and dead trees.
- Equipment and work practices that damage living tissue and bark beyond the scope of work shall be avoided. Climbing spurs shall not be used when climbing and pruning trees.
- Pruning tools (e.g. chain saws, pole saws, hand saws, pole pruners, etc.) shall be sharp and regularly sharpened and maintained throughout the Contract Term.
- Not more than 25% of the foliage of an individual tree should be removed within an annual growing season. The percentage and distribution of foliage to be removed shall vary according to the tree species, age, health and site, in accordance with the types of pruning identified above.
- Not more than 25% of the foliage of a branch or limb shall be removed when it is cut back to a lateral. The lateral shall be large enough to assume apical dominance.
- Heading shall be permitted only by the expressed permission of the City, when needed to reach a defined objective.
- Topping and lion tailing shall be considered unacceptable pruning practices.
- All pruning cuts shall be made in accordance with the American National Standard for Tree Care Operations—Standard Practices (ANSI A300 Part 1), as approved by the American National Standards Institute, and published by the National Arborists Association (revised 2001). All terminology included in these Technical Specifications shall be defined by ANSI A300 Part 1.
- When tracing wounds, only loose, damaged tissue should be removed. No other wound treatments shall be used.

Wood Waste & Debris Consolidation/Site Cleanup

- Tree branches shall be removed in such a manner so as not to cause damage to other parts of the tree, or to surrounding people and property. Where necessary, ropes or other equipment shall be used to lower large branches to the ground.

Wood Waste & Debris Consolidation/Site Cleanup (cont.)

- All severed limbs shall be chipped, hauled away from the site, and disposed of in a legal manner. All wood waste, sawdust, leaves, and associated organic debris shall be collected from both public ways and adjacent private property, hauled away from the site, and disposed of in a legal manner.
- Site cleanup shall follow as closely as possible to the pruning operation.
- Under no circumstances shall any litter or debris be blown, swept or raked onto an adjacent street, gutter, or into a catch basin.

Inspection, Remedies, and Acceptance

The City shall inspect the sites within the scope of work of these Contract Documents on each day that the Contractor performs work there. The City shall inform the Contractor's on-site project manager, and inform the Contractor in writing if necessary, of any deficiencies in the work. The Contractor and the City shall agree on a timetable for the remedy of any deficiencies. Upon completion of the remedies, and after another inspection of the site, the City shall notify the Contractor of the City's acceptance of the work. The Contractor shall not invoice the City for any work that has not been accepted by the City. (Note: please refer to the sections entitled "Payments" and "Schedule of Values" in the General Conditions of these Contract Documents.)

COMPENSATION

Payment shall be at the Contract bid unit price for each tree pruning, including all materials, labor, barrier and equipment required to complete the work.

ITEM 120.1

UNCLASSIFIED EXCAVATION

CUBIC YARD

Work to be done under this item shall conform to the relevant provisions of Section 120 of the Standard Specifications and to the following:

The work shall consist of the excavation of all materials encountered within the limits of the contract beyond those materials specifically classified and paid for under other items of this contract. Excavation for sidewalk and pedestrian ramp installation, including areas where any of these installations are to be located in present roadway areas, shall be considered incidental to the appropriate sidewalk or ramp items.

Excavation of existing hot mix asphalt, brick and concrete pavements as required for full-depth roadway construction or patching; and for removing existing materials in areas of proposed lawn areas shall also be paid for under this item. (Note: Excavation required for isolated tree planting in pits will not be measured as part of this Item - see Item 775).

CONSTRUCTION METHODS

Any streetcar track encountered shall be removed where directed. Track, as called for in this item, shall consist of the pair of parallel streetcar rails, ties, track and fastenings, frogs, switches and any other appurtenances that could be considered part of the track system.

The Contractor shall exercise special care when excavating near trees. When major roots are in the way, the Contractor shall go under or between them. In no case shall the Contractor disturb the root structure of the trees without direction from the City Arborist. Exposed roots shall be covered promptly.

The Contractor shall perform work in such a manner to minimize dust and utilize dust control techniques when necessary or as directed by the Engineer.

At the discretion of the Engineer, de-watering (pumping) may be required during trench excavation and the prosecution of the work. If such is the case, the Contractor shall obtain a dewatering permit from the City, United States EPA, or Massachusetts Water Resources Authority, as required, and water shall be discharged to a location accepted in advance by the Engineer.

All trench excavations shall strictly adhere to the latest OSHA requirements. Temporary trench support, in compliance with OSHA, required to excavate to a depth to prosecute the work shall along with the proper support of all existing utilities be the responsibility of the Contractor.

COMPENSATION

Unclassified Excavation will be measured for payment as specified in Section 120 of the Standard Specifications and the following:

Payment for work under this item will be at the contract unit price per cubic yard and shall include full compensation for saw-cutting, labor, materials, equipment, tools, disposal of construction debris (concrete, brick, asphalt, etc.) dust control and any other incidentals necessary for the satisfactory completion of this work as specified.

Payment for removal and disposal of streetcar track shall be made as follows:

1. If rails and ties exist, payment for removal of rails and ties and disposal of rails shall be made at one and one-half (1-1/2) times the contract unit price bid per cubic yard for Item 120.1. Measurement for depth shall be from the top of rail to bottom of tie, and width shall be to the outside limits of the tie. Length shall be along the centerline of the track.
2. If only ties exist, payment for removal shall be made at one and one-quarter (1-1/4) times the contract unit price bid per cubic yard for Item 120.1. Measurement for depth shall be from top of tie to bottom of tie, and width shall be to the outside limits of the tie. Length shall be along the centerline of the track. Disposal of RR ties will be paid for separately.

NOTES ON EXCLUSIONS: Disposal of excavated soil is not included for payment under this item and shall be paid for separately. Excavation which is specified as incidental to other items, including sidewalks other than porous asphalt sidewalks, ramps, and utility systems, will not be paid for under Item 120.1. **Excavation of existing pavements of all types (brick, asphalt, concrete) will not be paid for separately. Disposal of RailRoad ties will be paid for separately under 129.6.**

NOTE FOR ITEMS 125.1 THROUGH 126.99

A minimum unit bid cost has been established for the unit price bid items 125.1 through 126.11. The Contractor is directed to review the minimum unit bid prices and increase them within the FORMS FOR GENERAL BID as the Contractor sees fit. The Contractor is not obligated to accept the minimum unit prices indicated but shall not reduce them. The minimum unit prices established may be below actual market costs and are provided to avoid unbalanced bidding. The Contractor is directed to review the minimum unit prices presented and develop competitive unit prices for inclusion in the FORMS FOR GENERAL BID. Any bids received which do not

Payment for work under this item shall be at the contract unit price per foot and shall include full compensation for all labor, equipment, tools, sawcutting, excavation, removal, transporting and disposal, and any other incidentals necessary for the satisfactory completion of this work as specified.

ITEM 700.1	MASS. AVE. 4 INCH CEMENT CONCRETE SIDEWALK	SQUARE YARD
ITEM 700.2	MASS. AVE. 6 INCH CEMENT CONCRETE SIDEWALKS (DRIVEWAYS AND INTERSECTIONS)	SQUARE YARD
ITEM 700.3	MASS. AVE. CEMENT CONCRETE PEDESTRIAN RAMP	SQUARE YARD
ITEM 701	4 INCH CEMENT CONCRETE SIDEWALK	SQUARE YARD
ITEM 701.1	6 INCH CEMENT CONCRETE SIDEWALKS (DRIVEWAYS AND INTERSECTIONS)	SQUARE YARD
ITEM 701.2	CEMENT CONCRETE PEDESTRIAN RAMP	SQUARE YARD
ITEM 701.28	DETECTABLE TILE –CAST IRON	SQUARE YARD
ITEM 702	HOT MIX ASPHALT WALK SURFACE	TON

Work to be done under these items shall conform to the relevant provisions of Section 701 of the Standard Specifications and to the following:

MATERIALS

Concrete: Concrete for sidewalks shall conform to the Standard Specifications, M4.02.00 through M4.02.12 and be 4000 PSI at 28 day test, 3/4 inch coarse aggregate, 610 pounds cement per cubic yard, 7% air entrained (AASHTO - M154), Type A water reducing admixture (AASHTO - M194), 3 to 4 inch slump, and Type II dark-colored by adding 1-1/2 to 2 lbs. of lamp black per cubic yard at the plant.

The concrete shall contain 1 pound of 100% polypropylene microfiber per cubic yard. Fiber shall be added during batching at the plant to insure uniform distribution. The micro-fiber shall be W.R. Grace micro-fiber or equal and shall be used in accordance with the supplier's specifications.

Hot Mix Asphalt: Conform to Section 701 of the Standard Specifications. Sidewalk section shall be 2 1/2" of hot mix asphalt (after compaction); over 8 inches of gravel base.

Cast Iron Detectable Tile:

The detectable warning strip at concrete pedestrian ramps, raised side street treatments abutting concrete sidewalks, and raised crosswalks abutting concrete sidewalks shall be the Cast Iron Detectable Warning Plates by East Jordan Iron Works (800-626-4653) or approved equivalent product. The Cast Iron Detectable Plate shall meet all ADA Accessibility Guidelines for Detectable Warnings. Plates should have truncated domes and a slip resistant texture with a coefficient of friction rating greater than 0.80. Warning panels shall be at least 24" deep and 60" wide at the point of crossing.

Size: 24 in. (+/- 1") deep, cut as wide as the pedestrian ramp opening, and as wide of the crosswalk at raised side street treatments and raised crosswalks.

CONSTRUCTION METHODS

These items shall include excavation and disposal of the existing material and the fine grading and compaction of the sub-base prior to placement of concrete or asphalt. A jack hammer or saw cut shall be used at the beginning of each excavation and at all "back-of-sidewalk" limits in order to avoid damage to abutting properties and features which are to remain.

If the existing material is unsuitable or more material is needed for sub-base, additional material shall be installed and paid for under Item 151 Gravel Borrow as directed by the Engineer. If the existing material is brick, the City reserves the right to direct the Contractor to deliver the bricks to a specified site within the City at no additional cost.

In areas where sidewalks are to be constructed in present roadway areas, the full depth of existing asphalt pavement shall be completely removed. Excavation of existing hot mix asphalt, brick and concrete pavements as required for the work of this section is included under these items.

Where new sidewalk abuts existing-to-remain sidewalk, the limit of work shall be established at the existing nearest existing contraction or expansion joint, where a neat sawcut shall be provided.

The Contractor shall exercise special care when excavating near trees. When major roots are in the way, the Contractor shall go under or between them. In no case shall the Contractor disturb the root structure of the trees without direction from the City Arborist. Exposed roots shall be covered promptly. Excavation of all tree wells shall be done entirely by hand.

All existing traffic signs within the limit of work shall be removed and delivered to the Cambridge Traffic Department, and all existing sign posts shall be removed and properly disposed of by the Contractor. This work shall be incidental to the various sidewalk items.

New traffic and street name sign posts, including new bases, shall be installed and paid for under Items 847.1 and 874. The work shall be sequenced such that regulatory sign messages shall be continuously maintained throughout construction.

The sub-base shall be prepared at the appropriate elevation for the depth of concrete or asphalt to be installed. The sub-base shall be graded to follow the proposed sidewalk elevations shown on the Drawings. At locations where no proposed grades are indicated, the sub-base shall be graded to allow for sidewalks to be sloped from the City right of way towards the street at 1/8 inch to the foot, or as directed by the Engineer.

The Contractor shall raise all water curb stop boxes to final grade and coordinate raising of other public and private utility boxes prior to pouring of concrete or placing of asphalt. The Contractor shall remove material from curb stop boxes with compressed air, after raising is complete and prior to pouring of concrete or placement of asphalt. Prior to pouring the concrete or placing the asphalt, the Contractor shall go over locations where curb boxes have been raised with the Engineer.

Proper compaction shall be obtained by means of plate-type mechanical compactors. The material shall be compacted to ninety-five percent (95%) of the maximum dry density at optimum moisture content as determined by the AASHTO Standard Method of Test T99 Method C.

Installation of Concrete: Concrete shall be installed to a depth of 6" at pedestrian ramps, across driveways, at street intersection corners (5' beyond the point of tangency on either side of the corner curve), and at other locations as directed by the Engineer. At all other locations, concrete shall be installed to a depth of 4".

Concrete sidewalks shall be placed between April 1st (pending no upcoming snow storms) and November 1st only. Ambient temperature shall be 40 degree or more.

Finishing shall be as specified in Subsection 701.61B of the Standard Specifications. Curing shall be as specified in Section 476.71 of the Standard Specifications. Contractor shall propose curing method for review prior to starting. Any curing compound shall not discolor the concrete, shall be compatible with linseed oil application after 28 days, and shall be applied according to the manufacturer's specifications. The mixture shall be applied immediately after the finishing is complete and free water has left the concrete's surface. The Contractor shall provide the Engineer with the curing compound specification prior to its use.

Expansion joints and saw cuts for Item 701.10, at the Demonstration Block, shall be located as indicated on the plans and as detailed. Saw-cutting shall be performed in a timely manner as to avoid fractures and splinters. Note sample section of Demonstration Block Sidewalk is required for review and approval. Expansion joints and saw cuts for Item 701.10, at the Demonstration Block, shall be located as indicated on the plans and as detailed. Saw-cutting shall be performed in a timely manner as to avoid fractures and splinters. Note sample section of Demonstration Block Sidewalk is required for review and approval.

Expansion joints shall be placed every 30 feet. Expansion joints shall also be placed around all appurtenances such as utility poles, hydrants, manholes, and other obstructions extending into and through the sidewalk. Expansion joints installed around utilities shall be 3/8" foam expansion joint polyethylene at a depth to match the adjacent sidewalk (4" or 6"). It is also required that an expansion joint of 1/4" thick foam at 4" or 6" deep is placed longitudinally along the granite curb between curb and the concrete; and also between buildings or retaining walls and the concrete sidewalk as directed by the Engineer. Six-inch expansion joints shall be placed at all locations where six-inch concrete corner slabs or driveways meet four inch concrete walks.

Expansion material protruding above the finished sidewalk shall be trimmed flush with a sharp instrument as soon as the concrete has set.

Between the expansion joints at 30 foot spacing, the sidewalk shall be divided at 5 foot intervals with score joints, made with creasing tools having a penetration depth of minimum 1/2" and at 10 foot intervals with construction joints. Joints shall be placed 90 degrees transverse with the direction of traffic and shall be straight within a tolerance of 1/4" of a straight edge laid along the joint. Longitudinal joints shall be installed, at the direction of the Engineer, when the sidewalk is greater than 6' wide.

After 28 days, using pressure-spray equipment, the Contractor shall apply a mixture of boiled linseed oil to the new concrete pavement as an anti-spalling seal. The mixture shall consist of 50% double boiled linseed oil and 50% petroleum spirits, AASHTO M-233-79. Upon approval by the Engineer, the Contractor may use other products available on the market in accordance with manufacturer's recommendations (2 applications at right angles to each other are required for complete coverage). The sidewalk shall be swept and cleaned of any debris, gum, etc, and pressure washed, just prior to application of curing linseed oil compound.

"Don't Dump" Placards: The work of this Section shall also include the installation of Cast Iron or Steel "Don't Dump" placards, where new sidewalks abut existing or proposed catch basins and inlets. The placards will be furnished by the City at no cost to the Contractor, for installation by the Contractor.

Finish Grades: At locations where the Drawings do not indicate proposed sidewalk grades, the grades shall be discussed with the Engineer prior to work, in order to address existing and proposed drainage concerns. The Contractor shall be responsible for ensuring that all new sidewalks areas are graded to drain, either to existing structures, or new structures.

Pedestrian ramps and sidewalks shall be installed in strict conformance with the layout and grades shown on the Drawings, current Americans with Disabilities Act (ADA) and Massachusetts Architectural Access Board (AAB) regulations; and the applicable details of the Massachusetts Highway Department (MHD) Wheelchair Ramp Standards (latest edition).

The Contractor shall establish grade elevations at all pedestrian ramp and sidewalk locations, and shall set transition lengths according to the tables which are included on the Drawings. The Contractor shall use a digital "Smart Level" to check all sub-base grades for compliance prior to installation of concrete. The Contractor shall not proceed with concrete installation on a sidewalk or ramp that is out of compliance without first contacting the Engineer.

At all pedestrian ramps and driveways, joints and transition sections which define grade changes shall be formed, staked and checked prior to placing cement concrete. All grade changes are to be made at joints. At driveways, a joint shall be located between the sloping portion of the driveway (15% maximum slope), and the level area where pedestrians will cross the driveway (1.5% maximum cross slope).

The broomed finish on pedestrian ramps shall be perpendicular to the direction of the slope.

Detectable Tile

Cast iron detectable tiles shall be installed at time of sidewalk construction per manufacturers directions and as shown on the plans and specified herein. Retrofit, bolted, or surface applied installations shall not be accepted.

COMPENSATION

Sidewalk, driveways, and pedestrian ramps will be measured for payment as specified in Section 701 of the Standard Specifications, and the following:

Payment for work under these items shall be at the applicable contract unit prices and shall include full compensation for sawcutting, excavation (including removal of existing pavement in present roadway areas), disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.), removal and disposal of traffic signs, preparation of sub-base, raising of water curb stop boxes, installation of "Don't Dump" placards, furnishing and placing cement concrete and hot mix asphalt as indicated, furnishing and installing detectable warning tiles, expansion joints, concrete sealant, and any other incidentals necessary for the satisfactory completion of this work as specified.

The Engineer reserves the right to extend any sidewalk limit of work shown on the plans up to an additional fifteen (15) feet, in order to connect to an existing ADA-compliant sidewalk. The Contractor will be compensated at the appropriate contract unit price for such increased quantities.

Notes on Exclusions: Disposal of any excavated soil is not included for payment under this item and shall be paid for separately. Changes necessitated to private property due to changes in grade of the sidewalk are not included for payment under this item and shall be paid for separately under the appropriate items; for example: asphalt driveways, granite curb, fencing.

**ITEM 832.10 WARNING-REGULATORY AND ROUTE SQUARE FOOT
MARKER – ALUMINUM PANEL (TYPE A)**

Work to be done under this item shall conform to the relevant provisions of Section 828 of Standard Specifications and to the following:

The location, number and legend of new signs which are required shall be as shown on the Drawings or as directed by the Engineer. Signs will be mounted on posts which are furnished and paid for under Item 877.

The work under this Item includes all hardware, brackets, bolts, labor, etc. necessary to attach new sign panels to posts furnished under Item 877.

Signs

The legend, border, and background of sign panels (except as modified below) shall be Type "C", permanently applied legend, or Type "D", silk screen processed, according to the requirements of Section M9.30.0 of the Standard Specifications, Type III or Type IV.

Compensation

Signs will be measured for payment as specified in Section 828 of the Standard Specifications. Object Markers will also be measured and paid for under this Item.

Payment for work under this item shall be at the contract unit price per square foot, and shall include full compensation for all labor, materials, equipment, and other incidentals necessary for the satisfactory completion of the work as specified.

ITEM 850 TRAFFIC AND PEDESTRIAN MANAGEMENT LUMP SUM

DESCRIPTION

Work to be done under this item shall conform to the relevant provisions of Section 850 of the MassDOT Standard Specifications and to the following:

Work under this Item consists of developing and submitting traffic management plans; and furnishing, installing, relocating, maintaining in proper operating condition, and removing various traffic control devices for the protection of the traveling public and working personnel during construction and maintenance operations.

The design, application, and installation of all devices shall conform to:

- The detailed conditions specified in Paragraph 5 Traffic Control of Section 825 Supplemental Conditions of the Contract Documents;
- City of Cambridge standards, MassDOT's "Standard Details and Drawings for the Development of Temporary Traffic Control Plans" and the "Manual on Uniform Traffic Control Devices" latest edition, Part VI, hereinafter referred to as MUTCD, and/or as directed.

The Contractor shall be responsible for the installation of adequate safety precautions for the protection of the traveling public and all project personnel. All construction vehicles not protected by any form of traffic control

device on portions of the project which are open to traffic shall have an amber flashing light mounted on the cab roof or on the highest practical point of the machinery. The light shall be in operation whenever the equipment is working on the highway or travelway. Amber flashers must be a minimum of 40 candelas and have a flashing frequency of 50 to 60 times per minute. Either rotating beacons or strobe lights meeting these requirements are acceptable.

All materials provided by the Contractor under the items of this section shall remain the property of the Contractor upon completion of the project, unless otherwise specified below.

All work under this Section shall conform to the approved Temporary Traffic Control Plans, which shall be updated as needed by the Contractor throughout the life of the Project.

Work under this Item also includes providing snow removal and street sweeping within the work limits to maintain safe and efficient vehicular and pedestrian traffic flow, including accesses and sidewalks. Contractor shall plow snow out of the work zone in all areas where municipal snow removal is prevented by construction in the opinion of the City and Engineer. The Contractor shall also remove snow from all sidewalks in areas where construction related activities are occurring or have recently occurred. The Contractor shall sweep sidewalks, pedestrian walkways and detours, and streets within the work zone on a daily basis. In the event that the Contractor's work zone restricts municipal street sweeping in the area, the Contractor shall sweep the restricted streets (including streets outside the work zone) to a point where municipal street sweeping can continue.

The contractor will be responsible for ensure safe passage for cyclist on all Bicycle Priority Routes (BPR). The Contractor shall provide sign indicating traffic movements for cyclist and motorist at an appropriate distance for both means of transportation. The contractor shall attempt to keep the bicycle lanes open during construction or provide an equal bicycle lane of the same size of proper signage indicating to all to "share the road".

All trenches shall be plated or paved daily within the roadway for BPR's. Plates shall be recessed so only a 1/4-inch lip is exposed. A contractor can have greater lip but will need to use asphalt around the entire plate with a slope that does not exceed 10%. The asphalt shall be compacted. All plates shall be pinned to reduce movement.

COMPENSATION

Measurement for payment for Traffic and Pedestrian Management will be on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the original Contractual construction time limit as approved by the Engineer.

No payments shall be made during extended work shutdowns. An example of this would be winter shut down.

BASIS OF PAYMENT / INCLUSIONS

Payment for Traffic and Pedestrian Management shall be based on the lump sum price bid for this item in the proposal. Under the lump sum price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide, maintain, relocate, and remove Traffic and Pedestrian Management in areas directly or indirectly influenced by construction within the limits of work or outside the limits of work; along truck routes inside or outside the limits of work; as delineated in the approved Traffic and

Pedestrian Management Plan, by the MUTCD, ADA, MA AAB, and MassDOT standards; and as further required by the City and Engineer.

The work includes but is not limited to: fabrication of signage; furnishing and installing signage; mounting and securing signage; maintaining signage; protecting and storing signage not in use; relocating signage; removal of signage.

The work further includes, but is not limited to: obtaining permits; coordination with the City Department of Public Works and Traffic and Parking Department; coordination with private property owners within the limits of work; preparing, submitting, reviewing, implementing, and revising traffic management and control plans; work zone layouts, installing, and maintaining traffic management devices based on approved traffic management and control plans including precast concrete and/or triplex barriers with fencing and plywood panels, reflectorized drums, lane delineators, portable barricades, temporary crosswalks, and cones; temporary pavement markings; removal of temporary and existing pavement markings; furnishing, installing, shimming, pinning, maintaining, and removing steel road plates; furnishing, installing, and removing cold patch pavement as necessary or as directed by the Engineer; ordering and coordinating police details; furnishing and installing temporary construction fencing; maintaining roadways and sidewalks inside or outside the limits of work including sweeping and snow plowing locations where the work prevents municipal sweeping and plowing; establishing and dismantling detours; covering existing traffic signs; obtaining, posting and maintaining "No Parking" signs; meeting with police details daily; coordinating police detail locations; and all incidental work, whether listed here or not, required to provide maintenance and protection of traffic and pedestrians.

SPECIAL NOTES ON EXCLUSIONS

The following items are not included for payment under this item and are included for payment elsewhere; bituminous hot mix asphalt pavement; portable changeable message boards; temporary signal reconfiguration, and Police Details. Police Details will be paid directly by the City.

Signage damaged as a result of misuse or improper handling shall be replaced by the Contractor at no additional cost to the City.

ITEM 864.04	PAVEMENT ARROWS AND LEGENDS - REFL. WHITE (THERMOPLASTIC)	SQUARE FOOT
ITEM 865.1	CROSS WALKS AND STOP LINES REFL. WHITE (THERMOPLASTIC)	SQUARE FOOT
ITEM 866.24	24 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)	SQUARE FOOT
ITEM 866.06	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)	SQUARE FOOT
ITEM 867.06	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)	SQUARE FOOT

Work to be done under this item shall conform to the relevant provisions of Section 860 of the Standard Specifications and the following:

CONSTRUCTION METHODS

Broken lines through intersections are indicated only graphically on the Drawings. Actual pattern shall be 4-foot line and 4-foot space.

SECTION 00910

TREE PLANTING PREPARATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. General:

1. **Work shall consist of furnishing all labor, materials, equipment and transportation required to complete all the planting preparation work in strict accordance with these specifications and applicable drawings. Work shall include, but not be limited to:**
 - a. **Submitting samples of materials and analyses for approval.**
 - b. **Securing necessary permits and approvals.**
 - c. **Installing structural planting medium**
 - d. **Back filling with planting soil within tree planting area.**
 - e. **Installing Mulch in tree planting area**
2. **The City of Cambridge reserves the right to work with its own work force or other Contractor(s) to install the tree plantings.**
3. **The tree planting preparation will be performed by the requirements of the Contract Documents.**

1.02 - 1.03 (NOT USED)

1.04 DEFINITIONS

- A. Whenever used in any of the Contract Documents, the following meanings shall be given to the terms herein defined:
1. The term "Contract" means the agreement executed by the Owner and the Contractor, consisting of these Contract Documents.
 2. The term "Owner" means the City of Cambridge acting through its authorized representative, the Commissioner of Public Works, whose responsibility it shall be to coordinate review and approval by City, State and Federal departments and agencies which have jurisdiction over the various types of work to be carried out under this Contract.
 3. The term "Public Works Department (PWD)" means those persons employed by the Commissioner of Public Works for the purpose of directing or having charge of the work of this Contract or a portion thereof, limited by the particular duties entrusted to that person.
 4. The term "Local Public Agency" means the Public Works Department.
 5. The term "Awarding Authority" means the Public Works Department.
 6. The term "Contractor" means the person, firm or corporation entering into the Contract with the Owner to construct and install improvements embraced in this Contract.

7. The term "Contract Documents" means and shall include the following: Invitation to Bid; Bid Requirements; Contract Forms; Bonds and Certificates; Conditions of Contract; Addenda; if any; Technical Specifications; and Drawings.
8. The words "required", "permitted", "ordered", "designated", "prescribed", or words of like import shall mean the direction, requirement, permission, order, designation, prescription, etc. of the Owner or the Owner's representatives, and similarly, the words "approved", "acceptable", "satisfactory", or words of like import, shall mean approved by, or acceptable or satisfactory to the Owner's authorized representative, subject in each case to the final determination of the Owner unless otherwise expressly stated.
9. The terms "City" means the City of Cambridge, Massachusetts, within which the work of this Contract is to be carried out.
10. The term "MHD Standard Specifications" or "Standard Specifications" refers to the latest edition of the Massachusetts Highway Department Standard Specifications for Highways and Bridges, including supplements and amendments.
11. Occupational Safety & Health Administration- (OSHA) is the Federal agency responsible for insuring worker safety.

1.05 SAMPLES AND SUBMITTALS

- A. **Upon award of the contract and at least thirty (30) days prior to intended use, the Contractor shall provide the following samples and submittals for approval. Do not order materials until Contract Supervisor's approval of submittal has been obtained. Delivered materials shall closely match the approved samples. Should the source of supply be changed within the course of the contract, the Contractor shall submit new samples or submittals for approval per the original submission.**
- B. Soils and Soil Management: Contractor shall make the following submittals and perform the following testing program on all on-site soils to be reused as backfill and on all off site borrow soils and material placed on the project. The cost of all submittals and testing stated below shall be incidental to the work and paid for by the Contractor.
 6. Independent Laboratory and Testing Company. Submit 4 weeks prior to start of excavation, evidence that the Laboratory/testing company is:
 - a. accredited by the American Associates of the State Highway and Transportation Officials (AASHTO)
 - b. Has minimum 3 years' experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations.
 - c. Able to provide 3 references from previous work.
 7. Submit to the City and the Engineer grain size analysis curve (ASTM D422) and compaction test results (ASTM D1557) for each proposed source of backfill including suitable on-site soil to be reused as backfill, for review two weeks prior to use of the material. Grain size analysis shall indicate that the backfill material conforms to the gradation requirements specified.
 8. Contaminant analysis for off-site borrow materials used. Each material imported shall be accompanied by a certification statement and analytical results. At a minimum, the certification shall state that the point of origin and that the material is free of contaminants. The certification shall include representative sample analysis from each point of origin of backfill to be used on the site. The samples shall be

analyzed by a certified laboratory for total metals (EPA priority pollutant metals), volatile organic compounds (EPA Method 8270), petroleum hydrocarbons (EPA method 418.1), and Total PCB's and pesticides (EPA Method 8081 and 8082). On site soils designated as suitable for reuse can be reused as backfill without providing certification required above.

C. Planting soil: At least 30 days prior to ordering materials, the Contractor shall submit to the Owner's Representative representative samples, certifications, manufacturer's literature and certified test results for proposed planting soil.

D. Structural Planting Medium: At least 30 days prior to ordering materials, the Contractor shall submit to the Owner's Representative representative samples, certifications, manufacturer's literature and certified test results for proposed structural planting medium.

1.06 (NOT USED)

PART 2 – PRODUCTS

2.01 PLANTING SOILS

A. Contractor shall provide all planting soil required to complete the planting operation. Planting soil shall be a natural, fertile, friable loam typical of cultivated planting soil of the locality, containing at least 10% and not more than 20% decayed organic matter (humus). Planting soil shall be free of sub-soil, stones greater than one and one-quarter inches, earth clods, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter or debris. Planting soil shall not be by test either excessively acid or alkaline nor contain toxic substances. Planting soil shall not be delivered or used for planting while in a frozen or muddy condition.

B. Soil for planting trees shall be one of the following sandy loams; "course sandy loam", "sandy loam", and "fine sandy loam": determined by mechanical analysis (ASTM D 422) and based on the "USDA Classification System" and as defined in this Section. It shall be of uniform composition, without admixture of subsoil. Planting soil for trees shall have the following grain size distribution for material passing the #10 sieve:

<u>Millimeter</u>	<u>Percent Passing by Weight</u>	
	<u>Maximum</u>	<u>Minimum</u>
2	-----	100
1	100	80
0.5	87	67
0.25	78	48
0.10	68	30
0.05	55	22
0.002	7	2

1. Maximum size shall be one and one quarter inches largest dimension. The maximum retained on the #10 sieve shall be 25% by weight of the total sample.

2. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6.0 or less. ($D_{80}/D_{30} < 6.0$)

C. Name of planting soil supplier and sample to be approved by the City Arborist.

2.02 STRUCTURAL PLANTING MEDIUM (“SPM”)

- A. In specific areas designated in the Contract Documents the soil underlying the pavement cross section and the granular base material will be replaced with a material designed to structurally support the pavement slab and promote the root growth of street trees. This soil will be called Structural Planting Medium in this Section and shall be a mixture of Sand, Base Loam and Compost. Structural Planting Medium shall be the manufactured product of a commercial processing facility specializing in the production of manufactured soils and loam borrow. Structural Planting Medium shall be manufactured from sands, loams and compost, in accordance with the requirements of this Section. Structural Planting Medium shall be manufactured outside the Project limits and transported onto the Project for placement.
- B. The Structural Planting Medium shall consist of a blend of four parts by volume of Sand, one part by volume of Planting Soil and one part by volume of Compost. Blending of the components shall be carried out with earth moving equipment prior to placement. The components shall be blended to create a uniform mixture as determined by the Owner's Representative.
- C. Structural Planting Medium gradation shall be determined by the Soil and Plant Tissue Laboratory, University of Massachusetts, Amherst, using H₂O₂ to destroy organic matter. Structural Planting Medium shall conform to the following grain size distribution for material passing the #4 sieve:

U.S. Sieve No.	Percent Passing by Weight	
	Maximum	Minimum
#4	----	100
#10	81	100
#20	57	88
#40	27	57
#100	11	24
#200	08	12
.002mm	01	02

- D. Structural Planting Medium shall not contain less than 1.5 percent nor more than 3.0 percent organic matter as determined by the loss on ignition of oven-dried samples passing #10 sieve (Muffle furnace temperature: 450 +/- 10 degrees C for 8 hours).
- E. The acidity range of the Structural Planting Medium shall be pH 5.5 to 6.5. Structural Planting Medium shall have a starting pH of no lower than 5.0 at the manufacturing site.
- F. Structural planting medium shall be pH adjusted as required for planting of trees and shall be adjusted prior to delivery to the Project sites in accordance with recommendations by UMASS Soil & Plant Tissue Laboratory.

1. When pH of loam borrow is equal to or greater than 7 use aluminum sulfate to adjust pH downward to required levels.
 2. When pH of loam borrow is less than 7 use either sulphur or ferrous sulfate to adjust pH downward to required levels.
 3. When pH of loam borrow must be raised to the required levels use limestone.
 4. Regardless of amendment Contractor chooses to use, Contractor, not the Owner, shall be responsible for obtaining specified pH by planting time.
- G. Structural Planting Medium shall be free of debris and other extraneous matter. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to or less than 1.0 millimhos/cm. (Test minus sieve Number 10 material). Soil shall not have levels of Aluminum greater than 200 parts per million.
- H. No Structural Planting Medium shall be delivered to the site until the review and approval of soil test results and recommendations by the Owner's Representative, but such approval shall not constitute final acceptance. The Owner's Representative will reject any material delivered to the site which, after on-site, post-delivery testing, does not meet these specifications.

2.03– 2.04 (NOT USED)

2.05 MULCH

- A. Mulch shall be high quality, shredded or double-ground, premium bark mulch consisting of clean, organic plant material.
- B. Shall be uniform in color, a good brown color. The composition of the shredded pine bark material shall not exhibit a noticeable degree of any color change characteristics when wet.**
- C. The mulch must be free of dirt, insects, disease and extraneous debris that would be harmful to all trees being installed.**
- D. The shredded pine bark mulch material shall not have an unpleasant odor.**
- E. Bark Mulch shall be a well-graded material conforming to the following:
1. pH between 4.0 – 8.0
 2. Particle size 100% passing a 50mm (2 inch) screen
 3. Soluble salt content < 4.0 mmhos/cm
- F. Prior to the Contractor ordering shredded pine bark mulch material, the Contractor shall submit to the City Arborist, at the Contractor's expense, one cubic foot sample of the shredded pine bark mulch material. The Contractor shall not order any delivery of the shredded pine bark mulch material until the Contractor's sample has been inspected and approved by the City Arborist.**
- G. If the City Arborist disapproves of the sample submitted by the Contractor, then the Contractor shall continue at no expense to the City, to obtain other sources of pine**

bark mulch material as specified until the Contractor's sample of such material, meets with the City Arborist's approval.

PART 3- EXECUTION

3.01 – 3.02 (NOT USED)

3.03 STRUCTURAL PLANTING MEDIUM: EXCAVATION, FILLING AND COMPACTION

- A. Perform percolation tests on existing subsoils or placed fill prior to placing and spreading Structural Planting Medium:
1. Perform percolation testing of subsoil or placed fills to determine whether or not the subgrade will drain properly. Perform percolation tests in accordance with the requirements for percolation testing for each lift of SPM described in Section 3.04.
 2. In the event that percolation testing indicates that the subsoil, placed fills or ordinary borrow has been over compacted and will not drain, the Contractor shall loosen up the top 36 inches of the subsoil, ordinary borrow, special borrow or gravel borrow by ripping or other mechanical means. Re-compact the borrow by driving a small, tracked bulldozer over the area at low speeds so that the tracks of the bulldozer pass over the affected area and the soil is compacted to a density that will percolate in accordance with this Section.
 3. Perform sufficient percolation tests in areas of poorly draining or compacted subsoil or compacted placed fills as directed by the Owner's Representative to ensure that these underlying soils do not drain. Likewise, perform sufficient percolation tests after ripping and loosening to ensure that the soils are no longer too compact to drain.
- B. Excavate or fill subsoil or ordinary borrow as required by the Owner's Representative to achieve the elevations of the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the Contract Documents. Do not over excavate compacted subgrades of adjacent pavement or structures.
- C. Confirm that the subgrade is at the proper elevation and that no further earthwork is required to bring the subgrade to proper elevations. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the Contract Documents. Provide a written report to the Owner's Representative and the Owner's Representative that the subgrade has been placed to the required elevations and that the subgrade drains water in accordance with the required percolation tests. Perform no work of placing and spreading Structural Planting Medium until elevations have been confirmed and written report has been accepted by the Owner's Representative.
- D. Clear the subgrade of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Such construction debris, trash, rubble and foreign material shall be removed from the site

and disposed of in a legal manner. Fill any over excavation with approved fill and compact to the required subgrade compaction levels.

- E. Do not proceed with the installation of Structural Planting Medium until all utility work in the area has been installed.
- F. Protect adjacent walls, walks and utilities from damage or staining by the Structural Planting Medium. Use one-half inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface no later than the end of each working day.

3.04 STRUCTURAL PLANTING MEDIUM: PLACEMENT

- A. Immediately prior to placing and spreading the Structural Planting Medium, the subgrade shall be cleaned of all stones greater than 2 inches and all debris or rubbish. Such material shall be removed from the site, not raked to the edges and buried. Notify the Owner's Representative that the subsoil has been cleaned and request his/her attendance on site to review and approve subgrade conditions prior to spreading Structural Planting Medium.
- B. Structural Planting Medium delivered to the site shall be protected from erosion at all times. Materials shall be spread immediately. Otherwise, materials that remain on site for more than 24 hours shall be covered with tarpaulin or other soil erosion system acceptable to the Owner's Representative and surrounded by silt fence installed in accordance with the Division 1 Section 01560, TEMPORARY ENVIRONMENTAL CONTROLS, of this Specification.
- C. Structural Planting Medium shall be sampled and tested in accordance with the requirements of this Section to verify application and incorporation of limestone, fertilizer and other soil amendments.
- D. Soil additives shall be spread and thoroughly incorporated into the layer of Structural Planting Medium by harrowing or other methods reviewed by the Owner's Representative.
- E. No Structural Planting Medium shall be handled or installed in any way if it is in a wet or frozen condition. A moist Structural Planting Medium is desirable.
- F. Sufficient grade stakes shall be set for checking the finished grades. Deviation from indicated elevations that are greater than one-tenth of a foot shall not be permitted. Connect contours and spot elevations with an even slope. Finish grades shall be smooth and continuous with no abrupt changes at the top or bottom of slopes.
- G. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional Structural Planting Medium and the surface shall be re-graded and rolled until presenting a smooth and even finish corresponding to the required grades.
- H. Structural Planting Medium shall be spread in lifts not greater than 6 inches and compacted with a minimum of 2 passes of vibratory compaction equipment to a density between 92 and

94 percent Modified Proctor Maximum Dry Density in accordance with compaction standards of ASTM D1557 Method D. During the compaction process, all depressions caused by settlement or compaction shall be filled with additional Structural Planting Medium and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

- I. Phase the installation of the Structural Planting Medium such that wheeled equipment does not have to travel over already installed soil. If it is determined by the Owner's Representative that equipment must travel over already installed Structural Planting Medium, provide one inch thick steel plate ballast over the length and width of travel to cover Structural Planting Medium and protect it from compaction.
- J. Compact each lift sufficiently to reduce settling but not enough to prevent the movement of water and feeder roots through the soil. The Structural Planting Medium in each lift should feel firm to the foot in all areas and make only slight heel prints. At completion of the Structural Planting Medium installation, it should offer a firm, even resistance when a soil sampling tube is inserted from lift to lift. After the placement of each lift, perform percolation tests to determine if the soil has been over compacted. Perform the following percolation test procedure:
 - 1. Dig a hole in the installed soil that is a minimum of 4 inches in diameter, 4 inches deep. Do not penetrate through the lift being tested.
 - 2. Fill the hole with water and let it drain completely. Immediately refill the hole with water and measure the rate of fall in the water level.
 - 3. In the event that the water drains at a rate less than one inch per hour, till the Structural Planting Medium to a depth required to break the over compaction.
 - 4 Perform a minimum of one percolation test per location as directed by the Owner's Representative.

3.05 – 3.11 (NOT USED)

3.12 PLANTING HOLE PREPARATION

- A. Planting holes shall be filled with approved planting soil to required grades. Planting of trees will be by others under a separate City Planting Contract.**
- B. Surplus excavation and unsuitable material from the planting holes shall be removed from the site and either reused (if approved) or disposed of per the requirements of the Contract Documents.**
- C. Planting pits will require a minimum of 4' of walking space for sidewalk pedestrian traffic.**
- D. Tree wells shall be at least 16 square feet, 8'x2' or as directed by the City Arborist.**

3.13 to 3.18 (NOT USED)

3.19 MULCHING

- A. **Apply a three inch layer of mulch (after settlement) within new tree pits and tree planting areas.**
- B. **Place mulch immediately after preparation of tree pit.**
- C. **Existing street trees and planting beds shall receive 3” layer of mulch. The Contractor is to remove all existing unwanted vegetation (i.e. weeds) and debris prior to installation of mulch.**

PART 4 – COMPENSATION

0902.1 STRUCTURAL PLANTING MEDIUM CUBIC YARD

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the cubic yardage of Structural Planting Medium installed by the Contractor as shown on the Contract Drawings and as directed by the Engineer, complete and in place. Structural Planting Medium shall have a standard section as shown on the Contract Drawings.

BASIS OF PAYMENT:

Payment for Structural Planting Medium shall be based on the unit price bid for this item in the proposal. Under the unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete installation of Structural Planting Medium as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to the following; testing, furnishing and installing Structural Planting Medium; and all incidental work not included for payment elsewhere required to furnish and install Structural Planting Medium whether included here or not.

EXCLUSIONS AND SPECIAL NOTES:

Payment for tree planting and walks shall not be paid for under this item and are paid for elsewhere.

0902.2 PLANTING SOIL CUBIC YARD

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the cubic yardage of Planting Soil installed by the Contractor as shown on the Contract Drawings and as directed by the Engineer, complete and in place as required to establish finish grades for the planting areas.

BASIS OF PAYMENT:

Payment for Planting Soils shall be based on the unit price bid for this item in the proposal. Under the unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete installation of Planting Soil as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to the following; testing, furnishing and installing Planting Soil; and all incidental work not included for payment elsewhere required to furnish and install Planting Soil whether included here or not.

0902.3

MULCH

CUBIC YARD

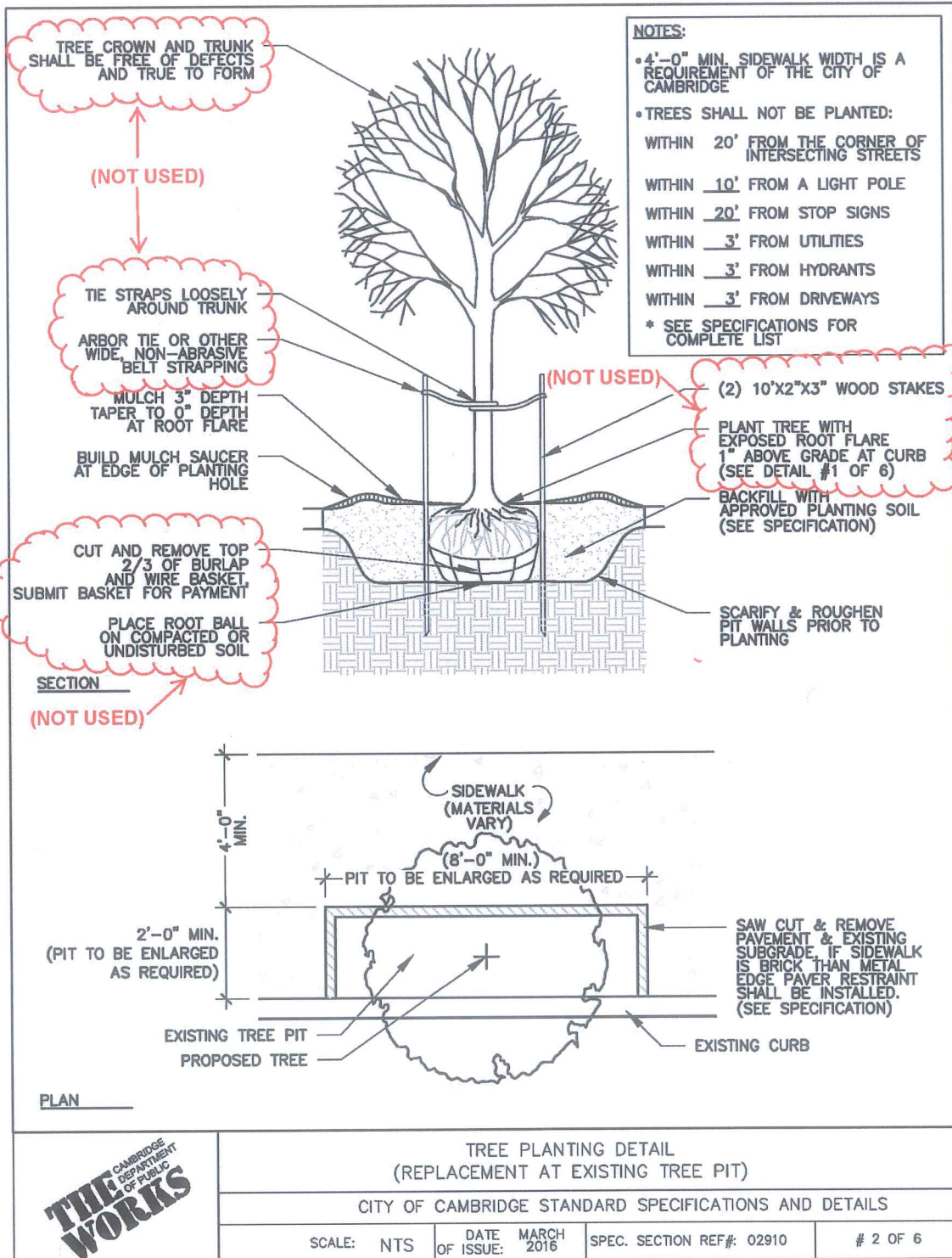
METHOD OF MEASUREMENT:

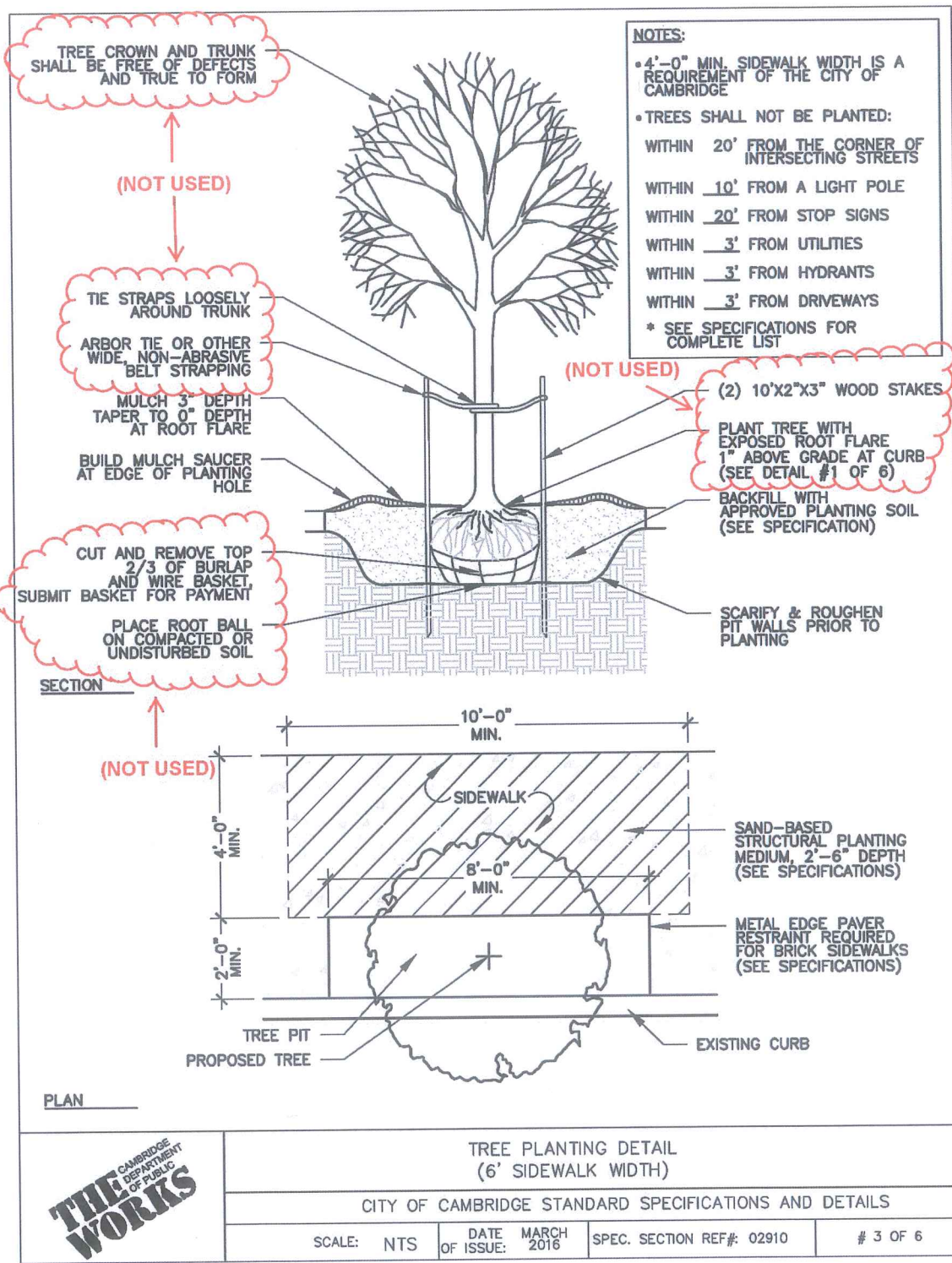
Measurement for Payment shall be based on the cubic yardage of Mulch installed by the Contractor as shown on the Contract Drawings and as directed by the Engineer, complete and in place.

BASIS OF PAYMENT:

Payment for Mulch shall be based on the unit price bid for this item in the proposal. Under the unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete installation of Mulch as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to the following; testing, furnishing and installing Mulch; and all incidental work not included for payment elsewhere required to furnish and install Mulch whether included here or not.

END OF SECTION 00910

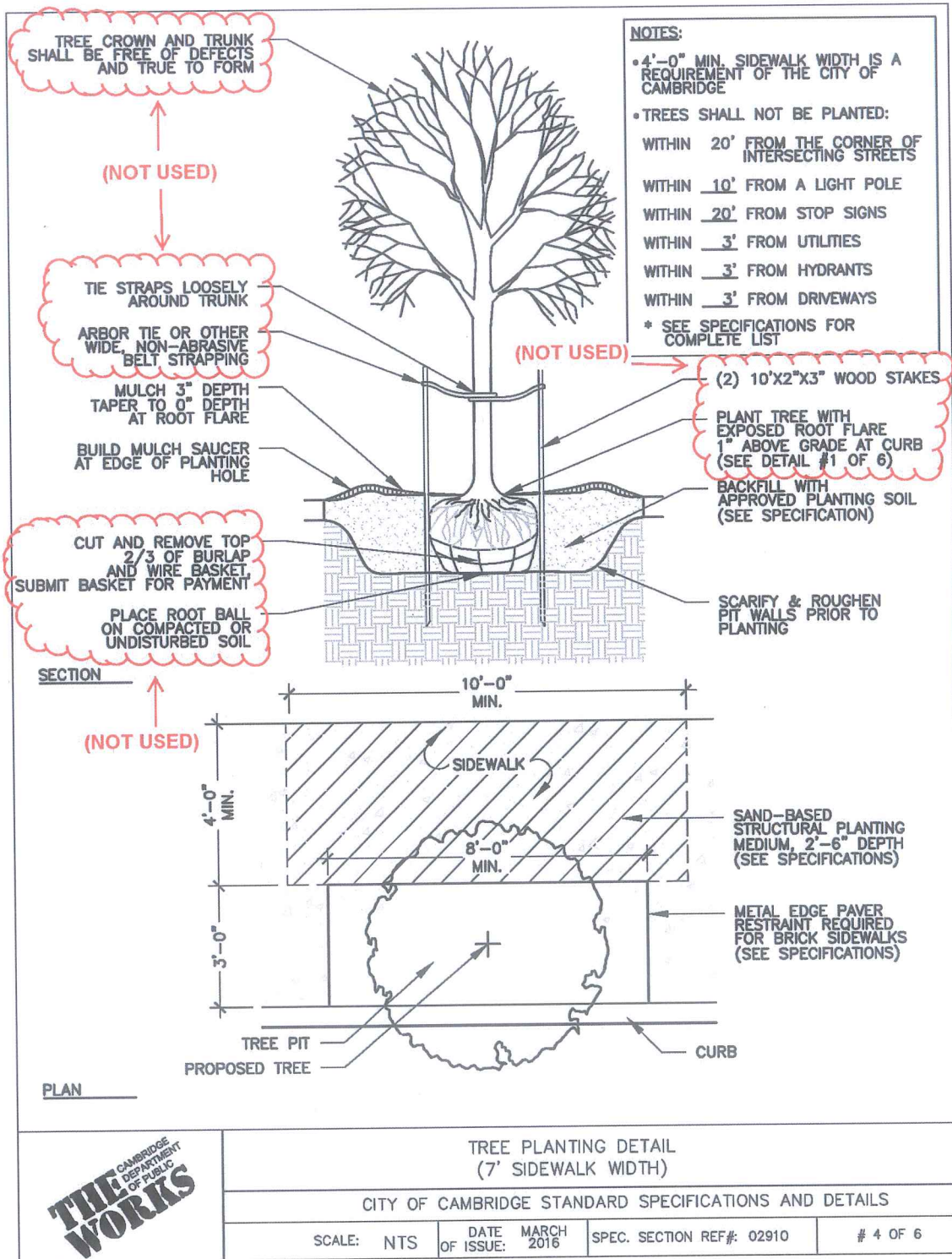


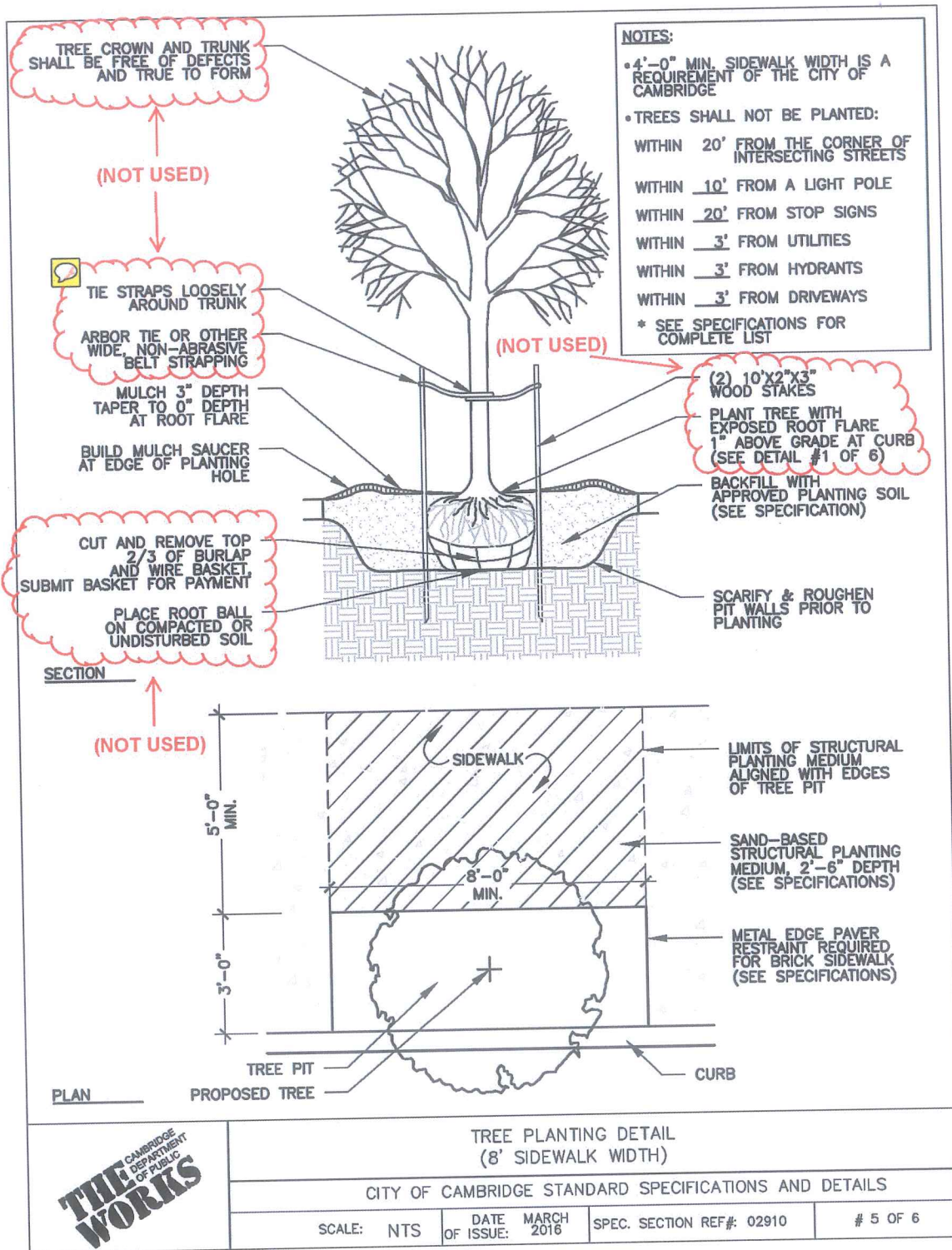


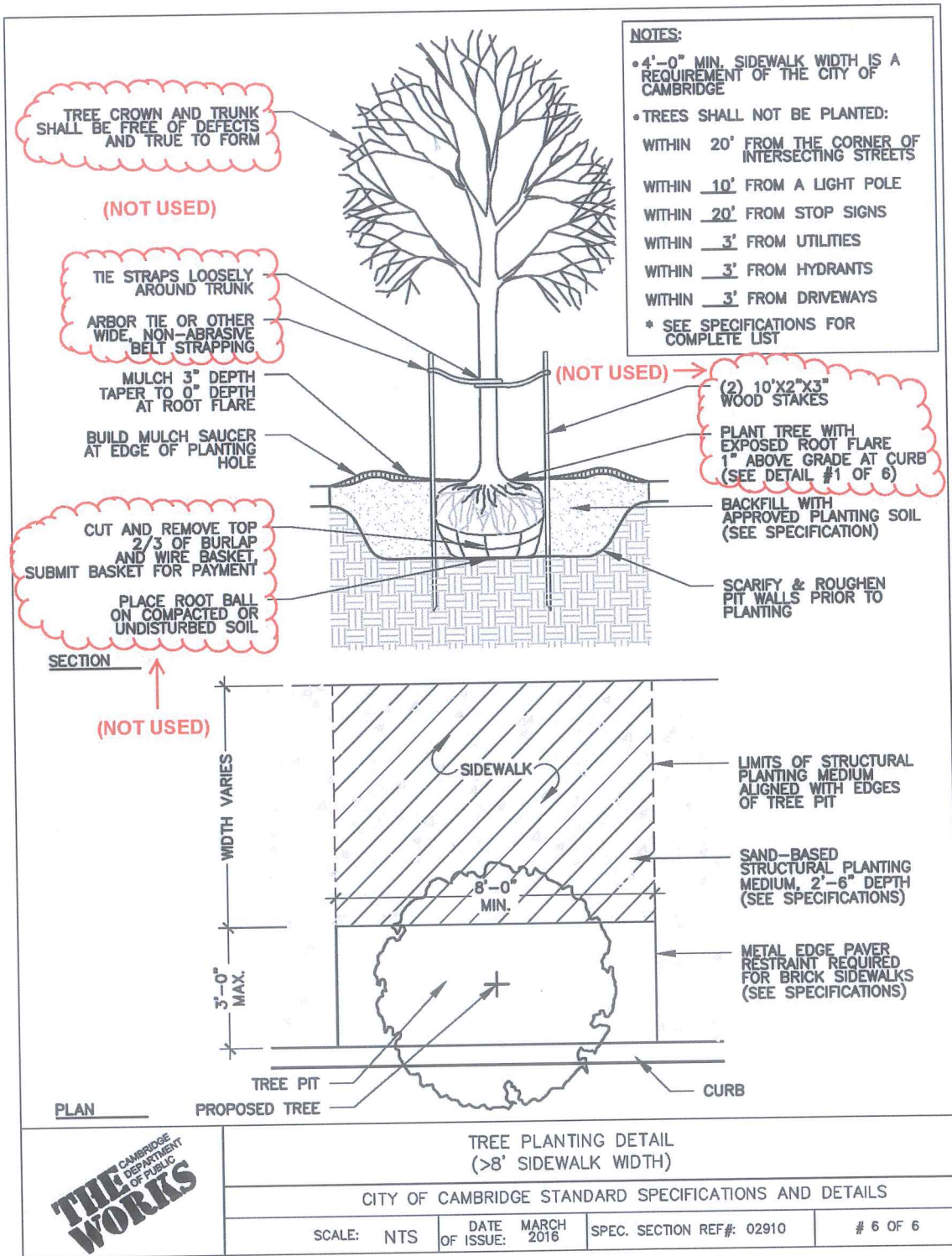
TREE PLANTING DETAIL
(6' SIDEWALK WIDTH)

CITY OF CAMBRIDGE STANDARD SPECIFICATIONS AND DETAILS

SCALE: NTS	DATE OF ISSUE: MARCH 2016	SPEC. SECTION REF#: 02910	# 3 OF 6
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City of Cambridge Department of Public Works
Division of Urban Forestry

Tree Protection during Construction

Public trees are protected by Massachusetts state law, Chapter 87. Section 12 states that a fine of up to five hundred dollars, (\$500.00) per incident of damage to public shade trees can be levied. Each branch broken or improperly pruned, each improper wounding of the trunks of the trees, and each root improperly pruned shall constitute an infraction. Section 12 further provides that anyone who negligently or willfully damages a tree will be liable to the City for all damages.

During all construction projects, the utmost care shall be taken by the contractor to avoid unauthorized, unnecessary or improper wounding of public or private shade trees. Prior to construction, the contractor shall provide a tree protection plan and work schedule. A Massachusetts or International Certified Arborist shall be sub-contracted by the contractor to provide a protection plan and perform specified work. *All plans and schedules shall be subject to review and approval by the City Tree Warden.* **Infraction of Massachusetts state law Chapter 87 or failure to provide a protection plan and work schedule will result in fines or the immediate cancellation of the contract.**

Pre-construction tree protection measures shall include the following:

1. Wrapping the trunks of trees with a diameter at breast height (DBH) of 6" or greater with a durable material such as two by four lumber sufficient to protect tree trunks from mechanical damage. Removal of protective wrapping shall be done by the contractor after construction in complete.
2. The proper pruning (raise pruning) of low branches to a height no greater than fourteen feet (14") above the roadway and eight feet (8") above the sidewalk. This includes trees endangered by traffic re-routing as the result of construction operations.
3. Traffic control plans shall be designed in such a way as to direct traffic away from tree trunks and branches.
4. Tunneling shall be the preferred method of excavation adjacent to tree roots to avoid root pruning. If root pruning is unavoidable, certified personnel shall execute the operation with sufficiently sharpened had tools and in such a fashion s to have minimum negative impact on tree health and safety.
5. Trucks and heavy equipment shall not pass over or park on roots of public shade trees. A protection zone shall be established by erecting a ridged fence outside the perimeter of the dripline of the tree. For occasional or one time access over roots, ½' plywood overlapped may be used. Permeable materials such as gravel or wood chips shall be placed over root systems of trees which are not covered by hardscape and over which trucks and heavy equipment must

travel during construction operations, when such travel is unavoidable, to prevent soil compaction and root damage. Material shall be replaced as needed.

6. All tree protection measures and operations shall be subject to review, approval or change by the City Tree Warden.