MIT
Design Standards

Land Survey

T11 Thematic Folder

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Department of Facilities

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1. INTRODUCTION

This guide is intended to promote consistency for all surveys performed on MIT's Cambridge campus, regardless of the surveyor performing each survey. The main objective of the MIT Survey Guidelines is to create and maintain composite master files, which can be updated as more recent surveys are completed. As the landscape of this campus is ever changing, the need for this type of consistent base map is critical for future planning.

The survey requirements outlined in this guide shall act as the minimum requirements for all survey work prepared for MIT throughout the Cambridge Campus. As each project will have its own specific needs, a project briefing shall be performed and, if possible, a site meeting between the project surveyor and appropriate MIT staff prior to preparing a proposal for the work. The surveyor shall develop a scope that is appropriate for the project after the project briefing and shall provide recommendations for survey items, including ones not listed in this guide.

2. MIT SURVEY CONTROL NETWORK

The **MIT Survey Control Network** has been established in order to provide consistent and uniform survey information throughout the campus and must be used by all surveyors performing work for MIT. The base control network is a starting point for the campus and allows for supplemental control to be set and used, in order to complete each project.

2.1 Datums

MIT's Control Network references Massachusetts (Mainland) State Plane Coordinate System (NAD 83) and Cambridge City Base Vertical Datum. These datum references must be used for all survey information within the MIT campus in Cambridge.

2.2 Locating and Setting Control

Prior to the commencement of any field survey, MIT will provide a current plan, coordinates, and elevations of the previously established control surrounding the project area. The surveyor is responsible for properly checking and tying into the control. No less than 3 existing points shall be confirmed by angle and distance observations for horizontal control prior to beginning the field survey, and a minimum of two vertical control points (if necessary) shall be leveled through to confirm their respective positions.

2.3 Control Point Recover Sheet

The surveyor should also complete and fill out the Control Point Recovery Sheet found in Appendix A, for all existing controls used or not found, and submit it to MIT at the completion of the project. Should there be a discrepancy between the field observed angles and distances greater than standard survey tolerances, those discrepancies should be noted in the notes section of the recovery sheet, including which points were occupied with the distance observed from each location.

2.4 Supplemental Control

Setting Supplemental Control: As necessary to perform each field survey, additional control may be set by the surveyor using the following guidelines:

1. The surveyor must inform MIT of their intention to set additional control and provide properly adjusted coordinates and recovery tie cards for each point set, which will be included in the updated control network for all points set as part of a closed loop traverse.
2. A closed loop traverse is required when two or more points are set in order to perform the field survey.
3. A spur point is allowable, as long as the point is set by turning a complete set in direct and reverse observations.
4. A spur points set will not be included into the MIT Control Network and it is not required to submit coordinates or tie sketches for these points.

Consult with MIT's Facility Information Systems (FIS) for a list of available control point numbers to be used for your project.

Minimum Requirements for Establishing Supplemental Control: Below is a list of minimum requirements for establishing supplemental control for the MIT Control Network:

1. Perform a closed traverse, turning a minimum of two sets of angles using both direct and reverse observations for each new point established.
2. Perform a closed loop level run to all newly established control points and properly adjust level run.
3. Perform traverse adjustment by applying angular balance and compass rule adjustment or a properly weighted least squares adjustment.
4. Prepare a sketch of all new point sets with finder ties and adjusted northing, easting and elevation values. Use MIT's 'Control Tie Sketch Card', found in Appendix B, for recording this data.
5. Provide MIT with a 'Control Recovery Data Sheet', found in Appendix A, for each existing control used.
6. Provide MIT with traverse adjustment print outs including pre and post adjustment coordinates.

Naming Control Points:

1. Network Points shall have the prefix 'MIT-', followed by a number, and must be a suitable point. Items such as stone or concrete bounds, survey disks, pk nails, mag nails, iron rods with caps, drill holes, and pin in lead will be acceptable. Do not use hub and tacks or scribe marks for any point to be included in the MIT Control Network. Establish new control within MIT property wherever possible.

2.5 Supplemental Control Accuracies

Horizontal Control Accuracy:

1. All horizontal control which is set and which will be incorporated into the MIT Control Network shall be part of a closed traverse. This traverse shall have a minimum closure of 1 part in 20,000 and minimum angular closure of 10 seconds multiplied by the square root of the number of sides.

Vertical Control Accuracy:

1. All vertical control points set shall be part of a closed differential level loop and have a minimum closure of 0.05 feet multiplied by the square root of the length of the level run in miles, as per Commonwealth of Massachusetts Regulations Chapter 250, Section 6.02.
2. Should the above control not be within the specified tolerances, the surveyor will re-run the traverse or level loop in order to meet these specifications.

3. SURVEY TYPES

All property line surveys performed for MIT shall adhere to the following subsections for each parcel or roadway retraced. The surveyor's scope, unless otherwise noted by MIT, will include performing research for locus, abutting roadways, and all abutting properties at the appropriate Assessor's Office, Registry of Deeds, Engineering Department, Massachusetts Highway Department (if applicable), and Massachusetts Land Court.

3.1 Property Line Surveys

Property Line Survey Tolerances:

1. Locations for all property monuments shall be performed from a closed traverse and the linear precision or positional tolerance of said traverse shall be noted on the plan and shall be in conformance with 250 CMR, Section 6.01, with a minimum precision of 1 part in 12,000. Locations may also be performed from previously established MIT control which has been properly adjusted; as long as the surveyor verifies the points by measurements to no less than 3 known points.

2. Distances shall be reported to the nearest 0.01 foot (0.12 inches), unless the course is tied to a water body, in which case a tie bearing and distance must be provided in order for future surveyors to be able to mathematically close the plan.
3. Provide a lot area to the nearest foot, when retracing an entire lot.

Property Line Drawing Content:

1. Monumentation found that has been used to retrace the property shall be clearly shown and labeled on the final plan with notations of held or the offsets from record location. Any monumentation used, which is outside of the plan limits, shall show bearing and distance ties to such monumentation.
2. Note any encroachments protruding from or onto the surveyed property.
3. Show any easements uncovered in the research.
4. Final property plans shall:

    a. Show all bearing and distances related to NAD 83.
    b. Note the discrepancies between record and calculated dimensions.
    c. Show all monumentation, including record building offsets used.
    d. Show all abutting owners with deed information.
    e. Show deed information for the surveyed parcel.
    f. List other deed and plan references used for the survey.
    g. The property lines shall be a closed polyline when applicable.

5. Label the northing and easting values for at least 2 property corners of the retraced parcel to the nearest 0.01 foot and any additional monuments set.

Property Line Survey Deliverables:

1. Upon completion of the survey project, the surveyor shall provide the following to MIT in the format described herein including:
    a. Digital files (plans for the surveyed parcel, final stamped and signed plans, and all field and office points to perform the survey including traverse points) in DWG format, and PDF format.
    b. Should MIT elect to file the plan at the Registry of Deeds, this must be requested of the surveyor during the proposal phase. The surveyor will be required to prepare 2 separate plans for MIT; one on the MIT base map standard 36 by 48 inch sheet size and one in accordance to the Registry of Deeds Standards, not to exceed a sheet size of 24 by 36 inch.

3.2 Topographic and Existing Conditions Surveys

The base property line survey shall be performed in the same manner as outlined in the Property Line Survey section of this manual, unless there is a previously recorded plan on file at the Registry of Deeds. In the case of an existing plan, the surveyor may tie into that plan and will not be required to perform a full retracement survey. The surveyor is expected to work in tandem with MIT and the environmental consultant in order to delineate the AUL area. The surveyor's scope, unless otherwise noted by MIT, will include performing research at the City of Cambridge Assessors, Middlesex County Registry of Deeds, City of Cambridge Engineering Department, and Massachusetts Land Court at a minimum. The surveyor will be required to adhere to the guidelines set forth in the following subsections.

Topographic and Existing Conditions Survey Tolerances:

1. All distances shall be reported to the nearest 0.01 foot, unless the course is tied to a water body, in which case a tie bearing and distance must be provided in order for future surveyors to be able to mathematically close the plan.

Topographic and Existing Conditions Drawing Contents:

1. Prepare written requests to utility companies in the area for underground utilities which fall within public roadways. Utilities to be requested in the research shall include: water, sewer, drain, gas, telephone, electric, telecom, steam systems, Massachusetts Water Resources Authority (MWRA) lines, and Massachusetts Bay Transportation Authority (MBTA) lines and tunnels.
2. Obtain MIT underground utility information from the MIT Facilities Department.
3. Determine with MIT personnel if Ground Penetrating Radar (GPR) services are going to be performed for the project prior to the survey and coordinate accordingly. The surveyor may be requested to provide control for the GPR services and should also budget for incorporating the GPR located utilities into the topographic survey file.
4. Obtain spot grades suitable to prepare one-foot contours, unless otherwise specified by MIT prior to the project. In all cases spot grades should be no more than 40-feet apart.
5. Locate major features such as: walks, curbing, walls, steps, fencing, buildings, manholes, gate valves, trees, landscaped area, pads, etc.
6. Obtain tree diameter for all located trees at 3-feet above ground level and note by text or symbol whether the tree is deciduous or coniferous.
7. Obtain threshold elevations at all building entrances which abut the survey.
8. Obtain locations and elevations of surface utility structures, as well as any evidence of underground utilities. Evidence will include painted lines by outside companies and patches in paved areas. Note underground lines on the plan which are a result of painted lines.
9. Compile underground utilities on the plan as obtained from MIT and the various utility

companies.

10. Obtain invert information on sewer and drain structures when specified by the project.
11. Set a minimum of two additional temporary benchmarks for construction; if there are no benchmarks within 200-feet of the project (see supplemental control accuracies).
12. Note on the final topographic plan if it is intended for design or if it represents as-built conditions.
13. Note on the plan the source for underground utility information.

Topographic and Existing Conditions Deliverables:

1. Upon completion of the survey project, the surveyor shall provide the following to MIT in the format described herein including:
    a. Digital files (plans for the surveyed parcel, final stamped and signed plans, and all field and office points to perform the survey including traverse points) in DWG format, and TIF or PDF format.
    b. Should MIT elect to file the plan at the Registry of Deeds, this must be requested of the surveyor during the proposal phase. The surveyor will be required to prepare 2 separate plans for MIT; one on the MIT base map standard 36 by 48 inch sheet size and one in accordance to the Registry of Deeds Standards, not to exceed a sheet size of 24 by 36 inches.

3.3 Activity and Use Limitation (AUL) Surveys

The base property line survey shall be performed in the same manner as outlined in the Property Line Survey section of this thematic folder, unless there is a previously recorded plan on file at the Registry of Deeds. In the case of an existing plan, the surveyor may tie into that plan and will not be required to perform a full retracement survey. The surveyor is expected to work in tandem with MIT and the environmental consultant in order to delineate the AUL area. The surveyor's scope, unless otherwise noted by MIT, will include performing research at the City of Cambridge Assessors, Middlesex County Registry of Deeds, City of Cambridge Engineering Department, and Massachusetts Land Court at a minimum. The surveyor will be required to adhere to the guidelines set forth in the following subsections.

AUL Survey Tolerances:

1. All distances shall be reported to the nearest 0.01 foot, unless the course is tied to a water body, in which case a tie bearing and distance must be provided in order for future surveyors to be able to mathematically close the plan.

AUL Drawing Content:

1. The following is required when producing AULs for sites on the MIT campus:

a. All monumentation found that has been used to retrace the property shall be clearly shown and labeled on the final plan with notations of held or the offsets from record location. Any monumentation used, which is outside of the plan limits, shall show bearing and distance ties to such monumentation.
b. Locations for all property monuments shall be performed from a closed traverse and the linear precision or positional tolerance of said traverse shall be noted on the plan and shall be in conformance with 250 CMR. Locations may also be performed from previously established MIT control which has been properly adjusted; as long as the surveyor verifies the points by measurements to no less than three known points. The plan shall be noted if existing MIT controls are utilized in the property retracement.
c. Locate the limits of the AUL area to be established by the environmental consultant for the project.
d. Locate any major physical features which fall within the AUL area, including but not limited to paving, walls, fencing, curbs, above ground tanks, buildings, planting areas, steps, etc.
e. Show any easements uncovered in the research.
f. Prepare a boundary description for both the affected property and the AUL area. Should an existing plan be on record at the Registry of Deeds or the Massachusetts Land Court, the description may recite the plan used. The AUL description must include a point of beginning that is tied to the main property.

AUL Deliverables:

1. Upon completion of the survey project, the surveyor shall provide the following to MIT in the format described herein including:

    a. Two copies of deeds, record plans, and certificates of title pertaining to MIT property shall be submitted in DWG format and PDF format, noting which parcel the deed pertains to.
    b. The surveyor shall anticipate preparing four separate plans for submission. The plan set will include: one 36 by 48 inch MIT Standard Plan, one 24 by 36 inch plan suitable for recording at the Registry of Deeds, one Exhibit A Plan on 8-1/2 by 11 inch sheet, and one Exhibit B Sketch Plan on 8-1/2 by 11 inch sheet.

3.4 Laser Scanning Surveys

Laser Scanning Tolerances:

1. Locations for all property monuments shall be performed from a closed traverse and the linear precision or positional tolerance of said traverse shall be noted on the plan and shall be in conformance with 250 CMR, Section 6.01, with a minimum precision of 1 part in 12,000. Locations may also be performed from previously established MIT control

which has been properly adjusted; as long as the surveyor verifies the points by measurements to no less than 3 known points.

2. Distances shall be reported to the nearest 0.01 foot (0.12 inches), unless the course is tied to a water body, in which case a tie bearing and distance must be provided in order for future surveyors to be able to mathematically close the plan.
3. Density spacing must be 1-3 mm and the tolerance of the position of each point must be 1-2 mm.

Laser Scanning Content:

1. Monumentation found that has been used to retrace the property shall be clearly shown and labeled on the final plan with notations of held or the offsets from record location. Any monumentation used, which is outside of the plan limits, shall show bearing and distance ties to such monumentation.
2. Locations for all property monuments shall be performed from a closed traverse and the linear precision or positional tolerance of said traverse shall be noted on the plan and shall be in conformance with 250 CMR. Locations may also be performed from previously established MIT control which has been properly adjusted; as long as the surveyor verifies the points by measurements to no less than three known points. The plan shall be noted if existing MIT controls are utilized in the property retracement.
3. Note any encroachments protruding from or onto the surveyed property.
4. Show any easements uncovered in the research.
5. Final property plans shall:
    a. Show all bearing and distances related to NAD 83.
    b. Note the discrepancies between record and calculated dimensions.
    c. Show all monumentation, including record building offsets used.
    d. Show all abutting owners with deed information.
    e. Show deed information for the surveyed parcel.
    f. List other deed and plan references used for the survey.
    g. The property lines shall be a closed polyline when applicable.
6. Label the northing and easting values for at least 2 property corners of the retraced parcel to the nearest 0.01 foot and any additional monuments set.

Laser Scanning Deliverables:

1. Upon completion of the survey project, the surveyor shall provide the following to MIT in the format described herein including:

    a. Digital files (plans for the surveyed parcel, final stamped and signed plans, and all field and office points to perform the survey including traverse points) in LAS format, and PDF format.
    b. Should MIT elect to file the plan at the Registry of Deeds, this must be requested

of the surveyor during the proposal phase. The surveyor will be required to prepare 2 separate plans for MIT; one on the MIT base map standard 36 by 48 inch sheet size and one in accordance to the Registry of Deeds Standards, not to exceed a sheet size of 24 by 36 inch.

4. DIGITAL SUBMISSION GUIDELINES

This section is to supplement the existing MIT BIM and CAD Guidelines for surveying only. The surveyor must review and adhere to the existing MIT BIM and CAD Guidelines unless otherwise specified herein.

All survey work must be performed in Massachusetts (Mainland) State Plane Coordinate System (NAD 83) and Cambridge City Base, utilizing existing MIT Campus Control and be drawn in this correct coordinate space.

4.1 Plan Creation

All survey plans created for MIT must follow the same criteria and show the same information. For reference, all topographic surveys shall be entitled either "Topographic Plan of Land for Design" or "Existing Conditions Survey"; this is important to the maintenance and updating of the MIT master files.

In addition, the appropriate Subsurface Utility Engineering (SUE) quality level must be indicated at the end of each layer name. A description of these SUE designators are found in the scale section below. Each survey drawing will be incorporated into MIT's master files, which will be the responsibility of MIT personnel at the completion of each project.

General Requirements:

1. Each survey plan shall show the following:

    a. North arrow.
    b. Reference to the NAD 83 datum.
    c. Graphic scale.
    d. Date of the survey.
    e. Pertinent notes related to the specific project.
    f. Deed and plan references (if applicable).
    g. Source for underground utility information (if applicable).
    h. Certification that the plan is based upon an actual field survey.
    i. A note shall be supplied as to the linear closure or positional tolerance of any closed secondary traverse set in order to perform the survey.

j. Benchmarks used and set.
k. All features shall be labeled or shown as a symbol, which is part of a legend.

CAD Requirements:

1. MIT requires all surveys to be in compliance with the layering standards and drafting practices set forth in this document as well as in the MIT BIM and CAD Guidelines for all AutoCAD® plans. Layering conventions for surveying are found in MIT Layering Standards for Surveys below.

4.2 Scale

In an effort to remain consistent, a scale of 1"=20' is preferred for all topographic surveys, unless site conditions dictate that a scale of 1"=10' is more advantageous and appropriate. The surveyor must request permission from MIT to prepare a topographic plan at a scale other than 1"=20' prior to the commencement of any work.

Property Line surveys, Easement surveys, and Activity and Use Limitation Plans may be produced at any scale as long as the property fits on one sheet and is legible.

4.3 MIT Layering Standards for Surveys

Layer Name Formatting:

1. MIT implements the same layer name formatting standard as the United States National CAD Standard (USNCS) for all of its surveying layers. In addition, MIT requires that the last letter of every underground utility layer name must indicate the standard Subsurface Utility Engineering (SUE) quality level (A, B, C or D) for the information on that layer. Please refer to Standard SUE Quality Levels.
2. Surveying layers are named according to the following system with the discipline designator always being 'SURV'.

Subsurface Utility Engineering (SUE) Quality Levels:

1. The 'Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data' defines the Subsurface Utility Engineering (SUE) quality levels used for all surveys at MIT. This document was published in 2003 and last updated in 2017 by the American Society of Civil Engineers and can be found at http://www.fhwa.dot.gov/programadmin/asce.cfm.
2. Surveyors must use one of the four quality levels of information at the end of every underground utility layer in the digital file.

a. Quality Level 'A' is also known as 'locating'. It is the highest level of accuracy presently available and involves the full use of the subsurface utility engineering services. It provides information for the precise plan and profile mapping of underground utilities through the nondestructive exposure of underground utilities, and also provides the type, size, condition, material and other characteristics of underground features.

b. Quality Level 'B' is also known as 'designating'. It involves the application of appropriate surface geophysical methods to determine the existence and horizontal position of virtually all utilities within the project limits. The information obtained in this manner is surveyed to project control. It addresses problems caused by inaccurate utility records, abandoned or unrecorded facilities, and lost references. The proper selection and application of surface geophysical techniques for achieving Quality Level 'B' data is critical. Information provided by Quality Level 'B' can enable the accomplishment of preliminary engineering goals. Decisions regarding location of storm drainage systems, footers, foundations and other design features can be made to successfully avoid conflicts with existing utilities. Slight adjustments in design can produce substantial cost savings by eliminating utility relocations.

c. Quality Level 'C' is probably the most commonly used level of information. It involves surveying visible utility facilities (e.g., manholes, valve boxes, etc.) and correlating this information with existing utility records (Quality Level 'D' information). When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, is primarily on rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.

d. Quality Level 'D' is the most basic level of information for utility locations. It comes solely from existing utility records or verbal recollections, both typically unreliable sources. It may provide an overall 'feel' for the congestion of utilities, but is often highly limited in terms of comprehensiveness and accuracy. Quality Level 'D' is useful primarily for project planning and route selection activities.

Standard Layer List:

The following layer list is an example of commonly used layer names along with the Quality Level designation when required. Modifications to or deviations from the layering standards as published in this document must be pre-approved by a member of the MIT Facility Information Systems group (FIS). Any special CAD requirements should be addressed at a joint meeting between the parties involved, prior to the development of CAD drawings for the project; otherwise the standards and guidelines in this document apply.

Title Block	
SURV-BSHBD	Title Block, Border, Text, Graphic Scale & Locus
SURV-LGND	Legend
Survey Information	
SURV-MNMT	Monuments & Description Text (Plotting)
SURV-CTP	Survey Control Points (STK, IP, SB)
SURV-TRV	Traverse Lines
SURV-BMRK	Bench Marks & Descriptions
SURV-BORG	Borings & Test Pits
SURV-BORG-TEXT	Borings & Test Pit Text
Survey Lines	
SURV-PROP	Property Lines
SURV-PRL-TEXT	Property Line Text & Dims.
SURV-LOT-TEXT	Lot Description & Text
SURV-ESL	Easement Lines
SURV-EAS-TEXT	Easement & Text Description
SURV-LIN	City, Town, County, & State Lines
SURV-ABL	Abutter Lines
SURV-ABU-TEXT	Abutter Text (N/F)
SURV-NAM-TEXT	Street, Stream, Lake Names
SURV-MSL	Misc. Lines (Buffer, Setback, Zoning…)
SURV-MSL-TEXT	Miscellaneous Line Text
SURV-FPL	100 Year Flood Plain Line
SURV-FPL-TEXT	Flood Plain Text
Natural & Landscape Features	
SURV-LED	Ledge & Rock Outcrop
SURV-PLANT-TREE	Tree Line, Trees, Shrubs & Other Vegetation
SURV-TRE-TEXT	Trees, Shrubs & Landscaping Text
SURV-WAT	Edge of Stream, Lakes, Brooks, & Marsh
SURV-WAT-TEXT	Stream, Lake, Brook Text
SURV-WTL	Flagged Wetland Line
SURV-WTL-TEXT	Wetland Flags & Text
SURV-MAR	Marsh Symbol
Manmade Features	
SURV-BLDG	Buildings
SURV-BLD-TEXT	Building Text
SURV-BLD-H	Building Hatch
SURV-BLD-OH	Building Overhead
SURV-SITE-FENC	Chain Link, Wrought Iron, Wood & Metal Fence Lines
SURV-SITE-TEXT	Fence Text
SURV-GDR	Guard Rails
SURV-SITE-WALL	Stone Walls

SURV-WLL	Retaining, Headwalls
SURV-WLL-TEXT	Wall & Guard Rail Text
SURV-STR	Ramps, Docks, Decks & Slabs
SURV-FEA	Posts, Signs, Mailbox, Lights, Etc.
SURV-FEA-TEXT	Site Feature Text
SURV-RLRD	Railroad Align & Text
SURV-PAV	Edge of Pavement, Curbs, Sidewalks & Drives
SURV-PAV-TEXT	Pavement, Ditch & Gravel Text
SURV-DIT	Drainage Ditches, Rip-Rap, Aprons, Dams & Culverts
SURV-SITE-WALK	Gravel Walks, Drives & Paths
SURV-GRV-TEXT	Gravel Text
SURV-PLY	Playgrounds & Playing Fields
SURV-BRI	Bridge Features
SURV-PAD	Conc. Pads
SURV-PAD-TEXT	Conc. Pad Text
SURV-PTL	Paint Lines, Parking Stripes, Etc.
Utility Features	
SURV-STRM-QL	Storm Drainage Lines
SURV-STRM-EQPM-QL	Storm Drainage Equipment
SURV-STRM-MHOL-QL	Storm Drainage Manholes
SURV-STRM-CBSN-QL	Storm Drainage Catch Basins
SURV-STRM-IDEN-QL	Storm Drainage Identification
SURV-RCVR-QL	Recovered Water Piping
SURV-RCVR-EQPM-QL	Recovered Water Equipment
SURV-RCVR-IDEN-QL	Recovered Water Identification
SURV-SSWR-INDR-QL	Indirect Waste Piping
SURV-SSWR-LABS-QL	Lab Waste Piping
SURV-SSWR-PIPE-QL	Sanitary Waste Piping
SURV-SSWR-VENT-QL	Sanitary Vent Piping
SURV-SSWR-QL	Sanitary Sewer Lines
SURV-SSWR-EQPM-QL	Sanitary Sewer Equipment
SURV-SSWR-MHOL-QL	Sanitary Sewer Manholes
SURV-SSWR-IDEN-QL	Sanitary Sewer Identification
SURV-EST-QL	Electrical Structural (PP, UP, MH, PED)
SURV-ELN-QL	Electrical Lines (Overhead & Underground)
SURV-ELE-TEXT-QL	Electrical Description & Text
SURV-CWTR-QL	Chilled Water Lines
SURV-CWTR-EQPM-QL	Chilled Water Equipment
SURV-CWTR-MHOL-QL	Chilled Water Manholes and Valve Boxes
SURV-CWTR-PROC-QL	Secondary Chilled Water - Equipment Cooling
SURV-CWTR-IDEN-QL	Chilled Water Identification
SURV-DOMW-QL	Domestic Water Lines
SURV-DOMW-EQPM-QL	Domestic Water Equipment
SURV-DOMW-MHOL-QL	Domestic Water Manholes and Valve Boxes

SURV-DOMW-IDEN-QL	Domestic Water Identification
SURV-DOMW-CPIP-QL	Domestic Cold Water Piping
SURV-DOMW-HPIP-QL	Domestic Hot Water Piping
SURV-DOMW-HOTR-QL	Domestic Hot Water Return Piping
SURV-CDSR-QL	Condenser Water Lines
SURV-CDSR-EQPM-QL	Condenser Water Equipment
SURV-CDSR-IDEN-QL	Condenser Water Identification
SURV-CNDW-QL	Condenser Water Supply/Return Piping
SURV-CNDW-EQPM-QL	Condenser Water Equipment
SURV-CNDW-IDEN-QL	Condenser Water Identification
SURV-CWTR-PROC-QL	Secondary Chilled Water - Equipment Cooling
SURV-HWTR-QL	Heating Hot Water Supply/Return Piping
SURV-HWTR-EQPM-QL	Heating Hot Water Equipment
SURV-HWTR-IDEN-QL	Heating Hot Water Identification
SURV-PROC-COLD-QL	Process Cold Water Piping
SURV-PROC-HOTS-QL	Process Hot Water Piping
SURV-PROC-HOTR-QL	Process Hot Water Return Piping
SURV-PROC-EQPM-QL	Process Water Equipment
SURV-PROC-IDEN-QL	Process Water Identification
SURV-GST-QL	Gas Structures (Gates, MH, MTRS)
SURV-GLN-QL	Gas Lines
SURV-GAS-TEXT-QL	Gas Description & Text
SURV-TST-QL	Telephone Structures
SURV-TLN-QL	Telephone Lines
SURV-TEL-TEXT-QL	Tel. Description & Text
SURV-MST-QL	Miscellaneous Utility Strs.
SURV-MLN-QL	Miscellaneous Utility Lines
SURV-MIS-TEXT-QL	Miscellaneous Utility Text
SURV-CST-QL	Cable TV Structures
SURV-CLN-QL	Cable Lines
SURV-CAB-TEXT-QL	Cable Description & Text
SURV-STS-QL	Steam Structures
SURV-STL-QL	Steam Lines
SURV-STM-TEXT-QL	Steam Description & Text
SURV-STEM-QL	High Pressure Steam Lines
SURV-STEM-EQPM-QL	High Pressure Steam Equipment
SURV-STEM-MHOL-QL	High Pressure Steam Manholes
SURV-STEM-IDEN-QL	High Pressure Steam Identification
SURV-STMP-QL	Medium Pressure Steam Lines
SURV-STMP-IDEN-QL	Medium Pressure Steam Identification
SURV-STEM-LPIP-QL	Low Pressure Steam Piping
SURV-STEM-LPIP-IDEN-QL	Low Pressure Steam Identification
SURV-STEM-LPIP-PROC-QL	Low Pressure Process Steam Piping

SURV-STEM-LPIP-PROC-IDEN-QL	Low Pressure Process Identification
SURV-OLN-QL	Overhead Wires
Grading	
SURV-SPG	Spot Grades
SURV-IND	Index Contours
SURV-INT	Intermediate Contours
SURV-GRD	Grid Ticks
SURV-GRD-TEXT	Grid Coordinate Text
SURV-BRL	Top Slope, Bottom Slope, Change in Slope

Effective Use of CAD Layers:

1. The effective use of CAD layering standards should:

    a. Allow users to isolate systems and drawing elements by controlling the visibility of objects - improving system performance and eliminating visual clutter.
    b. Expedite the import process and maintenance requirements for each set of drawings upon import into the MIT Facilities Information Systems GIS system.
    c. Facilitate the sharing of information between drawings and disciplines.
    d. Allow users to control display and printing characteristics such as color, line type, line weight, etc.

4.4 Deliverable Formats

Upon completion of the survey project, the surveyor shall provide the following to MIT:

Digital Formats:

1. Digital files with all of the point information in DWG or PDF format. Each file must be clearly marked with the following information:

    a. MIT Project Number.
    b. Date project started.
    c. Date of completion.
    d. Vol. # if applicable.
    e. Name of MIT project Manager.
    f. Disciplines
    g. Title.

Summary of Best Practices:

1. Use only USNCS and MIT standard layer names – reference the layer names provided in this document.
2. Use the minimum number of layers necessary to adequately separate entities in each drawing. The number of layers contained in each drawing will vary depending on the scope and complexity of the drawing, however drawings shall not contain extraneous, redundant, or overly detailed layer names.
3. Purge each drawing of unused layers prior to submittal. The drawing file shall contain only those layers necessary for displaying and plotting the information and drawing entities contained in each drawing. To ensure that subsequent prints made from each AutoCAD® drawing match the original, unused or unnecessary layers must be purged from the drawing prior to delivery.

APPENDIX A: CONTROL RECOVERY DATA SHEET

Control Recovery Data Sheets can be requested by emailing fis-request@mit.edu. Please fill out all the information on this sheet when recovering control (see sample below).

MIT CONTROL RECOVERY DATA SHEET

Company reporting: Surveyor XYZ, Inc.

MIT Point ID: MIT-1

Campus Location: Corner of Ames and Memorial Drive

Date found/not found: 4/21/2009

Condition: Disk was found in good condition

Notes:

APPENDIX B: CONTROL TIE SKETCH CARD

Control Tie Sketch Cards can be requested by emailing fis-request@mit.edu. Please fill out all the information on this card and attach an image of the control tie (see sample below).

MIT CONTROL TIE SKETCH CARD

Point ID: MIT-5

Type of Point Set (PK, MAG, EPLP, etc.): Aluminum Disk

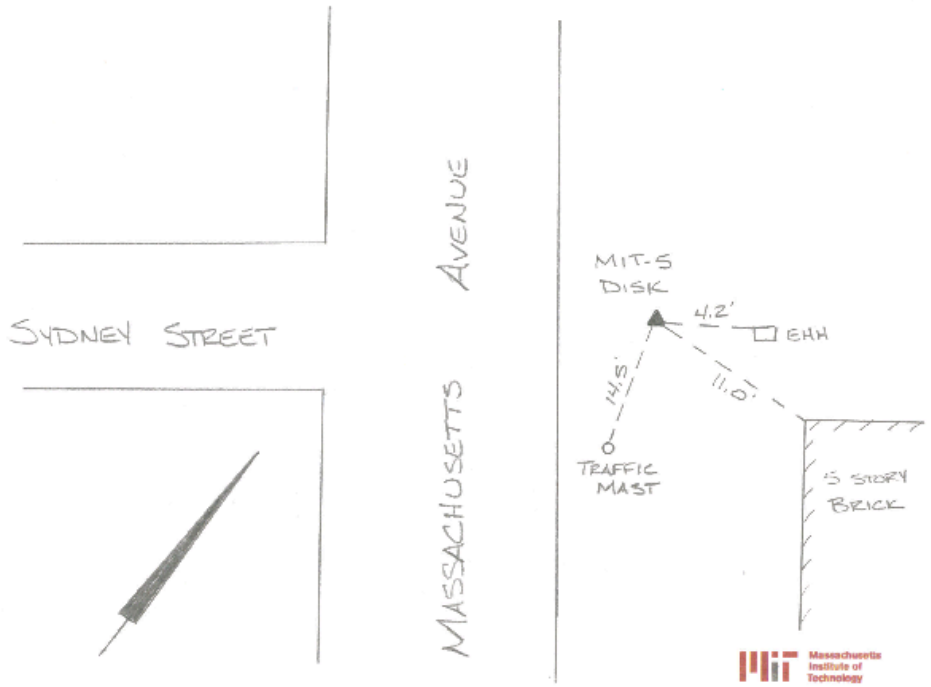
Name of Company establishing control: Surveyor XYZ, Inc.

Date adjusted: 4/7/2009

Northing (adjusted): 2957573.850

Easting (adjusted): 764415.289

Elevation (adjusted): 19.05



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