SECTION S626 - SURVEY MONUMENT

S626 GENERAL

As of the date of the start work order, the protection of all survey monuments on the job site is the responsibility of the general Contractor.

If a destroyed survey monument is found after this date, and the responsible party is unclear or undeterminable, the survey monument shall be replaced at the General Contractor expense.

It shall be the Contractor's responsibility to contact the City's Maps and Surveys Office to verify that the necessary ties have been taken to all existing survey monuments, prior to construction.

Survey monument issues that remain unresolved over 90 calendar days, from the date of destruction, may result in a declaration of Contract default.

In the case of utility Contractors, permits for proposed utility work may be withheld until any outstanding monument issues have been resolved.

All horizontal control survey monuments, whether new or set to replace destroyed monuments, will have the monument line intersection physically defined with the mark appropriate to the survey monument type.

S626-1 DESCRIPTION

The work shall consist of the installation of new survey monuments; adjustment, or removal of existing survey monuments; installation of new survey monument frames and covers; resetting of existing monument frames and covers; related survey work, submittal of survey data and monument certification; all as required in the Contract Documents, as directed by the City's Maps and Surveys Office and the Project Manager.

For purposes of this specification, all references are in accordance with *NYSDOT Standard Specifications (US Customary Units dated May 1, 2008)* edition, including any addenda.

S626-2 MATERIALS

S626-2.01 Horizontal Control Survey Monument (RCS)

Granite survey monuments shall be used for horizontal control only.

Granite shall be from approved quarries. The granite shall be hard and durable, of a light color, free from seams which impair its structural integrity, and of a good, smooth splitting appearance. The granite shall be rough quarried to the dimensions as shown on the detailed drawings. The top shall have a smooth finish, and quarrying holes will be permitted only in the sides and bottom.

S626-2.02 Brass Disc Survey Marker (RCS)

Brass disc survey marker will supplied by the City. The Contractor is to pickup and sign for the brass disc survey marker during normal business hours. The Maps and Surveys Office requires a minimum of at least 24 hours advance notice to make arrangements for pickup of the brass disc survey marker.

S626-2.03 Vertical Control Survey Monument (RTS)

Concrete survey monuments shall be used for vertical control only.

Concrete survey monument and base shall be constructed of Class K concrete with a number 5 (5/8 inch) iron rod set in the center of the concrete survey monument for its full length. The iron rod shall be topped with a 2 inch diameter domed cap with plastic insert, and tapered internal hole capable of accommodating ends of irregular shaped rebar.

S626-2.04 Monument Frame and Cover

Monument frame and cover is to be cast iron, with letters “RCS” cast into top of cover, per standard detail or approved equivalent. Equivalent frame and cover may be used only with prior written approval by City Survey office.

S626-2.05 Select Granular Fill

Select granular fill shall conform to the requirements of Section R203 Excavation and Embankment.

S626-2.06 Concrete

Concrete shall be Class K conforming to the requirements of Section S504 Portland Cement Concrete.

S626-3 CONSTRUCTION DETAILS

S626-3.01 General

Survey monument shall be set under the direction of a Land Surveyor licensed to practice in the State of New York. The City shall be provided with the required data for survey monument certification submittal and certification cards per Section S626-4 Monument Survey, Submittal and Certification Requirements.

The Contractor shall excavate for and install new survey monument, including frame and cover. The top of the survey monument shall not be less than 4 inches or more than 6 inches below finished grade (except for brass disc survey markers), and the frame and cover centered over the survey monument. Survey monument installation shall be coordinated with the installation of any surrounding work. The surface around the new survey monument shall be restored by the Contractor.

Special attention is directed to Section 104-22 of the Municipal Code of the City of Rochester, regarding requirements for a permit when working in the vicinity of a survey monument, as reiterated herein:

> *Section 104-22. Interference with survey monuments.*
>
> > *No person shall interfere with, disturb or move any survey monument without having obtained a permit in writing from the City Engineer. Interference for the purpose of this section shall be defined as any excavation work within three (3) feet of a survey monument or any extensive excavation work further than three (3) feet from a survey monument that may affect the accuracy of the monument.*

A survey monument will be considered destroyed that has been:

- Moved more than 0.02 of a foot in any direction from its City tied position
- Broken
- Disturbed to a point that the survey monument’s position is no longer fixed or stable
- Removed from the ground for any reason
- Vertically adjusted without the written authorization of the Maps and Surveys Office

In the event that a survey monument is destroyed during construction, the survey monument shall be replaced with a new unused survey monument of the type destroyed. The theoretical position of the intersection of the two monument lines shall be marked with a drill hole on a granite horizontal control survey monument, or a punch mark and cross on a brass disc survey marker. An elevation of a new vertical control survey monument will be established. The required data for survey monument certification submittal shall be prepared by a NYS Licensed Land Surveyor and provided to the Maps and Surveys Office by the Contractor, via the Project Manager.

Submittal of either horizontal (RCS) or vertical (RTS) monument certification data to the Maps and Surveys Office, via the Project Manager, does not constitute acceptance of the survey monument. Written acceptance or rejection of each survey monument will be made to the Project Manager by the Maps and Surveys Office after review of the submission.

S626-3.02 New Survey Monument

For the purposes of this specification, a new survey monument is defined as a survey monument designated by the Maps and Surveys Office to be set, excluding those survey monuments which are to be set to replace any destroyed survey monuments. New monument frame and cover shall be installed with each new survey monument installation.

New survey monument situations include:

- Survey monuments set to upgrade monument network density
- Survey monuments set to replace existing survey monuments in poor physical condition
- Survey monuments set within new streets to be dedicated or accepted by the City

RCS Monument - Rochester City Survey monument refers to a horizontal control survey monument set to define the limits of the City street right-of-way as shown on the City's official mapping. The RCS monument is typically set and marked with a drill hole at the intersection of two City monument lines, said monument lines being parallel to and 4.00 feet offset into the right-of-way from the street property lines (right-of-way lines).

RTS Monument - Rochester Topographic Survey monument refers to a vertical control survey monument set as a permanent benchmark referenced to elevations in the Rochester "City Datum".

S626-3.03 Theoretical Position

Horizontal control survey monument shall be placed, centered and marked at the intersection of the two monument lines located 4.00 feet from and parallel to the street property lines (right-of-way lines), unless otherwise authorized in writing by the Maps and Surveys Office.

S626-3.04 Drill Hole

Drill hole shall be 0.01 of a foot in diameter, a minimum of 0.03 of a foot deep, and at least 1/2 inch from the outer edge of the top of the horizontal control survey monument. A punch mark and cross shall be used on brass disc survey marker.

In both instances, the mark will be set to indicate the theoretical position of the intersection of two monument lines.

S626-3.05 Brass Disc Survey Marker (RCS)

A. General

Where pre-existing physical conditions prohibit the installation of a granite survey monument, brass disc survey marker may be installed. Brass disc survey marker can be used only when approved in writing by the Maps and Surveys Office.

At the request of the Contractor, a representative of the Maps and Surveys Office will inspect the proposed installation site, determine if conditions warrant a brass disc survey marker installation, and provide written authorization and direction.

The use of brass disc survey marker without prior written approval may result in the replacement of the brass disc survey marker with a new granite survey monument, and recertification, at the Contractor's expense.

The monument line intersection shall be set with a punch mark and cross.

B. Sidewalk Installation

For installation in existing concrete sidewalk, brass disc shall be installed recessed to half the dome height, and epoxy in place (1/8 inch all around). For installation in new concrete sidewalk, brass disc shall be installed embedded to half the dome height within the concrete, and before the concrete has set-up.

C. Installation over Subsurface Obstruction

Brass disc is to be installed top center of a poured-in-place, 12 inch top diameter, Class K, concrete column, with new monument frame and cover. The concrete column shall extend down to and rest on top of the subsurface obstruction. A minimum of two 1/2 inch diameter PVC pipe weeps shall be installed thru the top of the concrete column.

S626-3.06 New Monument Frame and Cover

New monument frame and cover shall be furnished and installed with new survey monuments, or to replace existing monument frames and covers, or over existing survey monuments where existing frame and cover is missing. New monument frame and cover shall be set centered over the survey monument, placed true to line and grade, make full and even bearing on the underlying surface, and are to be non-rocking when in place. The new monument frame and cover shall be set flush with the finished grade.

S626-3.07 Vertical Adjustment of Existing Horizontal Survey Control Monument

Survey monument vertical height adjustment is to take place only at the written direction of the Maps and Surveys Office. Survey monument vertical height adjustment performed without prior written authorization from the Maps and Surveys Office shall be considered destruction of the survey monument, and require monument replacement and certification. Adjustment of vertical survey control monuments is not allowed.

The existing monument frame and cover shall be removed, and the top of the existing survey monument cut off. All survey monuments adjusted are to be not less than 4 inches or more than 6 inches below finished grade. The theoretical position of the monument is to be reestablished, a new drill hole made and new monument certification prepared. All extraneous material shall be removed from the existing monument frame and cover. Existing monument frame and cover shall be set centered over the survey monument, placed true to line and grade, make full and even bearing on the underlying surface, and are to be non-rocking when in place. The existing monument frame and cover shall be set flush with the finished grade.

S626-3.08 Remove Existing Survey Monument

The existing survey monument, including frame and cover, shall be carefully excavated for and removed. Existing survey monument, including frame and cover, that is solid, undamaged and acceptable for re-use shall be cleaned of all extraneous material in such a manner as to be non-deleterious to the existing survey monument. Existing survey monument, including frame and cover, shall be safely stored on site, and the Maps and Surveys Office notified to arrange for pickup. The excavation shall be backfilled with select granular backfill and the disturbed surface area restored.

Any existing survey monument, and/or frame and cover, that are damaged or found to be unacceptable for reuse shall be disposed of by the Contractor.

S626-3.09 Destroyed Survey Monument

Destroyed survey monument shall be replaced with a new unused survey monument of the type destroyed.

Survey monuments destroyed after the date of the start work, and the responsible party is unclear or undeterminable, shall be replaced at the general Contractor expense.

S626-3.10 Reset Existing Monument Frame and Cover

The existing monument frame and cover shall be removed, cleaned of all extraneous material and reset over the existing survey monument. Existing monument frame and cover shall be set centered over the survey monument, placed true to line and grade, make full and even bearing on the underlying surface, and are to be non-rocking when in place. The reset existing monument frame and cover shall be set flush with the finished grade.

S626-3.11 Replace Existing Survey with New Horizontal Control Survey Monument (RCS)

Remove existing survey monument, including frame and cover and install new survey monument (RCS) with new frame and cover in accordance with Section S626 Survey Monument.

Existing frame and cover that is solid, undamaged and acceptable for re-use is to be cleaned of all extraneous material in such manner as to be non-deleterious to existing frame and cover, safely stored on site, and Maps and Surveys Office notified to arrange for pickup.

Existing frame and/or cover that are damaged or found to be unacceptable for reuse are to be disposed of.

Existing survey monument is to be disposed of.

S626-4 MONUMENT SURVEY, SUBMITTAL AND CERTIFICATION REQUIREMENTS

S626-4.01 General

In developing the theoretical block street line configuration and subsequent monument lines, monument line intersections and horizontal control survey monument positions, the City of Rochester official "SBL Mapping" should be the basis, in conjunction with the more detailed data available from the City District Mapping System and various land data records.

S626-4.02 Minimum Horizontal Survey Specifications (RCS)

Minimum station spacing:

- 300 feet

Horizontal directions:

- 2 positions, direct and reverse (main traverse)
- 5 seconds rejection from the mean of the 2 direct and reverse
- 1 position, direct and reverse (side shots)

Reciprocal vertical angles on theodolite traverses:

- 1 direct and reverse
- 20 seconds maximum spread

Maximum angular mis-closure:

- 10 seconds $\sqrt{N}$ = Number of sides/traverse angles
- not to exceed 5 seconds per station

Minimum positional closure:

- 1:20,000 closure after angle error distribution

Only properly maintained, 1 second least count, directional theodolites or total stations shall be used.

Only tripod fixed, precisely marked targets and prism with centers resolvable at minimum control station spacing shall be used.

Stable, properly maintained tripods shall be used.

Tribrach and instrument optical plummets shall be adjusted to within 0.003 of a foot at a 5.00 foot height of instrument.

Deviation from minimum specifications may be granted in writing by the Maps and Surveys Office under certain circumstances.

Electronic Distance Meters (EDM):

- Must be capable of a high degree of resolution and small inherent error, to maintain a high relative accuracy on the typically short traverse legs of City Survey lines - not to exceed Å (03MM + 2 PPM), verified by baseline results
- Must have been calibrated on any NGS certified EDM baseline within the last 6 months and data showing same provided with each Project submittal - include make, model and instrument serial number
- Steel taping of short distances to be accomplished with a calibrated invar tape or a tape compared to a standardized tape with applied temperature, sag, tension and slope corrections
- Meteorological conditions shall be measured on site, recorded and corrections applied. (Temperature measured to 1°F, pressure measured to 0.10 inch mercury)

- EDM distances of traverse legs shall be the mean of a minimum of 5 measurements in each direction

As a minimum, the block containing the survey monument to be set shall be traversed and all existing survey monument stones on both sides of the streets are to be located and used in the analyzation.

As a minimum, the field locations of three existing marked RCS survey monuments shall be analyzed in the determination of each RCS survey monument to be set. The final scope of located RCS survey monument required to reliably fit the developed theoretical figure to existing field locations of RCS survey monuments is a professional judgement decision of the NYS Licensed Land Surveyor.

S626-4.03 Required Data for Horizontal Control Survey Monument (RCS) Certification Submittals via the Project Manager

Complete Land Surveyor sealed copies of the EDM calibration performed within 6 months of the monument work. The calibration is to be performed on any NGS certified EDM baseline. Provided data will include final reduced results, adjustment made and the instrument make, model and serial number.

Complete Land Surveyor sealed copies of the field notes demonstrating adherence to minimum survey specifications (RCS) and noting:

- Date and temperature
- Crew
- Instrument make, model and serial number

Traverse print out indicating:

- Raw angular closure
- Closure after angular error distribution
- Final adjusted traverse configuration

Point number sheet for the Project area with corresponding coordinate dumps presented in a manner clearly delineating theoretical points from physical field measured points with a complete description of the field point.

Reference to SBL maps, District maps and any other data sources used to develop the theoretical block configurations.

Outline of adjustments, both linear and angular, made to record block configurations to create closed figures.

Two each 3 inches by 5 inches certification cards as shown in Contract Documents.

S626-4.04 Horizontal Control Survey Monument (RCS) Certification Cards

The submittal of two 3 inches by 5 inches certification cards on standard card stock, in the format shown in Contract Documents, are required for each survey monument to be certified.

Provide a minimum of five angle and distance ties to substantial, well defined and described, permanent points from the RCS monument drill hole or punch mark and cross set. Ties to nails in trees are not acceptable.

RCS monument drill holes set are to be 0.01 of a foot in diameter, 0.03 of a foot deep and at least 1/2 inch from the outer edge of the survey monument.

Maps and Surveys Office will furnish the monument number to be shown on the submitted certification cards.

A NYS Licensed Land Surveyor is to place their seal, sign and date the back of each card.

Certification to read:

> "*I _(printed name)_ NYSPLS # _____ hereby certify to the City of Rochester that the monument shown on the reverse side has been established on a 4.00 foot offset from the property lines (right of way) and that the monument line intersection has been marked with a drill hole or punch mark and cross. All in accordance with City of Rochester Specification S626.*" (Certification is to be on back of the card)

S626-4.05 Minimum Vertical Survey Specifications (RTS)

Instrumentation, calibration procedures, field and office procedures shall be in accordance with Federal Geodetic Control Committee Standards and Specifications to attain Second Order Class II results.

Peg test and rod calibration to be performed within 7 days prior to runs.

Minimum acceptable closures to be:

- 0.033 of a foot $\sqrt{run\ in\ miles}$

Level runs to begin at either an RTS monument or a Geodetic Control Monument with a published Rochester "City Datum" value, turn through the new RTS monument set and close to a second RTS or Geodetic Control Monument within specified tolerances.

Published Rochester "City Datum" elevations shall be obtained from the Maps and Surveys Office.

S626-4.06 Required Data for Vertical Control Survey Monument(RTS) Certification Submittal via the Project Manager

Copy of field level peg test and rod calibration performed within 7 days prior to level runs to include date, instrument and serial number.

Complete original field notes or Land Surveyor sealed copies demonstrating adherence to the specified Second Order Class II standards and noting:

- Date
- Crew
- Instrument make, model and serial number
- Published elevations
- Measured elevations
- Closure

Summary of adjustments performed.

Two each 3 inches by 5 inches certification cards as shown in Contract Documents.

S626-4.07 Vertical Control Survey Monument (RTS) Certification Cards

The submittal of two 3 inches by 5 inches certification cards on standard card stock, in the format shown in Contract Documents, are required for each survey monument to be certified.

Provide a minimum of 3 swing ties to substantial, well defined and described permanent points. Ties to nails in trees are not acceptable.

Show measured "City Datum" elevation of the new survey monument set and the elevation of each reference benchmark used with corner description of each.

Maps and Surveys Office will furnish the monument number to be shown on the submitted certification cards.

A NYS Licensed Land Surveyor is to place their seal, sign and date the back of each card.

Certification to read:

> "*I _(printed name)_ NYSPLS # _____ hereby certify to the City of Rochester that the vertical control monument shown above has been established in the City of Rochester datum using proper methods to establish Second Order accuracy. (Class II) 0.033' $\sqrt{loop\ in\ miles}$ "* (Certification is to be on front of the card)

S626-4.08 Monument Ties

Suggested tie types to include but not limited to:

- Drill hole in concrete walk
- Drill hole in concrete walk as a point on line to adjacent monument
- Drill hole in curbing
- Masonry building corner
- Drill hole in light pole base, sign base, signal box base, et cetera
- Masonry porch corner or step
- Chiseled cross in manhole rim, anchor bolt or metal pole
- Drill hole in water table
- Pk or Mag nail in wooden utility pole
- Set iron pin with cap (on sites void of potential tie objects)
- For RCS angle and distance ties the 0° origin can be adjacent monuments or long definable naturals such as building corners, church steeples, tower apexes, atoll lights or intersection stations

In general:

- Attempt to spread ties through 360° for strength of resection
- Diversify tie types with no more than two ties to a single type
- If ties are taken on a construction job avoid ties to manhole rims, curbing, et cetera, that will be destroyed
- Per City Forestry no ties to points in City trees are acceptable
- Ties are to be taken to substantial, well defined and described, permanent points
- Angle ties shown are to be the average of a minimum of 1 direct and 1 reverse reading

S626-5 METHOD OF MEASUREMENT

Quantity to be measured for payment will be number of units installed, adjusted, replaced or removed.

No payment will be made for destroyed monuments and their re-survey as defined under Subsection S626-3 Construction Details.

S626-6 BASIS OF PAYMENT

S626-6.01 General All Items

Unit price bid for all items includes cost of: related survey work; preparation and submittal of survey data and monument certification cards; excavation; furnishing and installing concrete and select granular backfill; and furnishing all labor, material and equipment necessary to complete work.

Excavation that is included in pay item does not include rock excavation. Rock excavation will be paid for under separate bid item.

Payment for new monument installation will be made as follows: Fifty percent (50%) will be paid upon completion of installation and acceptance of new monument. Remaining fifty percent (50%) will be retained until all of required monument certification record information has been submitted to and approved of by Maps and Surveys Office. Failure to correct any erroneous or incomplete monument certification record information, will result in forfeiture of retained fifty percent (50%).

Survey monuments destroyed after date of start work, and responsible party is unclear or undeterminable, are to be replaced at general Contractor expense.

S626-6.02 Horizontal Control Survey Monument (RCS)

Unit price bid also includes cost of: furnishing and installing new granite monument including frame and cover; setting theoretical position; drill hole.

S626-6.03 Vertical Control Survey Monument (RTS)

Unit price bid also includes cost of: furnishing and installing new concrete monument including frame and cover; iron rod; cap with plastic insert; establishing elevation of new monument.

S626-6.04 Brass Disc Survey Monument (RCS)

A. Installation in Sidewalk

Unit price bid also includes cost of: picking up and installing brass disc survey marker; setting theoretical position; punch mark and cross; epoxy.

B. Installation over Subsurface Obstruction

Unit price bid also includes cost of: picking up and installing brass disc survey marker; furnishing and installing frame and cover; setting theoretical position; punch mark and cross; concrete column.

S626-6.05 Vertical Adjustment of Existing Survey Monument

Unit price bid also includes cost of: removing, cleaning, and reinstalling existing frame and cover; cutting off top of existing survey monument; re-establishing theoretical position; drill hole.

S626-6.06 Remove Existing Survey Monument

Unit price bid also includes cost of: removing, cleaning and storing existing monument, frame and cover; making arrangement for pickup; disposal of damaged or unusable monument, and/or frame and cover.

S626-6.07 Install New Monument Frame and Cover

Unit price bid also includes cost of: furnishing and installing new frame and cover; removing and disposing existing frame and cover.

S626-6.08 Reset Existing Monument Frame and Cover

Unit price bid also includes cost of: removing, cleaning and resetting existing frame and cover.

S626-6.09 Replace Existing Survey Monument with New Horizontal Control Survey Monument (RCS)

Unit price bid also includes cost of: removing, cleaning and storing existing frame and/or cover and making arrangement for pickup; disposal of damaged or unusable existing frame and/or cover; removal and disposal of survey monument; furnishing and installing new monument including frame and cover; setting theoretical position; drill hole.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
S626.02	Horizontal Control Survey Monument (RCS)	Each
S626.03	Vertical Control Survey Monument (RTS)	Each
S626.04	Vertical Adjustment of Existing Survey Monument	Each
S626.05	Remove Existing Survey Monument	Each
S626.06	Install New Monument Frame and Cover	Each
S626.07	Reset Existing Monument Frame and Cover	Each
S626.08	Brass Disc Installation in Sidewalk (RCS) (Furnished)	Each
S626.09	Brass Disc Installation over Subsurface Obstruction (RCS) (Furnished)	Each
S626.10	Replace Existing Survey Monument with New Horizontal Control Survey Monument (RCS)	Each

REVISED March 3, 2015