STANDARD CONSTRUCTION SPECIFICATIONS
FOR MUNICIPAL CONSTRUCTION SURVEYS
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SECTION 65.01 GENERAL

Article 1.1 Scope of Work

The Contractor shall furnish all labor and materials necessary to perform all surveying and staking essential for the completion of construction in conformance with the Drawings, Specifications, and Contract Documents. The Contractor shall perform all the necessary Work and calculations required to accomplish the Work in accordance with this Division.

This Section establishes a minimum standard of field survey specifications and procedures to properly control Municipal construction projects. The Contractor shall insure that commonly accepted practice of survey methods and procedures are followed. Errors or damages resulting from the Contractor's survey shall be corrected or made whole at the expense of the Contractor. The Owner shall not be held liable for any additional expense. Any method conflicting with these survey specifications must be approved by the Engineer prior to its use.

An Alaskan Registered Professional Surveyor, subcontracted to the Contractor shall perform all surveying, monumentation, staking and cross section for quantities pay item measurements. All personnel involved in measuring and recording survey data shall be directly employed by the Surveying Subcontractor and shall not be employed by the Contractor or any of the other Subcontractors for the duration of the project. Failure to adhere to this specification will result in non-payment for all Work affected by non-compliance.

The Contractor shall notify the Engineer twenty-four (24) hours in advance prior to beginning Work. All requests for information or determinations concerning the project shall be directed to the Engineer.

Article 1.2 Payment - General

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

SECTION 65.02 CONSTRUCTION SURVEYING

Article 2.1 Project Control

The Owner may provide project horizontal and vertical control monuments to facilitate construction staking or the Owner may not have provided horizontal and vertical control monuments for a project. Regardless, the Contractor shall recover project survey control monuments shown on the Drawings or establish project survey control monuments to ensure the project is properly located and constructed according to the Contract Documents.

Survey control monuments may be shown on the Drawings. Prior to construction, the Contractor shall locate these monuments to ensure they have not been destroyed. In the event the Contractor is unable to locate certain monuments, the Contractor shall notify the Engineer immediately and provide five (5) working days for the Engineer to reestablish the missing monumentation.

The Contractor shall have no basis for a claim requesting additional compensation for costs incurred due to missing survey control which is shown on the Drawings, unless the Engineer fails to reestablish said control within five (5) working days after written notification from Contractor. The Contractor may be entitled an extension of time as the Engineer may determine. Claim for extension of time shall be in accordance with Division 10, Section 10.05, Article 5.23 - Delays and Extension of Time.

The Contractor shall notify the Engineer immediately if a discrepancy exists between the field conditions and the Contract Documents. Project staking, which would be directly affected by the discrepancy, shall cease until further notice by the Engineer. Work unaffected by the discrepancy shall continue uninterrupted.

The Contractor is responsible for preserving, protecting and replacing all monuments and lot corners, line stakes, grade stakes, reference points, and hubs. In the event of their loss or destruction, the Contractor shall pay all costs for their replacement.

A. Monuments

1. General Description

A monument is defined as a material object used to physically identify a measured point on the earth's surface, representing a land boundary that was determined by a land survey. The term "monument" will be deemed generic to identify public land corners, private property corners and public agency vertical and horizontal control monuments. If a question arises as to the validity of a found object being a monument, it should be submitted to the Engineer for clarification prior to disturbance or removal.

2. Existing Monument and Lot Corner Search

Contractor shall perform a monument search and make a record of the monument and lot corner search in the survey control field book, before commencement of construction staking. The monument search shall include both centerline and property monumentation.

Contractor shall locate and verify all project survey control monuments shown on the Drawings to ensure that they have not been disturbed or destroyed. In the event the Contractor is unable to locate any survey control monument that is shown on the Drawings, the Contractor shall notify the Engineer immediately. The Engineer shall have five working days to reestablish the missing monument or make a determination whether the project can be accurately staked without the missing monument.

The field book record of the monument and lot corner search shall state which monuments were found and which were not found. Contractor shall obtain record plats within the construction limits to assist in the search.

The Contractor shall replace all monuments and lot corners that are missing upon completion of construction unless the Contractor can show that the monument or lot corner was searched for and none existed prior to construction.

The requirement to search for existing monuments and lot corners is governed by a separate pay item in the Bid Schedule shall be measured and paid as identified in Article 2.15 – Method of Measurement and Article 2.16 – Basis of Payment.

3. Requirement to File Record of Monument

The State of Alaska Statute (AS 34.65.040) requires A RECORD OF MONUMENT to be filed with the State District Recorders Office immediately after establishment of survey control and prior to clearing and grubbing and/or excavation work for all applicable monuments. Monuments for which a record of monument shall be filed are defined as follows:

- U.S. public lands survey monument established by a cadastral land survey.
- Alaska state land survey monument established by a cadastral land survey.
- City of Petersburg land survey monument established by a cadastral land survey.
- Exterior boundary monument controlling a record survey.

- Geodetic control monument established by a federal, state, or municipal agency.

Proof of recording shall be submitted to the Engineer in the form of a copy of the monument of record bearing the State District Recorders stamp before the monument is disturbed or removed.

A second RECORD OF MONUMENT shall be filed for each monument after the monument has been replaced (refer to AS 34.65.040). The record of monument shall be filed within five (5) working days of the date the monument was installed. Proof of recording shall be submitted to the Engineer in the form of a copy of the record of monument bearing the State District Recorder's stamp.

B. Requirement to Establish Monuments

1. General

The Contractor shall replace any monument that exists within the construction limits if it is disturbed or removed due to project activity. All monumentation disturbed or removed shall be replaced with the same type monument or monument approved by the Engineer. All monuments that are replaced shall be crowned with a self identifying cap bearing the surveyor's license number, year set, the lot, block and subdivision name stamped into the cap. No plastic monument caps are allowed. Should a physical impediment prevent a monument from being reestablished at its original location, one or more reference monuments shall be established. The establishment of reference marks shall be coordinated with the Engineer.

2. Centerline Monumentation for Road Improvement Projects

Projects which include paving or repaving of the road surface shall establish monuments installed in a monument case at all project centerline PCs, PTs, angle points, and street intersections. Monuments established to identify street intersections, angle points, and PCs/PTs of curves shall be center punched and stamped with the following information:

- centerline stationing
- year set
- surveyor's license number
- the initials "C.O.P."

Monuments that are located in gravel road surfaces, fill slopes, back slopes or ditches shall be installed six inches (6") below the finished surface.

Existing subdivision lot corner monuments located within paved portions of a public use easement shall be replaced with a like monument installed flush with the top of finished pavement grade.

3. Utility Projects Within the Road Right Of Way

Maintenance and utility projects including storm drains, traffic signalization/channelization and gravel surface re-grading and reshaping projects, do not require the establishment of new monumentation. However, in accordance with SubArticle B.1 - General. above, the Contractor is responsible for replacing any existing monuments disturbed or removed during the Work.

4. Standard Monument and Monument Case Specifications

The standard monument is a five-eighths by thirty inch (5/8" x 30") iron rebar with a two inch (2") aluminum cap attached. The monument case shall conform to AASHTO M-105, Class 30A or DOT/PF Standard Drawing M-16.01. The case shall be coated with coal-tar pitch varnish. The top of the case shall be installed flush with the pavement surface. The top of a monument installed in a case shall be four-tenths feet (0.4') below the top of the case.

5. Request to Install Additional Monumentation

The Owner may request that additional monumentation be established and installed. Additional monumentation is extra to the project and not identified in the Contract Documents. The monuments would be established and installed according to SubArticles B.1 - General and B.4 - Standard Monument and Monument Case Specifications above.

This Work is governed by a separate pay item in the Bid Schedule and is separate from the lump sum construction survey pay item listed in Article 2.16. The measurement for this pay item is identified in Article 2.15 Method of Measurement.

C. Project Control Accuracy

1. Horizontal Control

The maximum permissible linear error allowed in establishing horizontal control is 1:10,000 feet. The maximum error allowed in unadjusted angular closure shall be calculated by the formula "15 times the square root of N." The term "N" signifies the number of transit setups in a traverse and "15" signifies fifteen seconds.

2. Vertical Control

Vertical datum shall originate from the MOA Benchmark Network or NGS Vertical Level Line System. All level circuits run to establish temporary bench marks shall have an accuracy no less than the value computed by the equation (three-hundredths feet (0.03') times the square root of the distance

in miles). Foresights and backsights shall be balanced. The maximum sighting distance shall not exceed three hundred feet (300'). All leveling circuits establishing TBMs will be adjusted utilizing recognized standard surveying adjustment methods. Side shots to establish an elevation on TBMs will not be allowed.

A minimum of two known bench marks shall be utilized when establishing TBMs to verify correct elevation information. A sufficient number of TBMs shall be set to control a project with a maximum spacing of eight hundred feet (800') between marks. Typically, a TBM should not be greater than two hundred feet (200') outside the construction limits of the project. All TBMs shall be located and be comprised of sufficient materials such that their integrity will not be compromised throughout the life of the project.

D. Construction Centerline

1. Establish Centerline

The construction centerline location and stationing shall conform to that shown on the Drawings. Any errors found in the line shall be corrected and shown on the specific plan view with reference to the centerline stationing. If control points do not exist they shall be established and referenced so that the line can be readily re-established when required. A minimum of two reference points shall be established to reference each project control point or monument. Each reference point shall be visible to the other reference point. The method of referencing control points shall be done in accordance to the Standard Details of these specifications. Reference points shall be placed at locations where there is the least possibility of their being disturbed during the construction period. Measurements and sketches of the reference points shall be kept in the horizontal control survey field book.

2. Check Existing Ground Profile

A centerline profile shall be run prior to establishing construction grade stakes. The existing ground elevations shall be checked against the existing profile elevations shown on the Drawings to verify design grade relative to the existing ground conditions. The Contractor shall review the centerline profile information and immediately notify the Engineer of any elevations that do not match the plan profile information. The Engineer will direct the Contractor how to proceed.

3. Pavement Rehabilitation Projects

This paragraph pertains only to pavement rehabilitation projects when a field survey of existing conditions was not conducted as part of the design process for the project. Contractor shall conduct a preconstruction survey to establish the existing road centerline and gutter lip profiles as applicable, within five working days prior to beginning construction staking, Contractor shall submit the survey field notes and a centerline profile plot drawn on vellum drawing paper at the same scale as the Drawing scale to the Engineer. The Engineer will have five days to review the survey notes and profile drawings prior to the start of construction.

Article 2.2 Field Notes

The Contractor will supply the Project survey field books. Field books will only be maintained by the Contractor. No survey Subcontractor will be allowed to check out field books. The Owner has the right to inspect and take possession of the field books at any time throughout the project. Each book shall be indexed and its contents referred to by page number prior to returning them to the Owner. All field books containing field note information shall be sealed and signed by an Alaskan Registered Professional Land Surveyor on the title page of each field book. The date, weather conditions, survey crew personnel, and instruments used shall be shown at the beginning of each day's notes. As a general rule, field notes for each phase of the Work shall be placed in a separate series of field books. All field books used for the project shall be submitted to the Owner upon completion of the project.

Field notes shall be neatly logged as follows:

- observations recorded directly in field book.
- notes shall be in pencil.
- notes shall be complete and reduced.
- sketches and traverse data shall be graphic.
- stationing shall increase from the bottom to the top of the page.
- notes shall be precise and sufficiently detailed.

Refer to Section 65.02, Article 2.13 – Electronic Data Collection and Radial Surveys for procedures for logging field notes with the use of electronic data collectors.

Pegging of notes and erasures of information will not be acceptable. A line shall be drawn through those portions of the notes in error leaving the original note legible. The correction shall be noted above the original entry. Corrections shall be initialed and dated. Where appropriate, a note of explanation shall be included.

Field notes shall conform to the note format shown in the Standard Details. All survey Work will be stopped until the notes are brought into conformance with this requirement. A copy of each day's field book notes shall be reduced and delivered to the office of the Engineer by 12:00 Noon the following work day. The Engineer may issue a stop work order at the Contractor's expense until the field notes are delivered within this time frame.

Failure on the part of the Contractor to keep and maintain complete and accurate field notes, as required by this Section, shall be sufficient reason to withhold payment for those items of Work where survey is required. No final project payment will be made to the Contractor until the field books have been submitted and approved by the Engineer.

Article 2.3 Party Chief's Daily Diary

The survey party chief shall keep a factual daily diary of all Work performed by the survey crew on the project. As a minimum, the diary shall contain the following information:

- date.
- crew.
- type & location of Work performed.
- Work accomplished.
- orders from the Engineer.
- signature of Party Chief.

This record shall be kept on the project site and submitted to the Engineer upon request. At completion of the project this dairy shall become the property of the Owner.

Article 2.4 Clearing and Grubbing Stakes

The Contractor shall stake the clearing and grubbing limits as shown on the Drawings and/or as directed by the Engineer. If possible, stakes shall be adjusted to avoid sharp breaks in the width of the clearing line. The staking of clearing limits shall be approved by the Engineer prior to the start of the clearing operations.

Distances shall be measured to the nearest foot and standard lath/flagging shall be placed to clearly designate the intended limits. Intervals for placement of lath/flagging shall vary based on the terrain and foliage density, with a minimum of fifty feet (50') and no greater than one hundred feet (100') between lath. In areas of heavy timber, clearing stakes shall be placed to avoid leaving trees on the clearing line. If, as the Work progresses, revisions are required to the originally staked clearing distances, the revisions shall be duly noted in the field notes.

Article 2.5 Cross Sections

The Contractor shall perform all cross sections necessary for determination of excavation and fill or backfill quantities, including intermediate and/or re-measure cross sections as may be required. Cross sections shall be required before excavation activity begins unless otherwise specified. When clearing and grubbing work is included in the contract the original cross sections shall be taken immediately after grubbing work is complete. Cross sections measured for pay quantities shall clearly identify in the field notes whether the Work was done before excavation or after excavation. When both usable and unusable excavation are a part of the project, the limits of usable or unusable materials shall be clearly identified in the cross sections, in the field book.

A. Methods and Procedures

1. Equipment

Cross sections may be accomplished with 1) an engineers level, 2) a self compensating surveyor's level, or 3) an electronic (laser) level, or 4) by electronic data collection and radial survey method. Neither radial methods nor electronic leveling shall be employed without prior approval from the Engineer. When radial methods or electronic leveling methods are used the survey shall comply with or exceed the accuracy established in this article. Conditions under which these methods may be used shall be discussed at the initial pre-construction meeting with the Engineer. For radial methods see Article 2.13 - Electronic Data Collection and Radial Surveys.

2. Procedure and Accuracy

When an engineering level, self compensating surveyor's level, or an electronic (laser) level is used, cross sections shall be taken perpendicular to the centerline along tangents and on radial lines along curves. A right angle prism shall be used to determine perpendiculars. The height of the instruments (H.I.'s) shall be recorded to the nearest hundredth of a foot (0.01'). All cross sectioning work shall be part of a closed level loop. If only one TBM is used the level set-up shall be broken and a different instrument height obtained before closing into the same TBM. The maximum allowable error for level loops used for cross sectioning shall be three hundredths of a foot (0.03'). Cross section readings shall be recorded to the nearest tenth of a foot (0.1'). Horizontal measures shall be recorded and accurate to the nearest tenth of a foot (0.1'). Work shall not be paid for if it does not meet the stated accuracy requirements.

3. Original Ground Measures

Cross section measures of original ground shall be taken at each fifty foot (50') station as indicated on the Drawings. Intermediate stations shall be measured by cross section wherever grade breaks occur. Additional cross sections shall be taken at stations to include quantities measurement of retaining walls, drainage structures, etc. Elevation shots for original ground cross sections shall be taken at the centerline of construction according to the Drawings and as a minimum, at the following points perpendicular to and on each side of the centerline:

- grade breaks
- edge of pavement
- curb and gutter
- shoulder of road
- toe of slope
- centerline of ditch
- top of bank
- all other physical features within the project limits.

In areas where overbreak or slides are anticipated, sections shall be extended out from centerline to include the anticipated disturbed ground area.

4. After Excavation Measures

Cross sections shall be taken at the same stations as the original ground cross sections. Elevation shall be for the bottom, sides and top of excavation at the following points on each side and perpendicular to the centerline:

- centerline
- grade breaks
- toe of excavation
- top edge of cut
- original ground at a minimum of ten feet (10') beyond the limits of excavation.

Work not meeting these requirements shall not be accepted by the Engineer for payment.

B. Notification Prior To Cross Section Work

The Contractor shall notify the Engineer twenty-four (24) hours prior to conducting any survey measurements involving pay quantities. The Contractor shall obtain approval of the excavation from the Engineer prior to taking cross sections and shall provide the Engineer the opportunity to be present during the survey. Pay quantity Work done without the Engineer's notification and approval, or any Work covered up before proper remeasure is made, shall be just cause for non-payment.

Article 2.6 Slope Stakes

Slope stakes shall be required for each cross section station and at additional intervals such as points of curvature and tangency of curves, street intersections, vertical curve intermediate stations to include the high or low point of the curve, and at grade breaks. The stakes are to be set at points where the cut or fill slopes intersect the surface of original ground.

Staking notes shall record the location of the slope stake in relation to the construction centerline, the existing elevation shot at the catch point, the planned elevation that the slope stake is identifying, what level of the design prism the catch point is identifying (i.e., top of unclassified fill, top of subbase, etc.), the percent of slope for cut/fill, the distance to point slope staked, and the station of the slope stake.

The information to be shown on a slope stake is as follows:

- distance from the catch point to the point being staked.
- percent of slope of the cut/fill.
- amount of cut/fill.
- stake's location in reference to the centerline.
- centerline station of the slope stake written on the back of the stake.

The use of hand levels for setting slope stakes shall be limited to one turning point up or down from the instrument to the catch point. Hand level turning points shall be clearly noted in the field book.

A reference stake shall be set for each slope stake. The reference stake shall be set a minimum of ten feet (10') and a maximum of fifteen feet (15') beyond the slope stake. The reference stake shall re-state the slope stake information in the event the slope stake is

disturbed or destroyed. A hub shall be driven flush with the ground at the reference stake and all elevations and distances referenced to the hub.

Article 2.7 Grade Stakes

A. Cut or Fill Stakes

Vertical cut/fill stakes shall be used where the design prism does not contain sloped shoulders and ditches and a slope stake would not be needed. The cut/fill stake shall be comprised of a standard wooden hub driven flush with ground surface and accompanied by a guard lath with the following information written on it:

- amount of cut or fill
- distance to the point of cut/fill from the hub
- description of the cut or filled type, i.e. subgrade, top classified
- offset distance from construction centerline to the cut/fill point
- centerline station written on the back of the lath of cut/fill point
- elevation of the top of hub.

Cuts shall be given to the nearest tenth of a foot (0.1'). Elevations of the top of hubs shall be given to the nearest hundredth of a foot (0.01'). Stakes shall be required at each fifty foot (50') station identified on the Drawings and at additional intervals such as points of curvature and tangency of curves, street intersections, vertical curve intermediate stations to include the high or low point of the curve, and at grade breaks. A record of the cut/fill, the design grade, the distance offset from centerline, the centerline station and the type of cut/fill being staked shall be written in the survey field book.

B. Finish Grade

Grade hubs shall be set to verify that the road prism is at the correct elevation prior to the placement of leveling course material. Wooden hubs, painted or topped with colored whiskers, shall be set at the top of classified fill, within two hundredths of a foot tolerance (0.02'). Stationing shall be fifty feet (50') on tangent and twenty-five feet (25') on curves unless the Engineer approves otherwise. All grade breaks, vertical curve intermediate points to include the high/low point of the curve, PC and PT of horizontal curves, and street intersections shall be staked.

Hubs shall be established on the centerline of the road prism as a minimum where poured curb and gutter is incorporated into the designed road prism. Otherwise, hubs shall be established at the shoulder of the designed road prism, as well as the centerline of the road prism.

When parking aprons are staked, hubs shall be set on a fifty foot (50') grid pattern unless approved otherwise by the Engineer. The field book shall contain the centerline station, the design finish grade elevation of the point staked, the elevation of the hub, and a description of the material being staked.

Article 2.8 Drainage Facilities

The location, type, size, length, and invert elevations for drainage facilities are given on the Drawings. Minor changes in locations and grades to meet existing field conditions may be made where necessary, but only with the approval of the Engineer. If the planned design grade is found to be unworkable in the field, the Engineer shall be notified immediately and all grade staking of the facility shall cease until further notice from the Engineer.

A. Storm Drains, Cleanouts, Outfalls, Catch Basins, Oil and Grease Separators, Culverts

A ground line profile shall be run directly above the centerline of the pipe before trenching occurs. The line and grade for storm drain pipe shall be given from reference hubs offset from each manhole, catch basin, angle point, outfall or cleanout. Reference hubs for culvert installation shall be offset from the pipe ends on the extended centerline of the culvert. One reference hub is required at each end of a culvert. Guard stakes shall be provided for each hub and shall identify the following information:

- station
- size, length and type of pipe
- the amount of cut or fill from the top of the hub to the invert at the end of the pipe
- the horizontal distance from the reference hub to the center of a manhole, cleanout, catch basin, angle point in a pipe, outfall or end of a culvert pipe.

For each structure, the field book shall show the location, type, and size of the structure with a staking diagram showing all distances and pertinent elevations. Two (2) reference hubs shall be set for each manhole, cleanout, catch basin, angle point, and outfall. The reference hubs shall be offset no greater than twenty-five feet (25') from the facility they are referencing.

B. Headwalls

Headwalls for storm drains and culverts shall be staked by setting a hub accompanied by a guard stake on each side of the storm drain or culvert. The hubs shall be on line with the face of the headwall, or as directed by the Engineer. An elevation shall be established on the hubs and written on the guard stake along with the offset distance to the center of the headwall.

C. Dikes and Ditches

Dikes/ditches shall be staked to the alignment, grade and slopes shown on the Drawings. Dikes/ditches shall be slope staked to the shoulder or flow line of the improvement with distances referenced to the improvement centerline. The criteria outlined in Article 2.6 – Slope Stakes shall govern the establishment of slope stakes for this Work.

D. Riprap and Slope Protection

All rip rap and slope protection shall be staked as soon as possible after the pipe, fill, channel change or dike has been constructed. Slope stakes shall be set if needed. See Article 2.6 – Slope Stakes for slope staking criteria.

E. Curb and Gutter

Reference stakes shall be set at even fifty foot (50') stations on tangents as shown on the Drawings. Horizontal curves shall be staked on even twenty-five foot (25') stations. All grade breaks, PVCs, PVTs, low points and high points on vertical curves shall also be staked. A hub and tack shall be set at an offset distance of three feet (3') to the top back of curb. A lath will be set behind the hub and tack with the offset distance marked below the offset and the station marked on the back of the lath. The cut and fill will be to the top back-of-curb within three hundredths of a foot (0.03'). All radius points at curb returns will be staked and additional stakes set breaking up the arc of the curve between curb returns. If valley gutters are to be built, they shall be staked and referenced.

Article 2.9 Water Systems

The Contractor shall stake in the field the alignment and grade for Work to be done under the Contract. Two (2) offset hubs and lath shall be set for each tee, hydrant, water service, valve, angle point, and grade break in the alignment. The lath shall identify the feature being staked and state the elevation of the hub, the offset distance to the center of the feature, and the station of the feature as shown on the Drawings. The offsets shall be set at a reasonable distance to protect them from disturbance.

The Contractor shall be responsible for, and pay all costs for, the transfer of the control points from the reference hubs to such hubs or batter boards as required for the prosecution of the Work. An original ground line profile directly above the water line shall be run prior to excavation. The ground line profile refers to the elevation of the ground directly above the centerline of pipe and the grade line refers to the elevation of the bottom of pipe, except where otherwise noted. The field notes shall record the profile, the hub elevations, offset of the hubs, and the station of the feature being staked.

Article 2.10 Sanitary Sewer Systems

Line and grade for sanitary sewer pipe shall be given from a minimum of two reference hubs for each manhole, outfall or cleanout. Guard stakes shall be provided for each hub showing the information necessary to construct the facility. The minimum information to be shown on the reference stakes and in the field book is as follows:

- centerline of pipe station.
- size and type of pipe.
- cut or fill from the hub to the invert at the end of the pipe.
- offset distance from the hub to the end of the pipe or center of the structure.

Article 2.11 Major Structures

Construction survey procedures shall be reviewed by the Engineer prior to commencing any construction staking. The Engineer's review and approval of survey procedures is required prior to commencing construction activities for major structures including bridges, docks, piers, piling foundations, drainage control facilities and large buildings.

Horizontal and vertical control for the project shall be verified by the Contractor prior to any construction activity. The Contractor shall verify existing field elevations where planned foundations, pilings, piers and support structures are to be placed prior to any construction activity. The Contractor shall verify depth of water and existing ocean or lake bottom elevations for all dock and pier construction prior to commencing pile driving and excavation activity. If any discrepancies are found between the Contract Documents and existing conditions the Contractor shall inform the Engineer immediately.

Article 2.12 Miscellaneous Construction

The Contractor shall provide sufficient stakes for adequate control of all structures and incidental construction not specifically covered above. A staking diagram with respect to centerline and measurements for pay quantities shall be maintained in the field notes. Other items such as horizontal and vertical control shall be shown in the field book and shall be governed by procedures established in previous articles of this Specification.

Article 2.13 Electronic Data Collection and Radial Surveys

Data gathered by electronic data collection or by radial methods shall be submitted in AutoCAD drawing file format to be determined by the Engineer. The Contractor shall be guided by the following specifications:

A. A standard field book shall be used to record the date of survey, weather conditions, instrumentation and data collector used, crew, project description and sketches, listing of horizontal and vertical control points used and established, and other information needed to set up the reconstruction of the survey.

B. A printout of the unedited output from the data collector or a copy of the radial field book entries to include: code descriptors, horizontal circle information, vertical circle information based on zenith, and slope distance expressed in feet. A sheet containing the explanation of the codes used to identify the various shots.

C. A printout of the reduced and adjusted data represented by point number, station left or right of centerline, elevation, descriptor and coordinates of the point.

D. A plot drawing, showing the control points used, points occupied and the radial observations expressed by point number.

E. All cross section data shall be submitted in an unedited points file so it can be independently run through a DTM program by the Engineer.

F. A cross section plot of each station shall be submitted to the Engineer for verification showing the following information:

- centerline or control line and station.
- point of elevation and offset from centerline.
- design grade road template with superimposed before and after excavation surfaces.
- quantity of cut or fill expressed in cubic yards.
- summary table of each section's cut or fill and total amount of quantities expressed in cubic yards.

Article 2.14 As-built Surveys and Record Drawings

As-built survey measurements shall be required for all constructed facilities and improvements to confirm the dimensions, lines, grades, locations, or materials that deviate from the Drawings. Survey measurements shall be taken, field notes shall be kept, and accuracy shall be attained in accordance with this Division. As-built information shall be marked on a clean set of full-size paper copy Drawings and be submitted to the Engineer at the completion of construction activity. When Record Drawings are to be submitted on the original mylar Drawings, the As-builts recorded on the paper copy Drawings shall be transferred to the mylar and both the paper copy and mylars submitted to the Engineer. The Drawings shall be clearly stamped "Record Drawings." No final project payment will be made to the Contractor until the Record Drawings have been submitted to and approved by the Engineer.

The following abbreviations shall be used on the Record Drawings to denote a deviation from the Drawings:

ASB "As-Built" - The actual horizontal, vertical, dimension, or quantity measured by survey after it has been constructed.

F.C. "Field Change" - Revision or change of original design made in the field.

"DELETED" - Not constructed.

Minimum requirements for construction of Record Drawings:

- When original mylar Drawings are used for Record Drawing purposes, all As-built information shall be in drafting ink and all information shall conform in size, type, and scale to the original. No stick-on information adhesives shall be accepted on the original mylars submitted for filing of Record Drawings.

- When paper copies are used for record Drawing purposes, As-built Work shall be marked in red ink or red pencil to clearly identify the changes to the original design.

- A straight line drawn through stationing, elevations, and notes shall show a change, deletion, or omission and shall be followed with the appropriate symbol.

- Storm sewer, water, sanitary sewer, gas lines, or any construction that has been deleted or relocated will be crosshatched.

- Crossed out information should still remain legible.

- The scale of new gas lines, water, sewer, or any new construction not shown should conform to the scale of the drawings.

- Reference information used to prepare Record Drawings, such as change orders, and field books, shall be noted on the drawings.

- Profile changes will be made with elevations or stationing only. The profile line need not be re-drawn unless the change is significant.

- As-builts for water, sewer, gas lines, and storm drain systems shall be accurate within three-hundredths feet (0.03') vertically and one-half feet (0.5') horizontally. As-built Information shall be referenced to existing subdivision survey control and/or monumented centerline of the right-of-way control.

- As-builts for structures shall be accurate to within one-half inch (1/2") vertically and horizontally.

- The name of the Record Drawing preparer, the employer, and the date of the preparation shall appear in the appropriate title block on each Record Drawing sheet.

The construction of Record Drawings is incidental to other Work and no measurement or payment shall be made.

Article 2.15 Method of Measurement

The method of measurement for surveying services shall be a lump sum cost item on the bid schedule. The lump sum cost for Construction Survey Measurement shall include all project control, project staking and quantities measurement for the following unit price items: clearing, clearing and grubbing, pavement removal, road excavation, trench excavation, topsoil, and seeding.

The measurement for Existing Monument and Lot Corner Search shall be a lump sum bid item measured at the time of completion of the establishment of project staking of centerline control. Contractor shall submit field book notes to the Engineer for the Owner's review and approval of the pay item.

Measurement for bid schedule item “Two-Person Survey Crew”, will be the cost per hour for a two person crew. The item, Two-Person Survey Crew, shall be used only for extra, additional, or unanticipated Work required for changes in the project as directed by the Engineer. Additional survey Work requiring one survey person shall be paid at forty-five forty-five percent (45%) of the bid amount per hour of a two-person crew. The item One-Person Survey Crew shall be used only for extra, additional, or unanticipated Work required for changes in the Project as directed by the Engineer.

For bid schedule item "Survey Monument Installed," the measurement shall be the cost to purchase the materials and install a monument per Article 2.1, SubArticle B.4 – Standard Monument and Monument Case Specifications. When the bid schedule contains an item "Survey Monument Installed in Monument Case," the measurement shall be the cost to purchase the materials and install a monument in a monument case, per Article 2.1, SubArticle B.4 – Standard Monument and Monument Case Specifications.

Computer time is incidental to other Work and will not be measured. Certified payrolls and daily time records are required for all Work to be measured by the hour and survey monuments installed.

Article 2.16 Basis of Payment

Payment for this item shall be in accordance with Division 10, Section 10.07 - Measurement and Payment and shall include full payment for all Work described in this Section.

Payment shall be made under the following units:

ITEM	UNIT
Construction Survey Measurement	Lump Sum
Survey Monument Installed in Monument Case	Each
Survey Monument and Lot Corner Installed	Each
Two-Person Survey Crew	Hour
Existing Monument and Lot Corner Search	Lump Sum