

Municipality of Anchorage

Port of Alaska

PORT OF ALASKA MODERNIZATION PROGRAM DESIGN/BUILD SERVICES FOR HELIPAD AND ACCESS ROAD

REQUEST FOR PROPOSAL NO. 2026P002

SECTION V

Sample Contract

Exhibit C

Owner's Project Criteria Documents

Part II.D

Survey Manual

FINAL

Anchorage Port Modernization Project Survey Manual

Prepared for
Port of Anchorage and Municipality of Anchorage

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Version History

The Version History table below lists in chronological order each revised version of this document issued.

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A	Overall Site Plan
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Acronyms and Abbreviations

ACSII	American Standard Code for Information Interchange
APMP	Anchorage Port Modernization Project
CAD	computer-aided design
CH2M	CH2M HILL, Inc.
dpi	dots per inch
DTM	Digital Terrain Model
GDOP	geometric dilution of precision
GPS	global positioning system
HI	instrument height
MASS	Municipality of Anchorage Standard Specifications
MLLW	Mean Lower Low Water
MOA	Municipality of Anchorage
PDF	Portable Document Format
POA	Port of Anchorage
PMC	Project Management Consultant
RTK	Real Time Kinematic

Introduction

1.1 General

The existing marine terminals at the Port of Anchorage (POA) have reached the end of their life span and suffer from severe corrosion on the wharf piling. The Anchorage Port Modernization Project (APMP) will replace two general cargo terminals and two petroleum terminals to ensure infrastructure resilience and to accommodate expected growth in core business lines over a 75-year life cycle. Completion of this project is critically important for the POA to continue to serve 87 percent of Alaska's population and to maintain its role as one of only 19 designated Department of Defense Strategic Seaports.

The Municipality of Anchorage (MOA) has contracted CH2M HILL, Inc. (CH2M) to provide project management services by providing project administration and controls, planning and design management, permitting and permit compliance management, construction management, and quality assurance/quality control during design and construction. CH2M functions as the Project Management Consultant (PMC) for the POA on the APMP.

1.2 Purpose and Intent

The APMP will include a number of design and construction projects for the POA that will update the POA's infrastructure. The APMP's complex design and construction coordination goals mandate a set of survey standards outlining consistent survey management practices. This manual serves that function, outlining survey control procedures and serving as a guide to streamline design and construction management practices to ensure consistency, quality, and efficiency.

The intent of this document is to ensure that consistent survey controls and procedures are used by all parties performing design or construction services. Any project at the POA that requires survey control will refer to this document for information regarding procedures and responsibilities. A copy of this manual, along with any job-specific modifications, will be given to any design or construction services provider before the submittal of cost estimates or proposals to provide those services. All design or construction to be performed for the POA either directly (that is, contracted by POA) or indirectly (as a subcontract to a prime consultant) will comply with the provisions of this document.

It is intended that this manual will be a living document that will be used for each construction project at the POA and that will be updated with current information, procedures, and forms as appropriate.

Survey Standards and Specifications

This section provides an outline of the procedures that will be followed for all surveying-related activities during the design and construction of the APMP. The POA reserves the right to modify the procedures, standards, and specifications described herein on an as-needed basis in order to best fit specific job requirements. All surveying work will be performed under the direct supervision of a Professional Land Surveyor licensed in the state of Alaska. The Surveyor of Record contracted for Surveying Services will furnish all labor and materials necessary to perform the surveying tasks as detailed in the individual requirements for this project. The Surveyor of Record will perform the necessary work, calculations, and quality control required to accomplish the work in accordance with all state, county, and local requirements. Errors or damages resulting from the Surveyor of Record's survey will be corrected or made whole at the expense of the Surveyor of Record.

2.1 Orientation Meetings

Before the commencement of any surveying fieldwork, an orientation meeting will be held. The Surveyor of Record and all party chiefs will be required to attend the meeting. The topics of discussion will include, but not be limited to, the following items.

2.1.1 Outline of Work

The Surveyor of Record will submit a proposed outline of the work that is to be done. The outline will reflect the provider's strategy to complete the required work. It will include the time needed for each task and a list of the equipment and methods to be used for each task. Throughout the duration of the project, the Surveyor of Record will follow this outline, and progress will be monitored and assessed with reference to the outline. The outline should be prepared by the Surveyor of Record to satisfy the procedures, standards, and specifications cited herein.

The provider will review the outline of work at the orientation meeting. If there are any indications evident at the time of the Orientation Meeting that the surveyor's outline will not meet the procedures, standards, and specifications cited herein, the Outline of Work will be returned to the provider for revision. It should be understood that it may not be possible at the time of the Orientation Meeting to determine whether the outline has addressed all of the project requirements. The POA reserves the right to request modifications to the Outline of Work throughout the duration of the project, if it becomes evident that project requirements will not be met.

2.1.2 Review of Requirements and Specifications

The Surveyor of Record will review the requirements set out in this manual regarding survey control, field procedures, format of all submittals, and quality reviews. Project control datums will be specified and acknowledged in writing at this time. Unless otherwise specified, all horizontal control will be based on the Local Ground Coordinates as shown in Appendix A. Vertical control will be referenced to Mean Lower Low Water (MLLW), also shown in Appendix A.

2.1.3 Review Schedule

Dates for reviews, if not established by the Surveyor of Record's contract, will be established at this meeting. At a minimum, Reviews will be made at the completion of the project control stage and at the 100 percent completion stage. Submittals for all reviews will comply with the requirements set forth herein.

2.1.4 Identification of Key Items

Key design or construction items, including project-to-project interfaces, if any, will be identified. Additional submittals to verify surveys of key items will be discussed. If possible at the time of the orientation meeting, the Surveyor of Record will provide the key item submittal requirements in writing.

2.1.5 Other Items

The provider will supply a checklist that lists all Reviews and submittals including, if available, key item submittal dates. Follow-up meetings for concluding orientation items, if warranted, will be scheduled.

2.2 Survey Control

2.2.1 Project Control Datum, Coordinate System, and Unit of Measure

This section provides a description of the network of control monuments established for use at the POA. An Overall Control Plan with coordinates and elevations is provided in Appendix A. Care should be exercised in the use of the coordinate and elevation data provided to ensure use of the correct datum for each survey application.

The coordinate system is Anchorage BOWL 2000 adjustment.

Project elevations are based on MLLW.

Periodically perform verification control surveys to monitor the stability of the control monuments, and report any change in position or elevation. Said reports will be included in subsequent revisions of this document.

The unit of measure for all surveys will be the U.S. Survey Foot.

2.2.2 Control Monuments

The primary horizontal and vertical survey control for all design and construction surveying applications will be the POA Control Monuments and their respective positions as provided in this Manual. All project control surveys will have a direct tie to two or more POA Control Monuments, and all coordinates and elevations will be based on the fixed horizontal and vertical positions of those monuments. Such direct ties will be documented in a field book, and the monuments that are tied will be clearly labeled.

2.2.3 Field Documentation of Control Surveys

All conventional traverse and level loops will be clearly documented in a field book, including notations for angles, distances, and type of points found or set. All field procedures will conform to specifications cited herein. When performing control surveys, data collectors may be used, but field notes of all angles, distance, and height must be kept as well. All misclosures will be plainly stated in the field notes or an attached printout, and no field work will be accepted for adjustment and further used when horizontal or vertical misclosure exceeds the specifications cited herein. Control points set by the Surveyor of Record should be described in field notes sufficiently to be located in the field by other parties. Field book recovery sketches and locative distance ties will be used in this regard.

2.2.4 Control Survey Review

Once the Surveyor of Record has completed their project control survey in compliance with the standards and specifications cited herein, they will submit copies of all control surveying field notes and accompanying reports and printouts for a review. Upon completion of this review the Surveyor of Record will be notified in writing as to the control survey's acceptability or lack thereof. Any use of the project survey control by the Surveyor of Record before notification of acceptance will be at the Surveyor of Record's own risk. The POA may require additional field data when it is needed in order to satisfy specifications and standards or to verify the results of the project control survey. The POA reserves the right to reject outright any control survey that does not meet the cited specifications and standards.

2.3 Field Procedures, Standards and Specifications

All surveys will be performed using equipment that is in good repair and close calibration according to commonly accepted surveying texts. All horizontal and vertical control surveys will be made using standard closed loop surveying practices. Control surveys that use a global positioning system (GPS) must be performed using a closed network configuration (that is, no radial surveys to open control lines). Conventional horizontal traverses will be one of two types: a closed loop that begins and ends at the same monument pair, or a traverse that begins at one pair of monuments and ends at a second pair of monuments. Where traverse lines pass close to additional control monuments, efforts should be made to include the additional monuments in the survey. Vertical control surveys will be made using closed level loops. GPS will not be used for vertical control except for aerial photography control surveys.

2.3.1 Horizontal Control

All distance measurements will be reported as true horizontal distances or as slope distances plus zenith angles. Distances will be measured to the nearest 0.01 foot. All angles should be measured using multiple observations with the instrument's scope in upright and inverted positions. The total angular misclosure of any conventional horizontal traverse will not exceed plus or minus 5 seconds times the square root of "n," where "n" equals the number of angle points in the traverse. The error of closure in any conventional horizontal traverse (before any adjustment of angles) will not exceed the ratio of 1:20,000, Second Order, Class II per Federal Geographic Data Committee National Accuracy Standards. All traverses will be adjusted by Least Squares adjustment or Compass Rule methods only. Spur lines or open traverses should not be used for survey control. Printouts of all field notes and adjustment statistics will be provided for the Review of the control survey.

- Backsight checks and verifications are always observed and electronically recorded and hand booked for back-up.
- Height of instrument, backsight, and foresight are always noted and checked.
- Field notes are to be completed for each setup as backup to electronic files. This includes Point IDs for backsight, occupied, foresight, instrument heights (HIs), mean angles, mean slope distance, description of points, and sketch.
- Photos of Control Points set should be included whenever possible.
- Raw Electronic data is collected for an electronic adjustment to eliminate possible human error of data input. Electronic adjustment programs (such as STARNET) provide reports. Copies of raw data will be a standard part of all submittal packages.

2.3.2 Vertical Control

All height differences and elevations will be measured to the nearest 0.01 foot. All level loops will begin and end at a point or points of known elevation. Initial vertical control for any survey project will include ties to at least two POA Control Monuments. All Control Monuments, benchmarks, and temporary benchmarks (TBMs) will be turned through (no sideshots). The vertical misclosure of any single loop will not exceed 0.03 foot times the square root of "m," where "m" equals the number of miles in the level loop, Second Order, Class I per Federal Geographic Data Committee National Accuracy Standards. No single loop will exceed 3 miles total. Backsights and foresights at each setup will be balanced, so that the difference between backsight and foresight will not exceed 30 feet. All level loops will be adjusted by Least Squares adjustment or pro-ration of error methods. Total station or trigonometric leveling will not be used for vertical control surveys. Printouts of all field notes and adjustment statistics will be provided for the review of the control survey.

- Leveling notes are booked as backup to electronic files. This includes Point IDs, temporary turning points, descriptions, plus and minus rods, and closure checks.

- Photos of Control Points set should be included whenever possible.
- Electronic data is collected for an electronic adjustment.
- Whenever possible, always included checks through a second benchmark when running level loops.
- Establish benchmarks with physical characteristics and quality commensurate with the order of the leveling survey. Use benchmarks of a stable, permanent nature.
- Stamp benchmarks with identifying information: the point designation at a minimum.
- Locate benchmarks where they will be easily accessible. Whenever possible, locate benchmarks outside of construction areas, clear of traffic, and within a public right of way or easement. Allow for future changes in landscaping and construction.
- Space benchmarks as required by project conditions and convenience of operation, trying not to exceed 1,000 feet and at a maximum, not to exceed 2,000 feet. Prepare a written benchmark/station description for inclusion in the survey report.
- Benchmarks should be shown on the Project Survey Control Plans.

2.3.3 Global Positioning System Surveys

All GPS baselines will be surveyed so as to form a network of lines. Open lines should not be used for control surveys. Networks will be adjusted by Least Squares adjustment methods. After final adjustment, the confidence region (error ellipse) at the 95 percent level for any given control point will not exceed 0.10 foot (semi-major axis). Printouts of all field notes and adjustment statistics will be provided for the Review of the control survey.

- All main GPS points are completed by Static procedures. This includes any GPS control, State Plane Coordinate point, or points being established for a base station.
- All Second Tier points are completed by rapid static, at a minimum. This includes any point that is used to control or adjust a total station traverse or being used for vertical control. These points are usually double tied at a different time of day from a different base station.
- Any point tied by GPS using Real Time Kinematic (RTK) methods, other than topographic survey shots, is double tied. The first and second ties are to be conducted at different times, to catch a different satellite geometry, and/or are tied from a different base station.
- Satellite conditions will be checked before any GPS work.
- Data sheets of point information are collected for all points occupied. This includes sketch, description, date, time, surveyor, project, instrument type and serial number, instrument heights in dual units (meters and US feet), and any other pertinent information.

2.3.4 Topographic and Utility Mapping

The Outline of Work established at the Orientation Meeting will be followed as closely as possible. All design or topographic surveys will be based on approved survey control as established using standards and specifications as cited herein. All key design items will be surveyed using the utmost in care, and the data will be submitted by the Surveyor of Record in a timely manner for review. Sufficient field checks will be made throughout each field day as the survey data is collected to ensure accuracy of the data. Field check data will be preserved and included with any review submittal. All pavement or hard surface data points will be measured horizontally and vertically to the nearest 0.03 foot. All natural ground data points will be measured horizontally and vertically to the nearest 0.1 foot. All mapping will conform to the specifications described in the POA computer-aided design (CAD) Drafting Standard, described in Section 2.6.3. Final submittals of mapping and other survey related products will be submitted for a final review.

- Backsight checks are always observed and recorded at the start and end of a setup. Raw check is noted in the field notes and stored to electronic files. Required adjustments are then completed and rechecked, if needed.
- Random backsight checks are completed when time allows or set up condition is questioned. Raw check is noted in the field notes and stored to electronic files. Required adjustments are then completed and rechecked, if needed.
- Accurately measure height of prism and instrument.
- Double check keyboard input of all angles, coordinates, and elevations.
- Ensure that accuracy standards are appropriate for the type of work being done.
- Make supplemental notes to accurately describe nonstandard items.
- All rod changes are noted in field notes.
- All code changes are noted in field notes.
- All special conditions are noted in field notes.
- Anything that could help clarify the site conditions or procedures is noted in field notes, including references to photos taken in the field.
- Field notes are to be used to verify that electronic data is correct; Field Notes take precedence over electronic files.
- Photos should be taken whenever the field notes alone may not be sufficient to help clarify details to the individual processing the field data.
- Gather one extra line of terrain points 20 to 30 feet outside the work limits.
- Always locate major features outside of the work area that may be impacted by project.

2.3.5 Utility Mapping

It is important to locate all significant utility facilities. The following are lists of facilities and critical points to be located for various utilities. Pothole of underground utilities may be requested; pothole locations will be located by the Surveyor of Record and shown on the project basemap.

2.3.5.1 Oil and Gas Pipelines

- Vents
- Angle points
- Meter vaults, valve pits, and so forth

2.3.5.2 Water and Sewer Lines

- Manholes, valve boxes, meter pits, crosses, tees, bends, and so forth
- Elevation on waterlines (if required), sewer inverts, and manhole rims
- When appropriate, or when requested, a sketch drawn of storm and sewer manholes identifying the type and size of pipes and the direction of flow; also, indicate which structure the pipelines flow to or from
- Fire hydrants
- Curb stops

2.3.5.3 Overhead Lines

- Supporting structures on each side of roadway with elevation of neutral or lowest conductor at each center line crossing point
- On lines parallel to roadway, supporting structures that may require relocation, including overhead guys, stubs, and anchors
- If possible, locations of position and elevation of low/sag points on overhead lines; record the day, date, and temperature in the field notes for all wire sag shots

2.3.5.4 Underground Lines

- Cables/lines (denote direct burial or conduit, if known), and so forth
- Manholes, pull boxes, and transformer pads

2.3.6 Construction Surveys

The Outline of Work established at the Orientation Meeting will be followed as closely as possible. All construction surveys will be based on approved survey control as established using standards and specifications as cited herein. Additional standards for construction surveys can be found in the document *Municipality of Anchorage Standard Specifications (MASS) – Division 65 Construction Surveys* (Municipality of Anchorage, 2015). For projects using MASSB specifications the term “Engineer,” where used within said standards, will mean “Owner’s Representative.” The project specifications and roles will be described in each individual contract and discussed at the orientation meeting.

All key construction items will be surveyed using the utmost in care, and the data will be submitted by the Surveyor of Record in a timely manner for review. Sufficient field checks will be made throughout each field day as the survey is conducted to ensure accuracy of the survey. Field check data will be preserved and included with any review submittal.

- Backsight checks are always completed at the start and end of a setup. Raw check is noted in the field notes and stored to electronic files. Required adjustments are then completed and rechecked, if needed.
- After a new setup is completed, the first staked point is a point staked from the last setup. This creates another check of the setup and a check of the previous setup stake out.
- All points staked are to be recorded electronically (stored with a unique point number with reference to the stake request point/station and offset), and a hard copy recorded to construction staking notes forms.
- All electronic files are downloaded daily for storage and safe keeping. This includes raw data file and stake out log files.
- A cut sheet will be created and provided to the construction contractor and field engineer for all construction staking tasks.

2.4 Standards for Office Data Reduction

All Electronic Data post-processed will be reviewed for completeness and conformity to the accuracy standards set forth in this document. Appropriate reports are to be generated that document the traverse closures, level loop closures, and GPS adjustment confidence levels. All level loops processed electronically will be hand-checked for accuracy. All traverse adjustments processed electronically will be hand-checked for accuracy.

CAD files produced will be created to conform to the CAD standards set in Section 2.6.3 of this document. Basemapping produced from topographic field surveys will be completed and checked for accuracy by the Party Chief in charge of the field crew that performed the work, to ensure that all physical characteristics of the topography were collected and are displayed correctly.

Any Triangulated Irregular Network (TIN) or Digital Terrain Model (DTM) created will be checked for blunders (such as rod busts, or wrong feature codes). Triangles and contours will be displayed and confirmed that the model represents a true representation of the ground surface. Triangles with a height greater than five times the base should be avoided and should be used in the model only after review and inspection proves that they accurately represent the existing surface. Triangles and contours will be displayed as true CAD entities and not as Architecture Engineering and Construction (AEC) objects or Proxy entities.

2.5 Documentation

2.5.1 Field Notes

The Surveyor of Record will furnish hardbound field books for recording survey information. At the completion of the project, scanned copies of all field books, with all markups and office calculations noted, will be provided as part of the project deliverables and will become the property of the Project Owner. The scanned field books must be clean, readable, and in Adobe portable document format (PDF).

Each book will be indexed and its contents referred to by page number before delivering them to the Owner. All field books containing field note information will 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 will be shown at the beginning of each day's notes. Field notes for separate survey tasks of the project will be placed in a separate series of field books.

Field notes should be logged as follows, with observations recorded directly in the field book:

- Field books will be Rite-in-the-Rain, All-Weather, No. 350-F, or similar.
- An index page will be included at the front of the book with specific references to pages where benchmarks and/or monuments were recovered, horizontal and vertical control were established, topographic surveys were performed, utilities were located, and property and boundary recovery information was obtained.
- Notes will be in pencil; redline book with corrections, means, level adjustments, and so forth.
- Each page will be labeled with the appropriate header information including date, crew, instrumentation, weather, and north arrows, as applicable.
- Notes will be complete and reduced.
- Traverse data will include sketches.
- If applicable, stationing will increase from the bottom to the top of the page.
- Field notes will be precise and sufficiently detailed.
- Monument recovery pages will include detailed descriptions of condition and location of the monuments with sketches identifying nearby streets and properties.
- Examples of formats for various types of field notes (control, level, and topographic) are included in Appendix B of this manual. The examples are provided as a guide to help ensure field notes for the project provide sufficient clarity of details, but all information shown above the grid lines (top of page), are standard, and should be included for all field note pages. The Surveyor of record should ensure that the level of detail shown on the attached examples are met for all field notes submitted for this project.

Requirements for scanned field book copies submitted in PDF format include the following:

- Scanned pages will be in color using a minimum of 300 dots per inch (dpi).
- Scan all pages including the cover, index page, and any blank pages.

- Review the scanned file and ensure that the entire page was captured and is clear and legible.
- Use Adobe optimization settings to compress the file size, and check to ensure the result is still clear and legible. Poor quality scans will be rejected and will require a new version to be created and submitted.
- If necessary to send a ZIP file, change the file extension to PDF, attach to email and note in the email text that this change was made. This will enable the ZIP file to pass through any firewalls.

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

Data gathered by electronic data collection methods will adhere to the following specifications:

- A standard field book will be used to record the date of survey, weather conditions, instrumentation, data collector or GPS units 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.
- GPS STATIC field notes will include receiver/unit name, height readings in feet and meters, antenna type, local start and stop time, geometric dilution of precision (GDOP), and satellite information.
- GPS RTK field notes will include base station name, rover height, horizontal and vertical precision to control checks, local time, and coordinate quality (C.Q.) readings to each point.
- All survey point numbers assigned to control will be noted in the field book.
- Topographic survey field notes will include code descriptors, rod heights, and any field notes necessary to complete the mapping of collected features upon completion of the survey field work.

Examples of Field Notes are attached as Appendix B.

2.5.2 Party Chiefs Daily Diary

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

- Date
- Crew names
- Type and location of work performed
- Work accomplished
- Signature of Party Chief

This record will be kept on the project site. At the completion of the project, this diary, or a scanned copy thereof, will become the property of the Project Owner.

2.5.3 Documentation for Work Completed with Electronic Data Collectors and Global Positioning System

The Surveyor of Record will provide digital copies of all unedited raw data files from electronic data collectors and GPS receivers used on the project. A sheet containing the explanation of the codes used to identify the various shots will be provided.

The Surveyor of Record will provide electronic American Standard Code for Information Interchange (ASCII) point files and raw data output files generated by electronic data collection from Total Stations and Static or RTK GPS units.

ASCII point files will consist of the reduced and adjusted data represented by point number, station left or right of centerline (if applicable), elevation, descriptor, and coordinates of the point.

All cross-section data will be submitted in an unedited points file in point, Northing, Easting, elevation, description (PNEZD) format so it can be independently run through a DTM program.

2.5.4 As-Built Surveys and Record Drawings

As-built survey measurements will be required for all constructed facilities and improvements (including, but not limited to, roadways, structures, utilities, and finish grading) to confirm the dimensions, lines, grades, locations, or materials that deviate from the Drawings. If as-built surveys are required at any time for this project, survey measurements will be taken, field notes will be kept, and accuracy will be attained in accordance with the requirements as stated in this manual. Additional standards for construction surveys can be found in the document *Municipality of Anchorage Standard Specifications – Division 65 Construction Surveys* (Municipality of Anchorage, 2015). For projects using MASSB specifications the term “Engineer,” where used within said standards, will mean “Owner’s Representative.” The project specifications and roles will be described in each individual contract and discussed at the orientation meeting.

As-built information will be marked on a clean set of full-size paper copy drawings and will be submitted to the POA 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 will be transferred to the Mylar, and both the paper copy and Mylars will be submitted to the POA. The drawings will be clearly stamped "Record Drawings."

2.6 Quality Reviews

2.6.1 Submittals

The contractor is responsible for having their own quality assurance/quality control plan that meets or exceeds the requirements of the POA/MOA, the APMP Project Quality Management Plan, and this Survey Manual.

The POA, with the assistance of the MOA and/or PMC, will review all submittals. Review may include, but not be limited to, reduction and office check of all control field notes; verification of coordinates and elevations; reduction and office check of field notes for key design or construction items; completeness of field notes; review and office check of final map submittals with regard to control and datum statements, key items, and drafting standards; adherence to schedule; proper documentation of surveying performed in conjunction with field revisions and change orders; and formats of electronic data files.

2.6.2 Control Survey

Control survey submittals will be as described above and will include field notes and final coordinates and elevations in hard copy and electronic ASCII-format files. The POA will check for errors and the proper reduction of field data. A check will be made to verify that all specifications were met. Upon completion of the review, the Surveyor of Record will be notified if the control survey is approved or if additional work is required.

2.6.3 Electronic Data and Computer-aided Design Drawings

All electronic data and CAD drawings will comply with the APMP CADD Standards Manual. This document describes the use of standard symbols, line types, layer/level naming conventions, standard drawing borders, and numbers. The APMP CADD Standards Manual will be provided separately to the Surveyor of Record, and full compliance with the formats and specifications therein is required.

An ASCII File will contain Point Number, Station, Northing, Easting, Elevation, and Description of all curve Beginnings, Endings, Points of Intersection, as well as all horizontal alignment Angle Points and Structural Points essential for survey layout. All Northings and Eastings will be shown to three decimal places, and all elevations will be shown to two decimal places.

The ASCII File must contain six fields formatted with comma delimiters as follows: Point Number, Station, Northing, Easting, Elevation, and Description.

2.6.4 Percent Completion Submittals

Field data and mapping, if included in the Surveyor of Record's scope, will be submitted at the appropriate stage of completion for review. Such submittals will be determined during the Orientation Meeting and become a part of the Outline of Work. The POA will check for errors and the proper reduction of field data. A check will be made to verify that all specifications were met. CAD files will be provided for review.

2.6.5 Other Key Items

Any other key items, including project-to-project interfaces, identified at the orientation meetings or during the course of the project will require field note, coordinate, and elevation submittals in hard copy and electronic formats. The POA will check for errors and the proper reduction of field data. A check will be made to verify that all specifications were met. Upon completion of the review, the Surveyor of Record will be notified if the survey is approved or if additional work is required.

SECTION 3

Schedule and Deliverables

A variety of different survey tasks may be required for the APMP. Appropriate schedules and survey deliverables will be outlined in each contract that contains survey component(s). These items will be discussed at the Orientation Meetings outlined in Section 2.1.

Safety

The contractor is responsible for their own safety plan that meets or exceeds the safety requirements of the POA/MOA, the POA Safety Manual, and this Survey Manual. All survey personnel will be briefed on the contents of the POA Safety Manual; the POA Safety Coordinator will provide this briefing.

4.1 General Safety Guidelines

The following safety guidelines will be beneficial for surveyors working in areas of vehicle traffic and/or construction zones:

- Whenever possible, always face traffic when working on the traveled way of a divided road or on shoulders of highways. If you cannot do this yourself, have a coworker act as a lookout. When working in a zone between two-way traffic, stand parallel to the traveled way and again use a lookout.
- Do not make sudden movements that might confuse a motorist and cause evasive action that can result in injury to the motorist or to surveyors.
- Minimize the crossing of traffic lanes on undivided highways. However, the best way to cross is with your vehicle by way of a ramp or service road to assure a safe crossing. If traffic lanes must be crossed on foot, wait for a natural break in traffic. A break in traffic in this instance is defined as all lanes being clear.
- Whenever possible, try to protect your crew with the use of an approved barrier to shield them from traffic.
- Follow proper equipment carrying procedures: when working near a heavily traveled highway, parallel to traffic, or on construction sites, be careful to keep level rods, range poles, and such from extending into a lane of traffic.
- Take special care when working on wet pavement in an active traffic area.
- When working in construction zones, or in areas with heavy equipment traffic, always make eye contact with equipment operators before moving in their “danger zone.”

4.2 Tailgate Meetings and Reports

Each field crew will hold a daily safety briefing each morning to discuss safety issues related to the day’s field activities. The meetings can be brief (5 to 10 minutes) but should address a minimum of three safety issues as a standard of practice.

Each field vehicle will maintain a Safety Meetings Log Book. Each Log Book will give a brief daily synopsis of the following:

- Project Task Tracking Number
- Date and Time
- Names of attendees
- Safety Topics Discussed
- Safety measures (that is, traffic control) to be used for the work that day

Safety Log Books will be made available to the Project Manager upon request for review.

4.3 Personnel Protective Equipment

All personnel are required to wear the appropriate personal protective equipment (PPE) during all operations where exposure to hazardous conditions exists. Safety footwear should be worn at all times for

work activities that present foot injury hazards from falling or moving objects, or from other hazards such as burning, scalding, cutting, and penetration. Acceptable forms of safety footwear should meet the safety shoe requirements established by the Occupational Safety and Health Act or by the American National Standards Institute. Footwear that has deteriorated to the point where it does not provide adequate protection is not acceptable. Safety footwear should have a sole and heel designed and constructed for slip resistance.

All personnel working or visiting locations designated as “Hard Hat Areas” will wear approved protective helmets. Inspect these helmets on a regular basis and immediately replace any found to be defective. Helmets are also to be worn any time a supervisor deems it necessary.

Personnel are required to wear high-visibility safety vests and rain gear of approved color whenever working on POA property, at any time when exposed to traffic (such as driveways, parking lots, and construction sites), and at any other time deemed necessary by the supervisor onsite. Safety vests must be worn when flagging and during nighttime operations. In addition, reflectorized safety vests are required during night operations. If rain gear or other outer garment is being worn, the reflectorized vest must be worn as the outer layer.

4.4 Vehicle Warning Lights

The use of flashing amber lights is another tool used by surveyors to let motorists know that they are working in the area. During work operations, use amber lights during the following conditions:

- When your vehicle is parked in the median without closure of the adjacent traffic lane
- When your vehicle is parked on the shoulder and work is being done in the immediate vicinity
- When your vehicle is accelerating to move from the shoulder, median, or a lane closure into traffic, and when your vehicle is slowing down in preparation to pull off the road onto a shoulder, median, or lane closure
- When highway conditions exist which, in the operator’s opinion, warrant the use of amber warning lights to protect workers and the public during conditions of reduced visibility such as fog or heavy rain
- Use of amber lights can be required at any other time at the discretion of the supervisor onsite

4.5 Traffic Control

The POA is a working site, with heavy machinery, truck traffic, and all the accompanying safety concerns that go with working on such a site. For survey work where Traffic Control is required, it will be performed by an approved flagging subcontractor, and a Work Zone Plan meeting Alaska Traffic Manual requirements must be submitted to the Project Manager in writing or PDF format (with figures) for review and approval before work can be performed. This will include traffic work (such as lane closures or shoulder closures) where impacts to the driving public may occur.

For survey work done off/outside the shoulder of the roadway, it will be the responsibility of the contractor to provide appropriate traffic safety measures (such as signs, cones, or flaggers) to ensure the safety of all survey crew members.

4.6 Hazard Reporting Procedures

- Report all POA hazards to your supervisor, if he/she is available. If supervisor is not available, report to the POA Safety Coordinator @ 441-6036.
- The supervisor must report hazards to the POA Safety Coordinator @ 441-6036 or by email to rotkispd@muni.org as soon as they have knowledge of the hazard(s).

Appendix A

Overall Control Plan

The Overall Control Plan is currently being developed and will be inserted into the manual in fall 2015.

Appendix B

Examples of Field Notes

HORIZONTAL CONTROL NOTES

5 L
AR

430	7	00
00	7	00

430

0

30 30

HT
499
Δ CH-700 HTK 687807.1016 38
1636406.6327

HTK Se @ TBC @ W SIDE
WALNUT ST between
PACIFIC & HEWITT ACROSS
from GRAINGER
+/- 2 E of 60 CLF

EW

	1	2
NECH-200		
BSECH-201		

$$\Delta HD = 443.13$$

CH-700
BSR

	HR	XR	SD	HD
1) 359.59.58	303.40.29	90.09.38	418 <u>534</u>	
2) 179.59.58	123.40.29	269.50.24	418 <u>535</u>	
3) 179.59.58	303.40.29	90.09.40	418 <u>535</u>	

HORIZON CLOSURE

№ CH-200
BSE CH-706

FS	CH-201	BS	SR	FS	SR
X	1)	00.00.00		56.19.29	
	2)	180.00.02		236.19.24	
					m)

LEVELING FIELDNOTES

BSB
BFL

WILD NAZ CH#779 S/N B

12 JUL

ACH-507 see flb 1/20
see flb 1/15

ACH-508 HTK see flb for TRAV NOTES
127 36

GPS CH-204
130 290

ACH-506
138 87

GPS CH-205
144 144

ACH-506

205

EL

125 530

126 545

127 355

128 190

129 290

130 285

131 530

134 370

138 870

144 640

138 870

134 745

5 790

131 32

4 775

132 135

4 780

132 825

4 635

133 800

4 510

135 020

4 735

135 995

4 465

137 830

3 460

141 470

2 600

147 140

2 500

147 045

8 175

141 870

7 125

138 265

3 520

3

V

CH-508 (HTK)

5 470

5 610

5 730

5 710

6 300

7 100

8 270

2 405

3 000

3 520

CH-508

TP

TP

GPS

CH-204

TP

TP

CH-506

TP

GPS

CH-205

CH-506

TP

LEVELING FIELDNOTES, CONT.

1/32

BSB
BFL

12 JULY 05

331143 EHOV	LEVELS CONT	STA	HI	EL
	-			
TP	6 465	4 580	138 265	131 800
GPS CH-204	6 005	4 950	136 380	130 295
TP	6 010	4 685	135 245	129 235
TP	5 575	4 720	133 920	128 345
CH-508	5 700	4 670	133 005	127 305
TP	5 430	4 500	132 035	126 605
CH-507	5 625		131 165	125 540

REC = 125 530 EOC = 0 10

TOPOGRAPHIC FIELDNOTES

SEPT 5

BOARD

M

CRA

CLEAR

225B

225A

BS = 00.00.00

41/6

32
5
44

PT #	CODE	ROD	NOTE	PT #	CODE	ROD	NOTE
------	------	-----	------	------	------	-----	------

20040 1990 4 94 BS ✓

20041 1000 7 00 FL

20047 1000 7 00 FL

20048 1990 4 94 BS ✓

20049 1000 4 94 "

20050 10000 4 26 FL @ BRIDGE DECK

20058 1000 4 26

20059 4 26 VD 9 44 BM CK

20060 1990 4 94 BS ✓

BS ✓

4 94

1990

20072

BS ✓

4 94

1990

BS ✓

LOW CHORD

LOWELL BRIDGE I-5 SB

LOW CHORD

WALK

FL

LOWELL

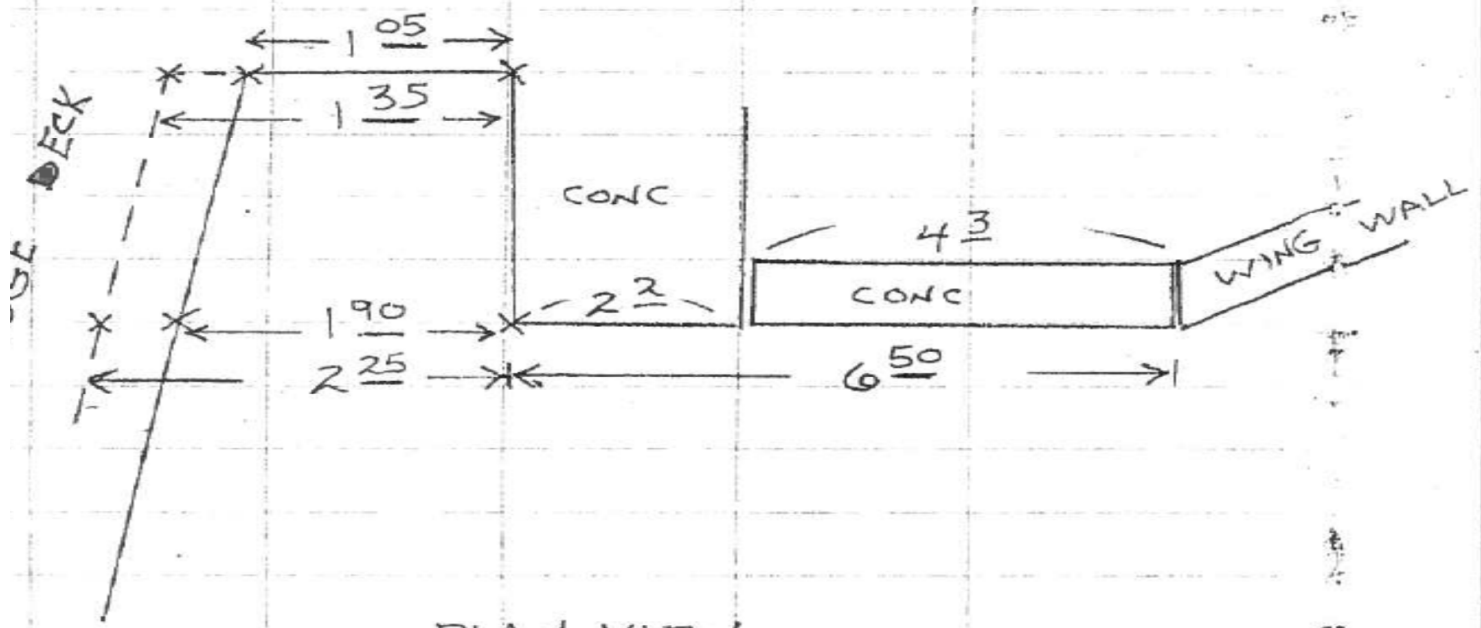
ELEVATION VIEW LOOKING ERLY



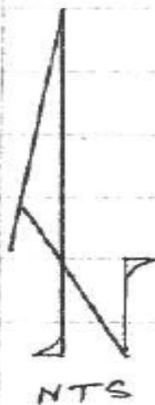
FIELD SKETCHES

1143
HOV

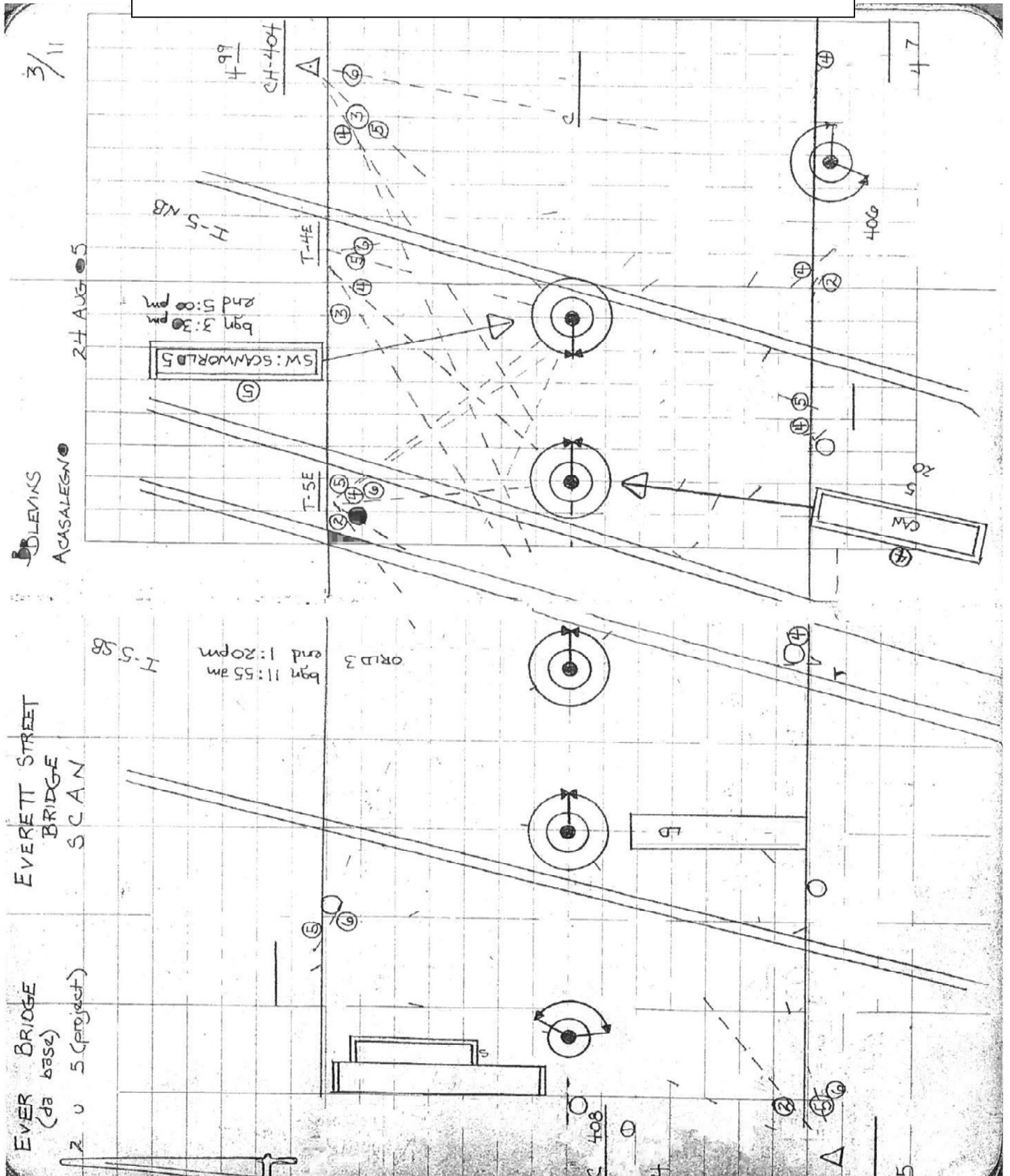
HEWITT AVE
ADDITIONAL MEASUREMENTS
X-SEC



PLAN VIEW



LASER SCANNING FIELDNOTES



GPS FIELDNOTES

SEATAC mp				140709-SMP-FW.TP		7-9-14	SMP-1/50
LOW ALTITUDE PHOTO I.D. POINTS				W/SMARTNET NETWORK USING GPS VIVA C102951		FARMER	
STA	STAFF	SU'S	PDOF	TIME	DESC.		
7509-167	2m	14/8	1.4	(4) MIN.	WISDOT BR. CAP @ SW 178TH ST.	USE, N. of	
300-23	2m	14/9	1.6	(15) MINUTES	NW COR of Co S. 158TH ST.	UK C HSE. #565	
300-01	2m	17/11	1.1	"	SW COR of S. 128TH ST	DRIVEWAY, S. of AVE	
300-02	2m	19/11	1.3	(15) MIN	Tip of Rt TH INTX S 128TH	SW, NW ROAD DES MOINES WY.	
300-03	2m	17/10	1	"	SE COR Asph 23RD AVE SW.	WAY TO HSE. 12635	
300-04	2m	17/10	1	" MIN.	SE COR CONC 12TH AVE S.	C HSE. 13235	
300-05	2m	14/8	1	"	E ROAD C G	BAW FIELDS	
300-06	2m	15/8	1.6	(15) MIN.	CORNER of DRIVEWAY HSE	DGE ASPH 12 S. 134TH ST	

GPS FIELDNOTES

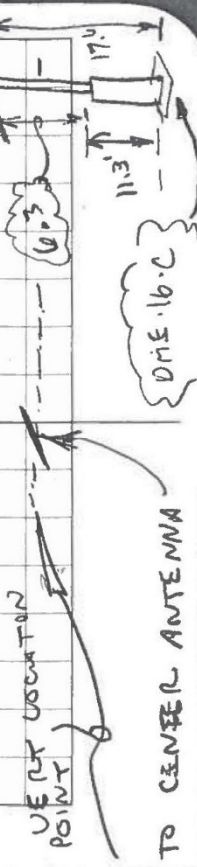
150402 sm.p. Fw. Tg 4-2-15 SMO-1/52
F. WARNER

GPS BASE > LEICA VIVA C-102950
(COVER) LEICA VIVA C-102951
Datum: WA NORTH G-12-A

Stop
DESC
FR-3" BAN. CAP, (X) 0.02 VERT.
CHK'S 0.02 H.

PT TALL & LIGHT FROM GROUND
17.13
11.3
6.3

North of CENTER of 4" POLE (DME)
(3 MIN. STOP) (SEE PHOTO)



SEATTLE MP.
ADDITIONAL NAV. AIDS @ SEATTLE AIRPORT
GPS BASE @ 1007 FAA BEJW

HT (HOOK) 1.305 M
4.281 FT
Full TAGL 5.11 FT
CHAM. #2 464.55

SV'S CSTART 17/9

BASE START 10:20 AM

PT STAFF SV'S PDOP STARTS
1008 CHK 2m 12/7 1.4 (1) MIN

16.0 GLIDE SLOPE
"GS-16.0"

HT. TO TOP of Tower
47.1 + 5.1 = 52.2

* DME 16.0 2m * SURVEY START IS (1.00')
13/7 1.7

Go up: 11.3 + 6.3 / 2
= 14.45 FT
FROM GROUND

GPS FIELDNOTES

GPS TIES TO NAV AIDS (CONT'D)		SEATAC M.D.
P+ 9501	STAFF 2M	SV's 13/6
		PDOY 17
		DESC BUDG.
9502	2M	BUDG. CORR- OFFSET
NOTE: THIS POLE DOES NOT LOOK TO BE COMPUTED IT DOES NOT HAVE THE "DME" ON TOP OF IT. I DID TIES TO IT OFF THE BUDG. BASE ELEV - IS SAME AS STAT 9502 W/IN (1) FOOT FW		

