Section 5.16
EARTHWORK NOTES AND DOCUMENTATION

5.16.1 Purpose

This section includes the accepted methods for recording earthwork notes for final pay quantities and provides procedures for documenting various excavation items, such as channel, borrow, and subsoil excavation by the Resident Office (RO), both Department and Consultant Construction Engineering and Inspection (CCEI) staff. Guidelines for verifying earthwork items and FDOT survey requirements for construction surveys are also defined in this section. It is not the intent of these procedures to supersede the requirements in the ***Surveying and Mapping Handbook***, but to enhance the process for documentation of quantities for the submittal of the ***Final Estimates Documentation***.

5.16.2 Authority

Section 20.23(3)(a), and **Section 334.048(3)**, Florida Statutes (F.S)

5.16.3 Reference

Chapter 472, Florida Statutes (F.S.)

Rule 5J-17, Florida Administrative Code (F.A.C.)

Surveying and Mapping (Procedure Topic 550-030-101)

5.16.4 General

Verify a project's existing and finished graded surfaces for conformity with the lines and grades shown in the plans through field survey and surface to surface comparison, or by an alternate method approved by the District Final Estimates Manager (DFEM) or the District Construction Engineer (DCE).

5.16.5 Bench Loop

A complete set of levels/bench loop run is required on all construction projects.

(A) Check Levels: run a complete set of levels/bench loop from the first to the last Benchmark (BM) on the job, turning through all existing BMs, without adjusting the height of instruments (HI) or "correcting up" for any differences at individual

benches. If the Check Levels are within Third Order Accuracy, no additional check levels will need to be run. Third Order Accuracy requires the closure to be within:

$$0.05 \text{ ft.} \times \sqrt{(\text{distance in miles})}$$

5.16.6 Existing Surface Verification

Verify the method(s) used to derive the existing surface (i.e., location survey, aerial photos, old as-built, etc.) with the Engineer of Record. Also confirm the project's location and type (i.e., urban, rural, limited access, resurfacing, etc.).

Verify the existing surfaces and check for changed conditions, such as commercial development, city or county projects, excessive erosion, or work performed by FDOT Maintenance. Perform quick checks, such as spot elevation checks and slope stake verification, to establish if changed conditions exist.

If checks indicate the existing surface is unchanged, the Senior Project Engineer (SPE)/Resident Engineer (RE) may waive the pre-construction survey requirement. Consider if a full design survey was completed, the type of work, monetary exposure, possible claims, and additional considerations before a waiver of survey is submitted.

Form 700-050-35, Earthwork Survey Waiver must be submitted to the District Final Estimates Manager before clearing and grubbing begins to justify and support waiving the pre-construction survey. The District Construction Engineer and/or District Final Estimates Managers must concur with the waiver. The ***Earthwork Survey Waiver*** must also be submitted with the ***Final Estimates Documentation***. Listed below are some examples where surveys may be eliminated:

(A) Small earthwork quantities

(B) Minor milling and resurfacing projects

(C) Minor widening projects

NOTE: An ***Earthwork Survey Waiver*** is not required on Design Build contracts.

Submit written notification to the Contractor of the Department's findings regarding acceptance or rejection of the existing surface as shown in the plans and obtain the Contractor's concurrence for actions taken. (See **Letter 5-16-1**.) Should the Contractor refuse to respond or reject the actions taken, a second notification will be submitted

advising the Contractor of the requirements as the Claimant per ***Specifications Section 9-3***. (See **Letter 5-16-2**.)

5.16.7 Pre-Construction Survey

When required, perform a pre-construction survey to verify the existing surface. This survey must be taken before the clearing and grubbing operation to adequately address existing surface conditions shown in the plans.

The following conditions require a pre-construction survey to be performed, unless the DFEM/DCE concurs with an ***Earthwork Survey Waiver***:

(A) New construction projects

(B) Major widening projects

(C) Construction of ponds

The pre-construction survey elevations are to be taken at break points shown in the plans and at other break points found to exist in the field within the Right-of-Way limits. See the ***Surveying & Mapping Handbook*** for further guidance.

Notify the Contractor in writing if there is a substantial change in areas where the Department is surveying. The survey notes along with any revisions to the existing surface resulting from the Department's survey will be provided to the Contractor. Should the Contractor wish to dispute the Department's survey, they must acquire their own survey of the disputed area, certified by a Professional Land Surveyor, and at no expense to the Department. The Contractor's field survey must be completed before any clearing and grubbing operations. (See ***Specifications Section 9-3.2***.)

If a deviation exists between the existing surface and the preconstruction survey, the latter will replace the existing surface shown in the plans.

Annotate the ***Final As-Built Plans*** in red with corrections to plan quantity regarding erroneous surfaces discovered by the preconstruction survey. Calculate a new quantity by the approved method for the area surveyed using the existing surface and the pre-construction survey with the replacements mentioned earlier. Submit this information to the Contractor and the DFEM as soon as possible. A surface comparison can increase or decrease the quantities. Before allowing an adjustment, the difference in the increases and decreases (net result) must be checked against the limit set in the ***Specifications***

Section 9-3.2. Verify the Contract's Special Provisions for changes on the amount of this limit.

5.16.8 As-Built Surfaces for Compliance

Document the project's as-built surfaces for compliance with plan dimensions and notify the Contractor of the Department's findings.

(A) As soon as the finished graded surface in a section of the project is complete, perform quick checks, such as spot surveys, slope, or slope stake verification, at intervals or in areas deemed necessary by the SPE.

(B) If quick checks indicate the as-built surface complies with the Plans, the SPE/RE may submit ***Form 700-050-35, Earthwork Survey Waiver*** to the District Final Estimates Manager with justification for waiving the as-built survey. The District Construction Engineer and/or District Final Estimates Managers must concur with the waiver.

(C) If the quick checks of the as-built surfaces reveal any substantial differences from the finished graded surface shown in the plans, then perform a full as-built survey to determine areas not constructed to plan dimensions.

(1) It will be necessary to either re-grade such areas to bring them into conformance (this is done at the Contractor's expense) or reduce the pay quantities for the appropriate earthwork items within the areas not constructed to plan dimensions. Selection of which method to use is at the Department's discretion. The decision will be based on the circumstances which exist on the project.

5.16.9 Final Pay Quantities

Use surface to surface comparison to determine final earthwork volumes and adjustments to plan quantities. The Department encourages the use of ***Trimble Business Center (Trimble)***; however, another approved software can be used or the PA and/or SPE may manually calculate these quantities/adjustments. If provided by the Engineer of Record, .GEN files can be used to generate earthwork quantities.

(A) Approved software must have the capability to compare surfaces, calculate volumes, and produce reports that detail earthwork quantities within the proper limits.

(B) Where any software has been used to calculate the earthwork volumes, the required compatible electronic files (e.g., Land XML and .csv) must be submitted with the ***Final Estimates Documentation*** so calculated quantities can be verified.

(C) To determine the volume, each location must have an existing surface, finished graded surface, and as-built finished graded surface.

(D) Any adjustment for finished graded surface revisions in earthwork items are limited to significant differences as defined in the ***Specifications Section 9-3.2***

(E) The construction tolerance, as defined in ***Specifications Section 120-12***, will not be used or considered as a pay tolerance, nor will the tolerance be construed as defining a revised finished graded surface.

(F) No adjustment will be made for the Contractor's failure to construct to plan dimensions, unless approved by the Engineer.

5.16.10 Minimum Requirements for Field Notes

Field notes are an important part of the ***Final Estimates Documentation*** for earthwork quantities. The following requirements are specifically written for earthwork pay items and are intended as minimum standards for any required note keeping. Ensure that minimum standard requirements are met, and additional details are added as needed to clearly document the field conditions.

(A) Use the ***Form 700-050-61***, **Final Measurement Miscellaneous** or ***Field Books***. (See ***CPAM 5.14*** for requirements.) The use of the ***Final Measurement Miscellaneous Form*** is preferred since it results in savings to the Department.

(B) Global Navigation Satellite System (GNSS) rovers can be utilized in lieu of traditional methods for surveying. Submit GNSS output, and reports to document data collection, surface verification and volume measurements. Ensure GNSS output includes accuracy and precision information, as well as pertinent field conditions and earthwork field note requirements indicated in these procedures.

(C) Contractor's records/survey notes are not acceptable to meet these minimum requirements. As an exception, Contractor's survey notes may be used if obtained by a joint survey under the responsible charge by the Department or its representative.

(D) Record the date, weather conditions, and the names of the individuals within the field crews on the page where each day's notes begin, or a record is stored within the data.

(E) Identify Centerline or Baseline (CL/BL) shots, as well as their location in reference to the CL/BL (i.e., left, or right).

(F) Ensure sketches are plain and legible, and spaced, so that figures are not written over one another. See the **Surveying and Mapping Handbook** for guidance.

(G) Use a 2H or 3H pencil; never use a pencil soft enough to blur.

(H) Record rod readings for earthwork notes (ground shots) to the nearest tenth (0.1) of a foot. Record rod readings on paved surfaces to the nearest hundredth (0.01) of a foot.

(I) Only use Project BMs after a complete set of levels/bench loop has been run. The HI is established from shots made to the BM's. Record the HI to the nearest hundredth (0.01) of a foot (or better) above the field notes to which it applies and at the top of the following pages until a different HI is established. Underscore each HI with double lines.

(J) Show BM location by description or station and offset in field notes and cross reference to the field record and page where BM elevations have been reestablished or verified. These level notes must carry the same closure tolerance as running check levels.

(K) Only set Temporary Benchmarks (TBM) after the project check levels have been completed. Run a complete set of levels/bench loop from one of the project BMs to the TBM and back or to another established project BM.

(L) When multiple HIs are required within only one cross-section, clearly indicate by brackets or other means to which HI the different shots are referenced.

(M) Using Direct Rod Readings is not acceptable.

(N) Use the same baseline and stationing for both the existing and finished graded surfaces. Exercise care where match lines are required to ensure that proper stationing on each baseline is reconciled, and that proper ties are made. Identify stations at which cut or fill begin (daylight lines) in the notes.

(O) The maximum distance between cross-sections is 100 feet for flat terrain, and 50 feet for rolling terrain or closer where conditions warrant. In all cases, reflect the breaks in terrain that will substantially affect the final quantities in the notes.

(P) Take full survey at all stations. Partial survey is not acceptable for earthwork purposes.

5.16.10.1 Plan Quantity Pay Items

Payment for Regular Excavation, Lateral Ditch Excavation, and Embankment made under the plan quantity concept are subject to the minimum standards as stated herein.

Pre-construction survey is required if the Department or the Contractor contends that there is a quantity error. If either party questions the plan quantity in accordance with ***Specifications Section 9-3***, perform the data collection according to the methods outlined herein.

As-built survey is required to document engineer approved changes in earthwork limits. Pay quantity for the approved changes will be calculated as indicated for final measure pay items.

5.16.10.2 Final Measured Pay Items

Field records for final measured earthwork pay items are required.

(A) Borrow Excavation

As-built survey of the finished graded surfaces are required on all projects with Borrow Excavation if the shoulder elevations move out horizontally and/or vertically. A waiver of survey or alternate method may be approved by the SPE. Listed below are some examples where surveys may be eliminated:

(A) Milling and resurfacing projects where shoulder elevation does not change

(B) Projects that involve only earthwork around box culvert extensions

(C) Projects that involve restoring eroded sections

Project flushed slopes that are constructed of borrow material and proposed for final payment are to be surveyed. Any volume that is determined to be above the finished graded surface shown in the plans must be deducted.

Additional borrow material required to fill unauthorized excavation (beyond the lines and grades shown in the plans or authorized by the engineer) will not be paid.

NOTE: For truck measured borrow requirements, see ***CPAM 5.14***.

(1) Fluff and Shrinkage

Consider fluff and shrinkage when vehicle load count is involved in reconciling quantities. A suggested formula for calculating **the Equivalent Truck Measured Volume** is:

Compacted Fill Volume × (1 + shrinkage factor) × (1 + fluff factor)

NOTE: Shrinkage and fluff factors must be entered as a decimal.

EXAMPLE:

Compacted Fill Vol.:	1 CY
Shrink Factor:	20%
Fluff Factor:	20%

1.00 CY × 1.20 × 1.20 = 1.44 CY

(B) Subsoil Excavation

Provide detailed notes for subsoil excavation to explain the disposition of this material. Below are the minimum standards for these field notes: (See ***Figures*** 5.16-1 through 5.16-4).

(A) Preconstruction survey is required prior to beginning of excavation.

(B) Record the authorized limits of muck excavation, as staked in the field in the earthwork notes for each pocket of muck excavation and should conform to control slopes set up by the ***Standard Plans Index 120-001***, or as shown in the plans.

(C) The listing of the limits is generally generated from the plan depth and checked as they are staked in the field. If, during the excavation, the muck is found to be deeper than the plan depth, correct the ***Final As-Built Plans*** by striking through the original limit and recording the new authorized limit. As such, field records should be included, dated and initialed.

(D) If subsoil excavation is required in an area where ditch excavation or the finished graded surface in the plans falls below the existing surface, the finished graded surface must be redeveloped to determine the authorized subsoil excavation. Identify this condition in the field notes.

(E) If extra depth muck excavation (depths greater than 5 feet) is encountered, record a list of the controlling elevations. (See ***Figures*** **5.16-5** through **5.16-7**).

(F) The maximum interval for subsoil cross-sections is 50 feet. The beginning and ending of excavation must always have a full cross-section and be identified with a note (Begin Cut or End Cut), or designated as a zero area.

(G) Partial sections must be extended to the match line to produce a complete cross-section for each station.

(H) Earthwork notes for subsoil excavation must include a note for each pocket of excavation explaining the disposition of the unauthorized excavated material.

(I) Where subsoil excavation extends outside the plans lines or authorized by the PA (including allowable tolerances) and the space is backfilled with roadway or borrow excavation, ensure additional material is not included in payment.

(J) Original cross-sections for subsoil excavation are used as the basis for plan quantities of embankment and regular excavation. When changes to the area of subsoil excavation are made in the field, adjustments to embankment or regular excavation will be made to accommodate the subsoil change, per Spec 9-3.2.2.

(K) Station’s pluses needed to obtain the maximum 50 feet interval or to obtain begin and end sections may be interpolated from the existing surface sections.

(L) The baseline (or centerline) used for location of original cross-sections is the baseline of survey. When the centerline of construction, as used for final cross-

sections and control slope limits, is different from the baseline of survey, some method must be employed to make the two surveys compatible with each other.

(C) Channel Excavation

Channel Excavation must be monitored closely since constant scouring and shoaling is normal in locations where this item is used.

(A) Preconstruction survey is required prior to beginning of excavation.

(B) As-Built survey of finished graded surfaces are required and must be compared with the finished graded surface shown in the plans to determine the limits of final pay quantity.

(C) Re-survey if shoaling occurs after the as-built survey and prior to final acceptance of the job and the Engineer authorizes the shoaled material to remain in place. Deduct the volume of any such material remaining within the limits of channel excavation shown in the plans from the quantity of Channel Excavation.

(G) Calculate an adjustment in quantity for the surveyed areas corresponding to the appropriate earthwork items using an approved method.

5.16.11 Electronic Data Collection on Construction Projects

(A) Requirements:

The methods described herein apply to surveys being performed on all Department contracts with automatic or semi-automatic total station equipment (radial survey).

NOTE: All survey data generated for construction must adhere to the Department's surveying standards.

In making the decision to use radial survey methods with total station equipment, the Consultant must assure the Department that the following field survey and data processing requirements can be met:

(1) Confirm sufficient project control data (horizontal and vertical) exists or can be established to provide for all radial survey coverage.

(2) Perform radial survey that meets the Triangulated Irregular Network (TIN) criteria for generating a Digital Terrain Model (DTM).

(3) Provide software to compute an acceptable DTM from the radial survey data points and break line data point strings.

(4) Field check the DTM surface, using cross-sections or profiles extracted from the DTM as compared to actual supplemental field survey.

(5) Compute cross-sections from the DTM surfaces, perpendicular to defined alignments.

(6) Compute earthwork volumes using Department approved surface to surface comparison software and methods.

(7) Furnish all deliverables in a file format that is compatible with Department software, as defined in these procedures or in the contract scope of services.

(B) Project Control System:

Radial surveys must be referenced to the same project control system (baseline/centerline coordinates and benchmark datum) that was used for the Location and Design work. This basic requirement is to ensure that all survey information for the project can be related to the same reference system. This requirement can be met by occupying the existing control points that were established during the original ground survey. Or, if additional control is needed, the existing control system may be extended by:

(1) Running a set of levels/bench loop through the required point or points.

(2) Setting an unknown point, occupying it with the total station instrument and taking sufficient observations to define its position relative to the existing control system, as further described later.

(3) Using technology, such as Global Navigational Satellite System (GNSS), and a set of levels/bench loop to supplement existing survey control.

(C) Calibration of Conventional Total Station equipment:

The Professional Surveyor and Mapper must take every precaution to ensure that the total station equipment is properly calibrated and is obtaining accurate field data. To identify systematic errors inherent in any angle-measuring device, an axis test of the instrument will be performed on a regular interval, at least once weekly.

An acceptable axis test consists of pointing at a fixed target three or more times in the Face 1 (direct) telescope orientation and recording the horizontal direction (H) and vertical direction (V) readings for each pointing. Then, transiting or “flipping” the telescope and pointing at the same target an equal number of times in the Face 2 (reverse) telescope orientation and recording those values. The values of the horizontal and vertical angle for each pointing at the target are used to perform the computations to determine if the instrument is in need of adjustment.

Each year and whenever the difference between the mean of the direct and the mean of the reverse readings depart from 180 degrees by more than 30 seconds, the instrument must be taken out of service and be adjusted for collimation error.

Readjustment of the instrument’s crosshairs and the level bubbles will be done whenever their misadjustments affect the instrument reading by the amount of the least count, as specified for the Third Order Class II surveys. The total station instrument and retro-reflector prisms should be serviced on a regular basis and checked frequently on a calibration baseline of known distance.

(D) Establishing Position and Orientation of the Surveying Instrument:

When collecting field data by radial survey, there are two acceptable methods of establishing position and orientation of the instrument:

(1) Setup Over Known Control Point: The instrument is setup over an existing control point, or one that can be related to the CL/BL of the project by the geometry and elevations furnished. The (XYZ) coordinate of the point setup over must be known. The height of the instrument above the control point must be measured and recorded. When the above is done, the position of the instrument has been established.

(a) To establish orientation of the instrument, a back sight will be made by pointing to a target of a known height on a second control point with a known (XYZ) coordinate. The instrument’s

horizontal circle will be “zeroed” while pointing to the back sight control point. A back sight measurement of the horizontal direction, vertical direction, and distance (HVD) will be measured and recorded, including the target height. Position and orientation is now completed. Radial measurements (HVD) may be made and recorded for new survey points. All horizontal angles will be expressed as angles measured in the direct (Face 1) position.

(b) At the end of the field survey operations, the user will again sight the original back sight control point and record the measurements, to ensure that the instrument was not disturbed during survey operations.

(2) Setup over an Unknown Point: When the instrument must be set-up in a location that does not have a prior known (XYZ) coordinate or is not tied to the control geometry and project benchmark datum, a semi-permanent monument should be set to perpetuate the location of the setup position. A bridge spike, hub and tack, iron rod, or equivalent marker, which will last throughout the data gathering operations, will serve this purpose. When the instrument is set-up, the height of the instrument above the set monument will be measured and recorded.

(a) To establish the position of, and orient the instrument setup over the unknown point, the setup must be tied by field measurements to two points of known position. A back sight will be made to the first control point with a known (XYZ) coordinate. The horizontal measuring circle will be “zeroed” and HVD measurements will be made and recorded. A second control point with known coordinates will be selected and HVD measurements made and recorded. If available, a third control point with known coordinates may be selected and measured as a check on the position of the instrument. Target heights will also be recorded for all measurements.

(b) With the setup position properly established, radial measurements (HVD) to additional new survey points may then be made and recorded. All horizontal angular values will be expressed as angles measured in the direct (Face 1) position.

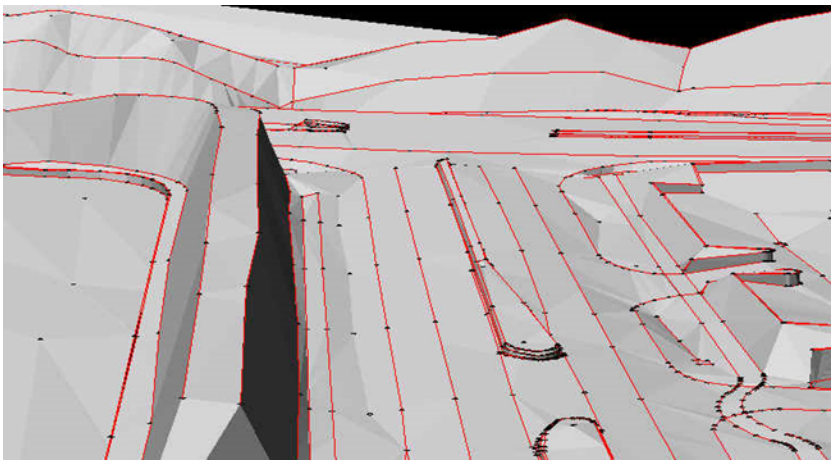
(c) At the end of the field measurements, the observer must always sight the original back sight and take check measurements and record them. Again, this is to ensure that the instrument has not been disturbed during survey operations.

(E) Field Observations (HVD) for DTM Surveys:

Radial survey procedures may be used to determine preconstruction surface elevations; and as the work of excavation or fill is accomplished, radial survey procedures may be used to determine final surface elevations. From DTM surfaces derived from radial survey methods, cross-sections can be generated as needed. This makes the DTM a valuable method for quantity surveys since cross-sections can be generated at any interval along an alignment on any of the DTM surfaces.

(1) Collect data points that represent surface elevations on the ground at reasonable proximity to accurately represent the surface. It is also important to define breaklines along boundaries in the terrain where sharp or abrupt changes in surfaces occur. Break lines along the terrain “discontinuities” will be defined by the Professional Surveyor and Mapper, by indicating the connection of points representing the break line profiles.

Below is an example of a terrain surface defined by points and breaklines:



The Department requires that the field measurements (raw field data) be recorded and submitted in an acceptable format, as backup records for all DTM’s.

(2) Most electronic data collectors are capable of recording HVD data. If the Consultant elects to use a data collection system that only produces (XYZ) coordinates, the raw field data (HVD) must be recorded in the field records. Reduced data, (XYZ) coordinates, alone will not be acceptable.

(3) To assist in verifying the field notes and as an aid in checking the reduced data, the survey party must prepare a sketch or layout of each setup and the area covered by observations. The sketch will show the setup point, the back sight point(s), and the identification data for the location of all field data taken from the setup position.

(4) ***Figures*** **5.16-8** through **5.16-11** provide examples of manual field records used in lieu of electronically collected data records.

(F) Generating the DTM Surfaces:

Surface-modeling techniques, such as using triangles to represent small continuous surface areas are known as the Triangulated Irregular Network (TIN). TIN has become the standard for terrain modeling for meeting engineering requirements. Each vertex of a triangle in the TIN is formed by a field measured data point, and is located by its (XYZ) coordinate. The TIN model is constructed by connecting these survey data points to their nearest neighboring points (in XY), forming a network (surface) of irregular triangles.

(1) It is important that the survey crew understand the TIN methodology and the assumptions made by the software when they are taking the survey data points for a DTM using the TIN method.

(2) Before the working cross-sections are generated for earthwork computations, the DTM surfaces must be field checked using randomly generated cross-sections or profiles extracted from the model. These cross-sections and profiles are then compared to actual ground shots taken to determine if the model matches the real-world terrain surface. This quality control check must be performed before TIN data is used in quantities calculations.

(G) Cross-Sections from DTM Surfaces:

Once the DTM surface has been computed and field checked, cross-sections may be computed at the specified interval along the CL/BL. If final quantities are to be compared

to original plan quantities, the location of TIN extracted cross-sections must be the same as the cross-sections contained in the design plans.

(1) Field measured quantities, such as subsoil excavation, may be referenced to a construction-established baseline, as long as the original and final measurements are from the same reference.

(2) Design cross-sections, preconstruction cross-sections, and final cross-sections must all be compared in order to determine final pay quantities. It is absolutely essential that all field data be referenced to the same alignment and station values.

(H) Survey Deliverable Data:

Requirements necessitate the retention of surveying records and backup data to support the quantity computations. This requires that the RO personnel deliver certain data in a format that can be retained, verified, and, if necessary, be used to replicate the processed data at some future point in time. For products that need to be signed and sealed by a Professional Surveyor and Mapper, reference ***Standards of Practice*** as set forth in ***Rule Chapter 5J-17 F.A.C.***

(1) When radial survey is used, project personnel must use the approved survey data formats authorized for use on FDOT surveys. ***Trimble*** or any other FDOT approved software should be used to calculate final pay earthwork volumes. If a consultant or CEI prefers to use any other software for radial surveying than that authorized for use by FDOT, they must show the Department's District Location Surveyor (DLS) that an alternate system is able to produce the electronic files required for delivery to the Department as outlined in this section. Prior to the work commencing, the consultant must receive an approval letter signed by the DLS stating that a proposed alternate system is able to produce the electronic files required by the Department.

(2) The RO personnel must submit:

(a) The pre-construction survey data files produced by the data collection system , regardless of format.

(b) The original field survey measurements in the approved file format for raw survey measurements (.XML format).

(c) Any changes not observed in the field must be annotated in redline markup on the ***Final As-Built Plans*** and include an explanation of each change.

(d) The reduced and processed field survey data in the standard comma delimited text file format with labeled column header information.

(e) The survey control used to reduce and process the original field survey data in the standard comma delimited text file format with labeled column header information.

(f) All output reports generated by the programs used to reduce and process the field survey data.

NOTE: It is the responsibility of the DLS or the delegate to verify survey data processing results before being accepted by the Department.

(3) At the completion of work, submit to the DLS or the delegate all files described herein, any additional reports and forms required by the DLS, such as a ***DTM Certification Form*** (if applicable), and a ***Project Certification Letter***.

(4) All reports related to the project.

(5) All output files for interfacing to ***Trimble***, including alignment and other geometric data (profiles) in .XML file format.

(6) All graphics files of planimetric detail in both 2D and 3D MicroStation or AutoCAD file format.

(7) All DTM TIN models represented as 3D MicroStation or AutoCAD files.

(8) A project Journal file that describes:

(a) For each DTM, a description of the surfaces, DTM settings used, survey data used to define the surface(s). The Journal will include the alignment names and scan/pattern lines used to cut cross-sections, cross-section file names with their usage/application, and contour settings.

(b) For each output report generated, describe the purpose of the report and the information needed to re-generate the report.

(c) For each output file, describe the purpose of the file and the information needed to re-generate the file.

(9) All data submitted must be identified with the Financial Project Identification Number(s), State Roadway Number(s), Consultant Identification (names, addresses, etc.), and Contract number.

(10) No project will be considered acceptable or complete until all deliverables are submitted and approved by the appropriate FDOT authority.

5.16.12 Boilerplate Letters

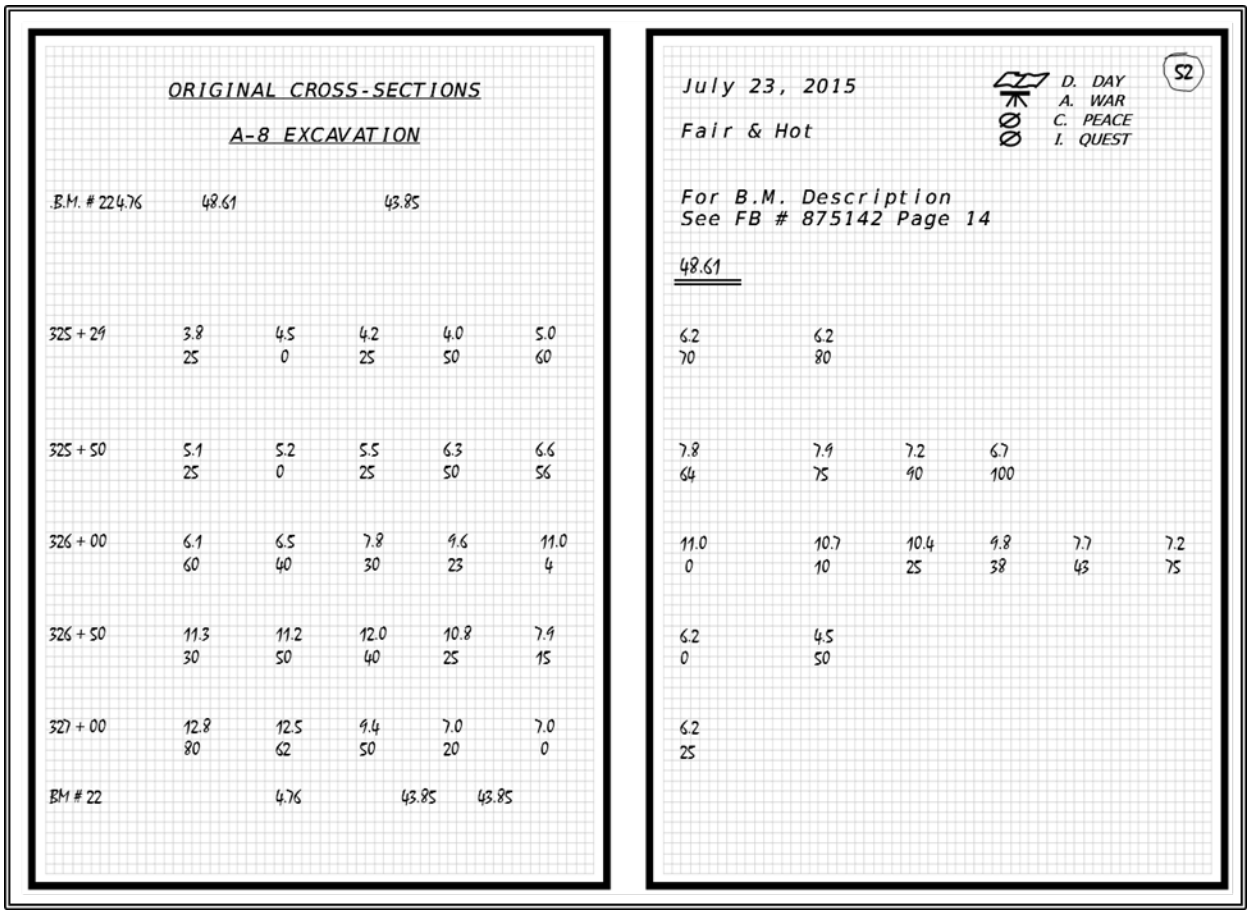
Final Estimate Boilerplate Letters can be found on the **State Final Estimate SharePoint site** (Internal Use Only) in editable format.

NOTE: The letters are used to convey necessary information to concerned parties throughout the close out process. The letters and memos are templates containing common boilerplate language. The DFEO representative will choose the appropriate paragraphs for a specific contract and delete the paragraphs and instructions which do not apply. No boilerplate letter can cover all situations that might arise. Occasionally, it may be necessary to insert additional paragraphs drafted to fit the circumstances arising on a specific contract (such as addressing bonds or value-added items).

Letter 5-16-1.....Preconstruction Survey Waiver Letter
Letter 5-16-2.....Follow-up Preconstruction Survey Waiver Letter

5.16.13 List of Figures Following This Chapter

Figure 5.16-1
ORIGINAL SUBSOIL – CROSS-SECTION NOTES



ORIGINAL CROSS-SECTIONS

A-8 EXCAVATION

B.M. # 224.76 48.61 43.85

325 + 29	3.8 25	4.5 0	4.2 25	4.0 50	5.0 60
325 + 50	5.1 25	5.2 0	5.5 25	6.3 50	6.6 56
326 + 00	6.1 60	6.5 40	7.8 30	9.6 23	11.0 4
326 + 50	11.3 30	11.2 50	12.0 40	10.8 25	7.9 15
327 + 00	12.8 80	12.5 62	9.4 50	7.0 20	7.0 0
BM # 22		4.76	43.85	43.85	

July 23, 2015

Fair & Hot

D. DAY
A. WAR
C. PEACE
I. QUEST

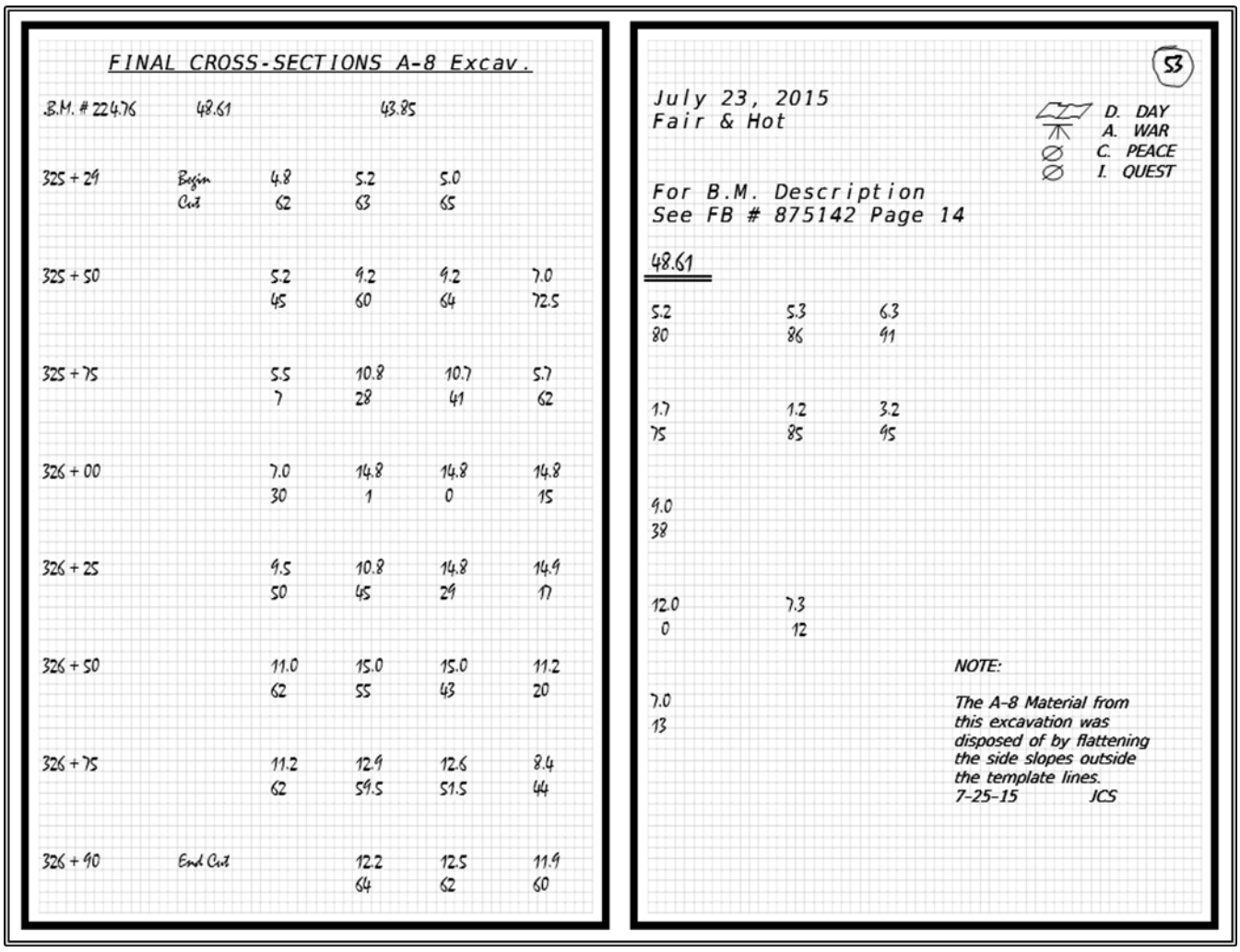
52

For B.M. Description
See FB # 875142 Page 14

48.61

6.2 70	6.2 80				
7.8 64	7.9 75	7.2 90	6.7 100		
11.0 0	10.7 10	10.4 25	9.8 38	7.7 43	7.2 75
6.2 0	4.5 50				
6.2 25					

Figure 5.16-2
FINAL SUBSOIL – CROSS-SECTION NOTES



FINAL CROSS-SECTIONS A-8 Excav.

B.M. # 224.76	48.61		43.85		
325 + 29	Begin Cut	4.8 62	5.2 63	5.0 65	
325 + 50		5.2 45	9.2 60	9.2 64	7.0 72.5
325 + 75		5.5 7	10.8 28	10.7 41	5.7 62
326 + 00		7.0 30	14.8 1	14.8 0	14.8 15
326 + 25		9.5 50	10.8 45	14.8 29	14.9 17
326 + 50		11.0 62	15.0 55	15.0 43	11.2 20
326 + 75		11.2 62	12.9 59.5	12.6 51.5	8.4 44
326 + 90	End Cut		12.2 64	12.5 62	11.9 60

53

July 23, 2015
Fair & Hot

D. DAY
A. WAR
C. PEACE
I. QUEST

For B.M. Description
See FB # 875142 Page 14

48.61

5.2 80	5.3 86	6.3 91
1.7 75	1.2 85	3.2 95
9.0 38		
12.0 0	7.3 12	
7.0 13		

NOTE:

The A-8 Material from this excavation was disposed of by flattening the side slopes outside the template lines.
7-25-15 JCS

Figure 5.16-3
SUBSOIL – CROSS-SECTION LIMITS NOTES

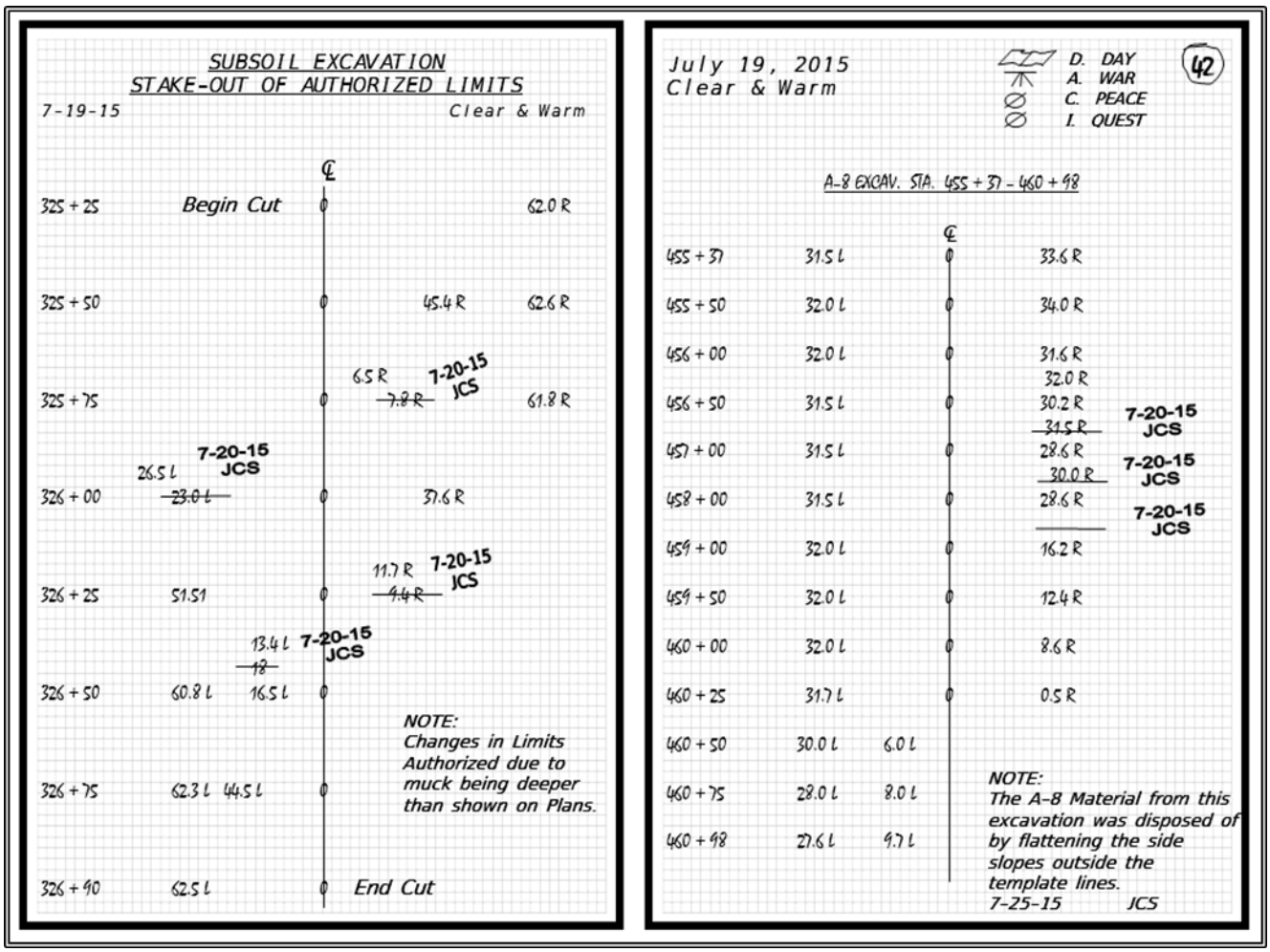
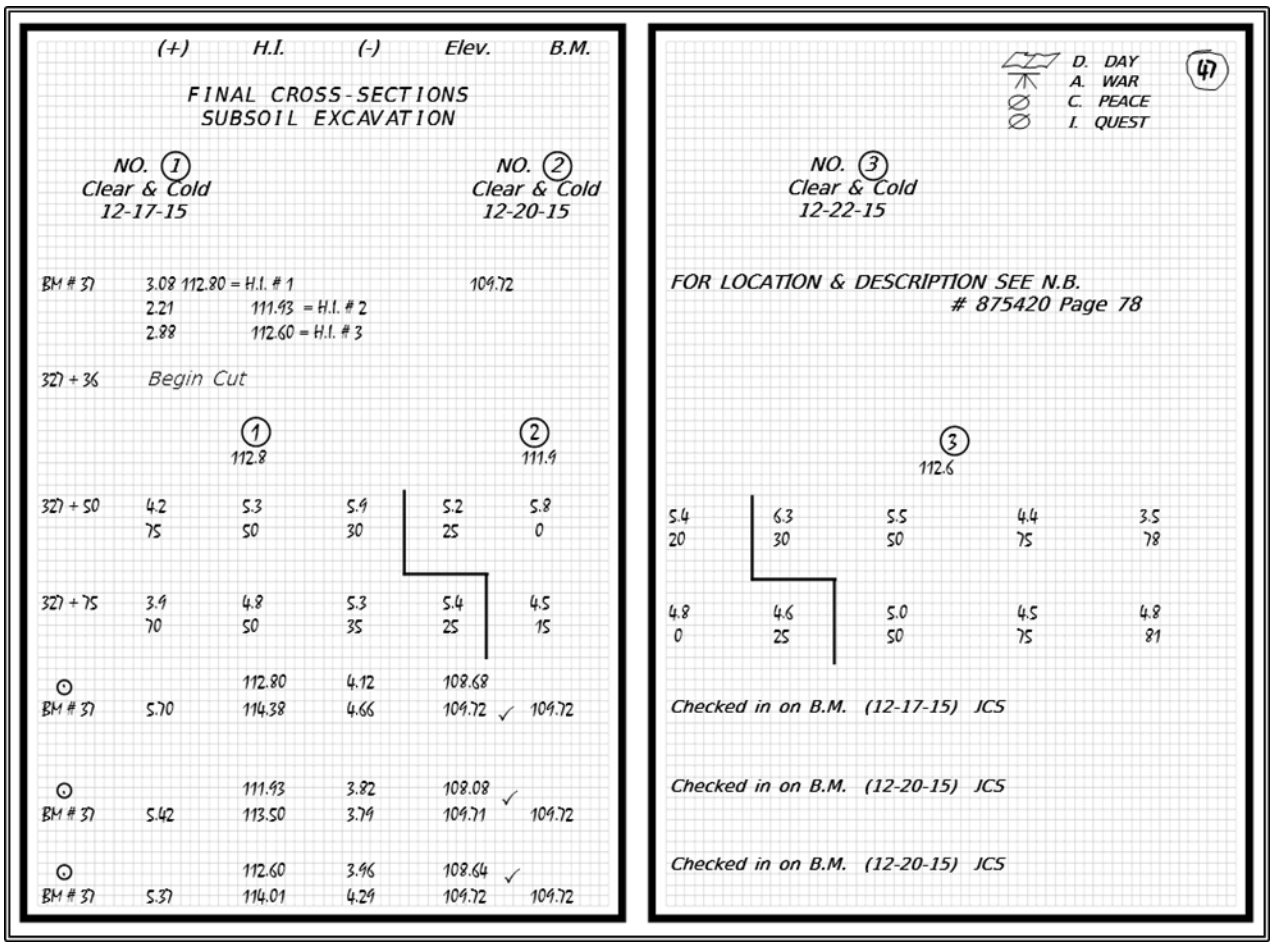


Figure 5.16-4
FINAL SUBSOIL – CROSS-SECTION NOTES



(+) H.I. (-) Elev. B.M.

FINAL CROSS-SECTIONS
SUBSOIL EXCAVATION

NO. 1
Clear & Cold
12-17-15

NO. 2
Clear & Cold
12-20-15

BM # 37 3.08 112.80 = H.I. # 1 109.72
2.21 111.93 = H.I. # 2
2.88 112.60 = H.I. # 3

32) + 36 Begin Cut

		1 112.8			2 111.9
32) + 50	4.2	5.3	5.9	5.2	5.8
	75	50	30	25	0
32) + 75	3.9	4.8	5.3	5.4	4.5
	70	50	35	25	15
⊙		112.80	4.12	108.68	
BM # 37	5.70	114.38	4.66	109.72 ✓	109.72
⊙		111.93	3.82	108.08 ✓	
BM # 37	5.42	113.50	3.79	109.71	109.72
⊙		112.60	3.96	108.64 ✓	
BM # 37	5.37	114.01	4.29	109.72	109.72

D. DAY
A. WAR
C. PEACE
I. QUEST

47

NO. 3
Clear & Cold
12-22-15

FOR LOCATION & DESCRIPTION SEE N.B.
875420 Page 78

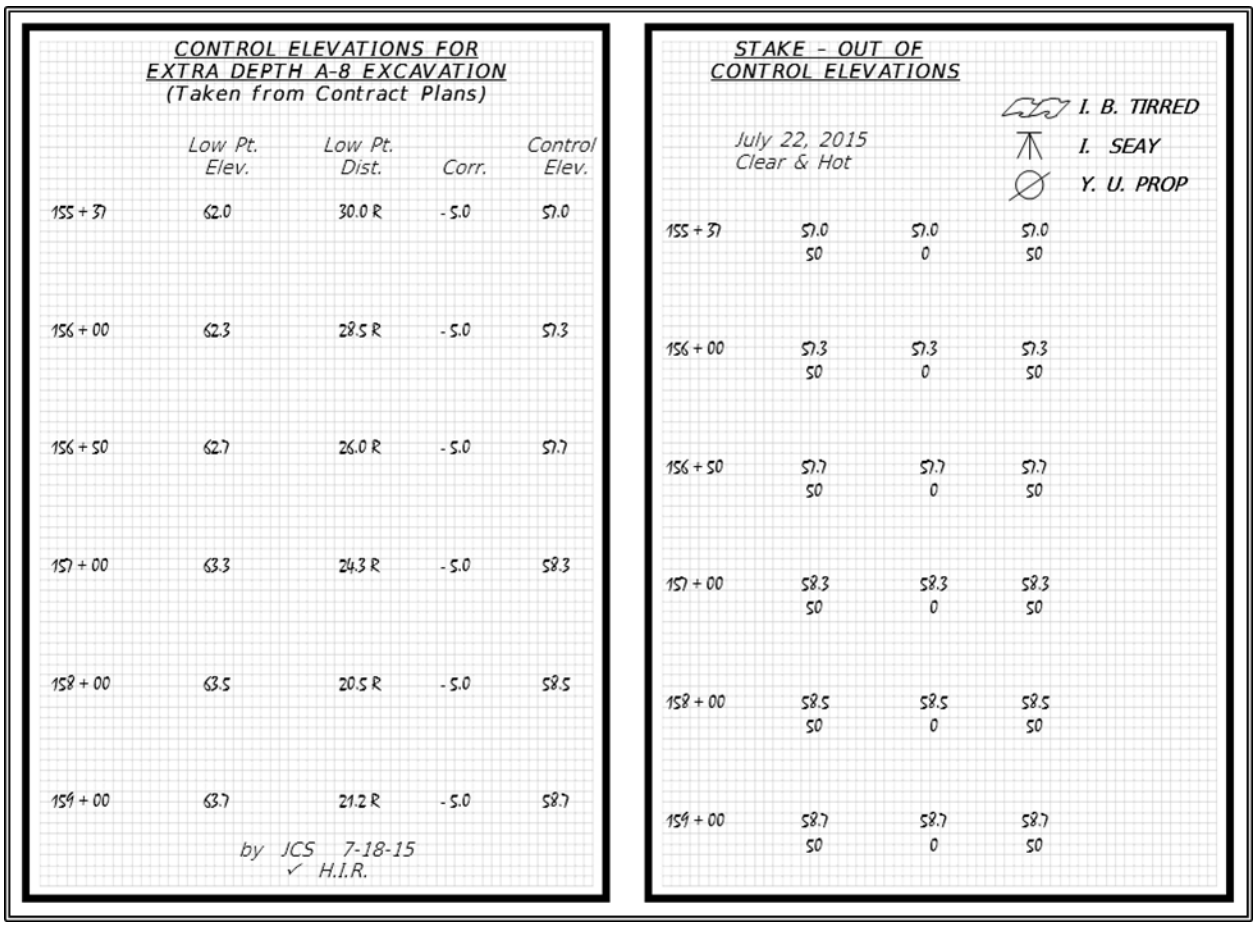
		3 112.6		
5.4	6.3	5.5	4.4	3.5
20	30	50	75	78
4.8	4.6	5.0	4.5	4.8
0	25	50	75	81

Checked in on B.M. (12-17-15) JCS

Checked in on B.M. (12-20-15) JCS

Checked in on B.M. (12-20-15) JCS

Figure 5.16-5
CONTROL ELEVATIONS FOR EXTRA-DEPTH MUCK



CONTROL ELEVATIONS FOR
EXTRA DEPTH A-8 EXCAVATION
(Taken from Contract Plans)

	Low Pt. Elev.	Low Pt. Dist.	Corr.	Control Elev.
155 + 37	62.0	30.0 R	- 5.0	57.0
156 + 00	62.3	28.5 R	- 5.0	57.3
156 + 50	62.7	26.0 R	- 5.0	57.7
157 + 00	63.3	24.3 R	- 5.0	58.3
158 + 00	63.5	20.5 R	- 5.0	58.5
159 + 00	63.7	21.2 R	- 5.0	58.7

by JCS 7-18-15
✓ H.I.R.

STAKE - OUT OF
CONTROL ELEVATIONS

July 22, 2015
Clear & Hot

I. B. TIRRED
I. SEAY
Y. U. PROP

155 + 37	57.0 50	57.0 0	57.0 50
156 + 00	57.3 50	57.3 0	57.3 50
156 + 50	57.7 50	57.7 0	57.7 50
157 + 00	58.3 50	58.3 0	58.3 50
158 + 00	58.5 50	58.5 0	58.5 50
159 + 00	58.7 50	58.7 0	58.7 50

Figure 5.16-6
EXTRA-DEPTH MUCK CASE I

CASE I:

IN EVERY CASE, THE POINT OF REFERENCE FOR DETERMINING EXTRA DEPTH SUBSOIL EXCAVATION SHOULD BE THE LOWEST ELEVATION THAT MUCK IS SHOWN ON THE PLAN CROSS-SECTION AND THIS ELEVATION PROJECTED HORIZONTALLY ACROSS THEIR ENTIRE CROSS-SECTION IN MAKING THIS DETERMINATION. EACH CROSS-SECTION SHALL BE CONSIDERED SEPARATELY.

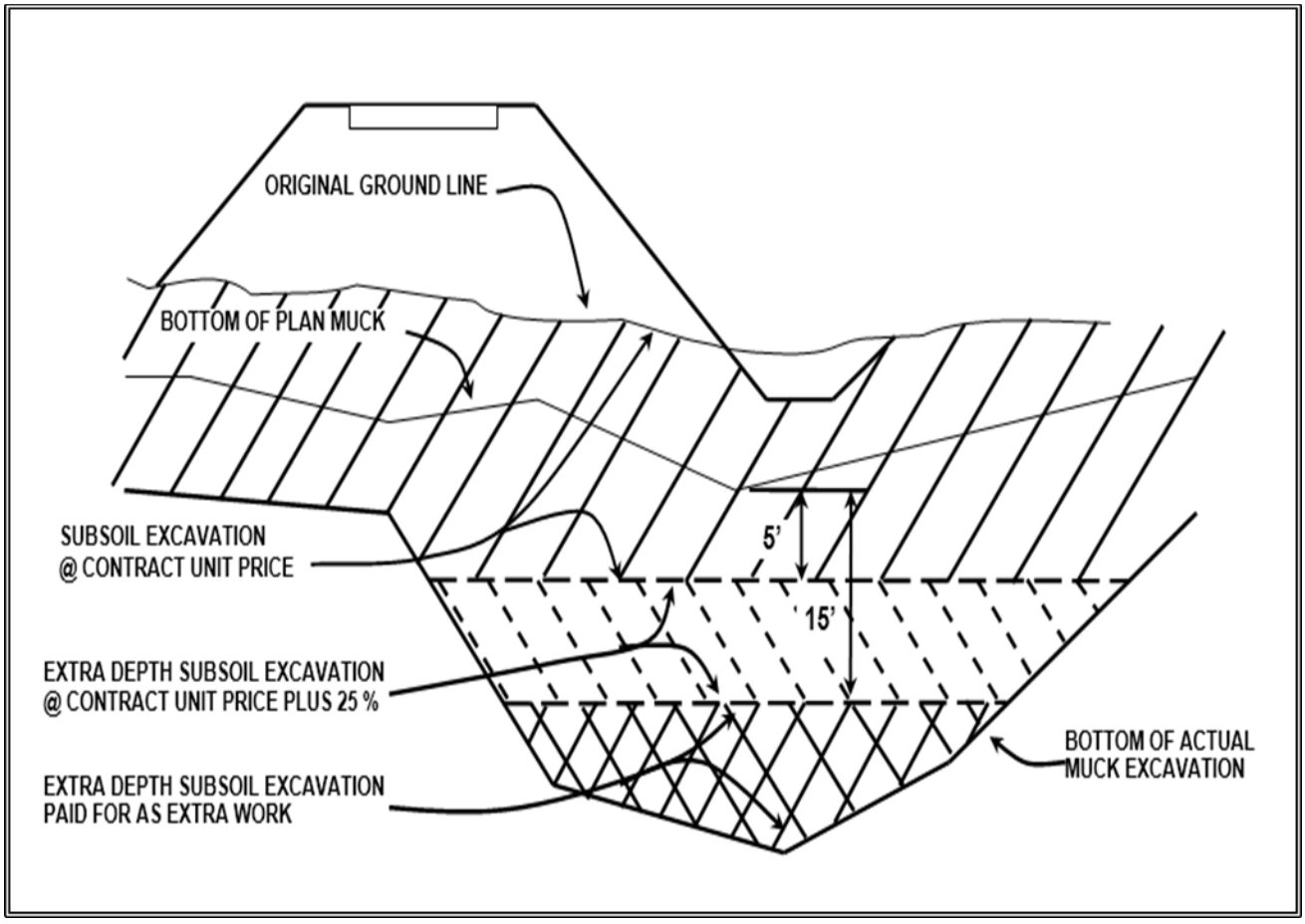


Figure 5.16-7
EXTRA-DEPTH MUCK CASE II

CASE II:

WHEN SUBSOIL EXCAVATION IS ENCOUNTERED WHERE NONE WAS SHOWN ON THE PLANS, EITHER IN SEPARATE AREAS OR AS AN EXTENSION TO AREAS THAT WERE SHOWN, THE POINT OF REFERENCE SHALL BE THE LOWEST ELEVATION ON THE GRADING TEMPLATE.

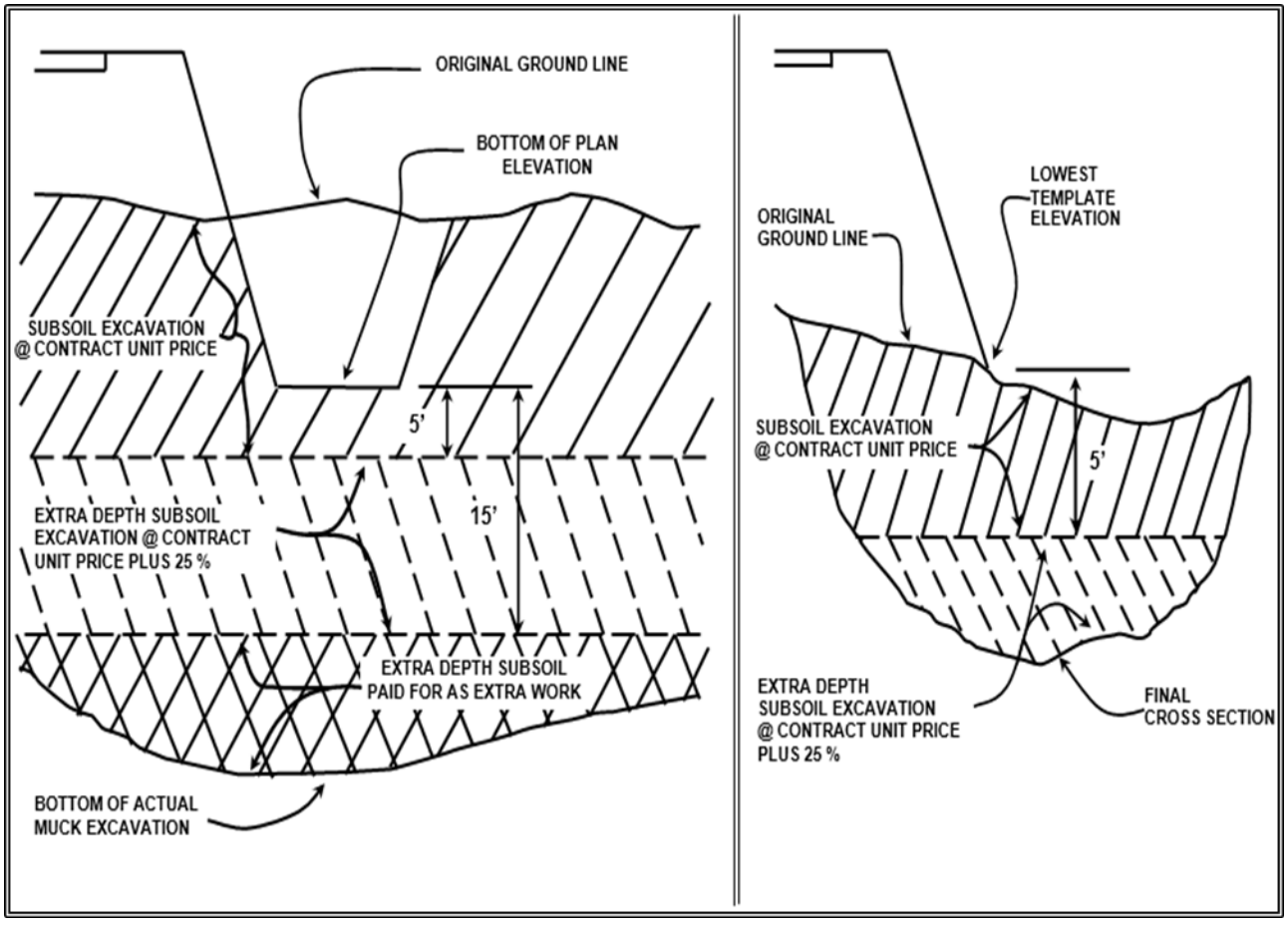


Figure 5.16-8
MANUSCRIPT FIELD BOOK NOTES

MANUSCRIPT FIELD BOOK NOTES-FDOT RADIAL & DTM FIELD SURVEYS

READER INFORMATION:

DATE: 05-26-15
FIELD PARTY:
Arnold Rodman
Jerry Gypsum
Jack Ketchum

FIN PROJ. NO: 1979341-52-02
DSECS: Broward Blvd Connector

S.P. ZONE: E (N/E/W) MAD: 83 (27/83)
UNITS: ✓ ENGLISH: _____ METRIC

INSTRUMENT NAME: Top Con GTS-38
WEATHER DATA: Warm, partly cloudy
AXIS TEST:

	FACE 1 (direct)		FACE 2 (reversed)	
1)	H: 0 0 1	V: 105 0 10	H: 180 0 1	V: 254 59 46
2)	H: 0 0 1	V: 105 0 12	H: 179 59 57	V: 254 59 48
3)	H: 359 59 58	V: 105 0 10	H: 179 59 54	V: 254 59 45
4)	H: 0 0 1	V: 105 0 12	H: 180 0 2	V: 254 59 45

COMMENTS: See attached for instrument errors

INSTRUMENT SETUP INFORMATION:

NAME OF POINT OCCUPIED: A-1
STAMPING: RLS # 4502 (may be a known point or unknown point)

FEATURE INFO: 5/8" Rod & Cap SURFACE: Ground ✓ ON _____ OFF
MEASURED INTRUMENT HEIGHT: 4.87'
X: _____ Y: _____ Z: _____
COMMENTS: Pt. in front of 7-11 store Sta 12+29 112.5' Lt.

BACKSIGHT NO. 1

NAME OF CONTROL POINT SIGHTED: C-1
STAMPING: Jones 1936 (XY AND Z MUST BE KNOWN)
FEATURE INFO: Brass Disk SURFACE: N/A _____ ON _____ OFF
HORIZ ANGLE (DDDMMSS) 124 41 10 VERT ANGLE (DDDMMSS) 89 59 58
DISTANCE: 258.97' _____ SLOPE ✓ HORIZONTAL
TARGET HEIGHT: 5.0'
X: 929 693.730 Y: 667 145.749 Z: 4.35
COMMENTS:

BACKSIGHT NO. 2

NAME OF CONTROL POINT SIGHTED: C-2
STAMPING: Jones 1936 AZ MK (XY AND Z MUST BE KNOWN)
FEATURE INFO: Brass Disk SURFACE: N/A _____ ON _____ OFF
HORIZ ANGLE (DDDMMSS) 65 28 44 VERT ANGLE (DDDMMSS) 90 0 1
DISTANCE: 428.15' _____ SLOPE ✓ HORIZONTAL
TARGET HEIGHT: 5.0'
X: 929 506.276 Y: 667 445.204 Z: _____
COMMENTS:

BACKSIGHT NO. 3

NAME OF CONTROL POINT SIGHTED: STA 12+75
STAMPING: _____ (XY AND Z MUST BE KNOWN)
FEATURE INFO: Nail in Cap SURFACE: N/A _____ ON _____ OFF
HORIZ ANGLE (DDDMMSS) 64 51 58 VERT ANGLE (DDDMMSS) 90 0 2
DISTANCE: 121.63' _____ SLOPE ✓ HORIZONTAL
TARGET HEIGHT: 5.0'
X: _____ Y: _____ Z: _____
COMMENTS: PC of 3 24 30 curve on Broward Blvd Connector
(Note: Horiz. Angle mandatory. Vert. Angle & distance optional)

Figure 5.16-9
EXAMPLE .TXT FILE

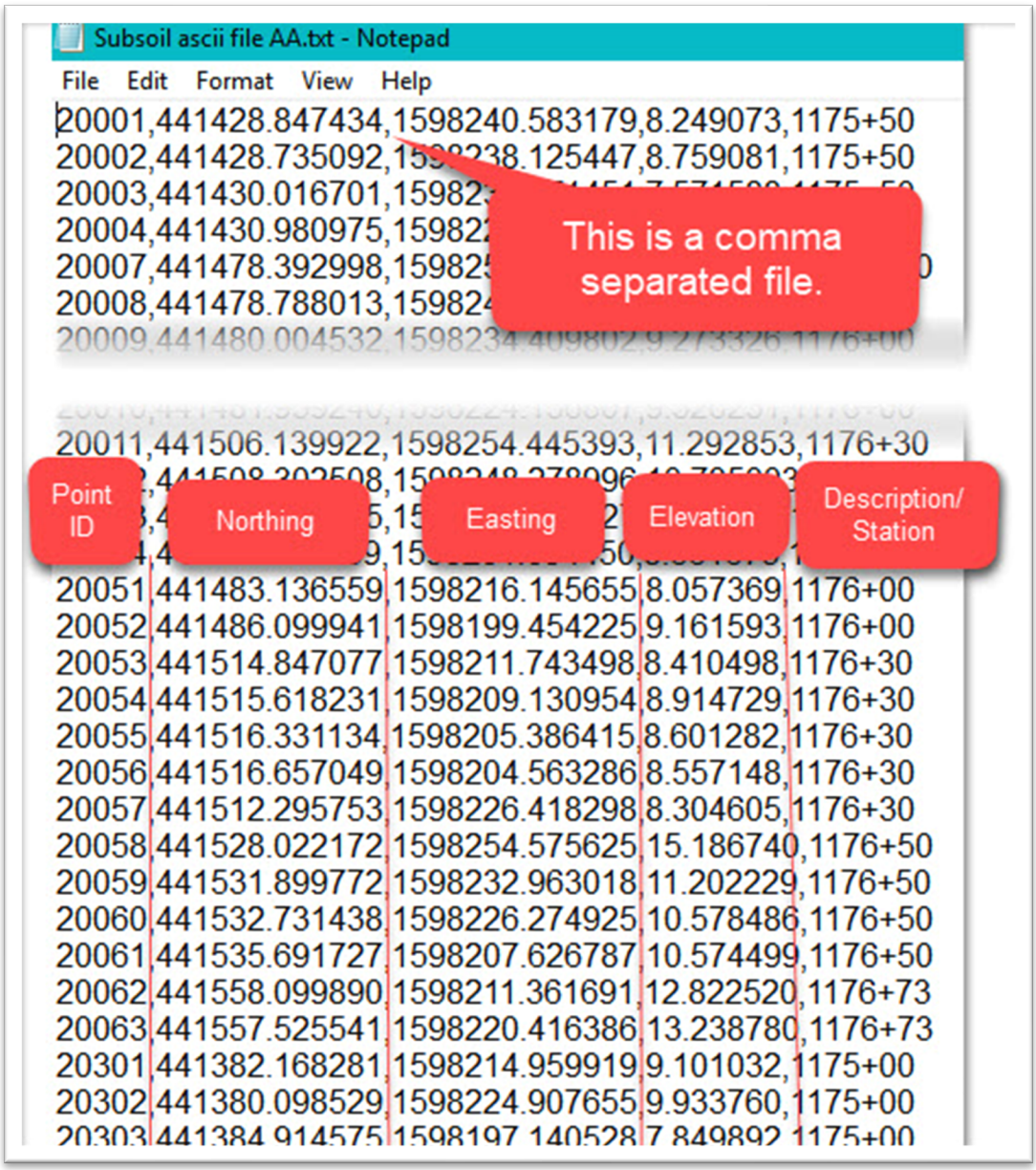


Figure 5.16-10
MANUSCRIPT FIELD BOOK NOTES

MANUSCRIPT FIELD BOOK NOTES – FDOT RADIAL & DTM FIELD SURVEYS

OBSERVATION:

POINT NAME EP - 1
FEATURE: ———
SURFACE: Ground ✓ ON ___ OFF
GEOMETRY: ✓ POINT ___ CURVE
HORIZ. ANGLE (DDDMMSS) 133 37 35
VERT. ANGLE (DDDMMSS) 89 59 59
DISTANCE 110.45' ___ SLOPE ✓ HORIZ
TARGET HEIGHT: 5'
ECCEN. DIST. ___ LT ___ RT ___ FR ___ BK
COMMENTS:

OBSERVATION:

POINT NAME EP - 2
FEATURE: ———
SURFACE: Ground ✓ ON ___ OFF
GEOMETRY: ✓ POINT ___ CURVE
HORIZ. ANGLE (DDDMMSS) 86 53 39
VERT. ANGLE (DDDMMSS) 89 59 20
DISTANCE 83.08' ___ SLOPE ✓ HORIZ
TARGET HEIGHT: 5'
ECCEN. DIST. ___ LT ___ RT ___ FR ___ BK
COMMENTS:

OBSERVATION:

POINT NAME EP - 3
FEATURE: ——— OFF
SURFACE: Ground ✓ ON ___ OFF
GEOMETRY: ✓ POINT ___ CURVE
HORIZ. ANGLE (DDDMMSS) 46 50 54
VERT. ANGLE (DDDMMSS) 89 59 59
DISTANCE 123.96' ___ SLOPE ✓ HORIZ
TARGET HEIGHT: 5'
ECCEN. DIST. ___ LT ___ RT ___ FR ___ BK
COMMENTS: point at PC STA on edge of pavement

OBSERVATION:

POINT NAME EP - 4
FEATURE: ———
SURFACE: ___ ON ___ OFF
GEOMETRY: ___ POINT ✓ CURVE
HORIZ. ANGLE (DDDMMSS) 32 30 6
VERT. ANGLE (DDDMMSS) 90 2 27
DISTANCE 194.78' ___ SLOPE ✓ HORIZ
TARGET HEIGHT: 5'
ECCEN. DIST. ___ LT ___ RT ___ FR ___ BK
COMMENTS:

OBSERVATION:

POINT NAME EP - 5
FEATURE: ———
SURFACE: Ground ✓ ON ___ OFF
GEOMETRY: ___ POINT ✓ CURVE
HORIZ. ANGLE (DDDMMSS) 26 33 1
VERT. ANGLE (DDDMMSS) 90 0 10
DISTANCE 271.92' ___ SLOPE ✓ HORIZ
TARGET HEIGHT: 5'
ECCEN. DIST. ___ LT ___ RT ___ FR ___ BK
COMMENTS:

OBSERVATION:

POINT NAME
FEATURE:
SURFACE: ___ ON ___ OFF
GEOMETRY: ___ POINT ___ CURVE
HORIZ. ANGLE (DDDMMSS)
VERT. ANGLE (DDDMMSS)
DISTANCE ___ SLOPE ___ HORIZ
TARGET HEIGHT:
ECCEN. DIST. ___ LT ___ RT ___ FR ___ BK
COMMENTS:

CHAIN FIELD NOTES

USER ASSIGNED CHAIN NAME: EP
FEATURE: edge of pavement (AP) SURFACE: ___ ON ___ OFF
STATIONING: ———
LIST OF POINTS IN CHAIN: EP - 1 → 5
COMMENTS: EOP @ inlets & midway between inlets & shot at PC

NOTE: A DETAILED SKETCH OF THE VICINITY MUST BE ATTACHED TO THESE NOTE FORMS.

Figure 5.16-11
NOTES ON GRID PAPER