



High-Precision Positioning Unit 3 Student Exercise: Introduction to Static GNSS Surveys

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This assignment teaches students to plan, execute, and assess a simple static GNSS survey in preparation for a more completely student-driven survey as the Unit 3 Summative Assignment. This exercise refers to the Static GPS/GNSS Survey Methods Manual, which should be reviewed before starting this assignment and will be herein referred to as the Manual. This survey will take a minimum of 2–4 hours, depending on the number of locations collected, the personal experience, and the processing time needed for each measurement. A single location must be occupied for a minimum of 15 minutes for a rapid-static survey. Multiple receivers can be used simultaneously to increase hands-on participation and allow for more points to be measured.

Preparing for the Survey

Time spent planning and preparing for a survey can dramatically decrease time and energy spent in the field later. It is important that a clear plan for the survey is in place and that all members of the team understand the operations before going into the field. Some aspects of the survey may need to be adjusted as field conditions change, but having a basic idea beforehand will make this process easier.

1. Site Selection and Survey Plan

Once you have been given your field site, make a plan as a group on how to conduct the survey. Draw a quick sketch of the site and a short written explanation. This should consider any challenges such as line of sight, multi-path errors, limited sky, etc., which should be discussed as a group. Remember that static occupations take at a minimum of 15 minutes per location. Your instructor will guide you on how much time is available.

The purpose of the study need not be complex. The intention is to gain experience with the hardware and techniques. The survey could be as simple as occupying a known benchmark location or establishing and measuring a new monument location.

As a group, discuss the equipment needs for the survey and make an equipment list. An example list may be given to you or can be written in a field book as appropriate.

1. Map or sketch of the study site with relevant information (points, landmarks, etc.)
2. Write a short description of the survey plan with justification for the technique used
3. Equipment list
4. Field notes on the setup. This should include all relevant metadata.

Guided Survey

Follow through the *Static GNSS Methods Manual* as your instructor guides you on the field survey process. You may choose to make notes directly in the manual, as you will use this same document to design and execute your own survey.

Executing the Survey

Execute the planned survey. Consult your instructor and the *Static GPS/GNSS Survey Methods Manual* as needed. Ask questions, as you will depend on your experience to conduct your own survey soon.

You are responsible for taking field notes, which are the main deliverable. An example of a field book setup may be provided, but is only a guide and may be modified or substituted based on preference.

Processing Data

Data should be retrieved and backed up as soon as possible after the survey is complete. It may take 24 hours or more for a solution from OPUS to be available.

Your instructor will guide you through an example processing solution. Follow “Section 5.3 Data Processing” in the *Static GPS/GNSS Survey Methods Manual* or the standalone *Static GPS/GNSS Data Processing with OPUS Manual*. Take notes as appropriate.

Final Deliverables

Once you receive a solution, plot it on an appropriate mapping program.

1. Initial survey design sketch map
2. Short survey plan
3. Equipment list
4. Field book or data log
5. A final map with the surveyed point(s) and appropriate symbols.
6. Answer the following questions:
 - Did the resulting positions accurately describe the object(s) you were trying to measure?
 - What issues or troubleshooting occurred in the field and how was this resolved?
 - How did the length of occupation affect the accuracy of results of your study?
 - How could you modify this design in the future to more effectively capture the object(s) of interest and/or mitigate various sources of error, uncertainty, or hazards?

Rubric

Component	Exemplary	Basic	Nonperformance
General Considerations	Exemplary work will not just answer all components of the given question but also answer correctly, completely, and thoughtfully. Attention to detail—as well as answers that are logical and make sense—is an important piece of this.	Basic work may answer all components of the given question, but some answers are incorrect, ill-considered, or difficult to interpret given the context of the question. Basic work may also be missing components of a given question.	Nonperformance occurs when students are missing large portions of the assignment, or when the answers simply do not make sense and are incorrect.
10 pts Survey Design	9–10 points: Student actively participated in discussion and formulation of the plan. The survey plan is reasonable and effective design for the area and accounts for potential obstacles. The survey map effectively illustrates the design components.	5–8 points: Student participated in discussion and formulation of the plan. The survey plan is reasonable but may not be the most effective design or account for potential obstacles. The survey map illustrates most of the design components.	0–4 points: Student did not participate in discussions or formulations of the plan. AND/OR Is missing various components of a reasonable survey design. Is missing several critical map components.
10 pts Field Book and Equipment List	9–10 points: Field book contains well-organized, concise notes on the setup, field survey, and results. Metadata is well kept and includes all appropriate components. An equipment list was kept and utilized.	5–8 points: Field book contains mostly organized notes on the setup, field survey, and results. May be missing 1 or 2 parts. Metadata is kept and includes most critical measures. An equipment list was kept but may not be well utilized.	0–4 points: Field book contains some notes, but may not be organized or is missing several components. Metadata is missing several critical components. An equipment list was not kept or utilized.
10 pts Final Map	9–10 points: Sketch includes all parts of the GNSS survey including the base station, measurement positions, and topography or other features. Sketch includes normal map elements such as	5–8 points: Missing 1–2 of the listed characteristics for an exemplary sketch. AND/OR All characteristics are	0–4 points: Missing 2–4 of the sketch components. AND/OR Most characteristics are present (1–2 missing) but are incorrect, showing a

	<p>titles, north arrow, scale, and legend.</p> <p>Sketch includes appropriate field observations from the site.</p>	<p>present but lack detail or are incorrect, showing a lack of comprehension.</p>	<p>lack of comprehension.</p>
<p>10 pts</p> <p>Write-Up or Discussion</p>	<p>9–10 points:</p> <p>The discussion is well written and includes all of the following components:</p> <ul style="list-style-type: none"> • Justification of survey design • Challenges and solutions • Discussion of the results <p>Should answer several of the questions.</p>	<p>5–8 points:</p> <p>The discussion is moderately well written and includes all of the components.</p> <p>OR</p> <p>The discussion is well written but missing 1–2 components or fails to answer some of the questions.</p>	<p>0–4 points:</p> <p>The discussion is poorly written discussion and is missing several components.</p> <p>AND/OR</p> <p>The discussion fails to discuss more than 2 critical components or fails to answer questions.</p>