

SOUTH CAROLINA GEODETIC SURVEY

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CHARLESTON COUNTY LiDAR QUALITY
ASSESSMENT

VRS GNSS SURVEY

PROJECT REPORT

February 2017

S.C. GEODETIC SURVEY
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I. INTRODUCTION

Purpose

This project was conducted to establish a network of geodetic control points of sufficient accuracy and spacing to support a quality assessment (QA) for a LiDAR-produced bare earth digital terrain model for Charleston County, SC. All checkpoint coordinates were determined using the SC Real Time Network (SCRTN) utilizing both GPS and GLONASS satellite constellations. The SCRTN control station coordinates were established using a three-minute (180 epochs) observation data set, with a one-second observation rate. Acceptance criteria for each data set allowed a maximum horizontal tolerance of +/-0.020 m (.066 ft.) horizontally and +/-0.040 m (.131 ft) vertically. Eighteen geodetic control checkpoints with repeated observations were used to verify the operation of the SCRTN across the county. A mean difference between published and observed vertical orthometric heights yielded a value of -0.02 ft. (0.010 m) with a standard deviation of 0.09 ft. (0.025 m). Five ground cover types were sampled: bare earth (o), urban (u), high grass (h), bush (b) and forested (f). A total of 170 points were observed including control points.

Planning and reconnaissance for the survey ensured that 5-cm orthometric and ellipsoid height accuracy could be met. Each VRS-derived QA checkpoint was positioned by the nearest five base stations, while atmospheric corrections were derived using the statewide network as a whole. All QA checkpoints were obtained using a fixed integer solution with a maximum RMS of 0.05m or less, a maximum PDOP of 6 and a minimum of six satellites with a mask angle of 10 degrees.

B. Time Period

The field reconnaissance and observations for stations initiated February 7 and ended February 22, 2017.

C. Point of Contact

Any specific problems with or questions about the project should be directed to Matt Wellslager phone 803-896-7715, E-mail matt.wellslager@rfa.sc.gov, 5 Geology Road, Columbia, South Carolina, 29210,

D. Accuracy Standards

The survey was designed to meet the standards for quality assurance of LiDAR-based elevation models. The VRS was designed to meet 0.024m 95% horizontal and 0.031m 95% vertical confidence interval including an allowance for NGS network accuracy stated by NGS to be 0.020m for directly connected network points and 0.050m for indirectly connected points (*Geometric Geodetic Accuracy Standards and Specifications For Using GPS Relative Positioning Techniques*, dated May 1988, Version 5.0, page 15). Our comparison checkpoints indicate a vertical accuracy of 0.026m 95% confidence interval including network accuracy indicating that the VRS and network are in good agreement. The computation of VRS accuracy is contained in *GPS + GLONASS for Precision, South Carolina's Virtual Reference Station*

Network, Inside GNSS, July/August 2007. All horizontal positions are referenced to the North American Datum 1983 (2011), while orthometric heights are referenced to North American Vertical Datum 1988. Horizontal positions are expressed in the South Carolina State Plane Coordinate Single Zone 3900, in International feet. Orthometric heights are expressed in Survey Ft.

II. LOCATION

The project area was Charleston County, SC.

III. CONDITIONS AFFECTING PROGRESS

No significant problems were encountered during the survey.

IV. FIELD WORK

A. Instrumentation

The SC Geodetic Survey used three Trimble R-8 GNSS receivers with built-in Trimble dual-frequency Zephyr Geodetic antennas. Two-meter fixed-height tripods were used on all stations.

B. Number and Type of Ground Covers Observed

The county was divided up into fourteen zones that depicted the best overall coverage of the county and representative of all five ground cover types. An attempt was made to measure at least one of each ground cover type in each zone and to obtain a total of 60 points across the county with a minimum of 20 urban, 20 open and 20 combined high grass, bush and forested. The point numbering scheme uses a three digit sequence starting with the county number (SC numbers its counties in alphabetical order), a dash, followed by zone number, a dash and then a sequence number corresponding to order of collection within the zone. The following summarizes the collection by zone:

Zone #	Open	Urban	High	Bush	forest
1	3	2	2	3	2
2	3	2	2	2	1
3	3	3	2	2	
4	3	3	2	1	1
5	3	1	2	2	2
6	3	3	2	2	1
7	3	3	2	2	2
8	3	3	2	2	1
9	3	3	2	2	1
10	3	2	2	2	1
11	2	2	2	2	2
12	3	3	1	2	2
13	3	3	2	2	1
14	3	3	2	2	1
Total	41	36	27	28	18

Total checkpoints: 150

C. Deviation from Instructions

There were no deviations from instructions.

V. DATA PROCESSING PERFORMED

A. Software Used

Data was downloaded from the TRIMBLE receivers using Trimble Business Center (TBC) Software. There was no post-processing required. TBC was used to generate reports of coordinates, RMS and orthometric heights. The output was reformatted to an Excel spreadsheet.

B. Data Rejected

No data was rejected.

C. Equipment

Receivers were used as described above in part B. Instrumentation under section IV. All R-8 antennas were supported on 2-meter, fixed-height poles while VRS base stations are mounted in such a manner as to achieve sub-centimeter stability. Each checkpoint location was photographed with a 35mm digital camera and numbered corresponding to the checkpoint number.

COMMENTS AND RECOMMENDATIONS

SCGS will be happy to supply any additional information as requested.

Respectfully submitted,

Matthew J. Wellslager