

**Medina Consultants
LiDAR Campaign
Final Report
For
Erie County Corridors & Niagara County
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Prepared by:

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EXECUTIVE SUMMARY

In December of 2006, Sanborn was contracted by Medina Consultants to execute a LiDAR (Light Detection and Ranging) survey campaign in the state of New York. LiDAR data in the form of 3-dimensional positions of a dense set of mass points was collected for approximately 555 square miles of Erie and Niagara Counties. This data was used in the development of the bare-earth-classified elevation point data sets.

The Optech ALTM 2050 LiDAR system was used to collect data for the whole survey campaign. The LiDAR system is calibrated by conducting flight passes over a known ground surface before and after each LiDAR mission. During final data processing, the calibration parameters are inserted into post-processing software.

Eight airborne GPS (Global Positioning System) base stations were used in this project. A new point was set at the Niagara Falls International Airport. The other base stations were set up at National Geodetic Survey (NGS) markers. NGS Monument PID: AA8259 is located in the town of Porter, PID: OG0512 is located in the Golden Hill State Park Campsite, PID: A2159 is located east of Gowanda, PID: AE2167 is located along Michigan Road in Java Village, PID: DF9363 is located at the Niagara Falls International Airport, PID: AI0132 is located northeast of the village of Orchard Park, and PID: DE7804 is located south of Lockport. These points were tied together to create a GPS survey network. The coordinates of these stations were checked against each other with the three dimensional GPS baseline created at the airborne support set up and determined to be within project specifications.

The acquired LiDAR data was processed to obtain first and last return point data. The last return data was further filtered to yield a LiDAR surface representing the bare earth.

The contents of this report summarize the methods used to establish the base station coordinate check, perform the LiDAR data collection and post-processing as well as the results of these methods.

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1 INTRODUCTION

This report contains the technical write-up of the Erie and Niagara Counties LiDAR campaign, including system calibration techniques, the establishment of base stations by a differential GPS network survey, and the collection and post-processing of the LiDAR data.

1.1 Contact Information

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1.2 Purpose of the LiDAR Acquisition

This LiDAR operation was designed to provide a highly detailed ground surface dataset to be used for the development of topographic, contour mapping and hydraulic modeling

1.3 Project Location

The corridors Erie County & Niagara County, New York

1.4 Project Scope, Specifications and Time Line

The spring 2007 LiDAR Flight Acquisition required the collection of approximately 526 square miles of Niagara County and approximately 30 square miles of the corridors of Erie County. Total, approximately 555 square miles was collected at a nominal point spacing of 1.4 meters and based on the Sanborn FEMA compliant LiDAR product specification.

Table 1: Project Specifications and Deliverable Coordinate and Datum Systems

Area (sq. mi)	555	Product type	Fema	Projection	New York State Plane West Zone
Vertical Accuracy (CM)	Bare Earth 18.5 (F)	Check Points required	Yes	Horizontal Datum Vertical Datum	NAD 83 NAVD 88
Horizontal accuracy (M)	1meter (F)	Number Collected	44	Units	US Survey Ft

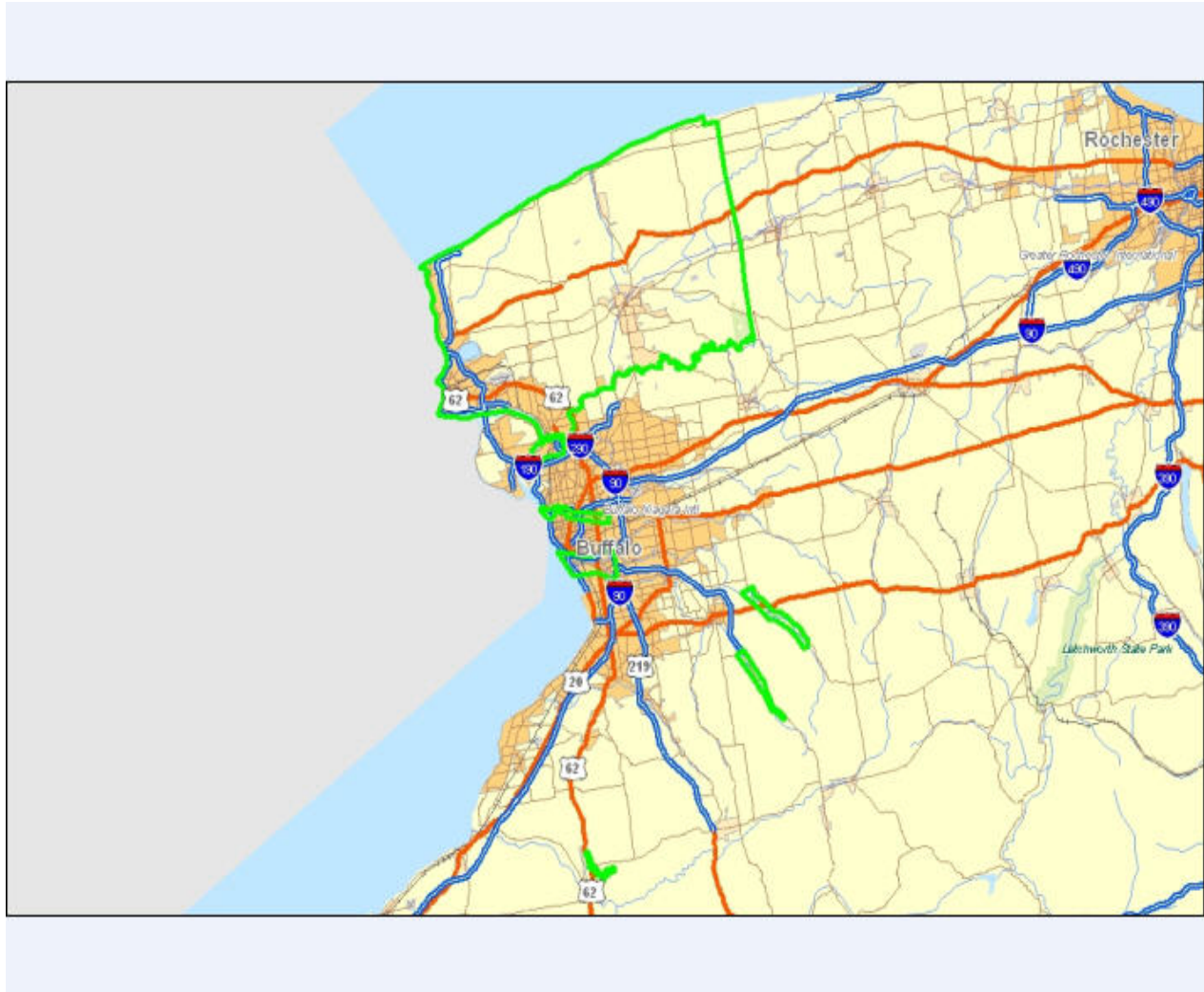


Figure 1: Area of Collection

2 LiDAR CALIBRATION

2.1 Introduction

LiDAR calibrations are performed to determine and therefore eliminate systematic biases that occur within the hardware of the Optech ALTM 2050 system. Once the biases are determined they can be modeled out. The systematic biases are corrected for include scale, roll, and pitch.

The following procedures are intended to prevent operational errors in the field and office work, and are designed to detect inconsistencies. The emphasis is not only on the quality control (QC) aspects, but also on the documentation, i.e., on the quality assurance (QA).

2.2 Calibration Procedures

Sanborn performs two types of calibrations on its LiDAR system. The first is a building calibration, and it is done any time the LiDAR system has been moved from one plane to another. New calibration parameters are computed and compared with previous calibration runs. If there is any change, the new values are updated internally or during the LiDAR post-processing. These values are applied to all data collected with this plane/ALTM 2050 system configuration.

Once final processing calibration parameters are established from the building data, a precisely-surveyed surface is observed with the LiDAR system to check for stability in the system. This is done several times during each mission. An average of the systematic biases are applied on a per mission basis.

2.3 Building Calibration

Whenever the ALTM 2050 is moved to a new aircraft, a building calibration is performed. The rooftop of a large, flat, rectangular building is surveyed on the ground using conventional survey methods, and used as the LiDAR calibration target. The aircraft flies several specified passes over the building with the ALTM 2050 system set first in scan mode, then in profile mode, and finally in both scan and profile modes with the scan angle set to zero degrees.

Figure 2 shows a pass over the center of the building. The purpose of this pass is to identify a systematic bias in the scale of the system.

Figure 3 demonstrates a pass along a distinct edge of the building to verify the roll compensation performed by the Inertial Navigation System, INS.

Additionally, a pass is made in profile mode across the middle of the building to compensate for any bias in pitch.

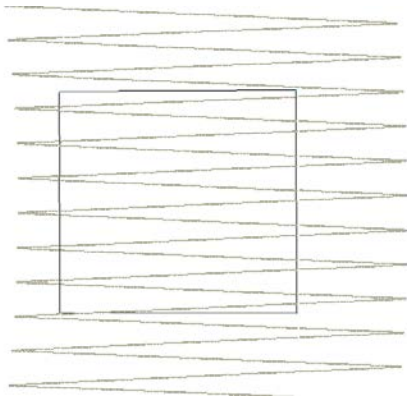


Figure 2: Calibration Pass 1

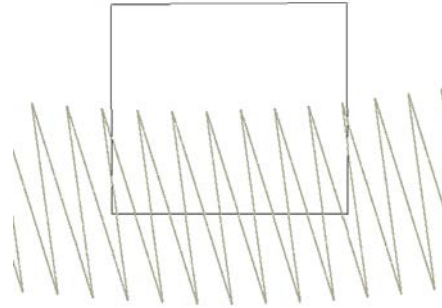


Figure 3: Calibration Pass 2

2.4 Runway Calibration, System Performance Validation

An active asphalt runway was precisely-surveyed at the Niagara Falls International Airport using kinematic GPS survey techniques (accuracy: $\pm 3\text{cm}$ at 1σ , along each coordinate axis) to establish an accurate digital terrain model of the runway surface. The LiDAR system is flown at right angles over the runway several times and residuals are generated from the processed data. Figure 4 shows a typical pass over the runway surface.

Approximately 25,000 LiDAR points are observed with each pass. These points are “draped” over the runway surface’s Triangular Irregular Network, TIN, to compute vertical residuals for every data point. The residuals are analyzed with respect to the location along the runway to identify the level of noise and system biases.

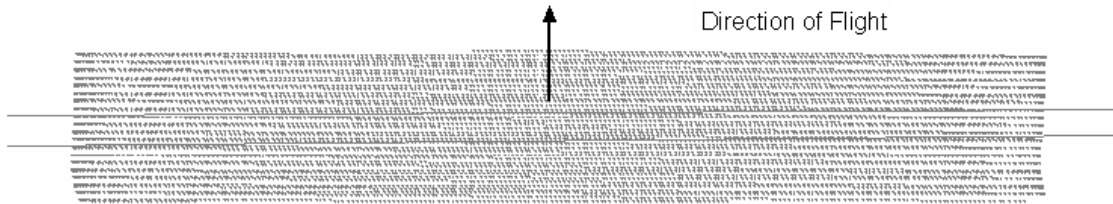


Figure 4: Runway Calibration

3 RUNWAY CALIBRATION, SYSTEM PERFORMANCE VALIDATION

3.1 Calibration Results

The LiDAR data captured over the building is used to determine whether there have been any changes to the alignment of the Inertial Measurement Unit, IMU, with respect to the laser system. The parameters are designed to eliminate systematic biases within certain system parameters.

The runway over-flights are intended to be a quality check on the calibration and to identify any system irregularities and the overall noise. IMU misalignments and internal system calibration parameters are verified by comparing the collected LiDAR points with the runway surface.

Figure 5 shows the typical results of a runway over-flight analysis. The X-axis represents the position along the runway. The overall statistics from this analysis provides evidence of the overall random noise in the data (typically, 7 cm standard deviation – an unbiased estimator, and 8 cm RMS which includes any biases) and indicates that the system is performing within specifications. As described in later sections of this report, this analysis will identify any peculiarities within the data along with mirror-angle scale errors (identified as a “smile” or “frown” in the data band) or roll biases.

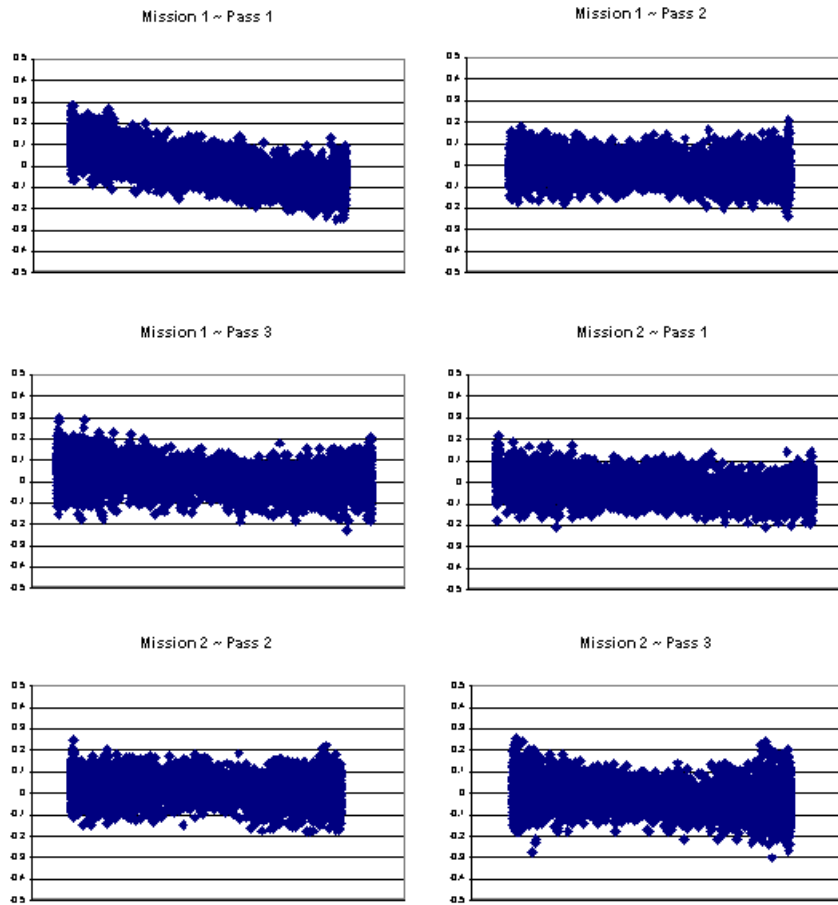


Figure 5: Runway Calibration Results

4 LiDAR FLIGHT AND SYSTEM REPORT

4.1 Introduction

This section addresses LiDAR system, flight reporting and data acquisition methodology used during the collection of the Erie and Niagara Counties campaign. Although Sanborn conducts all LiDAR with the same rigorous and strict procedures and processes, all LiDAR collections are unique.

4.2 Field Work Procedures

A minimum of two GPS base stations were set up, with one receiver located at the airport, and the secondary GPS receiver placed at a survey control point within the project area or within the required baseline specifications of the project.

Pre-flight checks such as cleaning the sensor head glass are performed. A four minute INS initialization is conducted on the ground, with the engines running, prior to flight, to establish fine-alignment of the INS. GPS ambiguities are resolved by flying within ten kilometers of the base stations.

The flight missions were typically four or five hours in duration including runway calibration flights flown at the beginning and the end of each mission. During the data collection, the operator recorded information on log sheets which includes weather conditions, LiDAR operation parameters, and flight line statistics. Near the end of the mission GPS ambiguities are again resolved by flying within ten kilometers of the base stations, to aid in post-processing.

Table 2 shows the planned LiDAR acquisition parameters with a flying height of 1,200 meters above ground level (AGL) on a mission to mission basis.

Table 2: LiDAR Acquisition Parameters

Average Altitude	1,200 Meters AGL
Airspeed	~120 Knots
Scan Frequency	32 Hertz
Scan Width Half Angle	18 Degrees
Pulse Rate	71000 Hertz

Preliminary data processing was performed in the field immediately following the missions for quality control of GPS data and to ensure sufficient overlap between flight lines. Any problematic data could then be re-flown immediately as required. Final data processing was completed in the office.

Table 3: Collection Dates, Times, Average Per Flight Collection Parameters and PDOP

Mission	Date	Start Time	End Time	Altitude (m)	Airspeed (Knots)	Scan Angle	Scan Rate	Pulse Rate	PDOP
003a	Jan. 3	22:41	01:20	1200	120	36°	32	71000	1.57
004a	Jan. 4	13:14	15:30	1200	120	36°	32	71000	1.92
004b	Jan. 4	17:22	22:08	1200	120	36°	32	71000	1.43
126a	May 6	19:42	23:11	1200	120	36°	32	71000	1.82
126b	May 6	19:42	23:11	1200	120	36°	32	71000	1.82
126c	May 6	19:42	23:11	1200	120	36°	32	71000	1.82
127a	May 7	14:31	18:01	1200	120	36°	32	71000	1.64
127b	May 7	14:31	18:01	1200	120	36°	32	71000	1.64
128a	May 8	14:57	17:53	1200	120	36°	32	71000	1.74
128b	May 8	19:59	23:48	1200	120	36°	32	71000	1.06
129a	May 9	11:26	14:09	1200	120	36°	32	71000	1.84
129b	May 9	15:17	18:39	1200	120	36°	32	71000	1.64

4.3 Final LiDAR Processing

Final post-processing of LiDAR data involves several steps. The airborne GPS data was post-processed using Waypoint's GravNAV™ software (version 7.5). A fixed-bias carrier phase solution was computed in both the forward and reverse chronological directions. The data was processed for both base stations and combined. In the event that the solution worsened as a result of the combination of both solutions the best of both solutions was used to yield more accurate data. LiDAR acquisition was limited to periods when the PDOP was less than 3.2.

The GPS trajectory was combined with the raw IMU data and post-processed using Applanix Inc.'s POSPROC (version 4.3) Kalman Filtering software. This results in a two-fold improvement in the attitude accuracies over the real-time INS data. The best estimated trajectory (BET) and refined attitude data are then re-introduced into the REALM Survey Suite OPTECH software to compute the laser point-positions. The trajectory is then combined with the attitude data and laser range measurements to produce the 3-dimensional coordinates of the mass points.

All return values are produced within REALM Survey Suite OPTECH software. The multi-return information minus the last return provides a useful depiction of the "canopy" within the project area. The last return is further processed to obtain the "Bare Earth Dataset" as a deliverable. All LiDAR data is processed using the binary LAS format 1.1 file format.

LiDAR filtering was accomplished using TerraSolid, TerraScan LiDAR processing and modeling software. The filtering process reclassifies all the data into classes within the LAS formatted file based scheme set using the LAS format 1.1 specifications or by the client. Once the data is classified, the entire data set is reviewed and manually edited for anomalies that are outside the required guidelines of the product specification or contract guidelines, whichever apply. Table 4 indicates the required product specifications.

The coordinate and datum transformations are then applied to the data set to reflect the required deliverable projection, coordinate and datum systems as provided in the contract.

The client required deliverables are then generated. At this time, a final QC process is undertaken to validate all deliverables for the project. Prior to release of data for delivery, Sanborn's Quality control/ quality assurance department reviews the data and then releases it for delivery.

Table 4: Processing Accuracies and Requirements

Accuracy of LiDAR Data (H)	1 meter RMSE
Accuracy of LiDAR data in bare areas	18.5 cm RMSE
Accuracy of LiDAR data in vegetated	37 cm RMSE
Percent of artifacts removed (terrain and vegetation dependent)	90%
Percent of all outliers removed	95%
Percent of all vegetation removed	95%
Percent of all buildings removed	98%

5 GEODETIC BASE NETWORK

5.1 Network Scope

During the LiDAR campaign, the field crew conducted a GPS field survey to establish final coordinates of the ground base stations for final processing of the base-remote GPS solutions. NGS points PID: AA8259, PID: OG0512, PID: AE2159, PID: AE2167, PID: DF9363, PID: AI0132, PID: DE7804 and the point set at the Niagara Falls International Airport were used for the LiDAR missions. See Table 5 for station names, orders and constraints.

5.2 Data Processing and Network Adjustment

The one static baselines created between the points was processed using Trimble Navigation's GPSurveyTM (Ver. 2.35a) software. Fixed bias solution was obtained for the baseline. The broadcast ephemeris was used, since the accuracy and extent of the network does not warrant the use of the precise ephemeris. The results were satisfactory; therefore, fulfilling project specifications for first order control network.

Table 5: NGS Control Constraints

Horizontal

NGS Station Name	PID	Order
YOUN USCG B	AA8259	A
THIRTY	OG0512	B
KELLEHER RM 3	AE2159	B
JAVA	AE2167	B
IAG A	DF9363	B
OP14	AI0132	1 ST
WD AE	DE7804	A

Vertical

NGS Station Name	PID	Order
YOUN USCG B	AA8259	1 – II
THIRTY	OG0512	2 – I
JAVA	AE2167	2 – II

5.3 Final LiDAR Verification

The LiDAR data for the Erie corridors of Buffalo, Clear, Grannis, East Branch Cazenovia and Tonawanda were evaluated using a drive survey. Tables 6, 7, 8,

and 9 indicate the results of the drive survey and the overall results as it compares to the LiDAR data set for these five corridors. The LiDAR data for the corridors of Cazenovia and Scajaquada were evaluated using the client supplied checkpoints. Tables 10 and 11 indicate the results and the overall results as it compares to the LiDAR data set for these two corridors. The LiDAR data for Niagara County was evaluated using a collection of 44 GPS surveyed checkpoints. Table 12 indicates the results for each point and the overall results as it compares to the LiDAR data set. For all tables, points indicating removed are points outside the statistical variance in the data, Z and statistical data are represented in feet, and the standard deviation and the root mean squared yield much better result than was required for the project.

Table 6: Buffalo Corridor Drive Profile Results

Number	Easting	Northing	Known Z	Laser Z	Dz	Intensity
2369	1157832.187	1008714.227	1002.291	1002.660	+0.369	2.3
2141	1180045.041	990715.535	1004.434	1004.710	+0.276	0.9
2149	1179692.367	991107.230	997.115	997.370	+0.255	0.8
2144	1179888.878	990887.516	1002.378	1002.630	+0.252	1.1
2146	1179810.823	990975.587	999.402	999.650	+0.248	0.9
2180	1177359.841	996562.277	1001.519	1001.690	+0.171	1.3
2157	1179357.119	991592.028	973.261	973.430	+0.169	0.9
2151	1179613.267	991193.995	995.986	996.150	+0.164	1.4
2264	1165428.760	1005289.864	918.712	918.870	+0.158	1.0
2150	1179652.840	991150.466	996.643	996.800	+0.157	1.3
2147	1179771.330	991019.877	998.384	998.540	+0.156	1.2
2159	1179267.342	991817.547	966.934	967.090	+0.156	1.2
2148	1179731.784	991063.836	997.734	997.890	+0.156	1.2
2261	1165641.361	1005229.757	929.916	930.070	+0.154	1.1
2162	1179175.481	992043.445	963.857	964.010	+0.153	0.9
2259	1165777.607	1005175.538	938.989	939.140	+0.151	1.7
2238	1167940.419	1004002.425	1015.953	1016.100	+0.147	1.1
2260	1165710.259	1005204.189	934.553	934.700	+0.147	1.1
2262	1165571.214	1005252.385	925.823	925.970	+0.147	1.0
2143	1179967.493	990800.832	1004.554	1004.700	+0.146	1.2
2154	1179464.775	991375.380	988.198	988.340	+0.142	1.2
2258	1165842.889	1005142.976	943.271	943.410	+0.139	1.4
2145	1179849.904	990931.418	1000.823	1000.960	+0.137	1.0
2294	1159694.813	1007122.615	952.796	952.930	+0.134	1.0
2189	1173423.710	1001223.834	970.258	970.390	+0.132	1.2
2263	1165500.164	1005272.118	922.204	922.330	+0.126	1.4
2235	1168268.361	1003834.412	1016.699	1016.820	+0.121	1.4
2158	1179289.836	991761.570	968.056	968.170	+0.114	1.1
2265	1165357.236	1005306.523	915.768	915.880	+0.112	1.2
2134	1180602.038	990105.317	1006.092	1006.200	+0.108	0.8
2395	1156584.392	1008505.199	1008.753	1008.860	+0.107	1.0
2398	1156505.823	1008503.763	1007.345	1007.450	+0.105	1.1
2257	1165906.595	1005107.741	947.456	947.560	+0.104	1.2
2142	1180006.341	990758.127	1004.817	1004.920	+0.103	1.1

2186	1173677.845	1001115.736	975.649	975.750	+0.101	1.2
2187	1173635.292	1001134.614	974.650	974.750	+0.100	1.4
2292	1159961.435	1006992.390	945.911	946.010	+0.099	1.1
2152	1179574.259	991237.746	995.257	995.350	+0.093	1.3
2133	1180681.798	990016.993	1007.368	1007.460	+0.092	1.0
2396	1156559.006	1008505.250	1008.140	1008.230	+0.090	1.3
2192	1173115.320	1001353.793	963.313	963.400	+0.087	1.1
2255	1166030.797	1005032.888	955.844	955.930	+0.086	1.3
2183	1173804.818	1001057.359	978.985	979.070	+0.085	1.2
2155	1179433.505	991426.385	984.306	984.390	+0.084	1.1
2125	1181100.536	989505.912	1009.587	1009.670	+0.083	0.9
2242	1167715.811	1004115.481	1016.207	1016.290	+0.083	1.2
2190	1173381.212	1001240.130	969.539	969.620	+0.081	1.4
2394	1156611.024	1008505.171	1009.480	1009.560	+0.080	1.2
2184	1173762.322	1001077.637	977.551	977.630	+0.079	1.2
2185	1173720.099	1001096.685	976.603	976.680	+0.077	1.1
2130	1180879.798	989790.032	1007.507	1007.580	+0.073	1.0
2140	1180283.995	990455.218	1002.250	1002.320	+0.070	1.3
2107	1181740.790	988600.644	1024.950	1025.020	+0.070	0.9
2244	1167599.498	1004173.716	1015.772	1015.840	+0.068	1.3
2156	1179405.597	991480.304	980.133	980.200	+0.067	1.3
2206	1171779.957	1001955.311	953.775	953.840	+0.065	1.3
2163	1179153.136	992099.091	963.740	963.800	+0.060	1.2
2234	1168321.801	1003807.094	1017.464	1017.520	+0.056	1.5
2193	1172868.991	1001463.637	960.365	960.420	+0.055	1.3
2397	1156533.224	1008504.778	1007.655	1007.710	+0.055	1.2
2393	1156669.980	1008505.584	1010.977	1011.030	+0.053	1.5
2196	1172714.317	1001534.926	959.078	959.130	+0.052	1.4
2195	1172765.545	1001511.465	959.499	959.550	+0.051	1.4
2298	1159365.484	1007284.930	959.770	959.820	+0.050	1.3
2240	1167830.014	1004057.938	1016.321	1016.370	+0.049	1.2
2129	1180917.400	989742.998	1007.323	1007.370	+0.047	1.0
2161	1179221.126	991930.004	965.575	965.620	+0.045	1.2
2153	1179536.174	991282.084	993.857	993.900	+0.043	1.0
2256	1165969.065	1005070.713	951.719	951.760	+0.041	1.4
2301	1159175.570	1007376.673	963.321	963.360	+0.039	1.3
2282	1162427.751	1006000.699	919.382	919.420	+0.038	1.1
2127	1180991.637	989647.861	1007.153	1007.190	+0.037	1.0
2296	1159562.100	1007187.978	955.676	955.710	+0.034	1.0
2128	1180954.593	989695.509	1007.158	1007.190	+0.032	0.9
2241	1167773.362	1004086.466	1016.390	1016.420	+0.030	1.5
2131	1180841.406	989836.529	1007.700	1007.730	+0.030	1.2
2132	1180802.232	989882.467	1007.914	1007.940	+0.026	0.8
2251	1166942.339	1004497.808	1009.985	1010.010	+0.025	1.4
2253	1166153.444	1004957.753	964.431	964.450	+0.019	1.1
2252	1166882.454	1004528.481	1007.912	1007.930	+0.018	1.2
2237	1167994.054	1003975.400	1015.820	1015.830	+0.010	1.3
2137	1180484.176	990238.331	1004.352	1004.360	+0.008	1.0
2160	1179244.381	991873.366	966.452	966.460	+0.008	1.1
2295	1159628.303	1007155.330	954.292	954.300	+0.008	1.1
2126	1181028.474	989600.407	1007.703	1007.710	+0.007	1.1

2188	1173550.107	1001172.209	972.513	972.520	+0.007	1.3
2254	1166092.116	1004995.217	960.104	960.110	+0.006	1.3
2102	1181964.547	988312.510	1029.235	1029.240	+0.005	0.8
2245	1167540.774	1004202.899	1015.635	1015.640	+0.005	1.2
2122	1181234.594	989315.788	1012.666	1012.670	+0.004	1.4
2297	1159496.203	1007220.571	957.187	957.190	+0.003	1.4
2103	1181925.238	988361.572	1028.479	1028.480	+0.001	1.0
2335	1157583.224	1008580.140	1010.057	1010.050	-0.007	2.5
2191	1173161.855	1001333.344	964.248	964.240	-0.008	1.3
2197	1172663.568	1001557.574	958.769	958.760	-0.009	1.5
2293	1159828.113	1007057.449	949.450	949.440	-0.010	1.2
2399	1156367.636	1008493.443	1006.649	1006.630	-0.019	1.1
2120	1181297.872	989222.250	1014.376	1014.350	-0.026	1.1
2243	1167657.792	1004144.594	1015.966	1015.940	-0.026	1.3
2300	1159238.079	1007346.207	962.207	962.180	-0.027	1.4
2121	1181266.616	989268.757	1013.517	1013.490	-0.027	1.2
2249	1167301.924	1004319.627	1015.389	1015.360	-0.029	1.4
2123	1181201.984	989363.223	1011.890	1011.860	-0.030	0.9
2231	1168474.426	1003727.478	1018.191	1018.160	-0.031	1.6
2299	1159301.350	1007315.902	960.902	960.870	-0.032	1.3
2233	1168374.075	1003780.220	1018.033	1018.000	-0.033	1.5
2302	1159050.907	1007440.375	965.855	965.820	-0.035	1.3
2104	1181886.657	988410.652	1027.845	1027.810	-0.035	0.9
2111	1181610.439	988782.233	1022.230	1022.190	-0.040	1.0
2250	1167241.665	1004349.097	1015.472	1015.430	-0.042	1.3
2269	1164861.561	1005426.974	906.373	906.330	-0.043	1.8
2272	1164644.968	1005471.806	904.075	904.030	-0.045	1.9
2248	1167362.070	1004290.597	1015.358	1015.310	-0.048	1.6
2247	1167421.995	1004261.447	1015.508	1015.460	-0.048	1.3
2135	1180562.733	990149.799	1005.520	1005.470	-0.050	1.2
2124	1181168.861	989410.755	1011.141	1011.090	-0.051	1.3
2239	1167885.720	1004029.917	1016.082	1016.030	-0.052	1.4
2115	1181454.604	989003.254	1018.544	1018.490	-0.054	1.6
2289	1161833.694	1006225.065	922.965	922.910	-0.055	1.0
2208	1171667.345	1002008.046	953.287	953.230	-0.057	1.3
2303	1158989.004	1007471.759	967.395	967.330	-0.065	1.2
2118	1181359.790	989132.330	1016.090	1016.020	-0.070	1.1
2281	1162496.854	1005974.697	918.672	918.600	-0.072	1.9
2116	1181423.027	989046.291	1017.776	1017.700	-0.076	1.6
2236	1168047.782	1003948.083	1015.788	1015.710	-0.078	1.4
2271	1164717.610	1005457.775	904.924	904.840	-0.084	1.2
2291	1161636.483	1006308.749	921.776	921.690	-0.086	1.1
2387	1157359.511	1008564.455	1016.666	1016.580	-0.086	1.2
2232	1168425.076	1003753.699	1018.399	1018.310	-0.089	1.4
2316	1157967.178	1007997.528	1016.883	1016.790	-0.093	1.5
2119	1181328.725	989176.628	1015.276	1015.180	-0.096	1.2
2390	1157244.041	1008545.130	1017.906	1017.810	-0.096	1.3
2288	1161898.152	1006198.919	923.097	923.000	-0.097	1.4
2273	1164498.100	1005495.451	902.429	902.330	-0.099	1.2
2304	1158927.325	1007502.118	969.299	969.200	-0.099	1.7
2203	1171945.561	1001878.326	954.370	954.270	-0.100	1.5

2229	1168571.474	1003674.682	1014.122	1014.020	-0.102	1.2
2112	1181579.200	988827.173	1021.383	1021.280	-0.103	1.1
2246	1167481.645	1004232.146	1015.614	1015.510	-0.104	1.3
2401	1155769.081	1008457.721	1017.487	1017.380	-0.107	1.1
2392	1157144.672	1008531.724	1018.430	1018.320	-0.110	1.5
2176	1177441.519	996352.490	1003.122	1003.010	-0.112	1.3
2171	1177590.234	995975.756	1003.264	1003.150	-0.114	1.3
2139	1180324.382	990411.690	1002.835	1002.720	-0.115	1.1
2172	1177553.489	996067.420	1004.445	1004.330	-0.115	1.3
2110	1181641.913	988737.316	1022.996	1022.880	-0.116	0.8
2205	1171835.924	1001929.146	953.929	953.810	-0.119	1.2
2283	1162293.755	1006050.276	920.790	920.670	-0.120	1.2
2391	1157212.663	1008540.450	1018.050	1017.930	-0.120	1.2
2270	1164789.748	1005442.734	905.750	905.630	-0.120	2.1
2138	1180444.572	990281.979	1003.812	1003.690	-0.122	1.0
2230	1168522.722	1003701.375	1016.733	1016.610	-0.123	1.6
2207	1171723.467	1001981.813	953.540	953.410	-0.130	1.7
2287	1162028.320	1006148.680	922.711	922.580	-0.131	1.3
2268	1165003.607	1005393.425	907.853	907.720	-0.133	1.3
2400	1155830.736	1008459.839	1014.933	1014.800	-0.133	1.2
2305	1158865.986	1007532.010	971.544	971.410	-0.134	1.4
2306	1158804.825	1007561.677	974.345	974.210	-0.135	1.1
2136	1180523.545	990194.228	1004.976	1004.840	-0.136	1.2
2177	1177421.395	996405.081	1002.706	1002.570	-0.136	1.4
2106	1181775.892	988554.058	1025.677	1025.540	-0.137	0.9
2182	1177297.890	996714.637	1000.222	1000.080	-0.142	1.3
2117	1181391.309	989089.150	1016.974	1016.830	-0.144	1.4
2175	1177461.137	996301.357	1003.404	1003.260	-0.144	1.1
2164	1179085.278	992266.205	964.095	963.950	-0.145	1.5
2114	1181516.923	988915.907	1019.896	1019.750	-0.146	1.5
2174	1177480.101	996252.072	1003.657	1003.510	-0.147	1.3
2181	1177339.290	996613.399	1001.121	1000.970	-0.151	1.5
2389	1157274.530	1008549.652	1017.702	1017.550	-0.152	1.2
2178	1177401.001	996458.195	1002.363	1002.210	-0.153	1.4
2173	1177534.791	996113.311	1004.516	1004.360	-0.156	1.3
2212	1171392.584	1002140.462	952.126	951.970	-0.156	1.3
2275	1164354.062	1005513.684	902.377	902.220	-0.157	1.3
2330	1157461.386	1008567.339	1014.490	1014.330	-0.160	1.5
2204	1171890.855	1001903.529	954.200	954.040	-0.160	1.2
2388	1157304.063	1008554.325	1017.441	1017.280	-0.161	1.1
2179	1177380.360	996510.584	1001.893	1001.730	-0.163	1.3
2225	1169972.747	1002914.246	937.043	936.880	-0.163	1.8
2286	1162094.829	1006123.576	922.496	922.330	-0.166	1.5
2307	1158743.985	1007592.129	977.547	977.380	-0.167	1.2
2349	1157629.905	1008389.108	1013.287	1013.120	-0.167	2.6
2167	1179009.221	992446.256	961.439	961.270	-0.169	1.8
2290	1161768.901	1006251.988	922.729	922.560	-0.169	1.1
2109	1181673.880	988692.393	1023.700	1023.530	-0.170	0.9
2214	1171284.434	1002198.162	951.661	951.490	-0.171	1.4
2199	1172463.494	1001645.463	957.352	957.180	-0.172	1.3
2274	1164425.619	1005504.874	902.302	902.130	-0.172	1.7

2170	1177930.363	995135.556	992.745	992.570	-0.175	1.1
2384	1157518.758	1008620.045	1011.551	1011.370	-0.181	2.0
2202	1172052.560	1001829.456	954.803	954.620	-0.183	1.2
2309	1158623.286	1007653.861	984.875	984.690	-0.185	1.1
2365	1157625.457	1008607.731	1009.697	1009.510	-0.187	0.9
2213	1171338.498	1002169.224	951.918	951.730	-0.188	1.3
2331	1157476.785	1008573.391	1014.118	1013.930	-0.188	1.4
2169	1177971.886	995029.932	990.959	990.770	-0.189	1.4
2166	1179035.649	992385.092	962.563	962.370	-0.193	1.4
2284	1162227.730	1006074.416	921.354	921.160	-0.194	0.9
2165	1179061.080	992325.099	963.367	963.170	-0.197	1.1
2279	1162640.177	1005920.423	917.428	917.230	-0.198	1.4
2308	1158683.521	1007623.025	981.088	980.890	-0.198	1.0
2313	1158221.287	1007864.059	1008.258	1008.060	-0.198	1.9
2315	1158015.037	1007972.458	1015.888	1015.690	-0.198	1.0
2278	1162713.150	1005892.591	917.401	917.200	-0.201	1.1
2386	1157385.146	1008569.995	1016.293	1016.090	-0.203	1.1
2360	1157600.246	1008524.898	1011.136	1010.930	-0.206	3.8
2108	1181706.787	988646.818	1024.437	1024.230	-0.207	1.2
2198	1172513.499	1001623.232	957.768	957.560	-0.208	1.2
2364	1157612.693	1008602.652	1010.008	1009.800	-0.208	1.1
2113	1181548.000	988871.702	1020.760	1020.550	-0.210	2.5
2402	1155706.423	1008455.371	1020.480	1020.270	-0.210	1.2
2209	1171612.032	1002033.916	953.037	952.820	-0.217	1.4
2333	1157543.255	1008587.901	1012.087	1011.870	-0.217	1.2
2344	1157613.517	1008449.418	1012.620	1012.400	-0.220	3.8
2329	1157448.513	1008559.163	1014.751	1014.530	-0.221	1.4
2372	1157832.099	1008672.832	1002.492	1002.270	-0.222	2.6
2276	1164282.688	1005522.607	902.994	902.770	-0.224	0.9
2359	1157617.627	1008470.474	1011.964	1011.740	-0.224	4.2
2280	1162567.728	1005947.964	917.876	917.650	-0.226	2.0
2328	1157439.653	1008549.310	1014.940	1014.710	-0.230	1.7
2371	1157836.424	1008674.471	1002.363	1002.130	-0.233	2.2
2314	1158114.907	1007919.588	1012.624	1012.390	-0.234	1.8
2210	1171556.774	1002059.758	952.787	952.550	-0.237	1.4
2310	1158563.547	1007684.955	988.748	988.510	-0.238	1.5
2194	1172817.197	1001487.271	959.971	959.730	-0.241	1.2
2341	1157600.698	1008485.084	1011.833	1011.590	-0.243	3.2
2226	1169913.420	1002945.608	940.800	940.550	-0.250	2.0
2383	1157523.775	1008624.509	1011.394	1011.140	-0.254	2.0
2277	1163496.923	1005635.071	920.487	920.230	-0.257	1.2
2351	1157645.471	1008384.100	1013.103	1012.840	-0.263	1.9
2317	1157876.120	1008048.128	1018.404	1018.140	-0.264	1.3
2339	1157594.638	1008516.416	1011.405	1011.140	-0.265	2.8
2228	1169681.845	1003069.421	947.106	946.840	-0.266	1.7
2285	1162161.390	1006098.758	922.016	921.750	-0.266	1.5
2105	1181811.926	988506.870	1026.349	1026.080	-0.269	0.9
2348	1157627.153	1008393.565	1013.359	1013.090	-0.269	3.3
2366	1157640.828	1008612.124	1009.331	1009.060	-0.271	1.4
2368	1157833.126	1008782.872	1004.881	1004.610	-0.271	2.7
2382	1157527.358	1008627.951	1011.241	1010.970	-0.271	2.0

2404	1155578.944	1008449.429	1027.672	1027.400	-0.272	1.4
2168	1178018.358	994915.376	988.474	988.200	-0.274	1.2
2385	1157511.286	1008614.087	1012.004	1011.730	-0.274	1.4
2215	1171230.155	1002227.080	951.445	951.170	-0.275	1.1
2350	1157634.096	1008385.498	1013.395	1013.120	-0.275	2.4
2312	1158331.600	1007806.409	1002.837	1002.560	-0.277	2.0
2403	1155642.981	1008452.564	1023.917	1023.640	-0.277	1.3
2218	1171066.041	1002314.745	950.390	950.110	-0.280	1.2
2334	1157571.372	1008588.337	1011.110	1010.830	-0.280	1.7
2361	1157597.875	1008535.446	1011.241	1010.960	-0.281	4.1
2337	1157589.878	1008561.404	1010.853	1010.570	-0.283	2.3
2320	1157749.927	1008130.260	1018.956	1018.670	-0.286	1.7
2200	1172158.653	1001782.150	955.326	955.040	-0.286	1.2
2340	1157598.226	1008495.070	1011.727	1011.440	-0.287	2.8
2332	1157528.450	1008585.721	1012.549	1012.260	-0.289	1.3
2405	1155514.459	1008446.478	1031.983	1031.690	-0.293	1.2
2311	1158388.321	1007776.553	999.528	999.230	-0.298	1.5
2336	1157587.275	1008571.978	1010.325	1010.020	-0.305	2.1
2345	1157616.709	1008440.975	1012.815	1012.510	-0.305	3.7
2346	1157622.351	1008425.215	1013.020	1012.710	-0.310	4.2
2377	1157559.080	1008640.194	1009.604	1009.290	-0.314	3.1
2347	1157626.083	1008399.194	1013.347	1013.030	-0.317	3.4
2211	1171501.401	1002085.889	952.558	952.240	-0.318	1.4
2327	1157434.878	1008539.504	1015.157	1014.830	-0.327	1.9
2216	1171175.604	1002256.122	951.198	950.870	-0.328	1.3
2227	1169796.469	1003007.110	945.219	944.890	-0.329	1.9
2318	1157832.943	1008074.320	1018.801	1018.470	-0.331	1.2
2338	1157591.446	1008550.174	1011.332	1011.000	-0.332	3.1
2342	1157603.662	1008475.558	1012.096	1011.760	-0.336	3.5
2378	1157545.890	1008639.614	1010.297	1009.950	-0.347	2.2
2321	1157709.926	1008162.340	1018.921	1018.570	-0.351	1.3
2217	1171120.907	1002285.350	950.885	950.530	-0.355	2.0
2221	1170899.207	1002404.464	948.989	948.630	-0.359	1.4
2343	1157606.782	1008466.572	1012.332	1011.970	-0.362	3.8
2358	1157623.416	1008458.094	1012.416	1012.050	-0.366	4.0
2319	1157791.045	1008101.225	1019.027	1018.660	-0.367	1.3
2219	1171010.984	1002344.362	950.115	949.740	-0.375	1.4
2326	1157433.172	1008532.153	1015.265	1014.890	-0.375	1.6
2362	1157595.770	1008545.523	1011.337	1010.960	-0.377	4.4
2376	1157566.176	1008639.209	1009.388	1009.010	-0.378	2.5
2406	1155383.972	1008442.184	1040.879	1040.500	-0.379	1.3
2222	1170787.665	1002463.792	947.239	946.860	-0.379	1.1
2220	1170955.319	1002374.419	949.714	949.310	-0.404	1.8
2324	1157541.195	1008344.666	1016.449	1016.040	-0.409	1.5
2201	1172105.813	1001805.554	955.069	954.660	-0.409	1.7
2357	1157624.061	1008456.841	1012.473	1012.060	-0.413	4.4
2223	1170677.218	1002523.627	944.077	943.640	-0.437	1.4
2367	1157833.643	1008719.604	1003.164	1002.720	-0.444	2.2
2381	1157531.052	1008631.314	1011.205	1010.760	-0.445	2.3
2352	1157651.010	1008387.237	1013.023	1012.560	-0.463	1.7
2353	1157656.560	1008404.057	1012.486	1012.020	-0.466	4.5

2356	1157631.072	1008444.243	1012.666	1012.200	-0.466	3.8
2370	1157849.296	1008674.561	1001.963	1001.490	-0.473	2.5
2224	1170622.261	1002553.886	942.203	941.720	-0.483	1.4
2379	1157540.868	1008637.768	1010.668	1010.180	-0.488	2.5
2373	1157642.643	1008628.467	1009.041	1008.550	-0.491	1.7
2354	1157655.068	1008408.386	1012.495	1012.000	-0.495	3.7
2374	1157593.852	1008632.839	1009.092	1008.590	-0.502	1.6
2375	1157578.879	1008636.400	1009.297	1008.790	-0.507	2.5
2380	1157535.435	1008634.552	1010.994	1010.470	-0.524	2.1
2322	1157601.039	1008270.489	1017.635	1017.100	-0.535	1.5
2355	1157639.435	1008431.729	1012.719	1012.180	-0.539	3.8
2363	1157593.145	1008578.499	1009.998	1009.450	-0.548	3.7
2323	1157569.772	1008307.635	1017.137	1016.570	-0.567	1.7
2325	1157515.529	1008380.792	1016.044	1015.460	-0.584	1.7

Average dz -0.122
 Minimum dz -0.584
 Maximum dz +0.369
 Average magnitude 0.177
 Root mean square 0.220
 Std deviation 0.183

Table 7: Clear and Grannis Corridors Drive Profile Results

Number	Easting	Northing	Known Z	Laser Z	Dz	Intensity
1652	1053672.475	897943.208	764.046	764.550	+0.504	0.8
1653	1053663.481	897926.233	763.636	764.140	+0.504	0.8
1654	1053652.490	897908.813	763.159	763.640	+0.481	0.9
1741	1053661.959	897888.062	763.332	763.800	+0.468	1.2
1672	1053296.324	897498.195	762.445	762.860	+0.415	1.0
1740	1053643.803	897874.877	762.618	763.030	+0.412	1.2
1739	1053626.575	897861.063	761.998	762.380	+0.382	0.8
1655	1053620.955	897875.926	762.067	762.440	+0.373	1.0
1742	1053679.721	897900.440	764.132	764.470	+0.338	1.6
1671	1053310.585	897522.709	762.246	762.580	+0.334	1.6
1656	1053600.526	897859.012	761.627	761.960	+0.333	0.8
1668	1053395.803	897642.417	761.177	761.510	+0.333	0.9
1666	1053403.578	897652.380	761.224	761.550	+0.326	0.9
1669	1053380.599	897621.831	761.158	761.480	+0.322	1.3
1667	1053401.303	897649.497	761.224	761.540	+0.316	1.1
1744	1053711.598	897925.023	765.007	765.320	+0.313	1.4
1743	1053696.233	897912.392	764.577	764.890	+0.313	1.3
1738	1053610.028	897846.512	761.561	761.870	+0.309	1.3
1658	1053553.821	897819.321	760.984	761.290	+0.306	1.0
1960	1053686.629	897976.150	764.905	765.210	+0.305	0.9
1737	1053554.802	897797.758	760.703	761.000	+0.297	1.0
1757	1054096.718	898358.675	766.096	766.390	+0.294	1.8
1764	1054004.144	898339.061	764.489	764.780	+0.291	2.1

1952	1053572.159	898562.725	761.900	762.190	+0.290	1.4
1723	1053404.736	897557.521	761.218	761.500	+0.282	1.3
1665	1053405.024	897654.236	761.279	761.560	+0.281	0.9
1955	1053627.977	898236.898	761.500	761.780	+0.280	1.3
1807	1055129.917	908028.685	871.511	871.790	+0.279	1.0
1716	1053297.764	897477.985	762.596	762.870	+0.274	0.9
1898	1055147.927	910305.950	808.349	808.620	+0.271	1.3
1959	1053684.861	897979.943	764.903	765.170	+0.267	1.0
1670	1053338.253	897564.539	761.965	762.220	+0.255	1.0
1950	1053529.137	898816.478	765.046	765.300	+0.254	1.2
1664	1053407.976	897657.978	761.308	761.560	+0.252	0.9
1762	1054039.700	898337.552	765.208	765.460	+0.252	1.4
1951	1053540.802	898741.157	764.070	764.320	+0.250	1.2
1956	1053664.176	898068.813	764.151	764.400	+0.249	1.3
1714	1053294.233	897471.349	762.633	762.880	+0.247	1.3
1644	1054109.927	898271.265	766.966	767.210	+0.244	1.5
1949	1053523.493	898854.607	765.528	765.770	+0.242	1.3
1947	1053512.540	898932.433	766.330	766.570	+0.240	1.4
1948	1053517.993	898893.154	765.902	766.140	+0.238	1.7
1713	1053290.097	897463.994	762.667	762.900	+0.233	1.3
1657	1053577.955	897840.170	761.329	761.560	+0.231	1.2
1957	1053673.438	898027.309	764.539	764.770	+0.231	1.5
1763	1054023.911	898338.507	764.876	765.100	+0.224	1.6
1717	1053303.425	897488.864	762.607	762.830	+0.223	0.8
1736	1053534.263	897777.962	760.679	760.900	+0.221	1.2
1780	1053287.474	900774.775	774.681	774.900	+0.219	1.4
1760	1054061.740	898339.540	765.655	765.870	+0.215	0.9
1953	1053578.589	898527.600	761.638	761.850	+0.212	1.6
1715	1053296.625	897475.832	762.669	762.880	+0.211	1.2
1650	1053721.195	897976.451	765.301	765.510	+0.209	1.2
1954	1053596.352	898424.958	760.984	761.190	+0.206	1.5
1747	1053761.072	897966.815	765.282	765.480	+0.198	1.4
1648	1053735.413	897976.540	765.233	765.430	+0.197	1.2
1748	1053795.510	897993.310	765.796	765.990	+0.194	1.5
1758	1054064.377	898340.227	765.700	765.890	+0.190	1.0
1659	1053505.653	897772.718	760.911	761.100	+0.189	0.9
1958	1053677.289	898009.643	764.741	764.930	+0.189	1.3
1647	1053738.143	897976.473	765.247	765.430	+0.183	1.1
1940	1053265.320	900799.201	774.700	774.880	+0.180	1.2
1946	1053490.984	899096.945	767.612	767.790	+0.178	2.1
1759	1054063.194	898339.909	765.704	765.880	+0.176	0.9
1897	1055146.938	910404.404	807.356	807.530	+0.174	1.4
1718	1053309.767	897499.807	762.519	762.690	+0.171	0.8
1941	1053270.159	900759.150	774.671	774.840	+0.169	1.1
1645	1054095.087	898258.241	766.832	767.000	+0.168	1.5
1735	1053513.395	897756.312	761.104	761.270	+0.166	1.1
1834	1059050.658	906074.378	934.240	934.400	+0.160	1.9
1770	1053587.110	898572.777	762.101	762.260	+0.159	1.2
1942	1053280.318	900681.017	774.941	775.100	+0.159	1.1
1719	1053319.508	897513.763	762.333	762.490	+0.157	1.4
1721	1053358.606	897556.199	761.775	761.930	+0.155	1.9

1712	1053284.552	897454.251	762.626	762.780	+0.154	1.2
1852	1055104.059	910804.406	803.718	803.870	+0.152	1.2
1673	1053267.135	897445.453	762.325	762.470	+0.145	1.2
1746	1053743.604	897952.714	765.266	765.410	+0.144	1.4
1751	1054017.535	898178.736	766.477	766.620	+0.143	1.7
1833	1059053.638	906106.246	935.009	935.150	+0.141	1.7
1651	1053710.997	897975.145	765.391	765.530	+0.139	1.6
1891	1055011.115	911275.635	801.451	801.590	+0.139	0.9
1945	1053485.816	899139.310	767.622	767.760	+0.138	2.6
1761	1054051.161	898337.817	765.517	765.650	+0.133	1.0
1720	1053345.485	897544.293	761.938	762.070	+0.132	1.6
1961	1053732.987	897963.399	765.299	765.430	+0.131	1.7
1767	1053732.520	898298.767	761.999	762.130	+0.131	1.8
1892	1055028.846	911173.105	801.071	801.200	+0.129	0.7
1815	1059087.564	908712.436	902.042	902.170	+0.128	1.5
1745	1053727.157	897938.583	765.274	765.400	+0.126	1.3
1802	1055135.723	907063.781	875.714	875.840	+0.126	1.8
1649	1053727.346	897976.719	765.342	765.460	+0.118	1.0
1917	1055091.271	905007.168	883.624	883.740	+0.116	0.9
1674	1053252.095	897418.585	762.206	762.320	+0.114	1.3
1944	1053337.312	900260.333	772.440	772.550	+0.110	1.5
1727	1053659.300	897273.401	762.951	763.060	+0.109	2.6
1752	1054101.752	898251.939	766.931	767.040	+0.109	1.5
1643	1054149.828	898305.781	767.689	767.790	+0.101	1.7
1943	1053285.442	900642.944	775.139	775.240	+0.101	1.3
1675	1053204.128	897334.254	761.670	761.770	+0.100	1.2
1916	1055091.895	905072.811	883.402	883.500	+0.098	0.8
1899	1055117.310	908073.796	871.273	871.370	+0.097	1.0
1707	1053249.148	897390.926	762.105	762.200	+0.095	1.3
1646	1053960.832	898139.909	766.315	766.410	+0.095	1.5
1749	1053974.840	898142.582	766.338	766.430	+0.092	1.8
1774	1053536.620	898885.553	765.929	766.020	+0.091	1.1
1705	1053238.026	897372.421	761.974	762.060	+0.086	1.1
1729	1053626.210	897305.257	762.754	762.840	+0.086	2.3
1750	1053996.342	898160.606	766.444	766.530	+0.086	1.5
1901	1055115.921	907938.107	872.035	872.120	+0.085	0.9
1889	1054985.152	911430.489	800.538	800.620	+0.082	1.4
1704	1053233.583	897365.075	761.929	762.010	+0.081	1.4
1722	1053371.106	897563.480	761.601	761.680	+0.079	1.6
1709	1053263.323	897416.237	762.303	762.380	+0.077	1.3
1801	1055136.832	907053.213	875.763	875.840	+0.077	2.5
1699	1053221.533	897344.820	761.796	761.870	+0.074	1.1
1700	1053223.379	897347.974	761.796	761.870	+0.074	1.3
1706	1053242.766	897380.256	762.046	762.120	+0.074	1.6
1771	1053580.643	898608.356	762.577	762.650	+0.073	0.9
1890	1054993.816	911378.799	800.891	800.950	+0.059	1.5
1703	1053229.027	897357.412	761.892	761.950	+0.058	1.5
1900	1055116.616	908005.991	871.642	871.700	+0.058	1.0
1775	1053348.304	900256.508	772.623	772.680	+0.057	2.1
1701	1053226.802	897353.702	761.863	761.920	+0.057	1.0
1813	1059081.824	908806.338	904.064	904.120	+0.056	2.3

1905	1055109.388	906613.972	878.235	878.290	+0.055	2.0
1779	1053297.414	900693.310	775.106	775.160	+0.054	1.3
1708	1053256.332	897403.616	762.209	762.260	+0.051	1.2
1800	1055135.719	907008.199	875.909	875.960	+0.051	2.0
1773	1053567.233	898683.033	763.460	763.510	+0.050	1.0
1710	1053270.642	897429.521	762.401	762.450	+0.049	1.2
1698	1053219.464	897341.360	761.801	761.850	+0.049	1.0
1806	1055128.086	907748.859	873.183	873.230	+0.047	0.9
1702	1053227.441	897354.819	761.873	761.920	+0.047	1.0
1768	1053627.085	898352.717	761.174	761.220	+0.046	1.2
1776	1053337.802	900352.434	773.757	773.800	+0.043	2.1
1894	1055074.257	910916.398	802.297	802.340	+0.043	1.3
1711	1053277.943	897442.626	762.529	762.570	+0.041	1.2
1803	1055133.481	907078.052	875.830	875.870	+0.040	1.7
1694	1053183.847	897226.741	761.301	761.340	+0.039	1.7
1726	1053684.031	897250.591	763.022	763.060	+0.038	1.8
1753	1054123.558	898271.509	767.274	767.310	+0.036	1.5
1769	1053593.326	898538.276	761.857	761.890	+0.033	1.1
1697	1053212.804	897329.998	761.758	761.790	+0.032	1.1
1766	1053794.469	898309.087	762.481	762.510	+0.029	1.8
1851	1055111.002	910759.607	804.293	804.320	+0.027	1.0
1725	1053688.226	897222.073	762.915	762.940	+0.025	1.6
1635	1054297.763	898287.598	770.666	770.690	+0.024	1.1
1724	1053647.602	897248.160	762.916	762.940	+0.024	1.5
1849	1055146.883	910536.956	806.417	806.440	+0.023	1.4
1695	1053178.622	897254.834	761.229	761.250	+0.021	1.8
1634	1054298.924	898286.525	770.681	770.700	+0.019	1.1
1902	1055113.922	907530.062	874.653	874.670	+0.017	1.2
1778	1053327.515	900442.051	775.003	775.020	+0.017	2.3
1772	1053574.059	898644.926	762.984	763.000	+0.016	1.2
1683	1053077.319	897047.777	760.286	760.300	+0.014	1.5
1812	1059080.120	908834.525	904.676	904.690	+0.014	1.9
1777	1053334.606	900380.978	774.152	774.160	+0.008	2.2
1888	1054958.894	911583.598	798.834	798.840	+0.006	1.4
1846	1059105.180	908456.095	900.675	900.680	+0.005	1.8
1799	1055134.428	906987.807	876.075	876.080	+0.005	2.1
1835	1059081.500	906044.599	934.155	934.160	+0.005	2.1
1814	1059085.561	908749.257	902.786	902.790	+0.004	1.9
1903	1055112.590	907328.555	875.256	875.260	+0.004	1.2
1805	1055124.020	907368.082	875.127	875.130	+0.003	0.8
1906	1055108.604	906555.266	878.977	878.980	+0.003	1.0
1677	1053133.943	897215.450	760.979	760.980	+0.001	0.9
1895	1055082.461	910865.382	802.849	802.850	+0.001	2.3
1676	1053152.407	897245.541	761.191	761.190	-0.001	1.4
1804	1055127.461	907220.588	875.604	875.600	-0.004	1.3
1798	1055133.339	906932.963	876.367	876.360	-0.007	2.2
1690	1053207.356	897178.365	762.278	762.270	-0.008	1.6
1904	1055110.709	906798.683	877.271	877.260	-0.011	0.9
1636	1054284.479	898298.742	770.567	770.550	-0.017	0.9
1687	1053201.796	897103.749	761.928	761.910	-0.018	2.2
1637	1054278.027	898304.491	770.488	770.460	-0.028	1.2

1912	1055096.571	905668.709	882.321	882.290	-0.031	0.9
1964	1054305.821	898277.822	770.742	770.710	-0.032	1.1
1692	1053200.110	897205.098	762.333	762.300	-0.033	1.8
1686	1053192.455	897059.112	761.945	761.910	-0.035	1.9
1765	1053860.275	898320.317	763.126	763.090	-0.036	2.2
1696	1053197.418	897303.573	761.637	761.600	-0.037	1.2
1856	1055026.809	911257.541	801.337	801.300	-0.037	1.7
1640	1054223.706	898346.029	769.369	769.330	-0.039	1.5
1811	1059081.198	908864.704	905.579	905.540	-0.039	1.8
1855	1055034.694	911212.639	801.229	801.190	-0.039	1.3
1797	1055131.168	906860.712	876.810	876.770	-0.040	1.9
1821	1059092.096	907869.110	916.680	916.640	-0.040	1.8
1919	1055089.718	904875.855	884.081	884.040	-0.041	0.9
1693	1053185.915	897224.388	761.525	761.480	-0.045	1.8
1810	1059082.892	908882.011	905.985	905.940	-0.045	2.4
1639	1054232.087	898344.573	769.488	769.440	-0.048	1.5
1907	1055102.108	906131.191	881.400	881.350	-0.050	1.1
1691	1053204.965	897192.161	762.363	762.310	-0.053	1.9
1808	1055132.112	908293.713	869.693	869.640	-0.053	1.2
1853	1055097.709	910847.360	803.016	802.960	-0.056	1.4
1678	1053115.863	897185.493	760.807	760.750	-0.057	1.1
1689	1053206.541	897151.235	762.067	762.010	-0.057	2.0
1963	1054313.398	898270.589	770.797	770.740	-0.057	1.4
1679	1053098.917	897156.687	760.678	760.620	-0.058	1.2
1965	1054301.087	898282.235	770.749	770.690	-0.059	1.0
1681	1053073.902	897106.357	760.585	760.520	-0.065	1.1
1893	1055066.272	910967.195	801.886	801.820	-0.066	2.7
1908	1055101.345	906002.497	881.746	881.680	-0.066	1.0
1682	1053068.891	897083.984	760.669	760.600	-0.069	1.8
1816	1059089.733	908427.263	901.231	901.160	-0.071	2.0
1915	1055094.345	905469.513	882.831	882.750	-0.081	0.9
1680	1053084.598	897130.525	760.557	760.470	-0.087	1.6
1909	1055099.211	905869.949	881.827	881.740	-0.087	1.1
1684	1053087.603	897036.646	760.592	760.500	-0.092	1.3
1685	1053100.222	897029.634	760.845	760.750	-0.095	1.8
1911	1055097.521	905735.825	882.315	882.220	-0.095	1.3
1809	1059085.654	908904.878	906.557	906.460	-0.097	1.5
1920	1055088.883	904809.897	884.238	884.140	-0.098	1.0
1910	1055098.246	905802.950	882.079	881.980	-0.099	1.2
1755	1054206.645	898336.013	768.992	768.890	-0.102	1.2
1962	1054293.986	898250.358	770.272	770.170	-0.102	0.9
1839	1059098.060	907705.538	919.403	919.300	-0.103	1.9
1854	1055043.199	911167.068	800.944	800.840	-0.104	1.2
1921	1055087.942	904743.757	884.458	884.350	-0.108	0.7
1841	1059099.486	907867.118	916.652	916.540	-0.112	2.0
1796	1055114.189	906226.208	881.385	881.270	-0.115	1.0
1847	1059104.040	908846.362	905.487	905.370	-0.117	1.2
1857	1055019.686	911301.455	801.265	801.140	-0.125	1.5
1688	1053203.578	897120.539	761.849	761.720	-0.129	2.4
1848	1055369.303	909846.256	814.010	813.880	-0.130	1.8
1859	1055005.501	911391.305	800.671	800.540	-0.131	1.5

1914	1055095.118	905535.722	882.707	882.570	-0.137	1.2
1913	1055095.731	905601.982	882.509	882.370	-0.139	1.0
1728	1053636.524	897294.629	763.011	762.870	-0.141	2.9
1858	1055013.030	911345.374	801.003	800.860	-0.143	1.5
1862	1054943.893	911736.580	796.569	796.420	-0.149	1.1
1825	1059082.082	907660.984	920.117	919.950	-0.167	1.8
1823	1059086.306	907765.900	918.619	918.450	-0.169	2.4
1732	1053599.919	897337.113	762.651	762.480	-0.171	2.2
1792	1055106.632	905161.947	883.394	883.220	-0.174	1.3
1790	1055104.188	905009.805	883.727	883.550	-0.177	1.1
1844	1059104.006	908037.791	913.098	912.920	-0.178	2.3
1795	1055112.698	906037.799	881.769	881.580	-0.189	1.1
1922	1055086.850	904677.909	884.857	884.660	-0.197	0.9
1826	1059079.107	907554.327	921.858	921.660	-0.198	1.6
1838	1059100.024	907464.322	923.059	922.860	-0.199	2.3
1829	1059075.054	907229.316	927.109	926.910	-0.199	1.7
1880	1054639.736	913871.641	775.933	775.730	-0.203	1.7
1879	1054622.630	913842.120	776.117	775.910	-0.207	2.3
1887	1054950.309	911633.523	798.098	797.890	-0.208	1.1
1866	1054888.212	912057.365	793.441	793.230	-0.211	1.2
1840	1059098.842	907812.239	917.604	917.390	-0.214	2.1
1918	1055090.427	904941.610	883.956	883.740	-0.216	1.2
1641	1054211.707	898344.546	769.197	768.980	-0.217	1.5
1828	1059076.229	907338.879	925.289	925.070	-0.219	1.6
1822	1059089.376	907817.724	917.620	917.400	-0.220	1.9
1827	1059076.971	907393.169	924.511	924.290	-0.221	1.8
1824	1059083.926	907713.692	919.452	919.230	-0.222	1.6
1830	1059074.130	907064.924	929.952	929.730	-0.222	1.5
1861	1054952.891	911684.798	797.286	797.060	-0.226	1.0
1868	1054870.417	912162.807	792.713	792.480	-0.233	1.1
1756	1054198.104	898382.751	769.013	768.780	-0.233	1.7
1843	1059102.419	907979.832	914.627	914.390	-0.237	2.1
1819	1059097.269	908021.279	913.660	913.420	-0.240	1.4
1793	1055108.867	905586.329	882.754	882.500	-0.254	1.1
1789	1055102.760	904932.846	884.165	883.910	-0.255	1.4
1845	1059104.950	908096.940	911.307	911.050	-0.257	2.3
1794	1055110.290	905845.557	882.080	881.820	-0.260	1.1
1842	1059100.567	907922.977	915.744	915.480	-0.264	3.2
1817	1059091.204	908376.610	902.427	902.160	-0.267	1.5
1791	1055105.615	905086.396	883.478	883.210	-0.268	1.2
1820	1059096.035	907970.760	914.966	914.690	-0.276	1.9
1865	1054897.192	912004.042	794.017	793.720	-0.297	1.0
1831	1059074.916	907012.127	930.880	930.580	-0.300	1.8
1836	1059088.968	906924.707	932.241	931.940	-0.301	2.7
1818	1059095.820	908274.986	905.513	905.210	-0.303	1.7
1860	1054961.919	911633.667	798.094	797.790	-0.304	1.2
1832	1059075.846	906909.918	932.595	932.290	-0.305	1.8
1787	1055099.751	904472.851	888.121	887.810	-0.311	1.0
1881	1054599.044	913799.663	778.096	777.780	-0.316	1.1
1788	1055101.667	904855.596	884.347	884.020	-0.327	1.0
1638	1054243.332	898338.433	769.938	769.610	-0.328	2.4

1837	1059091.059	906979.797	931.324	930.990	-0.334	2.9
1886	1054924.664	911786.163	795.811	795.470	-0.341	1.1
1923	1055086.223	904352.237	892.516	892.170	-0.346	0.9
1883	1054683.614	913225.764	787.889	787.540	-0.349	1.2
1924	1055084.856	904221.735	897.714	897.360	-0.354	0.6
1869	1054861.561	912215.069	792.456	792.100	-0.356	1.3
1867	1054879.321	912110.286	793.048	792.690	-0.358	1.2
1882	1054600.206	913768.842	778.422	778.050	-0.372	1.0
1885	1054713.690	913054.050	790.190	789.810	-0.380	0.9
1877	1054610.991	913754.225	778.441	778.060	-0.381	2.4
1864	1054906.219	911950.158	794.474	794.080	-0.394	1.1
1878	1054607.241	913783.028	778.110	777.690	-0.420	2.5
1876	1054616.230	913719.987	778.810	778.380	-0.430	3.1
1884	1054704.242	913111.237	789.631	789.200	-0.431	1.2
1874	1054660.331	913450.304	784.730	784.290	-0.440	1.1
1872	1054678.463	913343.038	786.269	785.810	-0.459	1.3
1871	1054687.993	913285.486	786.992	786.530	-0.462	1.4
1863	1054925.382	911842.161	795.313	794.850	-0.463	1.1
1873	1054669.064	913398.254	785.585	785.120	-0.465	1.1
1875	1054652.152	913500.356	783.679	783.170	-0.509	1.2
1870	1054707.118	913168.415	788.710	788.200	-0.510	1.2
1786	1055097.470	904320.939	894.050	893.440	-0.610	1.0
1925	1055083.737	904155.472	899.593	898.890	-0.703	0.9

Average dz +0.002
 Minimum dz -0.703
 Maximum dz +0.504
 Average magnitude 0.170
 Root mean square 0.214
 Std deviation 0.214

Table 8: East Branch Cazenovia Drive Profile Results

Number	Easting	Northing	Known Z	Laser Z	Dz	Intensity
2636	1164317.083	958264.769	1219.901	1220.150	+0.249	1.1
2611	1162127.679	960089.400	1122.930	1123.170	+0.240	1.1
2638	1164553.915	957963.913	1230.875	1231.110	+0.235	1.3
2609	1161933.144	960238.886	1117.026	1117.250	+0.224	0.9
2639	1164593.495	957911.253	1232.792	1233.010	+0.218	1.1
2637	1164514.152	958016.335	1229.065	1229.280	+0.215	1.4
2630	1163773.004	958820.714	1192.896	1193.110	+0.214	1.1
2633	1164101.301	958506.638	1208.715	1208.910	+0.195	1.1
2625	1163478.238	959068.334	1179.728	1179.920	+0.192	1.3
2634	1164191.901	958410.829	1213.369	1213.560	+0.191	1.0
2635	1164234.768	958362.056	1215.571	1215.750	+0.179	1.4
2640	1164632.139	957859.835	1234.537	1234.710	+0.173	1.3
2632	1163961.365	958643.448	1201.942	1202.110	+0.168	1.0
2647	1165273.858	956995.199	1261.793	1261.960	+0.167	1.2

2624	1163039.820	959402.476	1160.995	1161.160	+0.165	1.2
2613	1162268.003	959983.906	1129.155	1129.320	+0.165	1.0
2641	1164709.625	957756.992	1238.045	1238.210	+0.165	1.3
2619	1162677.081	959674.565	1145.906	1146.070	+0.164	1.0
2621	1162764.211	959607.900	1149.408	1149.570	+0.162	1.0
2612	1162174.709	960053.973	1124.802	1124.960	+0.158	1.1
2623	1162946.045	959472.602	1156.974	1157.130	+0.156	1.1
2622	1162853.650	959540.441	1153.155	1153.310	+0.155	1.3
2620	1162720.477	959641.447	1147.646	1147.800	+0.154	1.1
2617	1162590.448	959740.142	1142.257	1142.410	+0.153	1.5
2646	1165102.430	957227.822	1255.580	1255.730	+0.150	1.5
2614	1162314.337	959948.686	1131.150	1131.300	+0.150	1.3
2610	1162031.836	960162.806	1120.002	1120.150	+0.148	1.3
2616	1162546.117	959773.951	1140.466	1140.610	+0.144	1.0
2645	1165069.923	957272.035	1254.177	1254.320	+0.143	1.3
2629	1163724.760	958863.887	1190.870	1191.010	+0.140	1.3
2631	1163914.487	958687.667	1199.843	1199.980	+0.137	1.2
2642	1164861.853	957552.155	1244.794	1244.920	+0.126	1.4
2628	1163676.042	958906.016	1188.636	1188.760	+0.124	0.9
2649	1165350.517	956893.068	1263.220	1263.340	+0.120	1.2
2615	1162500.340	959808.687	1138.563	1138.680	+0.117	1.0
2653	1165796.172	956295.908	1267.459	1267.570	+0.111	1.5
2643	1164966.801	957410.761	1249.481	1249.590	+0.109	1.3
2627	1163627.013	958947.336	1186.469	1186.570	+0.101	1.3
2648	1165311.657	956944.764	1262.783	1262.880	+0.097	1.6
2644	1165036.271	957317.411	1252.713	1252.810	+0.097	1.6
2618	1162633.850	959707.339	1144.111	1144.200	+0.089	1.3
2651	1165551.510	956625.252	1265.744	1265.830	+0.086	1.6
2654	1165838.028	956239.609	1267.580	1267.660	+0.080	1.5
2652	1165713.875	956406.968	1267.027	1267.090	+0.063	1.2
2568	1158133.769	963245.081	1066.298	1066.360	+0.062	1.1
2588	1159955.892	961851.264	1103.502	1103.560	+0.058	1.2
2524	1149662.855	987543.210	934.983	935.040	+0.057	2.2
2516	1149636.785	987545.722	934.602	934.650	+0.048	2.2
2517	1149637.389	987545.782	934.613	934.660	+0.047	2.1
2518	1149638.223	987545.860	934.646	934.680	+0.034	2.1
2626	1163577.868	958988.077	1184.262	1184.290	+0.028	1.0
2520	1149655.249	987544.974	934.837	934.860	+0.023	2.8
2523	1149661.989	987543.487	935.006	935.020	+0.014	2.1
2650	1165430.210	956786.909	1264.848	1264.860	+0.012	1.1
2587	1159646.556	962106.619	1106.208	1106.220	+0.012	1.9
2558	1156426.351	967869.013	1046.961	1046.960	-0.001	1.3
2567	1158096.540	963272.734	1065.710	1065.700	-0.010	1.3
2522	1149657.485	987544.524	934.917	934.900	-0.017	2.0
2589	1160040.907	961786.357	1100.362	1100.320	-0.042	1.4
2566	1158031.588	963336.512	1065.721	1065.670	-0.051	1.3
2521	1149656.705	987544.725	934.943	934.890	-0.053	2.2
2584	1159368.210	962335.724	1099.854	1099.800	-0.054	2.0
2576	1158523.496	963031.118	1087.912	1087.850	-0.062	1.4
2519	1149651.789	987545.592	934.893	934.830	-0.063	2.4
2559	1156443.458	967817.471	1047.209	1047.140	-0.069	1.6

2608	1161473.373	960604.550	1117.326	1117.250	-0.076	1.9
2577	1158550.936	963012.200	1089.101	1089.020	-0.081	1.5
2528	1152568.961	978844.561	961.558	961.470	-0.088	2.1
2606	1161377.485	960679.969	1118.641	1118.550	-0.091	2.1
2565	1158004.604	963371.131	1065.933	1065.840	-0.093	1.4
2509	1146709.144	991042.302	912.807	912.710	-0.097	1.1
2512	1146841.624	990839.218	911.172	911.070	-0.102	1.0
2596	1160581.880	961352.356	1100.930	1100.820	-0.110	1.1
2590	1160131.379	961717.161	1097.301	1097.190	-0.111	1.8
2562	1156898.678	966427.320	1060.851	1060.740	-0.111	1.0
2597	1160670.559	961278.520	1102.903	1102.780	-0.123	0.9
2563	1156914.630	966377.902	1061.274	1061.150	-0.124	1.8
2561	1156882.944	966476.812	1060.449	1060.320	-0.129	1.4
2595	1160537.950	961389.502	1099.931	1099.800	-0.131	1.2
2585	1159408.084	962302.745	1101.135	1101.000	-0.135	1.5
2529	1152575.306	978836.519	961.966	961.830	-0.136	1.8
2594	1160494.412	961426.589	1098.957	1098.820	-0.137	1.2
2513	1147028.403	990581.181	909.679	909.540	-0.139	1.2
2581	1159074.649	962580.886	1093.520	1093.380	-0.140	1.4
2599	1160755.177	961206.028	1105.450	1105.310	-0.140	1.4
2564	1156931.124	966329.379	1061.761	1061.620	-0.141	1.7
2507	1146583.365	991250.109	914.126	913.980	-0.146	1.4
2511	1146796.539	990906.211	911.957	911.810	-0.147	1.1
2598	1160713.601	961241.750	1104.212	1104.060	-0.152	1.2
2586	1159586.757	962155.687	1105.384	1105.230	-0.154	1.3
2510	1146752.444	990973.973	912.347	912.190	-0.157	0.9
2607	1161424.700	960642.530	1118.170	1118.010	-0.160	1.1
2604	1161148.749	960866.723	1118.071	1117.910	-0.161	1.4
2578	1158686.258	962905.216	1090.815	1090.650	-0.165	2.3
2605	1161237.322	960793.901	1118.945	1118.780	-0.165	1.3
2575	1158395.714	963103.209	1078.460	1078.290	-0.170	1.7
2514	1147123.106	990456.719	908.632	908.460	-0.172	1.2
2593	1160270.089	961608.513	1095.584	1095.410	-0.174	1.3
2582	1159125.096	962538.636	1093.975	1093.800	-0.175	1.8
2506	1146543.165	991320.734	914.536	914.360	-0.176	1.4
2583	1159193.144	962481.764	1094.979	1094.800	-0.179	1.0
2530	1152644.629	978701.233	965.147	964.960	-0.187	1.2
2591	1160176.845	961681.559	1096.360	1096.170	-0.190	1.5
2555	1153561.982	976789.839	979.520	979.330	-0.190	1.5
2603	1161028.953	960971.544	1115.572	1115.380	-0.192	1.9
2515	1147169.917	990395.250	908.337	908.140	-0.197	1.0
2537	1152844.898	978199.421	969.640	969.440	-0.200	1.2
2592	1160223.224	961645.318	1095.697	1095.490	-0.207	1.5
2531	1152693.452	978583.095	966.569	966.360	-0.209	1.2
2548	1153232.945	977418.325	975.269	975.060	-0.209	1.4
2579	1158828.952	962786.637	1091.729	1091.520	-0.209	1.7
2573	1158324.107	963139.778	1073.770	1073.560	-0.210	1.4
2508	1146666.729	991111.324	913.301	913.090	-0.211	1.3
2533	1152727.386	978492.356	967.241	967.030	-0.211	1.4
2527	1152562.715	978863.961	961.562	961.350	-0.212	2.4
2602	1160955.259	961035.897	1113.202	1112.980	-0.222	2.0

2502	1146391.071	991608.171	914.824	914.600	-0.224	1.4
2532	1152710.286	978538.501	966.956	966.730	-0.226	1.1
2574	1158360.235	963121.196	1076.040	1075.810	-0.230	1.2
2600	1160878.113	961100.630	1110.083	1109.850	-0.233	1.3
2556	1153583.685	976737.354	979.784	979.550	-0.234	1.1
2539	1152889.148	978100.860	970.264	970.030	-0.234	1.2
2601	1160917.436	961067.491	1111.755	1111.520	-0.235	1.5
2526	1152524.481	978958.586	960.627	960.390	-0.237	1.4
2534	1152745.303	978444.943	967.479	967.240	-0.239	1.5
2500	1146316.514	991751.921	915.204	914.960	-0.244	1.6
2538	1152866.968	978149.728	969.949	969.700	-0.249	1.3
2560	1156755.420	966873.510	1056.579	1056.330	-0.249	1.6
2580	1158938.966	962695.661	1092.390	1092.140	-0.250	1.0
2536	1152802.993	978298.255	968.744	968.490	-0.254	1.5
2504	1146465.177	991463.567	914.616	914.360	-0.256	1.6
2499	1146278.840	991823.636	915.264	915.000	-0.264	0.9
2503	1146427.943	991535.709	914.664	914.400	-0.264	1.4
2541	1152933.443	978005.753	971.004	970.740	-0.264	1.2
2540	1152911.280	978052.980	970.669	970.400	-0.269	1.3
2542	1153022.234	977820.948	972.549	972.280	-0.269	1.3
2525	1152507.287	978996.474	960.255	959.980	-0.275	1.5
2554	1153514.302	976892.916	978.731	978.450	-0.281	1.2
2547	1153209.107	977463.584	974.954	974.670	-0.284	1.3
2544	1153067.943	977731.495	973.064	972.780	-0.284	1.2
2551	1153331.477	977233.133	976.623	976.330	-0.293	1.3
2543	1153044.875	977776.182	972.845	972.550	-0.295	1.1
2505	1146503.683	991391.897	914.600	914.300	-0.300	1.8
2545	1153115.104	977642.955	973.966	973.660	-0.306	1.2
2546	1153185.731	977508.594	974.712	974.390	-0.322	1.2
2550	1153282.735	977325.824	976.015	975.690	-0.325	1.3
2498	1146241.309	991895.343	915.296	914.970	-0.326	1.0
2535	1152783.276	978347.507	968.502	968.170	-0.332	1.2
2552	1153435.013	977044.245	977.959	977.610	-0.349	1.5
2549	1153257.490	977372.591	975.583	975.230	-0.353	1.3
2553	1153461.702	976994.488	978.164	977.810	-0.354	1.4
2501	1146354.020	991680.299	914.978	914.620	-0.358	1.0

Average dz -0.073
 Minimum dz -0.358
 Maximum dz +0.249
 Average magnitude 0.168
 Root mean square 0.187
 Std deviation 0.172

Table 9: Tonawanda Corridor Drive Profile Results

Number	Easting	Northing	Known Z	Laser Z	Dz	Intensity
2928	1069378.549	1100804.852	578.907	579.190	+0.283	0.6

2927	1069378.553	1100804.857	578.912	579.190	+0.278	0.6
2926	1069378.564	1100804.857	578.928	579.190	+0.262	0.6
2925	1069378.569	1100804.859	578.930	579.190	+0.260	0.6
2922	1069378.579	1100804.867	578.934	579.190	+0.256	0.6
2923	1069378.572	1100804.863	578.934	579.190	+0.256	0.6
2929	1069378.556	1100804.858	578.935	579.190	+0.255	0.6
2924	1069378.571	1100804.859	578.938	579.190	+0.252	0.6
2921	1069378.571	1100804.862	578.948	579.190	+0.242	0.6
2919	1069378.582	1100804.868	578.953	579.190	+0.237	0.6
2920	1069378.574	1100804.874	578.965	579.190	+0.225	0.6
2917	1069378.577	1100804.862	578.969	579.190	+0.221	0.6
2918	1069378.575	1100804.861	578.996	579.190	+0.194	0.6
2931	1069574.629	1100785.769	579.418	579.610	+0.192	0.8
2930	1069459.865	1100802.056	579.539	579.670	+0.131	0.9
3039	1068544.826	1094290.234	597.347	597.430	+0.083	1.2
2970	1073736.123	1096032.148	573.310	573.380	+0.070	1.0
2968	1073874.972	1095844.892	574.133	574.200	+0.067	1.3
2838	1065883.773	1099186.206	570.281	570.340	+0.059	1.5
2845	1066000.994	1099295.520	570.003	570.060	+0.057	1.1
2932	1070018.413	1100587.305	573.519	573.570	+0.051	0.9
2844	1065982.562	1099280.087	569.997	570.040	+0.043	1.4
2835	1065878.981	1099180.738	570.329	570.370	+0.041	1.9
2833	1065878.987	1099180.746	570.330	570.370	+0.040	1.9
2832	1065878.987	1099180.728	570.331	570.370	+0.039	1.9
2830	1065878.997	1099180.728	570.332	570.370	+0.038	1.9
2834	1065878.986	1099180.737	570.332	570.370	+0.038	1.9
2997	1073059.928	1096875.580	570.432	570.470	+0.038	1.2
2792	1065854.367	1099155.284	570.473	570.510	+0.037	1.4
2843	1065949.226	1099252.188	570.033	570.070	+0.037	1.3
2816	1065878.987	1099180.720	570.334	570.370	+0.036	1.9
2827	1065878.992	1099180.724	570.334	570.370	+0.036	1.9
3030	1070877.805	1096929.020	573.204	573.240	+0.036	0.8
2794	1065854.363	1099155.288	570.474	570.510	+0.036	1.4
2820	1065878.993	1099180.723	570.335	570.370	+0.035	1.9
2837	1065879.125	1099180.894	570.336	570.370	+0.034	1.9
3010	1074515.980	1094970.027	575.647	575.680	+0.033	1.3
3011	1074611.014	1094847.373	575.117	575.150	+0.033	1.3
3051	1065930.864	1099240.823	570.047	570.080	+0.033	1.5
2824	1065878.994	1099180.723	570.338	570.370	+0.032	1.9
3050	1065967.819	1099270.184	570.078	570.110	+0.032	1.5
2791	1065854.358	1099155.285	570.479	570.510	+0.031	1.4
2799	1065854.368	1099155.283	570.479	570.510	+0.031	1.4
2821	1065878.993	1099180.728	570.339	570.370	+0.031	1.9
2793	1065854.364	1099155.284	570.480	570.510	+0.030	1.4
2818	1065878.994	1099180.729	570.340	570.370	+0.030	1.9
2831	1065878.985	1099180.725	570.340	570.370	+0.030	1.9
2839	1065889.930	1099193.226	570.261	570.290	+0.029	1.2
2829	1065878.984	1099180.724	570.342	570.370	+0.028	1.9
2812	1065855.496	1099156.183	570.483	570.510	+0.027	1.5
2842	1065935.054	1099239.669	570.083	570.110	+0.027	1.3
2966	1074106.868	1095481.148	574.763	574.790	+0.027	1.3

2800	1065854.364	1099155.279	570.484	570.510	+0.026	1.4
2823	1065878.988	1099180.709	570.344	570.370	+0.026	1.9
2796	1065854.363	1099155.285	570.485	570.510	+0.025	1.4
2797	1065854.361	1099155.280	570.485	570.510	+0.025	1.4
2822	1065878.990	1099180.720	570.345	570.370	+0.025	1.9
2994	1073059.921	1096875.579	570.445	570.470	+0.025	1.2
2996	1073059.931	1096875.574	570.445	570.470	+0.025	1.2
2993	1073059.923	1096875.573	570.446	570.470	+0.024	1.2
2803	1065854.366	1099155.276	570.487	570.510	+0.023	1.4
2825	1065878.990	1099180.722	570.347	570.370	+0.023	1.9
2836	1065878.989	1099180.737	570.347	570.370	+0.023	1.9
2991	1073059.917	1096875.578	570.447	570.470	+0.023	1.2
3042	1065250.376	1098886.187	569.827	569.850	+0.023	1.6
2989	1073059.926	1096875.580	570.448	570.470	+0.022	1.2
2817	1065878.990	1099180.727	570.349	570.370	+0.021	1.9
2790	1065854.360	1099155.284	570.490	570.510	+0.020	1.4
2798	1065854.369	1099155.278	570.490	570.510	+0.020	1.4
2828	1065878.993	1099180.731	570.350	570.370	+0.020	1.9
2988	1073057.904	1096873.094	570.380	570.400	+0.020	1.4
2795	1065854.366	1099155.278	570.491	570.510	+0.019	1.4
2967	1073902.970	1095808.512	574.191	574.210	+0.019	1.3
2819	1065879.005	1099180.723	570.352	570.370	+0.018	1.9
2826	1065878.990	1099180.711	570.352	570.370	+0.018	1.9
2841	1065921.476	1099226.900	570.102	570.120	+0.018	1.6
2992	1073059.924	1096875.575	570.452	570.470	+0.018	1.2
2995	1073059.928	1096875.574	570.452	570.470	+0.018	1.2
3000	1073059.920	1096875.575	570.452	570.470	+0.018	1.2
2990	1073059.917	1096875.579	570.453	570.470	+0.017	1.2
2801	1065854.362	1099155.284	570.494	570.510	+0.016	1.4
2811	1065854.487	1099155.374	570.494	570.510	+0.016	1.4
3045	1065194.916	1098878.272	569.644	569.660	+0.016	1.6
2971	1073508.106	1096341.494	572.117	572.130	+0.013	1.2
2815	1065878.995	1099180.731	570.358	570.370	+0.012	1.9
3043	1065226.843	1098891.831	569.698	569.710	+0.012	1.4
2802	1065854.368	1099155.278	570.498	570.510	+0.012	1.4
2806	1065854.368	1099155.278	570.498	570.510	+0.012	1.4
2805	1065854.374	1099155.286	570.499	570.510	+0.011	1.4
2814	1065878.948	1099180.682	570.359	570.370	+0.011	1.9
2810	1065854.368	1099155.285	570.500	570.510	+0.010	1.4
3040	1065246.685	1098850.334	570.061	570.070	+0.009	1.2
2999	1073059.928	1096875.570	570.463	570.470	+0.007	1.2
2840	1065909.006	1099214.315	570.153	570.160	+0.007	1.1
2949	1070531.646	1095491.975	585.163	585.170	+0.007	1.6
2789	1065854.359	1099155.276	570.504	570.510	+0.006	1.4
2813	1065878.101	1099179.724	570.364	570.370	+0.006	1.7
2846	1066019.934	1099311.679	570.004	570.010	+0.006	1.6
3001	1073059.915	1096875.567	570.464	570.470	+0.006	1.2
2804	1065854.369	1099155.277	570.505	570.510	+0.005	1.4
2786	1065854.358	1099155.279	570.506	570.510	+0.004	1.4
2808	1065854.371	1099155.282	570.506	570.510	+0.004	1.4
2998	1073059.923	1096875.576	570.467	570.470	+0.003	1.2

2781	1065854.373	1099155.282	570.510	570.510	+0.000	1.4
2788	1065854.355	1099155.282	570.510	570.510	+0.000	1.4
2809	1065854.370	1099155.278	570.510	570.510	+0.000	1.4
2779	1065854.365	1099155.271	570.511	570.510	-0.001	1.4
3003	1073059.928	1096875.561	570.471	570.470	-0.001	1.2
3038	1068557.154	1094274.367	597.831	597.830	-0.001	0.9
2785	1065854.366	1099155.277	570.512	570.510	-0.002	1.4
2780	1065854.373	1099155.276	570.514	570.510	-0.004	1.4
2787	1065854.359	1099155.282	570.514	570.510	-0.004	1.4
2807	1065854.368	1099155.281	570.515	570.510	-0.005	1.4
3005	1073059.927	1096875.562	570.478	570.470	-0.008	1.2
2965	1074076.911	1095453.243	573.990	573.980	-0.010	1.2
3044	1065212.084	1098886.260	569.711	569.700	-0.011	1.4
3002	1073059.924	1096875.562	570.483	570.470	-0.013	1.2
3004	1073059.931	1096875.553	570.483	570.470	-0.013	1.2
2782	1065854.373	1099155.283	570.524	570.510	-0.014	1.4
3006	1073059.923	1096875.560	570.485	570.470	-0.015	1.2
2783	1065854.368	1099155.281	570.526	570.510	-0.016	1.4
3026	1070912.761	1096942.812	572.556	572.540	-0.016	1.1
2784	1065854.362	1099155.278	570.530	570.510	-0.020	1.4
2972	1073451.512	1096417.881	571.880	571.860	-0.020	1.2
3008	1073059.920	1096875.544	570.491	570.470	-0.021	1.2
2936	1070187.345	1100443.384	573.513	573.490	-0.023	0.9
2987	1073045.087	1096868.428	570.334	570.310	-0.024	1.5
3041	1065255.960	1098875.340	569.936	569.910	-0.026	1.6
3009	1073059.919	1096875.540	570.502	570.470	-0.032	1.2
2847	1066038.994	1099328.193	570.054	570.020	-0.034	1.4
2776	1065854.362	1099155.301	570.545	570.510	-0.035	1.4
3029	1070901.485	1096942.142	572.655	572.620	-0.035	0.8
2851	1066120.775	1099388.711	569.736	569.700	-0.036	1.1
2848	1066058.627	1099344.332	569.946	569.910	-0.036	1.2
2760	1065854.292	1099155.265	570.548	570.510	-0.038	1.4
2778	1065854.358	1099155.284	570.548	570.510	-0.038	1.4
3007	1073059.921	1096875.546	570.512	570.470	-0.042	1.2
3028	1070907.901	1096942.840	572.624	572.580	-0.044	1.0
3016	1073117.924	1096871.788	571.115	571.070	-0.045	1.1
3022	1070924.600	1096942.473	572.565	572.520	-0.045	1.0
2775	1065854.348	1099155.283	570.556	570.510	-0.046	1.4
3020	1070925.305	1096942.438	572.566	572.520	-0.046	1.0
2777	1065854.360	1099155.280	570.559	570.510	-0.049	1.4
2774	1065854.357	1099155.303	570.560	570.510	-0.050	1.4
2986	1072753.422	1097378.531	573.601	573.550	-0.051	1.3
2761	1065854.295	1099155.264	570.561	570.510	-0.051	1.4
2985	1072812.900	1097425.165	572.982	572.930	-0.052	1.8
2762	1065854.285	1099155.258	570.563	570.510	-0.053	1.4
3025	1070912.758	1096942.807	572.593	572.540	-0.053	1.1
2763	1065854.288	1099155.259	570.565	570.510	-0.055	1.4
2974	1073364.536	1096533.520	571.447	571.390	-0.057	1.4
3012	1073255.053	1096685.598	571.037	570.980	-0.057	1.2
3027	1070912.274	1096942.807	572.598	572.540	-0.058	1.1
2768	1065854.337	1099155.293	570.569	570.510	-0.059	1.4

3023	1070916.374	1096942.677	572.590	572.530	-0.060	2.3
2953	1073476.136	1095039.414	579.162	579.100	-0.062	1.0
3021	1070925.299	1096942.445	572.582	572.520	-0.062	1.0
2764	1065854.350	1099155.247	570.573	570.510	-0.063	1.4
3036	1068562.413	1094242.835	597.935	597.870	-0.065	1.3
2975	1073338.486	1096569.365	571.416	571.350	-0.066	1.0
3075	1065869.127	1099160.509	570.627	570.560	-0.067	1.2
3097	1065869.100	1099160.483	570.628	570.560	-0.068	1.3
2765	1065854.358	1099155.267	570.580	570.510	-0.070	1.4
2973	1073422.459	1096456.388	571.771	571.700	-0.071	1.1
2766	1065854.330	1099155.284	570.582	570.510	-0.072	1.4
2969	1073763.599	1095993.849	573.635	573.560	-0.075	1.0
2773	1065854.342	1099155.304	570.585	570.510	-0.075	1.4
2767	1065854.326	1099155.283	570.586	570.510	-0.076	1.4
2771	1065854.333	1099155.291	570.586	570.510	-0.076	1.4
2952	1073445.165	1095026.335	578.617	578.540	-0.077	1.1
3024	1070913.028	1096942.771	572.617	572.540	-0.077	1.1
3035	1068562.306	1094242.059	597.948	597.870	-0.078	1.4
2770	1065854.337	1099155.288	570.589	570.510	-0.079	1.4
3083	1065869.129	1099160.523	570.641	570.560	-0.081	1.2
2769	1065854.328	1099155.278	570.592	570.510	-0.082	1.4
2959	1073787.114	1095246.652	576.152	576.070	-0.082	1.1
3057	1065869.129	1099160.521	570.642	570.560	-0.082	1.2
3072	1065869.135	1099160.513	570.642	570.560	-0.082	1.2
3080	1065869.125	1099160.504	570.642	570.560	-0.082	1.3
3074	1065869.129	1099160.500	570.643	570.560	-0.083	1.3
3093	1065869.120	1099160.485	570.645	570.560	-0.085	1.3
2984	1072813.089	1097425.238	573.017	572.930	-0.087	1.8
3056	1065869.143	1099160.508	570.647	570.560	-0.087	1.2
3092	1065869.117	1099160.465	570.647	570.560	-0.087	1.3
3098	1065869.117	1099160.483	570.647	570.560	-0.087	1.3
2850	1066100.115	1099374.392	569.858	569.770	-0.088	1.2
3099	1065869.115	1099160.478	570.648	570.560	-0.088	1.3
2983	1072813.084	1097425.242	573.019	572.930	-0.089	1.8
3070	1065869.125	1099160.504	570.649	570.560	-0.089	1.3
3084	1065869.131	1099160.514	570.649	570.560	-0.089	1.2
3058	1065869.132	1099160.532	570.651	570.560	-0.091	1.2
3096	1065869.111	1099160.480	570.651	570.560	-0.091	1.3
2772	1065854.345	1099155.287	570.601	570.510	-0.091	1.4
3019	1070926.464	1096942.418	572.621	572.530	-0.091	1.2
3013	1073235.515	1096711.981	571.052	570.960	-0.092	0.9
3031	1070864.718	1096912.530	573.482	573.390	-0.092	1.0
3034	1068562.309	1094242.061	597.962	597.870	-0.092	1.4
3047	1065115.328	1098753.330	573.252	573.160	-0.092	0.9
3054	1065869.141	1099160.496	570.652	570.560	-0.092	1.3
3073	1065869.138	1099160.502	570.652	570.560	-0.092	1.3
3082	1065869.126	1099160.503	570.652	570.560	-0.092	1.3
2976	1073290.787	1096632.973	571.294	571.200	-0.094	1.2
2982	1072813.083	1097425.238	573.024	572.930	-0.094	1.8
3079	1065869.130	1099160.506	570.654	570.560	-0.094	1.2
3094	1065869.118	1099160.469	570.654	570.560	-0.094	1.3

3053	1065869.140	1099160.486	570.655	570.560	-0.095	1.3
3018	1072974.312	1097064.078	572.235	572.140	-0.095	1.0
3049	1065115.305	1098753.329	573.255	573.160	-0.095	0.9
2954	1073506.864	1095053.581	579.786	579.690	-0.096	1.0
3077	1065869.129	1099160.512	570.656	570.560	-0.096	1.2
3014	1073216.238	1096737.916	570.996	570.900	-0.096	1.3
2978	1072813.092	1097425.240	573.027	572.930	-0.097	1.8
3071	1065869.140	1099160.501	570.659	570.560	-0.099	1.3
3076	1065869.132	1099160.500	570.659	570.560	-0.099	1.3
3081	1065869.137	1099160.510	570.659	570.560	-0.099	1.2
3078	1065869.125	1099160.508	570.662	570.560	-0.102	1.2
3085	1065869.123	1099160.485	570.662	570.560	-0.102	1.3
3095	1065869.119	1099160.477	570.663	570.560	-0.103	1.3
3048	1065115.303	1098753.322	573.264	573.160	-0.104	0.9
3052	1065869.138	1099160.552	570.665	570.560	-0.105	1.2
3069	1065869.127	1099160.505	570.665	570.560	-0.105	1.3
2961	1073997.596	1095396.644	574.245	574.140	-0.105	1.1
3032	1068562.308	1094242.057	597.976	597.870	-0.106	1.4
3055	1065869.142	1099160.487	570.668	570.560	-0.108	1.3
3066	1065869.129	1099160.517	570.668	570.560	-0.108	1.2
3046	1065109.808	1098770.239	571.778	571.670	-0.108	1.1
3063	1065869.134	1099160.498	570.669	570.560	-0.109	1.3
3087	1065869.132	1099160.495	570.670	570.560	-0.110	1.3
3033	1068562.307	1094242.057	597.980	597.870	-0.110	1.4
2979	1072813.088	1097425.228	573.041	572.930	-0.111	1.8
3059	1065869.136	1099160.519	570.672	570.560	-0.112	1.2
3067	1065869.135	1099160.503	570.672	570.560	-0.112	1.3
2947	1070458.466	1099697.129	574.167	574.050	-0.117	1.0
2981	1072813.083	1097425.232	573.047	572.930	-0.117	1.8
3091	1065869.130	1099160.486	570.677	570.560	-0.117	1.3
3065	1065869.135	1099160.507	570.678	570.560	-0.118	1.2
3068	1065869.135	1099160.508	570.682	570.560	-0.122	1.2
3086	1065869.137	1099160.492	570.683	570.560	-0.123	1.3
3060	1065869.135	1099160.510	570.684	570.560	-0.124	1.2
3062	1065869.140	1099160.503	570.685	570.560	-0.125	1.3
2942	1070458.477	1099697.128	574.176	574.050	-0.126	1.0
3090	1065869.139	1099160.490	570.686	570.560	-0.126	1.3
3088	1065869.138	1099160.484	570.687	570.560	-0.127	1.3
2977	1072813.644	1097425.502	573.059	572.930	-0.129	2.0
3061	1065869.143	1099160.504	570.689	570.560	-0.129	1.3
2962	1074023.678	1095415.030	574.190	574.060	-0.130	1.1
2944	1070458.470	1099697.127	574.181	574.050	-0.131	1.0
2948	1070458.468	1099697.136	574.184	574.050	-0.134	1.0
3017	1073095.905	1096901.299	571.364	571.230	-0.134	1.0
2945	1070458.474	1099697.136	574.186	574.050	-0.136	1.0
2946	1070458.473	1099697.133	574.186	574.050	-0.136	1.0
2964	1074060.859	1095441.560	574.016	573.880	-0.136	1.1
3064	1065869.139	1099160.504	570.697	570.560	-0.137	1.3
2943	1070458.470	1099697.134	574.190	574.050	-0.140	1.0
3089	1065869.144	1099160.488	570.700	570.560	-0.140	1.3
2980	1072813.070	1097425.215	573.072	572.930	-0.142	1.8

2940	1070458.465	1099697.120	574.193	574.050	-0.143	1.0
2941	1070458.474	1099697.130	574.194	574.050	-0.144	1.0
2849	1066079.051	1099359.752	570.027	569.880	-0.147	1.4
2963	1074044.906	1095430.131	574.093	573.940	-0.153	1.1
2960	1073863.129	1095302.131	575.584	575.430	-0.154	1.2
2957	1073712.032	1095190.227	576.589	576.420	-0.169	1.2
2956	1073675.668	1095162.954	576.853	576.680	-0.173	1.1
3015	1073197.307	1096763.447	570.953	570.780	-0.173	1.0
2955	1073639.943	1095136.868	577.269	577.090	-0.179	1.3
2950	1072206.931	1095017.535	584.951	584.750	-0.201	1.5
2951	1072281.320	1095015.793	583.957	583.740	-0.217	1.4
2860	1066286.212	1099421.792	575.027	574.760	-0.267	1.8
2958	1073749.255	1095218.106	576.461	576.180	-0.281	1.3

Average dz -0.030
 Minimum dz -0.281
 Maximum dz +0.283
 Average magnitude 0.073
 Root mean square 0.096
 Std deviation 0.092

Table 10: Cazenovia Corridor Checkpoint Results

Number	Easting	Northing	Known Z	Laser Z	Dz	Intensity
147	1091206.787	1035520.596	589.990	removed	*	*
5	1083388.768	1042367.446	580.400	581.160	+0.760	1.1
46	1085388.557	1041254.363	585.953	586.580	+0.627	2.6
20	1083767.715	1041995.307	583.434	584.060	+0.626	2.6
138	1090628.113	1035882.684	592.808	593.420	+0.611	3.5
145	1091135.122	1035503.037	585.988	586.390	+0.402	1.7
67	1087167.968	1039188.793	588.378	588.750	+0.372	1.3
133	1089895.888	1035963.682	592.381	592.670	+0.288	3.5
113	1088955.278	1036681.626	591.972	592.240	+0.268	4.0
126	1089806.212	1035984.130	601.221	601.470	+0.249	1.4
139	1090639.594	1035904.245	589.099	589.340	+0.241	2.6
57	1086503.338	1040082.728	574.964	575.190	+0.226	2.1
118	1088754.552	1036560.294	594.710	594.930	+0.221	5.5
91	1088409.310	1036909.108	590.429	590.640	+0.211	1.7
24	1084087.629	1041851.842	587.839	588.050	+0.211	2.0
84	1087807.060	1038152.970	587.392	587.590	+0.198	0.4
129	1089889.116	1036125.145	583.545	583.740	+0.195	1.8
111	1088516.701	1036765.770	596.003	596.180	+0.177	2.2
136	1090613.364	1035839.993	593.312	593.480	+0.168	3.1
15	1083453.276	1042126.794	587.856	588.020	+0.164	1.6
45	1085387.745	1041258.899	585.868	586.030	+0.162	2.5
47	1085302.649	1041094.251	586.785	586.940	+0.155	1.9
34	1084353.650	1041745.351	585.468	585.610	+0.142	1.3
82	1087771.371	1038144.895	592.931	593.060	+0.129	3.5

14	1083377.313	1042124.980	588.422	588.530	+0.108	0.8
97	1088606.977	1037078.594	599.049	599.110	+0.061	1.2
127	1089812.251	1035908.683	593.213	593.270	+0.057	2.9
134	1089897.265	1035930.998	591.290	591.330	+0.040	4.2
13	1083401.658	1042180.657	588.634	588.670	+0.036	1.0
83	1087784.699	1038149.868	595.901	595.930	+0.029	1.3
105	1088440.438	1036812.261	600.134	600.140	+0.006	1.1
88	1088384.897	1036864.757	592.537	592.540	+0.003	1.9
42	1084484.412	1041963.659	584.351	584.350	-0.001	2.2
49	1085281.750	1041053.884	587.211	587.210	-0.001	5.2
73	1087769.770	1038854.364	597.692	597.690	-0.002	1.1
137	1090616.664	1035849.563	595.787	595.780	-0.007	3.9
56	1085922.821	1040994.894	586.878	586.870	-0.008	1.1
40	1084462.734	1041933.087	584.038	584.020	-0.018	1.3
87	1088372.832	1036832.111	594.795	594.770	-0.025	3.0
63	1087356.028	1039348.248	591.206	591.180	-0.026	0.7
135	1090595.583	1035797.978	593.429	593.390	-0.039	4.7
7	1083427.512	1042440.761	592.547	592.500	-0.047	5.0
106	1088419.588	1036791.618	599.919	599.860	-0.059	1.2
140	1090658.519	1035944.001	586.054	585.990	-0.064	2.4
8	1083518.996	1042447.085	592.525	592.450	-0.075	1.2
78	1087605.915	1038637.043	595.077	595.000	-0.077	1.2
44	1085394.680	1041277.057	586.489	586.410	-0.079	0.9
143	1090959.618	1035449.432	598.749	598.670	-0.079	5.9
77	1087642.877	1038682.108	596.673	596.570	-0.103	1.5
4	1083277.870	1042193.573	588.134	588.030	-0.104	1.5
9	1083496.421	1042395.625	591.476	591.370	-0.106	1.2
119	1088737.455	1036544.524	595.530	595.420	-0.110	6.1
29	1084201.925	1041963.057	589.411	589.300	-0.111	2.0
131	1089895.582	1036025.204	586.845	586.730	-0.115	2.0
28	1084223.553	1042012.036	589.248	589.120	-0.128	3.0
79	1087708.546	1038719.590	576.101	575.970	-0.131	0.9
132	1089895.739	1035973.105	595.879	595.740	-0.139	3.3
128	1089894.332	1036210.556	596.420	596.280	-0.140	5.2
41	1084470.542	1041947.161	584.846	584.700	-0.146	0.9
48	1085297.294	1041081.108	587.240	587.080	-0.160	0.8
26	1084257.476	1042087.330	587.619	587.450	-0.169	0.9
124	1089787.510	1036149.987	601.024	600.850	-0.174	2.3
51	1085718.821	1040804.027	587.920	587.720	-0.200	1.1
50	1085685.770	1040770.774	587.233	587.030	-0.203	1.1
141	1090707.376	1036027.803	585.790	585.580	-0.210	2.3
59	1086627.619	1040192.859	586.903	586.680	-0.223	1.2
32	1084141.920	1041815.892	587.204	586.970	-0.234	1.1
33	1084127.623	1041768.506	586.375	586.110	-0.265	1.3
123	1089779.515	1036219.600	595.235	594.970	-0.265	4.0
81	1087749.684	1038134.161	591.235	590.960	-0.275	4.6
80	1087711.960	1038725.616	574.559	574.130	-0.429	1.0
114	1088911.775	1036638.180	587.105	586.670	-0.435	1.1
85	1087819.959	1038154.437	584.244	583.720	-0.524	1.9
116	1088813.110	1036576.109	583.428	582.540	-0.888	0.8

Average dz +0.008
 Minimum dz -0.888
 Maximum dz +0.760
 Average magnitude 0.188
 Root mean square 0.260
 Std deviation 0.262

Table 11: Scajaquada Corridor Checkpoint Results

Number	Easting	Northing	Known Z	Laser Z	Dz	Intensity
250	1071836.470	1068256.543	586.633	587.460	+0.827	5.1
9	1063825.407	1067498.418	584.819	585.640	+0.821	2.1
126	1066991.601	1070498.384	572.103	572.920	+0.817	1.4
312	1069354.678	1069399.042	574.328	575.110	+0.782	1.6
231	1072213.782	1068032.597	574.529	575.310	+0.781	1.9
278	1070461.123	1069328.013	578.604	579.380	+0.776	2.1
117	1066695.452	1070449.929	586.715	587.420	+0.705	2.1
167	1073766.757	1065801.687	588.436	589.140	+0.704	6.2
146	1074590.640	1065588.983	590.329	590.980	+0.651	1.9
105	1066377.230	1070235.385	593.502	594.140	+0.638	4.2
19	1063712.117	1067395.385	572.692	573.300	+0.608	1.4
107	1066468.972	1070331.550	587.774	588.350	+0.576	3.6
106	1066457.167	1070338.374	590.485	591.060	+0.575	4.2
116	1066697.769	1070434.666	583.778	584.290	+0.512	5.1
108	1066467.253	1070316.807	586.452	586.960	+0.508	4.1
93	1066174.557	1070056.189	592.639	593.110	+0.471	0.4
267	1070356.363	1069111.650	588.182	588.650	+0.468	3.9
110	1066606.502	1070396.895	586.393	586.860	+0.467	1.6
345	1067335.924	1070569.488	577.940	578.380	+0.440	4.1
140	1074903.776	1065528.756	598.350	598.770	+0.420	2.8
260	1070457.145	1069134.453	589.561	589.970	+0.409	3.5
259	1070553.330	1069084.675	590.360	590.760	+0.400	5.3
212	1072723.427	1067245.586	574.563	574.960	+0.397	3.2
323	1068985.522	1069810.019	592.578	592.970	+0.392	2.7
141	1074912.879	1065546.280	602.562	602.950	+0.388	3.1
261	1070428.167	1069101.051	587.403	587.780	+0.377	1.6
307	1069575.805	1069096.813	599.013	599.380	+0.367	1.9
346	1067341.871	1070593.728	585.699	586.050	+0.351	4.5
112	1066614.944	1070311.305	583.913	584.250	+0.337	1.0
101	1066562.455	1069979.517	599.393	599.710	+0.317	1.5
246	1072209.219	1068773.986	588.616	588.930	+0.314	5.6
293	1069627.794	1069261.791	579.457	579.760	+0.303	2.3
13	1063903.781	1067298.332	585.348	585.640	+0.292	3.2
232	1072110.809	1068043.370	585.688	585.970	+0.282	4.1
262	1070394.231	1069051.726	585.698	585.980	+0.282	1.2
258	1070507.067	1069024.109	580.686	580.960	+0.274	6.0
264	1070329.377	1068927.976	585.353	585.620	+0.267	1.0
281	1069844.175	1069416.837	579.279	579.540	+0.260	5.5

100	1066542.724	1070025.603	601.251	601.510	+0.259	2.8
268	1070347.413	1069095.357	584.507	584.760	+0.253	4.6
152	1074374.968	1065462.559	603.848	604.100	+0.252	2.6
87	1065271.214	1068798.619	589.198	589.450	+0.252	1.4
128	1066981.109	1070549.002	591.909	592.150	+0.241	2.2
144	1074571.871	1065647.859	591.979	592.220	+0.241	2.0
80	1065235.824	1068641.287	588.969	589.210	+0.241	2.0
118	1066689.348	1070458.195	587.610	587.850	+0.240	2.1
251	1071210.346	1069204.434	578.371	578.600	+0.229	5.2
111	1066616.452	1070362.282	585.321	585.540	+0.219	0.8
344	1067477.131	1070385.071	585.245	585.460	+0.215	2.4
340	1068193.404	1070517.576	593.383	593.590	+0.207	3.5
257	1070405.964	1068858.372	578.763	578.970	+0.207	2.6
255	1070378.639	1068815.819	581.895	582.100	+0.205	5.7
113	1066608.813	1070296.055	583.496	583.700	+0.204	0.9
162	1074175.962	1065434.683	596.919	597.120	+0.201	4.8
194	1073249.551	1066891.573	585.170	585.370	+0.200	1.6
269	1070336.457	1069076.941	579.725	579.920	+0.195	2.7
270	1070195.500	1068969.476	583.911	584.100	+0.189	4.3
114	1066734.825	1070332.668	582.004	582.180	+0.176	2.3
36	1064348.713	1067473.548	580.105	580.280	+0.175	1.9
109	1066543.951	1070228.771	582.626	582.800	+0.174	2.1
236	1072162.760	1068147.415	579.404	579.570	+0.166	2.7
276	1070420.399	1069143.688	591.679	591.840	+0.161	2.5
263	1070362.644	1068991.267	585.891	586.050	+0.159	0.8
23	1064260.796	1067371.688	583.443	583.590	+0.147	0.7
256	1070396.190	1068840.834	579.915	580.060	+0.145	3.1
24	1064273.786	1067351.666	583.995	584.140	+0.145	0.7
271	1070175.661	1069099.650	586.849	586.990	+0.141	2.4
230	1072198.768	1068001.835	585.970	586.110	+0.140	2.8
197	1073153.820	1066760.054	577.981	578.120	+0.139	4.2
3	1064150.025	1067243.608	585.851	585.990	+0.139	1.2
95	1066258.718	1069963.806	582.063	582.200	+0.137	2.0
97	1066362.633	1070392.403	596.106	596.240	+0.134	4.5
25	1064286.607	1067333.489	584.562	584.690	+0.129	0.8
22	1064209.221	1067442.249	581.839	581.960	+0.121	1.0
26	1064315.587	1067291.133	585.761	585.880	+0.119	0.8
266	1070285.105	1068833.353	585.061	585.180	+0.119	0.9
186	1073979.314	1066543.232	585.594	585.710	+0.116	2.8
237	1072206.969	1068117.654	577.194	577.310	+0.116	3.0
275	1070367.784	1069128.016	590.479	590.590	+0.111	1.9
98	1066410.152	1070295.352	600.419	600.530	+0.111	2.4
94	1066157.922	1070077.743	592.949	593.060	+0.111	1.5
291	1069883.322	1069240.404	583.339	583.450	+0.111	1.3
244	1072477.763	1067853.107	577.140	577.250	+0.110	2.1
5	1064156.367	1067314.062	585.431	585.540	+0.109	1.7
315	1069216.149	1069694.316	585.963	586.070	+0.107	3.4
121	1066812.797	1070430.350	585.484	585.590	+0.106	3.6
119	1066732.785	1070453.882	587.085	587.190	+0.105	4.6
123	1066893.451	1070407.566	583.756	583.860	+0.104	2.3
306	1069565.619	1069121.742	599.587	599.690	+0.103	4.3

245	1072505.154	1067801.068	578.141	578.240	+0.099	1.8
122	1066847.938	1070420.234	584.755	584.850	+0.096	2.5
290	1069854.920	1069258.439	584.475	584.570	+0.095	1.0
85	1065171.125	1068765.975	579.388	579.480	+0.092	4.6
199	1073115.813	1066697.311	584.056	584.140	+0.084	4.7
151	1074372.185	1065477.301	605.088	605.170	+0.082	6.1
7	1064169.258	1067428.649	582.908	582.990	+0.082	0.9
233	1072139.614	1068087.815	579.748	579.830	+0.082	2.8
240	1072338.035	1068020.485	576.929	577.010	+0.081	2.1
120	1066777.462	1070440.684	586.142	586.210	+0.068	2.2
249	1071849.710	1068283.465	586.634	586.700	+0.066	4.4
163	1074178.389	1065451.888	596.869	596.930	+0.061	2.7
8	1064174.040	1067486.116	581.130	581.190	+0.060	0.7
243	1072447.415	1067898.175	577.078	577.130	+0.052	2.2
286	1069644.115	1069381.190	594.439	594.490	+0.051	1.1
170	1073647.815	1065870.458	597.755	597.800	+0.045	2.1
136	1075082.508	1065437.732	619.968	620.010	+0.042	1.1
6	1064159.647	1067343.427	585.309	585.350	+0.041	1.3
35	1064295.757	1067448.882	583.941	583.980	+0.039	2.6
334	1068869.322	1069811.258	588.762	588.800	+0.038	4.1
78	1065193.646	1068636.635	589.050	589.080	+0.030	2.4
242	1072414.896	1067941.811	577.013	577.040	+0.027	2.3
60	1064968.768	1067973.272	580.320	580.340	+0.020	3.0
124	1067007.992	1070413.366	582.325	582.340	+0.015	1.5
284	1069598.605	1069408.451	596.466	596.480	+0.014	1.1
313	1069403.804	1069263.401	581.507	581.520	+0.013	2.5
247	1072180.086	1068741.230	586.799	586.810	+0.011	3.9
303	1069415.644	1069485.040	603.726	603.730	+0.004	2.7
125	1067007.532	1070383.360	582.328	582.330	+0.002	1.1
299	1069598.920	1069127.652	599.092	599.090	-0.002	2.6
234	1072185.153	1068141.383	578.552	578.550	-0.002	3.6
241	1072377.981	1067982.520	576.978	576.970	-0.008	2.0
68	1065301.946	1068184.581	588.610	588.600	-0.010	3.7
156	1074303.870	1065557.609	599.000	598.990	-0.010	2.1
273	1070279.113	1069110.579	589.181	589.170	-0.011	2.0
317	1069269.784	1069729.239	603.082	603.070	-0.012	4.8
208	1073081.613	1067035.819	584.466	584.450	-0.016	5.4
265	1070307.470	1068886.645	585.327	585.310	-0.017	1.2
310	1069349.918	1069442.852	585.957	585.940	-0.017	2.2
304	1069432.940	1069444.153	603.238	603.220	-0.018	2.8
161	1074169.935	1065411.646	598.889	598.870	-0.019	5.3
227	1072601.537	1067698.327	581.870	581.850	-0.020	2.3
225	1072577.422	1067350.117	587.314	587.290	-0.024	2.4
302	1069405.006	1069510.216	604.005	603.980	-0.025	3.4
238	1072252.202	1068088.932	576.950	576.920	-0.030	2.1
165	1074195.533	1065581.947	592.502	592.470	-0.032	3.7
254	1071148.522	1068567.303	580.985	580.950	-0.035	5.3
130	1074984.927	1065323.470	620.106	620.070	-0.036	2.1
132	1075017.313	1065360.403	619.748	619.710	-0.038	2.2
184	1073748.881	1066533.544	584.779	584.740	-0.039	1.9
209	1073062.379	1067013.765	582.342	582.300	-0.042	4.0

285	1069620.363	1069395.292	595.523	595.480	-0.043	1.5
11	1063862.544	1067399.683	587.327	587.280	-0.047	1.8
79	1065203.817	1068637.943	589.158	589.110	-0.048	2.4
129	1066982.366	1070563.086	594.119	594.070	-0.049	3.9
342	1068160.509	1070315.996	585.811	585.760	-0.051	3.2
160	1074279.241	1065455.299	599.551	599.500	-0.051	1.5
91	1065607.688	1069324.714	596.672	596.620	-0.052	2.7
135	1075065.361	1065418.261	619.837	619.780	-0.057	2.3
166	1074204.523	1065627.570	593.378	593.320	-0.058	5.2
239	1072296.152	1068057.449	576.999	576.940	-0.059	2.6
328	1069131.528	1069833.026	599.280	599.220	-0.060	2.5
228	1072396.893	1067560.053	588.793	588.730	-0.063	4.0
205	1073104.414	1066815.112	586.558	586.490	-0.068	1.2
318	1069300.651	1069751.177	604.150	604.080	-0.070	3.2
148	1074363.840	1065631.378	599.241	599.170	-0.071	2.1
280	1070126.344	1069171.106	583.322	583.250	-0.072	1.2
12	1063882.271	1067346.455	587.224	587.150	-0.074	1.7
210	1072925.095	1066904.897	583.931	583.850	-0.081	5.0
90	1065513.229	1069400.285	588.303	588.220	-0.083	1.1
331	1068989.657	1069834.223	593.647	593.560	-0.087	3.8
332	1068934.519	1069827.131	591.654	591.560	-0.094	2.2
216	1072674.294	1067508.945	585.707	585.610	-0.097	5.0
153	1074375.854	1065444.531	603.618	603.520	-0.098	4.1
139	1074860.827	1065473.446	604.032	603.930	-0.102	3.5
213	1072827.081	1067339.482	580.153	580.050	-0.103	4.8
341	1068186.125	1070439.911	576.654	576.550	-0.104	2.4
134	1075050.537	1065401.569	619.845	619.740	-0.105	2.8
327	1069162.180	1069832.741	600.606	600.500	-0.106	3.1
221	1072609.062	1067340.207	587.394	587.280	-0.114	5.0
62	1064825.357	1068021.195	579.126	579.010	-0.116	2.4
155	1074308.374	1065578.610	598.308	598.190	-0.118	2.5
89	1065504.666	1069407.102	588.330	588.210	-0.120	2.7
188	1073758.974	1066631.095	576.102	575.980	-0.122	5.5
159	1074286.511	1065480.869	599.624	599.500	-0.124	2.3
338	1068859.232	1069837.516	589.118	588.990	-0.128	2.1
347	1067331.328	1070636.997	593.362	593.230	-0.132	5.3
335	1069203.714	1069877.366	602.069	601.930	-0.139	3.8
218	1072687.726	1067569.602	586.362	586.220	-0.142	3.5
252	1071150.188	1068613.200	578.906	578.760	-0.146	5.6
211	1072690.892	1067211.769	581.681	581.530	-0.151	5.3
333	1068913.693	1069823.003	590.784	590.630	-0.154	4.4
311	1069356.157	1069412.170	580.639	580.480	-0.159	2.1
309	1069355.565	1069525.405	604.380	604.220	-0.160	1.4
147	1074600.043	1065499.853	617.143	616.980	-0.163	5.8
131	1074999.306	1065341.060	619.673	619.510	-0.163	2.8
226	1072592.312	1067375.301	587.238	587.070	-0.168	3.9
175	1073992.303	1066437.409	583.680	583.510	-0.170	5.6
339	1068203.447	1070577.851	597.101	596.930	-0.171	5.1
158	1074292.170	1065504.378	599.582	599.410	-0.173	2.0
325	1069257.829	1069832.602	603.415	603.240	-0.175	3.9
138	1074815.291	1065417.498	616.702	616.520	-0.182	5.8

143	1074621.494	1065776.079	604.658	604.470	-0.188	1.7
326	1069216.215	1069831.830	602.529	602.340	-0.189	5.3
200	1073167.270	1066925.326	587.079	586.890	-0.189	2.0
115	1066754.539	1070302.278	581.541	581.350	-0.191	1.6
189	1073767.333	1066681.563	588.251	588.060	-0.191	3.8
154	1074313.885	1065603.734	597.556	597.360	-0.196	3.0
217	1072681.833	1067540.069	586.421	586.220	-0.201	4.3
248	1071875.774	1068330.945	584.061	583.860	-0.201	5.1
223	1072575.989	1067288.194	588.912	588.710	-0.202	5.2
172	1073791.689	1066387.004	584.283	584.080	-0.203	2.3
174	1073947.573	1066427.593	581.726	581.520	-0.206	4.4
63	1064817.718	1068029.090	579.236	579.030	-0.206	2.6
177	1073780.940	1066503.906	585.557	585.350	-0.207	1.5
203	1073134.834	1066869.559	586.591	586.380	-0.211	1.6
214	1072605.178	1067191.687	587.266	587.050	-0.216	4.4
84	1065158.991	1068763.711	579.604	579.380	-0.224	2.9
207	1073078.938	1066769.358	586.067	585.840	-0.227	2.0
219	1072692.800	1067600.066	586.257	586.020	-0.237	6.0
176	1073754.043	1066504.706	585.020	584.780	-0.240	1.4
190	1073771.544	1066700.696	588.852	588.610	-0.242	2.9
206	1073090.767	1066792.195	586.154	585.910	-0.244	1.4
180	1073864.859	1066508.474	586.675	586.430	-0.245	2.1
204	1073122.111	1066845.801	586.588	586.340	-0.248	1.9
222	1072593.035	1067313.883	588.489	588.240	-0.249	5.1
183	1073965.231	1066517.538	585.602	585.350	-0.252	1.9
316	1069245.239	1069714.863	598.573	598.320	-0.253	4.6
164	1074179.641	1065462.967	597.123	596.870	-0.253	3.3
92	1066181.947	1070047.251	592.494	592.240	-0.254	5.5
21	1063711.376	1067423.775	574.916	574.660	-0.256	3.3
235	1072390.233	1068427.168	578.396	578.140	-0.256	4.9
181	1073895.049	1066510.304	586.529	586.270	-0.259	1.9
300	1069536.221	1069277.896	579.991	579.730	-0.261	1.9
301	1069536.221	1069277.897	579.992	579.730	-0.262	1.9
324	1069287.976	1069831.808	604.266	604.000	-0.266	1.3
178	1073807.796	1066504.616	586.036	585.760	-0.276	1.6
179	1073830.359	1066505.827	586.461	586.180	-0.281	1.9
182	1073940.541	1066516.336	585.938	585.650	-0.288	1.9
198	1073131.827	1066731.945	583.999	583.710	-0.289	4.4
195	1073238.690	1066874.201	584.721	584.420	-0.301	1.0
173	1073855.568	1066406.979	582.502	582.200	-0.302	2.6
224	1072555.663	1067262.651	589.398	589.070	-0.328	5.4
142	1074954.918	1065608.552	617.549	617.220	-0.329	5.6
185	1073940.404	1066553.405	586.129	585.800	-0.329	3.2
201	1073154.459	1066902.829	587.004	586.670	-0.334	1.7
202	1073140.990	1066879.497	586.635	586.300	-0.335	1.8
319	1069168.425	1069812.849	600.316	599.970	-0.346	4.2
191	1073444.914	1066816.765	588.226	587.870	-0.356	4.0
253	1071148.027	1068554.487	583.710	583.330	-0.380	5.5
192	1073425.023	1066760.266	581.924	581.540	-0.384	4.8
277	1070469.935	1069333.152	581.401	580.990	-0.411	1.9
196	1073216.980	1066839.901	580.999	580.540	-0.459	4.5

187	1073737.341	1066576.440	584.314	583.820	-0.494	5.6
292	1069626.089	1069224.039	581.160	580.650	-0.510	1.8
145	1074583.289	1065613.320	590.000	589.450	-0.550	1.6
61	1064919.115	1067932.655	581.454	580.770	-0.684	2.8
137	1074796.769	1065393.848	616.706	616.000	-0.706	2.3

Average dz +0.025
 Minimum dz -0.706
 Maximum dz +0.827
 Average magnitude 0.206
 Root mean square 0.271
 Std deviation 0.270

Table 12: Niagara County Checkpoint Results

Number	Easting	Northing	Known Z	Laser Z	Dz
39	1071036.904	1097420.078	573.984	574.330	+0.346
3	1060720.102	1096625.149	571.505	571.850	+0.345
42	1029964.739	1155903.576	399.865	400.060	+0.195
40	1063248.776	1113566.719	575.250	575.400	+0.150
43	1029700.835	1185999.364	299.550	299.690	+0.140
41	1037890.679	1137064.594	600.938	601.040	+0.102
31	1133034.418	1129027.659	590.564	590.640	+0.076
1	1068361.236	1105283.074	576.130	576.170	+0.040
4	1074365.906	1100944.826	574.261	574.210	-0.051
25	1165507.634	1126261.435	602.684	602.590	-0.094
32	1152338.614	1133753.812	600.831	600.710	-0.121
26	1083746.793	1166892.416	393.902	393.780	-0.122
28	1081886.865	1208480.944	262.279	262.030	-0.249
27	1080293.997	1137582.519	606.612	606.340	-0.272
35	1176700.617	1167885.571	534.485	534.150	-0.335
30	1118084.930	1141216.952	607.111	606.650	-0.461
38	1157246.954	1180343.359	403.418	402.800	-0.618
33	1155603.378	1219637.893	307.838	307.190	-0.648
29	1079942.293	1157611.678	458.478	457.800	-0.678
34	1123826.207	1161814.495	488.801	488.120	-0.681

Average dz -0.147
 Minimum dz -0.681
 Maximum dz +0.346
 Average magnitude 0.286
 Root mean square 0.358
 Std deviation 0.335

6 GROUND CONTROL REPORT

6.1 Introduction

This section addresses Ground Control reporting in the Ellipsoid model used as part of the collection and the Geoid model used to compute orthometric heights.

6.2 Horizontal Datum

The horizontal datum associated with the LiDAR data is NAD83 (1993), as realized by the physical NGS control monuments used to constrain the survey control network.

6.3 Vertical Datum

The vertical datum associated with the LiDAR data is the NAVD88, as realized by the physical NGS benchmarks used to constrain the survey control network.