Curtin HIVE (Hub for Immersive Visualisation and eResearch)

and Department of Spatial Sciences

Underwater measurements and adjustment of the *Santo Antonio de Tanna*

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Abstract

Santo Antonio de Tana was a Portuguese ship that sank off the coast of Mombasa, Kenya, in 1698. Throughout the excavations of the shipwreck in (1978), different surveying measurements were taken. Beside the number of underwater images of the remains of the shipwreck, there are also number of physical underwater observations taken by a Tape. A 3D photogrammetric model from these images has been already created in 2018 using PhotoScan software. The goal of this project is to build a 3D reconstruction Model from the underwater measurements by trilateration procedure and the least squares adjustment. In addition, conducting a comparison between the trilateration 3D Model with the photogrammetric model as an accuracy assessment.

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1. Underwater survey

The primary objective of this project was to calculate the three-dimensional coordinates of the keelson in order to recalculate the trilateration from the observations that were taken during the excavations of the shipwreck in 1978. Three sets of control were established, one on the keelson, on the port and starboard side of the hull Furthermore, at the keelson control points, eleven 2 m heigh poles were placed on the keelson to create additional vertical control. Measurements were taken from the upper and lower keelson control points, to the port and starboard control points (Piercy, 1978). The initial calculations of the coordinates by Shaw (2018) it was assumed that the keelson was straight and the keelson coordinates lay in a straight line. It was known from the 1978 survey that the keelson had a curvature in the Y and Z directions (assuming the axis of the keelson lay in the X direction). Data from the 1978 survey included measurements taken from a string that had been stretched along the length of the keelson and measurements were taken from this string to each of the control point on the keelson (see Figure 1).

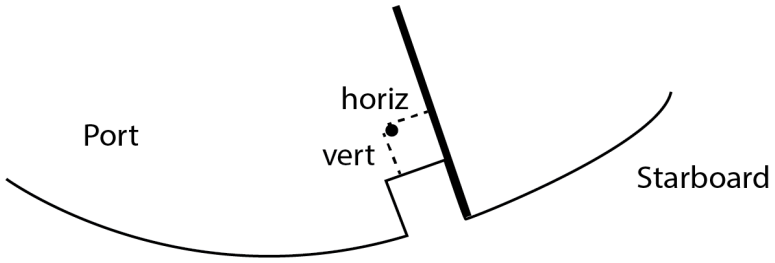

Figure 1: cross section of the ship showing keelson, port, starboard, and the pole.

2. Assumption of a local coordinate system

The given observations are only distance measurements taken between the marked control points. Meaning no reference points or benchmark are available. Thus, a local coordinate system must be assumed. Since that the depth measurements were taken from the string, the direction of this string is assumed to be a baseline and considered as the X-axis. The problem in this assumption is that the actual direction of the string is unknown. However, this assumption can be valid in only two cases:

A- The string tilted (not in horizontal level) but the depth measurements were taken perpendicularly from the string to the keelson.

B- The string was setup in a horizontal plane.

In one hand, by investigating the depth measurements, it can be seen that depth at the beginning, middle and the end were equal to 0, 0.39 m (the longest depth) and 0.02 m respectively. They are relatively very short distances and very likely to be taken vertically from the string with insignificant errors. From the other hand, the actual string level is estimated utilising the photogrammetric model generated by Photoscan. This is simply calculated by adding the depth measurements to the heights of the control points on the keelson. It is true that these heights (from PhotoScan) may not be accurate but they should be enough to provide an indication of the string level. It has been found that the tilted angle from the horizontal level is in range of (0.5 – 2) degrees. Considering (2 degrees tilted), the height error after 14 meters long is approximately 25mm. Therefore, in both cases (A or B), the error seems to be very low and thus, can be neglected. Thus, The X-axis is assumed to be the direction of the string, while Z-axis is presented by the depth from the string.

3. Approximate solutions and adjustment

Least squares adjustment requires accurate enough solution to the unknowns as well as a positive degree of freedom (redundant number of observations). MOVE3 software is used to perform the adjustment. Next two subsections will provide details of how the initial solutions to the unknowns are estimated. For some control points, it is very hard to estimate accurate initial solution due to missing information. Therefore, some assumptions need to be made. However, when the whole network solved together in one calculation, a more reliable solution will be obtained.

3.1 Keelson and poles

According to the assumed local coordinates system, the projection of the control point (named B0) on the string is considered to the origin of the coordinate system (0, 0, 0), so B0 coordinates are equal to (0, 0,-0.18), as - 0.18 is depth from the string. Given the depth, horizontal (shift from string (Y)), and the measured distances between the points on the keelson (1 m), initial coordinates of all points on the keelson are estimated as in shown in Table 1. After estimating initial coordinates of the keelson points, the least squares adjustment is needed to calculate the final adjusted locations. As principle, number of the observation must be larger than number of the unknowns to perform the adjustment. Each control point, provides three unknowns (X, Y, Z). From the given observations, only the measured distances between the keelson points can be utilized. While using the depth and horizontal measurements (Table 1) is not helpful because this lead to add extra unknowns e.g. the positions on the string in which the depths were taken from. Therefore, additional observations should be

calculated without adding extra unknowns. To solve this problem, the shift vectors (DX, DY, DZ) between the keelson points are estimated as in (Table 1). Appling the same concept, the coordinates of the top poles as well as additional observations are also estimated. The poles are assumed to be vertically placed on the keelson. This assumption may not be the case in reality but there are no clear information about this. Furthermore, this assumption will provide initial solution only, while the whole network (keelson, poles, port, and starboard) must be solved in one calculation to obtain reliable result.

Table 1: Example of estimating initial coordinates of the control points on the keelson and additional observation from the given underwater measurements. The distances between the points on the keelson are given (1 m each).

	Underwater measurements (m)		Initial coordinates (m)				Additional observations (m)		
	Horizontal	Depth	X	Y	Z	Direction	DX	DY	DZ
B0	~	-0.18	0	0	-0.18				
B1	0.24	-0.24	1	0.06	-0.24	B0toB1	1	0.06	-0.06
B2	0.29	-0.29	2	0.055	-0.29	B1toB2	1	-0.005	-0.05
B3	0.33	-0.33	3	0.02	-0.33	B2toB3	1	-0.035	-0.04
B4	0.35	-0.35	4	0.04	-0.35	B3toB4	1	0.02	-0.02
B5	0.37	-0.37	5	0	-0.37	B4toB5	1	-0.04	-0.02

3.2 Port and starboard

The control points on the port and starboard were measured from the keelson and from the poles. Some points have only two measured distances and therefore, cannot be solved. Some other have four, while the majority have six measured distances; three from the keelson and three from the poles. For unique solution, at least, three distance observations must be given. This means that enough number of observation is available and no more additional observations are needed. The procedure of calculating the location of an unknown point using distance measurements observed from known point's locations is called Trilateration (three distance measurements) or Multilateration (more than three). In order to estimate initial coordinates for the port and starboard points, MOVE3 is used. However, only X and Y coordinates are calculated while not able to estimate Z due to missing Geoid details in the available online version. Therefore, the elevation information (Z) are taken from the

given PhotoScan coordinates. At this stage, all the required initial coordinates are calculated and the whole network become ready to perform the adjustment.

Unfortunately, the adjustment has failed in the first iteration. This failure is mainly caused by some input distances observations are not accurate (blunder) as well as some initial coordinates may not been accurate enough for obtaining converging solution. Thus, manual solution and further investigations are needed to solve the problem. Several Algebraic methods have been published to solve the Multilateration problem e.g. Awange and Grafaren (2002). In this project, the method introduced by Norrdine, (2015) is utilised because it is less complexity and available with Matlab code. For some control points on the port and starboard, it has been found that every three set of measurements provides different solution (far away in position e.g. several meters). It true that the positions of the keelson and poles points may not accurate but should not lead to this huge error. This indicates that blunder measurements are very likely to be present in the given underwater measurements. Thus, the solutions that expected to be closer the actual are nominated. At the same time, the expected blunder measurements are omitted from the adjustment. Finally, the adjustment is run successfully with these updated coordinates and omitted measurements. As statistical test, the adjustment have not passed the F-test, achieving value 1.279, while the critical value is 1.09. However, the adjustment is passed the Chi-Square Test which is considered to be enough and no further investigation is required in this stage.

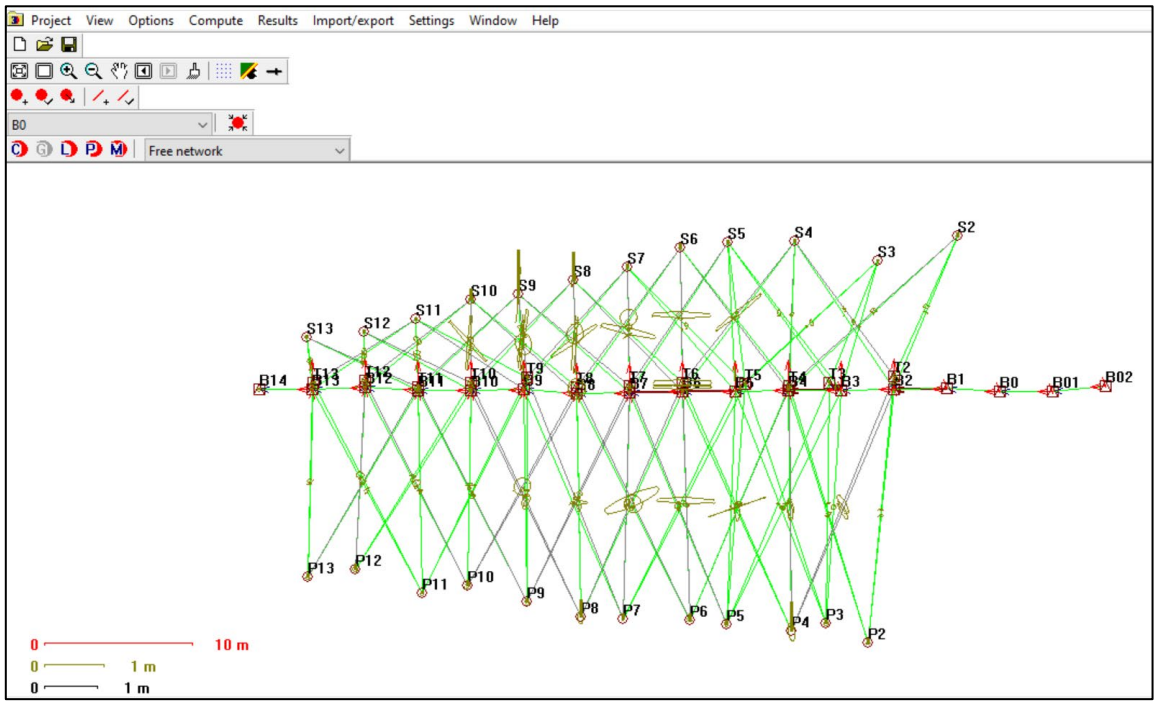

Figure 2: The whole network after adjustment in MOVE3.

4. Comparison with PhotoScan

The coordinate system of the adjusted coordinates (from MOVE3) is arbitrary selected as mentioned previously. For valuable comparison with the PhotoScan result, a 3D rotation to the MOVE3 coordinates must be applied in advance. So that the coordinate systems of both software are match to each other as much as possible. Matlab code is created to perform the rotation in term of least squares adjustment according to the following equations.

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = [\mathrm{M}] \begin{bmatrix} X' \\ Y' \\ Z' \end{bmatrix} \tag{1}$$

$$\mathbf{M} = \begin{bmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{bmatrix}$$

$$= \begin{bmatrix} \cos\phi\cos\kappa & \cos\omega\sin\kappa + \sin\omega\sin\phi\cos\kappa & \sin\omega\sin\kappa - \cos\omega\sin\phi\cos\kappa \\ -\cos\phi\sin\kappa & \cos\omega\cos\kappa - \sin\omega\sin\phi\sin\kappa & \sin\omega\cos\kappa + \cos\omega\sin\phi\sin\kappa \\ \sin\phi & -\sin\omega\cos\phi & \cos\omega\cos\phi \end{bmatrix} \tag{2}$$

In equation (1), (X, Y, and Z) are the coordinates of the target system (e.g. PhotoScan system) while X' , $Y'$and Z' are the coordinates of the input system (e.g. the adjusted MOVE3 coordinates). M is the rotation matrix including the rotation angles omega (ω), phi ($\emptyset$), and kappa (κ).

Accordingly, the obtained rotation angles (omega, phi, and kappa) are approximately (-19.4798, -2.6426, -2.9662) degrees respectively. From these angles, the rotation matrix is estimated and then, the new rotated coordinates are calculated. Compare to the PhotoScan coordinates, the Root Mean squared Error (RMSE) in XY plane are very low (0.28 m, 0.21 m) which indicates strong match between the MOVE3 and PhotoScan result. One control point on the starboard (S2) has unexpected high difference (-0.9219 MOVE3 VS -1.8935 PhotoScan) which lead to (0.97 m) shift. It is very hard to guess which one is the closer to the real coordinates.

Table 2: The absolute differences between PhotoScan coordinates and the MOVE3 (adjusted and rotated) coordinates.

	PhotoScan coordinates (m)			MOVE3 adjusted and rotated coordinates (m)			Differences (m)		
#Label	X	Y	Z	X	Y	Z	DX	DY	DZ
B1	-0.91	-0.05	-0.01	-1.01	0.08	-0.16	0.10	-0.13	0.15
B2	-1.88	-0.07	0.00	-2.01	0.04	-0.16	0.12	-0.11	0.16
B3	-2.88	-0.10	0.00	-3.01	-0.03	-0.17	0.13	-0.07	0.17
B5	-4.87	-0.17	-0.01	-4.99	-0.11	-0.13	0.12	-0.05	0.12
B6	-5.87	-0.16	-0.01	-5.99	-0.16	-0.11	0.12	-0.01	0.09
B10	-9.78	-0.22	0.00	-9.98	-0.38	0.16	0.20	0.16	-0.16
B11	-10.85	-0.29	0.11	-10.97	-0.45	0.28	0.12	0.15	-0.16
B12	-11.83	-0.38	0.17	-11.97	-0.48	0.39	0.13	0.10	-0.22
B13	-12.83	-0.39	0.27	-12.95	-0.59	0.51	0.12	0.20	-0.24
B14	-13.83	-0.43	0.32	-13.95	-0.67	0.62	0.11	0.24	-0.30
P2	-2.00	-5.18	0.63	-2.29	-4.77	-0.95	0.29	-0.41	1.58
P3	-2.97	-5.06	0.69	-3.01	-4.88	0.37	0.04	-0.17	0.31
P4	-4.13	-5.27	0.53	-3.70	-4.85	-0.24	-0.43	-0.42	0.77
P5	-5.10	-5.14	0.47	-4.90	-4.92	0.26	-0.19	-0.22	0.21
P6	-5.90	-4.91	0.21	-5.66	-4.56	-0.59	-0.24	-0.35	0.80
P7	-6.93	-4.99	0.00	-6.88	-4.75	-0.10	-0.05	-0.24	0.10
P8	-7.92	-4.98	-0.04	-7.69	-4.76	-0.09	-0.23	-0.22	0.06
P9	-8.92	-5.00	-0.05	-8.67	-4.72	0.57	-0.25	-0.27	-0.62
P10	-9.93	-4.48	-0.34	-9.82	-4.37	0.39	-0.11	-0.11	-0.74
P11	-10.95	-4.79	-0.02	-10.65	-4.69	0.75	-0.30	-0.10	-0.78
P12	-11.93	-4.05	-0.19	-11.97	-4.08	0.29	0.04	0.03	-0.48
P13	-12.94	-4.00	-0.13	-12.90	-4.07	-0.29	-0.04	0.07	0.16
S2	-1.89	2.61	0.84	-0.92	2.95	0.43	-0.97	-0.34	0.41
S3	-2.85	2.58	0.85	-2.46	2.63	-0.29	-0.40	-0.05	1.14
S4	-3.75	2.39	0.74	-3.92	2.30	1.64	0.16	0.09	-0.90
S5	-4.96	2.45	0.76	-5.29	2.86	-0.13	0.33	-0.41	0.89
S6	-5.85	2.25	0.72	-6.08	2.11	1.58	0.23	0.14	-0.85
S7	-6.86	2.02	0.63	-7.18	2.35	-0.27	0.32	-0.32	0.90
S8	-7.86	1.67	0.51	-8.15	1.86	0.25	0.29	-0.20	0.26
S9	-8.83	1.58	0.52	-9.21	1.75	-0.36	0.38	-0.17	0.88
S10	-9.82	1.27	0.52	-10.07	1.41	0.21	0.26	-0.14	0.31
S11	-10.81	1.02	0.56	-11.09	1.02	0.13	0.28	-0.01	0.43
S12	-11.85	0.91	0.43	-12.05	0.67	0.31	0.20	0.24	0.11
S13	-12.84	0.60	0.24	-13.11	0.45	0.52	0.27	0.15	-0.28
						RMSE	0.28	0.21	0.59

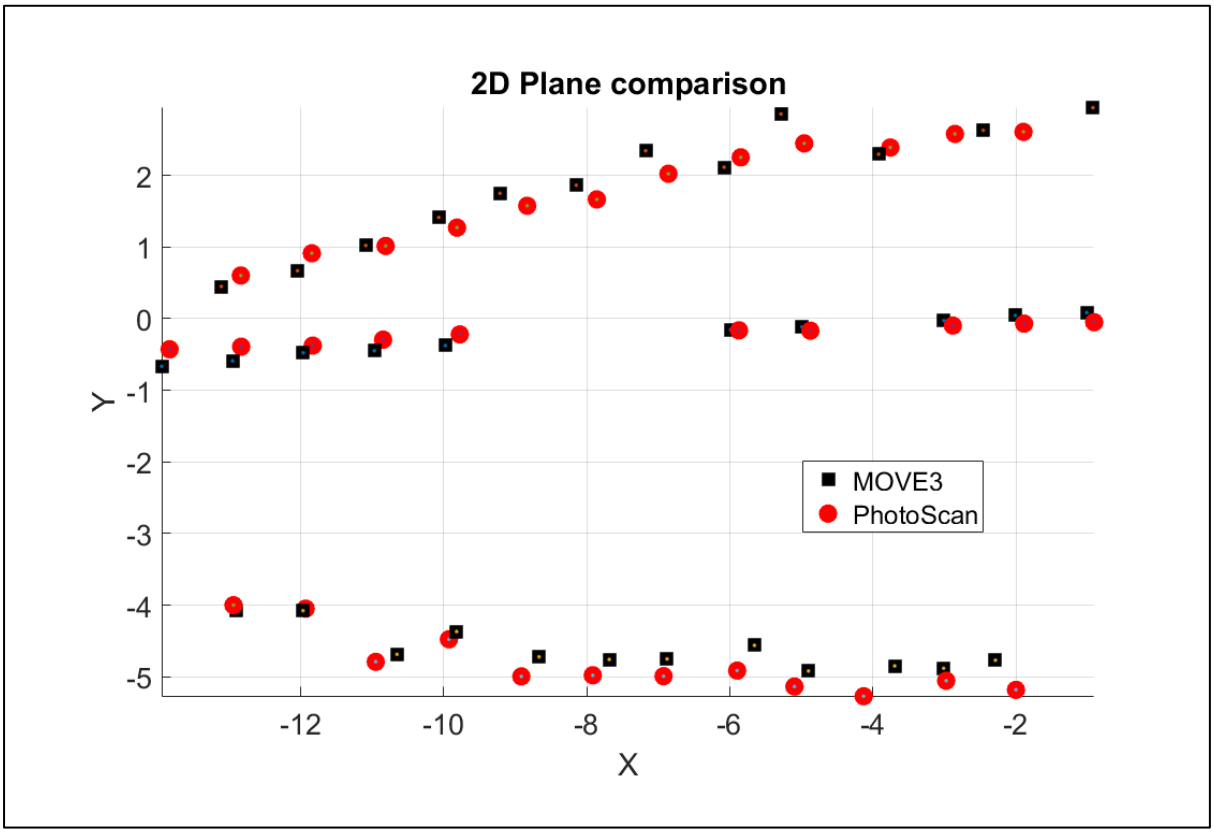

Figure 3: 2D plane comparison between the PhotoScan coordinates (red dots) and the rotated MOVE3 coordinates (black squares). Dimensions are in metres.

In regard to a comparison in the height, while the keelson coordinates show a good match, there are significant difference in many points in the port and starboard (see Table 2 and Figure 4). Some points exceed one meter height difference which is too high which lead to a high RMSE (0.59 m).

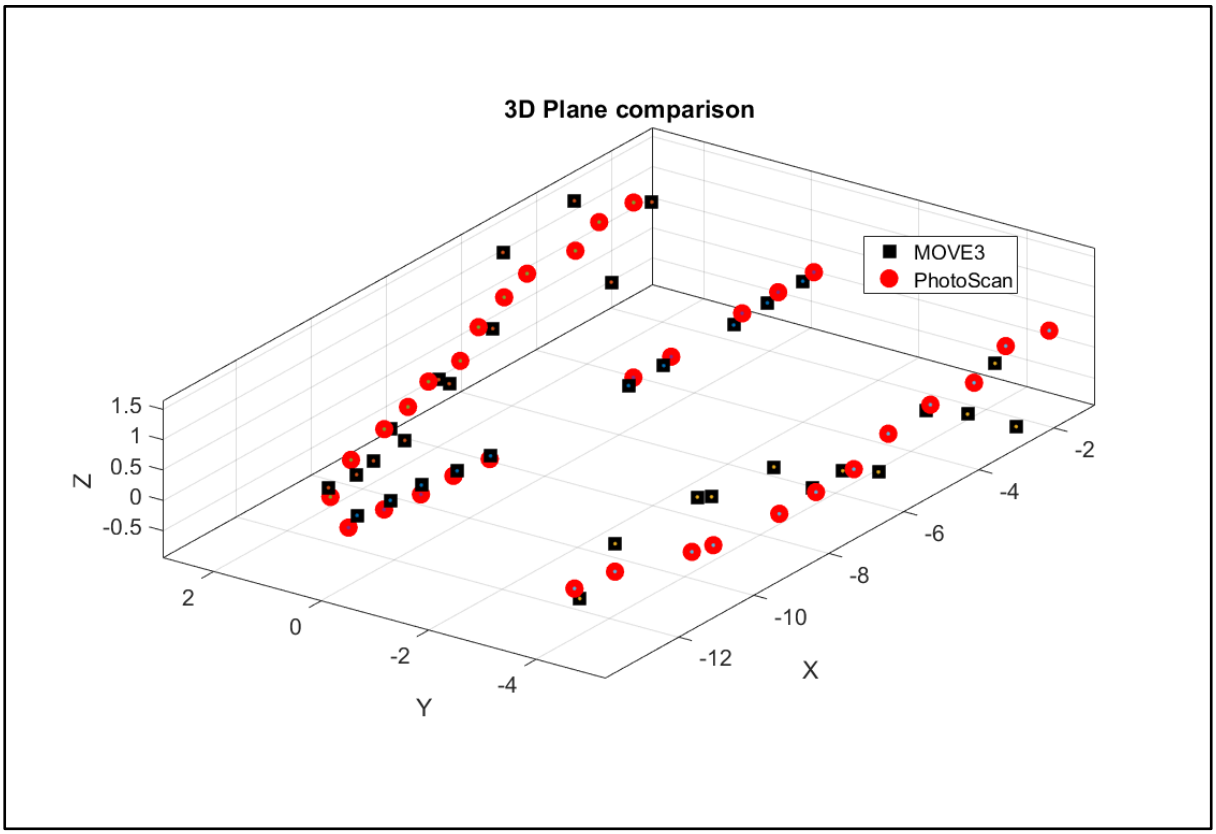

Figure 4: 3D plane comparison between the PhotoScan coordinates (red dots) and the rotated MOVE3 coordinates (black squares). Dimensions are in metres.

5. Conclusion

A 3D Model of the underwater measurements has been created using MOVE3 software. First of all, an arbitrary coordinate system is assumed. Then, initial coordinates to the keelson are estimated based on the measured depths from string as well as the vertical and horizontal shifts (Table 1). Since that the least squares adjustment requires redundant number of observations, additional observations are manually calculated which the vector shift in X, Y, and Z. Similar to the keelson, initial coordinates to the poles are also estimated. Unlike the keelson and the poles, the control points on the port and starboard are estimated using a Multilateration procedure as described in Norrdine, (2015). In normal

cases, a set of distances measurements (three or more) taken from known stations should be intersected approximately at one position. In our case, the majority of the control points on the port and starboard were measured from six different positions. However, it has been highlighted that every three distance measurements (from the six) provides different position. This strong evidence that blunder measurements are existing in the given underwater measurements. Thus, the locations that expected to be closer the actual (e.g. close to PhotoScan coordinates) are nominated. At the same time, the expected blunder measurements are omitted from the adjustment. Finally, the least squares adjustment is performed on the whole network in on calculation to obtain a reliable solutions.

In order to compare the obtained MOVE3 adjusted coordinates with PhotoScan coordinates, a 3D rotation has been applied to the MOVE3 coordinates, so the coordinates systems of both software are corresponding (as much as possible). The obtained rotation angles (omega, phi, and kappa) are approximately (-19.4798, -2.6426, -2.9662) degrees respectively. From these angles, the rotation matrix is estimated and then, the new rotated coordinates are calculated. Finally, the absolute difference between the rotated MOVE3 and the PhotoScan coordinates in X, Y, and Z. In the one hand, the result shows high level of corresponding in X and Y coordinates with achieved RMSE equal to 0.28m and 0.21m respectively, except one control point on the starboard (S2) which achieved (0.97m) shift in the X-direction. In the other hand, there are very large difference in Z, in particularly, the port and starboard which lead to high RMSE equal to 0.59m. Usually, a solution based on physical measurements and proved by least squares adjustment should be the more realistic solution that can be trusted. This statement is valid when a set of distance measurements intersect approximately at one position. However, this is not the case in our measurements as it has been found that every three set of measurements provides different solution (far away in position e.g. several meters). This very likely to be caused by some blunder measurements in the given underwater survey data. Hence, the confidence level with MOVE3 adjustment is reduced especially for those control points (on port and starboard) showing large height differences.

References

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Joseph. Awange and E. Grafarend, Algebraic Solution of GPS Pseudo-Range Equations. Journal of GPS Solutions 5 (4) pp. 20 – 32, 2002.

Appendix

The adjustment report of the MOVE3 is presented below:

MOVE3 Version 4.5.0 (x64)
Design and Adjustment of Geodetic Networks

www.MOVE3.com

Keelson2
28-07-2020 11:46:51

3D free network -- Projection : Temp -- Ellipsoid : GRS 1980

PROJECT
R:\SantoAntoniodeTana-WOODSA-SE04342\Lachlan Shaw\Yousif\MOVE3\Keelson and poles_P&S_final_2_Matlab_input.prj

STATIONS

Number of (partly) known stations	29
Number of unknown stations	24
Total	53

OBSERVATIONS

Distances	119
Shift vector	93
Known coordinates	7
Total	219

UNKNOWNS

Coordinates	159
Scale factors	1
Total	160

Degrees of freedom	59

ADJUSTMENT

Number of iterations	3	
Max coord correction in last iteration	0.0016 m	Tolerance exceeded

TESTING

Alfa (multi dimensional)	0.2929
Alfa 0 (one dimensional)	0.0010
Beta	0.80
Critical value W-test	3.29

Critical value T-test (3 dimensional)	4.24
Critical value T-test (2 dimensional)	5.91
Critical value F-test	1.09
F-test	1.279 Rejected

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Chi-Square Test (99.9%)	
Lower Bound	0.502
Upper Bound	1.719
Chi-Square Test	1.279 Passed

TEST SUMMARY

Record		Station	Target	Test	Factor	Red	Est err		
50	DE(shift)	B3	T3	W-test	1.5	74	0.2882	m	
52	DE(shift)	B5	T5	W-test	1.3	74	-0.2393	m	
12	DE	B6	B7	3D T-test	1.1	24	0.1384	m	
7	DE	B5	B6	3D T-test	1.1	24	0.1395	m	

VARIANCE COMPONENT ANALYSIS

	Variance	Redundancy
Terrestrial	1.279	59.0
Distances	1.055	20.4
Shift vector	1.397	38.6

PROJECTION AND ELLIPSOID CONSTANTS

Projection	Temp (TM)	
Longitude of origin/central meridian	0 00 00.00000 E	
Latitude of origin	0 00 00.00000 N	
Projection scale factor	1.000000000	
False Easting	100.0000	m
False Northing	100.0000	m
Ellipsoid	GRS 1980	
Semi major axis	6378137.0000	m
Inverse flattening	298.257222101	

INPUT APPROXIMATE TERRESTRIAL COORDINATES

Station	X East (m)		Y North (m)		Height (m)		Id.Sd XY (m)	Id.Sd h (m)	
B02	2.0000	*	0.1200	*	0.0000	*	0.0000	0.0000	base point
B01	1.0000	*	0.0000	*	-0.1000	*	0.0000	0.0000	base point
B0	0.0000	*	0.0000	*	-0.1800	*	0.0000	0.0000	base point
B1	-1.0000	*	0.0600	*	0.2400	*	0.0000	0.0000	known
B2	-2.0000	*	0.0550	*	-0.2900	*	0.0000	0.0000	known
B3	-3.0000	*	0.0200	*	-0.3300	*	0.0000	0.0000	known
B4	-4.0000	*	0.0400	*	-0.3500	*	0.0000	0.0000	known
B5	-5.0000	*	0.0000	*	-0.3700	*	0.0000	0.0000	known
B6	-6.0000	*	-0.0100	*	-0.3900	*	0.0000	0.0000	known
B7	-7.0000	*	0.0000	*	-0.3950	*	0.0000	0.0000	known
B8	-8.0000	*	-0.0600	*	-0.3900	*	0.0000	0.0000	known
B9	-9.0000	*	0.0200	*	-0.3900	*	0.0000	0.0000	known
B10	-10.0000	*	0.0180	*	-0.3100	*	0.0000	0.0000	known
B11	-11.0000	*	0.0250	*	-0.2400	*	0.0000	0.0000	known

Station	X East (m)		Y North (m)		Height (m)		Id.Sd XY (m)	Id.Sd h (m)	
B12	-12.0000	*	0.0650	*	-0.1800	*	0.0000	0.0000	known
B13	-13.0000	*	0.0250	*	-0.0900	*	0.0000	0.0000	known
B14	-14.0000	*	0.0250	*	-0.0200	*	0.0000	0.0000	known
T2	-2.0000	*	0.2400	*	1.7100	*	0.0000	0.0000	known
T3	-3.0000	*	0.1700	*	1.6700	*	0.0000	0.0000	known
T4	-4.0000	*	0.1700	*	1.6500	*	0.0000	0.0000	known
T5	-5.0000	*	0.1300	*	1.6300	*	0.0000	0.0000	known
T6	-6.0000	*	0.1450	*	1.6100	*	0.0000	0.0000	known
T7	-7.0000	*	0.0700	*	1.6050	*	0.0000	0.0000	known
T8	-8.0000	*	0.0600	*	1.6100	*	0.0000	0.0000	known
T9	-9.0000	*	0.1450	*	1.6100	*	0.0000	0.0000	known
T10	-10.0000	*	0.1580	*	1.6900	*	0.0000	0.0000	known
T11	-11.0000	*	0.1650	*	1.7600	*	0.0000	0.0000	known
T12	-12.0000	*	0.2050	*	1.8200	*	0.0000	0.0000	known
T13	-13.0000	*	0.1650	*	1.9100	*	0.0000	0.0000	known
S2	-0.7966		2.9609		-0.5480		0.0000	0.0000	
P2	-2.4889		-4.7043		0.6938		0.0000	0.0000	
P4	-3.8638		-4.5157		1.1572		0.0000	0.0000	
S4	-3.8819		2.8320		0.5222		0.0000	0.0000	
P3	-3.2540		-4.3718		1.7832		0.0000	0.0000	
S3	-2.3164		2.4664		-1.2902		0.0000	0.0000	
P5	-5.1441		-4.3875		1.5754		0.0000	0.0000	
S5	-5.1275		2.8126		-1.3914		0.0000	0.0000	
P6	-6.0298		-4.3010		0.7382		0.0000	0.0000	
S6	-6.0052		2.7123		0.3633		0.0000	0.0000	
P7	-7.1161		-4.2767		1.0779		0.0000	0.0000	
S7	-7.0236		2.3483		-1.4628		0.0000	0.0000	
P8	-7.9680		-4.3110		0.8340		0.0000	0.0000	
S8	-8.0515		2.1209		-0.8331		0.0000	0.0000	
P9	-8.9250		-3.9640		1.5800		0.0000	0.0000	
S9	-9.0713		1.9799		-1.1837		0.0000	0.0000	
P10	-10.0189		-3.6153		1.2200		0.0000	0.0000	
S10	-9.9815		1.7692		-0.7694		0.0000	0.0000	
P11	-10.9063		-3.8089		1.6113		0.0000	0.0000	
S11	-11.0240		1.3753		-0.8896		0.0000	0.0000	
P12	-12.1636		-3.3454		0.8920		0.0000	0.0000	
S12	-12.0020		1.1372		-0.6560		0.0000	0.0000	
P13	-13.0662		-3.4026		0.2833		0.0000	0.0000	
S13	-13.0835		1.0334		-0.4536		0.0000	0.0000	

INPUT STANDARD DEVIATIONS OF KNOWN STATIONS

Station	Sd X East (m)		Sd Y North (m)		Sd Height (m)		
B02	0.0000	*	0.0000	*	0.0000	*	base point
B01	0.0000	*	0.0000	*	0.0000	*	base point
B0	0.0000	*	0.0000	*	0.0000	*	base point
B1	0.0100	*	0.0100	*	0.0000	*	known
B2	0.0000	*	0.0000	*	0.0000	*	known
B3	0.0000	*	0.0000	*	0.0000	*	known
B4	0.0000	*	0.0000	*	0.0000	*	known
B5	0.0000	*	0.0000	*	0.0000	*	known
B6	0.0000	*	0.0000	*	0.0000	*	known

Station	Sd X East (m)		Sd Y North (m)		Sd Height (m)		
B7	0.0000	*	0.0000	*	0.0000	*	known
B8	0.0000	*	0.0000	*	0.0000	*	known
B9	0.0000	*	0.0000	*	0.0000	*	known
B10	0.0000	*	0.0000	*	0.0000	*	known
B11	0.0000	*	0.0000	*	0.0000	*	known
B12	0.0000	*	0.0000	*	0.0000	*	known
B13	0.0000	*	0.0000	*	0.0000	*	known
B14	0.0000	*	0.0000	*	0.0000	*	known
T2	0.0500	*	0.0500	*	0.0500	*	known
T3	0.0500	*	0.0500	*	0.0500	*	known
T4	0.0500	*	0.0500	*	0.0500	*	known
T5	0.0500	*	0.0500	*	0.0500	*	known
T6	0.0500	*	0.0500	*	0.0500	*	known
T7	0.0500	*	0.0500	*	0.0500	*	known
T8	0.0500	*	0.0500	*	0.0500	*	known
T9	0.0500	*	0.0500	*	0.0500	*	known
T10	0.0500	*	0.0500	*	0.0500	*	known
T11	0.0500	*	0.0500	*	0.0500	*	known
T12	0.0500	*	0.0500	*	0.0500	*	known
T13	0.0500	*	0.0500	*	0.0500	*	known

INPUT OBSERVATIONS

	Station	Target	St ih (m)	Tg ih (m)	Reading	Sd		
S0	B02	B01	0.0000	0.0000	1.0000	0.0100	m	
DE(shift)	B13	T13			0.0000	0.0500	m	
DN(shift)	B13	T13			0.1400	0.0500	m	
DH(shift)	B13	T13			2.0000	0.0100	m	
DE(shift)	B11	B12			-0.9970	0.0100	m	
DN(shift)	B11	B12			0.0400	0.0100	m	
DH(shift)	B11	B12			0.0600	0.0100	m	
DE(shift)	B02	B01			-0.9880	0.0100	m	
DN(shift)	B02	B01			-0.1200	0.0100	m	
DH(shift)	B02	B01			-0.1000	0.0100	m	
DE(shift)	B2	B3			-0.9990	0.0100	m	
DN(shift)	B2	B3			-0.0350	0.0100	m	
DH(shift)	B2	B3			-0.0400	0.0100	m	
DE(shift)	B3	B4			-1.0000	0.0100	m	
DN(shift)	B3	B4			0.0200	0.0100	m	
DH(shift)	B3	B4			-0.0200	0.0100	m	
DE(shift)	B5	B6			-0.9990	0.0100	m	
DN(shift)	B5	B6			-0.0100	0.0100	m	
DH(shift)	B5	B6			-0.0200	0.0100	m	
DE(shift)	B10	B11			-0.9980	0.0100	m	
DN(shift)	B10	B11			0.0070	0.0100	m	
DH(shift)	B10	B11			0.0700	0.0100	m	
DE(shift)	B01	B0			-0.9970	0.0100	m	
DN(shift)	B01	B0			0.0000	0.0100	m	
DH(shift)	B01	B0			-0.0800	0.0100	m	
DE(shift)	B1	B2			-0.9990	0.0100	m	
DN(shift)	B1	B2			-0.0050	0.0100	m	
DH(shift)	B1	B2			-0.0500	0.0100	m	

	Station	Target	St ih (m)	Tg ih (m)	Reading	Sd		
DE(shift)	B2	B3			-0.9990	0.0100	m	
DN(shift)	B2	B3			-0.0350	0.0100	m	
DH(shift)	B2	B3			-0.0400	0.0100	m	
DE(shift)	B6	B7			-0.9990	0.0100	m	
DN(shift)	B6	B7			-0.0500	0.0100	m	
DH(shift)	B6	B7			-0.0050	0.0100	m	
S0	B01	B0	0.0000	0.0000	1.0000	0.0100	m	
S0	B0	B1	0.0000	0.0000	1.0000	0.0100	m	
S0	B1	B2	0.0000	0.0000	1.0000	0.0100	m	
S0	B2	B3	0.0000	0.0000	1.0000	0.0100	m	
S0	B3	B4	0.0000	0.0000	1.0000	0.0100	m	
S0	B4	B5	0.0000	0.0000	1.0000	0.0100	m	
S0	B5	B6	0.0000	0.0000	1.0000	0.0100	m	
S0	B6	B7	0.0000	0.0000	1.0000	0.0100	m	
S0	B7	B8	0.0000	0.0000	1.0000	0.0100	m	
S0	B8	B9	0.0000	0.0000	1.0000	0.0100	m	
S0	B9	B10	0.0000	0.0000	1.0000	0.0100	m	
S0	B10	B11	0.0000	0.0000	1.0000	0.0100	m	
S0	B11	B12	0.0000	0.0000	1.0000	0.0100	m	
S0	B12	B13	0.0000	0.0000	1.0000	0.0100	m	
S0	B13	B14	0.0000	0.0000	1.0000	0.0100	m	
DE(shift)	B0	B1			-0.9960	0.0100	m	
DN(shift)	B0	B1			0.0600	0.0100	m	
DH(shift)	B0	B1			-0.0600	0.0100	m	
DE(shift)	B9	B10			-0.9970	0.0100	m	
DN(shift)	B9	B10			-0.0020	0.0100	m	
DH(shift)	B9	B10			0.0800	0.0100	m	
DE(shift)	B7	B8			-1.0000	0.0100	m	
DN(shift)	B7	B8			0.0000	0.0100	m	
DH(shift)	B7	B8			0.0050	0.0100	m	
DE(shift)	B8	B9			-0.9970	0.0100	m	
DN(shift)	B8	B9			0.0800	0.0100	m	
DH(shift)	B8	B9			0.0000	0.0100	m	
DE(shift)	B4	B5			-0.9990	0.0100	m	
DN(shift)	B4	B5			-0.0200	0.0100	m	
DH(shift)	B4	B5			-0.0400	0.0100	m	
DE(shift)	B12	B13			-0.9950	0.0100	m	
DN(shift)	B12	B13			-0.0400	0.0100	m	
DH(shift)	B12	B13			0.0900	0.0100	m	
DE(shift)	B13	B14			-0.9980	0.0100	m	
DN(shift)	B13	B14			0.0000	0.0100	m	
DH(shift)	B13	B14			0.0700	0.0100	m	
DE(shift)	B02	B01			-0.9880	0.0100	m	
DN(shift)	B02	B01			-0.1200	0.0100	m	
DH(shift)	B02	B01			-0.1000	0.0100	m	
S0	B2	T2	0.0000	0.0000	2.0085	0.0100	m	
S0	B3	T3	0.0000	0.0000	2.0056	0.0100	m	
S0	B4	T4	0.0000	0.0000	2.0042	0.0100	m	
S0	B5	T5	0.0000	0.0000	2.0042	0.0100	m	
S0	B6	T6	0.0000	0.0000	2.0060	0.0100	m	
S0	B7	T7	0.0000	0.0000	2.0042	0.0100	m	
S0	B8	T8	0.0000	0.0000	2.0036	0.0100	m	

	Station	Target	St ih (m)	Tg ih (m)	Reading	Sd		
S0	B9	T9	0.0000	0.0000	2.0039	0.0100	m	
S0	B10	T10	0.0000	0.0000	2.0049	0.0100	m	
S0	B11	T11	0.0000	0.0000	2.0049	0.0100	m	
S0	B12	T12	0.0000	0.0000	2.0049	0.0100	m	
S0	B13	T13	0.0000	0.0000	2.0049	0.0100	m	
DE(shift)	B02	B01			-0.9880	0.0100	m	
DN(shift)	B02	B01			-0.1200	0.0100	m	
DH(shift)	B02	B01			-0.1000	0.0100	m	
DE(shift)	B2	T2			0.0000	0.0500	m	
DN(shift)	B2	T2			0.1850	0.0500	m	
DH(shift)	B2	T2			2.0000	0.0500	m	
DE(shift)	B3	T3			0.0000	0.0500	m	
DN(shift)	B3	T3			0.1500	0.0500	m	
DH(shift)	B3	T3			2.0000	0.0500	m	
DE(shift)	B4	T4			0.0000	0.0500	m	
DN(shift)	B4	T4			0.1300	0.0500	m	
DH(shift)	B4	T4			2.0000	0.0500	m	
DE(shift)	B5	T5			0.0000	0.0500	m	
DN(shift)	B5	T5			0.1300	0.0500	m	
DH(shift)	B5	T5			2.0000	0.0500	m	
DE(shift)	B6	T6			0.0000	0.5000	m	
DN(shift)	B6	T6			0.1550	0.0500	m	
DH(shift)	B6	T6			2.0000	0.0500	m	
DE(shift)	B7	T7			0.0000	0.0500	m	
DN(shift)	B7	T7			0.1300	0.0500	m	
DH(shift)	B7	T7			2.0000	0.0500	m	
DE(shift)	B8	T8			0.0000	0.1500	m	
DN(shift)	B8	T8			0.1200	0.1500	m	
DH(shift)	B8	T8			2.0000	0.1500	m	
DE(shift)	B9	T9			0.0000	0.0500	m	
DN(shift)	B9	T9			0.1250	0.0500	m	
DH(shift)	B9	T9			2.0000	0.0500	m	
DE(shift)	B10	T10			0.0000	0.0500	m	
DN(shift)	B10	T10			0.1400	0.0500	m	
DH(shift)	B10	T10			2.0000	0.0500	m	
DE(shift)	B11	T11			0.0000	0.0500	m	
DN(shift)	B11	T11			0.1400	0.0500	m	
DH(shift)	B11	T11			2.0000	0.0500	m	
DE(shift)	B12	T12			0.0000	0.0500	m	
DN(shift)	B12	T12			0.1400	0.0500	m	
DH(shift)	B12	T12			2.0000	0.0500	m	
S0	B2	S2	0.0000	0.0000	3.1500	0.0100	m	
S0	B4	S2	0.0000	0.0000	4.3300	0.0100	m	
S0	T2	S2	0.0000	0.0000	3.7300	0.0100	m	
S0	B2	P2	0.0000	0.0000	4.8800	0.0100	m	
S0	B4	P2	0.0000	0.0000	5.0800	0.0500	m	
S0	T4	P2	0.0000	0.0000	5.1850	0.0500	m	
S0	B2	P2	0.0000	0.0000	4.8800	0.0100	m	
S0	B2	S2	0.0000	0.0000	3.1500	0.0100	m	
S0	B2	P4	0.0000	0.0000	5.6800		m	desel
S0	B2	S4	0.0000	0.0000	3.4550	0.0100	m	
S0	B3	P3	0.0000	0.0000	4.8720	0.0100	m	

	Station	Target	St ih (m)	Tg ih (m)	Reading	Sd		
S0	B3	S3	0.0000	0.0000	2.7100	0.0100	m	
S0	B3	P5	0.0000	0.0000	5.2600	0.0100	m	
S0	B3	S5	0.0000	0.0000	3.6650	0.0100	m	
S0	B4	P2	0.0000	0.0000	5.0800	0.0100	m	
S0	B4	S2	0.0000	0.0000	4.3300	0.0100	m	
S0	B4	P4	0.0000	0.0000	4.8000	0.0100	m	
S0	B4	S4	0.0000	0.0000	3.7850		m	desel
S0	B4	P6	0.0000	0.0000	4.9600		m	desel
S0	B4	S6	0.0000	0.0000	4.2900		m	desel
S0	B5	P3	0.0000	0.0000	5.1900	0.0100	m	
S0	B5	S3	0.0000	0.0000	3.7400	0.0100	m	
S0	B5	P5	0.0000	0.0000	4.8250	0.0100	m	
S0	B5	S5	0.0000	0.0000	2.9980	0.0100	m	
S0	B5	P7	0.0000	0.0000	5.0000	0.0100	m	
S0	B5	S7	0.0000	0.0000	3.3000	0.0100	m	
S0	B6	P4	0.0000	0.0000	5.2200	0.0100	m	
S0	B6	S4	0.0000	0.0000	3.6500	0.0100	m	
S0	B6	P6	0.0000	0.0000	4.4400	0.0100	m	
S0	B6	S6	0.0000	0.0000	2.8250	0.0100	m	
S0	B6	P8	0.0000	0.0000	4.9000	0.0100	m	
S0	B6	S8	0.0000	0.0000	2.9320		m	desel
S0	B7	P5	0.0000	0.0000	5.1200	0.0100	m	
S0	B7	S5	0.0000	0.0000	3.5200	0.0100	m	
S0	B7	P7	0.0000	0.0000	4.5100	0.0100	m	
S0	B7	S7	0.0000	0.0000	2.5800	0.0100	m	
S0	B7	P9	0.0000	0.0000	4.9500		m	desel
S0	B7	S9	0.0000	0.0000	2.9980	0.0100	m	
S0	B8	P6	0.0000	0.0000	4.8800	0.0100	m	
S0	B8	S6	0.0000	0.0000	3.4700	0.0100	m	
S0	B8	P8	0.0000	0.0000	4.4600	0.0100	m	
S0	B8	S8	0.0000	0.0000	2.1900	0.0100	m	
S0	B8	P10	0.0000	0.0000	4.4580		m	desel
S0	B8	S10	0.0000	0.0000	2.6300		m	desel
S0	B9	P7	0.0000	0.0000	4.9300	0.0100	m	
S0	B9	S7	0.0000	0.0000	3.2200	0.0100	m	
S0	B9	P9	0.0000	0.0000	4.4700	0.0100	m	
S0	B9	S9	0.0000	0.0000	2.0900	0.0100	m	
S0	B9	P11	0.0000	0.0000	4.7500	0.0100	m	
S0	B9	S11	0.0000	0.0000	2.4800		m	desel
S0	B10	P8	0.0000	0.0000	4.2500		m	desel
S0	B10	S8	0.0000	0.0000	2.8900	0.0100	m	
S0	B10	P10	0.0000	0.0000	4.0000	0.0100	m	
S0	B10	S10	0.0000	0.0000	1.7900	0.0100	m	
S0	B10	P12	0.0000	0.0000	4.2000	0.0100	m	
S0	B10	S12	0.0000	0.0000	2.3200	0.0100	m	
S0	B11	P9	0.0000	0.0000	4.8600	0.0100	m	
S0	B11	S9	0.0000	0.0000	2.8800	0.0100	m	
S0	B11	P11	0.0000	0.0000	4.2700	0.0100	m	
S0	B11	S11	0.0000	0.0000	1.4800	0.0100	m	
S0	B11	P13	0.0000	0.0000	4.1400	0.0100	m	
S0	B11	S13	0.0000	0.0000	2.3300	0.0100	m	
S0	B12	P10	0.0000	0.0000	4.4400	0.0100	m	

	Station	Target	St ih (m)	Tg ih (m)	Reading	Sd		
S0	B12	S10	0.0000	0.0000	2.6800	0.0100	m	
S0	B12	P12	0.0000	0.0000	3.6000	0.0100	m	
S0	B12	S12	0.0000	0.0000	1.1500	0.0100	m	
S0	B13	P11	0.0000	0.0000	4.7100	0.0100	m	
S0	B13	S11	0.0000	0.0000	2.4900	0.0100	m	
S0	B13	P13	0.0000	0.0000	3.5700	0.0100	m	
S0	B13	S13	0.0000	0.0000	1.0500	0.0100	m	
S0	T2	P2	0.0000	0.0000	5.1800	0.0100	m	
S0	T2	S2	0.0000	0.0000	3.7300	0.0100	m	
S0	T2	P4	0.0000	0.0000	5.8800		m	desel
S0	T2	S4	0.0000	0.0000	3.9800		m	desel
S0	T3	P3	0.0000	0.0000	4.5520	0.0100	m	
S0	T3	S3	0.0000	0.0000	3.8450	0.0100	m	
S0	T3	P5	0.0000	0.0000	4.9400	0.0100	m	
S0	T3	S5	0.0000	0.0000	4.4600	0.0100	m	
S0	T4	P2	0.0000	0.0000	5.1850	0.0100	m	
S0	T4	S2	0.0000	0.0000	3.6600		m	desel
S0	T4	P4	0.0000	0.0000	4.8600		m	desel
S0	T4	S4	0.0000	0.0000	2.9400	0.0100	m	
S0	T4	P6	0.0000	0.0000	4.9100	0.0100	m	
S0	T4	S6	0.0000	0.0000	3.5400	0.0100	m	
S0	T5	P3	0.0000	0.0000	4.7700	0.0100	m	
S0	T5	S3	0.0000	0.0000	4.4600	0.0100	m	
S0	T5	P5	0.0000	0.0000	4.5580	0.0100	m	
S0	T5	S5	0.0000	0.0000	4.0300	0.0100	m	
S0	T5	P7	0.0000	0.0000	5.0200	0.0100	m	
S0	T5	S7	0.0000	0.0000	4.3800	0.0100	m	
S0	T6	P4	0.0000	0.0000	5.1400	0.0100	m	
S0	T6	S4	0.0000	0.0000	4.4330		m	desel
S0	T6	P6	0.0000	0.0000	4.4200		m	desel
S0	T6	S6	0.0000	0.0000	3.7100		m	desel
S0	T6	P8	0.0000	0.0000	4.9200		m	desel
S0	T6	S8	0.0000	0.0000	3.7500	0.0100	m	
S0	T7	P5	0.0000	0.0000	4.8100		m	desel
S0	T7	S5	0.0000	0.0000	4.1900		m	desel
S0	T7	P7	0.0000	0.0000	4.5100		m	desel
S0	T7	S7	0.0000	0.0000	3.6200		m	desel
S0	T7	P9	0.0000	0.0000	5.1000		m	desel
S0	T7	S9	0.0000	0.0000	4.0800		m	desel
S0	T8	P6	0.0000	0.0000	4.7700		m	desel
S0	T8	S6	0.0000	0.0000	2.4600		m	desel
S0	T8	P8	0.0000	0.0000	4.3820	0.0100	m	
S0	T8	S8	0.0000	0.0000	3.4500		m	desel
S0	T8	P10	0.0000	0.0000	4.5000		m	desel
S0	T8	S10	0.0000	0.0000	3.5800	0.0100	m	
S0	T9	P7	0.0000	0.0000	4.7500		m	desel
S0	T9	S7	0.0000	0.0000	4.2300		m	desel
S0	T9	P9	0.0000	0.0000	4.2400	0.0100	m	
S0	T9	S9	0.0000	0.0000	3.3600		m	desel
S0	T9	P11	0.0000	0.0000	4.5400	0.0100	m	
S0	T9	S11	0.0000	0.0000	3.4200	0.0100	m	
S0	T10	P8	0.0000	0.0000	4.4300		m	desel

	Station	Target	St ih (m)	Tg ih (m)	Reading	Sd		
S0	T10	S8	0.0000	0.0000	3.9050		m	desel
S0	T10	P10	0.0000	0.0000	3.8550	0.0100	m	
S0	T10	S10	0.0000	0.0000	3.2000		m	desel
S0	T10	P12	0.0000	0.0000	4.2100	0.0100	m	
S0	T10	S12	0.0000	0.0000	3.4700		m	desel
S0	T11	P9	0.0000	0.0000	4.3000		m	desel
S0	T11	S9	0.0000	0.0000	3.7900		m	desel
S0	T11	P11	0.0000	0.0000	3.9000	0.0100	m	
S0	T11	S11	0.0000	0.0000	2.9300	0.0100	m	
S0	T11	P13	0.0000	0.0000	4.1700		m	desel
S0	T11	S13	0.0000	0.0000	3.7000		m	desel
S0	T12	P10	0.0000	0.0000	4.2800		m	desel
S0	T12	S10	0.0000	0.0000	3.6040		m	desel
S0	T12	P12	0.0000	0.0000	3.5400		m	desel
S0	T12	S12	0.0000	0.0000	2.6200	0.0100	m	
S0	T13	P11	0.0000	0.0000	4.4800	0.0100	m	
S0	T13	S11	0.0000	0.0000	3.0600		m	desel
S0	T13	P13	0.0000	0.0000	4.0000	0.0100	m	
S0	T13	S13	0.0000	0.0000	2.5000	0.0100	m	

INPUT ADDITIONAL PARAMETERS

		Value	Sd	
Scale factor	S0	1.0000000		free

ADJUSTED COORDINATES (free network)

Station		Coordinate		Corr (m)	Sd (m)
B02	X East	2.0000	*	-0.0000	0.0000
	Y North	0.1200	*	-0.0000	0.0000
	Height	-0.0000	*	-0.0000	0.0000
B01	X East	1.0000	*	-0.0000	0.0000
	Y North	-0.0000	*	-0.0000	0.0000
	Height	-0.1000	*	0.0000	0.0000
B0	X East	0.0026	*	0.0026	0.0072
	Y North	-0.0000	*	-0.0000	0.0100
	Height	-0.1800	*	-0.0000	0.0000
B1	X East	-0.9942	*	0.0058	0.0104
	Y North	0.0600	*	0.0000	0.0141
	Height	-0.2400	*	-0.4800	0.0100
B2	X East	-1.9936	*	0.0064	0.0130
	Y North	0.0550	*	0.0000	0.0173
	Height	-0.2901	*	-0.0001	0.0141
B3	X East	-2.9928	*	0.0072	0.0145
	Y North	0.0200	*	0.0000	0.0187
	Height	-0.3305	*	-0.0005	0.0158
B4	X East	-3.9872	*	0.0128	0.0166
	Y North	0.0382	*	-0.0018	0.0209
	Height	-0.3499	*	0.0001	0.0185
B5	X East	-4.9808	*	0.0192	0.0185
	Y North	0.0161	*	0.0161	0.0222
	Height	-0.3885	*	-0.0185	0.0205
B6	X East	-5.9794	*	0.0206	0.0204

Station		Coordinate		Corr (m)	Sd (m)
	Y North	0.0176	*	0.0276	0.0248
	Height	-0.4122	*	-0.0222	0.0229
B7	X East	-6.9777	*	0.0223	0.0221
	Y North	-0.0210	*	-0.0210	0.0264
	Height	-0.4210	*	-0.0260	0.0249
B8	X East	-7.9813	*	0.0187	0.0238
	Y North	-0.0301	*	0.0299	0.0289
	Height	-0.4120	*	-0.0220	0.0270
B9	X East	-8.9822	*	0.0178	0.0255
	Y North	0.0406	*	0.0206	0.0308
	Height	-0.4081	*	-0.0181	0.0288
B10	X East	-9.9808	*	0.0192	0.0273
	Y North	0.0342	*	0.0162	0.0323
	Height	-0.3283	*	-0.0183	0.0304
B11	X East	-10.9803	*	0.0197	0.0291
	Y North	0.0367	*	0.0117	0.0334
	Height	-0.2585	*	-0.0185	0.0317
B12	X East	-11.9793	*	0.0207	0.0308
	Y North	0.0810	*	0.0160	0.0352
	Height	-0.2009	*	-0.0209	0.0334
B13	X East	-12.9764	*	0.0236	0.0324
	Y North	0.0453	*	0.0203	0.0367
	Height	-0.1134	*	-0.0234	0.0349
B14	X East	-13.9747	*	0.0253	0.0341
	Y North	0.0453	*	0.0203	0.0381
	Height	-0.0434	*	-0.0234	0.0363
T2	X East	-1.9883	*	0.0117	0.0515
	Y North	0.2928	*	0.0528	0.0410
	Height	1.7071	*	-0.0029	0.0186
T3	X East	-3.2073	*	-0.2073	0.0290
	Y North	0.1708	*	0.0008	0.0404
	Height	1.6590	*	-0.0110	0.0192
T4	X East	-3.9707	*	0.0293	0.0517
	Y North	0.1156	*	-0.0544	0.0428
	Height	1.6543	*	0.0043	0.0216
T5	X East	-4.8032	*	0.1968	0.0311
	Y North	0.1537	*	0.0237	0.0413
	Height	1.6067	*	-0.0233	0.0223
T6	X East	-5.9794	*	0.0206	0.5004
	Y North	0.1727	*	0.0277	0.0557
	Height	1.5899	*	-0.0201	0.0257
T7	X East	-6.9777	*	0.0223	0.0547
	Y North	0.1091	*	0.0391	0.0565
	Height	1.5811	*	-0.0239	0.0274
T8	X East	-7.9813	*	0.0187	0.1519
	Y North	0.0900	*	0.0300	0.1525
	Height	1.5901	*	-0.0199	0.0305
T9	X East	-8.9235	*	0.0765	0.0359
	Y North	0.2749	*	0.1299	0.0445
	Height	1.5839	*	-0.0261	0.0310
T10	X East	-9.9808	*	0.0192	0.0570
	Y North	0.1743	*	0.0163	0.0594

Station		Coordinate		Corr (m)	Sd (m)
	Height	1.6738	*	-0.0162	0.0325
T11	X East	-10.9787	*	0.0213	0.0578
	Y North	0.0929	*	-0.0721	0.0449
	Height	1.7472	*	-0.0128	0.0334
T12	X East	-11.9793	*	0.0207	0.0587
	Y North	0.2211	*	0.0161	0.0611
	Height	1.8012	*	-0.0188	0.0353
T13	X East	-12.9630	*	0.0370	0.0559
	Y North	0.1627	*	-0.0023	0.0503
	Height	1.8884	*	-0.0216	0.0357
S2	X East	-0.7873		0.0093	0.0324
	Y North	2.9492		-0.0117	0.0267
	Height	-0.6262		-0.0782	0.0647
P2	X East	-2.4832		0.0057	0.0436
	Y North	-4.7345		-0.0302	0.0274
	Height	0.5453		-0.1485	0.0909
P4	X East	-3.9258		-0.0620	0.0542
	Y North	-4.5252		-0.0095	0.1713
	Height	1.1543		-0.0028	0.5145
S4	X East	-3.8662		0.0157	0.0239
	Y North	2.8402		0.0082	0.0283
	Height	0.5462		0.0240	0.0614
P3	X East	-3.2725		-0.0184	0.0440
	Y North	-4.3756		-0.0038	0.0446
	Height	1.7815		-0.0017	0.0835
S3	X East	-2.3013		0.0151	0.0329
	Y North	2.4650		-0.0014	0.0337
	Height	-1.2894		0.0009	0.0525
P5	X East	-5.1557		-0.0116	0.0335
	Y North	-4.3855		0.0019	0.0437
	Height	1.5759		0.0005	0.0846
S5	X East	-5.1188		0.0087	0.0257
	Y North	2.8253		0.0127	0.0323
	Height	-1.3908		0.0006	0.0584
P6	X East	-5.8514		0.1784	0.0496
	Y North	-4.3051		-0.0041	0.0359
	Height	0.6146		-0.1236	0.1205
S6	X East	-6.0289		-0.0237	0.0363
	Y North	2.7212		0.0089	0.0329
	Height	0.4159		0.0527	0.0808
P7	X East	-7.1022		0.0139	0.0347
	Y North	-4.2815		-0.0048	0.0415
	Height	1.0604		-0.0175	0.0928
S7	X East	-7.0264		-0.0028	0.0268
	Y North	2.3612		0.0129	0.0390
	Height	-1.4620		0.0008	0.0627
P8	X East	-7.9097		0.0583	0.0510
	Y North	-4.2588		0.0522	0.1117
	Height	1.0190		0.1850	0.3190
S8	X East	-8.0432		0.0083	0.0402
	Y North	2.1121		-0.0088	0.1107
	Height	-0.8745		-0.0414	0.4860

Station		Coordinate		Corr (m)	Sd (m)
P9	X East	-8.9180		0.0070	0.0499
	Y North	-3.9697		-0.0057	0.0469
	Height	1.5763		-0.0037	0.0773
S9	X East	-9.0855		-0.0142	0.0477
	Y North	1.8384		-0.1416	0.4743
	Height	-1.4735		-0.2898	0.7735
P10	X East	-10.0413		-0.0224	0.0496
	Y North	-3.6578		-0.0425	0.0520
	Height	1.2212		0.0012	0.1008
S10	X East	-9.9827		-0.0012	0.0359
	Y North	1.7376		-0.0316	0.0745
	Height	-0.8846		-0.1152	0.1991
P11	X East	-10.9007		0.0057	0.0393
	Y North	-3.8118		-0.0029	0.0446
	Height	1.6143		0.0030	0.0687
S11	X East	-11.0176		0.0064	0.0335
	Y North	1.3765		0.0012	0.0391
	Height	-0.8902		-0.0006	0.0420
P12	X East	-12.1595		0.0041	0.0488
	Y North	-3.3481		-0.0027	0.0510
	Height	0.8934		0.0014	0.1085
S12	X East	-11.9976		0.0043	0.0348
	Y North	1.1383		0.0011	0.0401
	Height	-0.6560		-0.0001	0.0461
P13	X East	-13.0626		0.0036	0.0496
	Y North	-3.5053		-0.1027	0.0397
	Height	0.2849		0.0016	0.0755
S13	X East	-13.0798		0.0037	0.0364
	Y North	1.0340		0.0006	0.0399
	Height	-0.4549		-0.0013	0.0420

ABSOLUTE STANDARD ELLIPSES AND CRITERION CIRCLES

C0 criterion 0.000 cm2

C1 criterion 1.000 cm2/km

Station	A (m)	B (m)	R (m)	A/B	A/R	Phi (gon)	Sd Hgt (m)
B02	0.0000	0.0000	0.0000	0.0	0.0	-8	0.0000
B01	0.0000	0.0000	0.0000	0.0	0.0	-8	0.0000
B0	0.0100	0.0072	0.0006	1.4	15.9	0	0.0000
B1	0.0141	0.0104	0.0011	1.4	12.9	2	0.0100
B2	0.0173	0.0130	0.0015	1.3	11.2	1	0.0141
B3	0.0187	0.0145	0.0020	1.3	9.4	1	0.0158
B4	0.0209	0.0166	0.0024	1.3	8.6	1	0.0185
B5	0.0222	0.0185	0.0029	1.2	7.7	1	0.0205
B6	0.0248	0.0204	0.0033	1.2	7.5	1	0.0229
B7	0.0264	0.0221	0.0038	1.2	7.0	0	0.0249
B8	0.0289	0.0238	0.0042	1.2	6.8	0	0.0270
B9	0.0308	0.0255	0.0047	1.2	6.6	0	0.0288
B10	0.0323	0.0273	0.0051	1.2	6.3	1	0.0304
B11	0.0334	0.0291	0.0056	1.1	6.0	1	0.0317
B12	0.0352	0.0308	0.0060	1.1	5.9	0	0.0334
B13	0.0367	0.0324	0.0065	1.1	5.7	0	0.0349
B14	0.0381	0.0341	0.0069	1.1	5.5	0	0.0363

Station	A (m)	B (m)	R (m)	A/B	A/R	Phi (gon)	Sd Hgt (m)
T2	0.0517	0.0409	0.0015	1.3	33.3	-93	0.0186
T3	0.0404	0.0290	0.0021	1.4	19.3	-2	0.0192
T4	0.0528	0.0413	0.0024	1.3	21.7	78	0.0216
T5	0.0413	0.0311	0.0028	1.3	14.7	2	0.0223
T6	0.5004	0.0557	0.0033	9.0	150.3	-100	0.0257
T7	0.0565	0.0547	0.0038	1.0	15.0	-1	0.0274
T8	0.1525	0.1519	0.0042	1.0	36.1	-1	0.0305
T9	0.0448	0.0356	0.0046	1.3	9.6	-12	0.0310
T10	0.0594	0.0570	0.0051	1.0	11.6	-1	0.0325
T11	0.0578	0.0449	0.0056	1.3	10.4	99	0.0334
T12	0.0611	0.0587	0.0060	1.0	10.2	-1	0.0353
T13	0.0593	0.0463	0.0064	1.3	9.2	64	0.0357
S2	0.0369	0.0200	0.0018	1.8	20.7	-61	0.0647
P2	0.0436	0.0274	0.0029	1.6	15.2	-99	0.0909
P4	0.1720	0.0522	0.0032	3.3	53.3	-6	0.5145
S4	0.0288	0.0234	0.0028	1.2	10.4	19	0.0614
P3	0.0450	0.0436	0.0030	1.0	15.1	36	0.0835
S3	0.0392	0.0261	0.0021	1.5	18.8	-48	0.0525
P5	0.0444	0.0326	0.0036	1.4	12.3	-17	0.0846
S5	0.0323	0.0256	0.0032	1.3	10.0	7	0.0584
P6	0.0502	0.0351	0.0038	1.4	13.1	-86	0.1205
S6	0.0376	0.0314	0.0036	1.2	10.5	69	0.0808
P7	0.0430	0.0328	0.0043	1.3	10.0	-26	0.0928
S7	0.0390	0.0268	0.0040	1.5	9.9	-0	0.0627
P8	0.1118	0.0507	0.0046	2.2	24.2	-4	0.3190
S8	0.1127	0.0342	0.0044	3.3	25.8	13	0.4860
P9	0.0512	0.0455	0.0050	1.1	10.3	68	0.0773
S9	0.4758	0.0284	0.0048	16.7	99.2	5	0.7735
P10	0.0551	0.0461	0.0054	1.2	10.2	41	0.1008
S10	0.0750	0.0348	0.0052	2.2	14.5	9	0.1991
P11	0.0450	0.0388	0.0058	1.2	7.8	17	0.0687
S11	0.0395	0.0331	0.0056	1.2	7.0	-17	0.0420
P12	0.0530	0.0467	0.0063	1.1	8.4	-39	0.1085
S12	0.0409	0.0339	0.0060	1.2	6.8	23	0.0461
P13	0.0503	0.0388	0.0067	1.3	7.5	-83	0.0755
S13	0.0410	0.0351	0.0065	1.2	6.3	29	0.0420

RELATIVE STANDARD ELLIPSES AND CRITERION CIRCLES

C0 criterion 0.000 cm2

C1 criterion 1.000 cm2/km

Station	Station	A (m)	B (m)	R (m)	A/B	A/R	Psi (gon)	Sd Hgt (m)
B02	B01	0.0000	0.0000	0.0000	0.0	0.0	-100	0.0000
B01	B0	0.0100	0.0072	0.0006	1.4	15.9	-100	0.0000
B0	B1	0.0100	0.0072	0.0006	1.4	15.8	-100	0.0100
B1	B2	0.0100	0.0072	0.0006	1.4	15.8	-100	0.0100
B2	B3	0.0071	0.0058	0.0006	1.2	11.2	-100	0.0071
B3	B4	0.0093	0.0071	0.0006	1.3	14.8	-99	0.0096
B4	B5	0.0093	0.0071	0.0006	1.3	14.8	-100	0.0096
B5	B6	0.0090	0.0070	0.0006	1.3	14.3	100	0.0098
B6	B7	0.0090	0.0070	0.0006	1.3	14.3	100	0.0098
B7	B8	0.0094	0.0071	0.0006	1.3	14.8	99	0.0099
B8	B9	0.0094	0.0071	0.0006	1.3	14.8	99	0.0099

Station	Station	A (m)	B (m)	R (m)	A/B	A/R	Psi (gon)	Sd Hgt (m)
B9	B10	0.0096	0.0072	0.0006	1.3	15.2	98	0.0097
B10	B11	0.0096	0.0072	0.0006	1.3	15.2	98	0.0097
B11	B12	0.0096	0.0071	0.0006	1.3	15.2	-97	0.0099
B12	B13	0.0096	0.0072	0.0006	1.3	15.2	-98	0.0099
B13	B14	0.0100	0.0072	0.0006	1.4	15.9	-100	0.0100
B2	T2	0.0500	0.0370	0.0002	1.4	206.3	-95	0.0121
B3	T3	0.0358	0.0253	0.0003	1.4	139.1	59	0.0111
B4	T4	0.0500	0.0360	0.0001	1.4	382.6	68	0.0113
B5	T5	0.0357	0.0254	0.0002	1.4	152.3	-58	0.0109
B6	T6	0.5000	0.0499	0.0002	10.0	2642.4	100	0.0118
B7	T7	0.0500	0.0499	0.0002	1.0	291.7	-100	0.0116
B8	T8	0.1500	0.1497	0.0002	1.0	914.8	99	0.0145
B9	T9	0.0329	0.0265	0.0002	1.2	134.5	-39	0.0116
B10	T10	0.0500	0.0499	0.0002	1.0	279.8	-100	0.0117
B11	T11	0.0500	0.0314	0.0001	1.6	459.0	97	0.0110
B12	T12	0.0500	0.0499	0.0002	1.0	279.8	-100	0.0117
B13	T13	0.0497	0.0292	0.0002	1.7	306.0	63	0.0077
B2	S2	0.0345	0.0132	0.0016	2.6	22.1	-93	0.0632
B4	S2	0.0364	0.0142	0.0021	2.6	17.7	94	0.0649
T2	S2	0.0593	0.0462	0.0015	1.3	40.6	95	0.0587
B2	P2	0.0418	0.0211	0.0024	2.0	17.6	98	0.0898
B4	P2	0.0418	0.0220	0.0024	1.9	17.2	-92	0.0899
T4	P2	0.0650	0.0253	0.0025	2.6	26.4	-99	0.0913
B2	P4	0.1711	0.0504	0.0024	3.4	70.0	-31	0.5143
B2	S4	0.0239	0.0177	0.0017	1.3	13.9	73	0.0598
B3	P3	0.0417	0.0405	0.0022	1.0	19.1	-99	0.0820
B3	S3	0.0355	0.0212	0.0013	1.7	26.9	-73	0.0500
B3	P5	0.0408	0.0276	0.0024	1.5	16.9	-51	0.0832
B3	S5	0.0267	0.0197	0.0018	1.4	14.9	59	0.0562
B4	P4	0.1708	0.0496	0.0023	3.4	75.9	-5	0.5142
B4	S4	0.0214	0.0193	0.0015	1.1	14.7	15	0.0586
B4	P6	0.0476	0.0278	0.0023	1.7	20.4	89	0.1196
B4	S6	0.0337	0.0232	0.0017	1.4	19.6	-85	0.0781
B5	P3	0.0442	0.0387	0.0023	1.1	19.2	70	0.0825
B5	S3	0.0378	0.0198	0.0018	1.9	21.1	-97	0.0521
B5	P5	0.0385	0.0292	0.0022	1.3	17.7	-15	0.0823
B5	S5	0.0243	0.0200	0.0015	1.2	16.6	-11	0.0549
B5	P7	0.0371	0.0249	0.0024	1.5	15.7	-62	0.0889
B5	S7	0.0299	0.0180	0.0016	1.7	18.7	47	0.0576
B6	P4	0.1711	0.0497	0.0024	3.4	70.5	22	0.5140
B6	S4	0.0241	0.0186	0.0018	1.3	13.7	-68	0.0594
B6	P6	0.0470	0.0276	0.0021	1.7	21.9	-82	0.1197
B6	S6	0.0327	0.0221	0.0014	1.5	23.2	74	0.0782
B6	P8	0.1089	0.0450	0.0023	2.4	47.2	-31	0.3182
B6	S8	0.1098	0.0269	0.0015	4.1	72.1	63	0.4854
B7	P5	0.0394	0.0298	0.0023	1.3	17.0	26	0.0833
B7	S5	0.0266	0.0186	0.0017	1.4	15.6	-65	0.0567
B7	P7	0.0351	0.0267	0.0021	1.3	16.6	-27	0.0898
B7	S7	0.0289	0.0178	0.0013	1.6	22.8	-6	0.0592
B7	P9	0.0451	0.0373	0.0022	1.2	20.7	61	0.0731
B7	S9	0.4735	0.0153	0.0015	31.0	323.4	59	0.7735
B8	P6	0.0451	0.0296	0.0023	1.5	19.3	-72	0.1212

Station	Station	A (m)	B (m)	R (m)	A/B	A/R	Psi (gon)	Sd Hgt (m)
B8	S6	0.0303	0.0249	0.0017	1.2	17.8	67	0.0806
B8	P8	0.1080	0.0459	0.0021	2.4	51.5	-1	0.3179
B8	S8	0.1087	0.0251	0.0012	4.3	94.0	15	0.4857
B8	P10	0.0464	0.0395	0.0021	1.2	22.4	19	0.0972
B8	S10	0.0691	0.0248	0.0014	2.8	49.3	64	0.1973
B9	P7	0.0341	0.0283	0.0023	1.2	14.7	24	0.0913
B9	S7	0.0316	0.0170	0.0016	1.9	20.4	-59	0.0604
B9	P9	0.0441	0.0353	0.0020	1.2	22.0	95	0.0718
B9	S9	0.4701	0.0154	0.0010	30.5	469.4	9	0.7757
B9	P11	0.0323	0.0284	0.0021	1.1	15.1	-35	0.0624
B9	S11	0.0248	0.0206	0.0013	1.2	19.2	35	0.0305
B10	P8	0.1088	0.0468	0.0023	2.3	46.6	26	0.3182
B10	S8	0.1096	0.0252	0.0015	4.3	74.7	-35	0.4858
B10	P10	0.0447	0.0381	0.0019	1.2	24.1	57	0.0962
B10	S10	0.0673	0.0229	0.0010	2.9	70.3	11	0.1980
B10	P12	0.0441	0.0321	0.0020	1.4	22.0	-82	0.1042
B10	S12	0.0261	0.0129	0.0012	2.0	21.2	99	0.0347
B11	P9	0.0451	0.0341	0.0022	1.3	20.3	99	0.0731
B11	S9	0.4739	0.0163	0.0014	29.0	346.9	-46	0.7734
B11	P11	0.0323	0.0266	0.0019	1.2	16.8	35	0.0611
B11	S11	0.0214	0.0175	0.0008	1.2	27.1	-47	0.0283
B11	P13	0.0391	0.0159	0.0020	2.5	19.1	87	0.0687
B11	S13	0.0229	0.0117	0.0012	2.0	18.5	-92	0.0269
B12	P10	0.0490	0.0342	0.0021	1.4	23.4	77	0.0972
B12	S10	0.0692	0.0225	0.0014	3.1	51.0	-48	0.1981
B12	P12	0.0399	0.0353	0.0017	1.1	22.9	-71	0.1051
B12	S12	0.0217	0.0156	0.0007	1.4	32.9	50	0.0318
B13	P11	0.0355	0.0240	0.0022	1.5	16.4	69	0.0619
B13	S11	0.0257	0.0152	0.0013	1.7	20.4	-91	0.0315
B13	P13	0.0388	0.0143	0.0018	2.7	21.7	-96	0.0685
B13	S13	0.0199	0.0122	0.0006	1.6	31.6	70	0.0221
T2	P2	0.0651	0.0266	0.0025	2.5	26.3	100	0.0941
T2	P4	0.1753	0.0707	0.0025	2.5	68.9	-31	0.5144
T2	S4	0.0535	0.0302	0.0016	1.8	32.8	-57	0.0579
T3	P3	0.0463	0.0160	0.0022	2.9	20.6	98	0.0845
T3	S3	0.0580	0.0383	0.0013	1.5	45.1	-38	0.0472
T3	P5	0.0373	0.0164	0.0024	2.3	15.3	97	0.0857
T3	S5	0.0566	0.0308	0.0017	1.8	33.7	37	0.0538
T4	S2	0.0581	0.0489	0.0020	1.2	28.6	70	0.0653
T4	P4	0.1747	0.0701	0.0023	2.5	76.4	-5	0.5143
T4	S4	0.0524	0.0239	0.0014	2.2	37.0	94	0.0567
T4	P6	0.0687	0.0246	0.0024	2.8	29.1	85	0.1212
T4	S6	0.0624	0.0252	0.0017	2.5	36.7	-83	0.0776
T5	P3	0.0432	0.0164	0.0023	2.6	18.5	-96	0.0849
T5	S3	0.0588	0.0330	0.0017	1.8	34.7	-60	0.0503
T5	P5	0.0377	0.0157	0.0022	2.4	16.8	-99	0.0844
T5	S5	0.0554	0.0331	0.0014	1.7	39.4	4	0.0522
T5	P7	0.0410	0.0183	0.0024	2.2	16.8	99	0.0908
T5	S7	0.0591	0.0310	0.0016	1.9	36.6	43	0.0553
T6	P4	0.5126	0.0199	0.0025	25.8	205.9	-95	0.5149
T6	S4	0.5004	0.0549	0.0017	9.1	293.8	57	0.0602
T6	P6	0.5021	0.0579	0.0022	8.7	227.1	-98	0.1203

Station	Station	A (m)	B (m)	R (m)	A/B	A/R	Psi (gon)	Sd Hgt (m)
T6	S6	0.5010	0.0554	0.0013	9.0	373.9	-99	0.0792
T6	P8	0.5021	0.1197	0.0024	4.2	211.7	74	0.3183
T6	S8	0.4887	0.0633	0.0015	7.7	331.3	-34	0.4850
T7	P5	0.0636	0.0582	0.0024	1.1	26.9	25	0.0836
T7	S5	0.0566	0.0533	0.0017	1.1	34.1	-68	0.0580
T7	P7	0.0611	0.0567	0.0022	1.1	28.1	-27	0.0904
T7	S7	0.0576	0.0531	0.0012	1.1	47.8	-6	0.0607
T7	P9	0.0673	0.0624	0.0022	1.1	30.2	62	0.0736
T7	S9	0.4762	0.0523	0.0014	9.1	333.9	61	0.7743
T8	P6	0.1566	0.1527	0.0024	1.0	65.7	-72	0.1221
T8	S6	0.1530	0.1518	0.0017	1.0	92.4	65	0.0820
T8	P8	0.1569	0.0451	0.0022	3.5	72.9	-100	0.3268
T8	S8	0.1851	0.1521	0.0011	1.2	167.8	15	0.4860
T8	P10	0.1569	0.1550	0.0021	1.0	74.0	24	0.0980
T8	S10	0.2024	0.1374	0.0014	1.5	148.3	41	0.1915
T9	P7	0.0471	0.0389	0.0024	1.2	19.6	16	0.0918
T9	S7	0.0456	0.0310	0.0015	1.5	31.4	-65	0.0619
T9	P9	0.0476	0.0154	0.0021	3.1	22.6	99	0.0748
T9	S9	0.4715	0.0323	0.0009	14.6	525.6	12	0.7764
T9	P11	0.0372	0.0159	0.0022	2.3	16.6	98	0.0661
T9	S11	0.0460	0.0259	0.0013	1.8	36.5	65	0.0306
T10	P8	0.1197	0.0685	0.0024	1.7	50.0	26	0.3183
T10	S8	0.1204	0.0560	0.0014	2.1	84.7	-38	0.4860
T10	P10	0.0654	0.0176	0.0019	3.7	34.1	-99	0.0996
T10	S10	0.0837	0.0550	0.0009	1.5	93.8	11	0.1985
T10	P12	0.0663	0.0234	0.0021	2.8	32.2	96	0.1070
T10	S12	0.0563	0.0516	0.0012	1.1	46.9	-96	0.0369
T11	P9	0.0660	0.0252	0.0022	2.6	29.4	-73	0.0747
T11	S9	0.4739	0.0524	0.0013	9.0	351.5	-47	0.7743
T11	P11	0.0574	0.0147	0.0020	3.9	29.4	-100	0.0617
T11	S11	0.0537	0.0443	0.0008	1.2	70.3	-94	0.0265
T11	P13	0.0628	0.0316	0.0021	2.0	30.4	74	0.0694
T11	S13	0.0528	0.0386	0.0012	1.4	42.9	-38	0.0298
T12	P10	0.0700	0.0606	0.0021	1.2	32.6	76	0.0977
T12	S10	0.0853	0.0548	0.0013	1.6	64.7	-51	0.1987
T12	P12	0.0640	0.0612	0.0018	1.0	35.5	-71	0.1056
T12	S12	0.0633	0.0530	0.0006	1.2	107.0	12	0.0275
T13	P11	0.0599	0.0164	0.0022	3.7	27.2	100	0.0626
T13	S11	0.0518	0.0432	0.0012	1.2	42.3	-2	0.0324
T13	P13	0.0590	0.0310	0.0018	1.9	32.0	92	0.0692
T13	S13	0.0555	0.0340	0.0006	1.6	96.7	70	0.0207

ADJUSTED ADDITIONAL PARAMETERS

		Adj val	Corr	Sd
Scale factor	S0	1.0010928	0.0010928	0.0027730

ADJUSTED OBSERVATIONS

	Station	Target	Adj obs	Resid	Sd	
S0	B02	B01	1.0109	-0.0109	0.0028	m
DE(shift)	B13	T13	0.0134	-0.0134	0.0462	m
DN(shift)	B13	T13	0.1174	0.0226	0.0345	m

	Station	Target	Adj obs	Resid	Sd	
DH(shift)	B13	T13	2.0018	-0.0018	0.0077	m
DE(shift)	B11	B12	-0.9990	0.0020	0.0072	m
DN(shift)	B11	B12	0.0443	-0.0043	0.0096	m
DH(shift)	B11	B12	0.0575	0.0025	0.0099	m
DE(shift)	B02	B01	-1.0000	0.0120	0.0000	m
DN(shift)	B02	B01	-0.1200	-0.0000	0.0000	m
DH(shift)	B02	B01	-0.1000	-0.0000	0.0000	m
DE(shift)	B2	B3	-0.9992	0.0002	0.0059	m
DN(shift)	B2	B3	-0.0350	0.0000	0.0071	m
DH(shift)	B2	B3	-0.0404	0.0004	0.0071	m
DE(shift)	B3	B4	-0.9944	-0.0056	0.0071	m
DN(shift)	B3	B4	0.0182	0.0018	0.0093	m
DH(shift)	B3	B4	-0.0193	-0.0007	0.0096	m
DE(shift)	B5	B6	-0.9986	-0.0004	0.0070	m
DN(shift)	B5	B6	0.0015	-0.0115	0.0090	m
DH(shift)	B5	B6	-0.0238	0.0038	0.0098	m
DE(shift)	B10	B11	-0.9995	0.0015	0.0072	m
DN(shift)	B10	B11	0.0025	0.0045	0.0096	m
DH(shift)	B10	B11	0.0698	0.0002	0.0097	m
DE(shift)	B01	B0	-0.9974	0.0004	0.0072	m
DN(shift)	B01	B0	-0.0000	0.0000	0.0100	m
DH(shift)	B01	B0	-0.0800	0.0000	0.0000	m
DE(shift)	B1	B2	-0.9994	0.0004	0.0072	m
DN(shift)	B1	B2	-0.0050	0.0000	0.0100	m
DH(shift)	B1	B2	-0.0500	0.0000	0.0100	m
DE(shift)	B2	B3	-0.9992	0.0002	0.0059	m
DN(shift)	B2	B3	-0.0350	0.0000	0.0071	m
DH(shift)	B2	B3	-0.0404	0.0004	0.0071	m
DE(shift)	B6	B7	-0.9984	-0.0006	0.0070	m
DN(shift)	B6	B7	-0.0386	-0.0114	0.0090	m
DH(shift)	B6	B7	-0.0088	0.0038	0.0098	m
S0	B01	B0	0.9996	0.0004	0.0072	m
S0	B0	B1	0.9993	0.0007	0.0072	m
S0	B1	B2	0.9996	0.0004	0.0072	m
S0	B2	B3	0.9996	0.0004	0.0061	m
S0	B3	B4	0.9936	0.0064	0.0070	m
S0	B4	B5	0.9934	0.0066	0.0070	m
S0	B5	B6	0.9978	0.0022	0.0069	m
S0	B6	B7	0.9981	0.0019	0.0069	m
S0	B7	B8	1.0025	-0.0025	0.0070	m
S0	B8	B9	1.0023	-0.0023	0.0070	m
S0	B9	B10	1.0007	-0.0007	0.0071	m
S0	B10	B11	1.0009	-0.0009	0.0071	m
S0	B11	B12	1.0005	-0.0005	0.0071	m
S0	B12	B13	1.0005	-0.0005	0.0071	m
S0	B13	B14	0.9997	0.0003	0.0072	m
DE(shift)	B0	B1	-0.9967	0.0007	0.0072	m
DN(shift)	B0	B1	0.0600	-0.0000	0.0100	m
DH(shift)	B0	B1	-0.0600	0.0000	0.0100	m
DE(shift)	B9	B10	-0.9986	0.0016	0.0072	m
DN(shift)	B9	B10	-0.0064	0.0044	0.0096	m
DH(shift)	B9	B10	0.0798	0.0002	0.0097	m

	Station	Target	Adj obs	Resid	Sd	
DE(shift)	B7	B8	-1.0036	0.0036	0.0071	m
DN(shift)	B7	B8	-0.0091	0.0091	0.0094	m
DH(shift)	B7	B8	0.0090	-0.0040	0.0099	m
DE(shift)	B8	B9	-1.0009	0.0039	0.0071	m
DN(shift)	B8	B9	0.0708	0.0092	0.0093	m
DH(shift)	B8	B9	0.0040	-0.0040	0.0099	m
DE(shift)	B4	B5	-0.9936	-0.0054	0.0071	m
DN(shift)	B4	B5	-0.0220	0.0020	0.0093	m
DH(shift)	B4	B5	-0.0386	-0.0014	0.0096	m
DE(shift)	B12	B13	-0.9971	0.0021	0.0072	m
DN(shift)	B12	B13	-0.0357	-0.0043	0.0096	m
DH(shift)	B12	B13	0.0875	0.0025	0.0099	m
DE(shift)	B13	B14	-0.9983	0.0003	0.0072	m
DN(shift)	B13	B14	0.0000	-0.0000	0.0100	m
DH(shift)	B13	B14	0.0700	-0.0000	0.0100	m
DE(shift)	B02	B01	-1.0000	0.0120	0.0000	m
DN(shift)	B02	B01	-0.1200	-0.0000	0.0000	m
DH(shift)	B02	B01	-0.1000	-0.0000	0.0000	m
S0	B2	T2	2.0091	-0.0006	0.0098	m
S0	B3	T3	2.0045	0.0011	0.0096	m
S0	B4	T4	2.0035	0.0007	0.0098	m
S0	B5	T5	2.0055	-0.0013	0.0096	m
S0	B6	T6	2.0059	0.0001	0.0098	m
S0	B7	T7	2.0041	0.0001	0.0098	m
S0	B8	T8	2.0036	0.0000	0.0100	m
S0	B9	T9	2.0044	-0.0005	0.0097	m
S0	B10	T10	2.0048	0.0001	0.0098	m
S0	B11	T11	2.0043	0.0006	0.0096	m
S0	B12	T12	2.0048	0.0001	0.0098	m
S0	B13	T13	2.0031	0.0018	0.0076	m
DE(shift)	B02	B01	-1.0000	0.0120	0.0000	m
DN(shift)	B02	B01	-0.1200	-0.0000	0.0000	m
DH(shift)	B02	B01	-0.1000	-0.0000	0.0000	m
DE(shift)	B2	T2	0.0053	-0.0053	0.0499	m
DN(shift)	B2	T2	0.2377	-0.0527	0.0372	m
DH(shift)	B2	T2	1.9972	0.0028	0.0121	m
DE(shift)	B3	T3	-0.2145	0.2145	0.0253	m
DN(shift)	B3	T3	0.1508	-0.0008	0.0358	m
DH(shift)	B3	T3	1.9895	0.0105	0.0111	m
DE(shift)	B4	T4	0.0164	-0.0164	0.0489	m
DN(shift)	B4	T4	0.0774	0.0526	0.0374	m
DH(shift)	B4	T4	2.0042	-0.0042	0.0113	m
DE(shift)	B5	T5	0.1775	-0.1775	0.0254	m
DN(shift)	B5	T5	0.1376	-0.0076	0.0357	m
DH(shift)	B5	T5	1.9951	0.0049	0.0109	m
DE(shift)	B6	T6	0.0000	-0.0000	0.5000	m
DN(shift)	B6	T6	0.1552	-0.0002	0.0499	m
DH(shift)	B6	T6	2.0021	-0.0021	0.0118	m
DE(shift)	B7	T7	-0.0000	0.0000	0.0500	m
DN(shift)	B7	T7	0.1301	-0.0001	0.0499	m
DH(shift)	B7	T7	2.0021	-0.0021	0.0116	m
DE(shift)	B8	T8	-0.0000	0.0000	0.1500	m

	Station	Target	Adj obs	Resid	Sd	
DN(shift)	B8	T8	0.1201	-0.0001	0.1497	m
DH(shift)	B8	T8	2.0022	-0.0022	0.0145	m
DE(shift)	B9	T9	0.0587	-0.0587	0.0274	m
DN(shift)	B9	T9	0.2343	-0.1093	0.0322	m
DH(shift)	B9	T9	1.9920	0.0080	0.0116	m
DE(shift)	B10	T10	-0.0000	0.0000	0.0500	m
DN(shift)	B10	T10	0.1401	-0.0001	0.0499	m
DH(shift)	B10	T10	2.0021	-0.0021	0.0117	m
DE(shift)	B11	T11	0.0017	-0.0017	0.0500	m
DN(shift)	B11	T11	0.0562	0.0838	0.0314	m
DH(shift)	B11	T11	2.0057	-0.0057	0.0110	m
DE(shift)	B12	T12	-0.0000	0.0000	0.0500	m
DN(shift)	B12	T12	0.1401	-0.0001	0.0499	m
DH(shift)	B12	T12	2.0021	-0.0021	0.0117	m
S0	B2	S2	3.1500	0.0000	0.0071	m
S0	B4	S2	4.3300	0.0000	0.0071	m
S0	T2	S2	3.7300	-0.0000	0.0071	m
S0	B2	P2	4.8811	-0.0011	0.0070	m
S0	B4	P2	5.0779	0.0021	0.0097	m
S0	T4	P2	5.1872	-0.0022	0.0097	m
S0	B2	P2	4.8811	-0.0011	0.0070	m
S0	B2	S2	3.1500	0.0000	0.0071	m
S0	B2	S4	3.4550	0.0000	0.0100	m
S0	B3	P3	4.8793	-0.0073	0.0095	m
S0	B3	S3	2.7129	-0.0029	0.0099	m
S0	B3	P5	5.2593	0.0007	0.0091	m
S0	B3	S5	3.6721	-0.0071	0.0091	m
S0	B4	P2	5.0779	0.0021	0.0097	m
S0	B4	S2	4.3300	0.0000	0.0071	m
S0	B4	P4	4.8000	-0.0000	0.0100	m
S0	B5	P3	5.1822	0.0078	0.0094	m
S0	B5	S3	3.7360	0.0040	0.0098	m
S0	B5	P5	4.8180	0.0070	0.0075	m
S0	B5	S5	2.9825	0.0155	0.0078	m
S0	B5	P7	5.0015	-0.0015	0.0093	m
S0	B5	S7	3.2882	0.0118	0.0092	m
S0	B6	P4	5.2200	-0.0000	0.0100	m
S0	B6	S4	3.6500	0.0000	0.0100	m
S0	B6	P6	4.4400	0.0000	0.0100	m
S0	B6	S6	2.8250	-0.0000	0.0100	m
S0	B6	P8	4.9000	-0.0000	0.0100	m
S0	B7	P5	5.1282	-0.0082	0.0093	m
S0	B7	S5	3.5314	-0.0114	0.0093	m
S0	B7	P7	4.5074	0.0026	0.0077	m
S0	B7	S7	2.5972	-0.0172	0.0081	m
S0	B7	S9	2.9980	-0.0000	0.0100	m
S0	B8	P6	4.8800	-0.0000	0.0100	m
S0	B8	S6	3.4700	0.0000	0.0100	m
S0	B8	P8	4.4600	0.0000	0.0100	m
S0	B8	S8	2.1900	-0.0000	0.0100	m
S0	B9	P7	4.9314	-0.0014	0.0094	m
S0	B9	S7	3.2091	0.0109	0.0093	m

	Station	Target	Adj obs	Resid	Sd	
S0	B9	P9	4.4700	-0.0000	0.0100	m
S0	B9	S9	2.0900	0.0000	0.0100	m
S0	B9	P11	4.7500	0.0000	0.0093	m
S0	B10	S8	2.8900	0.0000	0.0100	m
S0	B10	P10	4.0000	-0.0000	0.0100	m
S0	B10	S10	1.7900	0.0000	0.0100	m
S0	B10	P12	4.2000	-0.0000	0.0100	m
S0	B10	S12	2.3200	0.0000	0.0100	m
S0	B11	P9	4.8600	0.0000	0.0100	m
S0	B11	S9	2.8800	-0.0000	0.0100	m
S0	B11	P11	4.2761	-0.0061	0.0079	m
S0	B11	S11	1.4801	-0.0001	0.0100	m
S0	B11	P13	4.1400	-0.0000	0.0100	m
S0	B11	S13	2.3300	0.0000	0.0100	m
S0	B12	P10	4.4400	-0.0000	0.0100	m
S0	B12	S10	2.6800	-0.0000	0.0100	m
S0	B12	P12	3.6000	0.0000	0.0100	m
S0	B12	S12	1.1500	-0.0000	0.0100	m
S0	B13	P11	4.7034	0.0066	0.0093	m
S0	B13	S11	2.4898	0.0002	0.0098	m
S0	B13	P13	3.5700	-0.0000	0.0100	m
S0	B13	S13	1.0500	0.0000	0.0100	m
S0	T2	P2	5.1778	0.0022	0.0099	m
S0	T2	S2	3.7300	-0.0000	0.0071	m
S0	T3	P3	4.5435	0.0085	0.0093	m
S0	T3	S3	3.8399	0.0051	0.0096	m
S0	T3	P5	4.9507	-0.0107	0.0092	m
S0	T3	S5	4.4674	-0.0074	0.0095	m
S0	T4	P2	5.1872	-0.0022	0.0097	m
S0	T4	S4	2.9400	-0.0000	0.0100	m
S0	T4	P6	4.9100	-0.0000	0.0100	m
S0	T4	S6	3.5400	-0.0000	0.0100	m
S0	T5	P3	4.7789	-0.0089	0.0092	m
S0	T5	S3	4.4660	-0.0060	0.0095	m
S0	T5	P5	4.5480	0.0100	0.0093	m
S0	T5	S5	4.0232	0.0068	0.0096	m
S0	T5	P7	5.0199	0.0001	0.0100	m
S0	T5	S7	4.3806	-0.0006	0.0100	m
S0	T6	P4	5.1400	-0.0000	0.0100	m
S0	T6	S8	3.7500	-0.0000	0.0100	m
S0	T8	P8	4.3820	0.0000	0.0100	m
S0	T8	S10	3.5800	-0.0000	0.0100	m
S0	T9	P9	4.2400	0.0000	0.0100	m
S0	T9	P11	4.5350	0.0050	0.0099	m
S0	T9	S11	3.4197	0.0003	0.0097	m
S0	T10	P10	3.8550	-0.0000	0.0100	m
S0	T10	P12	4.2100	0.0000	0.0100	m
S0	T11	P11	3.9035	-0.0035	0.0099	m
S0	T11	S11	2.9303	-0.0003	0.0098	m
S0	T12	S12	2.6200	0.0000	0.0100	m
S0	T13	P11	4.4811	-0.0011	0.0099	m
S0	T13	P13	4.0000	0.0000	0.0100	m

	Station	Target	Adj obs	Resid	Sd	
S0	T13	S13	2.5000	0.0000	0.0100	m

TEST OF OBSERVATIONS

	Station	Target	MDB		MDBn	Red	BNR	W-test	Est err	T-test	Est err (m)	
S0	B02	B01	0.0430	m	4.3	92	1.2	-1.15				
DE(shift)	B13	T13	0.5420	m	10.8	15	10.0	-0.70		0.00		
DN(shift)	B13	T13	0.2853	m	5.7	52	3.9	0.62				
DH(shift)	B13	T13	0.0642	m	6.4	41	4.9	-0.27				
DE(shift)	B11	B12	0.0592	m	5.9	49	4.2	0.29		1.01		
DN(shift)	B11	B12	0.1482	m	14.8	8	14.2	-1.52				
DH(shift)	B11	B12	0.2717	m	27.2	2	26.9	1.61				
DE(shift)	B02	B01	0.0413	m	4.1	100	0.0	1.20		0.48		
DN(shift)	B02	B01	0.0413	m	4.1	100	0.0	-0.00				
DH(shift)	B02	B01	0.0413	m	4.1	100	0.0	-0.00				
DE(shift)	B2	B3	0.0510	m	5.1	66	3.0	0.03		0.00		
DN(shift)	B2	B3	0.0584	m	5.8	50	4.1	0.01				
DH(shift)	B2	B3	0.0584	m	5.8	50	4.1	0.06				
DE(shift)	B3	B4	0.0586	m	5.9	50	4.2	-0.80		0.28		
DN(shift)	B3	B4	0.1115	m	11.2	14	10.4	0.50				
DH(shift)	B3	B4	0.1537	m	15.4	7	14.8	-0.24				
DE(shift)	B5	B6	0.0582	m	5.8	50	4.1	-0.05		**5.30**	0.0363	
DN(shift)	B5	B6	0.0950	m	9.5	19	8.6	-2.63			-0.5658	
DH(shift)	B5	B6	0.2379	m	23.8	3	23.4	2.18			-1.2858	
DE(shift)	B10	B11	0.0592	m	5.9	49	4.2	0.22		1.60		
DN(shift)	B10	B11	0.1489	m	14.9	8	14.3	1.60				
DH(shift)	B10	B11	0.1818	m	18.2	5	17.7	0.10				
DE(shift)	B01	B0	0.0597	m	6.0	48	4.3	0.06				
DN(shift)	B01	B0		m								free obs
DH(shift)	B01	B0	0.0413	m	4.1	100	0.0	0.00				
DE(shift)	B1	B2	0.0597	m	6.0	48	4.3	0.06				
DN(shift)	B1	B2		m								free obs
DH(shift)	B1	B2	1.1922	m	119.2	0	119.2	0.06				
DE(shift)	B2	B3	0.0510	m	5.1	66	3.0	0.03		0.00		
DN(shift)	B2	B3	0.0584	m	5.8	50	4.1	0.01				
DH(shift)	B2	B3	0.0584	m	5.8	50	4.1	0.06				
DE(shift)	B6	B7	0.0582	m	5.8	50	4.1	-0.09		**5.41**	0.0395	
DN(shift)	B6	B7	0.0949	m	9.5	19	8.5	-2.61			-0.5836	
DH(shift)	B6	B7	0.2381	m	23.8	3	23.4	2.16			-1.3284	
S0	B01	B0	0.0594	m	5.9	48	4.3	0.06				
S0	B0	B1	0.0595	m	6.0	48	4.3	0.11				
S0	B1	B2	0.0595	m	6.0	48	4.3	0.06				
S0	B2	B3	0.0519	m	5.2	63	3.1	0.06				
S0	B3	B4	0.0578	m	5.8	51	4.0	0.89				
S0	B4	B5	0.0578	m	5.8	51	4.0	0.92				
S0	B5	B6	0.0567	m	5.7	53	3.9	0.30				
S0	B6	B7	0.0567	m	5.7	53	3.9	0.27				
S0	B7	B8	0.0579	m	5.8	51	4.1	-0.36				
S0	B8	B9	0.0580	m	5.8	51	4.1	-0.32				
S0	B9	B10	0.0587	m	5.9	50	4.2	-0.11				
S0	B10	B11	0.0587	m	5.9	49	4.2	-0.12				
S0	B11	B12	0.0586	m	5.9	50	4.2	-0.08				

	Station	Target	MDB		MDBn	Red	BNR	W-test	Est err	T-test	Est err (m)	
S0	B12	B13	0.0587	m	5.9	49	4.2	-0.07				
S0	B13	B14	0.0595	m	6.0	48	4.3	0.05				
DE(shift)	B0	B1	0.0598	m	6.0	48	4.3	0.11		0.00		
DN(shift)	B0	B1	0.9929	m	99.3	0	99.2	-0.11				
DH(shift)	B0	B1	0.9929	m	99.3	0	99.2	0.11				
DE(shift)	B9	B10	0.0593	m	5.9	49	4.2	0.23		1.60		
DN(shift)	B9	B10	0.1492	m	14.9	8	14.3	1.61				
DH(shift)	B9	B10	0.1805	m	18.1	5	17.6	0.10				
DE(shift)	B7	B8	0.0587	m	5.9	49	4.2	0.51		3.36		
DN(shift)	B7	B8	0.1173	m	11.7	12	11.0	2.57				
DH(shift)	B7	B8	0.2983	m	29.8	2	29.5	-2.86				
DE(shift)	B8	B9	0.0588	m	5.9	49	4.2	0.55		3.36		
DN(shift)	B8	B9	0.1159	m	11.6	13	10.8	2.59				
DH(shift)	B8	B9	0.2978	m	29.8	2	29.5	-2.87				
DE(shift)	B4	B5	0.0586	m	5.9	50	4.2	-0.77		0.32		
DN(shift)	B4	B5	0.1113	m	11.1	14	10.3	0.55				
DH(shift)	B4	B5	0.1562	m	15.6	7	15.1	-0.53				
DE(shift)	B12	B13	0.0593	m	5.9	49	4.2	0.30		1.03		
DN(shift)	B12	B13	0.1458	m	14.6	8	14.0	-1.51				
DH(shift)	B12	B13	0.2594	m	25.9	3	25.6	1.55				
DE(shift)	B13	B14	0.0597	m	6.0	48	4.3	0.05				
DN(shift)	B13	B14		m								free obs
DH(shift)	B13	B14	0.8518	m	85.2	0	85.1	-0.05				
DE(shift)	B02	B01	0.0413	m	4.1	100	0.0	1.20		0.48		
DN(shift)	B02	B01	0.0413	m	4.1	100	0.0	-0.00				
DH(shift)	B02	B01	0.0413	m	4.1	100	0.0	-0.00				
S0	B2	T2	0.2061	m	20.6	4	20.2	-0.31				
S0	B3	T3	0.1464	m	14.6	8	14.0	0.40				
S0	B4	T4	0.2086	m	20.9	4	20.4	0.33				
S0	B5	T5	0.1478	m	14.8	8	14.2	-0.47				
S0	B6	T6	0.2117	m	21.2	4	20.8	0.04				
S0	B7	T7	0.2117	m	21.2	4	20.8	0.04				
S0	B8	T8	0.6209	m	62.1	0	61.9	0.01				
S0	B9	T9	0.1642	m	16.4	6	15.9	-0.20				
S0	B10	T10	0.2117	m	21.2	4	20.8	0.04				
S0	B11	T11	0.1583	m	15.8	7	15.3	0.22				
S0	B12	T12	0.2117	m	21.2	4	20.8	0.04				
S0	B13	T13	0.0639	m	6.4	42	4.9	0.28				
DE(shift)	B02	B01	0.0413	m	4.1	100	0.0	1.20		0.48		
DN(shift)	B02	B01	0.0413	m	4.1	100	0.0	-0.00				
DH(shift)	B02	B01	0.0413	m	4.1	100	0.0	-0.00				
DE(shift)	B2	T2	3.0849	m	61.7	0	61.6	-1.59		0.00		
DN(shift)	B2	T2	0.3089	m	6.2	45	4.6	-1.58				
DH(shift)	B2	T2	0.2129	m	4.3	94	1.0	0.06				
DE(shift)	B3	T3	0.2395	m	4.8	74	2.4	**4.97**	0.2882	**8.27**	0.2884	
DN(shift)	B3	T3	0.2959	m	5.9	49	4.2	-0.02			-0.0080	
DH(shift)	B3	T3	0.2119	m	4.2	95	0.9	0.22			0.0128	
DE(shift)	B4	T4	0.9995	m	20.0	4	19.6	-1.59		0.84		
DN(shift)	B4	T4	0.3114	m	6.2	44	4.7	1.58				
DH(shift)	B4	T4	0.2121	m	4.2	95	1.0	-0.09				
DE(shift)	B5	T5	0.2399	m	4.8	74	2.4	**-4.12**	-0.2393	**5.68**	-0.2393	
DN(shift)	B5	T5	0.2948	m	5.9	49	4.2	-0.22			-0.0167	

	Station	Target	MDB		MDBn	Red	BNR	W-test	Est err	T-test	Est err (m)	
DH(shift)	B5	T5	0.2117	m	4.2	95	0.9	0.10			0.0053	
DE(shift)	B6	T6		m								free obs
DN(shift)	B6	T6	2.7433	m	54.9	1	54.7	-0.04				
DH(shift)	B6	T6	0.2126	m	4.3	94	1.0	-0.04				
DE(shift)	B7	T7		m								free obs
DN(shift)	B7	T7	3.2679	m	65.4	0	65.2	-0.04				
DH(shift)	B7	T7	0.2124	m	4.2	95	1.0	-0.04				
DE(shift)	B8	T8		m								free obs
DN(shift)	B8	T8	10.3791	m	69.2	0	69.1	-0.01				
DH(shift)	B8	T8	0.6227	m	4.2	99	0.4	-0.01				
DE(shift)	B9	T9	0.2471	m	4.9	70	2.7	-1.40		3.22		
DN(shift)	B9	T9	0.2699	m	5.4	59	3.5	-2.85				
DH(shift)	B9	T9	0.2124	m	4.2	95	1.0	0.16				
DE(shift)	B10	T10		m								free obs
DN(shift)	B10	T10	3.0355	m	60.7	0	60.6	-0.04				
DH(shift)	B10	T10	0.2125	m	4.2	95	1.0	-0.04				
DE(shift)	B11	T11	12.4481	m	249.0	0	248.9	-2.01		1.66		
DN(shift)	B11	T11	0.2655	m	5.3	61	3.3	2.15				
DH(shift)	B11	T11	0.2118	m	4.2	95	0.9	-0.12				
DE(shift)	B12	T12		m								free obs
DN(shift)	B12	T12	3.0355	m	60.7	0	60.6	-0.04				
DH(shift)	B12	T12	0.2125	m	4.2	95	1.0	-0.04				
S0	B2	S2	0.0584	m	5.8	50	4.1	0.00				
S0	B4	S2	0.0584	m	5.8	50	4.1	0.00				
S0	T2	S2	0.0584	m	5.8	50	4.1	-0.00				
S0	B2	P2	0.0581	m	5.8	50	4.0	-0.15				
S0	B4	P2	0.2104	m	4.2	96	0.8	0.04				
S0	T4	P2	0.2104	m	4.2	96	0.8	-0.04				
S0	B2	P2	0.0581	m	5.8	50	4.0	-0.15				
S0	B2	S2	0.0584	m	5.8	50	4.1	0.00				
S0	B2	S4		m								free obs
S0	B3	P3	0.1319	m	13.2	10	12.4	-2.34				
S0	B3	S3	0.2703	m	27.0	2	26.7	-1.88				
S0	B3	P5	0.0977	m	9.8	18	8.8	0.16				
S0	B3	S5	0.1003	m	10.0	17	9.1	-1.72				
S0	B4	P2	0.1742	m	17.4	6	16.8	0.89				
S0	B4	S2	0.0584	m	5.8	50	4.1	0.00				
S0	B4	P4		m								free obs
S0	B5	P3	0.1237	m	12.4	11	11.6	2.34				
S0	B5	S3	0.1936	m	19.4	5	18.8	1.88				
S0	B5	P5	0.0625	m	6.3	44	4.6	1.06				
S0	B5	S5	0.0663	m	6.6	39	5.2	2.47				
S0	B5	P7	0.1122	m	11.2	14	10.3	-0.40				
S0	B5	S7	0.1040	m	10.4	16	9.5	2.96				
S0	B6	P4		m								free obs
S0	B6	S4		m								free obs
S0	B6	P6		m								free obs
S0	B6	S6		m								free obs
S0	B6	P8		m								free obs
S0	B7	P5	0.1133	m	11.3	13	10.5	-2.26				
S0	B7	S5	0.1128	m	11.3	13	10.5	-3.12				
S0	B7	P7	0.0643	m	6.4	41	4.9	0.40				

	Station	Target	MDB		MDBn	Red	BNR	W-test	Est err	T-test	Est err (m)	
S0	B7	S7	0.0703	m	7.0	34	5.7	-2.96				
S0	B7	S9		m								free obs
S0	B8	P6		m								free obs
S0	B8	S6		m								free obs
S0	B8	P8		m								free obs
S0	B8	S8		m								free obs
S0	B9	P7	0.1193	m	11.9	12	11.1	-0.40				
S0	B9	S7	0.1119	m	11.2	14	10.4	2.96				
S0	B9	P9		m								free obs
S0	B9	S9		m								free obs
S0	B9	P11	0.1124	m	11.2	13	10.4	0.01				
S0	B10	S8		m								free obs
S0	B10	P10		m								free obs
S0	B10	S10		m								free obs
S0	B10	P12		m								free obs
S0	B10	S12		m								free obs
S0	B11	P9		m								free obs
S0	B11	S9		m								free obs
S0	B11	P11	0.0678	m	6.8	37	5.3	-1.00				
S0	B11	S11	0.4951	m	49.5	1	49.4	-0.13				
S0	B11	P13		m								free obs
S0	B11	S13		m								free obs
S0	B12	P10		m								free obs
S0	B12	S10		m								free obs
S0	B12	P12		m								free obs
S0	B12	S12		m								free obs
S0	B13	P11	0.1132	m	11.3	13	10.5	1.81				
S0	B13	S11	0.2435	m	24.3	3	24.0	0.13				
S0	B13	P13		m								free obs
S0	B13	S13		m								free obs
S0	T2	P2	0.2918	m	29.2	2	28.7	1.59				
S0	T2	S2	0.0584	m	5.8	50	4.1	-0.00				
S0	T3	P3	0.1140	m	11.4	13	10.6	2.34				
S0	T3	S3	0.1518	m	15.2	7	14.5	1.88				
S0	T3	P5	0.1056	m	10.6	15	9.6	-2.74				
S0	T3	S5	0.1302	m	13.0	10	12.3	-2.33				
S0	T4	P2	0.1722	m	17.2	6	16.6	-0.91				
S0	T4	S4		m								free obs
S0	T4	P6		m								free obs
S0	T4	S6		m								free obs
S0	T5	P3	0.1078	m	10.8	15	9.9	-2.34				
S0	T5	S3	0.1298	m	13.0	10	12.2	-1.88				
S0	T5	P5	0.1141	m	11.4	13	10.6	2.75				
S0	T5	S5	0.1436	m	14.4	8	13.7	2.36				
S0	T5	P7	2.9826	m	298.3	0	296.0	0.40				
S0	T5	S7	1.8929	m	189.3	0	188.2	-2.96				
S0	T6	P4		m								free obs
S0	T6	S8		m								free obs
S0	T8	P8		m								free obs
S0	T8	S10		m								free obs
S0	T9	P9		m								free obs
S0	T9	P11	0.2489	m	24.9	3	24.4	3.03				

	Station	Target	MDB		MDBn	Red	BNR	W-test	Est err	T-test	Est err (m)	
S0	T9	S11	0.1830	m	18.3	5	17.8	0.13				
S0	T10	P10		m								free obs
S0	T10	P12		m								free obs
S0	T11	P11	0.2501	m	25.0	3	24.6	-2.11				
S0	T11	S11	0.2058	m	20.6	4	20.1	-0.13				
S0	T12	S12		m								free obs
S0	T13	P11	0.2514	m	25.1	3	24.6	-0.70				
S0	T13	P13		m								free obs
S0	T13	S13		m								free obs

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