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U. S. GEOLOGICAL SURVEY

Surficial horizontal displacements on Slumgullion landslide,

Hinsdale County, Colorado

1985 to 1990

(Determined by direct visual comparison)

by

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CONTENTS

Page

FIGURES

TABLES

PLATE

INTRODUCTION

The Slumgullion earthflow, located in the San Juan Mountains of southwestern Colorado, has been the subject of numerous investigations for over a century. The Slumgullion earthflow has apparently been moving continuously for the last 300 years, and it provides an excellent opportunity for studying the mechanism of earthflow deformation. Slide activity is evidenced by constant formation and destruction of surface features and by measured displacement of points on the surface of the landslide.

Rates of movement on the active portion of the Slumgullion Landslide have been estimated in the past by several authors using a variety of methods. The first data are furnished by Crandell and Varnes (1961), who measured the displacement of trees and other recognizable points from aerial photographs taken in 1939 and 1952. They also measured displacement from control stakes and by time-lapse photography. More recently, additional displacement data have been produced from the ground survey of control points measured at selected sites on the active slide (Guzzi and Parise, 1992). Smith (1993) photogrammetrically determined displacements for 310 photo-identifiable points from the 1985 and 1990 aerial photographs.

A major obstacle to measuring displacements using the conventional photogrammetric method was to establish an accurate relationship between visually identifiable points from two different sets of aerial photographs taken at different scales (Smith, 1993). The standard photogrammetric approach yields accurate results, generally less than 0.5 m at 1:12,000 scale, but requires expensive instruments, takes considerable time, and requires a trained operator to set the models and acquire the results.

We have applied a geographic information systems (GIS) approach to making displacement measurements and have mapped the movements of visually identifiable objects (trees and bushes) on the active portion of Slumgullion landslide. Our approach was based on the idea that it should be possible to directly compare on the computer screen two images that were originally derived from aerial photographs. We compared ortho-images derived from 1985 photographs (1:12,000 scale) and 1990 photographs (1:6000 scale).

For this method to work, there has to be enough movement during the interval between the photography to make accurate measurements, but not so much movement so as to make object recognition between the sets of photographs a major problem. In the 5-year period between sets of aerial photography, about 25 to 30 m displacement can be expected in the fastest moving portion of the landslide (Crandell and Varnes, 1961). We estimated that over most of the active slide, it is reasonable to expect 15 to 20 m of displacement in 5 years. A 2-m measurement error (10 percent) for a direct comparison method was adopted as our minimum standard. In this study, we discovered that this minimum standard could only be attained by transforming the images to relief-corrected ortho-images: this was the most difficult part of the work.

GEOGRAPHIC AND GEOLOGIC SETTING

The Slumgullion landslide is located in the San Juan Mountains of southwestern Colorado, 5 km southeast of Lake City. The landslide occupies the valley formed by Slumgullion Creek, a tributary of the Lake Fork of the Gunnison River.

Landslide deposits of at least three different stages have been recognized on the basis of morphostratigraphic relations and differences in the degree of weathering and soil formation (R. F. Madole, written commun., 1994). Deposits from the oldest unit (emplaced prior to 1000 yr ago) have been found only in the upper part of the valley. A succeeding flow (900-700 B.P.) occupies the entire valley of Slumgullion Creek (Crandell and Varnes, 1960); it dammed the Lake Fork of the Gunnison River and created Lake San Cristobal.

The youngest and active portion of the landslide is moving entirely within the boundaries of an older flow and occupies roughly 30 percent of the surface of the previous flow. This report deals with the youngest and active portion of the landslide, and from this point on we will always refer to the active portion of the slide. Figure 1 shows a shaded relief model of the landslide, 10-m contours, and the local coordinate system.

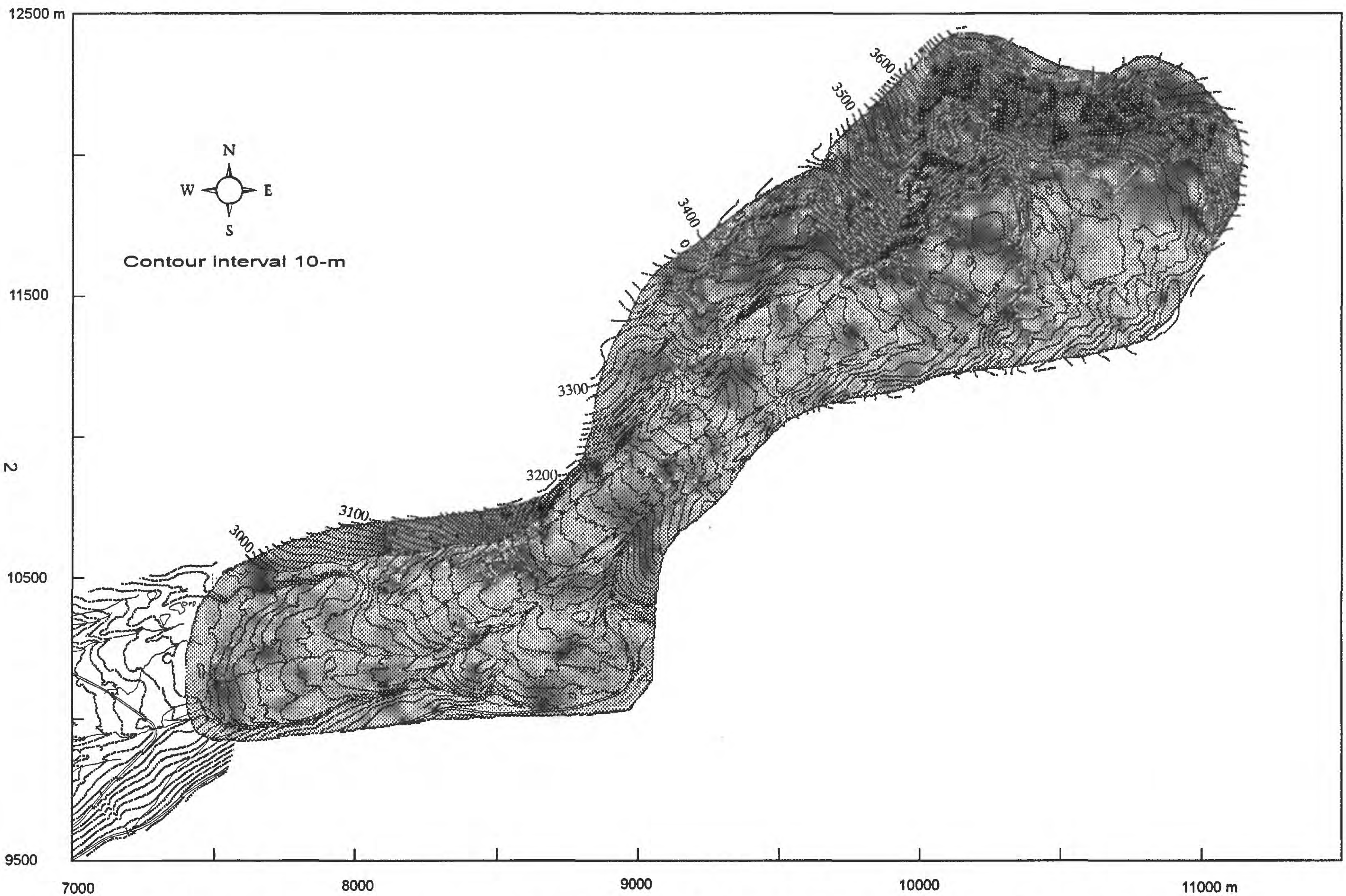


Figure 1. 10-m contours shown superimposed on shaded-relief model of active portion of Slumgullion landslide. Local coordinate system is used for the axes.

The landslide extends from the head scarp, at 3500 m elevation, down to the toe, at 2960 m elevation. The slide covers an area of about 1.46 km^2; the slide length is approximately 3.9 km, and has an average slope of 8°. The average thickness is about 13 m, and the estimated volume is 19.5 X 10^6 m^3 (Parise and Guzzi, 1992). The width of the upper part varies from 250 to 400 m, then decreases to a narrow section about 150 m wide at 3240 m elevation, apparently controlled by the shape of the pre-landslide valley (Parise and Guzzi, 1992). Further downslope, the width increases to 330 m in the vicinity of the toe.

The landslide head scarp is located on the northeastern border of the Lake City Caldera and exposes a wide variety of volcanic rocks of Tertiary age. Volcanic tuffs, rhyolite, and latite flows are the principal rock types; they appear to be hydrothermally altered and weathered (Crandell and Varnes, 1961; Lipman, 1976). The same kinds of materials are on the landslide surface.

METHODOLOGY

Before accurate measurements can be made between two sets of aerial photographs, the tilt and distortion in the photographs must be removed. The process of producing tilt-free relief-corrected digital ortho-photos (ortho-images) from aerial photographs taken in mountainous terrain requires properly distributed and precise ground-control as well as complex software.

Desktop Mapping System /Softcopy Photo Mapper (DMS/SPM) was used to produce the ortho-images that were required for accurate measurements of displacement. DMS/SPM runs on a 386/486 PC computer running DOS and uses the same rigorous photogrammetric techniques as those used in standard photogrammetry.

Project History

We used Desktop Mapping System's (DMS) GEOCODE program option in 1992 in a first attempt to correct for deformation in the scanned images (computer bitmaps/raster images) produced from the aerial photographs. This GEOCODE program option was primarily developed for use with satellite imagery, and there was some doubt that it could be applied to aerial photographs of mountainous terrain with any degree of success.

The early results on the active toe portion of the landslide produced a stereo model with a root mean square error in x and y (RMSExy) on the ground of 3 to 4 m for the 1990 aerial photographs, and 1.6 to 3.6 m for the 1985 aerial photographs. This is the opposite of what we expected because of the scale of the photography. The ground-control distribution was designed for the 1985 aerial photography and did not work as well with the lower altitude 1990 aerial photography, especially near the toe of the active slide. The photogrammetricists who set the 1990 models for the active toe also experienced similar problems. These results were above the minimum 2-m error level, and for this reason the project was shelved (for about 1 year).

The direct comparison method was restarted after acquiring a new program module for DMS called Softcopy Photo Mapper (SPM), which was designed specifically for use with aerial photographs. It was at this time that Marta Chiarle from the Italian National Research Council joined the project. Even with the new SPM program module, we continued to experience considerable difficulty in the vicinity of the landslide toe with meeting our accuracy expectations while working on the 1990 stereo model.

In an attempt to get around these problems, we tried ARC/INFO with a higher altitude 1:14,000 scale 1990 scanned image. The first step that is required to work with image data in ARC/INFO is to convert the image into GRID format. The first warping, made with the *GRIDWARP* command, used a 2nd-order polynomial with a nearest neighbor assignment. The resultant ARC/INFO warped image appeared quite good, and the errors at the link control points were very small. A link control point is a point that is used in the warping that associates the coordinate system to the image that is to be warped. We thought that the lower altitude 1990 aerial photographs (1:6000 scale) and a higher order polynomial with the cubic convolution solution would give even better results. The image was then warped with both 3rd- and 4th-order polynomials with a cubic convolution solution. The resultant images fit the link control points nearly perfectly but contained considerable distortion at small distances from the link control points. At this point we decided to use DMS/SPM to complete the remainder of the project.

The difficulty with meeting our 2-m accuracy requirement in the vicinity of the active toe for the 1990 stereo model was overcome by adding additional photogrammetric control points that were located on the landslide from the work by Smith (1993) and by the choosing the stable ground-survey control points nearer to the landslide. The technique of selecting ground-control points on or very near to the area of interest was also applied to the remainder of the stereo models.

The Process of Making an Ortho-Image

Figure 2 is a flow chart of the process of making an ortho-image. An accurate digital elevation model (DEM) that completely covers the area is an important part of the ground-control required by DMS/SPM to produce an ortho-image. Accurate DEMs have been created from the digital contour data (Powers and others, 1992). The DEMs had to be filled in or padded with artificial values because the photogrammetric work extended barely beyond the slide boundary, and the DEMs had to cover all the area that was to be ortho-rectified. The pad values were generated by a computer program that analyzed the original DEM data and used the nearest real elevation data to fill out the required rectangular area. The original DEMs had a grid spacing of 4 m, while the DEMs used in the process of making the ortho-images had a spacing of 8 m (fig. 3). The reduction in resolution of the DEMs was made because of the limited disk space that was available.

The photographic color transparencies (diapositives) were scanned at 400 dots per inch resolution (dpi) with a Howtek scanner attached to a Macintosh computer running Adobe Photoshop. Each complete color diapositive was scanned, including the fiducial marks, and then converted to an image having 256 shades of gray, which is a requirement of DMS/SPM. At 400 dpi, a 9" X 9" aerial photograph requires approximately 13 MB of disk space. It is important to note that scanned images of diapositives at 400 dpi contain more visual detail than scanned images of photographic prints. The scanned images were then transferred to the DOS-based PC for processing with the DMS/SPM software.

The selected ground-survey coordinates (Varnes and others, 1993) and the photogrammetric coordinates were typed into a file, and each group of *xyz* values was assigned a unique label (Appendix 1). These ground-control points (GCPs) were then linked to the displayed image by moving the crosshair to each label location on the display screen and clicking with the mouse, which established the relationship between the image and the GCPs in the file. This process was done for each of the two images that were used make up a stereo model. The two images that make up a stereo pair do not need to use the exact same GCPs.

Next, the orientation for each image used to make the stereo model had to be computed, and at this time, we had the opportunity to review the effect each ground-control point had on the root mean square error in *x* and *y*. A minimum of five points for each image are required by the DMS/SPM program to compute the orientation.

The next step was to select the extent of coverage for the stereo model on a side-by-side display of the scanned images on the computer screen. The stereo model is made up left and right overlapping images.

The stereo model was then displayed as a composite image of red and blue color bands; using eyeglasses with red and blue lenses, the image could be viewed in 3-dimensions (3-D). Viewing the model in 3-D we then measured the coordinates for GCPs and other known locations. This was done by positioning the floating mark (dot) on the ground surface at the point to be measured, and recording the *xyz* coordinates. The coordinates were then checked against the GCPs for accuracy.

Using DMS/SPM's Ortho-Photo program option, the cubic convolution method, the DEM, and the exact photogrammetric solution derived earlier with DMS/SPM, the tilt-free relief-corrected

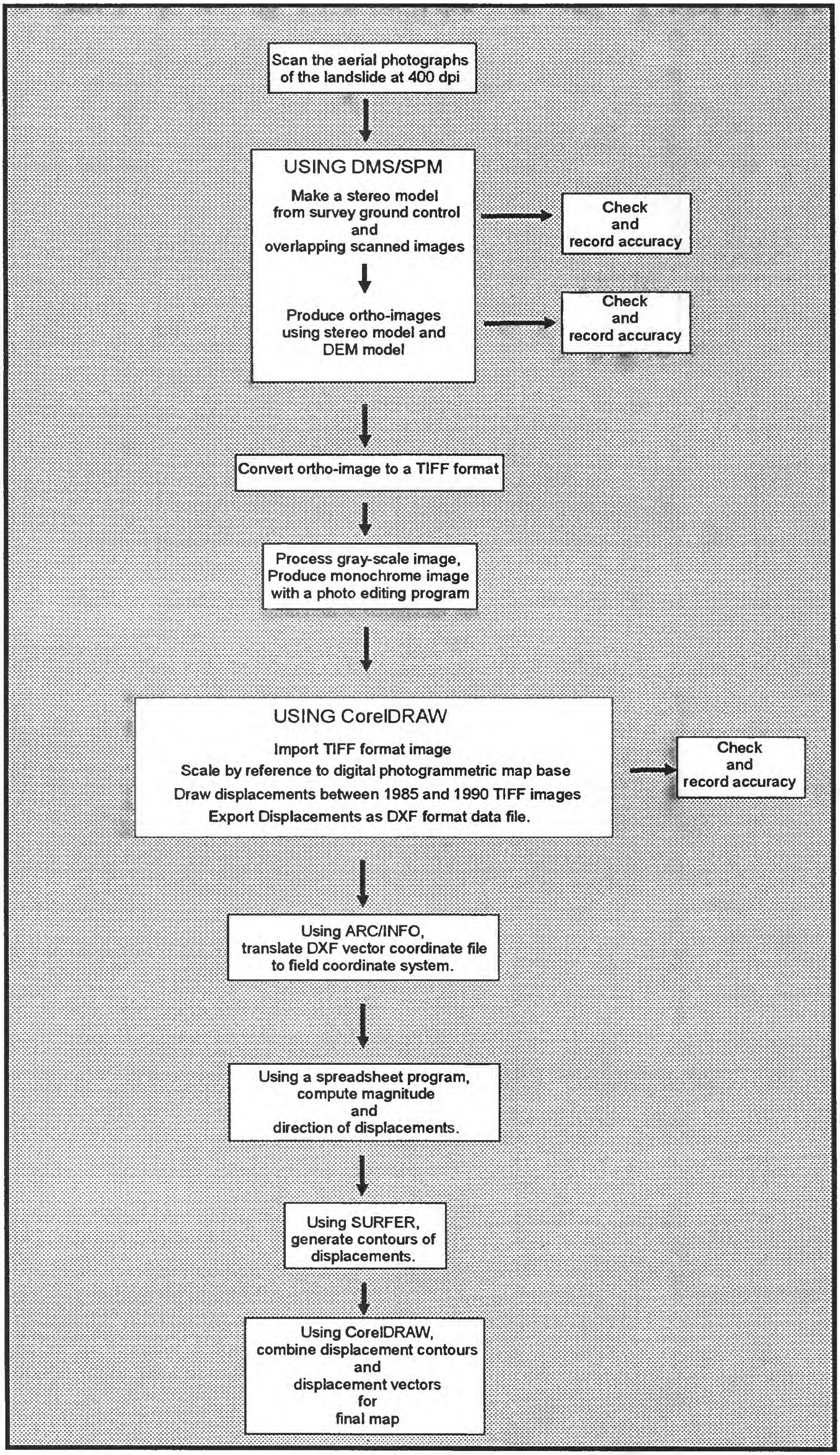


Figure 2. Flow chart of the procedure required to generate displacement vectors from aerial photographs.

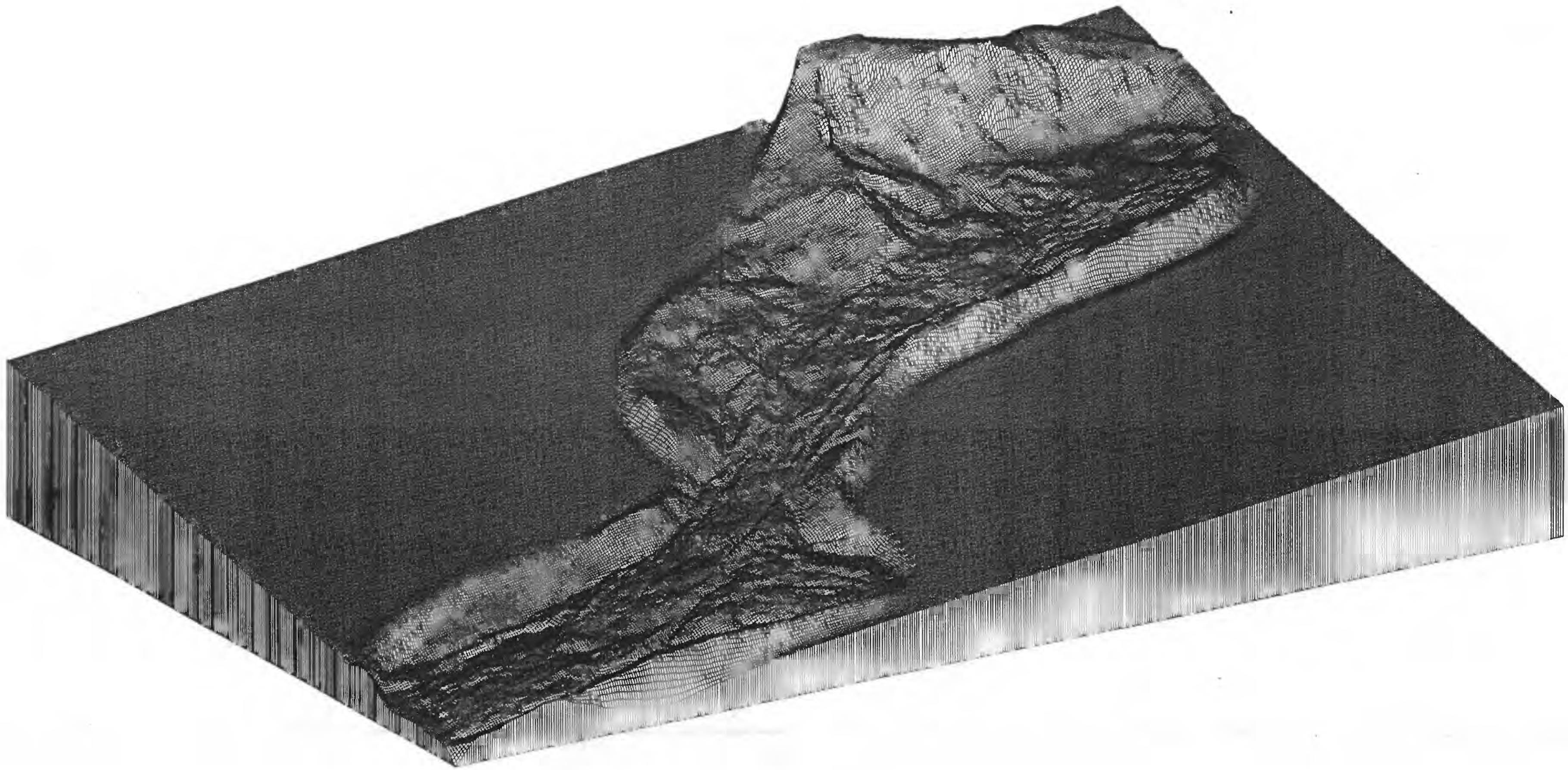


Figure 3. Orthographic view of Slumgullion landslide generated from the Digital Elevation Model (8-m grid spacing).

ortho-image was created. The still geocoded (user-coordinate referenced) ortho-image was then checked against the GCPs and the results recorded. The image was then converted to a tagged image file format (TIFF) image, transferred to a different PC, imported into a raster editing program for processing, and then to CorelDRAW for direct visual comparison with a second image.

Making the Direct Comparison

To compare directly the two ortho-images, each image is first registered to ground-control. Next, a 1985 gray-scale image is converted to a black-and-white (b-w) image where white is transparent. And lastly, the partially transparent 1985 b-w image is laid on top of the 1990 gray-scale image, and the displacement mapping is done between visually identifiable features common to both images (figure 4). This process was continued until all the ortho-images for both 1985 and 1990 were in one very large file (32.5 MB). The progression of new models and their aerial coverage along with the location of GCPs and their label names are shown in the figure 5. For reference purposes, the label names/numbers in figure 5 are the same as those used in the reports by Varnes (1986) and Smith (1993).

Processing the Displacement Data

The first step in processing the data was to select the vectors representing the displacements of photo-identifiable points and export them as a separate AutoCAD DXF file. The DXF file was then brought into ARC/INFO using the *DXFARC* command. ARC/INFO's *TRANSLATE* command then converted the coordinates of the DXF vectors into our user coordinates by a rotation, translation, and scaling of the vectors. ARC/INFO's *UNGENERATE* command was then used to create a file of the vectors in our coordinates system.

This file was then imported into a spreadsheet program, and the direction and magnitude of each vector was calculated, along with the change in x and the change in y. The processed spreadsheet file was then used as an input into Golden Software's SURFER program, and the magnitudes were contoured using a minimum-curvature algorithm. The contours and the vector magnitudes at each vector were saved as a DXF file. This file was then imported into CorelDRAW and combined with the vectors to produce a final plot.

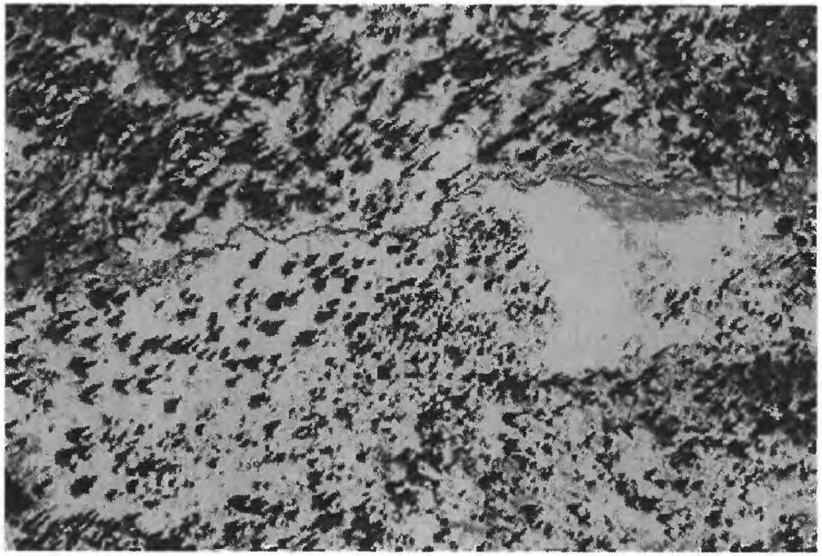
ACCURACY

The photogrammetric landslide displacement vectors mapped by Smith (1993), reported to have a precision (standard deviation) of 0.44 m in *xy,* provided us with numerous additional check points to verify the accuracy of our results. Our measurements were compared with the GCPs and Smith's points at three different stages for the purpose of determining the accuracy of our measurements.

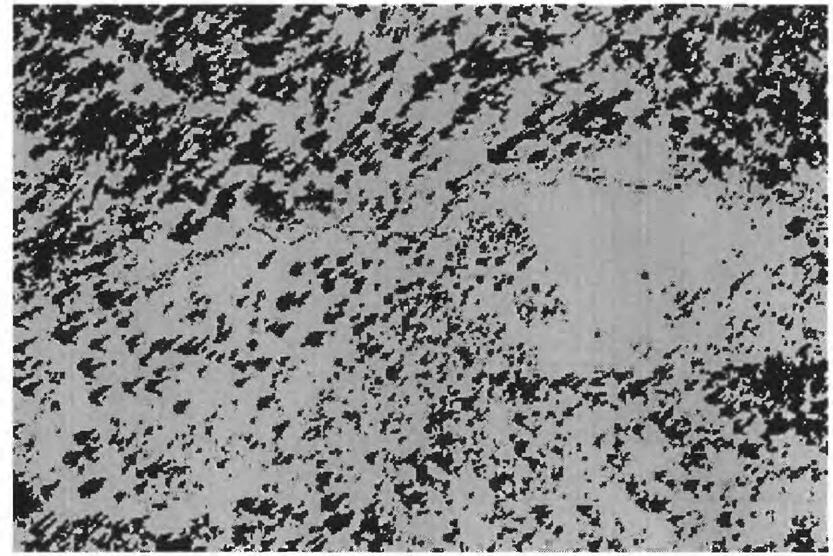
The first accuracy measurements were made while viewing the DMS/SPM stereo model, and the *xyz* coordinates were recorded. The next series of accuracies were recorded while viewing the geocoded ortho-image, and *xy* coordinates were recorded. The last and final set of *xy* coordinates were recorded in CorelDRAW prior to drawing the displacement vectors. Table 1 is a summary of the accuracies for all stages of ortho-image production.

The average errors for the ortho-images in DMS/SPM and the CorelDRAW images are almost the same. This suggests little or no loss of accuracy during the conversion. The stereo model errors are slightly larger, probably due to the difficulty of viewing portions of the image in three dimensions--good three-dimensional perspective is necessary for making accurate measurements. The slightly higher average errors that can be observed in the table for the 1985 data are caused by the difference in scale between the aerial photographs (1:12,000 scale for 1985, and 1:6000 scale for 1990).

(a)



(b)



(c)

(d)

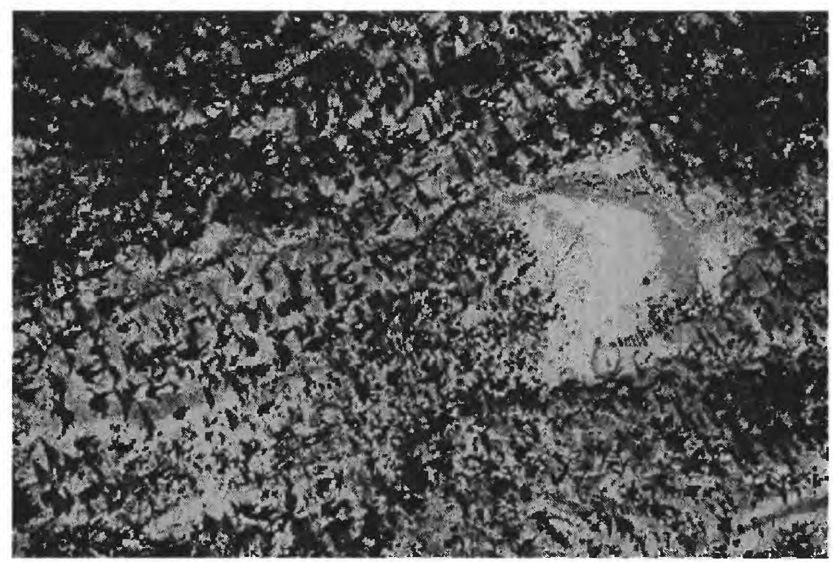


Figure 4 (a) Gray-scale ortho-image above active toe (1985). (b) Monochrome ortho-image above active toe (1985). (c) Gray-scale ortho-image above active toe (1990). (d) Gray-scale 1990 image visible through monochrome 1985.

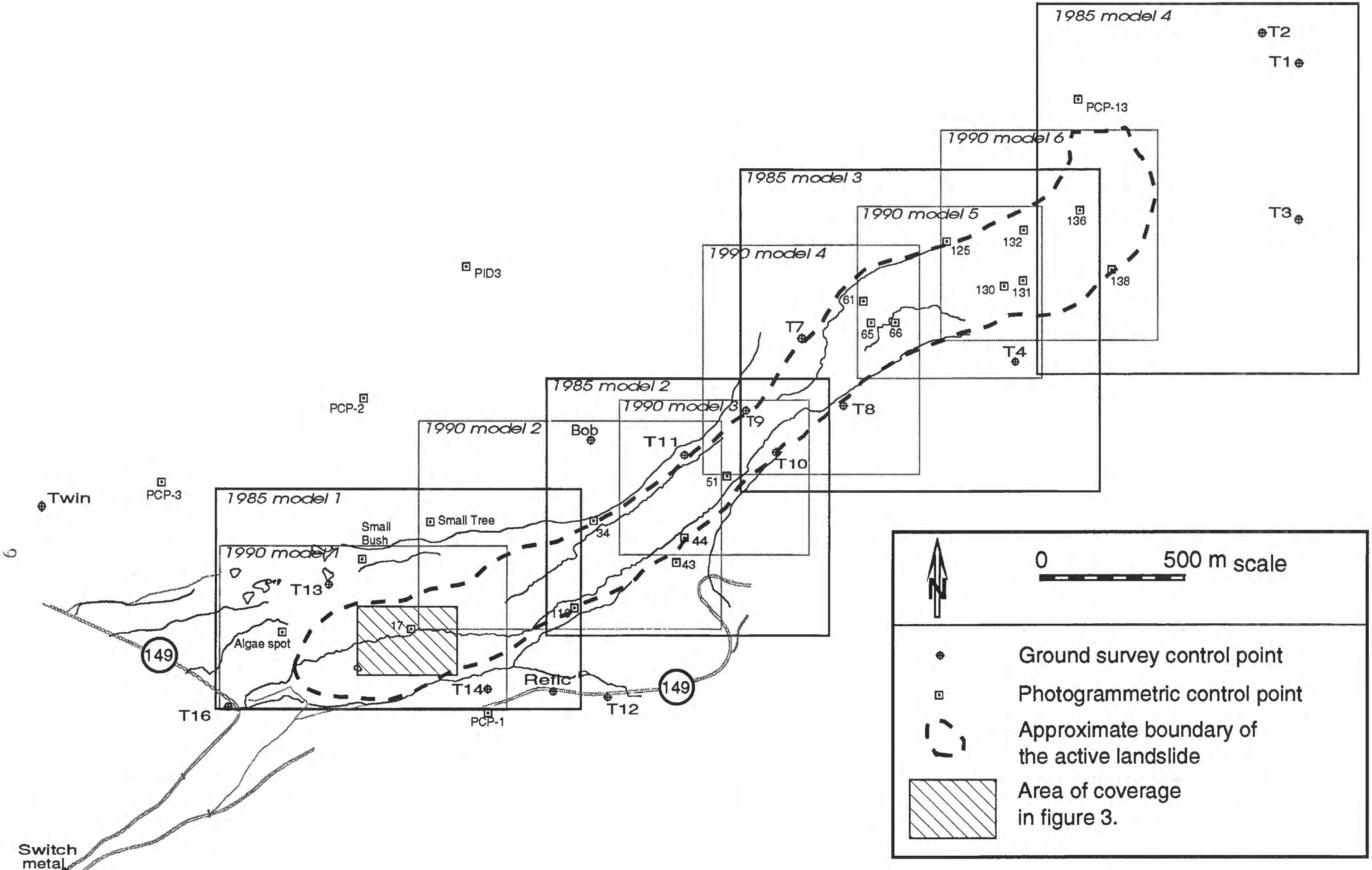


Figure 5 Distribution of ground survey control and photogrammetric ground control points and positions of stereo models and their relationship to the active landslide.

Table 1. Summary of the accuracies, where x is east-west, y is north-south, z is vertical, and $xy = \sqrt{x^2 + y^2}$.

	Averages (m)			
	x's	y's	xy's	z's
Stereo Models1990	0.9	1.4	1.7	3.3
Stereo Models 1985	1.3	2.0	2.4	5.2
Ortho-images1990	1.2	1.1	1.6	
Ortho-images 1985	1.6	1.3	2.1	
CorelDRAW 1990	1.1	1.1	1.6	
CorelDRAW 1985	1.7	1.0	2.0	

Table 2 shows the average accuracies for the control points that were measured in CorelDRAW for each ortho-image. The model numbers are the same as those used in figure 5.

Table 2. Average accuracies from measurements made in CorelDRAW for each ortho-image, where x is east-west, y is north-south, z is vertical, and $xy = \sqrt{x^2 + y^2}$.

1990 ortho-images			
	x's	y's	xy's
Model 1	1.5	1.8	2.3
Model 2	0.8	1.0	1.3
Model 3	1.1	1.1	1.6
Model 4	1.1	0.7	1.3
Model 5	0.6	0.8	1.0
Model 6	1.8	1.1	2.1
Averages	1.2	1.2	1.6
1985 ortho-images			
	x's	y's	xy's
Model 1	2.1	1.0	2.4
Model 2	1.4	1.3	1.9
Model 3	1.5	0.8	1.7
Averages	1.7	1.0	2.0

RESULTS

Advantages and Disadvantages of the Method

The greatest advantage of the direct image comparison method over standard photogrammetry is the ability to identify the same objects on two different images at the same instant. This method, now that it has been developed, is much easier and faster for making relatively accurate displacements in the *xy* plane than standard photogrammetry. Patterns of photo-identifiable objects as well as patterns that develop while drawing the displacement vectors are a tremendous aid in object mapping. Additional advantages are that the hardware and software required are less expensive than the costs associated with analog or analytic photogrammetry and that operators need less formal training. In addition, digital stereo-models, digital ortho-images, and digital displacement data are available for additional research.

Lower accuracy in the determination of coordinates on the slide surface might be a major drawback. The mostly unacceptable measurements in the vertical direction *(z)* did not allow us to determine vertical displacements. In addition, scanning photographic prints, and in some cases color transparencies, can result in a loss of detail depending on the resolution of the scanner used. Some loss in detail occurs during the process of converting color photographs to gray-scale images and gray-scale images to b-w images (fig. 4b). Finally, in order to map displacements, identifiable objects on the slide surface, preferably small trees or bushes, must be abundant and easily distinguished. Large trees have large shadows, and therefore it is more difficult to pinpoint where the tree ends and the shadow begins.

Displacement Data

More than 800 motion vectors have been mapped for the active slide surface, and a map of horizontal displacement contours has been produced showing the movement between 1985 and 1990 (plate 1). The tabular list of displacement data (Appendix 2) is sorted by the magnitude of the displacement and can be referenced by *xyz* coordinates. The displacement contours were computer-generated from a regularly spaced grid using the minimum-curvature algorithm in the program SURFER. This algorithm produces smoother contours than the other available methods and also tends to shows data trends rather than contouring individual values. The map is in AutoCAD's DXF format and is available for future studies.

About 50 vectors were drawn on what is considered to be stable ground. The vectors drawn at these stable points are representative of the error in the ortho-images near those locations and were used in part to calculate the average errors that were reported in tables 1 and 2. The agreement between the 1985 and 1990 images, and therefore the displacement accuracy, is better on the northern side of the slide than on the southern side. The reason for the difference in agreement could be due to the distribution and reliability of GCPs or the position of the slide with respect to the photographic flight path.

The boundary of the active slide was drawn after examination of the magnitudes of displacement vectors with respect to the positions of ground survey and photogrammetric ground-control points. The boundary that we have drawn differs in some locations from the boundaries that have been used in the past, primarily because we have taken only displacements greater than the accuracy of the method into account. The most apparent difference is that the slide boundary drawn near the active toe is noticeably narrower than the boundary defined by Guzzi and Parise (1992) from their field work. In addition, we could not precisely define the upper limit of the active slide because the slide movement gradually decreases toward the head scarp, reaching values that are less than the accuracy of the method.

The magnitudes of displacement vary from 0 to 29 m in the 5-year period (0 to 5.8 m/yr). The amount of displacement *(d)*, where $d = \sqrt{(x - x_o)^2 + (y - y_o)^2}$, for the 5-year period is shown plotted against the local *x*-coordinate system in figure 6. It is apparent in the figure that there is an area extending from the head scarp of the slide downslope about 500 m *(x)* where the velocities are almost constant and range from 1 to 1.8 m/yr. The velocities then begin to rapidly increase from a point starting 500 m *(x)* below the head scarp to a point about 1250 m *(x)* from the head scarp, reaching a maximum velocity of about 5.8 m/yr near the narrowest section of the slide: the increase in displacement is approximately 4 m per 100 m *(x)*. Downslope from the narrowest section the movement decreases at approximately 1.5 m per 100 m (*x*). The velocities are about 2 m/yr on the southern side of the active toe, about 1.5 m/yr on the front of the toe, and about 0.8 m/yr on the northern side of the toe.

The zone of rapid increase in displacement and the zone of reduction in displacement correspond to the zones of extending and compressive flow that were discussed by Savage and

Smith (1986). Minor deviations from the above mentioned trend seem to be related to changes in slope on the slide, most noticeably near 8800 *(x)* and again near 8500 *(x)*.

The magnitudes of displacements are not symmetrically distributed across the slide. On the northern side the magnitudes appear to be consistently lower by about 20 percent as compared to those on the southern side of the landslide. The difference in the amount of displacement between the northern and southern sides increases to more than 50 percent near the toe.

We also compared our displacement data with those previously reported. Our displacement contours were qualitatively compared with those drawn by hand by Smith (1993) and agreed quite well. In addition, we compared our velocities to the field-surveyed velocities recorded by Crandell and Varnes (1961), and to field-surveyed velocities by Guzzi and Parise (1992). Our velocities were an average derived from measurements nearest to their reported locations. The results of the comparison are illustrated in figure 7 and compare favorably with some small variations. The larger variations at points E and J might be due to the uncertainty in location and magnitude expressed by Guzzi and Parise (1992). The variation at points A and F, located at the edge of the toe of the slide, might be because our nearest veolcities were some distance above the toe.

CONCLUSIONS

The direct visual comparison technique that we have developed proves to be a valid tool for the analysis of aerial photographs. The technique can be used to analyze differences in ortho-images produced from two sequences of aerial photographs taken at different scales and horizontal-motion vectors can be measured accurately. The displacements that we measured agree quite well with field-surveyed displacement data and photogrammetrically derived displacement data. With this method more of the slide surface can be mapped in a shorter period of time than can be done using the standard photogrammetric approach.

The technique was applied to the measurement of surficial movements on an active landslide but could easily be applied to other features that tend to change with time. The technique is not limited to aerial photographs, but could easily be applied to terrestrial photographs and to video camera images, as long as control points are visible to link the images together.

We also learned from this study that the distribution and quality of ground-control is one of the most important considerations and must be taken into account before any aerial photographs are taken. The ground-control needs to be evenly distributed along both sides of the area of interest and include several points within the area of interest.

The direct visual comparison method is not a definitive one: the choice among topographic survey, analog (or analytic) photogrammetry and digital photogrammetry must take into account considerations about economic, human, and time resources available on the one hand, and accuracy requirements on the other.

DISTRIBUTION OF DISPLACEMENT MEASUREMENTS ALONG THE EAST TO WEST AXIS OF THE LOCAL COORDINATE SYSTEM SLUMGULLION LANDSLIDE, HINSDALE COUNTY, COLORADO

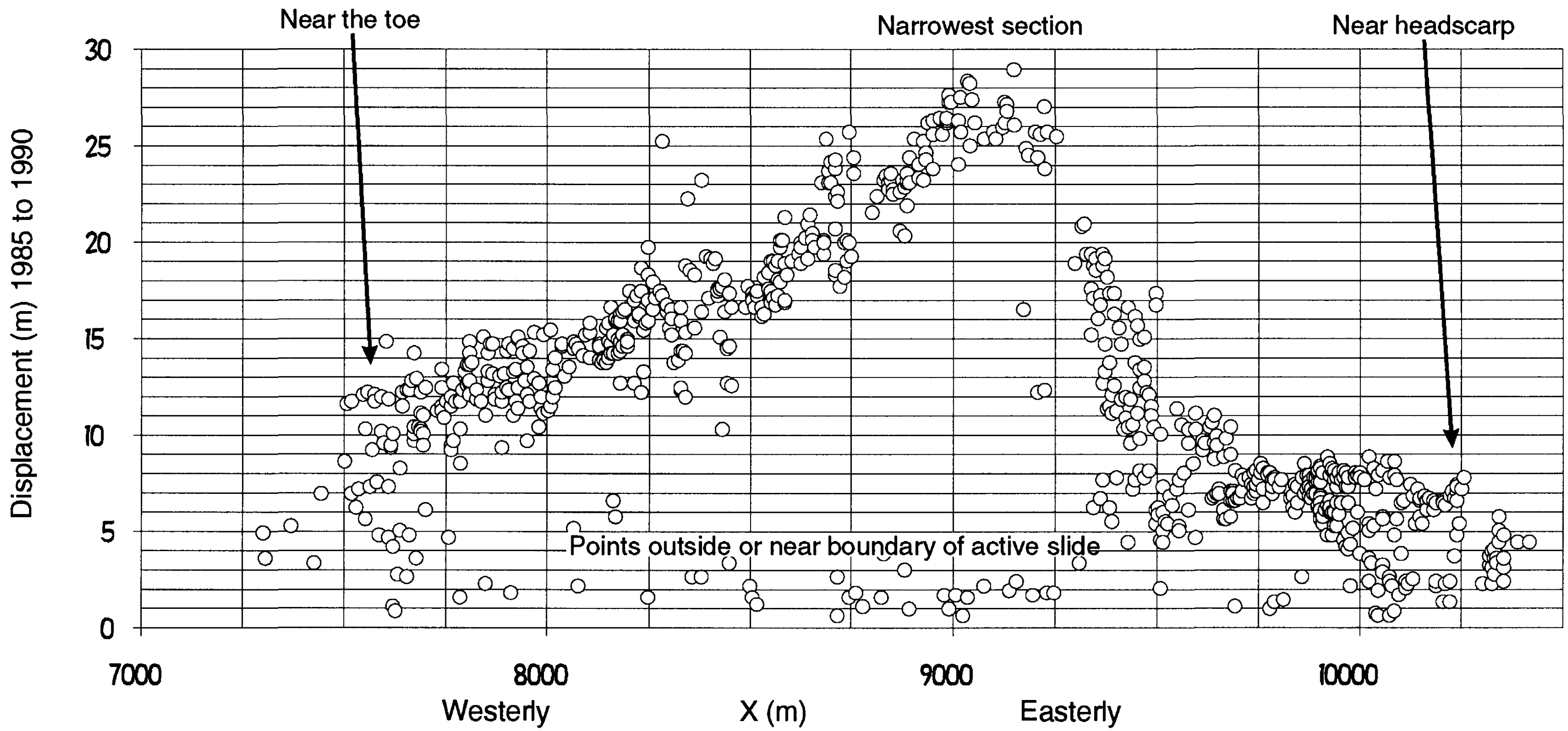


Figure 6. Slide displacement (m) plotted against local x-coordinate for the period 1985-90.

Point	Average velocity (m/year)	
	This Report	From Literature
A	2.3	0.8
B	2.8	2.6
C	4.6	4.6
D	5.8	6.0
E	1.1	1.8
F	2.0	1.4
G	3.8	3.7
H	3.0	2.9
I	2.4	2.6
J	1.4	2.3

Points A-E: Crandell & Varnes, (1961)
Points F-J: Guzzi & Parise, (1992)

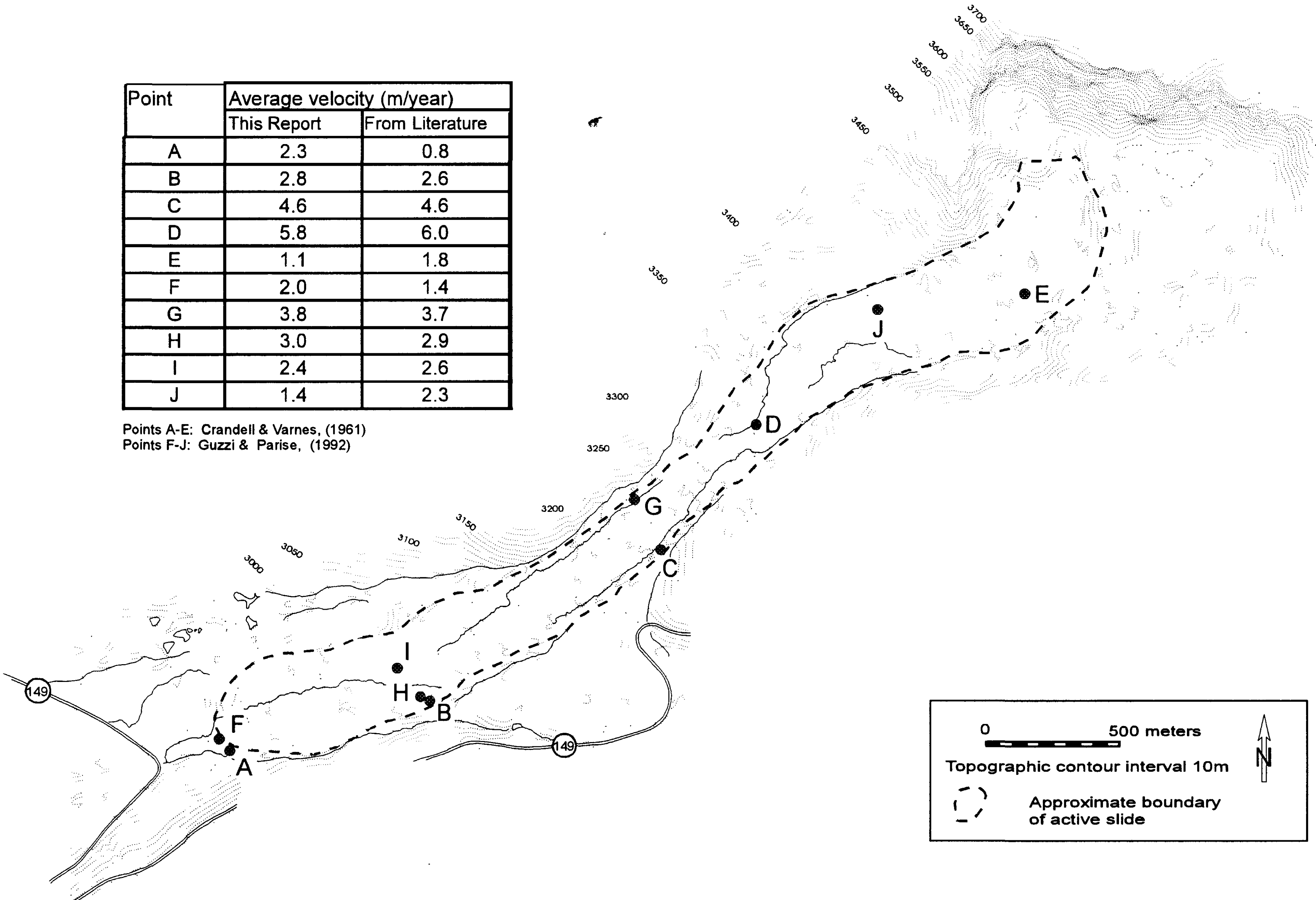


Figure 7. Comparison between average velocities on the landslide reported by previous authors and average velocities resulting from this report. The comparison has to be considered qualitative because the coordinate system was not defined until 1990.

ACKNOWLEDGMENTS

Without the assistance of Robert Desawal of the National Mapping Division-Rocky Mountain Mapping Center (NMD-RMMC) and the facilities of the Geographic Information Systems (GIS) laboratory headed by Michael Crane of NMD-RMMC, this project would not have been possible.

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Appendix 1: Ground Control Point Coordinates (m)			
LABEL	X	Y	Z
TWIN	6618.6	10670.6	3008.7
WHITE CROSS (T14)	8153.0	10038.4	3073.0
SWITCH (metal)	6709.5	9360.5	3002.9
REFLECT	8378.8	10030.3	3082.0
ALGAE SPOT	7442.0	10236.0	2965.0
SMALL BUSH	7720.0	10489.0	3000.0
SMALL TREE	7956.0	10613.0	3050.0
T9	9037.3	11004.5	3244.9
T10	9140.5	10859.0	3234.1
TII	8826.5	10847.9	3190.6
TI2	8562.1	10011.3	3085.0
TI3	7605.6	10400.9	2983.3
TI6	7259.0	9979.6	2943.7
bob	8505.3	10900.3	3265.2
TI9	5609.5	9806.5	2740.9
PCP 1	8151.5	9960.6	3080.7
PCP3	7028.9	10748.7	3080.2
PCP2	7721.4	11046.8	3093.1
43	8895.0	10473.7	3137.0
44	8825.7	10566.1	3169.9
51	8970.2	10778.3	3205.7
T1	11190.4	12197.1	3656.5
T2	10806.3	12338.3	3697.0
T3	11020.6	11659.9	3531.9
T4	9964.1	11173.2	3423.3
T5	9913.1	11889.4	3524.6
T6	10145.3	10571.3	3244.0
T7	9228.9	11251.8	3308.8
T8	9372.4	11019.3	3292.4
61	9438.9	11380.8	3310.9
PID3	8075.5	11500.2	3207.7
65	9465.9	11306.5	3321.4
66	9551.8	11303.3	3323.5
110	8444.6	10318.3	3105.7
PCP13	10177.6	12077.6	3485.0
17	7888.7	10246.4	3037.5
125	9723.7	11585.7	3355.9
130	9923.0	11434.7	3368.9
131	9988.7	11449.1	3383.8
132	9889.5	11623.0	3386.5
34	8515.9	10621.1	3131.2
136	10081.2	11691.5	3409.8
138	10392.1	11479.2	3436.1

Appendix 2:		Tabular List of Displacement Data					
1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
10073.5	11862.3	10073.3	11861.8	0.3	-0.5	-63.9	0.6
9021.2	10757.6	9021.2	10756.9	0.0	-0.6	-90.0	0.6
8715.8	10736.5	8715.8	10735.8	0.0	-0.6	-90.0	0.6
10045.4	11936.5	10045.2	11935.8	0.1	-0.6	-79.2	0.6
10038.0	11941.2	10038.3	11940.4	-0.3	-0.8	-108.2	0.8
10088.1	11858.9	10088.1	11858.0	0.0	-0.9	-90.0	0.9
7624.0	10326.9	7623.4	10327.6	0.6	0.6	45.2	0.9
9778.6	11268.7	9777.7	11269.1	0.9	0.4	23.1	1.0
8991.8	10979.2	8992.2	10980.1	-0.4	0.9	113.3	1.0
8894.6	10885.1	8895.7	10885.1	-1.0	0.0	180.0	1.0
9690.4	11574.4	9691.0	11573.5	-0.6	-0.9	-125.4	1.1
8780.5	10807.6	8780.6	10806.5	-0.1	-1.1	-96.5	1.1
7619.5	10320.3	7620.7	10320.2	-1.1	-0.1	-173.5	1.2
8514.2	10622.7	8515.4	10622.5	-1.3	-0.1	-174.2	1.3
10223.8	11932.4	10222.5	11932.1	1.3	-0.3	-11.1	1.3
9787.4	11604.7	9786.7	11603.6	0.6	-1.1	-60.9	1.3
10205.5	11942.9	10205.0	11941.7	0.5	-1.3	-68.5	1.4
9810.7	11271.5	9809.7	11272.5	1.0	1.0	44.9	1.4
8824.0	10847.8	8825.6	10847.8	-1.5	0.0	180.0	1.5
8743.8	10777.6	8745.3	10777.5	-1.5	-0.1	-175.1	1.5
8250.4	10539.4	8251.5	10540.4	-1.1	1.0	138.2	1.5
9037.7	10772.0	9036.3	10771.4	1.4	-0.6	-24.6	1.5
7783.1	10343.7	7782.2	10345.0	0.9	1.3	55.2	1.6
8507.5	10620.2	8509.1	10619.7	-1.5	-0.5	-161.5	1.6
9004.8	10736.2	9003.2	10736.0	1.7	-0.3	-8.6	1.7
10095.1	11790.5	10093.6	11789.8	1.5	-0.8	-26.6	1.7
8980.4	10703.1	8978.9	10702.3	1.5	-0.8	-26.5	1.7
9192.9	11220.9	9193.8	11222.4	-0.9	1.5	120.3	1.8
7910.6	10378.9	7910.6	10380.7	0.0	1.8	90.0	1.8
9244.3	11259.4	9245.5	11260.8	-1.1	1.4	129.3	1.8
9227.7	11279.2	9229.4	11280.0	-1.6	0.8	155.3	1.8
8759.0	10776.7	8757.4	10776.0	1.6	-0.8	-24.7	1.8
9137.2	10863.7	9135.4	10863.1	1.8	-0.6	-19.5	1.9
10042.8	11741.0	10041.0	11740.2	1.8	-0.8	-23.1	1.9
10116.6	11352.0	10114.7	11351.4	1.9	-0.6	-18.3	2.0
9507.0	11503.6	9509.0	11503.7	-2.0	0.1	176.6	2.0
9978.1	11676.6	9976.7	11675.0	1.4	-1.7	-49.8	2.2
10188.2	11911.2	10186.4	11909.9	1.8	-1.3	-35.5	2.2
8501.5	10618.1	8503.6	10617.7	-2.2	-0.4	-169.8	2.2
9073.0	11044.9	9075.1	11045.4	-2.2	0.5	166.7	2.2
10081.8	11323.5	10079.7	11323.0	2.2	-0.5	-13.3	2.2
8074.6	10411.8	8073.0	10413.3	1.6	1.5	42.7	2.2
10324.3	11941.6	10322.8	11939.9	1.5	-1.6	-47.2	2.3
10212.2	11889.3	10209.9	11889.2	2.3	-0.1	-3.0	2.3
10117.7	11768.9	10115.5	11768.0	2.2	-0.9	-22.2	2.3

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
10299.9	11837.7	10297.6	11837.2	2.3	-0.5	-12.4	2.3
7848.1	10348.8	7846.3	10350.4	1.8	1.5	40.7	2.3
10114.9	11792.5	10112.6	11791.9	2.3	-0.6	-15.7	2.4
10356.2	11841.8	10353.9	11841.0	2.3	-0.8	-18.4	2.4
10189.9	11371.0	10187.6	11370.3	2.3	-0.8	-18.4	2.4
10221.9	11398.8	10219.6	11398.1	2.3	-0.8	-18.4	2.4
10073.1	11330.2	10070.7	11330.5	2.4	0.3	6.2	2.4
9153.5	10882.8	9156.0	10882.5	-2.4	-0.3	-173.9	2.4
10025.1	11316.9	10022.7	11317.3	2.4	0.4	8.9	2.4
10130.9	11339.8	10128.7	11338.4	2.2	-1.4	-32.9	2.6
10071.2	11708.6	10068.7	11707.9	2.5	-0.6	-14.2	2.6
9857.6	11657.4	9856.6	11655.0	1.0	-2.4	-67.2	2.6
7656.3	10252.6	7653.7	10252.6	2.7	0.0	0.0	2.7
8379.6	10285.6	8379.6	10282.9	0.0	-2.7	-90.0	2.7
8354.8	10265.9	8353.0	10263.9	1.8	-2.0	-48.8	2.7
8717.1	10480.1	8716.6	10477.5	0.5	-2.7	-79.2	2.7
10330.7	11927.1	10328.6	11925.2	2.0	-1.9	-43.3	2.8
7632.5	10276.8	7629.7	10276.8	2.8	0.0	0.0	2.8
10058.9	11690.3	10056.2	11689.0	2.7	-1.3	-25.5	2.9
8882.2	10611.4	8880.1	10609.2	2.2	-2.2	-45.0	3.1
10325.9	11839.8	10323.0	11838.7	2.9	-1.0	-19.3	3.1
10351.2	11826.0	10348.2	11825.1	3.0	-0.9	-16.3	3.2
10320.9	11901.2	10318.0	11899.6	2.9	-1.5	-27.7	3.3
10317.8	11894.0	10314.8	11892.8	3.0	-1.3	-22.7	3.3
10055.7	11680.6	10052.6	11679.4	3.0	-1.3	-22.7	3.3
8445.4	10320.1	8444.3	10316.9	1.0	-3.2	-72.2	3.3
10338.9	11911.0	10336.0	11909.3	2.9	-1.8	-31.2	3.4
7428.0	10126.6	7430.3	10124.0	-2.3	-2.5	-131.8	3.4
10028.6	11684.7	10025.5	11683.4	3.2	-1.3	-21.8	3.4
9307.1	11404.1	9310.5	11404.0	-3.4	-0.1	-177.7	3.4
7677.6	10274.5	7674.0	10274.3	3.6	-0.3	-4.0	3.6
7305.2	10001.9	7306.6	9998.5	-1.4	-3.3	-112.9	3.6
10024.8	11680.7	10021.4	11679.5	3.4	-1.1	-18.5	3.6
10336.4	11879.7	10332.9	11878.5	3.4	-1.1	-18.5	3.6
10330.7	11895.4	10327.4	11893.9	3.3	-1.5	-24.7	3.6
10353.4	11820.8	10350.1	11819.3	3.3	-1.5	-24.9	3.6
10235.0	11409.6	10231.3	11409.1	3.7	-0.5	-7.9	3.7
10321.4	11911.6	10318.1	11909.8	3.3	-1.8	-28.3	3.8
9997.5	11662.1	9993.8	11661.1	3.7	-1.0	-15.3	3.8
10103.6	11686.7	10099.9	11685.7	3.7	-1.0	-15.3	3.8
8828.6	10568.0	8826.0	10565.2	2.7	-2.8	-46.3	3.9
10323.7	11537.2	10320.4	11535.0	3.3	-2.1	-33.2	3.9
10330.0	11907.5	10326.6	11905.3	3.4	-2.2	-32.2	4.1
9969.8	11622.0	9966.3	11620.0	3.6	-2.0	-29.7	4.1
10332.0	11830.4	10328.2	11828.8	3.8	-1.5	-21.7	4.1
7620.0	10215.1	7615.8	10215.1	4.2	0.0	0.0	4.2
9964.0	11667.7	9960.1	11666.1	3.9	-1.6	-22.7	4.3

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
9977.3	11603.7	9973.1	11602.5	4.2	-1.1	-15.2	4.3
9427.6	11396.6	9424.5	11393.4	3.0	-3.2	-46.2	4.4
10342.3	11757.8	10338.2	11756.0	4.1	-1.8	-23.7	4.4
10386.3	11851.1	10381.8	11851.3	4.5	0.1	1.7	4.5
9514.5	11483.3	9510.3	11481.8	4.2	-1.5	-20.0	4.5
10414.3	11750.8	10409.8	11750.2	4.4	-0.6	-8.1	4.5
9961.0	11653.8	9956.6	11652.2	4.3	-1.5	-19.4	4.6
9508.6	11407.2	9504.2	11405.9	4.4	-1.3	-15.9	4.6
7611.1	10206.1	7615.8	10206.2	-4.7	0.1	178.5	4.7
9591.8	11507.5	9587.1	11507.3	4.7	-0.3	-3.0	4.7
7757.6	10283.9	7752.9	10284.2	4.7	0.4	4.7	4.7
9928.4	11647.4	9924.1	11645.4	4.3	-2.0	-25.2	4.8
9922.0	11645.8	9917.7	11643.8	4.3	-2.0	-25.3	4.8
10353.3	11559.1	10348.9	11557.1	4.3	-2.0	-25.3	4.8
10086.2	11693.6	10081.6	11692.0	4.6	-1.5	-18.4	4.8
10238.6	11666.0	10234.7	11663.2	3.9	-2.8	-35.4	4.8
7586.5	10204.6	7581.7	10204.7	4.8	0.1	1.5	4.8
7658.1	10277.1	7653.3	10276.8	4.8	-0.3	-3.1	4.8
9931.0	11643.2	9926.8	11640.8	4.2	-2.4	-30.0	4.8
7300.3	10100.7	7304.1	10097.7	-3.8	-3.1	-141.2	4.9
9971.6	11615.5	9967.2	11613.3	4.4	-2.2	-25.9	4.9
9555.1	11439.5	9550.6	11437.2	4.4	-2.3	-27.1	5.0
7634.6	10217.4	7629.7	10216.6	5.0	-0.8	-8.6	5.0
10339.4	11758.8	10334.7	11757.0	4.7	-1.8	-20.8	5.0
9514.2	11485.8	9509.4	11484.4	4.8	-1.4	-16.1	5.0
10023.8	11634.3	10019.0	11632.6	4.8	-1.6	-18.9	5.1
9984.9	11576.1	9980.2	11574.1	4.7	-2.0	-23.2	5.1
8063.9	10109.5	8059.2	10107.2	4.7	-2.3	-26.0	5.2
7367.9	10420.4	7372.4	10417.6	-4.4	-2.8	-147.8	5.3
9553.4	11445.9	9548.7	11443.5	4.7	-2.4	-27.1	5.3
9945.2	11612.3	9940.4	11610.2	4.8	-2.2	-24.1	5.3
10035.5	11589.5	10030.5	11587.6	4.9	-1.9	-21.0	5.3
9938.8	11574.5	9933.8	11572.8	5.1	-1.6	-17.9	5.3
10244.2	11666.1	10239.9	11662.9	4.3	-3.2	-36.3	5.4
10155.8	11506.5	10151.1	11503.9	4.7	-2.7	-29.5	5.4
9527.2	11486.5	9522.2	11484.2	5.0	-2.3	-24.7	5.5
9499.5	11409.9	9494.5	11407.6	5.0	-2.3	-24.8	5.5
9910.4	11647.6	9905.5	11645.3	5.0	-2.3	-24.8	5.5
10020.2	11560.2	10015.4	11557.6	4.8	-2.5	-27.7	5.5
10136.0	11507.3	10130.9	11505.3	5.1	-2.0	-21.8	5.5
9390.0	11367.9	9386.3	11363.9	3.7	-4.1	-47.8	5.5
9518.8	11422.2	9513.7	11420.1	5.1	-2.2	-22.9	5.5
10091.9	11481.1	10087.5	11477.6	4.5	-3.4	-37.5	5.6
10058.4	11488.8	10053.6	11485.9	4.8	-2.9	-31.1	5.6
9669.3	11538.0	9663.7	11537.0	5.6	-1.0	-10.3	5.7
9661.9	11530.9	9656.3	11529.9	5.6	-1.0	-10.3	5.7
9903.3	11642.0	9898.4	11639.2	5.0	-2.8	-29.4	5.7

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
7550.0	10171.1	7544.7	10169.0	5.3	-2.0	-20.8	5.7
10148.2	11514.2	10143.6	11510.8	4.6	-3.4	-36.7	5.7
9910.2	11620.6	9905.1	11618.0	5.1	-2.7	-27.6	5.7
10341.5	11748.9	10336.1	11747.0	5.5	-1.9	-19.2	5.8
8170.1	10140.0	8164.9	10137.5	5.2	-2.5	-25.9	5.8
10058.2	11556.1	10053.0	11553.5	5.2	-2.5	-26.0	5.8
9910.5	11633.6	9905.8	11630.2	4.7	-3.4	-36.1	5.8
9681.8	11548.8	9676.3	11547.1	5.6	-1.6	-16.5	5.8
9950.4	11589.6	9944.9	11587.4	5.5	-2.2	-21.6	5.9
9505.2	11423.1	9499.6	11421.2	5.6	-1.9	-18.8	5.9
9903.2	11636.9	9898.0	11634.1	5.2	-2.8	-28.2	5.9
9512.4	11414.1	9507.1	11411.4	5.3	-2.7	-26.5	6.0
9995.9	11591.1	9990.5	11588.4	5.3	-2.7	-26.5	6.0
9931.4	11599.8	9925.6	11597.9	5.7	-1.9	-18.4	6.0
9840.4	11600.2	9834.9	11598.0	5.6	-2.3	-22.2	6.0
9924.5	11579.2	9918.9	11576.9	5.6	-2.3	-22.3	6.0
9939.6	11581.6	9933.9	11579.6	5.7	-2.0	-19.6	6.1
9914.3	11597.8	9909.0	11594.8	5.3	-2.9	-28.7	6.1
9903.8	11615.7	9898.5	11612.8	5.3	-2.9	-28.7	6.1
10181.5	11411.2	10176.6	11407.7	5.0	-3.6	-35.6	6.1
9579.9	11467.0	9574.0	11465.2	5.8	-1.8	-16.9	6.1
9664.2	11526.9	9658.3	11525.2	5.8	-1.8	-16.9	6.1
7698.1	10231.4	7692.1	10230.2	6.0	-1.3	-12.0	6.1
9926.9	11590.2	9921.2	11588.0	5.7	-2.3	-21.8	6.2
9497.2	11416.9	9491.2	11415.4	6.0	-1.5	-14.3	6.2
10167.4	11377.4	10162.2	11374.1	5.2	-3.3	-32.4	6.2
9836.5	11295.0	9830.6	11293.3	6.0	-1.6	-15.4	6.2
7527.6	10160.3	7521.7	10158.1	5.8	-2.2	-20.3	6.2
9927.5	11577.8	9921.7	11575.6	5.8	-2.2	-20.3	6.2
9503.6	11399.1	9497.4	11398.6	6.2	-0.5	-4.6	6.2
9345.9	11342.3	9341.6	11337.7	4.3	-4.6	-46.6	6.3
9898.5	11619.9	9892.9	11617.0	5.6	-2.9	-27.6	6.3
9382.1	11370.7	9377.3	11366.7	4.8	-4.1	-40.1	6.3
10208.9	11451.6	10203.1	11448.8	5.7	-2.8	-26.0	6.4
9897.5	11627.3	9892.0	11624.0	5.5	-3.3	-31.1	6.4
9899.6	11624.6	9894.2	11621.3	5.5	-3.3	-31.1	6.4
9536.7	11420.9	9530.6	11419.0	6.1	-1.9	-17.4	6.4
9921.1	11579.3	9915.1	11577.0	6.0	-2.3	-21.0	6.4
9952.7	11578.7	9946.6	11576.5	6.1	-2.2	-19.5	6.5
10188.2	11420.2	10183.7	11415.5	4.4	-4.7	-46.6	6.5
9945.3	11463.1	9939.1	11461.4	6.2	-1.8	-15.9	6.5
9902.8	11619.4	9897.2	11616.1	5.6	-3.3	-30.6	6.5
9845.7	11303.2	9839.6	11300.9	6.1	-2.3	-20.5	6.5
9973.3	11410.5	9967.2	11408.2	6.1	-2.3	-20.5	6.5
10207.8	11443.3	10202.4	11439.8	5.5	-3.5	-33.0	6.5
9759.5	11543.5	9753.7	11540.6	5.8	-2.9	-26.6	6.5
9901.9	11624.1	9896.2	11620.9	5.7	-3.2	-29.0	6.5

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
10104.1	11356.1	10098.1	11353.4	6.0	-2.7	-24.1	6.5
9925.5	11585.2	9919.4	11582.8	6.1	-2.4	-21.6	6.6
10147.8	11408.3	10142.2	11404.9	5.6	-3.4	-31.5	6.6
9690.9	11540.4	9684.5	11538.6	6.3	-1.8	-15.6	6.6
10204.2	11444.6	10198.7	11440.9	5.5	-3.7	-33.9	6.6
9679.4	11458.7	9673.3	11456.1	6.1	-2.5	-22.5	6.6
10164.0	11416.2	10159.2	11411.6	4.8	-4.6	-43.5	6.6
10241.6	11458.7	10236.9	11454.0	4.7	-4.7	-45.0	6.6
9684.6	11417.4	9678.1	11415.8	6.5	-1.5	-13.1	6.7
8161.6	10136.8	8156.2	10133.0	5.5	-3.8	-34.8	6.7
10108.4	11353.6	10102.3	11350.9	6.1	-2.7	-23.6	6.7
10180.4	11448.3	10175.3	11444.0	5.1	-4.3	-40.3	6.7
10181.8	11416.9	10176.7	11412.6	5.1	-4.3	-40.3	6.7
9732.4	11404.6	9725.8	11403.6	6.6	-1.0	-8.7	6.7
9636.7	11488.4	9630.3	11486.8	6.5	-1.6	-14.3	6.7
9901.8	11588.5	9895.8	11585.4	6.0	-3.0	-27.0	6.7
9879.7	11602.9	9873.8	11599.6	5.8	-3.3	-29.4	6.7
10232.0	11473.3	10228.0	11467.8	3.9	-5.5	-54.3	6.7
9362.6	11390.1	9357.9	11385.2	4.7	-4.8	-45.7	6.7
9827.5	11598.6	9821.1	11596.3	6.3	-2.3	-19.8	6.7
9702.8	11478.0	9696.4	11475.7	6.4	-2.3	-19.7	6.7
10172.1	11386.6	10166.2	11383.4	6.0	-3.2	-28.0	6.8
9695.4	11519.4	9689.4	11516.2	6.0	-3.2	-28.1	6.8
10150.6	11376.9	10144.3	11374.3	6.2	-2.7	-23.2	6.8
9899.8	11553.5	9893.5	11551.1	6.4	-2.4	-20.7	6.8
9640.9	11494.2	9634.6	11491.7	6.4	-2.4	-20.8	6.8
9533.1	11380.9	9526.5	11379.2	6.6	-1.6	-13.9	6.8
10225.0	11457.3	10219.9	11452.7	5.1	-4.6	-42.0	6.8
9874.0	11597.8	9868.1	11594.2	5.8	-3.6	-31.4	6.8
9835.1	11596.4	9828.6	11594.1	6.5	-2.3	-19.4	6.9
10157.4	11369.7	10151.2	11366.8	6.2	-2.9	-25.0	6.9
10130.5	11364.2	10123.8	11362.8	6.7	-1.4	-11.7	6.9
7441.5	10236.2	7448.2	10234.7	-6.7	-1.5	-167.1	6.9
9688.3	11536.7	9681.7	11534.7	6.6	-2.0	-17.1	6.9
9737.2	11414.1	9730.3	11413.1	6.9	-1.0	-8.4	6.9
9654.4	11480.0	9648.4	11476.5	6.0	-3.6	-30.8	6.9
9784.7	11287.1	9777.7	11287.0	7.0	-0.1	-1.1	7.0
9890.0	11596.4	9883.7	11593.2	6.2	-3.2	-27.1	7.0
9891.1	11554.9	9884.9	11551.8	6.2	-3.2	-27.0	7.0
9886.6	11560.2	9880.6	11556.7	6.1	-3.4	-29.4	7.0
9646.1	11491.5	9639.4	11489.6	6.7	-1.9	-15.8	7.0
9863.0	11547.9	9856.5	11545.2	6.5	-2.7	-22.4	7.0
7520.3	10160.9	7513.9	10158.2	6.5	-2.7	-22.4	7.0
10240.2	11468.3	10234.9	11463.8	5.3	-4.6	-40.6	7.0
9687.4	11530.5	9680.7	11528.4	6.7	-2.0	-16.7	7.0
9679.3	11529.3	9672.9	11526.3	6.4	-3.0	-25.6	7.0
9709.1	11547.9	9702.7	11544.9	6.5	-2.9	-24.3	7.1

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
9744.6	11398.5	9737.5	11398.5	7.1	0.0	0.1	7.1
10227.3	11456.2	10221.9	11451.5	5.3	-4.7	-41.4	7.1
10229.4	11473.8	10225.0	11468.2	4.4	-5.6	-51.5	7.1
10041.5	11468.9	10035.2	11465.6	6.3	-3.3	-27.5	7.1
9549.0	11386.7	9542.6	11383.4	6.3	-3.3	-27.4	7.1
9760.9	11538.8	9754.3	11536.0	6.6	-2.8	-22.9	7.2
9867.7	11604.2	9861.1	11601.4	6.6	-2.8	-22.9	7.2
9649.1	11519.7	9642.2	11517.5	6.9	-2.2	-17.5	7.2
7533.8	10149.6	7527.7	10145.8	6.1	-3.8	-32.0	7.2
10144.0	11377.6	10137.2	11375.0	6.7	-2.5	-20.6	7.2
10252.0	11485.6	10246.6	11480.9	5.5	-4.7	-40.7	7.2
9880.4	11412.6	9873.4	11410.8	7.0	-1.8	-14.3	7.2
9438.0	11378.7	9431.0	11376.8	7.0	-1.9	-15.2	7.2
7561.1	10167.1	7554.0	10165.6	7.1	-1.5	-12.1	7.3
7608.2	10230.2	7615.5	10229.3	-7.2	-0.9	-173.0	7.3
10241.2	11462.9	10235.3	11458.7	6.0	-4.2	-35.1	7.3
9969.9	11433.3	9962.8	11431.6	7.1	-1.6	-13.1	7.3
9844.4	11308.4	9837.4	11306.3	7.0	-2.1	-17.1	7.3
9517.0	11371.9	9509.7	11370.9	7.2	-1.0	-7.9	7.3
9941.1	11475.0	9933.8	11473.8	7.2	-1.1	-9.0	7.3
9876.9	11596.4	9870.3	11593.2	6.6	-3.2	-25.7	7.3
9784.9	11568.0	9778.2	11565.1	6.7	-2.9	-23.5	7.3
9800.0	11287.5	9793.0	11285.2	7.0	-2.3	-18.1	7.3
9964.1	11468.6	9957.2	11465.9	6.9	-2.7	-21.2	7.4
9738.9	11395.2	9731.6	11395.6	7.4	0.4	3.0	7.4
9732.7	11407.0	9725.3	11406.4	7.4	-0.6	-4.9	7.4
10127.3	11359.8	10120.1	11358.1	7.2	-1.7	-12.8	7.4
9837.8	11304.9	9830.6	11303.1	7.2	-1.8	-13.7	7.5
10238.3	11457.5	10232.9	11452.5	5.5	-5.1	-42.9	7.5
9745.3	11402.2	9737.8	11402.1	7.5	-0.1	-1.0	7.5
9890.2	11339.4	9882.8	11339.0	7.5	-0.4	-2.9	7.5
9876.2	11330.0	9868.7	11329.6	7.5	-0.4	-2.8	7.5
9899.0	11431.7	9891.8	11429.5	7.2	-2.1	-16.6	7.5
9905.4	11551.5	9898.7	11548.1	6.7	-3.4	-27.0	7.6
7579.6	10183.1	7572.1	10181.8	7.5	-1.3	-9.6	7.6
9365.5	11380.3	9359.9	11375.1	5.6	-5.2	-43.0	7.6
9788.1	11559.0	9781.3	11555.6	6.9	-3.4	-26.5	7.7
9748.9	11309.4	9741.4	11307.8	7.5	-1.6	-12.4	7.7
10013.4	11345.9	10006.1	11343.7	7.4	-2.2	-16.4	7.7
9444.0	11382.2	9436.5	11380.6	7.5	-1.6	-12.4	7.7
9939.8	11478.8	9932.2	11477.9	7.6	-0.9	-6.6	7.7
9715.7	11392.9	9708.1	11391.9	7.6	-1.0	-7.6	7.7
9782.9	11551.1	9775.8	11548.2	7.1	-2.9	-22.3	7.7
10093.3	11355.0	10086.0	11352.3	7.2	-2.7	-20.2	7.7
9939.4	11466.1	9931.8	11464.8	7.6	-1.3	-9.4	7.7
9889.2	11564.2	9882.5	11560.4	6.7	-3.8	-29.5	7.7
9954.8	11425.9	9947.3	11424.0	7.5	-1.9	-14.2	7.7

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
9808.3	11571.7	9801.2	11568.6	7.1	-3.0	-23.1	7.7
9555.2	11385.4	9548.5	11381.6	6.7	-3.8	-29.5	7.7
10001.1	11437.4	9993.8	11435.0	7.4	-2.4	-18.1	7.8
9723.6	11397.8	9715.8	11397.4	7.7	-0.4	-2.8	7.8
9397.8	11422.4	9391.2	11418.4	6.6	-4.1	-31.6	7.8
10253.7	11498.6	10248.7	11492.6	5.0	-6.0	-50.3	7.8
9961.8	11429.8	9954.1	11428.3	7.6	-1.5	-11.3	7.8
9888.2	11344.5	9880.5	11343.6	7.7	-0.9	-6.5	7.8
9989.6	11436.8	9982.1	11434.6	7.5	-2.2	-16.1	7.8
10076.1	11342.5	10068.9	11339.6	7.2	-2.9	-22.0	7.8
9972.2	11431.1	9964.7	11428.9	7.5	-2.1	-16.0	7.8
9893.1	11415.9	9885.5	11414.1	7.6	-1.8	-13.1	7.8
9787.2	11547.8	9779.9	11545.1	7.4	-2.7	-19.9	7.8
9858.8	11341.8	9851.1	11339.9	7.6	-1.9	-13.9	7.8
9942.1	11349.8	9934.3	11348.5	7.7	-1.3	-9.2	7.8
9467.7	11468.6	9461.3	11464.2	6.5	-4.4	-34.4	7.9
9927.2	11451.6	9919.9	11448.8	7.4	-2.8	-20.8	7.9
9896.4	11412.1	9888.7	11410.1	7.6	-2.0	-14.8	7.9
9871.8	11561.2	9864.7	11557.8	7.1	-3.4	-25.8	7.9
9994.9	11452.5	9987.7	11449.4	7.2	-3.2	-23.7	7.9
10042.7	11474.7	10035.4	11471.6	7.2	-3.2	-23.6	7.9
10082.6	11343.3	10075.8	11339.4	6.9	-3.9	-29.8	7.9
9711.6	11263.6	9703.8	11261.8	7.7	-1.8	-12.9	7.9
9772.1	11559.9	9764.9	11556.6	7.2	-3.3	-24.4	7.9
9866.0	11305.0	9859.0	11301.2	7.0	-3.8	-28.5	8.0
9996.4	11446.3	9989.1	11443.3	7.4	-3.0	-22.4	8.0
9769.9	11517.3	9762.1	11515.9	7.9	-1.4	-10.0	8.0
9906.4	11416.7	9898.9	11413.9	7.5	-2.8	-20.4	8.0
9777.6	11285.4	9769.6	11285.1	8.0	-0.3	-1.8	8.0
9734.5	11527.9	9727.4	11524.2	7.1	-3.7	-27.4	8.0
9566.1	11391.7	9559.5	11387.1	6.6	-4.6	-34.8	8.0
9754.6	11547.1	9747.5	11543.3	7.1	-3.8	-28.1	8.1
9998.7	11440.0	9991.1	11437.3	7.6	-2.7	-19.3	8.1
9951.0	11476.2	9943.1	11474.4	7.9	-1.8	-12.7	8.1
9968.1	11428.8	9960.4	11426.5	7.7	-2.3	-16.4	8.1
9985.5	11473.9	9977.8	11471.6	7.7	-2.3	-16.4	8.1
9958.3	11448.1	9950.6	11445.7	7.7	-2.4	-17.2	8.1
9691.9	11516.9	9684.5	11513.4	7.4	-3.4	-25.0	8.1
9457.4	11417.8	9450.3	11413.9	7.1	-3.9	-28.9	8.1
9929.6	11437.1	9921.9	11434.6	7.7	-2.5	-18.1	8.1
10059.4	11333.2	10051.6	11330.6	7.8	-2.5	-18.1	8.2
9740.3	11278.7	9732.4	11276.5	7.9	-2.2	-15.3	8.2
9478.9	11408.4	9470.9	11406.6	8.0	-1.8	-12.5	8.2
9936.4	11484.1	9928.4	11482.3	8.0	-1.8	-12.5	8.2
9898.5	11435.6	9890.7	11433.3	7.9	-2.3	-16.1	8.2
9758.4	11509.3	9750.8	11506.1	7.6	-3.2	-22.6	8.2
9932.6	11416.1	9924.7	11413.6	7.9	-2.5	-17.8	8.3

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
10031.8	11353.1	10024.0	11350.5	7.9	-2.7	-18.7	8.3
9903.7	11443.0	9895.9	11440.3	7.9	-2.7	-18.7	8.3
7639.6	10177.2	7631.7	10174.5	7.9	-2.7	-18.7	8.3
9902.1	11337.2	9893.7	11337.0	8.4	-0.2	-1.6	8.4
9755.7	11551.0	9747.7	11548.2	8.0	-2.8	-19.2	8.5
9922.9	11452.7	9914.8	11450.3	8.1	-2.4	-16.5	8.5
9860.4	11335.9	9851.9	11335.0	8.5	-0.9	-5.9	8.6
9588.0	11386.3	9580.7	11381.7	7.2	-4.6	-32.3	8.6
7783.1	10249.3	7774.8	10247.0	8.3	-2.3	-15.4	8.6
10069.7	11365.2	10061.7	11362.0	8.0	-3.2	-21.6	8.6
7498.5	10119.4	7491.5	10114.3	7.0	-5.1	-36.0	8.6
10087.6	11365.5	10079.4	11362.5	8.1	-3.0	-20.5	8.7
9638.6	11349.8	9630.1	11347.6	8.5	-2.2	-14.2	8.8
9918.5	11435.5	9910.1	11432.4	8.4	-3.0	-19.9	8.9
10022.6	11447.3	10014.5	11443.6	8.1	-3.7	-24.4	8.9
9660.5	11259.7	9651.6	11258.8	8.9	-0.9	-5.7	8.9
9678.2	11252.8	9669.8	11249.5	8.4	-3.3	-21.5	9.0
9614.3	11241.5	9606.2	11237.2	8.1	-4.3	-27.9	9.2
7571.0	10157.1	7562.0	10155.2	9.0	-1.9	-11.9	9.2
7764.1	10221.4	7755.4	10218.5	8.8	-2.9	-18.4	9.2
7890.9	10286.2	7881.6	10285.0	9.3	-1.1	-7.0	9.3
7614.9	10145.3	7606.0	10142.4	8.9	-2.9	-18.1	9.4
7762.1	10238.2	7753.1	10235.4	9.0	-2.8	-17.2	9.4
7697.2	10162.3	7688.4	10158.7	8.8	-3.6	-22.1	9.5
9648.9	11257.0	9639.6	11255.1	9.3	-1.9	-11.5	9.5
7616.1	10133.6	7607.2	10130.3	8.9	-3.3	-20.4	9.5
9640.0	11342.9	9630.6	11341.3	9.4	-1.6	-10.0	9.5
9617.1	11225.4	9609.1	11220.2	8.0	-5.2	-33.1	9.5
9580.1	11389.1	9571.8	11384.3	8.3	-4.8	-30.3	9.6
7599.8	10132.4	7591.2	10128.2	8.6	-4.2	-25.9	9.6
9435.9	11280.1	9427.5	11275.4	8.4	-4.7	-29.3	9.6
7669.0	10153.8	7659.6	10151.5	9.4	-2.3	-13.6	9.7
7770.6	10192.1	7761.3	10189.3	9.3	-2.8	-16.8	9.7
9609.0	11223.2	9600.8	11217.9	8.1	-5.3	-33.3	9.7
7953.4	10340.0	7944.0	10337.3	9.4	-2.7	-15.8	9.8
9455.2	11260.5	9446.5	11256.0	8.8	-4.4	-26.9	9.8
9670.7	11264.2	9660.9	11263.0	9.8	-1.3	-7.3	9.9
9648.7	11266.9	9638.8	11265.7	9.9	-1.3	-7.2	10.0
7669.1	10163.2	7659.6	10160.0	9.5	-3.2	-18.4	10.0
9508.7	11325.5	9499.3	11321.8	9.4	-3.7	-21.3	10.1
7617.8	10150.0	7608.3	10146.6	9.5	-3.4	-19.8	10.1
7694.0	10189.4	7684.4	10186.3	9.7	-3.0	-17.5	10.1
7590.8	10123.1	7581.9	10118.2	8.9	-5.0	-29.1	10.2
7688.3	10180.1	7678.8	10176.4	9.5	-3.7	-21.1	10.2
9579.0	11323.8	9569.4	11320.2	9.7	-3.6	-20.2	10.3
9594.9	11267.6	9585.5	11263.4	9.4	-4.2	-24.0	10.3
9418.1	11242.8	9409.5	11237.3	8.6	-5.6	-32.9	10.3

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8432.2	10553.0	8424.1	10546.6	8.1	-6.4	-38.0	10.3
7783.7	10204.0	7773.9	10200.7	9.8	-3.3	-18.6	10.3
7550.5	10107.5	7541.6	10102.2	8.9	-5.3	-31.0	10.4
7687.9	10169.3	7678.2	10165.9	9.8	-3.4	-19.3	10.4
9430.2	11286.5	9421.1	11281.6	9.1	-4.9	-28.4	10.4
7669.5	10147.8	7659.7	10144.3	9.8	-3.5	-20.0	10.4
9493.1	11292.6	9483.5	11288.4	9.5	-4.2	-23.7	10.4
9630.7	11276.2	9620.5	11273.8	10.2	-2.4	-13.3	10.4
7682.9	10157.0	7673.2	10152.9	9.7	-4.1	-22.8	10.5
9677.7	11259.9	9667.3	11258.8	10.4	-1.1	-6.2	10.5
7978.2	10359.0	7968.3	10355.6	9.9	-3.4	-19.0	10.5
9438.2	11255.4	9428.7	11251.0	9.5	-4.4	-25.0	10.5
9561.3	11308.3	9551.1	11305.4	10.2	-2.9	-16.0	10.6
9635.3	11270.0	9624.9	11267.8	10.4	-2.1	-11.7	10.6
9423.7	11251.0	9413.6	11246.9	10.2	-4.0	-21.7	10.9
7744.4	10035.5	7734.6	10030.6	9.8	-5.0	-26.9	11.0
7919.2	10324.6	7908.3	10323.6	10.9	-1.0	-5.3	11.0
7849.3	10218.2	7838.5	10216.2	10.8	-2.0	-10.6	11.0
7695.5	10087.4	7685.4	10083.2	10.2	-4.2	-22.4	11.0
9642.9	11285.1	9632.0	11283.6	10.9	-1.5	-7.9	11.0
9488.6	11297.9	9478.5	11293.6	10.2	-4.3	-23.0	11.0
9596.0	11270.4	9585.8	11266.1	10.3	-4.3	-22.7	11.2
9452.5	11345.0	9441.9	11341.3	10.5	-3.7	-19.2	11.2
7688.8	10200.2	7678.0	10197.3	10.8	-2.9	-15.1	11.2
7991.4	10231.3	7980.6	10228.4	10.8	-2.9	-15.1	11.2
9391.9	11283.7	9381.3	11279.9	10.5	-3.8	-19.8	11.2
9400.6	11302.1	9390.4	11297.5	10.3	-4.6	-24.0	11.3
7740.1	10176.1	7729.5	10172.4	10.7	-3.7	-19.0	11.3
8003.8	10211.2	7993.0	10207.8	10.8	-3.4	-17.6	11.3
7730.6	10181.3	7741.3	10185.1	-10.7	3.8	160.3	11.3
7929.8	10285.9	7918.7	10283.8	11.2	-2.0	-10.2	11.4
9547.4	11312.9	9537.1	11308.1	10.3	-4.8	-25.2	11.4
7982.9	10201.3	7972.0	10198.1	10.9	-3.2	-16.2	11.4
9379.4	11289.8	9368.8	11285.7	10.7	-4.1	-20.8	11.4
9485.5	11343.8	9474.4	11340.8	11.0	-3.0	-15.4	11.5
9384.9	11300.6	9374.5	11295.7	10.4	-4.8	-24.8	11.5
7644.4	10163.5	7633.5	10159.8	10.9	-3.7	-18.6	11.5
7763.2	10158.2	7752.4	10154.1	10.8	-4.0	-20.6	11.5
7737.5	10163.5	7747.7	10168.7	-10.3	5.2	153.1	11.5
8008.4	10216.5	7997.4	10213.2	11.0	-3.3	-16.6	11.5
7644.8	10033.2	7634.3	10028.5	10.5	-4.7	-24.0	11.5
7507.4	10095.0	7497.7	10088.5	9.7	-6.5	-33.9	11.6
7787.1	10194.4	7775.9	10190.9	11.2	-3.4	-17.1	11.7
7754.0	10031.7	7743.5	10026.6	10.5	-5.1	-25.7	11.7
7575.8	10123.8	7565.5	10118.2	10.3	-5.6	-28.5	11.7
7924.5	10146.8	7914.9	10140.0	9.5	-6.9	-35.7	11.7
7886.7	10265.8	7875.2	10263.2	11.4	-2.7	-13.1	11.7

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
7957.0	10332.9	7945.7	10329.7	11.3	-3.2	-15.7	11.7
7515.8	10058.9	7505.3	10053.7	10.5	-5.2	-26.3	11.8
7839.0	10078.0	7828.3	10073.1	10.7	-5.0	-24.9	11.8
7774.6	10166.4	7763.7	10162.0	10.9	-4.4	-22.1	11.8
7609.6	10098.6	7599.0	10093.2	10.5	-5.3	-26.8	11.8
7783.9	10164.7	7772.9	10160.6	11.1	-4.2	-20.7	11.8
7823.5	10207.7	7812.0	10205.1	11.6	-2.5	-12.3	11.8
9436.8	11317.9	9425.7	11314.0	11.2	-3.9	-19.4	11.8
9411.8	11312.2	9401.0	11307.3	10.8	-4.9	-24.6	11.9
7874.0	10248.8	7862.4	10245.9	11.6	-2.9	-14.1	11.9
7985.0	10152.4	7973.9	10148.2	11.2	-4.2	-20.6	11.9
8337.5	10492.7	8326.6	10487.8	10.9	-4.8	-23.8	11.9
7589.4	10090.3	7578.6	10085.1	10.8	-5.2	-25.7	12.0
7764.4	10017.6	7753.5	10012.6	10.9	-5.0	-24.4	12.0
9424.5	11315.4	9413.3	11311.0	11.2	-4.4	-21.7	12.0
8016.7	10225.7	8005.0	10222.8	11.7	-2.9	-14.0	12.0
7810.3	10210.0	7798.9	10206.2	11.4	-3.8	-18.4	12.0
9480.8	11333.8	9469.5	11329.6	11.3	-4.2	-20.3	12.1
7574.7	10111.9	7564.4	10105.6	10.3	-6.4	-31.7	12.1
7545.3	10062.8	7555.6	10069.1	-10.3	6.4	148.3	12.1
7871.8	10209.3	7860.0	10206.6	11.8	-2.7	-12.7	12.1
7951.9	10312.8	7939.9	10311.7	12.1	-1.1	-5.4	12.1
9387.7	11265.1	9376.9	11259.5	10.8	-5.6	-27.3	12.2
9475.8	11312.4	9464.6	11307.6	11.2	-4.8	-23.3	12.2
8232.5	10423.9	8222.9	10416.3	9.5	-7.6	-38.7	12.2
7643.1	10038.5	7632.0	10033.3	11.0	-5.2	-25.2	12.2
7689.3	10092.0	7678.5	10086.3	10.8	-5.7	-27.9	12.2
9207.3	11161.3	9198.8	11152.5	8.5	-8.8	-45.8	12.2
7557.9	10127.5	7547.2	10121.5	10.7	-6.0	-29.2	12.2
7887.0	10234.1	7875.1	10231.4	11.9	-2.7	-12.6	12.2
7826.0	10020.5	7814.5	10016.3	11.6	-4.2	-19.9	12.3
9222.5	11167.6	9213.4	11159.3	9.0	-8.4	-42.9	12.3
8327.2	10484.5	8315.9	10479.6	11.3	-5.0	-23.6	12.3
7906.7	10310.0	7894.4	10309.0	12.3	-1.0	-4.6	12.4
7653.5	10129.0	7642.1	10124.3	11.4	-4.7	-22.4	12.4
7792.8	10125.0	7781.1	10120.9	11.7	-4.1	-19.2	12.4
7660.7	10110.1	7649.7	10104.5	11.0	-5.6	-26.8	12.4
7900.8	10251.6	7888.7	10248.7	12.1	-2.9	-13.6	12.4
7928.9	10208.3	7916.7	10205.9	12.2	-2.4	-11.2	12.4
7700.3	10044.7	7689.2	10039.3	11.2	-5.5	-26.0	12.4
8330.6	10499.9	8319.3	10494.7	11.3	-5.2	-24.7	12.4
8016.8	10229.0	8004.6	10226.5	12.2	-2.5	-11.7	12.5
9459.8	11222.8	9448.5	11217.5	11.3	-5.3	-25.2	12.5
7901.6	10203.9	7889.7	10200.2	11.9	-3.7	-17.1	12.5
7739.5	10135.9	7728.0	10130.9	11.4	-5.1	-23.9	12.5
9392.9	11251.9	9382.0	11245.7	10.9	-6.2	-29.7	12.6
7805.6	10143.6	7793.7	10139.7	11.9	-3.9	-18.2	12.6

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8451.9	10547.2	8441.9	10539.6	10.0	-7.6	-37.2	12.6
8213.6	10437.4	8203.3	10430.0	10.3	-7.4	-35.6	12.6
9367.2	11295.6	9356.2	11289.4	11.0	-6.2	-29.3	12.7
8181.2	10455.3	8170.1	10449.1	11.0	-6.2	-29.4	12.7
7810.3	10133.7	7798.6	10128.8	11.7	-4.9	-23.0	12.7
7803.5	10201.8	7791.3	10198.3	12.2	-3.5	-16.2	12.7
8444.3	10537.8	8434.1	10530.2	10.2	-7.6	-36.9	12.7
7767.2	10140.9	7755.3	10136.2	11.8	-4.7	-21.7	12.7
7980.2	10198.9	7967.9	10195.7	12.3	-3.2	-14.4	12.7
7852.0	10192.4	7839.5	10189.4	12.4	-3.0	-13.7	12.8
7810.3	10151.0	7798.4	10146.3	11.9	-4.7	-21.5	12.8
7667.8	10060.4	7656.4	10054.5	11.4	-5.8	-27.1	12.8
7948.1	10095.5	7936.4	10090.1	11.7	-5.3	-24.5	12.8
9470.2	11313.7	9458.0	11309.7	12.2	-4.1	-18.4	12.8
7967.5	10175.4	7955.6	10170.4	11.9	-4.9	-22.5	12.9
7679.8	10092.1	7668.2	10086.3	11.6	-5.8	-26.8	13.0
8041.4	10125.9	8029.2	10121.1	12.2	-4.8	-21.6	13.1
7880.7	10238.9	7867.7	10236.9	13.0	-2.0	-8.9	13.1
7895.6	10106.7	7883.9	10100.6	11.7	-6.1	-27.5	13.2
7864.4	10152.6	7852.6	10146.8	11.8	-5.8	-26.3	13.2
8233.9	10445.9	8223.2	10438.0	10.7	-7.9	-36.4	13.2
7798.5	10151.3	7786.1	10146.6	12.4	-4.7	-20.7	13.3
9374.0	11305.3	9361.8	11300.0	12.2	-5.3	-23.6	13.3
7854.8	10024.6	7842.7	10019.3	12.2	-5.3	-23.6	13.3
7916.0	10197.7	7903.2	10194.0	12.8	-3.7	-16.0	13.3
7742.8	10083.4	7730.1	10079.3	12.7	-4.2	-18.2	13.4
7922.7	10193.9	7909.6	10190.8	13.1	-3.0	-13.0	13.4
8014.0	10123.9	8001.5	10118.8	12.4	-5.1	-22.2	13.4
9456.3	11322.7	9443.4	11318.7	12.8	-4.1	-17.6	13.5
9467.1	11339.4	9454.2	11335.2	12.8	-4.2	-18.0	13.5
8052.3	10125.9	8039.6	10121.2	12.7	-4.7	-20.3	13.5
7950.7	10105.4	7938.5	10099.4	12.2	-6.0	-26.0	13.6
7803.6	10136.0	7790.9	10131.1	12.7	-5.0	-21.3	13.6
7811.2	10013.0	7799.6	10005.7	11.6	-7.2	-32.0	13.6
9380.6	11266.6	9367.7	11261.7	12.8	-4.9	-21.1	13.7
9446.8	11190.1	9435.3	11182.6	11.6	-7.5	-33.0	13.8
8312.5	10499.2	8299.5	10494.5	13.0	-4.7	-19.9	13.8
8142.5	10251.2	8129.3	10247.3	13.2	-3.9	-16.6	13.8
7814.3	10158.9	7801.1	10154.8	13.2	-4.1	-17.0	13.8
7816.4	10163.2	7803.5	10158.4	13.0	-4.8	-20.4	13.8
8132.1	10185.0	8118.7	10181.4	13.3	-3.7	-15.4	13.8
8324.8	10389.5	8314.1	10380.6	10.7	-8.9	-39.8	13.9
8141.2	10151.3	8128.3	10146.3	13.0	-5.1	-21.4	13.9
8129.4	10250.1	8116.0	10246.4	13.5	-3.7	-15.3	14.0
8016.9	10122.4	8004.1	10116.6	12.8	-5.7	-24.0	14.0
8103.3	10210.1	8089.9	10205.7	13.3	-4.4	-18.4	14.0
8149.7	10367.6	8136.3	10363.2	13.3	-4.4	-18.4	14.1

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8138.2	10162.7	8125.1	10157.5	13.1	-5.2	-21.6	14.1
8148.0	10247.3	8134.3	10244.0	13.7	-3.3	-13.5	14.1
8086.8	10350.7	8073.6	10345.7	13.2	-5.0	-20.5	14.1
8341.4	10379.8	8329.4	10372.1	11.9	-7.7	-33.0	14.2
7811.2	10115.3	7798.0	10110.0	13.2	-5.3	-22.0	14.2
7854.6	10162.7	7841.2	10158.0	13.5	-4.7	-19.2	14.3
7938.9	10138.0	7926.4	10131.3	12.6	-6.7	-28.1	14.3
7671.0	10052.5	7658.2	10046.3	12.8	-6.2	-25.9	14.3
8174.1	10213.0	8160.4	10209.0	13.7	-3.9	-16.0	14.3
8160.0	10207.6	8146.8	10202.2	13.2	-5.5	-22.5	14.3
8156.2	10174.2	8143.4	10167.9	12.8	-6.3	-26.3	14.3
8334.5	10391.9	8323.1	10383.3	11.4	-8.6	-37.1	14.3
7898.0	10112.3	7885.1	10106.1	12.9	-6.2	-25.6	14.4
7959.8	10179.3	7946.3	10174.3	13.5	-5.1	-20.6	14.4
8179.5	10438.2	8167.5	10430.3	12.1	-7.9	-33.1	14.4
8154.4	10223.9	8140.6	10219.9	13.8	-4.0	-16.3	14.4
8329.6	10380.3	8318.0	10371.7	11.6	-8.6	-36.7	14.4
7916.8	10082.4	7904.6	10074.7	12.2	-7.7	-32.4	14.4
8441.6	10501.1	8430.1	10492.3	11.6	-8.8	-37.2	14.5
8067.8	10136.8	8054.5	10131.1	13.3	-5.7	-23.2	14.5
8077.3	10139.1	8064.3	10132.7	13.1	-6.3	-25.9	14.5
8446.6	10506.6	8435.1	10497.5	11.4	-9.0	-38.2	14.6
8065.3	10196.5	8051.2	10192.9	14.1	-3.7	-14.6	14.6
8033.9	10192.5	8020.1	10187.8	13.8	-4.7	-18.7	14.6
8187.6	10218.7	8173.6	10214.4	14.0	-4.3	-17.1	14.6
8440.2	10491.8	8428.4	10483.2	11.8	-8.6	-36.2	14.6
7937.4	10136.0	7924.5	10129.2	13.0	-6.9	-27.9	14.7
8194.2	10190.3	8179.9	10186.8	14.2	-3.5	-14.0	14.7
8182.7	10190.5	8168.9	10185.6	13.8	-4.8	-19.2	14.7
8127.1	10164.6	8113.7	10158.7	13.5	-5.8	-23.4	14.7
8126.9	10297.6	8113.3	10292.1	13.6	-5.6	-22.3	14.7
8155.0	10266.5	8141.2	10261.2	13.7	-5.3	-21.2	14.7
7866.6	10025.9	7853.3	10019.7	13.3	-6.2	-25.0	14.7
8073.5	10133.6	8060.2	10127.4	13.3	-6.2	-25.0	14.7
9370.3	11265.1	9357.5	11257.9	12.8	-7.2	-29.4	14.7
8037.9	10186.8	8024.0	10181.7	13.8	-5.1	-20.1	14.7
7906.2	10089.2	7893.8	10081.0	12.3	-8.1	-33.4	14.8
7858.9	10116.1	7846.0	10109.0	13.0	-7.1	-28.7	14.8
9411.1	11161.6	9399.8	11152.1	11.3	-9.5	-40.1	14.8
8178.5	10314.4	8165.0	10308.2	13.5	-6.2	-24.8	14.8
8150.7	10160.9	8137.0	10155.2	13.7	-5.7	-22.6	14.9
8066.2	10193.2	8051.8	10189.3	14.3	-3.9	-15.3	14.9
7602.0	10011.9	7589.0	10004.8	13.1	-7.1	-28.5	14.9
8198.2	10214.7	8184.1	10209.9	14.1	-4.8	-18.9	14.9
7807.4	10007.3	7794.8	9999.3	12.6	-8.0	-32.5	14.9
8196.8	10208.1	8182.6	10203.5	14.2	-4.6	-17.8	14.9
9456.8	11140.2	9443.6	11133.3	13.2	-7.0	-27.9	14.9

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8176.3	10173.2	8162.4	10167.5	13.8	-5.7	-22.4	15.0
7928.0	10079.3	7914.8	10072.2	13.2	-7.1	-28.3	15.0
7928.2	10062.1	7915.4	10054.2	12.8	-7.9	-31.5	15.0
7842.2	10119.1	7828.6	10112.6	13.6	-6.5	-25.5	15.1
8425.5	10504.3	8413.5	10495.0	11.9	-9.3	-37.8	15.1
9470.9	11155.4	9458.2	11147.1	12.7	-8.3	-33.0	15.1
8307.9	10421.6	8294.4	10414.7	13.5	-7.0	-27.4	15.2
7989.5	10104.3	7975.7	10097.9	13.7	-6.5	-25.3	15.2
9335.6	11194.6	9324.8	11183.9	10.8	-10.7	-44.7	15.2
8095.2	10370.6	8080.5	10366.9	14.7	-3.7	-14.0	15.2
8184.3	10296.8	8170.2	10291.1	14.1	-5.7	-22.0	15.2
8164.2	10227.5	8149.4	10224.2	14.9	-3.3	-12.5	15.2
7992.4	10111.9	7979.3	10104.1	13.1	-7.9	-31.0	15.3
8340.2	10370.0	8328.1	10360.8	12.2	-9.3	-37.3	15.3
8104.3	10147.2	8090.0	10141.5	14.2	-5.7	-21.9	15.3
7967.2	10085.7	7953.4	10078.9	13.8	-6.7	-25.9	15.4
8008.4	10108.8	7995.2	10100.8	13.2	-8.0	-31.2	15.4
8234.6	10387.8	8221.4	10379.8	13.2	-8.0	-31.2	15.4
9408.5	11168.4	9396.4	11158.6	12.1	-9.8	-39.0	15.5
8362.2	10423.8	8349.9	10414.2	12.3	-9.5	-37.7	15.6
8300.5	10407.3	8287.6	10398.7	13.0	-8.6	-33.7	15.6
8143.5	10170.4	8128.8	10165.2	14.7	-5.2	-19.4	15.6
9452.2	11192.6	9438.9	11184.2	13.2	-8.4	-32.4	15.6
8239.9	10308.1	8228.0	10297.8	11.9	-10.3	-40.7	15.8
8151.2	10375.5	8136.2	10370.6	15.0	-5.0	-18.3	15.8
8104.6	10160.0	8089.8	10154.7	14.9	-5.3	-19.7	15.8
8165.8	10264.9	8151.0	10259.0	14.7	-6.0	-22.0	15.9
8181.6	10267.2	8167.1	10260.6	14.5	-6.6	-24.5	15.9
8328.7	10426.3	8315.5	10417.4	13.2	-8.9	-33.9	15.9
8211.5	10324.4	8198.8	10314.7	12.7	-9.6	-37.2	15.9
8170.8	10169.2	8155.8	10163.8	15.0	-5.5	-20.0	15.9
8248.4	10336.8	8236.2	10326.5	12.2	-10.3	-40.2	16.0
8169.7	10285.4	8155.0	10279.2	14.7	-6.2	-22.9	16.0
8307.9	10345.5	8295.9	10334.7	11.9	-10.8	-42.1	16.1
9352.7	11100.9	9340.0	11091.0	12.7	-9.9	-37.9	16.1
8222.4	10280.0	8208.5	10271.8	13.8	-8.2	-30.8	16.1
8528.9	10586.5	8515.4	10577.7	13.5	-8.9	-33.4	16.1
9444.3	11135.6	9430.3	11127.4	14.0	-8.1	-30.2	16.2
8177.0	10261.9	8161.9	10255.9	15.1	-6.0	-21.5	16.2
8530.7	10380.9	8515.5	10375.2	15.2	-5.7	-20.5	16.3
8227.7	10331.2	8215.3	10320.7	12.4	-10.5	-40.3	16.3
8533.7	10544.6	8519.5	10536.6	14.2	-8.0	-29.3	16.3
9394.3	11091.5	9381.8	11081.1	12.6	-10.4	-39.6	16.3
8381.9	10422.0	8369.3	10411.4	12.6	-10.5	-40.0	16.4
8184.0	10284.8	8169.3	10277.5	14.7	-7.2	-26.1	16.4
8294.7	10441.1	8279.8	10434.1	14.9	-7.0	-25.1	16.4
8438.1	10353.2	8424.8	10343.5	13.3	-9.6	-35.9	16.5

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8304.2	10349.3	8291.5	10338.8	12.7	-10.5	-39.7	16.5
9170.5	11116.3	9158.6	11104.9	11.9	-11.4	-43.8	16.5
8259.9	10333.5	8247.7	10322.3	12.2	-11.2	-42.5	16.5
8188.1	10253.4	8172.5	10247.9	15.6	-5.5	-19.2	16.5
8451.1	10443.9	8438.4	10433.2	12.7	-10.7	-40.0	16.6
8507.8	10573.6	8494.2	10564.1	13.6	-9.5	-35.0	16.6
9430.9	11132.5	9416.4	11124.4	14.5	-8.1	-29.3	16.6
8530.0	10577.4	8515.8	10568.8	14.2	-8.6	-31.2	16.6
8159.2	10284.5	8143.9	10277.8	15.2	-6.7	-23.8	16.7
8325.6	10343.7	8312.4	10333.6	13.2	-10.2	-37.6	16.7
8489.5	10538.5	8475.5	10529.4	14.0	-9.1	-33.2	16.7
9500.0	11169.3	9484.8	11162.5	15.2	-6.8	-24.2	16.7
8560.1	10571.1	8546.6	10561.2	13.5	-9.9	-36.4	16.7
8296.2	10359.1	8283.2	10348.5	13.0	-10.7	-39.5	16.8
9362.1	11244.2	9349.7	11232.9	12.4	-11.3	-42.3	16.8
8550.4	10561.1	8536.9	10551.1	13.6	-10.0	-36.4	16.9
8583.7	10625.1	8570.3	10614.9	13.5	-10.3	-37.4	16.9
8583.9	10635.7	8570.3	10625.5	13.6	-10.1	-36.8	17.0
8505.2	10553.7	8491.7	10543.5	13.6	-10.2	-36.8	17.0
8216.2	10279.0	8201.4	10270.5	14.7	-8.5	-30.0	17.0
8250.2	10377.5	8235.4	10369.1	14.9	-8.4	-29.4	17.1
8395.6	10409.8	8381.9	10399.6	13.7	-10.2	-36.5	17.1
8504.0	10520.2	8489.6	10511.0	14.4	-9.3	-32.8	17.1
8263.2	10350.6	8249.6	10340.2	13.6	-10.4	-37.5	17.1
9345.1	11135.3	9330.6	11126.1	14.5	-9.1	-32.3	17.1
8554.8	10609.1	8540.7	10599.4	14.1	-9.8	-34.7	17.2
9361.6	11061.8	9348.6	11050.5	13.0	-11.3	-41.1	17.2
8218.8	10289.6	8204.1	10280.7	14.7	-8.9	-31.1	17.2
8513.6	10386.9	8498.3	10378.9	15.2	-8.0	-27.7	17.2
8421.4	10445.8	8408.2	10434.8	13.2	-11.0	-39.9	17.2
8283.6	10400.1	8269.0	10390.9	14.6	-9.1	-32.0	17.2
8565.0	10554.9	8550.9	10545.0	14.1	-9.9	-35.1	17.2
8547.8	10555.1	8533.0	10546.1	14.7	-9.0	-31.4	17.3
8283.0	10342.9	8269.8	10331.7	13.2	-11.2	-40.2	17.3
9392.2	11100.4	9378.0	11090.5	14.2	-9.9	-34.8	17.3
8503.6	10541.2	8489.2	10531.4	14.4	-9.8	-34.3	17.4
9495.2	11169.8	9479.7	11162.0	15.5	-7.9	-26.9	17.4
8449.9	10337.9	8436.1	10327.4	13.8	-10.5	-37.3	17.4
9386.0	11221.0	9372.2	11210.5	13.8	-10.5	-37.3	17.4
8228.6	10320.2	8214.6	10309.8	14.0	-10.4	-36.7	17.4
8548.5	10541.7	8533.4	10532.9	15.1	-8.8	-30.1	17.5
8200.3	10285.3	8184.9	10276.9	15.4	-8.4	-28.6	17.5
8515.1	10520.1	8500.8	10510.1	14.4	-10.0	-34.9	17.5
8274.3	10331.8	8261.6	10319.8	12.7	-12.1	-43.5	17.5
8421.7	10343.0	8408.0	10332.1	13.7	-10.9	-38.5	17.5
9338.4	11137.2	9323.9	11127.3	14.5	-9.9	-34.4	17.5
8421.1	10432.5	8408.1	10420.8	13.1	-11.7	-41.8	17.5

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8544.2	10543.1	8529.1	10534.1	15.1	-9.0	-30.8	17.6
8426.3	10429.2	8413.5	10417.1	12.8	-12.1	-43.3	17.6
8720.6	10709.8	8707.7	10697.7	13.0	-12.1	-42.9	17.7
8429.0	10334.4	8415.1	10323.3	13.8	-11.0	-38.6	17.7
8494.6	10556.7	8479.6	10547.2	15.0	-9.5	-32.4	17.8
8573.3	10573.7	8558.4	10563.6	14.9	-10.0	-34.0	17.9
8258.6	10326.4	8245.8	10313.8	12.8	-12.6	-44.4	18.0
8565.0	10565.8	8550.3	10555.3	14.7	-10.5	-35.5	18.1
8436.5	10394.3	8421.8	10383.8	14.7	-10.5	-35.6	18.1
8731.5	10680.8	8717.3	10669.5	14.2	-11.3	-38.5	18.2
9380.1	11093.9	9364.9	11084.0	15.2	-9.9	-33.0	18.2
8535.3	10375.8	8519.0	10367.7	16.3	-8.1	-26.5	18.2
8247.0	10302.6	8233.3	10290.6	13.7	-12.1	-41.3	18.3
8592.7	10592.2	8578.0	10581.3	14.7	-10.9	-36.6	18.3
8362.1	10322.7	8348.5	10310.4	13.6	-12.3	-42.2	18.3
8708.7	10725.8	8695.1	10713.5	13.6	-12.3	-42.2	18.3
8547.5	10386.7	8532.6	10375.8	14.9	-10.9	-36.3	18.4
8710.9	10720.1	8697.7	10707.0	13.2	-13.1	-44.7	18.6
9349.5	11057.5	9335.2	11045.7	14.4	-11.8	-39.5	18.6
8348.0	10343.3	8333.0	10332.3	15.0	-11.0	-36.4	18.6
8232.2	10275.8	8218.4	10263.1	13.7	-12.7	-42.8	18.7
8342.0	10318.7	8327.6	10306.6	14.4	-12.1	-40.0	18.7
8560.7	10557.7	8545.0	10547.4	15.8	-10.3	-33.1	18.8
9343.4	11068.2	9327.8	11057.6	15.6	-10.5	-34.0	18.8
9365.5	11098.4	9349.7	11088.2	15.9	-10.2	-32.6	18.8
9300.0	11012.5	9284.9	11001.2	15.1	-11.3	-36.8	18.9
8622.0	10446.8	8606.9	10435.5	15.1	-11.3	-36.8	18.9
8584.1	10597.8	8569.1	10586.3	15.0	-11.5	-37.6	18.9
8408.5	10313.2	8394.9	10300.0	13.6	-13.2	-44.2	18.9
8548.4	10389.8	8532.6	10379.1	15.7	-10.7	-34.1	19.0
8739.3	10727.6	8726.0	10714.0	13.3	-13.6	-45.5	19.0
8565.2	10400.5	8550.4	10388.5	14.9	-11.9	-38.8	19.1
8558.4	10411.5	8543.0	10400.2	15.4	-11.3	-36.3	19.1
8601.6	10432.2	8586.2	10420.9	15.4	-11.3	-36.3	19.1
8640.4	10607.5	8625.2	10595.9	15.1	-11.7	-37.7	19.1
8411.6	10325.3	8397.5	10312.4	14.1	-12.9	-42.6	19.1
9348.8	11088.4	9333.1	11077.3	15.6	-11.1	-35.3	19.1
8404.3	10329.9	8390.0	10317.2	14.4	-12.7	-41.5	19.2
9369.3	11091.9	9353.7	11080.7	15.6	-11.2	-35.6	19.2
8748.1	10730.7	8734.2	10717.4	13.8	-13.3	-43.9	19.2
8393.3	10316.6	8380.6	10302.1	12.7	-14.5	-48.7	19.3
9327.2	11046.3	9310.9	11035.8	16.3	-10.5	-32.9	19.4
9368.9	11080.5	9354.2	11067.9	14.7	-12.6	-40.5	19.4
8619.2	10427.9	8602.8	10417.5	16.4	-10.4	-32.4	19.4
8682.0	10640.8	8666.9	10628.6	15.1	-12.2	-38.9	19.4
9336.1	11057.4	9319.7	11046.9	16.4	-10.4	-32.4	19.4
8571.2	10398.0	8555.6	10386.0	15.6	-12.1	-37.7	19.7

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8658.5	10623.0	8642.9	10611.0	15.6	-12.1	-37.7	19.7
8248.7	10282.2	8234.3	10268.6	14.4	-13.6	-43.4	19.8
8625.6	10430.1	8609.2	10419.1	16.4	-11.0	-34.0	19.8
8745.6	10677.0	8730.8	10663.6	14.9	-13.3	-41.9	20.0
8622.9	10438.2	8607.3	10425.7	15.6	-12.4	-38.5	20.0
8733.2	10742.1	8718.7	10728.2	14.5	-13.8	-43.7	20.0
8682.5	10632.0	8666.5	10620.0	16.0	-12.1	-37.0	20.0
8571.2	10398.4	8555.5	10386.0	15.8	-12.4	-38.3	20.1
8581.6	10401.2	8565.6	10389.0	16.0	-12.2	-37.3	20.1
8655.0	10609.1	8639.3	10596.4	15.6	-12.7	-39.1	20.1
8682.1	10635.7	8666.4	10623.2	15.7	-12.6	-38.6	20.2
8739.8	10683.1	8724.7	10669.8	15.1	-13.3	-41.4	20.2
8637.6	10451.5	8621.1	10439.8	16.5	-11.7	-35.3	20.2
8881.8	10840.4	8863.8	10831.0	18.0	-9.4	-27.5	20.3
8654.3	10604.2	8638.6	10591.2	15.7	-13.1	-39.7	20.5
8870.9	10844.4	8853.2	10833.8	17.7	-10.5	-30.8	20.6
8708.0	10636.0	8692.0	10622.8	16.0	-13.2	-39.5	20.7
9316.0	11051.7	9298.0	11041.1	18.0	-10.5	-30.3	20.9
8643.5	10447.0	8627.3	10433.7	16.1	-13.3	-39.6	20.9
9320.1	11045.6	9302.7	11033.9	17.4	-11.7	-33.9	21.0
8586.2	10424.2	8569.1	10411.5	17.1	-12.7	-36.5	21.3
8644.6	10441.8	8628.0	10428.2	16.6	-13.6	-39.2	21.5
8803.9	10678.1	8789.3	10662.2	14.6	-15.9	-47.4	21.6
8885.6	10731.5	8869.3	10716.9	16.3	-14.6	-41.9	21.9
8716.1	10574.6	8699.9	10559.6	16.3	-15.0	-42.7	22.1
8343.3	10308.5	8326.5	10293.8	16.8	-14.7	-41.3	22.3
8710.4	10560.2	8693.9	10545.1	16.5	-15.1	-42.5	22.4
8812.2	10671.7	8797.6	10654.7	14.6	-17.0	-49.4	22.4
8853.9	10657.1	8839.1	10640.2	14.9	-16.9	-48.7	22.5
8715.0	10569.2	8698.1	10554.2	16.9	-15.0	-41.6	22.6
8872.0	10689.1	8856.2	10672.8	15.8	-16.3	-45.9	22.6
8843.4	10650.8	8827.6	10634.5	15.7	-16.4	-46.1	22.7
8851.1	10671.4	8835.3	10655.2	15.9	-16.3	-45.7	22.7
8882.3	10681.9	8866.6	10665.3	15.6	-16.6	-46.8	22.8
8892.7	10681.4	8877.6	10664.0	15.1	-17.4	-49.0	23.0
8885.6	10758.7	8869.2	10742.4	16.4	-16.3	-44.8	23.1
8841.8	10676.6	8824.7	10661.0	17.0	-15.6	-42.5	23.1
8701.0	10504.3	8683.0	10489.8	18.0	-14.5	-38.7	23.1
8674.7	10500.8	8655.5	10487.8	19.2	-13.0	-34.0	23.1
8691.5	10544.0	8673.8	10529.0	17.7	-15.0	-40.3	23.2
8887.0	10693.1	8871.2	10676.1	15.8	-17.0	-47.2	23.2
8929.3	10725.1	8914.1	10707.5	15.1	-17.7	-49.4	23.2
8831.7	10628.0	8815.3	10611.5	16.4	-16.5	-45.2	23.3
8381.9	10305.3	8365.4	10288.9	16.5	-16.4	-44.8	23.3
8874.1	10663.5	8858.1	10646.6	16.0	-16.9	-46.5	23.3
8846.1	10674.9	8830.2	10657.8	15.9	-17.0	-47.0	23.3
8916.2	10673.5	8900.4	10656.4	15.7	-17.1	-47.4	23.3

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
8833.9	10644.4	8817.9	10627.2	16.0	-17.2	-47.0	23.5
8888.5	10784.1	8870.4	10769.1	18.2	-15.0	-39.5	23.5
8846.9	10647.9	8830.4	10631.0	16.5	-16.9	-45.7	23.6
8757.5	10525.9	8739.4	10510.7	18.2	-15.1	-39.8	23.6
8695.1	10549.5	8676.4	10534.9	18.7	-14.6	-38.0	23.7
9224.2	11018.3	9204.9	11004.5	19.3	-13.8	-35.6	23.8
8948.0	10704.4	8932.4	10686.5	15.6	-17.9	-48.9	23.8
8709.7	10554.7	8691.5	10539.3	18.2	-15.5	-40.5	23.9
8913.5	10710.4	8897.4	10692.6	16.1	-17.8	-47.8	24.0
9013.6	10892.9	8996.9	10875.7	16.8	-17.3	-45.8	24.1
8700.9	10486.0	8682.2	10470.6	18.7	-15.4	-39.4	24.2
8931.8	10805.3	8910.9	10793.1	21.0	-12.2	-30.2	24.2
8712.7	10491.8	8693.5	10477.0	19.2	-14.9	-37.8	24.3
9206.4	10968.2	9185.9	10954.9	20.4	-13.3	-33.1	24.4
8894.8	10671.9	8878.2	10654.0	16.6	-17.9	-47.1	24.4
8753.7	10518.9	8735.8	10502.2	17.9	-16.6	-42.9	24.4
9184.7	10933.7	9166.0	10917.8	18.7	-15.9	-40.4	24.5
8930.5	10760.8	8913.8	10742.8	16.8	-18.0	-47.1	24.6
9177.2	10946.0	9157.6	10930.7	19.6	-15.4	-38.1	24.9
9043.6	10980.7	9025.8	10963.1	17.8	-17.6	-44.8	25.1
8282.7	10279.5	8266.9	10259.8	15.7	-19.7	-51.3	25.2
8928.5	10794.1	8907.7	10779.9	20.8	-14.2	-34.3	25.2
8685.5	10480.2	8665.1	10465.2	20.4	-15.0	-36.2	25.3
9073.5	10872.2	9056.6	10853.2	16.9	-18.9	-48.2	25.4
9102.0	10881.7	9083.8	10863.9	18.2	-17.8	-44.4	25.4
8906.0	10748.4	8888.5	10730.0	17.5	-18.4	-46.4	25.4
9251.9	11029.5	9230.1	11016.0	21.7	-13.4	-31.8	25.5
8950.5	10796.5	8929.9	10781.3	20.6	-15.2	-36.5	25.6
8974.6	10786.0	8955.7	10768.7	18.9	-17.3	-42.4	25.6
9214.6	10957.8	9193.6	10943.2	21.1	-14.6	-34.7	25.6
9019.6	10802.1	9000.1	10785.3	19.4	-16.8	-40.8	25.7
9098.9	10857.0	9080.3	10839.4	18.7	-17.6	-43.4	25.7
8745.1	10512.4	8726.0	10495.1	19.0	-17.3	-42.2	25.7
9202.2	10967.0	9180.5	10953.1	21.7	-13.8	-32.5	25.8
9229.8	10975.5	9207.8	10962.0	22.0	-13.4	-31.5	25.8
9119.1	10881.0	9100.5	10863.0	18.7	-18.0	-44.0	26.0
9151.9	10904.6	9133.4	10886.3	18.5	-18.3	-44.6	26.0
9129.4	10887.6	9110.2	10869.8	19.2	-17.8	-42.8	26.1
8982.7	10749.2	8965.3	10729.7	17.4	-19.6	-48.3	26.2
9054.3	10994.7	9035.5	10976.4	18.8	-18.3	-44.2	26.2
8941.0	10805.7	8918.4	10792.4	22.6	-13.3	-30.5	26.2
8952.4	10803.9	8931.1	10788.5	21.3	-15.4	-35.7	26.3
8983.6	10784.7	8963.7	10767.4	19.9	-17.3	-40.9	26.4
9010.4	10854.4	8990.5	10837.2	19.9	-17.3	-40.9	26.4
8986.9	10795.0	8966.5	10778.2	20.4	-16.8	-39.3	26.4
8967.6	10745.8	8950.2	10725.9	17.4	-19.9	-48.9	26.5
9135.1	10911.9	9115.8	10893.3	19.3	-18.5	-43.8	26.8

Appendix 2: --continued

1985 X	1985 Y	1990 X	1990 Y	Delta X (m)	Delta Y (m)	Angle degrees	length (m)
9222.9	10973.1	9199.4	10959.7	23.5	-13.3	-29.6	27.0
9133.3	10970.9	9113.7	10951.9	19.6	-18.9	-44.0	27.2
9128.9	10901.6	9109.0	10883.1	19.9	-18.5	-42.9	27.2
8987.7	10777.3	8968.5	10757.9	19.2	-19.4	-45.4	27.3
8996.8	10796.5	8975.0	10780.1	21.8	-16.4	-36.9	27.3
9049.0	10852.1	9032.6	10830.1	16.4	-22.0	-53.3	27.4
9017.5	10851.7	8996.6	10834.0	21.0	-17.8	-40.3	27.5
8990.2	10763.7	8972.2	10742.7	18.0	-21.0	-49.3	27.7
9038.7	10842.7	9019.4	10822.1	19.3	-20.6	-46.8	28.2
9037.0	10850.7	9017.5	10830.0	19.4	-20.7	-46.8	28.4
9151.1	10912.6	9129.7	10893.2	21.5	-19.4	-42.2	29.0