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SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Horizontal Accuracy Assessment of Digital Aerial Photograph in Urban Cadaster: The Case of Wereda 10, Gulelie Sub-City, Addis Ababa

BY

Azeneg Eneyew Kebede

A thesis submitted to the School of Graduate Studies of Addis Ababa University Presented in Partial Fulfillment of the Requirement for the Degree of Master of Science

(Geodesy and Geomatics Program)

Specialization in Geomatics

Advisor:
Andenet Ashagrie

Addis Ababa, Ethiopia
October, 2018

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Approved by the Board of Examiners

Name	Signature	Date
Andenet Ashagrie Advisor	_____	_____.
Dr Tulu Besha	_____	_____.
Examiner (internal) Dr Brhane Gesesse Examiner (External)	_____	_____.

Azeneg Eneyew

October, 2018

Acknowledgments

First and foremost it is my pleasure to thank Ato Andenet Ashagrie the principal supervisor of this thesis, for his continuous technical and scientific guidance, patience, motivation and enthusiasm. He guided me in all facets of my research from the proposal conception to the final write-up.

Big thanks to my best friend Cherenet Bekele for his continuous technical and scientific guidance, encouragement and reviewing of the whole thesis, and Abebaw Chanie for his great amount of advice and encouragement.

I am very grateful to my husband, Dawit Belay for his valuable support by giving different materials like papers and others, and who has been helping me by data collecting, encouragement and reviewing of the thesis.

The success of this thesis would not have been possible without the financial support from the Addis Ababa University, which is gratefully acknowledged.

Moreover I would like to extend my gratitude to the Addis Ababa City administration land holding and registering agency especially Gulelie Sub City Office.

Azeneg Eneyew

October, 2018

Abstract

Positional accuracy deals with the accuracy of the location of map features, and measures how far a spatial feature on a map is from its true or reference location on the ground. This research focused on the following problems: Coordinate shifting, area variation and shape difference between the ground measurement, line maps and digital aerial image. The main objective of this study is to assess the horizontal position accuracy of aerial photogrammetric image generated coordinates of Wereda 10, Gulelie sub city. There are three basic data sources used to assess horizontal accuracy assessment: Such as Geo referenced digital aerial photograph, digital line map and GPS data. This research contains the following steps: First step created twenty sample GCP points by using static GPS. The seconded step is process sample GCP points by using Leica Geo office combined software. While, the third step is measured hundred parcel corners points by using RTK GPS as a reference used the established GCP points. In addition, the fourth step is digitized parcel corner points and polygons from aerial photograph and digital line map. Finally, assessed horizontal accuracy, standard deviation, means value, minimum and maximum values. The paper describes the visualization possibility of estimated results of horizontal positional accuracy of digital aerial photographs and established cheek points and area, side length and coordinates comparison for digital aerial image and digital line map based on RTK GPS. The root mean square error results of twenty check points and digital aerial photograph the easting and northing component is 18.1cm and 18.8cm, respectively. The RTK GPS and aerial image comparison coordinates results show that the root mean square error of easting and northing component is 37.6cm and 38cm respectively. The RTK GPS and digital line map coordinates comparison results show that the root mean square error of easting and northing component is 39.2cm and 39.8cm respectively. The root mean square error is 5.828 m^2 and 5.852 m^2 in aerial photograph and digital line map respectively. The root mean square error is 38.1cm and 40 cm in aerial photograph and digital line map side lengths respectively. Therefore, these variations come from different factors: Such as shadows, topographic factors, vegetation covers and there are some limitations to these techniques as it solely on visual interpretation.

Keywords*:* GPS, RTKGPS, RMSE, Digital aerial image and Digital line map

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List of Acronyms

2D	Two Dimensional
3D	Three Dimensional
ASPRS	American Society for Photogrammetry and Remote Sensing
AU	African union
CAD	Computer aided design
CSA	Central Statics Agency
DOP	Dilution of Precision
DTM	Digital Terrain Model
FIG	International Federation of Survey
GCP	Ground Control Point
GDOP	Geometric Dilution of Precision
GIS	Geographic Information System
GNSS	Global Navigation Satellite Systems
GPS	Global Position System
GSD	Ground Sample Distance
HDOP	Horizontal Dilution of Precision
INSA	Information Network Security Agency
MAX	Maximum
MIN	Minimum
NGO	Non-Governmental Organization
NMAs	National mapping agencies
PDOP	Position Dilution of Precision
RINEX	Receiver Independent Exchange
RMSE	Root Mean Square Error
RTK	Real-Time Kinematic
SLR	Single Lens Reflex
UNECA	United Nations Economic Commission for Africa
VDOP	Vertical Dilution of Precision
WGS84	World Geodetic System of 1984

CHAPTER ONE

1. INTRODUCTION

1.1. Background

Positional accuracy deals with the accuracy of the location of map features, and measures how far a spatial feature on a map is from its true or reference location on the ground .There are two types of map accuracy assessment. The first type is positional accuracy assessment and the second type is thematic accuracy assessment (Green, 2009). The Glossary of the Mapping Sciences (ASPRS and ASCE, 1994) defines positional accuracy as "the degree of compliance with which the coordinates of points determined from a map agree with the coordinates determined by survey or other independent means accepted as accurate." All locations on maps and Geo referenced images are expressed by a set of x- and y-coordinates for horizontal location. Horizontal accuracy is to be assessed using RMSEx, RMSEy and RMSExy. Horizontal accuracy is more complex than vertical accuracy because the error is distributed in two dimensions (both the x and y dimensions) because requiring the calculation of the radial error and reliance on the bivariate normal distribution to estimate probabilities. The spatial accuracy evaluation of the digital aerial image and its suitability for a given application can be performed in a number of different ways. The first one difference or errors in feature locations between the digital aerial image and reference layer are observed and quantified. Another way to test the spatial accuracy is by using the global positioning system to determine accurate positions of features that can be easily identified on the digital aerial image (Green, 2009).

Photogrammetry is the science of determining the physical dimensions of objects from measurements on aerial photographs. Photogrammetry was firstly implemented in 1849 using terrestrial photographs taken on the earth's surface. Photogrammetry has the following advantages. Such as reduced time of field work, simultaneous three-dimensional coordinates, and in principle an unlimited number of points can be monitored (Isioye and Musa, 2007). Aerial photogrammetry images taken from aerial or satellite platforms. The

standards established the maximum RMSE permissible for map scales from 1:60 to 1:20,000.

In developing countries cad astral mappings are often criticized for being slow, expensive and major limitations on economic development. Most authorities agreed that some form of cadastral mapping in developing countries is essential for economic development and environmental management (Williamson and Enemark, 1996). The accuracy and quality of digital aerial image varies based on the accuracy of the source data. At this time Ethiopia is involved to develop high resolution and accurate rural and urban cad astral map (Zinabu, et al., 2017). This discipline has led to the development of specific measurement methods and has a characteristic vocabulary (Janssen and Vanderwel, 1994).Therefor, positional accuracy assessment is very important for cadastral map. Land is at the core of a nation's economy and as such it is essential to device methods for improving its management (Kurwakumire, 2014). The primary functions of cadastral survey is the foundation and satisfy the initial requirements of a land register by defining the parcels, which constitute the objects and units of the record (Fosu and Derby, 2008). Cadastral map is a map showing the position and boundaries of parcels for purposes of describing and recording ownership of property. A cadastral survey system is an interactive multitude of land administration sub-systems including adjudication, boundary definition and demarcation, surveying, registration, dispute resolution and information management. There has been a rapid rate of advancement in technology for surveying data collection tools. GNSS, digital photogrammetric work stations and processing software such as Model AutoCAD and Arc cadaster (Chileshe and Shamaoma, 2014). The existing cadastral surveying techniques can be divided into direct and indirect techniques. In case of direct technique, the relative position of points is located first on the ground, and the distance and angles are then measured using surveying instruments. On the other hand, in case of indirect technique, the surveyors use aerial photographs to delineate parcel boundaries and the polygons are then digitized in a second step. Cadastral surveying has three types of methods. Such as field survey, aerial survey and satellite images (Ali, et al., 2012).A cadaster is a parcel based, and up-to-date land information system containing a record of land rights, restrictions and responsibilities. Cadaster includes a geometric description of land parcels

linked to other records describing the nature of the interests and often the value of the parcel and its improvements. Cadastral maps are large scale maps and commonly used the range from scales of 1:500 to 1:10,000. Large scale maps showing more precise parcel dimensions and features. Cadastral maps are often prepared by cadastral surveys for each parcel based on ground surveys and aerial photography. Information's about land value, ownership, or land use, can be accessed by these unique parcel codes shown on the cad astral map (Ibraheem, 2012). The current cadastral systems in Ethiopia maintain 2D geometric descriptions of parcels. Cadaster usually maintained to register location, ownership, land value and attributes of land in a given jurisdiction, state or country (Bekele and Amezene, 2015).Therefore, the study aims to assessed the horizontal positional accuracy of aerial image and digital line map within a certain area in Gulelie Sub City especially Wereda 10. The author acknowledges the extensive list of publications on this and related topics, and refers readers to the selected bibliography for further reference. The goal of horizontal accuracy assessment is the identification and measurement of root mean square errors. Accuracy assessment of the registration of images can benefit from experiences already available in photogrammetry.

1.2. Statement of the Problem

In many countries, large scale cadastral mapping have prohibited the mapping of all land parcels at a common large scale, resulting in the use of different scales. Although the positional accuracy depends on the scale (i.e., the coordinates of the boundary points only represent the boundary in the cadastral map but not on the ground). For cadastral maps, the accuracy depends on the ground measurement. Therefore, mapping scale is important that the choice of a given accuracy specifications (Siriba, 2009). Accuracy of cadastral maps is immensely important subject. This subject is primarily used to maintain the boundaries of the property and resolve legal disputes before the courts (A lhameedwi, et al., 2017). Most of the urban land management in Ethiopia is increasingly difficult to cope with the demand for registering the process of land transactions as well as the rapidly changing patterns of land use associated with the accelerated urban growth. In addition to the absence of reliable information especially land related for the preparation and

implementation of urban plans in many urban centers. A typical problem include: inappropriate land use, building standards & regulations; land disputes do not solve quickly (Asmamaw, etal, 2017). Reconstructions of land cover have been used in landscape ecological analysis of land cover changes. However, because of difficulties in obtaining original historical data, assuring its accuracy and processing the large scale maps of the cadaster for analysis at these scales, techniques for studying specific land use changes based on cadastral map data for historical geographic spatial analysis has been limited(Harvey, etal,2014). Different problems about land information, such problems are land information is usually not coordinated or adequate, land information is available but largely inaccessible and the technological gap between the developing and developed nations with respect to land management (Kurwakumire, 2014). In the study area has different problems: Most people are not interested for the given cadastral map by the cause of area and shape variation between the new cadastral map and the previous one and most neighborhood peoples raise complain about boundary of the parcel. Thus, this study seeks to look at the following problems: Coordinate shifting, area variation and shape difference between the aerial image and ground measurement for cadastral maps. The goal of horizontal accuracy assessment is the identification and measurement of map errors. In this research to considered horizontal accuracy of digital aerial photograph and digital line map with ground control points. By used ground measurement the researcher assessed the accuracy of horizontal position of aerial image in Gulelie Sub City especially Wereda 10. In many countries, large scale cadastral mapping have prohibited the mapping of all land parcels at a common large scale, resulting in the use of different scales. The positional accuracy depends on the scale (i.e., the coordinates of the boundary point's only represent the boundary in the cadastral map but not on the ground). For cadastral maps, the accuracy depends on the ground measurement.

1.3. Objectives

1.3.1. General Objective

The main objective of this research is to assess the horizontal positional accuracy of digital aerial image generated coordinates in Wereda 10, Gulelie Sub City.

1.3.2. Specific objectives

- Examine the positional accuracy of digital aerial photograph image based on ground truth data sets.
- To assess the positional accuracy of digital aerial image with respect to RTK GPS based measured data sets.
- To assess the positional accuracy of digital line map with respect to RTK GPS based measured data sets.

1.4. Significance of the Study

The significance of the research will essentially examine the methods in an effect to prepare resourceful cadastral map for the study area. This is based on differential GPS and aerial photograph image. The research will also serve as an input to the forthcoming researchers, government bodies, NGOs and other concerned groups who have interest to pursue in related aspects of the research. The study it provides information on the quality of currently used aerial images for cad astral application.

1.5. Structure of the Thesis

This thesis has six chapters. The first part includes detailed discussion of the background; statement of the problem; objectives of the research and significance of the study is put with in this subdivision. While, chapter two has incorporated literature review. In addition to chapter three deals with description of study area, land use and land cover of the area, discusses with the data source, material and methodology. Finally chapter four deals with Results and Discussion and chapter five deals with conclusion and recommendation.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Accuracy Checking

The accuracy of the cadastral maps is analyzed through the accuracy of the transformation models, location accuracy and finally the area accuracy of each parcel. The accuracy of digital cadastral maps is assessed through one-to-one matching of the vectorised cadastral maps with the original analog map to ensure the shape and number of the respective parcel and the total number of parcels & other features in the village, particularly zero labels and duplicate labels and assessment of parcels area in vector layer with respect to the area of parcels mentioned in revenue records. Accuracy assessment was done by comparison of geo coordinates of randomly selected points generated by computer with that of observed through GPS, comparison of length measurement (of tie lines) generated by computer with that of actual field measurement and comparison of area of randomly selected parcels generated from image data set with that of actual field measurements. (Kumar, et al, 2014). Accuracy of the cadastral map, the spatial accuracy and integrity of cadastral maps can vary a great deal as shown by the reviews of the Danish and Australian cadastral systems. Cadastral maps can be graphic out-of-date approximations of the cadastral framework which are used primarily for charting of cadastral surveys or for valuation and land tax purposes, as originally used in Australia. On the other hand some cadastral maps are created by field surveys and in their digital form are as accurate as the supporting cadastral surveys, as seen in the cadastral maps of the Australian Capital Territory. If the map is compiled from sporadic cadastral surveys, the map will usually have a lower integrity and a greater variability of accuracy in the spatial location of parcel boundaries. (Williamson and Enemark, 1996).The accuracy of photogrammetric measurements is usually premised on the use of ground control points. These are points that can be accurately located on the photograph and for which we have information on their ground coordinates and/or elevations (often through GPS observations). The accuracy of area measurement is a

function of not only the measuring device used, but also the degree of image scale variation clue to relief in the terrain and tilt in the photography. (Lillesand, et al, 2004)

2.2. Types of Accuracy Assessment

Accuracy assessment has two components: Such as positional accuracy assessment and thematic accuracy assessment. Positional accuracy describes the location of cadastral map features and measures the distances of spatial feature on a map (Bolstad, 2005). Thematic accuracy describes with the attributes of cadastral map and measures. The horizontal accuracy of spatial data set is a function of both positional and thematic accuracy assessment.

2.2.1. Positional Accuracy Assessment

According to the glossary of the mapping sciences (ASPARS and ASCE, 1994). "Positional accuracy as the degree of compliance with which the coordinates of points determined from a map agree with the coordinates determined by survey or other independent means accepted as accurate". All locations on maps and Geo referenced images are described by x and y co-ordinates for horizontal location and include elevations which are represented by the letter z. The most important cause of positional error arises from the impact of topography on remotely sensed imagery. Two types of positional error assessments (Green, 2009).

2.2.1.1. Horizontal Accuracy Assessment

The accuracy of digital cadastral maps is assessed through one-to-one matching of the victories cad astral maps with the original analog map to definite the shape and number of the respective parcel. Accuracy assessment was done by comparison of geo co-ordinates of randomly selected points generated by computer with that of observed through GPS comparison of length measurement generated by computer with that of actual field measurement and comparison of area of randomly selected parcels generated from image data set with that of actual field measurements (Kumar, et al, 2014). Some cadastral maps are created by field surveys and in their digital form are as accurate as the supporting cad

astral surveys as seen in the cad astral maps of the Australian Capital Territory (Williamson and Enemark, 1996). The accuracy of area measurement is a function the measuring device used and the degree of image scale variation clue to relief in the terrain and tilt in the photography (Lillesand, et al 2004).

2.2.1.2. Vertical Accuracy Assessment

Vertical accuracy assessment as applied to contour maps on all publication scales. In checking elevations taken from the map the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale (Green, 2009).

2.2.2. Thematic Accuracy Assessment

Positional accuracy there is no government standard for assessing and reporting thematic accuracy. This omission is partially due to the inherent complexity of thematic accuracy but primarily to the fact that when maps were made from aerial photographs thematic accuracy was generally assumed to be at acceptable levels. It was the development and use of digital remote sensing devices that had the most profound impact on thematic accuracy assessment of maps created from all remotely sensed data (Green, 2009).

2.3. The Importance of Accuracy

There are several advantages of accuracy assessment. First users must consider the quality of data used to produce the spatial dataset (Wright, 1997). Second users must consider the utility of parcel spatial data. The GIS should not only make analysis easier but it should also increase confidence in the outcomes of analyses (Struck, 1998). There are many reasons for performing an accuracy assessment. Third analysts often need to compare various techniques algorithms analysts or interpreters to test which is best. Finally it is more and more common that some measure of accuracy be included in the contract requirements of many mapping projects. Therefore a valid accuracy is not only useful but may be required (Green, 2009).

2.4. Aerial Surveys

Digital cameras are produced with different sensor sizes and resolutions. Sensor size can be defined as the dimension of width and height of sensor array in millimeter or inches. Sensor resolution can be defined as the number of horizontal pixel multiplied by vertical pixel (Rao, et al ,2014) .There are various benefits using photogrammetry with digital camera imagery such as the prevention of differential stretch errors when scanning analogue films as well as the cost-cutting according to banning the use of analogue films(Kang, et al, 2008). Different characteristics of digital cameras. There is no fiducially mark in the digital images the camera calibration parameters are not stable and small format and others. The digital camera can also be categorized as a single lens reflex(SLR) for SLR digital camera the user has the full control on the camera such as controlling the focus aperture and shutter speed and compact for compact digital camera it uses the concept of point and shoot and it has the zoom facility. A digital camera could further be categorized as low resolution medium resolution and high resolution. Large-scale aerial photography provides a faster and cost effective means of extracting the cad astral information for parcel mapping (Rao, et al, 2014). The main problem in updating cad astral maps is the daily changes in urban area which can be considered as continuous problem with no end. Consequently the aerial photos represent the best reference for detecting and checking any changing that might happen (Khalfa and Alwan, 2014). Therefore when capturing digital data from a scanned aerial photograph or satellite imagery the desired ground resolution of the details which is independent of image and map scale should be considered (Siriba, 2009). In recent years much technological advancement has been made in the field of photogrammetry and the process of making maps using digital images. The photogrammetric data are affected by different factors such as topographic variations canopy earths' curvature and other error sources such as rectification and digitization. Other contributing error factors include the characteristics and calibration of equipment used for image capture such as the camera or scanner (Asmamaw, et al, 2017).

2.4.1. Photogrammetric Techniques in cadastral mapping

The accuracy and photo-map scale relationships mainly depend on the scale and resolution of aerial photography flying height base-height ratio and the accuracy of the stereo plotting. Based on the mapping scale and contour interval used to choose photographic scales. Although scale is a concept which relates to the level of generalization of digital geographic data. When capturing digital data from a scanned aerial photograph or satellite imagery the desired ground resolution or geometric accuracy of the details which is independent of image and map scale should be considered. Five approaches for photogrammetric mapping are identified. 1, the production of numerical coordinate data for points on the air photographs through the use of digital or analytical stereo plotters. 2, the preparation of base maps by photogrammetric stereo compilation. 3, instead of compiling the boundary lines and points using stereo photogrammetry orthorectified photographs are used. 4, involves the use of simply enlarged but rectified photographs to identify land parcel boundaries. 5, the identification and plotting of land parcel boundaries using simply enlarged and unrectified photographs (Sirba, 2009)

2.4.1.1. Camera calibration

Camera calibration methods may be classified into three basic categories: laboratory methods, field methods and stellar methods. Laboratory methods are most frequently utilized and are normally performed by camera manufacturers of the federal government (Wolf, et al, 1999). For an ideal camera three parameters need to be determined in calibration: A) the focal length of the camera this also determines the scale at which the aerial mapping takes place and its resolution on the ground. B) The location (xp-yp) of the principal point of the camera in relation to the set of fiducially marks at the edge of the image plane. C) The locations in millimeters of x and y of the fiducially marks in the camera co-ordinate system (Vermeer and Ayehu, 2016).

2.4.1.2. Interior orientation

Interior orientation is the process to express co-ordinates measured on the photographic plate or the scanned digital image film or image co-ordinates. It establishes the

transformation between these two co-ordinate frames. Typically there are either four or eight fiducially marks. The origin of the camera frame is the principal point and the projection of the optical center of the camera onto the image plane. After the interior orientation transformation is derived it may be used to convert the film co-ordinates of any point in the image to rectangular metric camera co-ordinates (x - y) (Vermeer and Ayehu, 2016).

2.4.1.3. Exterior orientation

Exterior orientation refers to establishing the connection between terrain co-ordinates. Three-dimensional and the camera co-ordinates for one given image (Vermeer and Ayehu, 2016). Before starting the object co-ordinates from our GCPs must be prepared in a file (Linder, 2005). Photogrammetry finding the conjugate points automatically can be executed especially when the operator provides good approximation and absolute orientation the relationship between the model and the object space is established. This requires the identification of ground control points (Hamruni, 2010).

2.4.1. 4.Correction of Measured Image Coordinates

Systematic errors is to model them mathematically and then applying corrections to the measurements. The major sources of the systematic errors are: displacement of the principal point comparator errors and deformations of the photographic material distortions caused by the optics of the camera atmospheric refraction and the curvature of the earth (Derenyi, 1996).

2.4.2. A typical workflow in digital aerial photogrammetry

Before starting our practical work beginning with the capture of the images and we have then to calculate the orientation parameters of all images we want to use. After this we can measure co-ordinates, create several kind of image products like surface models and finally we may use the results in additional cartographic or GIS software (Linder, 2005).

2.5. Cadastral Surveying Techniques

Three sets of complimentary techniques of cad astral surveying are common: field/ground surveying photogrammetry and remote sensing; all of which are concerned with the registering and presentation of spatially referenced data. Cadastral surveying has three possible methods: (a) ground survey (b) aerial survey and (c) satellite images. The ground survey method comes under direct technique while the aerial survey and satellite image methods are indirect technique (Dale and Mclaughlin, 1988). (Rao et al., 2014) says "field surveys are conducted by groups on ground using conventional surveying techniques and instruments". The ground survey method is the most accurate because most of the calculations are carried out in the field. Ground cadastral surveying technique in remote area and mountainous area is difficult due to bad weather condition or security reasons (Rao et al., 2014).

2.5.1. The Global Positioning System (GPS)

GPS is a satellite-based radio signal system which was established by the United States department of defense. GPS system provides position velocity and time anywhere in the world. Two types of GPS positioning :(a) absolute positioning and (b) relative positioning (alkan et al., 2015). The global positioning system has been used great success for the production and propagation of survey control. During the development of surveying by GPS the focus was on measured horizontal position and to measure height (Isioye and Musa, 2007). GPS has the following advantages: 1) GPS used to describe the geographical co-ordinates joined with satellite image, used to increase the positional accuracy of satellite images when three or more distinctive points can be located both on a satellite image, and on the ground GPS receivers can be used to collect accurate spatial coordinates at these positions. 2) GPS can be used in the ground reality of satellite images. When a particular satellite image has a region of unusual back scatter and the co-ordinates of that region can be loaded into a GPS receiver. 3) GPS has developed into a cost effective tool for updating GIS or computer aided design (CAD) systems and GPS is an excellent tool for data collection in many environments. The cadaster and land registry agency maintains two separate databases to control the information on ownership rights and parcels: a) cartographic

database mapping information system and b) administrative database automatic cadastral registers administrative database contains legal and administrative information of any parcel of land (Wakker et al, 2003). GPS applications can be categorized into two: such as static applications and kinematic applications. A) Static applications are concerned with positioning of stationary points. Static applications of GPS can be used in geodetic surveying, areal photogrammetric surveying, land surveying, orthometric height determination, topographic mapping monitoring, structural change and engineering surveys. B) Kinematic applications are concerned with the positioning of moving objects. (Mageed, 2014) says "kinematic applications of GPS can be used in attitude determination of a moving body where the attitude is defined as the orientation of a specific coordinate system in a land vehicle a ship or an aircraft with respect to a global or local coordinate system". GPS receivers can be categorized into two types: single frequency receivers and dual frequency receivers. A) Single frequency receivers which access the l1 frequency only. The single frequency receivers output the raw c/a code pseudo ranges the l1 carrier phase measurements and the navigation message and gives accuracy about 1cm+2ppm. B) Dual frequency receivers which access both l1 and l2 frequencies. The dual frequency receivers are the most complicated and most expensive receiver type. This type of receiver is the capacity of measuring all the GPS observables which are: l1, l2, carrier's c/a code and p-code and gives accuracy 5mm+1ppm. Single frequency receivers are affected more by ionosphere errors than dual frequency receivers but they are less expensive making them adaptable for certain surveying applications. Dual frequency multiple channel receivers can compensate well for ionosphere errors and these receivers are ideal for geodetic applications (Mageed, 2014).

2.5.1.1. Static GPS

Static GPS is a relative position determination method and the use of several GPS receivers with longer measurements of duration from 20 minutes up to several days. Static GPS is suitable for long distances above 20 kilometers but should not be used for baselines exceeding 50km. This method is often used to establish first and second order points which require high accuracy (Kartverk, 2005). The vectors are saved internally in each receiver and the vectors between the receivers and the known reference point is determined by

post processing the data (Wellenhof et al, 2008). According of (Alkan, 2015) "Static GPS surveying is a relative positioning technique that depends on the carrier-phase measurements and carrier-phase measurements is the most accurate positioning technique".

2.5.1.2. Real-Time Kinematic Global Positioning System

Real-time kinematic global positioning system is a surveying method performed with a relationship between a reference GPS rover units and sufficient satellite. The base station must be mounted on a known reference point while the rover is moveable. The base station acts as the known position with predetermined x- y- and z-coordinates from which the unknown positions are derived. Data from the base station to the rover is transmitted through radio contact which enables RTK GPS coordinates to appear in real-time in the rover (Wsdnr, 2004). When RTK surveying all receivers must observe minimum four common satellites (Moser, et al, 2016). RTK technology is enhanced with active repeater stations which are specially designed to re-transmit the base station signals in the areas of poor reception (Wayumba, 2013). There are an increasing number of applications for high precision carrier phase based positioning for machine and vehicle guidance and control lee 2009 RTK surveying has three methods: The survey involves a large number of unknown points located in the vicinity of a known point; the coordinates of the unknown points are required in real time; and the line of sight the propagation path is relatively unobstructed (Elrabbany, 1997).

2.6. Cadastral Surveying and Mapping

The cadaster is a register of parcel or survey of land for the purpose of taxation, description location of land, the rights to the land and information and showing details of ownership and the land value. Cadaster has three classifications: legal cadaster is a legally recognized register of land tenure, fiscal cadaster which was developed property valuation and multipurpose cadaster that contains both fiscal and the legal cadaster with the addition of other parcel-related information (Augustus and Moses, 2016). (Williamson, 2000) says that "the requirements of physical survey of land boundaries preceding registration may not be

necessary since registration can be based on old documents". Legal cadaster is measurement of legal ownership and registration of legal transactions. Legal cadaster deals with rights to use land, it is a complement to both property cadaster and tax cadaster and it is a register identify the legal owner and clear boundaries of each land parcel. To prepare a legal cadaster requires both fitting parcel boundaries through surveying and mapping and fitting legal rights which may involve negotiations among involved parties and a judicial determination of ownership (Larsson, 1990 a).Fiscal cadaster is a register of information for property taxes, locations and land values of the parcel. Governments need money which is produced through some sort of taxes. Land and land related properties are the major source of tax in different countries. Fiscal cadaster must include enough information to calculate a value using certain valuation methods (Larsson, 1990 a).Multipurpose cadaster is a combination of legal and fiscal cadaster .it contains information about land use and infrastructure (buildings, soil and other factors) (pro. no._03/2015). Each parcel must be described by a unique parcel identifier. The basic information wanted for development planning can be found from the legal or fiscal cadasters where they are kept up to date by concerned organizations. Instead of creating information system for planning purpose it has in many cases proved favorable to develop cadaster into a multipurpose cadaster (Larsson, 1990 a).

According of (Williamson and Enemark, 1996) "land parcels are defined by formal or informal boundaries marking the extent of lands held for exclusive use by individuals and specific groups of individuals". Each parcel is given a unique code such as an address, coordinates and lot number shown on map. For cad astral maps the scale range is 1:500 to 1:10 000. Large scale maps have more precise parcel dimensions and features. Such types of maps are often prepared by cad astral surveys based on ground surveys and aerial photography. Land value ownership can be accessed by new parcel code shown on the cad astral map thus creating a cadaster (Williamson and Enemark, 1996).Cadaster is described as a methodically arranged public inventory of data concerning properties within a jurisdiction. Based on a survey of their boundaries from a database perspective land information system is referenced to unique units of land and normally referred to as land parcels. The general description of these land parcels are normally shown on large scale

maps (Effenberg, 2001). According to (Gopikrihnan, 2013) an important aspect of "cad astral maps are to preserve the accuracy and precision of the areas of land parcels".

2.6.1. Components of a Digital Cadastral Mapping System

Digital cadastral mapping system has the following components: reference to a geodetic control network current base map layer digital image derived a cadastral layer delineating all real property parcels, digital aerial photographs, a unique parcel id assigned to each parcel ownership and parcel characteristic files and additional layers of interest (Ibraheem,2012).

2.6.2. Ground Control Point (GCP)

A ground control point is an object point which is represented in the image and from which the three-dimensional object co-ordinates are known. Find these points in a topographic map and get their co-ordinates out of the map x and y by manual measurement or by digitizing z by interpolating the elevation between neighboring contours. For each image we need at least 3 well-distributed GCPs. In geodesy the x axis shows to the north the y axis to the east in a right-hand system. In photogrammetric we use a mathematical co-ordinate system definition with x to the east y to the north in a left-hand system (Linder, 2005). GCPs are used in the geometrical transformation of the satellite image which can reduce systematic disturbances in the satellite image (Lillesand, et al, 2008). The GCP should have high contrast and consist of intersections of straight long lines such as house corners also states that such features are more common in urban areas than in rural. The challenging aspect of locating GCPs on historical aerial photos is that the correspondence between features on photos collected years or decades apart is sometimes poor. Even in developed areas GCPs may be difficult to locate and users are often faced with using a sub-optimal number type or spatial distribution of GCPs (Baltsavias and Gruen, 2003).

CHAPTER THREE

3. RESEARCH METHOLOGY

3.1. Description of the Study Area

Addis Ababa is the capital city of the Federal Democratic Republic of Ethiopia. The city has an international significance for being the seat of African Union and the United Nations Economic Commission for Africa (UNECA) and African union (AU). The geodetic bounding coordinates of the city are, φ=8º 49' 55" N to 9º 05' 53" N and λ=38º 38' 16" E to 38º 54' 19" E. The city lies at the foot of Mount Entoto and forms part of the watershed for the Awash. From its lowest point, around Bole International Airport, at 2,326 meters above sea level in the southern periphery, Addis Ababa raises to over 3,000 meters in the Entoto mountains to the north. The total area of the Addis Ababa city is about 527 km^2. The city has ten sub cities, the largest one is Bole sub-city and Addis Ketema is the smallest in its geographical area coverage. These sub cites also classifies in to one hundred sixteen Weredas (Socio-economic profile of Addis Ababa, 2012).The population of Addis Ababa is 3,194,999 with annual growth rate of 2.5(CSA, 2014). The topography of Addis Ababa is rugged with many typical volcanic features. While the central part of the city is characterized by gentle and rolling topography with scattered patches of hills, the southern and south eastern part is predominantly flat (Addis Ababa atlas, 2015). The Gulelie sub city is located in northern part of the city, near the Mount Entoto and Entoto Natural Park. It borders with the districts of Kolfe Keranio, Addis Ketema, Arada and Yeka. In Gulelie sub city the total area covered is 30.18 km^2 and has 10 Weredas (Addis Ababa atlas, 2015).Wereda 10 is one of the 10th Weredas' of gulelie sub city in Addis Ababa. Geographically, the district lies within the coordinates of $9^0$3'0" N- $9^0$5'15"N North latitude and $38^0$42'30" E- $38^0$43'45"E East longitude. It is found at western part of Gulelie sub city. Wereda 10 has 5km^2 or 534 hectare total area.

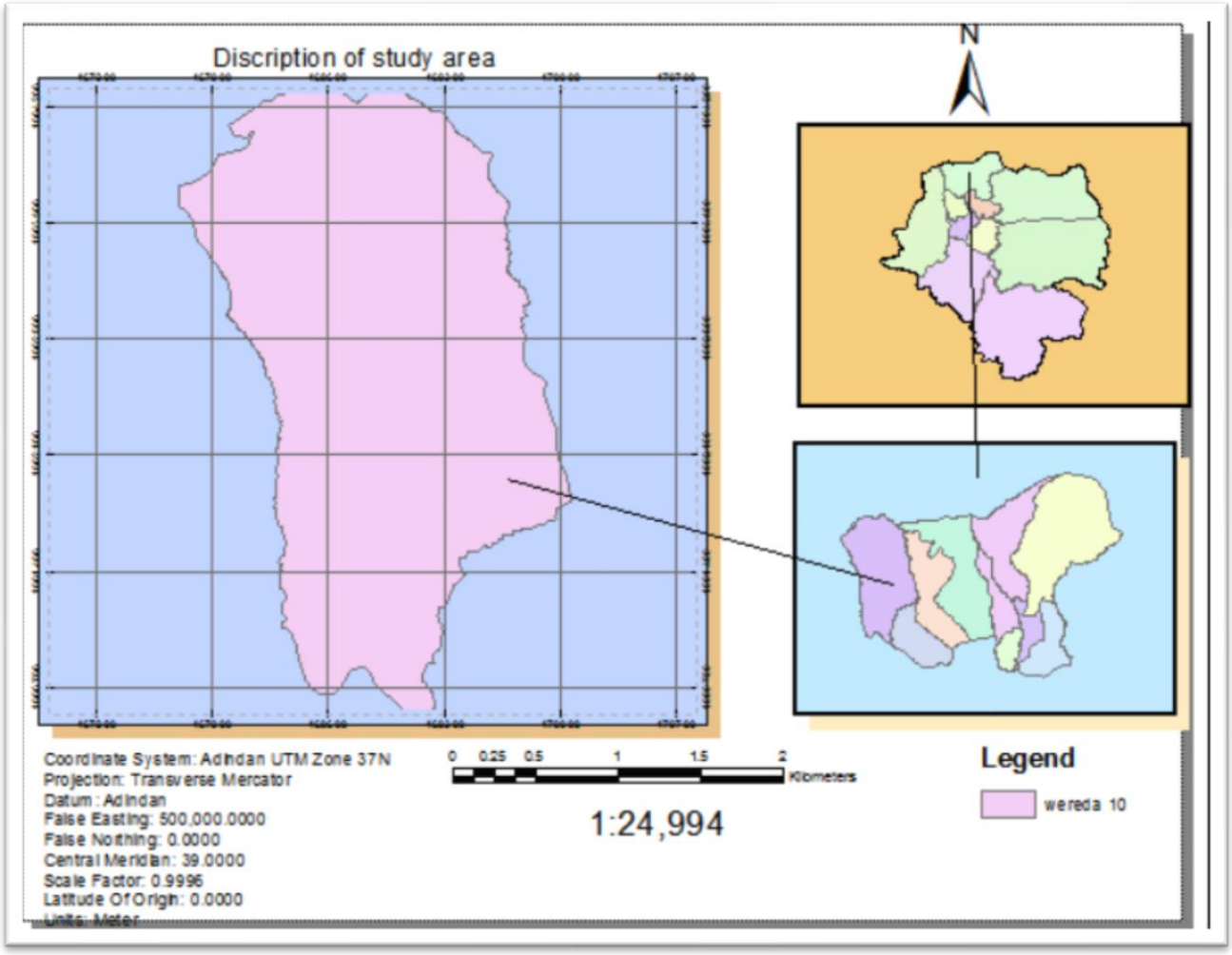


Figure3.1. Description of the study area

Source: Addis Ababa city administration of land holding and registration agency

3.1.1. Land Use and Land Cover in the Study Area

In most cases, the terms land use and land cover is used interchangeably. Land cover describes the physical material at the surface of the Earth. It comprises various land cover types such as trees, bare soil, grass, water etc. Whereas land use is a description of how people utilize the land and socio-economic activity such as urban land, agricultural land, forest land, water land, grazing land etc. (Wikipedia, 2008).The effect of land cover change

can directly or indirectly affect the way how human uses the land. Dynamics of land cover do not necessarily mean degradation of land or environment and the vice versa too. However, there are numerous natural and manmade driving forces that can alter the coverage and use of land, biodiversity, and other physical and human environments (George, 2005). Alteration in land use or land cover is principally due to the interaction of humans with their environment and its miss use. Thus, it is important to think about how to monitor and sustain the environment from climate change, biodiversity and the ecosystem. Hence, in order to manage the changes in land cover and use, it is necessary to have the information on existing and future land use/ land cover (George, 2005). Land is the economic resource of Addis Ababa; the land use pattern is characterized by haphazard development which mainly geared towards horizontal expansion. As the data collected and analyzed in 2004, out of the entire 51959 hectare of the city's land, road network area comprises 10.42%green area (forest, riverside greens etc.) accounts for 31.89%, residential covering 25.27 %(Addis Ababa atlas, 2015)

3.2. Data Source

This study used as horizontal accuracy assessment sample data, digital aerial image and digital line map acquired from aerial photogrammetric survey carried out over the whole area Wereda 10 in Gulelie sub city**.** The photogrammetric surveying was conducted by the Information Network Security Agency (INSA, in 2011 with a standard aerial camera at 1:2,000 scales and 20 cm Ground Sample Distance (GSD). There are three basic data sources used to assess horizontal accuracy assessment: such as data from Geo referenced digital aerial photograph of Wereda 10 in Gulelie sub city, digital line map and ground truth data. In this paper used already Geo referenced image. The minimum radiometric resolution of the digital photograph should 8 bit color photograph; the vertical accuracy for the digital terrain model should be 20cm; the ground sampling should be 20cm; the image should not be compressed. The digital image and digital line map was obtained from the Addis Ababa administration land holding and registration agency.

In this section, methods and techniques used to achieve the specified objectives are described. In this study involves five basic steps. The first step measured twenty sample

check points by using static GPS. The second step is process check points by using Leica Geo office combined software. The third step is measured hundred parcel corner points by using RTK GPS. The fourth step is digitized parcel corner points and polygons from aerial photograph and digital line map. The final step is horizontal accuracy assessment calculated.

3.3. Materials and Software

The researcher used the following materials: GPS (RTK and STATIC), Tripod, Geo referenced aerial photograph image (2011) and digital line map. The researcher also used the following software: Such as Arc GIS 10.3.1, LGO combined, Microsoft excel and Math type software.

3. 4.Methodology

3.4.1. Ground Survey

In order to evaluate the horizontal accuracy of aerial photograph, primary it has been established control points .To ensure the integrity of the surveys in areas where different methods are used the surveys have to be connected to higher level accuracy surveys. The field measurements were taken using Global Positioning System (GPS). Proper field reconnaissance is essential to the execution of efficient, effective GPS surveys. Reconnaissance of the study area was the first step in the establishment of control points and followed by marking twenty check points. Reconnaissance should include: Station setting or recovery, checks for obstructions and multipath potential, preparation of station descriptions (monument description, to-reach descriptions, etc.) and development of a realistic observation schedule. Hence selecting study area and finding suitable positions to establish GCPs (Ground Control Points) is one of the important activities of this stage. Ground control points can be placed systematically across the area, using differential GPS system. The equipment used during field work was Leica GS 14 GPS, which could be used both for static GPS surveying and RTK GPS surveying.

3.4.1.1. Static Surveying

Static survey methods require a schedule for the coordination of receivers, operators, observation times and the logistics of the project. The number of created check points are twenty and fairly distributed in the areas that are check point cites is clearly selected for appropriate work of the processes. Those control points were also suitable for satellite visibility, because GPS method was needed. The field work was conducted during a six day period, from 10 to 11 April 2018 site selection and from 26 to 29 April 2018 established twenty check points by using static GPS in Wereda ten, Gulelie sub city. The session period is one hour for each point. The maximum length of the baseline between the farthest GCP and Adis station in Arat kilo campus. The farthest distance is 15km. The check points have two coordinates (x and y) which are measured across digital images. The receiver type used was Leica GS 14 GPS.

3.4.2. Post-Processing

At the end of each day in the field the receiver data should be downloaded to a personal computer. This ensures that a back-up copy of all raw data is maintained in case the data becomes corrupted in the post-processing stage. Data were processed in the respective software of the instruments. Data from GPS processed in Leica Geo office software. All data collected and stored in the receiver relate to the World Geodetic System of 1984 (WGS84) reference ellipsoid. It is recommended that the data be processed on WGS84 and converted to the local datum once processing has been completed. Ethiopia uses local datum known by the name Adindan, in which the reference ellipsoid is known as Clark 1880 (a= 6378249.145, 1/f =293.465). It is non-geocentric datum with shift of the origin Δx = 165, Δy =11 and ΔZ= -206. This datum is originated in Southern Egypt and currently used by around six African countries, Burkina Faso, Senegal, Mali, Cameron and Sudan. The EMA in which the reference ellipsoid is known as Clark 1880 (a= 6378249.145, 1/f =293.466307656) and translational transformation parameters are Δx = -162, Δy = -12 and Δz = 206.The researcher uses the EMA translational transformation parameters. The data can easily be copied from the 'DBX' folder on the card to a PC using a card reader. By using Leica Geo office 8.3 DBX row data change to RINX data and download Adis station RINX

data and sp3 ephemeris data. These data shows appendix 2. Then by using Leica Geo office combined software process twenty established check points. The Adis RINX represents reference point and twenty established check points represents as robber used to processed points. After processes coordinates change WGS84 to Adindan datum.

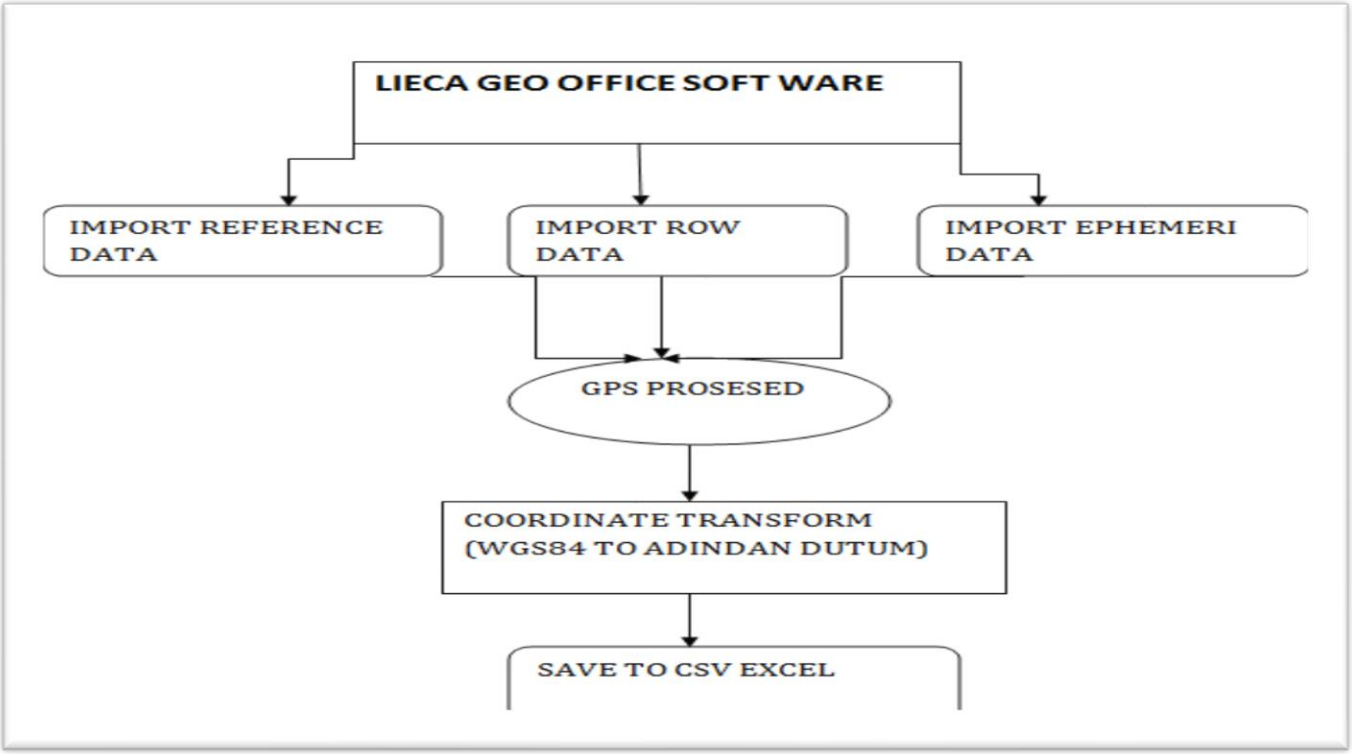


Figure3.2. Post processed steps measured points

3.4.3. RTK (Real Time Kinematics) GPS

All GPS is a distance (ranging) system. This means that the only thing that the user is trying to do is determine how far they are from any given satellite. All that the GPS satellite does is shoot out a signal in all directions, although there is a preferential orientation toward the earth. A base station is comprised of a GPS receiver, an antenna, and a tripod. The GPS receiver and the antenna shall be suitable for the specific survey as determined from the manufacturer's specifications. Real-Time-Kinematic GPS measurement technique is used to collect the coordinates of parcel corner points to test the accuracy associated with the orientation of the photogrammetric line map and aerial photograph. The three days were

used for RTK GPS surveying of land parcel corner points in Wereda 10, Gulelie sub city. The chosen epoch interval was set to five seconds. For RTK GPS surveying, radio contact had to be established between the base and the rover before the surveying could begin. All parcel corners were also surveyed with GDOP values below 5, which ensure that the geometry of the satellites is sufficient. The author collected hundred parcel corner points by using Leica GS 14 GPS. The author uses two established check points as a reference to collect parcel corner points. Such points are p06 and p10. (p10) uses station orientation and (p06) uses back sight.

3.4.4. Parcel Extraction from Digital Aerial Photograph and Digital Line Map

The parcels extracted from various datasets were compared using their attributes. Three parameters were used for comparison and analysis. These are area, length and position (coordinates).The digitizing process of the map features was carried using ArcGIS10.3.1 software. The parcel corner points were digitized using the editor function in Arc GIS, by zooming close to each of the surveyed parcel corners on the aerial image. Most of the parcels had distinct boundaries and the parcel points were digitized in the exact location of the parcel corner. Digitizing parcels for the ground measurement coordinates by using Arc GIS software to create polygon and dimension shape files and using editor icon to connected corner points of the parcels. The author extracted hundred parcels from ground measurement, aerial photograph and digital line map respectively. And the author also extracted 429 dimensions and coordinates from ground measurement, aerial photograph and digital line map respectively.

3.4.5. Horizontal Accuracy Assessment

To calculate the horizontal accuracy of the twenty established cheek points and the extracted points from aerial photograph. The extraction value of coordinate by using ARC GIS software by zooming in from the areal image. The user should zoom in until clearly see the exact location of the chosen point and using identify icon measure coordinates. The author used the root mean square

error. Root mean square error is the standard error measure used in ground controlled points. Control point coordinates and same points derived from aerial image were calculated and the distance between them was measured using the Euler's Distance Formula.

$$\Delta d = \sqrt{(x - x1) + (y - y1)}$$

$$RMSEx = \sqrt{\sum((xdata - xcheck)^2)/n)}$$

$$RMSEy = \sqrt{\sum((ydata - ycheck)^2)/n)}$$

$$RMSExy = \sqrt{\sum 1/2(RMSEx^2 + RMSEy^2)}$$----------EQ(1)

Horizontal accuracy at the 95% confidence level (CE95) was computed for anisotropic accuracies. For anisotropic accuracies, where RMSEx ≠ RMSEy

$$CE95 = 1.2238 * (RMSEx + RMSEy)$$----------EQ(2)

The root mean square error of the coordinates can be computed in Microsoft excel. To evaluate the accuracy of the aerial photograph, RMSE and standard deviation of the individual measurements were computed. Root mean square error is a measure of accuracy of the individual measurement. It can be computed from the deviations between true and measured values. So that statistical parameters such as the mean error, standard deviation or root mean square error can be calculated to get an accuracy assessment of the results.

We use RMSE test to calculate the error .Root mean square error is also known as to be the square root of the average of the squared gaps where these gaps are the variation in coordinate as assessed by an independent survey process. The shifts in twenty extracted points from the aerial image as compared to that of the established cheek points. The author will be take hundred total sample sizes by systematic random sampling technique, assess twenty check points for the study area. The sample points must also be well distributed across the study area. By using the above input data and the tool used to analyze the data, the overall procedure to generate the required output performed in the following hierarchical order.

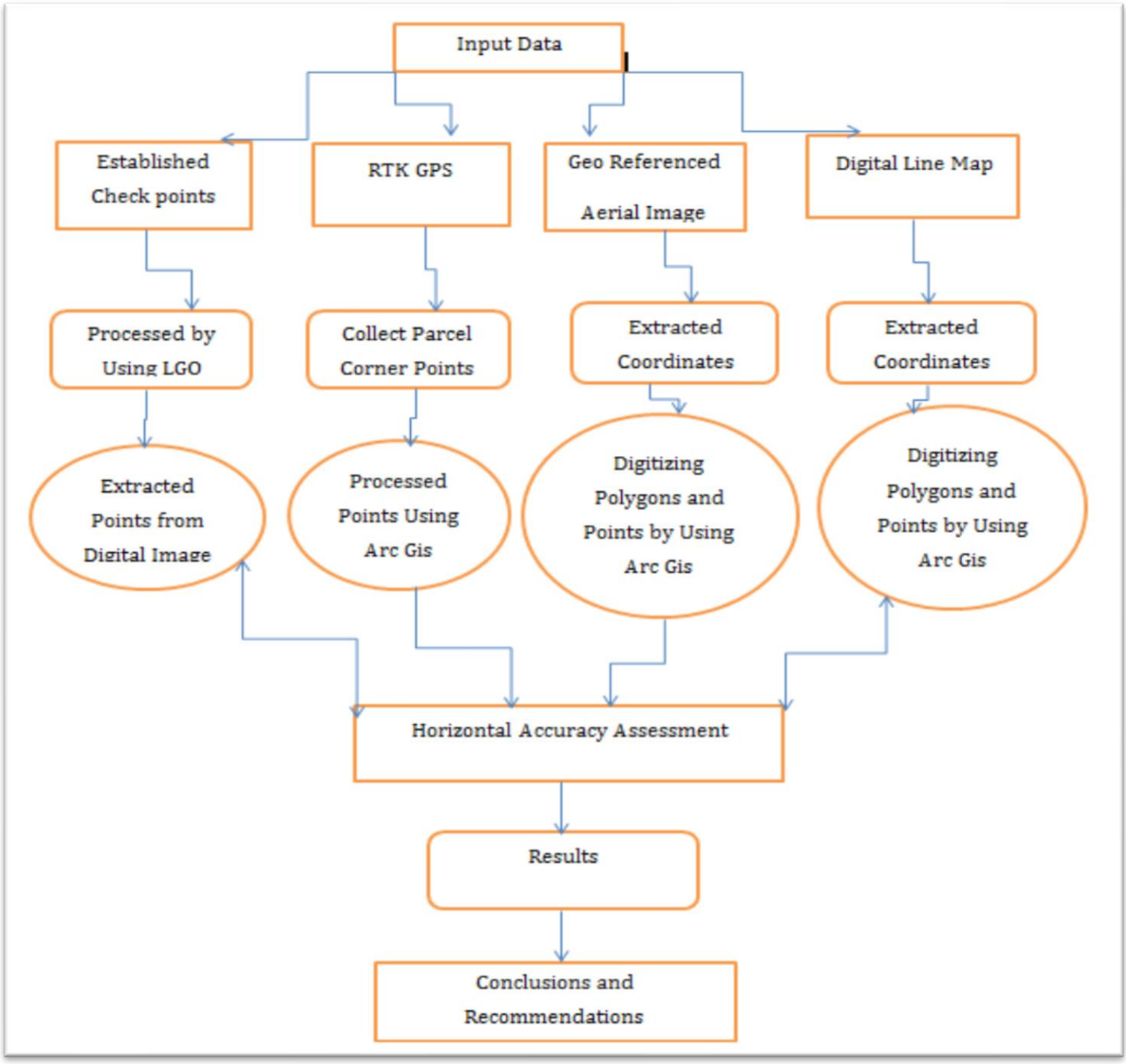


Figure3.3. the general work flow of research methodology

CHAPTER FOUR

4. RESULTS

4.1. Horizontal Accuracy Assessment of Digital Aerial Photograph

Statistical indices in this study can be used to evaluate, validate and compare the GPS data against areal image. This study explicitly examined the accuracy of digital image and its digital line map in terms of horizontal position. A minimum of twenty well defined test points should be used to evaluate the horizontal accuracy of digital aerial photograph. The check points will be ideally evenly distributed and located across the Figure 4.1.

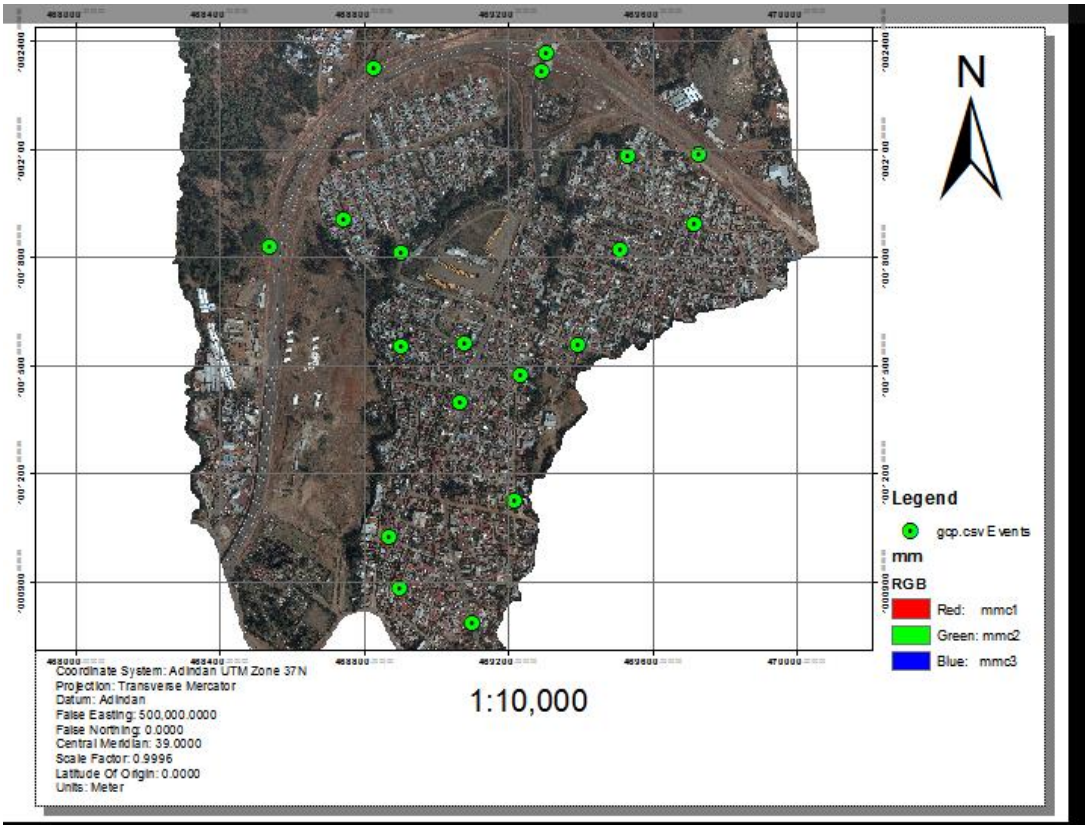


Figure4.1. the distribution of check points

The GPS coordinates for the twenty checkpoints were determined using Leica GEO office with the RMSE values listed (Table 4.1).The shifts in coordinates of the extracted points from the aerial image as compared to that of the check points are presented in Table 4.1.

The max and min, mean, standard deviation and RMSE in the easting and northing values computed at each site are also shown. The accuracy of digital image as compared to the GPS data acquired from LGO processing is 18.1 cm and 18.8 cm in x and y-direction, respectively in RMSE sense (Table 4.1).

Table 4.1.Horizontal Accuracy Assessment of Digital Aerial Photograph

	GROUND MEASUREMENT		EXTRACTED FROM IMAGE		DIVATIONS		VARIANCES	
point id	easting	northing	easting	northing	Δ easting	Δ northing	$(\Delta \text{ easting})^2$	$(\Delta \text{ northing})^2$
p01	469728.110	1002084.185	469728.191	1002084.514	0.081	0.329	0.007	0.108
p02	469296.013	1002317.598	469295.580	1002317.861	-0.433	0.263	0.187	0.069
p03	468833.146	1002324.969	468833.151	1002324.666	0.005	-0.303	0.000	0.092
p04	468845.267	1002568.044	468845.249	1002568.069	-0.018	0.025	0.000	0.001
po5	468541.095	1001828.773	468541.157	1001829.052	0.062	0.279	0.004	0.078
p06	468907.342	1001814.544	468907.242	1001814.370	-0.100	-0.174	0.010	0.030
p07	468746.634	1001904.199	468746.677	1001904.321	0.043	0.122	0.002	0.015
p08	469081.372	1001562.959	469081.266	1001562.635	-0.106	-0.324	0.011	0.105
p09	468905.859	1001551.800	468905.857	1001551.776	-0.002	-0.024	0.000	0.001
p10	469071.812	1001396.392	469071.864	1001396.363	0.052	-0.029	0.003	0.001
p11	468873.614	1001027.252	468873.624	1001027.245	0.010	-0.007	0.000	0.000
p12	468902.930	1000881.997	468902.854	1000881.982	-0.076	-0.015	0.006	0.000
p13	469102.417	1000788.933	469102.953	1000788.758	0.536	-0.175	0.287	0.031
p14	469278.342	1002326.250	469278.265	1002326.385	-0.077	0.135	0.006	0.018
p15	469218.875	1001125.402	469218.914	1001125.279	0.039	-0.123	0.002	0.015
p16	469237.074	1001473.852	469236.971	1001473.726	-0.103	-0.126	0.011	0.016
p17	469397.012	1001558.781	469397.100	1001558.730	0.088	-0.051	0.008	0.003
p18	469512.349	1001820.561	469512.275	1001820.209	-0.074	-0.352	0.005	0.124
p19	469536.881	1002082.534	469536.950	1002082.527	0.069	-0.007	0.005	0.000
p20	469720.068	1001892.243	469720.383	1001892.212	0.315	-0.031	0.099	0.001
	mean ΔX	0.016	RMSEx	0.181	max Δx	0.536		
	mean ΔY	-0.029	RMSEy	0.188	min Δx	-0.433		
	stan ΔX	0.180	RMSExy	0.184	man Δy	0.329		
	stan ΔY	0.186			min Δy	-0.352		

This study explicitly examined the accuracy of aerial photograph in terms of horizontal position. The GPS coordinates for the twenty checkpoints were determined using Leica Geo office software. In order to analyze the horizontal accuracy of aerial photo, the coordinate measurement of some independent check points is required. The check points are distributed across the research area. In this research there are twenty check points, whose coordinates are measured by using differential GPS technique with at least 1 hour observation. Then, the resulting coordinate from GPS measurement is compared against coordinate measurement from the aerial photo. The results show that the maximum

deviations are 0.536 and 0.329 for easting and northing respectively. These minimum deviations are -0.433 and -0.352 for easting and northing respectively.

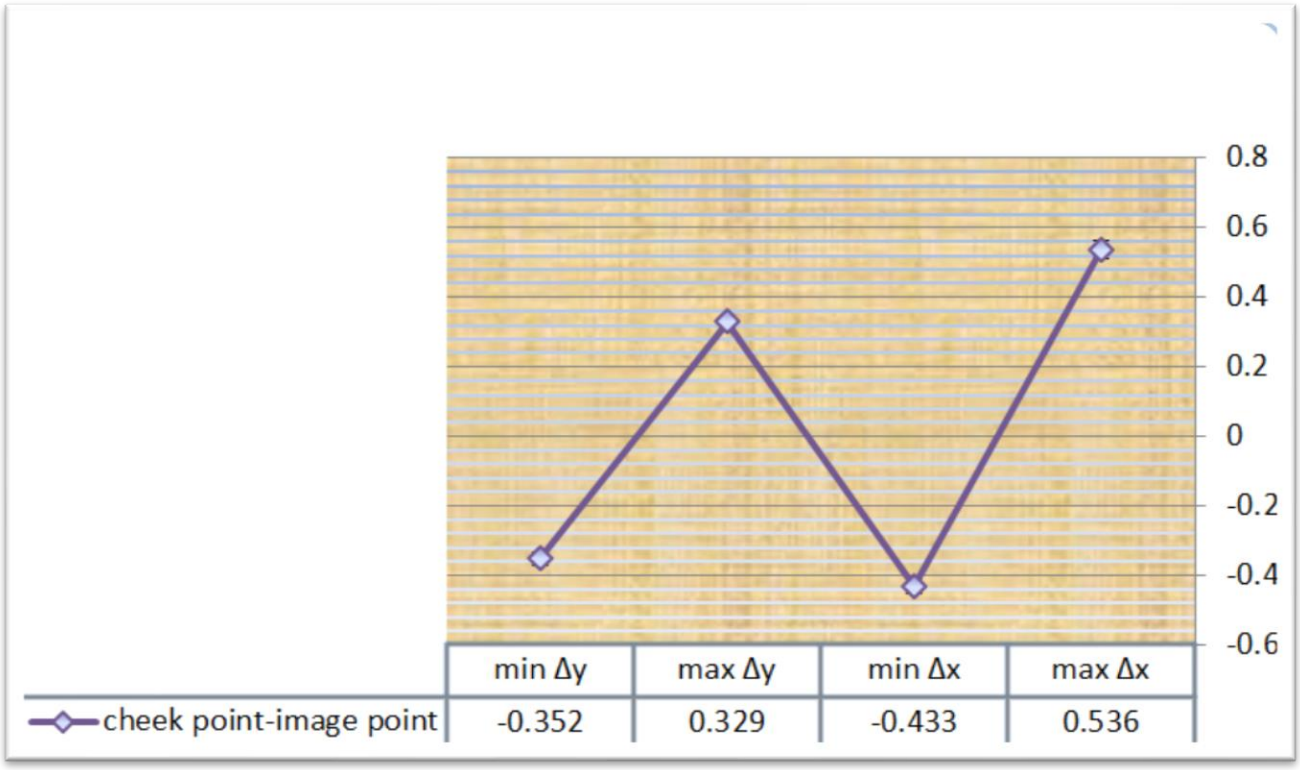


Figure4.2. Max and min range of the ground check points and digital aerial image points

The mean values and standard errors are 0.016 and 0.180,-0.029 and 0.186m for easting and northing respectively. The mean values in the Easting, Nothing and The standard deviation (Sx and Sy) that are associated with the LGO GPS solutions are presented in more illustrative way using histogram.

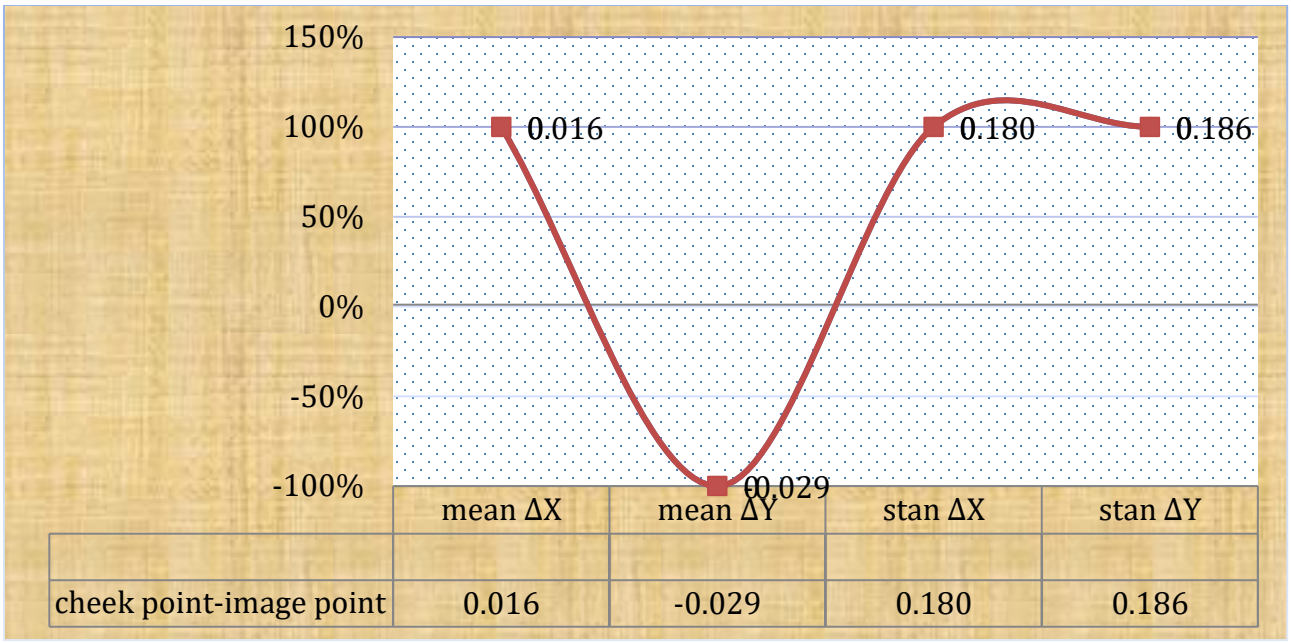


Figure4.3. Mean and standard error distribution

The root mean square error of easting and northing component is 0.181m and 0.188m respectively. These values correspond to horizontal RMSExy 0.184m.

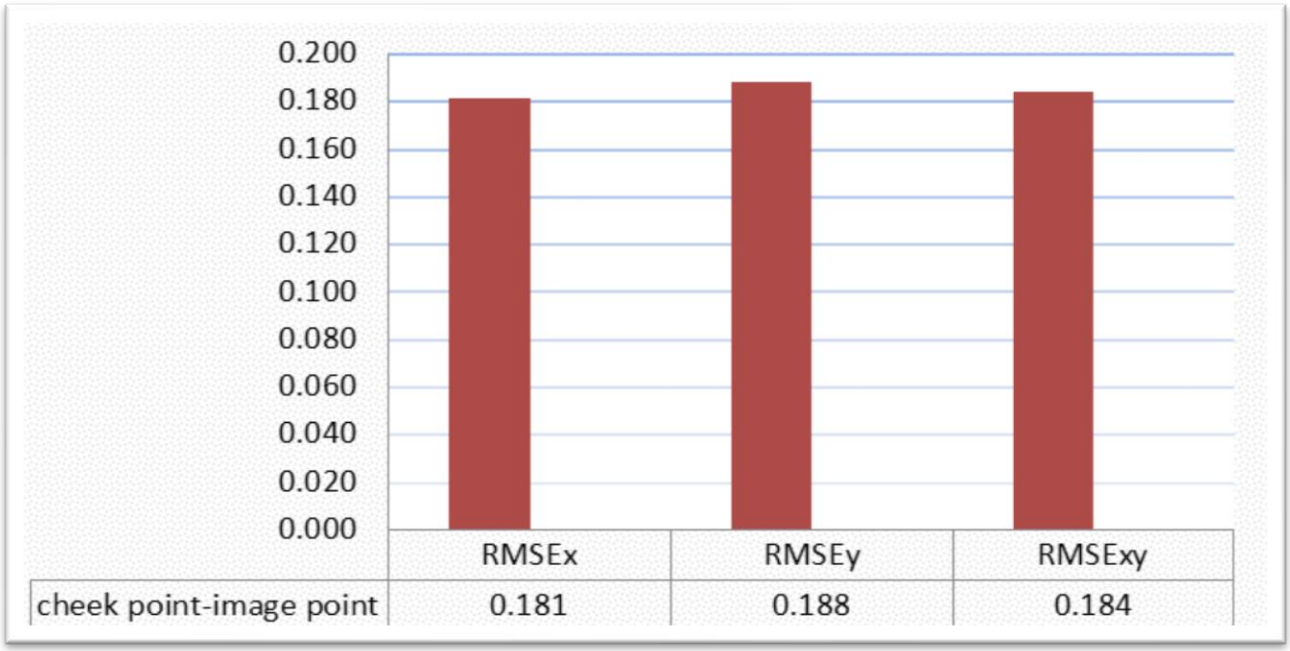


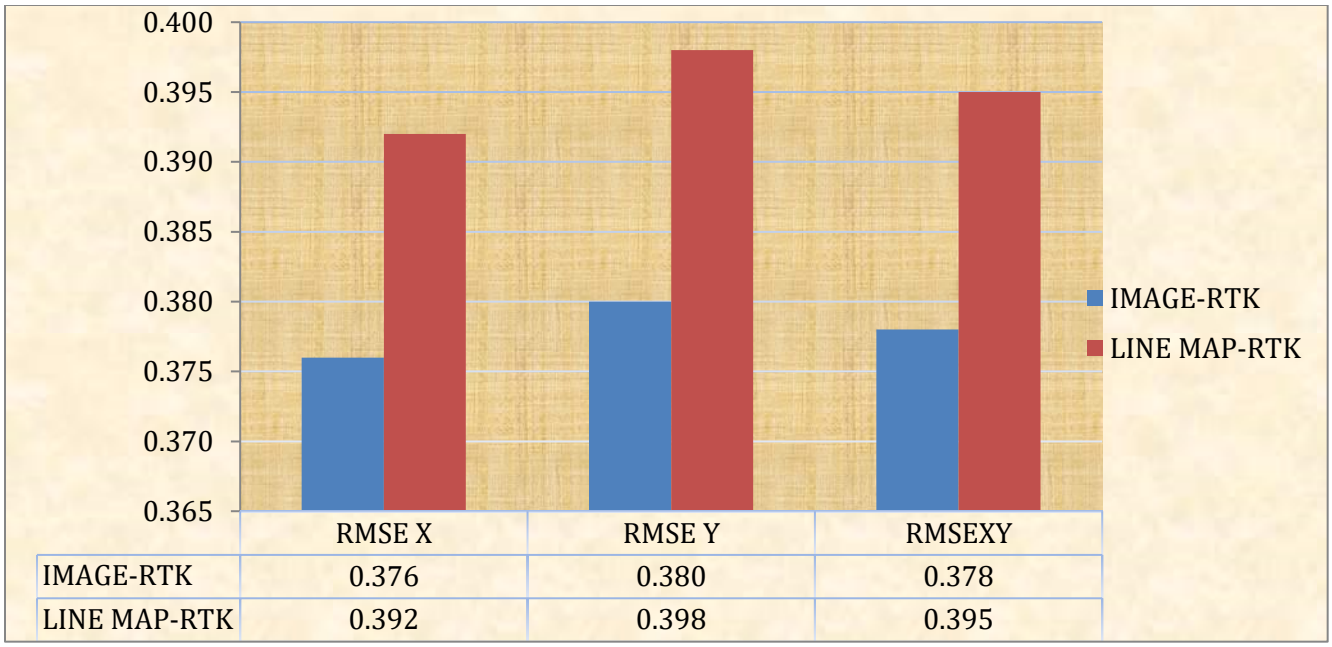
Figure4.4. RMSE of check point coordinates and aerial photograph coordinates

Horizontal accuracy at the 95% confidence level (CE95) was computed for anisotropic accuracies. Where RMSExy is the overall horizontal root mean square error. The CE 95 value in this research is 0.451m (eq.2).

4.2. Assessment of Digital Aerial Image and Digital Line Map Coordinates

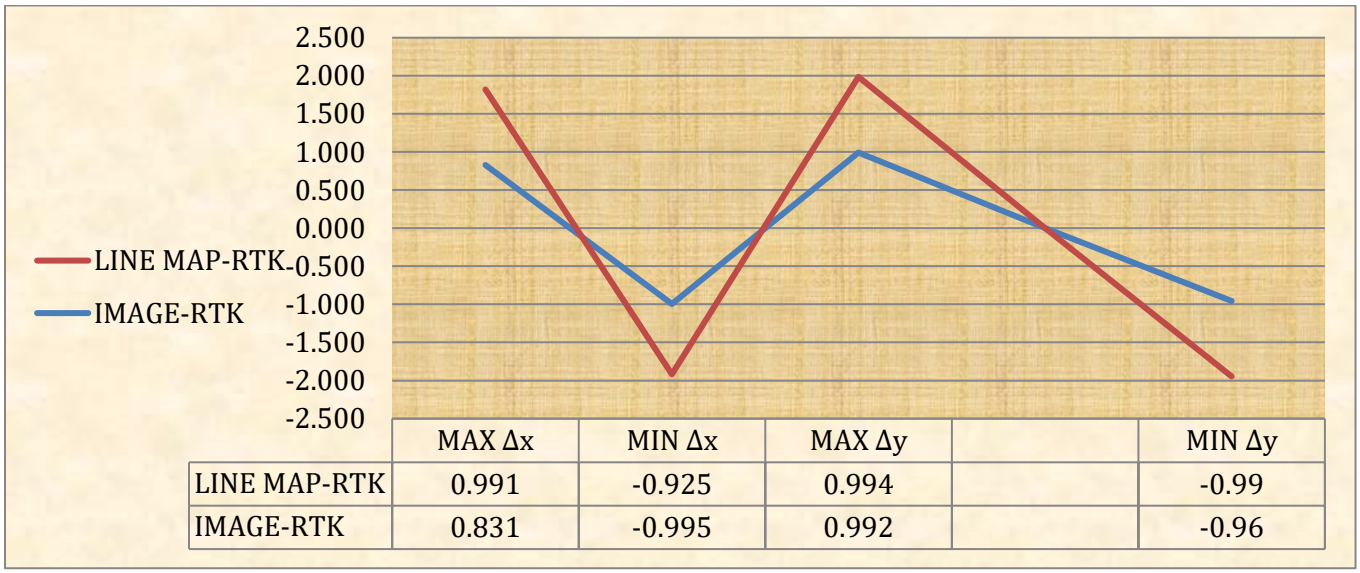
In this section tries to analyze the association of coordinates, areas and lengths of some selected parcels which are extracted from the methods i.e., GPS, aerial photograph and digital line map. In this particular study, 429 coordinate values were collected along the parcel corners. In this paper, horizontal RMSEs are considered. Horizontal errors are brought about by field measurements and digitization. In order to evaluate the horizontal accuracy of aerial photograph and digital line map, number of hundred parcels was selected in Wereda 10. These parcel corner points were then observed using Leica GS 14 GPS surveying .GPS receiver applying Real Time Kinematic (RTK) technique. In which the base station was located in Wereda 10 mekelakeya camp sefer. The station point is created by the researcher. These fixed control points are (p06 and p10). By used these reference points the rover was used to observe the required parcel corner points. The RTK GPS and aerial image comparison coordinates results show that the root mean square error of easting and northing component is 37.6 cm and 38 cm respectively. These values correspond to horizontal RMSExy 37.8 cm. Horizontal accuracy at the 95% confidence level (CE95) was computed for anisotropic accuracy based on (eq.2) is 0.841.

The RTK GPS and digital line map coordinates comparison results show that the root mean square error of easting and northing component is 39.2 cm and 39.8 cm respectively. These values correspond to horizontal RMSExy 39.5 cm. Horizontal accuracy at the 95% confidence level (CE95) was computed for anisotropic accuracy based on (eq.2) is 0.879. Differences between actual observed GPS coordinates of points and the extracted coordinates from digital aerial photograph and digital line map coordinates as listed below in figure 4.5



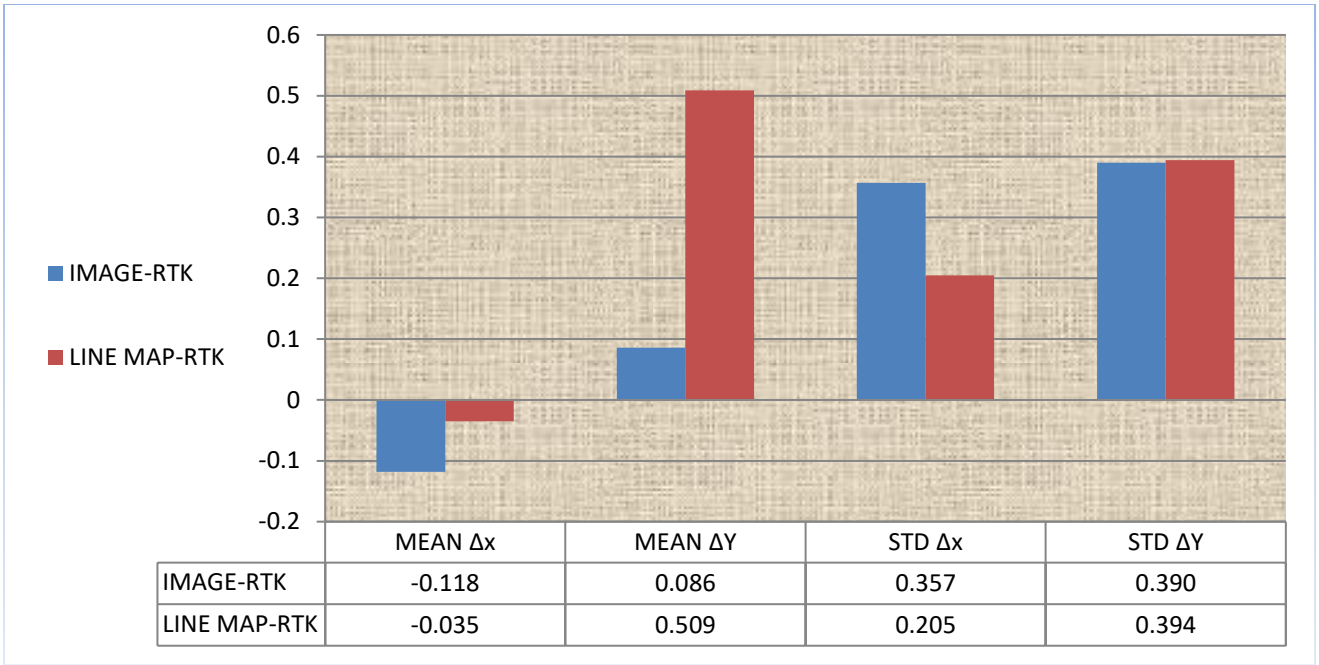
	RMSE X	RMSE Y	RMSEXY
IMAGE-RTK	0.376	0.380	0.378
LINE MAP-RTK	0.392	0.398	0.395

Figure 4.5.RMSE of digital aerial image and digital line map



	MAX Δx	MIN Δx	MAX Δy		MIN Δy
LINE MAP-RTK	0.991	-0.925	0.994		-0.99
IMAGE-RTK	0.831	-0.995	0.992		-0.96

Figure 4.6 MAX and MIN values of aerial image and line map-based coordinate



	MEAN Δx	MEAN ΔY	STD Δx	STD ΔY
IMAGE-RTK	-0.118	0.086	0.357	0.390
LINE MAP-RTK	-0.035	0.509	0.205	0.394

Figure 4.7. Mean and standard deviation between aerial image and line map coordinates

4.3. Area Comparison among Aerial Photograph and Digital Line Map Derived Parcels

Among the objectives of this study was to investigate the effect of area in the accuracy of digital aerial image and digital line map. It involved establishing the extent to which areas obtained by aerial photography technique deviated from the equivalent ground survey. As a reference area the GPS survey parcels were chosen. The areas of the matching parcels from each layer were extracted and used for analysis. A total of hundred parcels were derived from aerial photograph, line map and the same parcels observed by GPS. The results of extracted parcels generated from ground surveys, aerial photography and digital line map are shown in Figure 4.8.

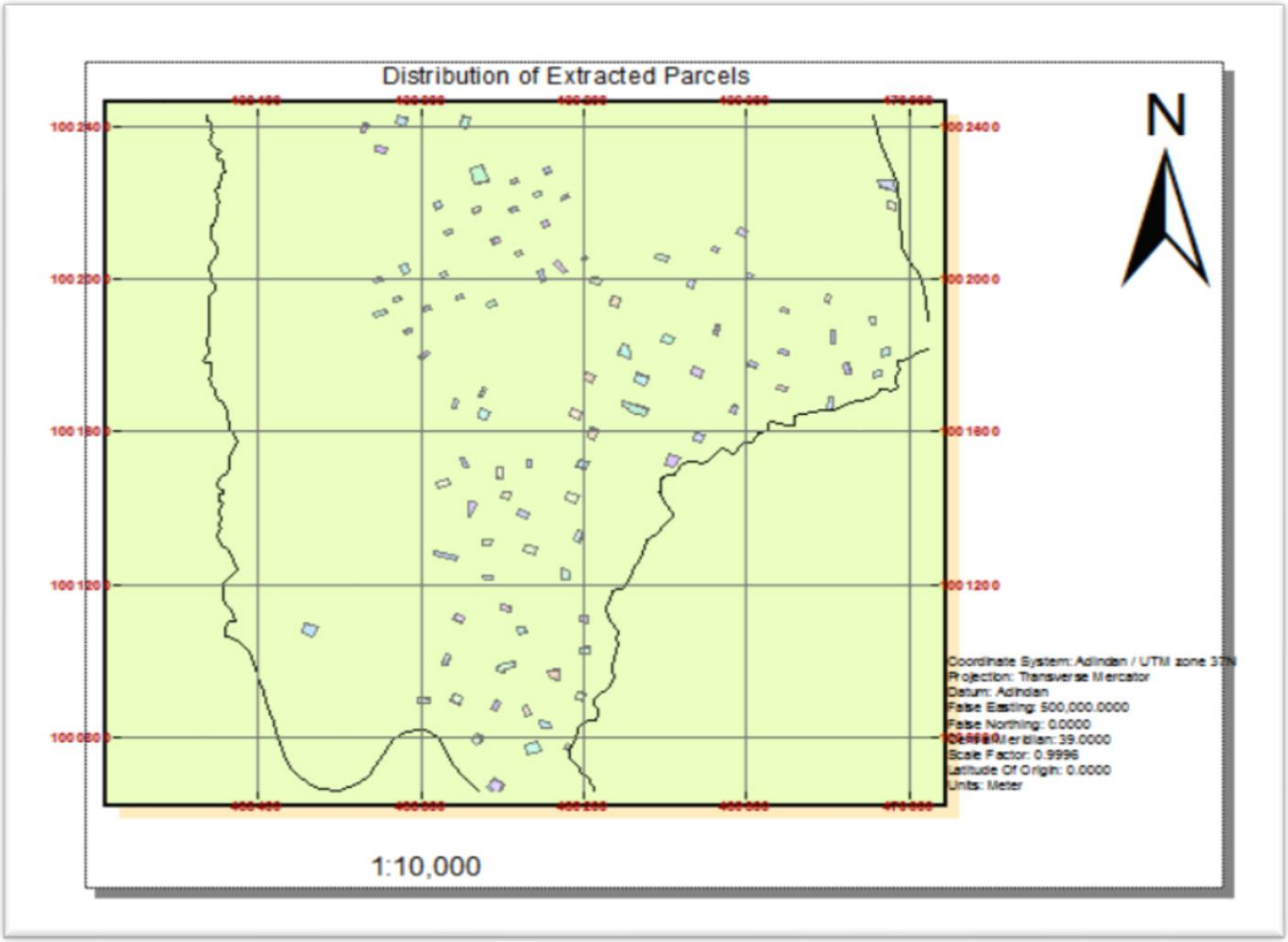
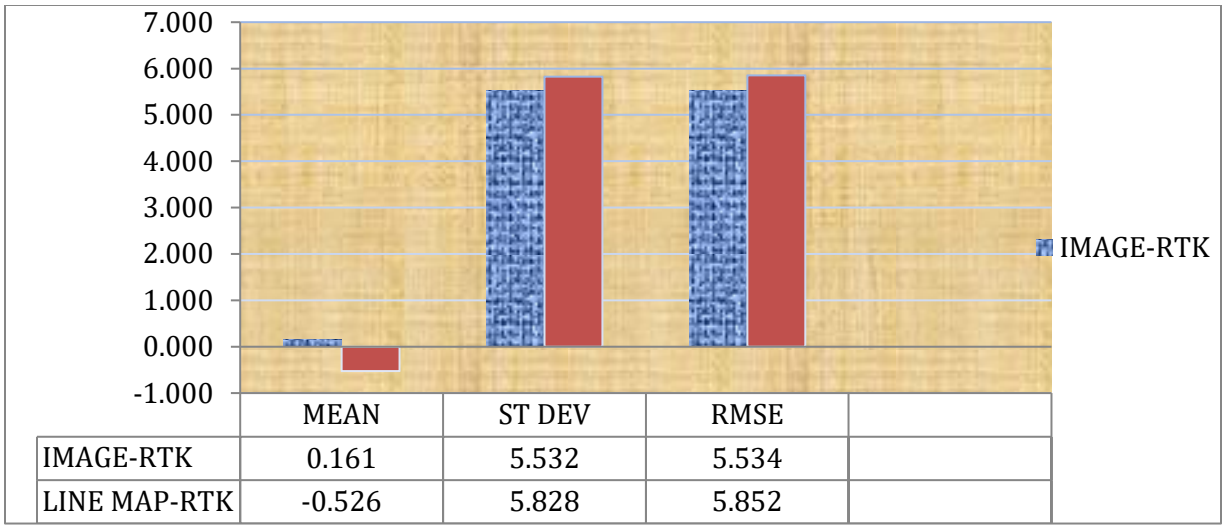


Figure 4.8 the extracted parcels distribution

The mean absolute horizontal error is 0.161 in aerial photograph and the mean absolute horizontal error is -0.526 in digital line map. The standard deviation of the differences between ground surveyed and digital aerial image area is 5.532 and the standard deviation of the differences between ground surveyed and digital line map is 5.534. The root mean square error is 5.828 and 5.852m^2 in aerial photograph and digital line map respectively. The results of compared parcel areas generated from ground surveys, aerial photography and digital line map are shown in Figure 4.9.



	MEAN	ST DEV	RMSE	
IMAGE-RTK	0.161	5.532	5.534	
LINE MAP-RTK	-0.526	5.828	5.852	

Figure 4.9. Parcel areas generated from ground surveys, aerial photography and digital line map.

The differences of the size of the parcels range from -9.945to 10.427m^2 in aerial photograph and -10.044 to 9.745m^2 in digital line map. The results of compared parcel areas generated from ground surveys, aerial photography and digital line map are shown in Figure 4.10.

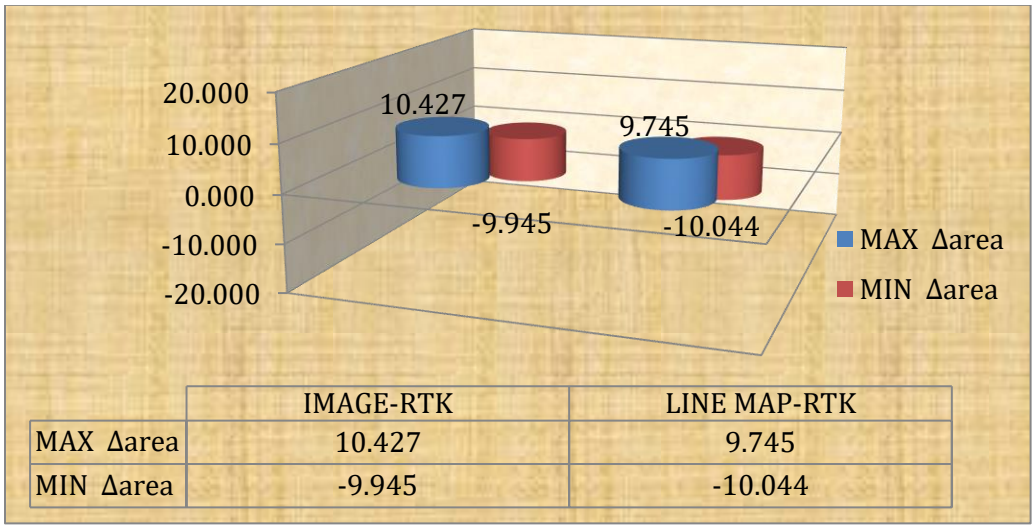


	IMAGE-RTK	LINE MAP-RTK
MAX Δarea	10.427	9.745
MIN Δarea	-9.945	-10.044

Figure 4.10.The maximum and minimum values in aerial photograph and digital line map

4.5. Comparison of Side Lengths from Aerial Image and Digital Line Map

The horizontal accuracy of side lengths can be tested by examining variation in the orientation of the digital line map using RTK GPS surveying technique. The length of the matching parcels from each layer were extracted and used for analysis. The author compared side lengths obetend by RTK GPS, aerial photograph and digital line map. In this research 429 side lengths were computed from coordinates obtained using RTK GPS, aerial photograph and digital line map respectively.

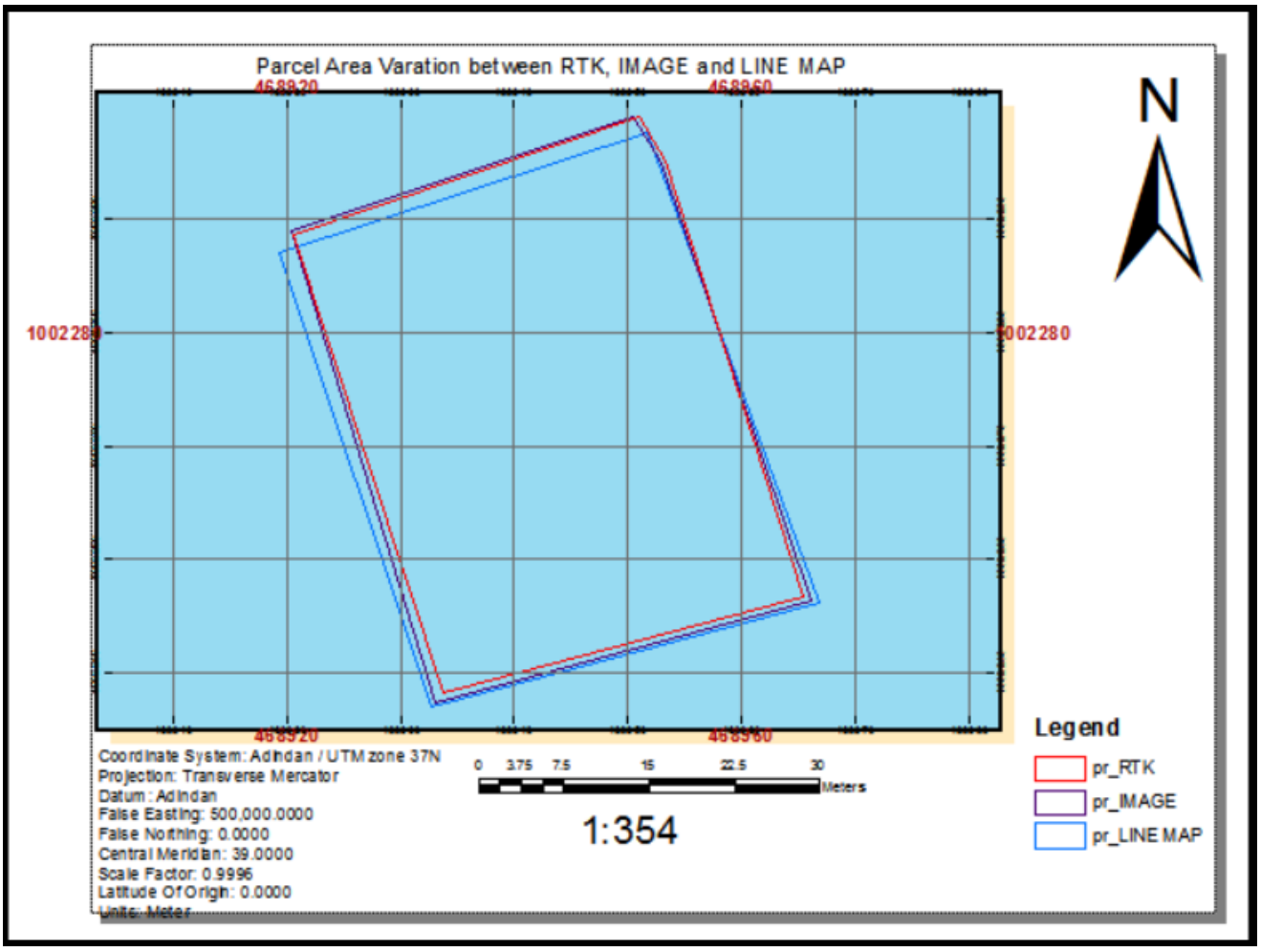


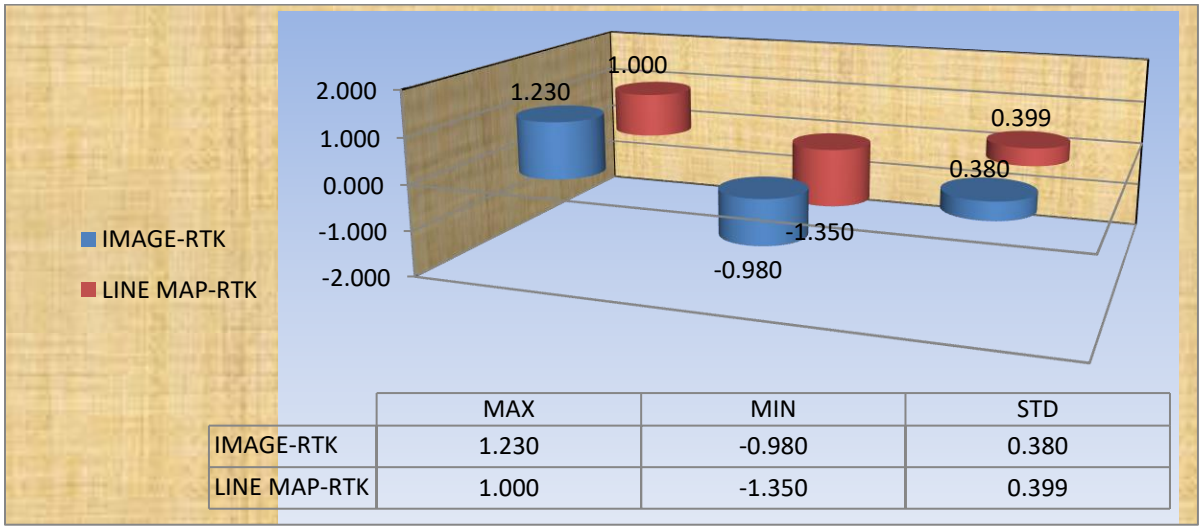
Figure 4.11 parcel side length and area variation between RTK, image and line map

The mean absolute horizontal error is 0.010 and -0.038 in aerial photograph and digital line map respectively. The root mean square error is 0.381 and 0.400 m in aerial photograph and digital line map respectively. The results of compared parcel lengths generated from ground surveys, aerial photography and digital line map are shown in Figure 4.12.

	IMAGE-RTK	LINE MAP-RTK
mean	0.01	-0.038
RMSE	0.381	0.4

Figure 4.12. Mean and RMSE values in aerial photograph and digital line map.

The differences of the size of the side lengths range from -0.980 to 1.230 and -1.350 to 1.000m in aerial photograph and digital line map respectively. The standard deviations 0.380 and0.399 m in aerial photograph and digital line map respectively.



	MAX	MIN	STD
IMAGE-RTK	1.230	-0.980	0.380
LINE MAP-RTK	1.000	-1.350	0.399

Figure 4.13. Standard deviation, min and max values in aerial photograph and digital line map

From the result supported, the digital image and line map is considered as appropriate for cadastral mapping applications, utility mapping, infrastructural mapping, road network mapping etc. In the Addis Ababa context, the accuracy requirement of the horizontal

position according to the National Mapping Agency (EMA) is ±40 cm at the scale of 1:2,000, which is the recommended scale for urban areas. This corresponds to two pixels at a Ground Sample Density (GSD) of 20 cm. therefore the digital image is useful for cadaster.

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CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

There has been a great deal of interest and attention given to the economic justification of cadastral and land information systems over the last decade. With regard to cadastral systems in the developing world the emphasis has been on the benefit to the national economy and to the land holder. Within the developed countries where cadastral systems are accepted as basic infrastructure in support of free market economies, the emphasis has been on the economic justification of the provision of land related data in digital form, usually to support or as part of a land or geographic information system.

The main objective of the study was to conduct accuracy assessment of the digital aerial image and its digital line map for large scale mapping production such as cadastral map. Cadastral data is important for decision making and it is basic for many computers based spatial applications. Therefore it should have the required accuracy. This research presents an assessment large-scale map study of the horizontal positional accuracy of digital aerial photograph and digital line map in the study area. The purpose of this thesis work was to evaluate and compare accuracy of three surveying methods (differential GPS, digital aerial image and digital line map).The comparison was made between RTK GPS versus Digital aerial image and RTK GPS versus Digital line map in the study area. To accomplish the objectives of the thesis, two major tasks have been performed: first, twenty check points established by using static GPS method was performed to compare the result with that of digital aerial image. Second, by measuring RTK coordinates, areas and side lengths and extracted coordinates, areas and side lengths from digital aerial image and digital line map and comparison has been made.

The horizontal positional accuracy was evaluated mainly in terms of RMSExy and 95 % confidence level and RMSE in x and y-direction from the datasets measured check points and GPS survey and digital aerial image derived coordinates. Whereas, the coordinates, area and side lengths of parcels accuracy assessment was expressed in terms of mean value

,RMSE ,min and max and the standard deviation between the digital line map ,digital aerial image and RTK GPS derived coordinates, areas and side lengths. When the hundred parcels are compared individually. From processing and analyzing result data from research, there are several things can be conclude

- For the accuracy assessment of digital aerial image the standard errors are 18 cm and 18.6 cm for easting and northing respectively. The Root Mean Square Error of easting and northing component is 18.1 cm and 18.8 cm respectively.
- The RTK GPS and aerial image comparison coordinates results show that the root mean square error of easting and northing component is 37.6 cm and 38 cm respectively. The RTK GPS and digital line map coordinates comparison results show that the root mean square error of easting and northing component is 39.2 cm and 39.8 cm respectively.
- The standard deviation of the differences between ground surveyed and digital aerial image area is 5.532 m^2 and the standard deviation of the differences between ground surveyed and digital line map is 5.534m^2. The root mean square error is 5.828 m^2 and 5.852 m^2 in aerial photograph and digital line map respectively.
- The standard deviation is 38 cm and 39.9 cm in aerial photograph and digital line map respectively. The mean absolute horizontal error is 0.010 and -0.038 in aerial photograph and digital line map respectively. The root mean square error is 38.1 cm and 40cm in aerial photograph and digital line map respectively.

According to the obtained results and analysis, some conclusions can be summarized and enumerated as:

- When the twenty check points larger RMSE are observed in the northing coordinates than the easting coordinates.
- For the digital line map based on RTK check point larger RMSE are observed with respect to coordinates, areas and side lengths than digital image.

Therefore these differences come from different causes. Such as shadows, topographic factors, the study area covered by vegetation and there are some limitations to these techniques as it solely on visual interpretation. In case of highly dense settlement area, shadow region, high canopy cover, unclear boundaries due to similar spectral reflectance,

small parcels etc. Similar accuracy cannot be achieved. From the result supported, the digital image and line map is considered as appropriate for cadastral mapping applications, utility mapping, infrastructural mapping, road network mapping etc.

5.2. Recommendations

Based on the analysis of the research findings, this study gives the following recommendations

- To increase the accuracy of cadastral map and to reduced conflicts between peoples in the study area increase number of check points and duration time.
- The researcher used aerial photo in the study area must be updated because after this photo taken many constructions build up.
- Digital line map preparation and ground control point establishment was done at national level, but many of control points are become disappear and demolished by urban expansion.

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List of Appendix

Appendix 1: Row data's collected by static GPS

2933_0426_100701.m00	4/26/2018 11:11 AM	M00 File	190 KB
2933_0426_111829.m00	4/26/2018 12:22 PM	M00 File	169 KB
2933_0426_124151.m00	4/26/2018 1:45 PM	M00 File	190 KB
2933_0426_140437.m00	4/26/2018 3:06 PM	M00 File	154 KB
2933_0426_152154.m00	4/26/2018 4:25 PM	M00 File	136 KB
2933_0427_092026.m00	4/27/2018 10:24 AM	M00 File	136 KB
2933_0427_103359.m00	4/27/2018 11:37 AM	M00 File	164 KB
2933_0427_114329.m00	4/27/2018 12:46 PM	M00 File	157 KB
2933_0427_125942.m00	4/27/2018 2:02 PM	M00 File	171 KB
2933_0427_142259.m00	4/27/2018 3:26 PM	M00 File	162 KB
2933_0427_153510.m00	4/27/2018 4:37 PM	M00 File	151 KB
2933_0428_073044.m00	4/28/2018 8:34 AM	M00 File	150 KB
2933_0428_084814.m00	4/28/2018 9:51 AM	M00 File	146 KB
2933_0428_100208.m00	4/28/2018 11:04 AM	M00 File	161 KB
2933_0428_111457.m00	4/28/2018 12:17 PM	M00 File	157 KB
2933_0428_122255.m00	4/28/2018 1:17 PM	M00 File	166 KB
2933_0428_132656.m00	4/28/2018 2:33 PM	M00 File	168 KB
2933_0428_144607.m00	4/28/2018 3:48 PM	M00 File	158 KB
2933_0428_155649.m00	4/28/2018 5:01 PM	M00 File	162 KB
2933_0429_083321.m00	4/29/2018 9:36 AM	M00 File	157 KB
2933_0429_095002.m00	4/29/2018 10:53 AM	M00 File	183 KB
2933_0429_115042.m00	4/29/2018 12:54 PM	M00 File	176 KB
2933_0429_130542.m00	4/29/2018 2:08 PM	M00 File	159 KB
2933_0429_142543.m00	4/29/2018 3:28 PM	M00 File	169 KB
2933_0429_154154.m00	4/29/2018 4:45 PM	M00 File	157 KB

Appendix 2: RINX and Ephemeris data

adis1160.18d	5/11/2018 2:28 PM	18D File	1,776 KB
adis1170.18d	4/28/2018 2:57 AM	18D File	1,817 KB
adis1180.18d	4/29/2018 3:09 AM	18D File	1,815 KB
adis1190.18d	4/30/2018 3:08 AM	18D File	1,798 KB
igs19984.sp3	5/24/2018 8:44 PM	SP3 File	246 KB
igs19985.sp3	5/24/2018 8:44 PM	SP3 File	244 KB
igs19986.sp3	5/24/2018 8:44 PM	SP3 File	246 KB
igs19990.sp3	5/24/2018 8:47 PM	SP3 File	246 KB

Appendix 3: GPS, Digital Aerial Photograph Image and Digital Line map coordinates

parcel no	RTK GPS coordinates		Areial Image coordinates		line map coordinates		image-rtk		line-rtk		$(\text{image-rtk})^2$		$(\text{line-rtk})^2$	
	Xr	yr	xi	yi	Xl	Yl	Δx	Δy	Δx	Δy	$(\Delta x)^2$	$(\Delta y)^2$	$(\Delta x)^2$	$(\Delta y)^2$
pr 1	468963.249	1000671.217	468963.349	1000671.182	468963.487	1000671.266	0.100	-0.035	0.238	0.049	0.010	0.001	0.057	0.002
	468982.757	1000695.495	468982.757	1000695.775	468982.753	1000695.495	0.000	0.280	-0.004	0.000	0.000	0.078	0.000	0.000
	469005.219	1000675.946	469005.070	1000675.949	469005.2	1000675.94	-0.149	0.003	-0.019	-0.006	0.022	0.000	0.000	0.000
	468988.871	1000648.344	468988.137	1000648.306	468988.885	1000648.341	-0.734	-0.038	0.014	-0.003	0.539	0.001	0.000	0.000
pr 2	469055.929	1000781.663	469055.929	1000780.942	469055.254	1000781.512	0.000	-0.721	-0.675	-0.151	0.000	0.520	0.456	0.023
	469087.920	1000791.776	469087.948	1000791.075	469087.92	1000791.763	0.028	-0.701	0.000	-0.013	0.001	0.491	0.000	0.000
	469095.254	1000768.716	469095.042	1000767.909	469094.642	1000768.884	-0.212	-0.807	-0.612	0.168	0.045	0.651	0.375	0.028
	469061.152	1000757.805	469061.054	1000757.166	469060.501	1000757.835	-0.098	-0.639	-0.651	0.030	0.010	0.408	0.424	0.001
pr 3	468928.187	1000793.046	468927.493	1000793.196	468928.479	1000793.659	-0.694	0.150	0.292	0.613	0.482	0.023	0.085	0.376
	468936.594	1000811.072	468936.073	1000810.716	468936.155	1000810.51	-0.521	-0.356	-0.439	-0.562	0.271	0.127	0.193	0.316
	468954.337	1000801.358	468954.123	1000801.015	468954.496	1000801.121	-0.214	-0.343	0.159	-0.237	0.046	0.118	0.025	0.056
	468944.337	1000783.835	468943.733	1000784.470	468944.074	1000784.153	-0.604	0.635	-0.263	0.318	0.365	0.403	0.069	0.101
	468938.812	1000781.933	468938.373	1000781.724	468938.788	1000781.864	-0.439	-0.209	-0.024	-0.069	0.193	0.044	0.001	0.005
pr 4	468987.346	1000977.445	468986.745	1000977.601	468986.967	1000977.705	-0.601	0.156	-0.379	0.260	0.361	0.024	0.144	0.068
	468993.221	1000992.279	468993.128	1000991.494	468992.502	1000992.466	-0.093	-0.785	-0.719	0.187	0.009	0.616	0.517	0.035
	469028.805	1001001.840	469028.581	1001001.514	469028.446	1001001.321	-0.224	-0.326	-0.359	-0.519	0.050	0.106	0.129	0.269
	469032.779	1000984.604	469032.366	1000984.109	469033.358	1000984.347	-0.413	-0.495	0.579	-0.257	0.171	0.245	0.335	0.066
	469006.584	1000982.860	469006.744	1000982.529	469006.018	1000982.47	0.160	-0.331	-0.566	-0.390	0.026	0.110	0.320	0.152
	469004.096	1000970.995	469003.423	1000970.656	469003.571	1000970.995	-0.673	-0.339	-0.525	0.000	0.453	0.115	0.276	0.000
pr 5	468862.155	1001018.414	468862.021	1001018.021	468862.076	1001017.787	-0.134	-0.393	-0.079	-0.627	0.018	0.154	0.006	0.393
	468872.893	1001014.079	468872.527	1001013.951	468873.057	1001013.496	-0.366	-0.128	0.164	-0.583	0.134	0.016	0.027	0.340
	468864.667	1000988.644	468864.073	1000988.650	468864.21	1000988.375	-0.594	0.006	-0.457	-0.269	0.353	0.000	0.209	0.072
	468853.179	1000992.604	468852.599	1000992.820	468853.382	1000992.058	-0.580	0.216	0.203	-0.546	0.336	0.047	0.041	0.298
pr 6	469049.578	1000879.625	469048.870	1000879.068	469048.824	1000879.534	-0.708	-0.557	-0.754	-0.091	0.501	0.310	0.569	0.008
	469062.684	1000883.620	469062.703	1000882.838	469062.695	1000883.366	0.019	-0.782	0.011	-0.254	0.000	0.612	0.000	0.065
	469069.954	1000859.365	469069.574	1000859.026	469069.5	1000858.635	-0.380	-0.339	-0.454	-0.730	0.144	0.115	0.206	0.533
	469056.578	1000855.652	469055.948	1000855.123	469055.734	1000855.002	-0.630	-0.529	-0.844	-0.650	0.397	0.280	0.712	0.423
pr 7	468874.875	1000896.774	468875.166	1000896.672	468874.69	1000896.738	0.291	-0.102	-0.185	-0.036	0.085	0.010	0.034	0.001
	468881.347	1000914.355	468881.860	1000913.558	468881.331	1000914.27	0.513	-0.797	-0.016	-0.085	0.263	0.635	0.000	0.007
	468901.472	1000904.456	468901.016	1000903.980	468901.527	1000904.311	-0.456	-0.476	0.055	-0.145	0.208	0.227	0.003	0.021
	468895.261	1000887.476	468894.825	1000887.391	468895.137	1000886.49	-0.436	-0.085	-0.124	-0.986	0.190	0.007	0.015	0.972
pr 8	469097.268	1000825.990	469096.646	1000825.218	469096.947	1000825.746	-0.622	-0.772	-0.321	-0.244	0.387	0.596	0.103	0.060
	469092.435	1000845.291	469091.884	1000844.532	469092.432	1000845.013	-0.551	-0.759	-0.003	-0.278	0.304	0.576	0.000	0.077
	469117.836	1000842.860	469118.131	1000842.862	469117.611	1000842.152	0.295	0.002	-0.225	-0.708	0.087	0.000	0.051	0.501
	469122.578	1000825.294	469122.867	1000824.553	469122.043	1000824.304	0.289	-0.741	-0.535	-0.990	0.084	0.549	0.286	0.980
pr 9	469181.104	1000899.883	469181.360	1000899.110	469181.453	1000899.456	0.256	-0.773	0.349	-0.427	0.066	0.598	0.122	0.182
	469184.941	1000920.358	469184.641	1000919.925	469184.599	1000919.934	-0.300	-0.433	-0.342	-0.424	0.090	0.187	0.117	0.180
	469203.328	1000915.597	469202.871	1000915.480	469202.696	1000915.379	-0.457	-0.117	-0.632	-0.218	0.209	0.014	0.399	0.048
	469200.558	1000898.527	469200.252	1000897.885	469199.979	1000898.257	-0.306	-0.642	-0.579	-0.270	0.094	0.412	0.335	0.073
pr 10	469039.620	1001071.736	469039.676	1001071.390	469038.936	1001071.358	0.056	-0.346	-0.684	-0.378	0.003	0.120	0.468	0.143
	469038.345	1001087.764	469038.340	1001087.000	469038.237	1001087.769	-0.005	-0.764	-0.108	0.005	0.000	0.584	0.012	0.000
	469057.046	1001088.839	469057.409	1001088.905	469056.981	1001088.691	0.363	0.066	-0.065	-0.148	0.132	0.004	0.004	0.022
	469058.673	1001073.572	469058.662	1001073.242	469058.464	1001073.345	-0.011	-0.330	-0.209	-0.227	0.000	0.109	0.044	0.052
pr 11	469189.076	1001035.444	469188.461	1001035.127	469188.633	1001035.147	-0.615	-0.317	-0.443	-0.297	0.378	0.100	0.196	0.088
	469213.929	1001037.803	469213.385	1001037.456	469213.731	1001037.068	-0.544	-0.347	-0.198	-0.735	0.296	0.120	0.039	0.540
	469215.459	1001022.027	469214.655	1001021.554	469215.009	1001021.288	-0.804	-0.473	-0.450	-0.739	0.646	0.224	0.202	0.546
	469191.084	1001020.032	469191.046	1001020.364	469191.08	1001019.666	-0.038	0.332	-0.004	-0.366	0.001	0.110	0.000	0.134
pr 12	469147.917	1001241.585	469146.933	1001241.694	469147.523	1001241.401	-0.984	0.109	-0.394	-0.184	0.968	0.012	0.155	0.034
	469167.321	1001232.617	469166.618	1001232.222	469166.677	1001232.638	-0.703	-0.395	-0.644	0.021	0.494	0.156	0.415	0.000
	469166.216	1001215.300	469165.904	1001215.214	469165.512	1001214.879	-0.312	-0.086	-0.704	-0.421	0.097	0.007	0.496	0.177
	469145.598	1001215.732	469145.346	1001215.765	469145.446	1001215.68	-0.252	0.033	-0.152	-0.052	0.064	0.001	0.023	0.003
pr 13	469188.743	1001103.506	469188.249	1001103.316	469188.69	1001103.515	-0.494	-0.190	-0.053	0.009	0.244	0.036	0.003	0.000
	469189.485	1001120.917	469188.778	1001120.540	469189.485	1001120.918	-0.707	-0.377	0.000	0.001	0.500	0.142	0.000	0.000
	469209.143	1001117.837	469208.834	1001118.053	469208.504	1001117.867	-0.309	0.216	-0.639	0.030	0.095	0.047	0.408	0.001
	469208.620	1001099.698	469208.040	1001099.585	469208.27	1001099.232	-0.580	-0.113	-0.350	-0.466	0.336	0.013	0.122	0.217
pr 14	468996.842	1001135.938	468996.835	1001135.033	468997.309	1001135.3	-0.007	-0.905	0.467	-0.638	0.000	0.819	0.218	0.407
	468997.591	1001147.286	468997.682	1001147.098	468997.521	1001146.988	0.091	-0.188	-0.070	-0.298	0.008	0.035	0.005	0.089
	469018.966	1001146.730	469018.838	1001146.590	469018.653	1001146.57	-0.128	-0.140	-0.313	-0.160	0.016	0.020	0.098	0.026
	469019.691	1001130.411	469020.140	1001130.122	469019.611	1001130.45	0.449	-0.289	-0.080	0.039	0.202	0.084	0.006	0.002
pr 15	468897.917	1001531.669	468897.871	1001531.231	468897.682	1001531.251	-0.046	-0.438	-0.235	-0.418	0.002	0.192	0.055	0.175
	468905.047	1001533.700	468905.043	1001533.695	468905.064	1001533.115	-0.004	-0.005	0.017	-0.585	0.000	0.000	0.000	0.342
	468910.045	1001523.984	468910.269	1001524.091	468909.624	1001523.807	0.224	0.107	-0.421	-0.177	0.050	0.011	0.177	0.031
	468913.946	1001509.985	468914.152	1001509.188	468913.021	1001509.297	0.206	-0.797	-0.925	-0.688	0.042	0.635	0.856	0.473
	468905.634	1001507.112	468905.288	1001507.058	468905.044	1001507.099	-0.346	-0.054	-0.590	-0.013	0.120	0.003	0.348	0.000
	468901.947	1001519.218	468902.444	1001519.295	468901.305	1001518.91	0.497	0.077	-0.642	-0.308	0.247	0.006	0.412	0.095
pr 16	468952.291	1001301.978	468952.649	1001302.069	468952.632	1001302.044	0.358	0.091	0.341	0.066	0.128	0.008	0.116	0.004
	468951.871	1001316.303	468951.989	1001316.188	468952.186	1001316.02	0.118	-0.115	0.315	-0.283	0.014	0.013	0.099	0.080
	468977.863	1001318.734	468977.056	1001318.332	468977.729	1001318.074	-0.807	-0.402	-0.134	-0.660	0.651	0.162	0.018	0.436

	468972.412	1001303.511	468972.865	1001303.679	468972.274	1001303.712	0.453	0.168	-0.138	0.201	0.205	0.028	0.019	0.040
pr 17	469062.527	1001372.779	469062.015	1001373.019	469061.66	1001372.057	-0.512	0.240	-0.867	-0.722	0.262	0.058	0.752	0.521
	469035.192	1001381.562	469035.609	1001381.645	469035.421	1001381.885	0.417	0.083	0.229	0.323	0.174	0.007	0.052	0.104
	469039.875	1001395.692	469040.266	1001396.091	469040.603	1001396.412	0.391	0.399	0.728	0.720	0.153	0.159	0.530	0.518
	469066.244	1001387.077	469065.639	1001387.386	469066.241	1001387.075	-0.605	0.309	-0.003	-0.002	0.366	0.095	0.000	0.000
pr 18	469060.250	1001506.409	469060.594	1001506.327	469060.707	1001506.31	0.344	-0.082	0.457	-0.099	0.118	0.007	0.209	0.010
	469062.362	1001528.465	469062.457	1001528.535	469062.542	1001528.505	0.095	0.070	0.180	0.040	0.009	0.005	0.032	0.002
	469071.168	1001528.018	469071.283	1001528.059	469072.017	1001528.27	0.115	0.041	0.849	0.252	0.013	0.002	0.721	0.064
	469069.395	1001505.205	469069.611	1001505.675	469069.911	1001505.847	0.216	0.470	0.516	0.642	0.047	0.221	0.266	0.412
pr 19	468997.838	1001430.161	468997.353	1001430.229	468997.552	1001430.114	-0.485	0.068	-0.286	-0.047	0.235	0.005	0.082	0.002
	469003.359	1001444.226	469003.586	1001444.215	469003.035	1001444.242	0.227	-0.011	-0.324	0.016	0.052	0.000	0.105	0.000
	469021.106	1001442.982	469020.350	1001442.796	469020.359	1001443.315	-0.756	-0.186	-0.747	0.333	0.572	0.035	0.558	0.111
	469022.647	1001438.938	469022.890	1001438.923	469022.264	1001439.028	0.243	-0.015	-0.383	0.090	0.059	0.000	0.147	0.008
	469017.532	1001422.608	469017.726	1001422.519	469016.748	1001422.964	0.194	-0.089	-0.784	0.356	0.038	0.008	0.615	0.127
pr 20	468954.015	1001213.957	468954.178	1001213.878	468954.28	1001213.86	0.163	-0.079	0.265	-0.097	0.027	0.006	0.070	0.009
	468951.565	1001222.672	468951.648	1001222.885	468951.753	1001222.881	0.083	0.213	0.188	0.209	0.007	0.045	0.035	0.044
	468978.247	1001222.482	468978.128	1001222.573	468977.989	1001222.566	-0.119	0.091	-0.258	0.084	0.014	0.008	0.067	0.007
	468978.133	1001214.104	468977.758	1001213.815	468977.247	1001213.754	-0.375	-0.289	-0.886	-0.350	0.141	0.084	0.785	0.123
pr 21	469050.857	1001287.991	469050.581	1001288.430	469050.818	1001288.236	-0.276	0.439	-0.039	0.245	0.076	0.193	0.002	0.060
	469057.000	1001303.947	469056.005	1001304.172	469056.293	1001304.176	-0.995	0.225	-0.707	0.229	0.990	0.051	0.500	0.052
	469085.120	1001298.562	469084.613	1001298.285	469084.53	1001298.028	-0.507	-0.277	-0.590	-0.534	0.257	0.077	0.348	0.285
	469079.338	1001280.634	469078.924	1001280.658	469079.033	1001280.844	-0.414	0.024	-0.305	0.210	0.171	0.001	0.093	0.044
pr 22	469191.660	1001307.261	469191.070	1001307.276	469191.284	1001307.328	-0.590	0.015	-0.376	0.067	0.348	0.000	0.141	0.004
	469175.442	1001318.413	469175.005	1001318.304	469174.971	1001318.948	-0.437	-0.109	-0.471	0.535	0.191	0.012	0.222	0.286
	469184.596	1001343.275	469184.106	1001342.921	469184.523	1001342.998	-0.490	-0.354	-0.073	-0.277	0.240	0.125	0.005	0.077

	469197.882	1001337.649	469197.484	1001337.671	469197.493	1001337.513	-0.398	0.022	-0.389	-0.136	0.158	0.000	0.151	0.018
pr 23	469181.863	1001414.999	469181.465	1001414.729	469181.56	1001414.531	-0.398	-0.270	-0.303	-0.468	0.158	0.073	0.092	0.219
	469154.156	1001424.273	469153.583	1001424.504	469153.901	1001424.453	-0.573	0.231	-0.255	0.180	0.328	0.053	0.065	0.032
	469160.502	1001443.403	469160.251	1001443.831	469160.467	1001443.216	-0.251	0.428	-0.035	-0.187	0.063	0.183	0.001	0.035
	469188.464	1001433.802	469187.675	1001433.394	469188.122	1001433.466	-0.789	-0.408	-0.342	-0.336	0.623	0.166	0.117	0.113
pr 24	469207.029	1001501.542	469207.029	1001501.542	469207.029	1001501.542	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	469183.366	1001509.212	469183.129	1001509.760	469183.366	1001509.212	-0.237	0.548	0.000	0.000	0.056	0.300	0.000	0.000
	469190.165	1001528.656	469189.431	1001528.916	469190.165	1001528.656	-0.734	0.260	0.000	0.000	0.539	0.068	0.000	0.000
	469213.921	1001520.364	469213.138	1001520.132	469213.921	1001520.364	-0.783	-0.232	0.000	0.000	0.613	0.054	0.000	0.000
pr 25	469225.902	1001579.605	469225.240	1001579.406	469225.858	1001579.61	-0.662	-0.199	-0.044	0.005	0.438	0.040	0.002	0.000
	469209.651	1001584.872	469208.869	1001585.393	469209.634	1001584.871	-0.782	0.521	-0.017	-0.001	0.612	0.271	0.000	0.000
	469217.534	1001609.437	469216.972	1001609.602	469217.571	1001609.414	-0.562	0.165	0.037	-0.023	0.316	0.027	0.001	0.001
	469234.221	1001604.551	469233.674	1001604.641	469234.208	1001604.541	-0.547	0.090	-0.013	-0.010	0.299	0.008	0.000	0.000
pr 26	469419.177	1001507.953	469419.041	1001508.077	469419.2	1001507.394	-0.136	0.124	0.023	-0.559	0.018	0.015	0.001	0.312
	469398.377	1001514.376	469398.228	1001514.824	469397.937	1001514.954	-0.149	0.448	-0.440	0.578	0.022	0.201	0.194	0.334
	469407.454	1001540.136	469407.277	1001540.049	469407.092	1001540.135	-0.177	-0.087	-0.362	-0.001	0.031	0.008	0.131	0.000
	469435.980	1001530.135	469436.027	1001530.334	469436.72	1001529.969	0.047	0.199	0.740	-0.166	0.002	0.040	0.548	0.028
	469434.063	1001525.102	469433.884	1001525.206	469434.72	1001525.969	-0.179	0.104	0.657	0.867	0.032	0.011	0.432	0.752
pr 27	468790.001	1000890.200	468790.543	1000889.870	468790.321	1000890.013	0.542	-0.330	0.320	-0.187	0.294	0.109	0.102	0.035
	468791.879	1000906.301	468791.004	1000906.190	468791.816	1000906.804	-0.875	-0.111	-0.063	0.503	0.766	0.012	0.004	0.253
	468823.963	1000903.072	468824.278	1000903.261	468823.38	1000903.275	0.315	0.189	-0.583	0.203	0.099	0.036	0.340	0.041
	468823.308	1000891.230	468822.968	1000890.545	468822.692	1000890.541	-0.340	-0.685	-0.616	-0.689	0.116	0.469	0.379	0.475
	468805.891	1000892.581	468805.145	1000892.490	468806.555	1000891.688	-0.746	-0.091	0.664	-0.893	0.557	0.008	0.441	0.797
	468805.712	1000890.549	468805.664	1000889.593	468806.237	1000890.767	-0.048	-0.956	0.525	0.218	0.002	0.914	0.276	0.048
pr 28	468507.319	1001075.577	468506.909	1001075.907	468507.814	1001075.459	-0.410	0.330	0.495	-0.118	0.168	0.109	0.245	0.014

	468516.075	1001100.277	468515.515	1001100.513	468516.426	1001099.986	-0.560	0.236	0.351	-0.291	0.314	0.056	0.123	0.085
	468546.528	1001088.383	468546.589	1001088.937	468546.562	1001088.554	0.061	0.554	0.034	0.171	0.004	0.307	0.001	0.029
	468531.553	1001064.390	468532.243	1001063.603	468531.553	1001064.914	0.690	-0.787	0.000	0.524	0.476	0.619	0.000	0.275
pr 29	469151.861	1000773.169	469151.015	1000772.785	469151.4037	1000772.28	-0.846	-0.384	-0.457	-0.889	0.716	0.147	0.209	0.790
	469162.028	1000785.427	469162.040	1000785.191	469162.2145	1000784.999	0.012	-0.236	0.187	-0.428	0.000	0.056	0.035	0.183
	469166.471	1000781.618	469166.930	1000781.428	469166.971	1000781.961	0.459	-0.190	0.500	0.343	0.211	0.036	0.250	0.118
	469161.716	1000767.904	469161.072	1000767.744	469161.2684	1000767.894	-0.644	-0.160	-0.448	-0.010	0.415	0.026	0.200	0.000
pr 30	468900.808	1001100.767	468900.679	1001100.823	468900.751	1001100.489	-0.129	0.056	-0.057	-0.278	0.017	0.003	0.003	0.077
	468879.215	1001108.785	468879.447	1001107.927	468879.868	1001107.933	0.232	-0.858	0.653	-0.852	0.054	0.736	0.426	0.726
	468884.865	1001122.601	468884.955	1001122.246	468885.294	1001122.103	0.090	-0.355	0.429	-0.498	0.008	0.126	0.184	0.248
	468906.482	1001114.571	468906.148	1001114.515	468906.47	1001114.323	-0.334	-0.056	-0.012	-0.248	0.112	0.003	0.000	0.062
pr 31	468920.946	1001376.439	468921.069	1001376.336	468921.23	1001376.535	0.123	-0.103	0.284	0.096	0.015	0.011	0.081	0.009
	468919.160	1001378.543	468919.005	1001378.638	468919.046	1001378.678	-0.155	0.095	-0.114	0.135	0.024	0.009	0.013	0.018
	468915.194	1001416.661	468914.818	1001417.016	468914.981	1001416.929	-0.376	0.355	-0.213	0.268	0.141	0.126	0.045	0.072
	468926.767	1001416.037	468926.724	1001415.984	468926.868	1001416.096	-0.043	-0.053	0.101	0.059	0.002	0.003	0.010	0.003
	468934.143	1001414.669	468934.582	1001414.476	468934.832	1001414.727	0.439	-0.193	0.689	0.058	0.193	0.037	0.475	0.003
pr 32	468952.825	1001690.383	468953.330	1001690.409	468952.891	1001690.69	0.505	0.026	0.066	0.307	0.255	0.001	0.004	0.094
	468943.158	1001693.485	468943.345	1001693.696	468943.127	1001693.625	0.187	0.211	-0.031	0.140	0.035	0.045	0.001	0.020
	468950.078	1001716.241	468950.518	1001716.532	468950.868	1001716.246	0.440	0.291	0.790	0.005	0.194	0.085	0.624	0.000
	468959.612	1001713.167	468960.213	1001713.252	468960.213	1001713.252	0.601	0.085	0.601	0.085	0.361	0.007	0.361	0.007
pr 33	468800.760	1001788.410	468800.901	1001788.810	468801.078	1001789.077	0.141	0.400	0.318	0.667	0.020	0.160	0.101	0.445
	468793.388	1001796.443	468793.489	1001796.694	468793.7	1001796.72	0.101	0.251	0.312	0.277	0.010	0.063	0.097	0.077
	468813.937	1001811.649	468813.629	1001812.305	468814.228	1001812.525	-0.308	0.656	0.291	0.876	0.095	0.430	0.085	0.767
	468820.287	1001806.931	468820.254	1001807.394	468820.084	1001807.915	-0.033	0.463	-0.203	0.984	0.001	0.214	0.041	0.968
pr 34	468763.086	1001855.450	468763.024	1001856.097	468763.384	1001856.062	-0.062	0.647	0.298	0.612	0.004	0.419	0.089	0.375

	468759.788	1001865.014	468760.087	1001865.097	468760.352	1001864.988	0.299	0.083	0.564	-0.026	0.089	0.007	0.318	0.001
	468776.184	1001870.864	468776.333	1001871.522	468776.798	1001871.173	0.149	0.658	0.614	0.309	0.022	0.433	0.377	0.095
	468778.910	1001861.332	468778.979	1001862.023	468779.131	1001862.005	0.069	0.691	0.221	0.673	0.005	0.477	0.049	0.453
pr 35	468804.690	1001924.577	468805.047	1001924.996	468805.022	1001924.69	0.357	0.419	0.332	0.113	0.127	0.176	0.110	0.013
	468821.739	1001930.538	468821.399	1001931.148	468821.516	1001930.856	-0.340	0.610	-0.223	0.318	0.116	0.372	0.050	0.101
	468824.936	1001919.783	468824.851	1001920.075	468824.713	1001920.135	-0.085	0.292	-0.223	0.352	0.007	0.085	0.050	0.124
	468807.931	1001913.484	468807.984	1001913.725	468807.942	1001914.364	0.053	0.241	0.011	0.880	0.003	0.058	0.000	0.774
pr 36	469104.150	1002274.669	469104.925	1002274.226	469104.302	1002274.571	0.775	-0.443	0.152	-0.098	0.601	0.196	0.023	0.010
	469099.339	1002288.101	469098.382	1002288.994	469099.566	1002288.855	-0.957	0.893	0.227	0.754	0.916	0.797	0.052	0.569
	469116.365	1002294.100	469116.356	1002294.765	469116.163	1002294.626	-0.009	0.665	-0.202	0.526	0.000	0.442	0.041	0.277
	469120.927	1002280.919	469120.529	1002280.891	469120.783	1002280.783	-0.398	-0.028	-0.144	-0.136	0.158	0.001	0.021	0.018
pr 37	469147.540	1002205.494	469147.105	1002205.724	469147.376	1002205.972	-0.435	0.230	-0.164	0.478	0.189	0.053	0.027	0.228
	469144.361	1002214.849	469144.089	1002214.932	469144.232	1002214.073	-0.272	0.083	-0.129	-0.776	0.074	0.007	0.017	0.602
	469161.905	1002221.125	469161.790	1002221.885	469161.991	1002222.116	-0.115	0.760	0.086	0.991	0.013	0.578	0.007	0.982
	469165.520	1002211.891	469165.401	1002211.074	469165.135	1002211.396	-0.119	-0.817	-0.385	-0.495	0.014	0.667	0.148	0.245
pr 38	469079.789	1002213.179	469079.505	1002213.390	469079.849	1002213.376	-0.284	0.211	0.060	0.197	0.081	0.045	0.004	0.039
	469076.710	1002222.658	469076.436	1002222.708	469076.066	1002223.536	-0.274	0.050	-0.644	0.878	0.075	0.002	0.415	0.771
	469094.015	1002229.001	469093.502	1002229.963	469093.375	1002229.662	-0.513	0.962	-0.640	0.661	0.263	0.925	0.410	0.437
	469097.300	1002219.342	469097.037	1002220.121	469096.907	1002219.795	-0.263	0.779	-0.393	0.453	0.069	0.607	0.154	0.205
pr 39	469105.466	1001994.144	469105.133	1001994.005	469105.437	1001994.833	-0.333	-0.139	-0.029	0.689	0.111	0.019	0.001	0.475
	469097.217	1001988.730	469096.870	1001988.115	469096.844	1001989.441	-0.347	-0.615	-0.373	0.711	0.120	0.378	0.139	0.506
	469086.915	1002021.201	469086.343	1002021.021	469086.419	1002021.206	-0.572	-0.180	-0.496	0.005	0.327	0.032	0.246	0.000
	469098.987	1002024.885	469098.537	1002024.937	469098.849	1002025.387	-0.450	0.052	-0.138	0.502	0.203	0.003	0.019	0.252
	469100.777	1002020.432	469100.320	1002020.688	469100.543	1002020.741	-0.457	0.256	-0.234	0.309	0.209	0.066	0.055	0.095
pr 40	468756.009	1002012.255	468756.007	1002012.354	468756.035	1002012.519	-0.002	0.099	0.026	0.264	0.000	0.010	0.001	0.070

	468749.520	1002034.163	468748.863	1002034.785	468748.786	1002034.016	-0.657	0.622	-0.734	-0.147	0.432	0.387	0.539	0.022
	468765.164	1002039.512	468764.897	1002039.347	468765.163	1002039.811	-0.267	-0.165	-0.001	0.299	0.071	0.027	0.000	0.089
	468772.666	1002017.853	468772.834	1002018.381	468772.686	1002018.034	0.168	0.528	0.020	0.181	0.028	0.279	0.000	0.033
pr 41	468849.708	1002003.226	468849.658	1002003.704	468849.965	1002003.836	-0.050	0.478	0.257	0.610	0.002	0.228	0.066	0.372
	468846.185	1002012.502	468846.350	1002013.494	468846.758	1002013.425	0.165	0.992	0.573	0.923	0.027	0.984	0.328	0.852
	468862.953	1002017.926	468862.887	1002017.984	468863.47	1002017.949	-0.066	0.058	0.517	0.023	0.004	0.003	0.267	0.001
	468865.759	1002008.903	468866.095	1002009.624	468866.666	1002009.583	0.336	0.721	0.907	0.680	0.113	0.520	0.823	0.462
pr 42	468978.202	1002090.907	468978.386	1002091.436	468979.111	1002091.598	0.184	0.529	0.909	0.691	0.034	0.280	0.826	0.477
	468972.634	1002105.789	468973.465	1002105.836	468972.994	1002105.625	0.831	0.047	0.360	-0.164	0.691	0.002	0.130	0.027
	468990.633	1002111.446	468990.848	1002111.551	468990.913	1002111.693	0.215	0.105	0.280	0.247	0.046	0.011	0.078	0.061
	468995.970	1002097.353	468995.928	1002097.772	468996.063	1002097.721	-0.042	0.419	0.093	0.368	0.002	0.176	0.009	0.135
pr 43	468734.954	1001940.971	468734.933	1001941.824	468735.337	1001941.814	-0.021	0.853	0.383	0.843	0.000	0.728	0.147	0.711
	468731.925	1001950.400	468731.599	1001950.661	468732.225	1001951.255	-0.326	0.261	0.300	0.855	0.106	0.068	0.090	0.731
	468747.900	1001956.492	468748.030	1001957.275	468748.143	1001956.584	0.130	0.783	0.243	0.092	0.017	0.613	0.059	0.008
	468751.256	1001946.869	468750.993	1001946.015	468751.572	1001947.762	-0.263	-0.854	0.316	0.893	0.069	0.729	0.100	0.797
pr 44	469099.858	1002134.411	469098.917	1002135.018	469099.337	1002134.934	-0.941	0.607	-0.521	0.523	0.885	0.368	0.271	0.274
	469094.774	1002149.149	469094.194	1002149.623	469094.456	1002149.314	-0.580	0.474	-0.318	0.165	0.336	0.225	0.101	0.027
	469112.068	1002154.529	469111.538	1002154.576	469111.769	1002155.342	-0.530	0.047	-0.299	0.813	0.281	0.002	0.089	0.661
	469117.817	1002140.709	469117.531	1002141.011	469117.233	1002140.785	-0.286	0.302	-0.584	0.076	0.082	0.091	0.341	0.006
pr 45	469111.755	1000974.703	469111.217	1000974.665	469111.8718	1000974.638	-0.538	-0.038	0.117	-0.065	0.289	0.001	0.014	0.004
	469139.028	1000977.690	469138.602	1000977.507	469138.5396	1000976.849	-0.426	-0.183	-0.488	-0.841	0.181	0.033	0.239	0.707
	469138.918	1000952.654	469138.982	1000952.093	469138.204	1000951.735	0.064	-0.561	-0.714	-0.919	0.004	0.315	0.510	0.845
	469120.865	1000955.395	469120.842	1000955.315	469121.4134	1000955.05	-0.023	-0.080	0.548	-0.345	0.001	0.006	0.301	0.119
pr 46	469034.741	1002058.083	469034.194	1002058.492	469034.48	1002058.407	-0.547	0.409	-0.261	0.324	0.299	0.167	0.068	0.105
	469031.518	1002067.658	469030.953	1002067.712	469031.019	1002068.488	-0.565	0.054	-0.499	0.830	0.319	0.003	0.249	0.689

	469048.458	1002073.376	469047.787	1002073.500	469048.172	1002074.37	-0.671	0.124	-0.286	0.994	0.450	0.015	0.082	0.988
	469051.700	1002063.844	469051.595	1002064.066	469051.547	1002064.091	-0.105	0.222	-0.153	0.247	0.011	0.049	0.023	0.061
pr 47	469040.056	1002177.131	469039.619	1002177.584	469039.398	1002177.221	-0.437	0.453	-0.658	0.090	0.191	0.205	0.433	0.008
	469022.856	1002171.968	469022.253	1002171.970	469022.749	1002172.895	-0.603	0.002	-0.107	0.927	0.364	0.000	0.011	0.859
	469019.118	1002181.622	469019.253	1002182.309	469019.411	1002182.502	0.135	0.687	0.293	0.880	0.018	0.472	0.086	0.774
	469036.608	1002187.405	469035.866	1002188.288	469035.868	1002188.259	-0.742	0.883	-0.740	0.854	0.551	0.780	0.548	0.729
pr 48	468919.270	1002287.002	468919.482	1002287.088	468919.821	1002287.216	0.212	0.086	0.551	0.214	0.045	0.007	0.304	0.046
	468951.720	1002297.558	468951.433	1002297.990	468951.624	1002297.532	-0.287	0.432	-0.096	-0.026	0.082	0.187	0.009	0.001
	468954.207	1002297.073	468954.000	1002297.942	468954.026	1002297.979	-0.207	0.869	-0.181	0.906	0.043	0.755	0.033	0.821
	468966.937	1002256.264	468966.123	1002256.445	468966.27	1002257.148	-0.814	0.181	-0.667	0.884	0.663	0.033	0.445	0.781
	468932.665	1002247.014	468933.033	1002247.442	468932.465	1002247.653	0.368	0.428	-0.200	0.639	0.135	0.183	0.040	0.408
pr 49	468931.692	1002171.715	468932.044	1002171.850	468932.279	1002171.824	0.352	0.135	0.587	0.109	0.124	0.018	0.345	0.012
	468928.897	1002181.144	468928.915	1002181.275	468928.977	1002181.167	0.018	0.131	0.080	0.023	0.000	0.017	0.006	0.001
	468945.361	1002186.896	468945.319	1002186.149	468945.577	1002186.02	-0.042	-0.747	0.216	-0.876	0.002	0.558	0.047	0.767
	468948.634	1002177.608	468948.759	1002177.910	468948.844	1002177.66	0.125	0.302	0.210	0.052	0.016	0.091	0.044	0.003
pr 50	468837.218	1002181.648	468837.799	1002182.102	468837.804	1002181.887	0.581	0.454	0.586	0.239	0.338	0.206	0.343	0.057
	468830.527	1002200.392	468830.464	1002200.628	468830.28	1002200.101	-0.063	0.236	-0.247	-0.291	0.004	0.056	0.061	0.085
	468847.212	1002206.386	468847.041	1002206.508	468847.12	1002206.688	-0.171	0.122	-0.092	0.302	0.029	0.015	0.008	0.091
	468854.144	1002187.104	468853.677	1002187.744	468853.83	1002187.089	-0.467	0.640	-0.314	-0.015	0.218	0.410	0.099	0.000
pr 51	468860.719	1002115.519	468860.851	1002116.504	468860.772	1002116.271	0.132	0.985	0.053	0.752	0.017	0.970	0.003	0.566
	468857.402	1002125.035	468857.676	1002125.090	468857.623	1002125.578	0.274	0.055	0.221	0.543	0.075	0.003	0.049	0.295
	468874.688	1002131.604	468874.191	1002131.643	468874.219	1002131.531	-0.497	0.039	-0.469	-0.073	0.247	0.002	0.220	0.005
	468878.191	1002121.643	468877.758	1002122.299	468877.546	1002122.31	-0.433	0.656	-0.645	0.667	0.187	0.430	0.416	0.445
pr 52	468690.014	1001988.931	468690.124	1001989.623	468690.841	1001988.99	0.110	0.692	0.827	0.059	0.012	0.479	0.684	0.003
	468686.625	1002001.223	468686.049	1002001.290	468686.798	1002001.605	-0.576	0.067	0.173	0.382	0.332	0.004	0.030	0.146

	468703.059	1002006.236	468703.643	1002006.221	468702.187	1002006.314	0.584	-0.015	-0.872	0.078	0.341	0.000	0.760	0.006
	468706.271	1001994.556	468706.851	1001994.683	468705.865	1001994.718	0.580	0.127	-0.406	0.162	0.336	0.016	0.165	0.026
pr 53	468713.638	1002331.980	468713.691	1002331.962	468713.865	1002331.761	0.053	-0.018	0.227	-0.219	0.003	0.000	0.052	0.048
	468716.760	1002342.199	468716.707	1002342.214	468717.083	1002341.641	-0.053	0.015	0.323	-0.558	0.003	0.000	0.104	0.311
	468689.326	1002346.818	468689.211	1002347.017	468689.672	1002346.319	-0.115	0.199	0.346	-0.499	0.013	0.040	0.120	0.249
	468687.209	1002336.771	468687.949	1002336.817	468687.703	1002336.053	0.740	0.046	0.494	-0.718	0.548	0.002	0.244	0.516
pr 54	468911.731	1002397.347	468911.222	1002396.434	468912.627	1002397.092	-0.509	-0.913	0.896	-0.255	0.259	0.834	0.803	0.065
	468895.469	1002401.350	468895.363	1002401.887	468894.847	1002401.022	-0.106	0.537	-0.622	-0.328	0.011	0.288	0.387	0.108
	468901.764	1002426.068	468901.713	1002426.082	468902.268	1002426.239	-0.051	0.014	0.504	0.171	0.003	0.000	0.254	0.029
	468918.659	1002422.021	468918.659	1002422.437	468919.334	1002422.022	0.000	0.416	0.675	0.001	0.000	0.173	0.456	0.000
pr 55	468833.662	1002515.431	468833.397	1002515.738	468832.942	1002515.832	-0.265	0.307	-0.720	0.401	0.070	0.094	0.518	0.161
	468813.617	1002516.783	468813.140	1002516.204	468813.468	1002516.389	-0.477	-0.579	-0.149	-0.394	0.228	0.335	0.022	0.155
	468813.677	1002526.654	468813.458	1002526.300	468813.63	1002526.28	-0.219	-0.354	-0.047	-0.374	0.048	0.125	0.002	0.140
	468836.094	1002525.023	468835.429	1002524.903	468836.013	1002524.558	-0.665	-0.120	-0.081	-0.465	0.442	0.014	0.007	0.216
pr 56	469925.710	1002237.922	469925.558	1002237.999	469925.5911	1002237.949	-0.152	0.077	-0.119	0.027	0.023	0.006	0.014	0.001
	469925.107	1002259.600	469925.608	1002259.360	469925.1	1002259.415	0.500	-0.240	-0.007	-0.185	0.251	0.058	0.000	0.034
	469961.576	1002257.671	469961.090	1002258.215	469961.5972	1002257.298	-0.486	0.544	0.021	-0.373	0.236	0.296	0.000	0.139
	469968.402	1002227.311	469967.493	1002227.456	469968.8908	1002227.408	-0.909	0.145	0.489	0.097	0.826	0.021	0.239	0.009
pr 57	469944.329	1002185.122	469944.329	1002185.122	469944.7659	1002185.43	0.000	0.000	0.437	0.308	0.000	0.000	0.191	0.095
	469944.351	1002203.254	469944.630	1002203.791	469944.0437	1002203.438	0.279	0.537	-0.307	0.184	0.078	0.288	0.094	0.034
	469968.604	1002197.002	469968.188	1002197.014	469968.7361	1002197.379	-0.416	0.012	0.132	0.377	0.173	0.000	0.017	0.142
	469968.086	1002179.144	469967.913	1002179.311	469967.8914	1002179.144	-0.173	0.167	-0.195	0.000	0.030	0.028	0.038	0.000
pr 58	469376.071	1002055.146	469376.523	1002055.030	469376.4235	1002055.565	0.452	-0.116	0.352	0.419	0.204	0.013	0.124	0.176
	469377.508	1002065.138	469377.842	1002065.136	469377.6068	1002065.135	0.334	-0.002	0.099	-0.003	0.111	0.000	0.010	0.000
	469407.523	1002056.192	469407.570	1002056.113	469407.4937	1002056.433	0.047	-0.079	-0.029	0.241	0.002	0.006	0.001	0.058

	469405.251	1002046.682	469405.163	1002046.642	469405.0072	1002047.374	-0.088	-0.040	-0.244	0.692	0.008	0.002	0.059	0.479
pr59	469514.154	1002076.585	469514.172	1002077.061	469514.1724	1002077.061	0.018	0.476	0.018	0.476	0.000	0.227	0.000	0.227
	469517.555	1002086.206	469517.686	1002086.047	469517.4517	1002086.783	0.131	-0.159	-0.103	0.577	0.017	0.025	0.011	0.333
	469532.598	1002080.960	469532.863	1002080.963	469532.9991	1002081.457	0.264	0.003	0.401	0.497	0.070	0.000	0.161	0.247
	469529.306	1002071.525	469529.219	1002071.823	469529.6933	1002071.804	-0.087	0.298	0.387	0.279	0.008	0.089	0.150	0.078
pr 60	469573.672	1002120.549	469573.832	1002120.451	469573.8619	1002120.325	0.160	-0.098	0.190	-0.224	0.026	0.010	0.036	0.050
	469581.919	1002134.176	469581.920	1002134.476	469582.3104	1002134.805	0.001	0.300	0.391	0.629	0.000	0.090	0.153	0.396
	469601.251	1002123.120	469601.140	1002123.778	469601.201	1002123.588	-0.111	0.658	-0.050	0.468	0.012	0.433	0.002	0.219
	469592.044	1002109.289	469592.462	1002109.269	469592.5682	1002109.014	0.417	-0.020	0.524	-0.275	0.174	0.000	0.275	0.076
pr 61	469598.880	1002006.423	469599.106	1002006.695	469599.2949	1002006.845	0.226	0.272	0.415	0.422	0.051	0.074	0.172	0.178
	469602.470	1002016.981	469602.710	1002017.431	469602.5806	1002017.202	0.240	0.450	0.111	0.221	0.057	0.202	0.012	0.049
	469618.536	1002011.485	469618.309	1002011.980	469618.1693	1002011.721	-0.227	0.495	-0.367	0.236	0.051	0.245	0.134	0.056
	469615.269	1002000.774	469615.272	1002000.767	469614.9684	1002000.88	0.003	-0.007	-0.301	0.106	0.000	0.000	0.090	0.011
pr 62	469453.516	1001980.594	469453.506	1001980.535	469452.8297	1001979.819	-0.010	-0.059	-0.686	-0.775	0.000	0.003	0.471	0.601
	469459.872	1001999.209	469459.679	1001999.277	469459.4026	1001999.092	-0.193	0.068	-0.469	-0.117	0.037	0.005	0.220	0.014
	469476.046	1001993.512	469476.185	1001993.920	469475.952	1001993.733	0.139	0.408	-0.094	0.221	0.019	0.166	0.009	0.049
	469469.221	1001974.360	469469.317	1001974.629	469469.0129	1001974.306	0.096	0.269	-0.208	-0.054	0.009	0.072	0.043	0.003
pr 63	469684.016	1001916.651	469683.909	1001916.908	469684.2659	1001916.774	-0.107	0.257	0.250	0.123	0.011	0.066	0.062	0.015
	469687.565	1001926.046	469687.684	1001926.460	469687.2987	1001926.352	0.119	0.414	-0.266	0.306	0.014	0.171	0.071	0.094
	469703.554	1001920.921	469703.828	1001921.432	469703.7645	1001921.223	0.274	0.511	0.210	0.302	0.075	0.261	0.044	0.091
	469700.768	1001911.852	469700.856	1001911.939	469700.9478	1001912.012	0.088	0.087	0.180	0.160	0.008	0.008	0.032	0.026
pr 64	469792.584	1001942.195	469792.746	1001942.618	469792.6248	1001942.393	0.162	0.423	0.041	0.198	0.026	0.179	0.002	0.039
	469798.852	1001958.615	469799.308	1001958.718	469799.6745	1001958.434	0.456	0.103	0.823	-0.181	0.208	0.011	0.677	0.033
	469809.730	1001952.947	469809.574	1001952.959	469809.7415	1001953.262	-0.156	0.012	0.012	0.315	0.024	0.000	0.000	0.099
	469804.322	1001937.913	469804.252	1001938.364	469804.6338	1001938.219	-0.070	0.451	0.312	0.306	0.005	0.203	0.097	0.094

pr 65	469905.115	1001880.651	469904.641	1001880.755	469904.6356	1001880.983	-0.474	0.104	-0.479	0.332	0.224	0.011	0.230	0.110
	469903.964	1001898.896	469903.990	1001899.401	469904.1514	1001899.317	0.026	0.505	0.187	0.421	0.001	0.255	0.035	0.177
	469914.522	1001899.434	469914.611	1001899.734	469914.9252	1001899.602	0.089	0.300	0.403	0.168	0.008	0.090	0.163	0.028
	469916.437	1001880.802	469916.754	1001881.004	469917.2071	1001881.315	0.317	0.202	0.770	0.513	0.100	0.041	0.593	0.263
pr 66	469807.001	1001831.048	469807.157	1001831.318	469807.4692	1001831.155	0.156	0.270	0.468	0.107	0.024	0.073	0.219	0.011
	469805.094	1001863.912	469805.249	1001864.198	469805.6974	1001864.022	0.155	0.286	0.603	0.110	0.024	0.082	0.364	0.012
	469815.596	1001864.156	469816.203	1001864.529	469816.2581	1001864.298	0.607	0.373	0.662	0.142	0.368	0.139	0.438	0.020
	469818.960	1001832.424	469819.098	1001832.646	469819.2634	1001832.537	0.137	0.222	0.303	0.113	0.019	0.049	0.092	0.013
pr 67	469680.180	1001806.445	469680.473	1001806.782	469680.1799	1001806.445	0.293	0.337	0.000	0.000	0.086	0.114	0.000	0.000
	469683.290	1001815.357	469683.219	1001815.688	469683.2902	1001815.357	-0.071	0.331	0.000	0.000	0.005	0.110	0.000	0.000
	469704.592	1001808.734	469704.143	1001809.195	469704.5915	1001808.734	-0.449	0.461	0.000	0.000	0.202	0.213	0.000	0.000
	469701.434	1001799.487	469701.021	1001799.622	469701.4343	1001799.487	-0.413	0.135	0.000	0.000	0.171	0.018	0.000	0.000
pr 68	469802.550	1001691.618	469802.592	1001692.034	469801.9573	1001691.709	0.042	0.416	-0.593	0.091	0.002	0.173	0.351	0.008
	469813.506	1001691.555	469813.816	1001691.859	469813.0489	1001691.278	0.310	0.304	-0.457	-0.277	0.096	0.092	0.209	0.077
	469811.489	1001663.153	469811.247	1001663.363	469811.5752	1001663.15	-0.242	0.210	0.086	-0.003	0.059	0.044	0.007	0.000
	469800.654	1001663.722	469800.267	1001663.853	469800.5502	1001663.777	-0.387	0.131	-0.104	0.055	0.150	0.017	0.011	0.003
pr 69	469930.036	1001816.709	469929.667	1001817.164	469929.8243	1001816.601	-0.369	0.455	-0.212	-0.108	0.136	0.207	0.045	0.012
	469950.513	1001821.586	469950.318	1001821.834	469950.1429	1001821.494	-0.195	0.248	-0.370	-0.092	0.038	0.062	0.137	0.008
	469952.706	1001802.430	469952.462	1001802.466	469952.2236	1001802.448	-0.244	0.036	-0.482	0.018	0.060	0.001	0.233	0.000
	469933.509	1001798.356	469932.912	1001798.692	469933.3485	1001798.551	-0.597	0.336	-0.160	0.195	0.357	0.113	0.026	0.038
pr 70	469525.834	1001881.307	469526.392	1001881.571	469526.6577	1001881.821	0.558	0.264	0.824	0.514	0.312	0.070	0.678	0.264
	469535.359	1001877.884	469535.457	1001878.333	469535.3113	1001877.799	0.098	0.449	-0.048	-0.085	0.010	0.202	0.002	0.007
	469526.592	1001852.730	469526.803	1001853.336	469526.6206	1001853.352	0.211	0.606	0.029	0.622	0.045	0.367	0.001	0.387
	469517.176	1001856.080	469517.219	1001856.663	469517.6639	1001856.053	0.043	0.583	0.488	-0.027	0.002	0.340	0.238	0.001
pr 71	469564.875	1001668.789	469565.056	1001668.956	469565.0948	1001668.777	0.181	0.167	0.220	-0.012	0.033	0.028	0.048	0.000

	469567.687	1001669.275	469567.835	1001669.417	469567.7067	1001669.082	0.148	0.142	0.020	-0.193	0.022	0.020	0.000	0.037
	469568.879	1001669.620	469568.705	1001669.144	469568.8623	1001669.217	-0.174	-0.476	-0.017	-0.403	0.030	0.227	0.000	0.162
	469578.648	1001667.162	469578.424	1001666.978	469578.648	1001667.162	-0.224	-0.184	0.000	0.000	0.050	0.034	0.000	0.000
	469573.021	1001648.570	469572.529	1001648.702	469573.0212	1001648.57	-0.492	0.132	0.000	0.000	0.242	0.017	0.000	0.000
	469559.394	1001651.813	469559.208	1001652.184	469559.5659	1001652.19	-0.186	0.371	0.172	0.377	0.034	0.138	0.030	0.142
pr 72	469673.243	1001713.247	469673.190	1001713.406	469673.1092	1001713.563	-0.053	0.159	-0.134	0.316	0.003	0.025	0.018	0.100
	469676.194	1001721.705	469676.239	1001722.180	469675.88	1001722.189	0.045	0.475	-0.314	0.484	0.002	0.226	0.099	0.234
	469700.452	1001714.192	469700.504	1001714.708	469700.2277	1001714.574	0.052	0.516	-0.224	0.382	0.003	0.266	0.050	0.146
	469697.732	1001705.735	469697.652	1001705.825	469697.3845	1001705.749	-0.081	0.090	-0.348	0.014	0.006	0.008	0.121	0.000
pr 73	469602.827	1001773.699	469602.934	1001773.946	469602.9953	1001774.305	0.107	0.247	0.168	0.606	0.011	0.061	0.028	0.367
	469607.649	1001784.829	469607.598	1001785.480	469607.504	1001785.511	-0.051	0.651	-0.145	0.682	0.003	0.424	0.021	0.465
	469629.450	1001778.654	469629.618	1001778.478	469629.4678	1001778.336	0.168	-0.176	0.018	-0.318	0.028	0.031	0.000	0.101
	469624.732	1001766.876	469624.579	1001767.298	469624.7445	1001767.028	-0.153	0.422	0.012	0.152	0.023	0.178	0.000	0.023
pr 74	469467.953	1001579.252	469467.765	1001579.308	469467.9533	1001579.252	-0.188	0.056	0.000	0.000	0.035	0.003	0.000	0.000
	469474.179	1001598.042	469473.872	1001598.176	469474.179	1001598.042	-0.307	0.134	0.000	0.000	0.095	0.018	0.000	0.000
	469497.553	1001589.778	469497.743	1001589.715	469497.5533	1001589.778	0.190	-0.063	0.000	0.000	0.036	0.004	0.000	0.000
	469491.158	1001570.819	469491.042	1001570.861	469491.1579	1001570.819	-0.116	0.042	0.000	0.000	0.014	0.002	0.000	0.000
pr 75	469272.594	1001953.699	469272.133	1001953.473	469271.8156	1001953.16	-0.461	-0.226	-0.778	-0.539	0.213	0.051	0.606	0.291
	469290.517	1001948.831	469290.587	1001948.670	469290.2697	1001949.455	0.070	-0.161	-0.247	0.624	0.005	0.026	0.061	0.389
	469283.221	1001927.249	469282.819	1001927.232	469282.8849	1001927.121	-0.402	-0.017	-0.336	-0.128	0.161	0.000	0.113	0.016
	469265.877	1001933.014	469265.398	1001933.317	469265.5736	1001932.606	-0.479	0.303	-0.303	-0.408	0.230	0.092	0.092	0.166
pr 76	469463.116	1001749.552	469463.117	1001750.062	469463.1156	1001749.552	0.001	0.510	0.000	0.000	0.000	0.260	0.000	0.000
	469469.859	1001768.844	469469.784	1001769.097	469469.8587	1001768.844	-0.075	0.253	0.000	0.000	0.006	0.064	0.000	0.000
	469493.313	1001760.752	469493.454	1001760.953	469493.3133	1001760.752	0.141	0.201	0.000	0.000	0.020	0.040	0.000	0.000
	469486.863	1001741.988	469486.730	1001742.183	469486.8633	1001741.988	-0.133	0.195	0.000	0.000	0.018	0.038	0.000	0.000

pr 77	469397.489	1001857.593	469396.927	1001856.981	469397.0223	1001857.65	-0.562	-0.612	-0.467	0.057	0.316	0.375	0.218	0.003
	469423.165	1001847.840	469422.602	1001848.226	469423.0811	1001848.31	-0.563	0.386	-0.084	0.470	0.317	0.149	0.007	0.221
	469416.757	1001829.017	469416.163	1001829.016	469416.4368	1001829.508	-0.594	-0.001	-0.320	0.491	0.353	0.000	0.103	0.241
	469389.825	1001837.803	469389.403	1001838.262	469389.577	1001838.178	-0.422	0.459	-0.248	0.375	0.178	0.211	0.062	0.141
pr 78	469286.314	1001803.182	469285.958	1001803.715	469285.4912	1001802.816	-0.356	0.533	-0.823	-0.366	0.127	0.284	0.677	0.134
	469294.202	1001828.893	469294.031	1001828.781	469294.3882	1001828.892	-0.171	-0.112	0.186	-0.001	0.029	0.013	0.035	0.000
	469309.299	1001823.833	469309.769	1001823.805	469309.7686	1001823.805	0.470	-0.028	0.470	-0.028	0.221	0.001	0.221	0.001
	469315.288	1001802.299	469315.962	1001802.216	469314.4366	1001802.112	0.674	-0.083	-0.851	-0.187	0.454	0.007	0.725	0.035
	469314.300	1001796.323	469314.089	1001796.314	469314.4685	1001796.256	-0.211	-0.009	0.169	-0.067	0.044	0.000	0.028	0.004
	469312.599	1001790.675	469312.226	1001791.153	469312.5072	1001790.569	-0.373	0.478	-0.092	-0.106	0.139	0.228	0.008	0.011
	469305.487	1001794.008	469305.297	1001793.715	469305.7848	1001794.084	-0.190	-0.293	0.298	0.076	0.036	0.086	0.089	0.006
	469314.216	1001806.155	469314.886	1001806.185	469313.4157	1001805.926	0.670	0.030	-0.800	-0.229	0.449	0.001	0.640	0.052
pr 79	469295.599	1001681.565	469295.348	1001681.574	469295.5988	1001681.565	-0.251	0.009	0.000	0.000	0.063	0.000	0.000	0.000
	469358.202	1001659.037	469357.751	1001659.461	469357.9579	1001658.597	-0.451	0.424	-0.244	-0.440	0.204	0.180	0.060	0.194
	469351.718	1001639.663	469350.903	1001640.031	469351.6152	1001639.903	-0.815	0.368	-0.103	0.240	0.664	0.135	0.011	0.058
	469313.123	1001653.051	469312.902	1001653.637	469312.8243	1001653.523	-0.221	0.586	-0.299	0.472	0.049	0.343	0.089	0.223
	469311.353	1001660.793	469310.973	1001660.773	469310.9077	1001660.535	-0.380	-0.020	-0.445	-0.258	0.144	0.000	0.198	0.067
	469296.213	1001666.761	469295.590	1001666.710	469295.7991	1001666.876	-0.623	-0.051	-0.414	0.115	0.388	0.003	0.171	0.013
pr 80	469164.563	1001641.711	469164.714	1001641.710	469164.5633	1001641.711	0.151	-0.001	0.000	0.000	0.023	0.000	0.000	0.000
	469171.406	1001661.538	469171.400	1001661.677	469171.4057	1001661.538	-0.006	0.139	0.000	0.000	0.000	0.019	0.000	0.000
	469195.679	1001652.299	469195.451	1001652.733	469195.6786	1001652.299	-0.228	0.434	0.000	0.000	0.052	0.188	0.000	0.000
	469189.186	1001633.270	469189.135	1001633.717	469189.1858	1001633.27	-0.051	0.447	0.000	0.000	0.003	0.200	0.000	0.000
pr 81	469836.403	1001777.812	469836.522	1001777.760	469836.6095	1001777.7	0.119	-0.052	0.207	-0.112	0.014	0.003	0.043	0.013
	469849.682	1001780.725	469849.785	1001780.656	469849.717	1001780.566	0.103	-0.069	0.035	-0.159	0.011	0.005	0.001	0.025
	469856.260	1001754.806	469856.094	1001755.351	469856.7801	1001754.636	-0.166	0.545	0.520	-0.170	0.028	0.297	0.271	0.029

	469840.896	1001751.383	469840.661	1001750.970	469841.1242	1001751.578	-0.235	-0.413	0.228	0.195	0.055	0.171	0.052	0.038
pr 82	469910.441	1001756.533	469910.361	1001757.035	469911.0213	1001756.536	-0.080	0.502	0.580	0.003	0.006	0.252	0.337	0.000
	469930.984	1001760.984	469930.824	1001761.238	469930.4067	1001761.153	-0.160	0.254	-0.577	0.169	0.026	0.065	0.333	0.029
	469934.088	1001744.053	469933.890	1001744.444	469933.9565	1001744.577	-0.198	0.391	-0.132	0.524	0.039	0.153	0.017	0.275
	469912.321	1001739.908	469912.369	1001740.412	469912.0702	1001739.861	0.048	0.504	-0.251	-0.047	0.002	0.254	0.063	0.002
pr 83	469019.429	1002258.881	469019.061	1002258.868	469018.9881	1002258.884	-0.368	-0.013	-0.441	0.003	0.136	0.000	0.194	0.000
	469035.856	1002264.935	469035.856	1002264.934	469035.3677	1002265.347	-0.001	-0.001	-0.488	0.412	0.000	0.000	0.238	0.170
	469039.877	1002252.495	469039.870	1002252.596	469039.5745	1002253.428	-0.007	0.101	-0.302	0.933	0.000	0.010	0.092	0.870
	469023.713	1002246.758	469023.831	1002247.521	469023.1463	1002247.501	0.118	0.763	-0.567	0.743	0.014	0.582	0.321	0.552
pr 84	469126.912	1002040.038	469126.358	1002040.704	469126.5127	1002040.401	-0.554	0.666	-0.399	0.363	0.307	0.444	0.159	0.132
	469133.897	1002047.221	469134.227	1002047.996	469134.2265	1002047.22	0.329	0.775	0.329	-0.001	0.109	0.601	0.109	0.000
	469160.824	1002021.079	469160.436	1002021.777	469160.6804	1002021.07	-0.388	0.698	-0.144	-0.009	0.151	0.487	0.021	0.000
	469152.453	1002015.688	469152.149	1002016.200	469152.7191	1002015.881	-0.304	0.512	0.266	0.193	0.092	0.262	0.071	0.037
pr 85	469216.354	1001992.450	469215.860	1001992.587	469216.1256	1001992.579	-0.495	0.137	-0.229	0.129	0.245	0.019	0.052	0.017
	469222.773	1002006.602	469222.702	1002006.795	469222.6417	1002006.35	-0.072	0.193	-0.132	-0.252	0.005	0.037	0.017	0.064
	469246.009	1001998.293	469246.030	1001998.794	469246.505	1001998.938	0.021	0.501	0.496	0.645	0.000	0.251	0.246	0.416
	469240.856	1001983.290	469241.442	1001983.165	469240.9754	1001982.885	0.586	-0.125	0.119	-0.405	0.344	0.016	0.014	0.164
pr 86	468962.948	1001937.465	468962.955	1001937.202	468963.8565	1001937.387	0.007	-0.263	0.909	-0.078	0.000	0.069	0.825	0.006
	468981.995	1001943.425	468981.280	1001943.407	468981.7065	1001943.955	-0.715	-0.018	-0.289	0.530	0.511	0.000	0.083	0.281
	468985.330	1001930.906	468985.085	1001930.908	468985.3858	1001931.18	-0.245	0.002	0.056	0.274	0.060	0.000	0.003	0.075
	468966.190	1001925.755	468966.848	1001926.348	468966.3276	1001926.067	0.658	0.593	0.138	0.312	0.433	0.352	0.019	0.097
pr 87	468687.101	1001901.862	468686.641	1001902.310	468686.9346	1001902.399	-0.460	0.448	-0.166	0.537	0.212	0.201	0.028	0.288
	468683.067	1001911.443	468682.953	1001911.467	468683.4661	1001912.02	-0.114	0.024	0.399	0.577	0.013	0.001	0.159	0.333
	468712.500	1001922.622	468712.512	1001922.941	468712.77	1001922.673	0.012	0.319	0.270	0.051	0.000	0.102	0.073	0.003
	468715.686	1001912.559	468715.929	1001912.598	468716.1831	1001912.963	0.243	0.039	0.497	0.404	0.059	0.002	0.247	0.163

pr 88	469193.222	1002053.540	469193.578	1002054.018	469194.2128	1002054.03	0.356	0.478	0.991	0.490	0.127	0.228	0.982	0.240
	469198.542	1002062.002	469198.616	1002061.787	469199.2351	1002061.697	0.074	-0.215	0.693	-0.305	0.005	0.046	0.480	0.093
	469209.097	1002055.528	469209.043	1002055.262	469209.7428	1002055.582	-0.054	-0.266	0.646	0.054	0.003	0.071	0.417	0.003
	469202.426	1002046.039	469202.886	1002046.330	469201.9957	1002046.04	0.460	0.291	-0.430	0.001	0.212	0.085	0.185	0.000
pr 89	468738.444	1002408.502	468738.714	1002408.512	468738.7142	1002408.512	0.270	0.010	0.270	0.010	0.073	0.000	0.073	0.000
	468741.798	1002418.344	468742.253	1002418.205	468741.7178	1002418.012	0.455	-0.139	-0.080	-0.332	0.207	0.019	0.006	0.110
	468744.689	1002427.461	468744.555	1002427.579	468744.9651	1002427.283	-0.134	0.118	0.276	-0.178	0.018	0.014	0.076	0.032
	468753.989	1002425.111	468754.159	1002425.841	468753.989	1002425.111	0.170	0.730	0.000	0.000	0.029	0.533	0.000	0.000
	468769.239	1002420.819	468768.526	1002420.819	468769.2986	1002420.528	-0.713	0.000	0.060	-0.291	0.508	0.000	0.004	0.085
	468762.572	1002401.723	468762.570	1002401.888	468762.5822	1002401.389	-0.002	0.165	0.010	-0.334	0.000	0.027	0.000	0.112
pr 90	468652.381	1002385.876	468652.376	1002385.870	468652.5941	1002385.357	-0.005	-0.006	0.213	-0.519	0.000	0.000	0.045	0.269
	468659.598	1002407.160	468660.046	1002407.403	468659.372	1002406.553	0.448	0.243	-0.226	-0.607	0.201	0.059	0.051	0.368
	468663.865	1002406.520	468664.014	1002406.518	468663.9766	1002406.303	0.149	-0.002	0.112	-0.217	0.022	0.000	0.012	0.047
	468671.671	1002404.778	468671.842	1002404.773	468672.1724	1002404.699	0.171	-0.005	0.501	-0.079	0.029	0.000	0.251	0.006
	468669.247	1002397.134	468669.224	1002397.411	468669.7836	1002396.546	-0.023	0.277	0.537	-0.588	0.001	0.077	0.288	0.346
	468663.856	1002381.761	468663.955	1002381.760	468664.505	1002381.7	0.098	-0.001	0.649	-0.061	0.010	0.000	0.421	0.004
pr 91	468885.772	1001953.130	468885.961	1001952.914	468885.9591	1001953.259	0.189	-0.216	0.187	0.129	0.036	0.047	0.035	0.017
	468903.216	1001958.799	468903.238	1001959.113	468903.3853	1001959.163	0.022	0.314	0.169	0.364	0.000	0.099	0.029	0.132
	468906.216	1001948.791	468905.889	1001948.795	468906.3682	1001948.571	-0.327	0.004	0.152	-0.220	0.107	0.000	0.023	0.048
	468889.129	1001943.130	468889.297	1001943.493	468889.2165	1001943.282	0.168	0.363	0.087	0.152	0.028	0.132	0.008	0.023
pr 92	468884.500	1001684.711	468884.450	1001685.126	468883.7495	1001685.126	-0.050	0.415	-0.751	0.415	0.002	0.172	0.563	0.172
	468892.994	1001681.161	468892.859	1001681.430	468892.992	1001681.512	-0.135	0.269	-0.002	0.351	0.018	0.072	0.000	0.123
	468885.386	1001659.575	468885.517	1001659.819	468885.5476	1001659.748	0.131	0.244	0.162	0.173	0.017	0.060	0.026	0.030
	468876.491	1001662.589	468876.500	1001662.961	468876.3898	1001662.818	0.009	0.372	-0.101	0.229	0.000	0.138	0.010	0.052
pr 93	468947.631	1001660.448	468947.818	1001660.659	468948.0622	1001660.931	0.187	0.211	0.431	0.483	0.035	0.045	0.186	0.233

	468971.087	1001653.242	468971.107	1001653.532	468971.4309	1001653.651	0.020	0.290	0.344	0.409	0.000	0.084	0.118	0.167
	468963.491	1001632.897	468963.844	1001633.122	468963.844	1001633.122	0.353	0.225	0.353	0.225	0.125	0.051	0.125	0.051
	468962.611	1001630.884	468963.098	1001630.805	468963.0038	1001630.849	0.487	-0.079	0.393	-0.035	0.237	0.006	0.154	0.001
	468951.510	1001633.240	468951.580	1001633.245	468951.8604	1001633.24	0.070	0.005	0.350	0.000	0.005	0.000	0.123	0.000
	468939.550	1001637.375	468939.589	1001637.668	468939.6844	1001637.935	0.039	0.293	0.134	0.560	0.001	0.086	0.018	0.314
	468940.349	1001639.928	468940.494	1001640.193	468940.494	1001640.193	0.145	0.265	0.145	0.265	0.021	0.070	0.021	0.070
pr 94	468840.769	1001467.735	468840.765	1001467.700	468840.3874	1001467.992	-0.004	-0.035	-0.382	0.257	0.000	0.001	0.146	0.066
	468868.508	1001477.342	468867.950	1001477.308	468867.9498	1001477.308	-0.558	-0.034	-0.558	-0.034	0.312	0.001	0.312	0.001
	468874.306	1001465.021	468874.561	1001465.306	468874.1781	1001465.378	0.255	0.285	-0.128	0.357	0.065	0.081	0.016	0.127
	468870.913	1001460.401	468870.945	1001460.400	468871.1955	1001460.518	0.032	-0.001	0.282	0.117	0.001	0.000	0.080	0.014
	468844.125	1001452.149	468843.475	1001451.898	468843.8262	1001451.868	-0.650	-0.251	-0.299	-0.281	0.422	0.063	0.089	0.079
pr 95	468831.771	1001279.305	468831.501	1001279.012	468831.3043	1001279.868	-0.270	-0.293	-0.467	0.563	0.073	0.086	0.218	0.317
	468834.316	1001288.698	468834.068	1001288.892	468833.6336	1001288.191	-0.248	0.194	-0.682	-0.507	0.062	0.038	0.466	0.257
	468891.021	1001272.812	468890.919	1001272.922	468890.8223	1001272.865	-0.102	0.110	-0.199	0.053	0.010	0.012	0.039	0.003
	468888.097	1001262.783	468887.686	1001263.011	468887.9441	1001263.078	-0.411	0.228	-0.153	0.295	0.169	0.052	0.023	0.087
pr 96	468987.449	1001505.804	468987.190	1001506.205	468987.1289	1001506.299	-0.259	0.401	-0.320	0.495	0.067	0.161	0.102	0.245
	469002.758	1001505.073	469002.628	1001505.166	469002.7181	1001505.22	-0.130	0.093	-0.040	0.147	0.017	0.009	0.002	0.022
	469000.673	1001478.710	469000.506	1001479.011	469000.7751	1001478.878	-0.167	0.301	0.103	0.168	0.028	0.091	0.011	0.028
	468984.683	1001480.104	468984.749	1001480.336	468984.5811	1001480.303	0.066	0.232	-0.102	0.199	0.004	0.054	0.010	0.040
pr 97	468985.269	1000898.449	468985.318	1000898.068	468985.6802	1000898.405	0.049	-0.381	0.411	-0.044	0.002	0.145	0.169	0.002
	468997.599	1000892.071	468997.198	1000891.938	468997.2187	1000891.473	-0.401	-0.133	-0.380	-0.598	0.160	0.018	0.145	0.358
	468986.082	1000869.849	468986.203	1000869.446	468985.4866	1000869.794	0.121	-0.403	-0.595	-0.055	0.015	0.162	0.355	0.003
	468973.742	1000875.897	468973.742	1000875.420	468973.7659	1000875.333	0.000	-0.477	0.024	-0.564	0.000	0.228	0.001	0.318
pr 98	469050.602	1000598.452	469050.497	1000598.552	469050.0756	1000598.736	-0.105	0.100	-0.526	0.284	0.011	0.010	0.277	0.081
	469053.546	1000613.374	469052.873	1000613.600	469053.798	1000613.904	-0.673	0.226	0.252	0.530	0.453	0.051	0.064	0.281

	469075.800	1000607.626	469075.333	1000607.383	469075.8	1000607.193	-0.467	-0.243	0.000	-0.433	0.218	0.059	0.000	0.187
	469067.433	1000584.686	469066.836	1000584.118	469067.2443	1000584.461	-0.597	-0.568	-0.189	-0.225	0.356	0.323	0.036	0.051
pr 99	469322.437	1001733.765	469322.362	1001733.435	469322.7384	1001733.38	-0.075	-0.330	0.301	-0.385	0.006	0.109	0.091	0.148
	469329.107	1001754.269	469329.110	1001754.265	469329.57	1001754.534	0.003	-0.004	0.463	0.265	0.000	0.000	0.214	0.070
	469360.447	1001743.635	469360.110	1001743.973	469360.447	1001743.635	-0.337	0.338	0.000	0.000	0.114	0.114	0.000	0.000
	469354.000	1001724.570	469354.309	1001724.868	469353.7968	1001724.698	0.309	0.298	-0.203	0.128	0.095	0.089	0.041	0.016
	469351.817	1001723.778	469351.589	1001724.312	469351.8169	1001723.778	-0.228	0.534	0.000	0.000	0.052	0.285	0.000	0.000
pr 100	469198.076	1001736.355	469198.006	1001736.653	469198.0759	1001736.355	-0.070	0.298	0.000	0.000	0.005	0.089	0.000	0.000
	469204.818	1001754.884	469205.102	1001755.052	469204.8184	1001754.884	0.284	0.168	0.000	0.000	0.080	0.028	0.000	0.000
	469228.442	1001747.293	469228.323	1001747.535	469228.442	1001747.293	-0.119	0.242	0.000	0.000	0.014	0.059	0.000	0.000
	469221.750	1001728.264	469221.613	1001728.236	469221.7495	1001728.264	-0.136	-0.028	0.000	0.000	0.019	0.001	0.000	0.000
		rmsex					**0.376**		**0.392**					
		rmsey						**0.380**		**0.398**				
		rmsexy					**0.378**			**0.395**				

	IMAGE-RTK	LINE MAP-RTK		IMAGE-RTK	Line map-RTK	
MAX Δx	0.831	0.991	RMSE X	0.376	0.392	
MIN Δx	-0.995	-0.925	RMSE Y	0.392	0.398	
MAX Δy	0.992	0.994	RMSEXY	0.378	0.395	
MIN Δy	-0.956	-0.990				

	IMAGE-RTK	LINE MAP-RTK		
MEAN Δx	-0.118	-0.035		
MEAN ΔY	0.086	0.059		
STD Δx	0.357	0.205		
STD ΔY	0.390	0.394		

Appendix 4: GPS, Digital Aerial Photograph Image and Digital Line map areas

parcel number	Area(m^2)			Area difference in (m^2)		Variance(IMAGE-RTK)	Variance(LINE MAP-RTK)
	RTKGPS	Areial Imge	LINE MAP	IMAGE-RTK	LINEMAP-RTK		
pr 1	1007.000	1000.231	1002.440	-6.769	-4.560	45.819	20.794
pr 2	841.237	845.588	835.945	4.351	-5.292	18.931	28.005
pr 3	443.642	435.789	435.857	-7.853	-7.785	61.670	60.606
pr 4	694.853	690.714	699.055	-4.139	4.202	17.131	17.657
pr 5	320.415	314.743	311.988	-5.672	-8.427	32.172	71.014
pr 6	346.791	345.659	351.916	-1.132	5.125	1.281	26.266
pr 7	410.894	405.631	415.107	-5.263	4.213	27.699	17.749
pr 8	459.905	468.925	458.896	9.020	-1.009	81.360	1.018
pr 9	364.919	365.445	362.505	0.526	-2.414	0.277	5.827
pr 10	297.489	300.594	299.246	3.105	1.757	9.641	3.087
pr 11	387.681	386.091	393.642	-1.590	5.961	2.528	35.534
pr 12	439.853	440.630	434.038	0.777	-5.815	0.604	33.814
pr 13	353.545	357.388	349.267	3.843	-4.278	14.769	18.301
pr 14	305.922	316.266	301.028	10.344	-4.894	106.998	23.951
pr 15	221.317	225.006	227.693	3.689	6.376	13.609	40.653
pr 16	335.651	333.052	328.959	-2.599	-6.692	6.755	44.783
pr 17	418.210	408.922	415.160	-9.288	-3.050	86.267	9.302
pr 18	202.964	199.888	208.089	-3.076	5.125	9.462	26.266
pr 19	365.284	368.987	360.368	3.703	-4.916	13.712	24.167
pr 20	217.055	221.854	219.475	4.799	2.420	23.030	5.856
pr 21	517.454	513.124	514.331	-4.330	-3.123	18.749	9.753
pr 22	472.018	467.137	464.319	-4.881	-7.699	23.824	59.275
pr 23	591.588	589.806	582.235	-1.782	-9.353	3.176	87.479
pr 24	508.323	515.612	508.323	7.289	0.000	53.130	0.000
pr 25	448.119	455.427	448.119	7.308	0.000	53.407	0.000
pr 26	718.484	716.323	719.512	-2.161	1.028	4.670	1.057
pr 27	442.660	435.496	436.746	-7.164	-5.914	51.323	34.975
pr 28	802.652	809.953	808.335	7.301	5.683	53.305	32.296
pr 29	126.687	128.910	130.749	2.223	4.062	4.940	16.499
pr 30	343.796	338.068	337.480	-5.728	-6.316	32.810	39.892
pr 31	410.836	409.376	406.300	-1.460	-4.536	2.132	20.575
pr 32	239.766	247.370	231.881	7.604	-7.885	57.821	62.173
pr 33	243.452	246.237	244.485	2.785	1.033	7.756	1.067
pr 34	171.486	164.464	161.746	-7.022	-9.740	49.308	94.868
pr 35	205.735	205.574	198.147	-0.161	-7.588	0.026	57.578
pr 36	253.602	249.238	252.369	-4.364	-1.233	19.044	1.520
pr 37	186.613	181.926	177.555	-4.687	-9.058	21.968	82.047
pr 38	186.474	194.893	194.831	8.419	8.357	70.880	69.839
pr 39	372.388	370.440	364.899	-1.948	-7.489	3.795	56.085
pr 40	390.104	395.416	399.083	5.312	8.979	28.217	80.622
pr 41	167.236	176.211	176.748	8.975	9.512	80.551	90.478
pr 42	292.083	282.138	283.506	-9.945	-8.577	98.903	73.565
pr 43	172.874	166.580	175.776	-6.294	2.902	39.614	8.422
pr 44	283.315	293.742	285.814	10.427	2.499	108.722	6.245
pr 45	503.038	506.111	509.093	3.074	6.055	9.448	36.669
pr 46	180.479	185.831	183.969	5.352	3.490	28.644	12.180
pr 47	188.543	189.926	181.698	1.383	-6.845	1.913	46.854
pr 48	1544.917	1538.473	1541.250	-6.444	-3.667	41.525	13.447
pr 49	173.487	180.367	174.067	6.880	0.580	47.334	0.336
pr 50	358.245	353.095	352.712	-5.150	-5.533	26.522	30.614
pr 51	190.886	183.468	182.995	-7.418	-7.891	55.027	62.268
pr 52	212.845	212.739	215.602	-0.106	2.757	0.011	7.601
pr 53	285.221	294.383	290.408	9.162	5.187	83.942	26.905
pr 54	427.704	436.086	437.145	8.382	9.441	70.258	89.132
pr 55	208.467	204.092	199.537	-4.375	-8.930	19.141	79.745
pr 56	1006.555	999.857	999.271	-6.698	-7.284	44.862	53.055
pr 57	433.621	436.773	439.084	3.152	5.463	9.933	29.841
pr 58	304.749	300.171	305.854	-4.577	1.106	20.952	1.223
pr59	161.093	169.097	167.906	8.003	6.813	64.053	46.412
pr 60	356.195	360.645	360.290	4.450	4.095	19.798	16.772
pr 61	191.677	183.590	184.798	-8.087	-6.879	65.395	47.317
pr 62	340.309	347.778	345.421	7.469	5.112	55.787	26.134
pr 63	166.850	174.415	170.163	7.566	3.314	57.241	10.981

pr 64	206.885	198.551	200.850	-8.334	-6.035	69.454	36.418
pr 65	202.245	205.821	204.161	3.576	1.916	12.786	3.671
pr 66	364.857	372.668	363.169	7.810	-1.688	61.002	2.850
pr 67	214.464	211.614	214.464	-2.851	0.000	8.127	0.000
pr 68	307.316	309.426	313.728	2.111	6.412	4.455	41.119
pr 69	384.712	391.676	375.793	6.964	-8.919	48.495	79.551
pr 70	268.072	261.934	266.380	-6.138	-1.692	37.672	2.863
pr 71	265.956	256.427	258.164	-9.530	-7.793	90.812	60.724
pr 72	227.441	237.302	233.791	9.861	6.350	97.239	40.326
pr 73	281.304	281.397	283.322	0.093	2.018	0.009	4.072
pr 74	492.267	498.764	492.267	6.498	0.000	42.220	0.000
pr 75	409.908	410.469	411.480	0.562	1.573	0.315	2.473
pr 76	500.710	500.513	500.710	-0.196	0.000	0.038	0.000
pr 77	573.058	566.760	568.042	-6.298	-5.016	39.668	25.162
pr 78	695.903	699.336	700.893	3.433	4.991	11.785	24.906
pr 79	1180.038	1171.285	1170.585	-8.753	-9.453	76.614	89.362
pr 80	533.921	538.253	533.921	4.332	0.000	18.765	0.000
pr 81	392.387	392.751	400.123	0.364	7.735	0.132	59.832
pr 82	365.649	364.891	359.287	-0.758	-6.362	0.575	40.479
pr 83	224.614	219.798	223.142	-4.817	-1.472	23.200	2.166
pr 84	358.775	362.168	366.967	3.393	8.192	11.509	67.112
pr 85	398.491	400.519	407.137	2.028	8.646	4.113	74.757
pr 86	249.577	252.998	246.964	3.421	-2.614	11.700	6.833
pr 87	324.413	325.535	319.471	1.122	-4.941	1.260	24.417
pr 88	130.567	126.087	128.439	-4.480	-2.128	20.068	4.529
pr 89	507.410	507.632	497.800	0.222	-9.610	0.049	92.350
pr 90	288.407	282.535	296.769	-5.872	8.362	34.475	69.929
pr 91	190.730	185.166	188.191	-5.564	-2.539	30.963	6.447
pr 92	215.637	216.788	225.382	1.151	9.745	1.324	94.968
pr 93	596.290	594.697	597.819	-1.594	1.529	2.539	2.337
pr 94	503.417	504.962	501.084	1.545	-2.333	2.387	5.443
pr 95	593.132	587.133	592.129	-5.999	-1.003	35.986	1.005
pr 96	409.947	408.420	418.680	-1.527	8.733	2.332	76.264
pr 97	347.730	353.041	356.318	5.311	8.589	28.204	73.765
pr 98	425.140	430.539	433.441	5.400	8.301	29.156	68.913
pr 99	709.811	705.378	699.768	-4.434	-10.044	19.657	100.874
pr 100	496.772	496.328	496.772	-0.443	0.000	0.197	0.000
mean				0.161	-0.526		
standared devation				5.532	5.828		
RMSE				5.534	5.852		
	MAX Δarea			10.427	9.745		
	MIN Δarea			-9.945	-10.044		

Appendix 5: GPS, Digital Aerial Photograph Image and Digital Line map side lengths

PARCEL NUMBER	RTK LENGTHS	AREAL IMAGE LENGTHS	LINE MAP LENGTHS	DIVATION of RTK LENGTH AND IMAGE LENGTH	DIVATION of RTK LENGTH AND LINE MAP LENGTH	VARIANCE of RTK LENGTH AND IMAGE LENGTH	VARIANCE of RTK LENGTH AND LINE LENGTH
pr 1	31.202	30.48	30.442	-0.722	-0.760	0.521	0.578
	29.777	29.316	29.53	-0.461	-0.247	0.213	0.061
	32.08	31.203	31.925	-0.877	-0.155	0.769	0.024
	34.48	33.654	34.167	-0.826	-0.313	0.682	0.098
pr 2	33.551	33.379	33.394	-0.172	-0.157	0.030	0.025
	24.198	24.497	24.111	0.299	-0.087	0.089	0.008
	35.804	35.74	35.823	-0.064	0.019	0.004	0.000
	24.423	24.304	24.065	-0.119	-0.358	0.014	0.128
pr 3	20.332	19.936	20.1	-0.396	-0.232	0.157	0.054
	20.228	19.621	19.721	-0.607	-0.507	0.368	0.257
	20.175	19.97	19.437	-0.205	-0.738	0.042	0.545
	5.84	6.068	5.725	0.228	-0.115	0.052	0.013
	16.081	16.48	16	0.399	-0.081	0.159	0.007
pr 4	15.955	16.875	15.764	0.92	-0.191	0.846	0.036
	36.846	37.805	37.299	0.959	0.453	0.920	0.205
	17.688	17.799	17.665	0.111	-0.023	0.012	0.001
	26.252	26.673	26.421	0.421	0.169	0.177	0.029
	12.123	12.02	12.512	-0.103	0.389	0.011	0.151
	17.948	18.08	17.829	0.132	-0.119	0.017	0.014
pr 5	11.58	11.266	11.777	-0.314	0.197	0.099	0.039
	26.732	26.684	26.638	-0.048	-0.094	0.002	0.009
	12.151	12.23	11.439	0.079	-0.712	0.006	0.507
	27.326	26.916	27.135	-0.41	-0.191	0.168	0.036
pr 6	13.701	14.196	14.2	0.495	0.499	0.245	0.249
	25.321	25.173	25.627	-0.148	0.306	0.022	0.094
	13.881	14.24	14.233	0.359	0.352	0.129	0.124
	24.974	24.821	24.515	-0.153	-0.459	0.023	0.211
pr 7	18.734	19.165	19.09	0.431	0.356	0.186	0.127
	22.427	22.397	22.536	-0.03	0.109	0.001	0.012
	18.08	17.681	17.995	-0.399	-0.085	0.159	0.007
	22.406	22.362	22.4	-0.044	-0.006	0.002	0.000
pr 8	19.896	19.925	19.823	0.029	-0.073	0.001	0.005
	25.517	26.31	25.205	0.793	-0.312	0.629	0.097
	18.194	18.909	19.194	0.715	1.000	0.511	1.000
	25.319	26.237	25.158	0.918	-0.161	0.843	0.026
pr 9	20.839	21.088	20.725	0.249	-0.114	0.062	0.013
	18.993	18.782	18.671	-0.211	-0.322	0.045	0.104
	17.293	17.791	17.331	0.498	0.038	0.248	0.001
	19.454	18.959	18.533	-0.495	-0.921	0.245	0.848
pr 10	16.078	15.703	15.819	-0.375	-0.259	0.141	0.067
	18.731	19.462	18.799	0.731	0.068	0.534	0.005
	15.353	15.685	15.357	0.332	0.004	0.110	0.000
	19.141	18.936	18.636	-0.205	-0.505	0.042	0.255
pr 11	25.023	25.024	25.172	0.001	0.149	0.000	0.022
	15.85	15.971	15.838	0.121	-0.012	0.015	0.000
	24.456	25.181	24.963	0.725	0.507	0.526	0.257

	15.542	15.5	15.572	-0.042	0.030	0.002	0.001
pr 12	21.371	21.818	21.064	0.447	-0.307	0.200	0.094
	17.352	17.271	17.795	-0.081	0.443	0.007	0.196
	20.622	20.578	20.088	-0.044	-0.534	0.002	0.285
	25.944	26.01	25.794	0.066	-0.150	0.004	0.022
pr 13	17.426	17.224	17.426	-0.202	0.000	0.041	0.000
	19.897	20.207	19.265	0.31	-0.632	0.096	0.399
	18.146	18.465	18.642	0.319	0.496	0.102	0.246
	20.238	20.132	19.99	-0.106	-0.248	0.011	0.062
pr 14	11.372	12.075	11.69	0.703	0.318	0.494	0.101
	21.382	21.185	21.135	-0.197	-0.247	0.039	0.061
	16.335	16.504	16.157	0.169	-0.178	0.029	0.032
	23.507	23.794	22.819	0.287	-0.688	0.082	0.473
pr 15	7.413	7.751	7.847	0.338	0.434	0.114	0.188
	10.926	10.936	10.89	0.01	-0.036	0.000	0.001
	14.532	14.4	15.434	-0.132	0.902	0.017	0.814
	8.794	9.079	8.232	0.285	-0.562	0.081	0.316
	12.655	12.588	13.364	-0.067	0.709	0.004	0.503
	13.086	12.839	12.867	-0.247	-0.219	0.061	0.048
pr 16	14.331	14.169	13.997	-0.162	-0.334	0.026	0.112
	26.105	26	25.594	-0.105	-0.511	0.011	0.261
	16.169	15.255	16.029	-0.914	-0.140	0.835	0.020
	20.179	20.306	19.687	0.127	-0.492	0.016	0.242
pr 17	28.711	27.731	28.683	-0.98	-0.028	0.960	0.001
	14.885	15.178	15.457	0.293	0.572	0.086	0.327

	27.74	26.84	27.3	-0.9	-0.440	0.810	0.194
	14.773	14.833	14.751	0.06	-0.022	0.004	0.000
pr 18	22.156	22.276	22.271	0.12	0.115	0.014	0.013
	8.817	8.842	9.484	0.025	0.667	0.001	0.445
	22.881	22.462	22.273	-0.419	-0.608	0.176	0.370
	9.223	9.032	9.214	-0.191	-0.009	0.036	0.000
pr 19	15.109	15.299	15.178	0.19	0.069	0.036	0.005
	17.79	17.835	17.338	0.045	-0.452	0.002	0.204
	4.327	4.596	4.669	0.269	0.342	0.072	0.117
	17.112	17.223	17.003	0.111	-0.109	0.012	0.012
	21.092	21.785	20.489	0.693	-0.603	0.480	0.364
pr 20	9.052	9.355	9.37	0.303	0.318	0.092	0.101
	26.682	26.473	26.25	-0.209	-0.432	0.044	0.187
	8.378	8.751	8.851	0.373	0.473	0.139	0.224
	24.118	23.57	23.994	-0.548	-0.124	0.300	0.015
pr 21	17.097	16.687	16.84	-0.41	-0.257	0.168	0.066
	28.63	29.228	28.894	0.598	0.264	0.358	0.070
	18.837	18.477	18.04	-0.36	-0.797	0.130	0.635
	29.415	29.377	29.166	-0.038	-0.249	0.001	0.062
pr 22	19.682	19.481	20.04	-0.201	0.358	0.040	0.128
	26.493	26.201	25.857	-0.292	-0.636	0.085	0.404
	14.428	14.342	14.077	-0.086	-0.351	0.007	0.123
	31.018	31.06	30.821	0.042	-0.197	0.002	0.039
pr 23	29.217	29.545	29.373	0.328	0.156	0.108	0.024
	20.155	20.409	19.862	0.254	-0.293	0.065	0.086

	29.564	29.335	29.313	-0.229	-0.251	0.052	0.063
	19.928	19.67	20.058	-0.258	0.130	0.067	0.017
pr 24	24.884	25.115	24.884	0.231	0.000	0.053	0.000
	20.598	20.551	20.598	-0.047	0.000	0.002	0.000
	25.161	25.244	25.161	0.083	0.000	0.007	0.000
	20.04	19.623	20.04	-0.417	0.000	0.174	0.000
pr 25	17.07	17.451	17.07	0.381	0.000	0.145	0.000
	25.792	25.567	25.792	-0.225	0.000	0.051	0.000
	17.334	17.449	17.334	0.115	0.000	0.013	0.000
	26.321	26.654	26.321	0.333	0.000	0.111	0.000
pr 26	21.769	21.874	22.439	0.105	0.670	0.011	0.449
	27.312	26.808	26.816	-0.504	-0.496	0.254	0.246
	30.228	30.356	30.337	0.128	0.109	0.016	0.012
	5.385	5.571	5.576	0.186	0.191	0.035	0.036
	22.708	22.674	23.41	-0.034	0.702	0.001	0.493
pr 27	16.21	15.544	15.864	-0.666	-0.346	0.444	0.120
	32.246	32.1	31.769	-0.146	-0.477	0.021	0.228
	11.86	11.753	11.767	-0.107	-0.093	0.011	0.009
	17.469	17.905	17.256	0.436	-0.213	0.190	0.045
	2.039	2.996	2.948	0.957	0.909	0.916	0.826
	15.714	15.095	14.996	-0.619	-0.718	0.383	0.516
pr 28	26.206	26.014	26.011	-0.192	-0.195	0.037	0.038
	32.693	32.069	32.227	-0.624	-0.466	0.389	0.217
	28.282	27.467	28.239	-0.815	-0.043	0.664	0.002
	26.691	27.092	26.186	0.401	-0.505	0.161	0.255

pr 29	15.93	15.95	15.47	0.02	-0.460	0.000	0.212
	5.85	6.57	6.43	0.72	0.580	0.518	0.336
	14.51	14.89	15.18	0.38	0.670	0.144	0.449
	11.17	11.73	11.75	0.56	0.580	0.314	0.336
pr 30	23.06	22.391	22.152	-0.669	-0.908	0.448	0.824
	14.926	15.348	15.241	0.422	0.315	0.178	0.099
	23.505	23.4	22.553	-0.105	-0.952	0.011	0.906
	14.924	14.766	14.971	-0.158	0.047	0.025	0.002
pr 31	2.759	3.139	3.086	0.38	0.327	0.144	0.107
	38.323	38.463	38.447	0.14	0.124	0.020	0.015
	11.589	11.739	11.92	0.15	0.331	0.023	0.110
	7.501	8.087	8.067	0.586	0.566	0.343	0.320
	40.443	40.559	40.574	0.116	0.131	0.013	0.017
pr 32	10.152	10.503	10.996	0.351	0.844	0.123	0.712
	23.784	23.929	23.921	0.145	0.137	0.021	0.019
	10.017	10.213	9.485	0.196	-0.532	0.038	0.283
	23.773	23.845	23.26	0.072	-0.513	0.005	0.263
pr 33	10.903	10.83	10.618	-0.073	-0.285	0.005	0.081
	25.563	25.503	25.905	-0.06	0.342	0.004	0.117
	7.91	8.227	7.451	0.317	-0.459	0.100	0.211
	26.913	26.821	26.762	-0.092	-0.151	0.008	0.023
pr 34	10.116	10	9.425	-0.116	-0.691	0.013	0.477
	17.408	17.56	17.555	0.152	0.147	0.023	0.022
	9.914	9.798	9.45	-0.116	-0.464	0.013	0.215
	16.881	17.031	16.829	0.15	-0.052	0.022	0.003

pr 35	18.061	17.562	17.628	-0.499	-0.433	0.249	0.187
	11.22	11.588	11.161	0.368	-0.059	0.135	0.003
	18.134	18.007	17.737	-0.127	-0.397	0.016	0.158
	11.556	11.61	10.727	0.054	-0.829	0.003	0.687
pr 36	14.267	13.977	13.594	-0.29	-0.673	0.084	0.453
	18.051	17.51	18.263	-0.541	0.212	0.293	0.045
	13.948	14.16	14.043	0.212	0.095	0.045	0.009
	17.903	17.925	18.264	0.022	0.361	0.000	0.130
pr 37	9.88	9.547	9.65	-0.333	-0.230	0.111	0.053
	18.632	18.673	18.751	0.041	0.119	0.002	0.014
	9.916	9.614	9.257	-0.302	-0.659	0.091	0.434
	19.084	19.334	18.813	0.25	-0.271	0.063	0.073
pr 38	9.966	10.749	10.842	0.783	0.876	0.613	0.767
	18.43	18.15	18.34	-0.28	-0.090	0.078	0.008
	10.202	10.401	10.476	0.199	0.274	0.040	0.075
	18.563	18.757	18.217	0.194	-0.346	0.038	0.120
pr 39	9.866	9.221	9.804	-0.645	-0.062	0.416	0.004
	34.066	33.54	33.594	-0.526	-0.472	0.277	0.223
	12.621	12.801	12.978	0.18	0.357	0.032	0.127
	4.799	5.317	4.631	0.518	-0.168	0.268	0.028
	26.702	26.183	26.429	-0.519	-0.273	0.269	0.075
pr 40	22.848	22.548	22.706	-0.3	-0.142	0.090	0.020
	16.533	17.312	17.378	0.779	0.845	0.607	0.714
	22.921	23.312	23.034	0.391	0.113	0.153	0.013
	17.572	17.512	17.522	-0.06	-0.050	0.004	0.003

pr 41	9.922	10.279	10.144	0.357	0.222	0.127	0.049
	17.521	17.403	17.598	-0.118	0.077	0.014	0.006
	9.449	9.927	9.908	0.478	0.459	0.228	0.211
	17.025	17.481	17.657	0.456	0.632	0.208	0.399
pr 42	15.889	16.087	15.81	0.198	-0.079	0.039	0.006
	18.867	17.999	18.651	-0.868	-0.216	0.753	0.047
	15.069	14.713	14.895	-0.356	-0.174	0.127	0.030
	18.901	18.687	18	-0.214	-0.901	0.046	0.812
pr 43	9.903	9.394	9.926	-0.509	0.023	0.259	0.001
	17.097	17.679	17.325	0.582	0.228	0.339	0.052
	10.191	9.718	10.42	-0.473	0.229	0.224	0.052
	17.336	17.223	17.241	-0.113	-0.095	0.013	0.009
pr 44	15.59	15.378	15.206	-0.212	-0.384	0.045	0.147
	18.111	18.338	18.352	0.227	0.241	0.052	0.058
	14.968	15.757	15.556	0.789	0.588	0.623	0.346
	19.438	19.438	18.822	0	-0.616	0.000	0.379
pr 45	27.44	27.3	27.2	-0.14	-0.240	0.020	0.058
	25.04	25.42	25.12	0.38	0.080	0.144	0.006
	18.26	18.29	18.95	0.03	0.690	0.001	0.476
	21.35	21.44	22	0.09	0.650	0.008	0.422
pr 46	10.102	10.718	10.654	0.616	0.552	0.379	0.305
	17.879	17.82	18.133	-0.059	0.254	0.003	0.065
	10.068	11.036	10.827	0.968	0.759	0.937	0.576
	17.91	18.194	17.984	0.284	0.074	0.081	0.005
pr 47	18.131	17.949	17.481	-0.182	-0.650	0.033	0.422

	10.352	9.398	10.163	-0.954	-0.189	0.910	0.036
	18.421	17.911	17.458	-0.51	-0.963	0.260	0.927
	10.294	10.314	10.64	0.02	0.346	0.000	0.120
pr 48	34.124	33.565	33.384	-0.559	-0.740	0.312	0.548
	2.533	2.82	2.2107	0.287	-0.322	0.082	0.104
	42.748	42.606	42.371	-0.142	-0.377	0.020	0.142
	35.495	35.305	35.401	-0.19	-0.094	0.036	0.009
	42.162	42.386	42.841	0.224	0.679	0.050	0.461
pr 49	9.786	9.95	9.894	0.164	0.108	0.027	0.012
	17.439	17.382	17.601	-0.057	0.162	0.003	0.026
	9.847	9.785	9.905	-0.062	0.058	0.004	0.003
	17.921	17.42	17.563	-0.501	-0.358	0.251	0.128
pr 50	19.895	19.94	20.636	0.045	0.741	0.002	0.549
	17.707	17.598	17.747	-0.109	0.040	0.012	0.002
	20.49	19.912	19.772	-0.578	-0.718	0.334	0.516
	17.783	16.85	17.184	-0.933	-0.599	0.870	0.359
pr 51	10.077	10.087	9.832	0.01	-0.245	0.000	0.060
	18.492	17.616	17.63	-0.876	-0.862	0.767	0.743
	10.559	10.593	9.792	0.034	-0.767	0.001	0.588
	18.514	17.879	17.836	-0.635	-0.678	0.403	0.460
pr 52	12.704	12.935	13.573	0.231	0.869	0.053	0.755
	17.151	17.156	17	0.005	-0.151	0.000	0.023
	12.106	12.49	11.234	0.384	-0.872	0.147	0.760
	17.224	17.47	17	0.246	-0.224	0.061	0.050
pr 53	10.685	11.462	11.304	0.777	0.619	0.604	0.383

	27.82	27.915	27.817	0.095	-0.003	0.009	0.000
	10.267	10.429	10.507	0.162	0.240	0.026	0.058
	26.859	26.7	26.694	-0.159	-0.165	0.025	0.027
pr 54	16.747	17	16.7	0.253	-0.047	0.064	0.002
	25.506	25.5	25.5	-0.006	-0.006	0.000	0.000
	16.809	17.468	17.599	0.659	0.790	0.434	0.624
	25.477	25.651	25.4	0.174	-0.077	0.030	0.006
pr 55	20.09	20.273	19.468	0.183	-0.622	0.033	0.387
	9.871	10.068	9.905	0.197	0.034	0.039	0.001
	22.476	22.03	22.2	-0.446	-0.276	0.199	0.076
	9.89	9.373	9.8	-0.517	-0.090	0.267	0.008
pr 56	21.69	21.5	21.6	-0.19	-0.090	0.036	0.008
	36.52	36.5	36.79	-0.02	0.270	0.000	0.073
	31.12	30.44	31	-0.68	-0.120	0.462	0.014
	43.99	44.23	44.12	0.24	0.130	0.058	0.017
pr 57	18.13	18.67	18.01	0.54	-0.120	0.292	0.014
	25.05	24.16	25	-0.89	-0.050	0.792	0.003
	17.87	19.1	18.55	1.23	0.680	1.513	0.462
	24.5	24.29	23.79	-0.21	-0.710	0.044	0.504
pr 58	10.09	9.4	10.11	-0.69	0.020	0.476	0.000
	31.32	31	29.97	-0.32	-1.350	0.102	1.823
	9.78	9.97	10.36	0.19	0.580	0.036	0.336
	30.38	29.93	29.73	-0.45	-0.650	0.202	0.422
pr59	10.2	10.59	10.26	0.39	0.060	0.152	0.004
	15.93	16.09	16.43	0.16	0.500	0.026	0.250

	9.99	10.54	10.2	0.55	0.210	0.302	0.044
	15.97	15.93	16.39	-0.04	0.420	0.002	0.176
pr 60	15.93	16.52	16.77	0.59	0.840	0.348	0.706
	22.27	21.44	21.97	-0.83	-0.300	0.689	0.090
	16.62	16.91	16.94	0.29	0.320	0.084	0.102
	21.55	21.73	21.86	0.18	0.310	0.032	0.096
pr 61	11.15	11.32	10.87	0.17	-0.280	0.029	0.078
	16.98	16.52	16.52	-0.46	-0.460	0.212	0.212
	11.2	10.66	11.1	-0.54	-0.100	0.292	0.010
	17.34	16.9	17.3	-0.44	-0.040	0.194	0.002
pr 62	19.67	20.59	20.36	0.92	0.690	0.846	0.476
	17.15	17.35	17.4	0.2	0.250	0.040	0.063
	20.33	20.48	20.63	0.15	0.300	0.023	0.090
	16.9	17.22	17.1	0.32	0.200	0.102	0.040
pr 63	10.04	10.27	10.05	0.23	0.010	0.053	0.000
	16.79	16.91	17.25	0.12	0.460	0.014	0.212
	9.49	10.06	9.63	0.57	0.140	0.325	0.020
	17.43	17.66	17.35	0.23	-0.080	0.053	0.006
pr 64	17.58	17.39	17.14	-0.19	-0.440	0.036	0.194
	12.27	12	11.32	-0.27	-0.950	0.073	0.902
	15.96	16.19	15.89	0.23	-0.070	0.053	0.005
	12.49	12.27	11.77	-0.22	-0.720	0.048	0.518
pr 65	18.281	18.66	18.34	0.379	0.059	0.144	0.003
	10.57	10.63	10.78	0.06	0.210	0.004	0.044
	18.73	18.85	18.43	0.12	-0.300	0.014	0.090

	11.32	12.12	12.1	0.8	0.780	0.640	0.608
pr 66	32.92	32.94	32.92	0.02	0.000	0.000	0.000
	10.5	10.96	10.56	0.46	0.060	0.212	0.004
	31.91	32.01	31.9	0.1	-0.010	0.010	0.000
	12.04	12	11.87	-0.04	-0.170	0.002	0.029
pr 67	9.44	9.32	9.44	-0.12	0.000	0.014	0.000
	22.31	21.91	22.31	-0.4	0.000	0.160	0.000
	9.77	10.07	9.77	0.3	0.000	0.090	0.000
	22.36	21.76	22.36	-0.6	0.000	0.360	0.000
pr 68	10.96	10.8	11.1	-0.16	0.140	0.026	0.020
	28.47	28.61	28.4	0.14	-0.070	0.020	0.005
	10.85	10.99	10.9	0.14	0.050	0.020	0.003
	27.96	28.21	28.72	0.25	0.760	0.063	0.578
pr 69	21.05	21.17	20.9	0.12	-0.150	0.014	0.023
	19.28	19.49	19.16	0.21	-0.120	0.044	0.014
	19.86	19.91	19.27	0.05	-0.590	0.003	0.348
	18.68	18.75	18.39	0.07	-0.290	0.005	0.084
pr 70	10.12	9.63	9.17	-0.49	-0.950	0.240	0.902
	26.64	26.45	26.42	-0.19	-0.220	0.036	0.048
	9.99	10.15	9.48	0.16	-0.510	0.026	0.260
	26.67	26.54	26.44	-0.13	-0.230	0.017	0.053
pr 71	2.85	2.66	2.63	-0.19	-0.220	0.036	0.048
	1.24	1.16	1.16	-0.08	-0.080	0.006	0.006
	10.07	9.89	10	-0.18	-0.070	0.032	0.005
	19.43	19.2	19.43	-0.23	0.000	0.053	0.000

	14.01	13.77	13.93	-0.24	-0.080	0.058	0.006
	17.84	17.84	17.48	0	-0.360	0.000	0.130
pr 72	8.96	9.29	9.06	0.33	0.100	0.109	0.010
	25.39	25.39	25.51	0	0.120	0.000	0.014
	8.88	9.33	9.27	0.45	0.390	0.202	0.152
	25.62	25.61	25.5	-0.01	-0.120	0.000	0.014
pr 73	12.13	12.44	12.08	0.31	-0.050	0.096	0.003
	22.66	23.11	23.11	0.45	0.450	0.202	0.202
	12.69	11.89	12.7	-0.8	0.010	0.640	0.000
	22.94	23.6	22.9	0.66	-0.040	0.436	0.002
pr 74	19.79	19.83	19.79	0.04	0.000	0.002	0.000
	24.79	25.33	24.79	0.54	0.000	0.292	0.000
	20.01	20.01	20.01	0	0.000	0.000	0.000
	24.69	24.89	24.69	0.2	0.000	0.040	0.000
pr 75	18.57	19.07	18.57	0.5	0.000	0.250	0.000
	22.78	22.74	23.52	-0.04	0.740	0.002	0.548
	18.28	18.45	18.16	0.17	-0.120	0.029	0.014
	21.75	22.2	21.4	0.45	-0.350	0.202	0.123
pr 76	20.44	20.17	20.44	-0.27	0.000	0.073	0.000
	24.81	25.03	24.81	0.22	0.000	0.048	0.000
	19.84	19.94	19.84	0.1	0.000	0.010	0.000
	24.92	24.89	24.92	-0.03	0.000	0.001	0.000
pr 77	27.47	27.13	27.36	-0.34	-0.110	0.116	0.012
	19.88	19.5	19.94	-0.38	0.060	0.144	0.004
	28.33	28.06	28.22	-0.27	-0.110	0.073	0.012

	21.22	21.17	20.92	-0.05	-0.300	0.002	0.090
pr 78	26.89	26.33	26.88	-0.56	-0.010	0.314	0.000
	15.92	15.9	15.9	-0.02	-0.020	0.000	0.000
	18.35	18.14	18.3	-0.21	-0.050	0.044	0.003
	4	3.98	3.86	-0.02	-0.140	0.000	0.020
	6.06	5.364	5.69	-0.696	-0.370	0.484	0.137
	5.9	6	6.03	0.1	0.130	0.010	0.017
	7.85	7.39	7	-0.46	-0.850	0.212	0.722
	21.25	21.77	21.82	0.52	0.570	0.270	0.325
pr 79	66.53	66.21	66.45	-0.32	-0.080	0.102	0.006
	20.43	20.6	19.74	0.17	-0.690	0.029	0.476
	40.85	40.36	41.11	-0.49	0.260	0.240	0.068
	7.94	7.39	8.24	-0.55	0.300	0.303	0.090
	16.27	16.49	16.02	0.22	-0.250	0.048	0.063
	14.82	14.87	14.69	0.05	-0.130	0.002	0.017
pr 80	20.98	21.45	20.98	0.47	0.000	0.221	0.000
	25.97	26.44	25.97	0.47	0.000	0.221	0.000
	20.11	20.04	20.11	-0.07	0.000	0.005	0.000
	26.03	25.5	26.03	-0.53	0.000	0.281	0.000
pr 81	13.59	13.58	13.42	-0.01	-0.170	0.000	0.029
	26.74	26.08	26.5	-0.66	-0.240	0.436	0.058
	15.74	16.04	15.79	0.3	0.050	0.090	0.002
	26.81	27.11	27.5	0.3	0.690	0.090	0.476
pr 82	21.02	20.89	20.8	-0.13	-0.220	0.017	0.048
	17.21	17.07	16.95	-0.14	-0.260	0.020	0.068

	22.16	22.1	21.23	-0.06	-0.930	0.004	0.865
	16.73	16.89	16.56	0.16	-0.170	0.026	0.029
pr 83	15.51	16.13	16.27	0.62	0.760	0.384	0.578
	13.07	12.57	12.64	-0.5	-0.430	0.250	0.185
	17.15	17	17.46	-0.15	0.310	0.022	0.096
	12.86	13.05	13.06	0.19	0.200	0.036	0.040
pr 84	10.02	10.73	10	0.71	-0.020	0.504	0.000
	37.53	37.07	37.21	-0.46	-0.320	0.212	0.102
	9.96	9.99	9.94	0.03	-0.020	0.001	0.000
	35.29	35.58	35.89	0.29	0.600	0.084	0.360
pr 85	15.54	15.5	16.17	-0.04	0.630	0.002	0.397
	26.68	26.5	26.3	-0.18	-0.380	0.032	0.144
	15.86	16.29	15.98	0.43	0.120	0.185	0.014
	26.16	26.26	26.67	0.1	0.510	0.010	0.260
pr 86	12.15	12.13	11.99	-0.02	-0.160	0.000	0.026
	19.96	19.79	19.69	-0.17	-0.270	0.029	0.073
	12.96	13.28	12.74	0.32	-0.220	0.102	0.048
	19.82	20.06	20.28	0.24	0.460	0.058	0.212
pr 87	10.79	10.52	10.23	-0.27	-0.560	0.073	0.314
	31.48	31.46	31.18	-0.02	-0.300	0.000	0.090
	10.56	10.23	10.29	-0.33	-0.270	0.109	0.073
	30.52	30.51	31.1	-0.01	0.580	0.000	0.336
pr 88	10	9.5	9.98	-0.5	-0.020	0.250	0.000
	12.38	12.3	12.3	-0.08	-0.080	0.006	0.006
	11.6	11.6	11.39	0	-0.210	0.000	0.044

	11.87	11.8	11.8	-0.07	-0.070	0.005	0.005
pr 89	10.4	10.3	9.96	-0.1	-0.440	0.010	0.194
	9.56	9.56	9.77	0	0.210	0.000	0.044
	9.59	9.99	10.21	0.4	0.620	0.160	0.384
	15.84	15.8	15.8	-0.04	-0.040	0.002	0.002
	20.23	20.59	19.61	0.36	-0.620	0.130	0.384
	25.06	25.09	24.62	0.03	-0.440	0.001	0.194
pr 90	22.47	22.54	22.25	0.07	-0.220	0.005	0.048
	4.31	4.07	4.3	-0.24	-0.010	0.058	0.000
	8	8.02	7.37	0.02	-0.630	0.000	0.397
	8.02	7.69	7.54	-0.33	-0.480	0.109	0.230
	16.29	16	16.33	-0.29	0.040	0.084	0.002
	12.19	12.31	12.65	0.12	0.460	0.014	0.212
pr 91	18.34	18.36	18.4	0.02	0.060	0.000	0.004
	10.45	10.07	10.05	-0.38	-0.400	0.144	0.160
	18	17.61	18.27	-0.39	0.270	0.152	0.073
	10.55	10.17	10.5	-0.38	-0.050	0.144	0.003
pr 92	9.21	10.11	9.96	0.9	0.750	0.810	0.563
	22.89	23.1	23	0.21	0.110	0.044	0.012
	9.39	10.28	9.66	0.89	0.270	0.792	0.073
	23.53	23.47	23.59	-0.06	0.060	0.004	0.004
pr 93	24.54	24.36	24.48	-0.18	-0.060	0.032	0.004
	21.72	21.66	21.89	-0.06	0.170	0.004	0.029
	2.2	2.42	2.42	0.22	0.220	0.048	0.048
	11.35	11.36	11.68	0.01	0.330	0.000	0.109

	12.65	12.59	12.8	-0.06	0.150	0.004	0.023
	2.68	2.68	2.4	0	-0.280	0.000	0.078
	21.77	21.74	22.08	-0.03	0.310	0.001	0.096
pr 94	29.36	29.2	29.65	-0.16	0.290	0.026	0.084
	13.62	13.25	13.46	-0.37	-0.160	0.137	0.026
	5.73	5.73	5.7	0	-0.030	0.000	0.001
	28.03	28	28	-0.03	-0.030	0.001	0.001
	15.94	15.84	15.8	-0.1	-0.140	0.010	0.020
pr 95	9.43	9.24	8.64	-0.19	-0.790	0.036	0.624
	58.89	58.99	59.21	0.1	0.320	0.010	0.102
	10.45	10.43	10.2	-0.02	-0.250	0.000	0.063
	58.7	58.96	59.08	0.26	0.380	0.068	0.144
pr 96	15.33	15.47	15.63	0.14	0.300	0.020	0.090
	26.45	26.24	26.41	-0.21	-0.040	0.044	0.002
	16.05	15.81	16.26	-0.24	0.210	0.058	0.044
	25.85	25.98	26.12	0.13	0.270	0.017	0.073
pr 97	13.88	14.26	13.87	0.38	-0.010	0.144	0.000
	25.03	25.49	25.53	0.46	0.500	0.212	0.250
	13.74	13.55	14.3	-0.19	0.560	0.036	0.314
	25.33	25.3	25.08	-0.03	-0.250	0.001	0.063
pr 98	15.21	15.38	15.6	0.17	0.390	0.029	0.152
	22.98	23.06	22.71	0.08	-0.270	0.006	0.073
	24.42	24.77	24.18	0.35	-0.240	0.122	0.058
	21.74	21.38	20.99	-0.36	-0.750	0.130	0.563
pr 99	21.56	21.33	21.28	-0.23	-0.280	0.053	0.078

	33.09	32.55	33.47	-0.54	0.380	0.292	0.144
	20.13	20.28	20.07	0.15	-0.060	0.023	0.004
	2.32	2.32	2.18	0	-0.140	0.000	0.020
	31.03	30.66	31.3	-0.37	0.270	0.137	0.073
pr 100	19.72	19.72	19.72	0	0.000	0.000	0.000
	24.81	24.41	24.81	-0.4	0.000	0.160	0.000
	20.17	20.43	20.17	0.26	0.000	0.068	0.000
	25.02	25.06	25.02	0.04	0.000	0.002	0.000
	IMAGE-RTK	LINE MAP-RTK			IMAGE-RTK	LINE MAP-RTK	
MEAN	0.01	-0.038		MAX	1.230	1.000	
RMSE	0.381	0.4		MIN	-0.980	-1.350	
				STD	0.380	0.399	