Palestine Polytechnic University

College of Engineering and Technology

Civil Engineering Department

Graduation Project

Design and Planning (AL-Carmel) Neighborhood in Haska – Hebron

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Hebron - Palestine

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The undersigned hereby certify that they have read, examined, and recommended to the Department of Civil Engineering and Architecture in the College of Engineering at Palestine Polytechnic University the approval of a project entitled **Design and planning (AL-Carmel) Neighborhood in Haska – Hebron**: by Liyana Masri and Ahmed Zaidan for partial fulfillment of the requirements for the bachelor's degree.

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ABSTRACT

Design and Planning (AL-Carmel) Neighborhood in Haska – Hebron

Project Team

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Supervisor

Msc. Musab Shahin

Our project aims to design the infrastructure of the residential neighborhood, in a modern, smart and creative style, with a special focus on re-sorting and distributing land and designing road networks.

The work team will use photogrammetry techniques in the first phase of the project to study and analyze the topography of the project site, and in the second phase, we will use land rezoning laws to make more appropriate roads that match the topography of the project site, and then sort and distribute the lands so that they are better suited for the purpose, as the study area for this project is Hebron (Haska), which has a total area of 700 dunums.

As part of our study to check the accuracy of Photogrammetry modeling elevations, and compare it with GNSS RTK elevation results, and keep acceptable accuracy levels as base of our neighborhood.

الملخص

تصميم وتخطيط ضاحية (الكرمل) في حسكا – الخليل

فريق العمل

ليانا مصري احمد زيدان

اشراف

م . مصعب شاهين

يهدف مشروعنا إلى تصميم البنية التحتية للحي السكني ، بأسلوب حديث ، ذكي ومبدع ، يركز بشكل خاص على اعادة فرز وتوزيع الاراضي و تصميم شبكات الطرق.

في المرحلة الأولى من المشروع ، سيقوم فريق العمل بدراسة وتحليل تضاريس موقع المشروع باستخدام تقنيات المسح التصويري , ثم في المرحلة الثانية من المشروع , سيقوم فريق العمل بتطبيق قانون اعادة تقسيم الاراضي ومن خلاله سنقوم بعمل اقتطاعات للأراضي لفتح طرق اكثر فعالية تتطابق مع تضاريس موقع مشروع , ومن ثم فرز وتوزيع الاراضي , لتكون الاراضي افضل للاستخدام , حيث تم اختيار منطقة الدراسة في الخليل (حسكا) والتي تبلغ مساحتها الإجمالية 700 دونم.

كجزء من دراستنا التحقق من دقة الارتفاعات في المودل الناتج عن التصوير الجوي ونقارنها بنتائج ارتفاع GNSS RTK, والحفاظ على مستويات الدقة المقبولة كأساس للضاحية.

DEDICATION

To those who have always believed in us …

To those who have been our source of inspiration …

To those who gave us strength …

To those who provide us their endless support and encouragement …

To our families …

to our friends…

To everyone who carries love in his heart for us …

ACKNOWLEDGEMENT

It has been a great opportunity for us to gain a lot of knowledge through working on this project, but the successful completion of any task would be incomplete without mention of the people who made it possible.

For that we would like to thank everyone who helped, supported and encouraged us:

Palestine Polytechnic University, Engineering Collage, Civil Engineering Department, including all members of the helpful and reverend staff.

Special thanks to our supervisor Msc. Musab Shahin who was the guiding light every step of the way as we worked for this project.

Thanks for all instructors for all efforts they did to provide us with all useful information and sharing their knowledge and experience to make from us successful engineers.

Finally, our deep gratitude and sincere thanks to our parents, brothers and sisters for their patience, for everyone who tried to help us during our work and gave us strength to complete this task.

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CHAPTER 1

INTRODUCTION

1.1 General Overview

Land is the basis of the Palestinian-Israeli conflict, land is one of the important and basic production factors that no development project should ignore, and land use planning is the key to the effective development of natural resources.

A prerequisite for achieving optimal use of land resources is the availability of accurate surveys and settlements, as well as a comprehensive real estate registration. photography and drones have facilitated land surveying operations at the lowest cost and fastest time, as we used this process for monitoring in the planning and establishment of the residential neighborhood.

1.2 Project Problem

The study area has a difficult topography to establish street and infrastructure networks, as it is difficult to work with devices such as GPS and total station, where we used aerial photography to facilitate the process of data collection

Figure 1.2-1 A Picture for The Study Area

1.3 Project Objectives

This project was selected to achieve the following thresholds:
-Linking the theoretical information acquired during the study period with practical information Life.
- Survey the Neighborhood using a drone.
- Use the aerial photo from the drone and enter it into Agisoft to Make a 3D model
-Prepare Topo map and clarify each element within the suburb in terms of (buildings, streets, stone wall, concrete wall, trees) and take level points to make a contour map.

1.4 Methodology

Determine the topic of research and inquire about the topic from the supervisor and the competent authorities such as the municipality of Hebron. Information was obtained from the municipality such as the structural plans and then:

Phase 1: Data collection
Determine the work area and then make an exploratory visit to the site and take a complete idea of the nature of the project, the problems related to it, and the important details in order to get the best and most accurate results.

Phase 2: Project Set
Choosing the study area and taking approval from the supervisor, and we set a suitable date for an exploratory tour of the place.

Phase 3: Control Point
Monitoring control points.

Phase 4: Drone
We flew a drone inside the study area and took the picture from the plane and processed it.

Phase 5: Model Photo process
Image processing and linking control points within Agisoft program.

Phase 6: Topomap
We drew inside Agisoft program, took general points, drew break lines, exported them, and made a Topo Map inside the civil program.

Phase 7: 3D Model
Inserting images into Agisoft and making a 3D model for them to produce ortho Photo

Phase8: Open and designed street

Opening streets parallel to contour lines so that all streets serve all lands

Phase 9: Re-sorting and dividing the lands

According to the law of re-zoning and placing the land in the closest place to its original position, and making an organized form of the land

Phase10: Findings and recommendations

Improving the shape of the plots of land ,It contributed to raising the investment value of these lands, It will also contribute to providing solutions to the current traffic crisis,

1.5 Study Area

The study area is expected in Haska, which is located in the northern region of the city of Hebron, as Figure (1.5-1) shows location of Haska according to Hebron Governorate, which has an area of 700 acres in Haska, as Figure (1.5-2) shows the Arial photo for project location.

Figure 1.5-1 Location of Haska according to Hebron Governorate

Figure 1.5-2 The Arial photo for project location.

1.6 Project timeline

Project Timeline in Introduction:

Table (1-1) Introduction timeline

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	the week	Activity
																`Data Collection
																Project Set
																Control Point
																Drone
																Model Photo process
																Topomap
																3D Model
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	the week	Activity
																Open and designed street
																Re-sorting and dividing the lands
																Findings and recommendations

1.7 Programs used in the project

-Microsoft Office: It was used in various parts of the project such as text writing, formatting, and project output.
- AUTOCAD 2022
-ARCPRO MAP 10.4.8
-AGI SOFT
-CIVIL 3D

1.8 The problems we encountered in the project

1- The inability to reach all areas covered by aerial photography because the topography of the area or the Disallow of the owners of the plots to access it.
2-Difficulty sorting the land and doing road and infrastructure works because of the difficult terrain
3- The project needs modern computers and has a high durability in order to work on high accuracy.

CHAPTER 2

SURVEYING

2.1 Definition, Categories, and Purpose of Surveying

Surveying is the process of determining the relative position of natural and manmade features on or under the earth's surface, the presentation of this information either graphically in the form of plans or numerically in the form of tables, and the setting out of measurements on the earth's surface. It usually involves measurement, calculations, the production of plans, and the determination of specific locations. The surveyor may be called on to determine heights and distances; to set out buildings, bridges and roadways; to determine areas and volumes and to draw plans at a predetermined scale.

There are two major categories of surveying:
1. Plane Surveying Plane surveying deals with areas of limited extent and it is assumed that the earth's surface is a plane and therefore no corrections necessary for the earth's curvature.
2. Geodetic Surveying Geodetic surveying is concerned with determining the size and shape of the earth and it also provides a high-accuracy framework for the control of lower order surveys. The highest standards of accuracy are necessary. Geodetic surveys cover relatively large areas (e.g. a state or country) for which the effects of earth curvature must be considered.

Apart from the two main categories, we may also classify surveys according to their different branches and those disciplines directly associated with surveying:
1. Topographic Surveys are concerned with the measurement and mapping of the physical features of the earth. These features are all natural and manmade features.
2. Engineering Surveys cover surveys carried out as part of the preparation for, and carrying out of, engineering works, including roads, railways, pipelines, drainage etc.
3. Cadastral Surveys are concerned with the measurement, definition and mapping and recording of property boundaries.
4. Hydrographic Surveys are those made for determining the shape of the bottom of lakes, rivers, harbors and oceans. They also include the measurement of the flow of water in streams and the estimation of water resources.
5. Aerial Surveys are made from an airplane, and for the purpose of mapping the terrain. The control for such a map is obtained from ground surveys, but the details are obtained from aerial photographs. This includes making measurements and interpretations from aerial photographs.
6. Astronomic Surveys are surveys made to determine the latitude, longitude and azimuth from observations to the stars.
7. Mining Surveys are those made to determine survey control for the development of both surface and underground mines within the mining industry, and the determination of volumes in mine production.
8. Computing is a specialized area of surveying where complex computer programs are used to solve problems within the surveying industry.

2.2 The Survey Process

The following sequence of steps is commonly followed when carrying out a survey:
Reconnaissance During the reconnaissance phase, the surveyor will obtain an overall picture of the area that the project will be conducted in. They will select where the control points will be located, the accuracy required for the control, and which survey instruments will be required for the project.
Measurement and Marking During the measurement and marking phase, the surveyor will perform all the observations in the field required to accurately determine the control points, as well as placing and observing to any temporary points such as wooden pegs. They would also perform any calculations from the observations, such as angular and linear mis close and area and volume calculations.
Plan Preparation During the plan preparation phase, the calculations that were performed from the field observations would be further enhanced and used to produce the final plans for the project.

Note:
Control – The accepted surveying practice is to work from the whole to the part when establishing control. That is, select a small number of primary control points that cover the whole area and form a well-defined network of figures. These are broken down into a smaller network of figures as required.
Accuracy – Some projects do not require the highest possible accuracy, and, therefore, it is not always necessary to use the highest possible precision. This point is further reinforced by the usual contracting requirement that the job be done in the shortest possible time at the least possible cost. Equipment and techniques to be used need to be carefully considered so that the project is completed according to instructions, using the most appropriate methods.

2.3 Units of Measurement

SI units the most commonly used in surveying being shown below:

Table (2-1) Units of Measurement

Quantity	Unit	Symbol
Length	kilometre	km
	metre	m
	millimetre	mm
Area	square metre	m^2
	hectare	ha
Volume	cubic metre	m^3
Angle	degrees	°
	minutes	'
	seconds	"
Mass (Weight)	Kilogram	kg
Temperature	Degrees Celsius	°C

The S1 unit for an angle is the radian (rad), but most surveying instruments measure in degrees, minutes and seconds, which is known as the sexagesimal system. This is the only unit of measure that is not SI.

2.4 Six of the Most Common Surveying Instruments

Surveying is one of the oldest professions, with records of land surveys dating back to ancient Roman times. You might assume that equipment used in the past was rudimentary and crude, but evidence indicates that ancient measuring tools for surveying were developed with surprising accuracy. Romans used an instrument called a groma to “trace on the ground simple and orthogonal alignments necessary to the construction of roads, city, temples, and agricultural lands subdivision1.” Since then, surveying instruments have evolved with respect to exponential developments in technology. These days, surveyors use elite electronic equipment in addition to more basic tools to aid in measuring and mapping efforts. Curious to know more about the equipment surveyors use? We have compiled a list of the six most used surveying tools, including:

1. Theodolite: A surveying instrument with a rotating telescope for measuring horizontal and vertical angles to make precise measurements of areas and triangulate the position of objects in a specific area.

2. Measuring tape: A length of tape or thin flexible metal, marked at intervals for measuring size or distance. Surveyors commonly use tape measures (known as measuring wheels) in lengths of over 100 meters.

3. Total station: A theodolite that uses electronics to calculate angles and distances and contains an on-board computer to collect data and perform triangulation calculations. This tool is used to record features in topographic surveying or to set out features (roads, houses, or boundaries).

4. 3D scanners: A surveying instrument that can accurately measure and collect data from objects, surfaces, buildings, and landscapes. This tool collects information in the form of point cloud data, which consists of millions of 3D coordinates. These coordinates can be used to create 3D computer-aided design (CAD) models, which can then help analyze topographic features and structures. The high accuracy of 3D scanners helps reduce project costs.

5. Level and rod: A graduated wooden or aluminum rod, used with a levelling instrument to determine the difference in height between points or heights of points above a vertical datum7. This tool is used to establish and verify elevations.

6. GPS/GNSS: The use of Global Positioning System signals and/or Global Navigation Satellite System signals via a receiver and antenna to determine the form, boundary, position, objects, or points in space relative to other forms, boundaries, or points. This technology has dramatically increased the speed and productivity of surveyors using on-demand centimeter-level accuracy provided by Real-Time Kinematic (RTK) positioning.

difference between GNSS and GPS:

GNSS stands for Global Navigation Satellite System, and is an umbrella term that encompasses all global satellite positioning systems. This includes constellations of satellites orbiting over the earth’s surface and continuously transmitting signals that enable users to determine their position.
The Global Positioning System (GPS) is one component of the Global Navigation Satellite System. Specifically, it refers to the NAVSTAR Global Positioning System, a constellation of satellites developed by the United States Department of Defense (DoD). Originally, the Global Positioning System was developed for military use, but was later made accessible to civilians as well. GPS is now the most widely used GNSS in the world, and provides continuous positioning and timing information globally, under any weather conditions.
Besides GPS, the GNSS currently includes other satellite navigation systems, such as the Russian GLONASS, and may soon include others such as the European Union’s Galileo and China’s Beidou.

GNSS is used in collaboration with GPS systems to provide precise location positioning anywhere on earth. GNSS and GPS work together, but the main difference between GPS and GNSS is that GNSS-compatible equipment can use navigational satellites from other networks beyond the GPS system, and more satellites means increased receiver accuracy and reliability. All GNSS receivers are compatible with GPS, but GPS receivers are not necessarily compatible with GNSS.

Both GPS and GNSS consist of three major segments: the space segment (satellites), the ground segment (ground control stations), and the user segment (GNSS or GPS receivers), and the exact location of each satellite is known at any given moment. Satellites are continuously sending radio signals toward earth, which are picked up by GNSS or GPS receivers. The ground control stations that monitor the Global Navigation Satellite System continuously track satellites, update the positions of each and enable information on earth to be transmitted to the satellites.

Currently, GNSS/GPS is being used in a variety of fields where the use of precise, continually available position and time information is required, including agriculture, transportation, machine control, marine navigation, vehicle navigation, mobile communication and athletics.

Figure 2.4-1 GNSS and GPS

GPS Accuracy:

it depends. GPS satellites broadcast their signals in space with a certain accuracy, but what you receive depends on additional factors, including satellite geometry, signal blockage, atmospheric conditions, and receiver design features/quality.

For example, GPS-enabled smartphones are typically accurate to within a 4.9 m (16 ft.)

However, their accuracy worsens near buildings, bridges, and trees.

High-end users boost GPS accuracy with dual-frequency receivers and/or augmentation systems. These can enable real-time positioning within a few centimeters, and long-term measurements at the millimeter level.

Figure 2.4-2 Surveying Instruments

At first, we placed large crosses to be clear during image processing, as in Figure 2.4-3. Then we monitored the control points within the study area using the GPS device. The map 2.4-4 shows the distribution of the control & check points, which are 54 control points and 10 check points.

Figure 2.4-3 Cross size

Figure 2.4-4 Distribution of Control & Check points in the study area

2.5 Uses of drones

1-Land surveying / cartography

Survey drones generate high-resolution orthomosaics and detailed 3D models of areas where low-quality, outdated or even no data, are available. They thus enable high-accuracy cadastral maps to be produced quickly and easily, even in complex or difficult to access environments. Surveyors can also extract features from the images, such as signs, curbs, road markers, fire hydrants and drains.

Figure 2.5-1 Cadastral map overlaid on aerial images

After post-processing with a photogrammetry software, these same images can produce very detailed elevation models, contour lines and break lines, as well as 3D reconstructions of land sites or buildings.

2-Land management and development

Aerial images taken by drones greatly accelerate and simplify topographic surveys for land management and planning. This holds true for site scouting, allotment planning and design, as well as final construction of roads, buildings and utilities.

Figure 2.5-2 Survey of an African road before construction planning

These images also provide the foundation for detailed models of site topography for pre-construction engineering studies. The generated data can also be transferred to any CAD or BIM software so that engineers can immediately start working from a 3D model.
As data collection by drones is easily repeatable at low cost, images can be taken at regular intervals and overlaid on the original blueprints to assess whether the construction work is moving according to plan specifications.

3-Precise measurements
High resolution orthophotos enable surveyors to perform highly-accurate distance and surface measurements.

Figure 2.5-3 Volume measurement of a landfill in the Bahamas

4-Slope monitoring
With automated GIS analysis, it is possible to extract slope measurements from DTMs and DSMs generated by drone imagery. Knowing the steepness of the ground’s surface, the areas can be classified and used for slope monitoring purposes, including landslide mitigation and prevention.
With orthomosaics taken at different times, it is possible to detect changes in earth movement and to measure its velocity. This data can help predict landslides and prevent potential damage to roads, railways and bridges.

5-Urban planning
The development of increasingly dense and complex urban areas requires intensive planning and therefore time-consuming and expensive data collection. Thanks to drones, urban planners can collect large amounts of up-to-date data in a short period of time and with far less staff. The images produced in this way allow planners to examine the existing social and environmental conditions of the sites and consider the impact of different scenarios.

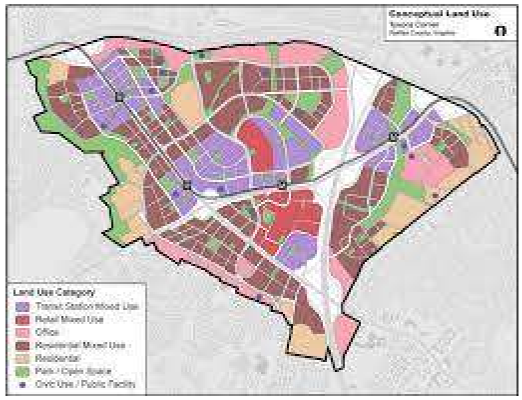


Figure 2.5-4 Zoning map overlaid on an aerial map of a mixed urban and leisure area

Thanks to 3D models, buildings can also be easily overlaid onto their environment, giving planners and citizens an experimental perspective of a complex development project. 3D models also allow analysis and visualization of cast shadows and outlooks/views.
Maps produced with a WingtraOne drone and Esri's ArcGIS Urban.

2.6 Accurate of drone survey

The performance and type of drone, the quality of its components, the camera resolution, the height at which the drone flies, the vegetation, and the method and technology used to geolocate the aerial images can heavily influence the accuracy of drone survey mapping. At this point, it is possible to reach an absolute accuracy down to 1 cm (0.4 in) and 0.7 cm/px (0.3 in/px) GSD under optimal conditions with a high-end surveying drone such as the WingtraOne.

2.7 Drone survey procedure

1. Check before you leave the office
Check the local regulations and make sure that you are allowed to fly your drone at the planned location. Also, make sure that the weather is suitable, meaning no rain, fog, snowfall or strong winds. Check that the battery of your drone and connected devices such as tablets are fully charged and that the memory card of your drone camera has sufficient empty space to capture the entire project.

2. Plan your flight
You can create the survey flight plan with the drone flight planning app on the tablet. For this, just tap and drag the points around the area you want to survey, or import a KML file. Make sure you account for tall objects within the flight plan, as well as altitude differences. If needed, you

can adjust flight settings such as altitude, ground sampling distance (GSD), flight direction and images overlap.

3. Set up your flight in the field
During this step, you basically unpack and assemble the drone and make sure that it is ready to take-off in safe conditions. Following the interactive check-list, you will one-by-one check every parameter, like the calibration of the airspeed sensor and making sure the camera lid is removed.

4. Fly and collect images
After pushing the take-off button, the drone autonomously takes off, captures images and lands back where it started. In this step, the operator essentially makes sure that nobody approaches the drone during take-off or landing and that the weather conditions stay optimal for the survey mission.

5. Geotag your images
After one or several flights, import the images into WingtraHub software to geotag them s. Geo-tagging assigns geographical position (X, Y, Z) information to the images either in a separate CSV file or in the images' meta-data.

2.8 Drone survey data processing

While surveying with drones, images of the ground are taken from multiple vantage points. Through processing these images, a photogrammetry software can then create orthomosaics and 3D models, from which it can measure accurate distance, as well as surfaces and volumes of physical objects.

1-Data outputs from the drone
Images taken by the drone are usually saved on a memory card (such as SD card), just like for any other camera. Depending on the technology used by the drone, the images are already geo-tagged or can be imported in a geo-tagging software, such as WingtraHub. According to the size of the survey site, you probably have between a few hundred images and a few thousand, and each image contains geographical information (X, Y, Z).

2-Importing into a photogrammetry software
After importing or uploading the geo-tagged images in a photogrammetry software such as Drondeploy, delair.ai, 3DR Site scan or Pix4D, images will be stitched together to create 2D or 3D models of the surveyed site. Image processing can be a lengthy process depending on the number of images and the performance of your computer. Some photogrammetry software are desktop-based, thus requiring robust hardware. Other software is cloud-based, employing powerful servers instead of your local computer to process the data.

CHAPTER 3

PHOTOGRAMMETRY PROCESSING

3.1 Definition of Photogrammetry

Photogrammetry has been defined by the American Society for Photogrammetry and Remote Sensing as the art, science, and technology of obtaining reliable information about physical objects and the environment through processes of recording, measuring, and interpreting photographic images and patterns of recorded.

3.2 Agisoft Photo scan

Program description
Agisoft Metashape Professional is software that maximizes the possibilities of photogrammetry. It incorporates machine learning technologies for analysis and post-processing to deliver the highest accuracy results. Agisoft Metashape is a standalone software product that photogrammetrically processes digital images and generates 3D spatial data that can used in geographic information system (GIS) applications, in cultural heritage documentation, for visual effects production, and for indirect measurements of objects of various scales.
Metashape makes it possible to:
process images obtained with RGB or multispectral cameras, including multi-camera systems,

convert photographs:
1-in to dense point clouds,
2-in to textured polygonal models,
3-in to georeferenced orthophoto maps,
4-in to digital elevation / terrain models (DEM / DTM).

Post-processing allows to remove shadows and texture distortions from the surface of models, calculate vegetation indices, compose prescription files for agricultural activities, automatically classify dense point clouds, etc.

The ability to export to all external post-processing packages makes Agisoft Metashape Professional a versatile photogrammetric tool.
Use Metashape for aerial photos:

Point clouds
similar quality as laser scans

Highly detailed
surfaces in TIN or GRID models

Texturised 3D models
based on original images

Orthophotos
With 2 cm precision

The core of Metashape is digital photogrammetry methods supported by modern computer vision algorithms.
Metashape knows what to offer to professionals. You can control the quality of the obtained results by using reports, fine-tune the workspace for specific tasks and use advanced features such as stereo mode or Python scripts.
A professional photogrammetric system can be easily operated by a novice: the intuitive interface is very easy to learn. You can get highly accurate results without even having specialized knowledge and training in photogrammetry.

3.3 Agisoft Works:

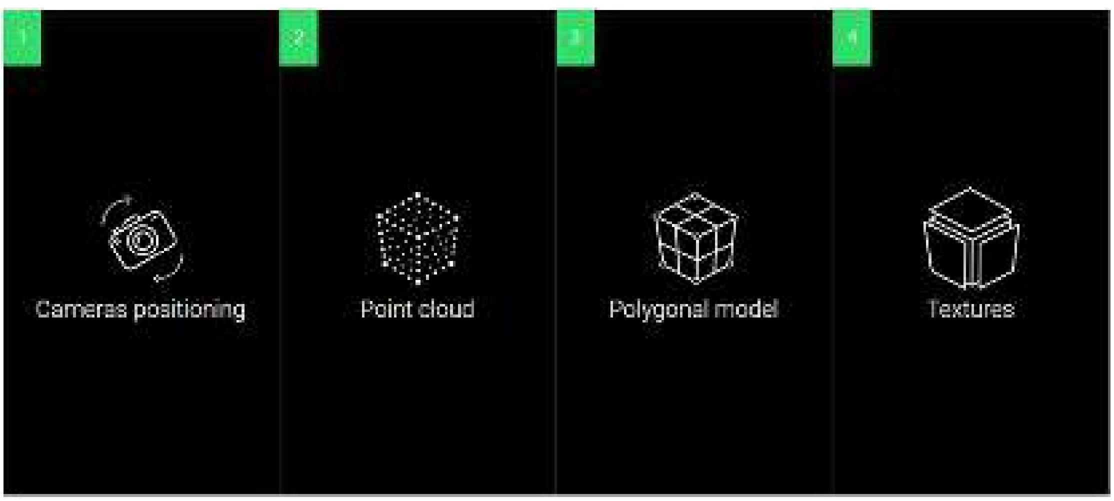


Figure 3.3-1 Agisoft Work

To find common points, Metashape uses an algorithm that first finds 'special' points in individual photographs. Then, on the basis of unique identifiers — descriptors — the points are identified. If a point is recognized in two or more frames, it becomes a match.

This is followed by frame alignment, or photo triangulation. This process is implemented with the use of the Bundle Block Adjustment algorithm, which is based on the least square’s method. Bundle Block Adjustment is an interpretation of the Bundle Method, the most rigorous method for solving photo triangulation. The calculation can include the coordinates of the anchor points

and the projection of markers on the frame. All parameters can be given weights — the scale of their participation in the calculation.
A dense cloud is built on the basis of depth maps. The Semi-Global Matching algorithm is used to create them. The essence of the algorithm is that for each pixel of the left image of a stereo pair there is a corresponding pixel on the right image. Each pixel in the left image is compared to a subset of pixels in the right image with the corresponding ordinate. Next, a parallelepiped is formed for the entire image, where one 'line' of cells corresponds to each pixel, and one longitudinal section of the cube corresponds to a row of pixels in the image. The elements of the cube are the values of the matching criterion, which are analyzed to find the minimum values for each pixel.

In addition, links between neighboring pixels in eight directions around a given pixel are analyzed. As a result, for each pixel of the left image, the corresponding value of the longitudinal parallax is found and, as a consequence, the spatial coordinates of the points of the dense model.

Some tips to ensure successful preparation of the 3D model:

1_If you can, maintain a perpendicular location relative to the object while you take photos.

2-Make sure that there are no moving objects in the background when you take the photos.

3-If you can, take photos in a location where lighting is consistent and doesn't cast shadows.

Agisoft photo scan.

Depending on which drone and camera you are using, the procedure in photo scan/ Metashape differs. Therefore, this instruction is divided in different sections depending on the function of each sensor/drone. The Agisoft manual is well written and give you a deeper understanding about the workflow described below.
The guide goes through how you create an ortho photo and 3D point cloud from images taken with a drone.

STEPS:

1-Import photos, location and accuracy.

2-Image quality.
Poor input, e. g. vague photos, can influence alignment results badly. To help you to exclude poorly
focused images from processing Metashape suggests automatic image quality estimation feature.

Images with quality value of less than 0.5 units are recommended to be disabled and thus excluded from photogrammetric processing, providing that the rest of the photos cover the whole scene to be reconstructed. To disable a photo use, Disable button from the Photos pane toolbar.

Metashape estimates image quality for each input image. The value of the parameter is calculated based on the sharpness level of the most focused part of the picture.

3-Align photos.
In case some extra images should be subaligned to the set of already aligned images, you can benefit from incremental image alignment option.
To make it possible, two rules must be followed:

1) the scene environment should not have changed significantly (lighting conditions, etc.).

2) do not forget to switch on Keep key points option in the Preferences dialog, Advanced tab BEFORE the whole processing is started.

4-Ground control points (GCP).
Ground Control Points, or GCPs, are marked points on the ground that have a known geographic location. In aerial surveying, a drone can be used to autonomously collect photos of the survey area. If used, GCPs must be visible in these aerial photos. The photos are then processed in the cloud using drone mapping software. A common solution for collecting and processing drone data, used by many mapping professionals, is Drone Deploy.
Services like Drone Deploy create 2D orthomosaics, 3D models, digital elevation models (DEMs), and 3D point clouds from drone images. For aerial survey applications GCPs, are typically required as they can enhance the positioning and accuracy of the mapping outputs.

5-Dense point-cloud
Metashape allows to generate and visualize a dense point cloud model. Based on the estimated camera positions the program calculates depth information for each camera to be combined into a single dense point cloud.
Metashape tends to produce extra dense point clouds, which are of almost the same density, if not denser, as LIDAR point clouds.
A dense point cloud can be edited and classified within Metashape environment and used as a basis for such processing stages as Build Mesh, Build DEM, Build Tiled Model.
Alternatively, the point cloud can be exported to an external tool for further analysis. Figure 3.3-2 shows dense cloud for study area

Figure 3.3-2 dense cloud for study area

6-Tiled Model

Hierarchical tiles format is a good solution for city scale modeling. It allows for responsive visualization of large area 3D models in high resolution. The tiled model can be either opened in Metashape itself or with Agisoft Viewer - a complementary tool included in Metashape installer package, or with some other external application which supports a hierarchical tiles format.
Tiled model is build based on dense point cloud, or mesh, or depth maps data. Hierarchical tiles are textured from the source imagery. Figure 3.3-3 shows tiled model for study area.

7-Digital Elevation Model

Metashape allows to generate and visualize a digital elevation model (DEM). A DEM represents a surface model as a regular grid of height values. DEM can be rasterized from a dense point cloud, a sparse point cloud or a mesh. Most accurate results are calculated based on dense point cloud data. Metashape enables to perform DEM-based point, distance, area, volume measurements as well as generate cross-sections for a part of the scene selected by the user. Additionally, contour lines can be calculated for the model and depicted either over DEM or Orthomosaics in Ortho view within Metashape environment. Figure 3.3-4 shows digital elevation model for study area.

8-Ortho Photo

Orthophoto export is normally used for generation of high-resolution imagery based on the source photos and reconstructed model. The most common application is aerial photographic survey data processing, but it may be also useful when a detailed view of the object is required. Metashape enables to perform orthophoto seamline editing for better visual results

EXPORTING ORTHO PHOTO

Place Markers

Markers are used to optimize camera positions and orientation data, which allows for better model reconstruction results. To generate accurately georeferenced orthophotos at least 30 – 40 ground control points (GCPs) should be distributed evenly within the area of interest, during our project we used 40 GCPs. Figure 3.3-5 shows Ortho Photo for study area.

Figure 3.3-3 Tiled model for study area

Figure 3.3-4 Digital Elevation Model for study area

Figure 3.3-5 Ortho photo for study area

3.4 Digitizing

We have set points from dense cloud, which represent points for the street, trees, electricity poles, buildings and points distributed over the entire study area, as shown in Figure 3.4-1, and we have placed a break line in areas where there is a difference in altitude as shown in Figure 3.4-2 in order to make a topo map as shown in Figure 3.4-3.

Figure 3.4-1 Distribution of general point in the study area

Figure 3.4-2 Breakline for study area

Figure 3.4-3 Topo map

CHAPTER 4

DESIGN AND PLANING

4.1 Settlement:

The Palestinian Land and Water Settlement Authority is a public governmental authority established in 2016 by a presidential decree issued by Palestinian President Mahmoud Abbas. It deals with land and water settlement and registration of properties in the State of Palestine.

Its main tasks

- Surveying and settling Palestinian lands and waters.
- Registering and confirming the rights of individuals, in order to prove the right to ownership, disposal or benefit.
- Assisting local authorities in preparing master plans and demarcating roads.

What is land settlement?

Settlement of lands and waters means the resolution of all disputes and issues related to any disposal rights, ownership rights in lands or waters, or usufruct rights, or any rights related to them that are subject to registration. And water, whether this right is recognized or disputed, based on the Land and Water Settlement Law No. 40 of 1952

Land leveling process

It aims to acquaint land owners with the processes of settlement and registration of land and water carried out by the Palestinian Land and Water Settlement Commission.

Settlement basins: It represents the land ownership reference, its borders and land areas

Settlement did not unify and re-sort the pieces, and did not care about the aesthetic appearance of the pieces, as we will do this project to unify the pieces and re-sort the pieces to improve the aesthetic appearance of the pieces.

Figure 4.1-1 Settlement transaction

4.2 Open and designed streets

The road and transportation planning guide in urban areas was used to modify and design streets in the study area

Preparing a road plan is one of the most crucial stages in the process of preparing urban plans. One of the most critical steps in preparing the master plan is the proper selection of the road site. In general, the appropriate path is chosen for each of the roads. This is so that the road achieves its purpose in a manner consistent with the appropriate engineering standards for the type of road. The guiding framework plan contains general guidelines related to roads, and general guidelines are taken into consideration when planning road networks. This shows the steps for choosing the road route

Topography: the topography of the area using the contour map of the area, topography: the path of the roads must be determined in proportion to where the most suitable roads from a topographical point of view are those that run parallel to the contour line, and the lines that cut the contour line at a perpendicular angle are not preferred, especially if that is a long distance Relatively, and therefore the plan should avoid, as much as possible, cutting the contour lines vertically, resorting to cutting them diagonally, and as close to the line parallel to them as possible because this would reduce the slope of the roads (vertical slope). Multiple, consecutive and long distances, the slope of the vertical road must be estimated and made sure that I can

Executing it in the field without exceeding the maximum inclinations), taking into account the excavation and filling works on the road. Shows how topography is considered in connection with road selection

In order to reduce areas of deduction from adjacent lands and to achieve equality between adjacent plots, it is necessary that the road passes along or evenly between the boundaries of the plots of land, in order to avoid creating an imbalance between adjacent plots. The road should also be designed so as not to leave small "waste" areas, or those whose shape impedes the landowner's ability to exploit the remainder of the road. • If the plots of land are longitudinal and narrow (marine), it is preferable to unify and re-divide the schools before proposing roads in them. • In the event that there is a “settlement road”, it can be used as a basis for choosing the path of the road, as it is preferable for the planner to benefit from such roads. Seek to ensure that the deduction rate does not exceed 30% of the land area, in order to avoid non-payment of compensation for seizure, in line with the applicable laws (Article 58 of the Cities, Villages and Buildings Regulation Law / Temporary Law No.

Leveling roads in urban plans the leveling roads, which are often limited in width, are dealt with carefully. This is so that they are considered as the basis for the process of developing and planning these roads in an appropriate engineering manner. This is so that these roads are used and expanded to a suitable road width where needed for plots of land that are not serviced by an organized street. In many cases, these roads are located on the borders of plots of land and separate adjacent plots, so they have sharp angles. The width of the road is determined on the plan based on the boundaries of the existing leveling road, fairly on both sides of the road in general. In particular, expansion takes place more on one side compared to the other. This is due to the presence of existing buildings, or roads that have been paved or paved. The road is widened in such a way as not to allow the presence of waste, or reduce its presence, on both sides of the road. When extending the leveling road, be sure to account for the horizontal bends so that they are within acceptable limits. When preparing the detailed plans, the minimum for organizing the leveling methods is 6 meters.

Whereas, the main streets were taken from the structural plan, their width is fixed, and their width is 16 meters, and we opened streets parallel to the contour lines, their width 10,12,14.as shown as figure 4.2-1

Figure 4.2-1 The distribution of rodas

Geometric **design of roads** is the branch of highway engineering concerned with the positioning of the physical elements of the roadway according to standards and constraints. The basic objectives of geometric design are to optimize efficiency and safety while minimizing cost and environmental damage. Geometric design also affects an emerging fifth objective called "livability," which is defined as designing roads to foster broader community goals, including providing access to employment, schools, businesses and residences, accommodating a range of travel modes such as walking, bicycling, transit, and automobiles, and minimizing fuel use, emissions and environmental damage.

Geometric roadway design can be broken down into three main parts: alignment, profile, and cross-section. Combined, they provide a three-dimensional layout for a roadway.

The **alignment** is the route of the road, defined as a series of horizontal tangents and curves.

The **profile** is the vertical aspect of the road, including crest and sag curves, and the straight grade lines connecting them.

Design standards

Roads are designed in accordance with design guidelines and standards. These are adopted by national and sub-national authorities (e.g., states, provinces, territories and municipalities). Design guidelines take into account speed, vehicle type, road grade (slope), view obstructions, and stopping distance. With proper application of guidelines, along with proper engineering judgement, an engineer can design a roadway that is comfortable, safe, and appealing to the eye. [citation needed]

Alignment

Horizontal alignment in road design consists of straight sections of road, known as tangents, connected by circular horizontal curves. Circular curves are defined by radius (tightness) and deflection angle (extent). The design of a horizontal curve entails the determination of a minimum radius (based on speed limit), curve length, and objects obstructing the view of the driver. Using AASHTO standards, an engineer works to design a road that is safe and comfortable. If a horizontal curve has a high speed and a small radius, an increased super elevation (bank) is needed in order to assure safety. If there is an object obstructing the view around a corner or curve, the engineer must work to ensure that drivers can see fa6r enough to stop to avoid an accident or accelerate to join traffic.

Profile

The profile of a road consists of road slopes, called grades, connected by parabolic vertical curves. Vertical curves are used to provide a gradual change from one road slope to another, so that vehicles may smoothly navigate grade changes as they travel.

Sag vertical curves are those that have a tangent slope at the end of the curve that is higher than that at the beginning of the curve. When driving on a road, a sag curve would appear as a valley, with the vehicle first going downhill before reaching the bottom of the curve and continuing uphill or level.

Crest vertical curves are those that have a tangent slope at the end of the curve that is lower than that at the beginning of the curve. When driving on a crest curve, the road appears as a hill, with the vehicle first going uphill before reaching the top of the curve and continuing downhill. As shown as figure 4.2-2/ 4.2-3

Figure 4.2-2 Profile

Figure 4.2-3 Profile

Cross Section Elements:

Cross section :

The term “cross section” is used to define the configuration of a proposed roadway at right angles to the centerline. Typical sections show the width, thickness and descriptions of the pavement section, as well as the geometrics of the graded roadbed, side ditches, and side slopes.

We explained the layers used and the thickness of each layer, and they are:

1) Subgrade

2) Subbase course

3) Base course

4) Surface course

For each group of streets with the same width, we made a special cross section for them. This cross section shows the width of the side walk and the width of each lane.

Work as shown in figure 4.2-4/4.2-5/4.2-6/4.2-7 the typical cross section

Figure 4.2-4 Typical cross section-01

Figure 4.2-5 Typical cross section-02

Figure 4.2-6 Typical cross section-03

Figure 4.2-7 Typical cross section-04

4.3 Land rezoning law

The lands were re-divided for the development and expansion of the master plan, with the aim of creating land areas that meet the increasing demand for land for construction purposes for housing, commercial centers, office buildings, and services.

The redesigned expansion plan to ensure that the following axes are addressed has been worked on

1- Providing central commercial and service areas that relieve pressure on the city's current commercial center, which is suffering from a suffocating crisis as a result of the rapid growth of the city.
2- Providing new residential areas that meet the needs of the city's high population increase as a result of natural increase and internal migration towards the city
3- Providing service areas and public facilities that include sites for public gardens, public squares for shopping and various social activities, sites for public schools that meet the standards required to provide classrooms and indoor squares...etc., with relatively large areas to compensate for the deficiency in the previous master plan.
4- Developing solutions to the problem of the current traffic crisis and providing a network of roads designed according to scientific standards so that the roads are wide and comfortable and connected to unloading roads outside the city that secure access and exit from newly developed areas without the need to pass through the city center.
5- That the plan be feasible and within the costs that the municipality's budget can bear.

These areas have been planned so that there will be two commercial centers that include public squares, commercial areas, and offices, in addition to a large residential area. Investment opportunities exist in these areas.

It is also proposed in the region that plots should be re-divided so that a legal percentage of deduction, as allowed by law, can be retrieved up to 30% of the total plot area without any compensation, so that the legal percentage is distributed to all plots in the region, provided the plots are revised to ensure the shape is improved and the plots are suitable for the intended use of the plots in accordance with Article 28, 30, and 31 of the Cities and Villages Organization Law 79 of 1966

Deductions: We made deductions based on the land area, as we analyzed the plot data in a program ‘ARC GIS PRO’.

And it became clear to us the need to find classifications for the cuts, as the areas vary in one basin, from: 50-30,000

We made a fair and not equal deduction based on the area of each piece, as we classified as follows:

Areas	Deduction ratio
0-350	100%
350-550	0-10%
550-800	10-15%
800-1000	15-20%
1000>	20-30%

Table 4-1Deduction percentages according to the area of the piece

In order to adhere to a fair deduction ratio, we have made a set of plot classifications. This is so that each piece present in the basin before deduction is within the classification group that we set Categories:

300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1200
1400
1600

Table 4-2 New land areas.

According to the law of re-division, land must be as close as possible to its original location so that it does not lose its characteristics. We have overcome this problem by dividing the study area into three regions (the valley area, the heads of the mountains area, and the area between the valley and the heads of the mountains).

Notes	code	Regions
Mountain peaks	A	Mountain Heads area
Between the valley and the main streets	B	The area between the valley and the heads of the mountains
50 meters from the side of the valley.	C	Al-Wad area

Table 4-3Classification of land places.

Figure 4.3-1 Plots of land before rezoning.

Figure 4.3-2 Land plots after rezoning

4.4 Case study

Land re-divisions in the city of Ramallah as part of the expansion of the structural plan are the first of the projects to be completed since the Ministry of Local Government approved the addition of approximately 2,400 local land administrations on an area covering about 11,290 offices and services for the entire region.

Excellence in the idea of the commercial area, the municipal area, citizens and landowners

Director of the land re-division project in the upcoming expansion Eng. Osama Hamida to meet the needs of citizens, improve the quality of services and develop the standard of living for citizens without prejudice to citizens' private property and without burdening the budget against the budget as a result.

The distinction in this project lies in the idea of compulsory re-division of lands in the expansion area (the surrounding area is 2900) approximately 2400 dunums (approximately 2400 dunums), the approximate total of which is more than 160 dunums.

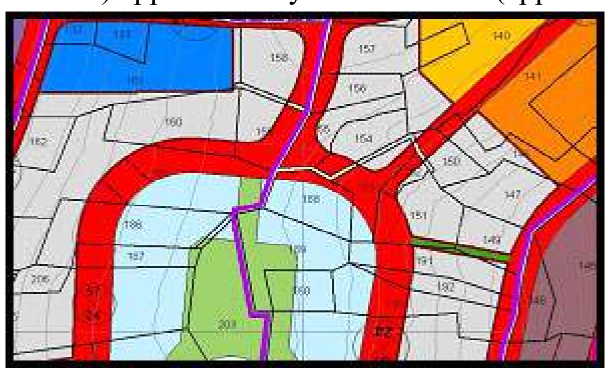


Figure 4.4-1 Plots of land before rezoning.

Figure 4.4-2 Land plots after rezoning.

CHAPTER 5

RESULTS AND RECOMMENDATIONS

5.1 Results:

1- Improving the shape of the plots of land so that they became more suitable for the proposed uses. This meant that they could be used to the maximum extent for the construction purposes for which they were allocated. In addition, none of the plots were expropriated to the exclusion of others. Instead, the deduction rates were distributed to everyone within specific criteria so that they include everyone without harming any particular plot.

2- Which will help in the optimal investment of these lands and will give developers more possibilities for creativity in the field of building design with higher aesthetic standards.

3- It contributed to raising the investment value of these lands, which doubled in most areas of the project.

4- It will also contribute to providing solutions to the current traffic crisis, as well as a wide and comfortable road network that is designed according to scientific standards.

In conclusion, it was impossible to implement the master plan, with its large public squares and wide streets, without rezoning the land.

5.2 Recommendations:

This project will work to meet the needs of the Hebron Municipality in its endeavor to achieve citizen satisfaction by providing urban areas for urban expansion, beautiful and environmentally friendly, that meet the needs of its residents and arrivals, so that they are attractive to tourism and investment, and meet the needs of citizens, while improving the quality of services and developing the standard of living of the citizen without prejudice to the rights of citizens. In private property and without loading the budget with huge sums as a result

1- The municipality adopts and implements this project.

2- Encourage the university to communicate with governmental and non-governmental agencies.

3- That the Palestinian settlement use the re-partition law and apply it in the areas where the law can be applied.

4- That this law be applied outside the city so that it is organized to avoid irrigation crises and so that the civilized character is present.

APPENDIX A

DJI Drone Phantom 4

Aircraft

Weight (Battery & Propellers Included)	1380 g
Diagonal Size (Propellers Excluded)	350 mm
Max Ascent Speed	S-mode: 6 m/s
Max Descent Speed	S-mode: 4 m/s
Max Speed	S-mode: 20 m/s
Max Tilt Angle	S-mode: 42° A-mode: 35° P-mode: 15°
Max Angular Speed	S-mode: 200°/s A-mode: 150°/s
Max Service Ceiling Above Sea Level	19685 feet (6000 m)
Max Wind Speed Resistance	10 m/s
Max Flight Time	Approx. 28 minutes
Operating Temperature Range	32° to 104°F (0° to 40°C)
Satellite Positioning Systems	GPS/GLONASS
Hover Accuracy Range	Vertical: ±0.1 m (with Vision Positioning) ±0.5 m (with GPS Positioning) Horizontal: ±0.3 m (with Vision Positioning) ±1.5 m (with GPS Positioning)

Vision System

Vision System	Forward Vision System Downward Vision System
Velocity Range	≤10 m/s (2 m above ground)
Altitude Range	0 - 33 feet (0 - 10 m)
Operating Range	0 - 33 feet (0 - 10 m)
Obstacle Sensory Range	2 - 49 feet (0.7 - 15 m)
FOV	Forward: 60°(Horizontal), ±27°(Vertical) Downward: 70°(Front and Rear), 50°(Left and Right)
Measuring Frequency	Forward: 10 Hz Downward: 20 Hz
Operating Environment	Surface with clear pattern and adequate lighting (lux>15)

Remote Controller

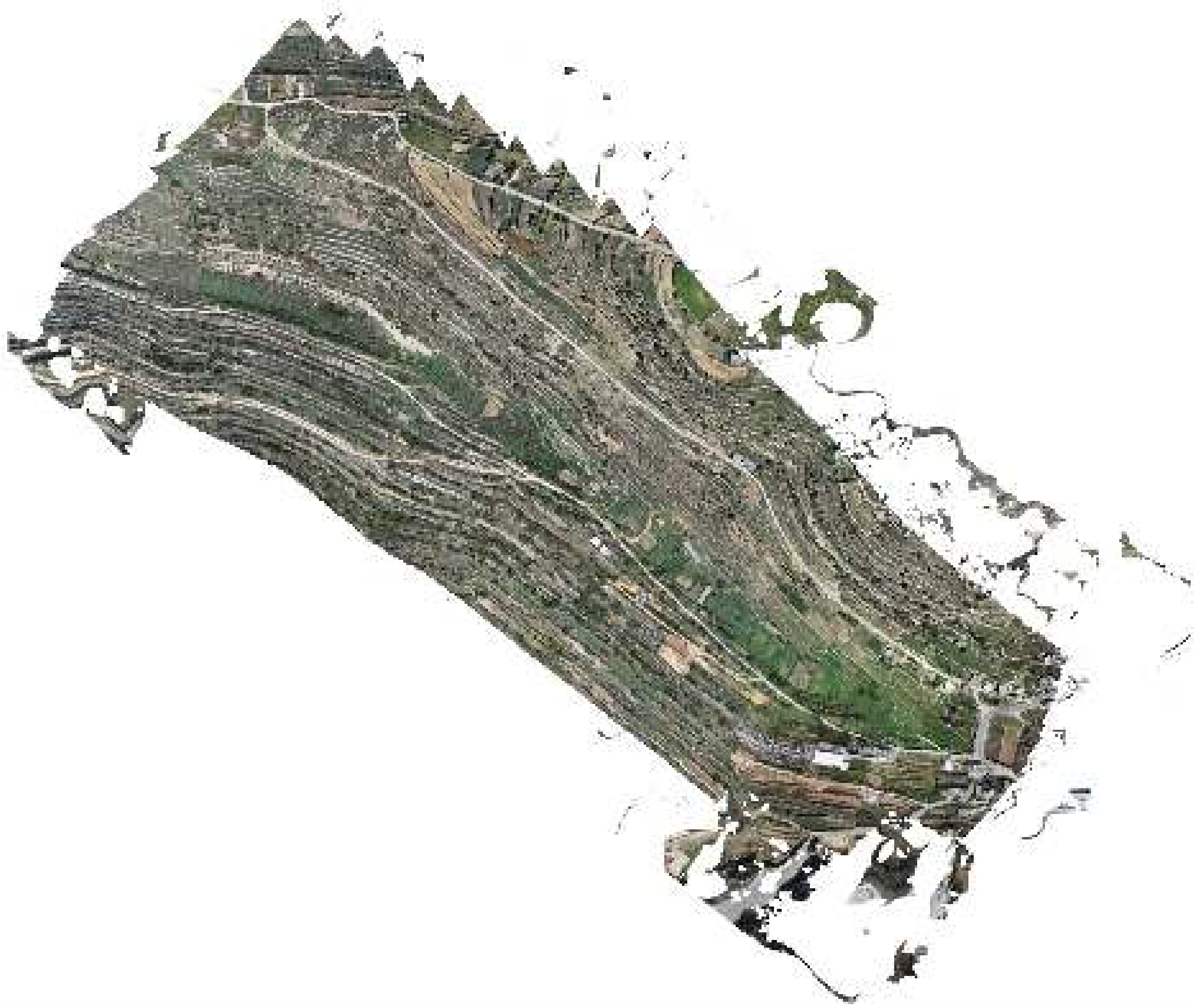
Operating Frequency	2.400 - 2.483 GHz
Max Transmission Distance	FCC Compliant: 3.1 mi (5 km) CE Compliant: 2.2 mi (3.5 km) (Unobstructed, free of interference)
Operating Temperature Range	32° to 104°F (0° to 40°C)
Battery	6000 mAh LiPo 2S
Transmitter Power (EIRP)	FCC: 23 dBm CE: 17 dBm MIC: 17 dBm
Operating Current/Voltage	1.2 A@7.4 V

Video Output Port	USB
Mobile Device Holder	Tablets and smart phones
Intelligent Flight Battery	
Capacity	5350 mAh
Voltage	15.2 V
Battery Type	LiPo 4S
Energy	81.3 Wh
Net Weight	462 g

APPENDIX B

Haska

Processing Report



Survey Data

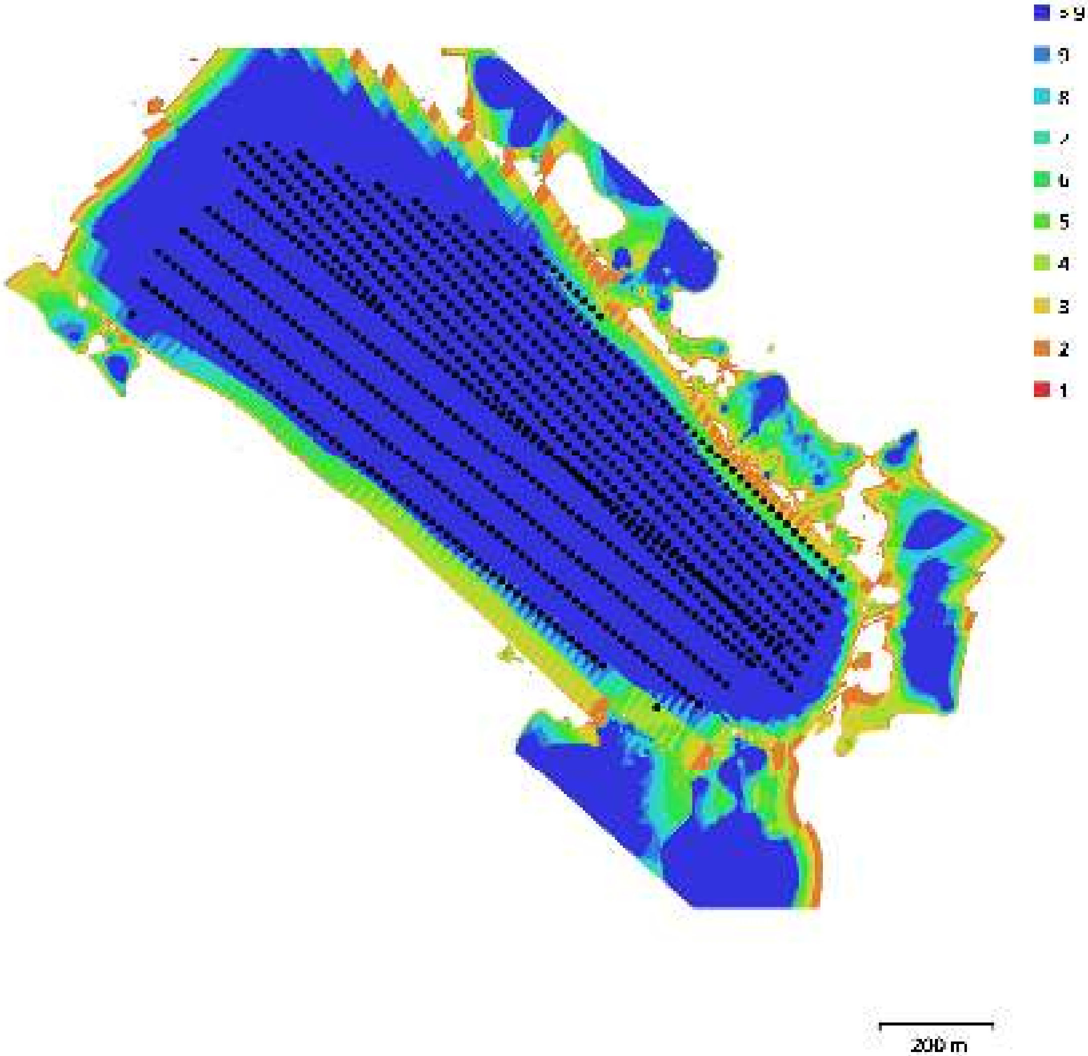


Fig. 1. Camera locations and image overlap.

Number of images:	866	**Camera stations:**	866
Flying altitude:	115 m	**Tie points:**	2,893,159
Ground resolution:	3.29 cm/pix	**Projections:**	13,217,760
Coverage area:	1.09 km²	**Reprojection error:**	1.15 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6310S (8.8mm)	5472 x 3648	8.8 mm	2.41 x 2.41 μm	No

Table 1. Cameras.

Camera Calibration

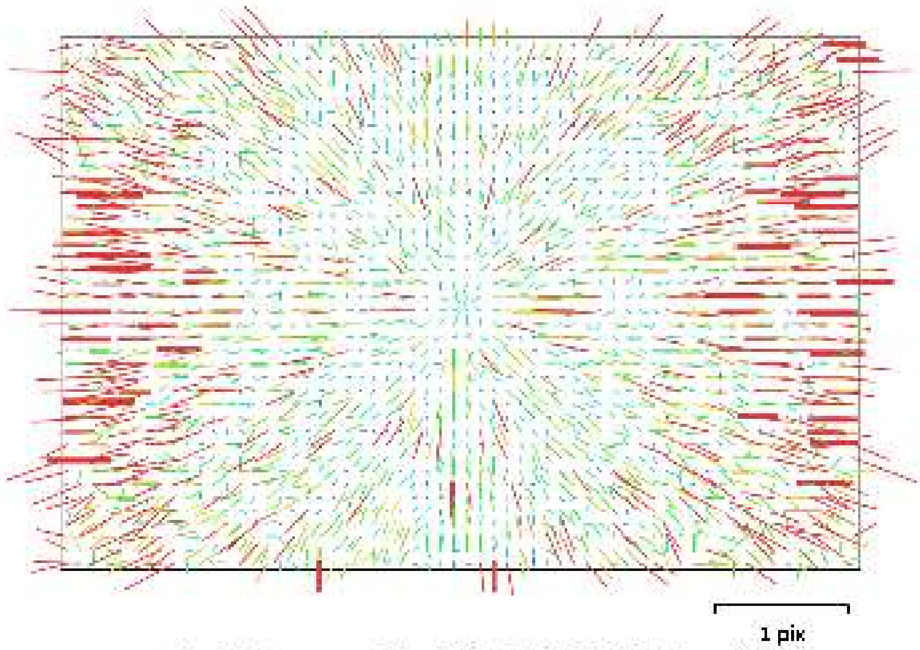


Fig. 2. Image residuals for FC6310S (8.8mm).

FC6310S (8.8mm)

866 images, additional corrections

Type	Resolution	Focal Length	Pixel Size
Frame	**5472 x 3648**	**8.8 mm**	**2.41 x 2.41 μm**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
F	**3685.04**	0.2	1.00	0.02	0.01	-0.06	0.02	-0.46	0.45	-0.43	0.40	0.00	-0.02
Cx	**2.42988**	0.062		1.00	-0.01	0.02	-0.14	-0.00	0.00	-0.00	0.00	0.99	-0.01
Cy	**-12.9934**	0.037			1.00	0.12	-0.01	0.01	-0.02	0.02	-0.02	-0.01	0.99
B1	**-0.589326**	0.012				1.00	-0.08	0.22	-0.22	0.21	-0.19	0.00	0.09
B2	**0.291414**	0.0079					1.00	0.01	-0.01	0.01	-0.01	-0.12	-0.01
K1	**-0.027716**	0.00029						1.00	-0.97	0.90	-0.86	-0.00	0.01
K2	**0.0357624**	0.0012							1.00	-0.99	0.98	0.00	-0.01
K3	**-0.0280309**	0.0015								1.00	-0.99	-0.00	0.01
K4	**0.0118381**	0.00071									1.00	0.00	-0.01
P1	**-0.000202092**	9.3e-06										1.00	-0.01
P2	**-0.00144026**	8.6e-05											1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

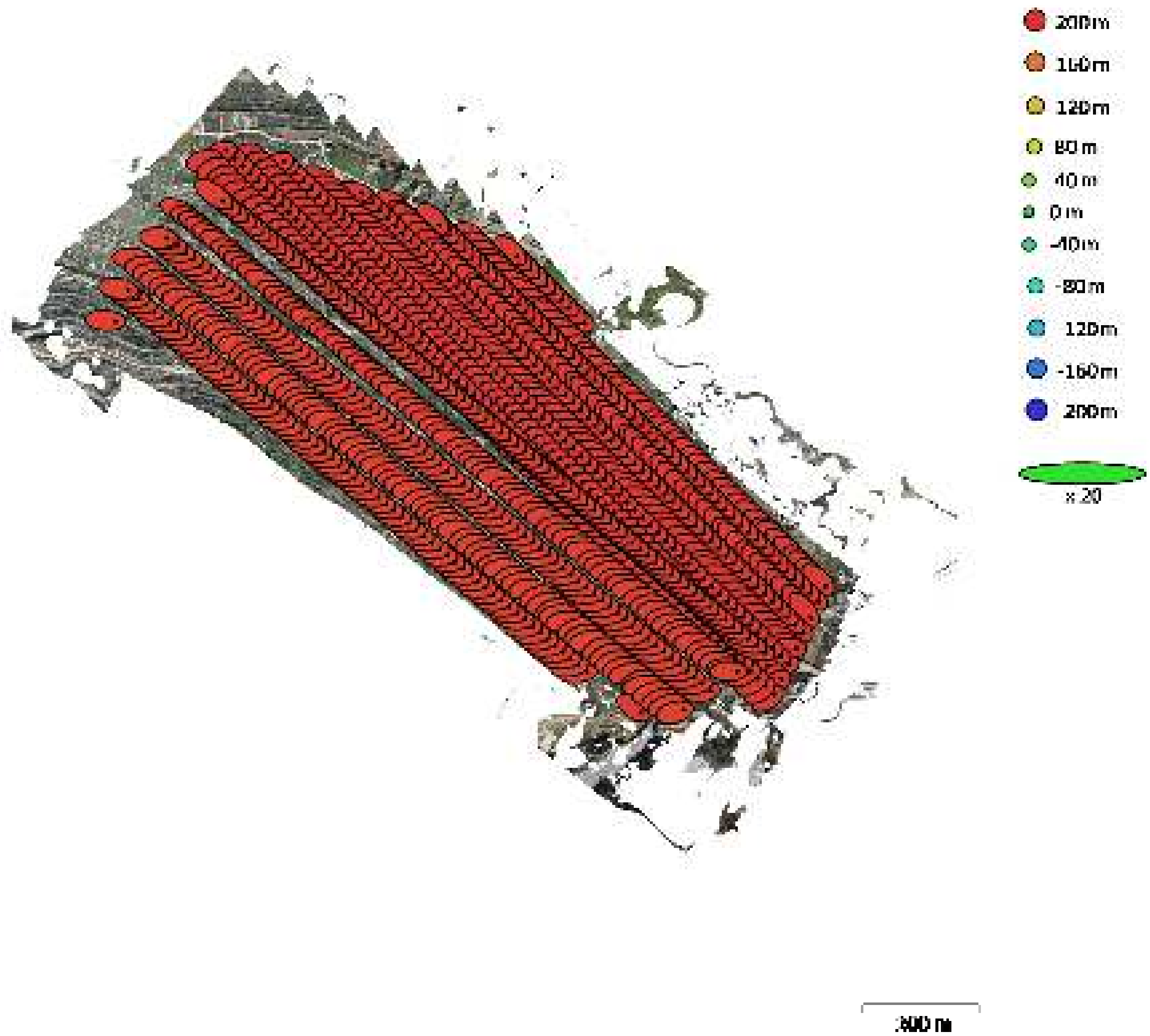


Fig. 3. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated camera locations are marked with a black dot.

X error (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
1.51713	0.719383	194.507	1.67905	194.514

Table 3. Average camera location error. X - Easting, Y - Northing, Z - Altitude.

Ground Control Points

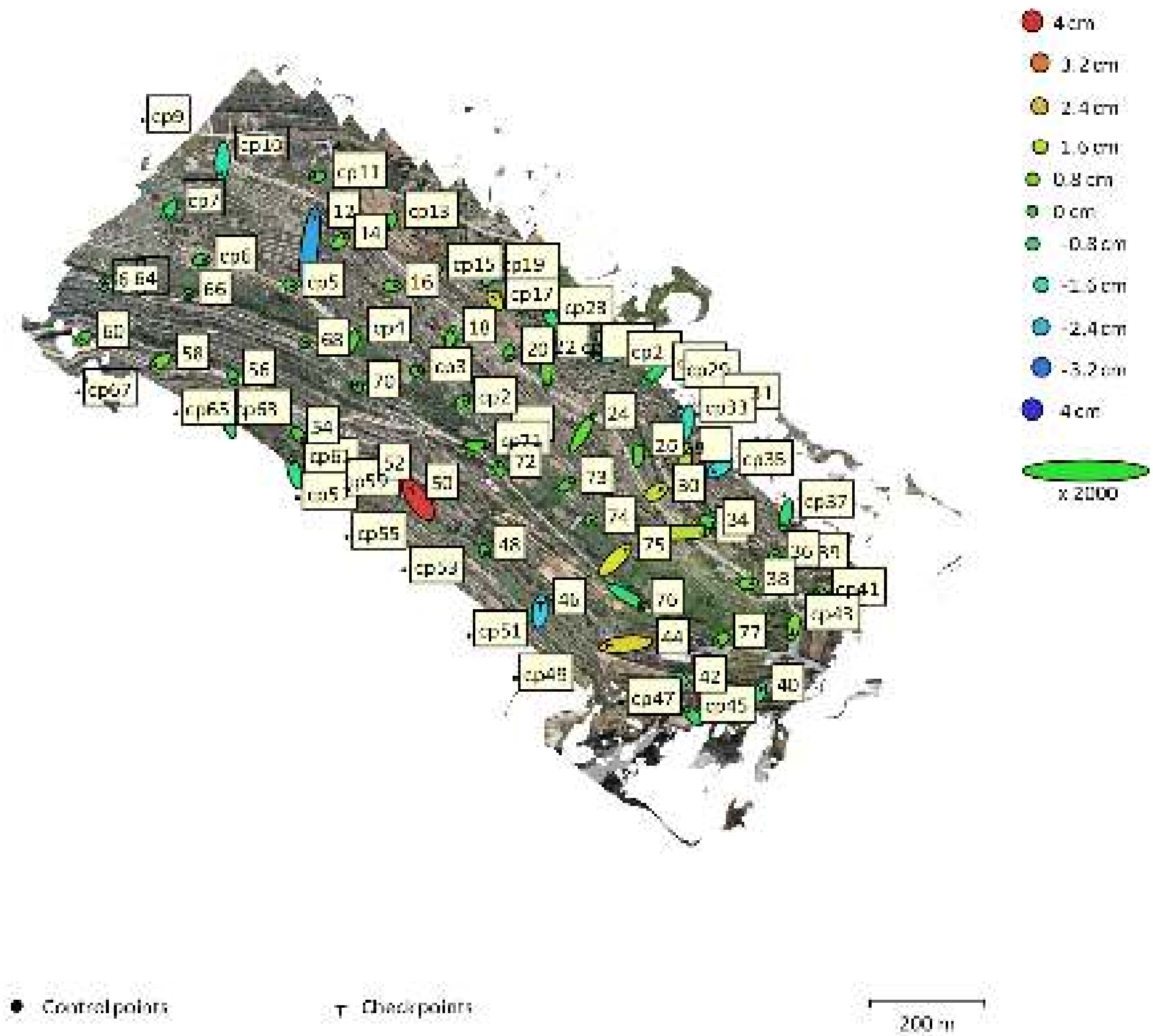


Fig. 4. GCP locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
54	0.761258	1.05469	0.726021	1.30072	1.48963

Table 4. Control points RMSE.
X - Easting, Y - Northing, Z - Altitude.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
10	1.98905	2.16297	2.08301	2.9385	3.6019

Table 5. Check points RMSE.
X - Easting, Y - Northing, Z - Altitude.

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
cp1	0.326046	-0.990003	0.415313	1.12201	1.591 (5)
cp2	0.319997	0.164053	0.325883	0.485295	1.585 (4)
cp3	0.287733	0.00937442	0.164194	0.331418	1.024 (4)
cp4	0.870337	1.74348	0.234081	1.96266	2.539 (4)
cp5	0.305135	-0.148918	0.00311381	0.339549	0.604 (4)
cp6	0.631479	0.0130968	-0.0888098	0.637828	1.248 (6)
cp7	-0.576841	-0.978595	-0.49844	1.2405	1.621 (4)
cp9					
cp10	-0.118314	-2.18793	-1.43961	2.62174	1.876 (5)
cp11	-0.550933	-0.0198199	-0.223783	0.594978	0.925 (4)
cp13	-0.490696	-0.799633	0.142844	0.949	0.984 (4)
cp15	-0.464066	0.281125	0.108625	0.553343	0.657 (4)
cp19	0.597801	1.15794	-0.491725	1.39283	0.712 (6)
cp23	-0.767785	1.26668	-0.761598	1.66553	0.830 (5)
cp25	-1.43497	0.130572	-1.41136	2.01696	1.023 (5)
cp27	-1.30842	-1.09052	-0.496394	1.77415	1.337 (3)
cp29					
cp31					
cp33	-0.484895	-2.29892	-1.54398	2.81141	0.944 (5)
cp35	-1.03211	-0.759566	-1.99118	2.36791	1.189 (5)
cp37	-0.444996	-1.748	-0.663957	1.92207	1.120 (3)
cp39	0.212509	0.265009	-0.969085	1.0269	1.248 (5)
cp41	-0.220009	-0.00312272	0.112895	0.247303	0.511 (4)
cp45	-0.804627	0.812283	-0.492228	1.2448	1.305 (3)
cp49					
cp47					
cp51					
cp53					
cp55					
cp57					
cp61	-0.49509	1.79882	-0.972226	2.10383	1.163 (5)
cp59	1.40819	0.937866	-0.910035	1.92113	1.130 (4)

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
cp63	-0.549322	1.68361	-0.803666	1.94478	1.527 (4)
cp65					
cp67					
cp71	1.47426	0.0969812	0.255251	1.49933	1.341 (6)
14	0.67303	0.561744	0.530563	1.02471	0.900 (4)
16	0.662531	0.011199	0.351552	0.750107	1.040 (3)
18	0.315722	0.90536	0.306556	1.00664	1.448 (4)
20	-0.0191826	-0.40984	0.191784	0.452899	1.025 (4)
22	0.00576433	-3.21552	0.458676	3.24807	5.495 (3)
24	1.5473	2.69025	0.59069	3.15919	3.702 (3)
26	0.131902	1.44698	0.416491	1.51149	1.263 (4)
30	0.767998	0.492694	1.66564	1.89919	1.720 (7)
34	0.801697	-0.353393	0.208827	0.900674	0.734 (5)
36	0.0444033	0.0444411	0.339972	0.345728	0.617 (4)
38	0.683589	0.0345871	0.682121	0.966323	1.142 (5)
40	0.360249	0.694894	-0.95542	1.2351	1.220 (5)
42	-0.629675	0.339339	-1.02433	1.24936	1.140 (5)
48	0.213564	-0.412126	-0.0750227	0.470198	0.624 (4)
54	0.454833	-0.569308	0.191667	0.753472	0.513 (8)
56	0.177565	-0.46521	0.043973	0.499883	0.461 (5)
58	-0.930017	-0.626676	0.644052	1.29324	0.964 (6)
60	-0.423293	-0.289057	0.25917	0.574369	2.326 (1)
62	-0.0288758	0.165336	0.0174498	0.168744	0.374 (3)
64	-0.698312	0.242812	0.398886	0.840064	1.542 (3)
66	-0.0200744	-0.0388986	0.00817565	0.04453	0.207 (3)
68	0.10088	0.0311531	0.01162	0.106219	0.276 (3)
70	-0.0550218	0.180758	0.0247086	0.190556	0.574 (3)
72	-0.156672	0.465018	0.121635	0.505552	0.759 (5)
73	0.689361	0.430617	0.0877602	0.817528	1.092 (4)
74	0.133429	-0.0196883	0.437476	0.457795	1.350 (5)
75	1.77333	1.73091	1.95021	3.15342	2.271 (6)
76	2.3468	-1.41627	-0.729296	2.8364	2.643 (4)

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
Total	**0.761258**	**1.05469**	**0.726021**	**1.48963**	**1.443**

Table 6. Control points.

X - Easting, Y - Northing, Z - Altitude.

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
cp17	-0.363358	0.584035	1.72743	1.85934	0.869 (4)
cp21	-2.05744	-0.0933919	-0.50931	2.1216	0.443 (7)
cp43	-0.299972	-1.26481	0.855655	1.55624	0.460 (4)
12	0.798913	5.54314	-2.61666	6.18155	0.443 (5)
28	-0.340158	-2.69003	1.61804	3.15753	0.427 (5)
32	4.47267	0.17234	1.5948	4.75162	0.791 (5)
44	-3.31109	-0.368693	2.16479	3.9731	0.262 (4)
46	0.154325	1.5147	-2.14437	2.62992	0.176 (4)
50	-1.3764	2.0539	3.8917	4.61068	0.448 (6)
52	-1.21161	0.440011	1.725	2.15342	0.272 (5)
Total	**1.98905**	**2.16297**	**2.08301**	**3.6019**	**0.500**

Table 7. Check points.

X - Easting, Y - Northing, Z - Altitude.

Digital Elevation Model

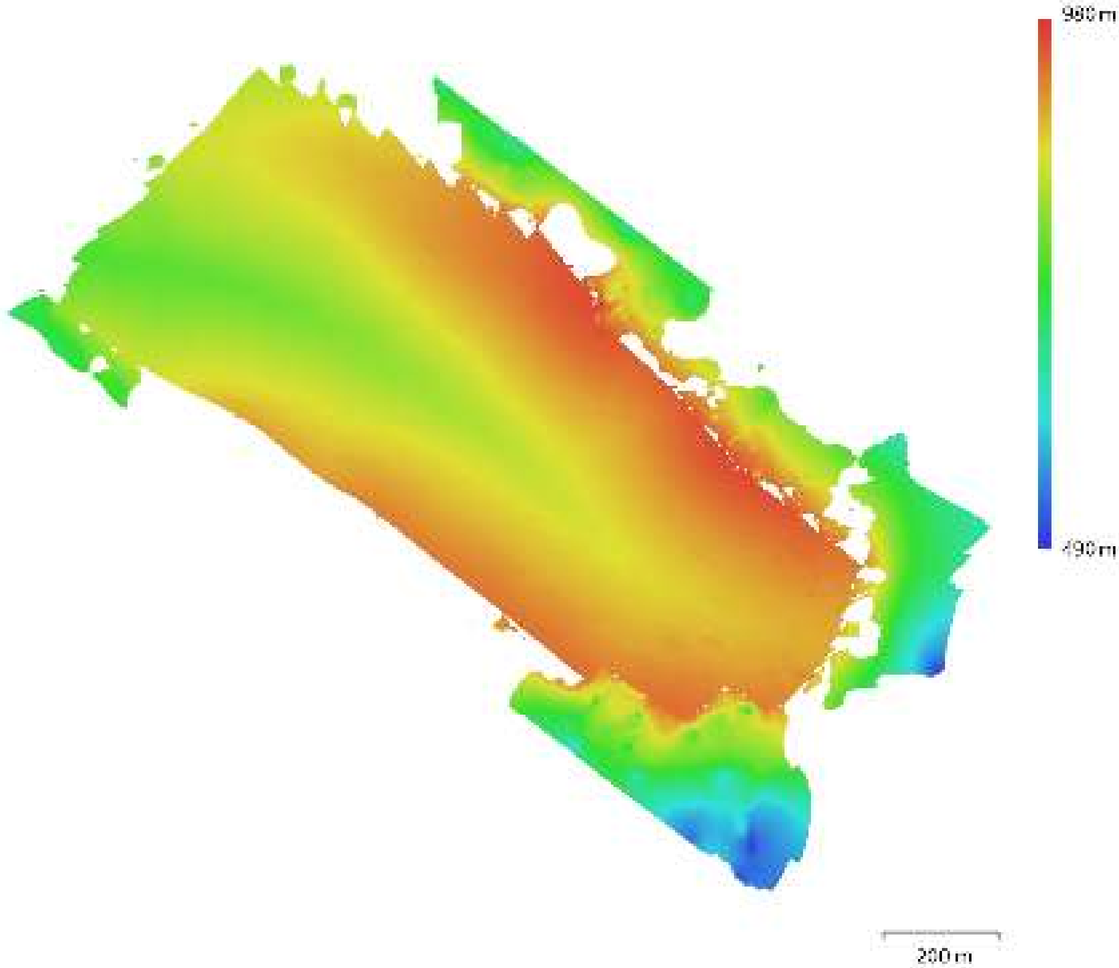


Fig. 5. Reconstructed digital elevation model.

Resolution:	13.2 cm/pix
Point density:	57.6 points/m²

Processing Parameters

General	
Cameras	866
Aligned cameras	866
Markers	76
Shapes	
Point	7723
LineString	1799
Coordinate system	Palestine 1923 / Palestine Grid (EPSG::28191)
Rotation angles	Yaw, Pitch, Roll
Point Cloud	
Points	2,893,159 of 3,221,110
RMS reprojection error	0.133034 (1.14766 pix)
Max reprojection error	0.519632 (57.5828 pix)
Mean key point size	7.13989 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	5.53939
Alignment parameters	
Accuracy	Medium
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Key point limit per Mpx	1,000
Tie point limit	100,000
Exclude stationary tie points	Yes
Guided image matching	No
Adaptive camera model fitting	Yes
Matching time	5 minutes 40 seconds
Matching memory usage	5.98 GB
Alignment time	22 minutes 24 seconds
Alignment memory usage	1.73 GB
Optimization parameters	
Parameters	f, b1, b2, cx, cy, k1-k4, p1, p2
Fit additional corrections	Yes
Adaptive camera model fitting	No
Optimization time	5 minutes 5 seconds
Date created	2022:03:01 16:05:18
Software version	1.7.6.13315
File size	347.81 MB
Depth Maps	
Count	866
Depth maps generation parameters	
Quality	Medium
Filtering mode	Mild
Max neighbors	40
Processing time	1 hours 3 minutes
Memory usage	4.43 GB
Date created	2022:03:01 18:52:03
Software version	1.7.6.13315

Points	64,450,689
Point colors	3 bands, uint8
Depth maps generation parameters	
Quality	Medium
Filtering mode	Mild
Max neighbors	40
Processing time	1 hours 3 minutes
Memory usage	4.43 GB
Dense cloud generation parameters	
Processing time	42 minutes 53 seconds
Memory usage	9.83 GB
Date created	2022:03:01 19:34:57
Software version	1.7.6.13315
File size	921.11 MB
Tiled Model	
Texture	3 bands, uint8
Depth maps generation parameters	
Quality	Medium
Filtering mode	Mild
Max neighbors	40
Processing time	1 hours 3 minutes
Memory usage	4.43 GB
Reconstruction parameters	
Source data	Dense cloud
Tile size	256
Face count	Medium
Enable ghosting filter	Yes
Processing time	1 days 14 hours
Memory usage	7.26 GB
Date created	2022:03:27 11:10:26
Software version	1.8.2.13956
File size	904.24 MB
DEM	
Size	14,525 x 13,204
Coordinate system	Palestine 1923 / Palestine Grid (EPSG::28191)
Reconstruction parameters	
Source data	Dense cloud
Interpolation	Enabled
Processing time	13 minutes 43 seconds
Memory usage	314.26 MB
Date created	2022:03:02 14:35:47
Software version	1.7.6.13315
File size	248.58 MB
Orthomosaic	
Size	53,019 x 44,875
Coordinate system	Palestine 1923 / Palestine Grid (EPSG::28191)
Colors	3 bands, uint8
Reconstruction parameters	
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	27 minutes 47 seconds
Memory usage	8.14 GB
Date created	2022:03:02 15:09:50

System

Software name	Agisoft Metashape Professional
Software version	1.8.2 build 13956
OS	Windows 64 bit
RAM	15.88 GB
CPU	Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz
GPU(s)	GeForce GTX 1050
	Intel(R) UHD Graphics 620

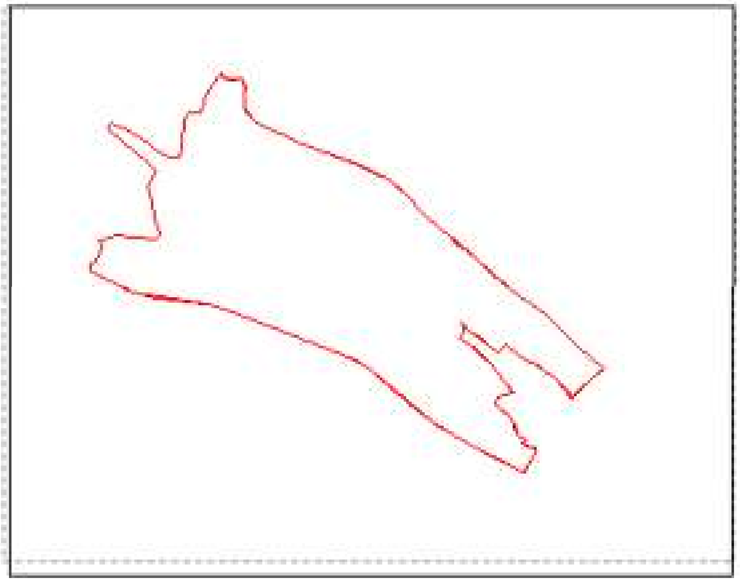
APPENDIX C

1-

Parcel number	Building area	Valley	A/B/C	current area	current area	New area	deduction ratio
39	No	No	B	255.472385	255	0	100%
34	No	No	B	288.1356879	288	0	100%
	No	No	A	322.7114233	323	300	7%
12	No	No	A	609.8626609	610	550	10%
44	Y	No	B	820.659066	821	700	15%
37	No	No	B	825.4732618	825	700	15%
42	No	No	B	835.747113	836	700	16%
26	No	No	B	839.8999881	840	700	17%
27	No	No	B	890.2816114	890	800	10%
45	No	No	B	897.1765725	897	800	11%
158	Y	No	B	977.2257392	977	900	8%
36	No	No	B	1010.853376	1011	900	11%
40	No	No	B	1115.766593	1116	1000	10%
38	No	No	B	1129.21637	1129	1000	11%
25	No	No	B	1175.80476	1176	1000	15%

41	No	No	B	1244.578332	1245	1000	20%
43	No	No	B	1320.613693	1321	1200	9%
32	No	No	B	1471.605528	1472	1200	18%
33	No	No	B	1497.658936	1498	1200	20%
29	No	No	B	3526.845	3527	3000	15%
23	No	No	A	1777.669366	1778	1400	21%
20	No	No	A	1790.508246	1791	1400	22%
46	No	No	B	2436.187184	2436	2000	18%
13	No	No	A	2483.88028	2484	2000	19%
22	No	No	A	2700.991734	2701	2200	19%
30	No	No	A/B	2784.761161	2785	2200	21%
15	No	No	A	3291.411834	3291	2600	21%
28	No	No	B	3414.380652	3414	2800	18%
21	No	No	A	3812.389872	3812	3000	21%
14	No	No	A	3947.998167	3948	3000	24%
24	No	No	B	4124.092412	4124	3400	18%
50	No	No	A	10914.62902	10915	9000	18%
49	No	No	A	11504.34382	11504	9000	22%
47	No	No	B	17674.0726	17674	14000	21%
58	No	No	B	26274.54978	26275	21000	20%
57	No	No	A/B	62069.39	62069	50400	19%
48	No	No	A	42305.91956	42306	34000	20%

2-

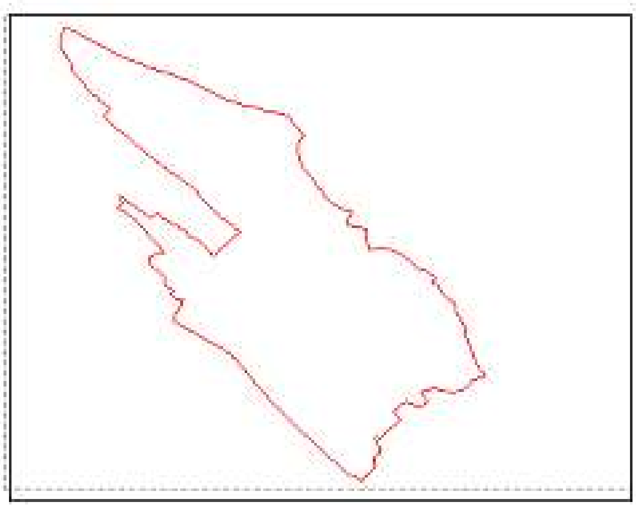


Parcel number	Building area	Valley	A/B/C	current area	current area	New area	deduction ratio
45	NO	No	C	167.5670657	168	0	100%
69	NO	Y	C	421.6850481	422	400	5%
67	NO	Y	C	423.6097669	424	400	6%
68	NO	Y	C	435.7259565	436	400	8%
81	NO	Y	C	441.2239306	441	400	9%
33	NO	No	A	505.2588009	505	450	11%
20	NO	No	A	617.8431058	618	550	11%
34	NO	No	A	674.0277568	674	600	11%
1	NO	Y	C	733.288818	733	650	11%
17	NO	No	A	750.9322623	751	650	13%
8	NO	Y	C	797.5953965	798	650	19%
91	NO	Y	C	803.7255378	804	650	19%
99	NO	Y	C	812.58822	813	700	14%
119	NO	Y	C	855.1395839	855	700	18%
42	NO	No	A	893.7565574	894	800	11%

105	**NO**	**Y**	**C**	**965.2417052**	**965**	**800**	**17%**
21	**NO**	**No**	**A**	**969.882193**	**970**	**800**	**18%**
104	**NO**	**Y**	**C**	**970.1724018**	**970**	**800**	**18%**
90	**NO**	**Y**	**C**	**981.3284615**	**981**	**800**	**18%**
62	**NO**	**No**	**A**	**1019.801768**	**1020**	**800**	**22%**
103	**NO**	**Y**	**C**	**1056.462517**	**1056**	**800**	**24%**
23	**NO**	**No**	**A**	**1057.560684**	**1058**	**800**	**24%**
16	**NO**	**No**	**A**	**1061.286992**	**1061**	**800**	**25%**
24	**NO**	**No**	**A**	**1097.485354**	**1097**	**850**	**23%**
109	**NO**	**Y**	**C**	**1121.862329**	**1122**	**900**	**20%**
92	**NO**	**Y**	**C**	**1143.057821**	**1143**	**900**	**21%**
118	**0**	**No**	**A**	**1149.952593**	**1150**	**900**	**22%**
106	**NO**	**Y**	**C**	**1151.688822**	**1152**	**900**	**22%**
110	**NO**	**Y**	**C**	**1208.67795**	**1209**	**1000**	**17%**
13	**NO**	**No**	**A**	**1212.350232**	**1212**	**1000**	**17%**
15	**NO**	**No**	**B**	**1265.33317**	**1265**	**1000**	**21%**
108	**NO**	**Y**	**C**	**1294.64531**	**1295**	**1000**	**23%**
49	**NO**	**No**	**A**	**1328.888551**	**1329**	**1000**	**25%**
107	**NO**	**Y**	**C**	**1356.645098**	**1357**	**1000**	**26%**
36	**NO**	**No**	**A**	**1444.9201**	**1445**	**1200**	**17%**
111	**NO**	**Y**	**C**	**1476.098064**	**1476**	**1200**	**19%**
43	**NO**	**No**	**A**	**1641.230562**	**1641**	**1200**	**27%**
14	**NO**	**No**	**B**	**1671.959201**	**1672**	**1400**	**16%**
54	**NO**	**No**	**A**	**1716.108974**	**1716**	**1400**	**18%**
25	**NO**	**No**	**A**	**1813.961392**	**1814**	**1400**	**23%**
38	**NO**	**No**	**A/B**	**1817.64846**	**1818**	**1400**	**23%**
18	**NO**	**Y**	**C**	**2021.36**	**2021**	**1600**	**21%**
102	**NO**	**No**	**B**	**2103.328304**	**2103**	**1600**	**24%**
44	**NO**	**No**	**A**	**2121.675207**	**2122**	**1600**	**25%**
37	**NO**	**No**	**A**	**2915.243109**	**2915**	**2400**	**18%**

101	**NO**	**Y**	**C**	**4391.468076**	**4391**	**3400**	**23%**
89	**NO**	**Y**	**C**	**6201.330587**	**6201**	**5000**	**19%**
9	**NO**	**Y**	**C**	**6955.908818**	**6956**	**5400**	**22%**
93	**NO**	**Y**	**C**	**12200.98521**	**12201**	**9000**	**26%**
100	**NO**	**No**	**B**	**32301.216**	**32301**	**24000**	**26%**

3-



Parcel number	Building area	Valley	A/B/C	current area	current area	New area	deduction ratio
55	NO	Y	C	46.23324563	46	0	100%
135	NO	Y	C	49.66365341	50	0	100%
106	NO	Y	C	113.8220697	114	0	100%
89	NO	Y	C	161.7329153	162	0	100%
45	NO	Y	C	167.5670657	168	0	100%
123	NO	NO	A	192.6823749	193	0	100%
50	NO	Y	C	204.4195333	204	0	100%
52	NO	Y	C	224.2634686	224	0	100%
40	NO	Y	C	248.5154733	249	0	100%
42	NO	Y	C	276.7600857	277	0	100%
16	NO	Y	C	277.7347046	278	0	100%
23	NO	NO	A	283.9876989	284	0	100%
19	NO	Y	C	292.9075197	293	0	100%
18	NO	Y	C	307.5452804	308	300	3%
93	NO	NO	B	356.7305429	357	350	2%
46	NO	Y	C	356.9783414	357	350	2%
33	NO	NO	B	358.605611	359	350	3%
43	NO	Y	C	360.7618784	361	350	3%

34	NO	NO	B	383.5549481	384	350	9%
132	NO	NO	A	384.1919164	384	350	9%
129	NO	NO	A	384.7752222	385	350	9%
122	NO	Y	C	397.1431837	397	350	12%
119	NO	NO	A	409.4777587	409	350	14%
109	NO	NO	A	424.5480197	425	400	6%
79	NO	NO	B	437.6605825	438	400	9%
90	NO	Y	C	440.2549338	440	400	9%
111	NO	NO	B	507.6256782	508	450	11%
69	NO	NO	B	532.9631852	533	500	6%
70	NO	NO	B	533.6261319	534	500	6%
51	NO	Y	C	542.90135	543	500	8%
47	NO	NO	A	547.8978514	548	500	9%
130	NO	NO	A	548.972329	549	500	9%
137	NO	Y	C	555.6603669	556	500	10%
62	NO	NO	B	563.9435906	564	500	11%
121	NO	Y	C	572.8057849	573	500	13%
11	Y	NO	A	606.6650647	607	550	9%
131	NO	NO	A	608.4352011	608	550	10%
74	NO	Y	C	608.5193417	609	550	10%
136	NO	Y	C	611.9913692	612	550	10%
87	NO	Y	C	621.3538823	621	550	11%
114	NO	NO	B	666.41774	666	600	10%
44	NO	Y	C	705.1679786	705	650	8%
35	NO	NO	A	728.9594613	729	650	11%
63	NO	NO	A	730.26573	730	650	11%
29	NO	Y	C	737.8666464	738	650	12%
113	NO	NO	B	777.1652655	777	700	10%
95	NO	NO	B	806.7040759	807	700	13%
133	NO	NO	A	812.4380793	812	700	14%

72	**NO**	**NO**	**A**	**1602**	**1602**	**1400**	**13%**
61	**Y**	**Y**	**C**	**817.9804928**	**818**	**750**	**8%**
21	**NO**	**NO**	**B**	**851.1890968**	**851**	**750**	**12%**
94	**NO**	**Y**	**C**	**853.5184369**	**854**	**750**	**12%**
112	**NO**	**NO**	**B**	**863.7236051**	**864**	**750**	**13%**
75	**NO**	**Y**	**C**	**865.3855276**	**865**	**750**	**13%**
88	**NO**	**NO**	**B**	**873.6038061**	**874**	**750**	**14%**
92	**NO**	**NO**	**B**	**877.9157459**	**878**	**800**	**9%**
59	**NO**	**Y**	**C**	**886.6834548**	**887**	**800**	**10%**
138	**NO**	**NO**	**B**	**891.252671**	**891**	**800**	**10%**
104	**NO**	**NO**	**B**	**896.755612**	**897**	**800**	**11%**
134	**NO**	**NO**	**A**	**921.0550143**	**921**	**800**	**13%**
39	**NO**	**Y**	**C**	**922.1282888**	**922**	**800**	**13%**
67	**NO**	**NO**	**B**	**923.7275985**	**924**	**800**	**13%**
10	**NO**	**NO**	**A**	**958.5117604**	**959**	**800**	**17%**
60	**NO**	**Y**	**C**	**1011.694369**	**1012**	**900**	**11%**
125	**NO**	**NO**	**A**	**1147.792272**	**1148**	**1000**	**13%**
65	**NO**	**NO**	**A**	**1161.35059**	**1161**	**1000**	**14%**
86	**NO**	**NO**	**A**	**1193.678004**	**1194**	**1000**	**16%**
126	**NO**	**NO**	**A**	**1250.493022**	**1250**	**1100**	**12%**
17	**NO**	**NO**	**A**	**1279.903289**	**1280**	**1100**	**14%**
68	**NO**	**NO**	**B**	**1310.779566**	**1311**	**1100**	**16%**
97	**NO**	**NO**	**B**	**1364.729062**	**1365**	**1200**	**12%**
124	**NO**	**NO**	**A**	**1399.886413**	**1400**	**1200**	**14%**
64	**NO**	**NO**	**A**	**1407.487057**	**1407**	**1200**	**15%**
78	**NO**	**Y**	**C**	**1417.589763**	**1418**	**1200**	**15%**
96	**NO**	**Y**	**C**	**1458.763389**	**1459**	**1200**	**18%**
71	**NO**	**NO**	**A**	**1495.06579**	**1495**	**1300**	**13%**
76	**NO**	**NO**	**B**	**1513.483708**	**1513**	**1300**	**14%**
53	**Y**	**NO**	**A**	**1518.317985**	**1518**	**1300**	**14%**

110	**NO**	**NO**	**B**	**1530.809946**	**1531**	**1300**	**15%**
38	**NO**	**NO**	**B**	**1653.981524**	**1654**	**1400**	**15%**
31	**NO**	**NO**	**A**	**1674.267125**	**1674**	**1400**	**16%**
49	**NO**	**NO**	**B**	**1692.800029**	**1693**	**1400**	**17%**
8	**Y**	**NO**	**A**	**1818.885254**	**1819**	**1800**	**1%**
82	**NO**	**NO**	**B**	**1873.051554**	**1873**	**1600**	**15%**
108	**NO**	**NO**	**A**	**2041.345201**	**2041**	**1800**	**12%**
83	**NO**	**NO**	**A**	**2060.309653**	**2060**	**1800**	**13%**
128	**NO**	**NO**	**A**	**2124.717268**	**2125**	**1800**	**15%**
77	**NO**	**NO**	**B**	**2187.237161**	**2187**	**1800**	**18%**
66	**Y**	**Y**	**C**	**2500.578752**	**2501**	**2000**	**20%**
73	**NO**	**NO**	**B**	**2647.225247**	**2647**	**2200**	**17%**
32	**NO**	**NO**	**A**	**2963.37446**	**2963**	**2400**	**19%**
22	**NO**	**NO**	**B**	**3391.815621**	**3392**	**3000**	**12%**
120	**NO**	**NO**	**B**	**6030**	**6030**	**5000**	**17%**
48	**Y**	**Y**	**C**	**5500.934432**	**5501**	**4000**	**27%**
9	**NO**	**NO**	**A**	**7649.474968**	**7649**	**6000**	**22%**
1	**NO**	**NO**	**A**	**19946.10662**	**19946**	**17000**	**15%**
98	**NO**	**NO**	**A**	**28808.1753**	**28808**	**26000**	**10%**

REFERENCES

1-DeWitt, B., Wolf, P., & Wilkinson,. Elements of Photogrammetry with Application in GIS. October 22, 2013.

2-Minchin, M.. In production to Surveying. 2003.

3- (wingtra.com/drone-mapping-applications/surveying-gis)

4- (lwsc.ps/index.php)

5- Ahn, K., & Song, Y.. Digital Photogrammetry for Land Registration in Developing Countries. Marrakech, Morocco. (18-22 May 2011)

6- Government, M. o. (2013). Ramallah.

7- (Government, Urban road and transport planning guide, 2013; Government, Diagram preparation procedures and tools guide, 2014)

8- R. Roess, E. Prassas and w. Mcshane, Traffic Engineering, 4 th ed., Newyork: Pearson, 2011

9-N. Garber, Traffic and Highway Engineering, 4 th ed., canda: cangage learning , 2009.