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Geospatial Analysis for urban planning “Series/Jenin” case study

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of Requirements of the Bachelor Degree in Surveying and geomatics
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جامعة بوليتكنك فلسطين
كلية الهندسة
دائرة الهندسة المدنية

دراسة الحالة الجغرافية المكانية للتخطيط العمراني "سيريس / جنين"

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بناء على توجيهات الأستاذ المشرف وبموافقة جميع أعضاء اللجنة الممتحنة تم تقديم هذا المشروع الى دائرة الهندسة المدنية في كلية الهندسة للوفاء الجزئي بمتطلبات الحصول على درجة البكالوريوس.

توقيع رئيس الدائرة

توقيع مشرف المشروع

.....

.....

Abstract

Geospatial Analysis for urban planning “Series/Jenin” case study

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This project aims to spatially study the existing master plans, get field readings using GNSS and aerial photogrammetry, and analyze data using geographic information systems. Here Series village was chosen as the study area, which has a total area of 12,495 dunams.

The aerial orthophoto will be evaluated, and to enhance the spatial accuracy the re-georeferencing to the aerial orthophoto will be done, after the control points coordinates have been observed by GNSS, after that studying and evaluation of the existing master plane useability in the practice for land parcels, buildings and street will be done using GIS techniques, finally use GIS to make new maps to prepare and evaluate the newly designed master plan.

The old master plan will be evaluated and analyzed digitally and by maps, then prepare statistics and maps to be used by the actual planner for the new master plan to get this project out of the proposal into implementation.

المخلص

دراسة الحالة الجغرافية المكانية للتخطيط الهيكلي "سيريس / جنين"

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يهدف هذا المشروع الى دراسة المخططات الهيكلية القائمة، ورصد قراءات ميدانية باستخدام نظم تحديد الموقع العالمي والتصوير الجوي وتحليل البيانات باستخدام نظم المعلومات الجغرافية وهنا تم اختيار قرية سيريس كمنطقة الدراسة والتي تبلغ مساحتها 12495 دونم .

تم تقييم الصورة الجوية، وتحسين الدقة المكانية تم عمل توقيع جغرافي مكاني للصورة الجوية وذلك بعد رصد عدة نقاط بإحداثياتها باستخدام اجهزة نظم تحديد الموقع العالمي، وبعد ذلك تمت عملية دراسة وتقييم استخدام المخططات الهيكلية القائمة في تسوية الاراضي والمباني والشوارع باستخدام تقنيات نظم المعلومات الجغرافية، ونهاية استخدام نظم المعلومات الجغرافية في عمل خرائط وتقييم المخططات الهيكلية الحديثة.

تم تقييم وتحليل المخططات الهيكلية القديمة رقمياً وبالخرائط، والمساهمة في إخراج المخططات الهيكلية الجديدة من خلال خرائط واحصائيات.

DEDICATION

To our true source of hope ...

to the people who keep us going through struggles and hardships ...

your encouragement and continuous support are only matched by your big hearts and pure
souls

To our families ...

To our dearest friends ...

To everyone who carries love in his heart for us ...

Thank you from the depths of our hearts.

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Project Team

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Chapter One: Introduction

1-1 Introduction.

1-2 Aims & Objectives.

1-3 Problem Statement.

1-4 Literature Review.

1-5 Methodology.

1-6 Project Scope.

1-7 Study area

1-8 Project Timeline

1-9 Programs Used in The Project.

1-1 Introduction

Palestine as a growing community tends to develop stages, so our community have to start right now and is increasingly making serious changes in all life aspects, it's so important to take care of one section of these changes which is the master planning, the master plan is the most important thing our lovely country generally needed and especially for Series village. master plan means the long-term planning documents that provide a conceptual blueprint for future growth and development. It's about making the connection between buildings, social settings, and their surrounding environments. And aims to achieve development in a balanced and controlled manner, to make the cities more resilient, while also ensuring sustainable development. [1]

1-1-1 Master planning roles

- Develop a phasing, and implementation schedule and identify priorities for action.
- Act as a framework for regeneration and attract private sector investment.
- Conceptualize and shape the three-dimensional urban environment.
- Define public, semiprivate, private spaces, and public amenities.
- Determine the mix of uses and their physical relationship.
- Engage the local community and act as a builder of consensus. [1]

GIS helps urban planners to develop the towns and cities we live in, prepare for future developments, and make adjustments as the population in an area change. An important and useful tool, GIS has become invaluable for many when it comes to effective urban planning.

GIS in urban planning enables spatial analysis and modeling, which can contribute to a variety of important urban planning tasks, these tasks include site selection, land suitability analysis, land use and transport modeling, the identification of planning action areas, and impact assessments.

GIS functionality such as interpolation, buffering, map overlay, and connectivity measurement help urban planners achieve these tasks. [3]

The use of aerial photography in city and regional planning is not new. For many years city planning departments have included a mosaic map, usually annotated as a part of their standard equipment and wall decoration. Also, the services of photogrammetry have been utilized to some extent. But many people were unaware of their role. [3]

1-2 Aims and objectives

This case study aims to evaluate and analyze the old master plan digitally and by maps, then prepare maps and statistics to formulate a master plan to make Series village a resilient civilized village. The objective of this study includes evaluating the aerial orthophoto, spatial accuracy enhances by georeferencing to the aerial orthophoto after the control points coordinates have been observed by GNSS, studying and evaluating the existing master plan useability in the practice for land parcels, buildings and street will be done using GIS techniques and finally, use GIS to make new maps to prepare for the newly designed master plan.

1-3 Problem statement

Master plans for cities have helped explain the process of development by understanding the complicated interrelationship between the various aspects of the cities and providing balanced solutions to meet the goals of development. A Master plan confirms the improvement of the city while also ensuring the city meets the targets of sustainable development, systematically. [1]

The problem this study case talks about is the lack of commitment to the existing master plans, while the development of the world in this field, we still clearly miss the master plan here in Palestine as a whole and Series especially, which have a population of 6350 (according to Palestinian statistics department 2020).

Commitment to the master plan aims to enforce the law and control the situation, in case the community doesn't comply with it as what is happening right now, loss the public right, land assaults, and a messy situation will escalate, it is very important to do this case study for its big role in serves the citizens of Series village in particular and Jenin governorate in general.

Therefore, the old master plan will be evaluated and analyzed digitally and by maps, then prepare statistics and maps to be used by the actual planner for the new master plan to get this project out of the proposal into implementation.

Palestine in general and Series, in particular, have a lack of commitment to the existing master plans which leads to losses in the public right, land assaults, and a messy situation.

1-4 Literature review

The role of land-use changes in developing city spatial models in Jordan: The case of the Irbid master plan (1970–2017). this research focused on explaining the development stages of planning from 1970 to 2017 in Irbid city, by evaluating Irbid city maps at various time intervals, and it also investigates the temporal and spatial features of urban expansion. Finally, for a better understanding of the city expansion, the study closes with a spatial model of the city that includes structural designs and practical proposals for Irbid urban development. [24]

Expansion of the Urban Plan in the village of Al-Burj, west of Dura city. The researchers chose to re-create an urban plan for this village as well as surrounding villages as an area for the search. The work of a new master plan is working to resolve the multiple problems in this village which include the development of the old master plan for the village and modifying it. [25]

The current master plans will be analyzed in the Series case study, and the GIS software will be used to evaluate and analyze previous urban plans digitally and using maps, as well as contribute to the creation of new urban plans through maps and statistics. In comparison to earlier studies. As a result of the civilian lack of commitment to the previous urban plan, which resulted in an infringement on the common good and streets, it was necessary to perform a case study on what to do to order to set the ground for the new urban plan that will solve everything.

1-5 Methodology

The work of this project depends on a strategy followed by the following steps:

- **Step 1:** Identify the subject of the research in agreement with the supervisor and was (Geospatial for Urban Planning) and inquire about the study from the competent authorities such as the local government.
- **Step 2:** Dealing with case studies by analysis, characterization, and extracting the results to be used in our project.
- **Step 3:** Identify the work area of Series town and then pay a reconnaissance visit to the site and take a full idea of the nature of the project and the problems related to it and the important details of design and implementation to get the best and most accurate results.
- **Step 4:** Coordination with Series municipality about the area and subject of the study to help us to carry out this project, and this study was agreed to its importance, and the geoprocessing works will be done for it and then presented to the supervisor for approval and approval of the department on this case study. An official book has been issued from the department to obtain an orthophoto of the study area, in addition to the necessary information.
- **Step 5:** Obtain the aerial orthophoto of the Series region from the local government.
- **Step 6:** Going to the field and taking control points distributed throughout the town by the GNSS tool.
- **Step 7:** Start searching the library, website, and the journal's publishers for references and sources that can be used in this project
- **Step 8:** Start writing the project with due process and the conditions to be provided in the introduction, review the supervisor, and take his advice and opinion.
- **Step 9:** Overlay the previous master plans into the corrected orthophoto to ensure their legal validity and compatibility with the objectives of the project with all necessary adjustments to them, and complete any shortage in them if there is.
- **Step 10:** Identifying the problems and conflicts in the study area and their size.

1-6 Project scope

This study is composed of four chapters:

1. Chapter one Introduction: talking about the introduction, problem statement, aims, objectives, and methodology.
2. Chapter two Urban planning: describes the master plan from its definition and tells its uses.
3. Chapter three GIS: describes the GIS analysis tools and terminology.
4. Chapter four Data Collection and Processing: is focused on Data correction.
5. Chapter five results analysis.
6. Chapter six for conclusion and recommendations.

1-7 Study area

Series is a Palestinian old village, located to the south of the city of Jenin, 31 km and it is administratively affiliated to Silat Al Dhaheer Municipality, affiliated to Jenin District with an area of 12,495 dunums. It is bordered to the north by the village of Al- Jadida and Sir, to the west by the town of Maythalun, to the south by the village of Yasid, and to the east by the Wadi Al-Fara'a region. the study area is shown in figure 1-1. [6]

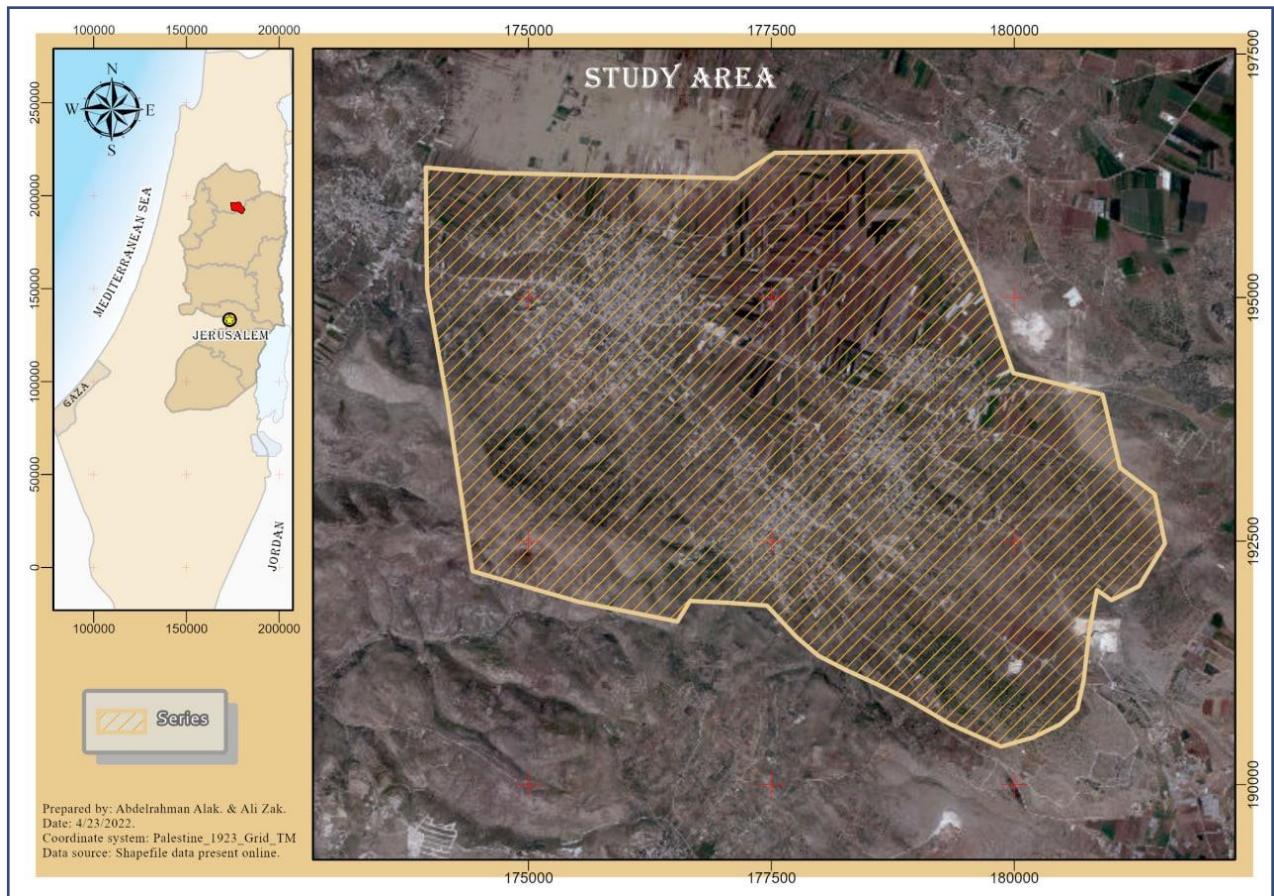


Figure 1- 1 : Study area

1-8 Project Timeline

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
Project selection and information collection	█	█	█																																
Site detection and reconnaissance			█	█																															
Fieldwork				█	█																														
Office work					█	█															█	█	█	█	█	█	█	█	█	█	█				
Preparing and studying the plans							█	█	█	█	█																								
Preparing the initial project report											█	█	█	█																					
Preparing the final project report																																			
Reviewing and printing initial project																█	█																		
Reviewing and printing final project																																			

Table 1-1 : Project Timeline

1-9 Programs that have been used in this study

- 1- ArcGIS Pro 3.0
- 2- QGIS.
- 3- AutoCAD.

Chapter two: Urban Planning

2-1 Introduction

2-2 Definition

2-3 Uses

2-4 Planning types

2-5 Planning components: (Requirements)

2-6 Mcloughlin's schematic series: (Urban Planning Procedure)

2-7 Urban planning pioneers: (examples)

2-1 Introduction

Urban planning is the art and science of organizing land use, building placement, and transportation networks to achieve the highest possible level of the economy, convenience, and beauty.

- ❖ An attempt to articulate the principles that should guide us in developing a civilized physical environment for human life, with the primary goal of anticipating and guiding change.
- ❖ Art of shaping and guiding the physical growth of a town by creating buildings and environments to meet various needs such as social, cultural, economic, and recreational, and to provide healthy living, working, playing, and relaxing conditions for both rich and poor people, thereby ensuring the social and economic well-being of the majority of mankind.

It's also a method for assisting a community in identifying its challenges and core values, developing goals and alternate approaches to accomplishing community goals, and avoiding unintended consequences of change. This planning process yields frameworks for dealing with change. Some are action-oriented concepts, such as the objective of becoming a major distribution center or stimulating investment in the city's core. Some are regulated, reflecting the community's goal to promote good growth while discouraging poor development. [1]

2-2 Definition

A city's urban planning concept is a set of eternally valid principles, phenomena, and aspects of spatial, functional, and operational arrangement in urban and landscape settings. It is usually based on the territory's potential, a city's function in the population system, and projections of its future size and character. In the context of population growth, the urban planning idea is a set of established principles and norms that ensure a balanced development of the settlement structure, settlements, and landscape. One of the duties of urban planning is to determine urban planning principles. [5]

2-3 Uses

2-3-1 The uses of urban planning

1. Regulating and coordinating land uses so that no conflict between them leads to negative effects.
2. Planning road networks to reach an easy and fast economic network.
3. Planning new suburban and city locations.
4. Replanning and renovating urbanely underdeveloped neighborhoods.
5. Improving the environment in general and the urban environment in particular.[5]

2-3-2 Reasons for urban planning

1. Improve and protect the environment in such a way that it is suitable for stability through environmental planning.
2. Creating job opportunities and suitable citizens through economic and urban planning.
3. Preserve environmental resources from unconsidered exploitation.
4. The optimal use of the civilian place in a way that facilitates the movement of the human being and makes it easy for obtaining their goods and needs for the development of their life, which is known as the functional or the moving aspect of planning.[5]

2-3-3 Objectives for urban planning

- Urban planning acts as the physical framework that contains all of the social, economic, and urban planning.
- Regulates the uses of the presence: residential- commercial - industrial, in other words, housing - work - and entertainment.
- Creating a network, services, and communities to accommodate the workers of these projects.
- Study the relationship of the study area to its surroundings in terms of location and function, as well as prioritize the identification of the areas for which the outline is prepared.
- Provide a network of roads and transportation connecting different parts.
- Providing an infrastructure network of electricity, energy, communications, water, drainage, etc. [23]

2-3-4 Planning processes

1. Select the target.
2. The possibility of achieving the goal with the available capabilities and resources.
3. The planning should be flexible.
4. Its duration should be agreed upon.
5. To have comprehensive and continuous thinking.
6. The plan should have legislative support to support it.
7. Their financing elements should be a benefit to them.[22]

2-3-5 Planning elements

1. Environment: It's the basis of the development of planning.
2. Technology: It's the one that leads to planning.
3. Society: This is where humans are.
4. Human: He is the planner and he is the beneficiary. [22]

2-3 Planning types

2-3-1 Basic planning types

1. Economic planning.
2. Social planning.
3. Urban planning.
4. Environmental planning.[1]

The types of planning vary depending on the place and sector in which it's planning and its intended goals so the other types of planning:

- a) Planning by inclusivity, including:
 1. Comprehensive planning: It covers all economic, social, and political sectors in countries and aims to achieve comprehensive and sustainable development in the country.
 2. Partial planning: It covers a particular economic sector, such as planning for the development of the industry sector.[1]
 - In our study, the planning followed comprehensive planning.
- b) Planning by time, and be:
 1. Short-term planning: The implementation plan is short to be extended from (1-2) years and has clear, detailed, and specific objectives.
 2. Medium-term planning: His plan lasts 3-5 years, and it's the pattern of planning in many Arab countries in general.
 3. Long-term planning: The duration of the plan is between 10 and 20 years to reach long-term development to achieve development in various areas.[1]

- In our study, the planning followed long-term planning.

c) Planning by location, including:

1. National planning: Planning covers all regions and territories within the borders of the State.
2. Regional Planning: Focuses on the development of one or several regions of the State, to find a balance in development between different regions.
3. Local planning: It is at the level of the administrative unit, such as a particular city or village. [1]

- In our study, the planning followed local planning, particularly for the village of Series.

2-4 Planning components: ((Requirements))

Proper and successful planning needs a range of basic elements, the most important of which are:

1. Specialized expertise in all aspects of planning.
2. Technical and administrative resources.
3. Data, statistics, and maps, the appearance of GIS have helped to serve planning purposes in all its different aspects, from valuable information about location, activities, and human and environmental phenomena, among others. [5]

2-5 Mcloughlin's schematic series: ((Procedure))

1. The decision-making phase is a long one and a meeting place for administrative methods with the technological and technical capacity associated with the institutions implementing the plan.
2. Accurately formulate and define goals, which is relatively long.
3. Identify the appropriate plan with the help of alternative models so that the plan is flexible and in line with the changes.
4. The evaluation phase and the appropriate plan is selected according to social influences and cost estimates.
5. The implementation phase is to start implementing the plan and may need alternative models to choose the appropriate ones.
6. The review and evaluation phase and this phase must go hand in hand with the plan to follow up on its functioning. [6]

2-6 Urban planning pioneers: ((examples))

2-6-1 Hippocampus of Miletus

- A pioneer of planning in the Greek era BC from Miletus, born at the end of the fifth century (480 B.C.), |
- Presents the idea of networking, square or perpendicular planning, streets with straight and parallel lines, on which vertical streets intersect vertically, this form has already appeared in the cities of Egypt, Iraq, and the Indus River Valley.
- Barclays tasked him with replanning the port of Athens with many curves, planned by several other cities such as Rhodes, Brunei, Miletus, and some North African cities. see the figure 2-1 & 2-2 & 2-3.[6]

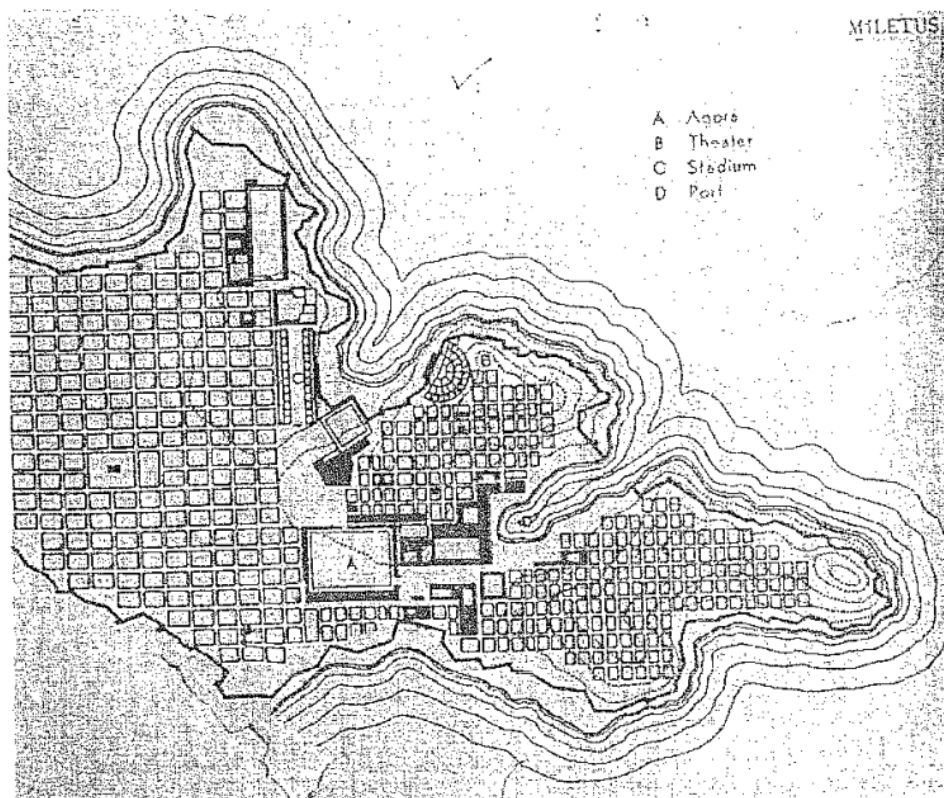


Figure 2- 1 : Hippocampus of Miletus [6]



Figure 2- 2 : Miletus city [6]

مدينة بيرين الإغريقية التي بناها الإسكندر الأكبر عام ٣٣٠ ق.

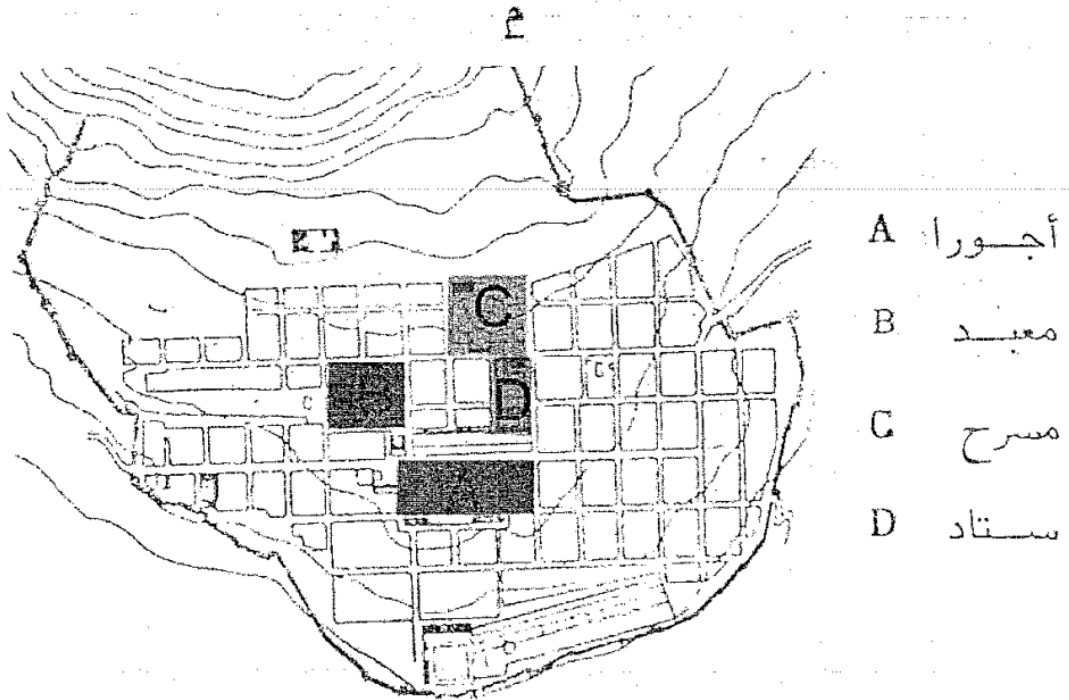


Figure 2- 3 : Beren City [6]

2-6-2 James Silk Buckingham-The model town idea creator

- A British architect and pioneer of planning, in 1849 research was published by him about problems resulting from the industry, and he prepared a blueprint for a model city of 10,000 people.
- He planned for upscale residence plans around the city center where public service buildings are clustered.
- Factories that use steam to operate their machines have planned their positions about half a mile away from the city.
- It was also suggested that the location of villas should be on the suburban agricultural land surrounding the city. see the figure 2-4. [6]

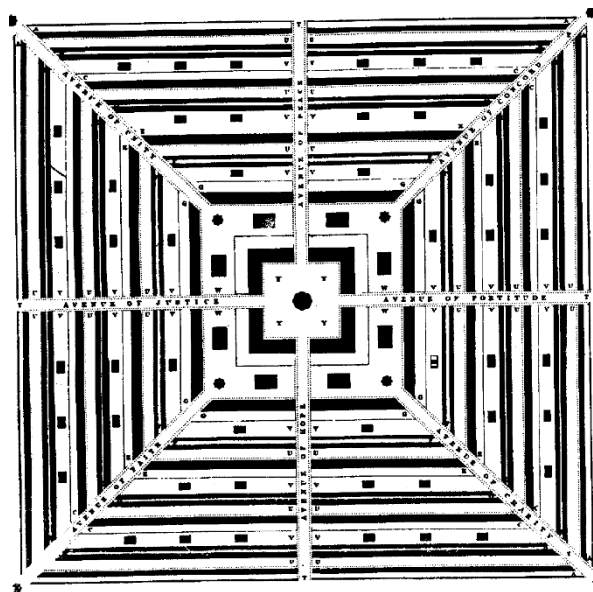


Figure 2- 4 : The model town [6]

2-6-3 Camillo Scheme

- A German scheme that emerged in the 19th century he created for Germany a national character for planning its cities and spreading its activity beyond Germany, planned some squares in France during the reign of Louis XIV and XV.
- His ideas are characterized by the architectural and planning development of medieval cities while retaining the view, character, and artistic taste of palaces, streets, and squares, both in form and function.
- Use public buildings as churches to close the perspective, especially in the squares, and make the intersection of the streets drift so that a perspective can be obtained for the whole street.
- It also used different levels of terraces, curtain walls, and staircase streets to give a beautiful architectural character and get rid of the boredom and repetition caused by square planning or any repeated planning. see the figure 2-5. [6]

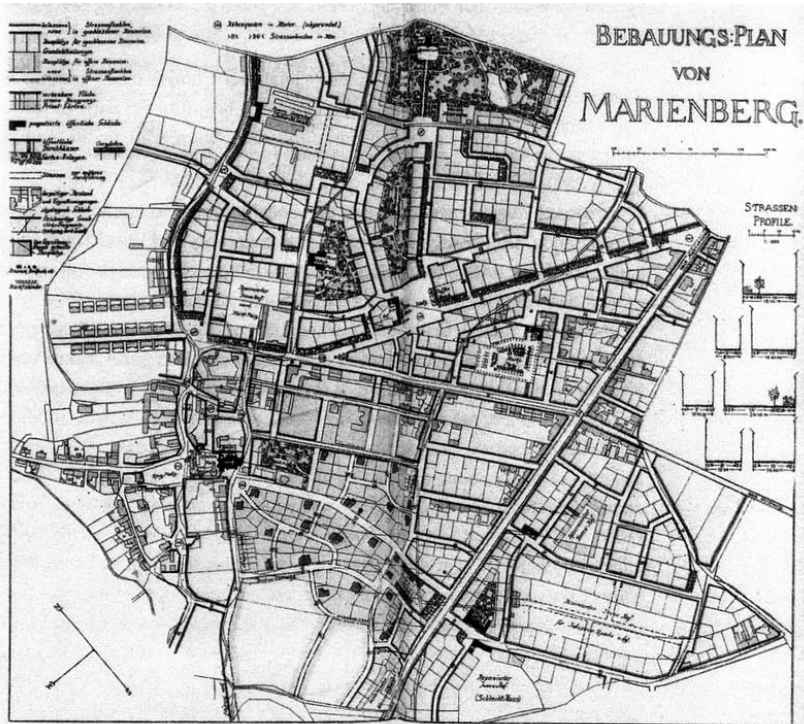


Figure 2- 5 : Bebauungs Plan [6]

2-6-4 Pierre Charles L'Enfant

- A French planner who planned Washington, the best example of planning a network of major roads above the Gedd site, planned two main sites, the Capitol - Congress and the White House, connecting them to a large garden street, and then planning a network of wide radiation streets that first appeared in America, with a network of square streets, resulting in the creation of plots of land in some sites of an abnormal shape. see the figure 2-6. [6]

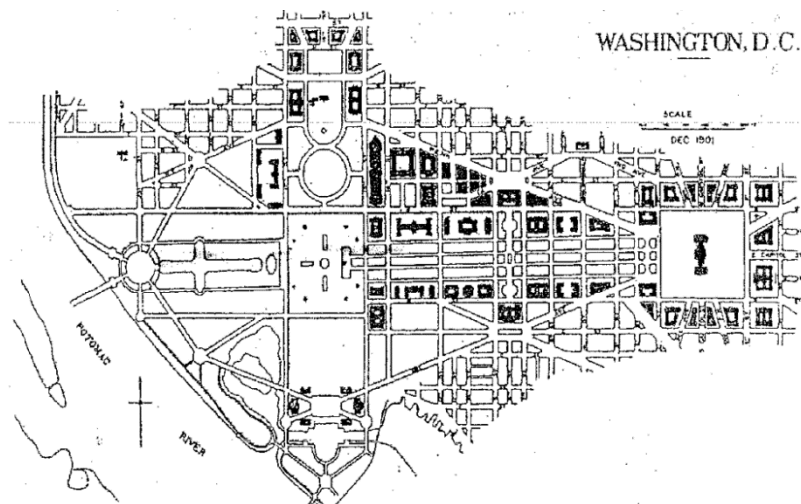


Figure 2- 6 : Washington D.C [6]

- The National Mall was the central point of McMillan's plan in 1901 and was the main open area where the principal could see the National Mall longitudinally. see the figure 2-7 & 2-8. [6]



Figure 2- 7 : Washington D.C [6]

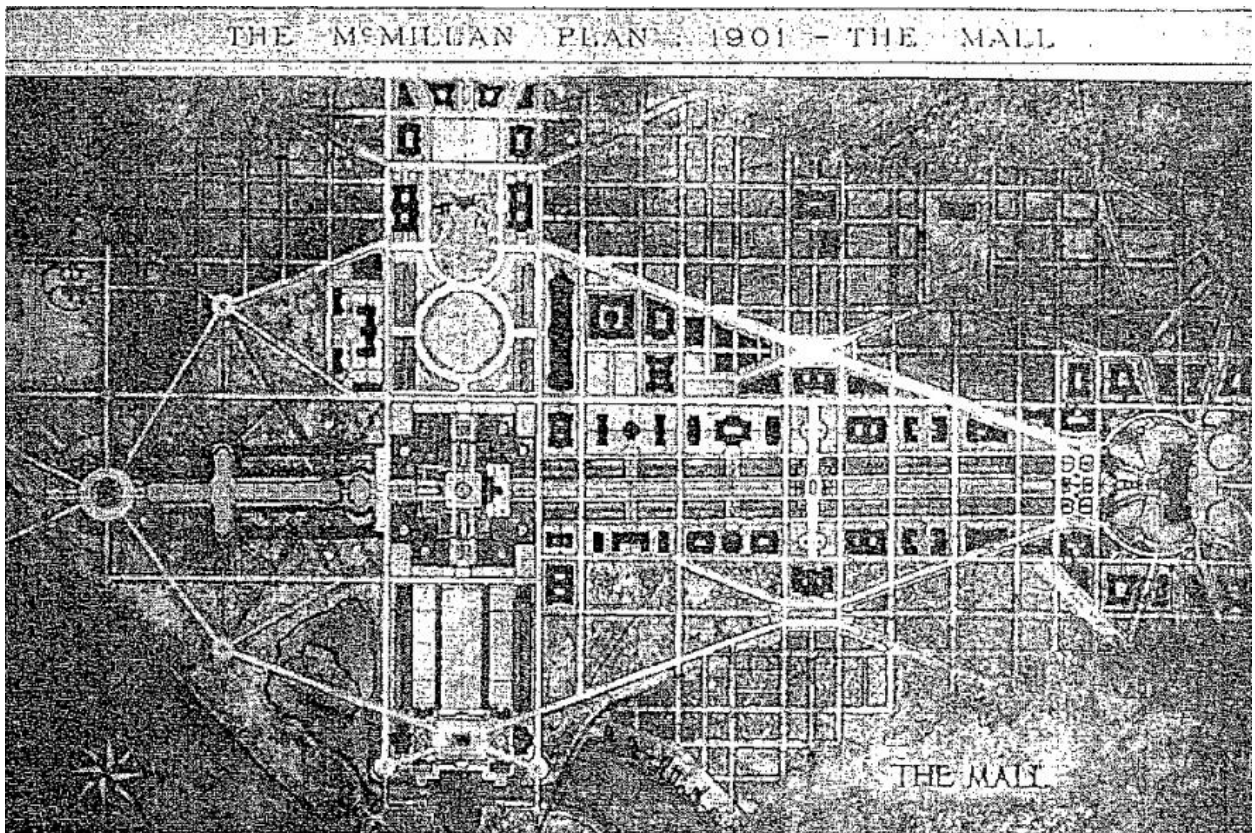


Figure 2- 8 : Washington D.C [6]

Chapter three: Geographic information system analysis

3-1 Introduction

3-2 GIS definition

3-3 GIS elements

3-4 GIS applications

3-5 GIS analysis

3-6 Coordinate system and GIS

3-7 Coordinate system in Palestine

3-1 Introduction

People usually face many problems, questions, and challenges that need support and assistance to confront and take decisions to solve them. For example, the urban planner faces questions in choosing the best site for establishing a new urban complex. The farmer faces a question about the properties of the soil in certain agricultural areas, the merchant faces a question about the best place to open his new store to get the largest profit, and the climate scientist faces questions about the development of the ozone hole in the last ten years, and the military commander also faces questions about the possibility of detecting forces The enemy and its weapons and equipment in the event of moving to a location, and to answer all these questions and many of them there is a need for the existence of special databases for these elements and linked to their geographical locations in nature, which is called (Spatial Data), and for this reason, technology appeared geographic information systems.[7]

This means the link between information and place, and this technology is used in various fields, including the field of urban planning by converting tables into maps and showing the data on maps. see the figure 3-1. [7]



Figure 3- 1 : Introduction to GIS [7]

3-2 GIS definition

The science of GPS has been defined by many specialists in several formats according to the point of view of each of them, yet the content remains the same. In the following, after the famous

definitions of the GIS, which approximate the full perception of the concept of this science. see the figure 3-2. [8]



Figure 3- 2 : GIS Definition [8]

- It is a type of IS (Information Systems) which is a geographical type where spatial data is placed on geographical maps and collected data and converted into maps. [8]
- It is a computer system that collects, maintains, stores, analyzes, outputs, and distributes data and is used in the field of planning and other various fields. [8]
- An advanced method used to collect, process, analyze and present spatial information in thematic tables or maps for many high-quality applications that are easy to visualize, computer screen, or freehand drawing. [8]
- A computer system is used to process, manage and analyze spatial data, i.e., geographically attributed to an area on the Earth's surface. [8]
- A powerful system for preparing maps and linking sites with information about them. [8]
- A computer-based method in collecting, processing, displaying, and analyzing data related to geographical location to extract important information in making appropriate decisions and used by qualified people to deal with it solve problems dealing with data and private information in the areas of development. [8]

- It is the science that is concerned with collecting, processing, and studying geographical information, and depends on recognizing maps, and aerial photographs, using tables, working on them, and making sure that they are completely correct and free from any errors so that they can be saved and used when needed, especially in cases that require study, or analysis by computer, map paper, or graphs. [8]
- It is the science of collecting, entering, processing, analyzing, displaying, and outputting geographical and descriptive information for specific purposes. This definition includes the ability of systems to enter geographical information (maps, aerial photographs, satellite visuals) and descriptive information (names, tables), process it (edit it from error), store, retrieve, query, analyze it (spatial and statistical analysis), and display it on a computer screen or paper in the form of maps, reports, and graphs. [8]
- Duiker Definition: "A geographic information system is a special case of information systems that contain information bases that depend on the study of the spatial distribution of phenomena, activities, and objectives that can be defined spatially as points, lines, or spaces to make the data ready for retrieval and analysis, or inquiring about data from through it". [8]
- Definition of Parker: "A geographic information system is an information technology system that stores, analyzes, and displays all spatial and non-spatial information". [8]

3-3 GIS element

A GIS is an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. GIS technology integrates common database operations, such as query and statistical analysis, with the unique visualization and geographic analysis benefits offered by maps. A working GIS integrates these five key components: [9]

1. Hardware
2. Software
3. Graphical & attribute data
4. People
5. Procedure. see the figure 3-3.

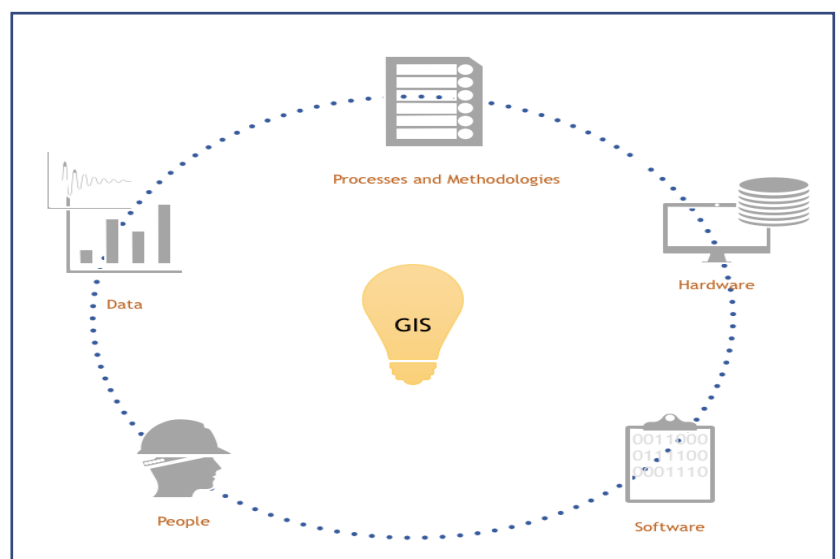


Figure 3- 3 : GIS elements [10]

3-3-1 Hardware

Hardware is the computer on which a GIS operates. today, GIS programs work on many types of computers, from mainframe services to serving giant projects to Personal Computers that can be used in business alone or in a network consisting of a group of personal computers, in addition to the spread of GPS devices, which are used to determine the coordinates of certain points on the surface of the Earth. [9]

3-3-2 Software

GIS programs provide tools and methods for storing, analyzing, and displaying geographic information. Among the basic components of GIS, programs are tools for inserting and adapting geographic information with the presence of GUI (Graphical User Interfaces a tool for easy communication between the device and the user. The programs consist of a set of basic components, which include: [9]

- Tools for storing different forms of metadata or geographic data.
- Integration with database software (Relational database).
- Research, analysis, and presentation tools.
- Graphical User interface (GUI) for easy handling of the program.
- Tools for creating Topological Relationships between GIS elements.
- Tools and means that allow a large number of users to enter data and work simultaneously and with high efficiency (Multi-User Management). [9]

3-3-3 Graphical & attribute data

Maybe the most important component of a GIS is the data. Geographic data and related tabular data can be collected in-house or bought from a commercial data provider. Most GIS employs a DBMS to create and maintain a database to help organize and manage data. At one time this consisted of hard-copy data, like traditional cartographic maps, surveyor's logs, demographic statistics, geographic reports, and descriptions from the field. Advances in spatial data collection, classification, and accuracy have allowed more and more standard digital base maps to become available at different scales. Data within GIS is divided into [9]

- **Tabular Data:** It includes data from tables and various statistics about natural elements that can be represented by nature.
- **Spatial data:** It includes geographical data that represents nature and can be collected from aerial photos, satellite images, and digital maps (Aerial Photos, Satellite Images, Digital Maps). Or buy it from a data source.

3-3-4 People

GIS technology has limited value without the people who manage the system and create plans to apply it to real-world problems. GIS users range from technical professionals who design and develop the system, to those who use it in their daily work. [9]

3-3-5 Procedure

A successful GIS operates based on a well-designed plan and business rules that are the models and specialized practical practices for each institution. Examples of analytical methods are the application of functions related to sciences such as climate, hydrology, or urban planning through GIS, or the application of quality control methods. (Quality Control) to ensure the accuracy of data entry, network analysis, or other analytical means that serve different applications. [9]

3-4 GIS applications

Geographic Information Systems (GIS) have different applications, and technological advancements have significantly enhanced GIS data, specifically how it can be used and what can be achieved as a result. Geographic Information Systems are a decision-making tool for any business or industry since it allows the collection, storage, management, and analysis of environmental, demographic, and topographic data. In this project, the focus will be on urban planning applications. [7]

Geographic Information Systems is a broad field in information technology that, like any other burgeoning technology, has a wide range of applications across a wide range of industries. The Geographic Information System (GIS) is used to raise awareness and share information about the environment, natural resources, potential disasters, risks, and planned urban routes. Organizations such as ESRI, Here Maps, and Leidos Group are developing models for natural resources, advanced driving systems, and even national defense systems. People and organizations can use GIS applications to conduct geological observations and analyze spatial data in granular detail. [7]

While maps and cartography were once limited to a few applications, geographic information systems (GIS) and geographic science now have applications in almost every field. GIS is used in everything from urban planning to environmental conservation to healthcare and marketing. It combines the science of geography with various types of data to reveal insights and patterns that help people make better decisions. While traditional GIS roles focused on data collection and basic analysis, the field's future is multi-disciplinary. Because of this new approach and GIS's broad reach. [7]

Geographical research is a search for answers to questions or queries about space, society, humanity, and natural processes. Geographical Information Systems (GIS) aid in the study's progress by allowing for high-accuracy data capture, database management, information handling, and analysis of complex phenomena within an interactive user interface environment. Mountains have verticality and variations in their landscape. The use of GIS in geographical research allows for the analysis of specific mountain landscape properties with a high level of accuracy. This paper is an attempt to demonstrate the utility of GIS in geographical research in the context of mountains using secondary data from a variety of sources. The introduction of GIS and its development in Nepal, research issues,

GIS application and challenges, and the new strategy for the application of GIS in the mountain context are all explained in detail. [7]

3-4-1 GIS applications in urban planning

3-4-1-1 Land use

Where it is possible to determine the quality of the use of the land, whether it is residential, industrial, commercial, or service by collecting data on the use of the land and giving each use a different color. It is agreed that the residential color is yellow and the commercial color is red, and so on. Then it appears on the maps to know the uses of each plot of land. The urban planner benefits from this area in the division of services, the distribution of housing for an area to be established, and the distribution of commercial centers and others. see the figure 3-4. [10]

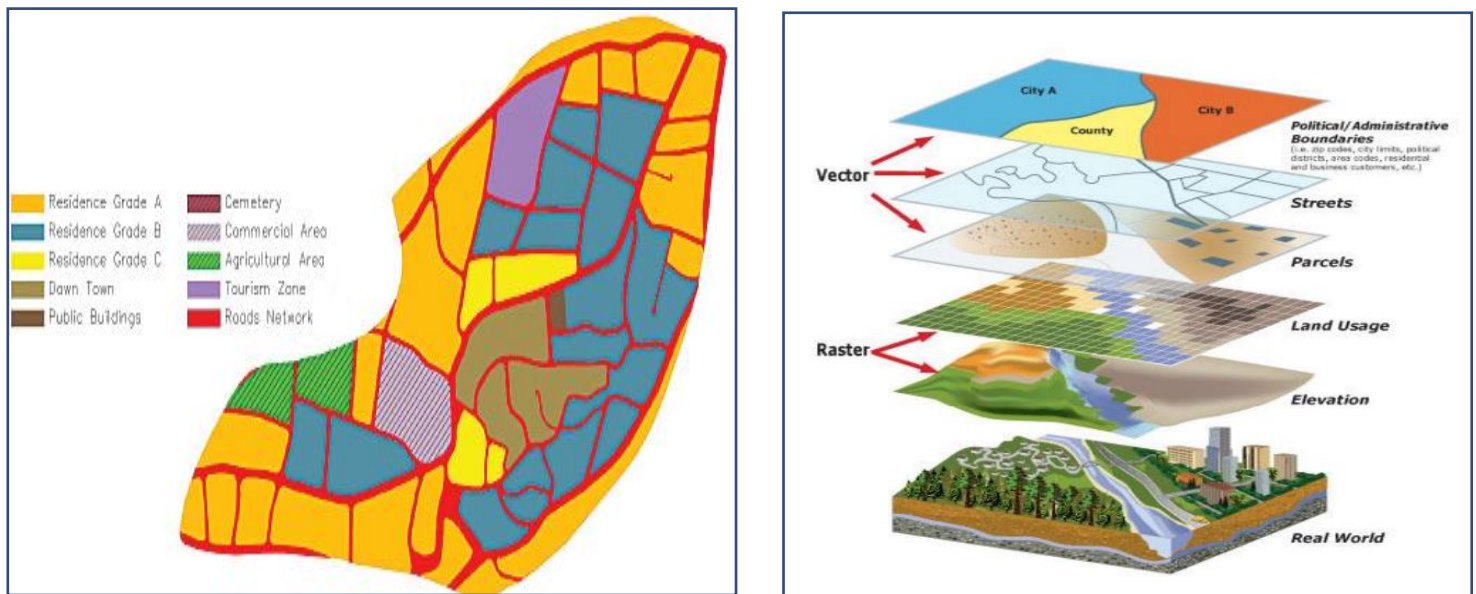


Figure 3- 4 : GIS application (land use) [11]

3-4-1-2 Roads

The urban planner uses it in the study of regional, national, main, and secondary roads and their distribution and distribution of urbanization and buildings in places parallel to road lines to facilitate transportation, reduce transportation costs and facilitate the process of movement for residents, workers, and others, and in planning modern roads and bridges, establishing and conducting planning operations at lower costs by taking into account the shorter distance. [10]

3-4-1-3 Neighborhoods study

The urban planner takes advantage of this field when planning new large cities when dividing them into neighborhoods or when studying a large pre-built area such as the city of Cairo. [10]

3-5 GIS analysis

3-5-1 GIS overlay

As shown in the example below, where parcels (polygons) and flood zones (polygons) are overlaid (using the Union tool) to create a new polygon dataset, an overlay operation is much more than a simple merging of linework; all the attributes of the features participating in the overlay are carried through. The parcels are split where the flood zone boundary crosses them, and new polygons are produced. The FID flood value determines whether polygons are outside (-1) or inside the flood zone, and all polygons keep their original land-use category values. see the figure 3-5. [11]

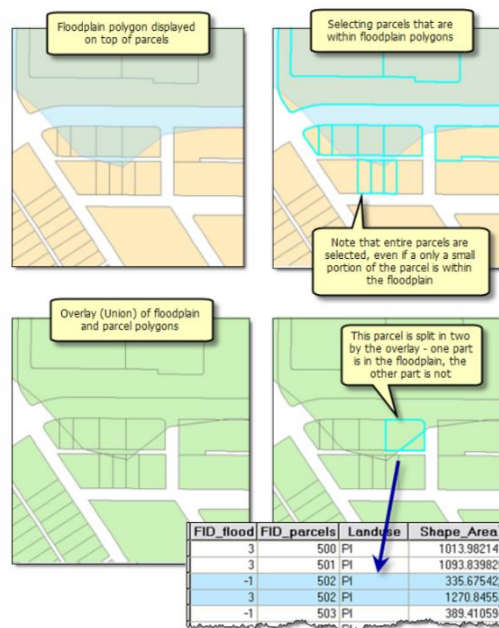


Figure 3- 5 : GIS overlay [12]

Select all polygons within the flood zone (using the Select Attribute By Layer tool, for example) and sum the area by land-use type to get the total area of each land-use type in the flood zone (using the Frequency tool). The result of this calculation is depicted in the figure 3-6. [11]

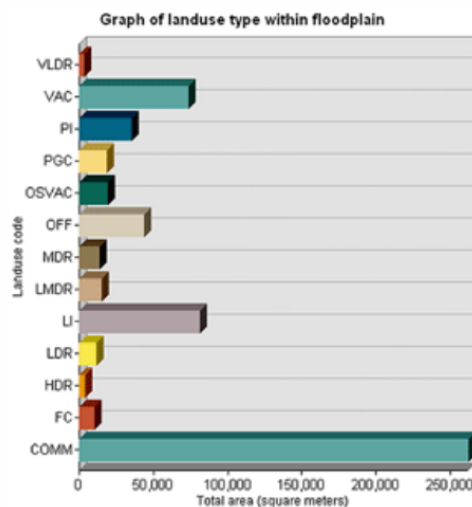


Figure 3- 6 : Graph of land use type [11]

To compute the amount of each vegetation type in each watershed, you'd overlay watershed boundaries with a vegetation layer. [11]

To generate a new line feature class, logging roads (lines) and vegetation types (polygons) are overlaid in the figure below. Where the lines intersected with polygons, they were separated, and each line feature was given the properties of both original layers. The vegetation types associated with each line are shown as symbols. see the figure 3-7. [11]

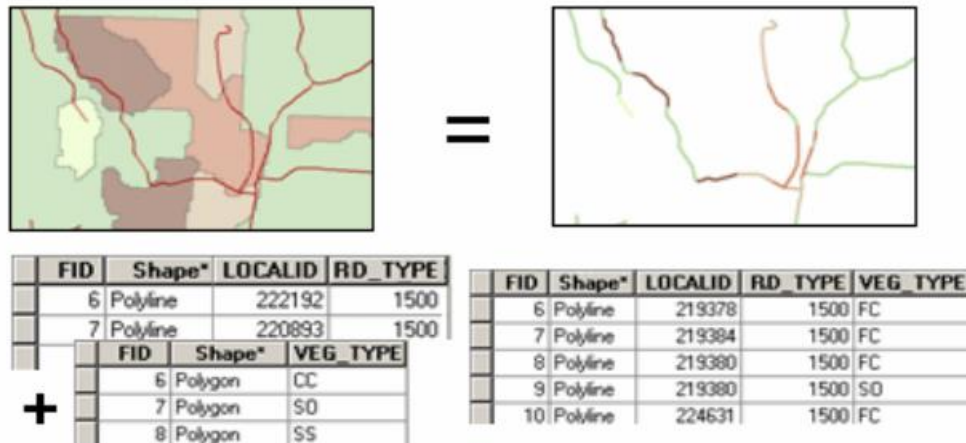


Figure 3- 7 : Feature line example [11]

Overlay analysis can be used to merge the properties of multiple datasets into a single one. Then you can look for specific locations or areas that have a specific set of attribute values, or that meet the criteria you select. This method is frequently used to locate areas that are ideal for a specific application or are at risk. To locate places susceptible to wildfire, you might overlay layers of vegetation type, slope, aspect, soil moisture, and so on. [11]

An overlay of steep slopes, soils, and vegetation is shown below. The intersection of the input polygon borders produces new polygons. The polygons that emerge have all of the properties of the source polygons. see the figure3-8. [11]

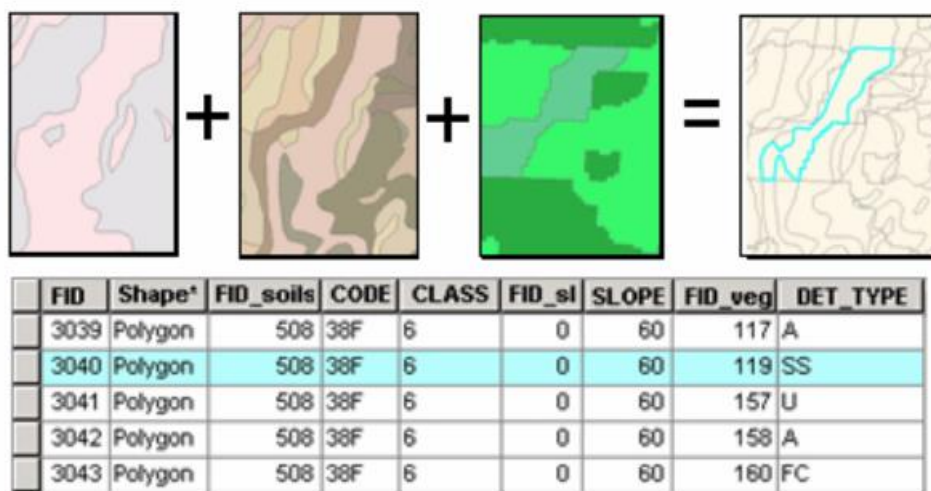


Figure 3- 8 : Feature polygon example [11]

Overlay analysis is frequently employed in conjunction with other forms of analysis. For example, datasets obtained from proximity analysis (such as the Buffer tool) or surface analysis could be included (the Slope or Aspect tool). Similarly, you'll probably do more analysis on the overlay findings, such as extraction to pick a subset of features or generalization (to dissolve polygons, for example). The overlay is frequently one phase in an analysis model or process, and it can occur at any point during the process. [11]

3-5-2 Overlay methods

Overlay analysis is frequently employed in conjunction with other forms of analysis. For example, datasets obtained from proximity analysis (such as the Buffer tool) or surface analysis could be included (the Slope or Aspect tool). Similarly, you'll probably do more analysis on the overlay findings, such as extraction to pick a subset of features or generalization (to dissolve polygons, for example). The overlay is frequently one phase in an analysis process or model, and it can occur at any point during the process. [11]

3-5-2-1 Feature overlay

The input layer, overlay layer, and output layer are the three main components of feature overlay. When features in the input layer overlap with features in the overlay layer, the overlay function divides them. Where polygons overlap, new areas are produced. Where polygons cross the lines in the input layer, the lines are split. The output layer stores the additional features, while the original input layer remains unchanged. Along with the original characteristics from the input layer, the attributes of features in the overlay layer are allocated to the corresponding new features in the output nodes. [11]

An example of a line-on-polygon overlay is shown below. At the polygon bounds, the line is split, and each of the resulting line features includes the original line properties as well as the polygon's attributes. see the figure 3-9. [11]

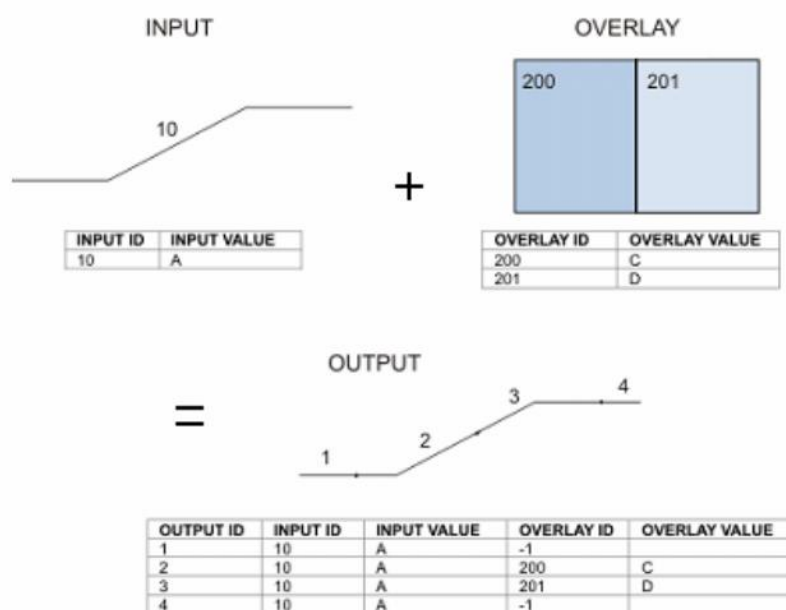


Figure 3-9 : line-on-polygon overlay [11]

3-5-2-2 Overlay raster

Each cell of each layer in the raster overlay refers to the same geographic region. As a result, it's ideal for merging characteristics from multiple levels into a single layer. Each characteristic is usually given a numerical value, allowing you to combine the layers mathematically and provide a new value to each cell in the output layer. [11]

An example of a raster overlay by addition is shown below. Two input rasters are combined to produce an output raster that sums the values of each cell. see the figure 3-10. [11]

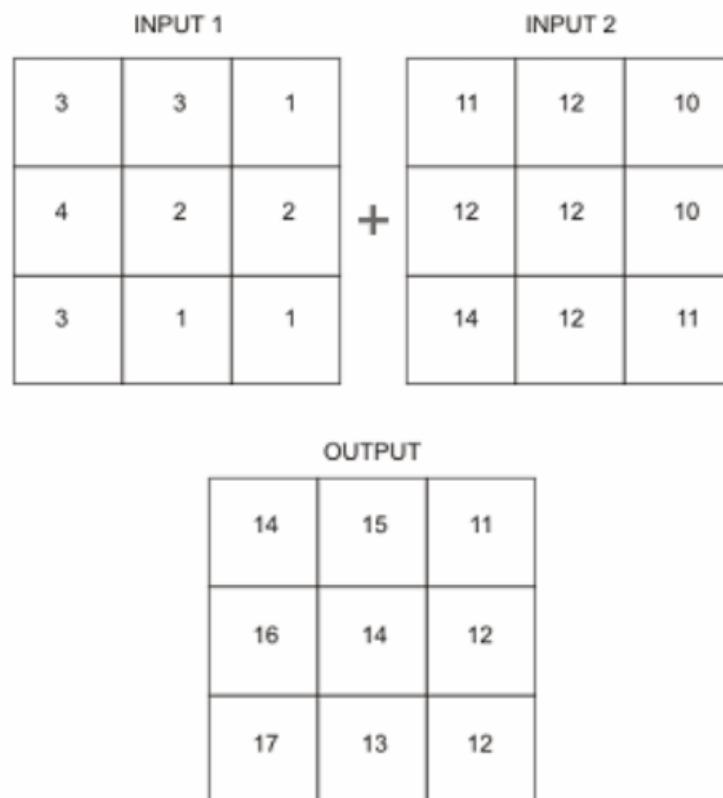


Figure 3-10 : Raster overlay by addition [11]

This method is frequently used to rank attribute values according to their suitability or danger, then add them together to obtain an overall rank for each cell. The relative importance of the various levels can also be allocated to generate a weighted ranking (the ranks in each layer are multiplied by the weight value of that layer before being totaled with the other layers). [11]

A raster overlay by addition for suitability modeling is shown below. On a scale of 1 to 7, three raster layers (steep slopes, soils, and vegetation) are assessed for development suitability. Each cell is scored on a scale of 3 to 21 once the layers are added (bottom). see the figure 3-11. [11]

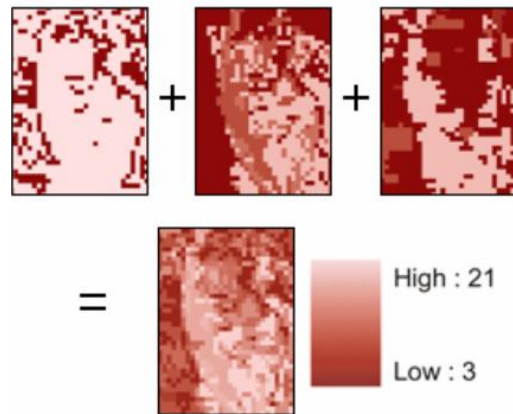


Figure 3- 10 : Raster overlay for suitability modeling [11]

Alternatively, you can use unique combinations of values from numerous input layers to assign a value to each cell in the output layer. [11]

3-5-3 Overlay tools

3-5-3-1 Feature overlay tools

The Analysis toolbox in the Overlay toolset contains the feature overlay tools. The tools are conceptually similar, but they differ in terms of which feature types you may overlay, whether you can overlay many layers at once and whether input and overlay features are kept in the output layer. [11]

3-5-3-1-1 Identity

Computes a geometric intersection of the input features and identity features. The input features or portions thereof that overlap identity features will get the attributes of those identity features. see the figure 3-12. [11]



Figure 3- 11 : Identity tool [11]

3-5-3-1-2 Intersect

Computes a geometric intersection of the input features. Features or portions of features that overlap in all layers and/or feature classes will be written to the output feature class. see the figure 3-13. [11]



Figure 3- 12 : Intersect tool [11]

3-5-3-1-3 Symmetrical Difference

Features or portions of features in the input and update features that do not overlap will be written to the output feature class. see the figure 3-14. [11]



Figure 3- 13 : Symmetrical difference tool [11]

3-5-3-1-4 Union

Computes a geometric union of the input features. All features and their attributes will be written to the output feature class. see the figure 3-15. [11]

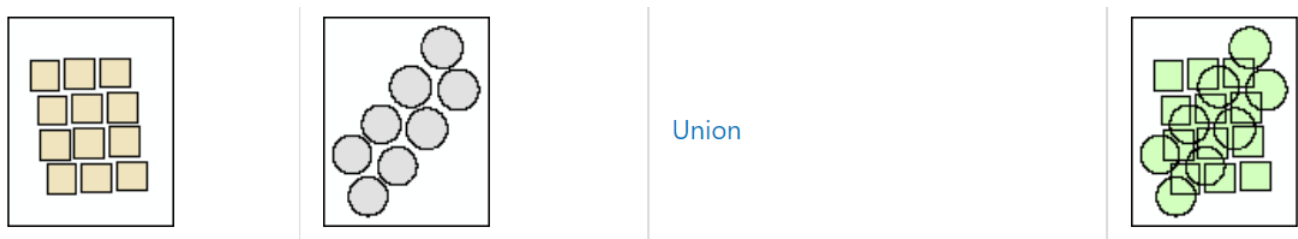


Figure 3- 14 : Union tool [11]

3-5-3-1-5 Update

Computes a geometric intersection of the Input Features and Update Features. The attributes and geometry of the input features are updated by the updated features in the output feature class. see the figure 3.16. [11]

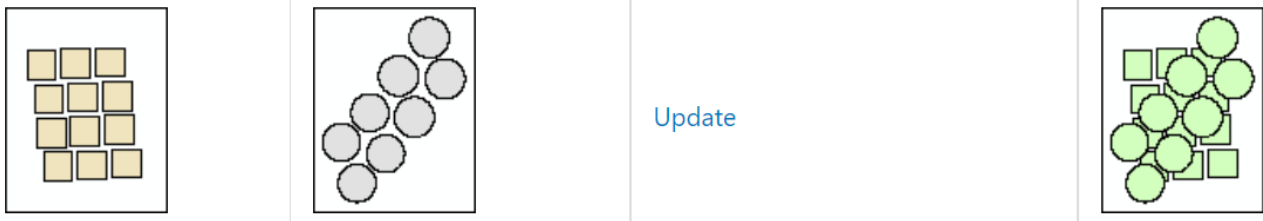


Figure 3- 15 : Update tool [11]

3-5-3-2 Raster overlay tools

Raster overlay tools are located in several toolsets in the Spatial Analyst toolbox. Spatial Analyst is an ArcGIS extension that is licensed separately. If your site has a Spatial Analyst license and the Spatial Analyst extension has been installed, you will have access to the Spatial Analyst toolbox in Arc Toolbox. [11]

3-5-3-2-1 Weighted Sum

Overlays several rasters, multiplying each by their given weight and summing them together. see the figure 3-17.

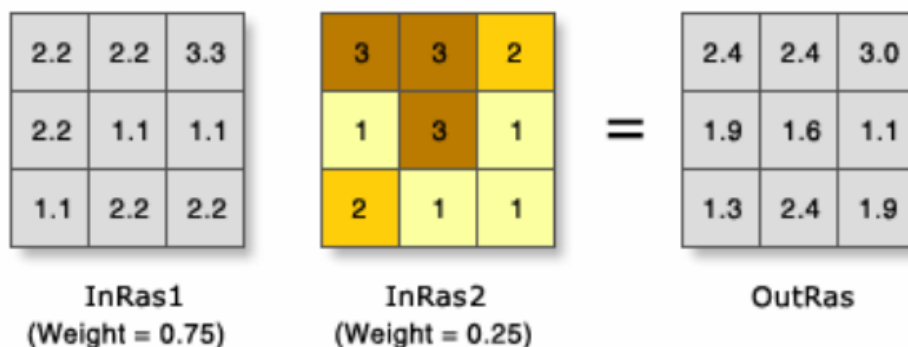


Figure 3- 16 : Weighted Sum tool [11]

In the illustration, the cell values are multiplied by their weight factor, and the results are added together to create the output raster. For example, consider the upper-left cell. The values for the two inputs become $(2.2 * 0.75) = 1.65$ and $(3 * 0.25) = 0.75$. The sum of 1.5 and 0.75 is 2.4. [11]

3-5-3-2-2 Weighted Overlay

Overlays several rasters using a common measurement scale and weights each according to its importance. see the figure 3-18. [11]

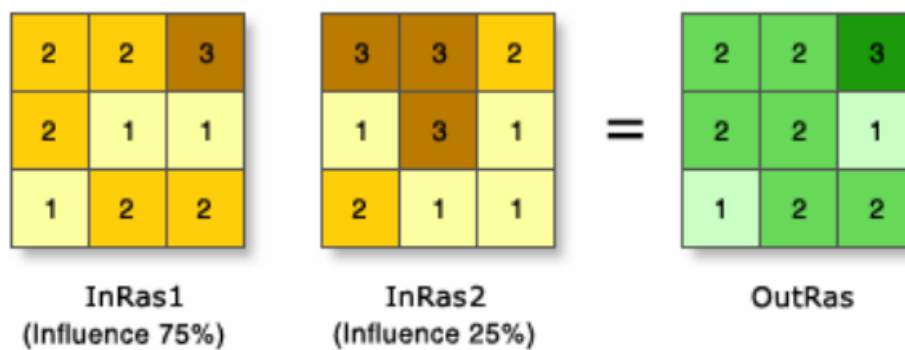


Figure 3- 17 : Weighted Overlay tool [11]

In the illustration, the two input rasters have been reclassified to a common measurement scale of 1 to 3. Each raster is assigned a percentage influence. The cell values are multiplied by their percentage influence, and the results are added together to create the output raster. For example, consider the upper-left cell. The values for the two inputs become $(2 * 0.75) = 1.5$ and $(3 * 0.25) = 0.75$. The sum of 1.5 and 0.75 is 2.25. Because the output raster from Weighted Overlay is an integer, the final value is rounded to 2. [11]

3-5-3-2-3 Combine

Combines multiple rasters so that a unique output value is assigned to each unique combination of input values. see the figure 3-19. [11]

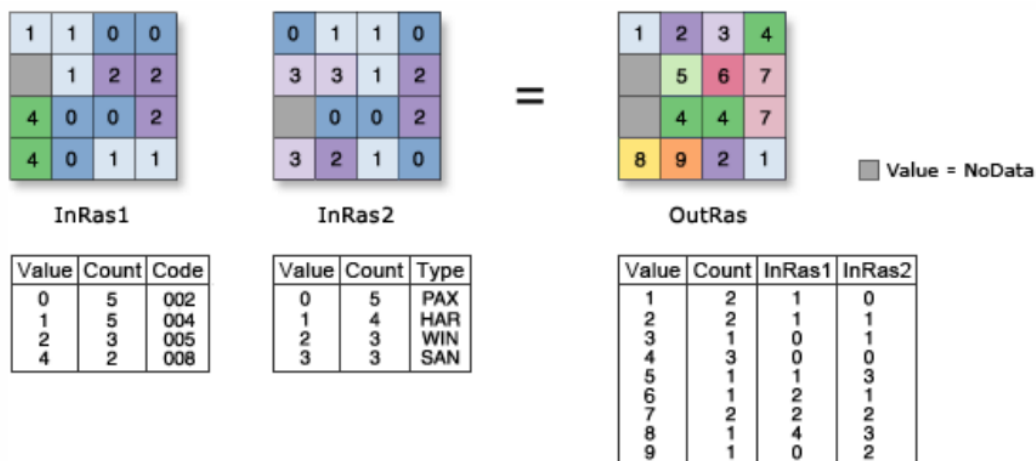


Figure 3- 18 : Combine tools [11]

3-5-3-2-4 Zonal Statistics

Calculates statistics on values of a raster within the zones of another dataset. see the figure 3-20. [11]

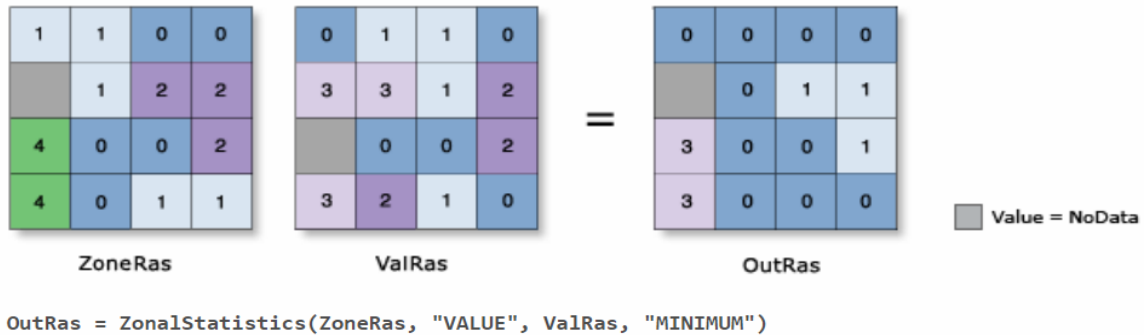


Figure 3- 19 : Zonal Statistics tool [11]

3-6 Coordinate system and GIS

Implicit with any GIS data is a spatial reference system. It can consist of a simple arbitrary reference system such as a 10 m x 10 m sampling grid in a wood lot or, the boundaries of a soccer field, it can consist of a geographic reference system, i.e., one where the spatial features are mapped to an earth-based reference system. The focus of this topic is on earth reference systems which can be based on a Geographic Coordinate System (GCS) or a Project Coordinate System (PCS). [7]

3-6-1 Geographic Coordinate Systems

A geographic coordinate system is a reference system for identifying locations on the curved surface of the earth. Locations on the earth's surface are measured in angular units from the center of the earth relative to two planes: the plane defined by the equator and the plane defined by the prime meridian (which crosses Greenwich England). A location is therefore defined by two values: a latitudinal value and a longitudinal value. see the figure 3-21. [7]

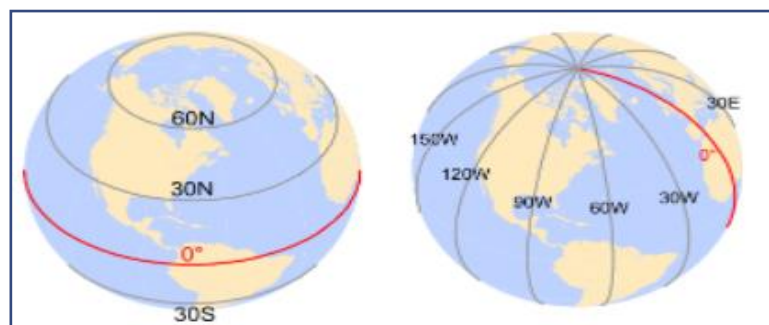


Figure 3- 20 : latitudinal and longitudinal [7]

to the location on the earth's surface. Longitude measures the angle between the prime meridian plane and the north-south plane that intersects the location of interest. For example, Colby College is located at around 45.56° North and 69.66° West. In a GIS system, the North-South and East-West directions are encoded as signs. North and East are assigned a positive (+) sign and South and West are assigned a negative (-) sign. Colby College's location is therefore encoded as +45.56° and -69.66°. [7]

3-6-2 Sphere and Ellipsoid

Assuming that the earth is a perfect sphere greatly simplifies mathematical calculations and works well for small-scale maps (maps that show a large area of the earth). However, when working at larger scales, an ellipsoid representation of the earth may be desired if accurate measurements are needed. An ellipsoid is defined by two radii: the semi-major axis (the equatorial radius) and the semi-minor axis (the polar radius). see the figure 3-22. [7]

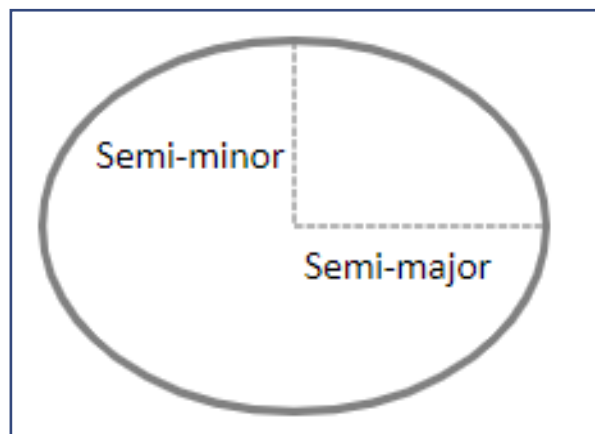


Figure 3- 21 : Ellipsoid shape [7]

The reason the earth has a slightly ellipsoidal shape has to do with its rotation which induces a centripetal force along the equator. This results in an equatorial axis that is roughly 21 km longer than the polar axis. see the figure 3-23. [7]

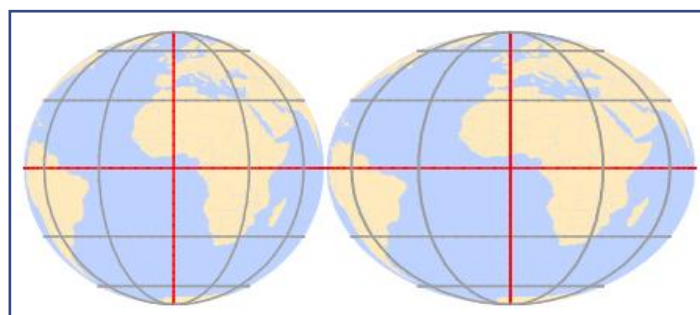


Figure 3- 22 simple sphere (left) & ellipsoid (right) [7]

3-6-3 Geoid

In a GIS environment, it's critical to represent the earth's true shape, the geoid, as a mathematical model. The earth's surface, however, is not perfectly smooth. It has undulations on its surface caused by changes in gravitational pull. Although these undulations aren't visible to the naked eye, they are measurable and can affect locational measurements. Note that we are not discussing mountains or ocean bottoms; instead, we are concentrating solely on the earth's gravitational potential, which is best visualized by imagining the earth's surface completely submerged in water and measuring the distance between the earth's center and the water surface over the entire earth surface. see the figure 3-24. [7]

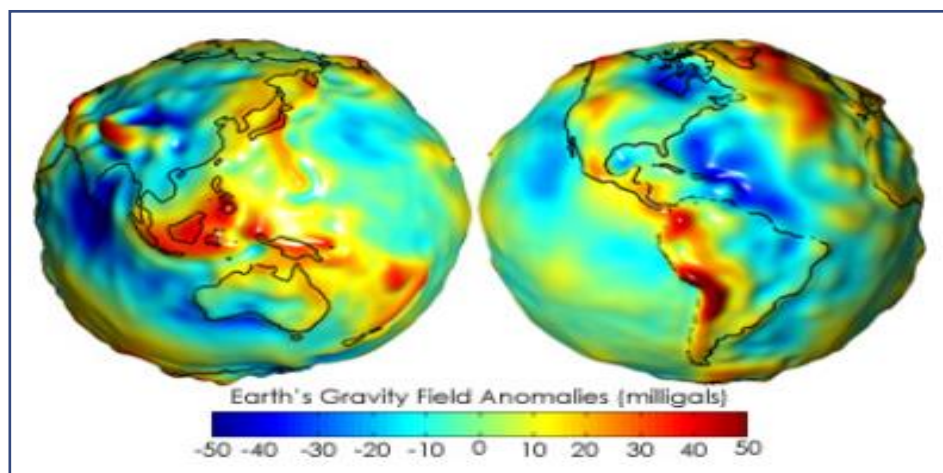


Figure 3- 23 : Earth geoid [7]

The flow of the earth's hot and fluid core is linked to the dynamic gravitational field. As a result, its geoid is constantly changing, albeit over a long period. Geodesy, a branch of applied mathematics, is concerned with the measurement and representation of the earth's shape. [7]

3-6-4 Datum

So, how do we reconcile our need to work with a (simple) mathematical model of the earth's shape with the geoid's undulating nature? The geoid should be aligned with the earth's ellipsoid (or sphere) representation, and the earth's surface features should be mapped onto this ellipsoid/sphere. The alignment can be local, with the ellipsoid surface closely fitting the geoid at a specific location on the earth's surface (such as Kansas), or geocentric, with the ellipsoid aligned with the earth's center. A datum is determined by how the ellipsoid is aligned with the geoid.[7]

3-6-5 Map projection

Your data will need to know how to draw after it has determined where to draw. The earth's surface is round, as is your GCS, but your map is flat, as is your computer screen. That is a significant issue. The round earth will deform if drawn on a flat surface. Consider attempting to lay an orange

peel flat on a table after peeling it. You can get close if you tear the peel apart first. Map projections are useful in this situation. They tell you how to distort the earth—how to tear and stretch that orange peel—so that the most important parts of your map are the least distorted and appear best on the map's flat surface. see the figure 3-25. [7]



Figure 3- 24 : Map projection [7]

You may already be aware that there are numerous map projections, each of which depicts the earth differently. Some are useful for preserving map areas, while others are useful for preserving angles or distances. [7]

A projected coordinate system (PCS) is a GCS that has been flattened using a map projection. [7]

Before your data can figure out where it is on the planet, it needs to have a GCS. Projecting your data is an option, but not your map. Because maps are flat, you'll need a PCS to know how to draw. [7]

3-7 Coordinate system in Palestine

For engineering applications, cadastral surveys or mapping were commonly built using local networks of horizontal triangulation points and leveling benchmarks. These points served as quality control and reference point for surveying operations. The network of geodetic triangulation was established in Palestine from the beginning. see the figure 3-26. [12]

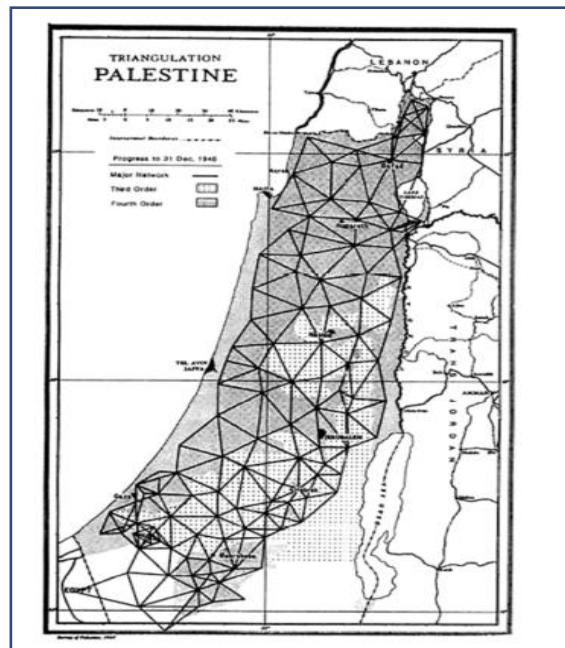


Figure 3- 25 : Geodetic Network of Palestine [12]

Angular triangulations and traverses were used from the 1920s to 1947. There were approximately 15,000 points in the network, ranging from major points (2nd order) to fourth-order points. Local surveyors occasionally prepared extra points during cadastral surveys. [12]

The leveling benchmarks network, on the other hand, was established in the 1920s and 1930s using precise differential leveling, starting from a gauge point in the Mediterranean Sea in Gaza City. Between the middle of the 1970s and the middle of the 1980s, a densification process was carried out between the major benchmarks. Since the early 1990s, both horizontal and vertical networks have been destroyed as a result of urban expansions or deliberate destruction by individuals motivated by political curiosity. [12]

The static observation was used to observe a selected group of points as a GNSS network in 1999. Based on the ITRF96 coordinate system, the network was adjusted to WGS84 coordinates. The transformation parameters were calculated using the original Pal1923Grid coordinates as a single solution for Palestine and two additional solutions for the West Bank and Gaza Strip, respectively (Mason 1999). [12]

Finally, because Palestine is located on the border between two tectonic plates (the Sinai and Arabian plates) along the Jordan Valley and the Dead Sea Rift, the geodetic network has been subjected to effective earth kinematics for over a century (GFZ-Potsdam 2019). As a result, the points had relative displacements of up to 30 cm. For some single points, additional local movements due to stone industries and urban projects must be considered. [12]

Because geodetic network calculations are based on three-dimensional geocentric coordinates or equivalent geographic coordinates, a reference ellipsoid is chosen to calculate three-dimensional

coordinates. After that, using a proper map projection, the three-dimensional coordinates are converted to horizontal easting and northing coordinates. Surveyors and engineers can use the horizontal coordinates to conduct cadastral, engineering, and mapping surveys. The coordinate system (Pal1923Grid) based on the Cassini-Soldner (Cassini) map projection was used for all engineering and cadastral surveys in Palestine (Epsg 2020). [12]

During World War II, a modified system for military mapping was used, which used the Pal1923Belt Transverse Mercator (TM) map projection, which was based on the same datum as Pal1923Grid (Epsg 2020). Even though both projections are cylindrical, they have different properties and applications, resulting in different coordinates and distortions (Snyder 1). [12]

The Palestinian Surveying Department requested that land surveyors add a set of parameters to their GNSS data collectors for cadastral surveys in 2018, claiming that the resulting coordinates will be compatible with Pal1923Grid coordinates even if Transverse Mercator Projection and different parameters are used. This system, known as New Pal TM, was based on ITRF2000 at epoch 2004.75 and was copied from the IGD05/12 system (Georepository 2019). see the figure 3-27. [12]

Parameter	Pal1923Grid	Pal1923Belt	New Pal-TM ¹
Ellipsoid	Clark 1880	Clark 1880	GRS 80
Semi-major axis	6378300.789m	6378300.789m	6378137.00m
Inverse flattening	293.4663155389802	293.4663155389802	298.257222100882
Projection type	Transverse Cylinder	Transverse Cylinder	Transverse Cylinder
Projection Name	Cassini-Soldner	Transverse Mercator	Transverse Mercator
Latitude of origin	31.73409694444445°	31.73409694444445°	31.73439361°
Central meridian	35.21208055555556°	35.21208055555556°	35.20451694°
False easting	170251.555 m	170251.555 m	169529.584 m
False northing	126867.909 m	126867.909 m	126907.39 m
Scale	1	1	1.0000067
Datum	Palestine_1923	Palestine_1923	ITRF00/2004.75
EPSG code	28191	28192	--
Usage	Cadastral/Engineering	Cartography/Mapping	Cadastral/Engineering

The transformed three dimensional coordinates projected coordinates are assumed to be equal to Pal1913Grid coordinates, although the different map projection and reference ellipsoid are integrated with a different datum.

Figure 3- 26 : Projected coordinate systems in Palestine [12]

The widespread adoption of modern geospatial technologies and applications necessitated the establishment of relationships between various datum and coordinate systems. The WGS84 or international terrestrial reference frames and systems (ITRF) is used to collect data and conduct surveys using GNSS technologies (ITRF 2019). Satellite images are also based on a variety of global systems. GIS software handles data from a variety of sources. [12]

Chapter four: Data collection and processing

4-1 Data collection in the survey

4-2 GNSS

4-3 Photogrammetry

4-1 Data collection

There are many methods to gather information in the survey

4-1-1 Land Surveying

The technique, profession, and science of accurately determining the terrestrial or three-dimensional position of points, as well as the distances and angles between them, is known as surveying or land surveying. It is commonly practiced by licensed surveyors and members of various building professions. These points are usually found on the Earth's surface and are frequently used to establish land maps and boundaries for purposes of ownership, location (building corners, surface location of subsurface features), and other government or civil law requirements (property sales). Surveyors use elements of mathematics (geometry and trigonometry), physics, engineering, and law to achieve their goals. [9]

The science and art of making all essential measurements to determine the relative position of points or physical and cultural details above, on, or beneath the surface of the Earth, and to depict them in a usable form, or to establish the position of points or details, according to the American Congress on Surveying and Mapping (ACSM). see the figure 4-1. [9]

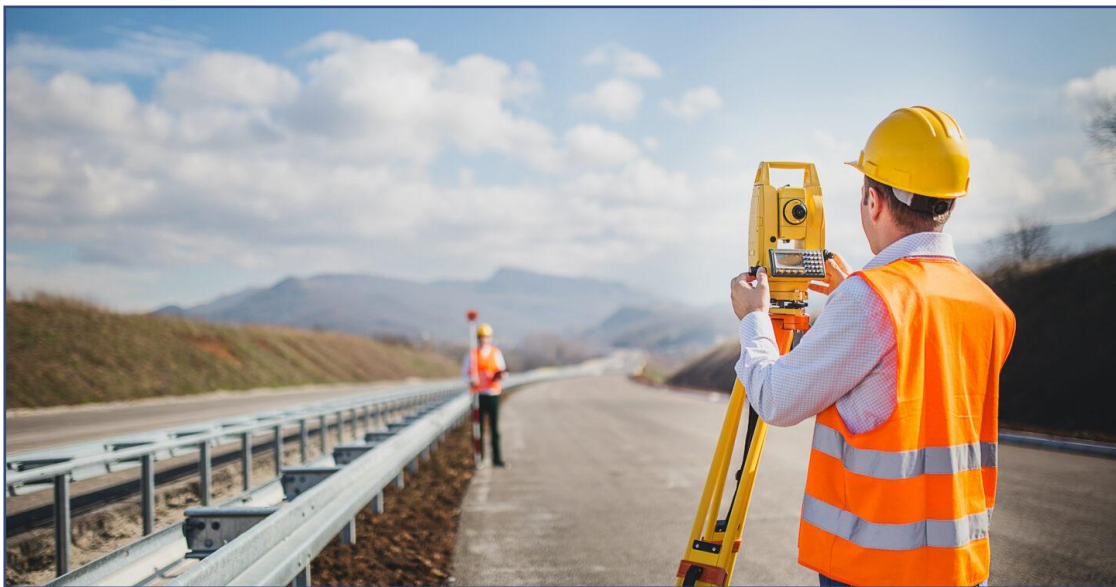


Figure 4- 1 : Land Surveying [9]

Furthermore, as previously mentioned, "land surveying" (also per ACSM) is a detailed study or inspection that includes gathering information through observations, field measurements, questionnaires, legal instrument research, and data analysis in support of planning, designing, and establishing property boundaries. It entails re-establishing cadastral surveys and land boundaries based on historical documents and evidence, as well as certifying surveys of subdivision plats or maps, registered land surveys, judicial surveys, and space delineation (as required by statute or local ordinance). Land surveying can include services like mapping and data collection, construction layout surveys, precision measurements of length, angle, elevation, area, and volume, horizontal and vertical control surveys, and land survey data analysis and utilization. [9]

Total stations, robotic total stations, GPS receivers, prisms, 3D scanners, radio communicators, handheld tablets, digital levels, and surveying software are among the tools used by surveyors to complete their work successfully and accurately. [9]

Since the beginning of recorded history, surveying has been an important part of the development of the human environment (about 6,000 years ago). It is required in nearly every type of construction project's planning and execution. Transport, building and construction, communications, mapping, and the definition of legal boundaries for land ownership are some of its most well-known modern applications. [9]

4-1-2 Global Positioning System

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions anywhere on or near the Earth where four or more GPS satellites are visible. Military, civil, and commercial users around the world rely on the system for critical capabilities. [9]

4-1-3 Photogrammetry

Photogrammetry is the science, technology, and art of recording, measuring, analyzing, and representing the Earth and its environment, as well as other physical objects and processes, using noncontact imaging and other sensor systems. Photogrammetry incorporates techniques from a variety of fields, including optics and projective geometry. [9]

The locations of object points in 3-D space are defined by 3-D coordinates. The image coordinates specify where the images of the object points appear on film or an electronic imaging device. A camera's location in space and view direction is predetermined by its exterior orientation. The geometric parameters of the imaging process are defined by the inner orientation. This primarily refers to the lens' focal length, but it can also refer to lens distortions. Additional observations are also very important: The connection to the basic measuring units is created with scale bars, which are a known distance between two points in space, or a known fixed point, the photogrammetric method can use any of the four main variables as an input or output. [9]

4-1-4 Remote sensing

Remote sensing is the science (and, to some extent, the art) of gathering information about the Earth's surface without physically touching it. This is accomplished by detecting and recording reflected or emitted energy, as well as processing, analyzing, and applying that data. [9]

4-2 GNSS

Global navigation satellite system (GNSS) is a general term describing any satellite constellation that provides positioning, navigation, and timing (PNT) services on a global or regional basis. [13]

The term GPS is now so familiar to the general public that it has become synonymous with any satellite navigation system—but we need to be careful. The term GPS is the name of the system created by the American military and stands for Global Positioning System. There are other systems too. The Russian military system for example is called GLONASS (Global Orbiting Navigation Satellite System), while China has developed a system called BeiDou-2. And all of them are considered under the GNSS. [13]

When talking about satellite navigation systems, a term you will often encounter is GNSS, which stands for Global Navigation Satellite System. This is the generic name used to describe any global system of satellites that transmit signals for navigation purposes on Earth. The distinction of using terms like GPS or GLONASS is important if you're using satellite systems for measurement purposes because each system works in a slightly different way (although the result appears to be the same). see the figure 4-2. [13]

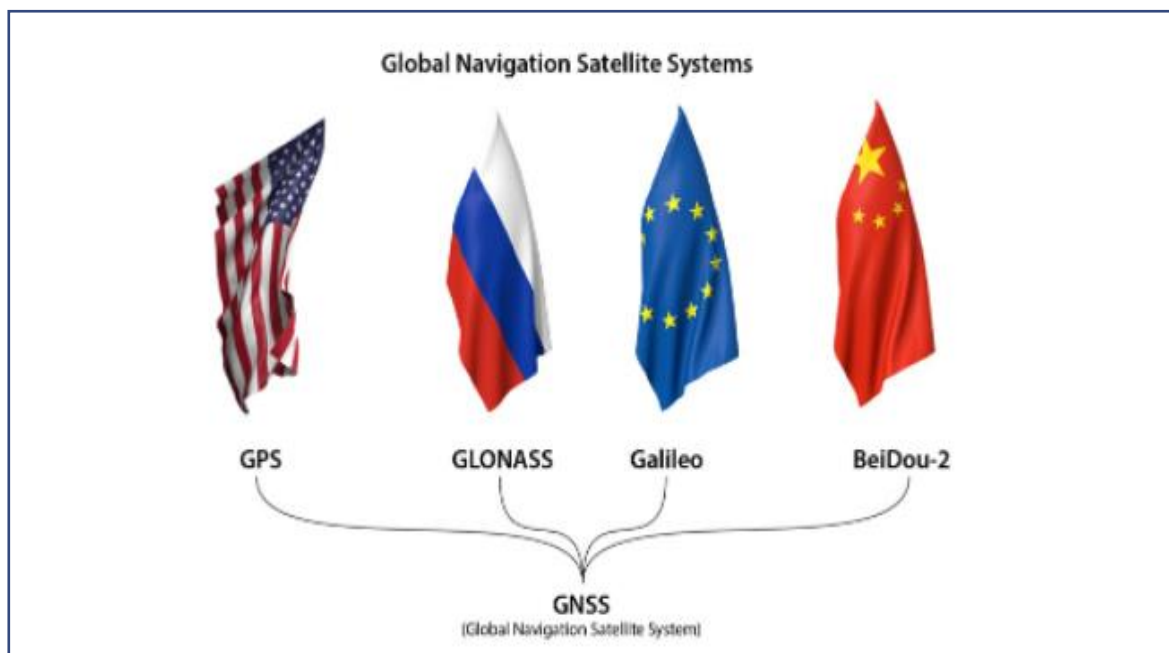


Figure 4- 2 : GNSS systems [13]

4-2-1 GPS features

1. The Global Positioning System (GPS) is a U.S.-owned utility.
 2. provides users with positioning, navigation, and timing (PNT) services.
 3. This system consists of three segments: the space segment, the control segment, and the user segment.
 4. The U.S. Air Force develops, maintains, and operates the space and control segments.
- [15]

4-2-2 Measurement methods (RTK & Static)

Before moving on to RTK and static, it's important to grasp the overall concept of positioning methods. The entire GNSS system is based on timing the time it takes for a signal to travel from a satellite to a receiver. [14]

Knowing the precise orbits of the space vehicles (the ephemeris) and travel times from at least four satellites allows you to form an area and then determine your precise location by finding the point where all the spheres cross. To get a better understanding of positioning. [14]

You might wonder how accurate your position is once you've determined it. Most GNSS or GPS receivers, such as the one in your smartphone or on most robotic platforms, determine your position with a precision of 2-4 meters. It's enough to use Google Maps to locate a store you're looking for. However, for purposes such as land surveying, the estimate is far too rough. So, what causes such an error and how can it be avoided? [14]

4-2-3 What Is RTK and How Does It Work

Real-Time Kinematic (RTK) is a technique that minimizes errors to provide accurate results and improved positional data down to centimeter resolution. [14]

The signal from satellites travels through the ionosphere and atmosphere for 20,200 kilometers before reaching the receiver. The ionospheric effect slows down the signal and can also cause it to be disrupted while traveling. Furthermore, numerous factors such as clouds or obstacles can affect travel time and increase position error. [14]

RTK comes to the rescue to solve these problems. Two GNSS receivers are required for RTK: one is stationary and referred to as a "base station," while the other is mobile and referred to as a "rover." The static base station is placed at known coordinates while both receivers observe the same satellites at the same time (a benchmark or a point measured beforehand). The base transmits corrections to the moving rover based on known coordinates and received satellite signals. The rover can achieve sub-centimeter accuracy this way. [14]

In this method, one receiver remains open over a known point (the Base Station) while another receiver moves between different positions (the Rover Station). Using a radio link, the position of the Rover Station can be calculated within a few seconds, ensuring a similar level of accuracy to baseline measurements as long as they are within 10km of the Base Station. [14]

4-2-4 Static survey

Static GPS surveying is a relative positioning method that uses two (or more) stationary receivers to track the same satellites at the same time. A base receiver is placed over a point with precisely known coordinates, such as a survey monument. The other receiver, the remote receiver, is positioned over an unknown location. This surveying method is based on taking simultaneous measurements at both the base and remote receivers for a set period, which is then processed to yield

the unknown point's coordinates. This type of survey is primarily used to establish control in situations where there is none and to achieve very high accuracies. [14]

This method involves simultaneously recording GPS observations over both a known and unknown survey point for at least 20 minutes to determine the coordinates for survey points. The data is then processed to produce coordinates that are accurate to within 5mm. [14]

4-3 Photogrammetry

4-3-1 Introduction

The American Society for Photogrammetry and Remote Sensing defines photogrammetry as the art, science, and technology of recording, measuring, and interpreting photographic images and patterns of recorded radiant electromagnetic energy and other phenomena to obtain reliable information about physical objects and the environment. The science began with the analysis of images, as its name suggests, although the usage of film cameras has drastically decreased in favor of digital sensors. Other records, such as digital imaging, radiated acoustic energy patterns, laser range data, and magnetic phenomena, are now analyzed by photogrammetry. Photographic and digital photogrammetry are both treated in this article because they share many of the same ideas, although additional sources of data are also discussed. The terms photograph and photo as used in this book can be considered synonymous with a digital image unless specifically noted. [15]

4-3-2 Photographic Types

Terrestrial and aerial photography are the two basic types of photography utilized in photogrammetry. Terrestrial photographs are taken with ground-based cameras, the position and orientation of which might be measured directly at the time of exposure. For taking terrestrial images, a wide range of cameras are employed, ranging from affordable commercially accessible cameras to precise, custom-designed cameras. While film cameras are still employed in terrestrial photogrammetry, digital cameras have become the primary image acquisition sensors. [15]

Aerial photography is usually divided into two categories: vertical and oblique. The camera axis is directed as close vertically as possible when taking vertical images. When an exposure is made with the camera axis vertical, the photographic plane is parallel to the datum plane, and the resulting photograph is called fully vertical. Due to unavoidable airplane tilts, the camera axis is rarely retained completely vertically in practice. see the figure 4-3. [15]

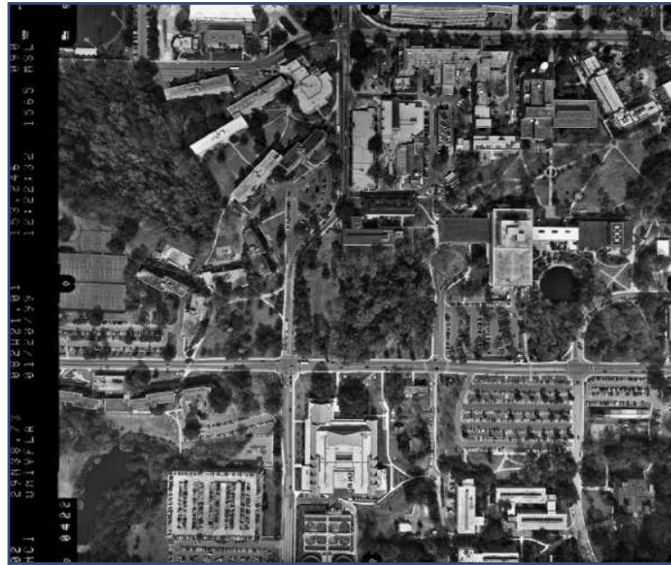


Figure 4- 3 : Vertical aerial photograph [15]

4-3-3 Uses of Photogrammetry

Topographic mapping was one of the first uses of photogrammetry, and it is still the most prevalent photogrammetric activity today. Many special-purpose topographic maps are photogrammetrically prepared by private engineering and surveying firms. These maps are used to plan and design highways, railroads, rapid transit systems, bridges, pipelines, aqueducts, transmission lines, hydroelectric dams, flood control structures, river and harbor improvements, and urban regeneration projects, among other things. A large number of topographic maps are produced for use as spatial data in geographic information systems. Orthophotos and digital elevation models (DEMs), two newer photogrammetric products, are increasingly frequently utilized to replace old topographic maps. An orthophoto is an aerial photograph that has been scaled uniformly across the image. As a result, orthophotos are similar to planimetric maps, however, unlike planimetric maps, which depict features using lines and symbols, orthophotos display actual photographs of features. As a result, they are more easily interpreted than planimetric maps, and many users prefer them. A DEM is an array of points in a given area whose X, Y, and Z coordinates have been computed. As a result, they provide a numerical representation of the topography in the area, from which contour cross-sections, and profiles, among other things, can be calculated. Because orthophotos and DEMs are both digital, one of their most prevalent applications is in conjunction with geographic information systems. [15]

4-3-4 Orthophoto

An orthophoto is an aerial photograph that has been geometrically corrected or 'ortho-rectified' such that the scale of the photograph is uniform and utilized in the same manner as a map. An orthophoto can be used to measure the true distances of features within the photograph. Planimetric corrections have been applied to remove lens distortions and optics, camera angle, and differences in elevation (topographic relief) through a process of measuring ground control points to 'tie' the photo to the ground, in a drawing-pin la-like manner. An orthophoto is an accurate representation of the earth's surface. Orthophotos have the benefits of high demand il, timely coverage combined with the benefits of a map including uniform scale and true geometry. see the figure 4-4. [15]

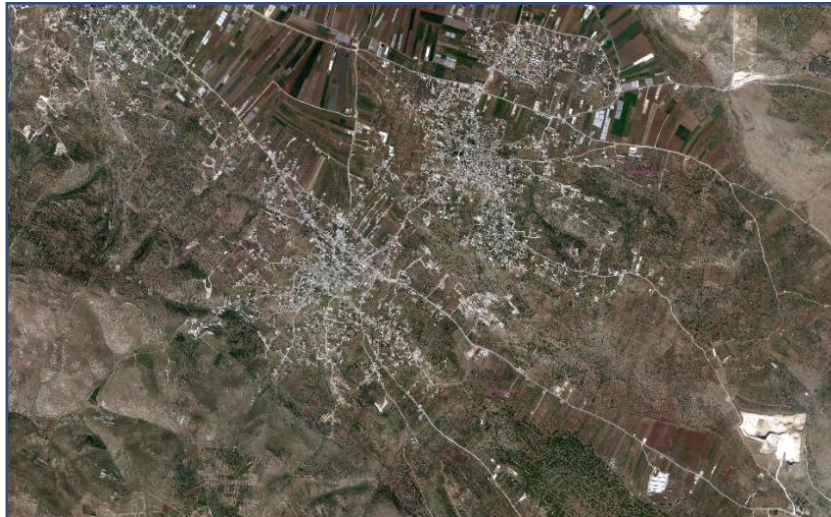


Figure 4- 4 : Series orthophoto

4-3-5 Photogrammetry processing

In this project, aerial photographs and their functions are used in the process of digitizing the required survey plans and inferring them, and taking the required data that represents the current situation of the area. Where the aerial photograph is used after ensuring the validity of its data in terms of image clarity and date of imaging, as well as according to the validity and the accuracy of its coordinates.

The aerial photograph of the Series town used in this project was taken from the Palestinian Ministry of Local Government, and the validity of the image was confirmed in terms of the date of photography and clarity, as the image was photographed in 2021, and any missing data were left for field survey work. In terms of the correctness of the coordinates, the image is in its correct location, but the accuracy of the coordinates is not acceptable and needs to be modified to put the image in its exact correct location.

4-3-6 Control point observation

The first practical step in the process of correcting the coordinates of the aerial image is the process of monitoring the control points in the town of Series, taking into account the selection of the locations of the points so that they are visible and accurately identifiable on the aerial image. In this project, more than 40 control points were taken and geo-referenced with the image. see the figure 4-5. [16]

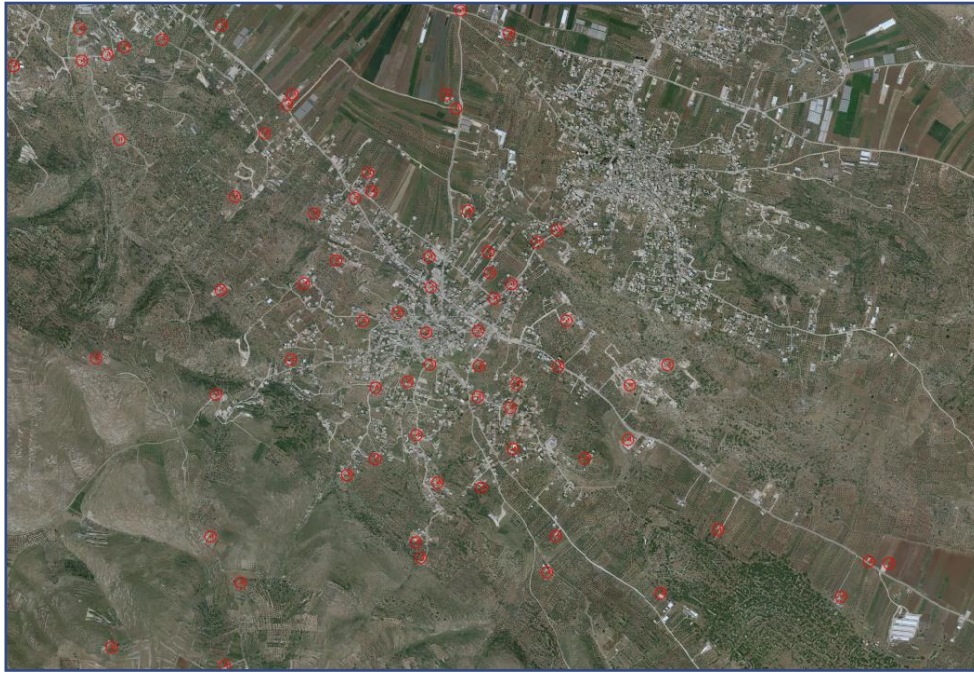


Figure 4- 5 : Control points distribution

4-3-7 Georeferencing

Georeferencing means that the internal coordinate system of a map or aerial photo image can be related to a geographic coordinate system. The relevant coordinate transforms are typically stored within the image file (Geo PDF and Geo TIFF are examples), though there are many possible mechanisms for implementing georeferencing. The most visible effect of georeferencing is that display software can show ground coordinates (such as latitude/longitude or UTM coordinates) and also measure ground distances and areas. Geographical locations can be defined in multiple spatial dimensions: 0-dimensional (points), 1-dimensional (lines), 2-dimensional (areas), and, rarely. [16]

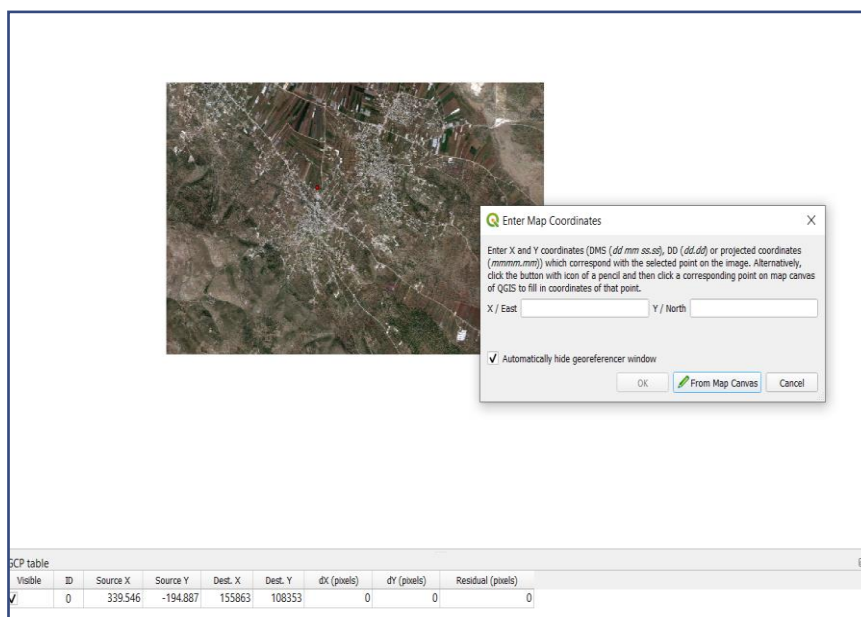


Figure 4- 6 : Georeferencing using QGIS

To correct the location of the image, Georeferencing must be made to the image by linking the observed control points in the field to their location on the image. see the figure 4-6.

When placing the old, unmodified photo and the photo after making the geographical reference, there is a clear difference in the displacement that may exceed 5 m in some places. This confirms the importance of correcting the coordinates by geo-referencing the image at the control points. see the figure 4-7.



Figure 4- 7 : Georeferencing

Chapter five: Results and analysis

5-1 Introduction

5-2 Collected data

5-3 Project obstacles

5-4 Introduction to ModelBuilder

5-5 Processing and results

5-1 Introduction

5-1-1 Study area

Identify the work area of Series village and then pay a reconnaissance visit to the site and take a full idea of the nature of the project, problems related to it, and the important details of design and implementation to get the most accurate results. see the figure 5-1.

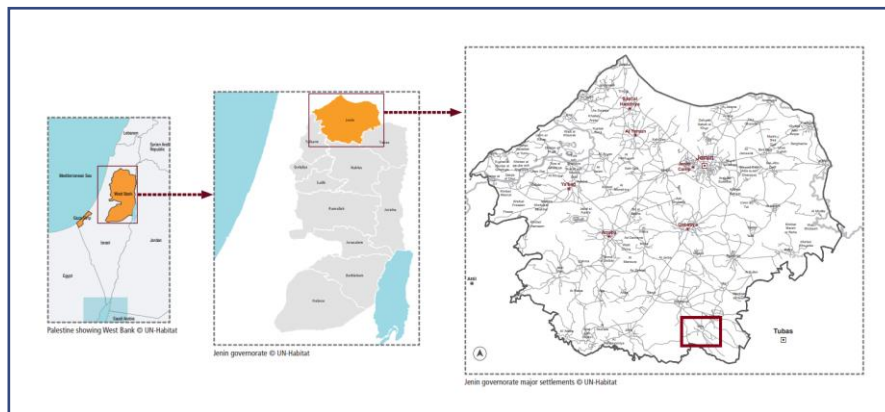


Figure 5- 1: Study area

5-2 Collected data

5-2-1 Orthophoto

See the figure 5-2.



Figure 5- 2 : Series orthophoto

5-2-2 Control points distribution in the orthophoto

See the figure 5-3.

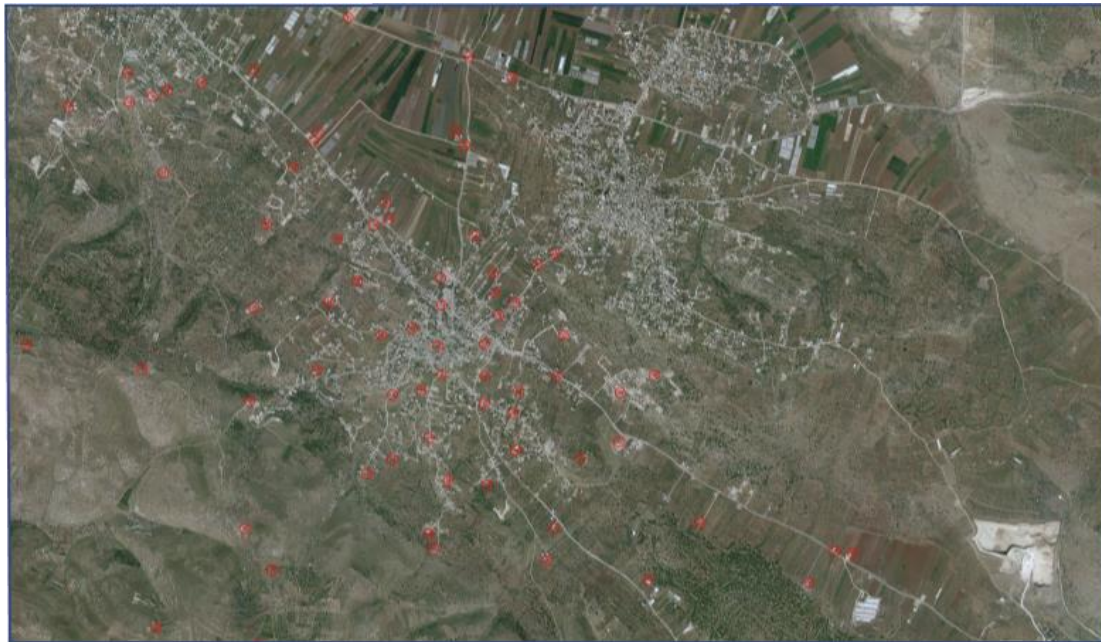


Figure 5-3 : Control points Distribution

5-2-3 Master Plan

See the figure 5-4.

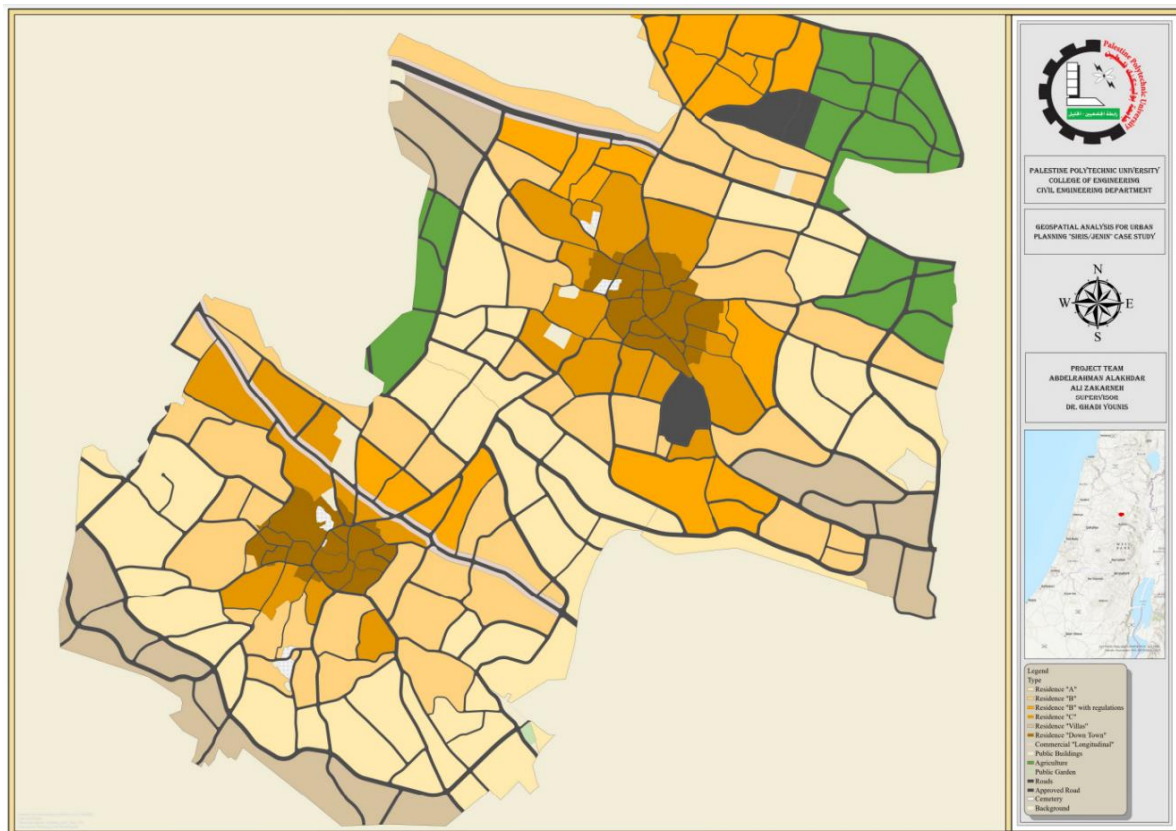


Figure 5-4 : Master Plan

5-2-4 Contour Shapefile

See the figure 5-5.



Figure 5- 5 : Contour 1m

5-2-5 Parcels

See the figure 5-6.

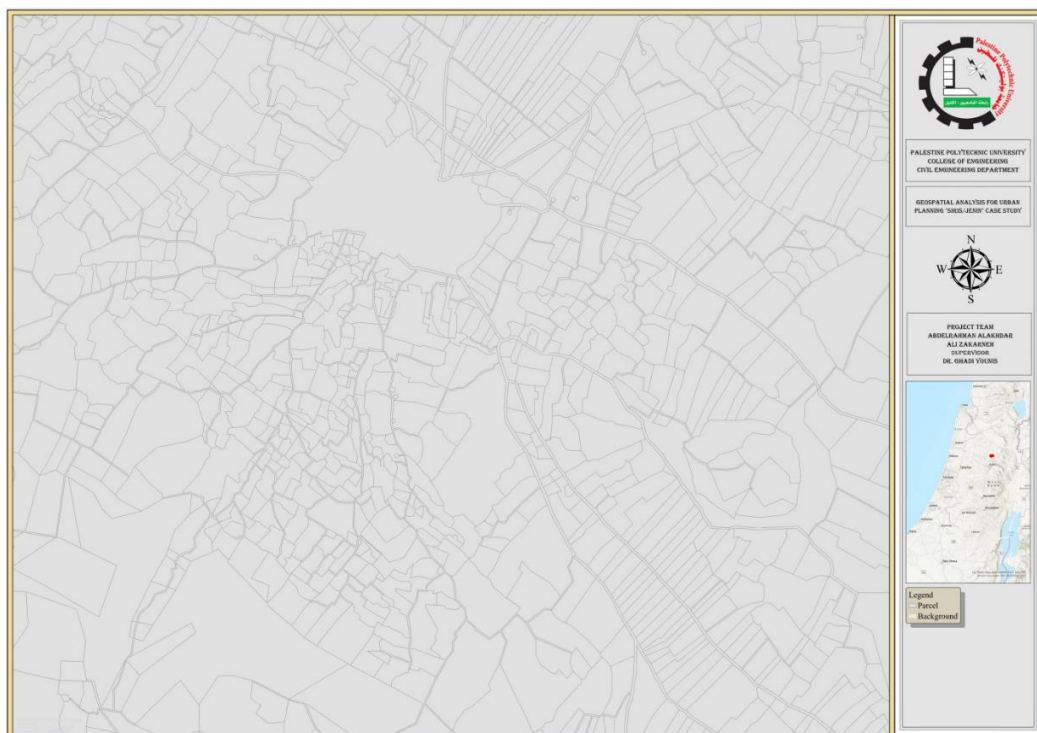


Figure 5- 6 : Series Parcels

5-3 Project obstacles

5-3-1 Displacement of the orthophoto

Before starting the implementation of any process in the project, it was necessary to make sure whether the aerial image that we obtained was linked to the coordinates or not, and it turned out that it was not linked to the coordinates, and therefore we moved to the georeferencing to the orthophoto. see the figure 5-7 &5-8 &5-9 &5-10.



Figure 5- 7 : Before georeferencing



Figure 5- 8 : After georeferencing



Figure 5- 9 : Displacement between the georeferenced orthophoto and original orthophoto



Figure 5- 10 : Displacement distance between the georeferenced orthophoto and original orthophoto

5-3-2 Difficulty displaying & deal with the orthophoto in the device

Pyramids can speed up the display of raster data by retrieving only the data at a specified resolution that is required for the display. With pyramids, a lower-resolution copy of the data displays quickly when drawing the entire dataset. As you zoom in, levels with finer resolutions are drawn; performance is maintained because you're drawing successively smaller areas. The database server chooses the most appropriate pyramid level automatically based on the user's display scale. Without pyramids, the entire dataset must be read from the disk and resampled to a smaller size. This is called display resampling and occurs when the ArcGIS display is refreshed. see the figure 5-11. [11]

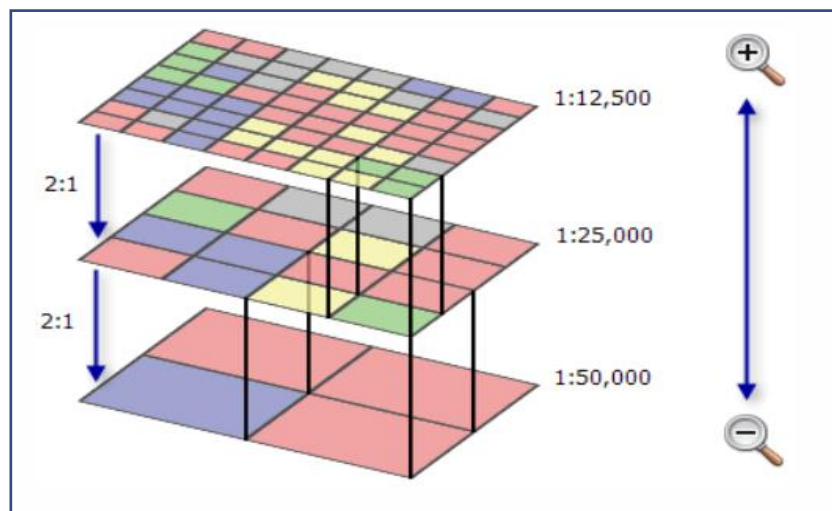


Figure 5- 11 : Build pyramids [11]

5-3-3 A large number of intersected places and the large time to search for them

Insert the previous master plan above the orthophoto, to identify the intersected area between them. see the figure 5-12 &5-13 &5-14 &5-15.

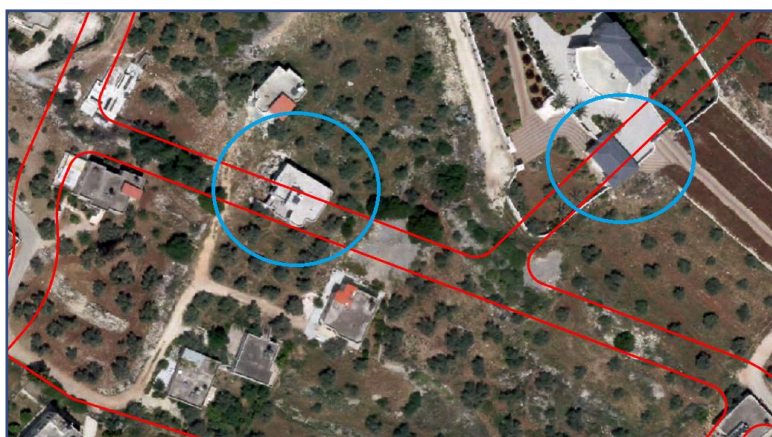


Figure 5- 12 : Intersection picture No.1



Figure 5- 13 : Intersection picture No.2



Figure 5- 14 : Intersection picture No.3

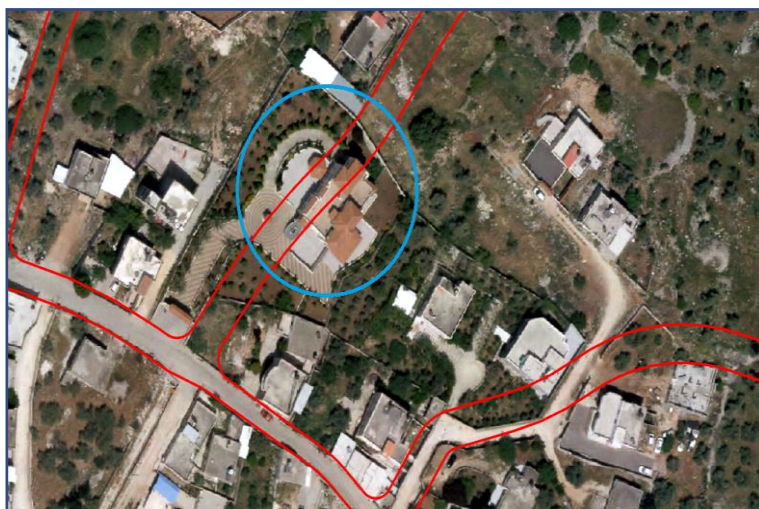


Figure 5- 15 : Intersection picture No.4

5-4 Introduction to ModelBuilder

ModelBuilder is a visual programming language for building geoprocessing workflows. Geoprocessing models automate and document spatial analysis and data management processes. ModelBuilder can create and modify geoprocessing models, where a model is represented as a diagram that chains together sequences of processes and geoprocessing tools, using the output of one process as the input to another process.[19]

5-4-1 ModelBuilder rules

- Build a model by adding and connecting data and tools.
- Iteratively process every feature class, raster, file, or table in a workspace.
- Visualize your workflow sequence as an easy-to-understand diagram.
- Run a model step by step, up to a selected step, or run the entire model.
- Make your model into a geoprocessing tool that can be shared or can be used in Python scripting and other models. [19]

5-4-2 ModelBuilder Creation

To build a geoprocessing model in ModelBuilder, add tools and data to a model, and make connections between them to establish the order of execution.[21]

5-4-2-1 Add ModelBuilder

On the Analysis tab, in the Geoprocessing group, click ModelBuilder see the figure 5-16.

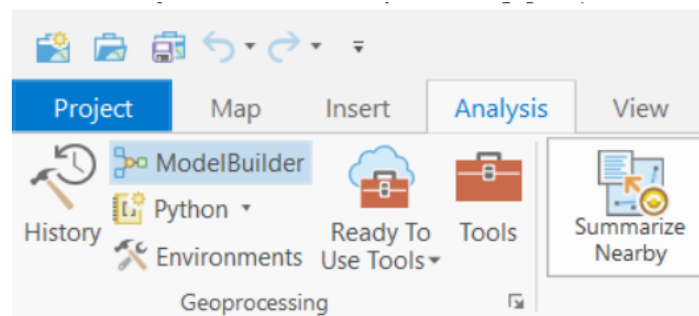


Figure 5- 16 : Insert ModelBuilder [21]

5-4-2-2 Add data

Models work with data, with the output of one geoprocessing tool being used as input to another tool. To add data to the model, drag layers from the map Contents and datasets from Project into the model.

The layers and datasets are added to the model and displayed as input data variables see the figure 5-17 [21].

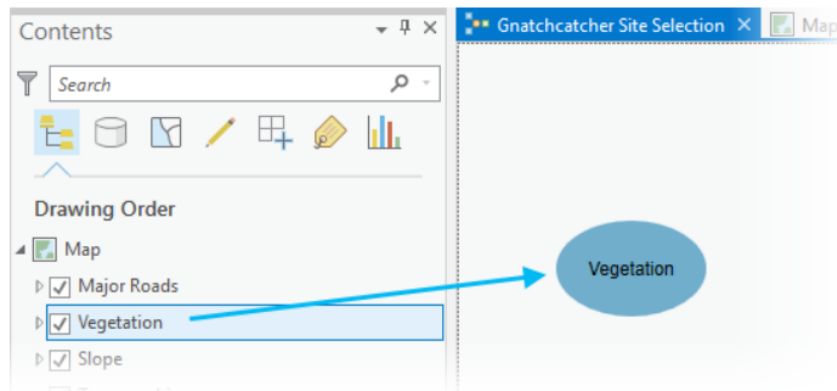


Figure 5- 17 : Add data to ModelBuilder [21]

5-4-2-3 Add geoprocessing tools

Geoprocessing tools are a fundamental building block of the model. ArcGIS Pro has many geoprocessing tools for accomplishing an extensive number of GIS tasks. Once you know the right tools for the work you are doing, it is straightforward to add those tools to a model.

To add a geoprocessing tool to your model start searching for a tool. A list of search results will display on the Add Tools to Model dialog box. Double-click a tool to add it to the model. Alternatively, you can drag a geoprocessing tool into the model from the Geoprocessing pane or Catalog pane see the figure 5-18 [21].

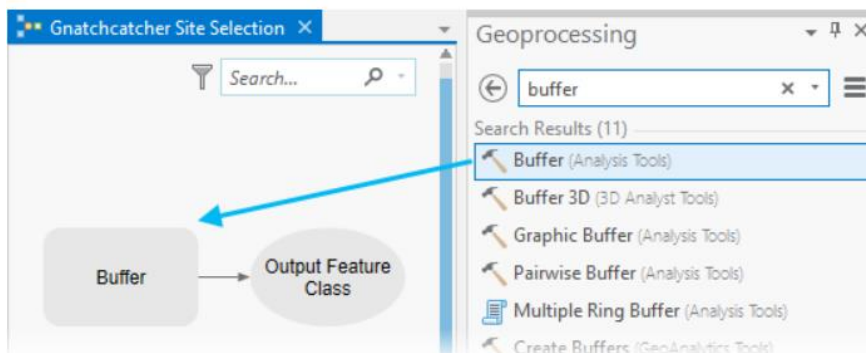


Figure 5- 18 : Add geoprocessing tool to ModelBuilder [21]

5-4-2-4 Connect data and tools

Geoprocessing models allow connecting of data and tools into processes. You must specify which data variables in the model should be processed by which geoprocessing tools.

Connect the data variables which added to the model directly to a tool by drawing a connection between them, then choose the tool parameter to which to connect the variable. We can connect the output of one tool as input to another tool see the figure 5-19[21].

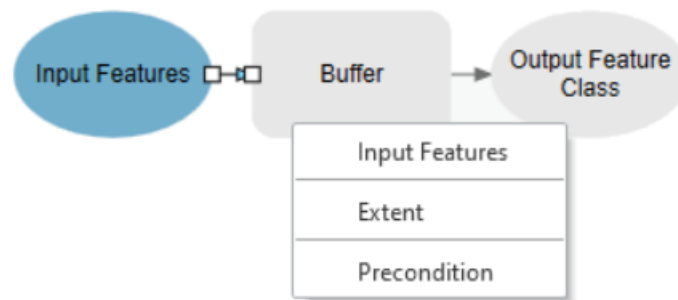


Figure 5- 19 : Data connect tool [21]

5-4-3 Model Elements

Model elements are the basic building blocks of models. There are four main types of model elements: geoprocessing tools, variables, connectors, and groups.

- Geoprocessing tools perform various operations on geographic or tabular data. When tools are added to a model, they become model elements. You can open the tool dialog box of any geoprocessing tool in your model to set the input and output parameters.
- Variables are elements in a model that holds a value or a reference to data. There are two types of variables: data and value variables.
- Connectors connect data and values to tools. The connector arrows show the direction of processing. There are four types of connectors: data, environment, precondition, and feedback.
- Groups are visual elements that group related tools together. These groups can collapse or expand to hide or show tools, providing more visual space to work with.[20]

The illustration and table below show the different model elements in ModelBuilder see the Table 5-1.




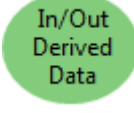
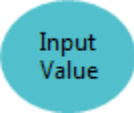

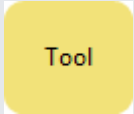
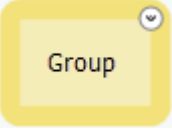
Element	Description
<p>Data variable</p> 	<p>Data variables are model elements that store paths and other properties of data on disk. Common data variables include feature class, feature layer, raster dataset, and workspace.</p>
<p>Derived or output data variable</p> 	<p>It is new data created by a tool in the model, when a geoprocessing tool is added to a model, variables for the tool's output parameters are automatically created and connected to the tool.</p>  <p>This tool creates a dataset that is written to disk when the model is run.</p>  <p>This tool alters the input data when the model is run. By default, the in/out derived data variable will have the same name as the input data but with a unique number appended at the end.</p>
<p>Value variable</p> 	<p>Value variables are values such as strings, numbers, Boolean (true/false values), spatial references, linear units, or extents. Value variables contain anything but references to layers or data stored on disk.</p>
<p>Derived value variable</p> 	<p>Values that are the result of a tool. Derived values can be inputs to other tools. The Calculate Value tool, for example, outputs the result of a logical or mathematical calculation.</p>
<p>Tool</p> 	<p>ModelBuilder utilities are tools that help construct models and only work within ModelBuilder, not in scripting.</p>
<p>Group</p> 	<p>Groups are visual categories that include other elements in the model. These groups can be expanded and collapsed.</p>

Table 5- 1 : ModelBuilder Element [20]

5-4-4 ModelBuilder Processes

A model process consists of a tool and all variables connected to it. Connector lines indicate the sequence of processing. Many processes can be chained together to create a larger process see the figure 5-20 [20].

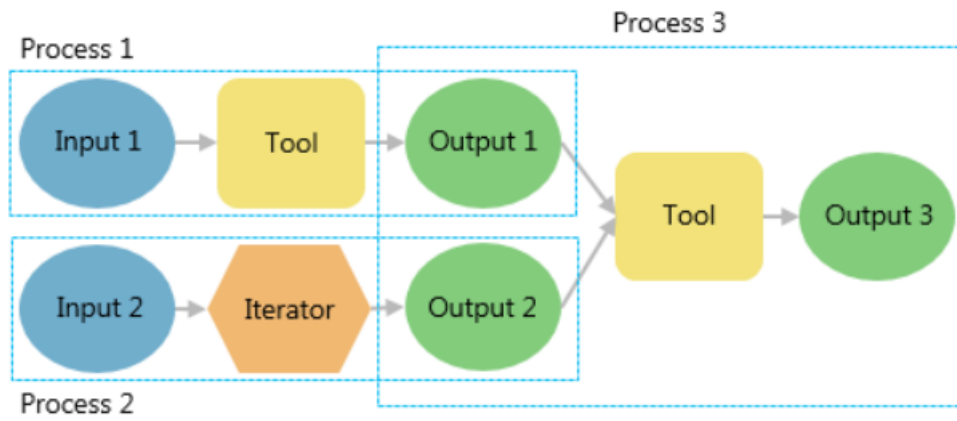


Figure 5- 20 : ModelBuilder Processes [20]

5-5 Processing and results

5-5-1 1st model “Budling &Road intersect”

5-5-1-1-1 Picture of model

see the figure 5-21.

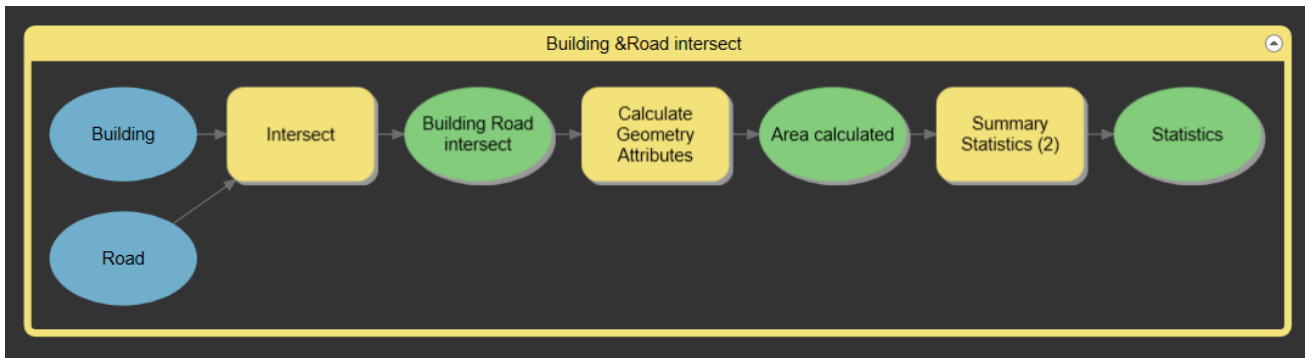


Figure 5- 21 : Budling &Road intersect model

5-5-1-1-2 Objectives of this model:

1. Find the intersected area between the current building and the old master plan roads.
2. Calculate the area of the intersection in square meters.
3. Calculate the statistic of intersected area.

5-5-1-1-3 The previous model runs the following tools in sequence:

1. Intersect — Overlay the output of the Erase tool with other map layers, including the current building and the old master plan roads. This identifies the areas that meet all criteria.
2. Calculate geometry attributes — Adds information to a feature's attribute fields representing the spatial or geometric characteristics and location of each feature, such as length or area and x-, y-, z-coordinates, and m-values.
3. Summary statistics — Calculates summary statistics for fields in a table.[22]

5-5-1-1-4 ModelBuilder results maps

What is observed from the map is the intersection between the current buildings and the proposed master plan, the deduction amount for the intersected area was calculated and classified every 35 m2 and the result was displayed using the following maps see the figure 5-22 &5-23 &5-24 &5-25 &5-26 &5-27.



Figure 5- 22 : Budling &Road intersect map1

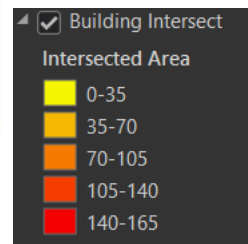


Figure 5- 50 : Budling intersect



Figure 5- 23 : Budling &Road intersect map2

Here Map3+4 is enlarged for more clarification.

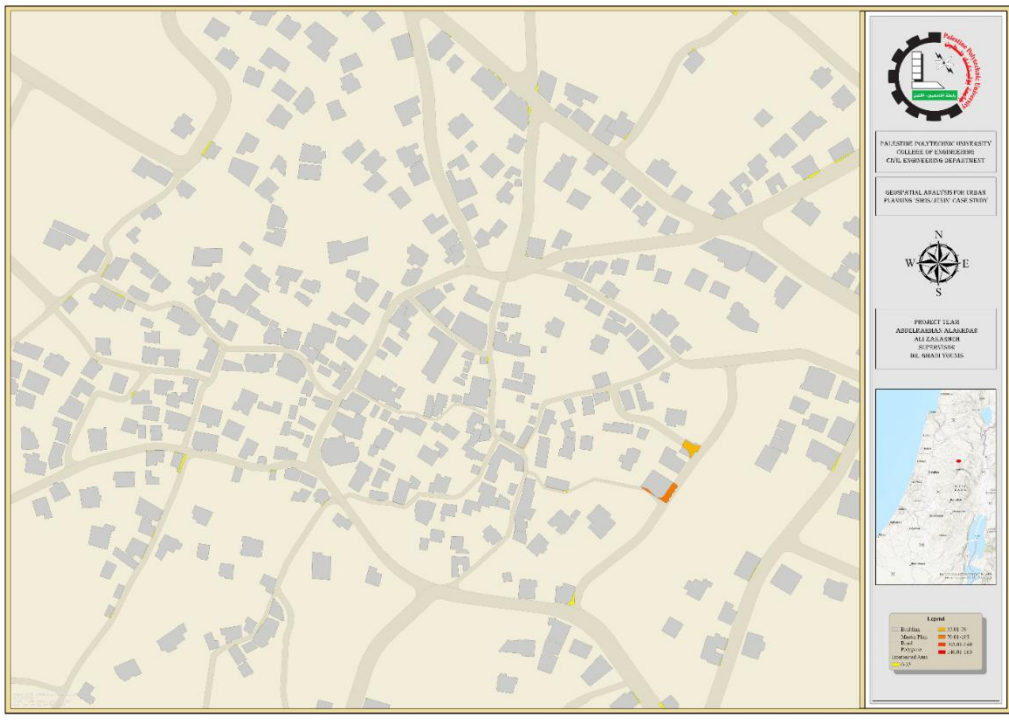


Figure 5- 24 : Budling &Road intersect map3

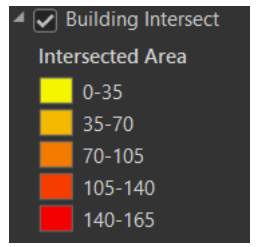


Figure 5- 50 : Budling intersect



Figure 5- 25 : Budling &Road intersect map4

Here Map5+6 is enlarged in different locations for more clarification.

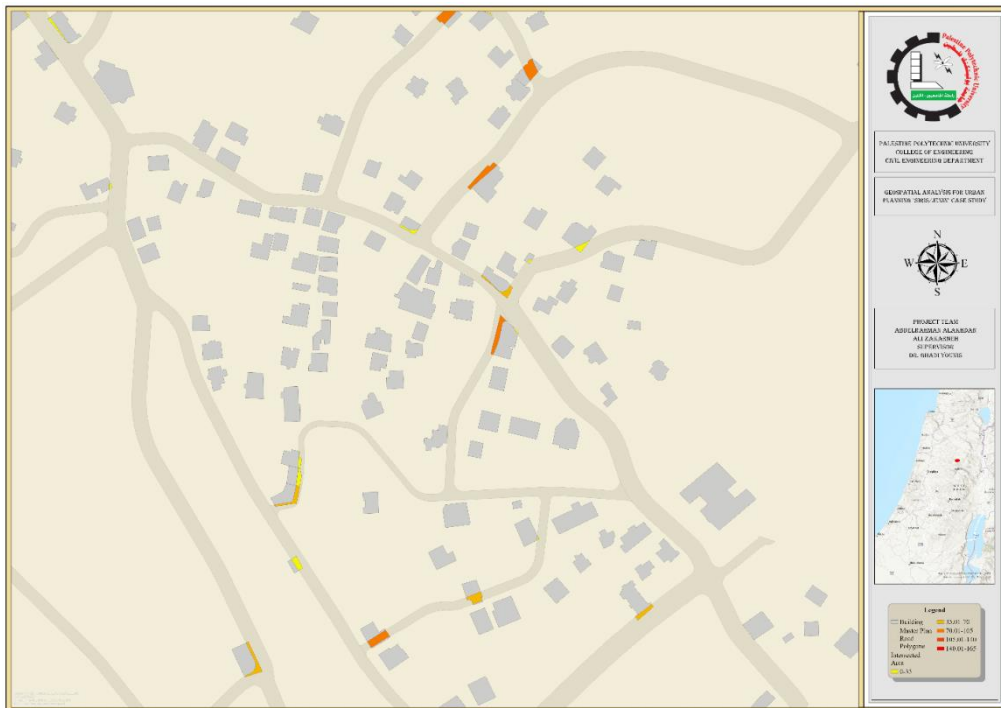


Figure 5- 26 : Budling &Road intersect map5

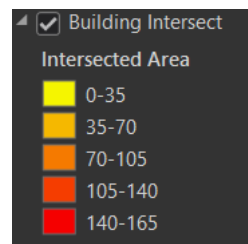


Figure 5- 50 : Budling intersect

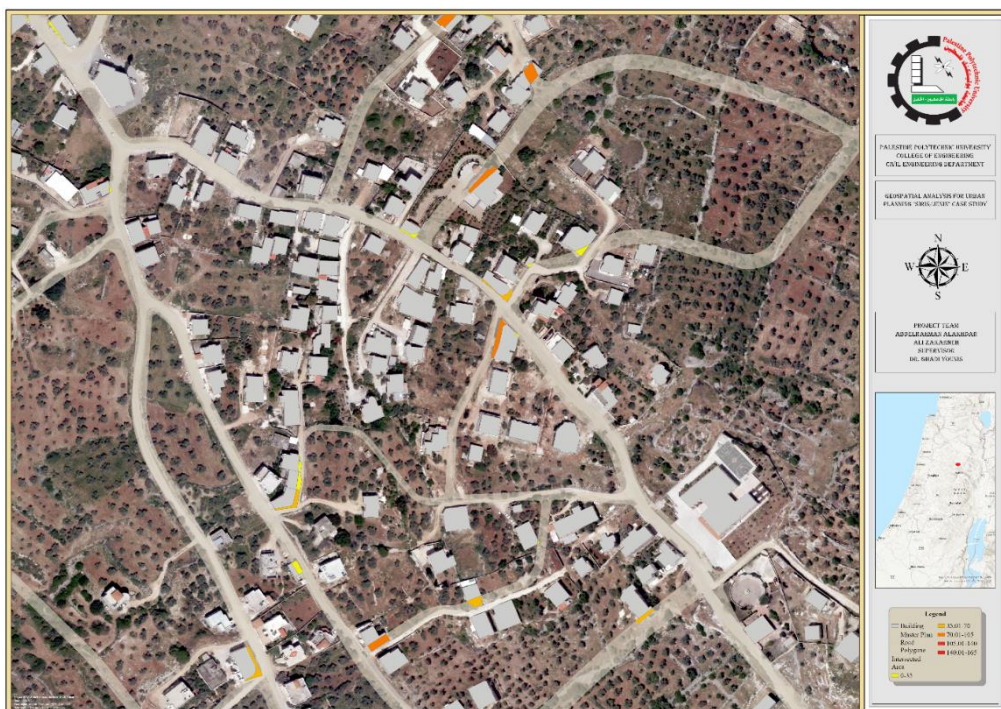


Figure 5- 27 : Budling &Road intersect map6

5-5-1-1-5 Statistics

See the figure 5-28.

FREQUENCY	COUNT_Shap	SUM_Shape_	MEAN_Shape	MIN_Shape_	MAX_Shape_	MEDIAN_Sha	STD_Shape_
216	216	3987.550348	18.460881	0.000036	165.391891	3.131112	31.814429

Figure 5- 28 : Budling &Road intersect statistics table

5-5-1-1-6 Bar charts

see the figure 5-29.

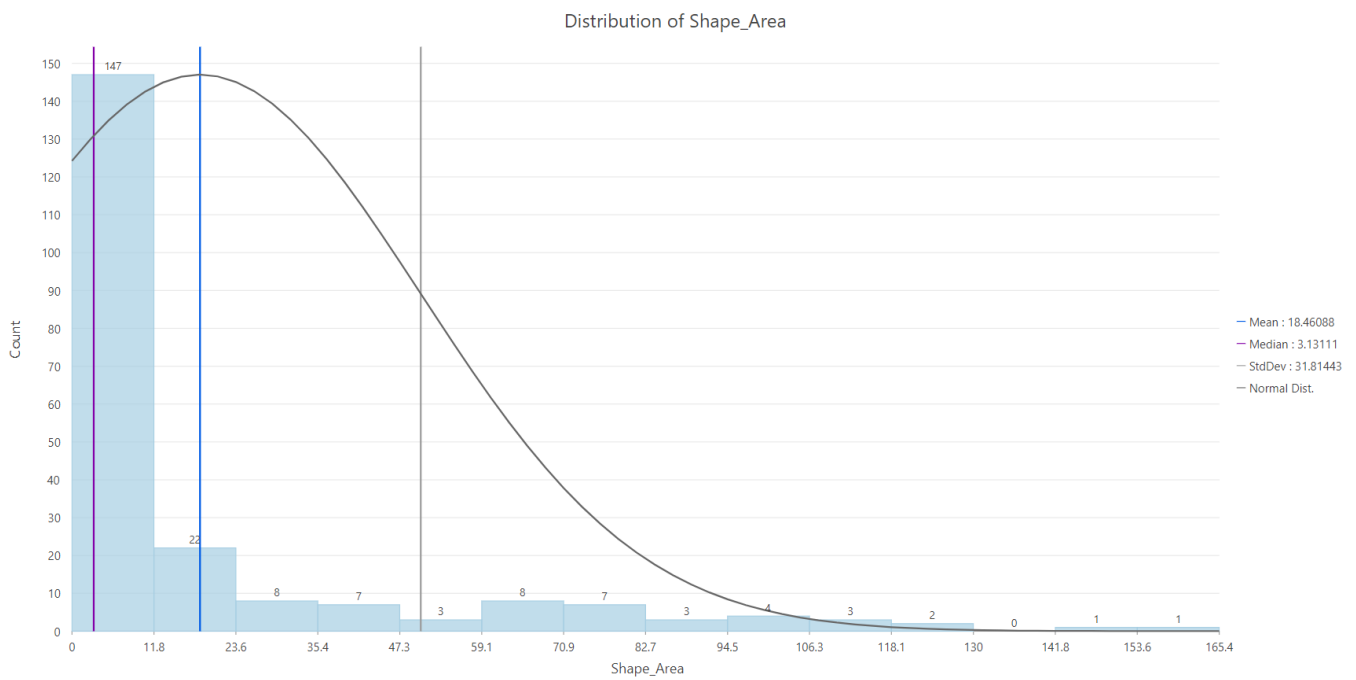
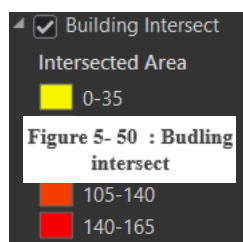


Figure 5- 29 : Budling &Road intersect Bar chart

5-5-1-1-7 Results discussion

F



5-5-2 2nd model “Budling &Buffered Road intersection”

5-5-2-2-1 Picture of model

See the figure 5-30.

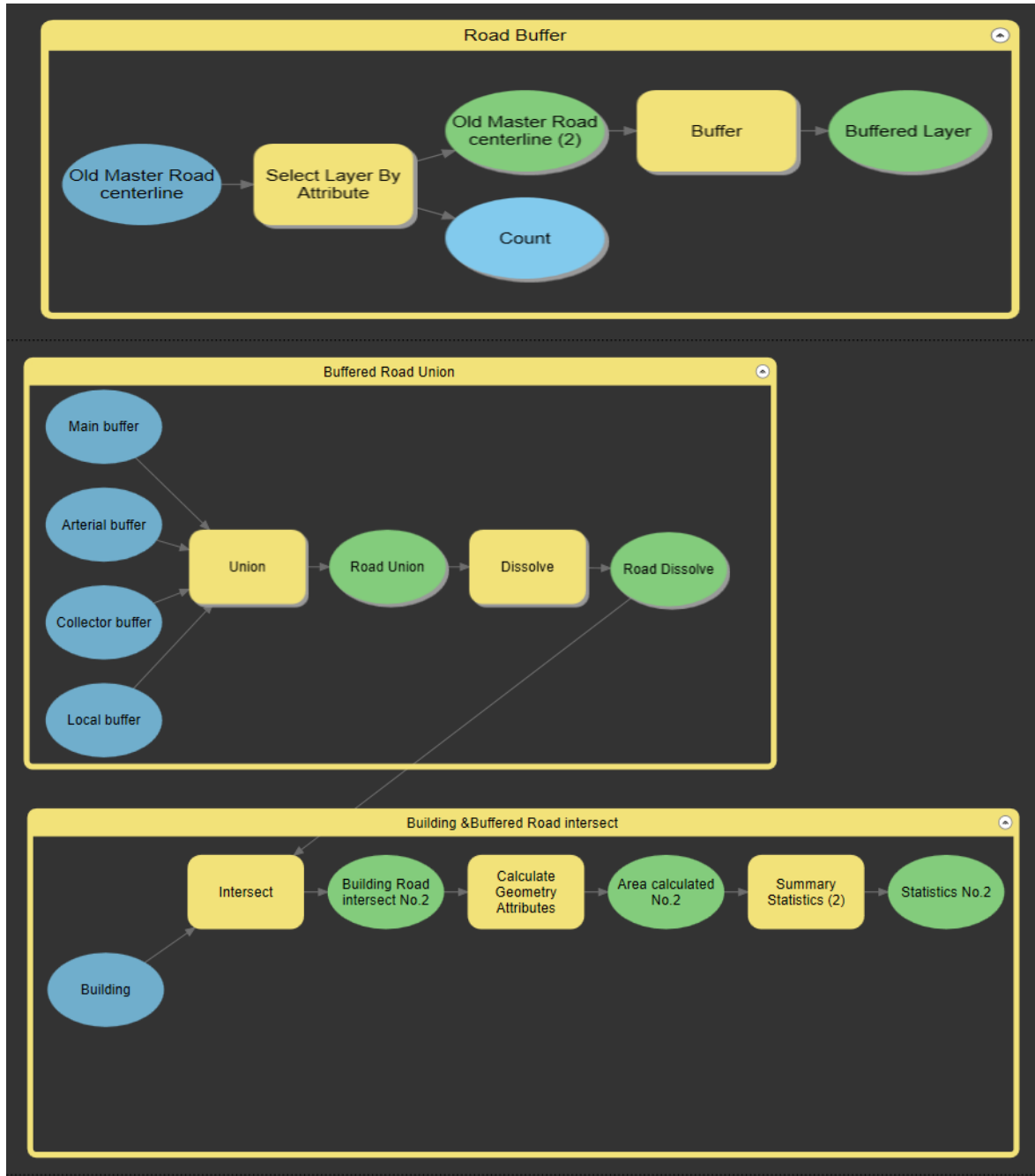


Figure 5- 30 : Budling &Buffered Road intersection model

5-5-2-2-2 Objectives of this model:

1. Buffer all the old master plan center line types with the standard road width according to AASHTO specifications.
2. Union and dissolve the buffered roads to remove the overlap and finally get one road polygon shape file in order to be used in the intersect area calculation with the buildings.
3. Find the intersected area between the current building and the buffered roads.
4. Calculate the area of the intersection in square meters.
5. Calculate the statistic of intersected area.

5-5-2-2-3 The previous model runs the following tools in sequence:

1. Select Layer by Attribute — Adds, updates, or removes a selection based on an attribute query.
2. Buffer — Creates buffer polygons around input features to a specified distance.
3. Union — Computes a geometric union of the input features. All features and their attributes will be written to the output feature class.
4. Dissolve — Aggregates features based on specified attributes.
5. Intersect.
6. Calculate geometry attributes.
7. Summary statistics. [22]

5-5-2-2-4 ModelBuilder results maps

What is observed from the map are the buildings that intersect and overlap with the Buffered Road Centerline after assuming its width to be according to AASHTO specifications, and the deduction amount for the intersected area was calculated and classified every 50sqaur meter, the result was displayed using the following maps see the figure 5-31 &5-32 &5-33 &5-34 &5-35 &5-36.



Figure 5- 31 : Budling &Buffered Road intersection map1

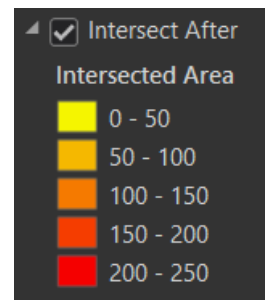


Figure 5- 51 : Budling intersected after



Figure 5- 32 : Budling &Buffered Road intersection map2

Here Map3+4 is enlarged for more clarification, and here the intersected area has been increased as shown in map3 compared to what it was in the 1st model map3.

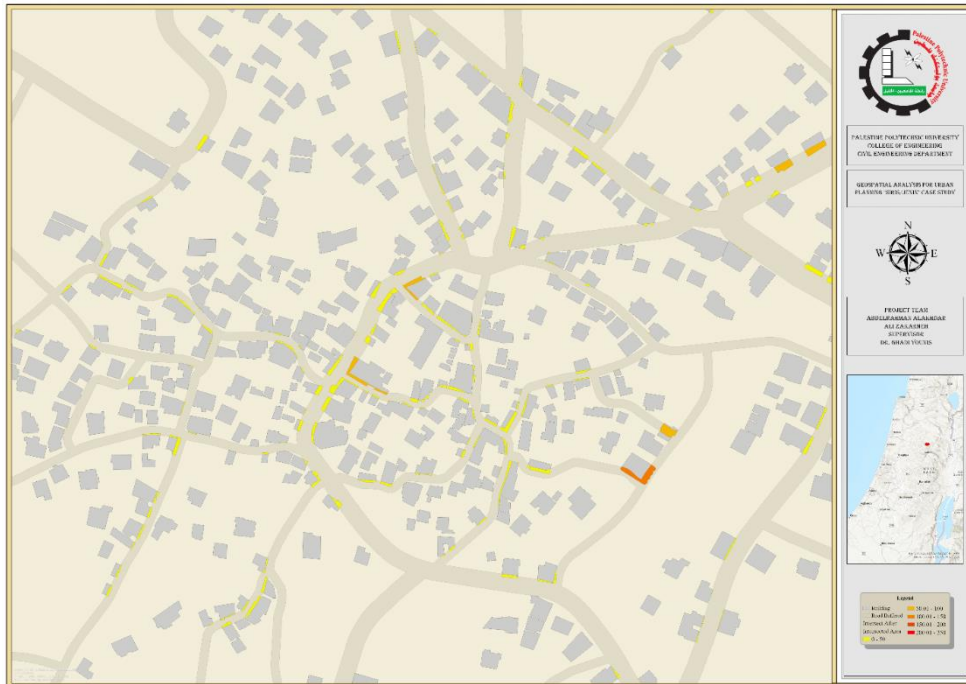


Figure 5- 33 : Budling & Buffered Road intersection map3

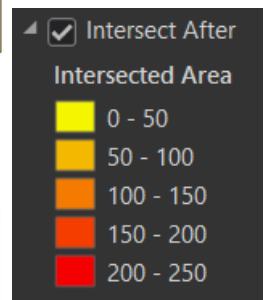


Figure 5- 51 : Budling intersected after



Figure 5- 34 : Budling & Buffered Road intersection map4

Here Map5+6 is enlarged in different locations for more clarification, and here the intersected area has been increased as shown in map5 compared to what it was in the 1st model map5.



Figure 5- 35 : Budling & Buffered Road intersection map5

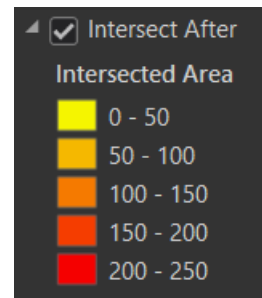


Figure 5- 51 : Budling intersected after

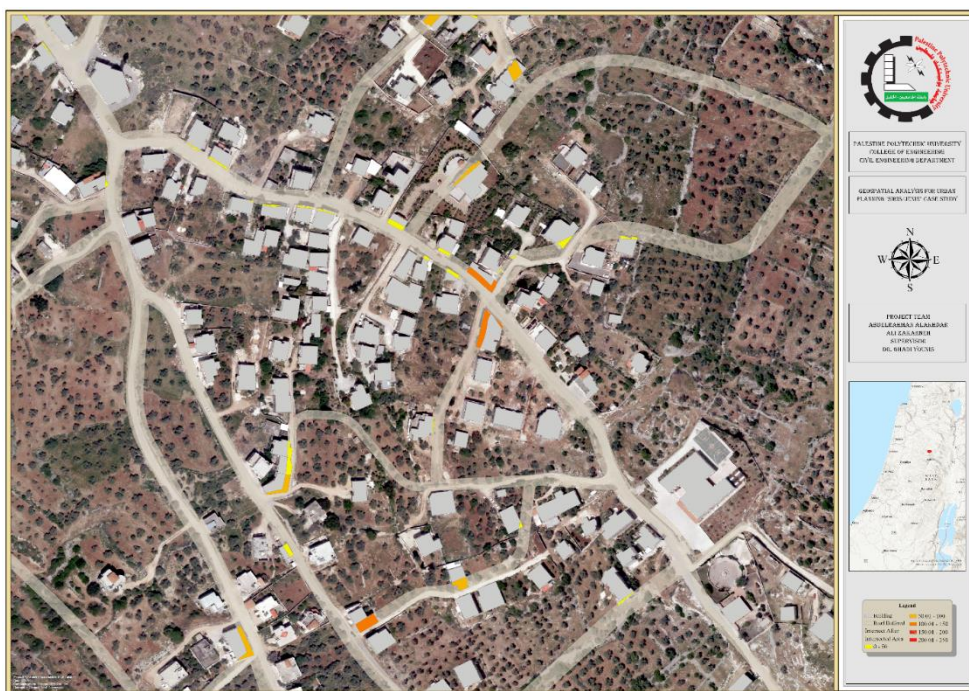


Figure 5- 36 : Budling & Buffered Road intersection map6

5-5-2-2-5 Statistics

See the figure 5-37.

FREQUENCY	COUNT_Shap	SUM_Shape_	MEAN_Shape	MIN_Shape_	MAX_Shape_	MEDIAN_Sha
305	305	7240.07489	23.73795	0.000139	247.115905	11.450638

Figure 5- 37 : Budling &Buffered Road intersection statistics table

5-5-2-2-6 Bar charts

See the figure 5-38.

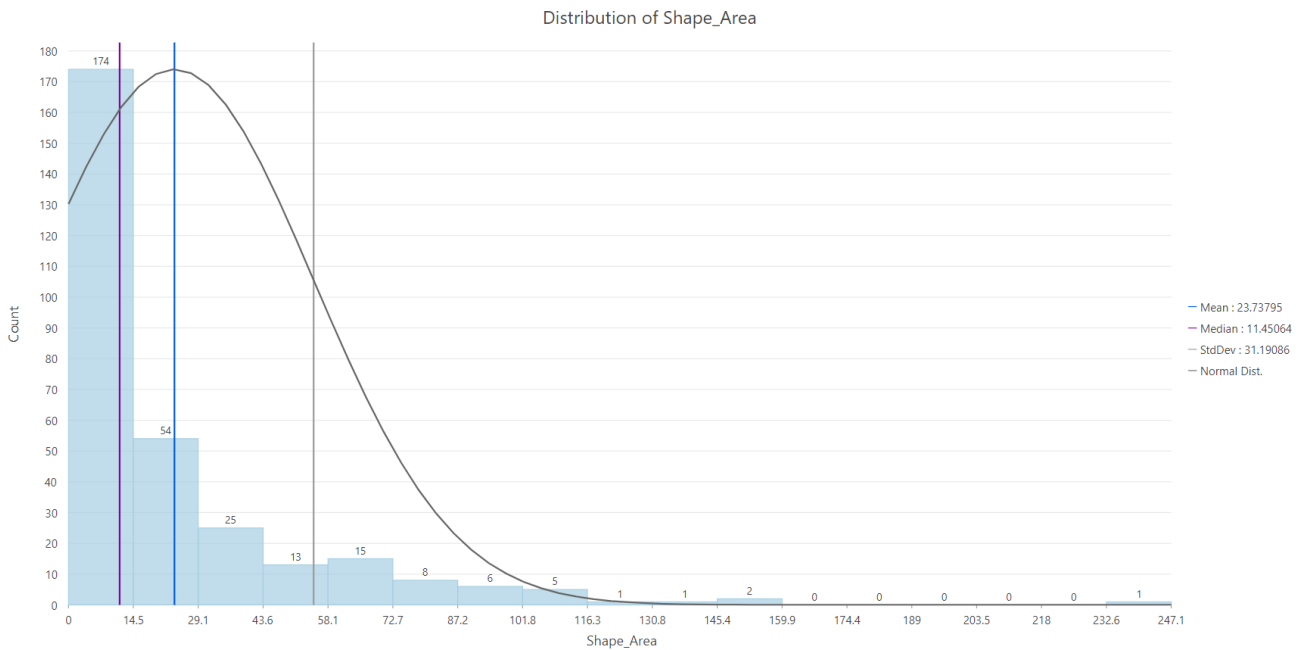


Figure 5- 38 : Budling &Buffered Road intersection Bar chart

5-5-2-2-7 Results discussion

Find and calculate the intersection area between the current building and the buffered road reclassify the intersected area in intervals every 50 square meters and come up with the following statistics, there are 305 areas of intersection with a total area of 7240 square meters, an average of 24 square meters, most intersections area ranges between 1-15 square meter and the largest area equals 247 square meters. The number increased and if there is any indication, that will indicate the failure of the master plan in particular in front of this number of intersections after applying master plan change according to standard ASSHTO specifications.

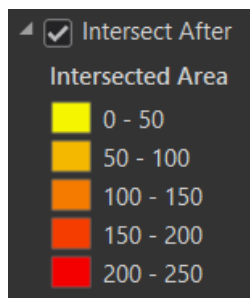


Figure 5- 51 : Budling intersected after

5-5-3 3rd model “Road Centerline Slope”

5-5-3-3-1 Picture of model

See the figure 5-39.

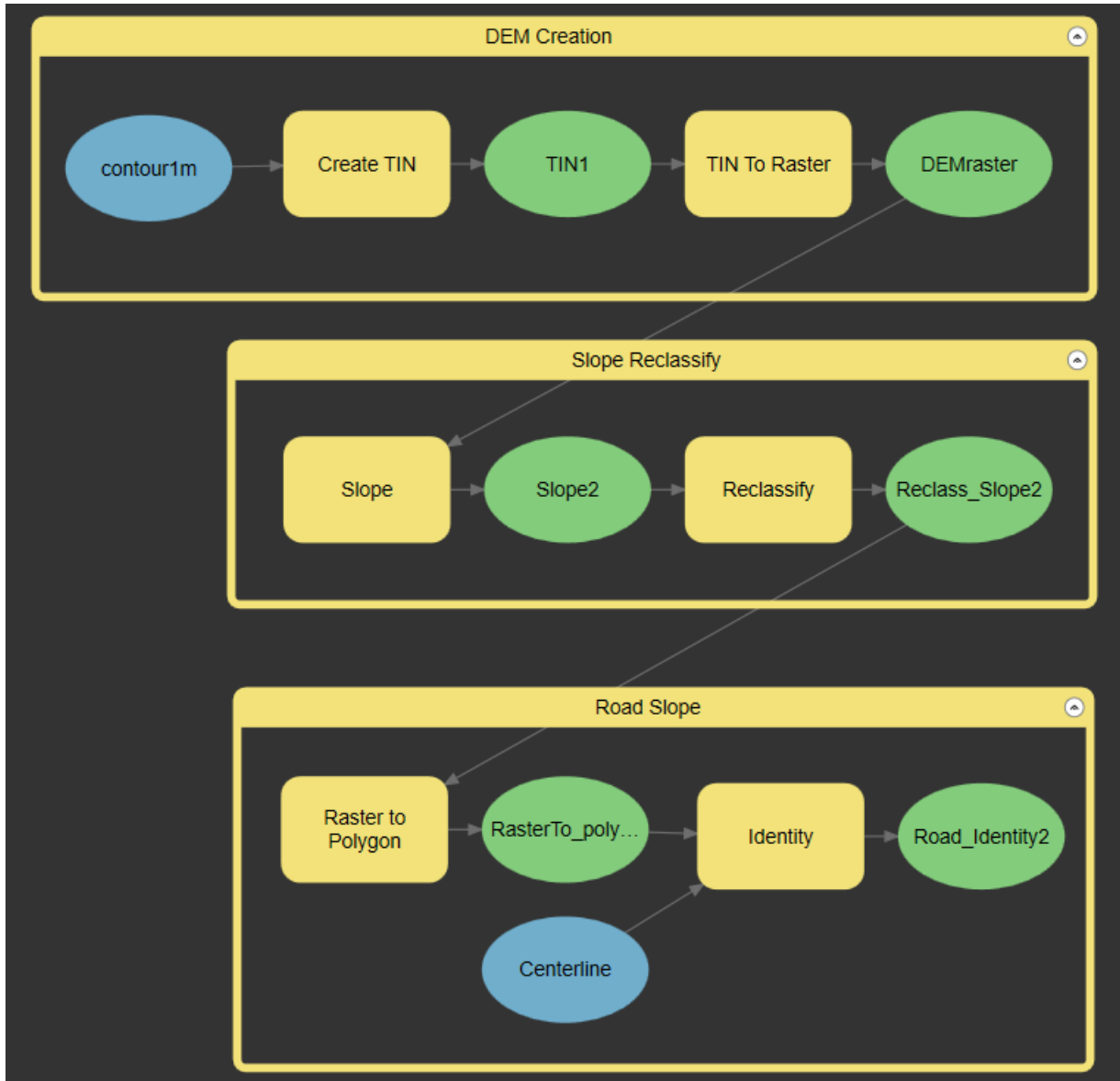


Figure 5- 39 : Road Centerline Slope model

5-5-3-3-2 Objectives of this model:

1. Use a contour layer to create a TIN surface then use it to generate a DEM raster.
2. Using the DEM raster to create a slope raster that will be reclassified into intervals every 5%.
3. Convert reclassified slope raster into shapefile "polygon" then and use it with the identify tool so that the road centerline takes the slope value from the slope shapefile.

5-5-3-3-3 The previous model runs the following tools in sequence:

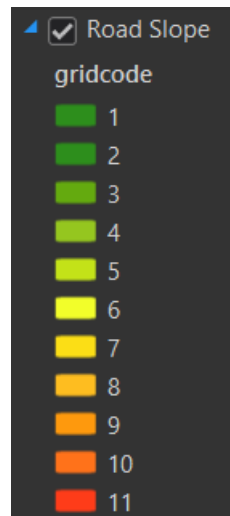
1. Create TIN — Creates a triangulated irregular network (TIN) dataset.
2. TIN To Raster — interpolates a raster using z-values from the input TIN.
3. Slope — Identifies the slope (gradient or steepness) from each cell of a raster.
4. Reclassify — Reclassifies (or changes) the values in a raster.
5. Raster to Polygon — Converts a raster dataset to polygon features.
6. Identity — Computes a geometric intersection of the input features and identity features. The input features or portions thereof that overlap identity features will get the attributes of those identity features. [22]

5-5-3-3-4 ModelBuilder results maps

What is observed that from the contour map the Slope map was gotten and the slope centerline was displayed using the following classification (every 1gridcode or color degree equals to 5% slope) See the figure 5-40 & 5-41.



Figure 5- 40 : Road Centerline Slope map1



Gridcode	Slope interval	
	From	To
1	0%	5%
2	5%	10%
3	10%	15%
4	15%	20%
5	20%	25%
6	25%	30%
7	30%	35%
8	35%	40%
9	40%	45%
10	45%	50%
11	50%	55%

Table 5- 2 : Slope interval table

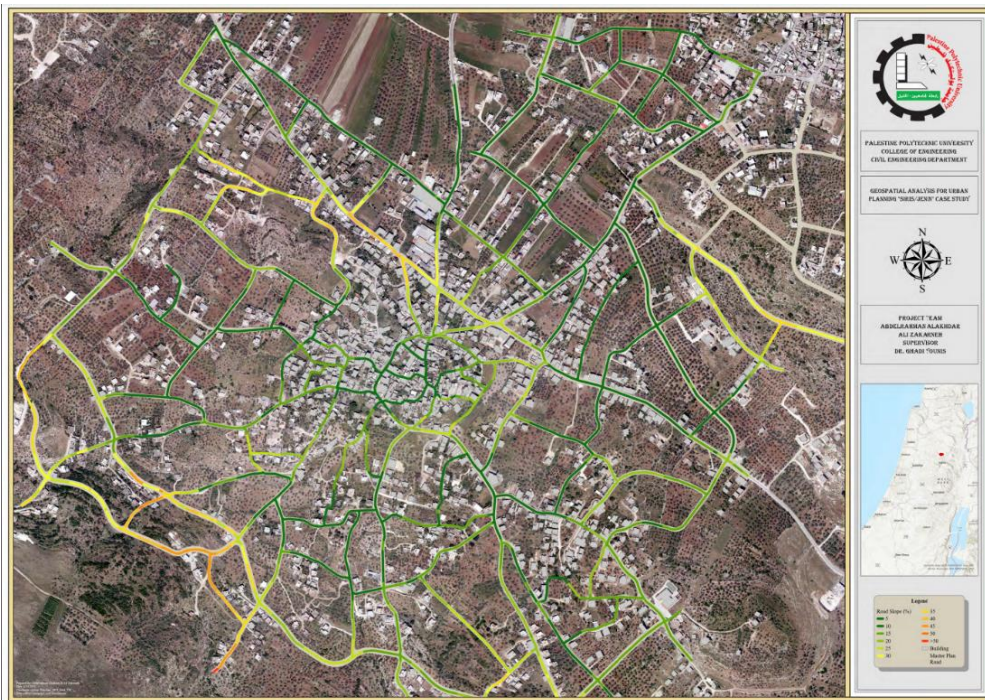


Figure 5- 41 : Road Centerline Slope map2

5-5-3-3-5 Statistics

See the figure 5-42.

FREQUENCY	COUNT_OBJECTID	MEAN_GRIDCODE	MEDIAN_GRIDCODE	STD_GRIDCODE
591	591	3.648054	3	1.900399

Figure 5- 42 : Road Centerline Slope statistics table

5-5-3-3-6 Bar charts

See the figure 5-43.

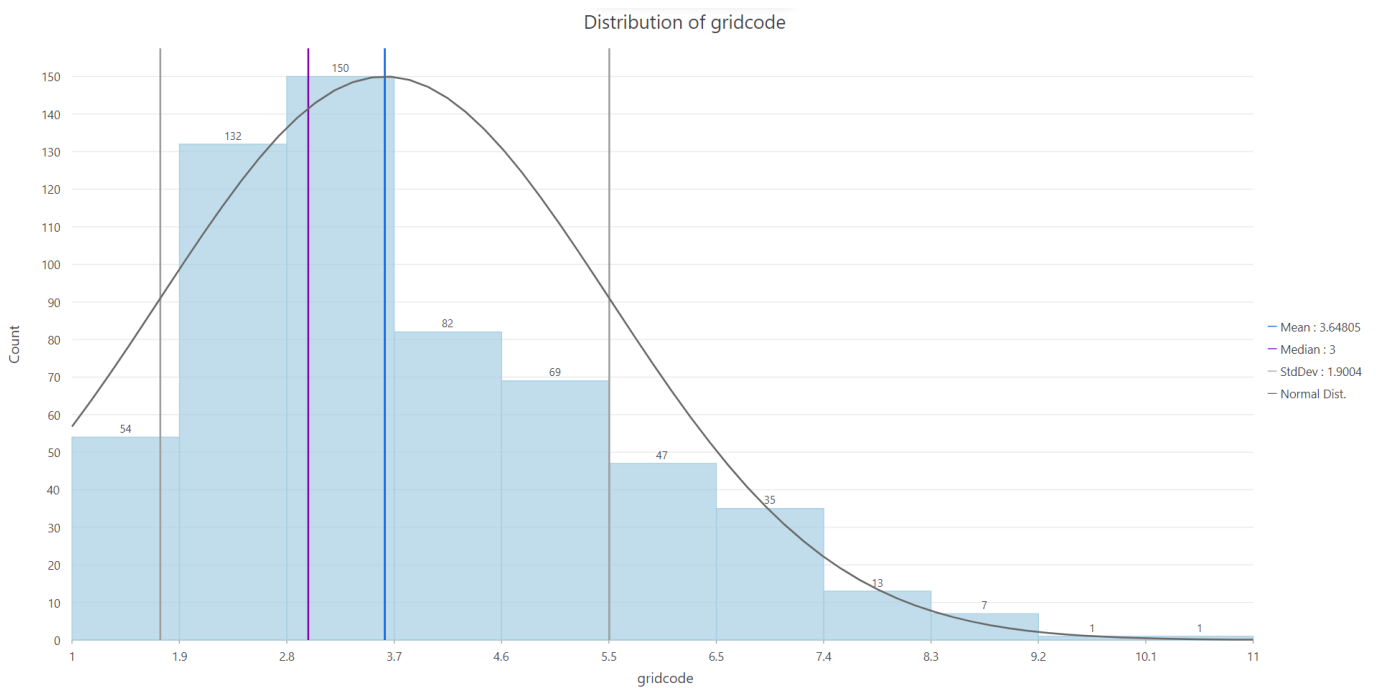


Figure 5- 43 : Road Centerline Slope Bar chart

5-5-3-3-7 Results discussion

Calculate the master road centerline slope then reclassify the slope in intervals every 5% and come up with the following statistics, there is a large sector of roads with a slope ranging between 10-25%, with an average of 15%, there are some roads in the southwest of the village that have a dangerous slope above 45%. If there is any indication, that will indicate that there is a good amount of road that allows safe riding conditions. But with some roads that the master plan failed at it.

Gridcode	Slope interval	
	From	To
1	0%	5%
2	5%	10%
3	10%	15%
4	15%	20%
5	20%	25%
6	25%	30%
7	30%	35%
8	35%	40%
9	40%	45%
10	45%	50%
11	50%	55%

Table 5- 2 : Slope interval table

5-5-4 4th model “Master plan-parcels deduction percentage”

5-5-4-4-1 Picture of model

See the figure 5-44 &5-45.

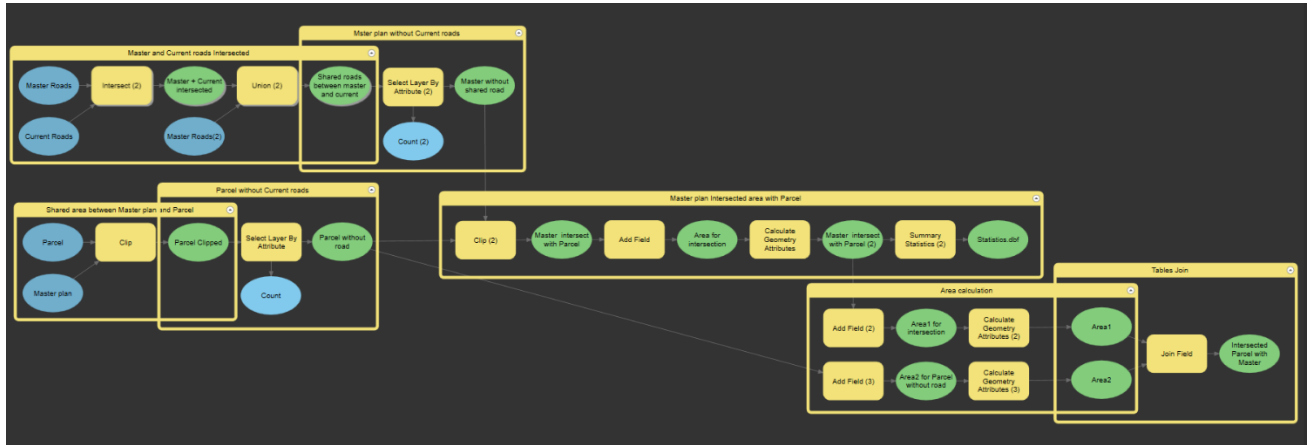


Figure 5- 44 : Master plan-parcels deduction percentage model

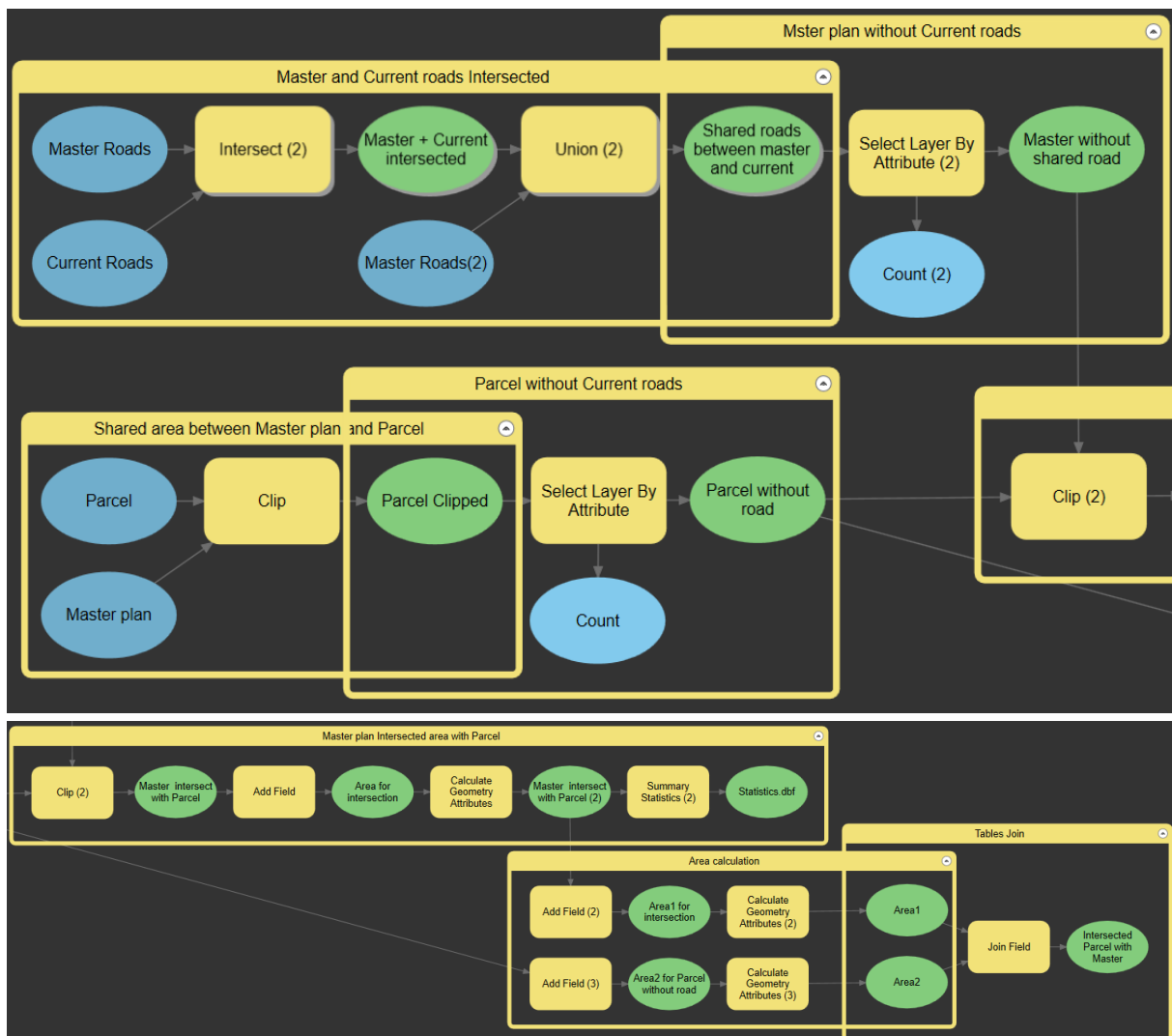


Figure 5- 45 : Same model but bigger

5-5-4-4-2 Objectives of this model:

1. Find the intersection between Master plan roads and Current Roads {Master-Current Roads intersection}.
2. Clip the Parcel layer to the project area which is the Master plan area.
3. Select & remove roads from the Parcel layer and save the output as {Parcel without roads}.
4. Select & remove {Master-Current Roads intersection} from the Master Plan and save the output as {Master without roads}.
5. Find the intersection between {Master without roads} & {Parcel without roads} and save the output as {Master-Parcel intersect} then calculate its area.
6. Add field and calculate its area for {Master-Parcel intersect} and for {Parcel without roads}.
7. Join tables between {Master-Parcel intersect} and {Parcel without roads} and present the output classification on the {Parcel without roads}.

5-5-4-4-3 The previous model runs the following tools in sequence:

1. Intersect.
2. Union.
3. Select Layer by Attribute.
4. Calculate Geometry Attributes.
5. Summary Statistics.
6. Clip — Extracts input features that overlay the clip features.
7. Add Field — Adds a new field to a table or the table of a feature class or feature layer, as well as to rasters with attribute tables.
8. Join Field — permanently joins the contents of a table to another table based on a common attribute field. The input table is updated to contain the fields from the join table. fields from the join table will be added to the input table. [22]

5-5-4-4 ModelBuilder results maps

What is observed from the map is the parcel that intersects and overlaps with the proposed master plan road, and the deduction percentage for that intersection was calculated and reclassified, the result was displayed using the following classification see the figure 5-46 &5-47.



Figure 5- 46 : Master plan-parcels deduction percentage map1

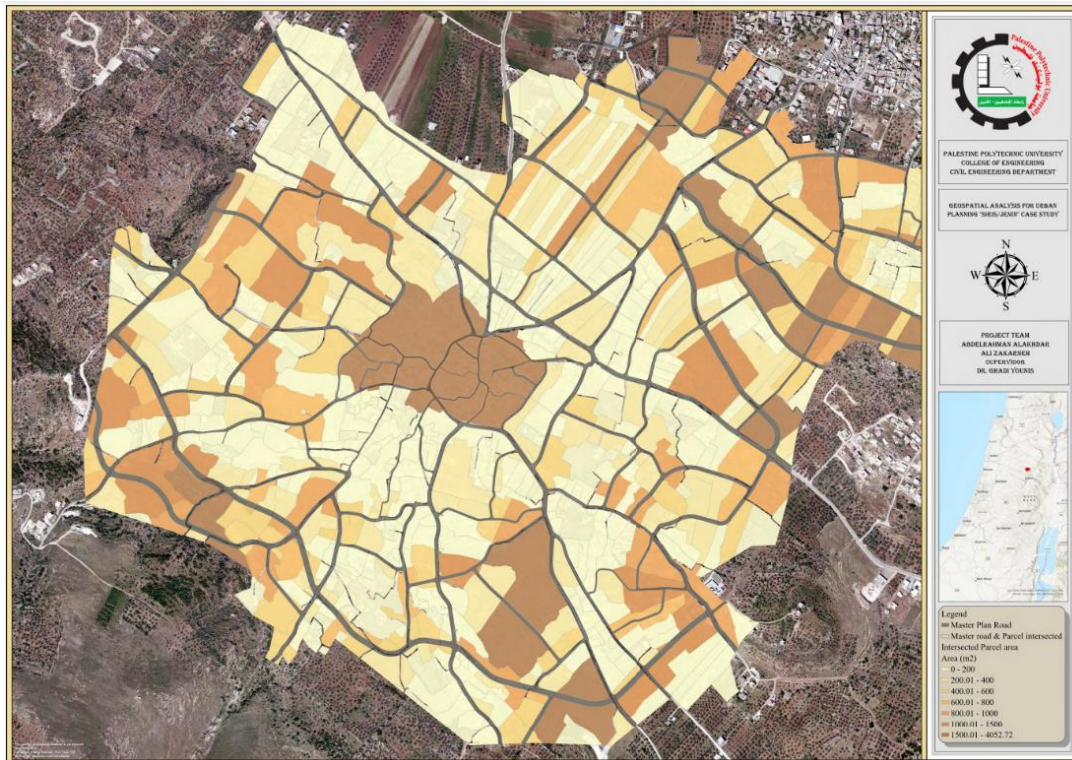


Figure 5- 47 : Master plan-parcels deduction percentage map2

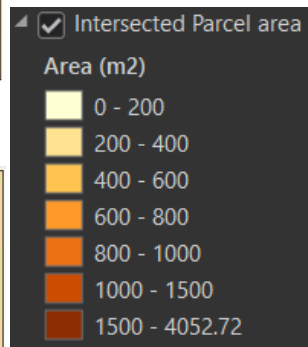


Figure 5- 52 : Intersected Parcel Area

5-5-4-4-5 Statistics

See the figure 5-48.

COUNT_Shap	SUM_Shape_	MEAN_Shape	MIN_Shape_	MAX_Shape_	MEDIAN_Sha
643	219851.670483	341.915506	0.004595	4052.73369	200.181327

Figure 5- 48 : Master plan-parcels deduction percentage statistics table

5-5-4-4-6 Bar charts

See the figure 5-49.

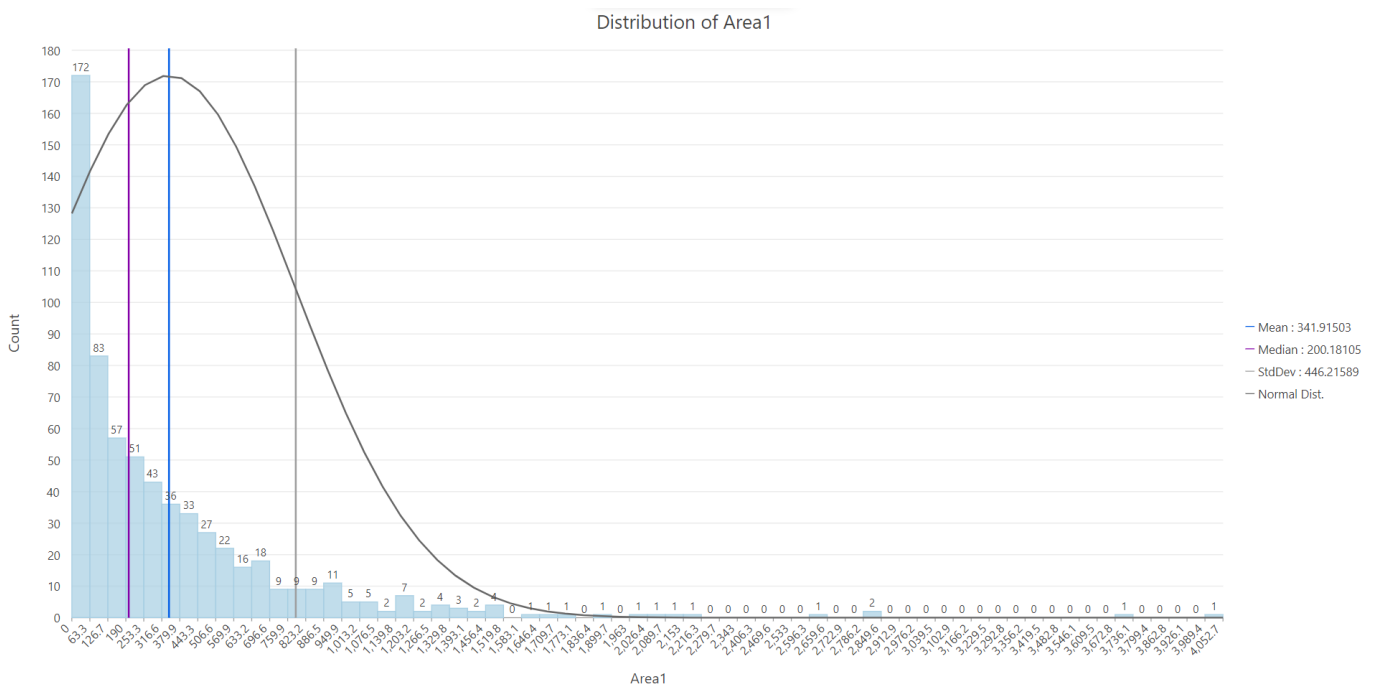


Figure 5- 49 : Master plan-parcels deduction percentage Bar chart

5-5-4-4-7 Results discussion

Find and calculate the intersection area between the parcel and the master plan road reclassify the intersected area in intervals every 200 square meters and come up with the following statistics, there are 643 areas of intersection with a total area of 219000 square meters, an average of 342 square meters, most intersections area ranges between 1-400 square meter and the largest area equals 4053 square meters. If there is any indication, that will indicate the failure of the master plan particularly in front of this number of intersections.

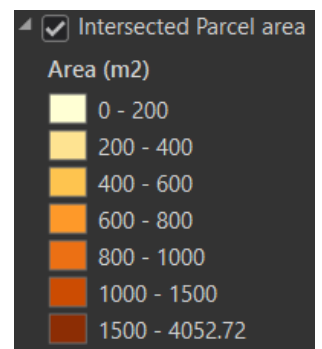


Figure 5- 52 : Intersected Parcel Area

chapter six: Conclusions & Recommendations

6-1 Conclusions

6-2 Recommendations

When carrying out any work, whether this work is engineering or non, it results in final results that determine the required matters and for which this work was carried out, whether positively or negatively. This chapter discusses the set of results reached in the process of master plan analysis and contains a set of recommendations that will give a good impression when implementing this project, as well as coming up with recommendations to the municipality and the competent institutions in order to achieve the desired goal of this study.

6-1 Conclusions

In the previous models, the area of deduction from the buildings was calculated, and in order to find out if there is any way to improve the situation and reduce the deduction, we resorted to the ASSHTO specifications, and the lowest permitted road widths were used in this step, as was explained previously, but the result was that the deduction areas increased, which indicates that any attempt to change or modify the width of the roads to match The ASSHTO specifications will only fail. Then, the processing dived into more details where the road slope was calculated through a contour map every 1 meter after conducting several conversion and export operations, it was concluded that most of the roads in the place of study have a very appropriate slope of less than 25%, which means comfortable driving on those roads with the existence of a small percentage of the roads, their locations must be changed because the slope is high. In the end, the deduction of the proposed master plan roads from the parcels was calculated and presented with an appropriate classification as it was explained.

All the previous geospatial analysis were done on the ArcGIS Pro3.0 program using the ModelBuilder tool, and it is possible to export this ModelBuilder to anyone in the world to carry out the same previous analyzes and build, add to them in order to enter into the details of the details in the analysis of the Master Plans.

6-2 Recommendations

1. Modifying the locations of the proposed roads in the current master or newer one so that they are identical to the current geospatial of the roads and do not intersect with buildings or lands, or there are intersections in a few portions for the sake of the public interest.
2. Any attempt to refer to AASHTO standards is a failed attempt based on what has been clarified, and it is necessary to refer to the models of local government in the roads and their expansions.
3. Modifying the locations of the proposed master roads in the southwestern area of the village, taking into account that the slope of the roads does not exceed 25%.

4. Emphasizing the importance of seeking to provide a master plan for the village, which organizes the urban development process in the village, and solves many of the problems that the village suffers from
5. Carrying out many field survey studies for the village, through which a comprehensive database can be formed on which any future planning process for the village can be based.
6. Carrying out actual and practical procedures on the ground to prepare a master plan for the village, and follow the correct and modern scientific methods in its implementation and relying on information taken accurately from the ground, and coming up with a master plan that is characterized by its sustainability and its ability to absorb future developments.
7. Raising awareness among citizens of the importance of adhering to regulatory laws, and their role in the development and progress of the village.
8. Work to find ways and means to implement the master plan by providing the legal force that supports and supports these laws and the executive force that works to implement them on the ground.
9. Starting to make the master plan for the village, according to the results have reached from our analytical study of the village and with the help of modern planning theories. During this land uses will be mainly determined and the relationships between them will be studied.
10. Studying the roads of the village, working on taking notes on each of the roads in the, village and proposing some solutions that address its problems, during which a re-planning of all the roads of the village will be carried out in terms of the road's route, direction, width and slope, and amending that in the new master plan.
11. Studying the existing services in the village such as health, educational, cultural, and other services, identifying the problems that these services suffer from and the lack of services provided, and proposing solutions on this matter and applying them in the master plan.
12. Allocating public housing for long-term urban growth.
13. Expanding roads and making regulatory laws for them.

14. Work on developing the recreational side of the village, as there is a green area in the village that can be developed and exploited as a public garden and a recreational place.

15. After creating a new master plan, its implementation must be monitored and heavy fines imposed as a deterrent to anyone who tries to breach it.

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