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Potentiality Analysis of Physical Development of International Airports Surrounding Zones

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ABSTRACT

The areas surrounding Iraqi international airports generally suffer from a lack of interest in their planning in a manner compatible with the airport with the absence of integrated planning between the airport and the city. From here, the search problem appears. It is represented by a lack of interest in the integration of urban planning and airport planning and the lack of a clear policy to deal with the areas surrounding international airports. A desire to achieve the research aims to introduce compatible uses in the vicinity of airports and review the planning and global directions for dealing with the areas surrounding the airports within urban areas. In contrast, the second aspect of the research aims to assess the uses of the land surrounding the airports and determine their compatibility with the planning directions of these areas. The research studied the areas surrounding Baghdad International Airport and conducted a comprehensive survey of land uses within a distance of (4) km from the airport runway center. Then it conducted an analysis using geographical information systems(GIS) and studied the survey results, and assumed that the current uses of the areas surrounding international airports do not reflect the optimal use of these areas and, therefore, not exploiting the current capabilities and development opportunities provided by the airport for the surrounding areas. The research hypothesis is tested through the use of (GIS) and displaying the results of the field survey of land uses within the study area. Furthermore, the methodology of comparative spatial analysis was done by monitoring the current situation through (GIS) and analyzing the result and comparing it with international standards to achieve results that contribute to attaining physical development. The first part of the research presents an introduction to international airports that are one of the most significant urban nodes in the city. The surrounding areas have many features that require regulation and coordination. The presence of incompatible uses in the vicinity of the airport leads to the loss of the advantages provided by the airport and the occurrence of adverse effects on the surrounding areas. Part two

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introduced compatible uses in the vicinity of airports. Part Three analyzed the case study of the areas surrounding Baghdad Airport. Then the results of the field survey showed that there are incompatible uses and the absence of compatible uses, and this case requires the identification of many planning procedures and benefiting from global trends in planning these areas.

Keywords: International Airports, Physical Development, Compatible, and incompatible uses.

تحليل إمكانات التنمية العمرانية للمناطق المحيطة بالمطارات الدولية

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الخلاصة

بشكل عام ، تعاني المناطق المحيطة بالمطارات العراقية الدولية من عدم الاهتمام بالتخطيط لها بطريقة تتوافق مع المطار وعدم وجود تخطيط متكامل بين المطار والمدينة ، ومن هنا تظهر مشكلة البحث والمتمثلة في عدم الاهتمام في دمج التخطيط الحضري وتخطيط المطارات ، وعدم وجود سياسة واضحة للتعامل مع المناطق المحيطة بالمطارات الدولية. رغبة في تحقيق أهداف البحث حيث يهدف البحث في المقام الأول إلى إدخال الاستخدامات المتوافقة في محيط المطارات ومراجعة التخطيط والاتجاهات العالمية للتعامل مع المناطق المحيطة بالمطارات داخل المناطق الحضرية ، بينما الجانب الثاني من البحث يهدف إلى تقييم استخدامات الأراضي المحيطة بالمطارات وتحديد مدى توافقها مع التوجيهات التخطيطية لهذه المناطق. يقوم البحث بدراسة المناطق المحيطة بمطار بغداد الدولي وإجراء مسح شامل لاستخدامات الأراضي على مسافة (4) كم من مركز مدرج المطار ثم إجراء التحليل باستخدام نظم المعلومات الجغرافية ودراسة نتائج المسح ، وافترض أن لا تعكس الاستخدامات الحالية للمناطق المحيطة بالمطارات الدولية الاستخدام الأمثل لهذه المناطق وبالتالي لا تستغل القدرات الحالية وفرص التطوير التي يوفرها المطار للمناطق المحيطة. يتم اختبار فرضية البحث من خلال استخدام نظم المعلومات الجغرافية (GIS) وعرض نتائج المسح الميداني لاستخدامات الأراضي داخل منطقة الدراسة ، يقدم الجزء الأول من البحث مقمداً للمطارات الدولية التي تعد من أهم العقد الحضرية في المدينة ، وما تتميز به المناطق المحيطة بالمطار التي تتطلب التنظيم والتنسيق وأن وجود استخدامات غير متوافقة في محيط المطار يؤدي إلى فقدان المزايا التي يوفرها المطار وحوادث آثار سلبية على المناطق المحيطة ، الجزء الثاني / إدخال استخدامات متوافقة في محيط المطارات الجزء الثالث / دراسة حالة المناطق المحيطة بمطار بغداد د مقارنة مع الاستخدامات المفضلة حول المطار. ثم أظهرت نتائج المسح الميداني وجود استخدامات غير متوافقة وغياب الاستخدامات المتوافقة التي تؤدي إلى التنمية في المنطقة ، وتتطلب هذه الحالة تحديد العديد من الإجراءات التخطيطية اللازمة والاستفادة من الاتجاهات العالمية لتخطيط هذه المناطق .

الكلمات الرئيسية: المطارات الدولية ، التنمية العمرانية ، الاستعمالات المتوافقة والغير متوافقة

1. INTRODUCTION

Airports are part of an international global network that facilitates international trade and economic growth. Airports are an urban growth contract that provides speedy cargo transportation, delivery of passengers, job opportunities, increased demand for services and housing, and increased travel and new tourism opportunities. The aviation industry and urban growth should be launched together to achieve sustainable urban development. Where sustainability refers to the relationship between social, economic, and environmental specialists in the community to realize sustainable development (Kamas, et al., 2019). Airports are usually described as mega-city projects that have significant impacts on the physical and environmental characteristics of the city. The quality of urban development depends on how planners exploit the physical infrastructure and economic opportunities that already exist and then turn them into something new. In most cities, these



opportunities are likely to focus on airports. The challenge lies in how to transform these facilities into places that attract people to work, live and relax, but unfortunately, little focus is directed to the future role of the airport and planning to develop it and develop the surrounding areas. However, noise concerns are receiving more organizational and technological attention than any other environmental problem related to aviation, as indicated in International reports of International Air Transportation Association (IATA2001) Where noise systems were initially applied in the United States of America in 1969, and the Chicago International Convention established international standards for the issuance of aircraft noise certificates in 1971 and the sixteenth document containing the principles of noise control was issued. Countries can prepare their own standards, and annoying aircraft begin to decline gradually, fewer people affected, and any attempt to balance the commercial and environmental objectives of airports (**Rakas, 2019**).

1.1 The concept of international airports

There are many definitions of the airport as it is a dynamic concept. The International Aviation Organization (ICAO) has defined as a specific area on the surface of the land or water that includes any buildings, installations, or equipment devoted entirely or partially to the arrival, departure, and movement of aircraft on the surface (**ICAO, 2016**). Currently, an airport is not only a part of the basic transport infrastructure in the countries, but it is an essential component of the urban structure of the surrounding areas, consisting of new urban cities and parks driven by the airport. It is defined as a small model of the city that works as an urban entity and a complex and huge regional growth center with multifunctions that arises as a small city with a center (located in a building of travelers). The presence of industrial zones of cargo loads and shipping warehouses and residential areas represented by hotels and major roads that reflect the richness and diversity of civilization and cultural cities (**Edwards, 2004**).

The international airport is designated by the Contracting State which is located in its territory as an airport for entry and departure for international air traffic and includes formations such as customs, immigration and public health (**ICAO, 2017**). The international airport provides services and facilities for the transportation of passengers and goods between countries and contains the air components:

(AIRSIDE) includes the facilities and material possessions at the airport that serve aircraft operations at the airport in addition to the airspace surrounding the airport represented by the area outside the land surrounding the airport where the aircraft maneuvers after take-off and before landing or when it passes to another airport which is planned to accommodate the movement of an aircraft.

(LAND SIDE) includes ground access components to the airport and ground traffic to and from the urban areas, as well as movement within the airport (**Horonjeff, et al., 2008**).

1.2 Airport planning

The Federal Aviation Administration (FAA) defines airport planning as a systematic process used to develop guidelines for efficient airport development in line with local and national goals. The primary goal of airport planning is to ensure the effective use of airport resources to meet the demand for aviation in a financially feasible manner taking into account the environment, airport,



airspace, safety, and societies Local (Arora, 2019). The International Civil Aviation Organization (ICAO) prepared an Airport Planning Manual in Document No. 9184, which consists of two parts. The first part (the master plan of the airport) includes airport planning, necessary facilities, and services for the movement of planes and travelers and the importance of the integration of their planning, in addition to its integration with urban planning and consider the needs of the city in addition to the needs of aviation. The International Air Transport Association prepared a report titled The Future of Aviation 2035. Recommendation No. 19 affirms the necessity of cooperation The Commercial Association of Airlines in the World with urban planners, especially in plans to develop the areas surrounding the airports (STANGEL, 2019).

The second part (land use and environmental management), which clarifies the operations of organizing land uses and controlling the harmful environmental impacts of the airport and confirms the need to integrate the planning of land uses with the comprehensive planning program for large areas with patterns of commercial, residential, industrial and agricultural land uses (ICAO, 1987).

1.3 Considerations to be taken into account in the airport area

- 1- Operational considerations/(airspace planning, presence of obstacles, hazards, weather, convergence, and landing aids).
- 2- Social considerations/should be signed carefully and near urban centers, provided that the places of population concentrations do not pass in the path of aircraft movement, and the proximity to the request center, ground access.
- 3- Environmental considerations/study the effects of the airport on the natural environment (air, land, water, the necessity of measuring and describing plane noise (Bakhsh, 1996).
- 4- Cost considerations/studying the cost of development work
- 5- Services / having water, energy, and sanitation supplies near the airport
- 6- Land value/The value of land located near airports in which future development work is expected to occur and adjacent to urban areas, and comprehensive transportation systems increases.

After what has been mentioned to international airports and their relationship with the city, the research will address the concept of Physical development, objectives, and the impact of the airport on achieving physical development driven by the airport.

1.4 the basic principles for achieving sustainable physical development

- Compliance with building codes issued by the competent authorities to achieve the physical requirements compatible with the civilizational identity of cities.
- Establishing development plans and programs for existing cities and they should be consistent with the available capabilities and resources.
- Achieving mixed land uses, organizing, and adjusting priorities in distributing land uses to bring them in line with the requirements of community development.
- Harmony and compatibility with the environment and nature and the identification of incompatible uses and effects (Muhammad, 2013).



The creation of extensive activities in the area surrounding the airport, such as hotels, air cargo users, and tour operators, in addition to employment sites and more induced effects that will follow these activities. They become access corridors to the airport and include industrial sites with the agglomeration economics, where surveys indicated the effects of proximity to the airport as a critical component of corporate location decisions (Banister, 2005). The results of the studies conducted in Germany in Lufthansa in 1989 confirmed that the use of the land by the airports is five times more efficient than the railways and six times more than the roads. Fig. 1. indicates the relative use of the land by the mode of transport and the number of kilometers per hectare.

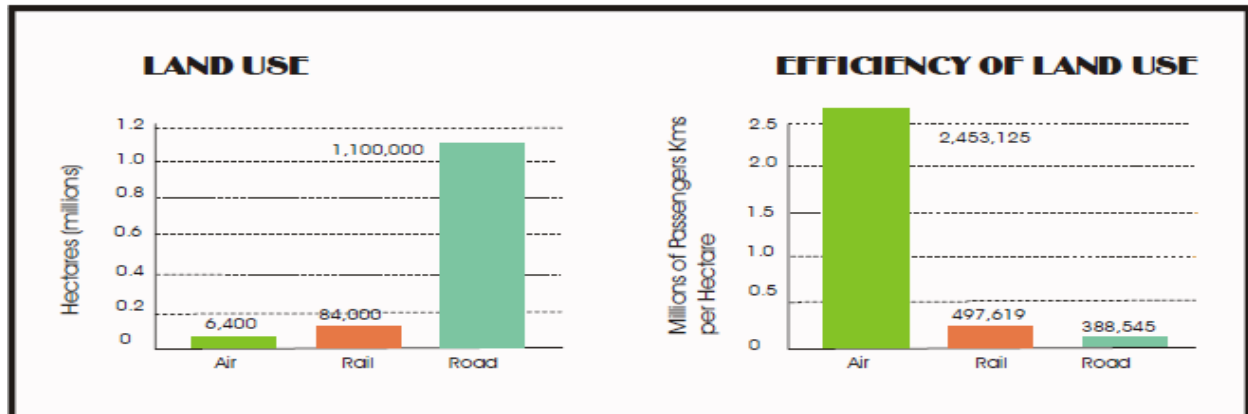


Figure 1. Efficient land use for air transport, Mazaza and Maddle, 2001.

1.5 Airports as centers of activities and their role in achieving development

The United Kingdom was the first country that implemented a new national policy for airports that were privatized in 1987 and lifted restrictions on the aviation industry and considered airport operators an effective way to increase revenue and relying on aviation revenue alone at first and then focusing a lot on the commercial activity at the airport terminal, providing a range of shopping facilities, and then focus later on business diversity and full use of the airport's location (Stevens, et al., 2007). The airports were transformed from a branch of the government into dynamic companies with a commercial orientation. They then followed three economic keys to transfer the airports during the last quarter of the century (privatization, marketing, and globalization) (Appold and Kasarda, 2016). Fig.2 illustrates how the different business methodology of airport operators leads to different urban ranges of airport impacts and their translation in each of the mentioned development concepts.

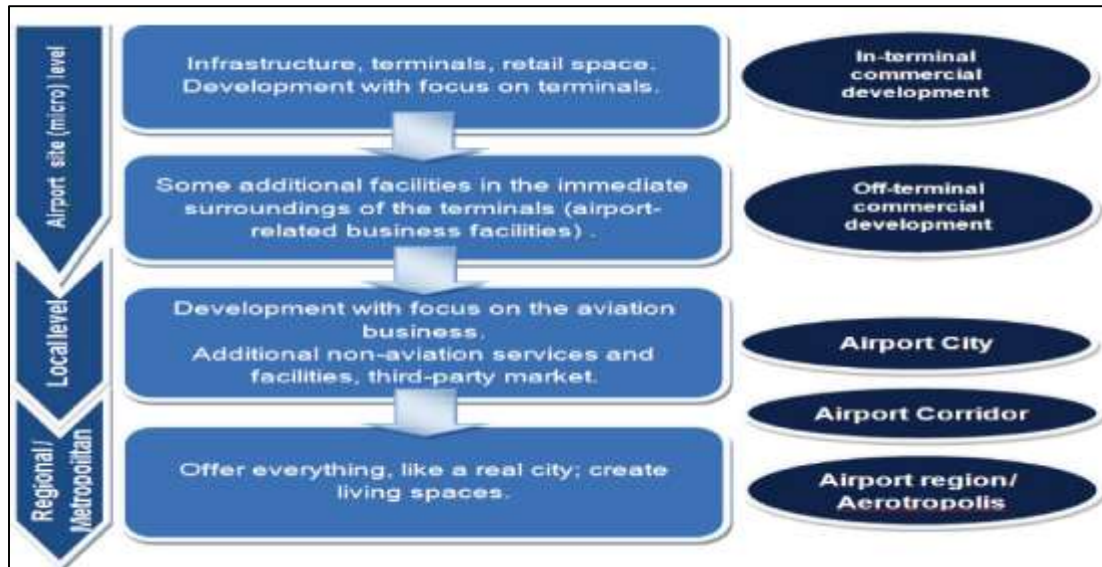


Figure .2 . Airport business approaches, spatial scale, and respective development concepts, peneda and macario, 2011.

Commercial development may be concentrated in the passenger terminal (infrastructure, passenger building, or retail space). Limited development is in the passenger terminal at airport sites where development is at the micro-level, or commercial development may be outside the passenger terminal with some additional services. Near the building of travelers, services related to airport work are also considered at the airport site and within the micro-level. As for the airport city, it includes development that focuses on aviation business in addition to non-air services and facilities, and this development will be at the local level and then expanding the spatial scale of development outside the airport, such as the airport corridors and the airport region, which includes all services in the actual city and provide spaces for living this development and be within the regional and metropolitan level.

The second part of the research will cover planning land use in the vicinity of airports.

The planning of land use surrounding the airport is described in document No. 9184, which was mentioned previously and that accurately describes the operations necessary to achieve an ideal relationship between the airport and its surroundings by introducing land uses compatible with aviation and ensuring that the gains achieved from low noise are not exploited by Urban sprawl near the airport (Abdullahi, 2012).

1.6 Land use properties near the airport

The basis for addressing the problems of land use compatibility at the airport is based on identifying compatible and incompatible land uses and the resulting effects. The land uses that are **compatible** with the airport are defined as the uses that can coexist with the airport without restricting the safe and effective operation of the airport and do not expose people who live or work near the airport From unacceptable levels of noise, **incompatible land** may change to compatible according to several variables including (land use management, airport land use location, development features, auxiliary measures associated with the use of land use).

The International Aviation Organization has classified land uses per their nature and compatibility with airports into several categories, including:



Natural land uses, these natural features in aircraft approach areas reduce aircraft noise, with the importance of focusing on bird control measures to protect the safety of aircraft.

Agricultural land uses, many airports provide opportunities to establish agriculture to increase revenue, prevent soil erosion, and prevent expansion at the expense of airport lands.

Highway and railways, the presence of the highway and railways near the airport or located under the approach of aircraft approach is the most preferred use in the vicinity of airports while maintaining safety areas

Uses of recreational lands, the development of undeveloped areas adjacent to the airport into integrated recreational complexes for walking and horse riding and facilities for outdoor seating and golf courses. A group of swimming pools, tennis courts can be assembled without spectators with other facilities such as clubs and restaurants hotels (ICAO, 2018).

Commercial land uses, including shopping centers, warehouses, offices, and a large part of these actions that occur during daylight hours and is not affected by the noise problem. However, it is vital to include sound and ventilation insulation work in building commercial structures. Located industrial sites near and inside the airport correspond to the surrounding noise in addition to the large need for industrial lands around the airport that contribute to the development of commercial and general aviation.

Municipal facilities, the presence of municipal utilities near the airport, is logical and compatible with the airport because the commercial, industrial and residential growth around the airport generates an increasing demand for water, electricity, and sanitation facilities.

Residential and institutional land uses, including residential homes, real estate, and offices. As for institutional housing, it includes community facilities such as schools and hospitals that should be planned with a comprehensive study of airport activities to reduce environmental and noise impacts (ICAO, 2018).

1.7 Standards of compatibility of land uses in the vicinity of the airport

The standards aim to provide the airport authority with an action plan to protect potential operations and investment in the airport and its surroundings from incompatible development among these standards.

1- Obstacles Limitation Surfaces

Any airspace design that is devoid of obstacles in the vicinity of the airport, methods of dealing with it by removing it or reducing its height or placing signals and lighting indicating the obstacle and publication chart of obstacles in the Aeronautical Information Publication (AIP). There are several surface obstacles limitation (Approach surface, Horizontal surface, Conical surface, Transitional surface) (ICAO-ANNEX 14, 2016), as shown in **Fig. 3**.

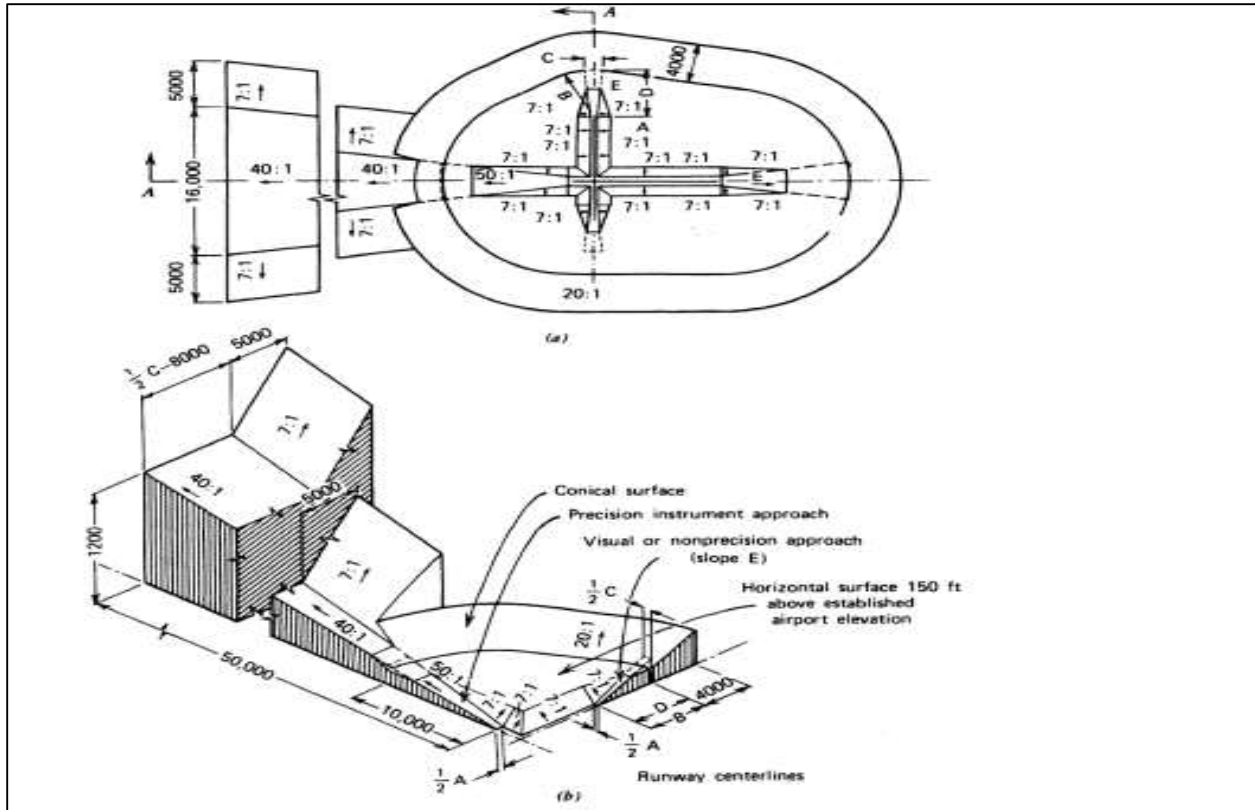


Figure. 3 Obstacle limitation surfaces, (Ashford and Wright, 1992).

2- Measuring the noise and draw contour lines of the airport's noise levels. The methodology for measuring noise according to the international aviation organizations (ICAO, FAA) confirms the use of the Integrated Noise Model (INM) Version7-od, computer Model. Information related to the airport and the plane, and then the program draws contour lines like the lines in **Fig. 4.**, which are a guideline for the distribution of land uses, as in **Table .1.**

Table .1 Guideline for the distribution of land uses according to (DNL).

Yearly Day–Night Average Sound Level (DNL) In Decibels						
Over 85	85-80	80-75	75-70	70-65	Below 65	Land use
RESIDENTIAL						
N	N	N	(1) N	(1) N	Y	Residential Homes
N	N	N	N	N	Y	Mobile home parks
N	N	(1) N	(1) N	(1) N	Y	Transient lodgings
Public use						
N	N	N	(1)N	(1)N	Y	Schools
N	N	N	30	25	Y	Hospitals and nursing homes
N	N	N	30	25	Y	Churches, auditoriums, and concert halls



N	N	30	25	Y	Y	Government services
(4)Y	(4)Y	(3)Y	(2) Y	Y	Y	Transportation
N	(4)Y	(3)Y	(2) Y	Y	Y	Parking
N	N	N	(1)N	(1)N	Y	Schools
N	N	N	30	25	Y	Hospitals and nursing homes
N	N	N	30	25	Y	Churches, auditoriums, and concert halls
N	N	30	25	Y	Y	Government services
(4)Y	(4)Y	(3)Y	(2) Y	Y	Y	Transportation
N	(4)Y	(3)Y	(2) Y	Y	Y	Parking
Commercial use						
N	N	30	25	Y	Y	Offices, business and professional
N	(4)Y	(3)Y	(2)Y	Y	Y	Wholesale/RETAIL
N	N	30	25	Y	Y	Retail trade, general
N	(4)Y	(3)Y	(2)Y	Y	Y	utilities
N	N	30	25	Y	Y	Communication
Manufacturing and production						
N	(4)Y	(3)Y	(2)Y	Y	Y	Manufacturing, general
N	N	30	25	Y	Y	Photographic and optical
(8)Y	(8) Y	(8) Y	(7)Y	(6)Y	Y	Agricultural (except livestock) and forestry
N	N	N	(7)Y	(6)Y	Y	Livestock farming and breeding
Y	Y	Y	Y	Y	Y	Mining and fishing
Recreational						
N	N	N	(5)Y	(5)Y	Y	Outdoor sports and spectator sports
						Outdoor music shells, amphitheaters
N	N	N	N	N	Y	Nature exhibits and zoos
N	N	N	N	Y	Y	Amusements, parks, resorts, and camps
N	N	N	Y	Y	Y	Golf courses, riding stables, and water recreation
N	N	30	25	Y	Y	

Notes:

Y (Yes) / land uses and related structures Compatible without restrictions.

N (no) /land uses and related not compatible and should be prohibited (25, 30, 35 Land uses and related structures generally compatible. Measures to chive noise level reduction of 25, 30, and 35)

1- Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor, NLR of at least (25-30) DB should be incorporated into building codes and be considered in individual approvals, normal residential construction can be achieved (20db) therefore reduction requirements are often (5,10,15) DB

2- Measures to achieve (25) DB, must be incorporated into the design and construction of a portion of these buildings where the public is received, office area, noise sensitive areas, or where the normal noise level is low.



- 3- Measures to achieve (30) DB must be incorporated into the design and construction of a portion of these buildings where the public is received, office area, noise-sensitive areas, or where the normal noise level is low.
- 4- Measures to achieve (35) DB must be incorporated into the design and construction of a portion of these buildings where the public is received, office area, noise sensitive areas, or where the normal noise level is low.
- 5- Land use compatibility provided that special sound reinforcement is installed.
- 6- Residential buildings require an NRL of (25) DB.
- 7- Residential buildings require an NRL of (30) DB.
- 8- Residential building not allowed (FAA, 1994).

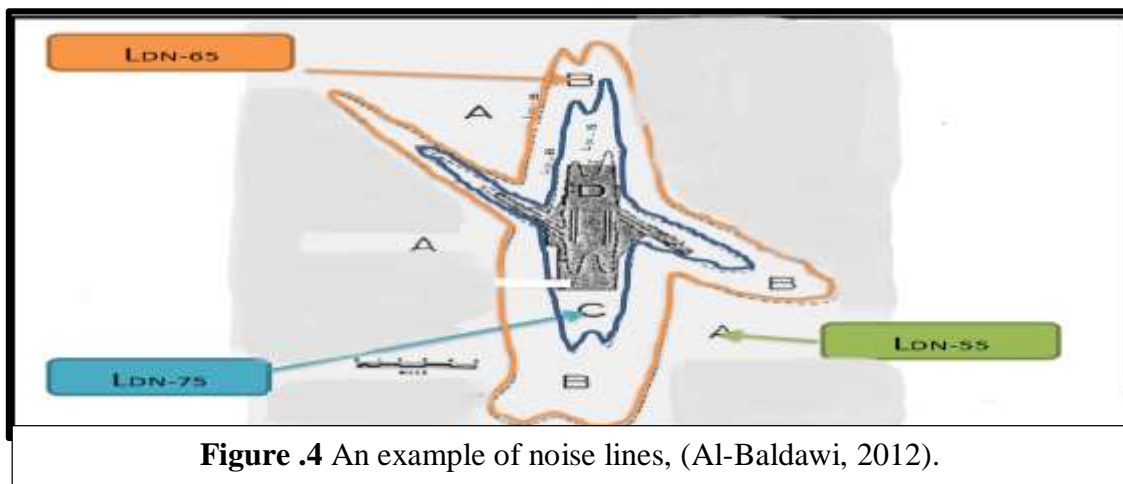


Figure .4 An example of noise lines, (Al-Baldawi, 2012).

1.8 The case study

The study area is the area surrounding Baghdad International Airport, which is the largest international airport in Iraq. The aim of the field study and the field survey identifying the types of land uses surrounding the airport and whether they are compatible or incompatible with the airport and its directions according to the preferred uses that international aviation organizations recommend their presence near the airport, because of its characteristics and features that can be exploited to stimulate the physical development of the areas surrounding it. A study has been determined, an area estimated at 4 km from the end of the parallel runways at the airport. Military, residential, educational, and other uses, in addition to that, the semi-circular area represents the conical surface, which is one of the surfaces of reducing obstacles in addition to the concentration of airport effects in this region. The GIS program is based on collection, maintains, stores, analyzes, outputs and distributes data and spatial information that helps in planning and taking decisions regarding city planning and infrastructure by creating layers where geographic information from maps and aerial photos is added in addition to descriptive information such as names and tables, Initially, it is revised from the error, stored, retrieved and displayed on the computer screen or in the form of map paper and helps in answering the questions to determine the usage pattern that occupies the place with giving measurements, locations and coordinates, i.e. data are collected on the site and then sort the data according to the type of location and its location



then define a map of Baghdad city on the program for geographic information systems and then define the study area and make layers for each use and make a database and analyze the most prominent features and nearby methods on the study area. **Fig.5** shows the Image of the Baghdad map, which is the source of all work outputs.

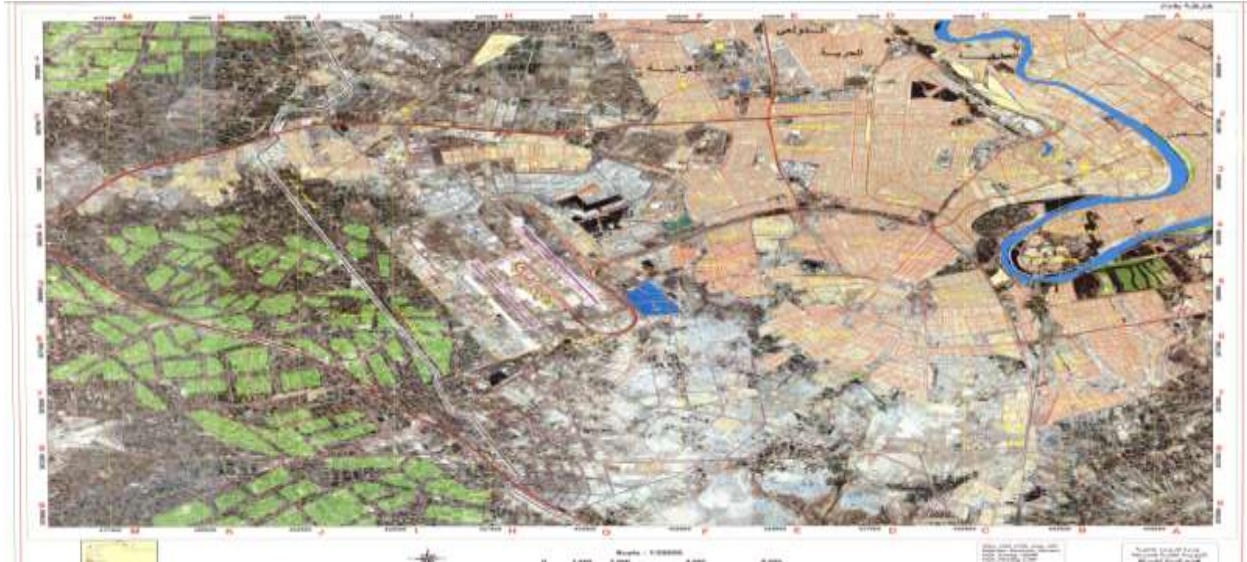


Figure .5 Image of the Baghdad map, State COMMISSION ON SURVEY, 2019.

Figure .6 The study area from the Baghdad map

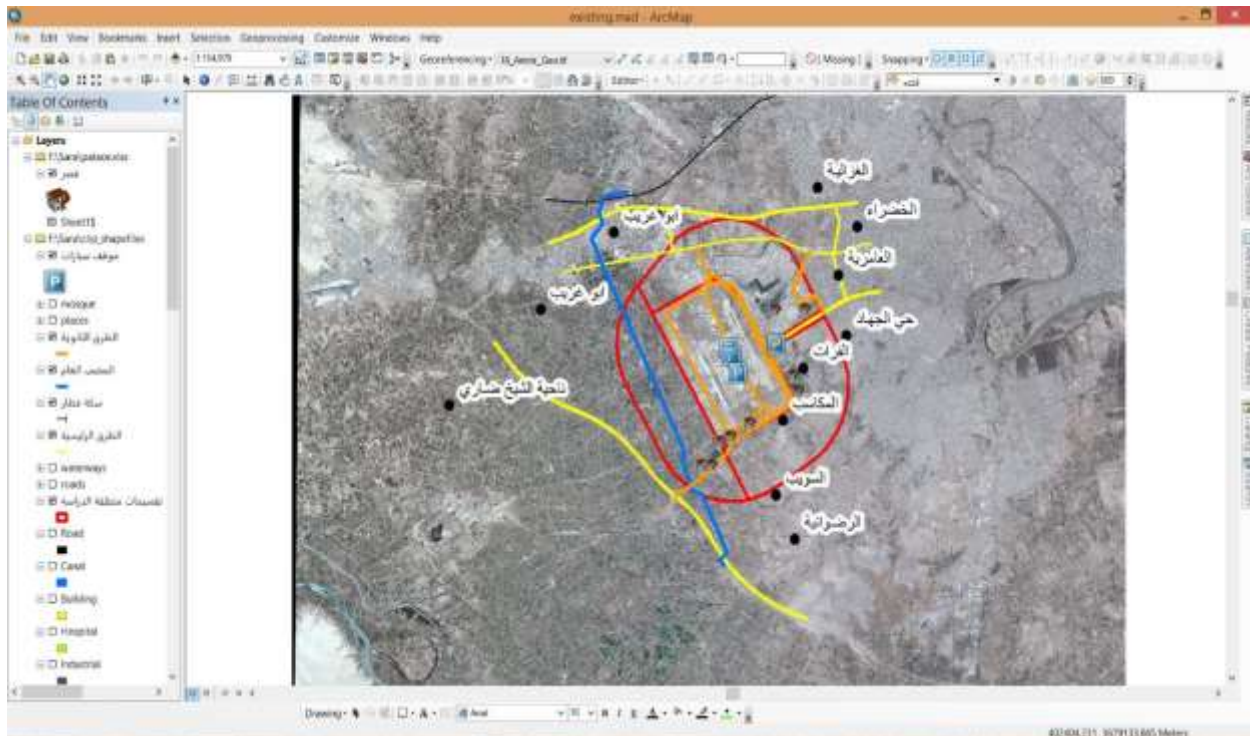


Figure .6. Study area, Researcher by use ARCGIS 10.5



The study area has been divided into three areas. It is divided by the main airport road to the southwestern part of the airport and the north-east part of the airport and the remaining part that includes relatively homogeneous uses, which is the northwestern part, as shown in **Fig. 7**.

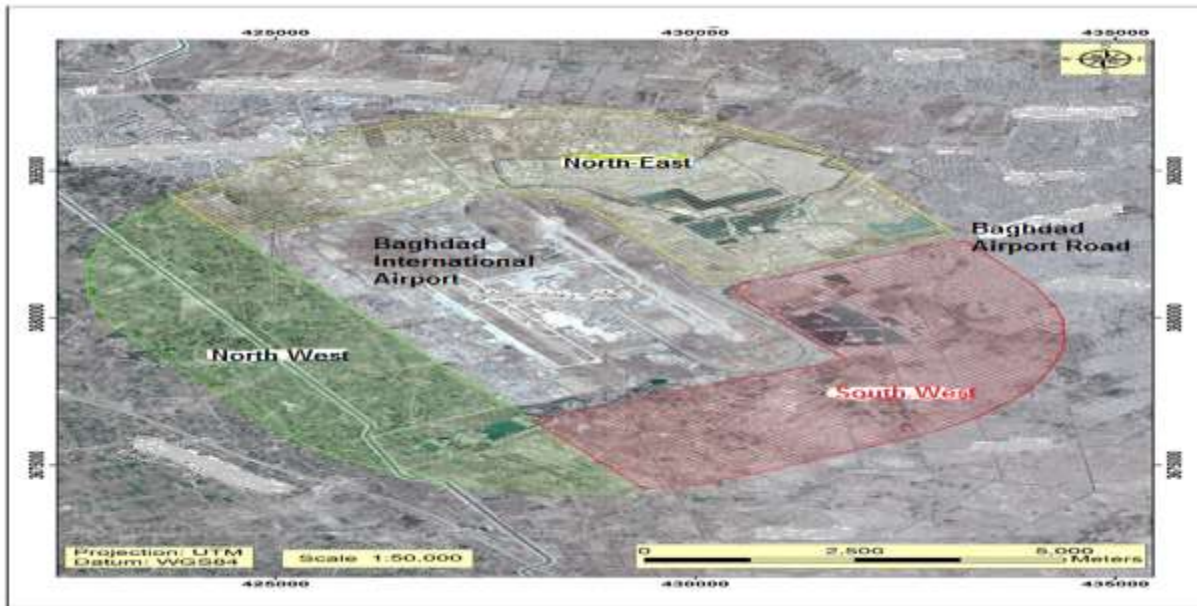


Figure .7 Dividing the study area, Researcher using ARCGIS 10.5.

(The Geographic Information Systems) enables the study of the site easily, especially when displaying results in a way that attracts eyesight like maps instead of rows and columns (**AL-Rubaie and ALMusawi, 2019**). The program was designed in conjunction with another set of programs and used to study the reality of the land uses of the areas surrounding the airport, then Create layers for each use (residential, commercial, industrial), as shown in **Fig. 8**.

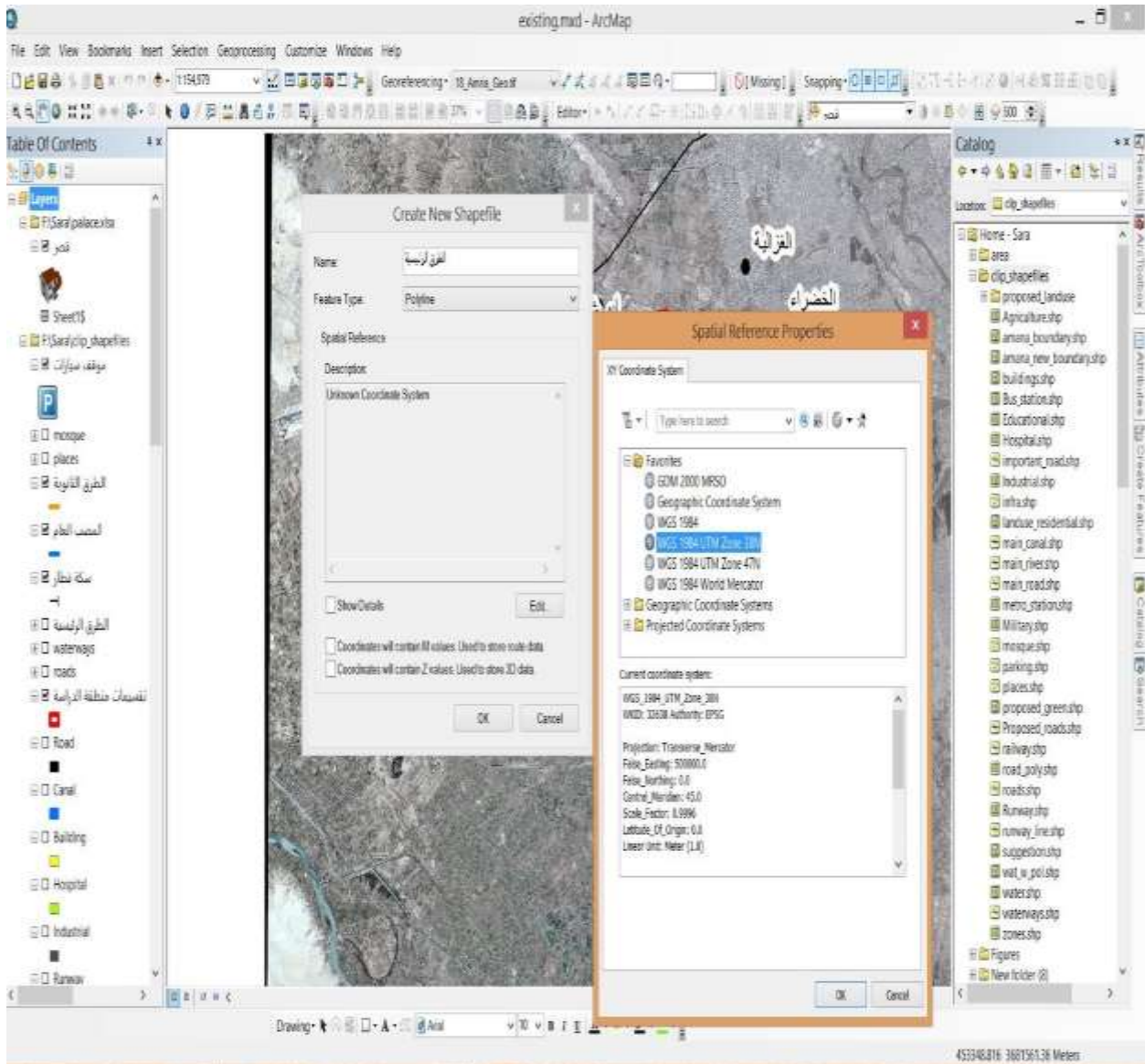


Figure .8 Layers of each uses, Researcher by use ARCGIS 10.5.

Fig.9 and **Fig.10** show the land use in the study area in several layers. Then the layers are shown as requested.

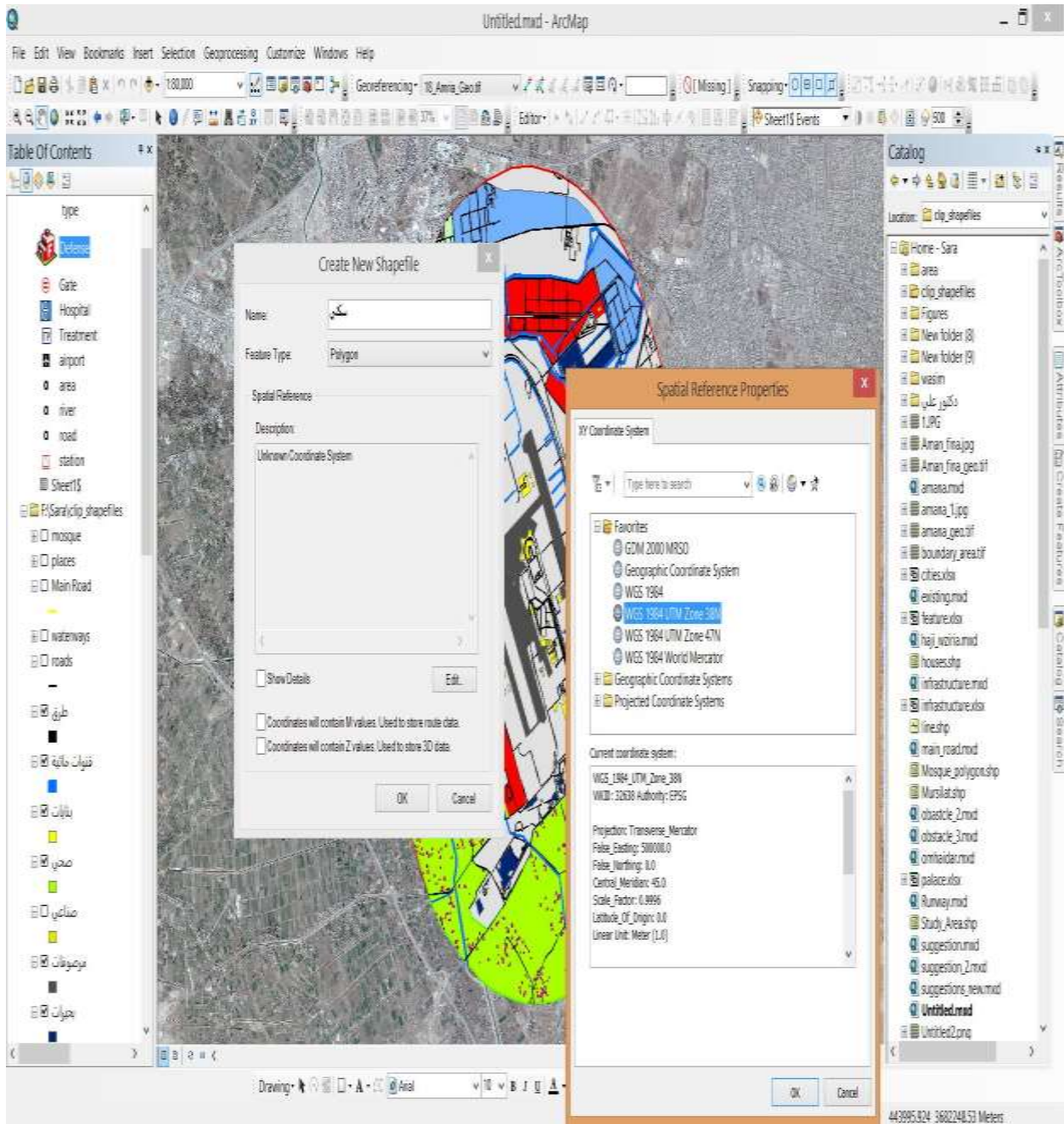


Figure .9 Features in the study area, Researcher by use ARCGIS 10.5.

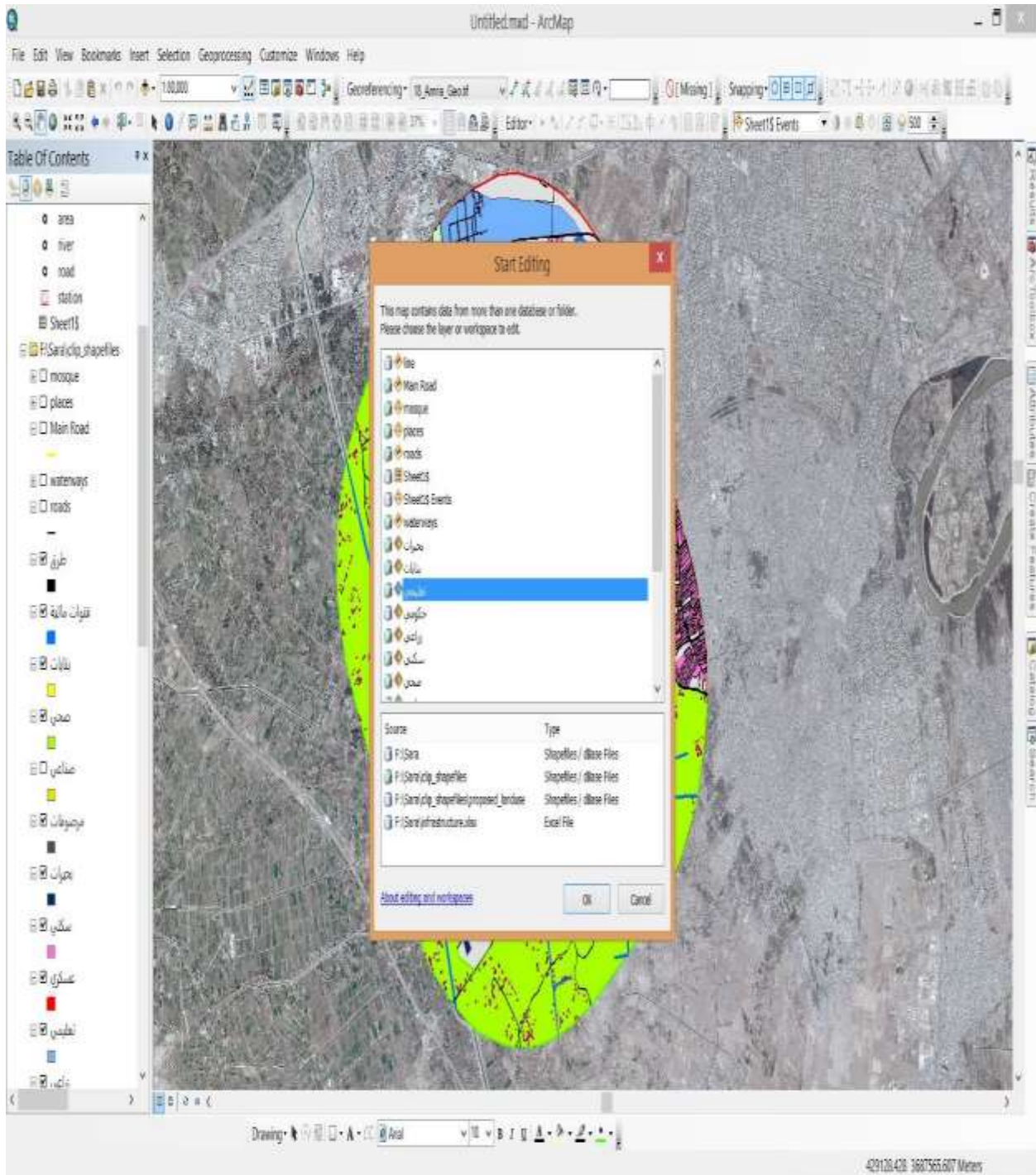


Figure.10 Uses the land in the vicinity of the airport, Researcher by use ARCGIS 10.5.



Fig .11 includes the uses of the study area.

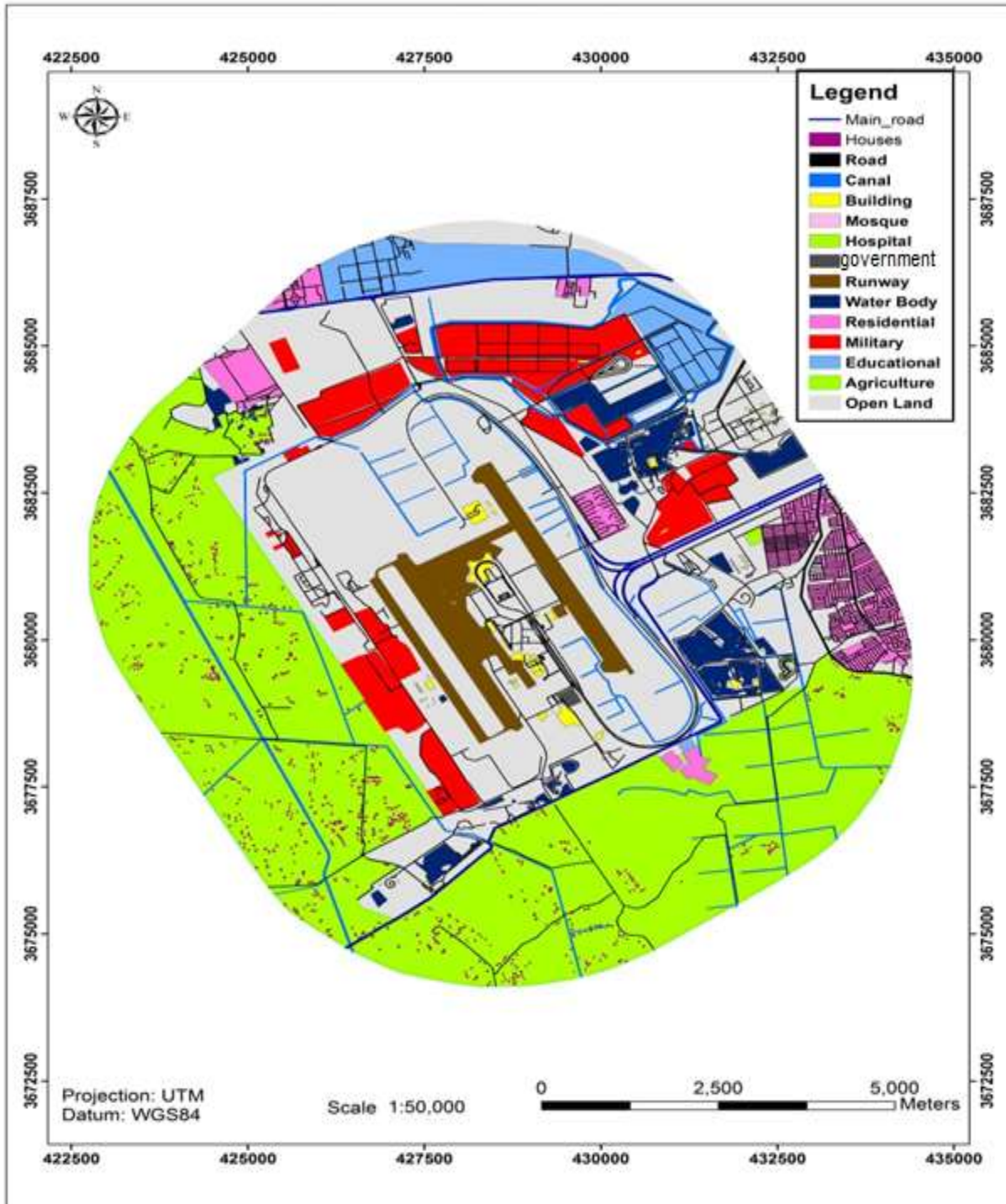


Figure .11 Land in the study area, Researcher by use ARCGIS 10.5.



Table .2 shows many uses and their proportions. Fig. 12 gives the research GIS results.

Table .2. The land uses of the study area and its proportions.

(Land use)	Area (m ²)	Ratio (%)
Building	542000	0,4
Education	4277000	3,2
Government	56000	0,04
Military	7134000	5,3
Mosque	26000	0,02
Residential	4300000	3,2
Road	4000000	3
Airport	30000000	22,4
Open land	39500000	30
Canales	2000000	1,5
Health	52000	0,03
Water body	333000	0,2
Agriculture	41200000	31
Total	133,420,000	100

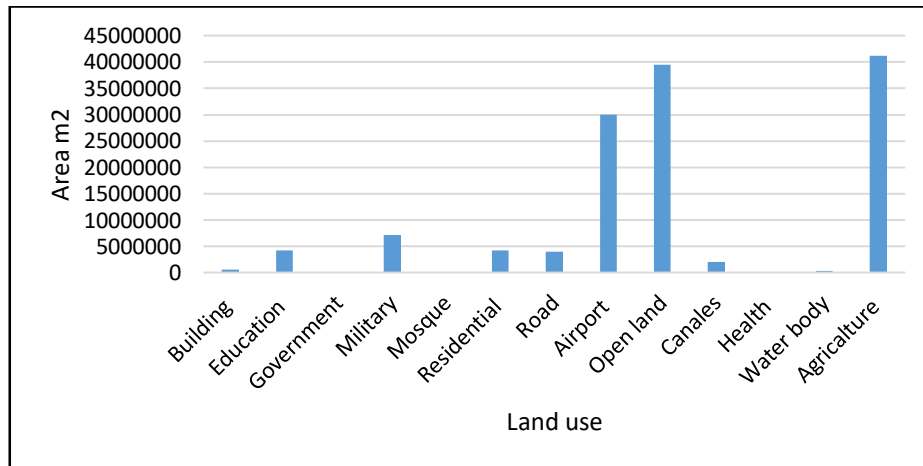


Figure 12 Research depending on GIS results.

The airport is the developmental hub in the region that includes the airside, the land side, and open spaces designated for civil aviation purposes and dedicated to navigational devices, lighting systems, and safety areas at the end of the runway and include many buildings, offices, maintenance services, freight building, medical center, and other supporting buildings, and there are some buildings located in the southeast or northeast from the airport represented by the presidential palaces and service buildings belonging to the palaces, and currently, some of them use government use, and some have been left since 2003,



The military use air defense and ground forces and gatherings. The military, which is one of the non-compatible uses in the vicinity of airports and preferably replaces them compatible with the uses of the airport and achieve the development of the region, where its proximity to the airport can be exploited in another way by placing uses that require fast transport, low cost, and a front side for the airport and travelers.

As for the residential use in the area, it is represented by a group of residential neighborhoods adjacent to the airport and located on the southeastern side of the airport, or what has been called (housing) in the map key includes houses. They are small, scattered farmers, and spaced between the agricultural lands in the western and southwestern parts of the airport.

Agriculture is an essential potential use in the region and is compatible with the airport to protect the airspace, mitigate the atmosphere, and reduce noise. Still, at the same time, this vast area is not exploited efficiently. The district's capabilities were not utilized by introducing sporting, entertainment, and commercial activities and events that are appropriate for the area and its development. Exploiting the proximity to the airport as well as airport economics in a way that brings life to the region and this region is vital and augmented by the presence of many major and international roads such as the old and new Abu Ghraib Road and International Road No. 1, Al-Radwaniyah road, in addition to the main airport road in the front side of the airport. This road network integrates these roads with air transportation and make shipping operations faster, easier, and less costly, and enhance its connection with the rest of the regions and achieve physical development in this region.

The educational use is represented by the College of Agriculture in the northwestern part of the airport and lands designated for higher education, with several roads and railways located northwest of the airport, which can be integrated with a light rail line used for public transport purposes to facilitate the process of current access to the airport and not limited to the private transport currently used and unfriendly with the environment in addition to the relative lack of public transportation in arriving at the airport in general and in reaching these areas in particular.

CONCLUSIONS

- 1- There are incompatible uses in the vicinity of Baghdad International Airport, including military use and residential areas extending towards the airport, and there are no compatible uses and achieve the development of the region, such as industrial and commercial uses.
- 2- There are many untapped potentials and opportunities in the area surrounding the airport and insufficient attention to the airport's interface and its development into a development hub and a critical urban node in the city.
- 3- Lack of interest in coordination between the authorities responsible for urban planning, highway, and railway planning with airport plans.
- 4- Insufficient attention to environmental assessment programs and Contouring noise lines around the airport
- 5- The result of the field survey and the identification of the current roads and the available means of transportation to reach these areas, the lack of free access to the area is found in addition to the



areas located in the western part of the airport, no roads are linking it with other parts such as the northeastern and southwestern part of the airport. It is a semi-isolated area, and it contains a percentage of unexploited lands in a way that achieves development for the region.

Recommendations

- 1-The necessity to introduce compatible uses with the airport and achieve development for the region and make the airport and its surroundings an area of attraction for the residents for travel or commercial purposes and increase the familiarity between the airport and the city.
- 2- Attention to integrate airport plans with urban development plans and reduce urban sprawl with Incompatible uses towards the airport.
- 3- Attention to updating airport plans, such as the Master plans for the airport and the obstacles limitation surface, and creating Contour lines for the airport noise levels that directly affect the distribution of uses, their type, and their characteristics in the areas surrounding the airport.
- 4- Commitment to the instructions and laws regulating these areas, whether for urban land uses, building laws, recommendations, or directives issued by international aviation organizations for the areas surrounding the airports in a manner that ensures the safety of airport operations and reduces the negative impacts of the airport on the surrounding areas and contribute to achieving sustainable physical development of the region.

REFERENCES

- Arora Engineers. 2019 "Using GIS for Collaborative Land Use Compatibility Planning near Airports", The National Academies of Sciences, pp .9.
- Ashford, N., and Wright, P. H., 1992." Airport Engineering", A Wiley-Interscience Publication, pp.221.
- Al-Baldawi Zainab, 2012. The role of environmental geology and green infrastructure in achieving urban site sustainability", A thesis submitted to the Center for Urban and Regional Planning –University of Baghdad, pp.44.
- AL-Rubaie Fatima and AL-Musawi, Nawar Omran, 2019." The effect of Diyala river water quality on the quality of Tigris river water using GIS mapping", Journal of Engineering, pp.2.
- Abdullahi Rashid, 2014. Land use compatibility for optimal development of Malindi Airport", pp.5.
- Appold, S. J., and Kasarda, J. D., 2016. "Strategically managing airport cities". Global airport cities, pp.8.
- Bakhsh, M., 1996. "Environmental impacts of Airports" , University of Salford, pp. 27.
- Banister, D., 2005."Transport and Urban Development", pp.212
- Edwards, B., 2004. "The modern airport terminal: new approaches to airport architecture", Taylor and Francis, pp.6.



- Federal Aviation Administration, 1994 "Airport noise compatibility planning" Part 150., Appendix A, Advisory Circular 150/5020-1, Government printing office. Washington DC, pp.62
- Horonjeff, R., et al., 1962." Planning and design of airports" (Vol. 4). New York: McGraw-Hill, pp.134.
- ICAO International civil aviation organization, 2016, "Annex 14 –V1-Aerodrome design and operations" , pp.2. & pp.89.
- ICAO International civil aviation organization, 2017." Annex 9 Facilitation", fifteenth edition, pp.3.
- ICAO International civil aviation organization, 1987. "Airport Planning Manual ", part I (9184), Master Planning, pp.12.
- ICAO International civil aviation organization, 2018. "airport planning manual Doc 9184", Part II- land use and environmental management, Fourth edition, pp.68-70.
- Kamas, et al., 2019. "Economies Benefits for the application of standards of sustainability in construction project, Journal of Engineering, pp.2.
- STANGEL, Michal., 2019. "Airport City". Strefa okołolotniskowa jako zagadnienie urbanistyczne, Helion, *Gliwice*, pp.135-139
- Muhammad, Jihad, 2013. "Urban Planning and the Role of Urban Legislation in Promoting the Urban Development Process", Project Submitted to the Center for Urban and Regional Planning, University of Baghdad, pp.20.
- Mazaza, and MRS Maddle, 2001. " Airports and Harbours: Drivers of Urban Development in The 21st Century ", Conference Papers Produced by Document Transformation Technologies, 16 – 20 July, pp.6.
- Rakas, J., 2019. "Aircraft Noise Estimation and Mitigation", the University of California at Berkeley, pp.30
- Penda, M., and Macario, M., 2011. " Transportation research board of the national academies ", Washington, pp.6.
- Stevens, et al., 2007. "Understanding the Australian Airport Metropolis", University of New South Wales, Sydney, pp.3.
- D. Kasarda, John, and J.appold, Stephen, 2014. "Planning Competitive Aerotropolis" in the Economics of International Airline Transport, pp. 286.