5.4 Strategic Orientations

Strategic Orientations serve as the practical translation of the macro political goals outlined in the Long-term Visions (See Section 4.2) into spatial and operational frameworks. These encompass overarching and cross-cutting Strategies and Policies that shape the future spatial development of Erbil. These spatial planning concepts lay the foundation for the Land Use Plan, and are further detailed in Draft Sector Strategies and Policies in Chapters 6 to 10.

The 25 Long-term Visions have been consolidated into 7 Strategic Orientations, as depicted in Figure 5.4.1 below. These Orientations are categorized based on a scale of sophistication, commencing with critical aspects vital for the survival and sustainability of human dwellings, such as ensuring access to water resources and resilience to flooding risks. The continuum extends to more sophisticated considerations like enhancing walkability, promoting urban well-being in the society, and establishing a city of pride through urban marketing and tourism promotion.

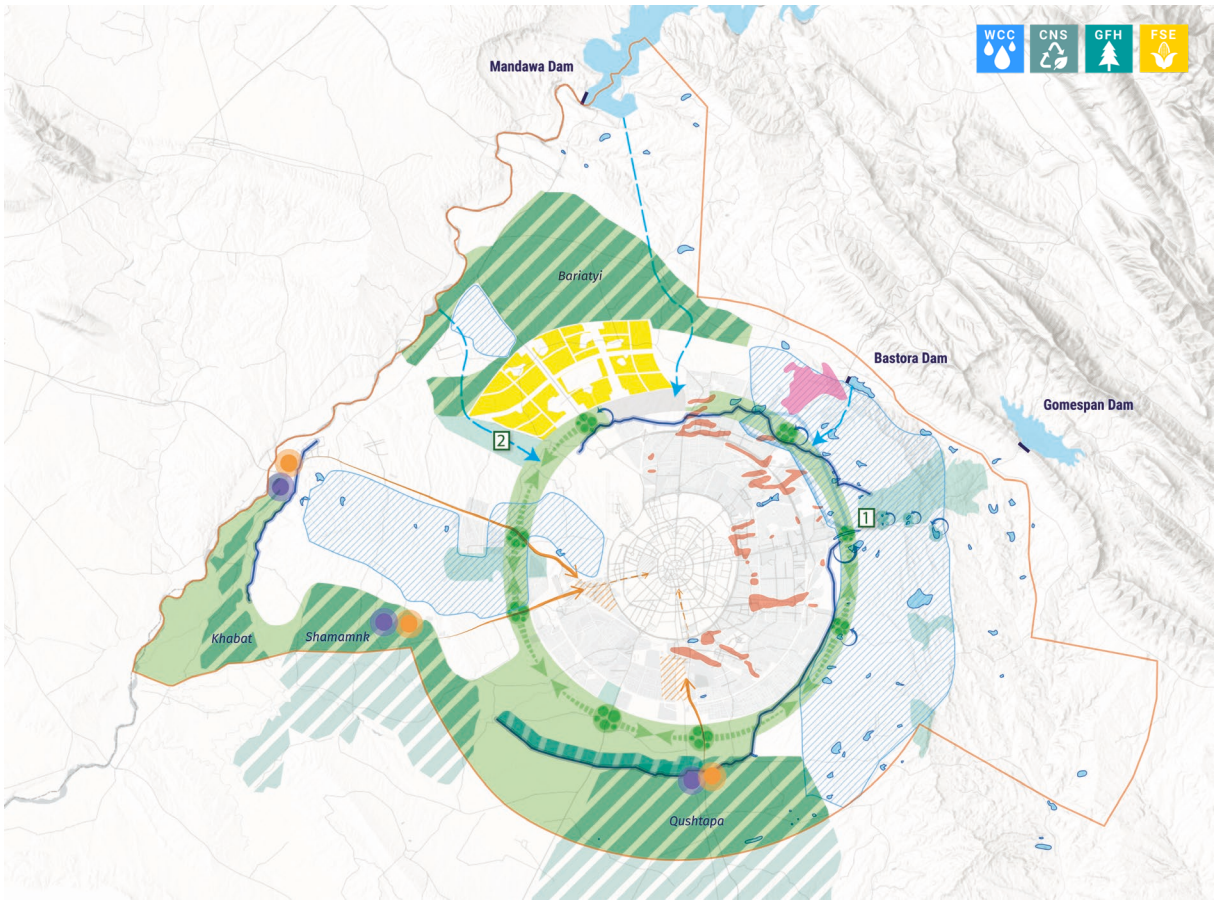
Source: JICA Project Team

Figure 5.4.1 Outline of Strategic Orientations

The subsequent sections elucidate the contents of each Strategic Orientation using a combination of maps and tables that compile all suggested planning principles and actions. Additional details about the context of formulating the Strategic Orientation, along with insights into international best practices, may be incorporated to enhance comprehension.

5.4.1 Strategic Orientation 1: Foundations for Urban Sustainability

	Planning Principles of the Strategic Orientation	Long-term Vision	Link to Strategies
SO1-1	**Ensure Water Resources Availability for Future Generations**		
SO1-1-1	Establish a Groundwater Recharge Zone (GRZ) as an Urbanization Restricted Area to ensure that rainfall will penetrate and recharge groundwater to support the reproduction of natural water cycle.	WCC	HYD-S1 (Section 8.1)
SO1-1-2	Fresh water development through construction of Gomespan Bastora dam (outside Target Area) and Mandawa dams (KRG/Iraqi Project – under confirmation) to fulfil the needs of population and economic development.	WCC	HYD-S3 (Section 8.1)
SO1-2	**Reduce Flooding Risk to boost Resilience while maximizing Water Harvesting**		
SO1-2-1	Reduce flooding vulnerability in urban areas located inside the High Flooding Risk Zones.	WCC	FLO-S9-1 (Section 8.7)
SO1-2-2	Develop the planned ponds to ensure flooding control, stormwater harvesting and groundwater recharge.	WCC	FLO-S3-2 (Section 8.7)
SO1-2-3	Develop the planned Flood Diversion Channels to ensure that the flow direction of floodwater is derived.	WCC	FLO-S5-1 (Section 8.7)
SO1-3	**Increase Freshwater Usage and Accessibility for Local Communities**		
SO1-3-1	Develop channels of freshwater from Great Zab River or dams for irrigation of the Inner Green Belt (feasibility to be assessed)	WCC	*Not considered technically yet*
SO1-3-2	Utilize rainwater harvested in ponds for irrigation of nearby afforestation operations, public parks and agroforestry areas	GFH CNS	GAM-S8 (Section 10.2)
SO1-4	**Increase Forest Canopy through Afforestation to tackle Effects of Climate Change**		
SO1-4-1	Expand Kaznazan forest as a large-scale carbon sink for the whole Erbil city	GFH CNS	
SO1-4-2	Promote agroforestry and tree planting inside the Inner GB to improve presence	GFH CNS	SO7-5-2
SO1-4-3	Build a Green Wall of trees alongside the Flooding Diversion Channel to prevent negative impacts of dust storms	GFH CNS	
SO1-4-4	Create a forest link from the Inner Green Belt to the Great Zab River (Green Belt Lung from Erbil 2030 MP)	GFH CNS	
SO1-5	**Ensure Food Security through preserving & enhancing Urban Agriculture**		
SO1-5-1	Establish Agriculture Preservation & Promotion Areas	FSE	AGR-S1-1 (Section 6.1.5)
SO1-5-2	Ensure the preservation of high-potential agricultural fields in future residential development areas, to reach self-sufficiency communities.	FSE	SO4-3-3 AGR-S1-2 (Section 6.1.5)
SO1-5-3	Implement Agriculture Irrigation Projects to boost agricultural productivity	FSE	AGR-S6-1 (Section 6.1.5)
SO1-5-4	Promote an Orchard Agriculture Expansion Area to diversify food production and enhance traditional landscape	FSE	AGR-S1-3 (Section 6.1.5)
SO1-5-5	Develop Agro-Industry and Food Processing Complex to maximize the value of harvested agricultural produce	FSE	SO3-1-3 AGR-S8 (Section 6.1.5)
SO1-5-6	Establish Agriproducts Packaging & Storage Complex to guarantee freshness and quality of agricultural produce for both local and export markets	FSE	AGR-S2-1 (Section 6.1.5)
SO1-5-7	Develop Short Food Supply Chains to increase food delivery capacity to the Erbil city centre and to reduce transportation emissions	FSE	AGR-S2-1 (Section 6.1.5)



SO1 ESTABLISH THE FOUNDATIONS FOR URBAN SUSTAINABILITY, RESILIENCE AND ADAPTATION TO CLIMATE CHANGE

SO1-1 Ensure Water Resources Availability for Future Generations
- Establish a Groundwater Recharge Zone (GRZ) to ensure rainfall infiltration and natural groundwater recharge
- Develop new freshwater through construction of Gomespan Bastora dam and Mandawa dam (KRG/Iraq Project)

SO1-2 Reduce Flooding Risk to boost Resilience while maximizing Water Harvesting
- Reduce flooding vulnerability in urban areas located inside High Flooding Risk Zones
- Build the network of ponds (MoAWR) to ensure flooding control, stormwater harvesting and groundwater recharge
- Develop the planned Flood Diversion Channels to ensure that the flow direction of floodwater is derived

SO1-3 Increase Freshwater Usage and Accessibility for Local Communities
- Develop channels from rivers or dams for irrigatation of the Inner Green Belt - *3 options, feasability to be assessed*
- Utilize rainwater harvested in ponds for irrigation of nearby afforestation operations, public parks and agroforestry areas

SO1-4 Increase Forest Canopy through Afforestation Operations to tackle Effects of Climate Change
- [1] Expand Kaznazan forest as a large-scale carbon sink for the whole Erbil city
- Promote agroforestry and tree planting in strategic Agro-Nodes to improve the presence of the Green Belt
- Build a Green Wall of trees, alongside the Flood Diversion Channel, to prevent negative impacts of dust storms
- [2] Create a forest link from the Inner Green Belt to the Great Zab River (Green Belt Lung from Erbil 2030 MP)

SO1-5 Ensure Food Security through preserving & enhancing Urban Agriculture
- Establish Agriculture Preservation & Promotion Areas
- Ensure the preservation of agricultural areas in future residential development areas: Agri-Neighborhoods
- Implement Agriculture Irrigation projects by MoAWR to boost agricultural productivity
- Promote an Orchard Agriculture Expansion Area to diversify food production and enhance traditional landscape
- Develop Food Processing Complex to maximize the value of harvested agricultural produce
- Establish Agriproducts Packaging & Storage Complex to ensure quality of products for both local and export markets
- Develop Short Food Supply Chains to increase food delivery capacity to the Erbil and to reduce transportation emissions

Source: JICA Project Team

Figure 5.4.2 Strategic Orientation 1: Foundations for Urban Sustainability

(1) Ensure Water Resources Availability for Future Generations (SO1-1)

Water availability is a critical aspect of ensuring sustainability for future generations, particularly in regions like KRI, where the impacts of climate change are increasingly evident. As the foundation of life and a key component of all socio-economic development, the importance of water cannot be overstated, and Erbil needs to become a Water Conscious City (WCC), as established by Long-term Vision (See Section 4.2.2).

This Strategic Orientation is translated in technical and operational terms in the Sector Strategies, Policies and Plan for Water Resources Development and Irrigation are detailed in Section 8.1.

1) Groundwater Recharge Zones (SO1-1-1)

One strategy to ensure water resources for future generations is the establishment of Groundwater Recharge Zones. These zones are crucial for facilitating the infiltration and natural recharge of groundwater, thereby replenishing this vital resource. Consequently, it is recommended that the urban form of the future urban development in these zones should be carefully regulated and constrained (See SO4-1-2 in Section 5.4.4).

The establishment of Groundwater Recharge Zones has been set-up at two distinct levels to optimize water resource management, particularly in response to varying needs and environmental conditions.

- Firstly, a wide area has been designated based on the recommendations of MoAWR (blue hatch), for the recharge of groundwater to support both domestic and agricultural water needs. This extensive zone is crucial for ensuring a consistent and reliable water supply for both household use and agricultural activities, which are vital for local economies and communities;
- Secondly, within this wide zone, a detailed zone has been specifically proposed by the JICA Project Team (blue hatch delineated by a blue outline) targeting domestic water needs. In this zone, the areas have been more narrowly defined, focusing on locations where groundwater recharge is most effective. This targeted approach takes into account several critical factors: the topography of the land, local weather patterns, and the geological conditions. These factors play a significant role in determining how effectively water can infiltrate and replenish underground aquifers.

2) Groundwater Recharge Zones (SO1-1-2)

Additionally, the development of new water sources through the construction of dams (SO1-1-2) is another significant strategic approach to ensure water availability.

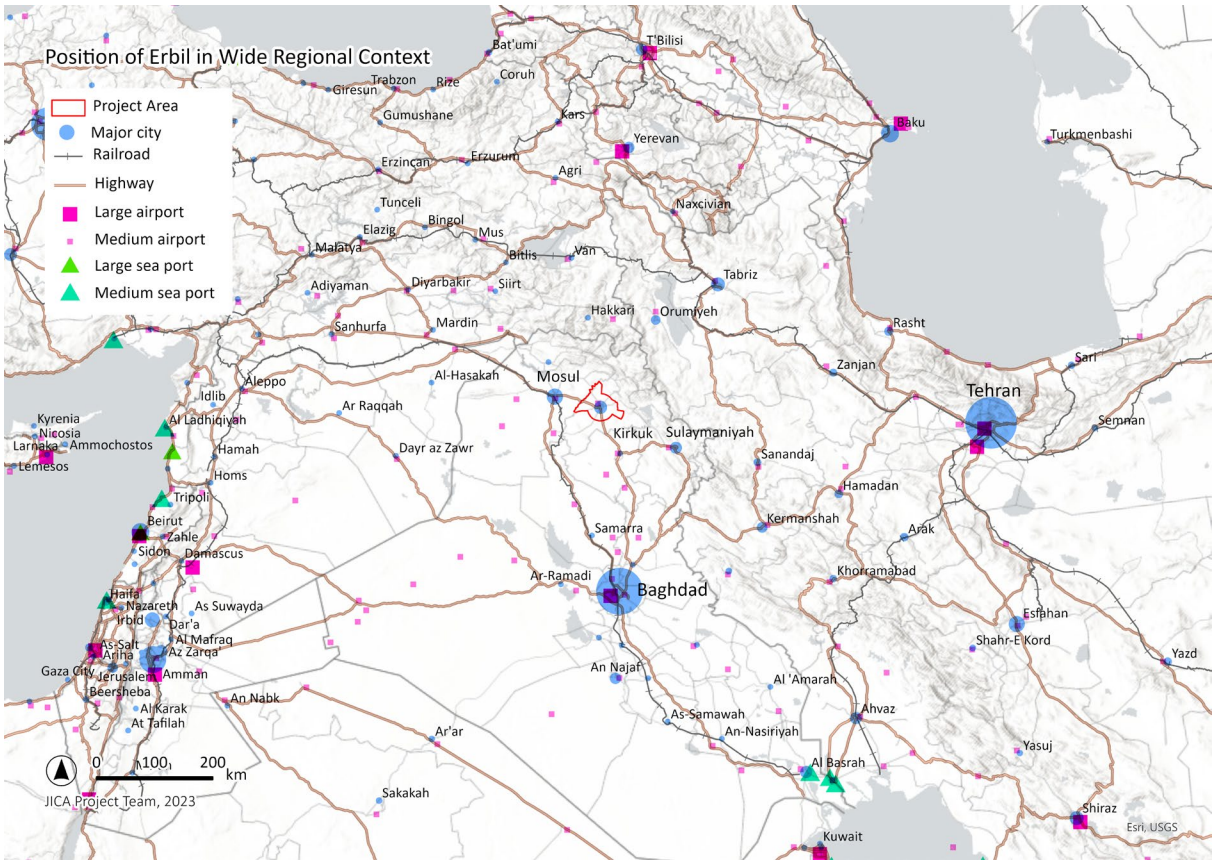
5.4.2 Strategic Orientation 2: International Competitiveness through Regional Connectivity

A key priority of the Masterplan is to ensure Erbil is positioned to be a successful hub within a national, regional and global context through enhancing economic and cultural exchange, business, trade, and policy collaboration, and by developing Erbil's competitive strengths in relation to these cities.

(1) Summary of Existing Issues and Opportunities relating to Regional Connectivity

1) Outline of Erbil's Position in Wide Regional Context and Related Challenges

Erbil occupies a central position at the intersection of several important trade routes in the Middle East region. The city is positioned between Iraq's national capital and largest economic and population centre, Baghdad, 360km to the south, Tehran, capital of Iran, 910 km to the East, and Beirut, capital of Lebanon, 1,000 km to the West, as shown in Figure 5.4.3 below. Improving connectivity with these important regional trading routes, both land and sea, are a priority for Erbil in the period to 2050.



Source: JICA Project Team

Figure 5.4.3 Position of Erbil in Wide Regional Context

Erbil lies along the historic Silk Route linking China and the West, a great driver of cultural exchange and economic development in history, and which is being revived through international trade cooperation, trade facilitation arrangements, investment and infrastructure projects. Building on the potential provided by Erbil's proximity to the reviving Silk routes, and to major sea ports in the Persian Gulf, Mediterranean, Caspian and Baltic, the city can leverage and benefit from it position, becoming an important node and a Major Trading City (MTC) and Connected Trading Core (CTC) through improved transportation and infrastructure connections. Important too will be protecting and strengthening Erbil's existing strengths in air connectivity and relationships with surrounding cities in the KRI, the rest of Iraq, as well as in Turkey and Iran.

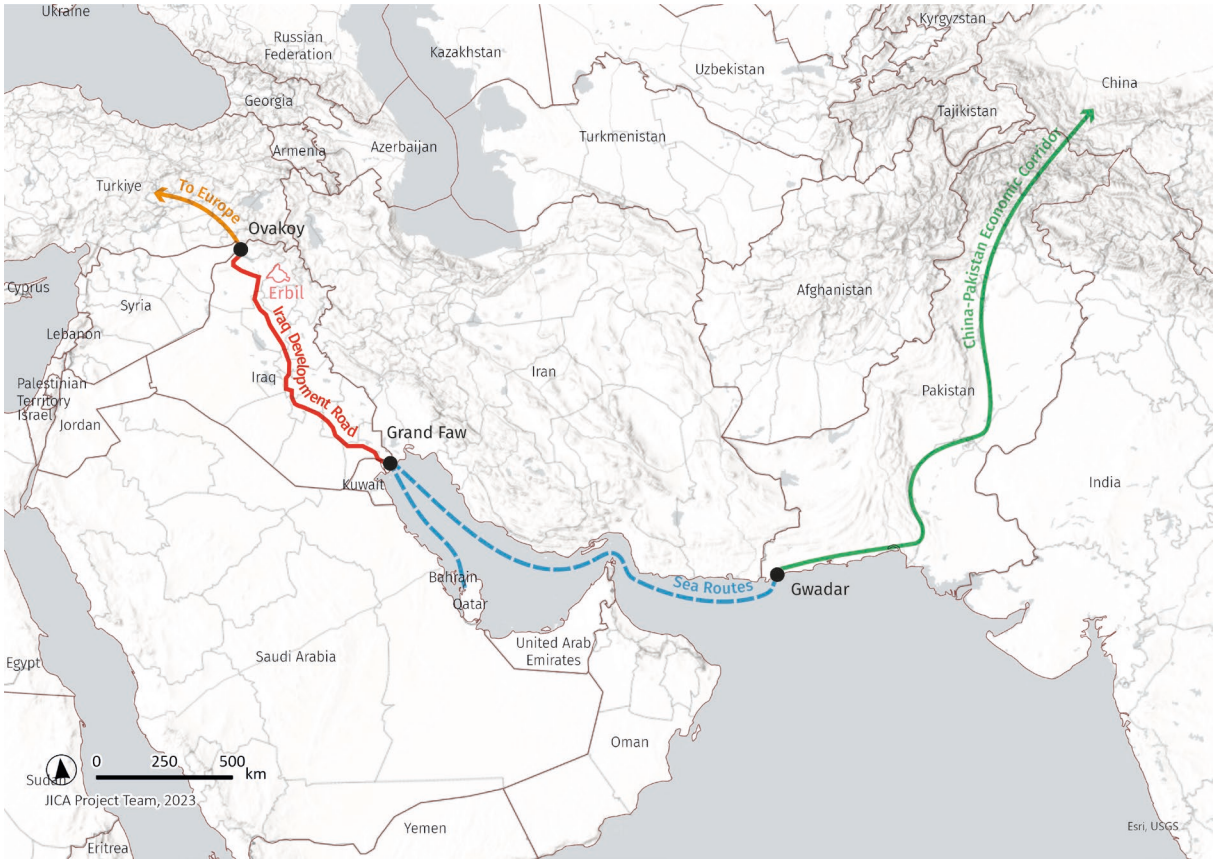
As the administrative and commercial capital of the Kurdistan Region of Iraq, the city has rapidly expanded during the 2010s and now enjoys greatly improved international connectivity. Instability in Mosul, has led Erbil to become a principal International Quality Service Centre (IQS), with numerous international flight connections to Erbil International Airport, the largest concentration of internationally branded hotels in Iraq, conferencing facilities, high quality educational and healthcare facilities, as well as a large and growing resident population. Continuing and enhancing this aspect of the city's role is a major priority for the Erbil Masterplan.

The city's recent position as a stable location in an otherwise unstable region during the period in which ISIS occupied Mosul and was subsequently removed, has led to Erbil hosting the operations of a number of international operations, both humanitarian, NGO, and private sector. As the political and administrative capital of the KRI, there is also a significant diplomatic and intergovernmental presence in the form of national missions as well as UN organisations. Erbil therefore has an international outlook and strong international connections giving it significant social capital and a higher level of integration with global networks of cultural and economic exchange than is typical of non-metropolitan centres of Erbil's size. This sets Erbil apart from many of its neighbour cities and is a competitive strength to be protected and further enhanced in the period to 2050. Ensuring Erbil remains a Competitive City (CMP)

is a priority for the Masterplan.

2) Challenges of Global-Scale & Regional-Scale Connectivity Improvement

The importance of connectivity is crucial to improving the performance, prosperity and development of cities[1]. Recent research emphasises that central to connectivity is investment in hard infrastructure including roads, rail networks, air services, as well as the soft infrastructure of political, social, and business networks which facilitate the flows of materials, people, trade, goods, services, and information.



Source: JICA Project Team

Figure 5.4.4 Global Position of Erbil on the Silk Road

The city is positioned close to the historic Silk Road and the overland routes between China and western Europe, which are once again being revived through renewed investment and international cooperation projects. Erbil's location provides opportunities for engagement with the Silk Road as both a trading hub, and through providing routes for exports from Erbil itself and the KRI.

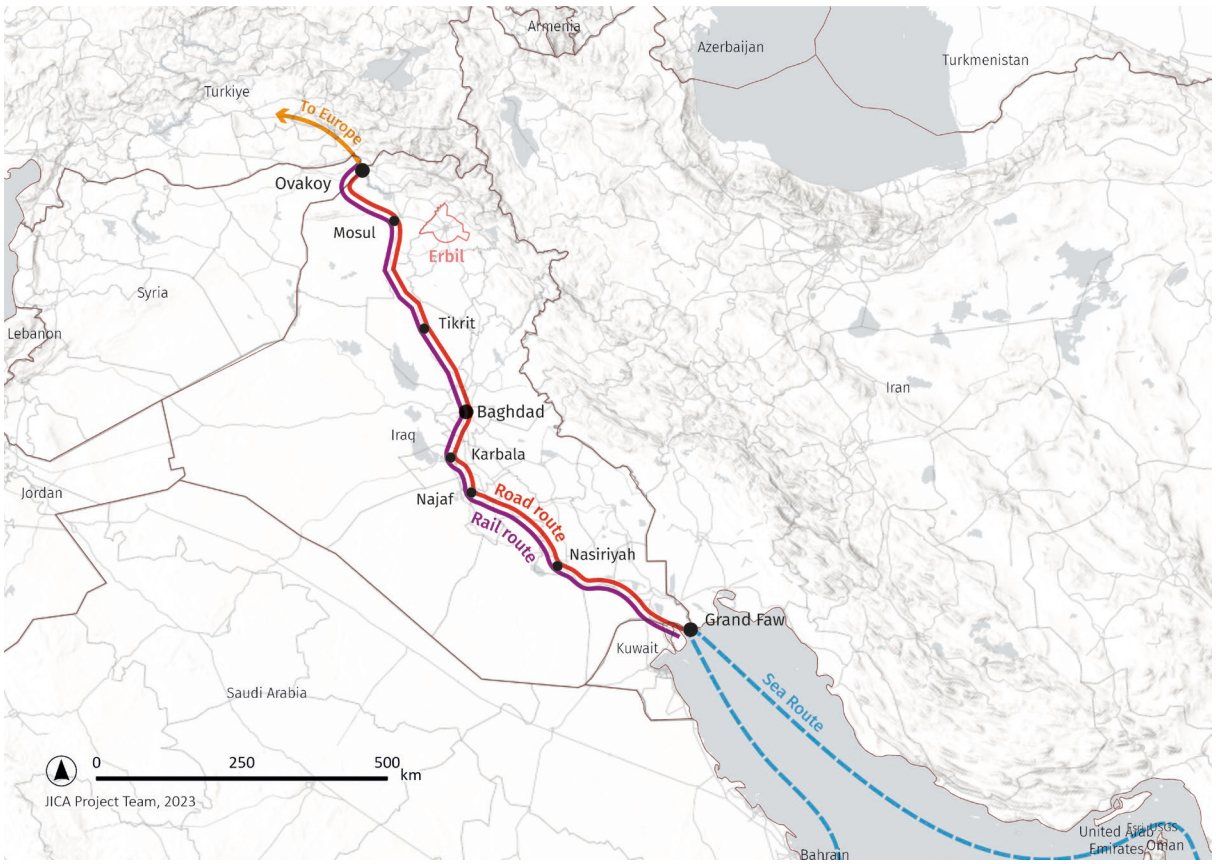
Erbil and the KRI are landlocked, but is positioned centrally between the Persian Gulf and its wider access to the Indian Ocean, the Mediterranean, the Caspian and the Black Seas. Ensuring the development of road infrastructure along with engagement at administrative, political and legal levels to facilitate the transportation of goods and people along these routes will greatly benefit Erbil and maximise the potential of its location.

Connectivity through Iraq Development Road and Grand Faw Port

A key opportunity for Erbil is presented by the new Grand Faw Port, currently under development and planned for operation by 2028, and intended to be one of the largest ports in terms of capacity in the Middle East. The 'Iraq Development Road' or 'Dry Canal' project is an ambitious road and rail project which aims to connect by 2029 the Grand Faw Port via Baghdad, Mosul and other major Iraqi cities,

[1] *Connecting Systems of Secondary Cities: How Soft and Hard Infrastructure Can Foster Equitable Economic Growth Among Secondary Cities* (Cities Alliance, 2019)

with Turkey, and both Mediterranean ports and land routes to markets in Europe. Erbil's position close to this route via Mosul presents significant opportunities for export of products to markets in the Persian Gulf, wider Indian Ocean, as well as to Europe, as shown in Figures 5.4.4 above and 5.4.5 below.



Source: JICA Project Team

Figure 5.4.5 Position of Erbil on the Iraq Development Road

Land Connectivity to the Neighboring Countries

Erbil should further develop the good road connectivity with Turkey through Dohuk and the Ibrahim Khalil border crossing, which is one of the principal border crossings between Iraq and Turkey and is within the KRI. This road connection provides Erbil with routes to export for oil, natural gas, as well as agricultural produce and other products. Upgrading of the road between Erbil and Duhok has greatly reduced journey times between Erbil and Turkey.

Road networks connecting Erbil to Iran are less developed and face greater physical barriers compared to Faw and Turkey, but nevertheless represent an important opportunity and should be developed further. Road connections to Iran via the Parwezkhan border crossing in the KRI and other border crossings in Iraq provide Erbil with connections to Tehran, Iranian ports on the Persian Gulf including Bandar Abbas, as well as to the Caspian Sea and wider Central Asia.

Opportunities for Exporting on International Market

Europe, a major exporter of oil and natural gas, represents an area of potential future growth with greater accessibility via the Iraq Development Road and further improvements in routes via the Ibrahim Khalil border crossing to Turkey. Potential markets for agricultural produce are also to be found in Europe, but also in other parts of the Middle East. Access to the Gulf sea ports at Faw as well as those in Iran will provide opportunities to export products to large markets of the Gulf Cooperation Council (GCC) countries.

Future growth of the manufacturing sector, further developing existing strengths and attracting new investment into opportunities around clusters in the economy of Erbil and the wider KRI which result

in an increase in exports of manufactured goods in the context of fertiliser products, polymers, plastics, and oil lubricants could find markets in Asia and Africa, accessible via sea ports in the Gulf as well.

International Air Connectivity

Erbil International Airport handled the largest number of international flights in Iraq in 2020 (28,029) more than three times the number of the second largest number (9,000) at Baghdad International Airport[2]. Erbil handled the second larges number of domestic flights (1,493) after Baghdad (2,301). The airport is served by Qatar Airways, Turkish Airlines, Austrian Airlines, Lufthansa, Royal Jordanian, Egyptair, Pegasus, Fly Dubai, Middle East Airlines, as well as Iraqi Airways, and provides connections with a wide range of international cities including Jordan, Iran, the wider Middle East, Turkey, and Western Europe. This level of connectivity places Erbil in a strong competitive position and a major international centre in the region.

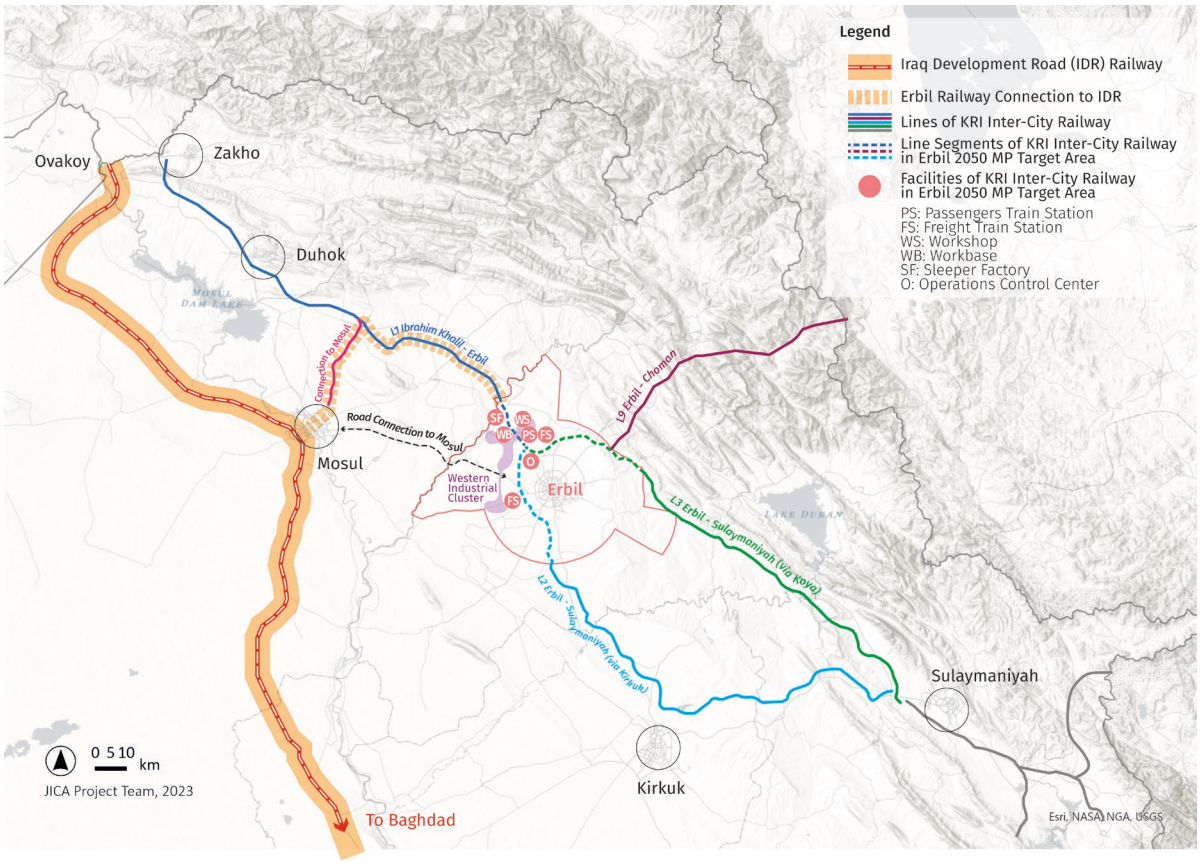
3) Challenges of Local-Scale Connectivity Improvement: Key Regional Neighbouring Cities

The future success of Erbil will require the city to play to its strengths and define its role in relation to neighbouring cities and the region. Principal regional population centres that Erbil must engage with are Mosul, Kirkuk, Sulaymaniyah and Duhok. Linkages between these cities can play an important role in enhancing value-add industrial processes and help Erbil to position itself in relation to regional supply chains and sources of labour and skills.

An opportunity for Erbil to improve its connectivity with neighbouring cities and to connect to the international market through the above-mentioned Iraq Development Road railway project via Mosul, is the implementation of the Kurdistan Inter-City Railway, for which a Feasibility Study (FS) is currently ongoing under the supervision of the Ministry of Construction and Housing (MoCH). As shown in Figure 5.4.6 below, Erbil has a central position between the regional cities and within the Kurdistan Inter-City Railway network, at the intersection of various railway lines and hosts various facilities related to the operation and maintenance of the railway. There is an urgent need to coordinate the Erbil 2050 MP supervised by MoMT/GDUP and the Kurdistan Inter-City Railway FS studies supervised by MoCH to reach a consensus regarding the right of way of railway lines and the implementation site of facilities, which shall be in line with the urban structure of Erbil 2050 MP.

The levels of existing connectivity between Erbil and each neighbouring city and the opportunities of clustering with them should be analysed to identify areas to prioritise for improvement. Results of preliminary analysis is described in subsequent paragraphs.

[2] Kapita, 'Transportation Sector in Iraq: Aviation and Maritime Scene Overview' citing COSIT, Iraq Ministry of Planning data.



Source: JICA Project Team

Figure 5.4.6 Position of Erbil in the Kurdistan Inter-City Railway Network

Mosul

Developing and improving both hard and soft connectivity with Mosul will be a priority for Erbil. Mosul provides an important connection with wider national Iraq rail and road transport networks including the Iraq Development Road, and by extension with global trade routes which form important potential export markets for Erbil.

Mosul, located 80km to the West, as Iraq's third largest city after Baghdad and Basra, was historically the main urban centre in the area. In the medium to long term as reconstruction efforts progress, security and prosperity are expected to return to Mosul. In certain domains, Mosul will regain some of the regional focus that has been lost primarily to Erbil. Much of the traffic of Erbil International Airport currently serves major nearby population centres of Mosul and Erbil. The reopening of Mosul International Airport is likely to take on some of the passenger and air freight traffic.

The proposed establishment of a railway network in the Kurdistan Region of Iraq envisages a freight logistics hub in Erbil close to the proposed Western Industrial Cluster composed of Ararat Industrial City and Zab Industrial Cluster areas (See Strategic Orientation 3), which would provide freight rail links with Mosul via a connection at Bardarash. Future expansion of manufacturing industries and the growth of industrial clusters around clean oil processing industry and textiles is proposed to the north west of Erbil close to the Mosul Road, providing good road connections with Mosul, the rest of Iraq and global trade routes.

Erbil will gain from its proximity to Mosul by complementing the city through prioritising sectors in which it has a competitive strength. In particular, Erbil's prioritisation of further developing its position as an International Quality Service Centre (IQS) will provide opportunities to both compete and collaborate with Mosul, while by striving to maintain a competitive flexible and attractive regulatory environment, Erbil can ensure its competitiveness with Mosul as that city recovers.

Kirkuk

Improving connectivity in terms of road links and cultural, business, and information links with Kirkuk, 95km to the south, will also be a priority. Kirkuk is economically significant and a major centre of oil extraction in the region, with some of the largest oil fields located around the city. Kirkuk is on the main road route between Erbil and Baghdad. The proposed Kurdistan Railway Network would connect with Iraqi national rail networks at Kirkuk and be Erbil's most direct connection with Baghdad by rail.

A city with a large Kurdish population, Kirkuk has many long-standing cultural connections with Erbil. Kirkuk International Airport opened in 2022 and currently has domestic flight connections, and flights serving Turkey, Iran and Azerbaijan. Erbil will ensure that transportation and infrastructure connections with Kirkuk are enhanced and develop partnerships, as well as complementing the Kirkuk economically through prioritising Erbil's strengths and benefitting from skills and expertise of Kirkuk's economy.

Sulaymaniyah

Connectivity with Sulaymaniyah, the second largest city in the KRI located 180km to the South-East is also a priority. It too has an International Airport, and like Erbil has an international outlook with more internationally branded hotels than Baghdad, as well as conference facilities, and is also a centre for health, higher education, and entertainment. Sulaymaniyah is a principal centre on one of the major routes between Erbil and Iran.

As with Erbil, Sulaymaniyah attracts tourists, business travellers, and investment from the rest of Iraq, Iran, Turkey and other countries. Along with Erbil, Sulaymaniyah has played a key role in developing and shaping the KRI. As a major centre of Kurdish culture, arts, and media, cultural exchange is an important element in the relationship between Erbil and Sulaymaniyah. Erbil will engage closely with Sulaymaniyah through political cooperation and economic integration to ensure a relationship between the two major urban centres of the Kurdistan Region work together for the benefit of the KRI.

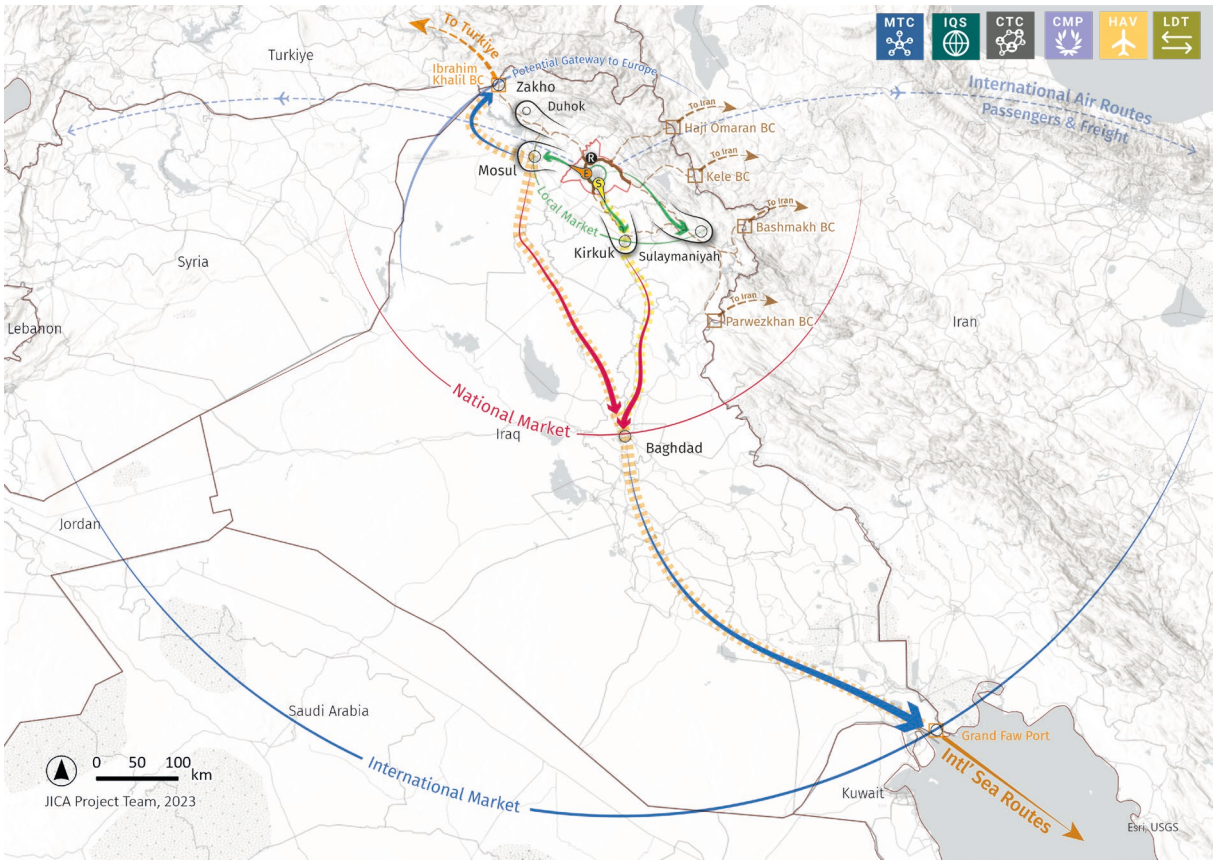
Transport connectivity and road infrastructure will be enhanced to facilitate movement between these two cities key to the future development of the Kurdistan Region of Iraq. The current journey time between the cities is over three hours using roads which are single carriageway for large stretches. The KRG will continue its programme of implementing road improvements and investigate the feasibility of new transportation methods.

Erbil and Sulaymaniyah will cooperate in tourism, working in conjunction with the KRG's tourism agency, Visit Kurdistan, to promote both cities as part of a single tourism destination, with a combined strategy to attract tourists to the KRI and the rest of Iraq. Further tourism infrastructure and coordination of tourism and support for tourists will be developed.

Both cities will similarly continue to cooperate in investment promotion. KRG Vision 2030 to have a dynamic private sector, leading the economy and creating sustainable jobs, empowered by a competitive business environment that attracts investment, and its associated target of raising the KRI's ranking on the World Bank's Doing Business Index is relevant to Sulaymaniyah, and both cities will be part of a jurisdiction competitive within the wider region as an attractive investment destination and hubs for innovative industries. Collaboration with Sulaymaniyah through cultural exchange, knowledge transfer, and as a source of complementary skills training and labour source will be important in the period to 2050.

(2) Propositions of Strategic Orientation 2: International Competitiveness through Regional Connectivity

Based on the major issues and challenges of Regional Connectivity summarized above, Strategic Orientation 2: International Competitiveness through Regional Connectivity proposes the following planning principles, as shown in Figure 5.4.7 below.



SO2 IMPROVE INTERNATIONAL COMPETITIVENESS THROUGH REGIONAL CONNECTIVITY AND INTEGRATION

SO2-1 Streghten Land Transport Infrastructure to boost Erbil's Connectivity with Global Networks of Cities and Trade Corridors

Connectivity through Kirkuk Road (South)

- Improve road connection with Baghdad through Kirkuk Road as a link to the National Market and to Iraq Development Road
- In Erbil, ensure that all urban functions incl. exporting industrial clusters are well connected to the South / Kirkuk Road

Connectivity through Iraq Development Road via Mosul (West)

- Improve rail & road connection with International Market through the Iraq Development Road via Mosul
- Target international market through connection to Grand Faw Port and Ibrahim Khalil Boarder Crossing (more uncertain)
- In Erbil, ensure integration of passenger and freight stations of inter-city railway and improve roads to the West/ Mosul

Connectivity through Inter-city Railway (East-West)

- Improve rail connection with Duhok, Sulaymaniyah, Mosul, Kirkuk as well as Turkish and Iranian borders
- Target commercial exchanges with Iran through railway connection to 4 different Boarder Crossings in the East
- In Erbil, ensure integration of passenger and freight stations of inter-city railway to all urban functions especially trading

SO2-2 Maintain and enhance Erbil's competitive strengths

Increase Exportations: *Develop industrial manufacturing sector to create products to export, by encouraging investment in and development of clusters around clean oil processing, agri-tech, and food processing and packaging*

- Exportation and commercial exchanges on the Local Market
- Exportation and commercial exchanges on the National Market
- Exportation and commercial exchanges on the International Market

*Maintain and enhance **Erbil International Airport's high level of international connectivity** and develop Erbil's status as a hub of aviation in the region. In Erbil, ensure the best connectivity of the airport to all passengers and freight functions*

SO2-3 Compete and Collaborate with Neighbouring Regional Secondary Hubs

- Improve hard and soft connectivity with neighbouring cities, collaborate and compete for investments

Source: JICA Project Team

Figure 5.4.7 Strategic Orientation 2: International Competitiveness through Regional Connectivity

	Planning Principles of the Strategic Orientation	Long-term Vision	Link to Strategies
SO2-1	**Strengthen Land Transport Infrastructure among others to boost Erbil's Connectivity with Global Networks of Cities and Develop Trade Corridors**		
SO2-1-1	Improve road connection with Baghdad through Kirkuk Road as a link to the National Market and to Iraq Development Road. In Erbil, ensure that all urban functions including exporting industrial clusters are well connected to the South via Kirkuk Road.	LDT MTC CTC	SO3-3-2
SO2-1-2	Improve rail & road connection with International Market through the Iraq Development Road via Mosul. Target international market through connection to Grand Faw Port and Ibrahim Khalil Boarder Crossing (more uncertain). In Erbil, ensure integration of passenger stations (PS) and freight stations (FS) of Inter-City Railway to manufacturing production sites and improve roads to the West to Mosul.	LDT MTC CTC	SO3-2-1 SO3-2-2
SO2-1-3	Improve rail connection with Duhok, Sulaymaniyah, Mosul, Kirkuk as well as Turkish and Iranian borders. Target commercial exchanges with Iran through railway connection to 4 different Border Crossings in the East. In Erbil, ensure integration of passenger stations (PS) and freight stations (FS) of Inter-City Railway to all urban functions especially trading.	LDT MTC CTC	
SO2-1-4	Support the integration of the Kurdistan Inter-City Railway development by arranging lands for operation and maintenance facilities (WS, WB, SF and O).	LDT CTC	
SO2-1-5	Alongside with infrastructure development, engage with cities and other nations in the region and through initiatives relating to the Silk Road revival, through information exchange, cultural exchange, building of administrative and legal connections to network Erbil with other cities in Asia and the Middle East and ensure Erbil is a connected trading core.	CTC MTC	
SO2-2	**Maintain and enhance Erbil's Competitive Strengths**		
SO2-2-1	Develop industrial manufacturing sector to create products to export, by encouraging investment in and development of clusters around clean oil processing, agri-tech, and food processing and packaging.	CMP	
SO2-2-2	Maintain Erbil International Airport's high level of international connectivity and develop Erbil's status as a hub of aviation in the region. In Erbil, ensure the best connectivity of the airport to all current and future urban functions, especially trading, and new neighbourhoods.	HAV CMP	SO3-4-1 SO4-4-3
SO2-2-3	Maintain and enhance Erbil's outward-looking and internationally connected status as an international quality service centre in the field of hotels and conference facilities, headquarters for international businesses, diplomatic missions, NGOs, and associated services.	IQS CMP	
SO2-3	**Compete and Collaborate with Neighbouring Regional Secondary Hubs**		
SO2-3-1	Develop and improve hard and soft connectivity with Mosul and collaborate by acting as an international quality service centre for Mosul, and compete for investment through maintaining a flexible and attractive regulatory environment.	CMP	
SO2-3-2	Develop and improve connections both hard and soft with Kirkuk including cultural exchange, trade, and as a source of skills and labour.	CMP	
SO2-3-3	Develop and improve hard and soft connectivity with Sulaymaniyah through cooperation in tourism, investment promotion, and through exchange of knowledge, skills and labour, and develop strengths in Erbil that may complement Sulaymaniyah's economy.	CMP	

5.4.3 Strategic Orientation 3: Innovative & Diversified Economy

(1) Summary of Existing Issues and Opportunities relating to Economic Diversification

1) General Context and Approach of Economic Diversification

General Context of Economic Diversification

A resilient and sustainable economy is crucial for the future prosperity of Erbil and its residents and in making Erbil a Major Trading Core (MTC), as stated by the Long-term Vision (See Section 4.2). The economy of the Kurdistan Region of Iraq, as well as of the rest of Iraq is overwhelmingly dependent on oil, which accounted for 83% of Iraq's export revenue in 2021[3]. Oil extraction currently accounts for c.33.6% of the KRI's GDP but only c.5.2% of employees. Oil price volatility has to date been a major challenge to the economy.[4] Among the KRG's Vision 2030 main pillars are:

i) Promotion of a diversified, productive, and competitive economy that creates added value for all and is resilient to external shocks;
ii) Dynamic private sector, leading the economy and creating sustainable jobs, empowered by a competitive business environment that attracts investment;
iii) Skilled and active labour force capable of competing in the 21st century and in the era of the 4th industrial revolution.

The economic development of Erbil to 2050 will need to both provide sufficient employment to the growing population of Erbil, and to enhance the economy through encouraging greater economic complexity and enlarge the industrial manufacturing and related sectors as a proportion overall.

General Approach of Erbil 2050 MP to Economic Diversification

Being both a strategic and spatial urban development planning document, the Erbil 2050 MP develop the concept of Economic Diversification through three different approaches:

i) Inter-sector diversification, for example between agriculture and industry with the Agro-Industry development (See SO1-5-5 Section 5.4.1);
ii) Intra-sector diversification for example finding various potential activities in the Tourism sector (See Strategic Orientation #7 Section 5.4.7);
iii) Spatialization diversification, for example by identifying and promoting comparative advantages for each region, which possesses distinct strengths and opportunities based on its natural resources, infrastructure, cultural assets, but also connectivity, etc.

2) Tourism Sector

The development of tourism is a key element of the KRG's wider vision for diversifying the economy of the Kurdistan Region as a whole. The Vision for Erbil is to become a Centre for Tourism, leveraging its strengths in terms of international and national connectivity, hotels, and visitor attractions, including its important heritage assets, to grow the tourism economy of the city, generating value and providing employment opportunities to residents (See Strategic Orientation #7 Section 5.4.7 for specific details on Tourism intra and inter sector diversification and spatialization initiatives).

3) Agriculture Sector

Increasing the agriculture sector's share of GDP is also a key target for the KRI as a whole and Erbil can play an important role in enhancing its own agricultural sector to generate value in the economy,

[3] Harvard Atlas of Economic Complexity (https://atlas.cid.harvard.edu/explore?country=108&queryLevel=location&product=undefined&year=2021&productClass=SITC&target=Product&partner=undefined&startYear=undefined)
[4] F.R. Gunter, *The Political Economy of Iraq* (Cheltenham, 2013), p. 14.

provide growth and export revenues, and crucially diversify the economy. Enhancing existing agriculture, facilitating new higher value crops, and growing export markets for agricultural produce will enable Erbil to pursue this vision (See Strategic Orientation #1 Section 5.4.1 for specific details on Agriculture intra and inter sector diversification and spatialization initiatives).

4) Industrial Sector

Clean Oil Processing Clustering

The Kurdistan Region has distinct advantages with significant reserves of oil, gas, and other raw materials, and an established extraction industry. The growing strength of the education sector is helping to educate an increasingly skilled workforce. There are opportunities for leveraging these strengths in the clean oil processing industry through enhancement by other petrochemical processes, promoting the further development of related industries including manufacturing of polymers, plastic, lubricant oil, pigments, waxes and glue, as well as fertilizers, which also has linkages with the KRG's aims of promoting diversification through the development of agriculture and food production. The concentration of petrochemical industries in the Great Zab Cluster zone (See Section 5.3.2) makes this area to the north of the Mosul Road, a strong location for further development of this clean oil processing cluster. The development of the Ararat Industrial Zone nearby to this location, already planned in Erbil 2030 MP, has progressed, and therefore represents now a real opportunity for developing this cluster further.

There is an opportunity of establishing a Western Clean Industry Cluster (WCIC) located between the Erbil International Airport and the Mosul Road, and targeting exportation given its proximity to the location proposed as a major logistics hub and loading and unloading area for the future Kurdistan Region freight Railway Network. This location therefore provides a high level of connectivity with Mosul and ultimately the proposed Iraq Development Road, which will facilitate the transportation of manufactured products to global export markets in Europe via Turkey and in the Gulf and Asia via the Iraqi road and proposed rail networks (See Strategic Orientation #2 Section 5.4.2).

It is recommended that a detailed planning of the whole WCIC zone is formulated, including integration of road and railway infrastructure and facilities such as loading and unloading functions of Freight Stations integrated with production units of Ararat Industrial Zone, regulation of petrochemical industries in Great Zab Cluster with environmental norm upgrading to avoid industrial wastewater going to Great Zab River, etc.

Agro-industrial Cluster

Erbil, as the capital of the Kurdistan Region, has a strong potential to develop as a cluster for agro-industry, building on the strengths in agriculture and further proposed development in that sector, to create a cluster of related industry further up the value chain. This will include food packaging and logistics relating to export, with opportunities for innovative storage and packaging processes to be explored, as well as the development of more advanced processing and manufacturing using agricultural produce from the region.

Further Potential Clusters

The Kurdistan Region also has strengths in the production of construction materials, including cement, gravel, clay and sand, with potential to develop further brick manufacturing, and other building materials to service the increasing levels of construction activity.

Further developing manufacturing industries will provide higher value employment and generally higher productivity compared to the service sector. The domestic economy provides considerable demand for manufactured goods, much currently met by imports from abroad, presenting an opportunity for growth of domestic manufacturing. Developing the manufacturing industry can also provide export opportunities.

Supporting and Promoting Innovation in Industry: Innovation Hubs

Crucially, further development of industrial sub-sectors, along with government support and academic

research inputs can serve to encourage innovation by building innovation ecosystems, networking organisations, processes, institutions and relationships which together allow the sharing of knowledge and know-how and serve to drive innovation.[5]

Crucial to building new clusters and supporting growth from within emerging clusters will be the establishment of Innovation Hubs with suitable investment and government support, focusing on growth clusters will be important in bringing together industry, academic researchers, entrepreneurs, and investors. Such Innovation Hubs concentrated spatially will need dedicated management to ensure opportunities for knowledge exchange and collaboration between the various elements are facilitated.

The Erbil Masterplan 2050 therefore addresses the need to plan for the delivery of space for both light and heavy industrial production, warehousing and logistics space, as well as a wide range of laboratory, workshop, and office space to supply the need for the growth of knowledge clusters and entrepreneurial activity surrounding this growth.

The KRG has supported the creation of the Kurdistan Innovation Institute with the aim of fostering these interconnections and knowledge sharing networks. A proposed Science Park will provide research and development laboratories, workshops, offices, meeting space and conferencing facilities, as well as amenity space, as well as business and networking support.

Investment Promotion

Growing investment in the industrial sector will be a key strategic priority for Erbil over the period to 2050. One of the priorities of the KRG Vision 2030 is the development of a dynamic private sector, leading the economy and creating sustainable jobs, empowered by a competitive business environment that attracts investment. Erbil's level of success in diversifying the economy, achieving economic growth, and developing employment opportunities for its residents will be determined by its ability to attract investment into the economy from the local private sector and from international sources.

The Erbil Master Plan 2050 will provide the basis for a wider investment promotion strategy, identifying target growth sectors and investible projects and programmes. With clusters established, specifically tailored investment campaigns will be conducted by government, including KRG representative offices abroad. In addition, a wider information and marketing campaign to promote the strengths of Erbil as a whole, and benefits and opportunities of investment in the city's economy.

The KRG will also support the growth of and diversification of the economy by progressing its reforms to ensure that the regulatory environment makes Erbil and the rest of the KRI an attractive destination for investment. Iraq currently ranks 172 of 190 countries in the World Bank's Ease of Doing Business Index. The KRG's Vision 2030 targets a ranking among the top 50, an improvement that will contribute to the investment appeal of Erbil as a city.

Ensuring flexibility in regulatory approach will be key in ensuring that innovation and new processes can be implemented within industry and contribute to economic growth. Removing legal and regulatory barriers to innovation within industry is essential. An attractive investment environment will set Erbil apart from its competitors.

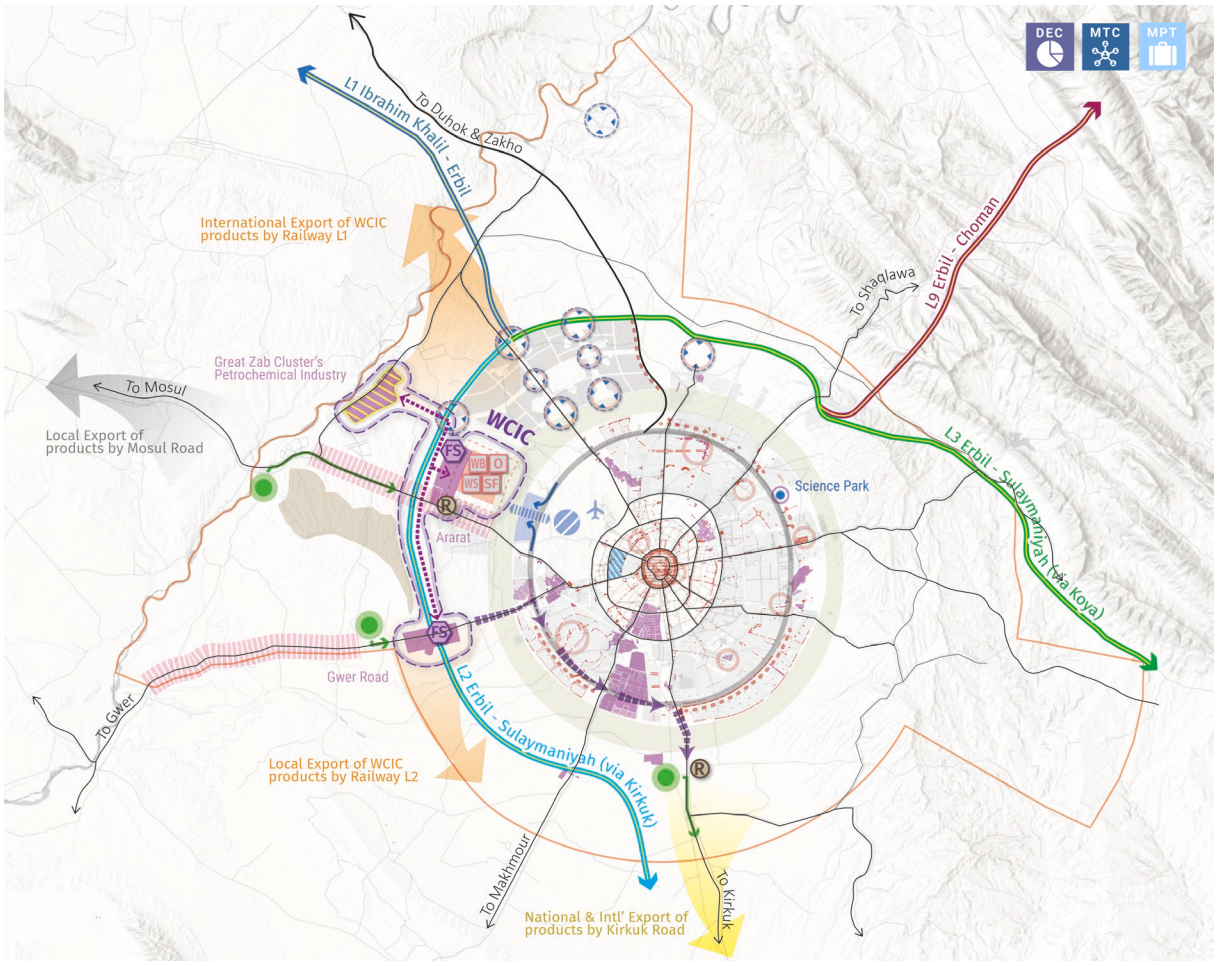
The KRG will make funds available to support innovation and the growth of small and medium sized enterprises, with priority subsectors targeted. These initiatives will be directed at building and encouraging knowledge partnerships between researchers and industries, and between different industries, as well as supporting the embedding of new technologies and practices.

(2) Propositions of Strategic Orientation 3: Promote Innovative & Diversified Economy and Boost Employment

Based on the major issues and challenges of Economic Diversification summarized above, Strategic Orientation 3: Promote Innovative & Diversified Economy and Boost Employment proposes the following planning principles, as shown in Figure 5.4.8 below.

[5] O. Granstrand, M. Holgerson, 'Innovation ecosystems: A conceptual review and new definition' (Technovation, 2020)

	Planning Principles of the Strategic Orientation	Long-term Vision	Link to Strategies
SO3-1	**Diversify and Expand the Manufacturing Sector through Export-Oriented Clusterization**		
SO3-1-1	Establish the Western Clean Industry Cluster (WCIC) between production site of refined oil in Great Zab area and transformation in Ararat and Gwer Road.	DEC	
SO3-1-2	Develop Food Processing Complexes in proximity of agricultural production areas and integrated to exportation rail and road networks, in Khabat, Shamamnk and Qushtapa.	DEC	SO1-5-5
SO3-1-3	Establish diversified Industrial Corridors along Mosul Road and Gwer Road to cater to a broader range of high-potential industries beyond petrochemicals, including the construction sector.	DEC	
SO3-2	**Establish Kurdistan Inter-City Railway (KICR) as the Backbone for Erbil's Export Industry**		
SO3-2-1	Design KICR lines L1 and L2 according to the shape of the future urban area of Erbil 2050 MP, passing through the WWPC so that it maximizes exportation potential.	MTC	SO2-1-2
SO3-2-2	Establish 2 Freight Stations of the KICR integrated with industrial production units of WWPC in Ararat and in Gwer Road Industrial Zones in order to maximize international exportation through Iraqi Development Road Railway via Mosul.	DEC	SO2-1-2
SO3-2-3	Concentrate all KICR operation facilities (Operation Centre, Sleeper's Factory, Workshop, etc.) in the proposed Erbil Railway Operation Hub integrated with industrial production of WWPC in Ararat Zone.	DEC	
SO3-3	**Enhance Road Infrastructure to support Exportation Capacity**		
SO3-3-1	Promote the 150m Ring Road to a primary road freight infrastructure. Southwest portion of 150m Ring Road can have specific lanes for trucks to enhance exportation speed and capacity.	DEC	
SO3-3-2	Establish Road Distribution and Storage Facilities promoting exportation by road in strategic locations, especially through Kirkuk Road and Mosul Road (to be studied through a specific study by Governorate of Erbil).	DEC	SO2-1-1
SO3-4	**Diversify Economic Opportunities towards Global Trade Connectivity through Air Freight**		
SO3-4-1	Develop an Air Freight Export Hub within Erbil International Airport to facilitate intl' exportation of goods transported from WCIC and 150 m Ring Road.	HAV	SO2-2-2 SO4-4-3
SO3-5	**Rationalize Business Activities to boost Tertiary Employment in a Sector in Mutation**		
SO3-5-1	Establish office and commercial areas in priority in newly created Mixed-Use Secondary and Tertiary Cores.	DEC	
SO3-5-2	Promote the creation of Specialized Clusters for Trade and Services, that foster collaboration, knowledge sharing, and economies of scale in Development Cores.	DEC MPT	
SO3-5-3	Promote aggregation of existing businesses in the dedicated International Business Core to resolve the scattering of company offices in gated communities to avoid the GHG emissions created by commuting.	DEC	
SO3-5-4	Make sure that new commercial developments in the outskirts of the city (shopping malls along 150m Road) does not compete with traditional commercial areas.	DEC	
SO3-5-5	Promote incentives and possibility of expansion and renewal of existing commercial activities in the Central Heritage & Business District and easing land use change.	DEC	
SO3-6	**Harness Innovation to empower all Economic Sectors for a Transformative Future**		
SO3-6-1	Establish a Science Park in Daraban Economic Core to support research and development in science and technology, in link with, but not limited to manufacturing and petrochemical industry developed in WCIC.	DEC	IND-S4-1
SO3-6-2	Promote the Western Hills, outside of development, as Rural Economic Diversification Innovation Incubator.	DEC	



SO3 PROMOTE INNOVATIVE & DIVERSIFIED ECONOMY AND BOOST EMPLOYMENT

SO3-1 Diversify and Expand the Manufacturing Sector through Export-Oriented Clusterization
- Priority Environmental Upgrading of existing Petrochemical industries to tackle air pollution problem
- Establish the Western Clean Industry Cluster (WCIC)
- Develop Food Processing Complexes in proximity of agricultural production areas and integrated to export networks
- Establish diversified Industrial Corridors along Mosul Road and Gwer Road

SO3-2 Establish Kurdistan Inter-City Railway (KICR) as the Backbone for Erbil's Export Industry
- Design KICR lines according to the shape of the future urban area, passing through the WCIC to maximize exportation potential
- Establish 2 Freight Stations of the KICR integrated with industrial production units to enhance international exportation
- Concentrate all KICR operation and maintenance facilities in proposed Erbil Railway Operation Hub

SO3-3 Enhance Road Infrastructure to support Exportation Capacity
- Promote the 150m Ring Road to a primary road freight infrastructure (special truck lane) to intl' markets via Kirkuk Road
- Connect all industrial zones of the WCIC through a dedicated new service road to increase efficiency and limit nuisances
- Establish Road Distribution and Storage Facilities promoting exportation by road in strategic locations

SO3-4 Diversify Economic Opportunities towards Global Trade Connectivity through Air Freight
- Develop an Air Freight Export Hub within Erbil International Airport to facilitate intl' exportation of goods

SO3-5 Rationalize Business Activities to boost Tertiary Employment in a Sector in Mutation
- Establish office and commercial areas in priority in newly created Mixed-Use Secondary and Tertiary Cores
- Promote the creation of Specialized Clusters for Trade and Services in Development Cores
- Promote aggregation of existing businesses in the dedicated International Business Core to resolve scattering of companies
- Ensure that new commercial developments in the outskirts of the city does not compete with traditional commercial areas
- Promote incentives and possibility of expansion and renewal of existing commerces in Central Heritage & Business District

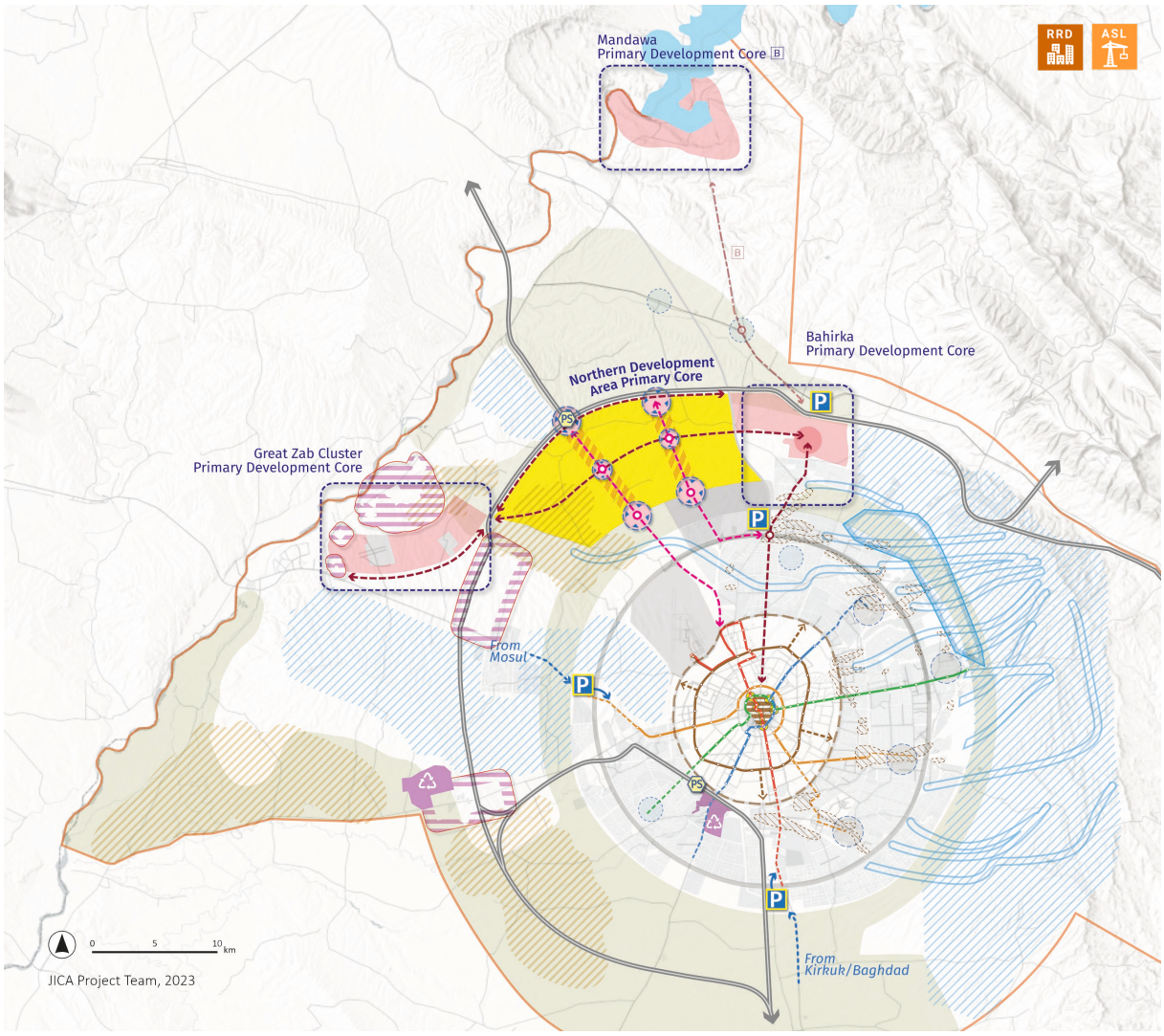
SO3-6 Harness Innovation to empower all Economic Sectors for a Transformative Future
- Establish a Science Park to support research and development in science and technology
- Promote the Western Hills, outside of development, as Rural Economic Diversification Innovation Incubator

Source: JICA Project Team

Figure 5.4.8 Strategic Orientation 3: Innovative & Diversified Economy

5.4.4 Strategic Orientation 4: A New Metropolitan Multi-Core & Fluid Model

	Planning Principles of the Strategic Orientation	Long-term Vision	Links
SO4-1	**Prohibit, Control and Regulate Urban Sprawl in Unsuitable Areas**		
SO4-1-1	Strongly prohibit any construction over the watercourse of seasonal rivers to prevent exacerbating flooding vulnerability.	WCC	FLO-S9 (Section 8.7)
SO4-1-2	Regulate urbanization in the eastern Groundwater Recharge Zone that do not hinder the natural processes of water infiltration and replenishment.	WCC	HYD-P2 (Section 8.1)
SO4-1-3	Restrict urbanization in areas with archaeological potential in order to safeguard the remnants of historical artifacts.	WCC	TOU-S5 (Section 6.3)
SO4-1-4	Limit urbanization on valuable and highly productive agricultural lands.	WCC	AGR-S4 (Section 6.1)
SO4-2	**Regenerate the Existing City to face Future Challenges and Boost Opportunities**		
SO4-2-1	Requalification of the Central Heritage & Business District through the Revitalization of the Citadel, ambitious modernization of the traditional urban fabric through urban renewal operations, especially around the BRT nodes, limitation of parking and introduction of walkability and traffic-calming measures.	RRD CMH	SO7-2-1 TOU-S3-1 4-1 (Section 6.3.3) TRA-S5-1 (Section 7.4.1)
SO4-2-2	Resorb flooding vulnerability risk in High Flooding Risk areas to be urbanized by 2040, in coordination with Detail Plans.	RRD WCC	
SO4-2-3	Explore the possibilities of brownfield redevelopment of strategically located old industries close to the City Centre.	RRD	
SO4-3	**Intensify Urban Area through the creation of a Compact and Polarized Multi-Core City**		
SO4-3-1	Prioritize the growth of future urban functions, economic activities, and housing supply within the three Primary Development Cores of Bahirka, Great Zab Cluster, and possibly Mandawa, each possessing its own unique development potential and obstacles.	RRD	
SO4-3-2	Establish a Hierarchy of Secondary and Tertiary Development Cores in strategic locations which are currently experiencing rapid growth and are situated at the convergence of future major transportation infrastructure projects.	RRD	SO3-5-1
SO4-3-3	Create a vast Residential Agri-Neighbourhood, a comfortable low density residential area of various housing typologies which melts with the preserved agricultural fields.	RRD FSE	AGR-S4-1 (Section 6.1.5)
SO4-4	**Articulate Urbanization with Public Transportation to create a Compact and Fluid City**		
SO4-4-1	Implement Mixed-Use Development Nodes within Gazna and Ashukan future development cores, connected to BRT lines extending to the North, following the principles of Transit-Oriented Development (TOD).	RRD PTW AAS	SO3-5-1
SO4-4-2	Promote dense development on both sides of the BRT lines extending to the North, following the principles of Public Transport-Oriented Corridors Trinary Road System.	RRD PTW ASL	
SO4-4-3	Develop a new BRT access to Erbil International Airport from the northern side in order to establish Gazna development core as a privileged gateway to the future metropolis expanding North, while rebalancing the centre of gravity of the whole city.	HAV	
SO4-5	**Enhance Internal and External Connectivity through Sustainable Urban Mobility**		
SO4-5-1	Giving importance to visitors from outside, establish Erbil's main Passenger Station of Kurdistan Inter-City Railway in a strategic location (2 options: in Bahirka Primary Core or in Daraban Economic Core), with priority access to the whole metropolis through the BRT network.	PTW	
SO4-5-2	Giving importance to visitors from outside and citizens living outside the city, develop Intermodal Stations (Park & Ride) in the vicinity of the 150-meter Ring Road that allow modal change from private car to public transportation in the strategic arterials of Mosul Road, Kirkuk Road and Bahirka Road (to refine based on traffic demand).	PTW	TRA-S3-1 (Section 7.4.1)
SO4-5-3	In pursuit of an enhanced accessibility for all residents of Erbil, envision the establishment of an extensive Bus Rapid Transit (BRT) network that spans across all future key neighbourhoods, emphasizing a commitment to fostering a low-emission urban environment (2 options for Brown Line: on 100m Ring Road or on 120m Ring Road).	PTW	TRA-S4-1 (Section 7.4.1)



SO4 INTENSIFY THE METROPOLITAN AREA THROUGH A NEW MULTI-CORE AND FLUID MODEL

SO4-1 Prohibit, Control and Regulate Urban Sprawl in Unsuitable Areas

- Strongly prohibit any construction over the watercourse of seasonal rivers to prevent exacerbating flooding vulnerability
- Prohibit urbanization in buffer zones from industrial estates
- Regulate urbanization on Ground Water Recharge Zone that do not hinder the natural processes of water infiltration
- Restrict urbanization in areas with archaeological potential in order to safeguard the remnants of historical artifacts
- Limit urbanization on valuable and highly productive agricultural lands

SO4-2 Regenerate the Existing City to face Future Challenges and Boost Opportunities

- Requalification of the Central Heritage & Business District: Revitalization of the Citadel & modernization of traditional areas
- Resorb flooding vulnerability risk in High Flooding Risk areas to be urbanized by 2040, in coordination with Detail Plans
- Explore the possibilities of brownfield redevelopment of strategically located old and polluting industries

SO4-3 Intensify Urban Area through the creation of a Compact and Polarized Multi-Core City

- Prioritize the growth of future urban functions, economic activities, and housing supply within 3+1 Development Cores
- Establish a Hierarchy of Secondary and Tertiary Development Cores in strategic locations
- Create a vast Residential Agri-Neighbourhood by preserving a portion of existing precious farmlands

SO4-4 Articulate Urbanization with Public Transportation to create a Compact and Fluid City

- Implement Mixed-Use Development Nodes connected to BRT lines following the principles of TOD
- Promote dense development along the BRT lines, following the principles of Public transport-oriented corridors

SO4-5 Enhance Internal and External Connectivity through Sustainable Urban Mobility

- Establish Erbil's main passenger station of Kurdistan Inter-City Railway in Bahirka Primary Core, with priority BRT access
- Develop Intermodal Stations (Park & Ride) in the vicinity of the 150-meter Ring Road
- Develop an extensive Bus Rapid Transit (BRT) network that spans across all future key neighbourhoods

Figure 5.4.9 Strategic Orientation 4: A New Metropolitan Multi-Core & Fluid Model

(1) Prohibit, Control and Regulate Urban Sprawl in Unsuitable Areas (SO4-1)

1) Strongly prohibit construction over the watercourse of seasonal rivers (SO4-1-1)

Strongly prohibit any construction over the watercourse of seasonal rivers to prevent exacerbating flooding vulnerability.

2) Regulate urbanization on Groundwater Recharge Zones (SO4-1-2)

Groundwater Recharge Zones (GRZ) are essential for the natural replenishment of groundwater reserves, which is vital for securing water resources for domestic use and agricultural activities for future generations (See SO1-1-1 in Section 5.4.1). Urban development patterns within these zones requires meticulous planning to minimize adverse effects on their groundwater recharge capacity.

The recommendations below relating to the control of urban form shall be detailed and translated into specific regulations in binding lower-level urban planning documents such as the Zoning Scheme, for which a Pilot is proposed in the scope of this Project (See PART II Section 5.3.2 Overlay Zoning).

In the Level I GRZ area designated for Strict Regulation (blue hatch with blue outline on map) in the Northeast part of Erbil beyond the 150-meter road, the main objective is to preserve as much as possible the integrity of natural landscapes by minimizing human impact. On the other hand, wider Level II GRZ areas designated for Permissible Regulation (blue hatch on map) offers greater development flexibility, provided that such developments do not impede groundwater infiltration.

(2) Regenerate the Existing City to face Future Challenges and Boost Opportunities (SO4-2)

1) Requalification of the Central Heritage & Business District (SO4-2-1)

Urban renewal stands as a critical imperative for injecting vitality into aging city fabrics, and this is particularly relevant for cities like Erbil. As shown in Figure 5.4.10 below, the strategic interplay between renewal initiatives around modern public transportation stations and lines (yellow area) is an opportunity for requalification of the Central Heritage & Business District (brown area), and a sustainable growth of Erbil as a whole.

Source: JICA Project Team

Figure 5.4.10 Close-Up of Requalification of the Central Heritage & Business District

As the city expands more and more to accommodate new populations, activities move further and further from highest density neighbourhoods in the city centre. In a near future, private investors will increasingly show interest to the potential of city centres revitalization.

Throughout history, cities such as Paris and Barcelona have demonstrated the transformative power of urban renewal. The mid-19th-century renovations by Haussmann in Paris not only modernized the city but also spurred economic growth. Similarly, Ildefons Cerdà's Eixample district in Barcelona showcased the harmonious blend of historic charm and innovative design, contributing to the city's cultural and economic vibrancy.

In the recent years, cities like Seoul, Singapore, and Tokyo serve as exemplars of successful urban renewal. Seoul's Cheonggyecheon Restoration Project transformed a neglected waterway into a thriving urban oasis. Singapore has preserved its cultural heritage through the rejuvenation of districts like Chinatown and Kampong Glam. Meanwhile, Tokyo's continual adaptation and innovation underscore the perpetual nature of urban renewal, making it called an “organic city”, which is living and renewing.

In this context, Erbil too stands at a crossroads where it must consider the benefits of urban renewal. As the city expands, thoughtful integration of renewal strategies becomes crucial. Coordinated with the introduction of structuring public transportation in the city centre, such as bus or LRT, Erbil can unlock the potential of urban renewal, attracting private investment and ensuring a prosperous future as a low-emission city which has the maturity of rebuilt itself. The only obstacle is the land tenure legal system.

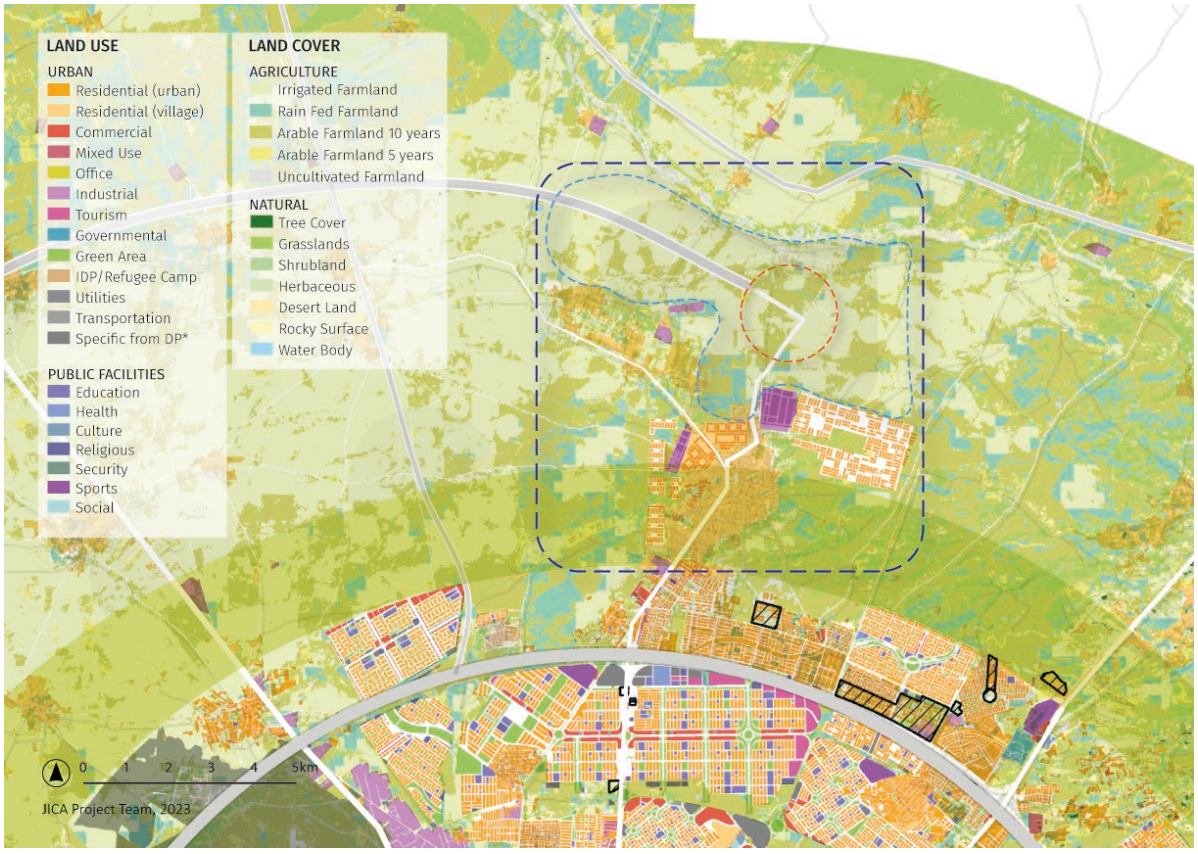
(3) Intensify Urban Area through the Creation of a Compact and Polarized Multi-Core City

1) Prioritize the growth in three Primary Development Cores (SO4-3-1)

Bahirka Primary Development Core

The potential site for Bahirka Primary Development Core is situated in a strategic location, bordered in the north by a meandering stream and in the south by the bustling expansion of Erbil's Northern ongoing residential and industrial development organized by approved Detailed Plans. The topography of the site is predominantly flat, offering a perfect canvas for development. Existing land use is predominantly irrigated and arable farmlands. Development area, delineated by the blue dashed perimeter in Figure 5.4.11 below, is of 2,000 ha, and a central core of 200 ha, marked by the red dashed perimeter, has been identified as the focal point for development. This central area strategically converges at the intersection of major roads, poised to become a vibrant hub of activity.

It may be expected that the Bahirka Primary Core accommodate 50,000 to 60,000 residents by 2050 (See Section 5.5.1), which corresponds of a population density of 63 to 75 residents/ha on 800 ha, after removing 30% of the area for roads and utilities, and another 30% for others land uses expected residential from the total area of 2,000 ha.



Source: JICA Project Team

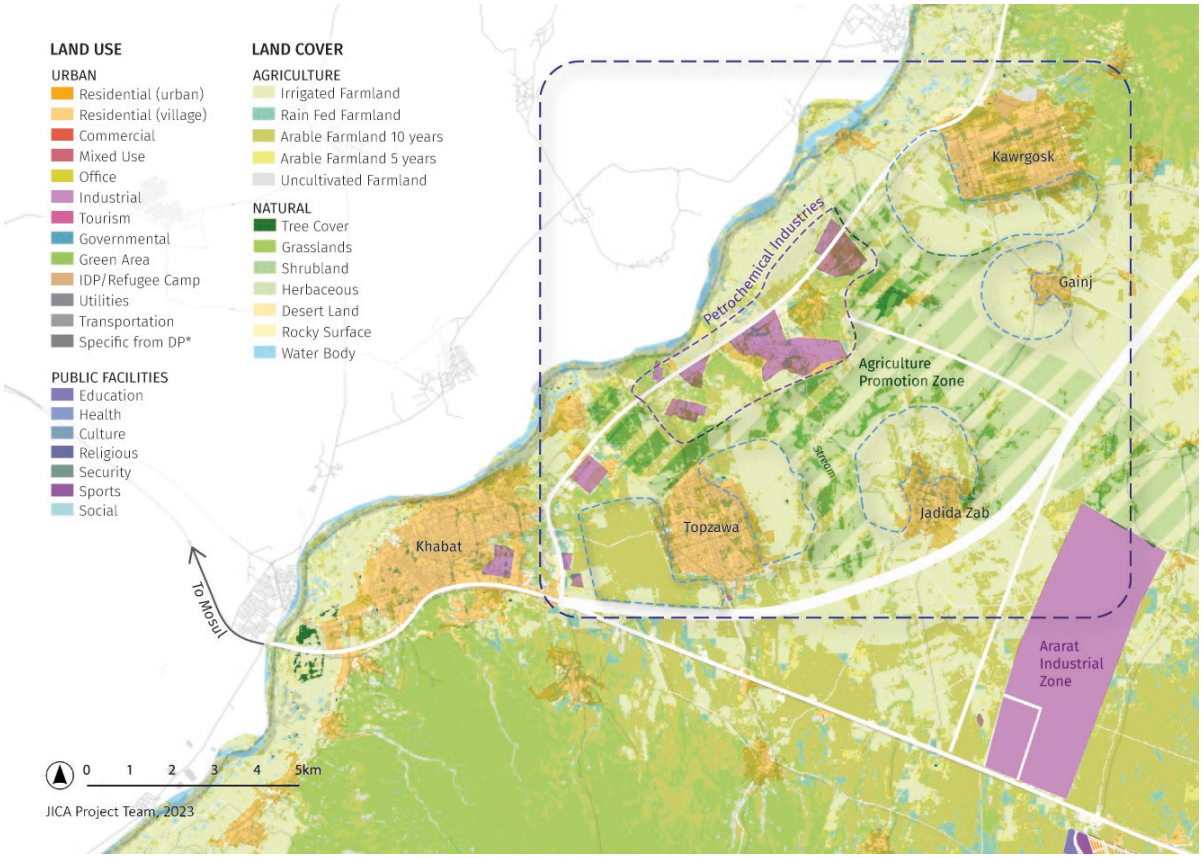
Figure 5.4.11 Site Situation of Potential Bahirka Future Primary Core Development

Great Zab Cluster Primary Development Core

Nestled amidst a predominantly flat landscape, the potential site for Great Zab Cluster Primary Development Core presents a unique opportunity to revitalize and consolidate existing small villages, transforming them into a network of thriving small towns. This Development Core embodies a vision of sustainable growth, seamlessly blending urban development with the preservation of natural resources and existing industries.

Regarding the urban development, the concept envisions a harmonious interplay between these towns, fostering complementary functions and enabling them to operate as a coherent whole. The strategic expansion area of each village is as follows: Topzawa with 350 ha in the west and 240 ha in the east, Jadida Zab with its expansive 500 ha, Gainj with 400 ha, and Kawrgosk with 510 ha, as shown in Figure 5.4.12 below. These expansions, totalling 2,000 hectares, will breathe new life into the region while preserving and enhancing existing agricultural practices in between the villages. Additionally, the existing petrochemical industries area will undergo careful regulation, ensuring its integration within the broader development framework.

It may be expected that the Great Zab Cluster Primary Core accommodate 40,000 to 50,000 residents by 2050 (See Section 5.5.1), which corresponds of a population density of 50 to 63 residents/ha on 800 ha, after removing 30% of the area for roads and utilities, and another 30% for others land uses expected residential from the total area of 2,000 ha.



Source: JICA Project Team

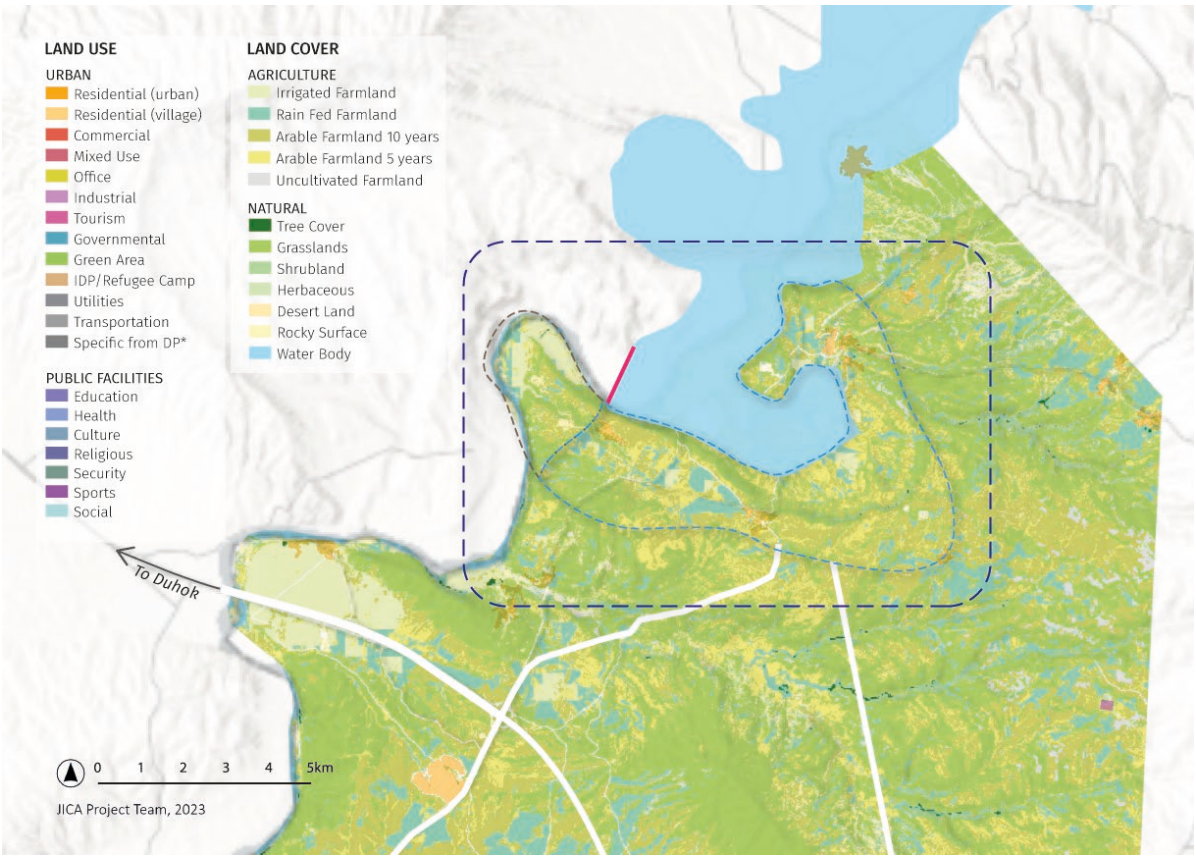
Figure 5.4.12 Site Situation of Potential Great Zab Cluster Primary Core Development

Mandawa Primary Development Core Ⓑ

Even though there are uncertainties regarding the actual period of construction, a dam on the Great Zab River in the area of Mandawa is planned by KRG and Iraqi Federal Government from more than a decade (See Section 8.1).

Even though Mandawa area is relatively far from the existing city centre, the proximity of a dam lake for urban development presents a compelling opportunity for the creation of an attractive Development Core for the Multi-Core City of Erbil. In addition to providing a sustainable source of electricity and drinking water, such a setting offers a unique blend of natural beauty and urban functionality, becoming a magnet for a diverse range of developments. Lakeside areas can be transformed into hubs of leisure and recreation, featuring hotels that capitalize on the scenic views and tranquillity of the water, which also makes it an ideal place for studying. Restaurants with picturesque lakeside settings can offer a delightful dining experience, and recreational facilities can cater to water-based activities. Furthermore, the lakeside locale becomes an ideal canvas for residential and office development, providing a distinctive and appealing work-live-play environment. The integration of urban amenities with the serene backdrop of a lake not only enhances the quality of life for residents but also attracts businesses and tourists, fostering a vibrant and sustainable urban ecosystem.

If the ambition of Mandawa Primary Core is kept as a proper Satellite City, it is assessed that it can accommodate 70,000 to 80,000 residents by 2050 (See Section 5.5.1), which corresponds of a population density of 97 to 111 residents/ha on 720 ha, after removing 30% of the area for roads and utilities, and another 30% for others land uses expected residential from the total area of 1,800 ha.



Source: JICA Project Team

Figure 5.4.13 Site Situation of Potential Mandawa Primary Core Development

2) Residential Agri-Neighbourhood (SO-4-3-3)

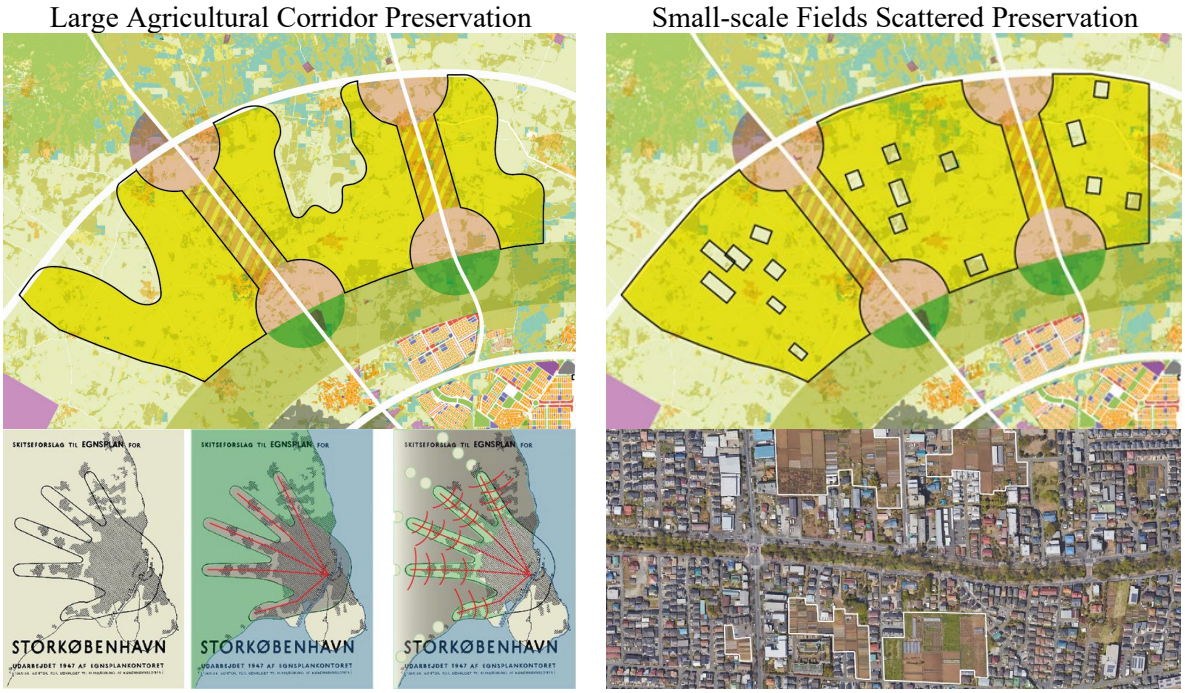
Residential Agri-Neighbourhoods are proposed in the Northern area beyond the Inner Green Belt, on rich agricultural areas. The proposed concept which integrates agricultural practices into residential areas, presents a multifaceted approach to addressing the challenges of urbanization, promoting sustainable development, and reducing the carbon footprint between food production and consumption. These neighbourhoods offer a compelling solution by fostering food security, enhancing environmental quality, and stimulating economic growth.

Through the integration of agricultural land and practices within residential developments, Residential Agri-Neighbourhoods establish a resilient and localized food system, reducing reliance on long-distance food transportation and ensuring a stable supply of fresh, nutritious produce for residents. This localized food production approach enhances food security, particularly in the face of disruptions to global food supply chains, and significantly reduces the carbon footprint associated with food transportation.

Furthermore, Residential Agri-Neighbourhoods contribute to improved environmental quality by preserving existing agricultural land and promoting sustainable agricultural practices. The presence of farms and gardens within these neighbourhoods enhances biodiversity, promotes soil health, water infiltration in groundwater, and mitigates urban heat island effects. Additionally, these green spaces contribute to air and water quality improvement through the absorption of carbon dioxide and other pollutants.

From an economic viewpoint, Residential Agri-Neighbourhoods stimulate local economic growth by creating employment opportunities in agriculture and retail sectors. The sale of locally grown produce directly to residents generates revenue for farmers and strengthens the local economy. Moreover, these neighbourhoods often attract environmentally conscious consumers and businesses, further boosting economic activity in the area.

There are several different possible spatial patterns for agriculture preservation and integration into the Residential Agri-Neighbourhoods, as shown in Figure 5.4.14. Each spatial pattern has advantages and drawbacks, and further detailed studies and discussions are necessary to decide the future shape of the harmonious fusion of urban and agriculture areas.



Example: Copenhagen (Danemark) Green Finger Plan

Example: Agriculture fields mixed in Tokyo urban area

Source: JICA Project Team, Copenhagen Metropolitan Government, Google Earth

Figure 5.4.14 Agriculture Preservation Spatial Patterns in Residential Agri-Neighbourhoods

(4) Articulate Urbanization with Public Transportation to create a Compact and Fluid City

1) Implement Mixed-Use Development Nodes in future Development Cores (SO-4-4-1)

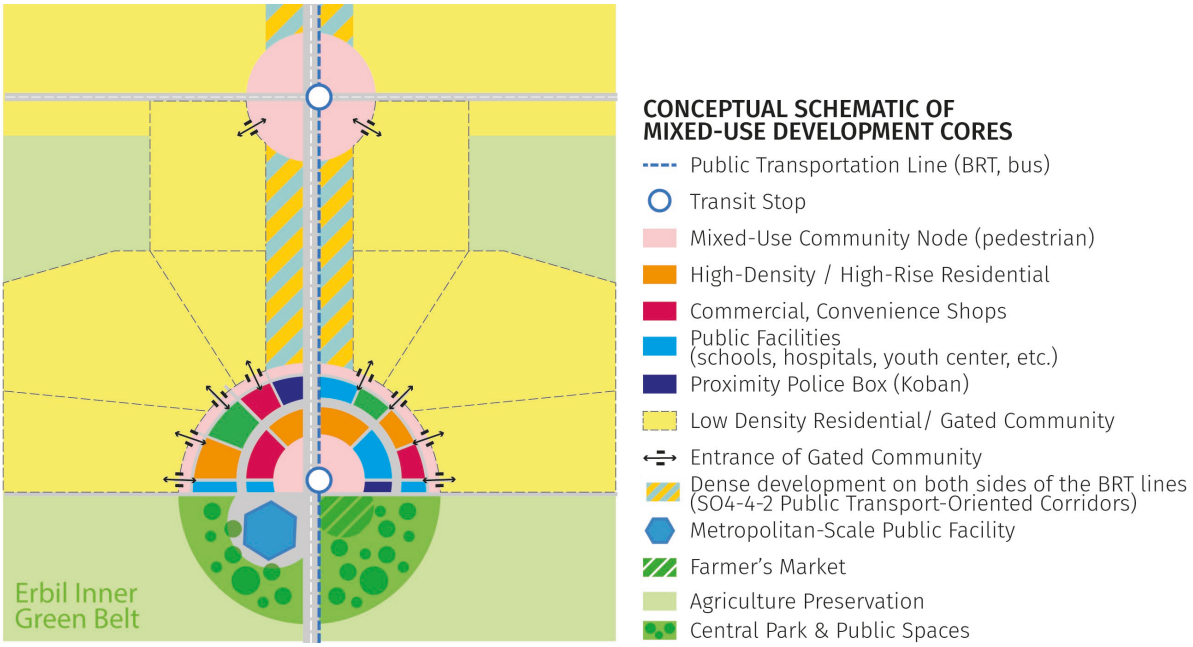
Given their close proximity to the existing city of Erbil and to its key attractive locations such as the Erbil International Airport or the 150-meter Ring Road, and due to their anchorage on proposed public transportation transit lines, the future Bahirka Primary Core, Gazna Secondary Core or Ashukan Tertiary Core emerge as highly strategic locations for accommodating future urban functions, as well as models for a new type of urban development approach in Erbil. For those reasons, it is proposed to implement the concepts, detailed below, of Mixed-Use Development Nodes in those Development Cores.

Mixed-Use Development Nodes are inspired by the principles of Transit-Oriented Development (TOD), which assume that urban development of a neighbourhood is physically oriented around a public transit station. By concentrating a mix of pedestrian-oriented development around public transport nodes, residents and workers are more likely to catch a train or a bus for out-of-neighbourhood trips, and walk or bike for shorter within-neighbourhood trips.

Integrated with the Green Belt, Mixed-Use Development Nodes in Erbil aims to function as community hubs, or "magnets of social life" for all close residential areas, with public places for daily socialization, civic celebrations, farmer's markets, cultural events, and other activities that help build the community. In that sense, it is recommended to involve the private housing sector at an early stage of the design, in order to, at least, create the entrance of gated communities towards the centre of the community.

Mixed-Use Development Nodes offer a number of advantages that can help to create more sustainable, livable, and low-carbon cities, such as, (i) reduce car dependence and thus greenhouse gas emissions by making walkable and bikable communities, (ii) improve air quality and reduce traffic congestion through utilization of public transportation, (iii) increase access to jobs, services, and amenities, (iv) improve social interaction and community cohesion, (v) increase property values and public tax revenue while reducing municipal fiscal burden due to the compactness of urban infrastructures, (vi) reduce sprawl and preserve open space, (vii) enhance livability by providing a mix of housing, jobs, services, and amenities within walking or biking distance, (viii) improve public health by reducing reliance on cars, promoting physical activity, and improving air quality.

Figure 5.4.15 below shows a Conceptual Schematic of typical Mixed-Use Development Core model, that can be implemented in Bahirka Primary Core, Gazna Secondary Core or Ashukan Tertiary Core.



Source: JICA Project Team

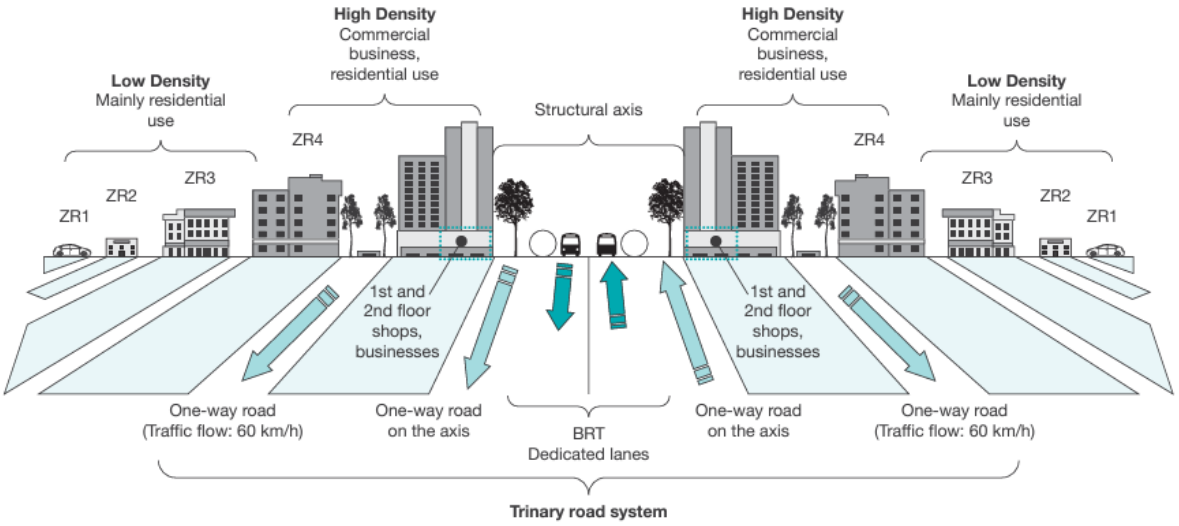
Figure 5.4.15 Conceptual Schematic of Mixed-Use Development Cores

2) Promote dense development on Public Transport-Oriented Corridors (SO4-4-2)

In the continuity of TOD-type Mixed-Use Development Nodes explained above, it is proposed to establish a special zoning for dense development on both sides of the BRT lines, following the principles of Public Transport-Oriented Corridors, inspired by Curitiba's (Brazil) Trinary Road System along the two arterial roads from Gazna Secondary Core or Ashukan Tertiary Core to the North.

Public Transport-Oriented Corridors are linear development zones centered around high-capacity public transport routes, such as BRT systems. They aim to concentrate development along these corridors, promoting mixed-use, pedestrian-friendly environments that encourage the use of public transport and reduce reliance on private vehicles.

A design element used to enhance accessibility and ensure balanced corridor growth in Curitiba is the 'Trinary' (three parallel) roadways with compatible land uses and building heights that taper with distance from the BRT corridor, as shown in Figure 5.4.16 below. Zoning ordinances and urban design standards promote ridership productivity and environmental quality. The first two floors of buildings along the busway, which do not count against permissible plot ratios (building height/land area), are devoted to retail uses. Above the second floor, buildings must set back at least 5 metres from property line to allow sun to cast on the busway. The inclusion of upper-level housing entitles property owners to density bonuses, leading to vertical mixing of uses within buildings. Further, the higher densities produced by the Trinary design have resulted in increased ridership. Concentrated commercial development has also channelled trips from residences beyond BRT terminuses to the trinary corridors.



Source: UN Habitat

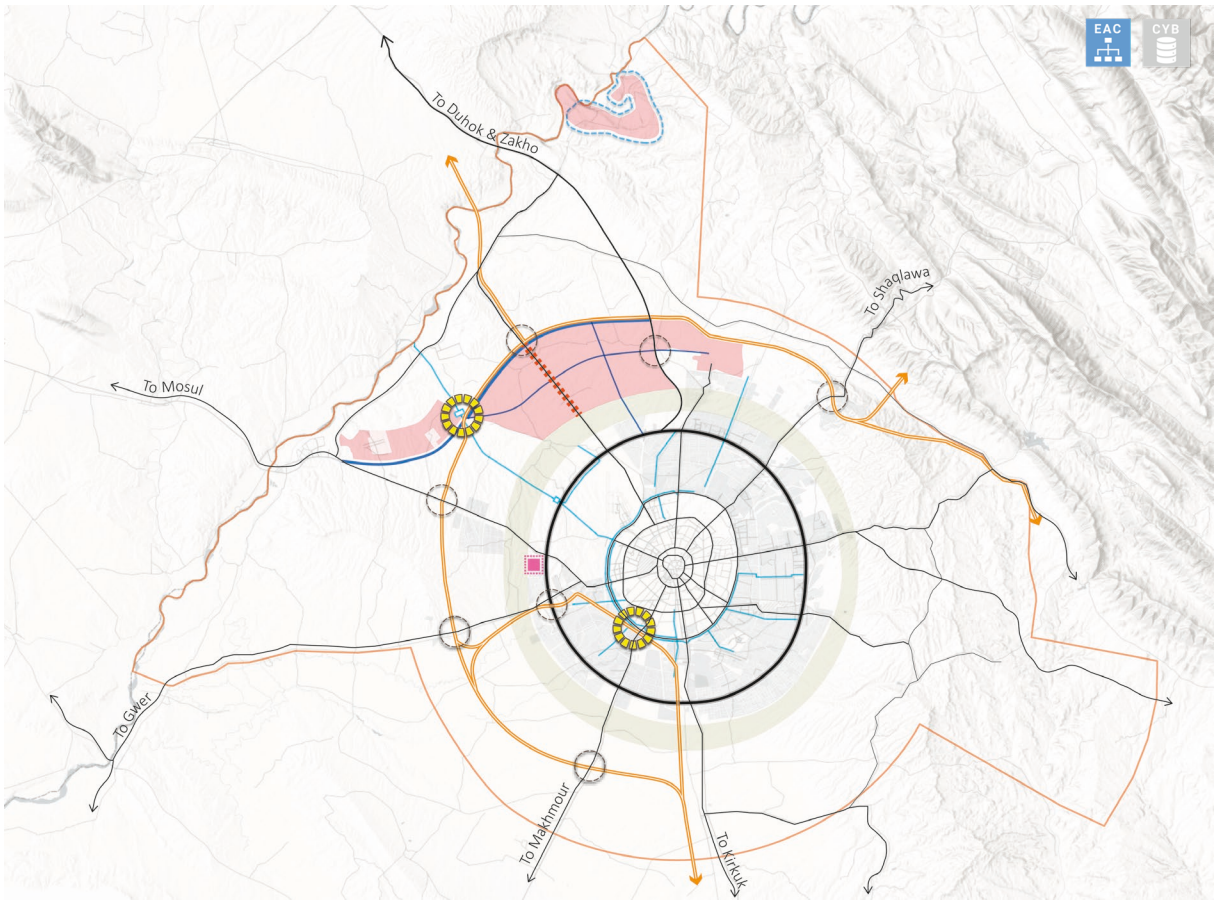
Figure 5.4.16 Concept of Public Transport-Oriented Corridors Trinary Road System

It is expected that the city of Erbil carefully considers the three above mentioned concepts of TOD-inspired Mixed-Use Development Nodes (SO-4-4-1), Public Transport-Oriented Corridors Trinary Road System (SO4-4-2) and Residential Agri-Neighbourhood (SO-4-3-3) in order to properly organize the various urban densities, housing typologies and urban functions of the Northern Development Area.

5.4.5 Strategic Orientation 5: Robust, Efficient & Resilient Infrastructure Networks

Infrastructure planning is fundamentally driven by demand and need. At the early stages of the MP formulation, the focus is put on developing a strategic framework for infrastructure development, laying the groundwork for more detailed planning in future phases. The current Strategic Orientation #5: Robust, Efficient & Resilient Infrastructure Networks, is dependent on the decision of other Strategic Orientations, and therefore were refined in later stages of the Project.

While specific infrastructure Strategies and Policies were finalized at subsequent stages (see Chapters 7 to 8), some important considerations for synergies between different infrastructure sectors and between infrastructure and economic development can be identified, as shown in Figure 5.4.17 below. For example, specific areas where a great number of different types of infrastructure are planned, such as railways and roads are planned.



S05 BUILD A STRONG, EFFICIENT AND RESILIENT INFRASTRUCTURE NETWORK PROVIDING SUFFICIENT SERVICE

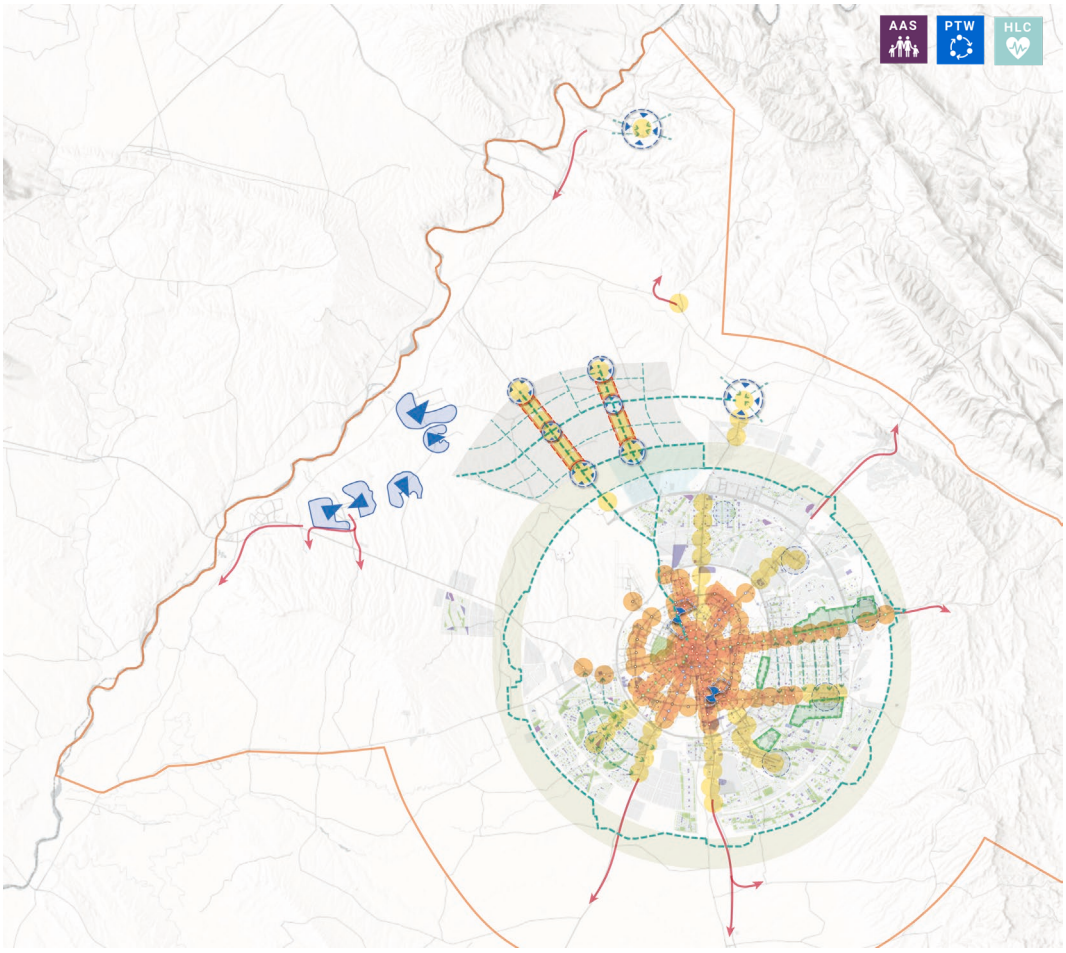
- Existing Major Road Network
- Proposed Major New Roads
- Future Kurdistan Inter-City Railway
- Water Suply main facilities and network (Erbil Emergency Water Project)
- Area where multiple infrastructures intersect, to plan carefully to ensure efficient integration and minimal conflicts
- Infrastructure Intersection (rail and road crossing) to plan
- Solid Waste Disposal Facility to Relocate
- Transformation of Duhok Highway into a Public Transit road for TOD development
- In the case of the construction of the Mandawa Dam, opportunity of self-sufficiency in renewal electrivity and water

Source: JICA Project Team

Figure 5.4.17 Strategic Orientation 5: Robust, Efficient & Resilient Infrastructure Networks

5.4.6 Strategic Orientation 6: Livable Human-Scale yet Connected Neighborhoods

	Planning Principles of the Strategic Orientation	Long-term Vision	Link to Strategies
SO6-1	**Balanced Distribution of Public Facilities and PT Stops at the Scale of the City**		
SO6-1-1	Increase the density of public facilities through the Neighbourhood Intersection Community Hubs (NICH) initiative that aims at compensating the lack of various types of public facilities within existing neighbourhoods by creating community hubs at the intersections of them.	AAS	
SO6-1-2	Reinforce coverage of green and public areas in the deprived neighbourhoods that are expected to be urbanized by 2040, in coordination with Detail Plans.	GFH AAS CNS	
SO6-1-3	Ensure the diffusion, through mobile devices, of education and health services in very remote areas to cover basic needs.	AAS	PBF-S7-2
SO6-2	**Promote Outstanding Level of Urban Services in Model Future Developments**		
SO6-2-1	Develop comprehensive, affordable and accessible public facilities and parks at the upcoming Mixed-Use Development Nodes future development cores, connected to BRT lines, following the principles of Transit-Oriented Development (TOD).	AAS	SO4-4-1
SO6-2-2	Concentrate the various metropolitan and district-scale structuring public facilities in the Secondary and Tertiary Development Cores.	AAS	SO4-3-2
SO6-2-3	In the Great Zab Cluster Primary Core, develop new high-standard public facilities to provide services to not only residents from extensions, but also to host community from villages.	AAS	
SO6-3	**Shaping the Future of Urban Mobility through Equitable Access, Walkability, and Cycling**		
SO6-3-1	Ensure equitable access to public transportation by implementing a robust BRT and bus network with convenient connections from all residential areas.	AAS	
SO6-3-2	Foster walkability through pedestrian priority areas inside the Mixed-Use Development Cores and in Central Heritage & Business District.	HLC AAS	SO4-2-1
SO6-3-3	Promote the usage of bicycle as a mean of local transportation to access the centre of Mixed-Use Development Cores, by designing dedicated bicycle lanes shaded by trees in all new residential neighbourhoods.	HLC	
SO6-3-4	Foster recreational use of bicycle by designing a dedicated bicycle lane shaded by trees on the newly proposed road around the Inner Green Belt, to link the gateways of all Erbil neighbourhoods and all Green Belt amenities together.	HLC NAT	
SO6-4	**Creation of an Urban Well-Being in Each Neighbourhood of Erbil**		
SO6-4-1	Establish small-scale green areas and walkways at the finest grain possible to tackle negative effects of Urban Heat Islands.	HLC GFH	
SO6-5	**Ensure Affordability and Variety of Housing Options**		
SO6-5-1	Promote Inclusionary Zoning (IZ) mechanism, which would allow public administration to require a minimum portion of new units in future residential developments located in Public Transport-Oriented Corridors to be provided at affordable rates, as shown on Figure 5.4.19 below. Inclusionary Zoning could help to bring more affordable housing units to the City over the long term.	AAS	SO4-4-2



SO6 CREATE LIVABLE AND HUMAN-SCALE NEIGHBORHOODS CONNECTED THROUGH PUBLIC TRANSPORTATION

SO6-1 **Balanced Distribution of Public Facilities and PT Stops at the Scale of the City**
- Develop Neighbourhood Intersection Community Hubs (NICH) to increase the density of public facilities
- Reinforce coverage of green and public areas in the deprived neighbourhoods expected to be urbanized by 2040
- Ensure the diffusion, through mobile devices, of education and health services in very remote areas to cover basic needs

SO6-2 **Promote Outstanding Level of Urban Services in Model Future Developments**
- Develop comprehensive, affordable and accessible public facilities and parks at the future Mixed-Use Development Nodes
- Concentrate various metropolitan and district-scale public facilities in Secondary and Tertiary Development Cores
- Develop new high-standard public facilities to provide services to not only new residents, but also to community from villages

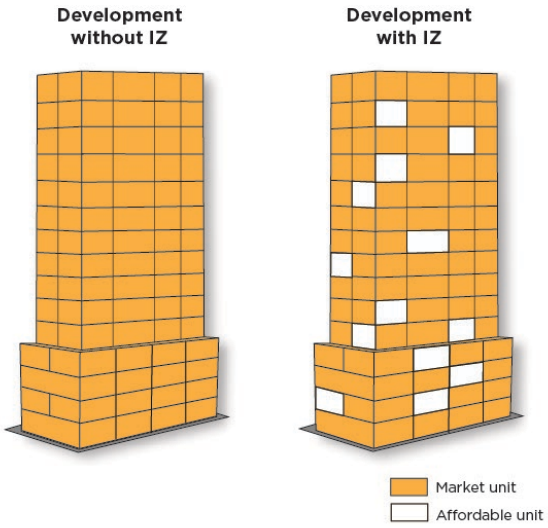
SO6-3 **Shaping the Future of Urban Mobility through Equitable Access, Walkability, and Cycling**
- Ensure equitable access to public transportation (1 km to bus stop - orange: proposed by previous study, yellow: new)
- Develop a bicycle lane network at the scale of the whole city, linking NDA to the Green Belt
- Promote the usage of bicycle as a mean of local transportation to access the centre of transit cores (stations)
- Foster walkability through pedestrian priority areas inside the Mixed-Use Development Cores and in Central District

SO6-4 **Creation of an Urban Well-Being in Each Neighbourhood of Erbil**
- Establish small-scale green areas and walkways at the finest grain possible to tackle negative effects of Urban Heat Islands

SO6-5 **Ensure Affordability and Variety of Housing Options**
- Promote Inclusionary Zoning: a minimum portion of new housing units to be provided at affordable rates

Source: JICA Project Team

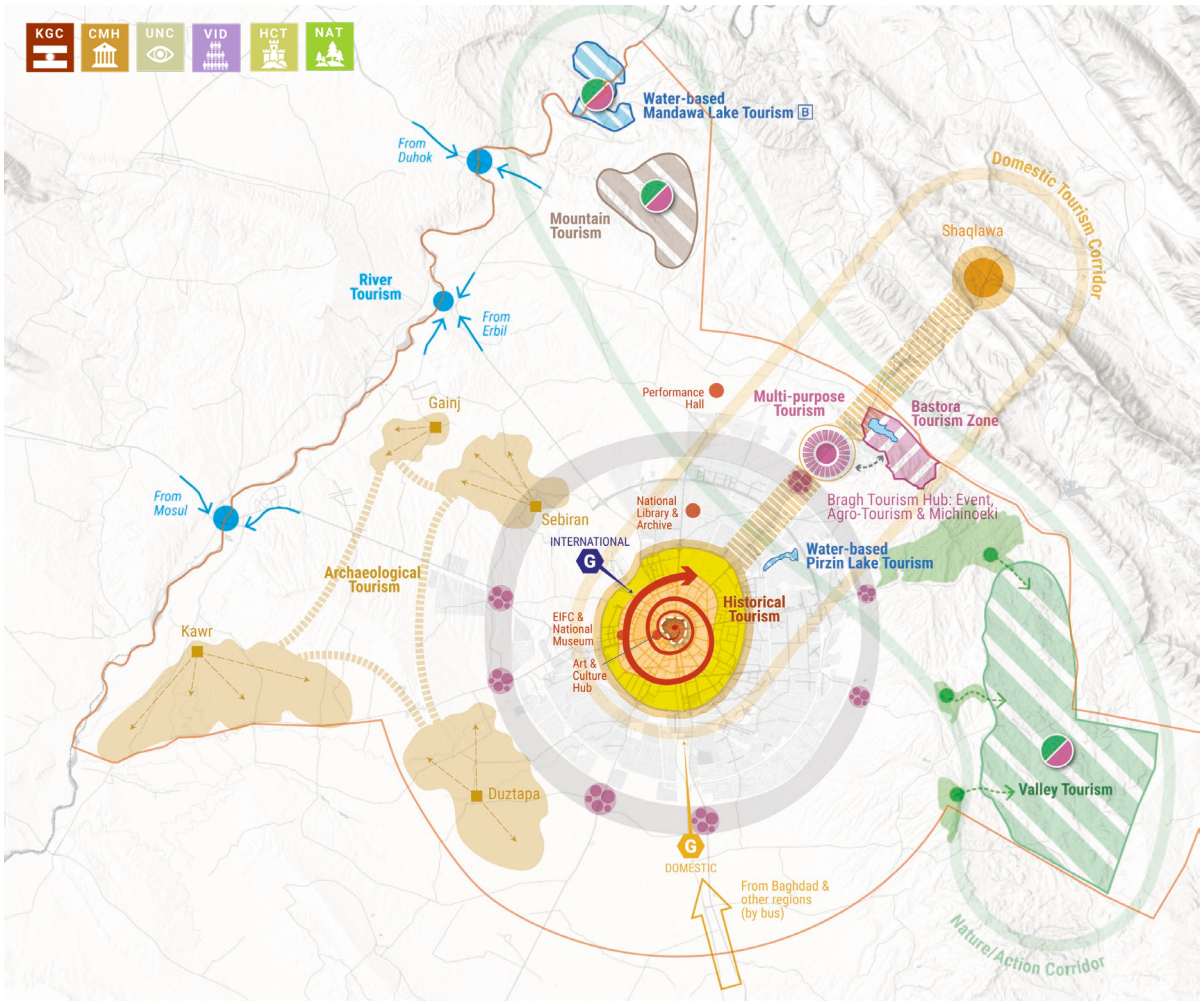
Figure 5.4.18 Strategic Orientation 6: Livable Human-Scale yet Connected Neighborhoods



Source: City of Mississauga

Figure 5.4.19 Concept of Inclusionary Zoning (IZ) mechanism for Affordable Housing

5.4.7 Strategic Orientation 7: Strong Kurdish Identity & Sustainable Tourism



SO7 ENCOURAGE STRONG KURDISH IDENTITY INTO THE PROMOTION OF SUSTAINABLE TOURISM

SO7-1 Streghten the International & Regional Influence of Erbil as the Major Gateway to Tourism in Kurdistan

- Promote Erbil International Airport as an unique Tourism gateway for international visitors to Erbil and to the whole KRI
- Promote the entrance to Erbil from Kirkuk road as a gateway for domestic visitors

SO7-2 Revitalize Erbil Citadel as the Pivot of a new Heritage & Urban Pride

- Starting from Revitalization of Erbil Citadel, operate a global enhancement of traditional urban heritage of the historical district
- Establish new public facilities in existing urban fabric as new cultural and art centers at the scale of the Kurdistan region
- Promote commercial and accommodation functions in the whole city to foster high-class Shopping and Urban Tourism

SO7-3 Establish Key Nature Tourism Sites in priority on a North-Southeast 'Nature/Action Corridor'

- Propose a large variety of both Eco-Tourism and Recreational actitivites in each Nature Tourism site in order to attract the most visitors possible and boost economic diversification
- Develop Water-based Tourism activities on Mandawa Dam Lake (sailing, swimming, fishing, etc.) B
- Develop Mountain Tourism activities on the hilly areas of Garwdalalan (trekking, camping, mountainbiking, etc.)
- Develop Valley Tourism activities on the natural features of Chamirga (hiking, bird-watching, horse-riding, etc.)
- Develop Water-based Tourism activities on Bastora Dam Lake (sailing, swimming, fishing, etc.) among others.
- Create entrances to Chamirga Park from afforestation areas
- Develop River Tourism activities on strategic gateway locations on Great Zab River (rafting, cruises, river-side restaurants, etc.)

SO7-4 Protect and give value to Ancient Heritage through the Development of Archaeological Tourism

- Conduct Inventory and Exploration of Archaeological Sites of Significant Touristic Potential
- Develop accommodation and supporting facilities of Archaeological Sites in nearby villages to support local economy
- Create a Global Network of all the Erbil's Archaeological Sites through Marketing and Infrastructure development

SO7-5 Promote the Kurdish Culture & Terroir through a brand new Multi-Purpose Tourism Hub

- On the strategic location of Bragh between the two main touristic attractions of Erbil Citadel and Shaqlawa, create a multi-purpose tourism area that includes a festival space, shop, parking, local products and souvenirs for sale, info, restaurants etc.
- Develop agroforestry and promote agri-products from Erbil Green Belt on strategic locations alongside main roads entering Erbil

Source: JICA Project Team

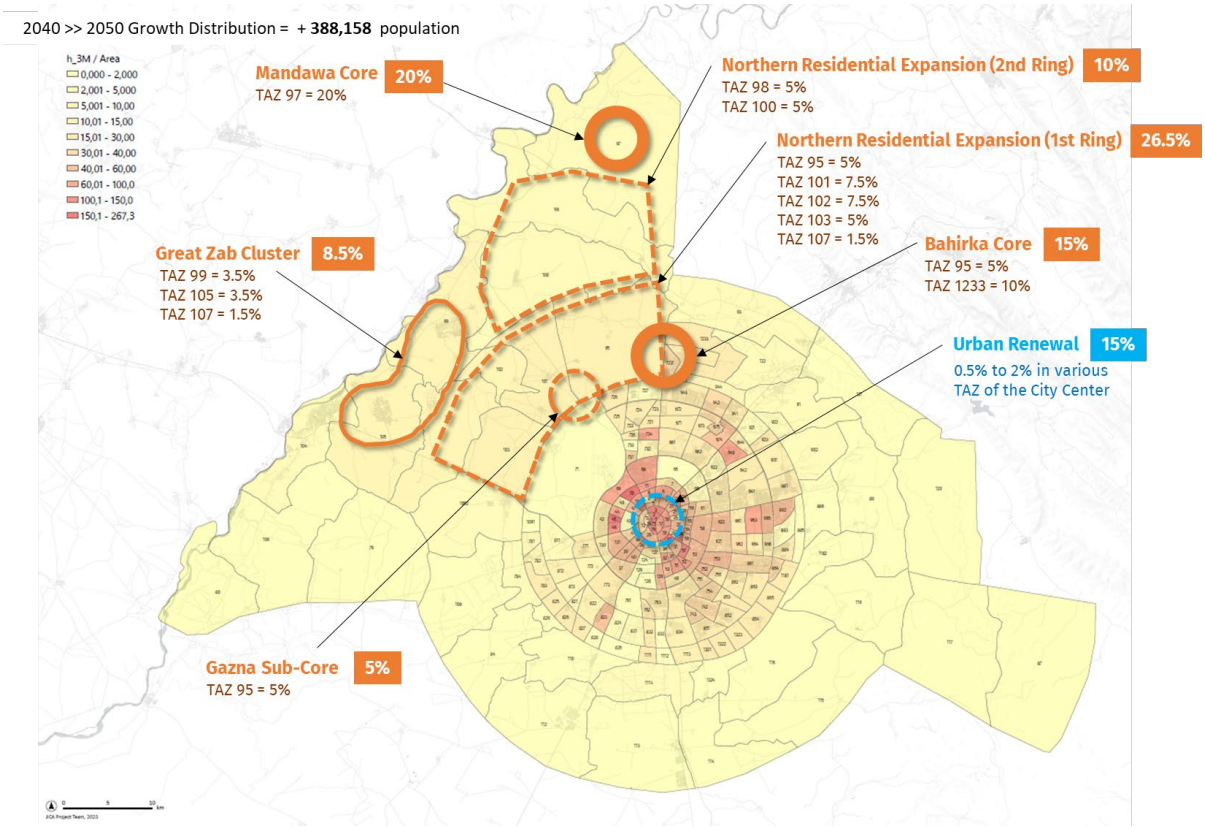
Figure 5.4.20 Strategic Orientation 7: Strong Kurdish Identity & Sustainable Tourism

	Planning Principles of the Strategic Orientation	Long-term Vision	Link to Strategies
SO7-1	**Strengthen the International & Regional Influence of Erbil as the Major Gateway to Tourism in Kurdistan**		
SO7-1-1	Promote Erbil International Airport as a unique Tourism gateway for international visitors to Erbil and to the whole Kurdistan Region.	HAV	TOU-S1-1 (Section 6.3.3)
SO7-1-2	Promote the Southern entrance to Erbil from Kirkuk Road as a gateway for domestic visitors from all Iraqi provinces.		TOU-S1-3 (Section 6.3.3)
SO7-2	**Revitalize Erbil Citadel as the Pivot of a new Heritage & Urban Pride**		
SO7-2-1	Starting from the Revitalization of Erbil Citadel, operate a global enhancement of traditional urban heritage of the historical part of the city, alongside with traffic calming policies. High-standard hotels can be developed in traditional areas, with a primary access to the Citadel.	CMH HCT MPT VID	SO4-2-1 TOU-S3-1 & 4-1 (Section 6.3.3) TRA-S5-1 (Section 7.4.1)
SO7-2-2	Establish new public facilities in existing urban fabric as new cultural and art centres at the scale of the Kurdistan region.		PBF-S4-1 (Section 9.2.1)
SO7-2-3	Promote commercial and accommodation functions in the whole city to foster high-class Shopping and Urban Tourism.	MPT	
SO7-3	**Establish Key Nature Tourism Sites in priority on a North-Southeast 'Nature/ Action Corridor'**		
SO7-3-1	Develop both eco-tourism and recreational Water-based Tourism activities on Mandawa Dam Lake.	NAT	TOU-S6-1 (Section 6.3.3)
SO7-3-2	Develop both eco-tourism and recreational Mountain Tourism activities on the hilly areas of Garwdalalan, on the road between Bahirka and Mandawa.	NAT	TOU-S7-1 (Section 6.3.3)
SO7-3-3	Develop both eco-tourism and recreational Valley Tourism activities on the natural valleys of Chamirga, integrated with Erbil city through strategic entrances from afforestation areas of Kaznazan and Punjina.	NAT	TOU-S8-1 (Section 6.3.3)
SO7-3-4	Develop River Tourism activities on Great Zab River, on strategic locations at the entrance of the city from Mosul and Duhok.	NAT	TOU-S9-1 (Section 6.3.3)
SO7-4	**Protect and give value to Ancient Heritage through the Development of Archaeological Tourism**		
SO7-4-1	Conduct Inventory and Exploration of Archaeological Sites of Significant Touristic Potential.	HCT	
SO7-4-2	Develop accommodation and supporting facilities of Archaeological Sites in nearby villages to support local economy.	HCT	
SO7-4-3	Create a Global Network of all the Erbil's Archaeological Sites through Marketing and Infrastructure development.	HCT	
SO7-5	**Promote the Kurdish Terroir through Agri & Culinary Tourism Locations**		
SO7-5-1	On the strategic location of Bragh between the two main touristic attractions of Erbil Citadel and Shaqlawa, create a Japanese-style roadside 'Michinoeki station' that includes parking, local products and souvenirs for sale, info, restaurants etc.	UNC	
SO7-5-2	Develop agroforestry and promote agri-products from Erbil Green Belt on strategic locations alongside main roads entering Erbil.	CNS	SO1-4-2 AGR-S9-1 (Section 6.1.3)

5.5 Land Use Plan

5.5.1 Distribution of Night & Day Population

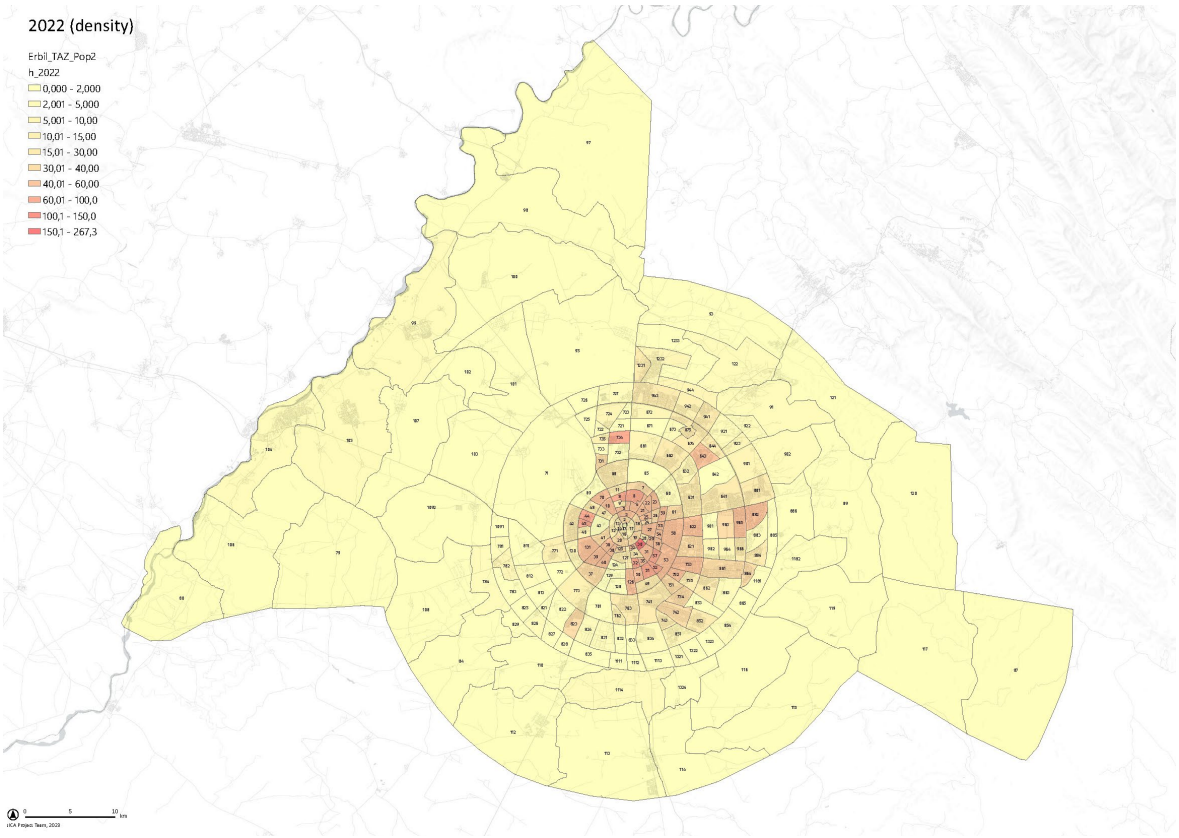
Based on the proposed Urban Structure and Strategic Orientations explained in previous Sections 5.2 and 5.3 respectively, the distribution of the Night Population growth from the 2040 up to 2050, accounting for 388,158, is proposed in each area according to the percentage shown in Figure 5.5.1 below.



Source: JICA Project Team

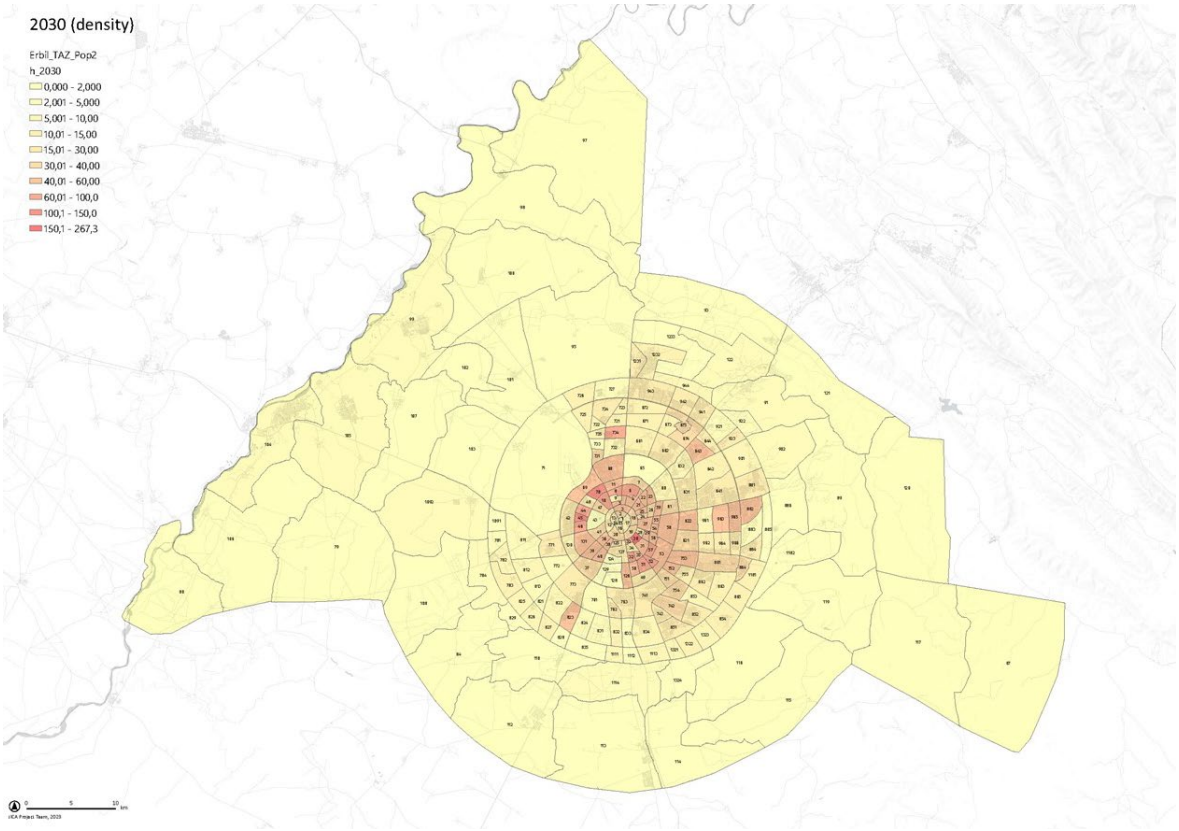
Figure 5.5.1 Concepts of Distribution of the 2040 – 2050 Population Growth

The Night Population distributed in all Traffic Zones of the Target Area is shown in Figures 5.5.2 to 5.5.5 and Table 5.5.1 below.



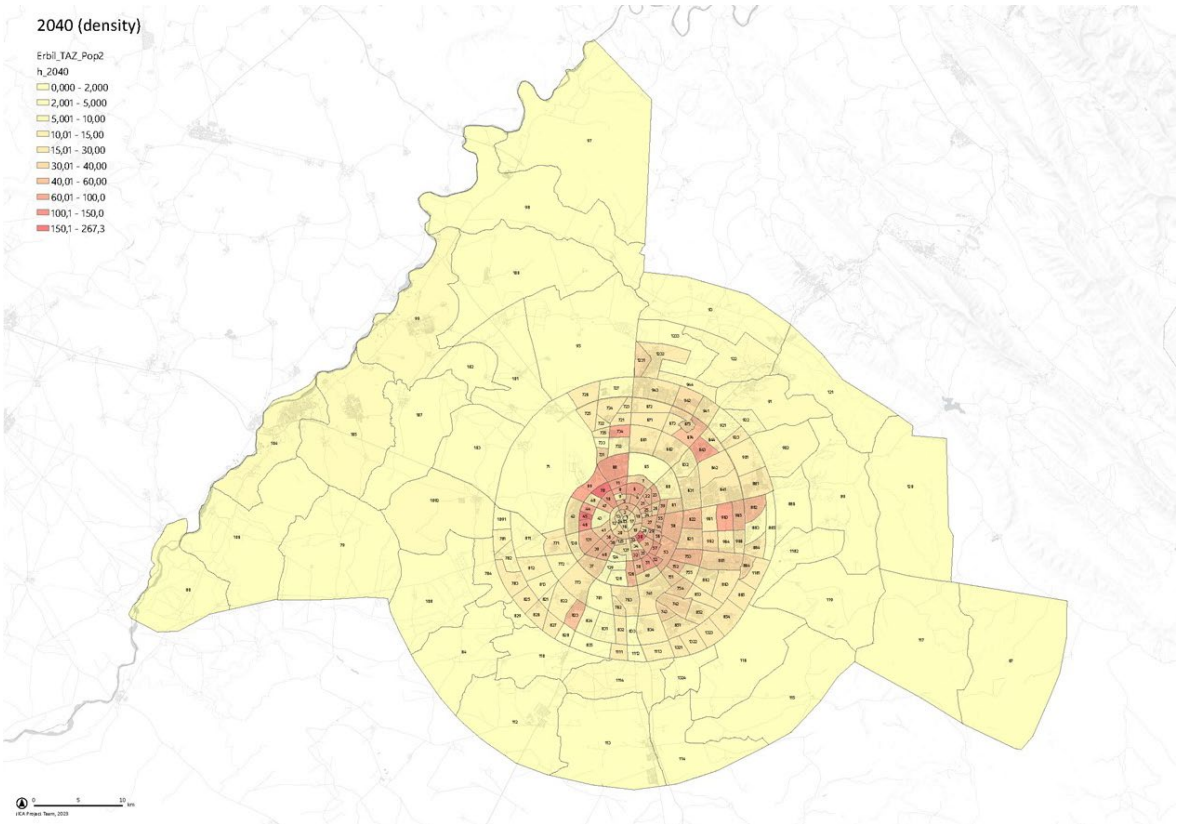
Source: JICA Project Team

Figure 5.5.2 Night Population Density by TAZ (2022)



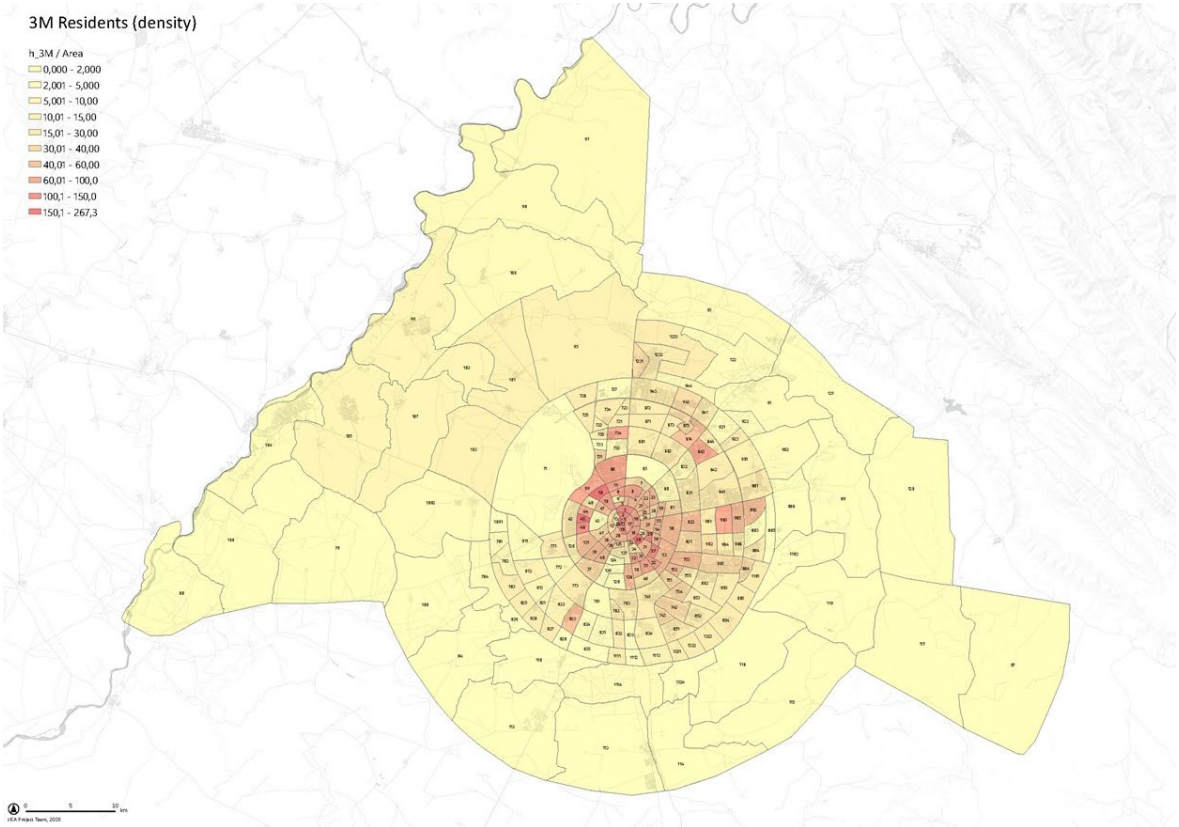
Source: JICA Project Team

Figure 5.5.3 Night Population Density by TAZ (2030)



Source: JICA Project Team

Figure 5.5.4 Night Population Density by TAZ (2040)



Source: JICA Project Team

Figure 5.5.5 Night Population Density by TAZ (2050)

Table 5.5.1 Distribution of Night Population by Traffic Zone

TAZ		2022	2030	2040	2050		Intention (Reference to Strategic Orientation)
1		13	13	13	*0.5%*	1,762	Citadel Revitalization (SO4-2-1, SO7-2-1)
2		3,685	3,685	3,685	*1.5%*	8,931	Urban Renewal (SO4-2-1)
3		7,228	7,228	7,228	*1.5%*	12,474	Urban Renewal (SO4-2-1)
4		8,720	8,720	8,720		8,720	
5		5,452	5,452	5,452		5,452	
6		17,484	17,484	17,484		17,484	
7		10,182	10,182	10,182		10,182	
8		11,214	11,214	11,214		11,214	
9		3,070	3,070	3,070		3,070	
10		10,944	14,420	18,715		18,715	
11		5,212	10,434	16,887		16,887	
12		3,578	3,578	3,578	*0.5%*	5,327	Urban Renewal (SO4-2-1)
13		1,484	1,484	1,484		1,484	
14		946	946	946	*1.5%*	6,192	Urban Renewal (SO4-2-1)
16		1,333	1,333	1,333	*1.5%*	6,579	Urban Renewal (SO4-2-1)
17		1,806	1,806	1,806	*2.0%*	8,801	Urban Renewal (SO4-2-1)
18		5,981	5,981	5,981	*1.5%*	11,227	Urban Renewal (SO4-2-1)
19		6,235	6,235	6,235	*1.5%*	11,481	Urban Renewal (SO4-2-1)
20		6,910	6,910	6,910	*0.5%*	8,659	Urban Renewal (SO4-2-1)
21		5,822	5,822	5,822		5,822	
22		6,489	6,489	6,489		6,489	
23		8,497	8,497	8,497		8,497	
24		2,399	2,399	2,399		2,399	
25		4,021	4,021	4,021		4,021	
26		5,139	5,139	5,139		5,139	
27		11,808	11,808	11,808		11,808	
28		1,754	1,754	1,754		1,754	
29		3,758	3,758	3,758	*1.5%*	9,004	Urban Renewal (SO4-2-1)
30		17,647	17,647	17,647		17,647	
31		8,923	8,923	8,923		8,923	
32		6,957	6,957	6,957		6,957	
33		2,150	2,150	2,150		2,150	
34		3,337	3,337	3,337		3,337	
35		3,178	3,178	3,178		3,178	
36		8,394	8,394	8,394		8,394	
37		20,447	20,447	20,447		20,447	
38		4,562	4,562	4,562		4,562	
39		17,355	17,355	17,355		17,355	
40		10,849	10,849	10,849		10,849	
41		9,284	9,284	9,284		9,284	
42		16,787	17,081	17,444		17,444	
43		-	-	-		-	
44		17,742	17,742	17,742		17,742	
45		10,956	15,696	21,554		21,554	
46		2,890	11,345	21,794		21,794	
47		4,760	6,774	9,262		9,262	
48		4,610	4,610	4,610		4,610	
49		9,778	9,778	9,778		9,778	
50		8,020	8,020	8,020		8,020	
51		13,334	13,334	13,334		13,334	
52		8,639	8,639	8,639		8,639	
53		33,058	33,058	33,058		33,058	
54		5,083	5,083	5,083		5,083	
55		3,853	3,853	3,853		3,853	
56		7,104	7,104	7,104		7,104	
57		9,636	9,636	9,636	*1.0%*	13,134	Urban Renewal (SO4-2-1)
58		41,590	41,590	41,590		41,590	
59		6,566	6,566	6,566		6,566	
60		2,666	5,191	8,312		8,312	
61		12,995	12,995	12,995		12,995	
62	*621*	25,718	25,718	25,718		25,718	
	622	24,828	24,828	24,828		24,828	
63	*631*	30,603	31,133	31,787		31,787	
	632	5,629	5,654	5,684		5,684	
64	*641*	32,749	35,391	38,657		38,657	
	642	30	10,361	23,129		23,129	
	643	24,639	30,285	37,262		37,262	
	644	6,291	6,291	6,291		6,291	
65		512	1,473	2,660		2,660	
66	*661*	7,886	12,748	18,757		18,757	
	662	20,791	22,276	24,112		24,112	
67	*671*	77	7,084	15,745		15,745	
	672	4,395	9,440	15,675		15,675	
	673	1,312	5,218	10,046		10,046	
	674	10,720	21,266	34,299		34,299	
	675	12,105	13,194	14,540		14,540	
68		27,701	44,779	65,885		65,885	
69		60	24,158	53,941		53,941	

TAZ		2022	2030	2040	2050		Intention (Reference to Strategic Orientation)
70		12,685	24,805	39,784		39,784	
71		15,682	17,182	19,036		19,036	
72	*721*	249	2,906	6,190		6,190	
	722	912	2,538	4,547		4,547	
	723	120	1,868	4,028		4,028	
	724	6,897	10,851	15,738		15,738	
	725	13	5,579	12,459		12,459	
	726	4	7,880	17,613		17,613	
	727	8,950	8,950	8,950		8,950	
73	*731*	7,998	8,094	8,212		8,212	
	732	2,503	4,086	6,042		6,042	
	733	77	77	77		77	
	734	22,132	24,112	26,560		26,560	
	735	2,253	2,868	3,629		3,629	
74	*741*	24,888	24,888	24,888		24,888	
	742	23,345	23,345	23,345		23,345	
	743	6,807	8,337	10,228		10,228	
75	*751*	10,939	10,939	10,939		10,939	
	752	11,038	11,038	11,038		11,038	
	753	32,955	32,955	32,955		32,955	
	754	13,532	13,532	13,532		13,532	
	755	6,902	8,447	10,356		10,356	
76	*761*	1,742	2,255	2,890		2,890	
	762	3,720	5,791	8,351		8,351	
	763	22,635	22,759	22,912		22,912	
77	*771*	11,558	14,256	17,591		17,591	
	772	1,191	3,233	5,756		5,756	
	773	17,755	20,960	24,921		24,921	
78	*781*	1,660	2,127	2,704		2,704	
	782	4,562	4,562	4,562		4,562	
	783	1,660	9,999	20,306		20,306	
	784	5,599	5,601	5,603		5,603	
79		5,592	5,592	5,592		5,592	
80		3,429	3,429	3,429		3,429	
81	*811*	2,825	5,245	8,235		8,235	
	812	2,060	5,705	10,211		10,211	
	813	9	2,103	4,692		4,692	
82	*821*	-	1,056	2,362		2,362	
	822	701	5,807	12,118		12,118	
	823	20,812	23,453	26,716		26,716	
	824	1,716	1,716	1,716		1,716	
	825	125	4,302	9,464		9,464	
	826	1,617	4,729	8,576		8,576	
	827	761	5,784	11,993		11,993	
	828	181	181	181		181	
	829	311	311	311		311	
83	*831*	1,896	1,896	1,896		1,896	
	832	301	5,186	11,223		11,223	
	833	886	886	886		886	
	834	2,769	7,875	14,186		14,186	
	835	314	314	314		314	
84		4,969	4,969	4,969		4,969	
85	*851*	7,160	13,515	21,370		21,370	
	852	14,869	16,438	18,378		18,378	
	853	30	4,788	10,668		10,668	
	854	3,754	8,544	13,773		22,912	
86	*861*	34,959	34,959	34,959		34,959	
	862	10,337	13,098	16,510		16,510	
	863	2,700	8,087	14,744		14,744	
	864	11,335	11,335	11,335		11,335	
	865	60	4,026	9,572		15,923	
87		4,484	4,484	4,484		4,484	
88	*881*	26,664	28,849	31,550		31,550	
	882	28,268	28,270	28,272		28,272	
	883	2,447	2,447	2,447		2,447	
	884	10,514	10,516	10,518		10,518	
	885	606	606	606		606	
	886	5,987	5,987	5,987		5,987	
89		1,151	1,151	1,151		1,151	
90	*901*	9,525	11,740	14,477		14,477	
	902	8,095	8,095	8,095		8,095	
91		18,035	18,035	18,035		18,035	
92	*921*	3,702	3,702	3,702		3,702	
	922	3,765	3,765	3,765		3,765	
	923	2,610	7,447	13,425		13,425	
93		19,358	19,358	19,358		19,358	
94	*941*	13,025	14,470	16,257		16,257	
	942	9,851	18,579	29,367		29,367	
	943	35,677	36,398	37,290		37,290	
	944	8,399	8,399	8,399		8,399	

TAZ		2022	2030	2040	2050		Intention (Reference to Strategic Orientation)
95		9,457	9,457	9,457	*15.0%*	61,921	Bahirka Core (East) (SO4-3-1) + Gazna Secondary Core (West) (SO4-3-2) + Northern Residential Expansion (First Ring) (SO4-3-3)
96	*961*	649	4,591	9,464		9,464	
	962	3,474	8,905	15,618		15,618	
	963	25,581	34,203	44,858		44,858	
	964	2,705	8,597	15,878		15,878	
	965	28,810	28,810	28,810		28,810	
	966	9,125	9,125	9,125		9,125	
97		8,744	8,744	8,744	*20.0%*	78,697	Mandawa Core* (SO4-3-1)
98		17,049	17,049	17,049	*5.0%*	34,537	Northern Residential Expansion (Second Ring) (SO4-3-3)
99		36,575	36,575	36,575	*3.5%*	48,817	Great Zab Cluster (SO4-3-1)
100		12,863	12,863	12,863	*5.0%*	30,351	Northern Residential Expansion (Second Ring) (SO4-3-3)
101		11,476	11,476	11,476	*7.5%*	37,708	Gazna Secondary Core (SO4-3-2) + Northern Residential Expansion (First Ring) (SO4-3-3)
102		2,304	2,304	2,304	*7.5%*	28,536	Northern Residential Expansion (First Ring) (SO4-3-3)
103		5,287	5,287	5,287	*5.0%*	22,776	Northern Residential Expansion (First Ring) (SO4-3-3)
104		34,555	34,555	34,555		34,555	
105		51,015	51,015	51,015	*3.5%*	63,257	Great Zab Cluster (SO4-3-1)
106		7,693	7,693	7,693		7,693	
107		7,536	7,536	7,536	*3.0%*	18,029	Great Zab Cluster (SO4-3-1) + Northern Residential Expansion (First Ring) (SO4-3-3)
108		16,068	16,068	16,068		16,068	
109	*1091*	194	194	194		194	
	1092	9,254	18,324	29,534		29,534	
110		6,312	6,312	6,312		6,312	
111	*1111*	69	3,074	6,788		6,788	
	1112	383	383	383		383	
	1113	731	2,930	5,727		9,528	
	1114	10,670	10,673	10,677		10,677	
112		14,267	14,267	14,267		14,267	
113		22,699	22,699	22,699		22,699	
114		10,850	10,850	10,850		10,850	
115		2,707	2,707	2,707		2,707	
116		4,532	4,532	4,532		4,532	
117		2,920	2,920	2,920		2,920	
118	*1181*	82	3,671	8,678		14,436	
	1182	2,910	2,910	2,910		2,910	
119		135	135	135		135	
120		225	225	225		225	
121		16,909	16,909	16,909		16,909	
122		19,885	19,885	19,885		19,885	
123	*1231*	9,315	13,949	19,677		19,677	
	1232	9,315	17,824	28,341		28,341	
	1233	-	188	421	*10.0%*	35,398	Bahirka Core (SO4-3-1)
125		3,457	3,457	3,457		3,457	
126		17,514	17,514	17,514		17,514	
127		10,200	10,200	10,200		10,200	
128		357	357	357		357	
129		383	383	383		383	
130		3,986	4,605	5,370		5,370	
131		26,303	26,303	26,303		26,303	
132	*1321*	1,036	2,422	3,274		6,578	
	1322	61	3,910	8,611		15,456	
	1323	168	2,983	6,188		11,426	
	1324	1,111	1,111	1,111		1,111	
TOTAL		**1,861,870**	**2,200,443**	**2,620,343**	*100.0%*	**3,008 501**	

Source: JICA Project Team

5.5.2 Land Use Plan

(1) Setting-up of Future Density Unit Values

Based on the analysis of (i) the existing population densities observed though Existing Land Use Land Cover (see Section 2.4) of (ii) the population densities planned in Detail Plans regulatory urban planning by KRG side relevant organization including UPDOE, and of (iii) internationally commonly agreed urban densities, the Future Density Unit Values for Land Use Planning are set as shown in Table 5.5.2 below.

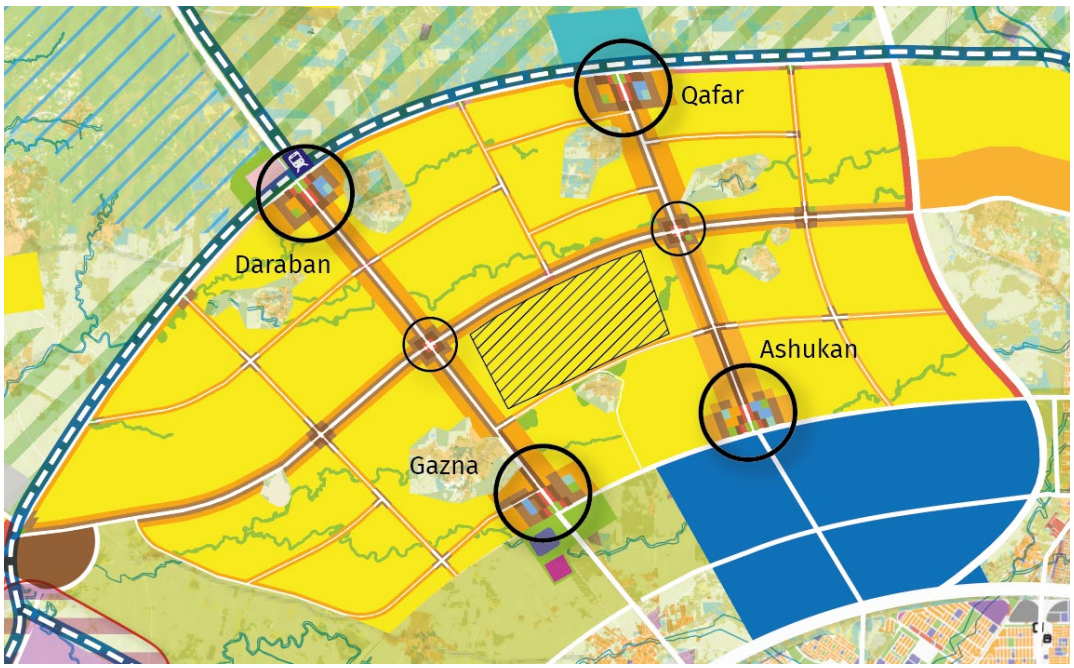
Table 5.5.2 Future Density Unit Values for Land Use Planning

Land Use Class	Population Density (inhab./ha)	Employment Density (worker/ha)	Description*
Residential Low Density	25	-	Sparse IH / high standard villa
Residential Medium Density	50	-	Moderately dense IH and villa
Residential High Density	100	-	Dense IH or sparse CH
Residential Very High Density	150	-	Dense CH
Agri-Neighborhood	25	0.9	Sparse IH mixed with farmlands
Mixed-Use Low Density	50	60	Moderately dense IH with SC
Mixed-Use Medium Density	75	80	Moderately dense IH / Sparse MUCB
Mixed-Use High Density	100	110	Dense IH with SC / MUCB
Commercial Strip	-	40	

Note (*): IH: Individual Housing; CH: Collective Housing; SC: Shops & Companies; MUCB: Mixed-Use Collective Building
Source: JICA Project Team

(2) Development Framework of Northern Development Area

Based on the proposed Urban Structure (see Section 5.3), the Strategic Orientations relating to promotion of TOD-type development in the Northern Development Area (see Section 5.4.1), the Distribution of Night & Day Population (see Section 5.5.1) and the Future Density Unit Values explained above, the Development Framework and Detailed Urban Structure for the Northern Development Area is proposed as shown in Figure 5.5.6 and Table 5.5.3 below.



Source: JICA Project Team

Figure 5.5.6 Detailed Urban Structure of Northern Development Area

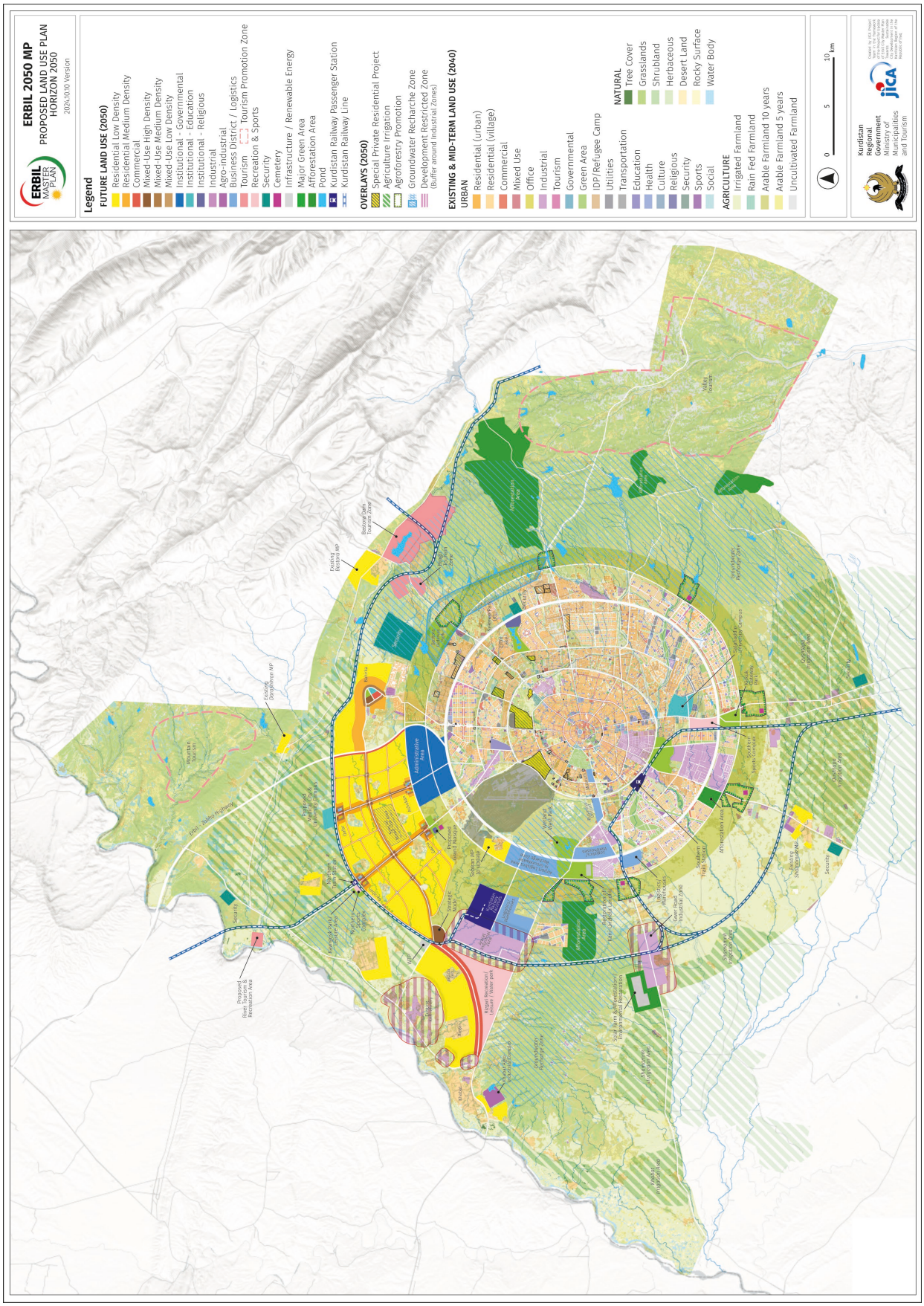
Table 5.5.3 Development Framework of Northern Development Area

Node Name	H*	Area (ha)	POPULATION		EMPLOYMENT		Main Functions
			2050 Ⓐ	2050 Ⓑ	2050 Ⓐ	2050 Ⓑ	
Bahirka Residential		1,152	57,600	57,600	-	-	Housing
Bahirka Core	1	201	20,100	15,075	22,110	16,080	Housing, Office, Commercial, Cultural
Gazna Core	2	96	7,200	7,200	7,680	7,680	Housing, Office, Commercial, Religious
Gazna Road Corridor		118	5,900	5,900	7,080	7,080	Housing, Commercial
Ashukan Core	2	95	7,125	7,125	7,600	7,600	Housing, Office, Commercial, Administr.
Ashukan Road Corridor		81	4,050	4,050	4,860	4,860	Housing, Commercial
Daraban Core	2	65	4,875	4,875	5,200	5,200	Housing, Office, Commercial, Sports
Qafar Core	2	96	7,200	7,200	7,680	7,680	Housing, Office, Commercial, Health
Great Zab Residential		878	21,950	21,950	-	-	Housing
Great Zab Comm. Front		413	-	-	16,520	16,520	Commercial
Intermediate Cores	3	130	9,750	9,750	10,400	10,400	Housing, Commercial
Small Cores	4	109	8,175	8,175	8,720	8,720	Housing, Commercial
AgriNeigh A		6,423	160,571	-	6,039	-	Housing, Agriculture
AgriNeigh B		6,158	-	153,946	-	5,790	Housing, Agriculture
Darashakan Res		109	5,450	5,450	-	-	Housing
Darashakan Mixed Use		145	7,250	7,250	8,700	8,700	Housing, Office, Commercial
Rashwan Residential		151	7,550	7,550	-	-	Housing
Rashwan Mixed		19	950	950	1,140	1,140	Housing, Office, Commercial
Mandawa Core	2	85	-	6,375	-	6,800	Housing, Office, Commercial, Tourism
Mandawa Mixed Use		57	-	2,850	-	3,420	Housing, Office, Commercial
Mandawa Residential		97	-	2,425	-	-	Housing

Note (*): H: Hierarchy of Nodes; 1: Primary Core; 2: Secondary Core; 3: Tertiary Core; 4: Quaternary Core.
Source: JICA Project Team

(3) Land Use Plan

The Land Use Plan shown in Figure 5.5.7 below reflects the Land Cover and the Land Use that will be achieved after implementation of proposed Urban Structure and all Strategic Orientations.



Source: JICA Project Team

Figure 5.5.7 Land Use Plan of Erbil 2050 MP

CHAPTER 6
ECONOMIC SECTORS DEVELOPMENT PLAN

6.1 Agriculture & Livestock Sector

6.1.1 Existing conditions

(1) Overview of the Agriculture Sector in Kurdistan & Erbil

The agriculture sector in Kurdistan and the city of Erbil plays an essential role in the region's economy. The area is known for its fertile land and diverse climate, which allows for the cultivation of a wide range of crops, including wheat, barley, beans, and fruits. The sector also includes livestock production, mainly sheep and cattle. However, the industry has faced several challenges, including a need for more access to financing, modern technology, and limited infrastructure. Despite these challenges, the KRG has been improving the sector by investing in irrigation systems, research and development, and farmer training programs.

Crops that are well-suited for cultivation in the Erbil city area include wheat, barley, oats, corn, and a variety of fruits and vegetables such as tomatoes, cucumbers, eggplants, peppers, melons, grapes, apples, peaches, apricots, and pears. The region may also grow lentils, chickpeas, and other legumes. Factors affecting crop suitability in the area include temperature, rainfall, and soil quality.

Table 6.1.1 Number of Villages and Farmers for Winter Crops in 2016-2017

Governorate	Total Villages	Villages that had Winter Crops	Percentage Rate (%)	Number of Farmers
Erbil	1,423	827	58	20,169

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan region statistics Office

Table 6.1.2 Agricultural Indicators at the Level of Erbil Governorate in 2016-2017

Year	Land Use for Agricultural Products (Millions of Donums)	Land under Plantation for Winter Crops (Millions of Donums)	Land under Plantation for Summer Crops (Millions of Donums)	Percentage Rate of Employees in Agricultural Activities 2015
2015	-	-	-	4.6
2017	2.14	1.17	0.09	-

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan region statistics Office

Table 6.1.3 Planted and Unplanted Area at the Level of Erbil Central Area in 2016-2017

District	No. Villages	No. Farmers	Planted Area (Donum)							Unplanted Area (Donum)
			Rain-fed Wheat	Irrigated Wheat	Rain-fed Barley	Irrigated Barely	Chick peas	Vege-tables	Total	
Erbil-Center	83	4,214	137,072	124,509	9,711	823	10	12,373	284,498	1,035

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan region statistics Office

Table 6.1.4 Total Planted Area and Available Area for Farmers who Planted Winter Crops at the Level of Erbil Governorate in 2016-2017

Governorate	Available Area (Donum)	Planted Area (Donum)
Erbil	1,166,390	1,050,640

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan region statistics Office

Average Potato production

Table 6.1.5 Potato Cultivated Area, Yield, and Production in Erbil

Year	Area (Donum)	Potato Tuber	Yield (kg/Donum)	Total Production (MT)	Number of Farmers
2015	4212	3159	8218	34614	129
2016	5619	4214	9301	52257	344
2017	5523	4142	6785	37474	319

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan region statistics Office

Average Barley production

Table 6.1.6 Area, Yield Production of Barley in Erbil in 2007-2017

Season	Area (Donum)	Yield (kg/Donum)	Production (MT)
2007-2008	640,505	4	2,562
2008-2009	806,420	270	217,733
2009-2010	432,020	139.1	60,084
2010-2011	390,558	95.3	37,212
2011-2012	110,176	105.6	11,633
2012-2013	137,140	404.4	55,457
2013-2014	326,043	322	105,000
2014-2015	416,959	203	84,643
2015-2016	328,000	250	82,000
2016-2017	82,111	312.4	25,654
2017-2018	-	-	-
2018-2019	-	-	-
2019-2020	-	-	-
2020-2021	-	-	-
2021-2022	-	-	-
Average	36,699	185.8	6,818

Source: Kurdistan Regional Statistics Office CSO 2007-2017

Average Lentils production

The production of lentil cultivation in 2016-2017 was 107 donums in Erbil governorate, and its production was estimated at 17 tones[1].

Table 6.1.7 Total Planted Area and Available Area for Farmers who Planted Winter Crops in Erbil in 2016-2017

Governorate	Available Area (Donum)	Planted Area (Donum)
Erbil	1,166,390	1,050,640

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan Region Statistics Office

Average Wheat production

Table 6.1.8 Wheat Production in Erbil City in 2013-2022

	2013	2014	2016	2017	2018	2019	2021	2022
Area (Donum)	99	147	473	81	-	-	-	-
Production (ton)	61	22	118	28	-	-	-	-

Source: Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurdistan Region Statistics Office

[1] "Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurditan region statistics Office."

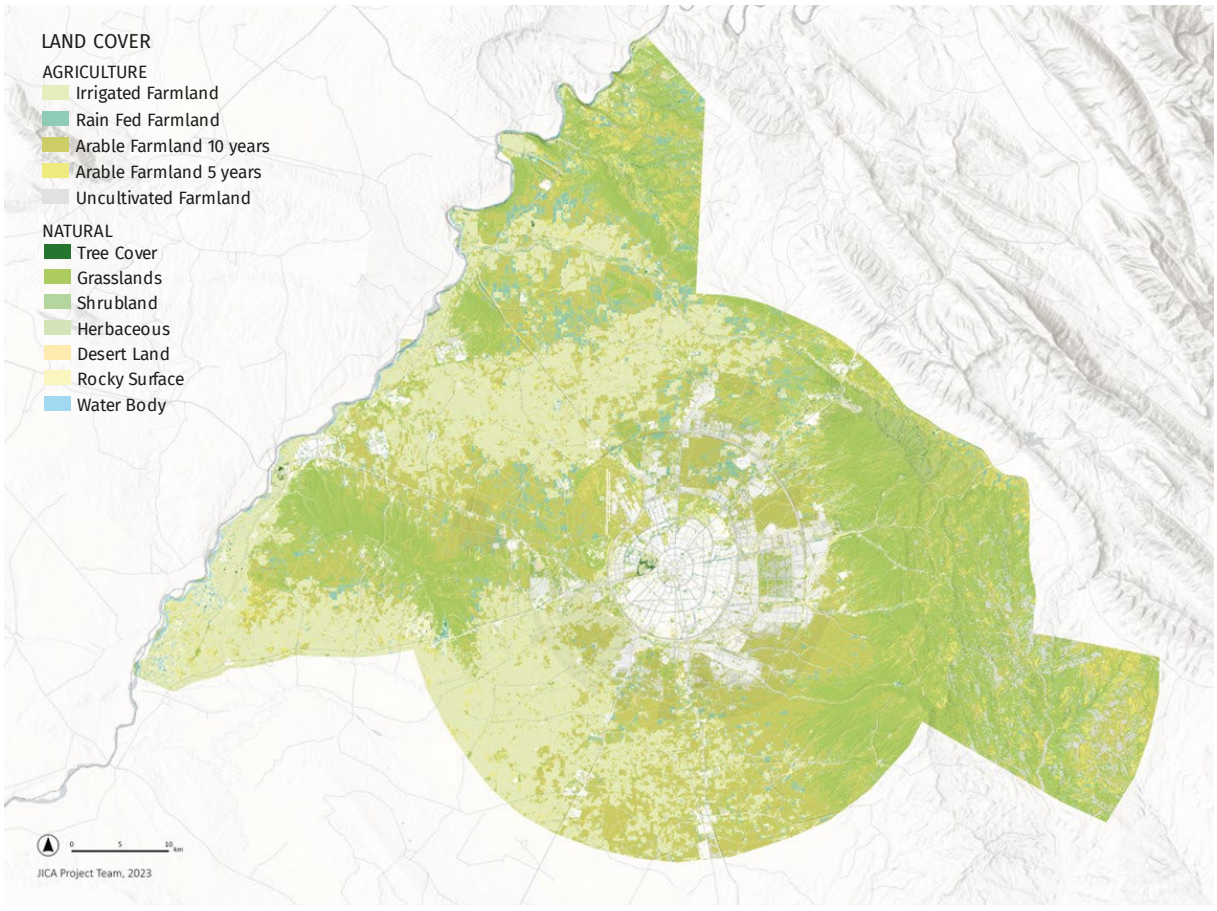
Average Chickpeas production

The whole area of chickpeas planted in 2016-2017, according to the statistics office of KRG, was about 12,259 donums and the prediction of production was 2,525; within that range, land under the cultivation of Chickpeas in Erbil was 2,787 donums, and output estimated at 451 tons2.

(2) Spatial Features of Agriculture Sector

1) Existing Agricultural Land Cover

Existing Agriculture Land Cover, as shown in Figure 6.1.1 below, has been produced in 2022 for the whole Kurdistan Region by the Kurdistan Region Statistics Office (KRSO) in collaboration with Salaheddin University in Erbil, with support from the World Food Programme (WFP). This data, which has been collected through our collaboration with MoAWR, gives an accurate representation of the existing situation of the different rural land cover classes. It comes as a supplementary information to the Existing Land Use Land Cover data which has been produced at the beginning of the Project (see Section 2.4.2) and which was more focused on urban land uses.



Source: JICA Project Team based on KRSO/WFP data

Figure 6.1.1 Existing Agricultural Land Cover

In the above-mentioned study by KRSO/WFP, each Agricultural Land Cover class is defined as below.

- **Arable Farmland** is any land capable of being ploughed and used to grow crops at least once within the last 5 or 10 years. This definition considers the recent history of the land's use and its ability to support agricultural activities. Arable land can vary in quality and suitability for crop production depending on factors such as soil type, topography, and climate.

[2] "Winter crop survey in Kurdistan region in 2016-2017, The MoP KRSO Kurditan region statistics Office."

- **Irrigated Land** is a type of cultivated land that requires artificial watering during the growing season due to a lack of natural precipitation or specific plant water requirements. Irrigation is used in various agricultural settings, and different methods of water delivery can be used, such as surface irrigation, sprinkler systems, or centre pivoted irrigation. Irrigated agriculture has been practiced for a long time and has been instrumental in increasing crop yields and food production in regions with limited rainfall, such as the Project Area. However, irrigation can also have negative environmental consequences, such as soil salinization, groundwater depletion, and water pollution.
- **Rain Fed Agriculture** refers to agricultural lands that only reply on precipitation (often rainfall) to grow crops in particular cereal crops and legumes. In rain fed agriculture, the timing and amount of rainfall are crucial factors that determine crop yield and quality. The management practices used in rainfed agriculture are often different from those used in irrigated agriculture, as farmers must adapt to the natural variability of rainfall and soil moisture.
- **Uncultivated or Abandoned Farmland** refers to agricultural land that is no longer being used for farming and has been left to grow wild. This can occur due to a variety of reasons, such as economic factors, changes in land ownership, or environmental degradation. Abandoned farmland can have both positive and negative impacts on the environment. On one hand, it can provide habitat for wildlife and promote biodiversity, as well as allow for natural regeneration of soil and vegetation. On the other hand, it can contribute to the spread of invasive species and increase the risk of wildfires, especially in areas with accumulated dry biomass.

Table 6.1.9 below shows the area figures of Existing Agricultural Land Cover classes.

Table 6.1.9 Existing Agricultural Land Cover Area

LULC Category	Area (ha)	Share	Share of AA&A*
Arable Farmland 10 Years	82,106	30.2%	50.1%
Arable Farmland 5 Years	10,235	3.8%	6.2%
Desert Land	103	0.0%	-
Grasslands	63,283	23.3%	-
Herbaceous	130	0.0%	-
Irrigated Land	**59,414**	21.8%	36.2%
Rain Fed Farmland	**12,159**	4.5%	7.4%
Rocky Surface	10,415	3.8%	-
Shrubland	1,526	0.6%	-
Tree Cover	296	0.1%	-
Uncultivated or Abandoned	9,941	3.7%	-
Urban	21,444	7.9%	-
Water	998	0.4%	-
Wetland	22	0.0%	-
Total	**272,071**	**100.0%**	**-**
Total AA&A*	**163,914**	**60.2%**	**100.0%**

Note: (*) AA&A refers to Active Agriculture (Irrigated and Rain Fed) + Arable farmlands (5 and 10 years)
Source: JICA Project Team based on MoAWR and WFP data

Active Agriculture, including Irrigated Lands and Rain Fed Farmlands, represents 26.3% (71,573 ha) of the total area of rural Land Cover. Active Agriculture combined with Arable Farmlands (5 and 10 years) cover approximately 60.2% (163,914 ha) of the total rural area. These classes represent areas where crops are grown and can have significant economic and social importance for the region. The significant share of irrigated and rainfed agriculture indicates a well-developed agricultural infrastructure of Erbil region.

2) Normalized Difference Vegetation Index (NDVI) Analysis

The Normalized Difference Vegetation Index (NDVI) is calculated using the near-infrared (NIR) and red bands of the electromagnetic spectrum and is commonly used to measure vegetation vigour and density. It provides an indication of plant health and biomass production. Higher NDVI values generally indicate healthier and more abundant vegetation, which can suggest better soil potential for agriculture. Figure 6.1.2 on next page shows the results of the NDVI analysis carried out on the Project Area.

3) Normalized Difference Water Index (NDWI) Analysis

The Normalized Difference Water Index (NDWI) is calculated using the near-infrared (NIR) and shortwave infrared (SWIR) bands and is primarily used to assess water content in vegetation and soil. NDWI values closer to zero or negative values typically indicate drier or less water-logged conditions, while positive values indicate the presence of water. Water availability is a critical factor for agricultural productivity, as it affects plant growth and nutrient uptake. Figure 6.1.3 on next page shows the results of the NDVI analysis carried out on the Project Area.

4) Agricultural Soil Potential Analysis

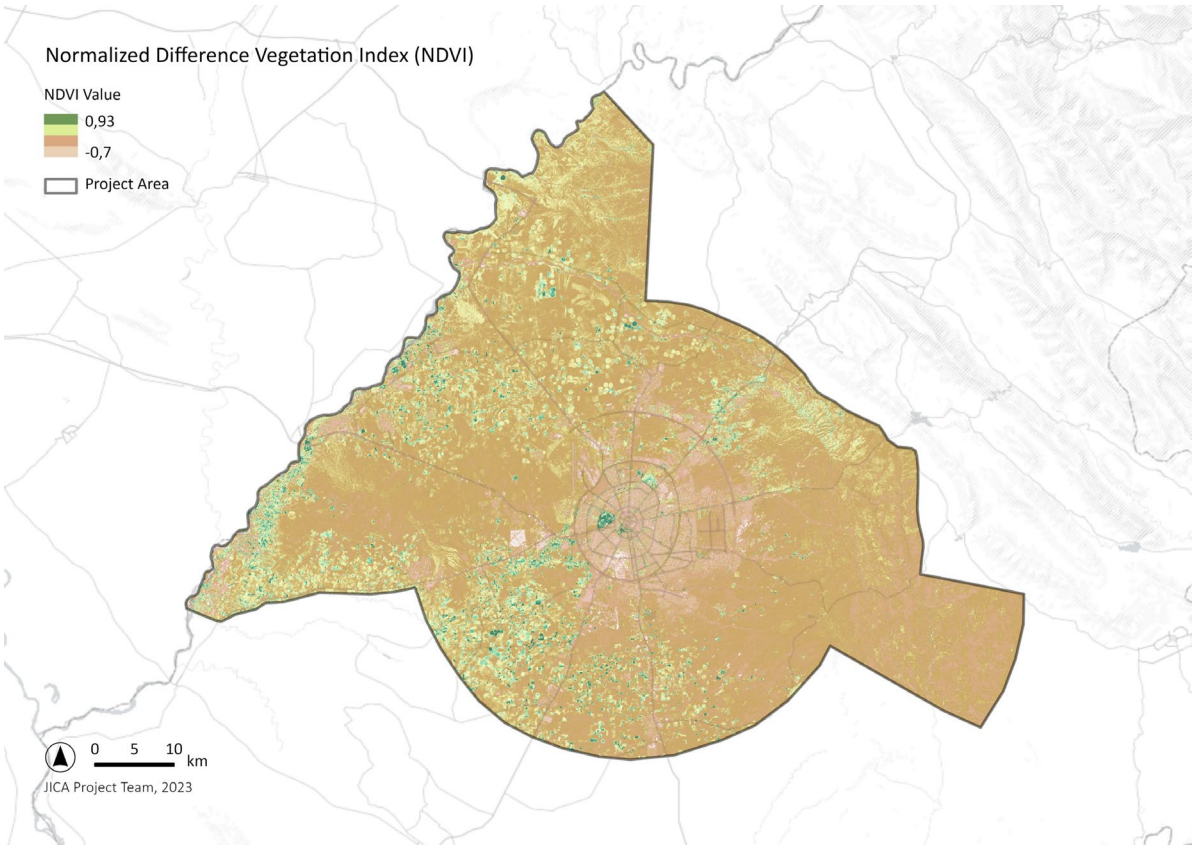
Examining the spatial distributions and differences in NDVI and NDWI within an agricultural region can provide valuable understanding of the soil's agricultural capacity. High NDVI values combined with positive NDWI values generally suggest fertile soil and favourable conditions for crop growth.

Therefore, the Southwest area near Great Zab River, in Municipality 6 and Shamamank, which shows high vegetation health and good water content, is very suitable for agriculture. Similarly, the Northeast area, where there are many orchards, also exhibits high NDVI and NDWI values, indicating suitability for agricultural activities. Therefore, the southwest and northeast parts of the Project Area should be prioritized for agricultural development.

(3) Legal And Institutional Frameworks of the Agriculture Sector

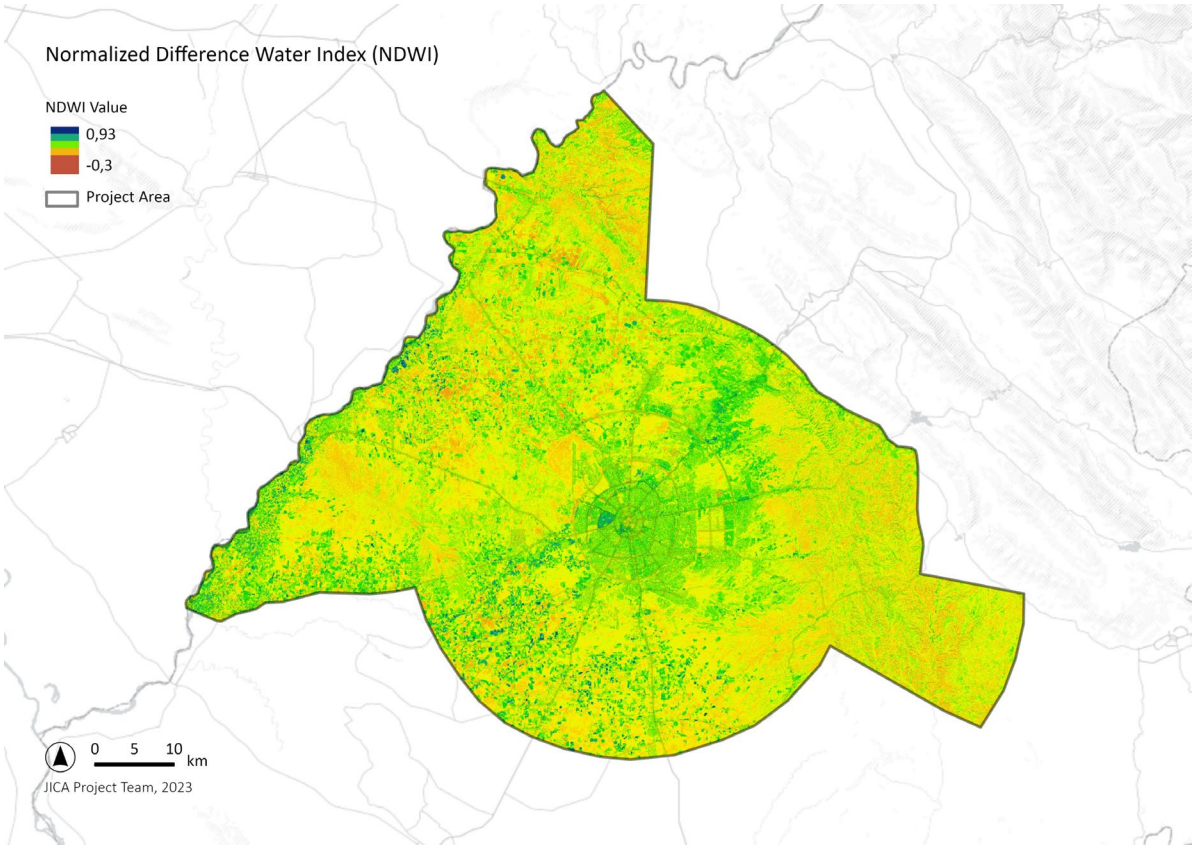
The Agricultural Property Ownership Law of 1932 is the first law regulating agricultural ownership in Iraq. In September 1958, Agrarian Reform Law No. 30 was issued regulating agricultural ownership and setting maximum limits for individual ownership of lands inside irrigated and rainfed areas, as well as a minimum limit of areas permitted to be distributed to farmers within the same concept. In 1970, Agrarian Reform Law No. 117 was issued, tackling many legal loopholes of the 1958 Law. In 1983, Law No. 35 on leasing agrarian reform lands to companies and individuals was issued. These three laws are significant legislations regulating this sector and are still enforced and operational in the Kurdistan Region. In 2006, Investment Law No. 4 was issued, allowing investment in the agricultural sector, besides other economic sectors. In 2007, the first amendment of the Law of Agricultural Ownership Regulation in Iraq's Kurdistan (No. 90 of 1975) was issued. And in 2008, a law regulating the process of agricultural land disposal in the Kurdistan Region was published. The multiplicity of laws, legislations, and instructions, as well as their tendency to limit the area of agricultural acquisition, even though they take into consideration irrigation systems, fertility level, and type of crops, has negatively impacted the performance of the farming sector, because acquisitions, in general, are still below optimal economic standards, and be among the reasons for the agricultural sector underperformance and deficiency[3]. The existing legal system for agricultural and land management, among other laws, is comprised of Area Agrarian Reform Law No. 117 of 1970 and Law No. 1 of 2008 Organizing Rights to disposal in agricultural land in KRG. Regarding a basin or specific watershed, there are no constraints on where the land can be found. The relationship between land management and water management must be taken into account in the legislative framework. It discovers the mechanism to rinse, but a direct connection between the land, crops, and basin is required to promote an integrated management system and grow the irrigation industry. This lack of control, which separates the management of land and water, leads to unrest and restricts the agriculture sector's ability to grow economically. The Kurdistan Agricultural Land Ownership Organization Law No. 90 of 1975.

[3] "Regional Development Strategy for Kurdistan Region 2012-2016."



Source: JICA Project Team based based on Sentinel 2 image from winter season (November 2021 – April 2022)

Figure 6.1.2 Normalized Difference Vegetation Index (NDVI) Analysis Results



Source: JICA Project Team based based on Sentinel 2 image from winter season (November 2021 – April 2022)

Figure 6.1.3 Normalized Difference Water Index (NDWI) Analysis Results

(4) Ongoing and Planned Policies, Programs, Plans and Projects in Agriculture Sector

1) Policies, Programs, Plans and Projects of Ministry of Planning for Agriculture development

Late in 2017, the Ministry of Planning to improve agriculture productivity established some instructions and focused on the following policy priorities[4]:

(a) Improving the skills of the farmers.

(b) Improving the investment environment for agriculture.

(c) Improving irrigation to enable agricultural production.

(d) Rehabilitating and managing the land.

(e) Developing infrastructure for the agriculture industry.

(f) Improving the availability of agriculture data and information.

(g) Implementing legal reforms for the agricultural sector.

(h) Minimizing price distortions for agricultural products.

(i) Developing export potential.

Table 6.1.10 Some of the Projects Planning to Implement

1.Construction of dairy projects	2.Enhancement of meat production	3.Providing Veterinarian services	4.Fish production projects	5.Establishing of olive orchards	6.Establishing typical nurseries	7.Poultry farms	8.Greenhouses projects
9.Producing of certified seeds for field crops	10.Organic agriculture	11.Agro-Industry factories	12.Irrigation projects	13.Construction of dams	14.Construction of cold storage and warehouses.	16.Honey production and packaging	

Source: Opportunities for Investment in Agriculture and Water Resources Sectors in Kurdistan Region - Iraq 2021

Table 6.1.11 Approved Licensed Agricultural Projects in Erbil in 2006-2021

Governorate	Licensed Projects by Sectors
Erbil	15 projects

Source: Opportunities for Investment in Agriculture and Water Resources Sectors in Kurdistan Region - Iraq 2021

2) Agricultural Projects in Inner Green Belt Master Plan

Table 6.1.12 Review of Agricultural Projects in Inner Green Belt MP

Project in Inner Green Belt MP (2012)	Implementation Monitoring Score		Changes in conditions (2006-2022)	Recommendation for Erbil 2050 MP Strategy & Indicator Integration	
4 Green Belt markets	**NI**	Not started.	N/A	**Partial**	Erbil 2050 MP proposes a similar type of farmer's markets integrated with other functions in 8 different Agro-Nodes located inside the Green Belt (see Section 10.3).
Orchard nurseries and laboratories	**NI**	Not started.	N/A	**Partial**	Erbil 2050 MP promotes the implantation of orchard nurseries and laboratories to provide trees for agroforestry development in the 8 different Agro-Nodes located inside the Green Belt (see Section 10.3).

Source: JICA Project Team

[4] "Review of the Agricultural Sector in The Kurdistan Region of Iraq: Analysis on Crops, Water Resources and Irrigation, and Selected Value Chains."

(5) Livestock Sector

1) Overview of the Livestock Sector in Kurdistan & Erbil

The main types of livestock raised in the region include sheep, goats, cattle, and poultry. The sector also consists of the production of dairy and meat products. Most livestock is grown by small-scale farmers and herders, with a smaller number of larger-scale commercial farms also present. The sector faces challenges such as disease, lack of infrastructure and technology, and limited market access, but there are also efforts to modernize and improve the industry.

2) Legal and Institutional Frameworks of the Livestock Sector

Based on the authority given to us under paragraph 3 of Article 5 of the law Ministry of Agriculture and Water Resources No. 6 of 2010 and according to Article 11 of the law protection and development of agricultural products No. 4 of 2008 for the regulation establishment of livestock projects and licensing, issued the many guidelines[5]. Instruction No. 8 of Establishment and licensing of livestock projects.

3) Ongoing and Planned Policies, Programs, Plans, and Projects in Livestock Sector

According to statistics that are now available for 2006, there were 3,826,265 heads of livestock distributed as follows: 1,258,155 goats, 2,195,319 sheep, and 372,791 cattle are included. Goats make up 33% of all livestock, sheep make up 57%, and cattle make up 10%.

Table 6.1.13 Total Livestock (Head) Erbil Governorates

Governorate	Sheep	Goat	Cow	Total
Erbil	399,442	468,749	82,680	950,871

Table 6.1.14 Poultry Farms Projects at the Level of Erbil Governorate in 2017

Year	Poultry for Meat	Egg Laying Chicken	Poultry Slaughterhouse
2017	467	8	4
2019	-	-	-
2021	-	-	-

Note: Increasing the livestock by 5% annually with a total growth rate of 3.5%[6]

Table 6.1.15 Livestock Projects in KRG in 2021[7]

Projects	No	Capacity of the Projects
Broiler Poultry Farm	1,790	27,125,054 chickens/ year
Layer Poultry Farm	20	2,474,657,900 eggs/ year
Hatchery Projects	48	312,828,680 eggs/ year
Poultry Slaughterhouses	10	38,900 chickens/ hour
Animal Slaughterhouses	29	-
Animal Feed Plant	42	-
Fish Projects	404	3,235 tons/ year
Fish Fingers Projects	4	1,000,000 fingers/ year
Calves Fattening Farm	88	90,993 calves
Dairy Cattle Breeding Farm	85	10,916 milk cows
Lamb Breeding Farm	83	22,920 lambs
Chicken Parent Stock	1	1,500,000 parent stocks/year 1,500,000 broiler/ year
Buffalo Breeding Farm	1	75 buffalos
Ostrich Farm	1	6,000 ostriches

Source: Opportunities and challenges in sectors and industries of the Region

[5] "Ministry of Agriculture and Water Resources No. 7064: on 4/10 /2021 Based on the authority given to us under paragraph 3 of Article 5 of the law Ministry of Agriculture and Water Resources No. 6 of 2010 and according to Article 11 of the law."
[6] "Regional Development Strategy for Kurdistan Region 2012-2016."
[7] "Opportunities for Investment in Agriculture and Water Resources Sectors in Kurdistan Region - Iraq 2021."

6.1.2 Key Planning Issues

Agricultural issues in the Kurdistan region span a wide range of topics, from water scarcity and soil degradation to the effects of climate change on farming techniques. The Central government of KRG has exacerbated these issues by failing to address the underlying causes and their impact on production levels. For example, excessive pumping for irrigation has resulted in a significant reduction of groundwater reserves, leading to an acute water shortage for drinking and agricultural purposes. Furthermore, political conflicts with neighbouring countries have interfered with import/export agreements related to Kurdish farming, leading to periodic food shortages within the region. Finally, rapid population growth is straining existing resources and infrastructure, making it difficult for farmers to anticipate crop yields. The authorities are acutely aware that addressing these challenges is vital if they are to make progress toward improved food security and economic stability.

(1) Converting agricultural land to urban uses could be more efficient. It lacks transparency (Urban sprawl and agrarian conflicts)

The Kurdistan Region has undergone substantial urbanization and development since achieving autonomy. Unfortunately, agriculture is frequently seen as a reserve for future urban expansion in developing nations like Kurdistan.

(2) Lack of biotechnology

There is no doubt that to meet the future food demand in the average expanding population, it is essential to introduce advanced farming tourniquets and inventions. Therefore, biotechnology is a strategic key to the Region's agricultural future; there needs to be an establishment of a center for agriculture Biotechnological lack of funding for food safety and health institute[8].

(3) Lack of collaboration between sectors

The collaboration and coordination of development and overlapping different strategies of many sectors need to be in a better situation, such as agriculture and extractive industries, agriculture, and education.

(4) Agricultural data, research, and planning

KRG intends to develop agricultural data, research, and planning as reflected in a strategic plan developed from 2009 to 2013. There is a fundamental issue regarding databases and technology.

(5) Water management and irrigation infrastructure issues

However, the Erbil governorate has sufficient water sources to support a thriving agricultural sector. It needs to manage these resources in a better way. The concern is the scarcity and salinity of water used for irrigation or drinking, which affects all agricultural activities.

(6) Lack of infrastructure, Agro-industry

There has yet to be a concrete plan for a thriving agro-industry. To succeed, it needs to encourage the private sector to invest in cold storage facilities, transportation logistics centers, and facilities for packing agricultural products.

(7) Land ownership and national legislative framework (Poor government policies)

Land ownership legal framework issues must be resolved, and MoA needs to enable the creation of large farms for greater production efficiencies.

(8) Livestock

Currently, there is a shortage of quality feed for livestock in the KRG; this shortage is the essential constrain to the development of the livestock industry, the deficiency of feed from poor management

[8] "Kurdistan Region Economic Development Assessment, USAID for Iraq."

and conservation of rangelands (Overgrazing) and also the lack of proper conservation crops and techniques by farmers[9].

(9) Tax and import legislation

More than 80% of KRG's essential agriculture products are imported. An open border has resulted in the region becoming a market for often substandard or contaminated goods.

(10) Investment opportunities

In terms of investment, small profit margins do not allow investing in new technologies, which could lower the cost of production and make Erbil's farmers more competitive.

(11) Farmer preparation and training issues (Agricultural Education, Training, Research, and Extension)

Farmers in KRG have a long history of agriculture to build on. Still, there is a pressing need for better farmer preparation and training to increase agricultural productivity, especially in modern farming practices and equipment[10].

(12) From the customer perspective: path towards self-sufficiency and future possible exports

From the consumer perspective, results from Household Survey can be analysed as follow to understand the potential of Erbil's agricultural sector.

- Erbil customers agree to a large majority that (1) supporting agriculture around Erbil should be a priority (591 households, 86.4% including strongly agree 57.0% and agree 29.4%), that (2) local agricultural produce is good value for money (593 households, 86.7% with strongly agree 51.9% and agree 34.8%), and that (3) they usually prefer to buy local agriculture produce if there is a choice (653 households, 95.5% with strongly agree 62.3% and agree 33.2%) which is a good signal to engage in more promotion of Erbil's urban agriculture and supply to local markets;
- However, more than half of Erbil customers consider that local agricultural produce is lower quality than imported produce (353 households, 51.7% with strongly agree 26.5% and agree 25.2%), which raise the necessity of increasing produce quality for local market and future export.

6.1.3 Sector Strategies & Policies

(1) Overall Goals of the Agriculture & Livestock Sector

The Overall Goals of the Agriculture Sector development in Erbil 2050 MP, which are outlined in the Regional Development Strategy Goals 2012 master plan MoAWR (mentioned hereafter as "MoAWR 2012"), contained in the latest policies of the Ministry of Agriculture and Water Resources and will realize the Long-term Development Visions, can be summarized as below.

- AGR-I: Raise production to reach food security and reduce dependency on imports – increase quantity
- AGR-II: Give more value-addition to agriculture produces – increase quality
- AGR-III: Promote sustainable and low-carbon agriculture practices
- AGR-IV: Develop human resources in the agriculture and irrigation sectors
- AGR-V: Keep and enhance the diversity of agricultural products to contribute to economic diversification
- AGR-VI: Protection of agricultural lands integrity
- AGR-VII: Contribute to greening through agriculture to tackle the effects of Climate Change

[9] "AGRICULTURE RECONSTRUCTION AND DEVELOPMENT PROGRAM FOR IRAQ Poultry Survey in Erbil, Dahuk and Sulaymaniyah Summary Report."
[10] "Ministry of Planning Kurdistan Regional Government, A Vision for the Future 2020." Ministry of Planning Kurdistan Regional.

(2) Linkage with Strategic Orientations of Erbil 2050 MP

Strategies and Policies of the Agriculture Sector mainly support the realization of the Strategic Orientation #1: Establish the foundations for urban sustainability, resilience, and adaptation to climate change, and #3: Promote innovative & diversified economy and boost employment (See Section 6.3), which contributes significantly to the implementation of Long-term Development Vision (See Section 4.2) of Food Sufficiency & Export (FSE) and Diversified Economy (DEC).

(3) Strategies & Policies of the Agriculture Sector

Table 6.1.16 below summarizes the Strategies and policies of the Agriculture Sector proposed to tackle existing issues and to achieve Erbil 2050 MP's Long-Term Visions and Overall Sector Goals.

Table 6.1.16 Strategies & Policies of the Agriculture Sector

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
Agriculture Production	**AGR-S1:** Increase agricultural productivity and efficiency	- **AGR-S1-1:** Establish Agriculture preservation & promotion area (South-West / Qushtapa area, Great Zab cluster area, corridor areas) - **AGR-S1-2:** Create an Orchard agriculture expansion area in Northeast of Erbil (Pirzin/Bulakh area) - **AGR-S1-3**: Biotechnology: Provide farmers with modern farming technologies to improve access to quality seeds and fertilizers and to enhance productivity.	- [AGR I] Reach food security - Lack of biotechnology - [AGR-VII] Contribute to greening through agriculture
Agriculture product supply	**AGR-S2:** Establish Short Food Supply Chains (SFSCs) to make the city of Erbil benefit from its urban agriculture (example)	- **AGR-S2-1**: Infrastructure (Storage facilities and roads): o To minimize post-harvest losses and ensure a consistent food supply, invest in transportation and storage for efficient agricultural production. In the strategic locations of Khabat, Gwer Road, and Qushtapa, establish cold storage facilities to extend the shelf life of perishable goods such as vegetables o Encourage efforts to create strategic food stockpiles to lessen the effects of unanticipated occurrences like natural catastrophes or interruptions in the world's food supply chain. - **AGR-S2-2**: Market Research. Launch market research to: o Identify the best location for establishing markets; o Analyze the demand for locally-produced food and potential customer base for SFSCs (sample size of 1,000 households).	- [AGR I] Reach food security
Agriculture crops	**AGR-S3** Identifying Strategic Crops which have the have the biggest potential [KRSO]	- **AGR-S3-1:** Cultivating high-value crops By establishing orchards for Olives, Almonds, Pistachios, and Nuts, dedicated fields for Maize, Sunflower, and Cotton, and modern greenhouses for Vegetables, Flowers, and Herbs, Erbil can become a focal point for premium agricultural products. Integrating advanced processing and packaging techniques will ensure quality preservation with a focus on sustainability. This initiative enhances local and international market access and promotes economic growth and community involvement.	- [AGR-II] Increase value-addition - [AGR-I] Reach food security
Agriculture lands	**AGR-S4**: Protect agricultural lands	- **AGR-S4-1:** Preserve existing precious farmlands even within the future urbanization area in Northern Residential Agri-Neighborhoods (See SO4-3-3, Section 5.4.4) - **AGR-S4-2:** Develop knowledge on the characteristics of farmlands in the Erbil area o Land suitability analysis: Conduct a comprehensive assessment of available agricultural land and its productivity, considering factors like soil quality, water availability, and crop suitability. o Identify Priority Areas: Based on the results of the above-mentioned Land suitability analysis, identify areas with high	- Urban sprawl on valuable farmlands (URB-07) - Lack of Collaboration between sectors - [AGR-VI] Protection of agricultural lands integrity

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
		agricultural potential that should be protected from urban development. - **AGR-S4-3:** Build Trust and Collaboration o Inter-Ministerial Committees: Create joint committees or working groups comprising representatives from the MoAW and GDUP to foster collaboration. o Conflict Resolution Mechanisms: Develop precise resolution mechanisms to address land use and planning disputes between the two ministries, MoAw and GDUP. o Shared Vision: Establish a vision for sustainable urban development that integrates agriculture as an essential component of urban life.	
Agriculture data	**AGR-S5** Enhance Agricultural Data, Research, and Planning [MoAWR 2012]	- **AGR-S5-1:** Establishment of a Comprehensive Agricultural Database o Allocate funds to build and maintain a comprehensive agricultural database. o Collaborate with universities and research institutions to collect and analyze data. o Train government personnel and agricultural engineers in data management and analysis. - **AGR-S5-2** Research and Extension Services (Agriculture & Irrigation Training / University / Innovation research function) o Establish agricultural & irrigation research centers focused on local challenges and crop varieties. There are two propositions regarding the project location (first in Qushtapa, in link with agro-industrial area, or second in Northern urban preservation and promotion area). o Provide farmers access to extension services that guide modern farming practices. o Create farmer training programs to ensure they can use new technologies effectively.	- Lack of agricultural data, research, and planning
Irrigation and water management	**AGR-S6** Improve water management and irrigation towards sustainability of water resources	- **AGR-S6-1**: Engage in Water Source Diversification o Establish Agriculture irrigation areas (reflect MoAWR projects of Shamamak/Qushtapa/Khabat/Bariatyi) o Exploit Surface Water: Maximize the utilization of existing water bodies such as Great Zab, Little Zap, Bastora Dam, Gomaspan Dam, and other proposed reservoirs and ponds; o Implement Rainwater Harvesting: Encourage collecting and storing rainwater during the wet season for agricultural use during dry periods. - **AGR-S6-2: Enhanced Irrigation Techniques:** o Modern Irrigation Methods: Promote the adoption of modern irrigation techniques, such as drip and sprinkler systems, to reduce water wastage. o Smart Irrigation: Utilize sensor-based technologies to monitor soil moisture levels and weather conditions, allowing for precise irrigation scheduling.	- Lack of water management and irrigation infrastructure issues - [AGR-III] Promote sustainable agriculture

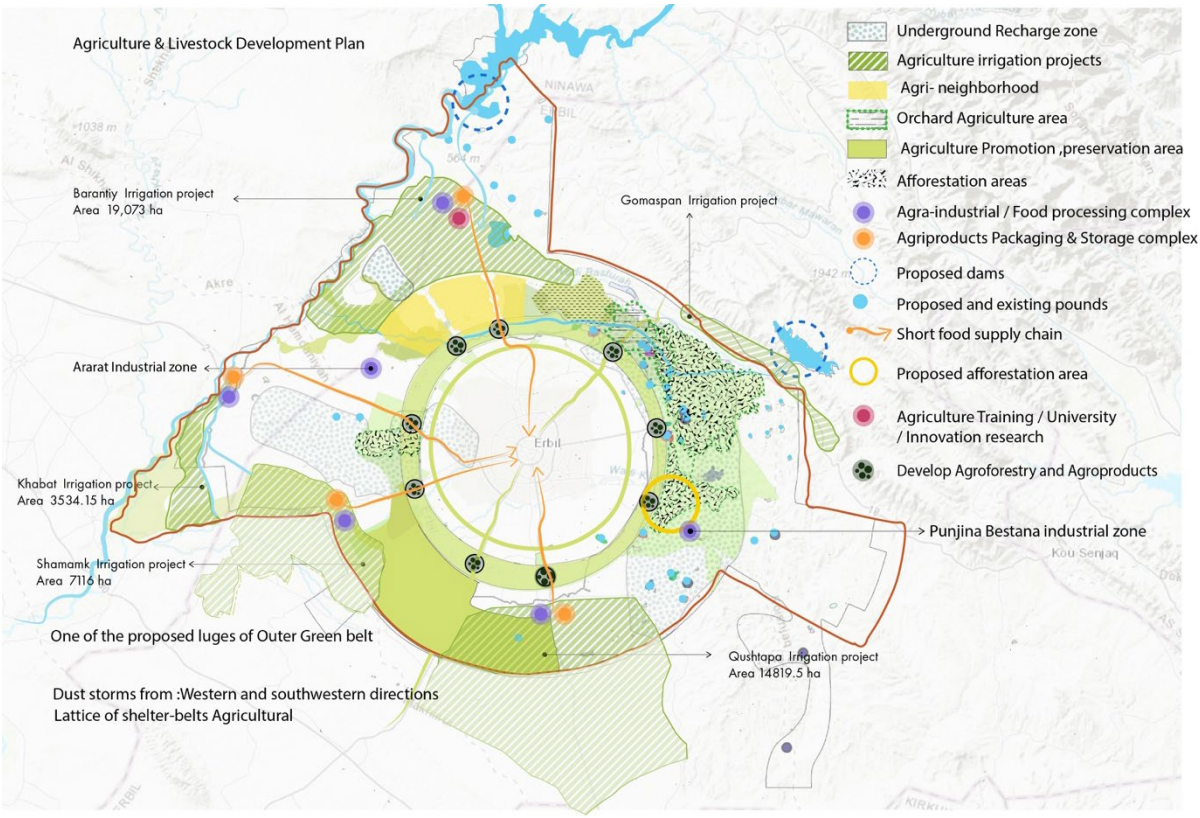
Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
Livestock	**AGR-S7:** Promote sustainable livestock production and industry enhancement	- **AGR-S7-1: Livestock Zoning Regulations:** Develop and enforce zoning regulations that support livestock farming in appropriate areas such as Qushtapa, Shamamk, Khabat, and Dashti Hawler while safeguarding the environment and urban development. - **AGR-S7-2: Improvement of Livestock Feed:** o Promote the cultivation of alternative livestock feeds, including fodder crops and forage species suitable for Erbil's climate. o Introduce silage production methods to preserve forage crops and provide quality feed during the off-season. Support Seed Yield. o Encourage the adoption of high-yield forage crop varieties and provide farmers with improved seeds. - **AGR-S7-3: Develop Fish farms** in Mandawa dam lake to farm high value-added fish species such as tilapia, catfish, carp, trout, salmon, and sturgeon.	- Lack of Livestock production and management - [AGR-III] Promote sustainable agriculture - [AGR-II] Increase value-addition - [AGR-I] Reach food security
Agro-Industry	**AGR-S8** Promote sustainable Agro-industry	- **AGR-S8-1: Basic Infrastructure Development:** Invest in necessary infrastructure such as roads, electricity, and waste management systems to properly establish new food processing industries in Khabat and Qushtapa. - **AGR-S8-3: Develop Strategic and High Value-Addition Agro-Industries** in planned industrial areas of Ararat and Punjina Bestana but also in newly developed areas of Khabat and Qushtapa areas, such as the following: o Sugar Production Factory; o Tomato Paste and Ketchup Factory; o Vegetable Oil Production Factory (From Olive, Sunflower, or Maize); o Dairy Products (Milk, Cheese, Yogurt and/or Ice Cream) Factories; o Fruit Juice Factory (For Pomegranates, Grapes, Apples, and other Fruits); o Processing Facilities for Grain Products (Pasta, Noodles, and others); o Meat Processing and Packaging Factory; o Honey Processing and Packaging Factory; o Factories of Biscuits, Cakes, Chocolates, and Other Confectionery Items. - **AGR-S8-3: Private Sector Investment:** Offering incentives, such as tax breaks or low-interest loans, to attract private sector investment in cold storage and transportation logistics centers. Also, facilitate partnerships between agribusinesses and the private sector. Additionally, it promotes investment in marketing efforts to showcase local agricultural products.	- Lack of infrastructure for Agro-industrial development - [AGR-III] Promote sustainable agriculture - [AGR-II] Increase value-addition - [AGR-I] Reach food security
Agroforestry	**AGR-S9** Promote Sustainable Agroforestry	- **AGR-S9-1: Strategic implementation of Agroforestry Agriculture Belt** in Erbil involves establishing interconnected zones in the southern, southeast, and northern regions, employing Agroforestry methods as a pivotal approach. Beginning with the southern and southwest sections as a protective shield against summer dust waves, this lattice will be a shelter and critical link to the inner green belt. Simultaneously, the northern part will be strategically positioned between orchards, safeguarding urban agriculture lands and connecting seamlessly to the entire Erbil city network. Furthermore, recognizing the significance of Agroforestry, this strategy emphasizes its integral role within	- [AGR-VII] Contribute to greening through agriculture - [AGR-III] Promote sustainable agriculture

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
		the main Inner Green Belts, mainly focusing on zones 5 to 8. By harmonizing these elements, Erbil's agricultural landscape can be transformed into a resilient and interconnected network, providing ecological benefits and fortifying the city's commitment to sustainable urban agriculture.	
Organic & Responsible Agriculture	**AGR-S10** Promote Organic Agriculture	- **AGR-S10 -1: Incorporate a comprehensive organic agriculture strategy**: specifically, within the Inner Greenbelt, emphasizing adopting sustainable farming practices. This includes promoting soil health through organic amendments and crop rotation, implementing natural pest management techniques, encouraging local composting initiatives, and facilitating farmer education on organic methods. Additionally, it establishes supportive policies for organic certification labels, such as developing local markets for organic produce and integrating water conservation measures to enhance the overall sustainability of agriculture in Erbil.	- [AGR-III] Promote sustainable agriculture - [AGR-II] Increase value-addition
	AGR-S11 Promote Responsible Agriculture	- **AGR-S11-1: Promote Responsible Agriculture** through the promotion of various labels and certifications such as the Animal Welfare Approved (AWA) label or the Demeter Certified Biodynamic certification. Financial incentives, such as subsidies and tax reductions, to local farmers who obtain and maintain these certifications. Additionally, the policy supports farmers by providing access to expert-led training and technical assistance, coordinated in collaboration with international agricultural specialists and academic institutions. This initiative aims to elevate the standards of farming within the region, increasing the competitiveness of Erbil's agricultural exports by aligning with global sustainability and ethical practices.	- [AGR-III] Promote sustainable agriculture - [AGR-II] Increase value-addition

Source: JICA Project Team

6.1.4 Agriculture & Livestock Sector Development Plan

Agriculture is an essential sector in Erbil's economy. However, population growth combined with the need to produce more food from a limited and shrinking land and water resource base has resulted in farming systems that maximize short-term returns at the expense of long-term sustainability. Based on the Strategies and Policies mentioned above, Figure 6.1.4 and the sections below explain the tentative agriculture development plan.



Source: JICA Project Team

Figure 6.1.4 Agriculture Development Spatial Plan

1) Agriculture Crops Strategy

Identifying Strategic Crops (AGR-S3)

Identifying strategic crops is crucial in the framework of an agricultural development plan within an urban development master plan, as it ensures the optimization of local resources, enhances food security, and promotes sustainable economic growth tailored to the specific needs and potential of the urban area. In terms of existing situation of crops, the top seven cultivated crops in Erbil Governorate in terms of area, production, and gross income are shown in Table 6.1.17 below.

Table 6.1.17 Top Seven Crops for Area, Production, Gross Income in Erbil Governorate

Rank	Area (ha)		Production (ton)		Gross income (million IQD)	
1st	Wheat*1	336,982	Wheat	349,493	Wheat	146.8
2nd	Barley*2	68,923	Barley	64,099	Watermelon	31.5
3rd	Melon*.2	3,750	Watermelon	48,490	Tomato	23.6
4th	Tomato*2	2,500	Tomato	47.190	Barley	23.6
5th	Watermelon*2	2,500	Potato*2	37,474	Cucumber	13.3
6th	Cucumber*2	2,000	Cucumber	26,672	Potato	9.8
7th	Corn*.2	1,866	Corn	22,562	Corn	4.5

Source: *1: Figure in 2022, calculated by the JICA Project Team based on the report published by USDA.
*2: Calculated by the JICA Project Team based on the statistics of MoAWR between 2014 - 2017.

Wheat ranks first in terms of area, production volume, and gross income. The government's Public Distribution System (PDS) scheme offers a higher purchase price for wheat production than international prices to ensure staple foods, and wheat production shall continue to be maintained from the perspective of achieving food self-sufficiency (Overall Goal AGR-I).

Barley is mainly used for livestock feed, and like wheat, is purchased through PDS, but at a price equivalent to three grades of wheat (first grade: IQD 850 K/ton, second grade: IQD 750 K/ton, third grade: IQD 650 K/ton). The same is likely true for the KRG as well.

Self-sufficiency rates for typical crops in Erbil Governorate in 2017 are shown in Table 6.1.18 below.

Table 6.1.18 Self-sufficiency Rates by Crop

Crop	Self-sufficiency Rate (%)	Crop	Self-sufficiency Rate (%)
Wheat*1	158	White grape	68
Potato*2	65	Red grape	54
Tomato	49	Black grape	81
Cucumber	76	Red apple	7
Melon	70	Green apple	12
Watermelon	72	Pomegranate	63

Source: *1 Figure in 2022 in Erbil Governorate and calculated by the following conditions: population = 2,210,000 in 2022, per capita annual consumption = 100 kg/ person/year.
*2 Other than wheat, all figures in 2017 in KRG based on the statistics from MoAWR.

The self-sufficiency rate of wheat is high, and the population of the Erbil Governorate by 2050 would be able to support itself if production were to increase by about 10% while the agricultural land of the entire Erbil Governorate is maintained.

On the other hand, based on the Food Sufficiency & Export (FSE) Long-term Vision (see Section 4.2), KRG would also be expected to export and supply wheat to all of Iraq, setting the target of self-sufficiency rate at 200%, as shown in Table 6.1.19 below, would require the following conditions.

a) A slight improvement in yield productivity (50% increase) and
b) Reaching the same productivity as Iraqi level (about 3 times more).

Table 6.1.19 Projection Objective to Meet 200% of Self-Sufficiency Rate of Wheat

Year	Population	Area (ha)	Yield (ton/ha)	Production	Self-sufficiency rate (%)
2030	2,590,000	345,000	1.5	518,000	200
2040 (a)	3,150,000	420,000	1.5	630,000	200
2040 (b)		210,000	3.0	630,000	200
2050 (a)	3,850,000	510,000	1.5	770,000	200
2050 (b)		255,000	3.0	770,000	200

Source: JICA Project Team

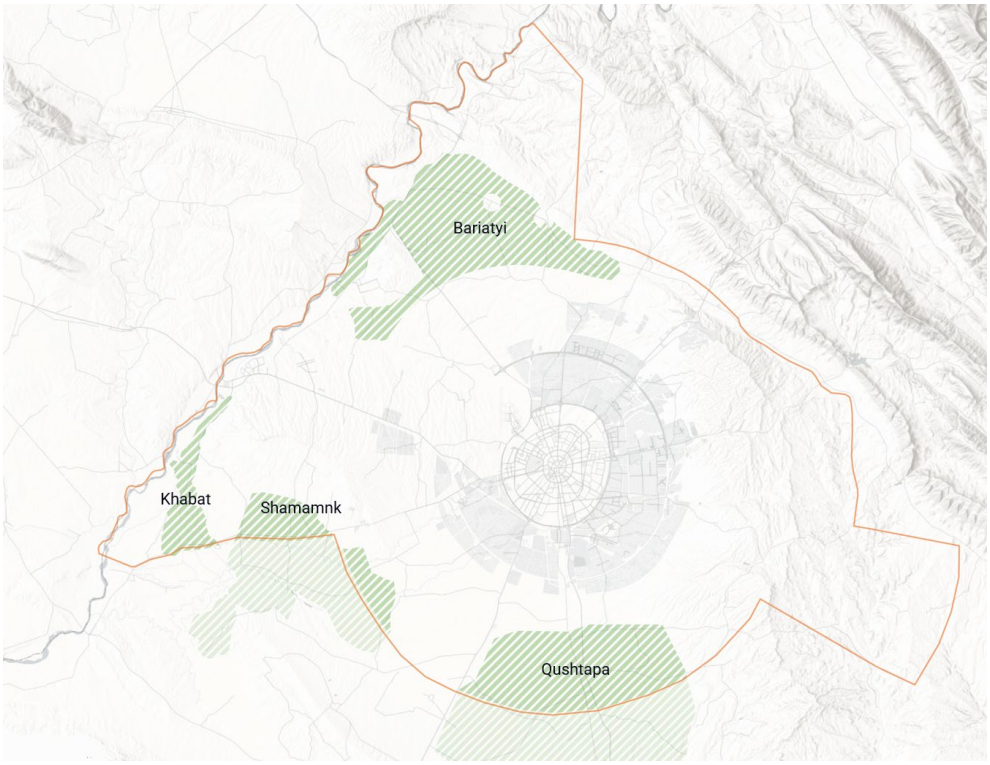
If yield productivity increases by about 50%, a 200% self-sufficiency target can be achieved with wheat acreage remaining almost the same as the current level until around 2030. However, if productivity does not increase further, farmland will need to be increased thereafter, which will conflict with urbanization, the goal of the Project.

If the Erbil Governorate as a whole secures the above agricultural land for wheat and productivity increases to the Iraqi average level, self-sufficiency could be achieved at the 200% level. By 2050, production would more than double (148% in 2030 compared to 2022, 180% in 2040, and 220% in 2050), and since less area would be devoted to wheat, other high value-added crops could be grown. Through these efforts, the 200% increase of the contribution of agriculture sector to GRDP by 2050 (see Section 4.3.2) will be reached.

2) Irrigation and Water Management Strategies (AGR-S6)

Improve water management and irrigation towards sustainability of water resources (AGR-S6)

In the perspective of improving water management and irrigation towards sustainability of water resources, reflect in Erbil 2050 MP the 4 irrigation areas promoted by MoAWR, as shown in Figure 6.1.4 below. For hydrological technical details regarding of proposed Irrigation Plan for Agricultural Water, refer to Section 8.1.2.



Source: JICA Project Team

Figure 6.1.5 Irrigation Areas promoted by MoAWR

Shamamk Irrigation Area:

The area of Shamamk Irrigation Area is about 11,847 ha and its share within the Project Area is about 5,826 ha. Located approximately 30 kilometres from the city centre, this area offers exceptional accessibility and efficient transportation linkage. What makes this location particularly noteworthy is the presence of existing infrastructure, encompassing well-developed transportation networks, well-maintained roads, reliable electricity supply, and the primary water source for the project is linked to the secondary canal from Great Zab River as depicted in Figure 6.1.4. Moreover, the strategic choice of the Shamamk area results in minimal environmental impact on nearby ecosystems, ensuring the eco-friendliness and alignment with the city's sustainability goals.

Khabat Irrigation Area:

Khabat Irrigation Area is already ongoing and represents a vital water source for farmers, contributing considerably to advancing agricultural practices, enabling crop cultivation, and enhancing livestock production. It is located in the western part of Erbil within the Khabat district, extending towards the Gower area. The primary water source for the project is linked to the Great Zab River, as depicted in Figure 6.1.4, facilitating the supply of 9.8 /m^3/s to sustain its operations. This project holds the capacity to irrigate an expansive area of approximately 3,534 ha, making it a significant contributor to regional agricultural development.

Bariatyi Irrigation Area:

Covering an extent of approximately 19,073 ha, the Bariatyi Plain and Zrarati region stand out for their fertile soil and existing water resources sourced from the Great Zab River and the alternative of the Mandawa dam. Moreover, the project's strategic location near the Great Zab River and underground water offers a unique opportunity for sustainable land for irrigation. Recommendations include utilizing the Great Zab River for irrigation and establishing irrigation canals to ensure water access across all agricultural lands. This initiative holds promise for enhancing agricultural productivity in the area, especially given its exceptional fertility and strategic positioning northwest of Erbil. The fact that Bariatyi Irrigation Area is located just a little north of the proposed Urban Northern Development area makes it an ideal location of urban agriculture to provide food security to the city.

Qushtapa Irrigation Area:

The Qushtapa Irrigation Project, situated from the southern reaches of Qushtapa district to the elevated terrains of Zurgazraw along the Erbil-Makhmur Road, harnesses water from various sources to address critical agricultural needs. Drawing primarily from groundwater channels merging into the Lesser Zab River and supplemented by rainwater and underground water wells, the project area within the target area is about 14,820 ha. The project's inception stems from strategically implementing modern irrigation techniques to optimize agricultural productivity year-round.

3) Agriculture Product Supply Strategies (AGR-S2)

The strategic location of the Agri-product Packages and Storage Complex within Erbil City's master plan is a pivotal component of the city's vision for agricultural development and food security. These well-placed complexes play a fundamental role in ensuring the efficient handling and storage of agricultural products, reducing post-harvest losses, and enhancing accessibility to essential markets. By strategically positioning these complexes, Erbil City aims to strengthen its agricultural sector, reduce dependency on imports, and promote the region's sustainable growth. This strategic placement aligns with the city's broader master plan, creating a more autonomous and food-secure future as depicted in Figure 6.1.4.

Khabat Agro-industry Complex Area:

The Agri-product Packages and Storage Complex leverages its unique location, positioned near the banks of the Great Zab River and the emerging purpose development cluster. Its adjacency to the river offers the advantage of water transportation for efficient product distribution, reducing transportation costs and facilitating the movement of agricultural goods to nearby production areas. Additionally, this site is part of a larger development complex, fostering synergies with various agri-related activities. This integration within a broader development strategy enhances the complex's capacity to serve as a central hub for the agricultural sector, as illustrated in Figure 6.1.4.

Qushatapa Agro-industry Complex:

The third of these complexes is strategically situated in the southern part of the city, within the MoAW proposed irrigation area along Kirkuk Road. This location benefits from outstanding accessibility to the city center, significantly reducing transportation costs and ensuring the prompt delivery of agricultural products to local markets. It boasts an established infrastructure, contributing to the complex's operational efficiency and effectiveness, as shown in Figure 6.1.4.

Barantiy Agro-industry Complex:

The third of these complexes is strategically situated in the northern part of the city, within the MoAW proposed irrigation area along Duhok road. This location benefits from outstanding accessibility to the city center, significantly reducing transportation costs and ensuring the prompt delivery of agricultural products to local markets. It boasts an established infrastructure, contributing to the complex's operational efficiency and effectiveness, as shown in Figure 6.1.4.

These strategically chosen locations exemplify careful planning and represent a significant step towards achieving Erbil City's agricultural development goals and enhancing food security. By thoughtfully

positioning these Agri-product Packages and Storage Complexes, the city is poised to foster a more sustainable and food-secure future, in line with its comprehensive master plan.

4) Promotion of Organic & Responsible Agriculture

Promotion of Organic Agriculture (AGR-S10)

Promote the strengthening of Organic Agriculture to become a major part of Erbil's agriculture production. This process shall start with the formulation of a comprehensive Organic Agriculture Strategy at the level of KRG. A certification label, easily recognizable by a logo on products, shall be developed for farmers who favours soil health through organic amendments and crop rotation, natural pest management techniques, local composting initiatives, Additionally, a specific label can be developed for locally grown vegetables and fruits through Organic methods within the Erbil Green Belt.

Figure 6.1.5 below shows some examples of logos of Organic Agriculture certification labels, with a global label from the European Union (left), a local label from New York City's urban Organic Agriculture from National Organic Farming Association of New York (NOFA-NY) (center), and a fictive tentative logo for a potential Erbil's Green Belt Organic Agriculture certification label (right).

Source: EU, NOFA-NY, JICA Project Team

Figure 6.1.6 Examples of Organic Agriculture Certification Labels

Promotion of Responsible Agriculture (AGR-S11)

Promote Responsible Agriculture through the adoption of various existing labels and certifications such as the Animal Welfare Approved (AWA) label or the Demeter Certified Biodynamic certification. Financial incentives, such as subsidies and tax reductions, can be granted to local farmers who obtain and maintain these certifications. Additionally, the policy supports farmers by providing access to expert-led training and technical assistance, coordinated in collaboration with international agricultural specialists and academic institutions. This initiative aims to elevate the standards of farming within the region, increasing the competitiveness of Erbil's agricultural exports by aligning with global sustainability and ethical practices.

Figure 6.1.6 below shows some examples of logos of Responsible Agriculture certification labels, with the above-mentioned AWA (left) and Demeter (center), and a fictive tentative logo for a potential Erbil's Responsible Agriculture or Animal Welfare certification label (right).

Source: AGW, Demeter, JICA Project Team

Figure 6.1.7 Examples of Responsible Agriculture Certification Labels

5) Agriculture & Irrigation Training / University / Innovation Research (AGR-S5)

The proposed Agriculture & Irrigation Training/University/Innovation Research initiative encompasses a strategic development plan outlined in the AGR-S4 framework. A vital element of this plan is AGR-S4-1, which focuses on creating and maintaining a Comprehensive Agricultural Database. This involves allocating funds to establish and continuously maintain an extensive database. Collaborative efforts with universities and research institutions will be crucial in collecting and analyzing data. Additionally, government personnel and agricultural engineers will be trained in data management and analysis to ensure the effective use of this resource.

In conjunction with AGR-S5-1, AGR-S5-2, which encompasses Research and Extension Services, will be integral to the project's success. Agricultural research centers will be established to address local challenges and crop varieties. The project's location will be determined considering two possibilities: the first in Qushtapa, closely linked with the agro-industrial area, and the second in the Northern urban preservation and promotion area. This might be an opportunity to integrate with the new proposed campus of Salhaddin University in the exact location. These research centers will provide farmers access to extension services, offering guidance on modern farming practices. Furthermore, farmer training programs will be developed to ensure that new technologies are effectively utilized.

The choice of the project's location is pivotal to its success. The decision is between situating it in Qushtapa, closely connected to the agro-industrial area, or in the Northern region, amid existing fields surrounded by urban areas. Careful consideration of this factor is vital in effectively implementing the comprehensive plan for this Agriculture Training/University/Innovation Research project.

6.2 Industry Sector

6.2.1 Existing Conditions

Spatial Distribution of Industrial Zones

Figure 6.2.1 shows the spatial distribution of existing Manufacturing and Oil-Related Industrial Zones in the Project Area. It shall be noted that a total of 2,449 ha has been identified based on the Existing Land Use Land Cover geographic data (see Section 2.4.2), which is a bigger figure than the one provided by the Ministry of Trade and Industry (see next paragraphs).

Source: JICA Project Team

Figure 6.2.1 Existing Main Manufacturing and Oil-Related Industrial Estates

Manufacturing industry

A total of 44 Industrial Zones has been identified by JICA Project Team within the Project Area based on the information from Ministry of Trade and Industry. Industrial Zones are widely distributed across Erbil and generally mixed in terms of uses, sizes and types of buildings. These principal industrial areas account for approximately 75% of the industrial labour force, the remaining 25% employed in industries located ad hoc locations outside of the principal industrial areas. Some of the latter are smaller workshop spaces in mixed neighbourhoods, while others are larger industrial facilities located on their own sites outside of the principal industrial areas, as shown in Table 6.2.1 below.

Table 6.2.1 Outline of Existing Manufacturing Industrial Zones in Project Area

Location	Sum of Area m2	Sum of Employees	%GT Sum of Area m2	%GT Sum of Employee
South industrial zone	1,431,486	3,374	31.11%	27.68%
Timar industrial zone	517,062	1,896	11.24%	15.55%
Kasnazan industrial zone	479,972	1,528	10.43%	12.53%
Kirkuk road	218,300	976	4.74%	8.01%
Gwer road	266,419	856	5.79%	7.02%
Qushtapa industrial zone	169,168	813	3.68%	6.67%
Land not allocated	431,372	792	9.38%	6.50%
Bahirka industrial zone	129,831	406	2.82%	3.33%
Khabat industrial zone	136,830	293	2.97%	2.40%
Qatawi industrial area	272,639	163	5.93%	1.34%
Ankawa	12,533	135	0.27%	1.11%
Daratu industrial zone	29,803	134	0.65%	1.10%
Bastora	73,956	100	1.61%	0.82%
Bnaslawa industrial zone	43,253	100	0.94%	0.82%
North industrial area	21,688	86	0.47%	0.71%
Makhmour Road	2,500	70	0.05%	0.57%
Pirzin	50,000	60	1.09%	0.49%
Pirdawd		50	0.00%	0.41%
Tairawa	1,500	37	0.03%	0.30%
City Center	1,400	36	0.03%	0.30%
Nawroz	2,611	29	0.06%	0.24%
Gird Jutyar	30,000	25	0.65%	0.21%
Grda Rasha	13,600	25	0.30%	0.21%
Kawrgosk		26	0.00%	0.21%
Shawes	3,100	24	0.07%	0.20%
Khabat road		22	0.00%	0.18%
Hamza Kor		20	0.00%	0.16%
Qoritan	125,000	15	2.72%	0.12%
Gwer / Trajan	95,000	15	2.06%	0.12%
Kani Qrzhala		12	0.00%	0.10%
Taq taq		12	0.00%	0.10%
Kulki Gawra	10,000	10	0.22%	0.08%
Pirmam Road		10	0.00%	0.08%
Hasarok		8	0.00%	0.07%
Dolaza	1,000	6	0.02%	0.05%
Badawa	438	6	0.01%	0.05%
Gazna road		5	0.00%	0.04%
Mala Omar industrial area		5	0.00%	0.04%
Swire	20,493	3	0.45%	0.02%
Mosul road	7,500	2	0.16%	0.02%
Zanko	1,723	2	0.04%	0.02%
Mnara	800	2	0.02%	0.02%
Banaman		2	0.00%	0.02%
TOTAL	4,600,977	9,377	100%	100%

Source: Ministry of Trade and Industry

The South Industrial Zone located within 120 Metre Road and Timar Industrial Zone similarly located to the south south-west of the centre of the city near the Makhmour Road, outside the 120 Metre Road account for 41.33% of the industrial sector in terms of employees. Other than at these sites, industrial employment is spread widely across different locations. These 44 sites add up to a total of area of 4,600,977 m2 or c.460 hectares.

Oil-related Industry

The Kurdistan region of Iraq, rich in natural resources, has witnessed significant growth in its oil industry, laying the foundation for an emerging refinery sector. Erbil also contribute to this effort, as it is becoming

a hub for energy-related enterprises. As the administrative heart of the KRG, Erbil hosts several key oil refineries, such as KAR refinery in the Great Zab Cluster area or Lanaz refinery in Gwer Road area, that contributes to the energy exports of the region. The Ministry of Natural Resources is tasked with the critical responsibility of overseeing this sector. It regulates the exploration, production, and distribution activities, ensuring that the extraction and processing of crude oil are conducted in a manner that maximizes efficiency, safety, and environmental sustainability, which shall be even more enhanced in the future. The ministry's role is crucial in shaping policies that attract investment, promote technological advancement, and enhance the capacity of the oil industry, thus bolstering Erbil's status in the regional energy landscape. There is a total of 370 ha of Oil-Related Industrial Zones, as shown in Table 6.2.2 below.

Table 6.2.2 Outline of Oil-Related Industrial Zones of Project Area

Name	Location	Area (m2)	Area (ha)	Share of Area
Lanaz Oil Refinery	Gwer Road	618,668	61.87	16.73%
Halband	Gwer Road	383,810	38.38	10.38%
Mardan	Gwer Road	87,547	8.75	2.37%
Vesin	Gwer Road	95,928	9.59	2.59%
Mateen	Gwer Road	193,403	19.34	5.23%
Apex	Gwer Road	85,545	8.55	2.31%
Abraj Dubai Oil Refinery	Gwer Road	41,591	4.16	1.12%
Irth Al-hadharh Oil Refinery	Gwer Road	27,331	2.73	0.74%
Erbil Oil Refinery	Great Zab Cluster	1,543,110	154.31	41.73%
Bedyal Petroleum	Great Zab Cluster	251,911	25.19	6.81%
Kurdoil Paint Factory	Great Zab Cluster	75,060	7.51	2.03%
Independent Oil Tools - Iraq	Duhok Road	35,040	3.50	0.95%
Royal Oil & Gas Refinery	Duhok Road	176,219	17.62	4.77%
Al-Braheen Oil Refinery	Qushtapa	82,328	8.23	2.24%
TOTAL		3,697,491	369.75	100%

Source: JICA Project Team based on OSM

6.2.2 Key Planning Issues

From the perspective of private industrial sector, the following issues were pointed out by the Ministry of Industry Erbil as the major issues in the industrial sector.

- Rising taxes (rent price for factories at 750 to 1,000 IQD per m2 per year, 250 IQD for small factories);
- High electricity cost (rise from 60 IQD per KWh before up to 120 IQD now);
- High fuel cost ($250/tank in Erbil compared with $90/tank in other parts of Iraq);
- Inadequate infrastructure, such as reliable electricity and water supply, which hinder the efficiency and growth of industrial operations.

From the planning perspective, the major issues in the industrial sector in Erbil are as follows.

- Irregular implantation of industrial companies in unsuitable areas;
- Presence of informal industrial companies, which do not hold official licence;
- Very poor enforcement of environmental norms to industrial companies, leading to high levels of air pollution.

6.2.3 Sector Strategies & Policies

(1) Overall Goals of Industry Sector

The Overall Goals of the Industry Sector development in Erbil 2050 MP, which are outlined in the KRG 2030 Vision Economy and Productivity pillar, contained in the latest policies and communication from the Ministry of Industry and the Board of Investment, and which will realize the Long-term Development Visions, can be summarized as below.

- IND-I: Economic diversification to move away from reliance on single sector;
- IND-II: Provision of diverse range of employment opportunities;
- IND-III: Development of and investment in new industrial sub-sectors;
- IND-IV: Establishment of new innovation hubs and industrial zones;
- IND-V: Attract inward investment to high growth industrial sub-sectors, especially manufacturing;
- IND-VI: Environmental upgrading of industrial sector to contribute to pollution reduction.

(2) Linkage with Strategic Orientations of Erbil 2050 MP

Strategies and Policies of Industry Sector mainly support the realization of the Strategic Orientation #3: Promote innovative & diversified economy and boost employment (See Section 5.4), which implements especially the Long-term Development Vision (See Section 4.2) of Diversified Economy (DEC). The industrial sector also provides a key element in further developing products for export in alignment with Strategic Orientation #2: Improve international competitiveness through regional connectivity and integration.

(3) Strategies & Policies of Industry Sector

Table 6.2.3 below summarizes the Strategies & Policies of Industry Sector proposed to tackle existing issues and to achieve Erbil 2050 MP Long-Term Visions and Overall Sector Goals.

Table 6.2.3 Strategies & Policies of Industry Sector

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
Economic Diversification	**IND-S1**: Encourage diversification through improvement, intensification and expansion at Tiemar industrial area	- **IND-S1-1**: Form management body to actively manage Tiemar Industrial area, and implement programme of quality improvements and intensification, including relocations of existing businesses and densification of site layouts - **IND-S1-2:** Facilitate delivery of expansion of Tiemar industrial area by 2040	- Undiversified economy relying on oil revenues - Relatively limited foreign investment in manufacturing - Relatively limited existing complexity in industrial sector – target to increase Economic Complexity Index ranking to top 50 from 109 of 133 (KRG Vision 2030 target) - Lack of innovation among producers[1] - Target to increase industrial share of GDP from 6% in 2015 to 12% in 2030 (KRG Vision 2030 target)
	IND-S2: Encourage diversification through development of Ararat Industrial Zone	- **IND-S2-1**: Facilitate delivery of new Ararat Industrial Zone on Mosul Road (see also **IND-S6**) by 2050 - **IND-S2-2**: Ensure Ararat Industrial Zone allows for a range of industrial sub-sectors and reflects growth sectors. Further work to identify areas for sector focus to be undertaken. - **IND-S2-3**: Ensure Ararat Industrial Zone has focus on petrochemical processing sectors to take advantage of geographical proximity to the existing Great Zab Industrial area to encourage emergence of petrochemical processing-based sector cluster. (Link to **IND-S6**)	

[1] Assessment of Labour Market and Skills Analysis Iraq – Manufacturing (UNESCO, 2019)

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
	IND-S3: Encourage diversification through synergies with heavy industry promoted in KRI outside of Erbil	- **IND-S3-1**: Support the formulation of a whole strategy for development of clean heavy industry in Kurdistan, with identification of most suitable sites for industrial zones that can benefit to the economy of Erbil, especially through the connection of the Kurdistan Inter-City Railway.	- Encourage foreign direct investment in non-oil sectors through delivery of industrial zones
	IND-S4: Facilitate flexible laboratory and workshop space to allow for growth needs of knowledge-based enterprise at Daraban Economic Core and other locations across Erbil.	- **IND-S4-1**: Allow for development of flexible office, workshop and / or laboratory space collocated in areas of mixed development - **IND-S4-2**: Focus delivery of laboratory, R&D, and office / workshop space connected with wider petrochemical processing at Daraban Economic Core. Also relevant for R&D / laboratory space in relation to food processing and agriculture.	
	IND-S5: Ensure that the transformation of the existing Great Zab industrial area into a regularised and spatially limited zone	- **IND-S5-1**: Regularise existing uses within the 'unofficial' Great Zab industrial area - **IND-S5-2**: Facilitate improved access to industrial sites within the Great Zab industrial area - **IND-S5-3**: Allow for intensification of land use where appropriate within the Great Zab industrial area and support existing operators in enhancing and expanding operations where appropriate	
	IND-S6: Facilitate the development of a petrochemicals industry cluster at the Great Zab cluster area and Ararat Industrial Zone	- **IND-S6-1**: Facilitate connections between the existing Great Zab industrial area and the Ararat Industrial Zone including delivery of road connections for heavy duty trucks and investigate potential for pipeline links between refineries in Great Zab area and processing facilities at Ararat. - **IND-S6-2**: Ensure Ararat Industrial Zone planning recognises sector focus of petrochemical processing industry related sectors through active cluster management	
	IND-S7: Develop Circular Economy through Recycle Industry & Eco-Friendly Industrial Raw Materials	- **IND-S7-1:** Promote industrial contribution of the reuse of recycled materials (plastic, steel, concrete, wood, textiles). - **IND-S7-2:** Develop innovative sources of Eco-friendly industrial raw materials such as Bamboo, Precast Concrete, Hempcrete, Terrazzo, Cork, etc.	- [IND-VI] Environmental Upgrading
Employment / Social	**IND-S8**: Facilitate continued provision of and growth in opportunities for a diverse range of employment in the industrial sector	- **IND-S8-1**: Facilitate land availability to sustain employment proportionate to future population of Erbil - **IND-S8-2:** Ensure diverse range of industrial facilities ranging from heavy industry to manufacturing facilities, to light industrial workshops, research & development, laboratory, and office space - **IND-S8-3:** Promote growth of higher value businesses	- Annual population growth forecast higher than Iraqi average and four times greater than OECD average. - High proportion of population working age - Financial sustainability of economy through reliance on government salaries - Dependence on oil and gas sector - Relatively high youth unemployment – target 13% (OECD avg)

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
			compared to baseline - Relatively low participation rate of the overall labour force – target of 50.6% (OECD avg) compared to 39.6% in 2017 - Low participation rate of the female labour force - Labour force – Erbil Vision 2030 – 'A skilled and active labour force capable of competing in the 21st century in the era of the 4th industrial revolution'
Regional Position	**IND-S9**: Ensure connectivity of manufacturing facilities to markets (Link so SO#2)	- **IND-S9-1**: Connect key strategic industrial growth sites by road via 150m Road, Mosul Road, Kirkuk Road and Duhok Road to Mosul, Baghdad / Al Faw / Gulf, and Turkey/Europe respectively.	- Landlocked region with difficult access to trading routes from seaports - Competitiveness in relation to Mosul, Sulaymaniyah and Kirkuk
Regional Position	**IND-S10:** Encourage exports of manufactured goods	- **IND-S10-1:** Facilitate development of sufficient supply of logistics and warehousing facilities with good road connections to key strategic routes to Mosul, Turkey, and Baghdad / Faw / Gulf.	- Competitiveness in relation to Mosul, Sulaymaniyah and Kirkuk - Undiversified economy and opportunity to grow domestic manufacturing / industrial base (in parallel to specialist agricultural storage facilities AGR-6-2 and AGR-S1-1)
Urban Environment	**IND-S11**: Facilitate colocation of employment uses within mixed-use neighbourhoods where not likely to cause odour or noise pollution.	- **IND-S11-1:** Promote development of light industrial, workshop, laboratory, office use within mixed use neighbourhoods contributing to vitality of CBDs as focal points for economic as well as cultural activity, and providing local opportunities for employment with minimal commuting distances - **IND-S11-2**: Facilitate the relocation of uses likely to cause odour, noise, or other disturbance in close proximity to residential neighbourhoods - **IND-S11-3:** Encourage the redevelopment of brownfield and underutilised sites to create dense liveable communities	- Dispersed urban structure and lack of CBD - Lack of functional mix inside residential fabrics (especially small-scale non-polluting manufacturing industries) - Conflicting neighbouring uses in older residential fabrics - Road congestion
Operational Costs	**IND-S12**: Improve affordability of electricity and fuel for industrial usage	- **IND-S12-1**: Ensure new industrial development is adequately supplied with 24-hour electricity	- High electricity costs - High fuel costs

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
	IND-S13: Ensure through planning that new industrial development is adequately planned and managed and that government supports connection of services.	- **IND-S13-1:** Ensure that new industrial development is adequately supported with connection of services.	- Lack of services
	IND-S14: Improve operational affordability through tax incentives and investment pro	- **IND-S14-1**: Provide tax incentives to encourage inward investment and focus investment on growth of target sectors	- High and rising taxes placing pressure on costs for manufacturing industry
Targeting Growth Sectors	**IND-S15**: Encourage investment in industrial sectors targeted for growth including through synergistic linkages between industrial and other sectors.	- **IND-S15-1:** Encourage investment in industries that have synergies and cross connections with the petrochemicals sector - **IND-S15-2**: Encourage investment in industries that have synergies and connections with the aviation sector - **IND-S15-3:** Encourage investment in industries that have synergies and connections with the health sector	- Lack of diversification in the economy - Lack of economic complexity

Source: JICA Project Team

6.2.4 Industrial Sector Development Plan

(1) Future Development of the Industrial Sector

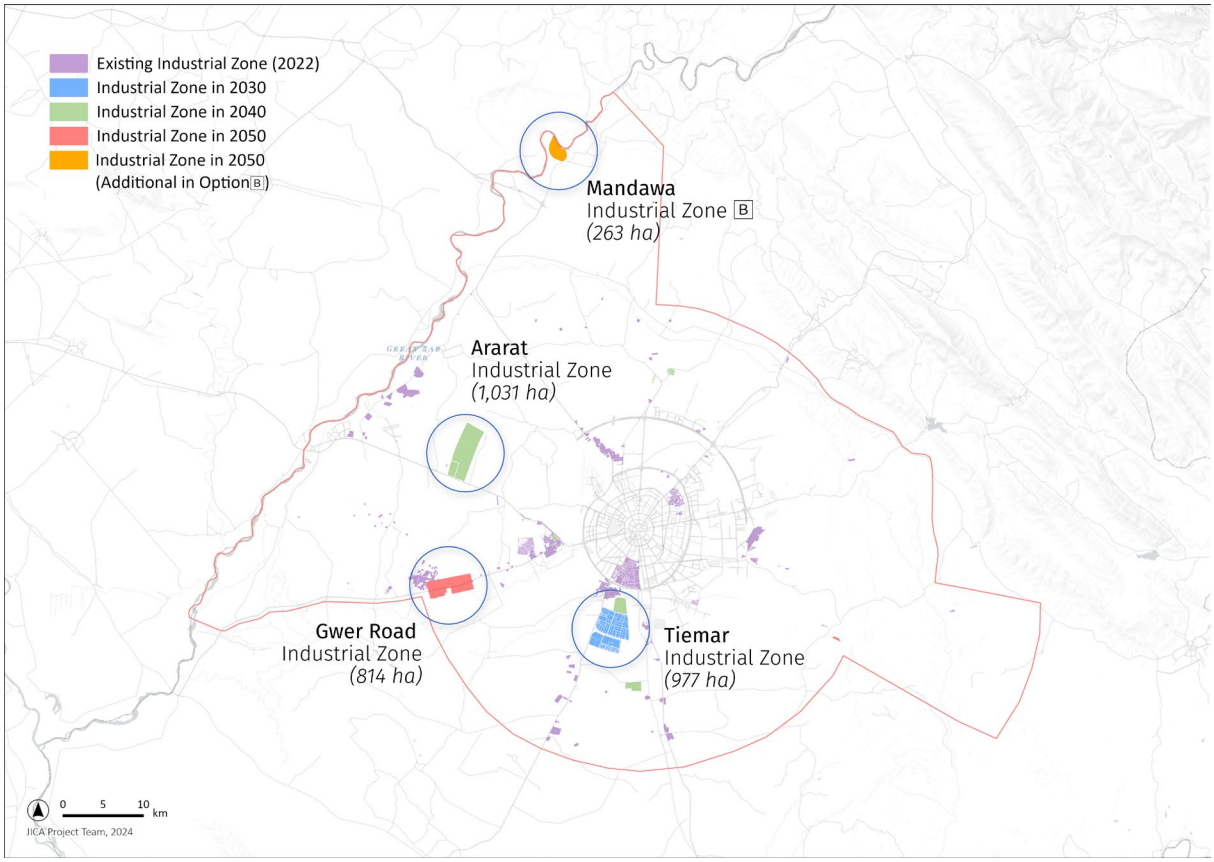
1) Considered Industrial Zones: Focus on Light Industry

The current section is designed to provide a comprehensive overview of the strategic initiatives and projects that are set to shape the industrial landscape of the region in the coming years. The focus is primarily on the Light Industry projects that have received official approval from the KRG, underscoring our commitment to align with the regional policies and economic objectives. Special attention is devoted to the development of the three key Industrial Zones of Tiemar (977 ha), Ararat (1,031 ha), and Gwer Road (814 ha), but it shall also be noted that a total of 1,478 ha of small-scale industries included in Urban Detailed Plans provided by UPDOE, will be implemented until 2040. Future industrial zones to be developed are shown in Table 6.2.4 and Figure 6.2.2 below.

Table 6.2.4 Outline of Proposed New Future Industrial Zones

Horizon	Industrial Zone	Area (ha)	Small-scale Industries in DP	Total Area (ha) by Horizon	Proposed proportion of Oil-related (ha)		Proposed proportion of Manufacturing (ha)	
2030	Tiemar	977	739	1,176	*10%*	118	*90%*	1,058
2040	Ararat	1,031	739	1,770	*20%*	354	*80%*	1,416
2050	Gwer Road	814	-	814	*50%*	407	*50%*	407
2050 B	Mandawa	264	-	1,077	*0%*	0	*100%*	1,077

Source: JICA Project Team



Source: JICA Project Team

Figure 6.2.2 Spatial Distribution of Proposed Future Industrial Zones

2) Heavy Industry: the case of Pungina Bestana

As mentioned in the Review of Industrial Development Policies of Erbil 2030 MP (see Section 3.4.4), the heavy industry area of Pungina Bestana was not proposed originally in Erbil 2030 MP, but was added lately in 2012 version of the Land Use Plan. Therefore, it can be considered that the proposition of having heavy industry in Pungina Bestana has been enough documented and technically analysed, and as a result, lacks legitimacy within KRG decision makers.

Based on (i) a letter from the Council of Ministers addressed to MoMT on July 25, 2022, which required the Erbil 2050 MP to not accommodate any industrial zone in the city centre and on (ii) the doubts expressed by several decision-makers, a conscious decision has been made to avoid heavy industry from the immediate vicinity of the city, thus leading to the exclusion of the site of Pungina Bestana. This exclusion has also been decided based on the consideration of the following technical factors:

- **Groundwater Recharge Zone**: Located in a vital groundwater recharge zone (See SO1-1 in Section 5.4.1), the site's proximity to this sensitive zone raises significant environmental concerns. The introduction of heavy industry activities in this area poses a substantial risk of soil contamination, which could lead to the degradation of the groundwater quality. This potential pollution could have far-reaching impacts on both the local ecosystem and public health.
- **Watercourses:** The site is situated along the paths of multiple seasonal rivers (See SO4-1, Section 5.4.4), which heightens the risk of surface water pollution. Industrial processes often involve the discharge of various pollutants, and the proximity of these watercourses to the proposed industrial activities could lead to the contamination of these critical water sources, affecting both aquatic life and human communities downstream.
- **Topography:** The hilly terrain of the Pungina Bestana site presents additional challenges, particularly in terms of construction. Building factories, amenities, and infrastructure such as roads on such terrain would likely incur higher public and private costs due to the need for extensive landscaping and structural reinforcements to accommodate the uneven ground.
- **Accessibility:** The current accessibility of the site by road is limited, which poses a significant obstacle to efficient export capabilities. The lack of robust transportation infrastructure could impede the movement of goods and materials in and out of the area, thereby affecting the operational efficiency of exportation and economic viability of any industrial activities established there.
- **Relevancy of the location at the regional scale:** Locating heavy industry near a large urban centre such as Erbil poses risks due to potential pollution and health hazards for the city's residents. This proximity could lead to increased air and noise pollution, impacting the quality of life and public health. Therefore, the proposed location may not be ideal considering other potentialities at the scale of regional planning.

Given these concerns, it is imperative to consider alternative locations in the whole KRI that might offer fewer environmental risks and logistical challenges. This evaluation should be a key component of the broader strategic planning for industrial development in the region.

Therefore, it is recommended to initiate a comprehensive study aimed at formulating a cohesive strategy for the development of clean heavy industries across Kurdistan. This strategy would involve identifying optimal sites for industrial zones that align with environmental standards and economic objectives, potentially outside the immediate vicinity of Erbil. A key factor in this strategic development would be the integration with the Kurdistan Inter-City Railway (See SO2-1 in Section 5.4.2), which could provide crucial logistical and transportation support, enhancing the economic interconnectivity and benefiting Erbil indirectly. Such a focused approach on clean heavy industry would not only contribute to the sustainable economic growth of the region but also ensure that the economic benefits extend to Erbil, fostering a balanced and forward-thinking industrial landscape across Kurdistan.

(2) Summary of Industrial Sector Development Indicators

In accordance with the Socio-Economic Framework and necessary units necessary for calculation and

planning, Development Indicators for the Industrial Sector in 2030, 2040 and 2050 population, are summarized in Table 6.2.5 below and explained in the subsequent sections.

Area Development

The area designated for industrial activities, including both oil-related and manufacturing industries, is projected to experience robust growth from 2022 to 2050. By 2040, the total industrial area has more than doubled, indicating vigorous industrial expansion. This expansion continues into 2050, with the area for oil-related industry more than tripling and manufacturing industry area nearly tripling from 2022 levels.

Employment Growth

Employment within the industrial sector demonstrates a strong upward trend, with both oil-related and manufacturing industries contributing to a surge in job creation. By 2040, employment numbers in oil-related industries more than double, a trend that holds steady through to 2050. Manufacturing industry employment also sees a substantial increase, more than doubling by 2040 and continuing to rise sharply by 2050. This indicates that the industrial sector is likely a key driver of job creation in Erbil's economy, possibly through direct employment opportunities and the ancillary jobs generated by industrial expansion.

Increase of GRDP Contribution

The contribution of industrial sectors to the Gross Regional Domestic Product (GRDP) showcases significant growth, with both oil and manufacturing industries increasing their economic output. The oil industry more than doubles its GRDP contribution by 2040 and nearly doubles again by 2050, signifying its growing economic importance. Similarly, the manufacturing industry's contribution more than doubles by 2040 and increases substantially by 2050. A boost of 20% more of the GRDP contribution has been added from 2040 to 2050 to reflect the increase of exportation potential driven by the implementation of Kurdistan Inter-City Railway. These trends underscore the industrial sector's burgeoning role in the regional economy, with its expanding economic weight reflecting increased productivity, possibly due to technological advancements, and a higher global demand for industrial goods.

Table 6.2.5 Industrial Sector Development Indicators

Item	Unit	2022	2030	2040	2050 Ⓐ	2050 Ⓑ
Area of Oil-related Industry	Ha	370	542	896	1,303	1,303
	Growth	*100%*	*146%*	*242%*	*352%*	*352%*
Area of Manufacturing Industry	Ha	2,449	3,993	5,409	5,816	6,079
	Growth	*100%*	*163%*	*221%*	*238%*	*248%*
Total Area of Industrial Sector	Ha	**2,819**	**4,535**	**6,305**	**7,119**	**7,382**
	Growth	***100%***	***155%***	***231%***	***295%***	***300%***
Employment in Oil-related Industry	Emp	5,117	6,822	11,288	18,250	18,250
	Growth	*100%*	*137%*	*216%*	*329%*	*329%*
Employment in Manufact. Industry	Emp	33,869	50,304	68,180	81,490	85,173
	Growth	*100%*	*149%*	*201%*	*240%*	*251%*
Total Employment of Ind. Sector	Emp	**38,986**	**57,126**	**79,468**	**99,740**	**103,422**
	Growth	***100%***	***147%***	***204%***	***256%***	***265%***
GRDP Contribution of Oil Industry	M IQD	48,970	71,681	118,534	206,881	206,881
	Growth	*100%*	*146%*	*242%*	*422%*	*422%*
GRDP Contribution of Manuf. Ind.	M IQD	1,221,150	1,991,237	2,697,300	3,480,292	3,637,661
	Growth	*100%*	*163%*	*221%*	*285%*	*298%*
Total GRDP Contribution of Indu.	**M IQD**	**1,270,120**	**2,062,918**	**2,815,834**	**3,687,173**	**3,844,542**
	Growth	***100%***	***162%***	***222%***	***290%***	***303%***

Source: JICA Project Team

(3) Diversifying the Economy: Manufacturing Subsectors

Existing Situation of Manufacturing Subsectors Distribution

Developing the manufacturing sector is an important strategy for the Kurdistan Region in diversifying the economy away from the oil and extractive sector. Manufacturing provides relatively high value employment with higher pay and higher productivity compared to service sectors. It also provides a strong base for growing exports, in line with SO2: Improve International competitiveness through regional connectivity and integration (See Section 5.4.2). Furthermore, manufacturing, in conjunction with research and development, has the potential to promote innovation and embed new products and systems, which in turn drive the agenda for other parts of the economy, in line with SO3: Promote innovative & diversified economy and boost employment (See Section 5.4.3).

Analysis of data for existing industrial areas shows that manufacture of non-metallic products accounts for the largest manufacturing sector in Erbil (36.55%) with the manufacture of food products (21.28%) and Construction (20.79%) the next largest subsectors, as shown in Table 6.2.6 below.

Table 6.2.6 Categories of Existing Industrial Zones of Project Area

Classification (ISIC)	Sum of Area m2	Sum of Employee	%GT Sum of Area m2	%GT Sum of Employee
Textiles	31,226	233	0.54%	1.83%
Nonmetallic	1,222,414	4,660	19.79%	36.55%
Metallic	395,039	1,669	6.27%	13.09%
Machinery	149,796	714	2.35%	5.60%
Food	582,387	2,714	9.40%	21.28%
Electrical	26,802	110	0.42%	0.86%
Construction	2,203,913	2,651	61.23%	20.79%
TOTAL	4,611,577	12,751	100%	100%

Source: Ministry of Trade and Industry

Key Unit Figures of Manufacturing Subsectors

Based on the data above, as well as on other insights, baseline unit figures of the key indicators to be calculated specifically for the industrial development in Erbil, will be detailed in Draft Final Report.

(4) Identification of Future Priorities in Manufacturing Subsectors

The future development of the industrial sector has been identified as one of the key potential areas of opportunity for the Kurdistan Region's economy to diversify beyond the dominant oil and extractive sector. In order to capitalize on this opportunity and to truly realize the Economic Diversification, it is crucial to identify priority subsectors and key activities within the industrial sector that can effectively contribute to a more diversified and sustainable economic landscape in Erbil. Table 6.2.7 gives commonly-agreed definitions of the Manufacturing Subsectors in economic and environmental terms, while Table 6.2.8 shows the adopted score on a maximum of 10 for each criterion and the global score.

Table 6.2.7 Commonly-agreed Definition of Manufacturing Subsectors

Manufacturing Subsector	General Definition and Economic Aspects	Sustainability & Environmental Aspects	Development Opportunities in Erbil
Textile	The textiles industry involves the design, production, and distribution of yarn, cloth, and clothing. It is labour-intensive and offers employment opportunities in manufacturing, design, and retail.	Textiles can have significant environmental impacts, including water pollution and waste. However, there is a growing movement towards sustainable textiles using organic materials and eco-friendly processes.	Erbil could develop eco-friendly textile manufacturing, leveraging local materials and traditional designs to cater to the global market for sustainable fashion.
Nonmetallic	This industry includes the production of nonmetallic mineral products like glass, ceramics, and cement. It offers jobs in extraction, processing, and manufacturing.	Nonmetallic mineral production can be energy-intensive and contribute to CO2 emissions. The use of recycled materials and energy-efficient technologies can mitigate these impacts.	Erbil has the potential to innovate in energy-efficient nonmetallic production, especially in building materials to support sustainable construction.

Manufacturing Subsector	General Definition and Economic Aspects	Sustainability & Environmental Aspects	Development Opportunities in Erbil
Metallic	Metallic industries focus on the extraction, smelting, and refining of metals. Employment is found in mining, engineering, and metallurgy.	The metallic sector can cause environmental degradation and pollution. Implementing recycling and sustainable mining practices can reduce the ecological footprint.	Erbil could explore opportunities for sustainable metal extraction and recycling to meet the demands of various sectors, including construction and technology.
Machinery	This sector produces industrial and consumer machinery and equipment. It offers skilled jobs in design, engineering, and manufacturing.	Machinery production can be resource-intensive, but advancements in technology are leading to more energy-efficient and durable products.	Development in Erbil could focus on producing machinery tailored to local industries, fostering technological advancement and self-sufficiency.
Food Processing	The food processing industry transforms raw agricultural products into food items. It provides employment in processing, packaging, and quality control.	The industry faces challenges in waste management and energy use, but opportunities exist for organic production and waste reduction techniques.	Erbil has the opportunity to develop a regional food processing hub, focusing on traditional and organic products with high export potential.
Electrical	This industry encompasses the manufacturing of electrical equipment, components, and appliances. It offers roles in engineering, assembly, and electronics.	Electrical industries are working towards reducing electronic waste and improving energy efficiency of products.	Erbil could become a centre for the production of energy-efficient electrical components, contributing to the global demand for greener electronics.
Construction	The construction industry is involved in building infrastructure, residential, and commercial properties. It is a significant source of employment in trades, management, and architecture.	Construction can impact land use and resources, but sustainable building practices and materials are becoming increasingly prevalent.	Erbil could leverage sustainable construction practices to build green spaces and infrastructure, attracting investment and improving quality of life.

Source: JICA Project Team

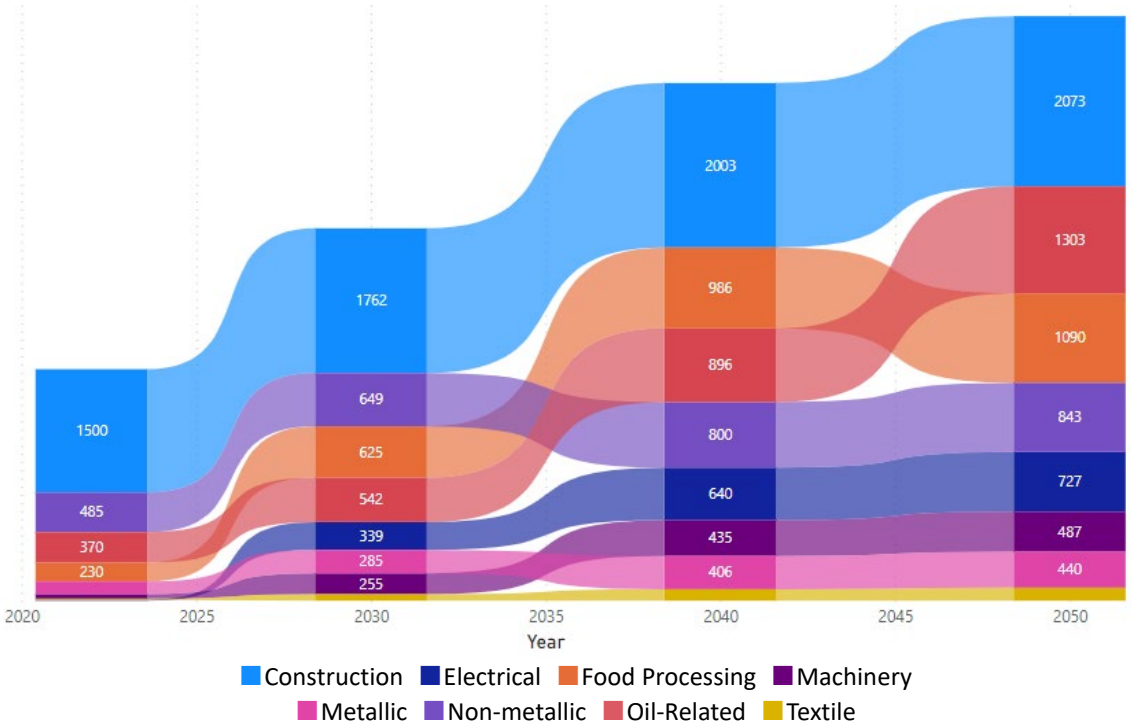
Table 6.2.8 Scoring of Priorities in Manufacturing Subsectors

Manufacturing Subsector	Economic Score	Environmental Score	Opportunity in Erbil Score	Global Score
Textile	5	3	6	4.7
Nonmetallic	6	4	7	5.7
Metallic	7	2	4	4.3
Machinery	8	5	5	6.0
Food Processing	7	6	8	7.0
Electrical	7	7	6	6.7
Construction	6	4	9	6.3

Source: JICA Project Team

(5) Development Roadmap of Manufacturing Subsectors

Based on the identification of the priorities in terms of manufacturing subsectors to be developed in Erbil in above sections, a roadmap for development of subsectors has been drafted, as shown in Figure 6.2.3 below, reflecting the effort of Economic Diversification in spatial development of industry.



Source: JICA Project Team projection based on Ministry of Trade and Industry data for 2022

Figure 6.2.3 Development Roadmap of Manufacturing Subsectors Area

Above figure indicates that, in 2022, the construction subsector was the largest, followed by electrical, metallic, and food processing, with the non-metallic, machinery, oil-related, and textile sectors being smaller in comparison. By 2050, there are some noticeable changes:

- The construction subsector remains the largest, but its growth slows down gradually, testifying the slower pace of urban development in Erbil from 2040 to 2050;
- The electrical subsector, as the second priority behind food processing, shows substantial growth by 2050;
- The food processing subsector expands significantly, suggesting a strong development focus in this area;
- The machinery and metallic subsectors also show growth, but not as pronounced as in electrical and food processing;
- The non-metallic, oil-related, and textile subsectors exhibit the least growth, maintaining a relatively small share of the total.

(6) Calculation of Key Indicators for each Manufacturing Subsectors

Area Development

Based on the Global Score of Priorities in Manufacturing Subsectors shown in Table 6.2.8 above, the share of the total of new industrial areas by manufacturing subsector by decade has been established as following:

- 25.5% of additional areas for Food Processing, as 1st priority subsector (global score of 7.0);
- 21.5% of additional areas for Electrical, as 2nd priority subsector (global score of 6.7);
- 17% of additional areas for Construction, as 3rd priority subsector (global score of 6.3);
- 12.8% of additional areas for Machinery, as 4th priority subsector (global score of 6.0);
- 10.6% of additional areas for Non-metallic, as 5th priority subsector (global score of 5.7);
- 8.5% of additional areas for Metallic, as 6th priority subsector (global score of 4.7);
- 4.3% of additional areas for Textile, as last priority subsector (global score of 4.3).

Based on those percentages, calculation of additional area and combined total area of industries for each manufacturing subsector has been done, and reflected in Table 6.2.9 and 10 respectively.

It is recommended that all organizations responsible in industrial area development, that is to say for investment project approval (Board of Investment), site planning (UPDOE) and land attribution (Presidency of Erbil Municipality), join forces to allocate future industrial lands according to those figures. Implementing a real-time monitoring system for this indicator would enable prompt tracking and adjustments. This proactive approach ensures that development remains on course and allows for swift corrective actions when necessary. Details of this approach will be detailed in the Governance part of Implementation Strategy of the Draft Final Report.

Table 6.2.9 Additional Industrial Area by Subsector

	2022		2030		2040		2050 A		2050 B	
AREA	*Share*	Area (ha)	*Share*	Area (ha)	*Share*	Area (ha)	*Share*	Area (ha)	*Share*	Area (ha)
Oil-related (Refineries)		**370.0**		**171.6**		**354**		**407**		**407**
Manufacturing	*100.0%*	**2,449.0**		**1,544**		**1,416**	*100.0%*	**407**		**670**
Textiles	***0.5%***	13.2	*4.3%*	65.7	*4.3%*	60.3	*4.3%*	17.3	*4.3%*	17.3
Nonmetallic	***19.8%***	484.7	*10.6%*	164.3	*10.6%*	150.6	*10.6%*	43.3	*10.6%*	43.3
Metallic	***6.3%***	153.6	*8.5%*	131.4	*8.5%*	120.5	*8.5%*	34.6	*8.5%*	34.6
Machinery	***2.4%***	57.6	*12.8%*	197.2	*12.8%*	180.8	*12.8%*	52.0	*12.8%*	183.5
Food processing	***9.4%***	230.2	*25.5%*	394.3	*25.5%*	361.5	*25.5%*	103.9	*25.5%*	103.9
Electrical	***0.4%***	10.3	*21.3%*	328.6	*21.3%*	301.3	*21.3%*	86.6	*21.3%*	218.1
Construction	***61.2%***	1,499.5	*17.0%*	262.9	*17.0%*	241.0	*17.0%*	69.3	*17.0%*	69.3

Source: JICA Project Team based on Ministry of Trade and Industry data for 2022

Table 6.2.10 Total Industrial Area by Subsector

	2030		**2040**		**2050 A**		**2050 B**	
AREA	**Area (ha)**	***Share***	**Area (ha)**	***Share***	**Area (ha)**	***Share***	**Area (ha)**	***Share***
Oil-related (Refineries)	**542**		**896**		**1,303**		**1,303**	
Manufacturing	**3,993**		**5,409**		**5,816**		**6,079**	
Textiles	78.9	*2.0%*	139.2	*2.6%*	156.5	*2.7%*	156.5	*2.6%*
Nonmetallic	649.0	*16.3%*	799.6	*14.8%*	842.9	*14.5%*	842.9	*13.9%*
Metallic	285.0	*7.1%*	405.5	*7.5%*	440.1	*7.6%*	440.1	*7.2%*
Machinery	254.7	*6.4%*	435.5	*8.1%*	487.4	*8.4%*	618.9	*10.2%*
Food processing	624.5	*15.6%*	986.1	*18.2%*	1,090.0	*18.7%*	1,090.0	*17.9%*
Electrical	338.9	*8.5%*	640.2	*11.8%*	726.8	*12.5%*	858.3	*14.1%*
Construction	1,762.4	*44.1%*	2,003.4	*37.0%*	2,072.7	*35.6%*	2,072.7	*34.1%*

Source: JICA Project Team

Employment Growth

The distribution of employment growth by Subsector has been calculated by multiplying the Ideal Employment Density to the calculated area shown in section above. The Ideal Employment Density for each horizon is obtained by adding, each decade, the share of priority by manufacturing subsector.

Table 6.2.11 Additional Industrial Employment by Subsector

	2022		2030		2040		2050 A		2050 B	
EMPLOYMENT	*Share*	*Emp*	*Density*	*Emp*	*Density*	*Emp*	*Density*	*Emp*	*Density*	*Emp*
Oil-related (Refineries)		**7066**		**2,613**		**5,583**		**7,975**		**7,975**
Manufacturing	*100.0%*	**31,921**		**15,527**		**16,759**		**12,297**		**15,979**
Textiles	*1.8%*	584	*46.0*	1,048	*48.0*	1,001	*50.0*	646	*50.0*	646
Nonmetallic	*36.6%*	11,667	*26.6*	1,516	*29.5*	1,535	*32.6*	1,053	*32.6*	1,053
Metallic	*13.1%*	4,178	*29.5*	1,344	*32.0*	1,335	*34.8*	899	*34.8*	899
Machinery	*5.6%*	1,788	*35.0*	2,393	*39.5*	2,470	*44.5*	1,727	*44.5*	3,567
Food processing	*21.3%*	6,793	*37.0*	5,061	*46.5*	5,815	*58.4*	4,526	*58.4*	4,526
Electrical	*0.9%*	275	*32.4*	3,692	*39.3*	4,098	*47.7*	3,081	*47.7*	4,921
Construction	*20.8%*	6,636	*5.2*	472	*6.1*	505	*7.1*	367	*7.1*	367

Source: JICA Project Team based on Ministry of Trade and Industry data for 2022

Table 6.2.12 Total Industrial Employment by Subsector

	2030		2040		2050 A		2050 B	
EMPLOYMENT	***Emp***	***Share***	***Emp***	***Share***	***Emp***	***Share***	***Emp***	***Share***
Oil-related (Refineries)	9,679		15,262		23,237		23,237	
Manufacturing	**47,447**		**64,206**		**76,505**		**80,185**	
Textiles	1,632	*3.4%*	2,633	*4.1%*	3,279	*4.3%*	3,279	*4.1%*
Nonmetallic	13,183	*27.8%*	14,718	*22.9%*	15,771	*20.6%*	15,771	*19.7%*
Metallic	5,522	*11.6%*	6,857	*10.7%*	7,756	*10.1%*	7,756	*9.7%*
Machinery	4,181	*8.8%*	6,651	*10.4%*	8,378	*11.0%*	10,218	*12.7%*
Food processing	11,854	*25.0%*	17,669	*27.5%*	22,195	*29.0%*	22,195	*27.7%*
Electrical	3,967	*8.4%*	8,065	*12.6%*	11,146	*14.6%*	12,986	*16.2%*
Construction	7,108	*15.0%*	7,613	*11.9%*	7,980	*10.4%*	7,980	*10.0%*

Source: JICA Project Team

(7) Gap Analysis between Existing Industries and Potential Opportunities

The Board of Investment has identified a number of specific areas in which to encourage inward investment promotion efforts, which develop existing sectors further, introduce new processes and products in sectors that relate to existing product types, and which suggest areas for development of industrial clusters, as shown in Table 6.2.13 below.

Table 6.2.13 Gap Analysis between Existing Industries and Potential Opportunities

First Classification (ISIC)	Product type	Share of Employment (2022)		Opportunity Areas (BoI)	Expected Share (2050)	Gap (2022-2050)
Textiles	**Mattresses and pillows**	0.70%	1,8%	**Pillow and Mattress Production**	4.3%	**+2.5**
	Additional textiles			**Leather Products manufacturing** **Clothing manufacturing** **Plain Cotton Fabric Production** **Wool Rug and Carpet String Production** **Military Uniform and Equipment Sewing** **Venetian Blind, Plastic Curtain, and Strip Curtain Production**		
Nonmetallic	Wood carpentry	8.35%	36.6%		20.6%	**-16.0**
	Plastic Products	7.86%		**PVC Manufacturing** **Plastic Pipe Manufacturing**		
	Hygiene	7.34%		**Cleaning Products Manufacturing**		
	Wash and Oil Services	3.15%				
	Cardboard and paper	1.54%		**Paper Products Manufacturing**		
	Glass	1.29%				
	Printing press	1.05%				
	Clothing	0.84%				
	LPG Services	0.39%				
	Carpet	0.39%				
	Co2, N2, O2 production and bottling	0.38%				
	Automotive oil production	0.36%		**Engine Lubricant Manufacturing Facility**		
	Furniture	0.27%		**Furniture Manufacturing (Tables and Chairs)**		
	Paint	0.14%				
	High pressure hose	0.14%				
	Manufacturing car batteries	0.11%		**Battery Manufacturing**		
	Charcoal	0.08%				
	Agricultural hose	0.07%				
	Decoration	0.06%				
	Gypsum board	0.04%				
	Cosmetic	0.03%				
Oil-Related	**Petrochemical Processing**	No data		**Ammonia, Urea, and Petrochemical Production** **Ethylene and Propylene Production** **Nylon and Polyester Fabric Manufacturing**	-	-

First Classification (ISIC)	Product type	Share of Employment (2022)		Opportunity Areas (BoI)	Expected Share (2050)	Gap (2022-2050)
				Pigments, Waxes, Glue, and Silicon Production **Chemical Fertilizer Production**		
Metallic	Blacksmith	6.46%	13.1%		10.1%	**-3.0**
	Aluminum & PVC	6.01%				
	Blacksmith (Doors & Windows & Fences)	3.34%				
	Blacksmith (Fences)	0.34%				
	Blacksmith (Furniture)	0.06%				
Machinery	Lorry and Truck Body Production	2.46%	5.6%		11.0%	**+5.4**
	Refrigerator and cooling machines	1.46%				
	Boiler and Water tank	0.72%				
	Manufacturing agriculture equipment	0.25%		**Agricultural Equipment Assembly**		
	Electrical generators	0.16%				
	Manufacturing equipment	0.13%				
	Car Body Production	0.11%		**Automotive Assembly** **Tire Manufacturing**		
Food Processing	Food Packaging	4.94%	21.3%	**Storage and Packaging for Fruits and Vegetables for Export**	29.0%	**+7.7**
	Chips	4.84%				
	Ice Cream	2.11%				
	Beverages	1.80%				
	Dairy	1.38%				
	Juice	0.84%				
	Ice	0.78%				
	Meat Products	0.77%				
	Sweets	0.76%				
	Salt	0.56%				
	Nuts	0.51%				
	Water	0.47%				
	Animal feed	0.44%				
	Food Production	0.44%		**Sugar Production** **Tomato Paste and Ketchup Production** **Vegetable Oil Production (olive, sunflower, maize)** **Dairy Production** **Fruit Juice Production** **Processing of Grain Products (pasta, noodles)** **Meat Processing and Packaging** **Honey Processing and Packaging** **Biscuits, Cakes, Chocolates, and other Confectionary Production**		
	Grains	0.37%				
	Syrup	0.34%				
	Cigarette	0.23%				
	Grinding grain	0.17%				
	Oil	0.09%				
	Pastry	0.06%				
Electrical	Electrical board	0.18%	0.9%		14.6%	+13.7
	Electricity pole	0.12%				
	Power transformers	0.10%				
	Electricity poles and networks	0.06%				
	Additional electrical and related			**Consumer Electronics Manufacturing** **Cable and Wire Manufacturing** **Electrical Switch and Socket Manufacturing**		
Construction	Concrete, Blocks & batching plant	10.84%	20.8%		10.4%	-10.4
	Tiles	3.01%				
	Block (Thermal)	2.48%				
	Asphalt	1.95%				

First Classification (ISIC)	Product type	Share of Employment (2022)		Opportunity Areas (BoI)	Expected Share (2050)	Gap (2022-2050)
	Brick	1.40%		**Brick Manufacturing**		
	Stone cutting and breaking	1.35%		**Marble and Granite Processing**		
	Plaster	0.23%				
	Construction materials	0.10%		**Cement Manufacturing** **Aluminum Scrap Recycling and Remanufacturing**		
	Qormid construction	0.07%				
	Construction of cabins and caravans	0.06%				
	Pavement construction	0.02%				
	Structural Profile Manufacture		0%	**Steel Structure and Profile Manufacturing** **Aluminum Profile Manufacturing** **Prefabricated Building Manufacturing** **Iron Melting and Production manufacturing (beams, bars)**		

Source: JICA Project Team based on figures by Ministry of Trade and Industry and information from BoI

The analysis presented in the table above sets out where the Kurdistan Board of Investment has identified projects that complement existing sectors and shows emerging clusters. The Kurdistan Region has substantial oil and gas reserves, positioning it as a compelling destination for investment related to the petrochemicals sector. By pursuing market-driven opportunities and attracting investment from domestic investors and foreign investment, the KRI will pursue the goal of becoming a leading supplier of petrochemical products derived from oil and natural gas. Other clusters around textiles and construction materials will be pursued.

The future development of the industrial manufacturing sector should be guided to encourage investment in and the development of industry sub-sectors which grow and expand clusters or networks of knowledge-driven industries. A cluster involves not just colocation of industries, but connections across different sectors and subsectors, and where supply chains and markets are linked. A cluster, for example, could include suppliers of specialist components, machinery and services, as well as connections up and down the supply chain, connecting complimentary products, skills of employees, technologies, or common inputs. Clusters often include governmental and other institutions including training providers, universities, research and technical support.[2]

The potential for the development of such clusters in Erbil and the Kurdistan Region include:

- Petrochemicals: Petrochemical product refinery, polymer production, plastic production, fertilizer production, lubricant oil manufacturing, rubber production, pigments, waxes and glue production
- Textiles: opportunities to develop textile processes and manufacturing benefitting from petrochemical processes
- Construction materials: opportunities for expanding existing construction materials and non-metallic mineral production sectors such as cement, with downstream products, and taking advantage of significant domestic and regional demand for construction
- Health and cosmetics sector: potential linkages with the Long-Term Development Vision of Erbil as an 'International Quality Service Centre', and drawing on existing strengths of universities in Erbil, as well as strengths in the health tourism sector
- Aviation Hub: potential to explore manufacturing as well as servicing opportunities in the context of the Long-Term Development Vision of Erbil as a 'Hub of Aviation'

The KRG has supported the formation of the Kurdistan Innovation Institute to support and invest in innovation and building expertise to support capacity of the manufacturing sector. The Institute brings together government, universities, and the industrial sector ecosystem and encourage sharing of ideas

[2] Cluster definition summarised from M. Porter (1998) 'Cluster and the New Economics of Competition in Harvard Business Review (https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition)

between them to develop the region's innovation.

(8) Eco-friendly Construction Materials Strategy (IND-S7)

In order to promote a diversified and circular economy in Erbil, the promotion of Eco-friendly Industrial Raw Materials such as bamboo, precast concrete, hempcrete, terrazzo, and cork is proposed. This strategy encompasses research, policy advocacy, supply chain development, capacity building, pilot projects, market development, and financial support.

- Research and Development: Collaborate with local and international institutions to study the feasibility and benefits of these materials in the context of Kurdistan and in link with other industrial clusters. Conduct thorough testing to ensure compliance with local standards.
- Policy Advocacy: Promote government incentives for green building practices and incorporate sustainable materials into urban plans such as Zoning Schemes and local building codes.
- Supply Chain Development: Identify and develop local sources for these materials and establish partnerships with suppliers to ensure a steady supply. Bamboo and hemp cultivation can be promoted in proposed Agro-Nodes or in tree buffers zones (see Section 10.3).
- Capacity Building: Implement training programs for construction workers and artisans, and provide ongoing technical support.
- Pilot Projects in Public Sector: Construct demonstration buildings for public facilities to showcase the viability and benefits of eco-friendly materials, with robust monitoring and evaluation frameworks.
- Market Development: Foster consumer demand and encourage product innovation through marketing initiatives, supported by Board of Investment.
- Financial Mechanisms: Explore green financing options and attract investments to support sustainable construction projects, especially through the Erbil Urban Climate Fund (see PART V Section 4.3).

(9) Need for offices, laboratories and other typologies

Associated with the aim of developing economic complexity and encouraging innovation, the development of some of these economic sectors will lead to the need for types of space that is not the traditional industrial space. For example, in creating an effective petrochemicals processing cluster, soft connectivity and opportunities to share knowledge and drive innovation will be needed. The provision of research and development space in the form of laboratories or offices will be facilitated. These should be collocated where possible within mixed use neighbourhoods contributing to vitality of CBDs as focal points for economic as well as cultural activity and providing local opportunities for employment with minimal commuting distances. (IND-U1-1).

As part of the KRG's Kurdistan Innovation Institute (KII) a KII Science Park has been proposed to build a 200,000 m^2 cluster of mixed offices, laboratories, workrooms, meeting areas, sports and accommodation facilities designed to support research and development in science and technology.[3]

(10) Industrial Water Demand Assessment

In the context of industrial water demand, the absence of a standardized unit water allocation for industrial purposes within Iraqi or Kurdistan jurisdictions necessitates reference to international benchmarks, such as those established in Japan or other Middle Eastern nations. The selection of appropriate criteria for water demand estimation is contingent upon the specificity required and the availability of data on industry size or employment figures.

Japanese methodology predominantly utilizes the number of industry employees and the type of industry to ascertain water usage, which could be adopted here if the industry classification is known. Additionally, empirical data can inform the calculation of specific unit water usage by industry. Alternatively, a more generalized approach may estimate industrial or commercial water consumption

[3] Source: KRG Prime Minister's Office

as a proportion of total water demand.

Conversations with the General Directorate of Water Services (GDWS) reveal that many factories rely on self-sourced underground or river water, rendering the volume of water extracted unmonitored. Although an estimation based on the overall percentage is feasible, a detailed analysis by industry type would exceed our current capabilities and would, therefore, require the expertise of an industrial sector specialist.

The unrecognized extraction of groundwater for industrial use presents a broader concern for the water resources sector, which warrants discussion and potential regulatory attention to ensure sustainable management and equitable distribution of this vital resource.

6.3 Tourism Sector

6.3.1 Existing Conditions

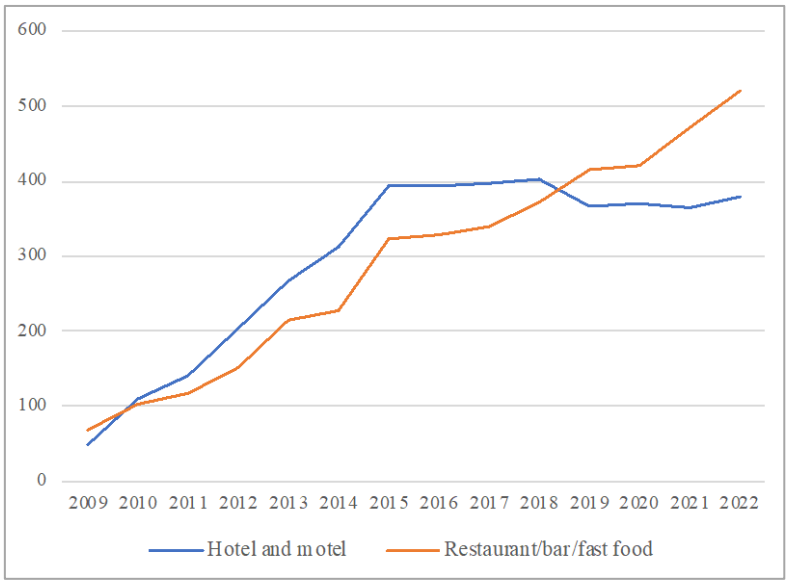
(1) Touristic Facilities

The numbers of the existing touristic facilities in Erbil Governorate are shown in Table 6.3.1. Figure 6.3.1 shows that the number of hotels plus motels continued to grow rapidly at an annual average rate of 41.5% between 2009 and 2015, then remained stable until 2022. The number of restaurants plus restaurant/bar plus fast food kept growing from 2009 until 2022 at an annual average of 16.8% per year.

Table 6.3.1 Number of Touristic Facilities in Erbil Governorate

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Hotel	38	80	101	147	187	214	275	276	273	280	272	278	266	282
Motel	11	30	40	57	81	99	119	118	124	123	95	93	98	98
Restaurant											200	202	237	262
Restaurant & Bar	69	102	117	151	215	228	323	329	340	372	52	50	62	72
Fast Food											163	169	173	187
Cafeteria	26	28	39	40	49	-	100	109	115	125	150	171	181	222
Touristic Village											3	3	3	4
Touristic Site	1	15	20	21	30	34	42	43	43	43	14	14	13	15
Touristic Resort											7	7	8	4
Coffe Shop	2	2	2	2	3	-	3	3	-	-	-	-	-	-
Amusement Park	-	-	-	-	-	3	3	3	3	-	4	4	2	4
Hall	8	10	12	13	14	23	26	26	27	-	21	22	23	25
Shops	122	166	167	189	198	-	248	250	260	277	162	172	176	181
Aviation Agency	5	-	-	-	-	-	-	-	-	-	11	11	11	25
Aviation Office	-	-	-	-	-	-	-	-	-	-	9	9	32	29
Aviation Company	157	164	178	178	275	275	278	278	280	-	2	2	243	447
Alcohol Selling Company	-	-	-	-	-	-	-	-	-	-	7	7	7	11
Massage Centers	-	-	-	-	-	-	-	-	-	-	13	13	13	18
Touristic Shades	-	-	-	-	-	-	-	-	-	-	-	-	-	9

Source: Board of Tourism



Source: JICA Project Team

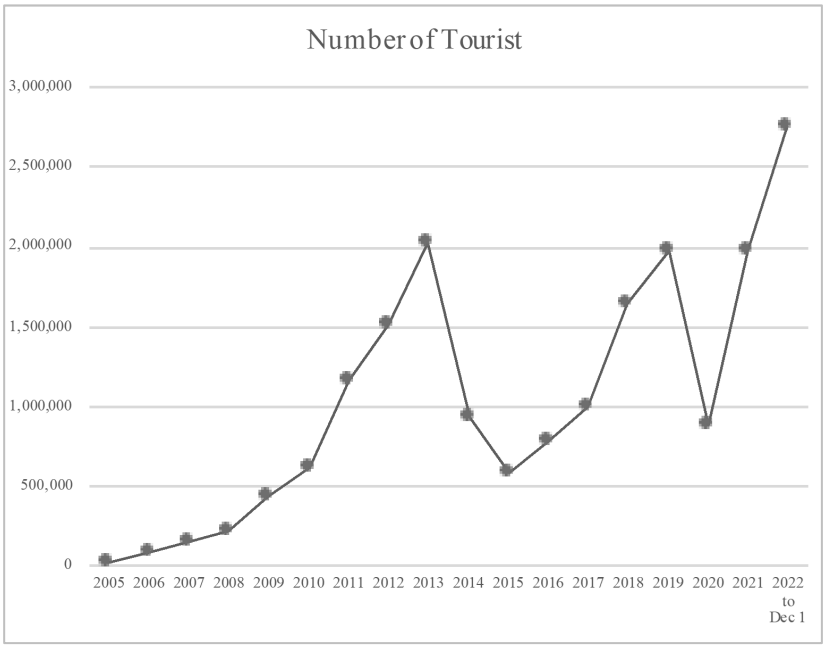
Figure 6.3.1 Number of Hotels/Motels and Restaurants/Bars/Fast Food

(2) Number of tourists

The number of tourists visiting Erbil Governorate is shown in Table 6.3.2 below.

Table 6.3.2 Number of Tourists to Erbil Governorate

Year	Number of Tourist
2005	17,898
2006	86,417
2007	153,571
2008	211,780
2009	426,398
2010	615,479
2011	1,168,174
2012	1,518,830
2013	2,029,623
2014	937,591
2015	579,876
2016	776,165
2017	996,621
2018	1,644,941
2019	1,983,391
2020	882,248
2021	1,975,000
2022 to Dec 1	2,752,523



Source: Board of Tourism

The number of tourists visiting Erbil was very low in 2005 because there were almost no touristic opportunities. The number rose sharply since then, mainly the tourists from the southern and central parts of Iraq, due to increased security. The number peaked at around 2 million in 2013, then declined suddenly due to the ISIS crisis for the following two years. They began to rise again in 2016 and exceeded the past peak in 2022 at 2.75 million, though the number dropped dramatically in 2020 due to COVID-19.

6.3.2 Key Planning Issues

(1) SWOT analysis

Table 6.3.3 SWOT Analysis of the Tourism Sector of the Kurdistan Region

Strengths	Weaknesses
- A positive of the Region from an international perspective - Natural assets - Historical and cultural assets - Economic and social growth - Government interest in developing the tourism sector - Interest in investing in the region	- Administrative structures - Weak policies and regulatory frameworks - Delayed planning for growth and its negative consequences - Weak institutions and channels for travel and tourism - Weak infrastructure - Poor quality/staff/marketing/information - Seasonal tourist activities and the lack of tourism research
Opportunities	**Threats**
- Source markets growth - Investment possibilities - Government support - Providing resources - Interest in education	- Competition with neighbouring countries - Rising costs - Lack of demand for tourism investment - Lack of staff - Environmental degradation

The Ministry of Municipalities and Tourism and the Board of Tourism prepared a plan titled "Tourism

Strategic Plan for Kurdistan Region (Tourism MP 2013)" in 2013. A SWOT analysis was undertaken in Tourism MP 2013 as shown in Table 6.3.3 above.

(2) Tourism Development Policy

1) Policies and targets

Tourism MP 2013 presents the vision, mission, values and principles and strategies for tourism promotion in the Kurdistan Region as shown in Table 6.3.2 below.

These key concepts are still valid as of January 2023. The Board of Tourism indicated the following directions for tourism promotion in January 2023.

- The prime minister indicated the directions of tourism promotion including improvement of curriculum for tourism human resources development, obligation to employ Kurdistan workforce at more than 75% (it is less now), and new types of tourism such as medical tourism, dark tourism (museum/monument showing genocide and tortures by the previous regime, like Hiroshima)
- The target of tourist arrivals to Kurdistan is 20 million by 2030. They were roughly 4 million in 2021 and 6 million in 2022.

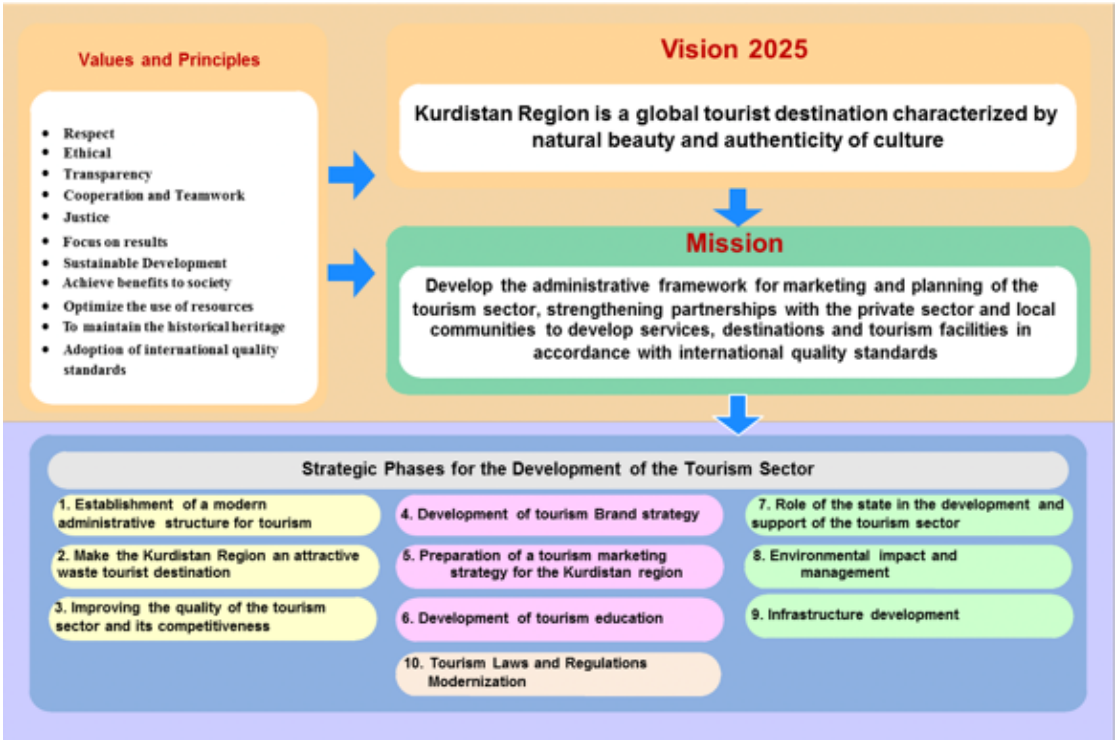


Figure 6.3.2 Vision, Mission, Values and Principles and Strategies for Tourism Promotion in the Kurdistan Region Proposed by Tourism Master Plan 2013

2) Tourism promotion in the Erbil 2050 MP area

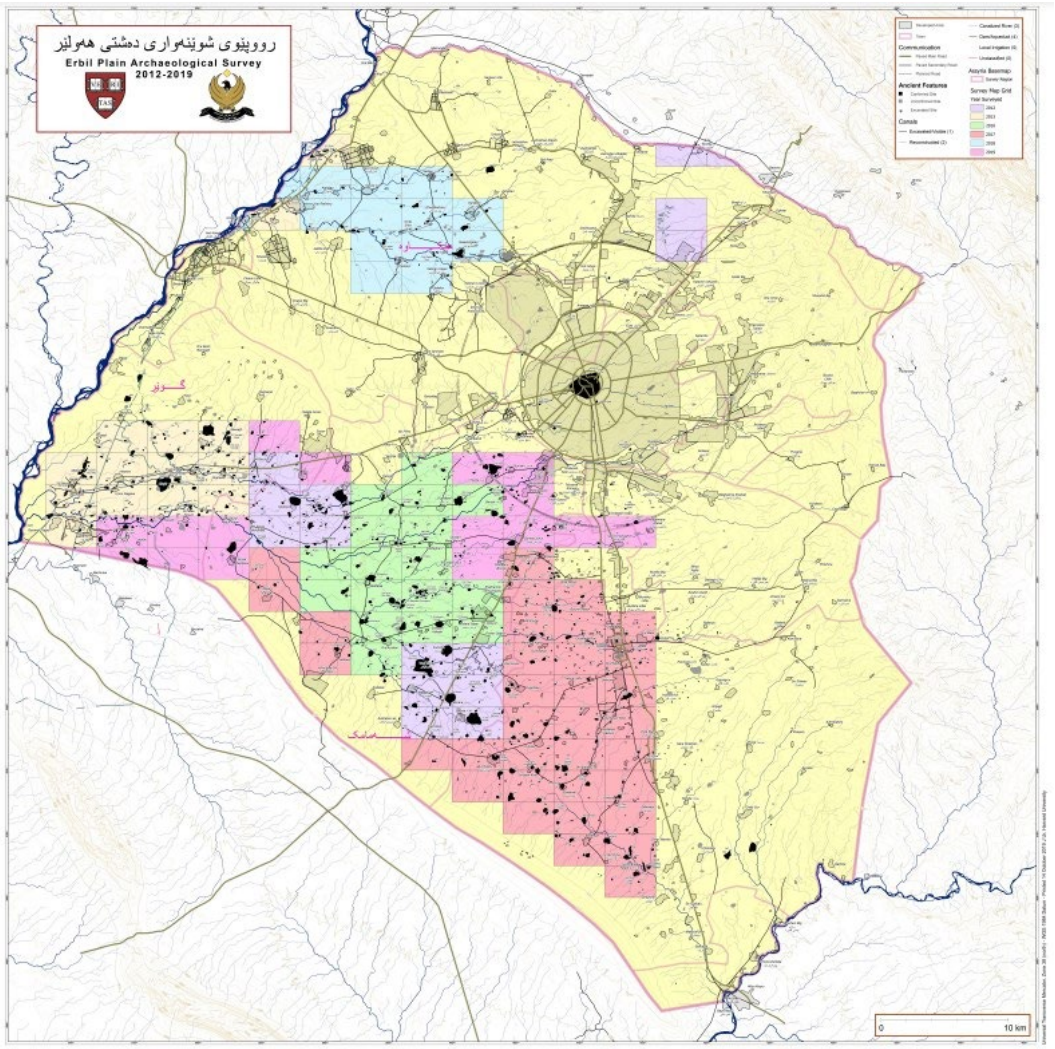
Tourism MP 2013 indicates the major touristic destinations as shown in Table 6.3.3.

Erbil City is itself a major touristic destination with an important cultural/ historical asset such as Citadel and modern accommodation, entertainment, shopping and business facilities as well as the major gateway for the entire Kurdistan region. Although Citadel has a potential to be an attractive touristic attraction, its quality is being degraded due to inadequate maintenance.

The following eleven possibilities are indicated for tourism promotion for Erbil by Tourism MP 2013: (i) annual special events, (ii) restored Citadel, (iii) traditional area around Citadel, (iv) Museum of Modern History, (v) "Aqua Park" with "health centers", (vi) art gallery, (vii) "Garden of Paradise" city

center park, (viii) indoor entertainment complex, (ix) public transport system with banners and sign posts, (x) entertainment center, (xi) assignment of a major street for tourist hotels and restaurants of global brand.

As shown in Figure 6.3.4, there are numerous archaeological sites in and around Erbil, which can be attractive touristic destinations once properly renovated. There is a law concerning archaeological sites. There is a committee headed by the Director General of the Board of Tourism and comprising the General Directorate of Antiquities and Heritage of the Ministry of Municipality and Tourism. It is surveying all the regions to identify the areas for preservation and giving priority. They will renovate and provide a guideline for investors.



Source: MoMT/General Directorate of Antiquities and Heritage

Figure 6.3.3 Archaeological Sites in and around Erbil City

6.3.3 Sector Strategies & Policies

(3) Overall Goals of Tourism Sector

The Overall Goals of the Tourism Sector development in Kurdistan Region including Erbil, which are outlined in the Tourism Strategic Plan for Kurdistan Region (MoMT/Board of Tourism, 2013), in the 8-year plan (2020-2029) from the Board of Tourism, in the 10-year plan (2020-2029) from the Directorate of Tourism Erbil, in the Council of Minister's Resolution N° 151 of June 5, 2022 as well as contained in the latest policies of Board of Investment (2023), and which will realize the Long-term Development Visions, can be summarized as below.

- TOU-I: Generate economic wealth and job opportunities that can benefit directly and indirectly to the Region as a whole but also to the local communities
- TOU-II: Attract more tourists from all Iraqi provinces
- TOU-III: Increase the number of foreign tourists
- TOU-IV: Diversify the tourism offer in terms of activities, spatially and on the four seasons, taking consideration of extreme hot temperatures in the summer
- TOU-V: Improve quality of tourism services and develop tourism infrastructure
- TOU-VI: Strengthen tourism marketing
- TOU-VII: Promote eco-friendly, sustainable, low-carbon and inclusive tourism practices and make it benefit to Erbil host communities
- TOU-VIII: Strengthen a deeper understanding and appreciation among Erbil's residents for their city's history, topography, culture, and natural beauty.

(4) Linkage with Strategic Orientations of Erbil 2050 MP

Strategies and Policies of Tourism Sector mainly support the realization of the Strategic Orientation #7: Encourage strong Kurdish identity into the promotion of sustainable tourism (See Section 5.4.7), which implements especially the Long-term Development Vision (See Section 4.2) of Diversified Economy (DEC).

(5) Strategies & Policies of Tourism Sector

Table 6.3.4 below summarizes the Strategies & Policies of Tourism Sector proposed to tackle existing issues and to achieve Erbil 2050 MP Long-Term Visions and Overall Sector Goals.

Table 6.3.4 Strategies & Policies of Tourism Sector

Theme	Sector Strategy / Policy	Action / Priority Project / KPI	Planning Issue to solve & Sector Goal to achieve
International & Regional Influence	**TOU-S1**: Become a Tourism Hub/Gateway of the whole Kurdistan Region for both international and domestic visitors	- **TOU-S1-1**: Promote Erbil International Airport as a unique gateway to international visitors, by setting-up an information kiosk within the airport, that provides brochures, maps showcasing local attractions and events. - **TOU-S1-2**: Promote Erbil Citadel as the major pivot of international and domestic tourists to showcase information about touristic activities available in Erbil and in the whole Kurdistan, by implementing *The Kurdistan Experience*. - **TOU-S1-3**: Establish the entrance to Erbil from Kirkuk Road as a gateway for domestic visitors coming by road (by bus or car), by developing a unique Welcome Pavilion where visitors can rest, get information on key attractions and accommodation, and can park their vehicle to board on public transportation to join the city centre.	- [TOU-VI] Strengthen tourism marketing - [TOU-II] Attract more tourists from all Iraqi provinces - [TOU-III] Increase the number of foreign tourists
	TOU-S2: Host Major Events & Festivals	- **TOU-S2-1**: Promote the hosting of international and national scale sports events in new dedicated large-scale public facilities.	- [TOU-II] - [TOU-III] - [TOU-VIII]

		- **TOU-S2-2**: Promote the hosting of musical and theatral events in new dedicated public facilities. - **TOU-S2-3**: Promote the creation of new Cultural Festivals with the potential of international renown, inspired by Kurdish culture and history.	Strengthen a deeper understanding and appreciation among Erbil's residents for their city
Cultural & Historical Tourism	**TOU-S3:** Erbil Citadel Revitalization	- **TOU-S3-1**: Promote the establishment of new touristic and economic activities through the formulation of the Erbil Citadel Revitalization strategy and plan.	- [TOU-II] - [TOU-III] - [TOU-VIII]
	TOU-S4: City Centre Traditional Urban Heritage Enhancement	- **TOU-S4-1**: Restore various types of valuable key urban heritage in the oldest part of Erbil City (Municipality 1), and promote them as both cultural touristic attractions and effective places of socialization for local communities: o Commercial heritage such as Sheikhalla and Qaisary Markets; o Traditional houses to be turned into museums or accommodation options close to the Citadel; o Religious heritage such as Choli Minaret, Khanaqa mosque, and numerous other old mosques.	
	TOU-S5: Archaeological Tourism Development	- **TOU-S5-1**: Based on the survey by Directorate of Antiquities and Harvard University, identify high-potential archaeological sites and elaborate a detailed plan for archaeological excavations, ensuring proper environmental protection of sites as well as documentation and preservation of artifacts; - **TOU-S5-2:** Establish on-site museums, visitor centres nearby Archaeological Sites to provide information, guided tours, and educational resources, and develop accessibility infrastructure. - **TOU-S5-3:** Promote the development of supporting facilities such as accommodation in villages surrounding archaeological sites (Sebiran, Gainj, Kawr, Duztapa) so that Archaeological Tourism can also benefit to local economy. - **TOU-S5-4:** Establish a coherent and complimentary network of Erbil Archaeological Sites.	- [TOU-I] Generate economic wealth and job opportunities that can benefit directly and indirectly to the Region as a whole but also to the local communities - [TOU-III]
Nature Tourism (including both Ecological and Recreational)	**TOU-S6:** Valley Tourism Development	- **TOU-S6-1**: Develop both eco-tourism and recreational Valley Tourism activities on the natural valleys of Chamirga in the Southeast of the Target Area.	- [TOU-VII]
	TOU-S7: River Tourism Development	- **TOU-S7-1:** Develop River Tourism activities on Great Zab River, on strategic locations at the entrance of the city from Mosul and Duhok. - **TOU-S7-2:** Promote River Tourism activities on and alongside newly developed Cornish river	- [TOU-VII]
	TOU-S8: Water-based Tourism Development	- **TOU-S8-1**: Develop both eco-tourism and recreational Water-based Tourism activities on Pirzin Lake. - **TOU-S8-2**: Develop both eco-tourism and recreational Water-based Tourism activities on Bastora Dam Lake. - B **TOU-S8-3**: Develop both eco-tourism and recreational Water-based Tourism activities on Mandawa Dam Lake.	- [TOU-IV] Diversify the tourism offer in terms of activities, spatially and on the four seasons - [TOU-II] - [TOU-III]
	B **TOU-S9:** Mountain Tourism Development	- **TOU-S9-1**: Develop both eco-tourism and recreational Mountain Tourism activities on the hilly areas of Garwdalalan, on the road between Bahirka and Mandawa.	
Agri & Culinary Tourism	**TOU-S10:** Agricultural & Culinary Experience Tourism Development	- **TOU-S10-1**: Promote Agricultural & Culinary Experience Tourism such as Farmer's markets where fresh produce and local cooked food is served, inside the Inner Green Belt through road-side agroforestry key locations. - **TOU-S10-2:** Promote Agricultural & Culinary Experience Tourism in orchards areas near Bragh in the Northeast of Erbil.	
	TOU-S11: Food Terroir & Marketing Development	- **TOU-S11-1**: Establish a roadside 'Michinoeki station' on the strategic location of Bragh between Erbil and Shaqlawa that proposes comprehensive services for visitors (parking, local products and souvenirs for sale, restaurants, etc.).	

Urban Tourism (MICE, Medical and Shopping Tourism)	**TOU-S12:** MICE Tourism Development	- **TOU-S12-1**: Endorse Erbil as the Meetings, Incentives, Conferences, and Exhibitions/Events (MICE) tourism capital of Kurdistan and of Northern Iraq.	
	TOU-S13: Medical Tourism	- **TOU-S13-1**: Promote the Medical Tourism Sector in Erbil to attract more visitors from nearby regions.	
	TOU-S14: Shopping Tourism	- **TOU-S14-1**: Promote various types of accommodation and high-standing shopping venues.	
Policies	**TOU-P1**: Reach a high level of hospitality	- **TOU-P1-1:** Promote the creation of a travel environment in Erbil that fosters high levels of hospitality, leading to customers satisfaction and visit repetition. Hospitality shall be considered as a key indicator of Tourism sector (assessment of existing levels of hospitality shall be done through customer surveys, collection of online reviews, etc.).	- [TOU-V] Improve the quality of tourism services
	TOU-P2: Environmental considerations *[BoT]*	- **TOU-P2-1:** Environmental considerations when increasing the number of tourists and developing an environmental plan that is consistent with this expansion in this important sector. In addition to the following: - **TOU-P2-2:** Adopting a green and sustainable tourism slogan - **TOU-P2-3:** Supporting local communities in creating job opportunities and opening environmental bazaars (heritage and folkloric handicrafts) - **TOU-P2-4:** Environmentally friendly means of transportation - **TOU-P2-5:** Sustainable waste management to preserve the environment - **TOU-P2-6:** Periodic environmental monitoring and inspection of tourist sites to ensure compliance with environmental conditions - **TOU-P2-7:** Taking into consideration safety issues for visitors and tourists on rivers and mountainous areas	- [TOU-VII] Promote eco-friendly, sustainable, low-carbon and inclusive tourism practices and make it benefit to Erbil host communities

Source: JICA Project Team

6.3.4 Tourism Sector Development Plan

(1) Development Targets for Tourism Sector

In accordance with the Socio-Economic Framework and necessary units necessary for calculation and planning, Development Targets for the Tourism Sector in 2030, 2040 and 2050 population, are summarized in Table 6.3.5 below and explained in the subsequent sections.

Table 6.3.5 Development Targets for Tourism Sector

Item	Unit	Baseline (2022)	2030	2040	2050
Population	Nbr. of Residents	1,861,870	2,200,443	2,620,343	3,008,501
Visitors	Nbr. of Visitors	2,752,523	4,036,655	4,993,503	6,000,000
Visitors Growth Rate	%	2.15%	2.15%	2.15%	2.15%
Tourism Dependency Rate	%	148%	183%	191%	200%
Average Length of Stay (ALOS)	Nbr. of Nights	2.0	2.5	3.0	3.5
Total Bed-Nights Demand	Nbr. of Bed-Nights	5,505,046	10,091,638	14,980,509	21,000,000

Source: JICA Project Team, Board of Tourism

1) Estimated Number of Visitors in Erbil

KRG Vision 2030 is expecting that the annual number of visitors in the whole Kurdistan Region will double from 3,057,000 in 2020 to 6,114,000 at horizon 2030. Even though some well-known areas in the world have doubled their numbers of visitors within a decade, such as Dubai (UAE) with a growth rate of 6 to 7% per year, or Bali (Indonesia) and Phuket (Thailand) with 8 to 10% increase per year from the 2000's to the 2010's, it seems difficult for Erbil, based on its potentials and threats, to reach the same growth pattern. Erbil may be closer to Amman, which has the role of a gateway to Jordan's historical and archaeological treasures, and which has experienced a relatively modest yet steady tourism growth,

with an average annual increase of approximately 3 to 4% from 2010 to 2021. Therefore, the annual increase rate of visitors in Erbil is set to 2.15 %.

2) Tourism Dependency Ratio

In 2050, when the population in Erbil will reach 3 million, the rounded figure of annual visitors is estimated to reach 6,000,000, slightly less than the double of the current figure, corresponding to a Tourism Dependency Ratio (ratio of annual visitors to the resident population) that is growing from 148% currently to 200%, which seems to be a decent yet challenging goal to achieve for the future economic diversification. For the sake of comparison, while cities like Venice (Italy) and Petra (Jordan) boast some of the world's highest Tourism Dependency Ratios, at 10,000% and 2,000%, respectively, smaller tourist destinations such as Muscat (Oman) and Aqaba (Jordan), renowned for their natural beauty and historical significance, exhibit a Tourism Dependency Ratio of 200%.

3) Average Length of Stay (ALOS)

The Average Length of Stay (ALOS) is the average number of nights visitors are expected to stay in the city. In the absence of data on ALOS in Erbil, it is estimated at 2.0 for the baseline situation in 2022, considering that other major touristic destinations worldwide fluctuate between 2 nights for Granada (Spain) or Bruges (Belgium), 2 to 3 nights in Amman (Jordan) or Shiraz (Iran), 3 to 4 nights in Dubai (UAE) or Rome (Italy) and 4 to 5 nights in Tokyo (Japan) or Sydney (Australia). The implementation of the above-mentioned strategies which operates a diversification and a both temporal and spatial expansion of the tourism offer, is expected to have an impact on the extension of the ALOS, growing from 2.0 in 2022, 2.5 in 2030, 3.0 in 2040 and 3.5 in 2050, showing an average annual growth rate of 1.68%.

4) Total Bed-Nights Demand

The Total Bed-Nights Demand, calculated based on the number of visitors and the ALOS, is estimated to be of 5,505,046 in 2022, 10,091,638 in 2030, 14,980,509 in 2040 and 21,000,000 in 2050, showing the figure more than tripling in three decades, and an average annual growth rate of approximately 8%.

5) Existing Accommodation Capacity and Future Forecast of Accommodation Supply Needs

It is necessary to assess the current number of hotel rooms and beds available in Erbil to complete the Tourism Sector Development Plan. This analysis will help in identifying gaps in accommodation supply and areas that require additional development. While JICA Project Teams would like thank the Board of Tourism and the Directorate of Tourism Erbil for their previous cooperation, their further assistance will be needed to complete the Tourism Sector Development Plan, which results will be published in PGR2.

(2) Basic Target Market Identification

Target Market Identification involves selecting and defining the specific groups of individuals or businesses that a tourism product or destination aims to attract. The Table 6.3.6 below displays a Basic Target Market Identification for Erbil Tourism Sector, including general travel motivations, destination preferences, cultural expectations, and average annual outbound tourists by region. The linkage of the Target to the proposed Strategy is mentioned in the right column.

Table 6.3.6 Basic Target Market Identification for Erbil Tourism Sector

Origin of Visitor	Main Travel Motivations	Destination Preferences	Accommodation Preferences	Cultural Expectations	Related Strategy
Europe (approx. 500 million outbound tourists annually)	- Cultural experiences: European tourists are drawn to destinations with rich histories, museums, and cultural events. - Leisure and relaxation: They often seek to unwind and relax on their	- Mediterranean destinations (Spain, Italy, Greece) - Western Europe (France, UK) - Historical cities	- Europe's tourists often prefer a variety of options, from luxury hotels and resorts to boutique hotels and vacation rentals. - Budget-friendly choices: Hostels and budget hotels are popular among younger	- Interest in historical and cultural sites - Culinary experiences - Appreciation for art and	TOU-S2 TOU-S3 TOU-S4 TOU-S5 TOU-S7 TOU-S8 TOU-S10 TOU-S12

Origin of Visitor	Main Travel Motivations	Destination Preferences	Accommodation Preferences	Cultural Expectations	Related Strategy
	vacations, enjoying beautiful landscapes, beaches, and outdoor activities. - Adventure: Some seek adventure through hiking, skiing, or other outdoor activities.	(Rome, Paris) - Nature destinations (Switzerland, Austria)	travellers.	architecture	
Asia (approx. 350 million outbound tourists annually)	- Cultural discovery: Asian tourists often travel to learn about different cultures, traditions, and history. - Nature and wildlife experiences: Many seek nature-based adventures. - Shopping: Asian tourists are known for their shopping enthusiasm.	- Southeast Asia (Thailand, Bali, Vietnam) - Historical and cultural sites (China, India) - Japan for its unique culture - Shopping in South Korea and Hong Kong	- Wide range of accommodations: Asia's travellers prefer everything from high-end luxury hotels to budget-friendly guesthouses. - Eco-friendly options: Eco-resorts and lodges are gaining popularity.	- Respect for traditions and customs - Importance of family and group harmony - Varied expectations depending on country and culture	TOU-S3 TOU-S6 TOU-S7 TOU-S8 TOU-S9 TOU-S10 TOU-S11 TOU-S12 TOU-S14
North America (approx. 90 million outbound tourists annually)	- Adventure and outdoor activities: Many North American tourists seek adventure through activities like hiking, skiing, and water sports. - Family vacations: Family-friendly destinations and accommodations are a common choice. - Cultural exploration: They are interested in exploring the history and culture of their chosen destinations.	- European destinations (Italy, France, UK) - Beach destinations (Caribbean, Mexico) - National parks (US and Canada) - Urban centres (New York, London)	- Variety of accommodation types: North American tourists prefer a range of options, from hotels and vacation rentals to RV parks and campgrounds. - Family-friendly options: Resorts with activities for children and larger suites or condos for families.	- Appreciation for diverse cultures and cuisines - Respect for local customs and traditions - Casual and friendly interactions	TOU-S3 TOU-S6 TOU-S7 TOU-S8 TOU-S9 TOU-S10 TOU-S12
Middle East (approx. 50 million outbound tourists annually)	- Family gatherings: Family is a central focus for Middle Eastern tourists, and they often travel to reunite with relatives. - Religious pilgrimages: Many undertake journeys to Mecca and Medina for religious purposes. - Luxury travel: High-end accommodations and experiences are preferred by some.	- Islamic destinations (Mecca and Medina for pilgrimage) - Luxury resorts and cities (Dubai, Istanbul) - Exotic destinations (Maldives, Seychelles) - Historical and cultural sites (Egypt, Jordan)	- Luxury resorts and hotels: Middle Eastern tourists often seek opulent accommodation options, including 5-star resorts and serviced apartments. - Family-friendly accommodations: Spacious suites or villas are favoured for family gatherings.	- Focus on religious and historical sites - High-end shopping and luxury experiences - Cultural respect and modesty in dress and behaviour	TOU-S3 TOU-S4 TOU-S6 TOU-S7 TOU-S8 TOU-S9 TOU-S12 TOU-S13 TOU-S14

Source: JICA Project Team based on UNWTO Tourism Barometer 2022, TripAdvisor Travelers' Choice Awards

(3) Additional Explanation of Strategies, Policies and Actions

1) International & Regional Influence Strategies

International & Regional Hub (TOU-S1)

Aspiring to establish itself as the preeminent Tourism Hub and Gateway for the entire Kurdistan Region, Erbil shall establish a comprehensive strategy to attract both international and domestic visitors. The focal point of this initiative is the elevation of Erbil International Airport into a distinctive gateway for international visitors (TOU-S1-1). Within the airport premises, the implementation of an information kiosk shall serve as an integral component, disseminating informative brochures and maps that showcase local attractions and events. Central to this strategy is the promotion of the Erbil Citadel as the cornerstone of tourist activity, acting as a pivot for both international and domestic visitors (TOU-S1-2). Leveraging *The Kurdistan Experience*, as it was planned in Erbil 2030 MP (Refer to Section 3.4.8),

an initiative encapsulating the richness of regional culture and heritage, Erbil aims to position itself as a beacon of cultural tourism. Furthermore, the establishment of the entrance of Erbil from Kirkuk Road as a gateway for domestic visitors underscores the commitment to visitors from all Iraqi provinces (TOU-S1-3). A unique Welcome Pavilion will be developed, offering a resting area, comprehensive information on key attractions and accommodation, and facilitating seamless transitions to public transportation for convenient access to the city centre.

Host Major Events & Festivals (TOU-S2)

TOU-S2-1 & 2: Erbil, as the capital city of Kurdistan Regional, is poised to strategically elevate its cultural and recreational profile by hosting large-scale international and national sports and music events. The city should prioritize the construction of state-of-the-art public facilities that can accommodate such events (such as, for sports events, in North Sports Complex in Daraban Core or South Sports Complex on Kirkuk Road in as explained in Strategy PBF-S1-2, and for musical events, in National Performance Hall in Bahirka Core and in Open Theatre as explained in Strategy PBF-S1-6), thereby creating a magnetic draw for domestic visitors from surrounding cities and regions. The objective is to position Erbil as a regional hub for entertainment, fostering cultural exchange and economic growth. By attracting high-profile events, the city aims to enhance its reputation as a dynamic cultural and recreational centre, encouraging increased tourism and patronage from residents of neighbouring cities within the Kurdistan Region. The proposed initiative aligns with the broader objective of bolstering Erbil's status as a vibrant and inclusive metropolis with a diverse range of offerings, further solidifying its position as the cultural and economic heart of Kurdistan.

TOU-S2-3: Erbil, as a city with a rich cultural heritage, shall strategically promote the inception of new Cultural Festivals that possess the potential for international acclaim, drawing inspiration from the profound tapestry of Kurdish culture and history. The city's ambition should be to establish festivals that attain global recognition akin to renowned celebrations such as the Carnival in Rio de Janeiro in Brazil, the Diwali Festival of Lights in India or the Aomori Nebuta Festival in Japan. By harnessing the distinctiveness of Kurdish traditions, Erbil can cultivate unique cultural experiences that resonate on a global scale. Festivals celebrating Kurdish music and dance, with distinctive Kurdish clothes and colours, lightings of Newroz’s bonfires and traditional culinary arts could be conceived to engage and captivate international audiences. Additionally, historical commemoration of the Anfal campaigns and of the Halabja chemical attack with a memorial festival that promotes peace and solidarity, can be hold once a year. It is recommended to hire international consultants to formulate a complete strategy and plan of Cultural Festival creation.

2) Cultural & Historical Tourism Strategies

Citadel Revitalization (TOU-S3)

The Erbil Citadel is one of the oldest continuously inhabited settlements in the world, boasting a rich historical and cultural heritage. Recent efforts have focused on the extensive renovation of the Citadel's buildings carried out under the supervision of the High Commission for Erbil Citadel Revitalization (HCECR) under Erbil Governorate Office to preserve its historical significance. The next crucial step is to reintroduce life and vitality into the Citadel, in order to transform it into a thriving hub for tourists and local communities. While the traditional architecture and exterior aspect of the Citadel shall be preserved, the inside of buildings will propose new activities.

The primary objective of Citadel Revitalization is to leverage the restored Erbil Citadel for economic gain by attracting tourists, supporting local artisans and businesses, and promoting the region's culture and history. To achieve this objective, the ideas mentioned in the Table 6.3.7 below must be refined and developed through a specific Citadel Revitalization strategy and plan.

Table 6.3.7 Possible Activities to be implanted through Citadel Revitalization

Theme	Possible Activities	International Examples & Recommendations
Art, Cultural and Educational Facilities	- Establish a few traditional dwellings as Heritage Houses to be used as living museums, offering visitors a glimpse into the architecture, furnishings, and daily life of a particular historical period or cultural context or the Citadel; - Organize educational programs to enhance visitor knowledge; - Introduce art galleries in Heritage Houses of the Citadel. - Organize festivals and cultural events within the Citadel.	- In Fes Medina, Morocco, a UNESCO World Heritage Site known for its rich history, traditional architecture, and vibrant culture, there are numerous examples of Heritage Houses that showcase the traditional Moroccan lifestyle: Dar Batha (former royal palace turned into museum), Dar Seffarine (restored 14th-century house been transformed into a guesthouse), etc.
Accommodation	- Variety of accommodation options from high-standard boutique hotels to guesthouses.	
Economic Activities	- Introduce authentic Kurdish restaurants and speciality shops; - Create spaces for local artisans to produce and sell traditional handicrafts (carpets and kilims, jewellery, textiles, ceramics etc.).	
Promotion of Kurdistan's Touristic Sites	- Set up tourist information centres within the Citadel (refer to TOU-S1).	

Source: JICA Project Team

In terms of implementation, KRG can get inspiration from urban acupuncture approach that was developed in Taipei (Taiwan) through their Urban Regeneration Stations (URS), which is a strategy that uses small-scale, targeted interventions to revitalize urban spaces and stimulate community engagement. It involves identifying specific underutilized or abandoned areas within the city and transforming them into dynamic, community-oriented hubs. Public organizations play a central role in the Urban Acupuncture approach by coordinating and supporting these revitalization efforts. It is recommended to hire international consultants to formulate a complete Citadel Revitalization strategy and plan, and to establish the Erbil Urban Renewal and Citadel Revitalization Committee.

3) Nature Tourism Strategies

Based on the Planning Principle of combination of Eco-Tourism and Recreational Activities in Nature Tourism Sites contained in Strategic Orientation #7: Encourage strong Kurdish identity into the promotion of sustainable tourism (See Section 5.4.7), Table 6.3.8 shows the possible activities to be integrated in each Nature Tourism sites.

Table 6.3.8 Possible Eco-Tourism and Recreation Activities in Nature Tourism Sites

		Water-based Tourism (Bastora /Mandawa 🄱)	Mountain Tourism (Garwdalalan)	Valley Tourism (Bira Jina)	River Tourism (Great Zab River)
Nature Tourism	Eco-Touristic Activities	- Lakeside Picnic - Kayaking/Canoeing - Lake-side hiking - Bird watching - Camping & Stargazing	- Botanical Tours - Nature Photography - Wildlife Observation - Camping	- Hiking - Nature Photography - Cultural Experiences (visit Local Villages) - Camping	- River Cruises - Bird watching - River-side hiking - Riverbank Yoga
	Recreational Activities	- Fishing - Sailing & Windsurfing - Stand-Up Paddleboarding - Wakeboarding - Swimming Beaches - Water sliders and diving boards	- Trekking - Mountain Biking - Rock Climbing - Zip Lining - Off-Roading - ATV Riding	- Trail Running - Hiking - Horseback Riding - Off-Roading - ATV Riding	- Kayaking/Canoeing - Rafting - Fishing - Camping - River-side Restaurant

Source: JICA Project Team

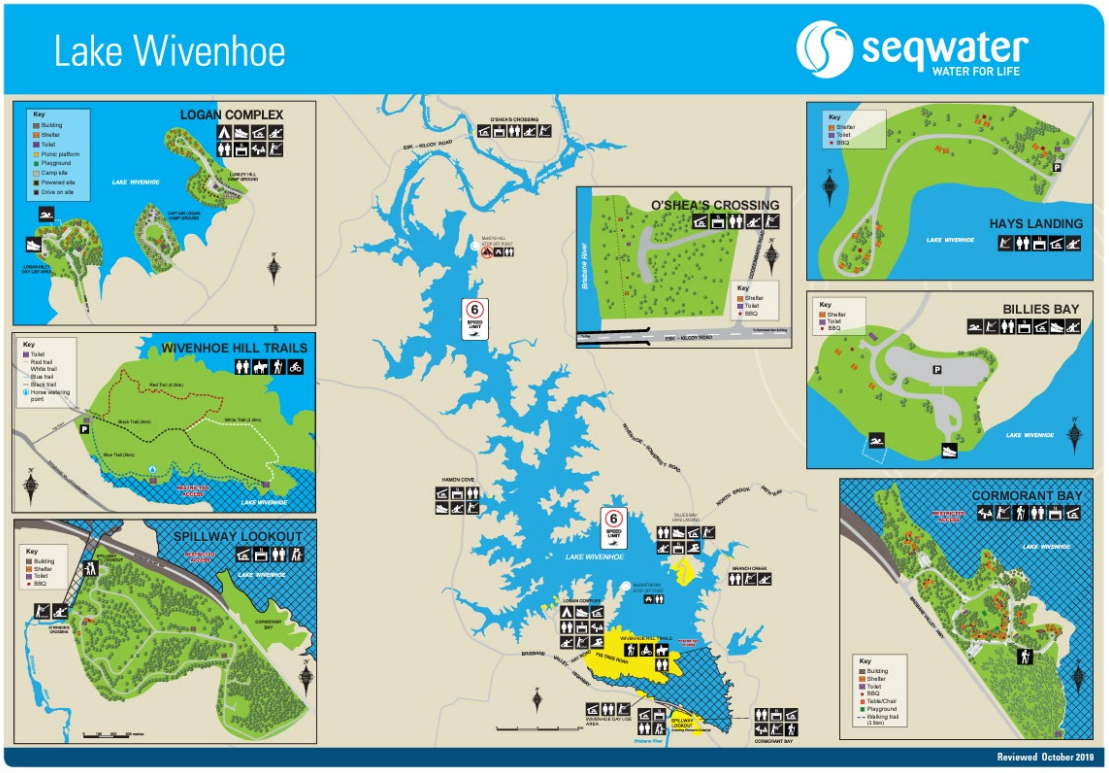
<u>Water-based Tourism Development (TOU-S6)</u>

The planning of Water-Based Tourism including eco-tourism and recreational activities on urban lakes such as Pirzin Lake, or on dam lakes, such as Mandawa Dam Lake 🄱, demands careful consideration and strategic separation to ensure the harmonious coexistence of nature-based experiences and leisure

pursuits.

This integration should be guided by comprehensive regulations that prioritize environmental preservation, safety, and sustainable tourism practices. Successful international examples showcase the effectiveness of well-planned initiatives, for instance Wivenhoe Dam in Australia, which has successfully implemented measures to regulate eco-tourism and recreational activities, as shown on Figure 6.3.4 below. With designated areas for bird watching, nature walks, and eco-friendly tourism, it coexists seamlessly with spaces dedicated to water sports, swimming, and leisure activities. Similarly, Lake Tahoe in the United States is renowned for its clear waters and well-managed recreational zones, offering a balance between eco-conscious exploration and water-based leisure.

These examples underscore the importance of thoughtful planning and clear regulations to create a thriving and sustainable environment that caters to diverse interests while safeguarding the ecological integrity of dam lake ecosystems. It is therefore recommended to hire international consultants with an expertise in tourism and environmental planning to formulate Mandawa Dam Lake Recreation Strategy and Zoning Plan alongside the planning of urban development in this area.



Source: Seqwater (2019)

Figure 6.3.4 Example of Mixed Tourism Activities planned on Dam Lake (Lake Wivenhoe)

4) Agri & Culinary Tourism Strategies

Food Terroir & Marketing Development (TOU-S11)

In order to foster a sustainable form of tourism and to showcase the rich agricultural potential of Kurdistan, it is proposed to establish a roadside 'Michinoeki station' at the strategic crossroads of Bragh, strategically located between Erbil and Shaqlawa.

Drawing inspiration from the Japanese model, the Michinoeki, or Michi no Eki, literally meaning Roadside Station, is envisioned as a comprehensive facility offering an array of services to road visitors. Beyond conventional amenities such as parking, restaurants, and rest areas, the station aims to become a focal point for the promotion and sale of local products and souvenirs, thereby providing a platform for regional artisans and producers. This strategic location presents an opportune gateway to highlight and develop the food terroir and agricultural products unique to Kurdistan.

6.4 Investment Sector

6.4.1 Existing Conditions

(1) Recent Investment Trends

Trends of investments in the Kurdistan Region and Erbil Governorate are reviewed, referring to the data on the list of projects approved by the Board of Investment and the General Directorate of Investment Erbil, which are publicized on the Board of Investment homepage. These data are to be replaced with updated data to be provided by the General Directorate of Investment Erbil once they are made available.

Table 6.4.1 below shows that Erbil Governorate attracts the highest portions of investments in terms of the number of investments including those by foreign investors and investment value. Sector-wise, Erbil attracted the highest investments in housing, tourism, and trading projects, whereas Sulaymania and Duhok attracted the highest investments in industry and agriculture respectively.

Table 6.4.1 Investment Trends of the Kurdistan Region by Governorate

Item		Unit	Duhok	Sulaymania	Erbil	Total
Number of Projects		Number	276	273	449	998
		%	28%	27%	45%	100%
Investment Value		$ million	6,517	17,295	35,266	59,078
		%	11%	29%	60%	100%
Number of Foreign/Joint venture Projects		Number	17	8	47	72
		%	24%	11%	65%	100%
Investment Values of Foreign/Joint venture Projects		$ million	1,201	2,451	10,074	13,726
		%	9%	18%	73%	100%
Top 5 Sectors in Investment Value (million $)	Industry	$ million	1,605	10,079	7,759	19,443
		%	8%	52%	40%	100%
	Housing	$ million	3,559	2,641	11,053	17,253
		%	21%	15%	64%	100%
	Tourism	$ million	907	1,505	10,491	12,903
		%	7%	12%	81%	100%
	Trading	$ million	402	985	3,377	4,764
		%	8%	21%	71%	100%
	Agriculture	$ million	632	208	209	1,049
		%	60%	20%	20%	100%

Source: BOI Homepage

Table 6.4.2 indicates China was the largest source country of foreign investments in terms of investment value, whereas such countries geographically close to Erbil as Turkey and Lebanon were high in terms of the number of investments to the Kurdistan region. A total of 30 cases of joint venture projects promoted with various combinations of Iraq and other source countries have been observed other than these independent foreign investment projects.

Table 6.4.2 Top 5 Sources Countries of Foreign Investments

Source Country	Investment Value (million $)	Number of Projects
China	4,906	1
UAE	2,527	2
Turkey	1,230	15
Lebanon	1,024	9
USA	115	4

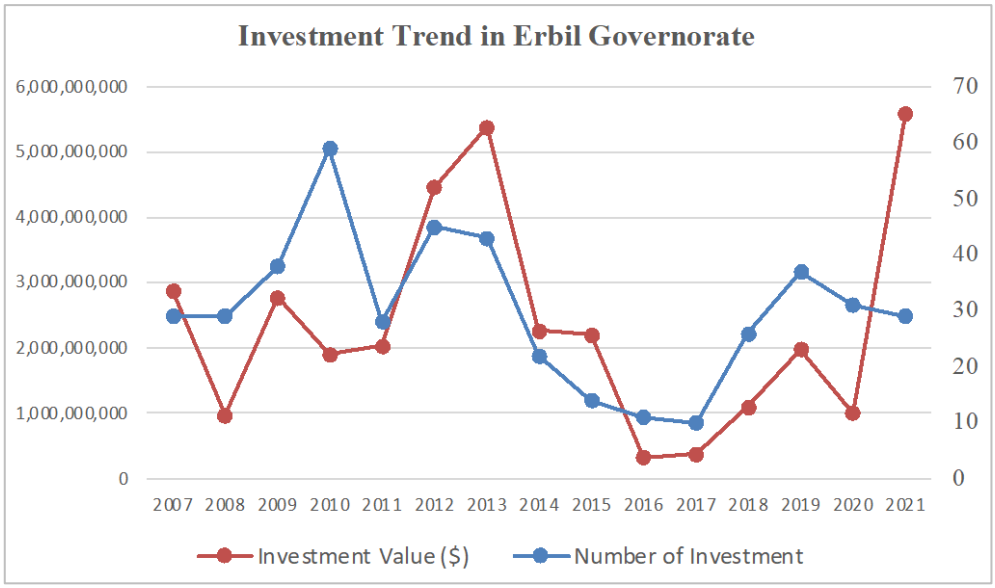
Source: BOI Homepage

Table 6.4.3 and Figure 6.4.1 below show the trends of investments in Erbil Governorate in the number of investments and investment values. The investment values peaked in 2,013 at 5,384 million US$, then started to decline as a result of the ISIS crisis and hit the bottom in 2,016. As the security situation improved since 2,017, the trend turned positive and jumped up in 2,021 to US$5,594 million.

Table 6.4.3 Number and Investment Values of Approved Projects by Year

Year	Number of Investment	Investment Value ($)
2007	29	2,883,240,711
2008	29	976,682,815
2009	38	2,777,813,547
2010	59	1,909,459,990
2011	28	2,028,054,979
2012	45	4,461,589,146
2013	43	5,384,741,466
2014	22	2,267,361,309
2015	14	2,206,545,135
2016	11	321,595,539
2017	10	382,290,058
2018	26	1,097,234,369
2019	37	1,978,685,008
2020	31	1,009,132,000
2021	29	5,594,717,617
Total	451	35,279,143,689

Note: The data in 2021 is until October 21.
Source: BOI Homepage



Source: BOI Homepage

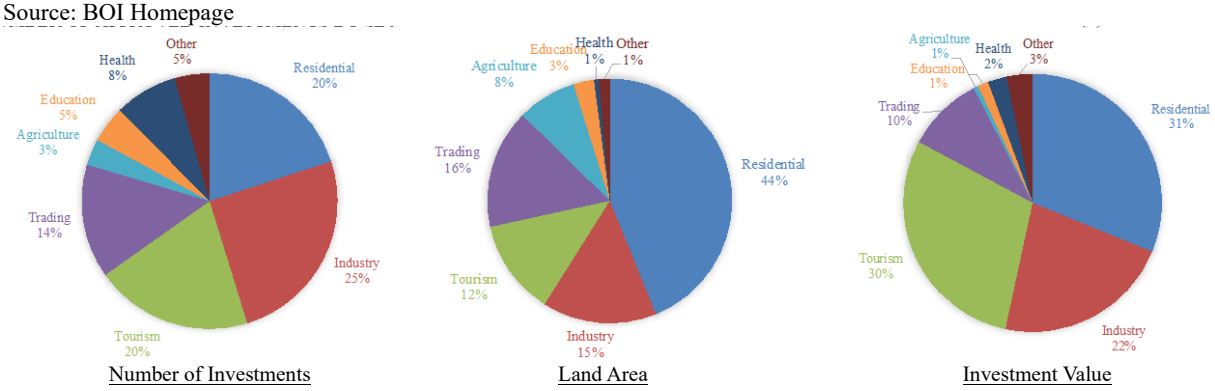
Figure 6.4.1 Annual Trends of Investment to Erbil Governorate

Table 6.4.4 and Figure 6.4.2 show sector distributions of investments in Erbil Governorate. "Residential", "industrial" and "tourism" are the three largest sectors in number, land area and investment value. Most of the tourism investments are hotel projects.

Table 6.4.4 Investments in Erbil Governorate by Sector

Purpose of Investment	Number	Area (Donum)	Investment ($)
Residential	90	16,360	10,998,432,165
Industry	114	5,649	7,833,403,949
Tourism	90	4,714	10,396,542,356
Trading	65	5,900	3,388,324,545
Agriculture	15	2,916	208,630,709
Education	21	1,016	470,638,257
Health	36	243	833,200,368
Other	20	536	1,149,971,339
Total	451	37,333	35,279,143,689

Note: The data in 2021 is until October 21.
Source: BOI Homepage



Source: BOI Homepage

Figure 6.4.2 Sector Distribution of Investment Projects in Erbil Governorate in Number, Land Area and Investment Value

(2) Investment Law

The Kurdistan Region Investment Law came into effect in July 2006, replacing the former Prime Minister's decree no. 89 of 2004. It determines the basic conditions of investment in the Kurdistan Region as follows.

- The sectors covered by the law include manufacturing, electric power, agriculture, hotels, tourists and recreational projects, health, scientific and technological research, communication and transportation, infrastructure, free zone, education, and any other project
- Foreign investors are treated in the same way as national investors and are entitled to own all the capital.
- Investors may acquire land at a promotional price or free of charge, exempting the application of the State Law of Sale and Lease of Properties of the State or lease plots of land.
- Tax and customs exemptions are applied to non-custom taxes and duties (10 years), imported equipment and machinery, spare parts and raw materials (5 years).
- Additional privileges may be provided to projects in underdeveloped areas and joint ventures of national and foreign investors and service sector projects.
- Investors are not allowed to own plots of land that contain oil, gas or any expensive or heavy mineral resources.

(3) Investment Promotion Policy

The approach of the Board of Investment is to prepare a menu of high-potential projects in the Kurdistan Region and attract potential investors by presenting it to them rather than waiting for investors to come and propose projects. The "Investors Guide – Together towards a better future –" prepared by the Board of Investment presents project ideas for each sector as follows.

- Industrial sector:

  cities and industrial zones (e.g. Ararat Industrial Zone, Tiemar zone), petrochemical industry (six opportunities in plants for petrochemical, ethylene and propylene, nylon and polyester fabrics, PVC, pigments, engine lubricants, pharmaceutical and medical industries (10 project ideas), food industry (19 project ideas), construction and mining (8 project ideas), textile industry (7 project ideas), miscellaneous industries (27 project ideas)
- Agriculture sector:

  dams (total of 9 dams, 3 each in each governorate), agriculture and livestock (18 project ideas)
- Tourism sector:

  26 project ideas for tourism compounds, hotels, sport tourism complexes, aquariums, mineral water baths, ruins, waterfalls, mountain resorts, amusement parks and ski resorts in Erbil Governorate
- Electricity sector:

  8 project ideas for solar (2 projects) and hydropower (6 projects) electricity generation
- Health sector:

  53 project ideas including general hospitals, specialty hospitals, medical city, physiotherapy, laboratory, medical centers
- Social affairs sector:

  5 project ideas including nursing home for elderlies, addiction treatment center, autism center, neuro-rehabilitation center, disabled rehabilitation center
- Housing, roads, and transportation sector:

  18 project ideas including residential units, highways, railways, trams, city bus network, terminal stations, airport terminals and ancillary/commercial/economic facilities (especially strengthening Erbil International Airport), cargo city, aircraft maintenance centers
- Higher education and scientific research sector:

  7 project ideas including student bus track and facilities, sports complex, dormitories, universities, research/development center and lab, training center
- Culture and youth sector:

  3 project ideas including arts education complex, sport training complex and technical and professional institute

6.4.2 Issues to be tackled

Issues to be tackled in investment promotion are being collected from the perspective of private investors currently.

6.4.3 Sector Strategies & Policies

(1) Overall Goals of Investment Sector

The Overall Goals of the Investment Sector development in Erbil 2050 MP, which are contained in the latest policies and communication from the Ministry of Planning priority (KRG 2030 Vision, Economy and Productivity pillar) and Board of Investment, and which will realize the Long-term Development Visions, can be summarized as below:

- INV-I: Make Erbil competitive with other regional trading centres
- INV-II: Maximise Erbil's connectivity and complementarity with surrounding region cities
- INV-III: Attract domestic private sector investment
- INV-IV: Attract international investment
- INV-V: Increase investment into development of priority industrial manufacturing, agricultural, and tourism sectors
- INV-VI: Attract green investments that will support the realization of low-carbon urbanization

(2) Linkage with Strategic Orientations of Erbil 2050 MP

Strategies and Policies of Investment Sector mainly support the realization of the Strategic Orientation #2: Improve international competitiveness through regional connectivity and integration (See Section 5.4.2), which implements especially the Long-term Development Vision (See Section 4.2) of Major Trading Core (MTC), and Connected Trading Core (CTC) and Competitive City (CMP).

(3) Strategies & Policies of Investment Sector

Table 6.4.5 below summarizes the Strategies & Policies of Investment Sector proposed to tackle existing issues and to achieve Erbil 2050 MP Long-Term Visions and Overall Sector Goals.

Table 6.4.5 Strategies & Policies of Investment Sector

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
Competitive City	**INV-S1**: Encourage and facilitate both foreign direct investment and domestic private sector investment in non-oil sectors.	- **INV-S1-1**: Implement investment promotion plans of Board of Investment. - **INV-S1-2**: Identify target sectors and subsectors within agriculture, tourism, and industry. - **INV-S1-3**: Prepare detailed plans and implementation frameworks for key industrial zones (Timar, Ararat, Gwer Road) to provide investable prospects. - **INV-S1-4**: Prepare Agriculture sector investment plan. - **INV-S1-5**: Prepare Tourism sector investment plan. - **INV-S1-6**: Prepare Infrastructure investment plan. - **INV-S1-7**: Initiate data collection, analysis and dissemination initiatives to provide robust data to plan makers and investors.	- Lack of diversity in the economy - [INV-I] Make Erbil competitive with other regional trading centres - [INV-III] Attract domestic private sector investment - [INV-IV] Attract international investment
	INV-S2: Ensure a competitive regulatory environment including through implementation of zoning scheme.	- **INV-S2-1**: Continue to review the Investment Law no. 4 of 2006 and build on this with further regulatory reform. - **INV-S2-2**: Implement development management / zoning scheme to regularise development and reduce risk and uncertainty.	- Increase ease of doing business ranking to rank among top 50
Low-Carbon City	**INV-S3**: Promote Green Investments	- **INV-S3-1: Establish Erbil Urban Climate Fund (EUCF)**: The EUCF is set up to receive climate finance and on lend to retail banks for financial instruments to finance private sector transition, including homeowners, to climate proof their assets, business model and operations and adopt zero-emission mitigation measures. - **INV-S3-2: Incentives for Green Building Development**: Offer financial incentives such as tax breaks, grants, or subsidies for private developers who incorporate green building practices, energy-efficient technologies, and sustainable materials in their projects. - **INV-S3-3: Public-Private Partnerships (PPPs) for Sustainable Infrastructure:** Encourage PPPs to develop sustainable urban infrastructure, such as energy-efficient	- [INV-VI] Attract green investments that will support the realization of low-carbon urbanization

		public transportation systems, renewable energy projects, and smart city initiatives. Provide long-term contracts and financial support to attract private investors. - **INV-S3-4: Green Certification Requirements**: Mandate green building certifications for new developments and offer expedited approval processes or additional incentives for projects that achieve higher levels of certification (e.g., LEED certification). - **INV-S3-5: Research and Development Grants:** Offer grants or subsidies to private companies investing in research and development of green technologies applicable to urban development (energy efficiency, water conservation, waste reduction, etc.). - **INV-S3-6**: **Green Innovation Hubs**: Develop designated areas or innovation hubs within the city that focus on green and sustainable technologies. Provide infrastructure and regulatory support to attract businesses working on eco-friendly solutions. - **INV-S3-7: Streamlined Permitting Processes for Green Projects:** Simplify and expedite permitting processes for projects that align with low-carbon and sustainable development goals. This can reduce barriers and attract private investment by speeding up project timelines.	
Regional Position	**INV-S4**: Enhance regional connectivity of Erbil across transportation infrastructure including roads, railways and airports.	- **INV-S4-1**: Maintain, enhance and improve road connections between Erbil and Sulaymaniyah. - **INV-S4-2**: Maintain, enhance and improve road connections with Duhok and Turkey. - **INV-S4-3**: Maintain, enhance and improve road connections between Erbil and Mosul and linkages with and access to the Iraq Development Road / Dry Canal. - **INV-S4-4**: Maintain, enhance and improve road connections to Kirkuk. - **INV-S4-5**: Explore opportunities and feasibility for new transportation networks including freight and passenger rail networks within the KRI and linking with Iraq rail networks.	- Landlocked city with physical barriers between Erbil and surrounding regional markets, trading hubs and sea ports. - [INV-II] Maximise Erbil's connectivity and complementarity with surrounding region cities
	INV-S5: Relations with neighbouring cities, including engagement and build partnerships.	- **INV-S5-1**: Engage with Sulaymaniyah through KRI tourism strategy. - **INV-S5-2**: Engage with Sulaymaniyah to develop complementarity in industrial manufacturing, investment promotion strategies. - **INV-S5-3**: Engage with Kirkuk and develop complementary economic sectors, build knowledge transfer partnerships, and develop cooperative relationship. - **INV-S5-4**: Engage with Mosul and develop complementary economic sectors, build knowledge transfer partnerships and develop cooperative relationship.	- Need to manage potential interrelationships between Erbil and neighbouring cities. - [INV-II]

Source: JICA Project Team

(4) Investment Promotion Development Plan

Encouraging foreign and domestic investment into Erbil is crucial to the future development and prosperity of the city. The Investment Law of 2006 provides a legal framework for attracting foreign and domestic investment to contribute to the process of economic development, infrastructure development, and job creation in the KRI. The Investment Law provides for the removal of certain legal barriers, provides incentives and tax exemptions to investors, and governs the allocation of land for investment projects.

1) Investment Promotion and Regulatory Environment (INV-S2)

The Board of Investment exists to coordinate inward investment, identify investment opportunities that

meet broader economic development priorities and strategies, promote investible projects, and allocate suitable land for projects. The Kurdistan Investment Guide is published to present ideas for projects with investment potential.

In contrast to many of the surrounding economies, the KRI treats foreign and domestic investors the same and allows full foreign ownership of companies, providing a competitive advantage to Erbil in relation to Mosul and other cities in Iraq outside the KRI, as well as to Iran.[1]

The investment promotion strategy for Erbil to 2050 is to maintain and develop the Board of Investment's approach in accordance with the Investment Law, with ongoing review of the regulatory environment in light of new technologies and processes in industry, as well as in light of the regulatory environments of neighbouring jurisdictions.

Further analysis of priority economic sectors and the creation by the Board of Investment/Statistics Office, or other agency of the KRI of accessible datasets to allow investors to assess potential supply chain, labour and skills supply, and markets, will further increase the competitive advantage of Erbil as an investment destination.

The creation of sector-specific investment promotion plans for industrial manufacturing, agriculture, healthcare, and tourism will provide policy makers with further insight into subsectors in which to prioritise investment, as well as to guide investors' understanding of the opportunities and future direction of the economy.

2) Promote Green Investments (INV-S3):

Detail information on Erbil Urban Climate Fund (EUCF) mechanisms in PART V Section 4.3.

3) Connectivity and Transport Communications (INV-S4)

The enhancement of regional connectivity through an ongoing programme of maintenance and improvement of road links to neighbouring cities, Sulaymaniyah, Mosul, and Kirkuk, as well as to points of connection to wider infrastructure networks such as the Iraq Development Road, and road routes to Europe via Duhok and Turkey, will ensure that Erbil is able to effectively leverage its advantageous geographical position at the intersection of regional trading routes. The KRG will furthermore continue to investigate the opportunities for development of freight and passenger rail infrastructure links between Erbil and the proposed rail element of the Iraq Development Road project, and with other major cities in Iraq and the KRI.

4) Engagement with Regional Neighbours (INV-S5)

Erbil will engage with, and where appropriate, undertake joint economic and spatial planning with surrounding cities in the region to understand policies for future economic development. Erbil will plan to maintain a competitive edge as well as seek complementarity. Mosul and Kirkuk provide potential sources of labour, skills and knowledge which can benefit Erbil in the development and diversification of its economy. Sulaymaniyah as a key partner in the KRI is an important cultural and political partner for Erbil, as well as source of skills, knowledge and labour which has the potential to support growth and diversification of Erbil's economy. Joint planning for investment promotion, tourism, healthcare, and other sectors will help the two cities to develop in a complimentary manner.

[1] This does not include land that contain oil, gas, or other mineral resources, which cannot be owned by investors.

CHAPTER 7
URBAN TRANSPORTATION DEVELOPMENT PLAN

7.1 Existing Transport Conditions

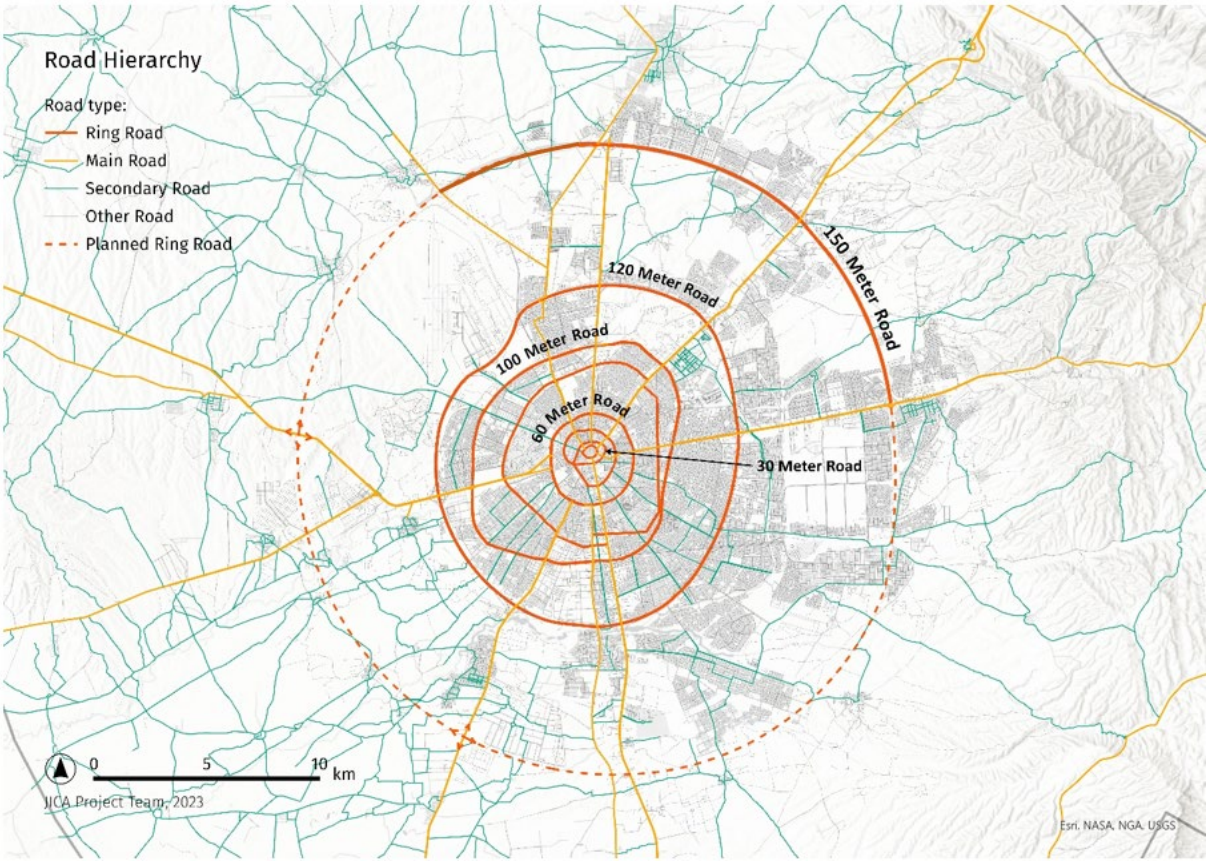
7.1.1 Road and Road Traffic

(1) Road Network of the Project Area

The road network of Erbil is characterized by a number of ring and radial roads with the Citadel as the center core. There are six ring roads namely 30m, 60m (Ring way 3), 40m, 100m (Ring way 4), 120m (Ring way 5) and 150m Road (Ring way 8). 40m Road is not a complete ring road. Grade separated intersections exist on 60m and 100m Road. 120m and 150m Roads are fully access controlled freeways. 150m Road is under construction, only a short section in the north is open to traffic. Radial roads connect Erbil with other cities in Iraq like Mosul, Duhok, Koya, Kirkuk etc. or to the neighboring countries like Iran and Turkey. According to the GDUP staff, wide ring roads disconnect the residential areas at the both sides of the Ring way. There is a service road that is laid in parallel to the ring road but its function is not clear in terms of the local traffic. The traffic going to the other side of the ring road needs to use the radial roads. As such the driving distance may increase.

(2) Road Classification

There is no road statistics in Erbil that indicates the road classification. Therefore, GIS data was used to understand the road density and the width in order to classify the roads. Figure 7.1.1 shows the current road network in Erbil and Table 7.1.1 indicates the road classification and road density.



Source: JICA Project Team

Figure 7.1.1 Current Road Network in Erbil

Table 7.1.1 Road Classification and Density

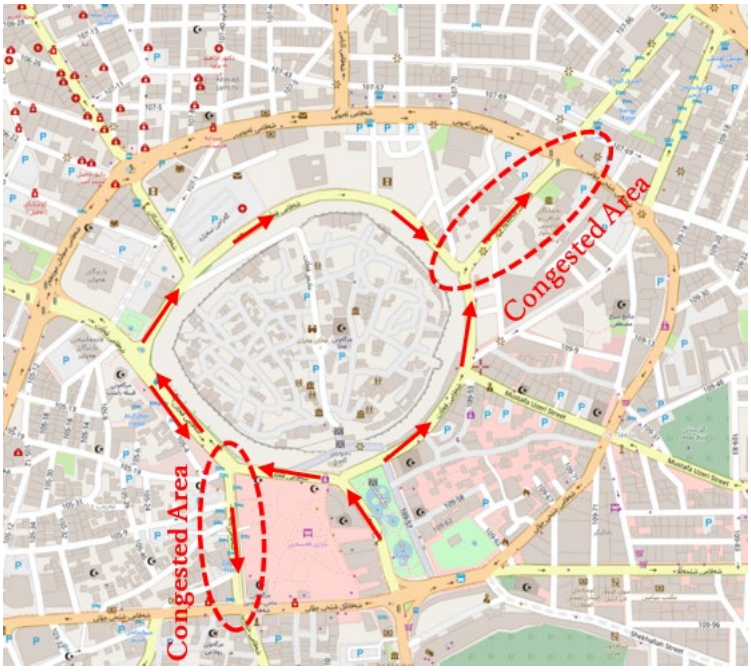
Road Classification	Erbil M/P coverage Area	Area inside Ring Way 5
Primary (km)	153.82 (8.3%)	52.71 (52.6%)
Secondary (km)	416.13 (22.6%)	17.27 (17.2%)
Tertiary (km)	1272.18 (69.1%)	30.27 (30.2%)
Total (km)	1842.76 (100.0%)	100.25 (100.0%)
Road density (km/km^2)	0.658	0.973

Source: Aggregated GIS data on 2022

It is noteworthy that the road network inside 120m Road is well developed with the majority of it is the primary and secondary roads. The majority of the roads outside of the 120m Road are traditional village roads or newly developed roads in residential or commercial area. The primary road of this area is only the radial roads from/to Erbil City. Therefore, the percentage of the tertiary road is high.

(3) Road and Road Traffic Condition

The road condition of the newly developed freeways is good. The main problem of the Erbil urban roads is low visibility of the lane markings. There is also damaged pavement even on the primary roads. Primary roads inside 120m Road have multiple lanes and often have service roads at both sides. On the other hand, roads in the village area are narrow and less than 10m wide with low level of maintenance. The streets in the historic area around the Citadel is very narrow, maze and partly one-way that is not suitable for the vehicles. The road around the Citadel is mainly one-way, but not in one direction like a roundabout. Therefore, the traffic from the opposite direction convenes in two points as shown in Figure 7.1.2.



Source: JICA Project Team based on Open Street Map

Figure 7.1.2 One-way Traffic Control and Congested Areas of the Historic Area

There is no statistics about the current road condition except the data observed from project/study by international and/or domestic partners.

There are traffic lights at some intersections, but there are many closed intersections where the median has a continued barrier to block the crossing traffic. Hence, U-turn points are provided at some distances away from the intersection as shown in Figure 7.1.3. It causes additional traffic to reach U-turn point and then reach the intended destination. Congestion at the U-turn points are also common in particular at the rush hour, because turning vehicles do not form one line, but try to turn from outer lanes and block

the traffic going in straight direction. Humps before the U-turn point force the vehicle to reduce speed but obstruct smooth flow of the traffic.

Source: JICA Project Team

Figure 7.1.3 Strait/Turn-left System at Median Blocked Intersection

Figure 7.1.4 shows the queueing traffic on 60m Road. This congestion is caused by the closure of several intersections. The vehicle is forced to make a U-turn on 60m Road and blocks several lanes, obstructing the traffic going in straight direction. Merging vehicle from the side streets and right turning vehicles after the U-turn cross the lane ("scissor-like" movement called by Erbil Traffic Engineering Directorate) create additional burden on 60m Road so that consequently, all lanes are blocked.

Source: JICA Project Team

Figure 7.1.4 Traffic Congestion on 60m Road

(4) On-street Parking

Available street parking is very limited in Erbil, and there are signs to prohibit parking or stopping. However, there is no enforcement and therefore all streets are parked with cars for a long time, sometimes in two rows and obstructs traffic lane. According to the GDUP staff the fine for the illegal parking is low compared to the income, therefore, there seems to be no effective parking control in place. Lack of parking facilities at business establishments or public facility like medical complex and school are raised by the Erbil Traffic Engineering Directorate. Even in the outskirts oil tankers park in the street along Makhmur Road outside of 120m Road, according to the Erbil Traffic Engineering Directorate. However, no effective measure has been adopted so far. The taxis waiting in street for passenger causes major traffic congestion in downtown inside 30m road. The traffic police officers

control the traffic at hotspots in downtown and major intersection during the traffic peak hours. Newly constructed commercial and residence complex has parking space inside, but the drivers often stop in the street to do a quick shopping or delivery. Private parking space exists also in the congested historic area, but because of the narrow streets access to those parking space is very difficult and time consuming.

Source: JICA Project Team

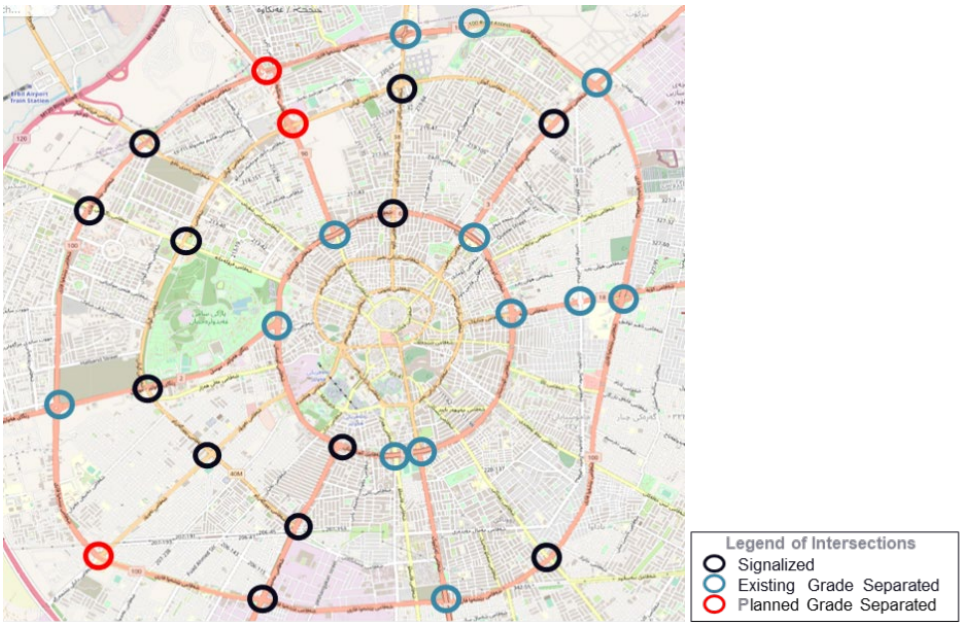
(5) Planned and On-going Road Projects

Erbil 2030 MP proposes an extendable grid-shaped road network far beyond the urbanized area with Ring ways up to 22. So far, the 120m Road is fully completed and 150m Road is under construction. According to the Green Belt Plan the Ring way 8 (150m Road) shall accommodate pedestrians and bicyclists in a greenery environment, but the currently constructed 150m Road is a freeway with 4 lanes in each direction in order to serve the new commercial and residential complex around it.

Source: JICA Project Team

Figure 7.1.5 Progress of 150m Ring Road Construction

For the urbanized area in Erbil three grade-separated intersections are planned in the Erbil Masterplan in order to solve the congestion at the intersections. The current and planned grade separation inside 100 m Road is shown in Figure 7.1.6.

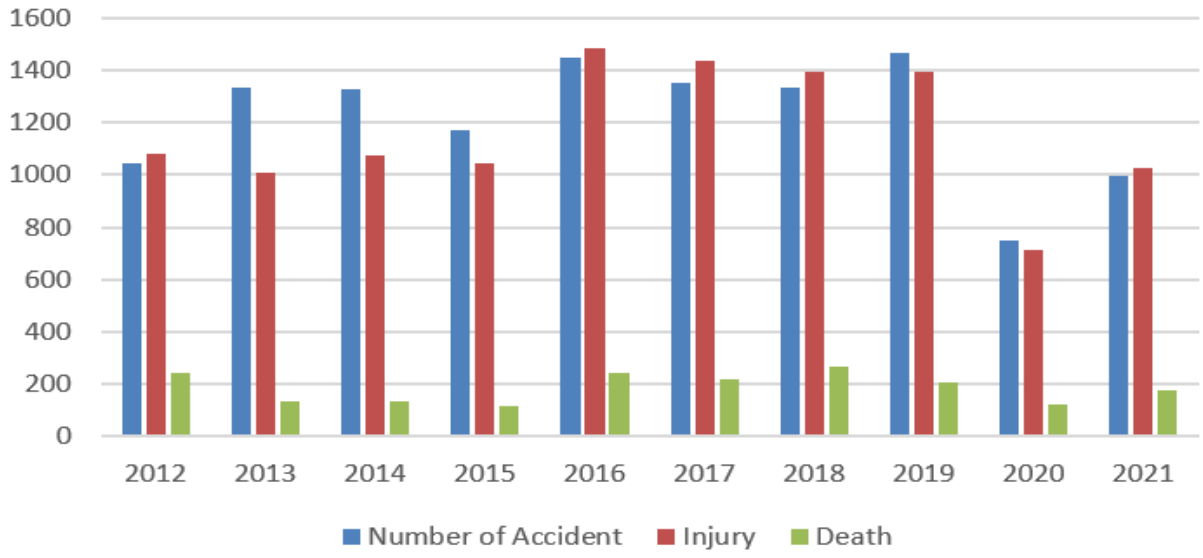


Source: JICA Project Team based on Open Street Map

Figure 7.1.6 Grade-separated and Signalized Intersection

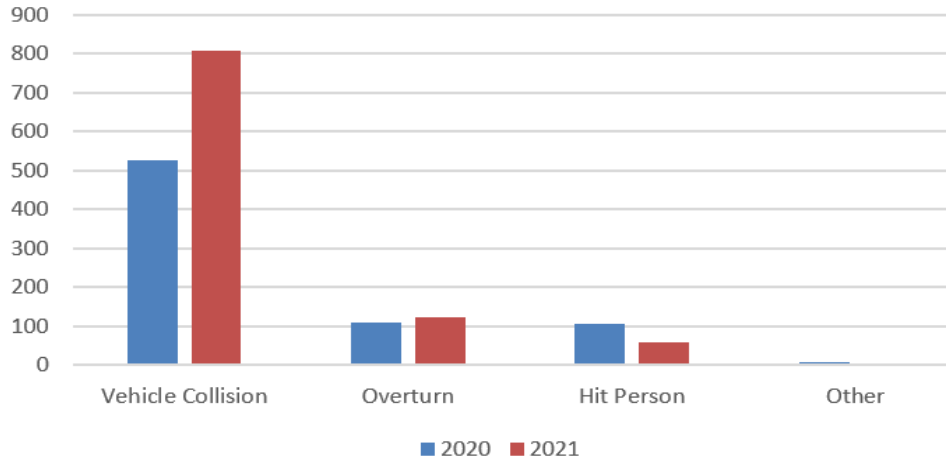
(6) Road Safety

The record of traffic accident and its cause is shown in Figure 7.1.7. and 7.1.8 respectively. Accidents between the vehicles is the most cause of the accident. The traffic police conduct speed checks by radar randomly on ring and major arterial roads. Over speeding is subject to a designated fine. Signaling, U-turn rule and speed humps contribute to avoid vehicle accidents because the recklessness of the drivers would create accidents if the vehicle are free to turn or cross the intersection. However, U-turn points become the cause of congestion during the rush hours. Those physical measures would aim at reducing the traffic accidents but reduces the capacity of the roads and intersections. Therefore, a balanced solution between the traffic safety and traffic capacity will be necessary for the future. Modification of the signal phase as mentioned in Section 7.7 is a possible solution. There are also illuminated pedestrian crossing and pedestrian overpass at selected places in Erbil.



Source: JICA Project Team based on data from Erbil Traffic Police

Figure 7.1.7 Traffic Accidents in Erbil



Source: JICA Project Team based on data from Erbil Traffic Police

Figure 7.1.8 Causes of Traffic Accidents in Erbil

7.1.2 Public Transport

(1) Current Public Transport System

There are three types of public transport modes in Erbil namely bus, mini-bus (coaster) and taxi. Buses including mini buses provide a cost-effective transport to and from the downtown. There are also lines on the ring roads, but due to low ridership and also because of a technical problem, the 100m Road line has stopped operation. There are abundant number of taxis in Erbil. As the total number of the taxis is not controlled and anyone who has a general license can start the taxi service, the taxis are in oversupply.

There are three transport terminals in Erbil and one is under construction. The downtown terminal which is located under ground floor of building is served by many minibus lines connecting to the various areas in Erbil. The international terminal is located in the north-eastern part of Erbil near the Family Mall and used by the international bus lines to neighboring counties like Iran and Turkey, minibus and taxis bound for other towns in Iraq. The south terminal is located near the Kirkuk Road and used by the minibus and taxis to the other towns in Iraq.

Downtown Terminal

International Terminal

New South Terminal under Construction

Source: JICA Project Team

(2) Bus and Mini Bus

Bus and Mini Bus are operated by private companies. The Transport Syndicate that is a part of the Labor Syndicate controls the operation of all buses. There are 33 bus routes of which 4 are on the ring road and the rest are on the radial roads and connects the downtown and surrounding municipality or village of Erbil City. There are also 42 mini bus lines that connects Erbil and other towns in the Kurdistan Region. International bus service exists between Erbil and neighboring countries like Iran and Turkey. Table 7.1.2 shows the number of bus operation and passenger volume by routes. Large bus (45 seats) is used on the Mantkawa-92 route only and connects downtown and universities and their dormitories along the Kirkuk Road. All other routes are served by mini bus (14 seats) or Coaster (21 – 25 seats). The operating hour is between 7am and 7pm and frequency is 5 to 10 minutes interval. Bus stops has in general a small shelter with roof, but there is no timetable displayed at the bus stops or published on the web site. The Syndicate assigns an operation manager for each route who watches the buses at a particular point on the bus route against his time table. If a bus is delayed the manager informs the bus driver and the bus operator shall be liable for a designated fine. The Syndicate is also the first contact point from the passengers in case of complains on the bus service or requests to open a new bus route. After receiving a request, the committee consisting of the officials of KRG and the Syndicate inspects the area to be served by the new bus route and decides whether or not to open a new line.

Table 7.1.2 Number of Bus Passenger by Route

No.	Bus route	No. of bus	Type of bus	No. pass / day	Start-end
1	Rizgary	45	Koaster bus	(1800) Passenger	Center to Rizgary
2	Ainkawa	38	Koaster bus	(2000) Passenger	Canter to Ainkawa
3	Kwestan	37	Mini bus	(1200) Passenger	Center to Kwstan
4	Kurdistan	32	Koasterbus	(1680) Passenger	Center to Kurdistan
5	Ronaky 99	40	Koasterbus	(2240) Passenger	Center to Ronaky 99
6	Sarwaran	29	Koaster bus	(1760) Passenger	Center to Sarwaran
7	Shawes	27	Koaster bus	(2376) Passenger	Center to Shawes
8	Rasty	21	Mini bus	(1440) Passenger	Center to Rasty
9	Krekaran(hay umal)	43	Koaster bus	(2560) Passenger	Center to Krekaran
10	Badawa	29	Koaster bus	(2400) Passenger	Center to Badawa
11	Hawleri new	20	Koaster bus	(2400) Passenger	Center to Hawleri new
12	Ary	28	Mini bus	(1920) Passenger	Center to Ary
13	Mamostayan	28	Koaster bus	(2400) Passenger	Center to Mamostayan
14	Nawroz	39	Koaster bus	(2400) Passenger	Center to Nawroz

No.	Bus route	No. of bus	Type of bus	No. pass / day	Start-end
15	Brayati	41	Koaster bus	(2232) Passenger	Center to Brayati
16	Iskan	34	Mini bus	(2800) Passenger	Center to Iskan
17	Bahrika	35	Koaster bus	(3000) Passenger	Center to Bahrika
18	Zilan	22	Mini bus	(1792) Passenger	Center to Zilan
19	Pirzin	13	Mini bus	(1120) Passenger	Center to Pirzin
20	Awena	38	Mini bus	(2688) Passenger	Center to Awena
21	Pirash	20	Mini bus	(1000) Passenger	Center to Pirash
22	Roshanbirl	25	Mini bus	(2016) Passenger	Center to Roshanbiri
23	Qalay new	21	Koaster bus	(2400) Passenger	Center to Qalay new
24	Jamka	23	Koaster bus	(2160) Passenger	Center to Jamka
25	Qushtapa	11	Koaster bus	(1600) Passenger	Center to Qushtapa
26	Daratu	41	Koaster bus	(3720) Passenger	Center to Daratu
27	Binislawa	33	Koaster bus	(2640) Passenger	Center to Binislawa
28	Kasnazan	38	Koaster bus	(2240) Passenger	Center to Kasnazan
29	Mantkawa	32	Big bus	(3120) Passenger	Center to Mantkawa
30	100 meter circle	41	Koaster bus	(1500) Passenger	circle
31	60 meter	45	Koaster bus	(1500) Passenger	circle
32	40 meter	56	Koaster bus	(4000) Passenger	circle
33	30 meter	46	Koaster bus	(1200) Passenger	circle
Total		1071		(71394)	

Source: Ministry of Transport

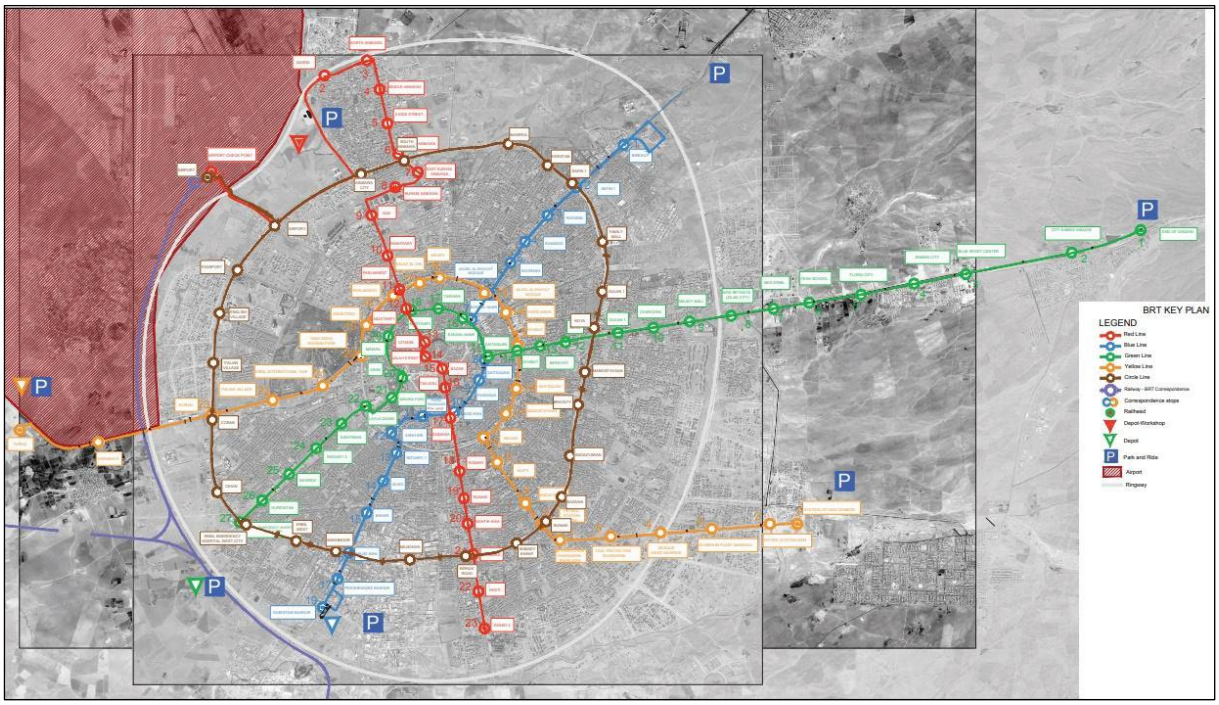
(3) Taxi

There is no official statistic on the number of registered taxis, and the current number of taxi is estimated between 32,000 and 35,000. There are three types of taxis in Erbil: City taxi with a red colored sign on the door, intercity taxi with a brown colored sign on the door (Bagdad bound taxi is yellow), and airport taxi. The price of the city taxi is negotiated between the passenger and the driver. Intercity taxi can be boarded only at designated points like the bus terminal located at the north-eastern part of Erbil (near the Family Mall) or south of the city near the Kirkuk Road. The price per passenger is fixed for the intercity taxi, and it departs when all passengers are boarded, or the fare of the empty seats are paid by the passenger. Taxi with online booking service is called Careem and has recently acquired the Uber. There are estimated 500 Careem taxis in Erbil. There are two points where the city taxis accumulate: Downtown shopping area and some selected gas stations. In downtown especially around the Citadel or at the Main Bazaar the taxis are waiting for passengers, and often block the lanes. By observing the area around Citadel, the expert team noted that more than half of the passing vehicle is taxi with or without the passengers. At some gas stations where the gas price is a bit lower than other ones the taxis form a long queue.

(4) LRT and City Bus Study

Following the concept of the Erbil 2030 MP that foresees reduction of the total traffic volume and vehicle-km of the morning peak hour by 25% an Italian company conducted a technical study and prepared a tender document on 4 LRT lines in Erbil in 2012. Seven targets in city mobility are mentioned: Accessibility (good combination of public and private transport), Sustainability (respectful use of environmental resources), Reliability, Security, Flexibility (adaptability of the transport system to user needs), Control (effective compliance of the transport system to the needs of users), Sharing (involvement of the citizen in decision making). The LRT project has not been implemented because of the high investment costs, and a long-term contract associated with a high degree of future uncertainty. Subsequently, the same Italian company conducted another study on the city bus in 2015. The network

of LRT and city bus are identical, only the circular line has been added to the city bus network as shown in Figure 7.1.9. Table 7.1.3 shows the comparison between the proposed LRT and city bus network. Both network plans are based on the Erbil 2030 MP that foresees the developments along the six main radial roads with around 150,000 people to settle to the north, around 200,000 people to the south-east, around 250,000 people to the north-west as long-term targets. Modern technologies like automatic vehicle location system, priority signaling system, public information system and ticketing system are proposed and the Park and Ride facilities at the termini and along the ring roads will ensure smooth access to the buses. The city bus report also contains preliminary design of the routes, rolling stocks and facilities along with estimated investment costs totaling 350 million USD and annual operation cost of 13 million USD. An OD and interview survey to about 2800 adults was conducted and the new city bus lines (featured like a BRT) with modified minibus routes were planned by using the simulation. The daily passenger volume of the new city bus lines was estimated at 22,300 and that of the minibuses at 8,000. By dividing the annual operation cost of 13 million USD by the yearly passenger forecast (22,300 x 365 = 8,139,500), each passenger needs to pay 1.59 USD to cover the annual operational cost. This is almost 5 times the current minibus fare.



Source: Erbil City Bus System, Ministry of Transport and Communication, 2015

Figure 7.1.9 Proposed Route of LRT/City Bus

The difference between LRT and BRT is on cost and capacity. Investment cost of LRT may be around 60 - 70% higher than BRT based on the actual cost comparison. An LRT train can carry twice the passenger of an articulated bus. On the other hand, LRT has a solid infrastructure, and it is not possible to change the routes once it is constructed. BRT lane can be added or shifted easily as demand changes. Bus fleet can be added or modified easily compared to LRT. Therefore, as the actual demand for the public transportation is not exactly known, the Expert team recommends to start BRT service, and as the demand grows, shift to LRT. Modern buses with hybrid engine are environmentally friendly and equipped with air conditioning similar to LRT. This will ensure a high level of comfort in BRT like LRT. Underground railway costs considerably high, around 600% or more than LRT, according to the simulation in Canada. LRT track can be shifted to underground in congested sections. Figure 7.1.10 shows the actual example of LRT to run underground in a German city of Dusseldorf. This solution is less costly than constructing a full underground railway.

Source: Westdeutsche Zeitung

Figure 7.1.10 Example of LRT Exiting Underground

Table 7.1.3 Outline of Planned LRT/City Bus Project

LRT	City Bus
Red Line: Length = 19360 m No. of Stops = 24 Range = 842 m No. of Boreholes = 17 Blue Line: Length = 13860 m No. of stops = 19 Range = 815 No. of Boreholes = 15 Green Line: Length = 22510 m No. of stops = 28 Range = 878 No. of Boreholes = 19 Yellow Line: Length = 21380 m No. of stops = 25 Range = 890 No. of Boreholes = 12 Circular Line (25km) : Length = 25000 m No. of stops = 24 Range = 815 Total Length = 102,110 m Total No. of Stops = 120 Total no. of boreholes = 63	Red Line: Length = 21000 m No. of Stops = 24 No. of Boreholes = 30 N0. Of buses (20 bus 12m + 4bus 18m) Blue Line: Length = 16000 m No. of stops = 19 No. of Boreholes = 21 N0. Of buses (15 bus 12m + 3bus 18m) Green Line: Length = 23000 m No. of stops = 28 No. of Boreholes = 34 N0. Of buses (22 bus 12m + 4bus 18m) Yellow Line: Length = 22000 m No. of stops = 25 No. of Boreholes = 34 N0. Of buses (20 bus 12m + 5bus 18m) Circular Line (25km) : Length = 25000 m No. of stops = 24 No. of Boreholes = 20 N0. Of buses (23 bus 12m + 4bus 18m) Total Length = 107,000 m Total No. of Stops = 120 Total no. of boreholes for checking soil bearing capacity = 139 No. of Buses = 100 bus 12m + 20 bus 18m

Source: GDUP

7.1.3 Analysis of the Mobility of the People from the Household Survey

The Household Survey done for this Project in September 2022 contains questions about the destination and mode of traffic. In terms of the destination all members of the household were asked the following question.

Which area does he/she travel to for their place of work or place of study?
Areas to be selected are the following.

Destinations inside 100m Road:
- Inside 60 Meter Street e.g., Tairawa, Mastufi, Setaqan, Qalat, Bazar, Minara, Zaniary, Sydawa
- Azadi
- Runaky, Eskan, Mufti, Pizishkan, Mantikawa
- Mamostiyan, Khabat
- Brayati, Khanzad, Raparin
- Shorsh, Kani, Nuseran
- Kwestan
- Salahadeen, Matufi, MRF Quatro
- Kuran Aynkawa
- Bakhtiary and Gulan Tower
- Waziran, MNW & Star Towers
- Naz Naz, Park View
- Dream City
- Empire, MRF, Ruya, English Village, Italian Village 1
- Raparin, Nishtiman, Nawroz
- Rizgari, Kurdistann Bahar

Destinations between 100m and 120m Road:
- Zanko, Marhabad
- Badawa, Karezan
- Zanayan, Chwar Chra, Chnar
- Gulan and Safeen (Family Mall)
- Aynkawa
- North Industrial Zone
- Sarbasti
- Toraq (Tishk University, Lebanese French University etc.
- South Industrial Area

Destinations outside of 120m Road:
- Zheyan, Roshanbiry, Darato, Zaton, Galawezh
- Banislawa
- Hsrok, Zilan and Harkewe
- Between Heran City and Kasnazan
- Shaways
- Between Pirzin, Media City, Italian Village 2 and Atkunze
- Mulla Omar and American Village
- Slava City, Korean Village, Kalakan, Ganjan City
- Bharka, Shekhahsal
- Lebanese Village, Noble City, Gird Jutyar

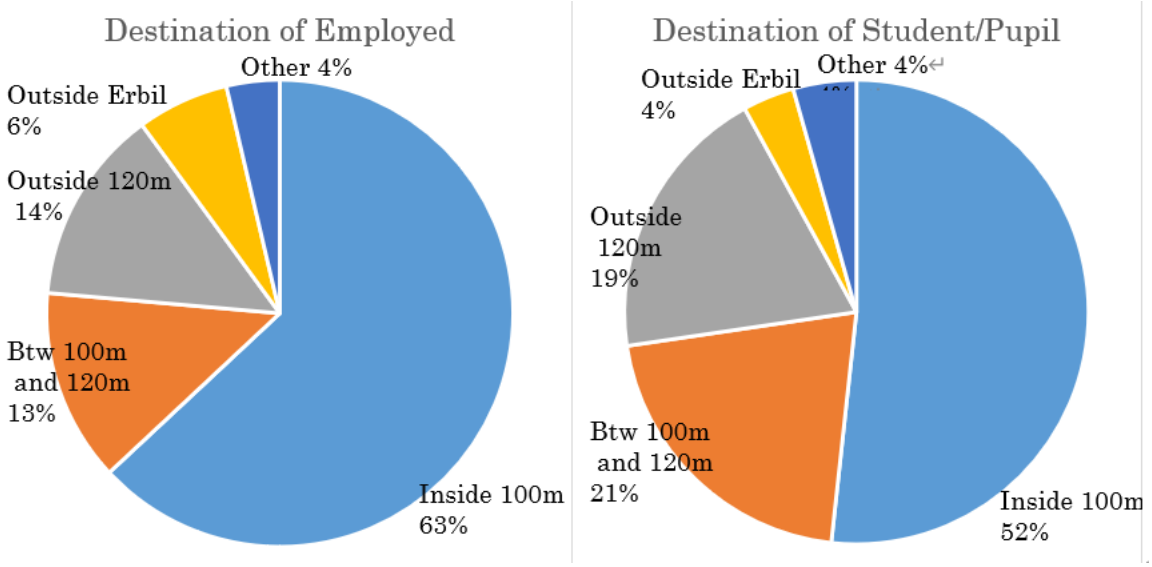
Outside Erbil
All Others

Source: Result of House Hold Survey

Answers were collected from 1009 households, and as multiple members of the household gave the destination, 1825 answers were valid for the analysis of which 992 were employed people (full time, part time, self-employed) and 743 were students/pupils. In general, the destination of the employed people differs from that of the student/pupil so the analysis was done separately.

Figure 7.1.11 shows the destination of the employed people and students/pupils. Percentage of the

destination inside 100m Road is larger for the employed people while the destinations between 100m and 120m Road and outside of 120m Road is bigger for the students/pupils. It is also noteworthy that there is no big difference of the percentage of destination between 100m and 120m Road and outside of 120m Road both for the employed people and student/pupil respectively.

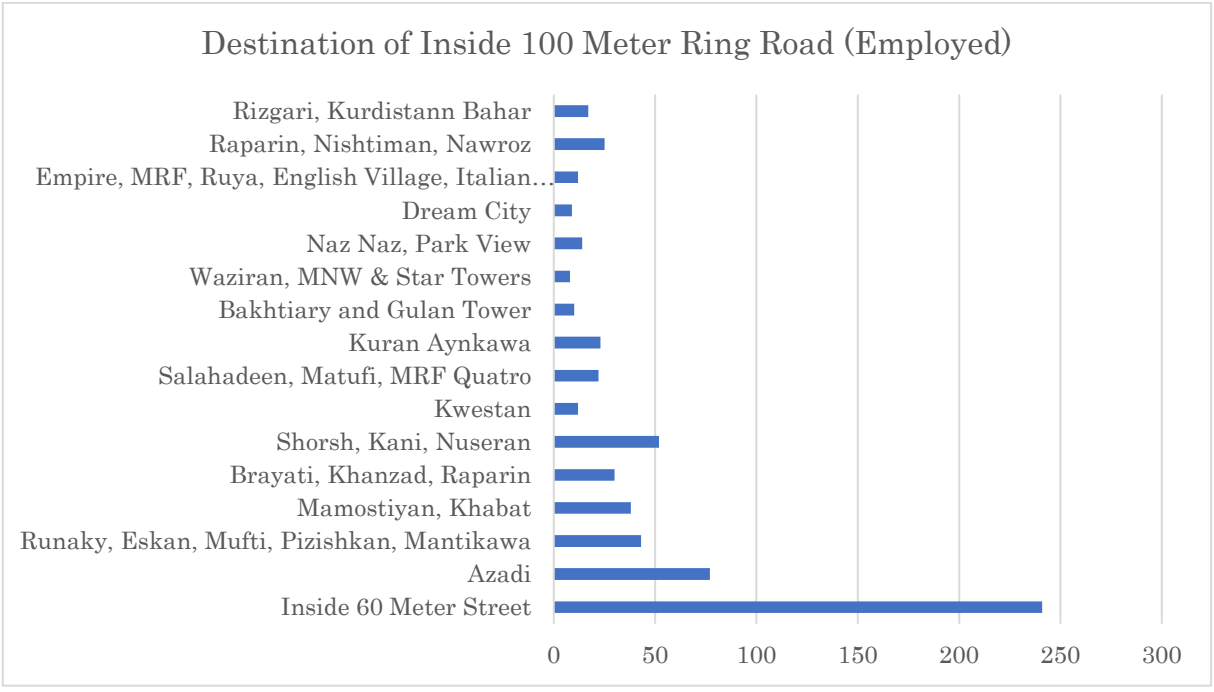


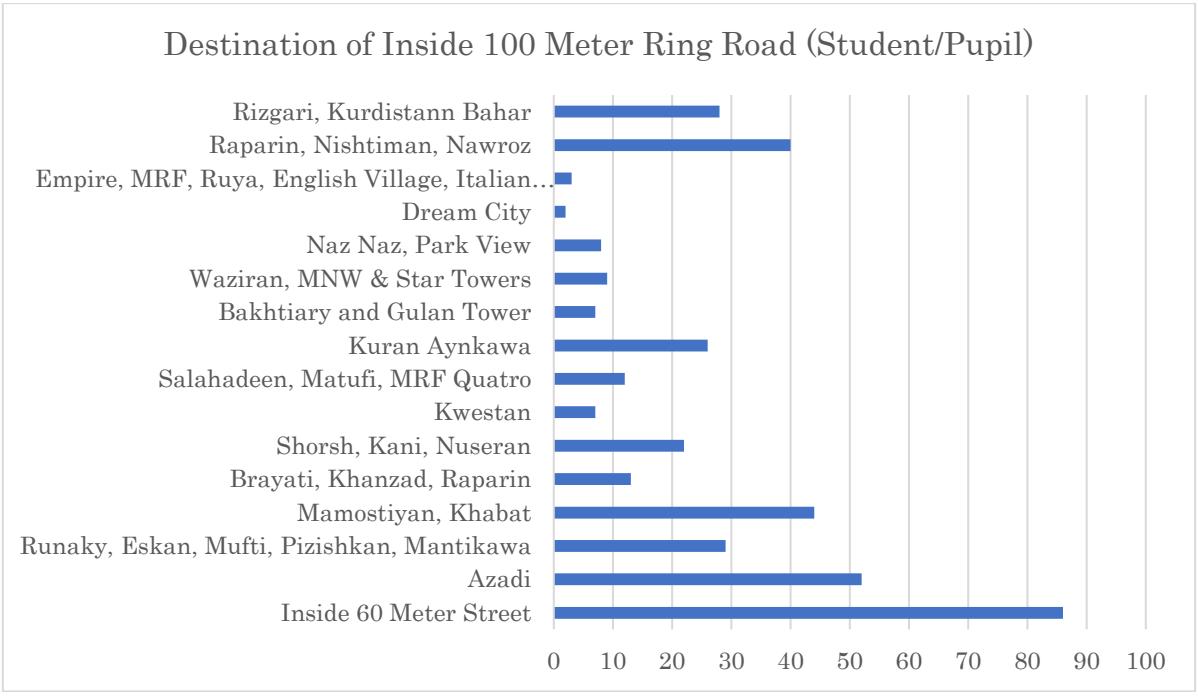
Source: Result of Household Survey

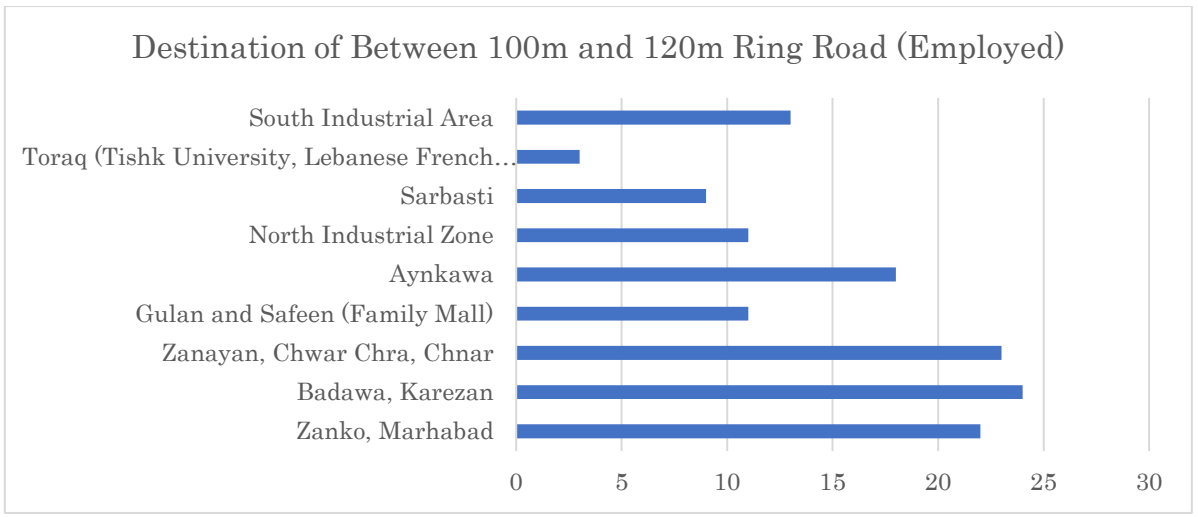
Figure 7.1.11 Destination of Employed and Student/Pupil from the Household Survey

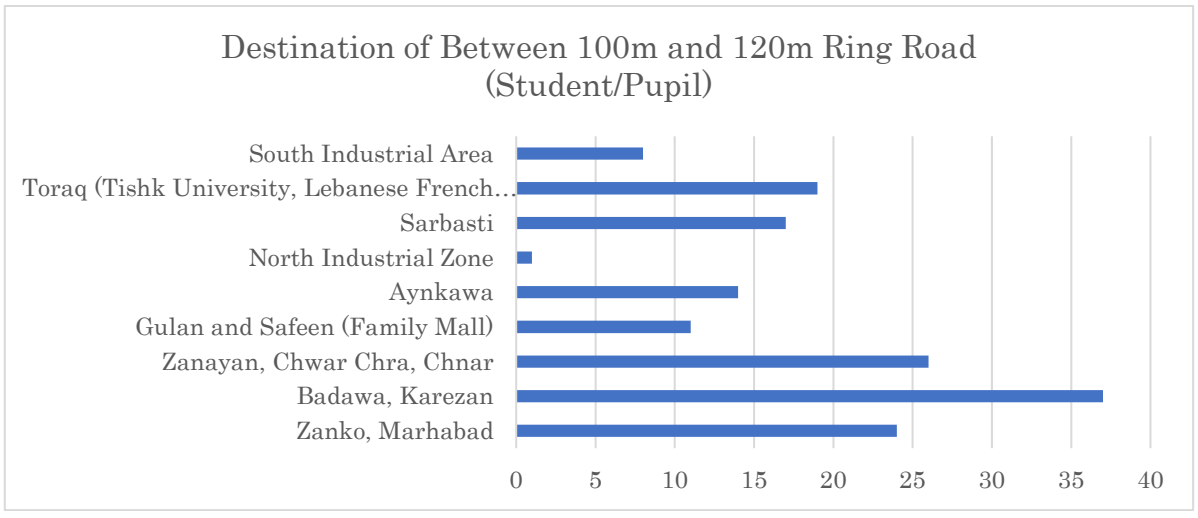
By looking at detailed destination for each of the destination groups as shown in Figure 7.1.12, namely Inside 100m Road, Between 100m and 120m Road, and Outside 120m Road, a very high concentration is observed for the destination Inside 60m Road, especially for the employed people. Similar pattern is seen for the students/pupil as well, but the concentration to the area Inside 60m Road is a bit less and other areas like Azadi and Mamostiyan have some level of concentration.

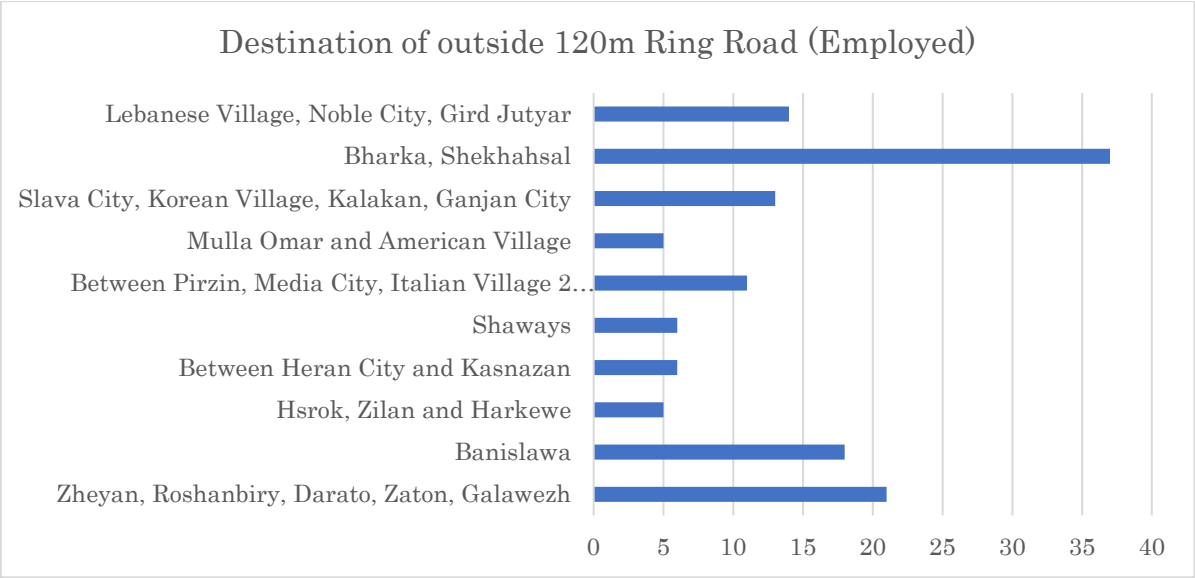
Certain level of concentration was observed at Badawa - Karezan, Zanayan - Chnar and Zanko - Marhabad for the area between 100m and 120m Road and at Bharka - Shekhahsal for the area outside of 120m Road, but the level of the concentration is not so high as Inside 60m Road. The monocentric concentration of the trip to the area Inside 60m Road is obvious from the survey.

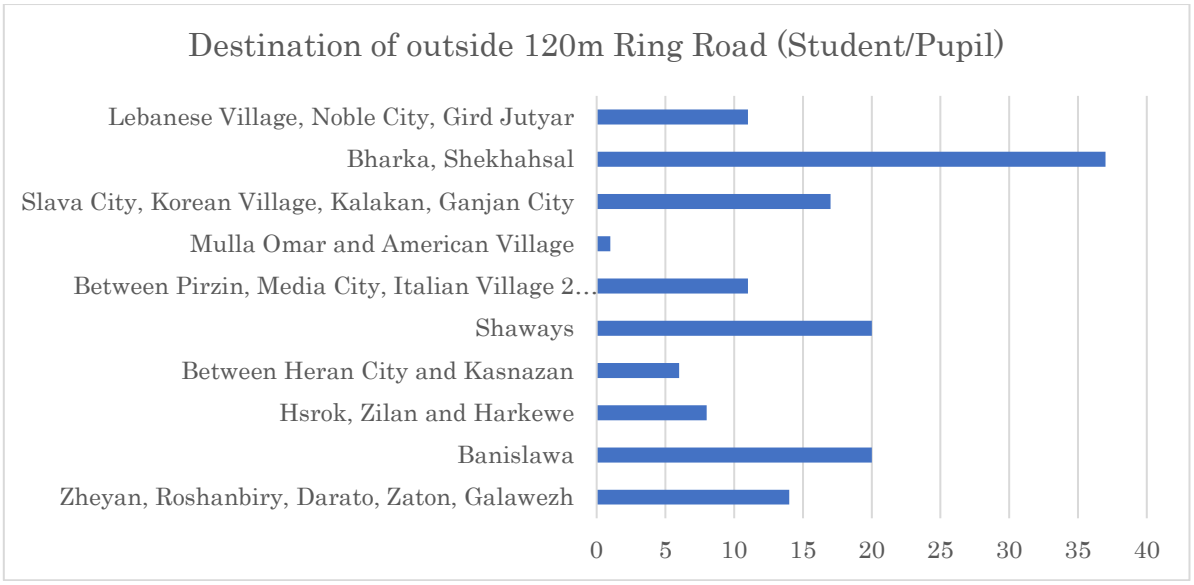



Destination of Inside 100 Meter Ring Road (Student/Pupil)
Rizgari, Kurdistann Bahar
Raparin, Nishtiman, Nawroz
Empire, MRF, Ruya, English Village, Italian…
Dream City
Naz Naz, Park View
Waziran, MNW & Star Towers
Bakhtiary and Gulan Tower
Kuran Aynkawa
Salahadeen, Matufi, MRF Quatro
Kwestan
Shorsh, Kani, Nuseran
Brayati, Khanzad, Raparin
Mamostiyan, Khabat
Runaky, Eskan, Mufti, Pizishkan, Mantikawa
Azadi
Inside 60 Meter Street
0 10 20 30 40 50 60 70 80 90 100


Destination of Between 100m and 120m Ring Road (Employed)
South Industrial Area
Toraq (Tishk University, Lebanese French…
Sarbasti
North Industrial Zone
Aynkawa
Gulan and Safeen (Family Mall)
Zanayan, Chwar Chra, Chnar
Badawa, Karezan
Zanko, Marhabad
0 5 10 15 20 25 30


Destination of Between 100m and 120m Ring Road (Student/Pupil)
South Industrial Area
Toraq (Tishk University, Lebanese French…
Sarbasti
North Industrial Zone
Aynkawa
Gulan and Safeen (Family Mall)
Zanayan, Chwar Chra, Chnar
Badawa, Karezan
Zanko, Marhabad
0 5 10 15 20 25 30 35 40

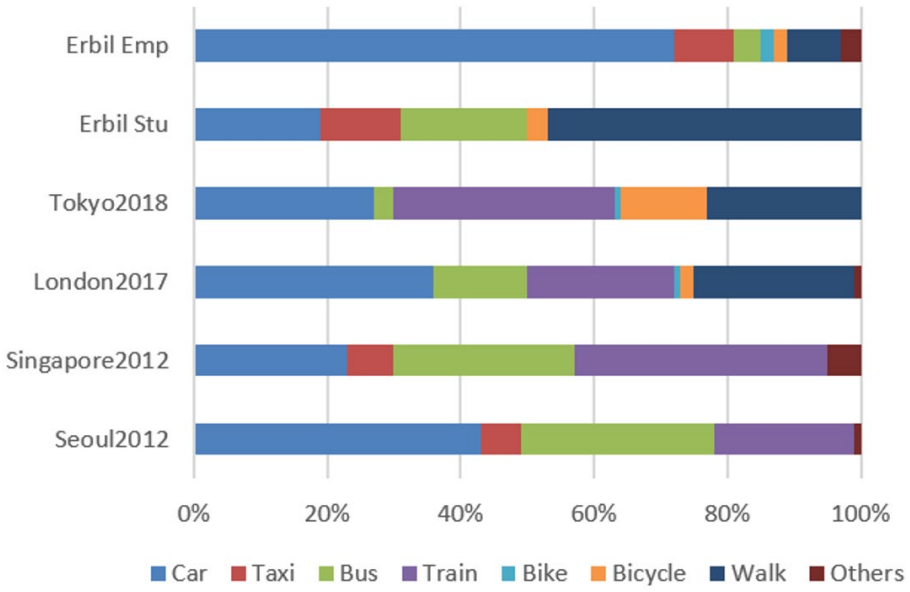




Source: Result of Household Survey

Figure 7.1.12 Number of Responses on the Detailed Destinations

The Household Survey also has question on the preferred mode of travel to the destination. There were 1123 responses from the employed people and 831 responses from the students/pupils. Driving the own car was by far the most preferred mode of transport, and with being driven by other family member or friend, the use of car is over 70% of the travel mode of the employed people. Use of taxi is 9% and bus is only 4%. This pattern of modal split varies very much from those of other cities as shown in Figure 7.3.13. The policy of reducing the private car use by 25% during the peak time will bring the car share down to the level similar to Seoul. The configuration of the preferred travel mode of the students/pupils is different from the employed people and percentage of car use is similar to London; percentage of bus is similar to Singapore and Seoul. The most preferred mode is walking (47%) which is highest among the compared cities. The category of public transport like taxi (12%), shared transport for students such as school/university bus (9%), ordinary bus or minibus (10%) together outweighs the car use.



Source: House Hold Survey

Note: Taxi for Tokyo and London is not indicated and is included in car

Figure 7.1.13 Preferred Mode of Transport in other Cities

7.2 Road and Transport Characteristics

To grasp current road traffic condition in Erbil, several kinds of simple traffic survey were conducted in September 2022 under the supervision of GDUP. The types of traffic survey are as following for the purpose of each survey.

Table 7.2.1 Types of Traffic Survey and Purpose

No.	Survey Type	Purpose
1	Cordon Line Survey	To acquire trip information of passengers in private vehicles as well as buses on the major roads crossing the proposed green belt (near ring road No.8) and volume inbound/outbound from/to Erbil CBD. The number of the survey points is 10 as shown in Figure 7.2.1. The survey was conducted on 10 October 2022 for 24 hours.
2	Screen Line Survey	To acquire trip volume crossing small drainage located southern part of Erbil CBD. It is used to estimate existing person/vehicle trip pattern (OD matrix). The number of the survey points is 17 as shown in Figure 7.2.1. The survey was conducted on 17 October 2022 at S1 to S10, and on 19 October 2022 at S11 to S17.
3	Bus Passenger and Operating Survey	To collect detailed passenger volume data of every route / several major stops and bus operating condition such as travel time to consider appropriate bus service in updating transport master plan. The survey was done on 23 October 2022 between 7am - 10am, 11am - 2pm and 4pm - 7pm.
4	Taxi OD Survey	To acquire trip information of passengers using taxi which is major transportation modes for citizens in Erbil. Observed data will be summarized and used as supplement for preparing person trip flow. The survey was done for 34 taxis for the period from 28 September to 12 October 2022.

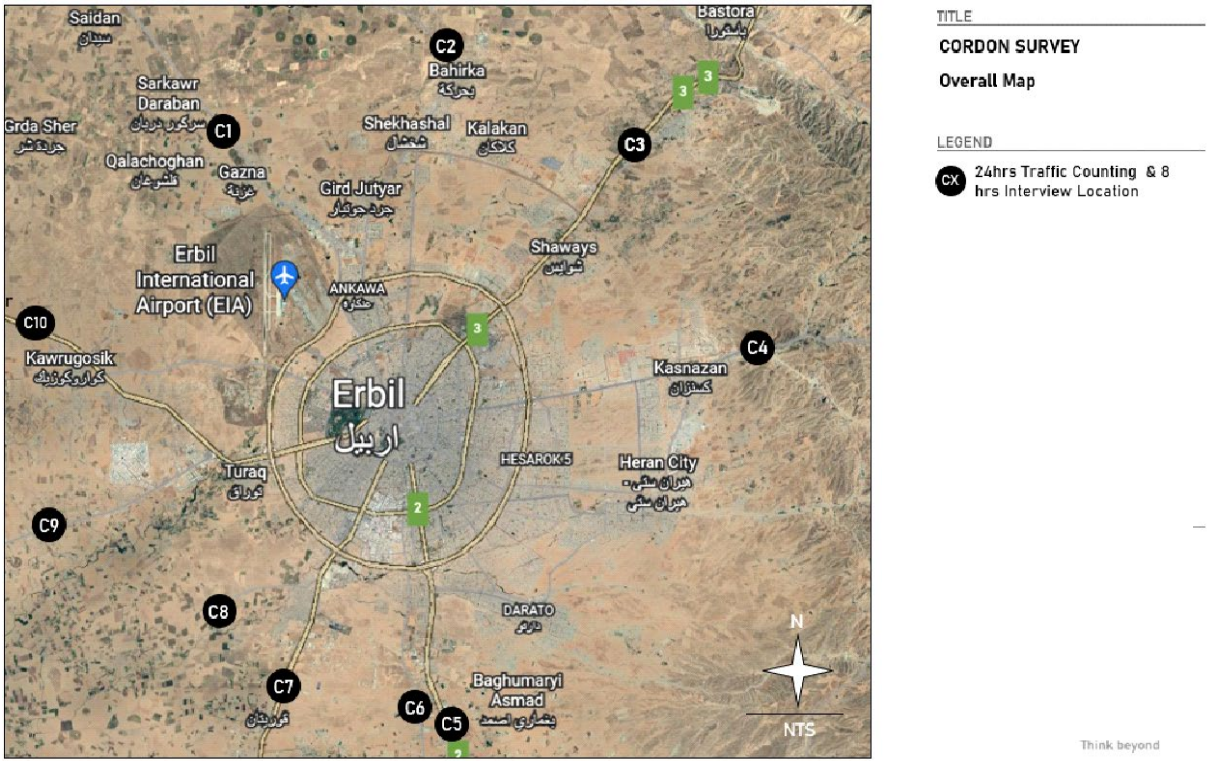
Source: JICA Project Team

7.2.1 Results of Cordon Line Survey

(1) Survey Location

Traffic volume at cordon line locations (Figure 7.2.1) is collected using video recording methodology in which the data is divided to 30 minutes periods and classified into eight vehicle categories as follows:

1) Private Car (for private use (sedan, SUV, pick-up, etc.))
2) Taxi (All kinds of taxis)
3) Large Bus (Ordinary bus with seat capacity more than approximately 30.)
4) Coaster Bus (Seat Capacity approximately 30)
5) Mini bus (seat capacity less than 30)
6) Small truck (lightweight truck, pick-up truck with 2 axles)
7) Large truck (more than 2 axles)
8) Motor cycle
9) Others (3-wheel vehicle, other)

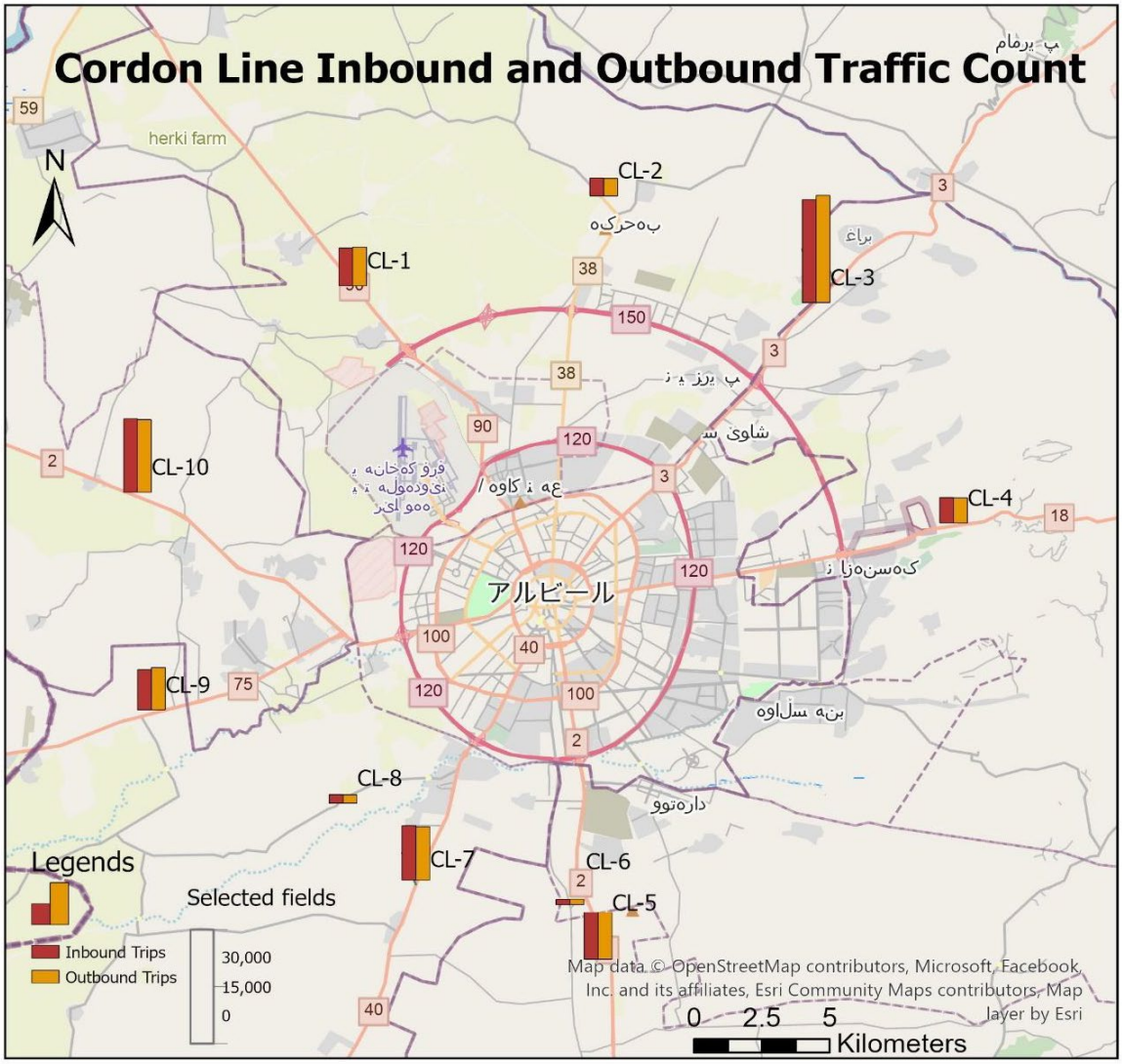


Source: JICA Project Team

Figure 7.2.1 Location of Cordon Line Survey

(1) Traffic Count

Most of the cordon line are on radial arterial roads connecting Erbil CBD except 2 locations (C6, C8). Therefore, heavy traffic was observed in the survey location. Total traffic count reaches 236,000 vehicles per day (24hours survey for every cordon location). Average passenger volume by car classification is as shown in Figure 7.2.2. Total inbound/outbound from/to Erbil CBD per day is around 450,000 passenger per day.



Source: JICA Project Team

Figure 7.2.2 Traffic Volume at Cordon Line Survey Points

(2) Roadside Interview

A roadside interview was done between 7am - 10am, 11am - 2pm and 4pm - 7pm at all ten cordon lines. The target number of vehicles to be interviewed is about 5% - 10% of daily traffic. The main purpose of the roadside interview is to provide information about: Vehicle Type, Origin-Destination, Trip Purpose, Number of Seats, Estimated Travel Time, Bus Company Name and Bus Route Number (Bus Only), Name of Start/End Terminal (Bus Only), Type of Commodity (Truck Only), Maximum Load (Truck Only), and Loading Ratio (Truck Only).

Table 7.2.2 Sample Number of Interview at Cordon Line

Survey Location	# of interview	Traffic Volume	Sample Ratio
C1	1,598	20,117	7.9 %
C2	1,344	9,247	14.5 %
C3	2,059	55,305	3.7 %
C4	1,176	13,344	8.8 %
C5	1,544	42,622	3.6 %
C6	825	2,839	29.1 %
C7	1,600	28,408	5.6 %
C8	696	4,448	15.6 %

Survey Location	# of interview	Traffic Volume	Sample Ratio
C9	759	21,709	3.5 %
C10	1,111	38,420	2.9 %
Total	12,712	236,459	5.4%

Source: JICA Project Team

Table 7.2.3 Average Passenger by Car Classification

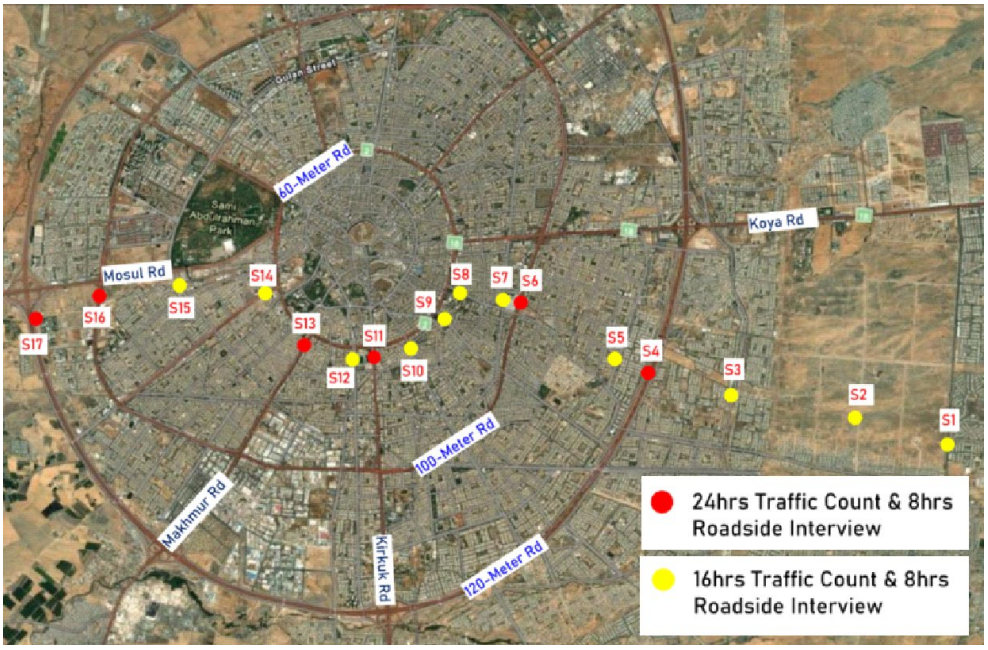
Classification	Number of Sample	Average Passenger Volume
Private Car	8,765	1.9
Taxi	1,132	2.0
Motor Cycle	130	1.3
Large Bus	12	19.5
Coaster	16	12.2
Mini Bus	191	5.3
Small Truck	814	1.5
Large Truck	295	1.1
Lorry	78	1.2
Others	1	2.0
Total	11,434	1.9

Note: Consider only effective sample for all interview survey
Source: JICA Project Team

7.2.2 Results of Screen Line Survey

(1) Survey Location

The methodology of the screen line survey is the same as the cordon line survey. The survey locations are as shown in Figure 7.2.3.

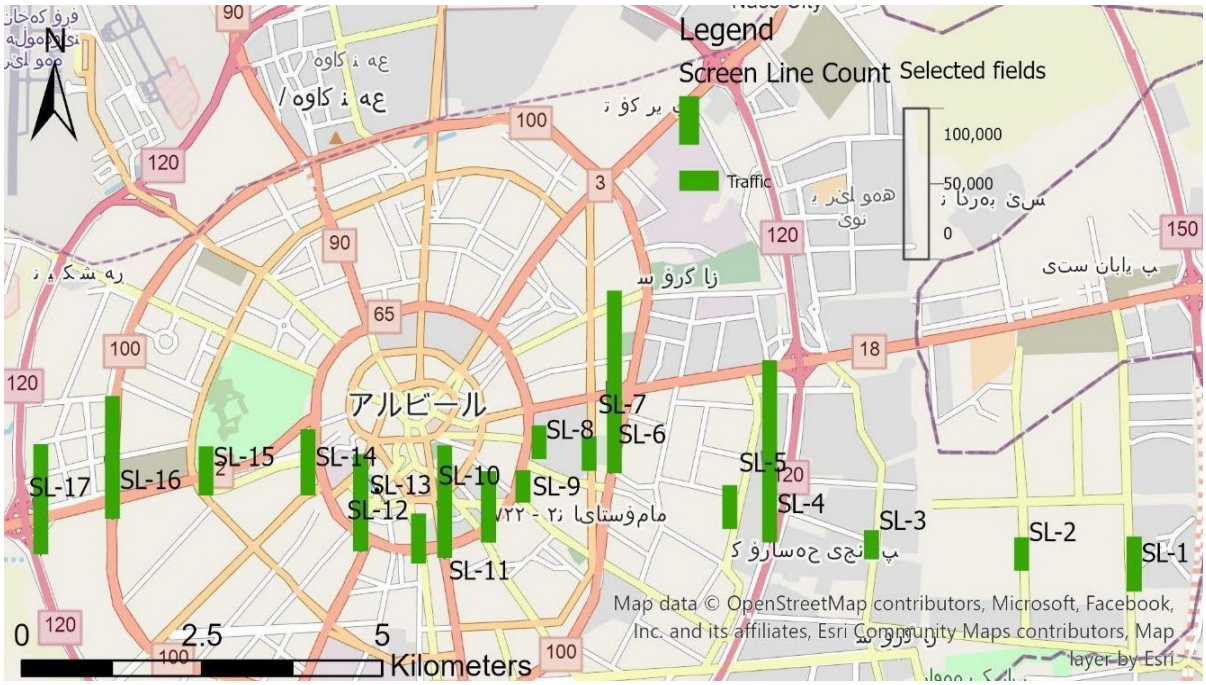


Source: JICA Project Team

Figure 7.2.3 Location of Screen Line Survey

(2) Traffic Count

Heavy traffic volume is observed on targeted section of screen line survey even outside 120m Road as shown in Figure 7.2.4. Especially traffic on 100m and 120m Road accommodates more than 70,000 vehicles per day (24 hours) and more than 120,000 for high crowded section.



Source: JICA Project Team

Figure 7.2.4 Location of Screen Line Survey

(3) Roadside Interview

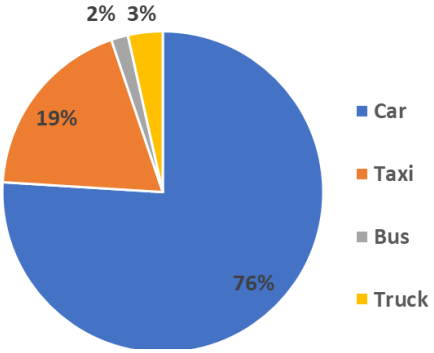
Similar to the cordon line survey, a roadside interview was done between 7am - 10am, 11am - 2pm and 4pm - 7pm at 15 locations. S4 and S17 are on 120m Road and thus the interview at roadside was not permitted by the authority for the safety reason. The average target number of vehicles to be interviewed is about 3% as shown in Table 7.2.4. The main purpose is the same as the interview of the cordon line survey.

Table 7.2.4 Sample Number of Interview at Cordon Line

Survey Location	# of interview	Traffic Volume	Sample Ratio
S1	1,240	33,150	3.7%
S2	1,250	20,188	6.2 %
S3	820	17,691	4.6 %
S5	780	26,743	2.9 %
S6	1,700	120,901	1.4 %
S7	820	21,064	3.9 %
S8	1,100	20,467	5.4 %
S9	1,320	19,732	6.7 %
S10	1,260	43,148	2.9 %
S11	1,150	74,766	1.5 %
S12	1,430	30,269	4.7 %
S13	1,430	64,543	2.2 %
S14	1,560	39,909	3.9 %
S15	1,300	29,434	4.4 %
S16	1,670	81,327	2.1 %
Total	18,830	643,332	2.9 %

Source: JICA Project Team

Based on the surveyed data, the majority of the traffic consists of private cars, followed by taxis as shown in Figure 7.2.5

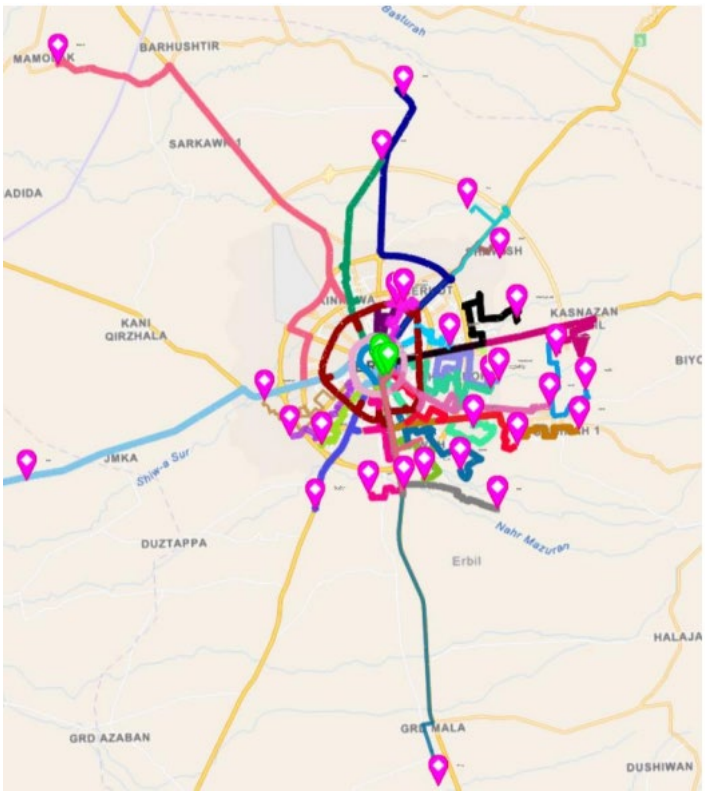


Source: JICA Project Team

Figure 7.2.5 Modal Split based on the Screen Line Survey

7.2.3 Results of Bus Passenger and Operating Survey

Passenger counts at the main terminals are organized by manual counting. The survey was conducted for two parts, namely passenger counting and travel time for each bus line, at morning and evening peak-hour and off peak, based on a smart device application which is capable of GPS tracking and option to record location of each boarding and un-boarding along the trip. Figure 7.2.6 shows the bus route surveyed. There are 32 surveyed routes.



Source: JICA Project Team

Figure 7.2.6 Bus Route Data Obtained from Survey

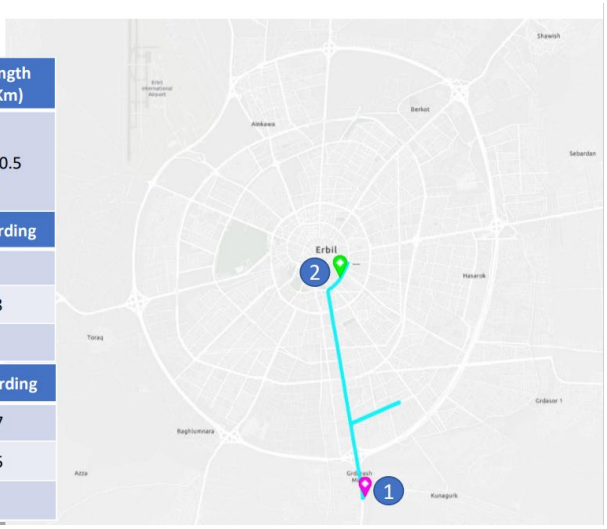
The route with the highest passenger counts is the Mantkawa route, followed by the Daratu and Ari routes as shown in Figure 7.2.7.

Mantkawa Route

Period	Travel Time (min.)	#No. Stops	Length (Km)
7-10	36	22	10.5
11-2	41	32	
4-7	Closed		

1 Period	Boarding	Un-Boarding
7-10	557	1
11-2	9	928
4-7	0	0

2 Period	Boarding	Un-Boarding
7-10	25	117
11-2	92	535
4-7	40	53

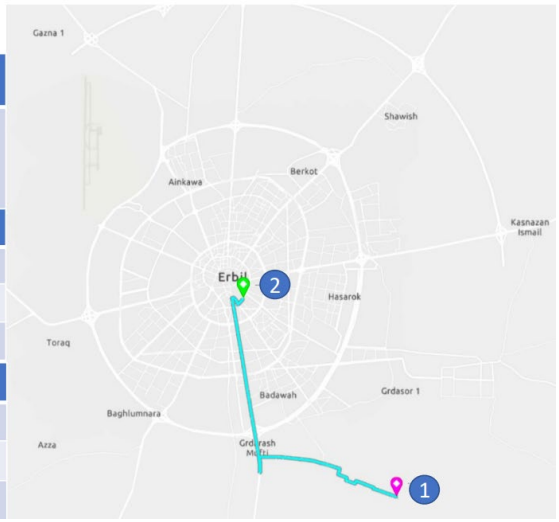


Daratu Route

Period	Travel Time (min.)	#No. Stops	Length (Km)
7-10	43	32	14
11-2	47	40	
4-7	45	35	

1 Period	Boarding	Un-Boarding
7-10	143	10
11-2	84	85
4-7	38	123

2 Period	Boarding	Un-Boarding
7-10	156	191
11-2	449	120
4-7	427	80

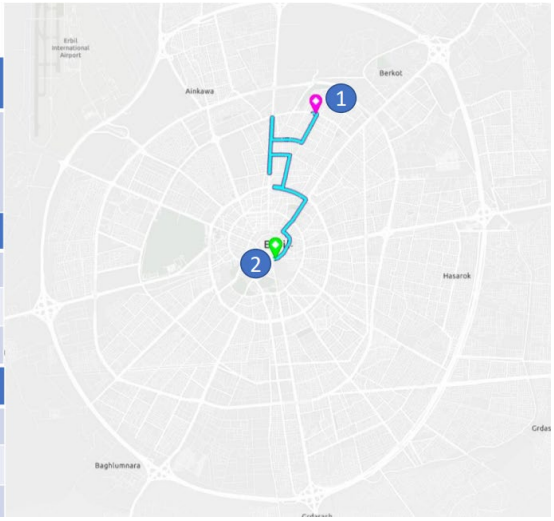


Ari Route

Period	Travel Time (min.)	#No. Stops	Length (Km)
7-10	33	23	8
11-2	32	18	
4-7	28	15	

1 Period	Boarding	Un-Boarding
7-10	430	74
11-2	248	47
4-7	307	83

2 Period	Boarding	Un-Boarding
7-10	7	211
11-2	102	94
4-7	186	23



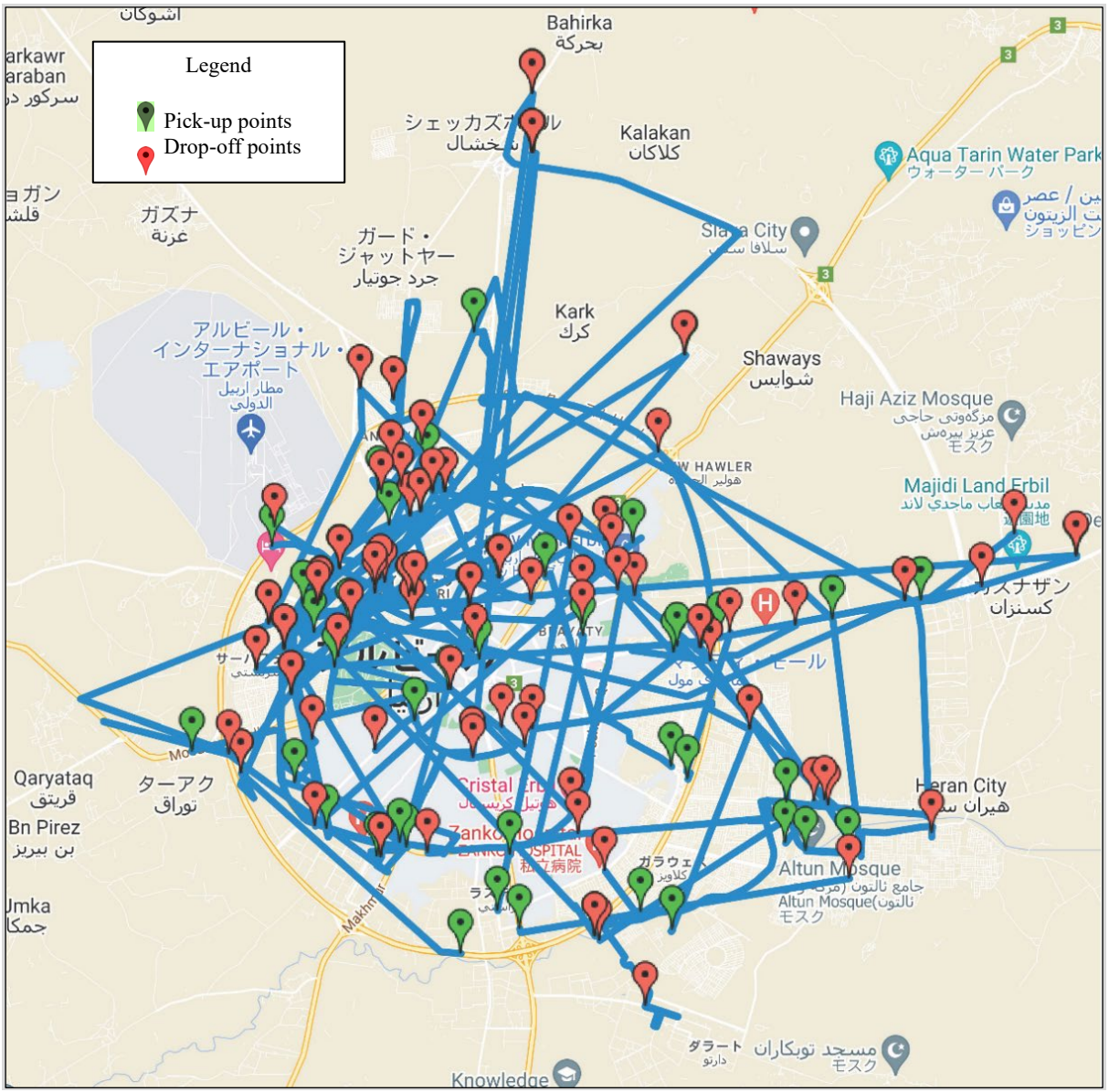
Source: JICA Project Team

Figure 7.2.7 Highest Bus Passenger Counts Obtained from Survey

7.2.4 Results of Taxi OD (Origin-Destination) Survey

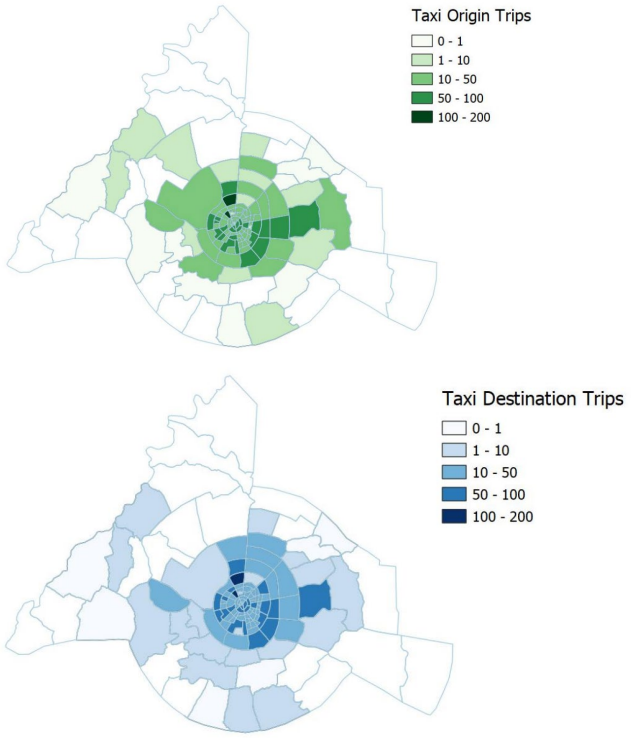
The taxi OD survey was conducted by 35 taxi drivers (vehicles) participated from the beginning, however, six withdrew from the survey due to personal reasons. Therefore, additional five drivers were added to the team, and the trip recording period was extended for those drivers who joined after. In the end, daily trips were recorded for 34 taxi drivers for the period of two weeks. During the survey period, total of 3,700 taxi trips were recorded an average of seven trips per day per taxi driver. The average trip length is 18 km.

Figure 7.2.8 shows actual tracking data of one taxi driver. Figure 7.2.9 shows the pickup (origin) zone and drop off (destination) zone. They are almost identical, therefore, it is assumed that the taxi ride mostly covers area inside of 100m Road.



Source: JICA Project Team

Figure 7.2.8 Sample of Taxi Tracking for 2 weeks



Source: JICA Project Team

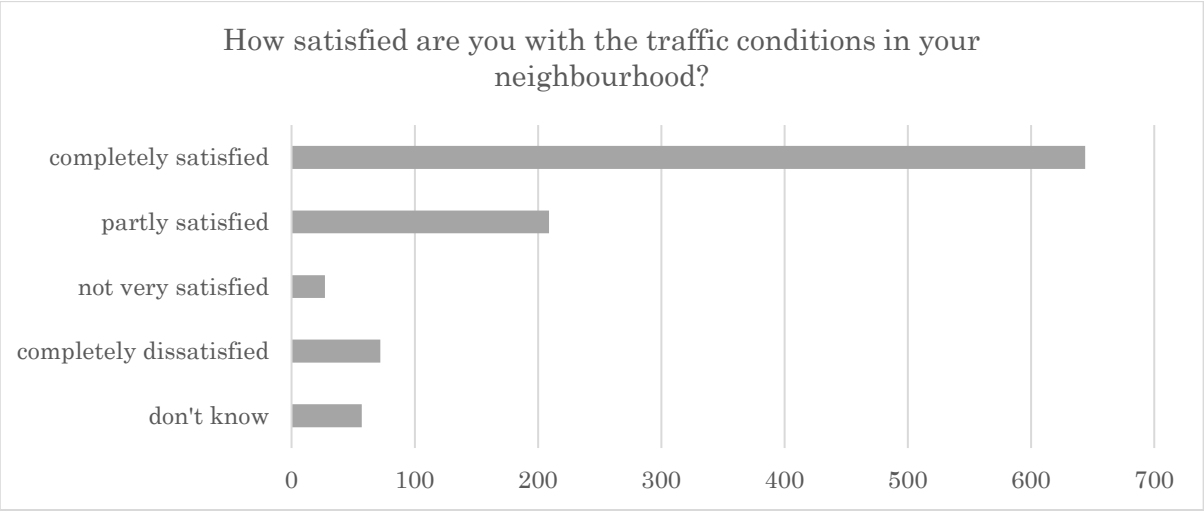
Figure 7.2.9 Taxi Pick-up and Drop-off Zone

7.3 Identification of Urban Transportation Issues

The main issue of the Erbil 2030 MP is that it is not clear under what conditions and with what model the various scenarios of the future traffic pattern are calculated. It is shown that road traffic will decrease by 25% when public transportation is introduced, but the basis for this estimate is not clear. It is therefore important to show the facts or evidence in introducing the future measures. Data on traffic volume exists partially as the content of a feasibility report of individual section of the roads such as 120m and 150 m Roads. Therefore, a road network planning cannot be done on the basis of the area wide traffic volume forecast.

In general, the road network of Erbil inside 120m Road with many ring and radial roads is good, so new road would not be necessary. However, the hierarchy and cross-sectional structure of the road network is not clear, and the alignment does not take into account the current road network and land use. This has led to problems such as the loss of continuity because the function of the service roads along 120m Road is not clear and they do not form a local road network.

The very high preference of car use by the employed people reflects the current main issue of the traffic in Erbil. Congestion at intersections or at U turn points and on-street parking problems are generally observed traffic issues of Erbil city. Surprisingly, many people are satisfied with the traffic conditions in their neighborhood, according to the Household Survey as shown in Figure 7.3.1.



Source: Result of Household Survey

Figure 7.3.1 Level of Satisfaction on Road Traffic Condition

While the number of the answers to the traffic problem is not big, road congestion, speeding, junction/U turn points, using local roads for shortcut are the concern of the people as shown in Figure 7.3.2. Localized measures e.g. improvement of congested intersection and reviewing the U turn points would address the issues of the car traffic on spot but not in a long term.

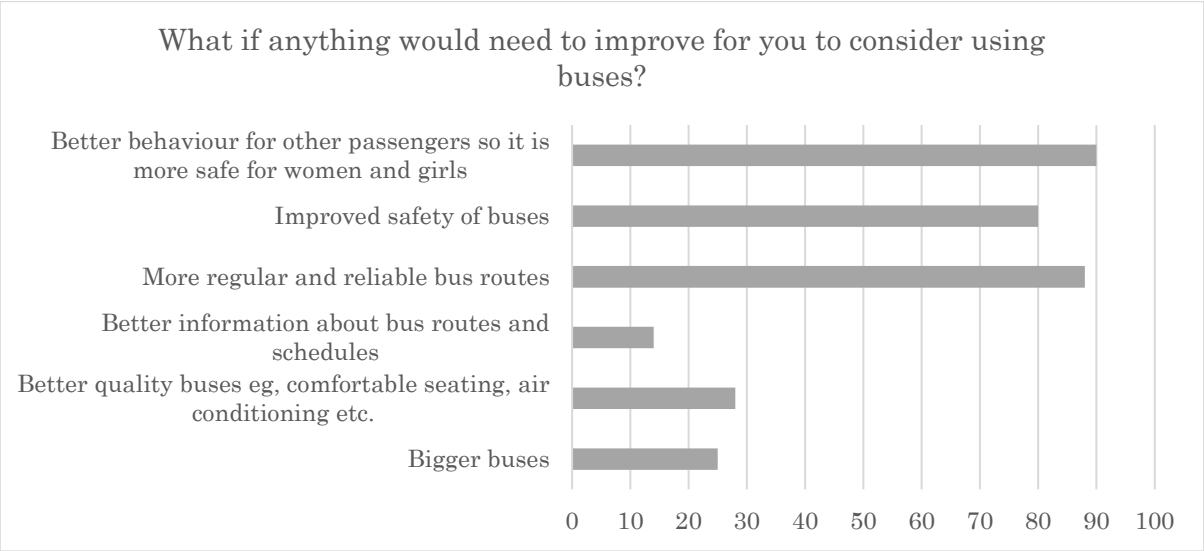
While local traffic problems have been identified and some measures have been taken, their effects have not been analyzed.

Source: Result of Household Survey

Figure 7.3.2 Reasons of Dissatisfaction on Road Traffic

In Erbil, there have been plans for BRT and LRT, but they have not yet been introduced. One of the reasons for this is the organizational and institutional problem of relying entirely on the private sector for public transportation. It will be difficult to handle the traffic in Erbil only by buses in the future, and it is necessary to develop a new mode of public transport in the near future. It is also necessary to create a system and structure for the public to be involved to some extent in the development of public transportation. Issues raised by the people by the Household Survey are shown in Figure 7.3.3. Safety and manner of the passengers are the most concern followed by the reliability of the bus services.

The reason of discontinuation of the bus service on 100m Road is said to be a technical problem, but the detail is not clear. One of the reasons could be the mismatch of demand and bus route because the destination of the people is not along 100m Road but rather the city center according to the Household Survey. In this respect a study of the passenger demand of entire Erbil would be necessary to evaluate the existing bus network and develop future plan.



Source: Result of Household Survey

Figure 7.3.3 Raised Points for Improvement of Public Bus

7.4 Urban Transportation Sector Strategies & Policies

(1) Overall Goals of Transportation Sector

The Overall Goals of the Transportation Sector development in Erbil 2050 MP, contained in the latest policies of the KRG and which will realize the Long-term Development Visions, can be summarized as below.

- TRA-I: Enhance public transport efficiency and reliability to provide a viable alternative to private vehicle usage and reduce car dependency (and aiming to cover 25% of future traffic demand during morning peak hours with public transport and thus contributing to the creation of a low-carbon city)
- TRA-II: Promote walkability and cycling as proper modes of transportation through infrastructure improvements
- TRA-III: Enhance road quality, safety and visibility, by addressing the deterioration and bad state of roads to ensure safety for all road users
- TRA-IV: Alleviate road congestion by implement traffic management strategies, particularly in central zones and U-turn points
- TRA-IV: Improve parking systems through regulation and sufficient supply of parking spaces
- TRA-V: Improve and expand the overall transportation infrastructure to meet the growing demands of urban mobility
- TRA-VI: Promote multimodal transportation by developing integrated transportation systems that facilitate seamless transitions between different modes of transport.

(2) Linkage with Strategic Orientations of Erbil 2050 MP

Strategies and Policies of Transportation Sector mainly support the realization of the Strategic Orientations #2: Improve international competitiveness through regional connectivity and integration and #6: Create livable and human-scale neighborhoods connected through public transportation (See Section 5.4), which implements especially the Long-term Development Visions (See Section 4.2) of Long-Distance Land Transport (LDT) and Public Transit-based Walkable City (PTW).

(3) Strategies & Policies of Transportation Sector

Table 7.4.1 below summarizes the Strategies & Policies of Transportation Sector proposed to tackle existing issues and to achieve Erbil 2050 MP Long-Term Visions and Overall Sector Goals.

Table 7.4.1 Strategies & Policies of Transportation Sector

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
Road	**TRA-S1:** Completion of the existing Concentric Grid and the initiation of a novel Road Development Model supporting Multi-Core City, inspired by the concentric/radial grid model	**TRA-S1-1:** Complete the construction of existing unfinished Ring Roads by addressing gaps and constructing the necessary missing links on the 40m Road. **TRA-S1-2:** Initiation of a novel Road Development Model supporting Multi-Core City, inspired by the concentric/radial grid model with the construction of the following major roads: Concentric Road linking Bahirka Core and Great Zab Cluster (going through Qafar and Daraban); Radial Road from Duhok Road Interchange in Yusif Milyan area to 150 m Road (going through Rashwan, Qafar and Ashukan) **TRA-S1-3:** Setting an appropriate cross section (depending on category and function of the road) and securing the right-of-way.	Deterioration, bad state and lack of roads (TRA-05)
Road	**TRA-P2:** Policy 2: Achieving a high Level of Service at road junctions	**TRA-S2-1:** Construction of grade-separated junctions, especially where public transport like BRT will be introduced. **TRA-S2-2:** Congestion hot spots inside 100m road will be assessed and change in junction crossing and U-turn points will be planned. **TRA-S2-3:** Lane markings and/or cones as well as signalization will be planned to increase the capacity of streets and junctions.	Low visibility of lane markings on urban roads (TRA-04) Road congestion in particular in central zone inside 60-meter road and sporadically at U turn points of roads (TRA-06)
Public Transportation	**TRA -P3**: Policy 3: Increasing the use of Public Transportation during peak hours	**TRA -S3-1**: Modal shift from private car to public transport, Park and Ride facilities shall be planned along 120m and 150m road with convenient transit service to the Erbil center. **TRA -S3-2**: Transport terminal at planned Iraqi railway station, Airport, city cores will be designed based on the future traffic forecast of the transport model.	High dependency on private cars for commuting and other trips (TRA-01) Lack of efficient public transport system (TRA-02)
Public Transportation	**TRA -P4**: Policy 4: Achieving an affordable public transport system	**TRA -S4-1**: Re-assessment of the planned BRT lines based on the transport model will be done. **TRA -S4-2**: Setting a proper mechanism for operation of BRT including dedicated bus lane and priority signal. **TRA -S4-3**: Reorganization of the mini-bus as feeder service	High dependency on private cars for commuting and other trips (TRA-01) Lack of efficient public transport system (TRA-02)

Theme	Sector Strategy / Policy	Action (incl. Draft Priority Project)	Planning Issue to solve & Sector Goal to achieve
Traffic Management / Traffic Safety	**TRA -P5**: Policy 5: Traffic control and calming in consideration with land use and traffic conditions	**TRA -S5-1**: Traffic calming by closing the streets for car traffic inside 30m road with introducing an appropriate Shuttle Mover service will be planned. **TRA -S5-2**: Taxi waiting areas along 30m road will be planned. **TRA -S5-3**: CCTV cameras will be used for real-time surveillance of the traffic volume and speed control. **TRA -S5-4**: Use of appropriate and efficient speed reducing measures like the humps to reduce traffic accidents	High dependency on private cars for commuting and other trips (TRA-01) Lack of efficient public transport system (TRA-02) Low visibility of lane markings on urban roads (TRA-04)
Walkability	**TRA -P6**: Policy 6: Traffic calming in consideration with land use and traffic conditions	**TRA -S6-1**: Standard cross section of the residential road and of some selected trunk road shall be introduced for the better amenity.	Lack of walkability and low adoption of walking and cycling as modes of transportation (TRA-03)
Parking	**TRA -P7**: Policy 7: Comprehensive parking management in consideration with land use and street/traffic conditions	**TRA -S7-1**: Metered parking system, parking information boards, enforcement of parking regulation will be planned.	Insufficient and unregulated parking system (TRA-07)
Fueling Station	**TRA -P8**: Policy 8: Introducing requirements for PFS implantation and design	**TRA -S8-1**: Relevant regulations to be confirmed. So far, the queueing cars at PFS that is cheaper than the others are do not obstruct the passing traffic on the trunk roads. The number of PFS seems to be sufficient inside 100m road.	

Source: JICA Project Team

7.5 Traffic Demand Forecast

(1) Outline of the Transport Model

The Project Team conducted four traffic and transport surveys in October 2022 to grasp the road and transport condition in Erbil, namely Screen and Cordon Line Survey, Bus Operation Survey and Taxi Operation Survey. Some results from the Household Interview Survey were also used to understand the origin-destination and preferred mode of movement. The result of the survey is used to develop and calibrate the transport demand model. Quantitative analysis of the movement supplements the result of the model as well as used for the planning purposes. Input to the GIS database for Erbil is done as well.

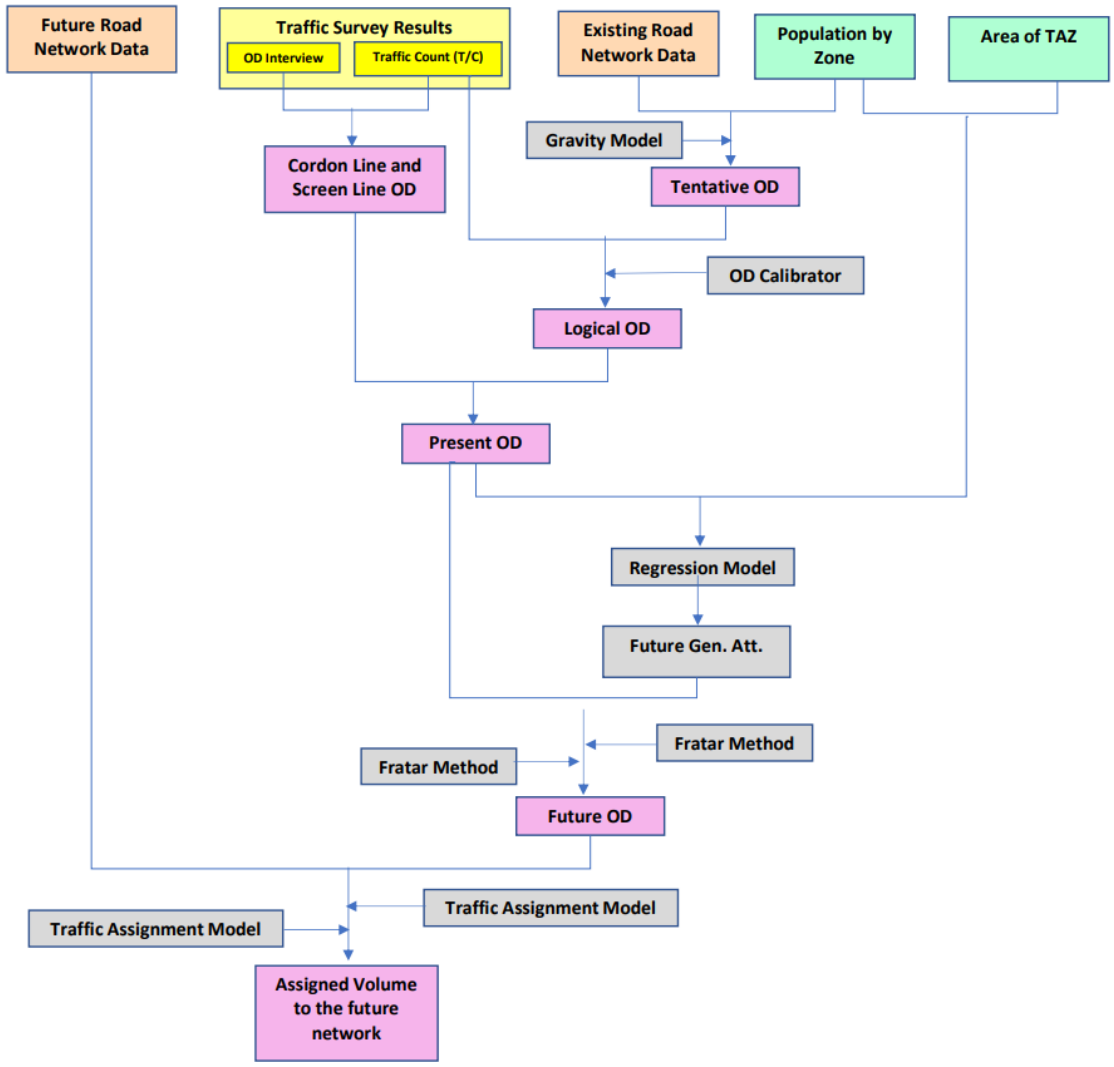
The framework of the transport model follows the conventional four step approach that has been well tried and found to be effective in many cities of the world. The four-step approach consists of a series of nested and cascading sub-models:

- Trip Generation - Estimating the “amount” of travel and where it begins and finishes;
- Trip Distribution - Linking the trip ends together to form trips between the origins and destinations;
- Modal Split - Accessing the modal shares of the available travel modes; and,
- Assignment - Usage of each segment of the highway and public transport networks.

(2) Methodology

The methodology involves a multi-step approach to refine and expand the OD data across various transportation modes, namely private cars, taxis, buses, and trucks. The steps are explained below.

1) Seed OD Matrix Preparation: Currently there is no reliable OD data for Erbil city. The OD data prepared in 2006 MP looks too rough as it is based on only on few hours traffic count in limited locations. On the other hand, a comprehensive person-trip survey has not been conducted for Erbil city so far. Therefore, seed OD matrices are prepared for each mode using a gravity model. Key input variables include distances between zones and population data, establishing a fundamental framework for subsequent analyses.
2) Calibration of Seed OD Tables: To enhance precision, the seed OD tables undergo a calibration process using traffic count data from both cordon lines and screen lines. This step ensures alignment with observed traffic patterns in these control points.
3) Expansion of OD Matrices: Subsequently, the OD sample data are expanded for cordon lines and screen lines across all modes of transportation. Traffic count data is used for calculating the expansion factors.
4) Combination of OD Tables: The calibrated seed OD, expanded cordon line OD, and expanded screen line OD tables are integrated into a unified dataset.
5) Calibration of Combined OD Data: The newly established combined OD dataset undergoes a further calibration process, leveraging screen line traffic count data to refine the accuracy of the OD estimations. This calibration ensures that the combined data accurately mirrors the real-world transportation dynamics within the project area.
6) Conversion to Person Trip OD: Finally, the OD data by mode is converted into person trip OD data, considering vehicular occupancies. This conversion enhances the applicability of the data for future analyses.
7) Traffic Assignment: Using the road network data, OD will be allocated to every road link. Then, in line with a strategy a part of the traffic will be shifted to the public transportation link.



Source: JICA Project Team

Figure 7.5.1 Methodology for the Transport Modelling

(3) Calibration

The observed and estimated traffic volumes crossing ten cordon lines and seventeen screen lines in the Study Area (refer to Section 7.2.1 and 7.2.2) are compared for validation. As for vehicle trips, all types of private vehicles and trucks are consolidated since it is not possible to make a clear comparison of observed vehicles by individual vehicle types due to the problems of identification of individual vehicle types in the vehicle traffic assignment. Therefore, all vehicle trips are converted into PCU (Passenger Car Unit). Person trips include all the passengers crossing those screen lines. There are few locations where the observed traffic volume and estimated traffic volume varies up to 200%. It has been likely caused by traffic congestion where the number of passing vehicle decreases as the velocity goes down. But overall correlation coefficient is 0.9 as shown in Table 7.5.1, so that the model is judged as valid in general.

Table 7.5.1 Comparison Across Cordon and Screen Lines (Vehicle Trips)

Location	Observed (PCU/day)	Estimated (PCU/day)	Difference	(Estimated/ Observed)
MA90-CL1	23293	38067	14774	163%
MA38-CL2	10217	9359	-858	92%
MA03-CL3	59565	42874	-16691	72%
MA18-CL4	15738	11442	-4296	73%
MA02-CL5	50004	43783	-6221	88%
SA07-CL6	3499	5254	1755	150%
MA40-CL7	32296	38903	6607	120%
SA93-CL8	5114	5666	552	111%
MA75-CL9	27706	12992	-14714	47%
MA02-CL10	48182	54371	6189	113%
SA49-SL1	39052	15330	-23722	39%
SA50-SL2	24532	23100	-1432	94%
GR32-SL3	20531	10373	-10158	51%
M120-4SL4-1	13091	5366	-7725	41%
M120-2SL4-2	52366	45677	-6689	87%
M120-1SL4-3	52366	47529	-4837	91%
M120-3SL4-4	13091	3080	-10011	24%
GR15-SL5	30325	25028	-5297	83%
MA100-SL6	126528	122501	-4027	97%
AR43-SL7	23679	17925	-5754	76%
GR16-SL8	23125	46589	23465	201%
GR07-SL9	22434	43735	21301	195%
GR08-SL10	49055	63296	14242	129%
MA02-SL11	77016	82153	5137	107%
GR06-SL12	34029	56774	22745	167%
MH-40-SL13	67342	83545	16204	124%
SA06-SL14	45337	44488	-849	98%
SA01-SL15	34061	55478	21418	163%
MA100-SL16	85875	68340	-17535	80%
M120-3SL17-1	8776	2819	-5957	32%
M120-1SL17-2	35102	30307	-4795	86%
M120-2SL17-3	35102	31299	-3803	89%
M120-4SL17-4	8776	6265	-2511	71%

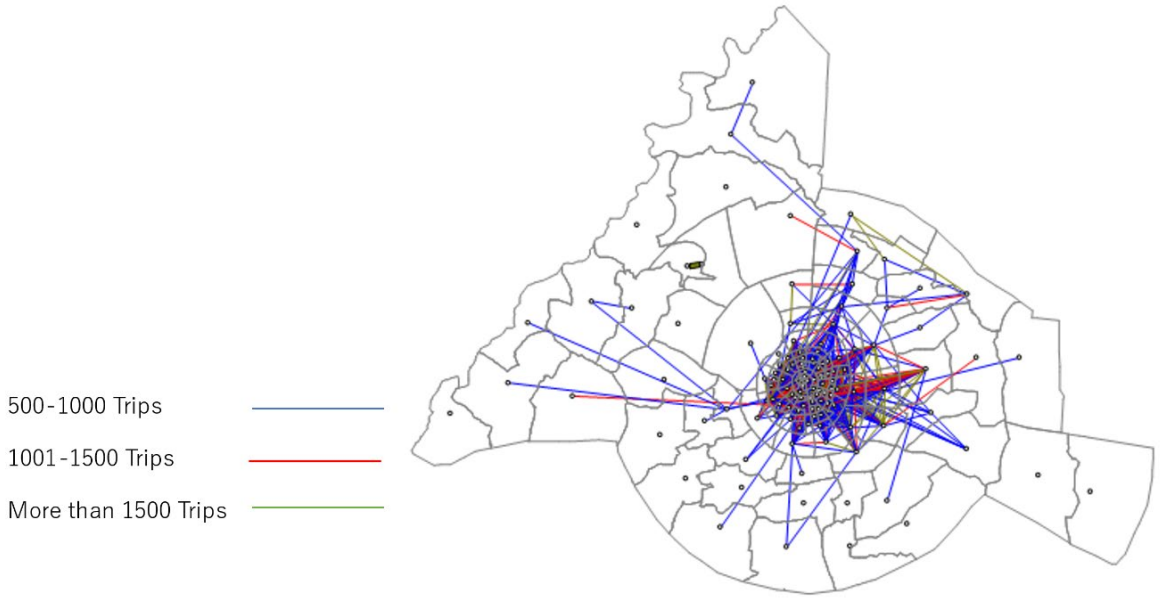
R=0.901

Source: JICA Project Team

(4) Desire Line Diagram and Present Traffic Allocation

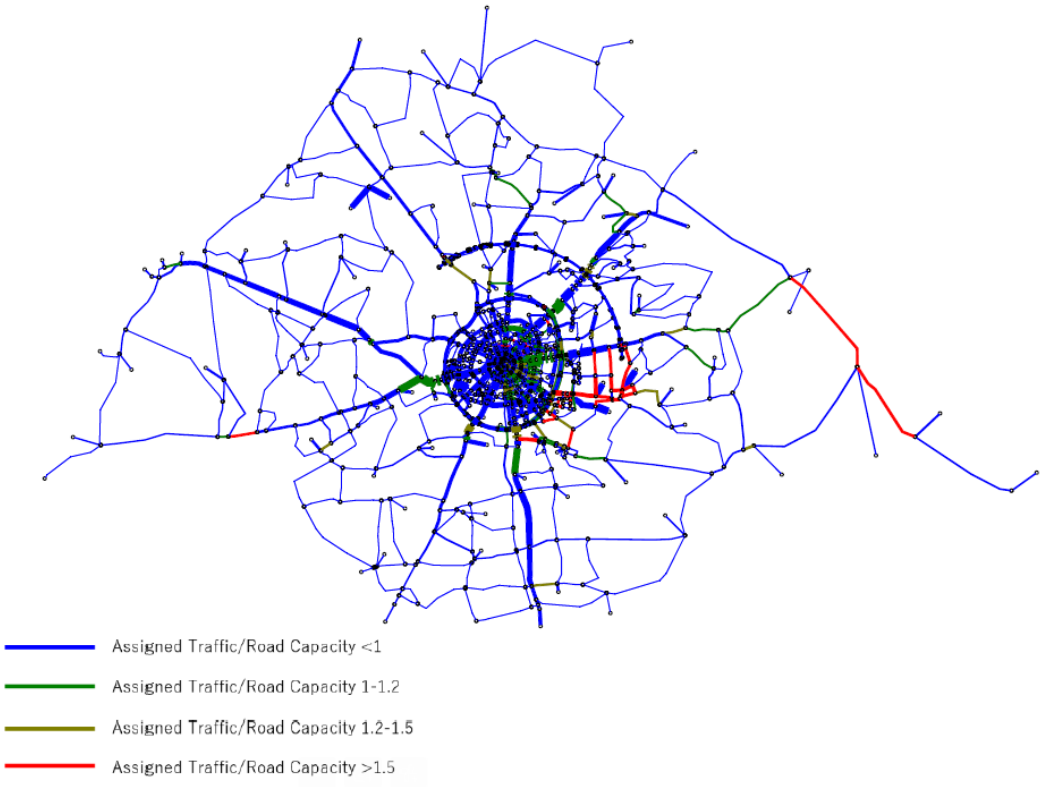
The desire line diagram that explains trip distribution or Origin-Destination is produced by the transport model as shown in Figure 7.5.2. Most of the trips is currently concentrated within 120m Road. The present traffic is then allocated to the present road network in Figure 7.5.3. According to the model the

present traffic volume is mostly less than the road capacity, only on a few north-south bound roads in the eastern part of Erbil the traffic volume exceeds the road capacity.



Source: JICA Project Team

Figure 7.5.2 Desire Line Diagram for Current Movement (All Modes)

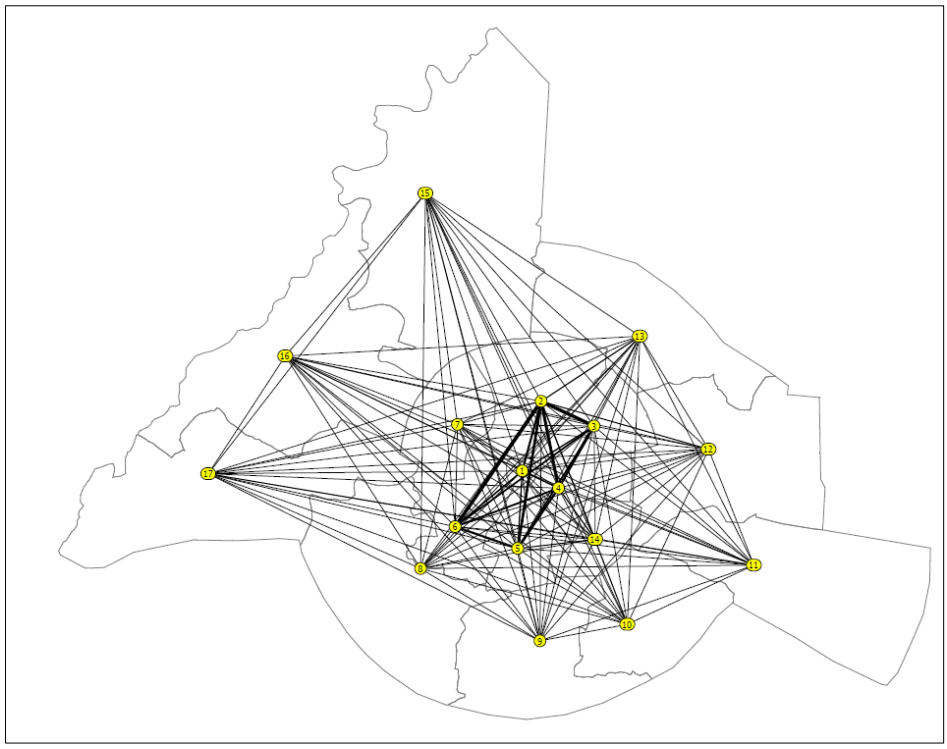


Source: JICA Project Team

Figure 7.5.3 Current Traffic Volume on Existing Road Network

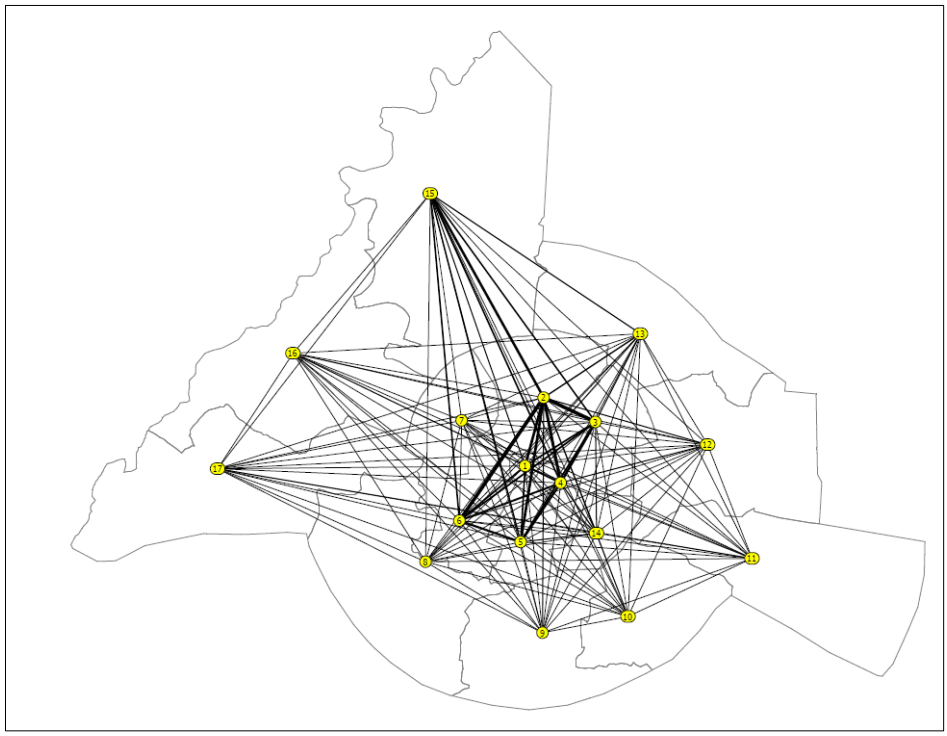
(5) Future Traffic Demand

The desire line for 2040 and 2050 with and without Mandawa dam Development, based on the future population, is shown in Figure 7.5.4, 7.5.5 and 7.5.6 respectively. Movements around central Erbil is still high in the future, but the movements will be extending to the outer areas.



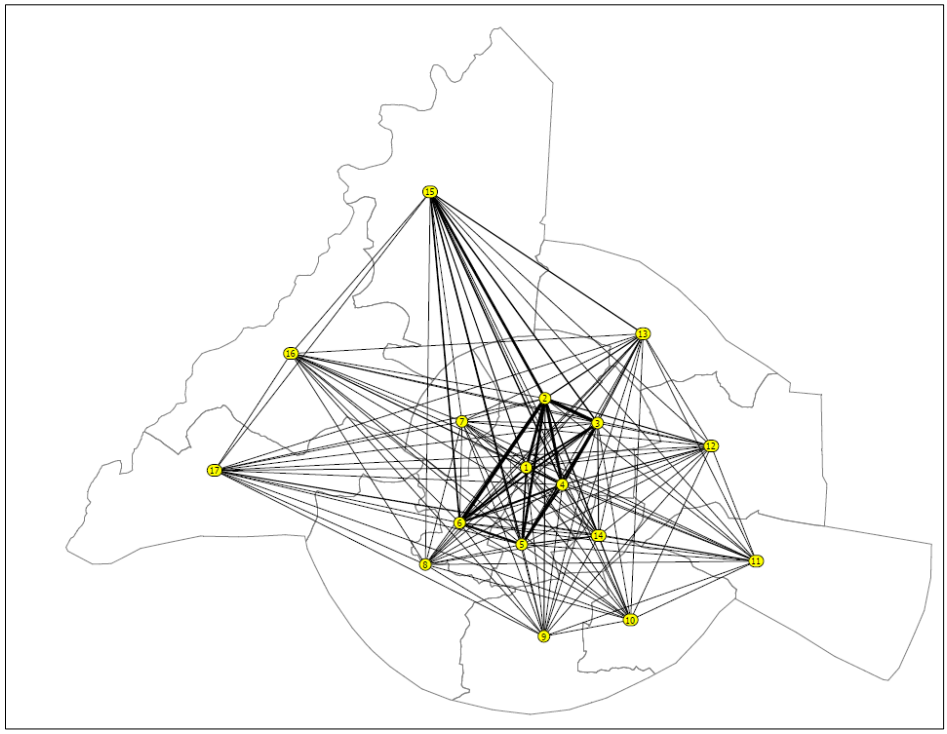
Source: JICA Project Team

Figure 7.5.4 Desire Line Diagram (All Modes) for 2040



Source: JICA Project Team

Figure 7.5.5 Desire Line Diagram (All Modes) for 2050 (Option A - without Mandawa dam development)



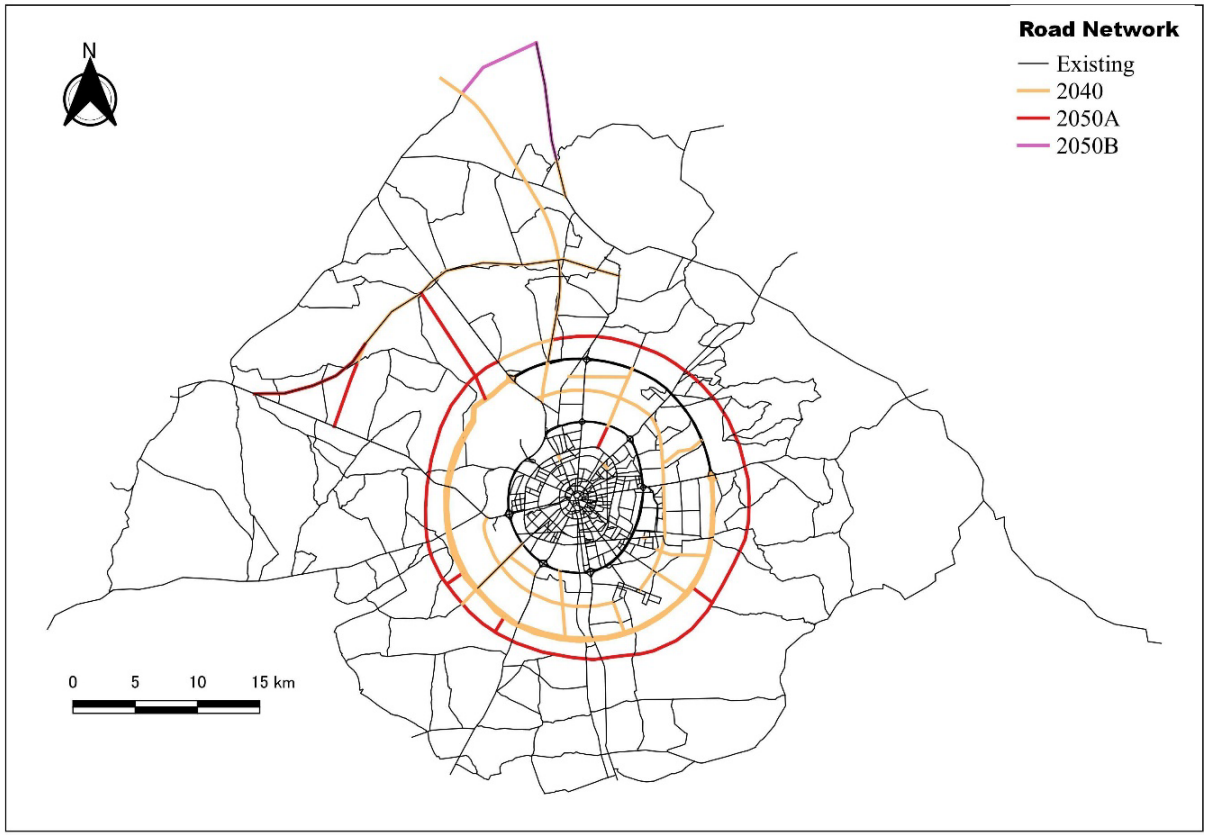
Source: JICA Project Team

Figure 7.5.6 Desire Line Diagram (All Modes) for 2050 (Option B - with Mandawa dam development)

7.6 Road Network Development Plan for 2040 & 2050

Following the basic concept of the concentric/radial grid model the future road network is developed to support the Multi-Core Development Model as shown in Figure 7.6.1. Completion of 150m Road and construction of a ring road outside of the Green Belt is proposed. Depending on the land use, conservation or development of the Green Belt a parkway like Figure 7.6.2 may be planned. New roads will be planned in the northern and eastern area as well as area between 120m and 150m Road in line with the land use and development plan.

If the Mandawa dam Development is not undertaken by 2050 the road that leads to the dam area can be constructed later than 2050. The road network will be developed step-wise in consideration to the gradual development of the new cores and new communities.



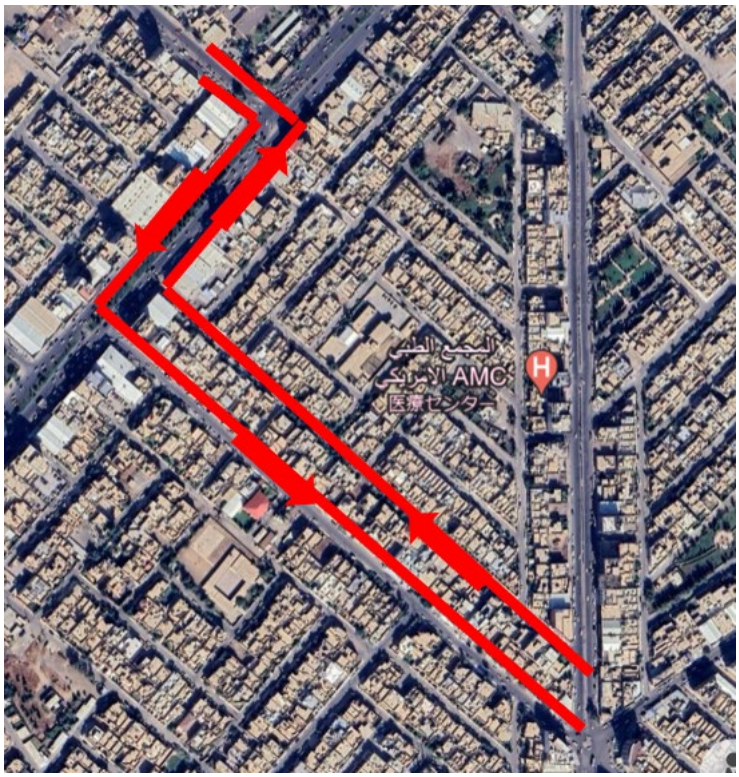
Source: JICA Project Team

Figure 7.6.1 Road Network for 2040 and 2050

Source: Pinterest

Figure 7.6.2 Eastern Parkway in Brooklyn, NY

In order to ease the traffic concentration on 60m and 100 m Road the 40m Road needs to carry more traffic so that it can function as an additional ring road. There are two missing sections in the build-up area. Land readjustment method may avoid relocation, but the area is mainly established residential area so that planning a high rise building to accommodate the residents of the houses may not be appropriate. Therefore, use of existing road with diversion of the route may be a realistic solution as shown in Figure 7.6.3.and 7.6.4. Appropriate direction signs and traffic signal will ensure smooth flow of the traffic.



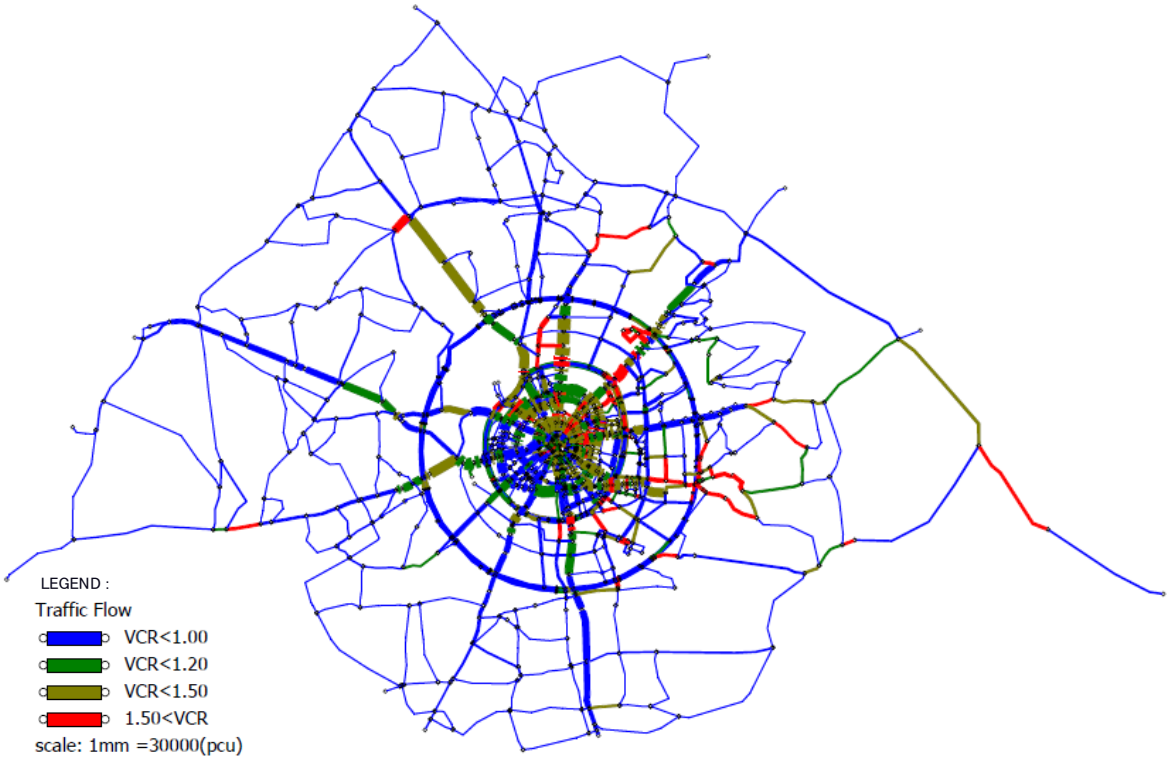
Source: JICA Project Team

Figure 7.6.3 Missing Section of 40m Road at Pirmam Street/Daik Intersection

Source: JICA Project Team

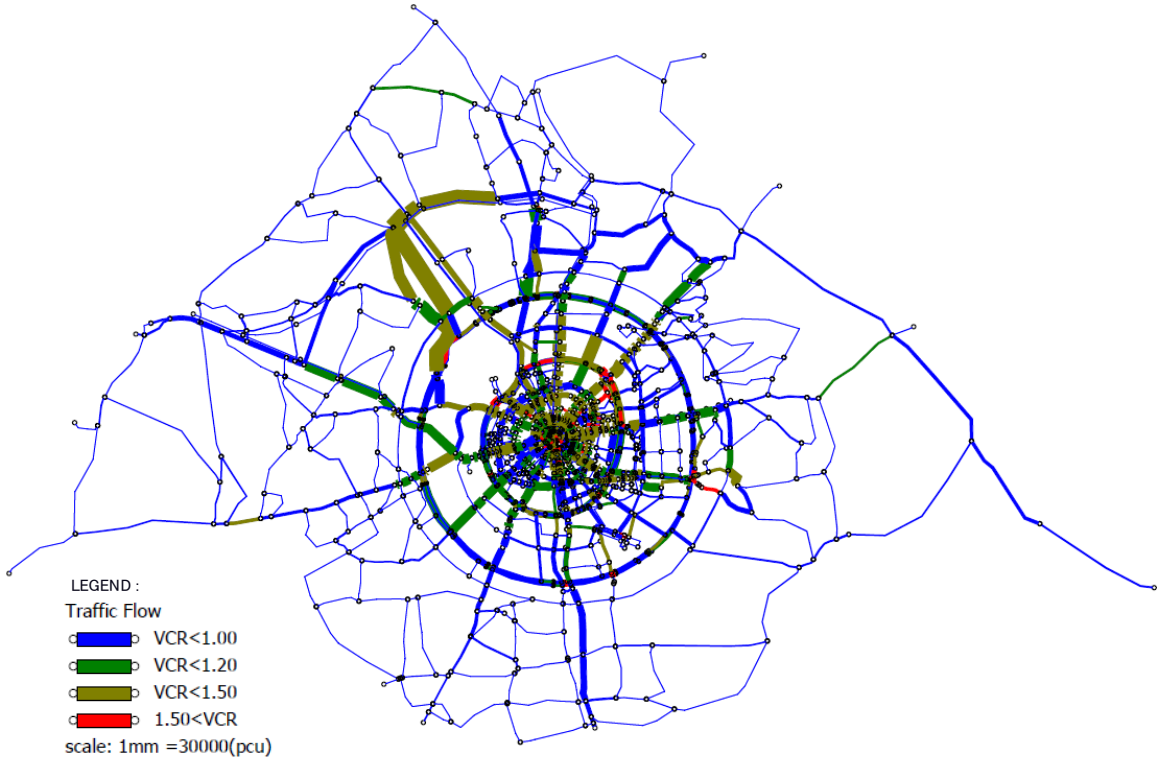
Figure 7.6.4 Missing Section of 40m Road in Azadi Area

Erbil-Duhok highway provides a fast connection from Erbil (outside of 150m Road) to the area 3km before Mandawa Village. Erbil-Zakho Expressway has also been planned and reduces the distance from Erbil to Mandawa. Other roads can be developed step-wise according to the land development of the area. Gazna Road that connects to Erbil-Duhok expressway has a narrow section between 120m and 150m Road. Erbil-Mosul Road has two lanes for each direction, but the road surface is damaged. These roads need to be rehabilitated and widened. Based on the assumption of the future population the forecast road traffic on the future road network is shown in Figure 7.6.5 for 2040 and 7.6.6 for 2050 without Mandawa dam, 7.6.7 with Mandawa dam development.



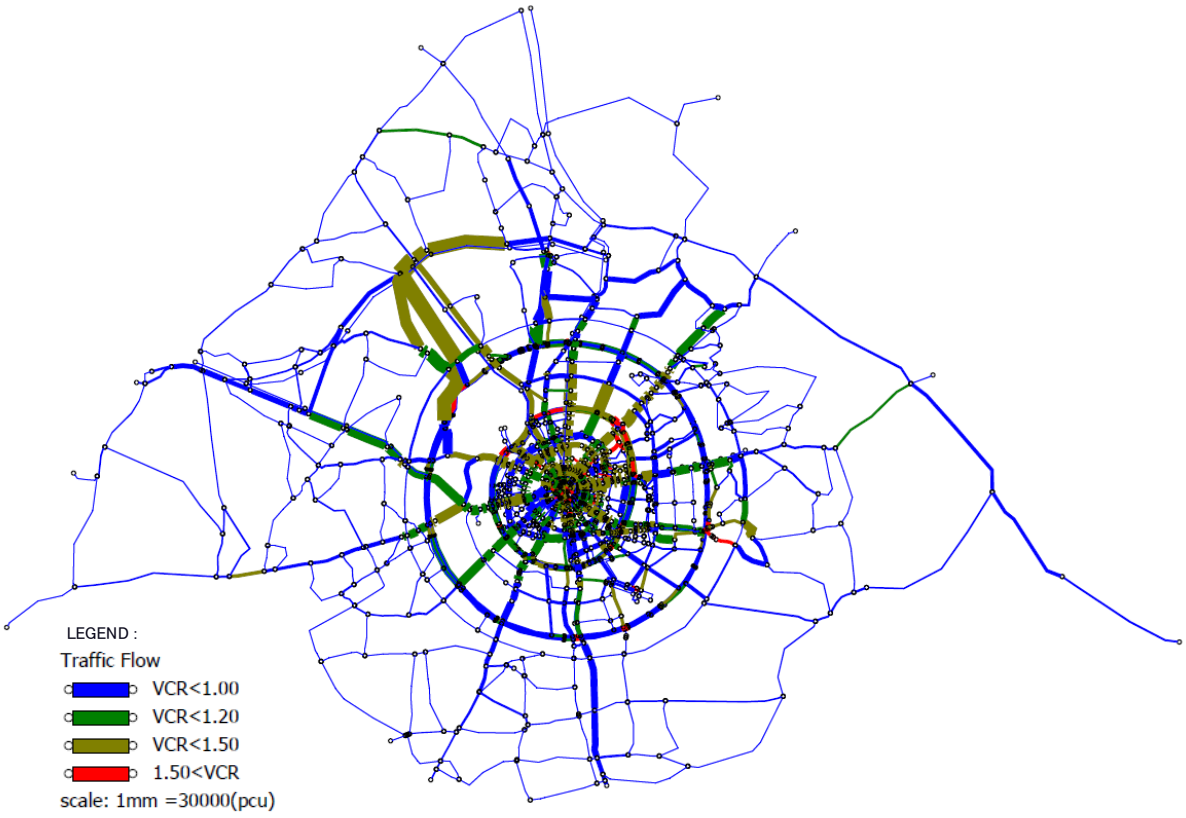
Source: JICA Project Team

Figure 7.6.5 Forecast Traffic Volume on Road Network for 2040



Source: JICA Project Team

Figure 7.6.6 Forecast Traffic Volume on Road Network for 2050 (Option A - without Mandawa dam development)



Source: JICA Project Team

Figure 7.6.7 Forecast Traffic Volume on Road Network for 2050 (Option B - with Mandawa dam development)

The proposed cross section for 3 lane road (like 150m Road) and 2 lane road is shown in Figure 7.6.8. However, Gazna Road has not enough with as shown in Figure 7.6.9 so that wide median and footpath may not be laid down.

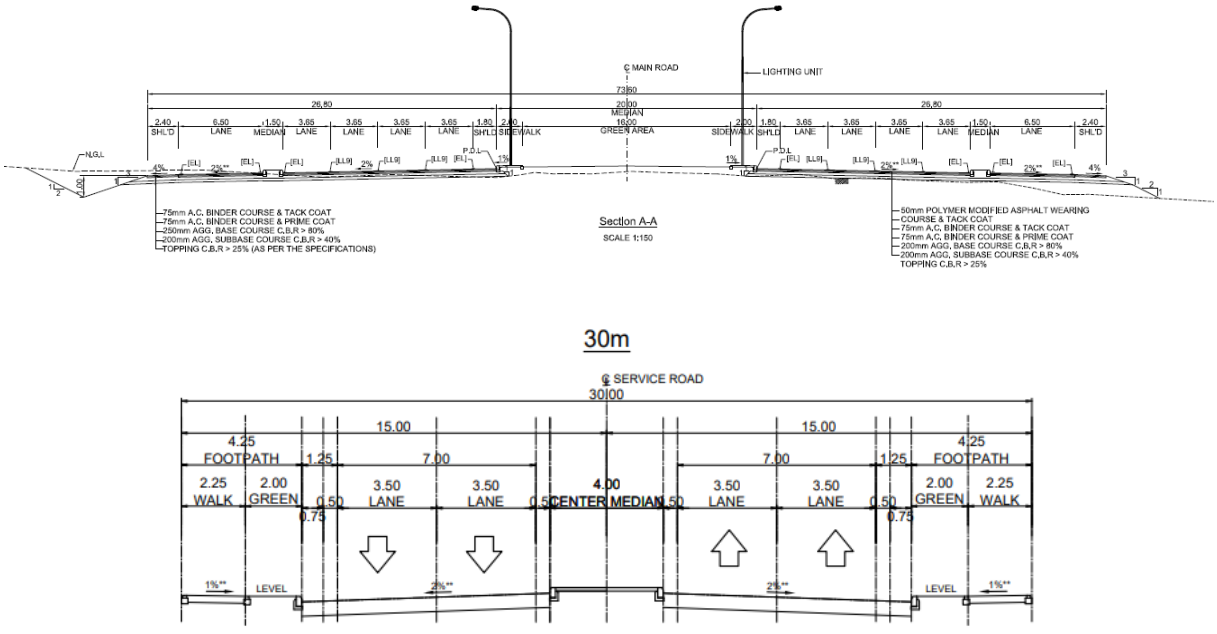


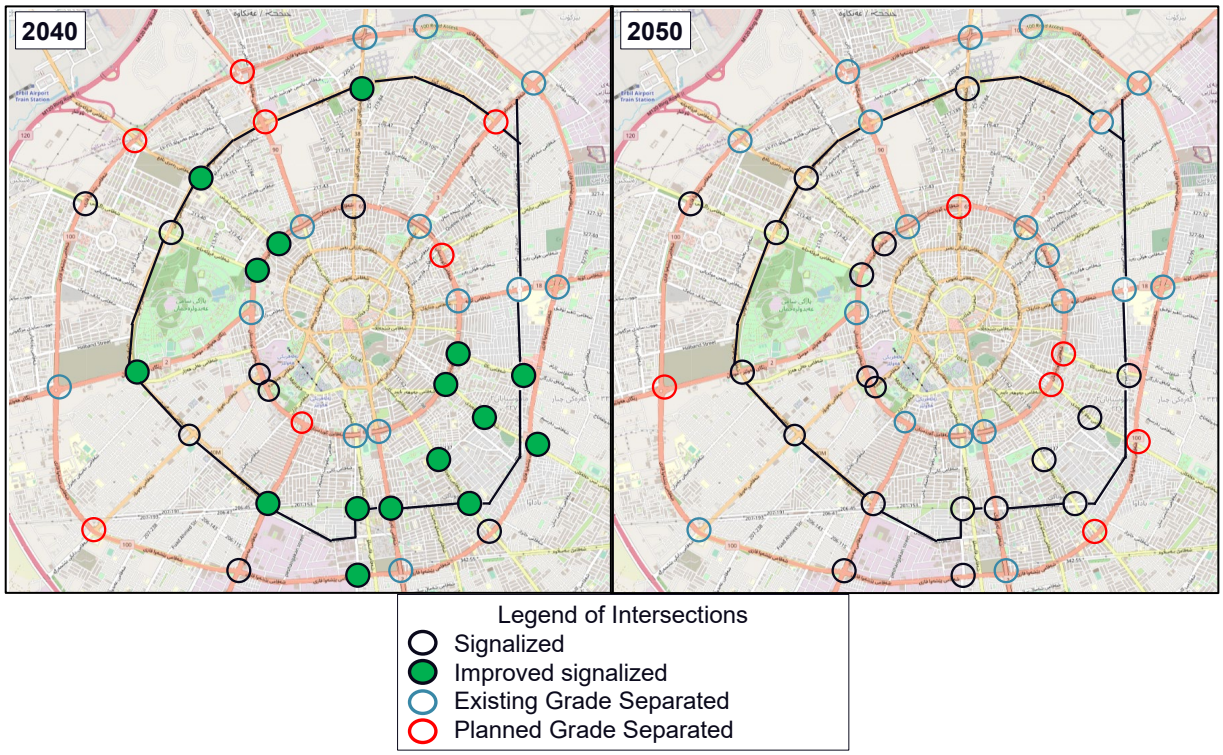
Figure 7.6.8 Proposed Cross Sections

Source: JICA Project Team

Figure 7.6.9 Current Gazna Road

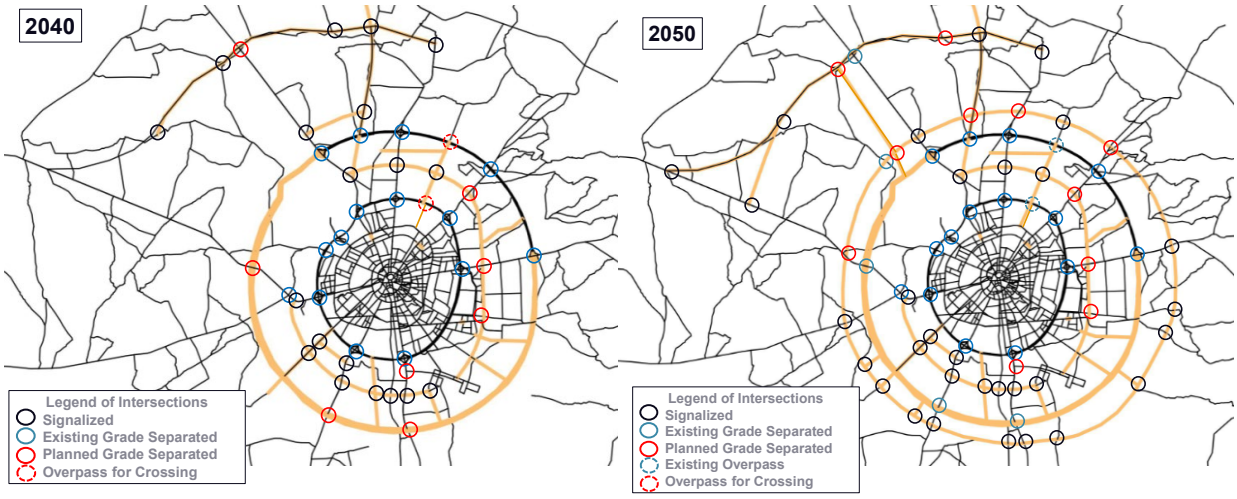
7.7 Improvement on Bottleneck Intersections for 2040 & 2050

The existing planning contains three grade separated intersections. Erbil Traffic Police provided opinion on further improvements. Based on future traffic forecast and local conditions the JICA Project Team proposes seven grade separated intersections and many signalizations by 2040 as shown in 7.7.1 inside 120m Road. When the traffic further increases six signalized intersections will be changed to grade separated intersection by 2050 as shown in Figure 7.7.2. With future land development outside of 120m Road eight grade separated intersections are planned. The new arterial road located between the Pirmam Road and Bahirka Road will cross 120m and 150m Road as overpass without junction. Signalization of major intersections are proposed by 2040. By 2050 the new ring road outside of 150m Road will have grade separated intersections in the north where traffic increase will be high, and signalized intersections in the south.



Source: JICA Project Team

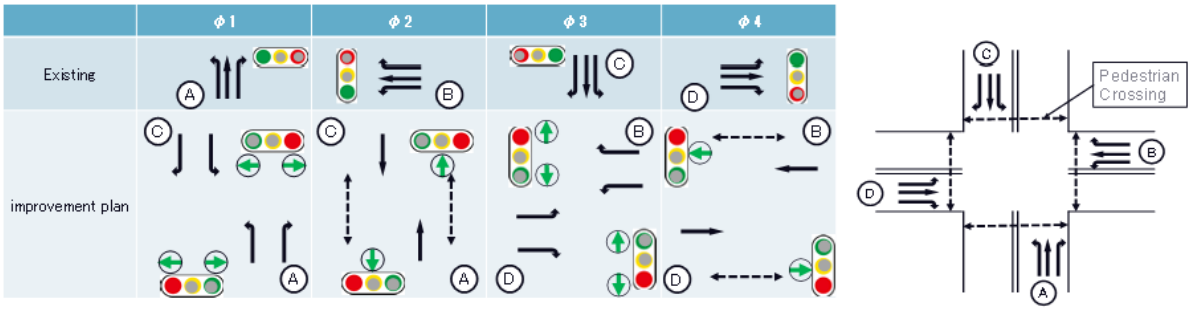
Figure 7.7.1 Existing and Planned Intersection Improvements Inside 120m Road



Source: JICA Project Team

Figure 7.7.2 Existing and Planned Intersection Improvements Outside 120m Road

The current signal control is in four phases, one by one for each direction as shown at the upper part of Figure 7.7.3. This causes a long waiting time for the traffic. If the straight traffic in both direction and all turning traffic are grouped as shown in lower part of Figure 7.7.3 as improvement plan the volume of passing traffic at each signal phase will increase thereby increasing the capacity of the intersection. It is also important that the pedestrians also need to follow the signal as shown as dotted line to avoid collision with the turning vehicles. The improvement plan will be applied to all new signalized intersections shown in Figure 7.7.2 as improved signalized intersection. Modern technology can adjust the time of the green and red light based on the detected traffic volume and coordinate the green phase with nearby signals. This kind of the signal is called Smart Signal. It can also be designed to let BRT buses and emergency vehicle pass without waiting.



Source: JICA Project Team

Figure 7.7.3 Current and Proposed Signal Control

Solution to for the congested U-turn points is to change the closed intersection to a signalized intersection. As the first step the U-turn remains in place while the closed intersection is changed to a signalized intersection. As the second step, U turn lane is strictly separated from passing lanes for the smooth flow of the traffic. When the U-turn vehicles become minimum the U-turn point may be eliminated.

7.8 Public Transportation Development Plan for 2040 & 2050

The long-term vision of the urban transportation sector is “A genuine choice of affordable private or public transport with an excellent public transport system that reduces the need to use cars”. Accordingly, the strategy sets as 25% of future traffic demand at morning peak will be covered by public transport. The public transportation model uses this as an assumption to estimate the future demand on the BRT network proposed by the Feasibility Study of 2015 and extends the lines up to 150m Road.

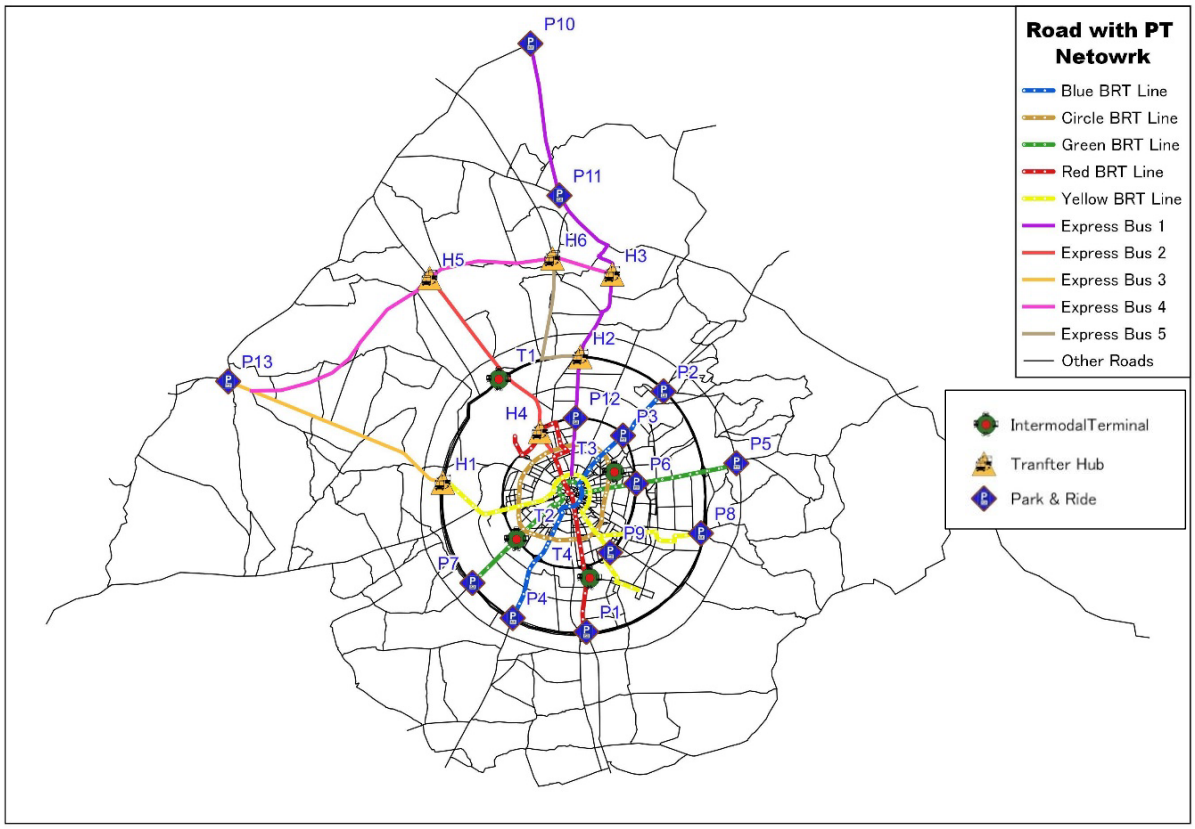
There is a concept to develop several new urban cores along the Great Zab River and in the northern area of Erbil with a forecasted total population of around 600,000 (Bahirka, Mandawa and Great Zab Cluster) in 2050. This level of future population volume would be appropriate to introduce public transportation, but it is difficult to forecast exact passenger volume, as the demand varies whether the new residents would work inside the new cores or commute to Erbil. Express Bus transport would be suitable to meet varying demand because there are various bus sizes and is also possible to adjust frequency of service to the demand. Modern bus fleet with hybrid engine will very much contribute to reduction of greenhouse gas compared to the conventional diesel engine.

- EB1 will connect Erbil Center with Bahirka and eventually Mandawa. For the first phase of this line the bus may start at at Ankawa Mall with connection to BRT Red Line. Depending on the passenger demand this line may finally goes to Erbil center and eventually becomes a new BRT line to Bahirka.
- EB2 will serve new developments along the Duhok Road and Gazna Road, and eventually continue to Duhok. For the first phase of this line the bus may start at Ankawa Mall with connection to BRT Red Line.
- EB3 will be the extension of BRT Yellow Line to connect Great Zab Cluster and eventually continue to Mosul.
- EB4 runs on the new outer ring road that connects the road to Mandawa (EB1), Duhok Road (EB2) and Mosul Road (EB4) so that the newly developing towns are connected directly without using the arterial roads leading to Erbil.
- EB5 will serve the new townships outside of 150m Road in the vicinity of Bahirka. It will connect to EB1 and EB4.

Additional secondary bus routes may be planned to supplement the BRT and Express Buses in order to promote the use of public transportation by serving new townships, but it is not possible at this stage to propose the individual routes. When the new township developments are realized and enough population is settled in the area an Origin-Destination survey or a household interview survey may be conducted for the planning of the local feeder bus service.

The reason of discontinuation of the bus service on 100m Road is said to be a technical problem, but the detail is not clear. One of the reasons could be the mismatch of demand and bus route because the destination of the people is not along 100m Road but rather the city center according to the Household Interview Survey. Another reason could be the lack of access and connectivity of the bus line.

The existing South Bus Terminal near the Kirkuk Road will be connected to BRT Red Line. The current International Bus Terminal near the Family Mall will be made accessible to BRT. In addition, Erbil International Airport and Erbil Railway Passenger Station will also be served by BRT. By reorganizing the mini bus routes the downtown bus terminal will be gradually phased out. A transfer hub station will be planned at connection points of BRT and Express Bus. A good interline connectivity between the BRT lines and feeder buses is also important to ensure convenience of bus service. In order to shift from the car use to a bus ride car parking space at selected bus stops along 120m and 150m Roads and on the arterial main roads which is called Park and Ride system will be effective. Figure 7.8.1 shows the complete route network, with locations of intermodal terminals (such as planned railway station and existing international bus terminal), transfer hub and Park and Ride. Figure 7.8.2 is a model of transfer hub between BRT and feeder bus. Ankawa Mall as shown in Figure 7.8.3 can be the first place to build such an interchange hub.



Source: JICA Project Team

Figure 7.8.1 Public Transport Network for 2050

Source: JR West

Figure 7.8.2 Japanese Model of Transfer Hub

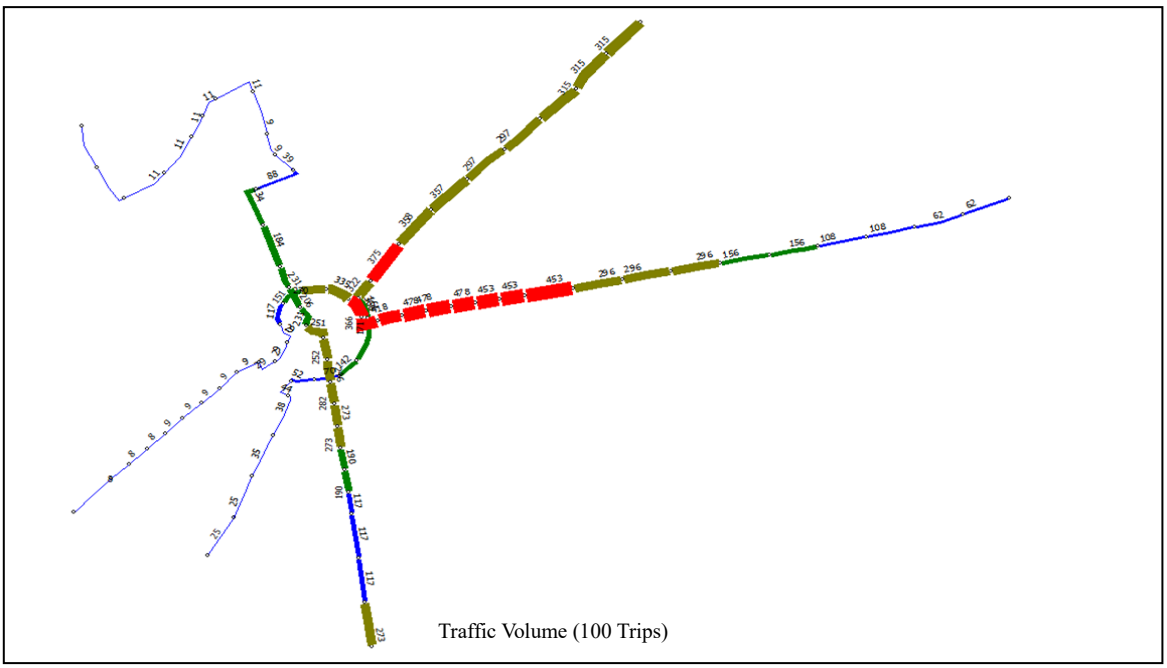
Source: JICA Project Team

Figure 7.8.3 Ankawa Mall

Among the BRT lines the Red, Blue and Green Lines are of the high priority. The Red Line serves Erbil Airport, Ankawa Mall with connections to Express Bus Lines to the northern cores, and central Erbil. It runs southbound on the current Mantkawa bus line route which is the only route served by a big bus and also would connect to Daratu which has the second highest daily passenger volume after 40m Road line. Blue Line will contribute to de-congestion of Pirman Street and provides public transportation along the Makhmur Road. Green Line will contribute to de-congestion of Koya Road and provides public transportation in Municipality 6.

The future demand forecast for public transportation is shown in Figure 7.8.4 for 2040 and 7.8.5 for 2050. A high passenger demand around 50000 and more per day is observed on Pirmam Street and Koya Road in 2040. For 2050 Yellow Line on Mosul Road and 60m Road will get high ridership.

Consideration to convert BRT to LRT will be done by that time. The advantage of the stagewise shift from BRT to LRT is that a certain demand for LRT will have been realized by BRT beforehand. The existing BRT lane can be converted to LRT track so that the adversely effect to the car traffic can be reduced.



Source: JICA Project Team

Figure 7.8.4 Forecast Demand on BRT for 2040

Source: JICA Project Team

Figure 7.8.5 Forecast Demand on BRT for 2050

Short walking distance between the bus stops, easy recognizable location of the bus stops, electronic display to inform waiting time for the next bus or approaching bus are the recommended measures for

the convenience of the bus users.

Cash payment on board of the bus at each ride is very cumbersome. Using an IT technology like a chargeable smartcard or mobile application will reduce the burden of fare payment and collection. It will also enable to record actual ridership of the passenger so that the operator can easily obtain the data about the occupancy for adjusting the bus operation to the demand. Cashless system is also suitable to introduce various discounts like 11 for 10 (every 11th ride is free). The Transport for London (TfL) uses the fare cap system. A single bus trip costs GBP 0.85 but the daily cap is GBP 2.55 (fare as of October 2023), meaning after 3 trips one can use the bus for no more charge. There are also a weekly and monthly fare cap system for regular users. This system is particularly useful for the combination of BRT and feeder bus. If a shuttle is introduced around the Citadel and the fare cap system is also applied the passenger can hop on and off as much as they like. This system will attract many new riders.

Another effective measure to attract more passenger is the accessibility to the buses and provision of appropriate information on bus operation. The current buses do not have a timetable displayed at the bus stop while the bus driver and operation supervisor obviously have. Therefore, it is impossible for the non-locals and visitors to use the bus. Even the regular bus passenger would have no means to know the time of the departure or approximate time to ride. Creating a homepage for the bus service containing the bus routes, fare, and time table, even the real-time location of the bus can make the bus very attractive. Bus stops with a clear signboard shall be placed nearest to the facilities such as the airport terminal building, intercity train station building, park entrance, shopping mall etc. for the convenience of the bus user.

CCTV security camera of on board the bus will provide good security. Articulated bus may accommodate women-only section for the comfort of female passengers, as the most response about the bus service at the Household Interview Survey was “Better behaviour for other passengers so it is more safe for women and girls” (See Figure 7.3.3).

7.9 Traffic Management Plan

(1) Traffic Control and Management Measures

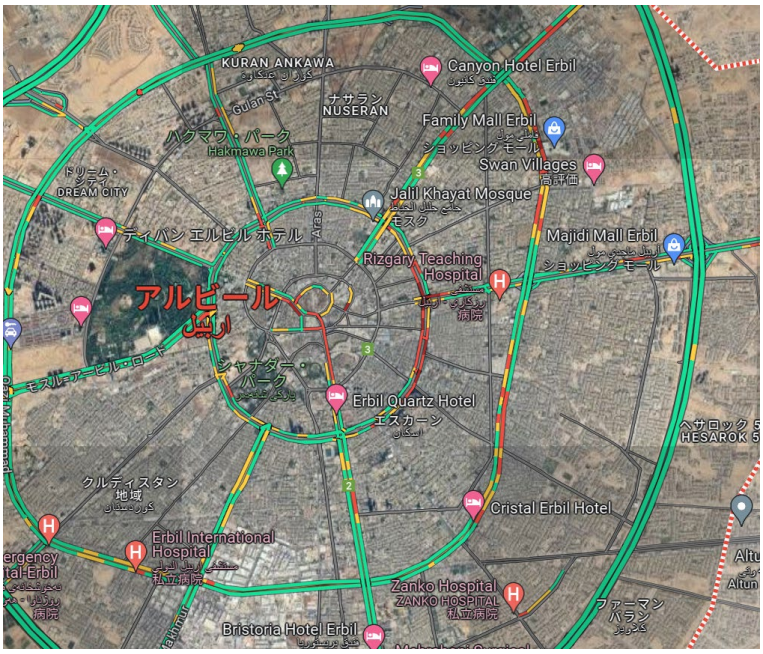
Traffic congestion is observed mainly in the historic area around the Citadel and at U-turn points as explained in Section 7.1.1, and on some sections of the ring and arterial roads during the morning and afternoon commuting time. The traffic backup lengths are usually less than 1km, so compared to the world’s large cities the traffic congestion in Erbil is not very serious yet. However, as the car usage is very high (over 70% of total mode – see Figure 7.2.5 of Section 7.2.2) the traffic congestion will soon become serious if no proper traffic control is implemented in the new future. The main arterial roads and ring roads generally have adequate widths to cope with the traffic volume, but turning vehicle obstructing the passing lane and on-street parking reduces the capacity of the roads.

Signalling, U-turn rule and speed humps contribute to avoid serious traffic accidents because the recklessness of the drivers would create accidents if the vehicle is free to turn or cross the intersection. However, U-turn points become the cause of congestion during the rush hours. Reduction of the closed intersections and changing them to the signalized intersection will reduce the traffic congestion at-U turn points. The clear lane making or separation at remaining U-turn points will contribute to the smooth flow of traffic. Measures for improvement of intersections are explained in Section 7.8.

When the closed intersections and missing link on 40m Road are constructed, it can function as additional ring road so that the traffic can distribute to 40m, 60m and 100m Ring roads. Google map can indicate on-time traffic congestion as shown in Figure 7.9.1. Some drivers may already use it, but it is recommended to display on the major arterial road to indicate the congestion on the ring and major arterial roads so that the drivers can avoid the congested route. Radio broadcast about the traffic condition at every hour is another useful tool to ensure the traffic flow. Awareness campaign to observe the traffic rules and parking rules is also advisable to broadcast.

When the traffic congestion becomes serious for the future and a network of effective public transport is established, some measures to reduce the car traffic such as congestion charge needs to be introduced,

because traffic management will be more cost effective than building a network of elevated urban toll expressway.

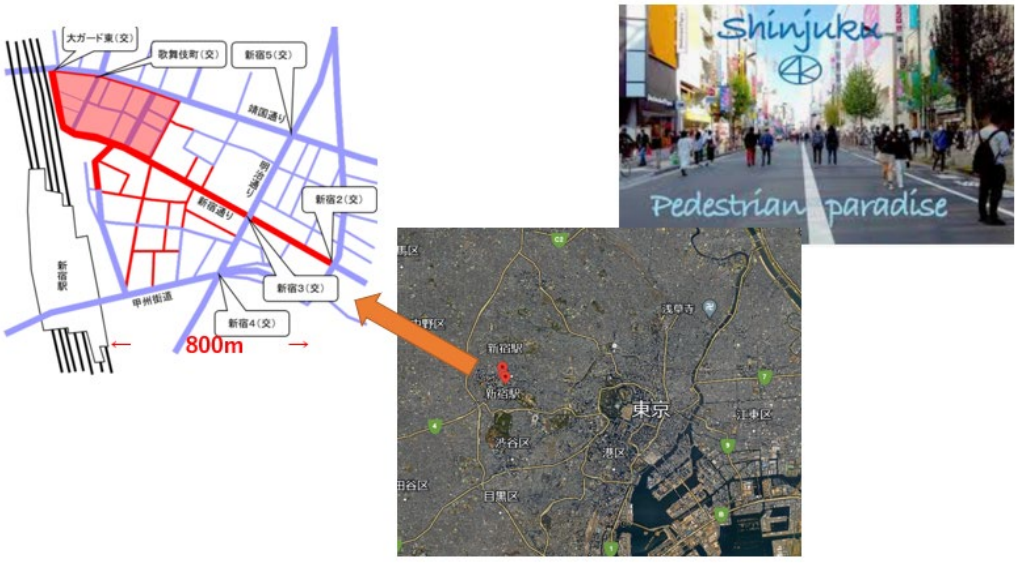


Source: Google map

Figure 7.9.1 Traffic Congestion Shown in Google Map

Regarding the traffic control in the historic area around the Citadel the Shekhallah Bazaar Project has a plan about the traffic measure to close or restrict cars in the Arab Quarter of central Erbil. While the idea to conserve the historic area is appropriate, the concept lacks supplemental mode of mobility.

There are many examples of car-free zone in the world. Tokyo has three car-free zones on weekend: Ginza, Sinjuku (as shown in Figure 7.9.2., zone and street in red are car-free) and Akihabara area. While conservation of the area is important, business and commercial traffic shall not be adversely affected. Car free zone on holiday or permission of vehicular traffic during a certain time of the day would reduce the negative consequence of the car free zone.



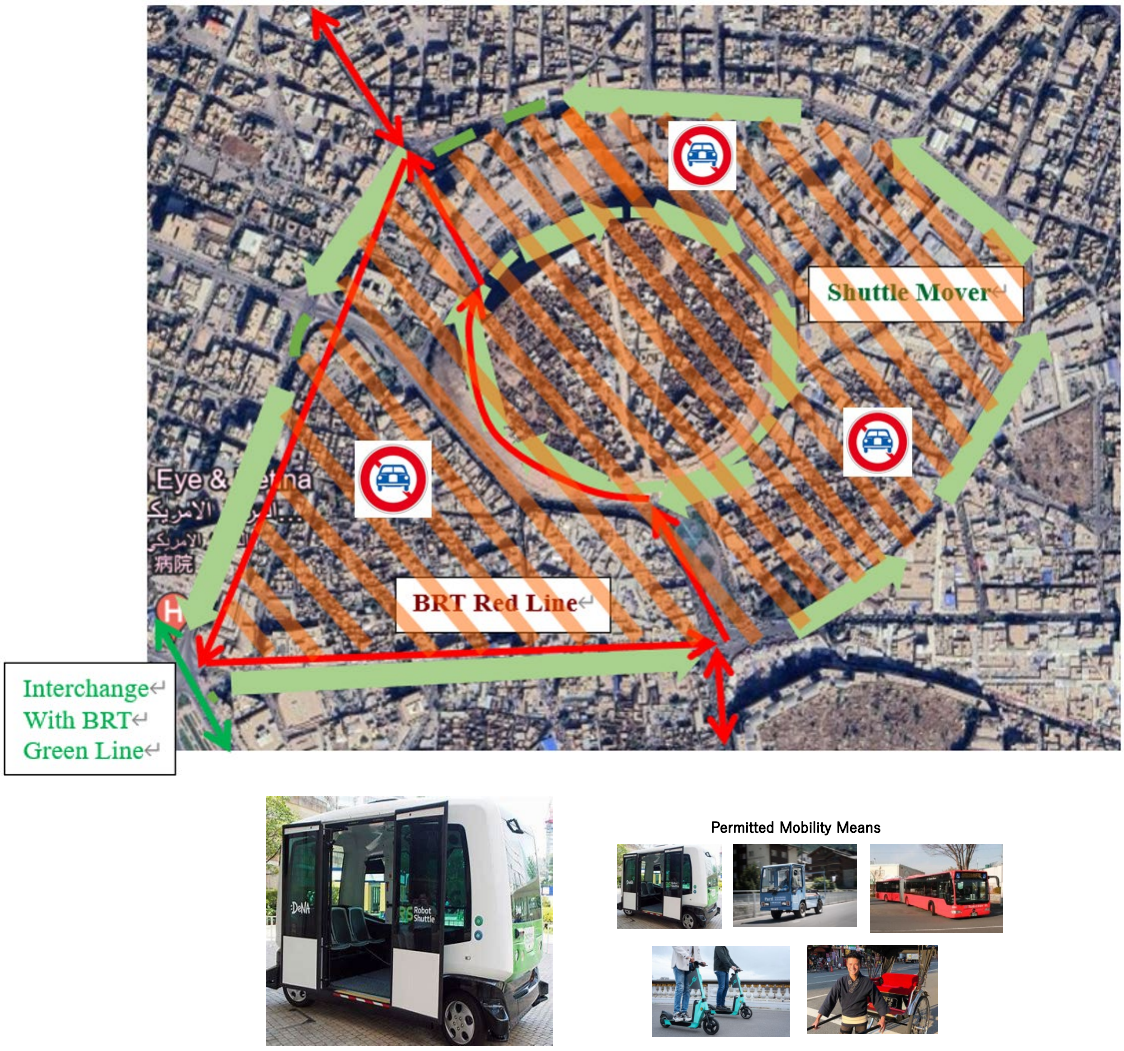
Source: Tokyo Metropolitan Police, Google map, YouTube

Figure 7.9.2 Example of Car Free Zone in Tokyo

The JICA Project team suggests to introduce a slow-moving Shuttle Mover Service around the Citadel

for the convenience of the people who needs to park their cars outside of the area as shown in Figure 7.9.3. The Shuttle Mover Service is a small driverless vehicle that moves round the Citadel on two streets in opposite direction and also connects to the BRT lines so that the visitors of the historic area can move easily. With the introduction of the Shuttle Mover the car traffic inside the Ayubi Street and Kotri Salam, where the outer Shuttle Mover will be running, shall be restricted only for those having the permits like the residents and shop/business owners. The number of permits shall be within the total number of parking space of the area to avoid oversupply of permits beyond the parking capacity. While Ayubi Street and Kotri Salam is already partly one-way, a total clockwise one-way system is recommended to avoid congestion. Only BRT and Shuttle Mover runs in opposite, counter clockwise direction.

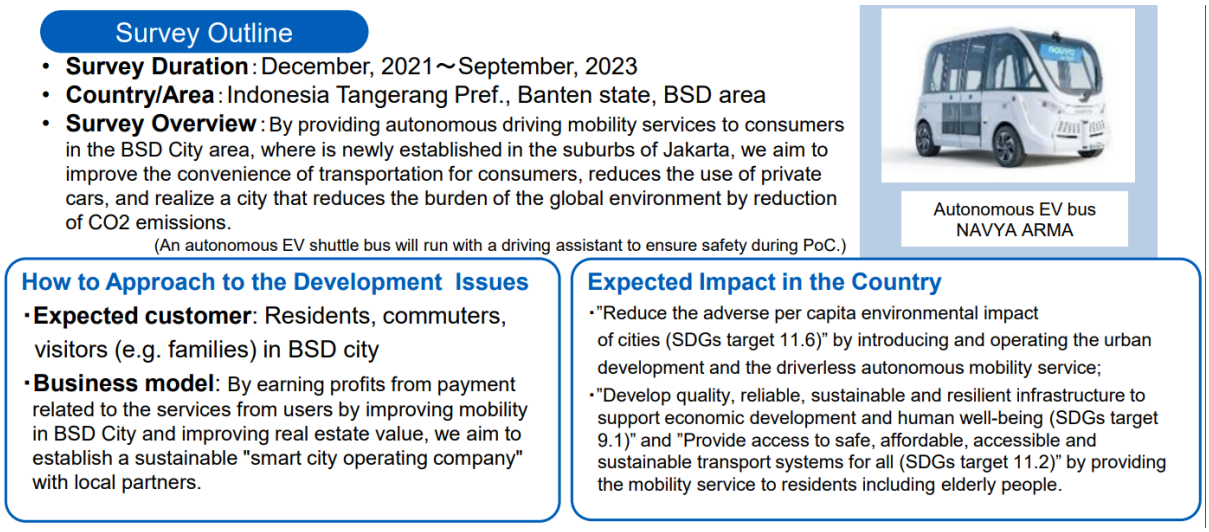
It is also important to implement the traffic management stepwise, so that the visitors, locals and businesspeople are not affected by a sudden change. Recommended steps would be: 1. Implement the new rule on holiday; 2. Expand the rule to weekday evening; 3. Full implementation. Local traffic survey and interviews to the shops and visitors are useful to assess the effect of the measure.



Source: JICA Project Team

Figure 7.9.3 Proposed Car-free Area and Shuttle Mover Route

JICA has implemented a pilot project of mobility service in a new town outside of Jakarta, Indonesia in collaboration with a private company. Figure 7.9.4 shows the outline of the project.



Source: JICA Homepage

Figure 7.9.4 Example of a Shuttle Mover Project

(2) Parking Management

Available street parking is very limited in Erbil, and although there are signs to prohibit parking or stopping in street there is no effective enforcement. Therefore, all streets are parked with cars for a long time, sometimes in two rows and obstructs traffic lane. Erbil Traffic Police is aware of the issue and suggests following measures:

- Obliging business owners (hotel, restaurant, commercial buildings etc) to provide enough parking places.
- Allocation of a few locations for building multi-story car parks to limit the access of cars to the city center.
- Establishment of on-street parking for a fee on some suitable locations.
- Forcing all medical complexes to provide their own car parking because they currently use the street for parking their cars (in particular along 40m Road).
- Obligating schools to provide their own car parking for teachers and students.
- Provide a parking area outside 120m ring road for oil and gas tankers that usually park on streets due to lack of parking space for them. In particular, two locations at north and south of city for truck and gas/oil tankers parking, to avoid parking on streets that usually causes traffic problems.

JICA Project Team agrees on above suggestions. For example, in central Tokyo there is an obligation to provide one parking space for every 250m^2 commercial floor or 350m^2 residential floor. Such parking ordinance is recommended for Erbil. The developer shall be requested to provide underground or multi story parking spaces to accommodate vehicles. Parking fee may be reduced for customers who has done shopping in the same facility. Truck parking areas as shown in Figure 7.9.5 along 150m Road will solve on-street parking of the trucks and oil tankers.

Source: Inter Truck

Figure 7.9.5 Example of a Truck Parking Area

Inside 30m road there are many private parking spaces but they are not enough to meet the parking demand. Narrow and maze streets are not suitable for the car access. Therefore, parking permit system needs to be introduced. The location of all existing parking spaces and their capacity shall be recorded first. Then, based on the total parking capacity parking permits shall be issued to the residents and shop/business owners. Cars that do not have parking permit are banned from entering the area inside 30m road. A few private parking spaces shall be converted to the taxis pool in order to reduce the wandering and waiting taxis.

Fringe parking by private sector shall be promoted along 30m and 60m road. On street parking may be allowed if the street has enough width, but the parking charge of on-street parking shall be increased every 20 minutes in order to restrict long time parking. Drivers looking for a parking place shall be guided in order to reduce unnecessary movement to find a parking place. An electronic signboard displaying available parking place on the main road as shown in Figure 7.9.6 can guide the drivers to the empty parking lots thereby reducing the time and efforts to look for an empty parking lot but it is very costly.

Source: Ministry of Land, Infrastructure and Transport

Figure 7.9.6 Japanese Example of a Parking Information Board

Park and Ride opportunity along 120m and 150m road with easy connection to BRT lines can provide the car users a good alternative to go to the center of Erbil as explained in Section 7.7.

Although the traffic police officers control the traffic at hotspots in downtown and major intersection during the traffic peak hours and newly constructed commercial and residence complex has parking space inside, the drivers often stop in the street to do a quick shopping or delivery. As the number of police officers is limited, cities in the developed country usually contracts out the parking control. The controller in charge can record the parking offending cars with a handheld device and issue the fine ticket as shown in Figure 7.9.7. Using the modern IT technology, a platform to cover all parking related feature such as payment, enforcement, analytics, management is being developed by a private company.

Source: Web Cartop homepage

Figure 7.9.7 Japanese Example of a Parking Controller

Queueing cars at some fuel stations has been said to cause traffic problem. However, by observing these queues the cars do not block the through traffic lanes and is therefore unlikely to obstruct the traffic.

(3) Urban Mobility Through Walkability and Cycling

The Household Interview Survey done by this Project in September 2022 contains a question on the preferred mode of travel. There were 1123 responses from the employed people and 831 responses from the students/pupils. While over 70% of the employed people gives the use of car, use of bicycle is 1% and walking 8%. On the other hand, the most preferred mode of the students/pupils is walking (47%). Use of bicycle is 3%. The result shows that the walking is generally within the neighbourhood area to go to school.

The main streets inside 100m road have sidewalks at the both sides. Small streets in the historic area inside 30m road and residential roads shares the street with cars, bicycles and pedestrians. In order to prevent accidents involving pedestrians and to ensure their safety, accident data shall be recorded and analyzed. If necessary, pedestrian sidewalk, pedestrian crosswalks with speed humps and pedestrian overpass or underpass need to be considered. Erbil Traffic Police suggests the following:

- Construction of several pedestrian crossing bridges, especially near the neighbourhoods of Badawa, Shikh Ahmad, Polisan, Ankawa, Jawazat, Krekaran, Ahmadi Khani.
- Construction of a fence on Saydawa bridge and construction of a pedestrian crossing bridge for pedestrians that usually cause traffic congestion.
- Construction of a few pedestrian crossing bridges in addition to construction of fence along the Koya Road.
- Pedestrian crossing bridge and fencing to separate pedestrians and car traffic needs to be planned on some congested points on 30m Road and Koya Road.
- Rearrangement of the Rasti Road specially at parts inside Azadi neighbourhood, that needs pedestrian sidewalks.
- Removal of all obstructions on the walkways such as shop extensions, this usually leads pedestrians to walk on the street.

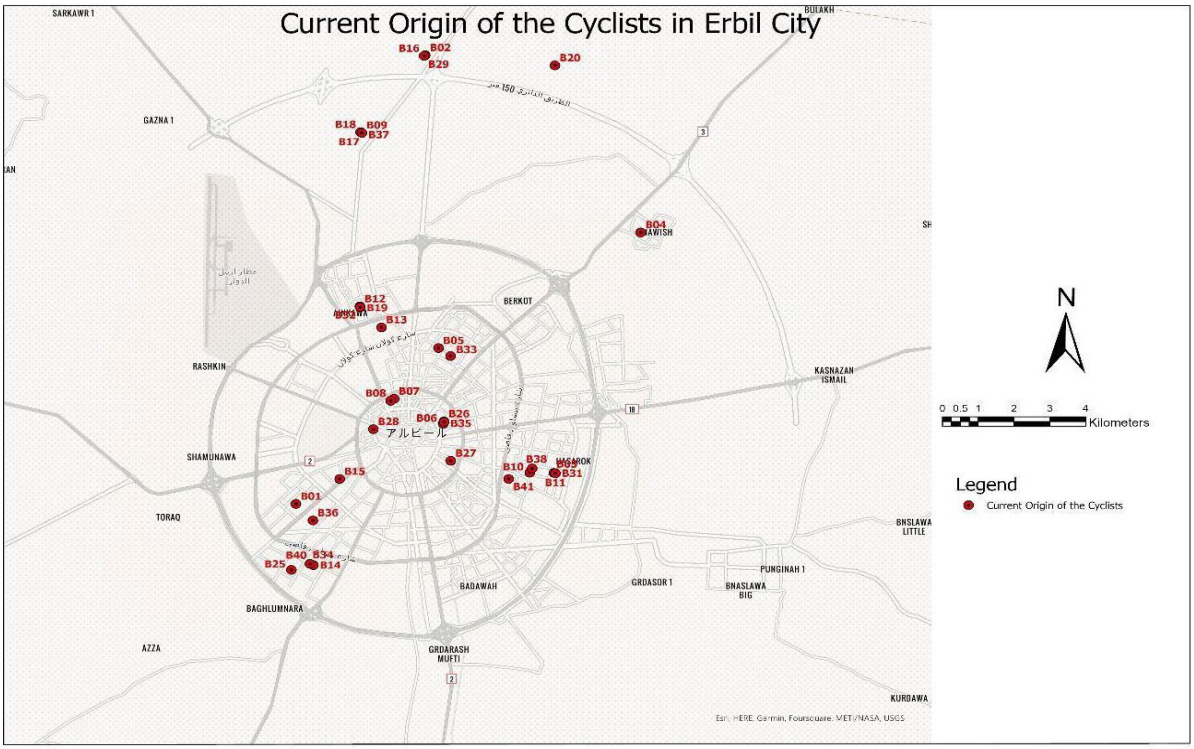
As mentioned, the historic area with many small streets is not suitable for the car traffic, and priority shall be given to the pedestrians and cyclists during the daytime. Figure 7.9.8 is the Higashi-Chaya preservation area of the Kanazawa City in Japan where the study group from KRG attending the Knowledge Co-Creation Program of JICA visited in December 2022. The street is closed for cars from 9am to 7pm, and pavement is decorated with stones in order to enhance the amenity of walking and cycling. This method can be applied to the area around the Citadel and historic conservation area.

Source: JICA Project Team

Figure 7.9.8 Japanese Example of a Walkable City

Another congested area in Erbil is the area near the Saydawa Bridge on 30m Road. The area is congested by pedestrians and cars, and interfere each other. Drainage issue also exists. While the Traffic police suggest fencing of the road to avoid crossing the street the JICA Project Team suggests total grade separation of pedestrians and cars.

Although the percentage of the cyclists is very small, the location of the respondents of the Household Interview Survey who are using bicycle is plotted on a map shown in Figure 7.9.9. There seems to be a cluster of the users inside the 60m road and some areas between 100m and 120m road such as Zanayan-Chwar Chra-Chnar, South Industrial Area, and Ainkawa. There are also a few cyclists in the newly developed area along 150m road. The destination given by the responses are the same area as the origin, hence the bicycle is currently used for a short distance. In case of Tokyo 50% of the cyclists travel the distance of 2km and less, and 90% within 5km. Therefore, bicycle is to be considered as an alternative mode to walking, not as substitute to car. The dry climate of Erbil is a positive factor for enhanced bicycle use, but the very high air temperature during the summer months makes cycling a big challenge. Hence, trees along the bicycle path will be very important. Preferred area for the bicycle path will be the access roads to the parks and greenery as well as to schools and bus terminals.



Source: Result of Household Survey

Figure 7.9.9 Location of Origin of the Bicycle User

Deputy Governor and his team recently started to draw up a concept to promote bicycle use. As many Arterials in Erbil has abundant width of the sidewalk, it is possible to bring a bicycle path as shown in Figure 7.9.10.

Source: JICA Project Team

Figure 7.9.10 Japanese Example of a Sidewalk Shared by Pedestrian and Bicycle

If the walkway and bicycle path cannot be built due to a limited width bicycle and car need to share the lane as shown in Figure 7.9.11. It is important to clearly mark the cycle lane to prevent collision with cars or protect from illegal parking.

Source: JICA Project Team

Figure 7.9.11 Japanese Examples of Bicycle Lane Marking and Sign

A conceptual drawing is shown in Figure 7.9.12 how to use the side road (service road) effectively. The high trees along the paths and lanes will provide nice shades to the pedestrians and cyclists.

Source: JICA Project Team

Figure 7.9.12 Suggested Use of the Side Road