

A Descriptive Study on the Expressway No.1, the Main Route of the Future Dry Canal Project in Iraq

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Abstract

This paper aims to present the main current features of the Expressway No.1 in Iraq as one of the biggest and attractive roads structures built in the Middle-East. This main corridor it was and still one of the most important travelled roads for decades, it is vital to Iraq's economy. The Expressway No.1 is heavily used by trade freight trucks, tourists, and the general public in the country. This super modern path with 1,250 km long connects Kuwait and southern regions of Iraq with the capital Baghdad, with western regions on the borders with Jordan and Syria. It should be one of the main future routes for the Iraqi upcoming project (The Dry Canal) as a new connection through the Iraq territory for international trade movement between East and West of the world. In spite of its some advantages, this route maybe suffers numerous deficiencies in the services provided to its user's faces. Consequently, this descriptive study) attempt by fact finding researching to realize and include all the general existing, available characteristics and details of this huge main road. The main objective for this study is describing the Expressway No.1 actual general shape after talk over each feature in order to determine the general situation according prioritization.

Keywords: Expressway No.1, Iraqi Corridors, Installations, Transportation, Freight.

I. Introduction

Transportation is one of the Iraqi economy's most active sectors in the late 1980s; it was allocated a large share of the domestic development budget because it was important to the Iraqi governments for several reasons, they recognized that transportation bottlenecks limited industrial development more than any other factor, especially, Iraq planned to an major target called (Dry Canal Project), to make freighting distance among east and west of the world more shorter [4] [7] [14]. Iraq's main transport corridors run North-South from Turkey, South-North through its ports of Um Qassr and East-West through its neighbours' ports, Syria on the Mediterranean, and Jordan on the Red Sea on Gulf of Aqaba. [1][2][7] (Fig.1, 2, 3)

After recuperating from years of wars and violence, Iraq has embarked on an ambitious plan to rehabilitate and enhance the performance of the existing transport corridors networks by fielding new hi-tech equipment and starting cooperation in a broad range of transportation fields. It should be noted that the development of transportation corridors within and across, Iraq creates additional prerequisites for maintaining security and developing the economy in the country. [15]

Compiling regional and local economic and demographic data is an important step in describing the current Expressway No.1 situation; also, Data on population by geographic area provide a key indicator of the economy served by this highway. In fact, General data, such as sections, lengths, total populations and number of existent installations along the route and around its area, traffic flows, also by using images and maps [9]. All these data can serve as a basis for forecasting and indicate a major description for the Expressway No.1.

I.1 General Description

A transport corridor is physically defined as a combination of routes that connect centres of economic activity across one or more adjoining countries, each route being composed of links over which transport services travels and nodes that interconnect the transport services. The end points are gateways that connect the economic centres to the hinterland or to the global trade routes [11].

The Statistics and the Data must be gathered to describe any transportation infrastructure; such like

expressways, should include the recognition of an existing description to meet the present and growing needs in the future. This problem will result in a series of actions, starting with searching out the data and screening geographic areas and specific locations. Routes that satisfy the screening criteria are subject to detailed evaluation, economic, demographic, facility condition, and systems performance data may be kept in a variety of forms, tabular databases, images and maps [9].

The Iraqi Highway design manual of 1982 grouped roads into a three-level; hierarchy of primary, secondary and tertiary highways. There is a secondary classification which has roads grouped into one of 4 classes (A, B, C, D). The allocation of a road to a classification determines factors such as its design speed, total width of highway and design capacity etc. [5] (Tab.1)

The expressway system in Iraq appears to be in fair condition, and the primary and secondary roads, most of which are in average condition, were designed over twenty years ago. However, in the intervening years, there has been limited maintenance, consistent overloading of freight trucks, and excessive use by heavy military vehicles. This resulted in a significant backlog of maintenance, which only began to be addressed in 2000 when a modest budget was allocated to implement an initial maintenance program [1] [4] [10]. While about 50% of the expressway system is considered to be in fair conditions, the percentage of primary and secondary roads in good condition is between 30% - 20%. Just 10% of village roads are considered to be in good condition. Most roads have not been well maintained in recent years, and signage and highway furniture that was damaged or missing has not been replaced or upgraded. [5].

1.2 General Data & Features

Transport corridors are of significant developmental importance because they promote trade among cities and countries along the corridor, support regional economic growth and enhance regional integration. From an economic perspective, their function is to promote internal and external trade by providing more efficient and effective transport and logistics services. As such they can be categorized into three categories: foreign trade corridors, which are used for imports and exports, domestic trade corridors that are used to distribute goods within the country, or transit trade corridors, which are used to transport cargo of other countries. [11]

An inventory of the location, extent, and quality of existing transport facilities is a key step in assessing future transport needs. A road data bank should be established and updated on a regular basis. Key characteristics of roads and highways include functional class and other route designations (national, regional, or local jurisdiction; truck and/or bus route), limited-access, number of lanes, lane and shoulder widths, design speeds, capacity, and pavement type and condition. [9]

The Expressway No.1 in Iraq by far is the largest expressway project in the Middle East, passes through 7 governorates and 17 Districts whose total population is around 5.5 million. There are 6 population centres within 1 km of the Expressway, and a further 4 within 2kms [2] [3] (Tab.7). This expressway has two main sections (Western and Southern), with (10 parts), and was built under the most rigorous technical conditions, in order to ensure a comfortable and safe drive at maximum speed of 150 km/h and maximum axle load of 16.3 tons [1] [5] [7] (Fig.1, 2) (Tab.11, 12). The two major main sections and the length of the each one is as following:

A. Southern Section;

This section of the road from Baghdad West (R.0) to Safwan-Basrah interchange is about 510 km of 3x3 lanes with standing lane (15.5m width), then the road splits into a 51 km 2X2 lane heading to Basrah city, and 64 km 2X2 lane heading to Safwan city on borders with Kuwait. The southern part includes a section from Diwanayah city to Nasiriyah city (R6) that is 145 km long and under construction with funding from the Government of Iraq. [1][2][3] (Fig.2, 8, 9) (Tab.2, 4).

B. Western Section;

This section of the road starting from Bagdad West to Rutbah is a 455 km 3X3 lane with standing lane (15.5m width), splitting into two 2X2 lane roads, from Rutbah city to Trebil center on the (Jordanian Border), and Rutbah city to Al Walid center on the (Syrian Border). [1][2][3](Fig.3, 16, 17) (Tab.3, 5)

The extent and quality of existing data sources varies considerably from country to country. Most countries will have some type of national census from which population and demographic data can be obtained. Many countries also collect data on total establishments, employment, and sales by industry on a regular basis although the level of geographic detail varies. Regardless of the extent of existing data, it is important that the road and highway of these data as a major part of their description. [9]

Consequently, it is necessary to summarize the currently general features of the expressway No.11.[1] [2] [3], and as follows:

1. The total length of the expressway No.1 including interchanges: (1250 km).
2. The total path with 6-lane sections: (800 km).
3. The total path with 4-lane sections: (450 km).
4. The total number of existing access roads: (250 km).
5. The total number of the interchanges: (25).

6. The total number of the branches: (3).
7. The total number of the bridges: (80) with total length: (9230 m).
8. The total number of the road overpasses: 117 with total length[⊗] 6820 m).
9. The total number of rest areas with fuel station: (7) new stations to be established; (15) existing needs to be upgraded.
10. The total number of parking areas: (200)

I.3 Land Use

"Compiling regional and local economic and demographic data is an important first step in assessing transport needs. Data on population by geographic area provide a key indicator of the market served by the road or highway, and thus the potential demand [9]. Additional demographic data, such as income, automobile ownership, and children and elderly population can further help identify personal transport needs (low automobile ownership, for example, might indicate a high importance of public transit service and non-motorized traffic accommodation.) Economic data, such as number of establishments and total employment in an area, can indicate major destinations for goods movement and business travel. Economic data by type of industry is important because different industries will have different needs for transport services. Finally, economic and demographic data can serve as a basis for forecasting traffic flows over an improved transport network". [9] [10]

Land use along the Expressway No.1 is predominantly agricultural, but land is less likely to be used for agriculture in the drier western area. Settlements close to the Expressway are relatively few except in Babil governorate which is considerably more urbanized. Industrial land use is rare or almost non-existent [2] [3]. The land use along the Expressway No. 1 includes the following:

- A. Agriculture lands.
- B. Moderately urbanized areas.
- C. Urbanized areas. [1][2] (Tab. 9)

There are limited numbers (176) of installations and establishments along the Expressway given its length [1] [2] [3] (Fig. 22, 23, 24, 25, 26) (Tab.6, 13) and these installations falls into the following categories:

1. Service installations including shops, restaurants, car repairs, etc.
2. Farms; with some livestock concerns, some of which span the Expressway.
3. Public installations; including security check points, police stations, and Ministry-owned gas stations, service stations and restaurants.
4. A very limited number 2 of religious establishments established for travellers use.

I.4 Installations along the Path

"For transport corridor planning, forecasts are needed to determine the adequacy of existing facilities and services in the corridor and the potential need for expanding these facilities and services. For facility planning, forecasts are needed to determine the appropriate capacity of new facilities that may be built and of existing facilities that are being considered for expansion. Therefore, if the existing facility inventory data is not current, procedures to update these data need to be devised. A combination of interviews with local professionals, site visits and field data collection and other appropriate means can be used to jump-start the process. As with population and industry data, satellite imaging or aerial photography can also serve as a data source on the location and nature of existing transport facilities "[9].

There are (176) of different kinds of installations along the both sections of the Expressway No.1, 118 of which operate on a year-round basis, some operate on a seasonal basis only, the remaining were operating with randomly timer or fully abandoned. Further efforts, prior to commencement of any future road development, will be made to re-confirm that these have indeed been fully abandoned. A full inventory of the 176 private business installations identified along the Expressway No.1 which are either encroaching on the existing right of the way [1] [2] (Fig. 22, 23, 24, 25, 26). The study provides the following information on these installations:

1. 118 installations are privately owned small business or vending entities which were actively operate permanently. The vast majority of these are family owned and run businesses whose employees are immediate family members.
2. 22 installations were privately owned small businesses and vending entities which were closed /inactive at the time to time. This group may be operating on a seasonal basis during the tourism season or when farm produce is available for sale.
3. 36 were closed and were reported to have been abandoned.
4. 16 Government-owned installations, mainly gas stations but in some cases restaurants or service entities, which are leased to private individuals who, on average, employ 5 workers.
5. 2 Mosques; both just outside the right of the way.
6. 15 security check points or police stations.

Most these have intruded on the state-owned of the road or are immediately nearby to it [1] [2] [3] (Fig.4, 5)

(Tab.13, 6).

Considerable encroachment on the Expressway No.1 has occurred over the years. An inventory of the encroaching installations was undertaken in August 2012 and was augmented in June, 2013 [1]. Along the Expressway No.1, almost all are small businesses serving passing traffic, some of which appear to operate only on a seasonal basis. Some of the installations are public, including police stations, check points and other public services such as fuel stations, but most of these installations encroached on the expressway will need to be relocated [1] [2] [3] (Fig.4,5, 22, 23, 24, 25, 26). These installations have different kinds of services and as follows:

1. Officials Installations (Security Checks Points and Police Stations).
2. Commercials Installations;
 - a. Private Installations (Shops & Small Business)
 - b. Official Installations Rented to Private (Gas Stations & Restaurants).
3. Cultural Installations (Mosques); There are only 2, both being just outside the road [1] [2]

Most of the installations are enduring constructions, being constructed of blocks and having either concrete or metal sheet roofs. However, some portable caravans, some palm thatch booths, and some mud brick and tent structures also exist [3]. All of the privately owned small businesses provide services to passing traffic; they are restaurants; food and basic supply shops; agricultural produce vendors; tire repair and vehicle maintenance shops; and very small scale fuel and oil shops. Of the full inventory of 176 installations for which data was collected in 2013, these can be characterized as small, informal, and unlicensed operators of a range of businesses. It has been established that some of the installations (22 in total) operate on a seasonal basis only while 36 have reportedly permanently closed or abandoned. [2] [3] (Fig.4, 5) (Tab.6, 13)

The negative environmental impacts of the Expressway No.1 future development are expected to be minor, temporary, and site-specific in nature. The negative social implications of this development involve the relocation of 125 small business and vending installations which have encroached on the right-of-way or which are located immediately adjacent to the right-of-way and will be adversely affected by the installation of road barriers and fencing; and the rehabilitation of existing underpasses which facilitate the movement of people, farm machinery and animals from one side of the Expressway to the other. [3] [7]

"Travellers wishing to stop at most of the commercial facilities along the route are required to turn at right angles off the route and drop some inches off the bitumen paving onto rutted informal dirt paths to reach the facility. Alternatively, they park immediately on the right of the road. Freight truck traffic evidently uses excessively worn and retreaded tires and suffers frequent tire blow-outs -- tire repairs are frequently done with the trucks parked on the outer lane and right of the road, where other passing trucks subsequently stop to provide assistance and enjoy a social break. Individuals and families with young children walk cross the lanes to reach facilities on the other side of the road. Vehicles re-entering the road from roadside facilities do so by re-mounting the road which is several inches higher than the dirt road edges, and then turning onto the road at a sharp angle "[2].

I.5 Settlements & Population

The extent and quality of existing data sources varies considerably from country to country, in fact, most countries will have some types of national census from which population and demographic data can be obtained, others collect data on total establishments, employment, and sales by industry on a regular basis although the level of geographic detail varies. [9] Regardless of the extent of existing data, it is important that the road and highway administration establish the management of these data as a routine part of their work. In cases where national and local sources do not contain the required data, or where these sources have not been recently updated, satellite imagery or aerial photography can be used to estimate population and economic data. Photographs can be analyzed to determine the location of housing units and therefore to estimate the population of an area. Photographs can also be used to locate concentrations of businesses as well as major industries. [9]

The total population of the urban centers along the Expressway No.1 {the governorates are 7, Al-Anbar, Baghdad (R,0), Babil, Al Qadisiyah, Dhi Qar, Al Mothanah , Al Basrah and (17) Districts belongs to these governorates } is approximately 5.6 million inhabitants according to the 2009 census. [1] [2] [3] (Tab .7, 8, 10)

C. Southern Section;

The Governorates in this section are (5); Babil, Al Qadisiyah, Dhi Qar, Al Mothanah, and Al Basrah. The divergence between urban hubs and their hinterland are starkest for the region containing the southern portion of the route. A few population settlements are situated within 2kms of the Expressway, and the most urbanized area along the Expressway No.1 is in Babil Governorate [1] [4] (Tab .7, 8, 10)

B. Western section;

The Expressway No.1 goes through the biggest governorate in Iraq (Al-Anbar). Half of the residents of this governorate are living on the banks of the Euphrates River outside cities and the towns, there were between 1.9 million and 2 million inhabitants in the districts, the largest cities are Ramadi and Fallujah. [1] [4] (Tab. 7, 8, 10).

I.6 Environment & Eco-Regions

Highways have significant impacts on both nearby communities and the natural environment. People and properties may be in the direct path of road works and affected in a major way. People may also be indirectly affected by construction, through the disruption of livelihood, loss of accustomed travel paths and community linkages, increases in noise and pollution, and more road accidents. Disturbances to the natural environment may include soil erosion, changes to streams and underground water, and interference with animal and plant life. New roads may bring development to previously underdeveloped areas, sometimes causing significant effects on sensitive environments and the lifestyles of indigenous people. [8]

The expressway No.1 spans most of the western, central and southern territories of Iraq. It crosses flatland, primarily desert and semi-desert. The western section of the road crosses sparsely populated area; the central and southern part crosses more densely populated agricultural land. Most of the expressway No.1 passes through agricultural land within (6) governorates and (17) population centres [1] [2] [3] (Fig. 2, 9) (Tab.9), as following:

A. Southern Section;

The southern section of the Expressway No. 1 extends from Ramadi to Basrah through Baghdad (R.0) and occurs totally within the Arabian Desert and saharo-Arabian xeric shrublands Eco-region. This desert ecosystem is one of the largest eco-regions in Iraq. It constitutes up to 50% of the country's total area. The region receives little rain (125mm/annum). Temporal and seasonal water pools do exist in this region, and it is intercepted by many wadis which carry water during winter and spring rains. Occasional brackish salt flats exist in some areas, a few of which in Iraq have been utilized for water storage (e.g. Razaza Lake) (Fig.18). The Expressway No. 1 passes 10 km to the North of the ecologically important site within the Arabian Desert Eco-region of the Mysayab and the Hindiya Dam (Fig.21), also passes 6km to the West of the Basrah Khor Al-Zubair, and 36 km to the West of the Eco-region of Hur Al-Hammar. marsh. [1] [2] (Fig.2, 19)

B. Western Section;

The Expressway No. 1 western section between Trebil center and Ramadi area falls largely within the Mesopotamian shrub desert region and comprised of several main wadis crossing the western desert of Iraq to the Euphrates. The stony desert carries only a sparse herb growth, and only in the wadi where there are temporary pools and springs is there more abundant vegetation. The Expressway No. 1 passes 2 km to the North of the ecologically important site boundary within the Mesopotamian Shrub Desert Eco-region of the Habbaniyah Lake. Sand dunes are very common which cause many accidents; there should be special equipment at Al Rutbah Centre to avoid these accidents. [1] [2] (Fig 2, 20)

II. Economic Vision

"The benefits and impacts transport corridors bring to a national economy are greater than those of mere transport infrastructure. Transport infrastructure deals with basic connections among regions or cities and achieves the start of trade and the development of such other social side effects as an increase in employment, access to education, healthcare, etc. transport corridors go one step further: They refine the transport and logistics services and make trading far more competitive as it is by definition aims to linking provinces countries and regions main strategies and mechanisms that are being implemented in transport corridors and their effects and impacts on trade. They are also important for security and territorial integrity of countries and regions, and for tourism or movement of people in general. In addition, if not properly managed, transport corridors development can involve negative externalities such as spread of diseases and illegal activities "[11].

According to preliminary analysis from the 2012 Household Income and Expenditure survey, headcount poverty fell by more than (10 %) points in Basrah city, while rising in the four provinces around it. Improved this transport link had facilitated movement of people, goods, and services between these locations, providing an equalizing force in Iraq's development outcomes. Similarly, the Baghdad-West to Hit city section improves accessibility of the sparse regions of Al Anbar province. [1] [2] [4] [7 (Tab.10)]

Iraq has three main transport corridors: North-South from Turkey; South-North through its port of Um Qassr; East-West through its neighbor's ports on the Mediterranean and Gulf of Aqaba. Other corridors link Iraq with Iran in the East and Saudi Arabia in the South-West. Iraq's transport corridors are inefficient because of institutional weaknesses and infrastructure deficiencies. [4] [7]

About 50 % of Iraq's imports come through its North-South corridor and enter through the Ibrahim El Khalil on the northern border, from Europe, Russia and Central Asia via Turkey. Most Asian imports are transshipped at Dubai and use the port of Um Qassr to access the South-North corridor to reach Baghdad [1][5]. This part of the corridor accounts for about 25% of total imports. The East-West corridors carry about 25 % of the imports coming from Europe, Africa and Asia through the Mediterranean ports in Syria and Lebanon and the port of Aqaba in Jordan, approximately (750-1000) fuel vehicle pass to Jordanian and Syrian borders daily. [3] [4]

Other corridors link Iraq with Iran in the East and Saudi Arabia in the South-West . This network includes one major part of the expressway system; it is the Expressway No.1 of (1250 km long) which consists of one six-

lane highway connecting Basrah city in the south with the Jordanian border and the Syrian borders in the west via Baghdad. The expressway No.1 could be divided in 2 major sections and 10 parts that were built by well-known construction building companies from different countries in the world and passes through several governorates and Districts in Iraq. [1] [2] [7] (Tab 11, 12)

The Expressway No.1 carries between 15,000 and 30,000 Annual Average Daily Traffic, 50 % of which is trade traffic. This main expressway makes part of the primary road network, which were designed to very high standards. The Iraq Expressway No.1 is the first in a planned network of national highways in Iraq, links Jordan & Syria to the southern Iraqi ports and Kuwait in the south via Baghdad & Basrah. [1][2]

The enhancing of general Iraqi corridors project including the Expressway No.1 is of strategic projects that will provide Iraq's corridors of trade and economic vitality of Iraq with neighbouring countries. [6] The main contribution of transport corridors to economic growth is subsequent to the reduction of logistics costs and transportation time along supply chains, which eventually help improve trade competitiveness. However, experience demonstrates that not all technical collaboration initiatives are successful and their success is much dependent upon the existence of proper corridor management mechanisms and trade and transport facilitation initiatives [11].

Findings

We initiated by analysing all the major features that could describe the Expressway No.1;

- 1) General data
- 2) Land Use
- 3) Installations along the path
- 4) Settlements & Population
- 5) Environment & Eco-Regions

We asked the following question: How the general existing features of the Expressway No.1 could be?

Discussions & Conclusions

- The trade traffic along the South- Centre Iraq and East-West Corridors is being served by Expressway No.1 Because of their economic importance, which goes far beyond the mere impact of transport infrastructure, the development of transport corridors such like Expressway No.1 has been high in the priority of Iraq, with various development strategies ranging from working on interconnections and interoperability to increasing route capacity for reaching the international trade access.
- In most cases, priority is given to the developing the expressway's flow performance and create a new trade movement at border crossings and international gateways with neighbouring countries and the world. Addressing the institutional weaknesses and infrastructure deficiencies along the expressway No.1 as one of the Iraq's main transport corridor should result in better service quality along this corridor. Particularly, this main international trade flow road expected to play a very important role on the Iraqi Dry Canal future project, which it should transforming the Iraqi territory to a new hub for international trade movements. The traffic along the South- Centre Iraq and East-West Corridors is being served by Expressway No.1 with 1250 km long, the rote 2 sections and 10 parts; Southern with 510 km & Western with 455 km. This corridor is considerate as one of the longest routes in the Middle East and one of the most important highways in Iraq.
- Most of the expressway adjacent land along the road is owned by the Government, except some farms and installations owned by private. There are 176 official and private installations and adjoining to this expressway; many of them are assembling randomly on the right of way. These installations include; Police posts, Army posts, check points, Commercial (stand-alone) privately owned rest areas. Formal rest areas with integrated services, Small and fragmented shops, some of which are informal and unlicensed and farms or state leased lands.
- Most of the installations include medium or bad partial services like restaurants and shops. Many restaurants moved from the city to the area of the express way to follow traffic. In fact, Informal and illegal service stations are now dominating service delivery and they are very close to road and cannot be moved back because of obstacles behind it parking, especially of trucks needs management and repair. Most of the parking of trucks is obstructing movement and activities. The installation along the way slows traffic unnecessarily on a high speed Expressway, distracts drivers, and in effect removes sections of the "safety corridor" alongside the Expressway. The alternative presented of relocating these installations, or replace them to dedicated and serviced lay-bys represents the most feasible and the safest option for the public, and received almost universal support and experiences in this domain.
- Since the Expressway is already in existence and should be used in future for international trade, it would be feasible to rebuild the entire necessary facilities requested along the 1250 km road distance. A workable option is to rehabilitate and improve the installations for serving the road.
- Previously many violations have been occurred due to the bad security issues along the expressway, so that, it expected to minimize the violations by raising the security of the expressway, and study the best locations for security and other installations along the road. Renovation welcomed to reduce accidents that are frequently occurring in front of the new complexes and along the way by creasing the number of the security points. Also, to ensure order and safety; the relocation of police and security centres along the Expressway as their current

inappropriate locations are widely considered to cause accidents; provision of lighting at the lay-bys for security and safety; provision of adequate numbers of overpasses to serve community members who need to cross the road; rehabilitation of underpasses for agricultural and herding enterprises along the road; reduce the opportunities for vehicles to make U-turns since this is causing accidents.

- There are 4 Expressway maintenance centres along the western part of the road. The Maintenance of the Expressway is not sufficient and they do not have sufficient equipment to follow-up required maintenance work for the expressway. It is required to provide the Expressway traffic by sufficient equipment. Confining vehicle maintenance and refuelling to areas in construction camps designed to contain spilled lubricants and fuels.
- There are very few settlements and communities immediately alongside this route which are even of moderate size. Population settlements in the surrounding areas tend to be very small and are sparsely scattered, often being +20kms or more from the road way in some parts.

Recommendations

A. I recommended: It is important to substitute the existing randomly installations with a new suitable complexes or small urban centres, well designed, planned with the most suitable modes. Located in the right nodes and include all the necessary facilities to serve all kinds of travellers and to run the future Dry Canal project. These new complexes must be comprehensive and executed as part of a full network along the Expressway No.1.

B. I recommended: The urban plan design of these new complexes should include the following:

1. Restaurants, Cafeterias & Rest houses;
2. Commercial Shops & Markets;
3. Hotels and Motels: Touristic zone should be separated;
4. Vehicles Maintenance Centres & Gas stations;
5. Security & Traffic control Check points;
6. Medical & Telecommunications Centres;
7. Warehouses & Stores;
8. Management Offices;
9. Employees Housing Zone;
10. Parking: the need for establishment parking for vehicles, in areas of the new complexes and particularly freight trucks to separate truck visitors from other visitors.
11. Green Areas: to reducing the dusty weather effects, noise and environmental pollution and to improve compound with landscape in the new complexes design, by creating a large green landscape spaces and plant suitable trees

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Reference

- [1] Ministry of Construction and Housing, Environmental and Social Impact Assessment Study (ESIA), The Rehabilitation of Expressway No. 1 in Iraq, (ERRP.CON.SSS.ESIA EW-1), Final report, September 25, 2013; <http://www.imariskan.gov.iq/oldmoch/mshareabankdwale/pdf3/Final%20ESIA%20Expressway%20No.%201%20Main%20Report-English.pdf>.
- [2] Ministry of Construction and Housing, Environmental and Social Impact Assessment Study (ESIA), the Rehabilitation of Expressway No. 1 in Iraq, (ERRP.CON.SSS.ESIA EW-1), Executive Summary, Final English, September 25, 2013; http://www.imariskan.gov.iq/oldmoch/mshareabankdwale/pdf/DRAFT_RAP_Executive_Summary_Englishpdf.
- [3] Ministry of Construction and Housing, Environmental and Social Impact Assessment Study (ESIA), The Rehabilitation of Expressway No. 1 in Iraq, (ERRP.CON.SSS.ESIA EW-1), Arabic Translation, Final, September 25, 2013; <http://www.imariskan.gov.iq/oldmoch/mshareabankdwale/pdf3/Final%20ESIA%20Expressway%20No.1%20Executive%20Summary-Arabic.pdf>.
- [4] The World Bank, Iraq Transport Corridors Project (P131550), Environmental and Social Audit for R6 Stretch of Expressway No.1, Executive Summary, November 14, 2013; <http://documents.worldbank.org/curated/en/2014/03/19314558/iraq-transport-corridors-project-p131550-implementation-status-results-report-sequence-01>.
- [5] Robert Bartlett, GTA-303 Road Classification, some current examples (draft paper), ResearchGate; April 2013;

<http://www.researchgate.net/publication/236522667>.

[6] Road numbering systems, Iraq national roads, 31-10-2009;

<https://sites.google.com/site/roadnumberingsystems/home/route-lists/iraq-national-roads>.

[7] The World Bank, Transport Corridors Project, International Bank for Reconstruction and Development, Project Appraisal Document, Report No: PAD648, November 21, 2013;

http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/12/03/000461832_20131203103102/R

endered/PDF/PAD6480PAD0P13010Box379877B00OUO090.pdf.

[8] The World Bank, Construction & Maintenance;

<http://www.worldbank.org/transport/roads/con&main.htm#roads>.

[9] The World Bank, Planning of Roads and Highways, Planning Tools and Analysis Methods;

http://www.worldbank.org/transport/roads/pl_sect6.ht.

[10] Mohammed Feghoul, World Bank, Agencies Participating: UNDP & ITU, TaskManger, Transportation & Telecommunications, Working Paper, October 2003;

<http://siteresources.worldbank.org/INTIRAQ/Overview/20147782/TRANSPORT-TELECOM%20final%20sector%20report%2016%20October.pdf>.

[11] Islamic Development Bank, a Study of International Transport Corridors in OIC Member Countries, Global Advisory and Training Services September 2011;

<http://www.comcec.org/userfiles/file/ulastirma/idb-transportcorridors-study.pdf>.

[12] Logistics in Iraq Modernises with New Freight Truck Location and Cargo Management System.

<http://www.forwardingworld.com/news/1369511578/Logistics-in-Iraq-Modernises-with-New-Freight-Truck-Location-and-Cargo-Management-System/>.

[13] Excavations in Iraq, 1987–88,

<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9198297&fileId=S0021088900004629>.

[14] Transportation in Iraq, <http://countrystudies.us/iraq/61.htm>

[15] Iraq on the move: Transportation History, <http://www.alburhangroup.com/history-transport.html>.

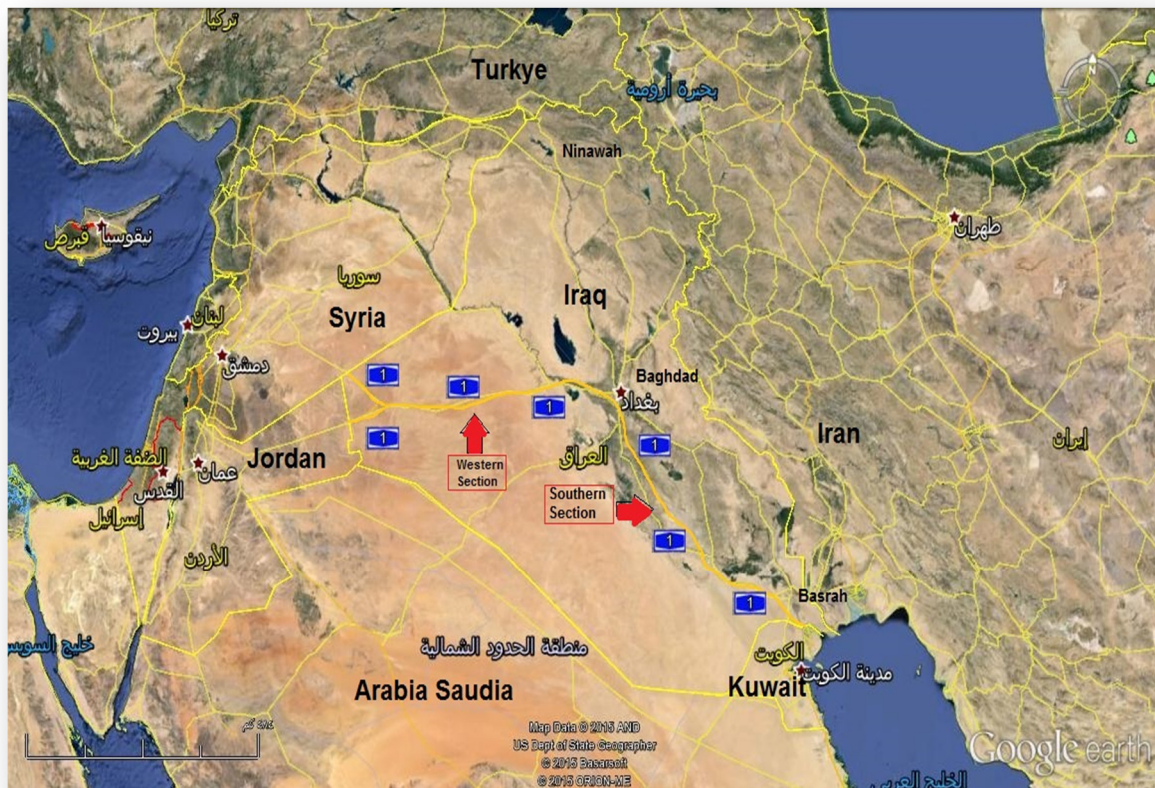


Fig.1; Expressway No.1 Map (Southern & Western Sections)

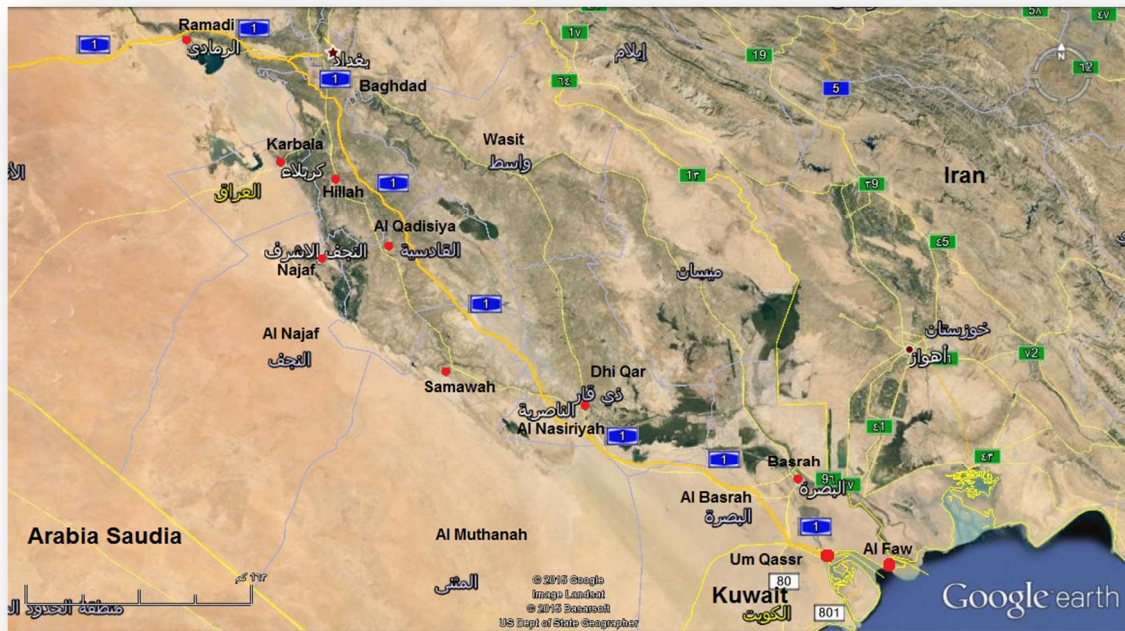


Fig.2; Expressway No.1 Map (Southern Section)



Fig.3; Expressway No.1 Map (Western Section)

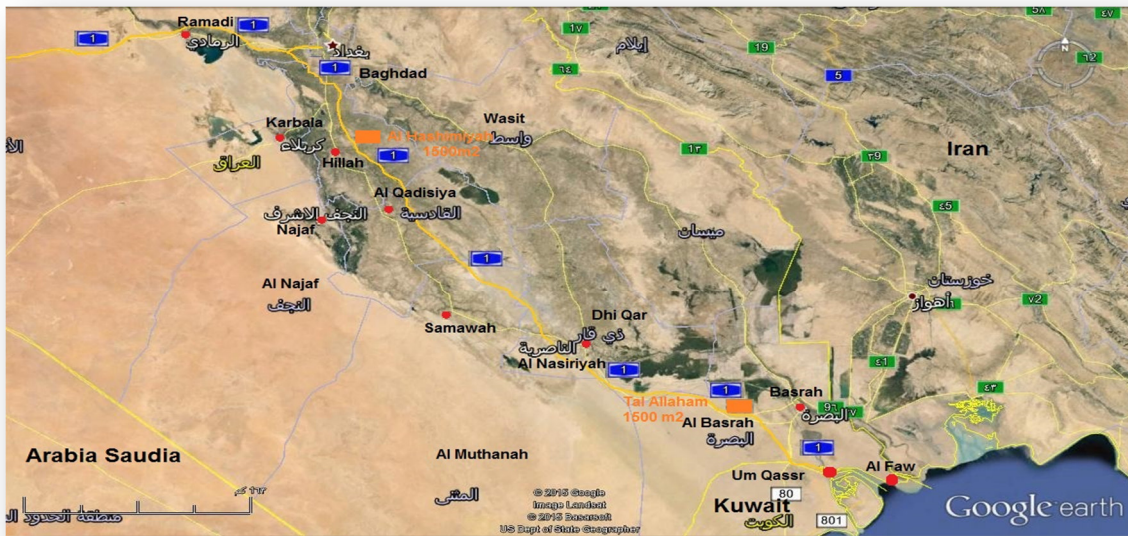


Fig4; Southern Section Existing Official Stations

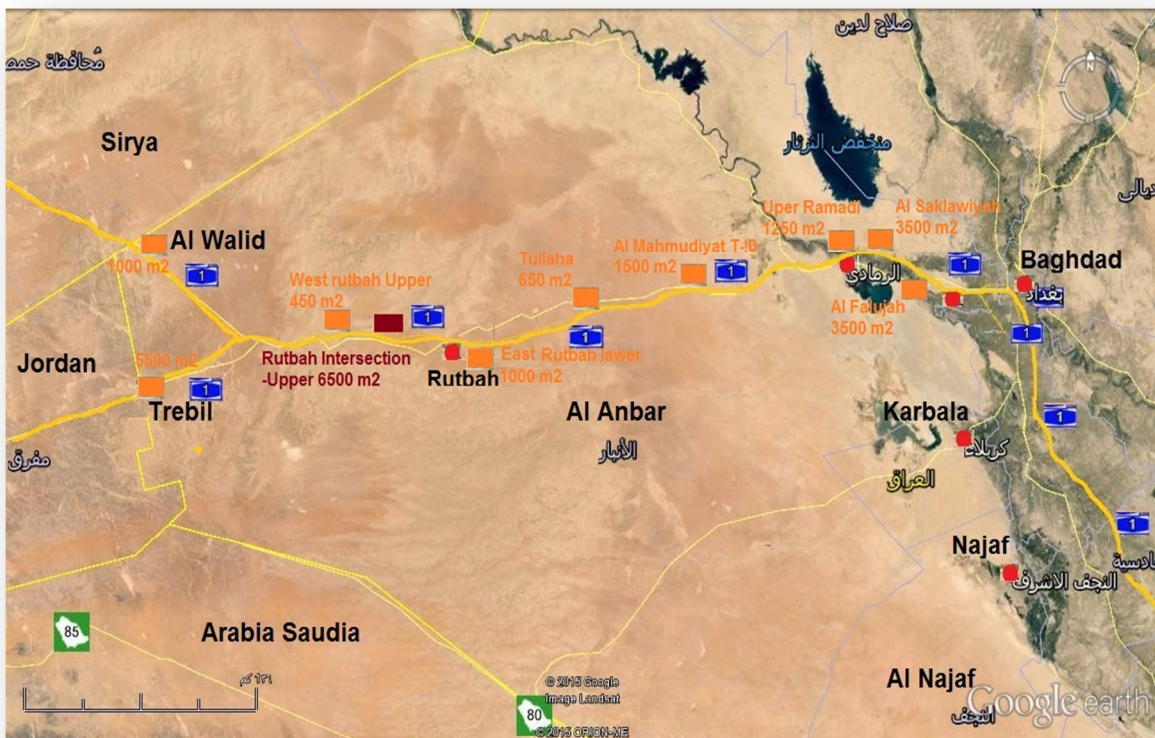


Fig 5; Western Section Existing Official Stations [1]

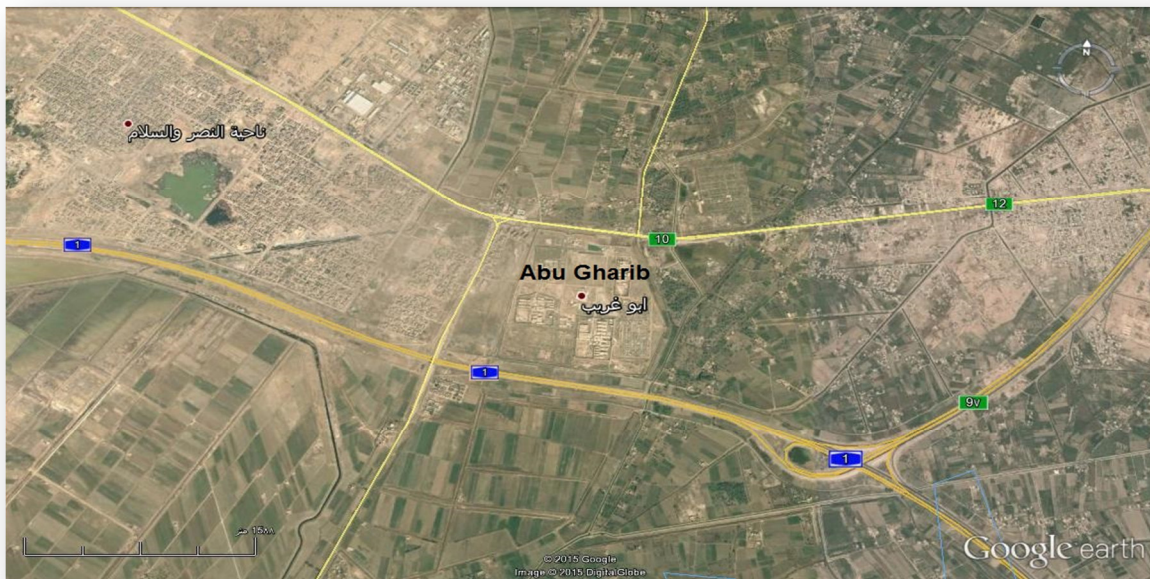


Fig.6; Expressway No.1 Baghdad West km.0 intersection with Abu Gharib



Fig.7; Expressway No.1 intersection with Hilla City (Southern Section)



Fig.8; Expressway No.1 intersection with Diwaniyah City (Southern Section)



Fig.9; Expressway No.1 intersection with Euphrates River near Al Nasiriyah city (Southern Section)



Fig.10; Expressway No.1 intersection with Basrah city & Al Zubair (Southern Section)



Fig.11; Expressway No.1 intersection with Safwan (Southern Section)



Fig.12; Expressway No.1 intersection with Um Qassr port & Al-Faw (Southern Section)



Fig.13; Expressway No.1 intersection with Al Fallujah city (Western Section)



Fig.14; Expressway No.1 intersection with Al Saklawiyah (Western Section)



Fig.15; Expressway No.1 intersection with Al Ramadi city (Western Section)

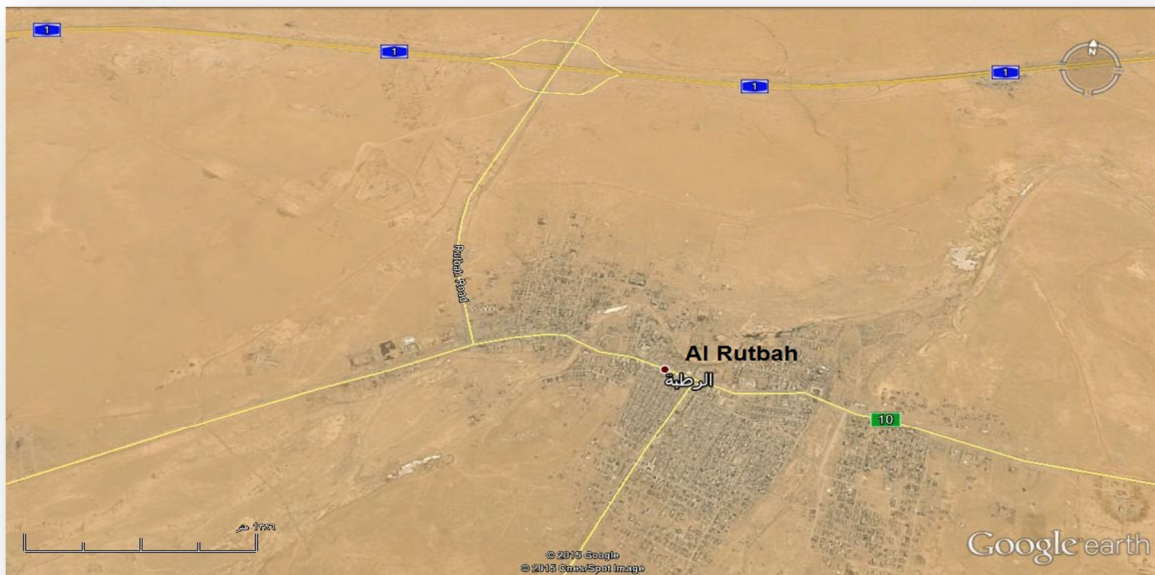


Fig.16; Expressway No.1 intersection with Rutbah city (Western Section)

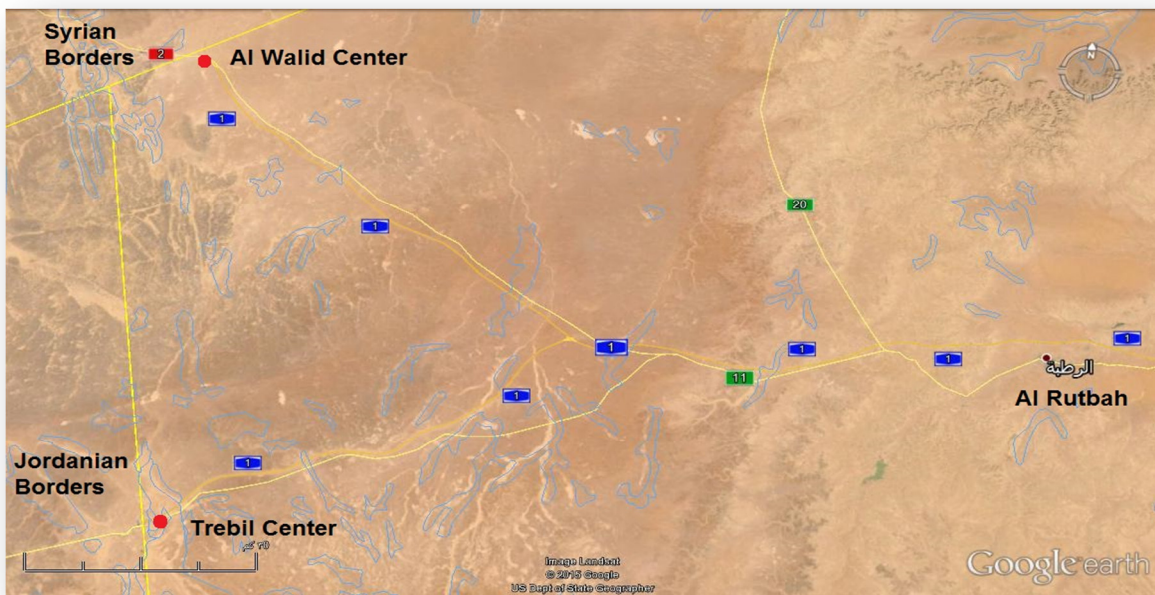


Fig.17; Jordanian junction-Syrian border (Western Section)



Fig.18; Expressway No.1 intersection with Razaza lake (Southern Section)

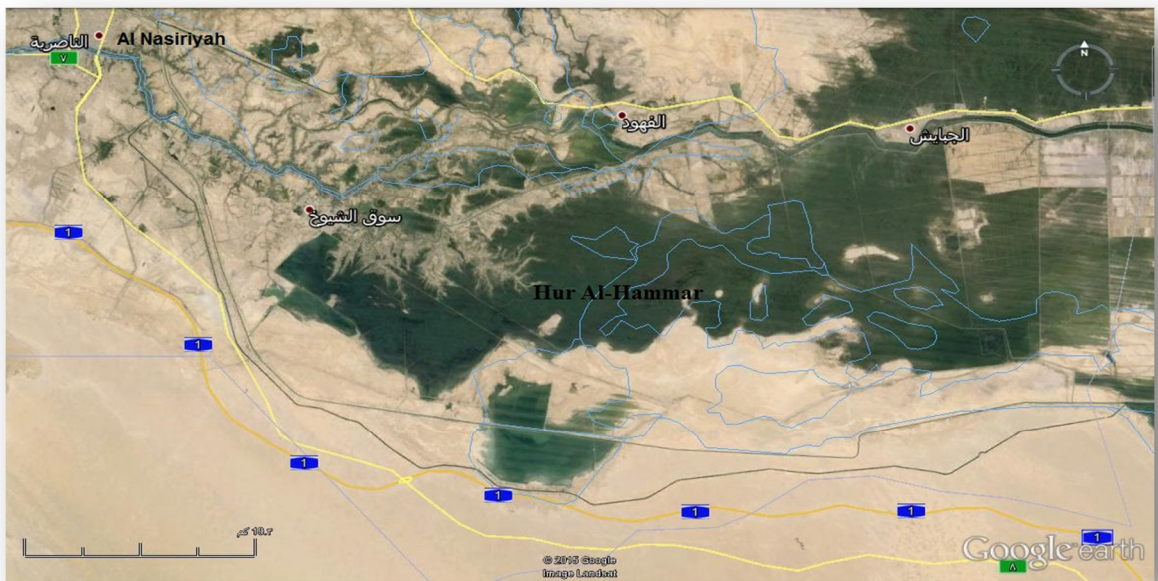


Fig.19; Expressway No.1 intersection with Hur Al-Hammar (Southern Section)



Fig.20; Expressway No.1 intersection with Habbaniyah lake (Western Section)

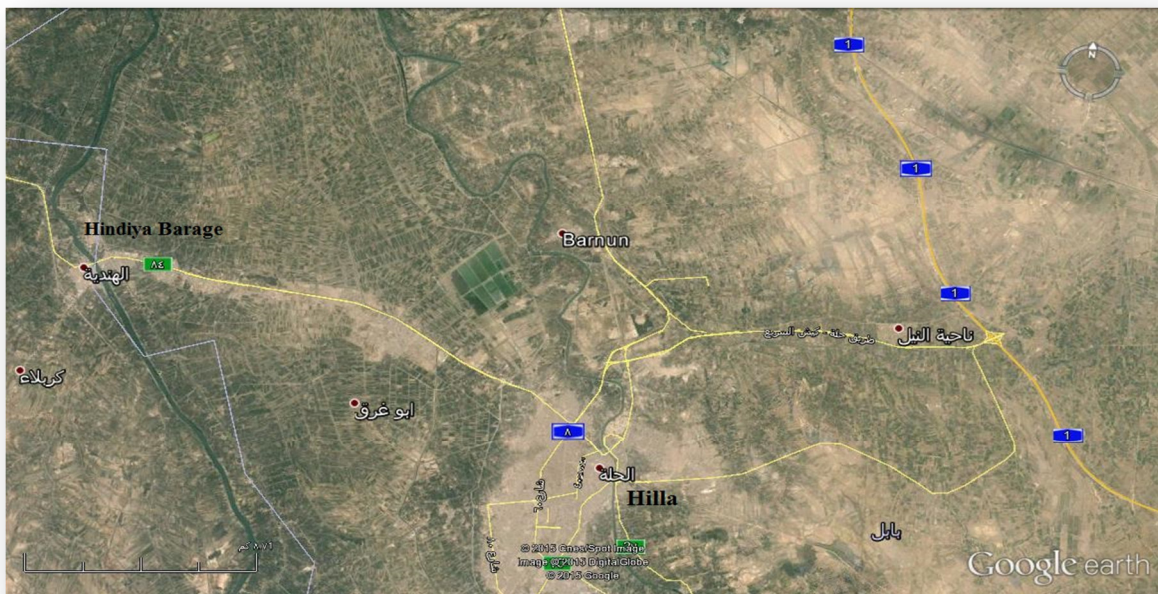


Fig.21; Expressway No.1 intersection with Hindiya Dam (Southern Section)



Fig.22; Sample of bridges along the Expressway No.1



Fig.23; Sample of restaurants along the Expressway No.1



Fig.24; Central Gas Station for Rutbah District



Fig.25; Sample of shops along the Expressway No.1



Fig.26; Sample of check points along the Expressway No.1



Fig.27; view of 3x3 lanes along the Expressway No.1

System of Highway	Corresponding Highway Classes	
	Litter symbol	Design speed km/h
1. Primary Highways	A6/40	120 100 80
	A6/33	120 100 80
	A4/33	120 100 60
	A4/25.5	120 100 80
	A2.13.5	100 80 70
2. Secondary Highways	A6/33	120 100 80
	A4/33	120 100 80
	A4/25.5	120 100 80
	A2/13.5	100 80 70
	B2/12	80 70 60
3. Tertiary Highways	A4/25.5	120 199 80
	A2/13.5	100 100 80
	B2/12	80 70 60
	C2/11	80 70 60
	D2/9.5	70 60 50
The letter symbol (e.g.) A6/40 indicates: ÿ A = secondary classification ÿ 6 = 6 number of traffic lanes ÿ 40 = total width of highway		

Tab.1; Iraq roads general classification

Section A	Part	Length [km]
R4: Baghdad West – Hilla	Southern	105km
R5: Hilla – Diwaniyah	Southern	77km
R6: Diwaniyah-Nasiriyah	Southern	145km
R7: Nasiriyah – Rumaila	Southern	145km
R8A: Rumaila – Basrah	Southern	31km
R8B: Rumaila – Safwan	Southern	81km

Tab. 2; Expressway No.1 Lengths (Southern Section)

Section B	Part	Length [km]
R9A: Baghdad West – Habbaniyah	Western	63km
R9B: Habbaniya – Hit	Western	61km
R10: Hit – Tullaha	Western	134km
R11: Tullaha – Rutbah	Western	137km
R12: Rutbah - Jordanian border	Western	129km
R13: Jordanian junction-Syrian border	Western	76km

Tab.3; Expressway No.1 Lengths (Western Section)

Southern Section (Parts)	Length (km)	Lanes Existing
R4:Baghdad West-Hilla	105	3x3
R5: Hilla-Diwaniyah	77	3x3
R6: Diwaniyah-Nasiriyah	131	3x3
R7: Nasiriyah-Rumaila	145	3x3
R8: Rumaila-Safwan	112	3x3

**Tab.4; Expressway No.1 Path (Southern Sections parts)
 Length & lanes**

Western Section (Parts)	Length (km)	Lanes Existing
R9: Baghdad West-Hit	124	3x3
R10: Hit-Tallaham	134	3x3
R11: Tallaham-Rutbah	137	3x3
R12:Rutbah-Jordanian border	129	2x2
R13:Jordanian-Syrian border	76	2x2

**Tab.5; Expressway No.1 Path (Western Sections parts)
 Length & lanes**

Governorate	No. of Installations
Babil	66
Al-Anbar	26
Dhi Qar	25
Al Basrah	4
Al Qadisiyah	14
Al Mothanah	41

Tab.6; Number of installations by Governorate

Population Centre Section. B	Distance KM	Population Centre Section. A	Distance KM
Abu Ghraib	0.8	Umm Qasr	0
Rutbah	0	Sedra	0.2
Al-Qariyan	2	Safwan	1.5
Trebil	0	Qal'at Shakir	1.5
Umm Al-Mahaweel Village	0.4	Manazel Al-Hajjana	1.5

Tab.7; Population Centers that are within 2 km from the Expressway No.1

Governorate	City	Average Distance From Expressway (km)
Al Anbar	Al Rutbah	2.77
Al Anbar	Ramadi	9.75
Al Anbar	Fallujah	3.45
Baghdad	Abu Ghraib	1.94
Babylon	Hillah	22.00
Al Qadisiyah	Al Diwaniyah	11.70
Dhi Qar	Nasiriyah	31.20
Basrah	Basrah	32.40

Tab.8; Location of Main Cities along the Expressway and Relevant Distances

Land Use	Hectares
Agriculture	4,090,473
Residential	118,418
Industrial	7,256

Table 9; Area of Land Use

Governorate	District	Population	Economic Establishments	Residential Units	No. of Buildings
Al-Anbar	Al Rutbah	39,000	1,686	5,447	8,567
	Ramadi	491,700	20,527	62,384	89,115
	Fallujah	526,861	24,876	66,007	91,599
Baghdad	Abu Ghraib	269,171	18,881	39,320	56,646
	Al Madaen	383,868	17,665	56,639	77,930
	Al Mahaweel	299,578	12,138	39,299	50,751
Babel	Al Hilla	701,041	29,917	108,607	126,389
	Al Hashmiyah	399,717	15,955	55,300	68,004
Al-Qadisiyah	Al Diwaniyah	499,926	21,046	71,155	87,881
	Afak	151,559	9,116	20,421	30,273
	Al Rumeitheh	290,955	19,676	34,469	52,204
Al-Muthanah	Al Khader	94,137	5,968	11,189	16,609
	Al Nasiriyah	643,137	24,075	84,540	96,364
Dhi Qar	SouqAl Shyoukh	267,403	7,528	32,974	39,682
	Al Jabayesh	85,225	2,682	10,188	13,004
Al-Basrah	Al Zubair	425,471	14,012	59,983	74,162
	Al Faw	34,840	1,403	4,910	6,032

Fig.10; Depiction of the population of each governorate along the Expressway

Southern Section Parts	
Path	No.
Bagdad West R.O - Hilla	R4
Hilla - Diwaniyah	R5
Diwaniyah - Nasiriyah	R6
Nasiriya - Rumaila	R7
Rumaila - Safwan /Basrah	R8

Tab 11; The Expressway No.1 Southern Section parts path

Western Sections Parts	
Path	No.
Baghdad - Hit	R9
Hit - Tullaha	R10
Tullaha - Rutbah	R11
Rutbah - Tribel	R12
Rutbah - Al Walid	R13

Tab 12; The Expressway No.1 Western Section parts path

installations	Operating	Closed but Operate on a Seasonal basis	Possibly Abandoned
	118	22	36

Tab 13; Summary of installations along the Road