Seminar series nr 189

Accessibility to Health Services in the West Bank, Occupied Palestinian Territory

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2010
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Accessibility to Health Services in the West Bank, Occupied Palestinian Territory

A Minor Field Study

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2010-04-11

Master's Degree in Physical Geography and Ecosystem Analysis

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Abstract

The Palestinian Territory has since 1967 been occupied by Israel. Following a large number of disturbances as protests to the occupation, Israel has imposed mobility restrictions for Palestinians in the West Bank and Gaza. The mobility is regulated by for example checkpoints, roadblocks and earth mounds. In 2002, Israel started to build a concrete wall around and inside the Palestinian Territory of the West Bank, opposing international law and human rights. The restricted mobility is affecting the accessibility for the Palestinian people. The term accessibility means in this context the ability for people to reach certain geographical locations that might be of importance, such as health care facilities. This study aims at assessing, quantifying and documenting the present accessibility status to general hospitals by using a GIS-based model that includes information on the roads system, hospitals and Israeli physical obstructions across the West Bank. When talking about accessibility to health care, the time it takes to reach the facility is in many cases more important than distance and therefore, accessibility is in this study measured by time. Data on road speeds was collected from speed measurements and data on delay at checkpoints was collected by interviews. When all data was collected and synthesized, a network model was built and analyzed using the Network Analyst tool of ArcGIS. Three types of Network Analyses were conducted: Service Area, Closest Facility, and Route. It was found that most people live within a border of 15 minutes to a general hospital but there are 25000 people that have no accessibility at all in the present situation. 285000 people are affected by at least one checkpoint on the way to the quickest reachable general hospital, and the delay at checkpoints can be up to 3 hours long. The result also shows that the Israeli imposed physical obstructions, including checkpoints and barriers increases the travel time significantly, both at the regional and intra-regional levels.

Key words: Geography, Physical Geography, GIS, MFS, Network Analysis, Occupied Palestinian Territory, Accessibility, Health Care

Sammanfattning

Det Palestinska Territoriet har sedan 1967 varit ockuperat av Israel. Som följd av ett stort antal oroligheter och protester mot ockupationen har Israel infört restriktioner för rörlighet inom Västbanken och Gaza. Rörligheten är styrd med hjälp av exempelvis vägspärrar och blockerade vägar. År 2002 började Israel bygga en betongmur runt om och inuti Västbanken, trots att det motsätter sig internationell lag och mänskliga rättigheter. Den begränsade rörligheten påverkar i sin tur tillgängligheten för den palestinska befolkningen. Tillgänglighet innebär i den här kontexten möjligheten att nå specifika geografiska platser som kan vara av betydelse för samhällets medborgare, till exempel sjukvård. Målet med denna studie är att uppskatta, kvantifiera och dokumentera den nuvarande tillgängligheten till allmänna sjukhus med hjälp av en GIS-modell som inkluderar vägkvalitet, sjukhus och de Israeliska fysiska hindren. Vid transport till sjukvård kan tid ofta vara en mer avgörande faktor än avstånd och således är tid, i denna studie, det använda måttet på tillgänglighet. Data på väghastigheter samlades in genom hastighetsmätningar och information om fördröjningar vid vägspärrar baserades på intervjuer. När all data var insamlad byggdes ett nätverk med hjälp av GIS som sedan analyserades med Network Analyst. Tre sorters analyser genomfördes, Service Area, Closest Facility och Route. Resultatet visade att de flesta människor bor inom 15 minuter från ett allmänt sjukhus men mer än 25000 människor har ingen tillgänglighet alls i den gällande situationen. 285000 personer måste passera en vägspärr på väg till ett allmänt sjukhus, och förseningen vid vägspärrar kan vara över till tre timmar långa. Resultatet visar också att vägspärrar och barriärer ökar restiden avsevärd, både regionalt och intra-regionalt.

Nyckelord: Geografi, Naturgeografi, GIS, MFS, Nätverksanalys, Ockuperade Palestinska Territoriet, Tillgänglighet, Sjukvård

Preface

This study was sponsored by the Swedish International Development Cooperation Agency (SIDA) as a Minor Field Study (MFS) scholarship, supplied by GIS-centre at Lund University. The field work was conducted at Applied Research Institute – Jerusalem (ARIJ) as an internship from the 10th of October 2009 to the 6th of January 2010.

Acknowledgements

Many people have been of great help in this study but there are some that I would like to give a special thanks to. First, I would like to thank my supervisor, Ulrik Mårtensson at Lund University, for all help and correspondence before, during and after my field work. I would also like to thank Dr Jad Issac for having me as an intern at ARIJ, providing me with data, knowledge, accommodation and much more. Furthermore, I would like to thank my supervisor at ARIJ, Issa Zboun for supporting this study and helping me with anything I may have needed. Hamza Halaibeh and Elia Kahlilieh have played an important part in my fieldwork and analysis. They should be acknowledged along with the whole GIS-unit at ARIJ that have all been very helpful and generous with their expertise knowledge (كلكم خبراء). A special thank you goes to Ahmad El-Atrash for assisting me at all times, providing me with thoughts and ideas. My thanks also go to Salem Thawaba for providing the basic idea and giving me the right contacts.

Table of Contents

List of Maps

List of Figures

List of Tables

List of Acronyms and Abbreviations

ARIJ – Applied Research Institute Jerusalem

DOP – Declaration of Principles

GIS – Geographical Information Systems

GPS – Global Positioning System

ICJ – International Court of Justice

IF – Israeli Forces

MoH – Palestinian Ministry of Health

MSL- Mean Sea Level

NGO – Non Governmental Organisation

OPT – Occupied Palestinian Territories

PCBS – Palestinian Central Bureau of Statistics

PLO – Palestinian Liberation Organisation

SPSS - Statistical Package for the Social Sciences

UN – United Nations

UNOCHA – United Nations Office for Coordination of Humanitarian Affairs

UNRWA – United Nations Relief and Work Agency

Chapter 1: Introduction

1.1 Accessibility Definition

Accessibility is an important feature for all people that have a need to reach destinations not situated in their home surroundings. It can be the ability to go to a market to sell or buy food, the ability for children to get to school or the ability to reach jobs for adults. Accessibility has therefore a socioeconomic importance that should not be neglected. Furthermore, accessibility has importance for quality of life, to be able to visit friends and family or to spend the weekend on the country side. A low accessibility situation where people have to spend hours in a car due to traffic congestions or other obstacles is impeding the possibilities for a well functioning life.

Accessibility can be divided into at least four features that all have effects on the overall accessibility. The most important features are: availability of facilities, availability of transportation, affordability and maybe most importantly: mobility. Mobility is used herein to refer to the physical ability to move.

When trying to quantify accessibility one often talks about the cost to reach the service (Guagliardo 2004). This cost can be defined in a number of ways, but it is common to use distance, time or economical cost.

If the accessibility is measured by distance, Euclidean distance is easily used, but it does normally not give a realistic value of the accessibility (Dahlgren 2008). In most cases it is impossible to travel on a straight line between two points; therefore it is more common to measure the distance in the road network.

Another type of impedance is time which may give an even more realistic value of accessibility (Dahlgren 2008). An accurate accessibility analysis with time as impedance requires high quality data (e.g. travel speed and distance) in the network to decrease the degree of generalization as much as possible.

Accessibility in the Occupied Palestinian Territory (OPT) can be divided into two groups and several subgroups, as follows:

- International accessibility – OPT to outside world
    - By air
    - By sea
    - By land
- National accessibility
    - Between West Bank and Gaza
    - Internal accessibility
        - Intra regional accessibility (between governorates)
        - Regional accessibility (within governorates)

These accessibility types in OPT will be further elaborated and described in Chapter 2: Background.

1.2 Definition of Study Area

The study was conducted in the West Bank, which has a mass area of 5661 km^2 (ARIJ GIS Database 2009). The border of the West Bank is the armistice line defined by the United Nations in 1949 (fig 1.1). The Gaza Strip is excluded from this study mainly due to the difficulty of entering the area. No data could because of this have been collected and it would not be valid to use the model on the Gaza area since the collected data would only be representative the West Bank.

Map 1.1: The Occupied Palestinian Territory.

1.2.1 Geography

The terrain of the West Bank is hilly with the lowest point at -408 meters below Mean Sea Level (MSL) at the Dead Sea and the highest point at Tall Asur with 1022 meters above MSL (CIA World Factbook 2009). Considering geomorphology, the West Bank can be divided into four major areas, Nablus Mountains, Jerusalem Mountains, Hebron Mountains and the Jordan Valley (Issac *et al* 2007). The geology of the West Bank consists mainly of marine sedimentary rocks, for example limestone, dolomite and chalk.

The climate of the area is strongly influenced by the Mediterranean climate with dry, hot summers and cool, wet winters (Issac *et al* 2007). The western winds are moist as they come from the Mediterranean Sea. In the northern parts, these winds moves freely and give the areas a marine influence on the climate. In the southern parts, the terrain is hillier and serves as a barrier to the moist air. This leaves the winds reaching the southern parts drier. The rain season is between October and April and the highest rainfall month is January. The mean annual temperature is around 15-17 degrees in the highlands around Hebron and Ramallah, 17-18 degrees around Bethlehem, Jerusalem and Nablus. In the Jordan Valley and around Jericho, the mean annual temperature is 24-25 degrees. In the south, climate is affected by the Negev Desert to the west and the Arabian Desert to the east. Sand storms with hot winds containing sand and dust are common during spring and early summer.

The main land use in the West bank is agricultural and in 2008, around 54.8% of the mass area consisted of arable land, pastures, crops and other agricultural areas (Issac *et al* 2007). Almost one third of the West Bank area was in 2008 classified as open spaces with little or no vegetation, but a small area of less than 4% consisted of shrub and herbaceous vegetation. The main waters in the West Bank are the Dead Sea and the Jordan River, both also having shorelines in Israel and Jordan. Palestinian built-up areas take up 5% of the area while 4% of the West Bank area consists of Israeli settlements, outposts and military areas.

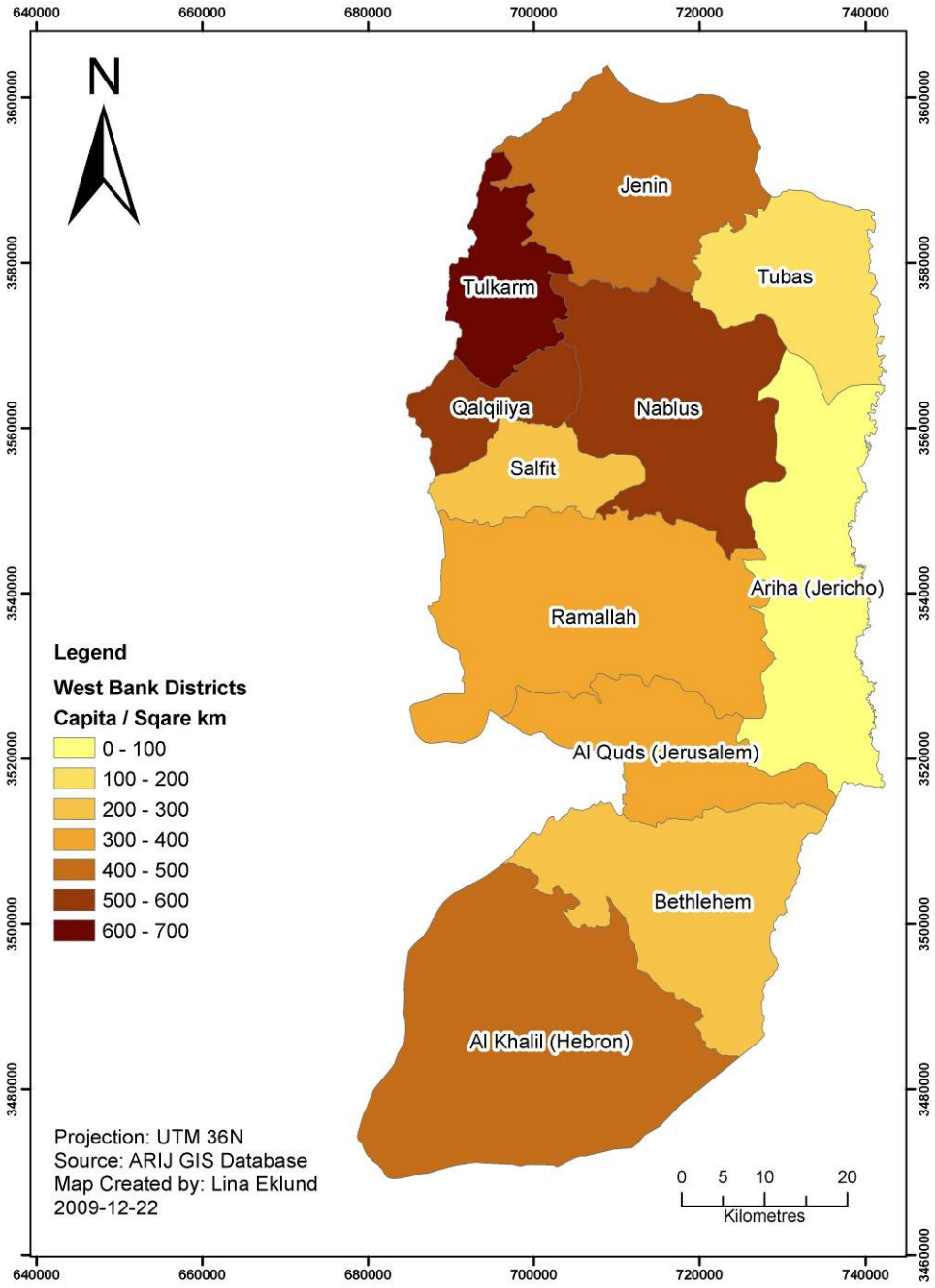
1.2.2 Population

In the last survey of Palestinian Central Bureau of Statistics conducted in 2007, there were 2 350 583 people living in the West Bank, distributed on 427 097 households (PCBS 2007). The average sex ratio in the whole West Bank is 103.1, where men have a slight majority in all governorates. The average household size is 5.5 capita and the largest average households are to be found in Hebron. Approximately 52 % of the population is aged between 15 and 64 years and 39% are younger than 14 years. More than 24% of the population in the West bank is registered as refugees from the Arab-Israeli wars (see Chapter 2). Additionally 1.8% is unregistered refugees. 186642 people (8%) have a higher education (college or university) and 16680 of them are educated within the health field. The population is most dense in the governorate of Tulkarm and least dense in the governorate of Jericho and Al-Aghoar (Ariha) (map 1.2).

1.1.3 Administrative divisions

The West Bank is divided into 11 governorates (map 1.2) (referred to as “districts” in maps); Bethlehem, Hebron (Al Khalil), Jenin, Jericho and Al-Aghoar (Ariha), Jerusalem (Al Quds),

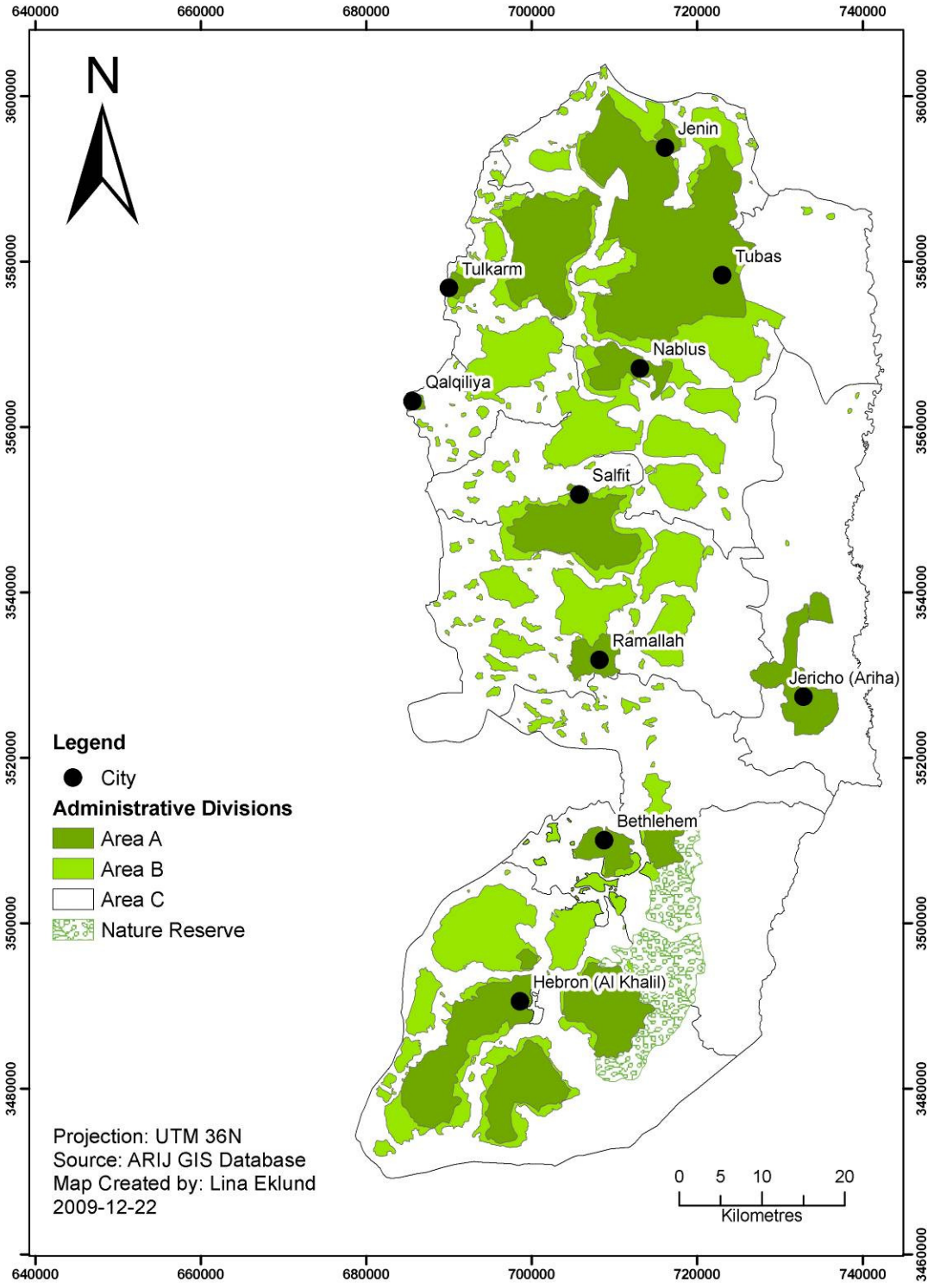
Nablus, Qalqiliya, Ramallah and Al Bireh, Salfit, Tubas and Tulkarm (ARIJ GIS database 2009). Within these governorates, there are 668 Palestinian communities (referred to as localities in maps).



Map 1.2: Population density in the West Bank governorates (districts).

The Palestinian National Authority (PNA) has sovereignty over all Palestinian main cities and has Ramallah as its political headquarter, but Jerusalem is considered the capital of Palestine.

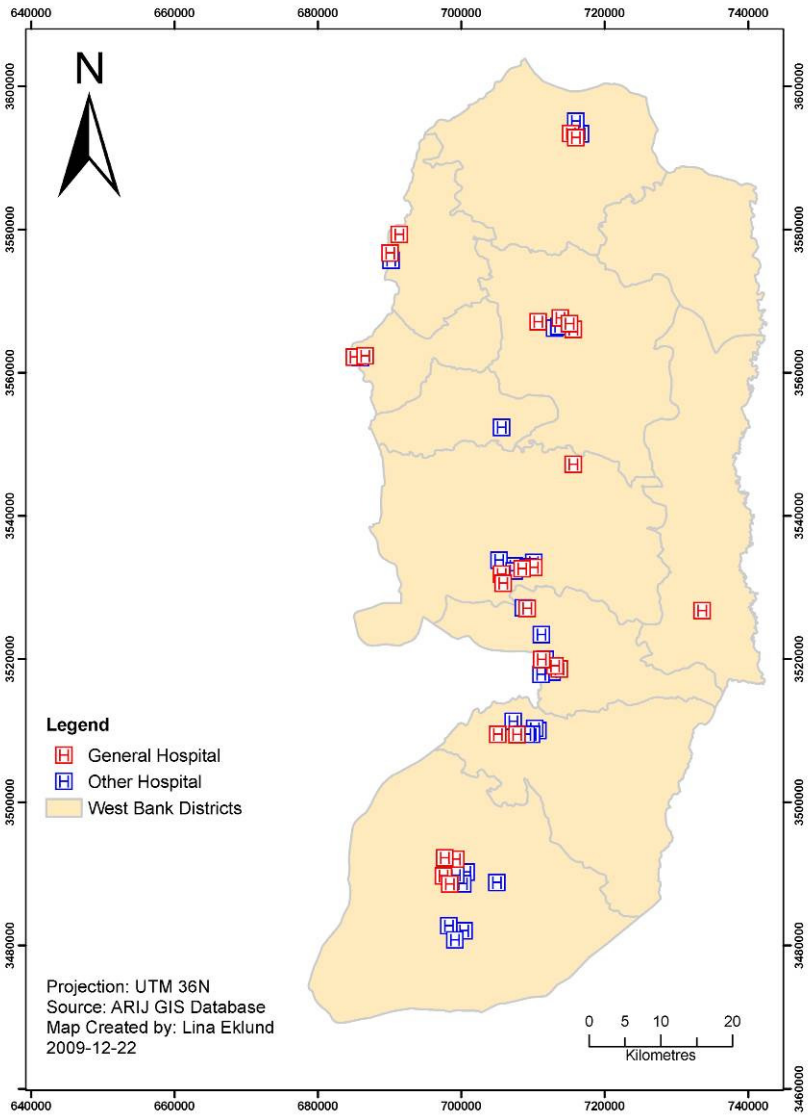
After the Oslo Peace Accords in 1993, the West Bank was divided into three geopolitical areas: A, B and C (map 1.3). Area A is under full PNA control and there is almost no Israeli presence. Area A includes all Palestinian main cities and takes up about 1000 km^2 (18%) of the West Bank Area (ARIJ GIS database 2009). Area B is under Palestinian civil control, but the security is handled by the Israeli army. This area also takes up about 18 % of the West Bank area. Area C is under full Israeli control and includes Israeli settlements, Israeli bypass roads and closed military areas. These areas include 61% of the West Bank total mass area. Additionally, there are nature reserves that constitute 3% of the West Bank area, which are inaccessible for Palestinians.



Map1.3: Geopolitical divisions in the West Bank**.**

1.2.4 Health Care

There are 667 clinics and 56 hospitals in the West Bank (excluding East Jerusalem) which leaves an average ratio of around 3500 people per clinic and 42000 people per hospital. (ARIJ GIS database 2009). 26 of the hospitals are general hospitals that provide general treatment. In addition, there are 20 maternity hospitals, 7 specialized hospitals and 3 rehabilitation hospitals.



Map 1.4: Distribution of hospitals in the West Bank.

12 of the hospitals are Governmental and included in the general health insurance that in the year 2004 covered 51.8% of the West Bank population (PCBS 2004). These hospitals are however considered to be of poorer quality than the 21 private ones. Additionally, there is one United Nations Relief and Works Agency (UNRWA) hospital and 22 hospitals owned by other Non Governmental Organisations (NGO's).

There are different reasons for going to a hospital. Sometimes it is a planned visit, maybe a check-up or a monthly treatment. At other times it is completely unplanned and there is a time limit for how quickly you need to access the hospital, depending on the seriousness of the accident or disease. In any case, access to hospital care is important and should be as good as possible. No one should be out of reach to hospitals. It should also be considered that not all accidents happen at home, which is why hospitals should be accessible even in less densely populated areas.

1.3 Research theme

One of the most important service types to access is health care, which is defined by the United Nations (UN), as a basic human right according to the 25th Article in the Declaration of Human Rights (UN 1948).

This study will therefore mainly focus on the accessibility to health care in the West Bank due to the mobility limitations and the availability of facilities. Since there are a number of Hospital types with different specialisations, general hospitals were chosen as they can provide the broadest range of services. Of course, this limits the study to only cover cases where the incident or disease requires a general hospital.

Studies show that time is a more important measure for accessibility to health care than for example distance or cost (Bosanac et al 1976). It was found that utilization of health services is mainly affected by travel time. In the 1970's, many studies conducted in the United States unanimously suggested a travel time standard of 30 minutes to health care. The travel time standard was suggested by a Wisconsin Health Task Force that in 1972 stated that primary care service systems "should be available for all citizens, as soon as practicable, within a one-way travel time of not more than 30 minutes". The State Comprehensive Health Planning agency conducted in 1975 public hearings that resulted in a recommendation of a maximum travel time standard of 30 minutes in non-emergency cases. Furthermore, the agency recommended that this standard should cover between 90-95% of the population in a community. The standard of 30 minutes is further supported by the Kentucky State Department of Health in 1972.

In this study, time is used as a measure for accessibility. This is because time is a limiting factor when trying to reach health facilities. Time as impedance also suits the study area more since Israeli Checkpoints increases the time but has no effect on the routes distance. Other barriers may have more effect on the distance but an increase in distance usually increases travel time also.

1.4 Research Aim and Objectives

The aim of this study is to assess the present accessibility situation for the Palestinian people in the West Bank, in light of the complex geo-political status that they live in. The focus will be on accessibility to health care which is considered a basic human right.

Availability of facilities, road quality, Israeli physical obstructions (e.g. checkpoints and road blocks) and other factors affecting mobility will be taken into account when modelling the accessibility using Geographical Information Systems (GIS).

The main objectives of this study are:

- To develop a spatial GIS-based model of accessibility that takes into account the physical properties of the road as well as the mobility obstacles.
- To document and analyze the impact of limitation in mobility on the current transportation system in the West Bank and its effects on the accessibility to health services.

Focus will be on the accessibility situation for a Palestinian, without a permit to enter Israel or Jerusalem, going by a vehicle (private or public) during present conditions and comparing it to a situation of complete closure and to a situation without any mobility obstacles.

1.4.1 Research Questions

To reach the aim of this study, some questions were formulated that will be worked towards answering. They are divided into Main and Secondary questions where the main question describes the broad aim of the research and the secondary questions were narrower in terms of scope and needed to be answered as a process toward the research work.

Main Question:

What factors have the greatest influence on accessibility in the West Bank?

Secondary Questions:

- Is travelling speed in the study area related to road type and slope?
- What are the average speeds for each road class?
- How is the Accessibility for the Palestinian People affected by the Israeli Checkpoints and Barriers?
- How many people are affected by a limited accessibility?

1.5 Research Organization

The thesis consists of six chapters, organized as follows:

Chapter 1: Introduction

This chapter provides the reader with some introductory information that will be helpful in the understanding of the thesis. In the prologue, the research problem background is defined and elaborated. After the defining of the study area, the research theme is presented. The aim and objectives of this study are described and elaborated.

Chapter 2: Background

This chapter contains the historical and geopolitical background of the study area. It also provides information about the accessibility-related infrastructure and a description of the accessibility situation in the OPT.

Chapter 3: Methodology

In this chapter, the used methods are described. The GIS data that was used is shortly presented and a description of the field data collection is provided. Furthermore the data preparation, evaluation and analysis are described. The chapter also includes a short theoretical background for the used GIS analysis.

Chapter 4: Results

In this chapter, the results from the field data collection and the analyses are presented in charts, maps and tables along with descriptive texts.

Chapter 5: Limitations and Discussion

This chapter contains a discussion of the possible sources for errors, both from the existing data and from the data collection. The methods for collection of data and the methodology is also evaluated and discussed. Finally, the results are discussed and interpreted.

Chapter 6: Conclusion and Final Remarks

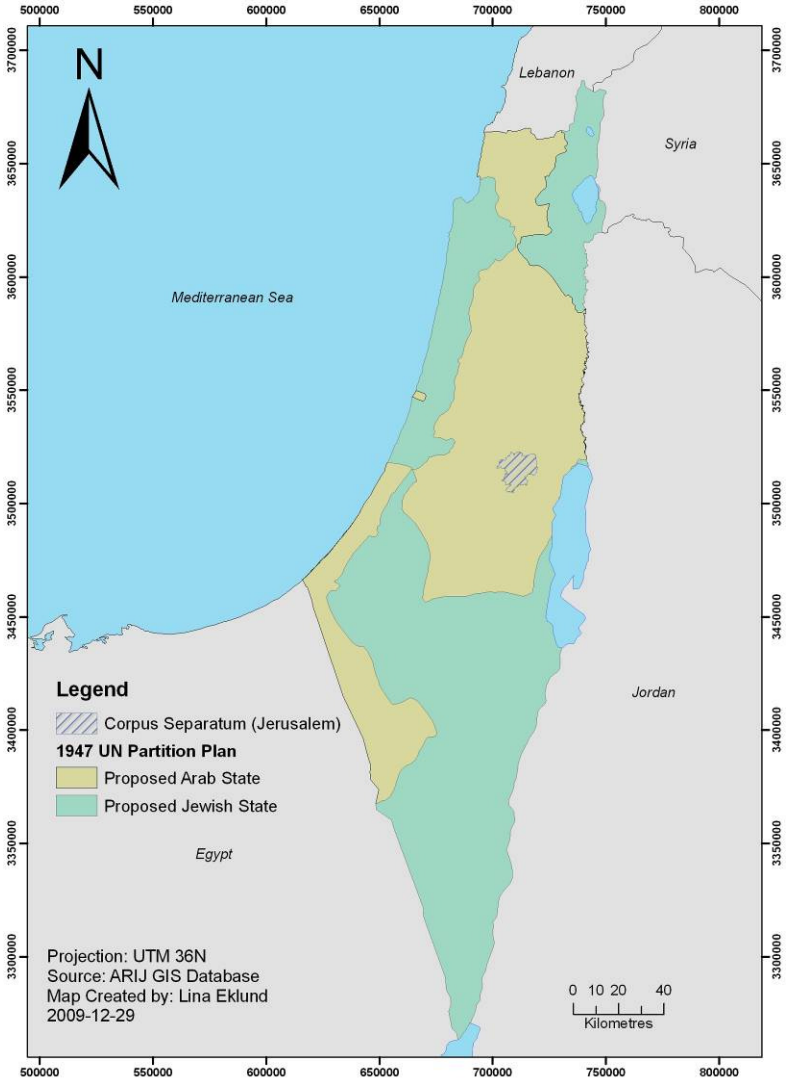
The conclusions are presented in this chapter.

Chapter 2: Background

2.1 Brief Historical and Geopolitical Background

After the dissolution of the Ottoman Empire in the 1920's, Palestine came under British administration that lasted until 1948. The British promised Palestine sovereignty but also agreed with European and American Zionists, in the Balfour declaration 1917, to build a Jewish national home in Palestine.

In 1947, the UN had come up with a partition plan that gave the Palestinians right to the West Bank, Gaza Strip, parts of the Galilee and a strip bordering to the Sinai Peninsula, 42% of Mandate Palestine. (Cleveland 2004; Issac *et al* 2009). The rest would be Jewish. Jerusalem, 1% of the Palestine area, was to become an international territory (*Corpus Separatum*).



Map 2.1: The United Nations partition plan from 1947.

The plan was accepted by the Jewish leaders but rejected by the Arab leaders and hence not implemented. In May 1948, the British mandate of Palestine ended and the Jewish leaders declared independence of the state of Israel based on the UN Partition Plan (Ben Gurion, 1948). The next day, armies from Egypt, Syria, Lebanon, Transjordan and Iraq invaded Israel. The war lasted until December and resulted in Arab defeat and the partition of Palestinian land between Egypt (the Sinai Peninsula and Gaza Strip), Transjordan (West Bank) and Israel.

The war of 1948 is known to the Palestinians as *Al Nakba* –The Catastrophe, as the war caused the exodus of approximately 80% of the Palestinian population from the newly created state of Israel. Today there are about 4.7 million people living as Palestinian refugees in Jordan, Lebanon, Syria and the OPT (United Nations Relief and Works Agency 2008).

A new Arab-Israeli war broke out in June 1967 and lasted for six days. The main actors were on one side Egypt, Jordan and Syria and on the other side Israel. The war resulted in an Israeli occupation of East Jerusalem, the Gaza strip, the West Bank, the Sinai Peninsula (later returned to Egypt) and the Golan Heights.

Since the occupation began in 1967, there has been two big *Intifadas* (uprisings) with intention to end the occupation. The first *Intifada* started in 1987, lasted for six years and included demonstrations, strikes, boycotts and refusal to pay Israeli taxes. This uprising was more or less unarmed. The second *Intifada* or the *Al-Aqsa Intifada* started out in 2000 as a demonstration but was soon militarized. It was during the Second *Intifada* that Israeli checkpoints and barriers were introduced more regularly within the OPT. Increased control of Palestinians wanting to enter Jerusalem was also a consequence of the disturbances. The uprising calmed down in 2006 but there is still no official ending date to the *Intifada.*

2.2 Transportation and Infrastructure

In 2008 there were 65 207 licensed private cars in the whole West Bank (PCBS 2008). This means that about 15% of all households in the West Bank have access to a car. The rest have to rely on public transportation such as taxis, buses and a service taxis. There are no operating railways in the West Bank.

Buses are the cheapest way to travel while taxi is the most expensive of the public transportation types. Service taxis are vans that can take seven people (excl. driver). These taxis have certain itineraries and will wait until the car is filled before it leaves. The cost is shared between the passengers and it is a bit cheaper than regular taxis.

Availability of the public transportation modes is varying depending on location and time of day. Some bus routes are very limited and even nonexistent. Service taxis start in the morning and ends in the afternoon, depending on itinerary.

2.2.1 Road System

The whole road network in the West Bank (Map 2.2) has a total length of 11 900 km (ARIJ GIS database 2009). 450 km of these roads are Main Roads (Figure 2.1) which are mostly

two-lane roads and at some places four-lane highways (MOPIC 1998). The width of these roads ranges between 6 to 14 meters.

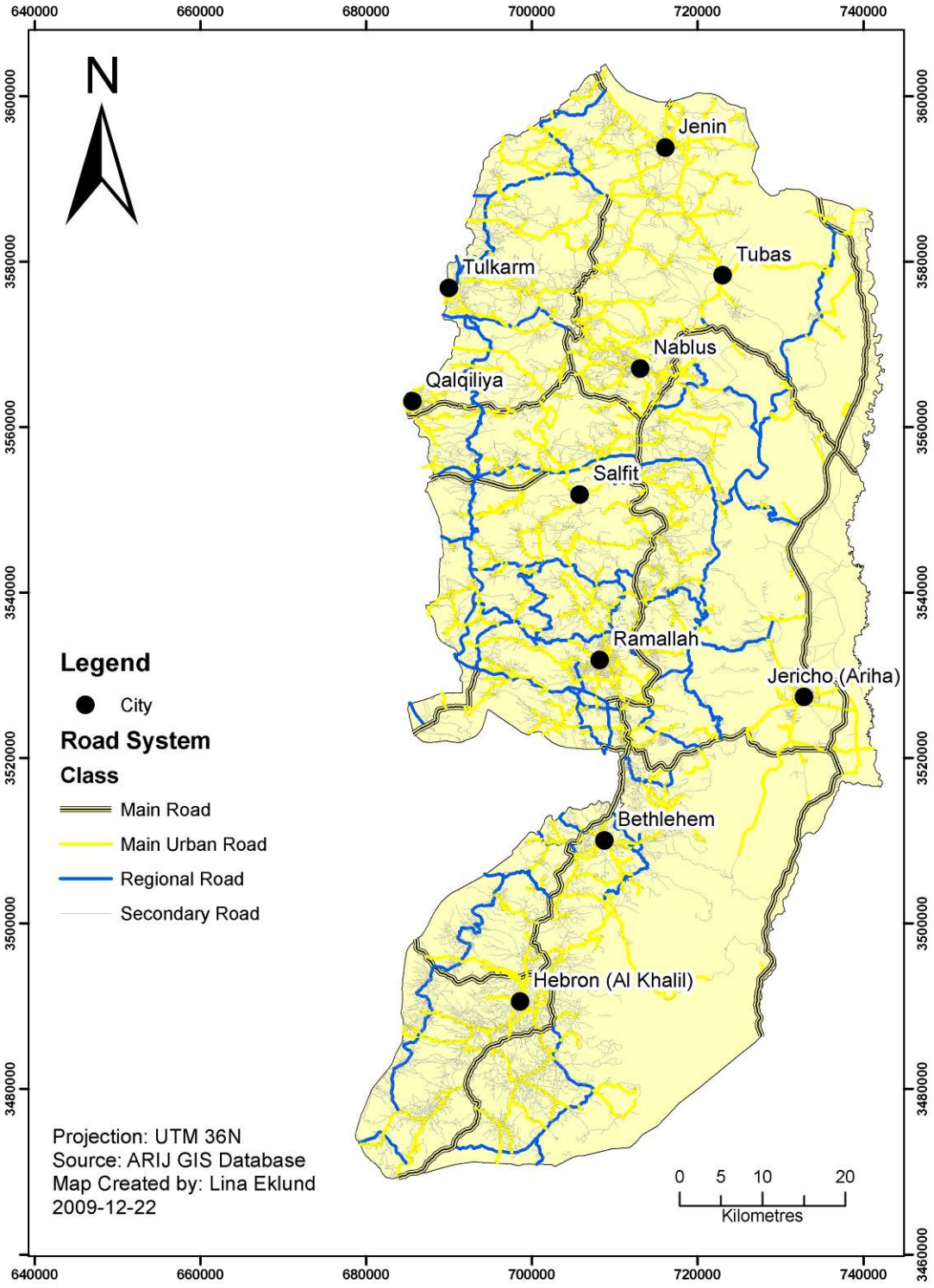
Figure 2.1: Newly paved Main Road. Photo: Lina Eklund 2009

The Regional roads have a total length of 650 km and are defined as mainly two-lane roads with a width of 3 to 6 meters *(MOPIC* 1998). Main Urban Roads (Figure 2.2) are to be found within and between main cities. They connect nearly all Palestinian communities and are generally of poor quality. The Secondary roads (Figure 2.3) are narrow roads mainly within and around built-up areas. They have a total length of 10800 km, are usually one-lane roads and are rarely wider than 6 meters. It should be noted that the numbers from MOPIC are out of date and maybe not completely correct. However they give an idea of the differences between classes.

Some of the Main and Regional Roads within the West Bank are Israeli bypass roads. These roads are built for Israeli Settlers and Soldiers so that they easily can bypass Palestinian communities.

Figure 2.2: Main Urban Road. Photo: Lina Eklund 2009

Figure 2.3: Secondary Road. Photo: Lina Eklund 2009



Map 2.2: Road System in the West Bank.

2.2.2 Mobility obstacles

Mobility in the West Bank is restricted by a number of obstacles. The Government of Israel states that these obstacles are imposed for security reasons, to protect Israeli citizens from Palestinian militant attacks that, between the years 2000 and 2005, have killed 1000 Israelis (United Nations Office for Coordination of Humanitarian Affairs 2005). The movement restrictions are however in conflict with human rights article nr. 13, which states that "Everyone has the right to freedom of movement and residence within the borders of each state." (United Nations 1948).

The mobility changes from day to day. It is dependent on the political situation, the number of vehicles on the roads and the will of the Israeli Soldiers. After disturbances, the control is intensified with more checkpoints and closed roads.

The Separation Barrier

The Separation Barrier is at some places a concrete wall (Figure 2.4 and 2.5) and elsewhere a fence around and inside the West Bank (map 2.3). According to the Government of Israel, the barrier is supposed to reduce the number of terrorist attacks by preventing suicide bombers to enter Israel (UNOCHA 2007). The nongovernmental Palestinian organisation Applied Research Institute – Jerusalem (ARIJ) however states that the purpose of the Wall is to take more land from the Palestinians and to annex the settlements to Israel.

The Wall construction began in 2002 and by 2007, a total of 376.5 km was finished and 295.7 still planned for (ARIJ GIS database 2009). In total, the separation barrier will have a length of about 767 km of which nearly 1/3 runs inside the West Bank and not on the official Armistice Line of 1949 (UNOCHA 2007). The barrier will isolate 13% of the West Bank territory from the rest of the West Bank. Construction is planned for the Wall to encircle 69 settlements (83% of the West Bank settlers) so that they will be physically connected to Israel.

Figure 2.4: The Separation Wall in Bethlehem, Photo: Lina Eklund 2009

Figure 2.5: The Separation Wall in Ramallah, Photo: Lina Eklund 2009

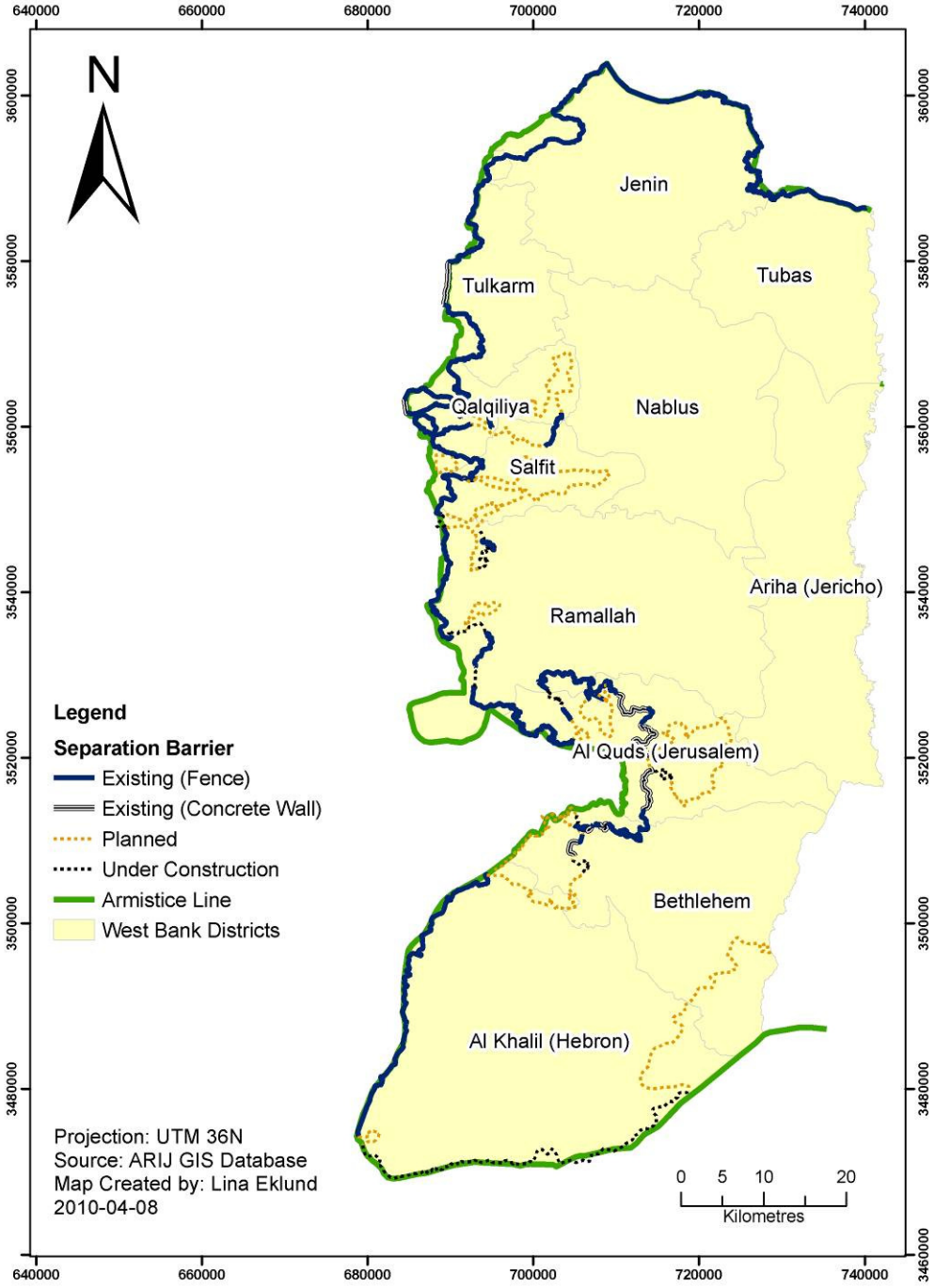
The International Court of Justice (ICJ) has stated that the barrier is in violation to international law and has advised Israel to:

- cease construction of the Barrier including in and around East Jerusalem,
- dismantle the sections already completed,
- repeal or render ineffective forthwith all legislative and regulatory acts relating thereto.

(UNOCHA 2007)

This is no binding law and, although a General Assembly resolution supported by the majority of the UN states has called on Israel to comply with the ICJ opinion, Israel has not complied.

The Wall is a great obstacle to accessibility as the existing segments are impossible to pass through except through wall gates where you can pass through if you have a permit. They all have different opening hours; some are open all the time while some are only open a few days a week at certain hours (ARIJ GIS database 2009). Over 78 Palestinian communities are isolated by the Wall, which has created a Western Segregation Zone (behind the Wall).



Map 2.3: The Separation Barrier and the Armistice line.

Israeli Checkpoints

Checkpoints have been used by Israel in the Palestinian Territory since the occupation started in 1967. They are barriers manned by the Israeli Forces (IF), Border Police, civil Police or a private security company (UNOCHA 2009). The purpose is to control documentation and to

check the vehicles of the people wanting to pass. There are three kinds of checkpoints: permanent, partial and temporary. The permanent checkpoints are always staffed while the partial only are operated at occasion. The temporary, or flying, checkpoints can appear anytime, anywhere along a road, just consisting of soldiers and their vehicles. Since this type of checkpoint is so unpredictable, they are a greater problem than the regular ones. Checkpoints are found both between Palestinian cities in the West Bank and on the border to Israel and East Jerusalem. The border checkpoints are only open to Israelis, foreigners and Palestinians with a permit or with Israeli citizenship. No Palestinian Registered vehicles can pass.

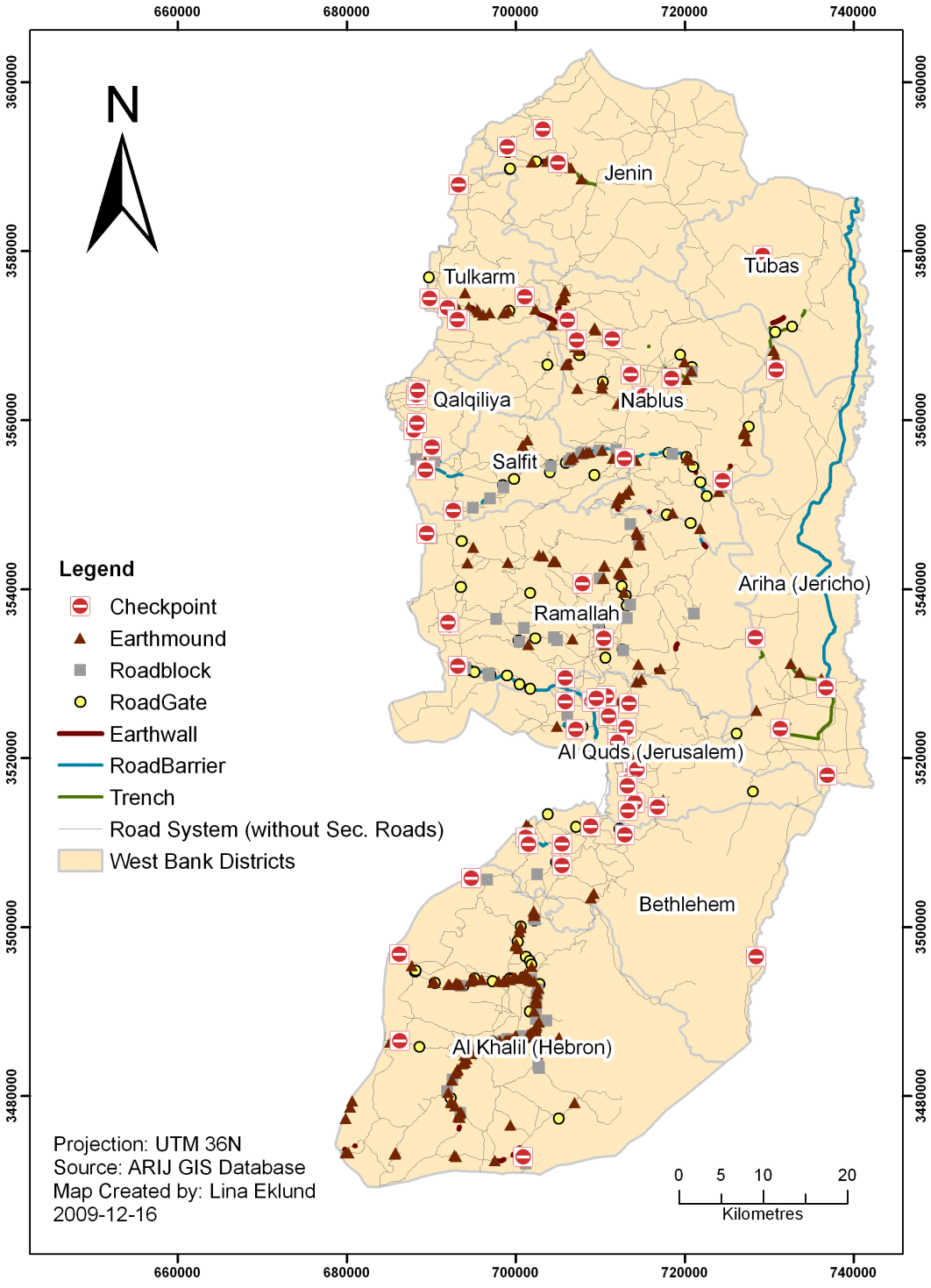
In the West Bank, there are presently 66 permanent checkpoints (map 2.4) and 18 partial (ARIJ GIS database 2009). In addition to these, there are flying checkpoints that can appear at any time. Along the Armistice line there are 8 terminals/checkpoints and the Segregation Wall has 113 gates, with a few of them operating daily.

Other Israeli Physical Obstructions

These Physical Obstructions are of the "impassable" kind that will not let anybody through.

- **Earth mounds** are piles of dirt, rocks and rubble on the roads put there to prevent from accessing a certain road (UNOCHA 2009). This type of obstacle is often moved or removed.
- **Road blocks** have the same purpose as earth mounds but consist of concrete blocks of about 1 m^3 or bigger.
- **Earth walls** are a long series of earth mounds along a road to prevent from entering it.
- **Trenches** are ditches dug to along roads to prevent vehicles from entering.
- **Road barriers** are earth walls, fences or concrete barriers with a length of at least 100 m along a road, to prevent access to it (UNOCHA 2009).
- **Road gates** are metal gates mainly used to shut out Palestinian villages from the road network. They are not always closed but when they are, there is no going into or out of the village.

There are a total of 527 barriers of these kinds in the West Bank (map 2.4) and the most common type is earth mounds (ARIJ GIS database 2009). All these obstacles are used to force people to take one certain route that leads through a checkpoint where they can be controlled.



Map 2.4: Israeli physical obstructions in the West Bank.

In addition to the obstacles implemented by the Israeli Government, there are natural features of the area affecting the accessibility. One important factor is the steep slopes that affect the travel speed and increases the fuel consumption.

2.3 Accessibility in the Palestinian Context

The above mentioned infrastructure and mobility obstacles are all connected to the historical background and geopolitical status in the OPT. They are also considered to be the main factors affecting the accessibility in the territory, both between the West Bank and Gaza and within the West Bank. The Palestinian accessibility is one of the main problems in the OPT, acknowledged by the United Nations.

2.3.1 International Accessibility

For Palestinians living in either the West Bank or Gaza, it is difficult to travel internationally. For West Bankers, the Qalandya airport, located 9.5 km north of Jerusalem, became inaccessible to Palestinians in 1967 (Issac *et. al.,* 2007). This action left them with the option only use Israeli Airports, such as the Ben Gurion International Airport in Tel Aviv. Since the second *Intifada*, Palestinians have prohibited to use all Israeli air navigation facilities. In Gaza, the Arafat International Airport, located 36 km east of Rafah city, was opened in 1998. Restrictions on the airport was imposed by the Israeli Army in October 2000 and in December 2001, the main runway of the airport was bulldozed. A re-construction of the airport has been estimated by Palestinian transport officials to $ US 27 millions.

With no air transport, Palestinians are left to use the existing land borders to go abroad. Gazans can only go to Egypt by the Rafah Border Crossing in the southern Gaza Strip. The Rafah border has been closed since the Israeli blockade of Gaza in June 2007 and has since then only been opened in special cases. West Bankers can go to Jordan by the Allenby Bridge Border Crossing in Jericho. Sea transport from and to Gaza is also restricted due to Israeli regulations. A Palestinian sea port project was started during the presidency of Yassir Arafat but could not be commenced as several Israeli attacks resulted in the destruction of all temporary infrastructures.

2.3.2 Access between West Bank and Gaza

At present (January 2010), there is no access between the West Bank and the Gaza Strip. Since the blockade of Gaza, no Gaza Palestinian is allowed to leave the area and no West Bank Palestinian is allowed to enter.

In 1995, the Interim agreement was signed between Israel and the Palestinian Liberation Organisation (PLO). One of the subjects agreed upon was that the West Bank and Gaza belonged to the same territorial unit, the Palestinian Territory (Gisha 2006). This meant furthermore that Israel was obliged to provide access between the two areas by instituting a "safe passage" that would connect the West Bank and Gaza. In October 1999, a Safe Passage Route between West Bank and Gaza was opened. With this route, it became easier for Palestinians to travel between the two areas of the territory.

After the start of the second *Intifada*, in September 2000, the safe passage route was closed leaving the access between Gaza and West Bank very limited (Gisha 2006). This mainly affected the population of Gaza and their accessibility to medical care, education and economical opportunities. It also became impossible for Gaza residents to enter the West Bank via Jordan. Since 2003, Gaza registered citizens have been prohibited to re in the West Bank, even if they have been living there for several years. People in this situation will be arrested and brought back to Gaza against their will. This leaves a number of people living within the West Bank with very limited mobility due to the risk of being caught at a checkpoint and deported to Gaza.

2.3.3 Internal Accessibility within the West Bank

The internal accessibility in the West Bank is one of the main issues for Palestinians. The West Bank is fragmented by Israeli infrastructure, for example the Segregation Wall, Israeli-only-roads (by-pass roads) and an extensive system of checkpoints and road barriers (see section 2.2.2). This fragmentation combined with the Palestinian road network of varying quality are features affecting Palestinian accessibility.

Low accessibility in the West Bank is defined by the Palestinian Ministry of Planning and International Cooperation (MOPIC) (1998) as long distances, long travel times and large costs. In this report, MOPIC developed an accessibility index to measure the accessibility on the intra-regional level. The index entailed a comparison between the Euclidean distance and the actual route distance. It was found that "on average, the actual travelling distance between two urban centres is over one and a half times longer than the straight line distance". This meant an increase of 22 km in average to all "intra-regional routes". The reason for the difference was found to be topography and deficiencies in the road network.

Accessibility to land, markets and commercial centres is extra important for the rural population (UNOCHA 2007). Accessing markets has both become expensive and time-consuming for farmers and businesses. In 2007, 40.4% of the West Bank population (excluding East Jerusalem) reported difficulties getting to work. The reason for these difficulties was mainly Israeli Checkpoints, Israeli Physical Obstructions and difficulties to acquire permits from the Israeli Authorities. Costs for transports have between 2000 and 2007 increased with almost 100% due to the increased travel time and the detours that trucks are being forced to take due to the Israeli restrictions and physical obstructions.

2.3.4 Accessibility to Health Care

In 2004, UNOCHA created a map that focused on access to healthcare including both Clinics and Hospitals. It was divided into three areas; Difficult Access, Very Difficult Access and Extremely Difficult Access. In this map, a large area around Nablus has an Extremely Difficult Access to health care. Other Extremely Difficult Areas are Bethlehem and communities situated in the Western Segregation Zone.

Between October 2000 and September 2008, the Israeli Human Rights organisation B'tselem has reported 66 cases of deaths in the OPT, directly related to delay caused by the limited mobility (B'tselem 2008). Of these 66 deaths, 16 were in Gaza and 50 were in the West Bank.

23 of the cases were in Nablus governorate which is an area that has had many problems with Huwwara checkpoint. Generally, most cases of deaths have been in the northern parts of the West Bank in the governorates of Ramallah and El Bireh, Salfit, Tulkarem, Qalqiliya, Jenin and Nablus. Some deaths have also been reported in Bethlehem governorate and Hebron. In many of the reports, ambulances have been held for hours, regular cars have been forced to take detours on dirt roads and women have been forced to give birth on the road.

A study, concerning the armed conflict and the effects on access to emergency health care in the West Bank was conducted at the National Institute of public health in Copenhagen (Rytter *et al*. 2006). The study was conducted during eight days in January 2005 at three hospitals, one in Bethlehem and two in Nablus. Information was obtained using registration forms for each patient to fill in, partly details about the patient (age, sex, residence, civil status et.c.) and also information about the hospital route (distance, transportation time, means of transportation and delay). Two kinds of delay was identified, conflict delay (checkpoint, curfew and detour) and other delay (e.g. traffic congestions). During the eight days the study was conducted, 2228 people contacted the three hospitals of which 394 (18%) reported delay from checkpoints or detours. A result from the study was that admission was "significantly more common for patients who were delayed as a result of the conflict (32%) than for those who were not (13%; $P<0.0001$)" (Rytter *et al.* 2006). The reason for this is discussed, saying that a need to pass a checkpoint might discourage people to seek medical care until their condition is serious, due to fear of being delayed or denied access at checkpoints.

Further investigations on accessibility to health care in the West Bank will be presented in Chapter 4: Results.

2.3.5 Accessibility to Jerusalem (in Arabic: Al Quds)

Jerusalem, and especially its Old City, is one of the most important cities in the world, both historically and religiously. It is home to the three monotheistic religions and houses some of the most important religious shrines in the world, such as the Al-Aqsa mosque, the Dome of the Rock, the Wailing Wall and the Church of the Holy Sepulchre. In addition to the spiritual importance, Jerusalem is also considered the capital of Palestine as well as of Israel.

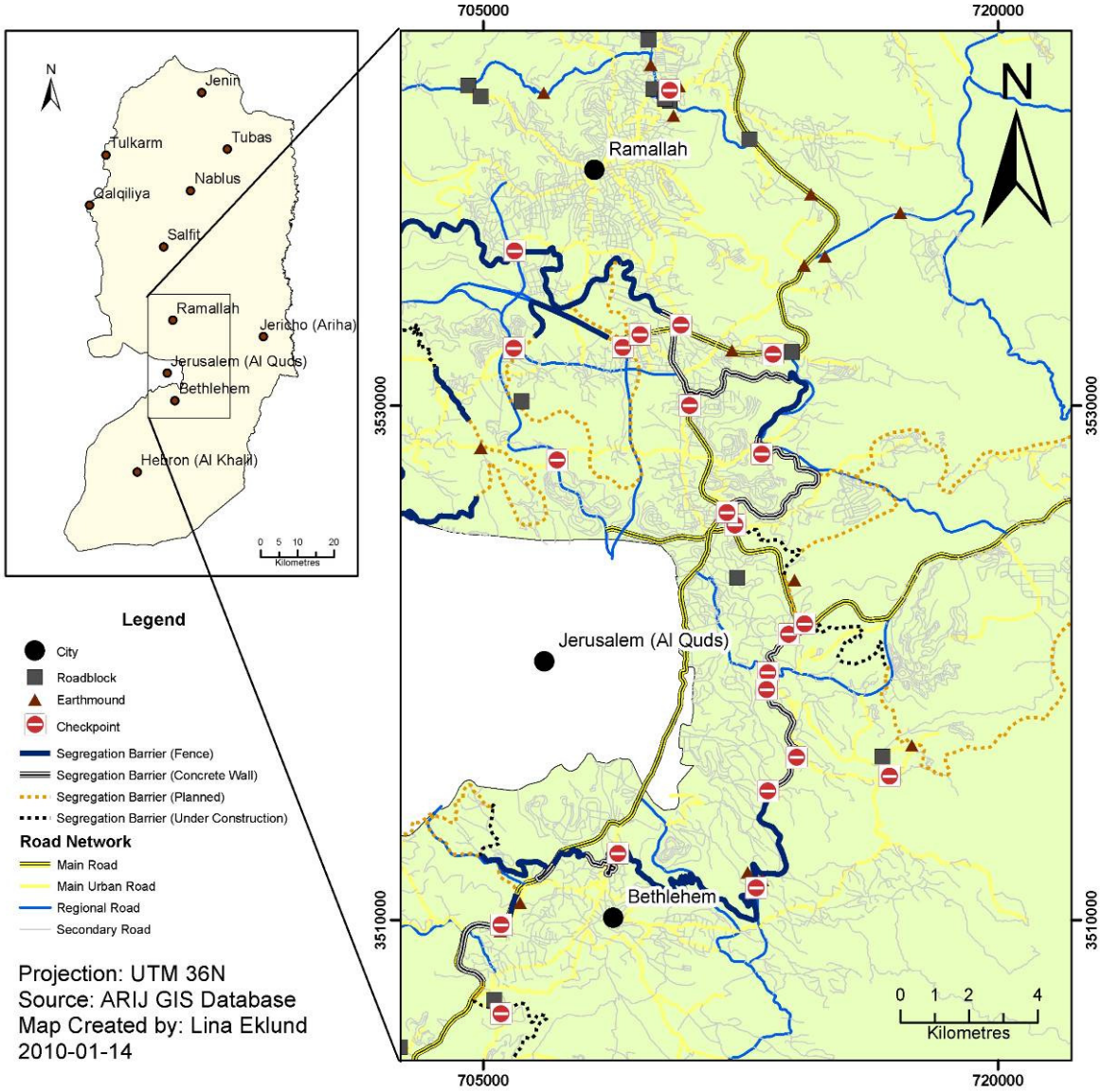
Until 1967, East Jerusalem (including the Old City), was under Arab control but after the war it became occupied by Israel. In the early 90's and especially after the signing of the Declaration of Principles (DOP), Israel started to put restrictions on Palestinians from the West Bank and Gaza to enter Jerusalem, using checkpoints and permit regime (Issac *et.al.* 2007).

Jerusalem also holds economic importance for people of the OPT coming to work, especially since the tourism business became severely affected by the Second Intifada. The closure policy after 1993's DOP has resulted in an economic descent in the Palestinian Territory.

In the transportation context, Jerusalem plays an important geographical part connecting the northern parts of the West Bank to the Southern parts (map 2.5). Today Jerusalem, as well as Israel, is inaccessible to all Palestinians living in the West Bank without a permit. To use the road going through Jerusalem from e.g. Bethlehem to Ramallah, it is not only necessary to

have a permit but also an Israeli registered car, since no Palestinian Cars are allowed into Jerusalem or Israel.

The case of Bethlehem – Ramallah will be further investigated in Chapter 4, section: 4.



Map 2.5: Infrastructure around Jerusalem.

There are six Palestinian Hospitals in East Jerusalem that offer special healthcare for the whole West Bank Population (UNOCHA 2007). Palestinians rely on these hospitals for routine treatments, emergencies and specialist treatments. All Palestinians that have a West Bank ID must, in order to be able to apply for a permit to enter Jerusalem, have a letter of referral from a Palestinian hospital and also coordination documents from the receiving hospital in Jerusalem. The process of acquiring these documents and applying for the permit can take several weeks. And even when a permit is issued, long queues at the Jerusalem checkpoints can delay the patients for their scheduled treatments.

Chapter 3: Research Methodology

3.1 Data

The data used in the analysis has both been existing data and data collected during field work. Most of it is quantitative but some data is qualitative.

3.1.1 GIS-Data

The GIS-layers was obtained mainly as shapefiles from the ARIJ GIS Database. The source for most Israeli Physical Obstruction layers was UNOCHA, updated 2009. The layer with the Hospitals was originally created in 2006 and was obtained from the Palestinian Ministry of Health (MoH). The Roads layer was digitized by ARIJ from a satellite image taken 2004 by the Spot Satellite. For more details on the used GIS data, see Appendix 1.

GIS-data used in the analysis:

- Aerial Photos of West Bank, (0.75 m resolution)
- Checkpoints
- Earth mound
- Earth wall
- Green line Checkpoint
- Hospitals
- Palestinian Localities
- Road barrier
- Road block
- Road system
- Trench
- West Bank Districts

3.1.2 Field Data

Information about delay at checkpoints and most common transportation mean were gathered through semi-structured interviews using a pre-designed questionnaire (see Appendix 2). Data on road speeds was obtained during the field data collection through speed measurements.

Interviews and Questionnaires

In 7 cities, a total of 70 semi-structured interviews were conducted with the purpose to get information about delays at checkpoints, travelling time, closest facilities and also to get a picture of the accessibility situation in the area. Interviews were held with random people in the streets of both sexes and different ages. A questionnaire was developed for each city (see Appendix 2), including questions about the closest cities, health facilities and universities.

In addition to the interviews, inquiry forms were handed out at the municipalities of Salfit, Tubas, Al Ram, and at the Ministry of Local Government based in Ramallah. The questionnaires resulted in additionally 59 informants. The questionnaires was mainly answered in Arabic and translated with help from colleagues at ARIJ.

Data on longest and shortest delay at checkpoints was the most important result of the interviews (see Chapter 4). Also, questions about the closest hospitals and universities were asked and the answers were compared to the GIS layers to see if they needed to be completed.

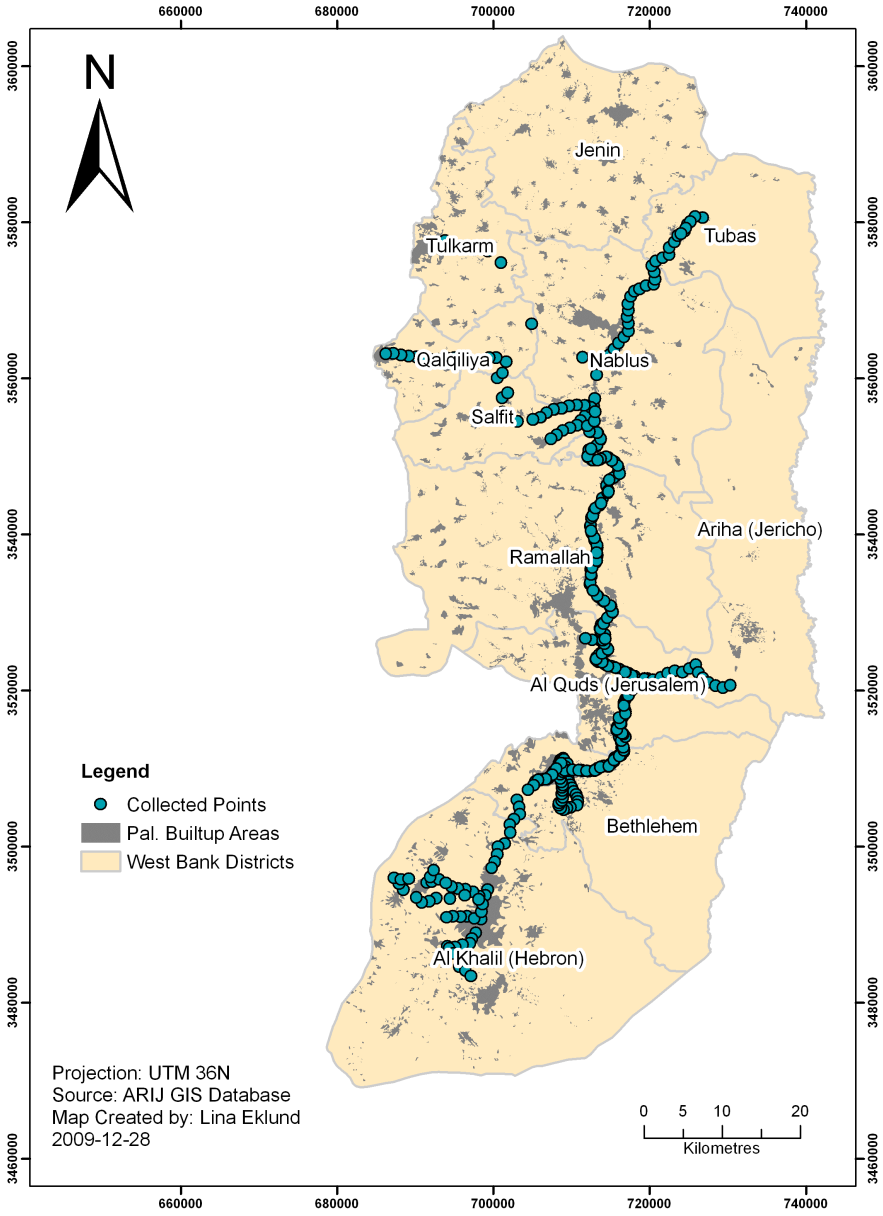
The quantitative information was analysed in Excel and averages and mode values for delay time was calculated to be used in the further analysis.

The results were used in the Closest Facility Analysis and are presented in Chapter 4: Results.

Road Speed Collection

To collect data on road speeds, the idea was to locate sample points and record the momentary car speed for that point. The points were collected when travelling by passenger car and service taxi from Bethlehem to a number of cities in the West Bank (map 3.1). When a Global Positioning System (GPS) was available, a track was recorded, which made it easier to know what route was taken. The GPS used was a Trimble GeoXT.

For every kilometre, the momentary speed from the speed meter was written down along with potential comments on road quality or characteristic features for the location. The speed values were rounded off to the closest multiple of five, e.g. 37 was rounded off to 35 and 92 was rounded off to 90. For all trips, an easy to find starting point was defined (e.g. bus station) to start digitizing from. The points were then digitized using the track layer from the GPS, aerial photographs, the road layer, the comments and the measure tool. For each point, the speed and a comment was inserted manually. All points were in the end merged into one layer. After that, all zero-values and errors such as traffic congestions were removed. During the field data collection, no continuity in traffic congestions was found and therefore they were not considered representative.



Map 3.1: The collected speed points' spatial distribution.

3.1.3 Data preparation

The roads layer was digitized from a satellite image from 2004 with a resolution of 2.5 metres. Since 2004, some roads might have changed, some might have been improved and some are just not included in the layer. For Main Roads, Main Urban Roads and Regional Roads, the layer seemed accurate but the network of Secondary roads has been found somewhat incomplete.

To evaluate and improve the layers accuracy, topology rules was built using ArcCatalog. The rules that were set up were:

1. Must Be Larger Than Cluster Tolerance
2. Must Not Intersect
3. Must Not Have Dangles
4. Must Not Overlap

The first rule was set up because it is mandatory for all lines and polygons. It means that the features cannot be smaller than the preset cluster tolerance. The second rule made it possible to find the places where lines intersect, e.g. junctions and to adjust these errors by splitting the lines, creating a junction in the GIS layer. The third rule was set up to find all dangles i.e. endpoints that are not connected to another line, to see if there are any segments that should be connected but are not. This rule generated around 8900 "errors" of which most were exceptions. To check all of them would require a lot of time, so focus was put on the three higher road classes. Duplicated road segments with sometimes different road classes were found using the fourth rule. This type of error would create problems in the Network analysis so they were removed.

An evaluation of accuracy was also conducted after building the network. A route going from Jenin in the north, via the largest cities, to Hebron in the South was analyzed using all physical obstructions and checkpoints as barriers. This scenario would represent a closure and if the network would work properly, the analysis would not result in a complete route going between all cities. However, a route was found which lead to the conclusion that the network had errors. To find the errors, this route was followed and all junctions were checked. At many places, the roads were connected where they should not be. Also, viaducts was found and corrected by moving the vertices so that the network would not consider the intersections as junctions.

Road Speeds

One hypothesis was that the speed is correlated to slope angle - with higher slopes you get a lower speed. The slope values were extracted to the points from a 40 m resolution slope raster obtained from ARIJ GIS Database. Correlation was tested by plotting the slope values on the x-axis and the speed values on the y-axis in Microsoft Excel (Figure 4.3 in chapter 4). The low R^2-value suggests that there is no correlation between speed and slope. Hence, the theory was discarded and the assumption that speed is only related to road class was made.

To connect the speeds with road classes, a spatial join between the speed points layer and the roads layer was conducted in ArcGIS. It resulted in a layer with the speed points and the road class corresponding to each point's location. All points that were inside a built up area was then searched out and sorted into a special group. This distribution was based on the theory that a built up area is a restricting factor to the speed.

The attribute table for the layer was exported to Microsoft Excel where the speeds were sorted into five groups, the four road classes; Main Road, Main Urban Road, Regional Road, Secondary Road and one class with all types of classes inside a built-up area.

Tests for normality of each group were conducted using the computer application “Statistical Package for the Social Sciences” (SPSS). Looking at the Expected Normal plots, all groups could be considered normally distributed (Appendix 3). After the normality tests, an ANOVA was conducted to see if the speeds of the original classes (excluding built-up area) differed from each other, which they did (Appendix 4).

To test the theory that the speeds within a build-up area differs from the speeds outside a built-up area, an independent sample t-test was conducted for the four road classes (Table 4.2). The Secondary roads within a built-up area were found to belong to the same population as the ones outside a built-up area and were because of this removed from the built-up area class. Main Roads was also removed from the Built-up area class as there was no significant difference to be found. The class of built-up area roads finally included Main Urban Roads and Regional Roads for which the t-tests resulted in a significant difference from the speeds outside of built-up areas. After testing and grouping the data, averages speeds were calculated for each road class.

To find all the road segments that are within a built-up area, an “Identity overlay” between the roads layer and the built-up areas layer was conducted in ArcMap. The resulting layer was a roads layer where segments were split at intersections with built up areas. These segments were reclassed for all Main Urban Roads and all Regional Roads within a built-up area and assigned the resulting speed values (Table 4.3).

The checkpoints were integrated in the road network by making a 5 meter buffer around every checkpoint. The buffer polygons were then used to split the road system into more segments. Two fields were added into the table. One field had the value 1 for all segments within the checkpoint buffer and 0 for outside the checkpoint buffer. The other one contained the length of the checkpoint segment. The reason for having two Checkpoint fields in the attribute table was to be sure that the checkpoints were counted correctly when accumulating them in the Network Analysis.

In the example below (fig 3.2, table 3.2), the checkpoint controls traffic both in N-S and E-W direction but the checkpoint feature is placed 2.5 m from the junction due to inaccuracy in digitizing. The road segments are split in four places, at the intersections with the buffer zone and at the junction. In the table, the checkpoint values are stored. If someone decides to travel from point A to point B, he/she would pass by one checkpoint. The Network Analysis would say that two checkpoints are passed and that the checkpoint length is 12 meters (7.5 + 4.5 m). By comparing the Checkpoint field sum and the Checkpoint length field sum, it was possible to find these errors and correct them.

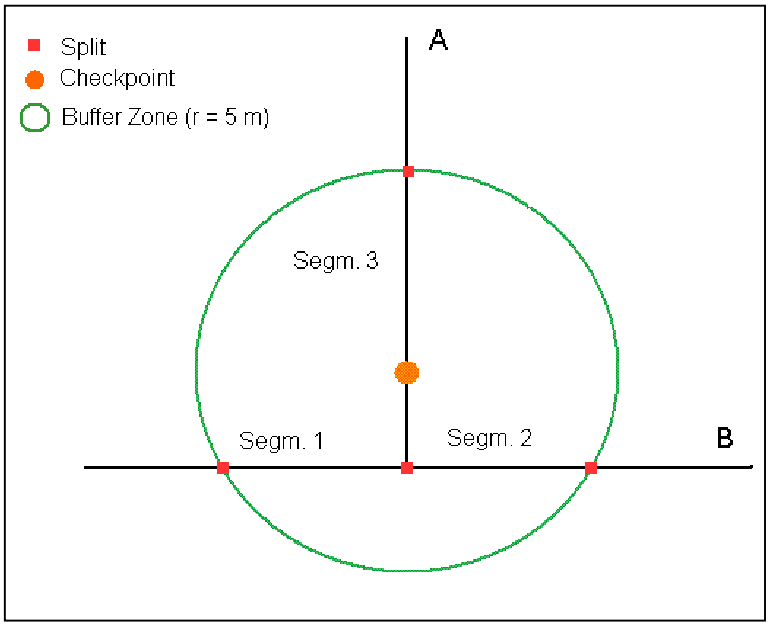


Figure 3.1: Example of a checkpoint in the road network.

Table 3.1: Example of attribute table for road network in Fig. 3.2.

Segment no	Checkpoint 1/0	Checkpoint length
1	1	4.5
2	1	4.5
3	1	7.5

All road segments were assigned a speed according to the Road class in Table 4.2 (Chapter 4).

3.2 Network Analysis

To model the accessibility, Network Analysis was chosen. One reason that vector analysis was used instead of raster was because the study area is relatively large. To get a detailed analysis with raster data would require working with high resolution raster which, because of the extent of the study area, would mean large files and time consuming analyses. Raster is also more often used when it is possible to travel off road, which is not an option in the study area due to the topography and the many closed military areas.

3.2.1 Theory of Network Analysis

Network Analysis is a way of studying transportation flows (Harrie *et.al*. 2008). The transportation can be for example of cars along a road system or water along a stream network. An important difference between a network and a regular line layer is that the network holds information about the relationship between the line segments, i.e. topology. For example it holds information about which segments are connected (nodes). In addition to this information, the network segments also have a friction value that shows the cost of travelling the segment. For a road network this can for example be speed and/or length depending on the wanted result.

When solving a network problem such as finding the least cost route from one point to another in a network, an algorithm called Dijkstras Algorithm is used. This algorithm uses two matrixes, one *Adjacency Matrix* where information about friction values between nodes is stored, and one *State Matrix* where information about the network analysis is saved and changed as the algorithm executes (Harrie 2008). The *State Matrix* has three columns; Distance, Path and Visited.

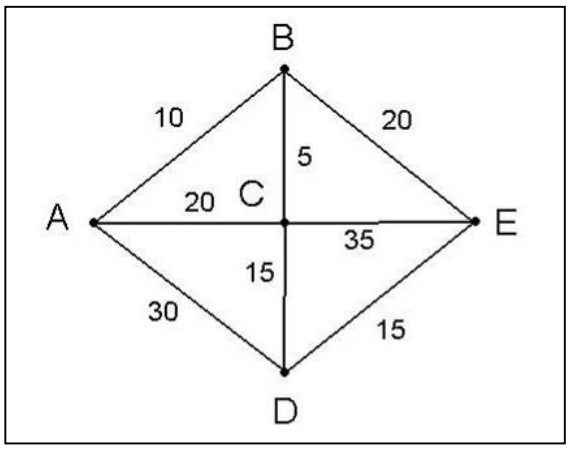


Figure 3.2: Example model of a road network.

The algorithm starts by analysing the route from a defined starting node (e.g. A) to the closest neighbour nodes (B, C and D) (Figure 3.2). It saves information about the costs for travelling between the starting node and the neighbouring nodes in the *Distance* column (Table 3.2). It also stores information about by which node the routes go by in column *Path*, which in this first step is the first node (node A). Finally, it states that the node is visited in the column called *Visited*.

Table 3.2: Example of a state matrix.

Node	Distance	Path	Visited
A	0	A	Yes
B	10	A	No
C	20	A	No
D	30	A	No
E	∞	-	No

The second step of the algorithm proceeds from the node with the least cost route (Harrie *et. al.* 2008). For the example above (figure 3.2), this would be node B. From this node, the same analysis is made as for step one, all neighbouring nodes are controlled to see if there may be routes that have a sum that is less than the previous discovered routes. If that is the case, the new shortest routes are recorded in the matrix. For example, in the network above, the cumulated cost of travelling from A to C is less going by B than just going directly from A to C.

The third step does the same thing but now with the node that has the least cost route from A and that is not yet visited, in this example node C (Harrie *et. al.* 2008). The network repeats these calculations until all nodes are checked and a least cost path from the starting node to the ending node is found.

A common limitation in network analyses that are based on travel time is that some generalizations usually have to be made. For example, the analysis assumes that the velocity over a line segment is constant all the time. This means in road networks that the cars keep the same speed through junctions and turns. The analysis does usually not take into account traffic lights, stop signs and pedestrian crossings and in some cases, this may be negligible. It does however create some limitations that should be noted.

3.2.2 Building the Network

Before loading all barrier types into the Network Analysis, they were controlled and corrected. This was done by comparing the checkpoints, earth mounds, road blocks and road gates to aerial photographs from 2009 to check that they were correctly placed. If they were not, they might be blocking the wrong road which could affect the accuracy of the analysis. Some features were moved, some removed and some were added.

The barriers that was stored as line segments, trenches, earth walls and most importantly – the Separation Barrier was needed as point layers in the analysis. Hence points were extracted at all intersections with the road network.

The Network was built using ArcCatalog. Four frictions were defined:

- Distance (meters)
- Time (minutes)
- Checkpoint (Boolean)
- Checkpoint length (meters)

For the analyses, three scenarios were defined.

Scenario 1: All physical obstructions that presently most often are closed (road blocks, earth mounds, trenches, the Segregation Barrier and some Road Gates) are considered impossible to pass. Checkpoints and most Road Gates are however crossable.

Scenario 2: As scenario 1 but now all checkpoints and road gates are closed also.

Scenario 3: Represents a situation with no barriers or checkpoints at all.

Three types of Network Analyses were conducted, Service Area, Closest Facility and Route Analysis.

3.2.3 Service Area Analysis

The Service Area function generated polygons divided by break values over the whole study area. To get an overview of the accessibility situation, three analyses, one for each scenario, were conducted using time as impedance. The input facilities were all general hospitals in the West Bank, both privately owned and Governmental. One accessibility map was created for each scenario. In addition to this, a table was produced with the area of the polygons with different estimated accessibility values.

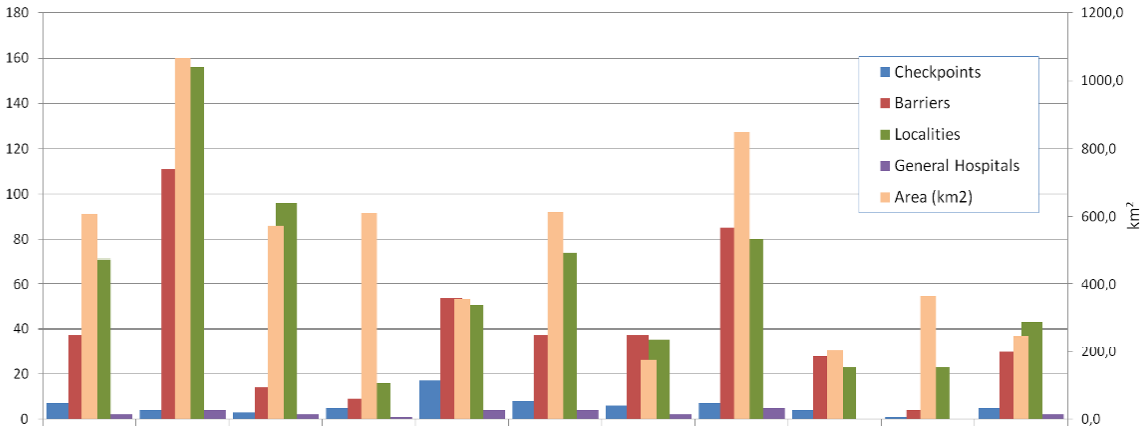
3.2.4 Closest Facility Analysis

The Closest Facility Analysis generates routes to the closest facility from specific incidents. The differences between Closest Facility Analysis and Service Area Analysis are that you get an output of lines going between the incidents and the closest facility. In the analysis you can choose to include more than the analysis friction value in the output attribute table.

The purpose of the Closest Facility Analysis was to get a more detailed result than with the Service Area. In this analysis Scenario 1 was used. For each governorate, a route between every locality and the quickest reachable general hospital was generated. Time was again the impedance and it was specified that the resulting attribute table should contain fields showing accumulation of Time, Distance, Checkpoint and Checkpoint length. Furthermore, the maximum tolerance was set to 500 meters for the localities. This meant that the locality must be closer than 500 m to the road network or else it is unlocated.

The analysis had 48 errors meaning that for 48 communities (localities), no route was found. The errors were of two types. The most usual type was that the locality was unlocated. The other type was that the locality was on a “non traversable network element”. This meant that there was no route to be found because the locality was trapped between e.g. barriers and disconnected road segments.

Another Closest Facility Analysis was conducted with scenario 3 – no barriers. The purpose for this was to get values to compare with, to see how the barriers and checkpoints affect the travel time. The numbers of input features per governorate are shown in figure 3.3, below.



	Bethlehem	Hebron	Jenin	Jericho	Jerusalem	Nablus	Qalqiliya	Ramallah	Salfit	Tubas	Tulkarm
Checkpoints	7	4	3	5	17	8	6	7	4	1	5
Barriers	37	111	14	9	54	37	37	85	28	4	30
Localities	71	156	96	16	51	74	35	80	23	23	43
General Hospitals	2	4	2	1	4	4	2	5	0	0	2
Area (km2)	607,9	1067,5	572,7	609,2	353,7	613,6	174,4	848,8	202,1	366,0	245,3

Figure 3.3: Summary of input features and area for each governorate.

The tables were exported and analyzed in Excel. The average travelling time (without delay at checkpoints) for all localities was calculated and found to be 15 minutes. This value was used as a threshold value to see how many people are living more than the average time away from a general hospital. Another threshold value was 30 min as presented by Bosanac *et al*. (1976). Three accessibility levels were defined (Table 3.3) and used in the analysis.

Table 3.3: Accessibility standards.

Travel Time	**Accessibility Level**
0-15 minutes	Good Accessibility
15-30 minutes	Intermediate Accessibility
> 30 minutes	Bad Accessibility

A chart was also created to show the localities for which a route was not found during the Closest Facility Analysis. The number of people affected was presented in a table and a chart (table 4.4 and figure 4.6).

To try to decide on what factors are affecting the estimated accessibility, some correlation plots were made. In these, the average travel time for each governorate was plotted on the Y-axis with the different factors per governorate on the X-axis. Then the r^2-value was calculated in Excel and from that the r value was determined. This value shows the level of association between two sets of corresponding variables (Hammond *et al* 1978). A value of zero implies no relationship, while a value of 1 or -1 means that a linear equation can describe the relationship perfectly. If the value is negative or positive is determined by the inclination of the line. Since the r-value was found by computing the square root of the r^2-value, there is no way of knowing whether the r value is negative or positive. It is however not important in this case as the interesting thing is to see how strong the relationship is.

3.2.5 Route Analysis

To go even more in detail and describe the accessibility situation, a case study was conducted with the Route Analysis tool. The route to be found was between Bethlehem and Ramallah, two cities that are situated in an area largely affected by the Separation Barrier. This case study was also conducted to show the difficulties in travelling between governorates, a kind of travel that might be more affected by checkpoints and barriers than travels within governorates. It was specified that the quickest route was to be found between the two cities. All three scenarios were tested and the Euclidean distance between Bethlehem and Ramallah was measured for comparison.

Chapter 4: Results

4.1 Interviews and surveys

The most common transportation type is Service Taxi which was mentioned as transportation mean in almost 50% of all interviews and surveys. Comparing the two groups, there was no important difference between the distributions. It was found that the Municipality informants used taxi more than the informants that were interviewed in the streets.

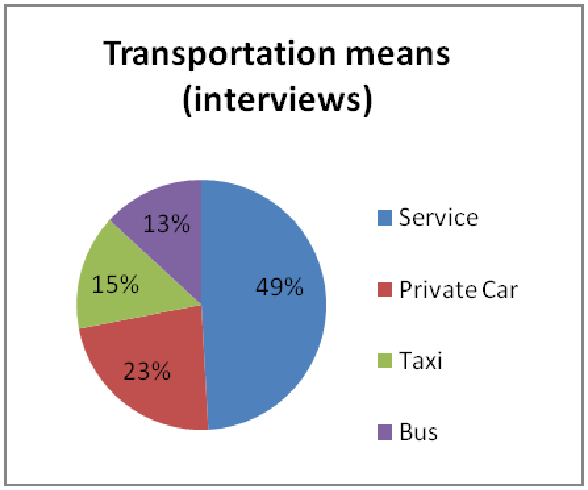


Figure 4.1: Distribution of transportation means from interviews.

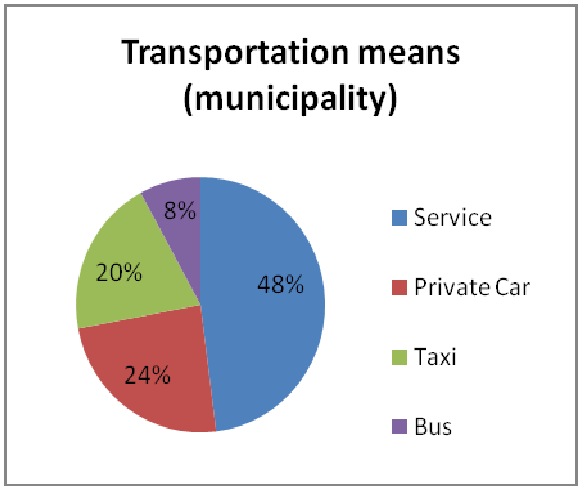


Figure 4.2: Distribution of transportation means from municipalities and ministry informants.

Concerning delay at checkpoints, it was found that if someone gets stopped at a checkpoint, s/he may have to wait from one minute to the whole day, depending on the mood of the checkpoint soldier. The situation now is however much better than some years ago, during the *Second Intifada*, when it was very common to wait 3 hours or more. Nowadays, the average longest delay at checkpoints is around 3 hours and 15 minutes (Table 4.1). The shortest delay has an average of around 15 minutes. The most common mentioned (mode value) time for shortest delay was 5 minutes and the most common time for longest delay was 2 hours.

Table 4.1: Values for estimated delay at checkpoints.

Delay at checkpoints	Minutes
Average longest	194
Average shortest	15
Mode Longest	120
Mode Shortest	5

4.2 Road Speeds

4.2.1 Statistical tests

The correlation plot between speed and slope showed no relation (Figure 4.3). The normality plots showed normal distribution for all groups. The ANOVA analysis gave zero significance which means that there is difference in speed between the road classes. Independent sample T-tests (Table 4.2) showed that there is no difference in speed between Main Roads and Secondary Roads within or outside of built-up areas (P>0.05). For Main Urban Roads and Regional Roads, there is a difference in speed (P<0.05), which means that the speeds on these road types are affected by the Built-up area. Comparison between all road classes shows that the average speeds between the classes are all different (P<0.05). For more information about the statistical outputs, see Appendix 5.

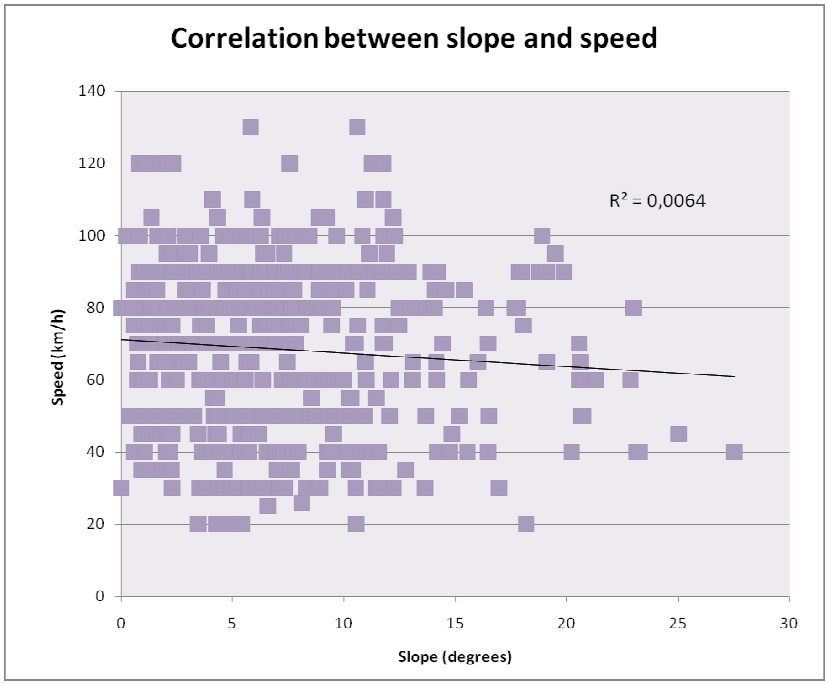


Figure 4.3: Correlation plot between slope and speed.

Table 4.2: P-values from Independent Sample T-tests between road speed classes.

Road Types	Built-up area Roads	Main Road	Main Urban Road	Regional Road	Secondary Road
Built-up	-				
Main Road	0.100	-			
Main Urban Road	0.000	0.000	-		
Regional Road	0.000	0.001	0.000	-	
Secondary	0.659	0.00	0.000	0.000	-

4.2.2 Speed values

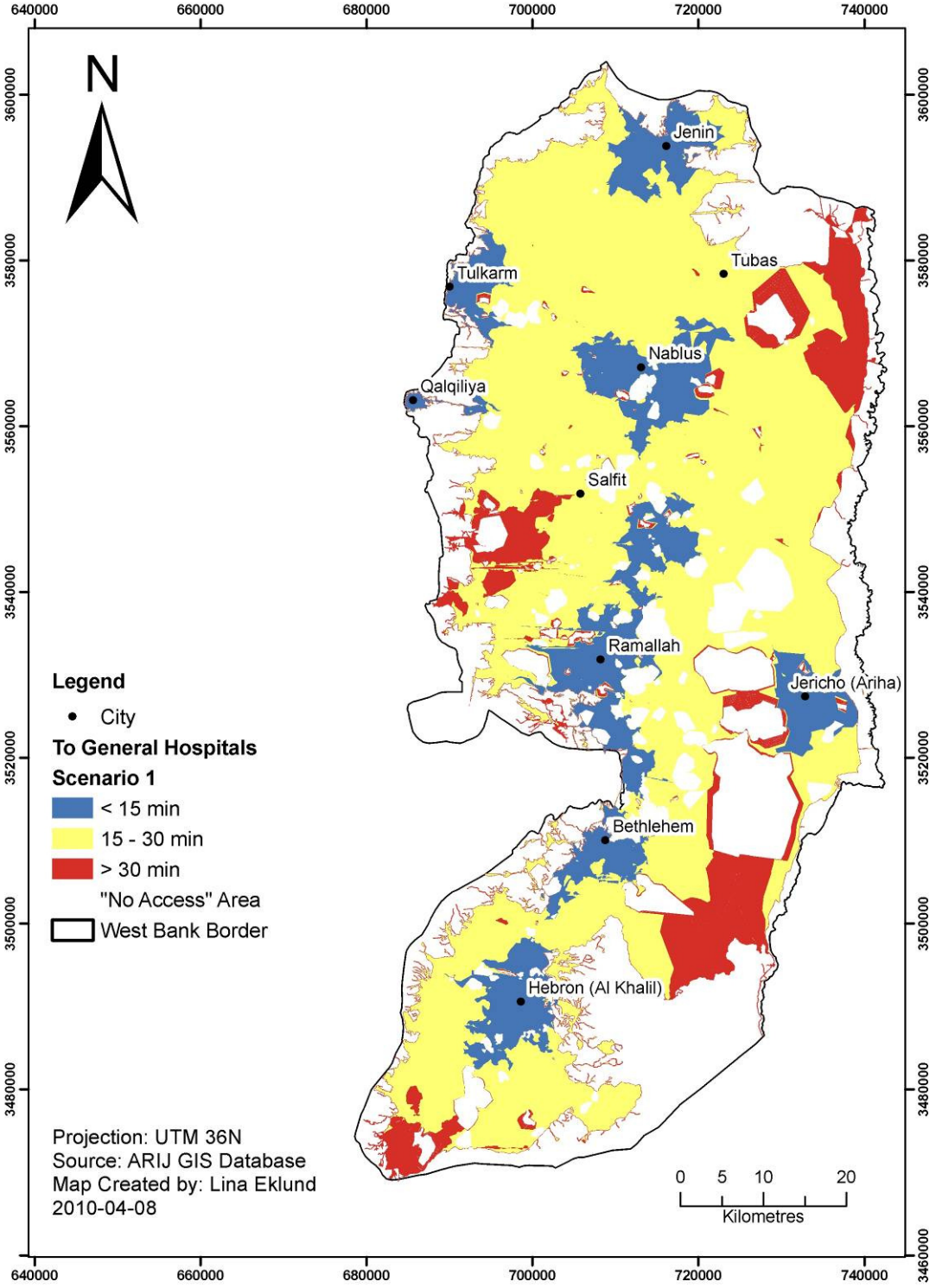
Five classes were defined with speeds ranging from 30 km/h to 85 km/h. Most points were collected on Main Roads and Main Urban Roads during intra-regional travel. Secondary roads were more seldom used. The friction value was used in the network analysis.

Table 4.3: The resulting road speed values from the data collection.

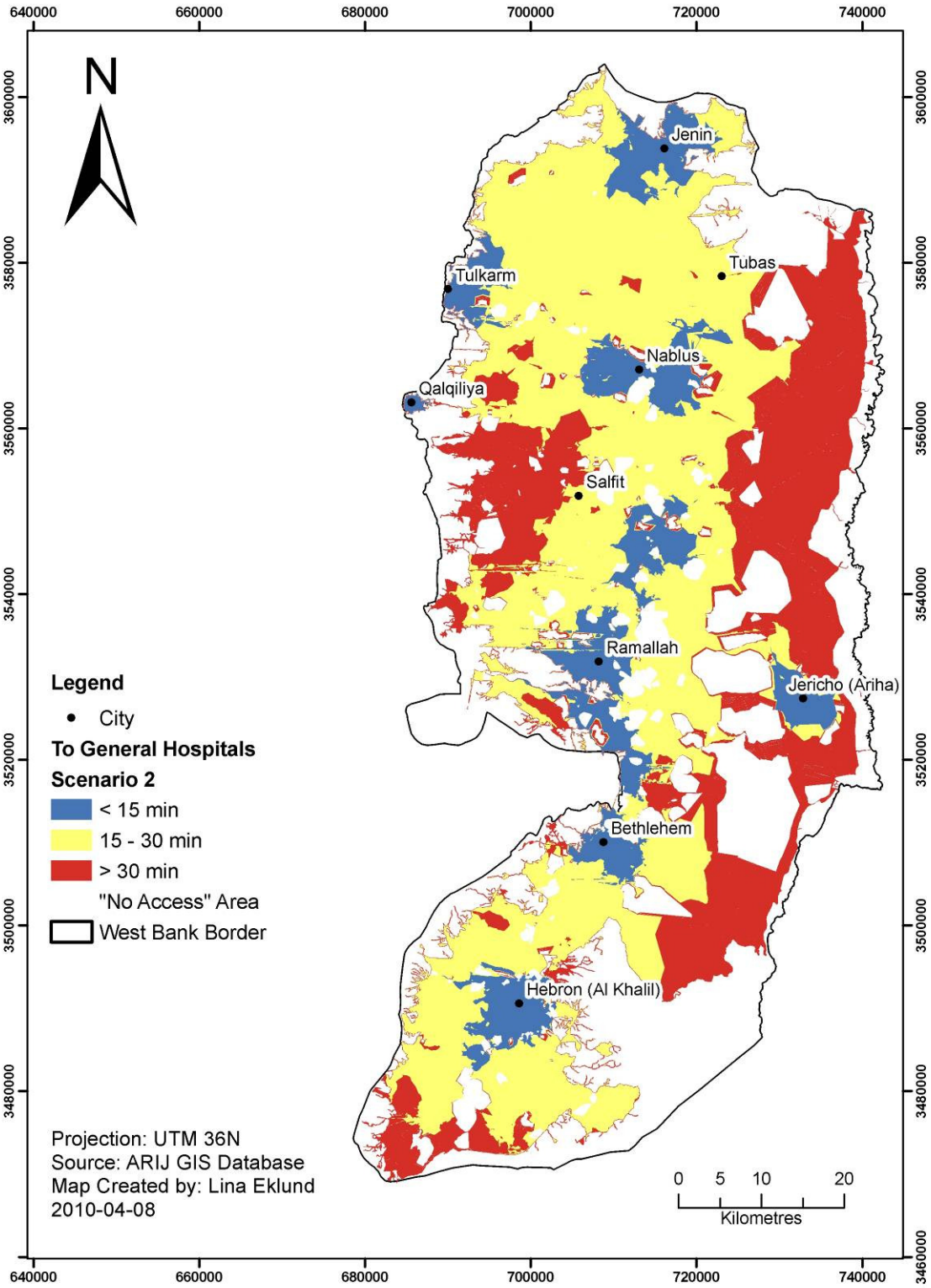
Road class	Average Speed (km/h)	Number of Points	Friction value (s/m)
Main Road	85	172	0,042
Main Urban Road	59	123	0,061
Regional Road	80	87	0,045
Secondary Road	30	57	0,120
Built-up area Roads	46	91	0,078

4.3 Service Area Analysis

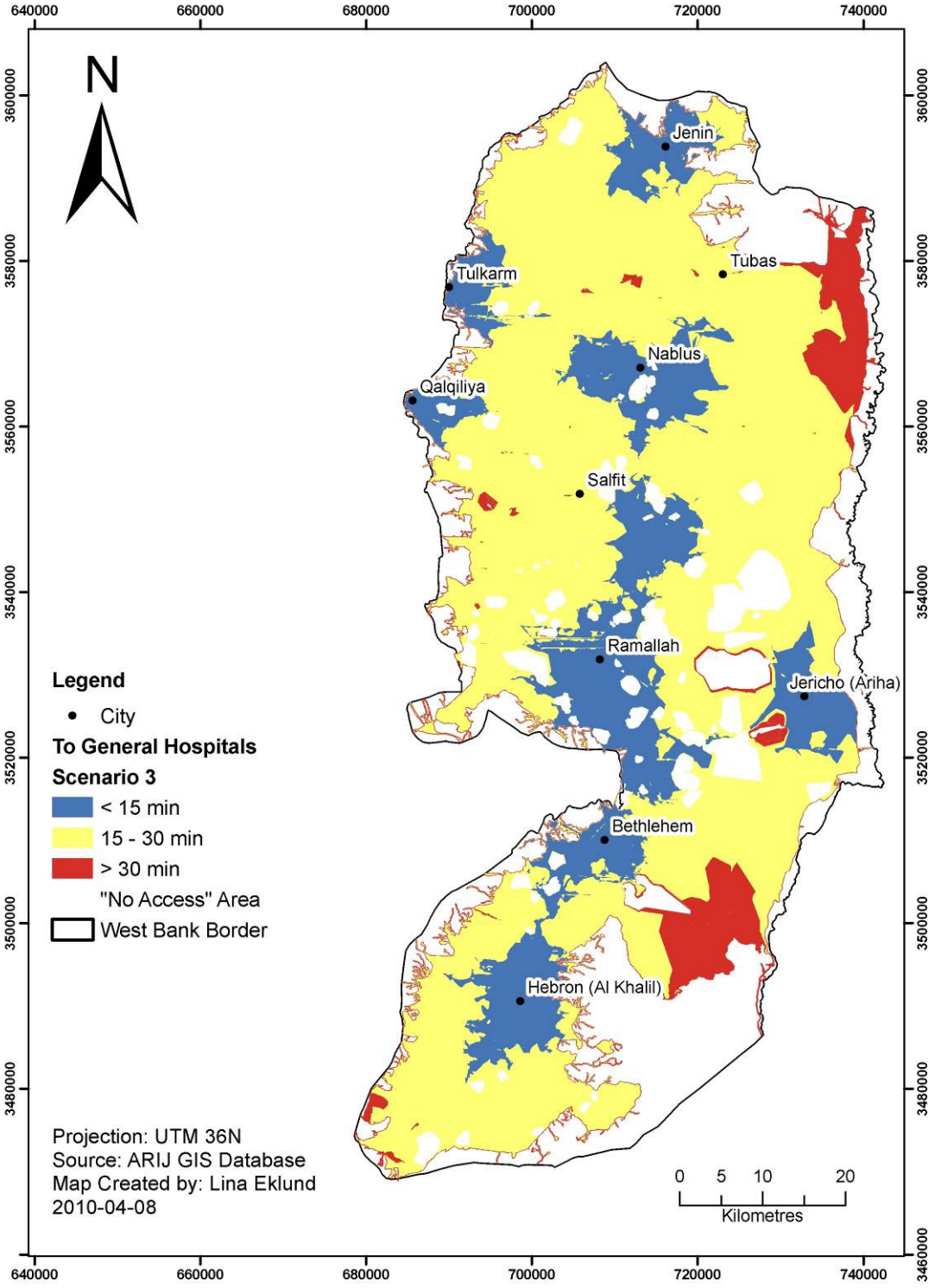
The Service Area Analysis resulted in three maps, one for each Scenario (maps 4.1-4.3). Note that delays at checkpoints are not included. The colour of the polygons stretches from blue, good accessibility, to red, bad accessibility, with yellow in the middle as the intermediate accessibility. White areas are areas where there is no accessibility at all.



Map 4.1: Estimated time to general hospitals in the West Bank – Scenario 1 – "Present day" situation.



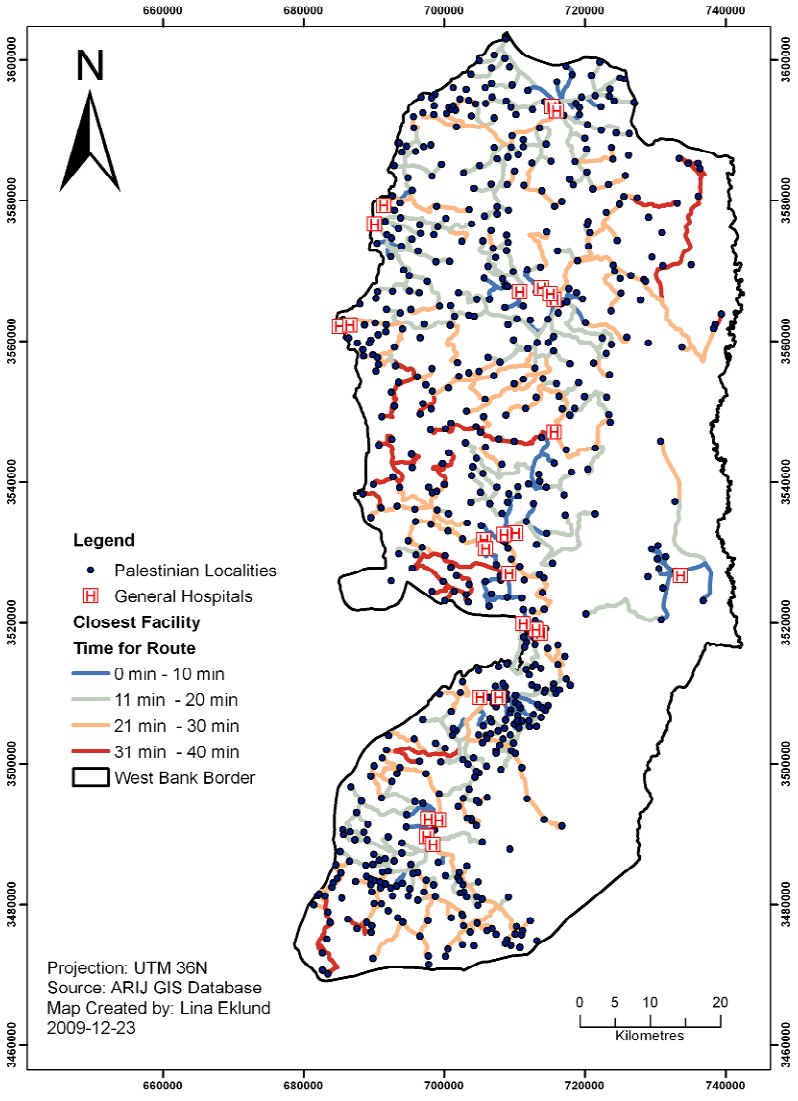
***Map 4.2**:* Estimated Time to general hospitals in the West Bank – Scenario 2 - All barrers and checkpoints closed.



Map 4.3: Estimated Time to general hospitals in the West Bank – Scenario 3 – No checkpoints or barriers.

4.4 Closest Facility Analysis

The output of the analysis was a layer with all routes between localities and the quickest reachable general hospital (Map 4.4). From the attribute tables, some useful information were derived and presented in charts and tables. All tables can be found in Appendix 6. It was found that 48 localities with a total of 25084 people (1% of the West Bank population) have no accessibility to general hospitals (no routes were found) in scenario 1. When testing Scenario 3, no barriers or checkpoints, 5 of these localities were without a route to a general hospital and for the rest, a route was found. The results also showed that 284915 people (12%) have to pass through at least one checkpoint when going from their community to the quickest reachable general hospital.



Map 4.4: Closest Facility Routes – visual output of the Closest Facility Analysis.

4.4.1 Estimated Accessibility per Governorate

Figure 4.4 shows the average estimated travel time (blue) in each governorate for Scenario 1 (with 15 minutes delay at checkpoints) and for Scenario 3 (green). It also shows the longest (red) and shortest (yellow) travel time to general hospitals for each governorate.

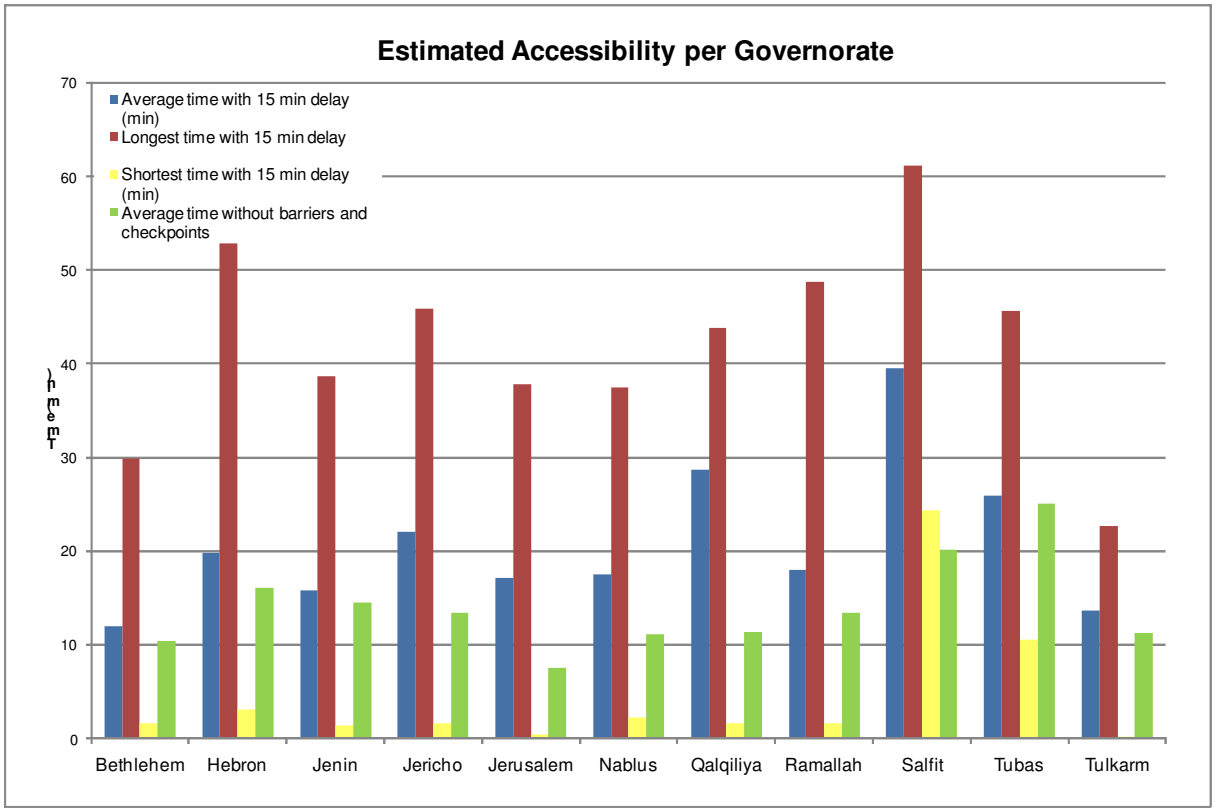


Figure 4.4: Estimated travel time to general hospital distributed on governorates.

4.4.2 Affected Population

The chart shows the distribution of the population into three accessibility groups. It shows how the group sizes changes when adding barriers and delay at checkpoints. People living in good accessibility are transferred into the intermediate and bad accessibility group. For instance, comparing the scenario of no barriers or checkpoints with the scenario with five minutes delay, the bad accessibility group is increased by more than 70000 people.

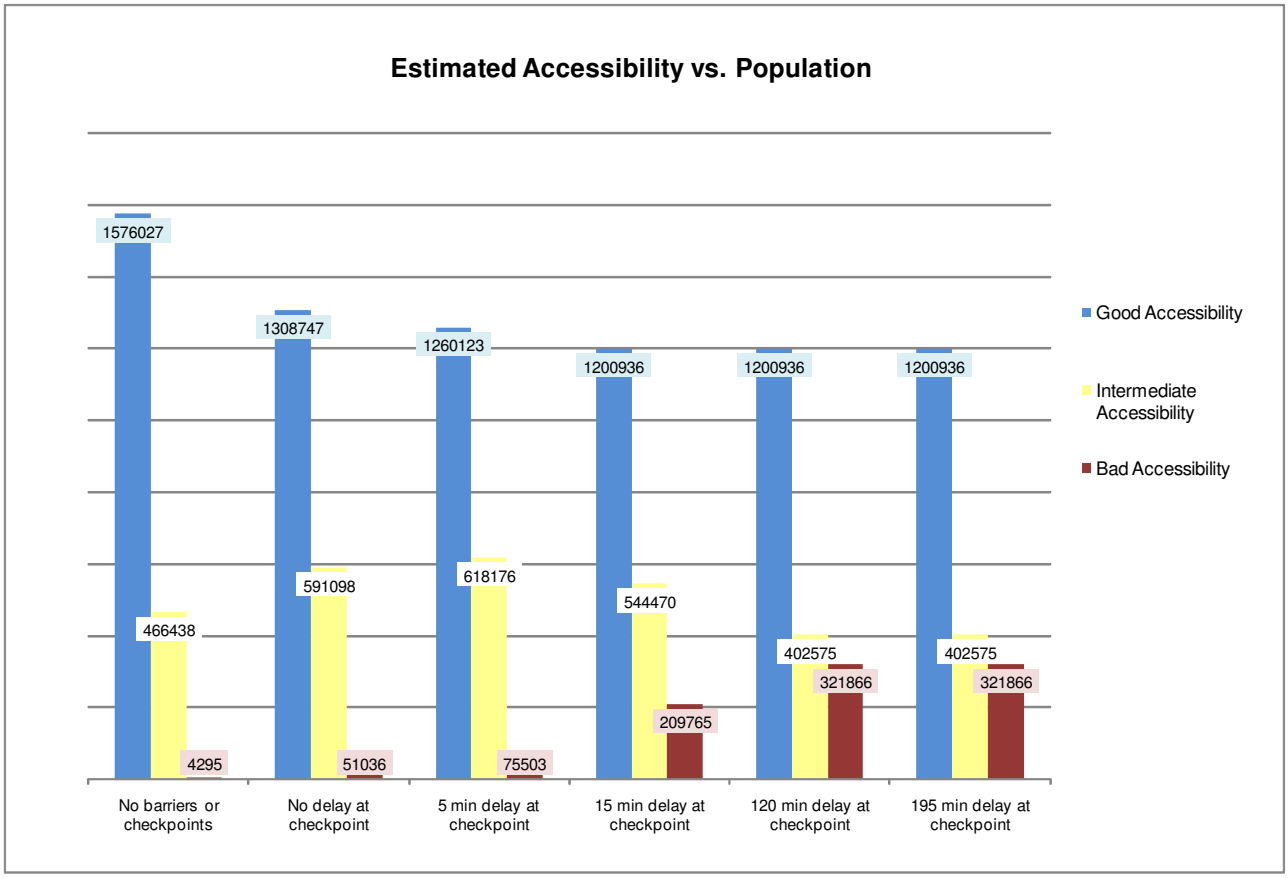


Figure 4.5: Affected population by the estimated accessibility.

4.4.3 No Accessibility

There were 48 localities for which no route was found to a general hospital. The table and the chart show which governorate has the most localities of this type, namely: Hebron, Jenin, and Qalqiliya governorates. Tulkarem has no error route.

Table 4.4: No of localities per governorate with no accessibility and the affected population.

	Localities	% of Localities	Population	% of Localities Population	% of West Bank Population
Bethlehem	3	6.3%	2135	8.5%	0,0908%
Hebron	13	27.1%	4799	19.1%	0,2042%
Jenin	9	18.8%	4868	19.4%	0,2071%
Jericho	1	2.1%	4	0.0%	0,0002%
Jerusalem	3	6.3%	1757	7.0%	0,0747%
Nablus	3	6.3%	758	3.0%	0,0322%
Qalqiliya	9	18.8%	10089	40.2%	0,4292%
Ramallah	1	2.1%	234	0.9%	0,0100%
Salfit	1	2.1%	0	0.0%	0,0000%
Tubas	5	10.4%	440	1.8%	0,0187%
Tulkarm	0	0.0%	0	0.0%	0,0000%
Total	48	100%	25084	100%	1,0671%

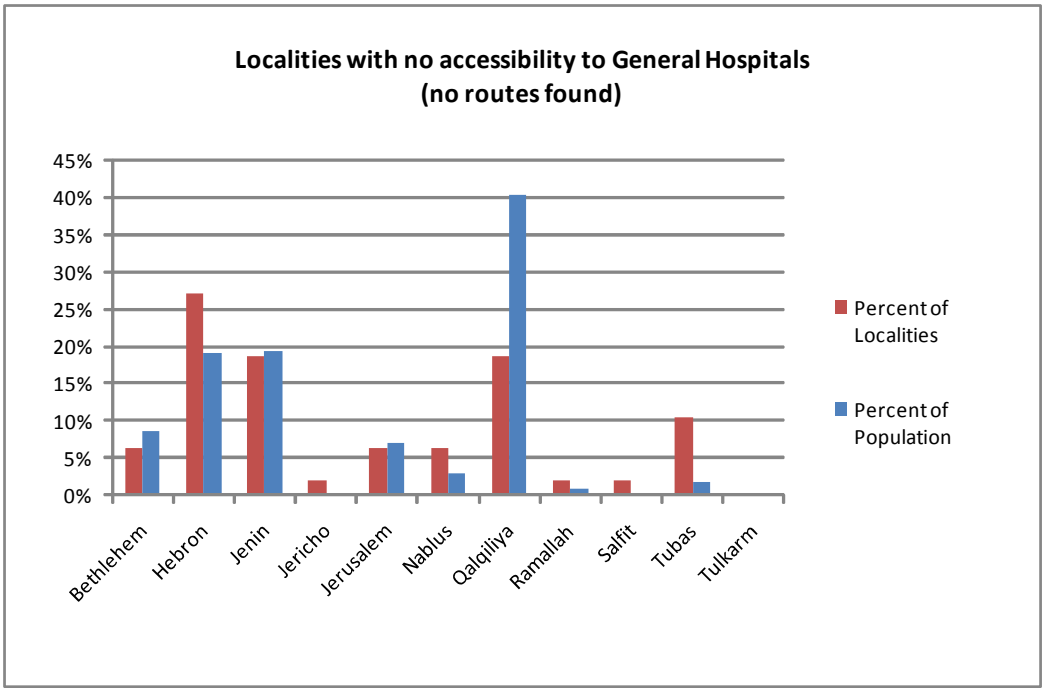


Figure 4.6: Localities with no accessibility and the affected population per governorate.

4.4.4 Factors affecting accessibility

The correlation plots shows the relationships between average travel time to general hospital (with 15 minutes delay) and four important factors. The correlation plots are sorted on the strength of the relationship. The average number of checkpoints per route and per governorate was found to be the main factor affecting the average travel time.

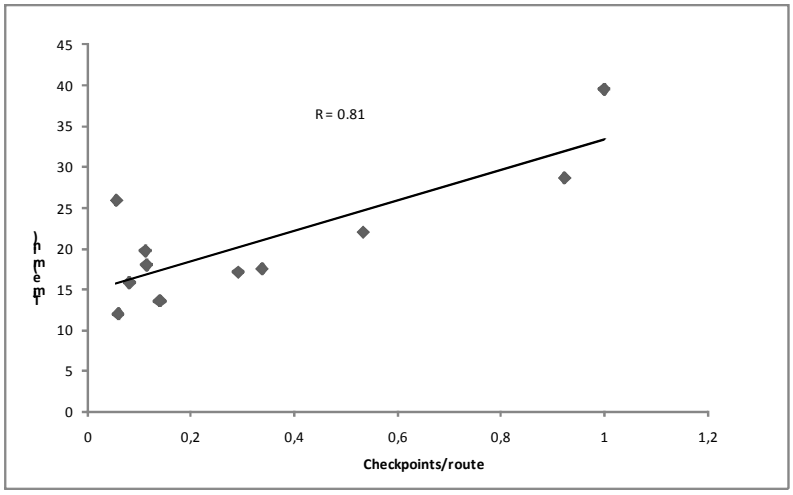


Figure 4.7: Correlation between average travel time to general hospitals (with 15 min delay) per governorate and average number of checkpoints per route.

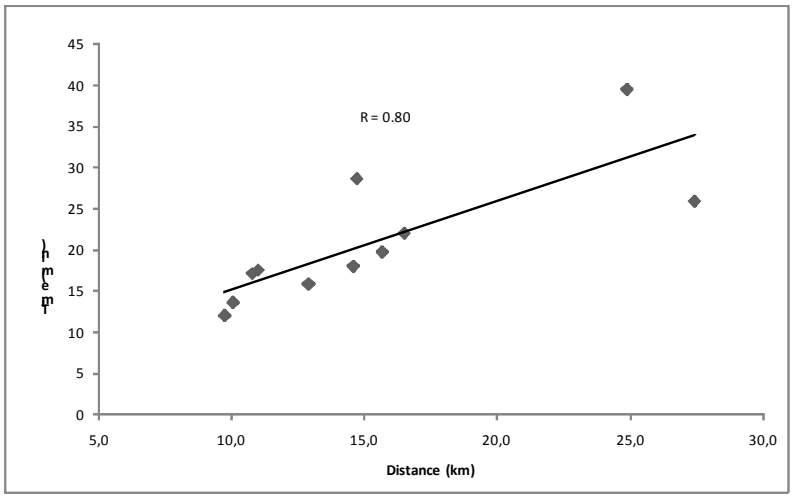


Figure 4.8: Correlation between average travel time to general hospitals (with 15 min delay) per governorate and average route distance.

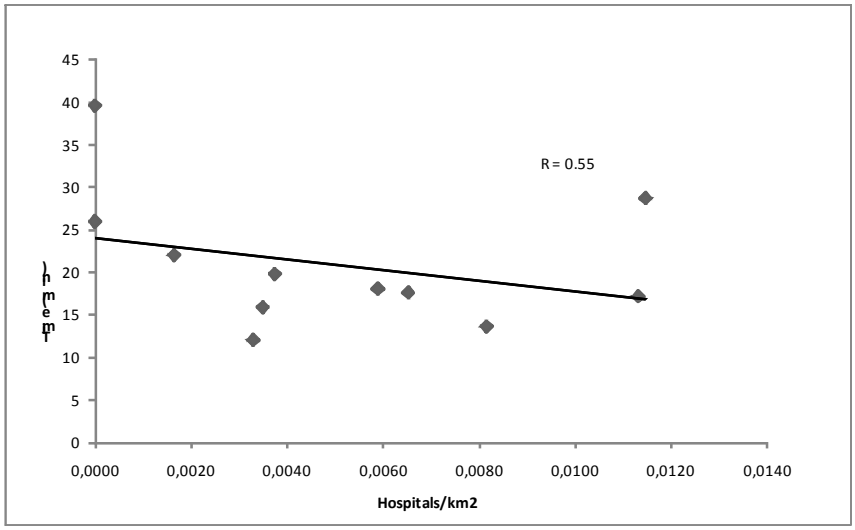


Figure 4.9: Correlation between average travel time to general hospitals (with 15 min delay) per governorate and hospital density.

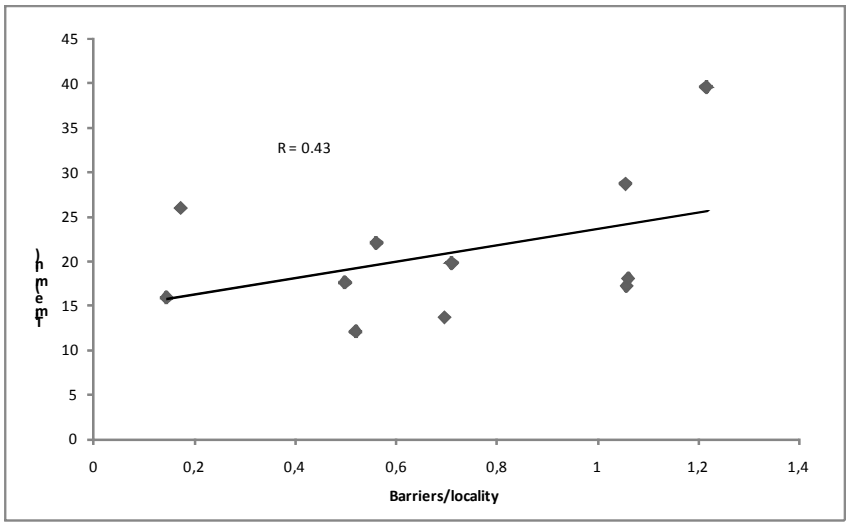


Figure 4.10: Correlation between average travel time to general hospitals (with 15 min delay) per governorate and number of barriers per locality.

4.5 Case Study Bethlehem - Ramallah

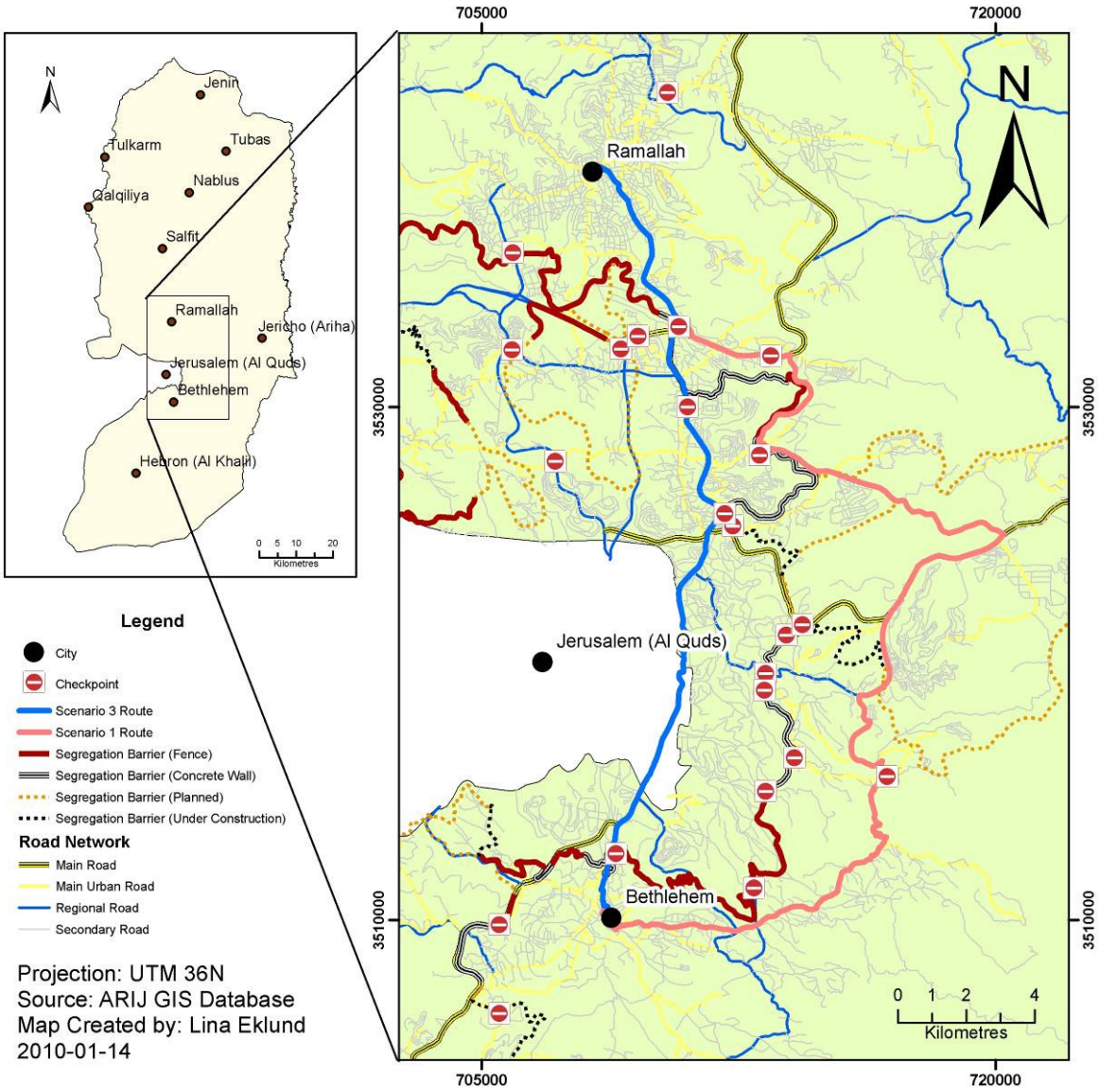
The Euclidean distance between the cities was found to be approximately 22 km.

The Network Analysis resulted in two routes, one for scenario 1 (with barriers but checkpoints and roadgates open) and one for scenario 3 (a scenario with no barriers or checkpoints). For scenario 2 (complete closure), no route was found.

For scenario 1, a route of 46.7 km was found and the time for this route, without any delay at checkpoints would be 48 minutes. This route goes through 2 checkpoints and assuming a

delay of 5 minutes at each checkpoint would make this travelling time 58 minutes. With 15 minutes, the average shortest delay at checkpoints, the route takes 1 hour and 18 minutes.

If it would be possible to travel through Jerusalem, in a scenario with no Segregation Wall, Barriers or Checkpoints, the route would be 25.4 km and take approximately 24 minutes.



Map 4.5: Routes between Bethlehem and Ramallah.

Chapter 5: Limitations and Discussion

In this chapter, the results from the field data collection and from the analyses are analyzed and discussed. Sources of error and ideas on how to avoid them are presented and discussed.

5.1 Limitations

In this section, limitations in the raw data and methods are discussed. These limitations may have an effect on the model output which is also discussed here. Ways to eliminate these limitations are also suggested.

5.1.1 Interviews

When using interviews to get data, it is important to be consequent on how the questions are asked and to be clear with what you are asking for. In the beginning of the interviews, the questions were very general, but after the first interviews, they were changed to be more precise. One source of incoherency was that not all interviews were conducted by the same interpreter and there was not always enough time to explain to the interpreter how to ask the questions.

The values for delay have been interpreted to represent delay when detained, especially the long delays but can also be delay due to traffic congestions caused by checkpoints, more likely the reason for short delays.

5.1.2 Estimation of Road Speeds

Some other methods for recording points was considered and tested but discarded. The methods included recording points or a track with GPS and instead of digitizing just using the points or extracting the points from the track. However, these methods were not used due to unreliability of the GPS. At places with bad reception, the GPS would not record any points and there would be loss of data. Because of that, the somewhat time consuming method of digitizing each point was considered better.

It can be discussed whether there are better ways of estimating road speeds than taking points of momentary speed. For example the time it takes to drive a certain distance could be measured and might even be an easier and more efficient way. This method was not used, mainly because one of the aims was to connect speeds to slope angle which requires a momentary speed value. When the correlation between speed and slope was tested and the hypothesis discarded, the points were already collected. Another reason for not using average speed over distances is that delay from checkpoints and traffic congestions would be included. All in all, the points with momentary speeds were easy to work with as it was just a set of values with coordinates.

The combination of measuring every kilometre, writing down the speed from the speed meter and then digitizing the points can lead to a number of errors. It is dependent on the accuracy of the car's distance meter, the accuracy of the car's speed meter, the ability to record the exact speed at the exact right distance and then the ability to locate these points on an aerial photography. It is not exact to the meter level but the purpose of the collection was to get

sample speeds for each road class and for that the method works well enough. Due to the uncertainty in accuracy, the speed values were rounded off.

The resulting speed values for the different road classes were found to be realistic although a bit high. Traffic congestion values could have been included in the model but it would maybe have given more inaccuracy as they are a very irregular.

The method is probably more accurate than it would have been to use speed limits on the roads, since they rarely are being followed.

One reason that Main Road points were found within built-up areas might be that the polygons are not that accurately digitized. When overlaying the points with the built-up area layer, it was assumed that they covered only the urban area but it is possible that the polygons cover nearby built-up area roads that are classified as Main Roads. However, these roads are probably just bypassing the communities and hence not affected by the urban area, as proved by the statistical tests (section 4.2.1).

When digitizing the points using the measure tool, only the two-dimensional length is measured while the z-values are not taken into account. Hence there might be an inaccuracy in where the points should be located and errors of this type were actually detected during the digitizing. Using the aerial photograph in combination with the comments made during the field data collection, the inaccuracy was compensated.

5.1.3 Network Model

Limitations in the input data can be expected, especially in the road network that was digitized from a satellite image. The roads might not be completely accurately placed and some might be missing. Since 2004 when the satellite image was taken, new roads may have been built and old ones could have been rebuilt. The classification of the roads can also have errors as it is unclear how the roads were classified and which parameters were taken into account. During the data preparation, the road network layer was processed to find these errors and correct them.

The topology of the network was processed but as there were almost 9000 errors of the type "Dangles" that could not all be checked, there might be some relevant errors left. Most of these errors are however exceptions that represent roads leading to villages.

Another problem with the network model is that it is only two-dimensional while reality, especially in the study area, is three-dimensional. Although no correlation between speed and slope was found, the slopes give the roads a different length which could affect the travel times. When building the network, it is possible to include elevation in the model and in this case, it might have provided more accuracy for the model.

This model could have been processed and evaluated more but as time was a limiting factor in this study, the line was drawn and the model was considered sufficiently accurate.

5.1.4 Service Area Analysis

The result of the Service Area Analysis was a good way to visualize the accessibility situation. The problem with the Analysis was however that there was no possibility of including waiting time at checkpoints in the analysis. First, segments of 50 m around checkpoints with friction values representing delay from interviews was used to include delay in the model. Later it was realized that when the delay was too long, the Algorithm would take another route to avoid the checkpoint to get as low values as possible. This would however not be realistic as people rarely expects to be detained for an hour at a checkpoint and because of that takes a longer route.

Due to these limitations, the Scenario 1 map shows only how the accessibility situation is affected by the barriers where vehicles cannot pass. It does not include any delay at checkpoints. The Scenario 2 and 3 maps are more realistic since they consist only of passable or impassable features.

A comment to the results would be that the result only shows the accessibility to hospitals classified as general hospitals. No deep investigation in how up-to-date this layer is has been made which means that there might be more general hospitals and there might be less. The layer was created in 2006 and it is possible that more hospitals have been built since then. Another problem is the geographic accuracy of the points. This layer was created just for visualising the hospitals distribution and might not be completely suitable for a detailed spatial analysis. More exact layers were requested but not found.

Another limitation is that it is not realistic to expect people to only go to the quickest reachable hospitals. When the situation is urgent, it is likely to think that people would go to the quickest reachable hospital. However, when the situation is not as serious, people might choose to go to a more remote hospital, one that might be for example better or cheaper. The purpose of this study is however not to predict people's choice of hospital, but to predict how long time it would take to get hospital care in case of accidents or urgent diseases.

One benefit with the Service Area polygons is that it visualizes the accessibility situation, independent on where you are in the West Bank. It is possible that accidents happen far away from built-up areas and that is why it is important to have a good accessibility even in less densely populated areas.

The problem with including checkpoints could most probably have been worked around with some knowledge in GIS-programming; it should be possible to build an algorithm that does this. One that would find the least cost route but then also accumulates checkpoints and integrates these values in the attribute table. This could be a way to develop and improve the study.

The small differences in white areas between the scenarios imply that there might be inaccuracies in the model, for example roads that are closed in reality might not be closed in the model. This is an error that can be avoided by extensive correction of all barriers. Going through all barriers one by one would be extremely time-consuming since there are more than

500 barriers in the whole study area. This could have been done if a smaller study area was used but for this project it was considered important to model the Whole West Bank.

5.1.5 Closest Facility Analysis

It is important to note that the estimated travelling times are given with detailed numbers but should be rounded off to integers. It has to be taken into account that the hospital might not be completely accurately placed. Because of this inaccuracy in placement, a fringe of about 5-10 minutes may be added on each estimated accessibility value.

When comparing the governorates by shortest travelling time, it is important to keep in mind that a low value means that one of the localities is really close to the hospital. The localities are however represented as points in this model, which does not show the real extent of the locality. A travelling time of 0.22 minutes may be possible but it is not a value that can represent a whole locality.

Important to note about the correlation is that the plots (figure 4.7 – 4.10) are built on average travelling time values for each governorate. Averages are not always representative and can be somewhat misleading. Especially since the number of localities differs between the governorates. When the number of localities is low, the average is more easily affected by extreme values.

Building the correlation plots on the summary values for each governorate gives a small number of points. It may have been more preferable to generate the plots on a more detailed level. This would however lead to very low and possibly very similar values for numbers of Hospitals, checkpoints and barriers, which might make it more difficult to find a correlation at all.

5.1.6 Case Study

It should be remembered that in neither of these calculations is the topography of the area considered. The routes are probably a bit longer, especially for the Scenario 1 route since it is going through Wadi Nar, a steep valley located east of Jerusalem. Furthermore, the previously discussed limitations in the network are affecting this case study as well.

5.2 Discussion

5.2.1 Service Area Analysis

Scenario 1

Looking at Scenario 1, the situation does not look so bad. Most areas in the West Bank are within 30 min from the closest hospital. Two cities have an intermediate accessibility to general hospitals; Salfit and Tubas. This is because there is no hospital of this type in either of these cities. The other cities have a good accessibility to general hospitals and it is obvious that the rural areas are more challenged in terms of accessibility to health care. There are some “white areas” where there is no accessibility according to the analysis. This is probably due to limited extent in the road network and to barriers. These areas with no accessibility is however mainly not areas where Palestinians are living. It is mainly in Area C and areas of

Settlements, which are not included in this model. Due to above mentioned limitations; this model of Scenario 1 shows the ideal present situation when all checkpoints are open and no one gets stopped. It is likely that the values for travel time are higher.

Scenario 2

Closing all checkpoints and road gates (Scenario 2) is supposed to show the worst case scenario. It increases the travelling time for some areas, especially the areas that are located remotely from the general hospitals. For the areas close to the hospitals, the change is negligible. One surprising result to find is that the "white areas" extent in Scenario 2 is not much different from the "white areas" extent of Scenario 1. The hypothesis was that when closing all checkpoints and road gates, it should be impossible to move anywhere. The explanation for this result can simply be that the closure does not affect as much on the local scale but perhaps more on the regional scale, for example in between cities. Most localities are clustered around the cities, in Area A and B (see fig. 1.3) and because of this; most cities, towns and villages are within access to a general hospital.

Scenario 3

In Scenario 3, all barriers were removed as to show the ideal situation that might come from an ending of the occupation. For this scenario, most areas had an estimated accessibility less than 30 minutes to a general hospital. In this model, the only factors affecting accessibility were the road quality, extent of the road network and the availability of general hospitals. The scenario 3 model still left some inaccessible areas which lead to the conclusion that the road system must be a restricting factor to accessibility. In some areas, there are no roads, especially in the western parts of the West Bank where the Palestinian population is less dense.

5.2.2 Closest Facility Analysis

This type of analysis gave a more detailed result than the Service Area, because it gave estimated accessibility values for each locality in the West Bank.

The closest facility analysis resulted in 620 routes for 668 localities. For 48 localities, no route to a general hospital was found. Some routes were not found because of "non traversable network elements" which means that the locality is trapped between barriers and/or unconnected network segments. This error is a possible effect of the physical obstructions imposed by the Israelis. The other, more common error was that the locality was situated more than 500 meters from the network, which might not be a realistic problem because there might be smaller roads not included in the road system layer. But it could also be that the locality is situated far from a road, which affects the accessibility.

The result showed that more than 25000 people were affected by inaccessibility to a general hospital. This is the amount of people living in a locality for which a route was not found to a general hospital. Some of these more than 25000 people might have a way to get to a hospital, but it can include walking or driving in difficult terrain. 1% of the population might not be a large percentage but no matter how large population you have, 25000 people without access to hospitals is a high number. It should be remembered also that this is 2007's numbers and

for many smaller localities, no information about population was available. It is possible to assume that this number is higher.

12% or 285000 people have to pass by at least one checkpoint every time they go to the quickest reachable general hospital. This means that 12 % of the population are in risk of being delayed for several hours. They can never be completely sure that they will reach the hospital in time. This contingency is difficult enough when going somewhere for any reason but when it is important to reach a hospital in a certain time, this can cause great implications. In addition to these permanent checkpoints are the unpredictable flying checkpoints that are difficult to include in a model.

Summary of Estimated Travel Time

The result shows that Salfit has the worst accessibility when it comes to longest time, average time and shortest time to general hospital. With checkpoints and barriers removed, the average time is half the average time with checkpoints and barriers. This example shows quite clearly how the accessibility is affected by barriers and checkpoints. Looking at the chart (fig. 3.4) showing the input to the Closest Facility analysis it is clear that Salfit has not the largest number of barriers and checkpoints. It is however important to take into consideration that Salfit has the second smallest area of the governorates and also the second highest barrier density (barriers/km^2). Another reason for bad accessibility to hospitals in Salfit is the fact that there are no general hospitals in Salfit. You have to go to Qalqiliya, Nablus or Turmusayya when in need of a general hospital.

In terms of average time to general hospital, Qalqiliya has the second worst accessibility. The average time is however below the 30 minutes limit which means that the situation is not too bad. Qalqiliya has two general hospitals and the smallest area of all governorates. These two properties help to increase the accessibility because better hospital availability probably decreases travel distances which in turn decreases travel time.

In Tubas, the Average time to general hospital for Scenario 3 is almost as much as the value for Scenario 1. This indicates that the barriers and checkpoints have little influence on travelling time in this governorate. When looking at figure 3.4, it is obvious that Tubas has the lowest number of checkpoints and barriers, which explains the similarities in average time. The negatively influencing factor on accessibility in Tubas is the lack of general hospitals. The closest hospitals are to be found either in Jenin or Nablus and this is why the estimated travel times are fairly high in comparison with other governorates.

The governorate with the lowest average time to general hospital is Bethlehem. It also has the second smallest value for longest time to general hospital. This makes Bethlehem a candidate for the governorate with the best estimated accessibility to general hospitals. The average time without barriers is not much different from the average time with checkpoints and barriers. This indicates that Bethlehem's 37 barriers and 7 checkpoints are not that important for the accessibility. Many of the barriers represent places where the roads intersect the Segregation Barrier, which in the Bethlehem area mainly affects the people living on the other side of the wall. Some of the checkpoints are also entrances to East Jerusalem, for which all Palestinians

need a permit to pass. Hence, the number of barriers that affects the accessibility is lower than the one mentioned above.

Accessibility vs. Population

Figure 4.5 shows how the number of people that have good, intermediate and bad estimated accessibility to general hospitals increases with barriers and delay at checkpoints.

For Scenario 3, approximately 1576000 people, (approximately 67% of the whole West Bank population) would have a good accessibility to a general hospital. Around 467000 people (~20%) would have an intermediate accessibility and only 4300 people (~0.18%) would have a bad accessibility to a general hospital. These values are ok. The accessibility in this scenario is not dependant on the Israeli Physical Obstructions, but instead probably on availability of Hospitals and limitations in the Road Network.

With barriers but no delay at checkpoints (Scenario 1), the number of people with bad accessibility to a general hospital is increased to 51000 (~2.2 % of the population) an increase of 46700 people, which shows how much only the barriers affect accessibility. For the intermediate accessibility group, the increase is with 125 000 people to 591000 people (~25%).

When assuming 5 minutes delay at checkpoints, additionally around 25 000 people are added to the group with bad accessibility to general hospitals, which totals it to 75500 people (~3.2% of the population). The amount of people living with intermediate accessibility is increased with more than 27000 people, to 618000 people (~26.3%).

If the delay at checkpoint is 15 minutes, the amount of people in the bad accessibility group is increased with 134000, from 75500 to 210000 people (~9% of the population). For the intermediate group, this value is decreasing, because people from this group are transferred into the bad accessibility group. The number of people living with a good accessibility situation is 1200000 (~51%) which is a value that from this point stays constant no matter how much you increase the delay at checkpoints.

For 120 minutes delay, the bad accessibility group increases with more than 100000 people to322000 people (~13.7%) while the intermediate group decreases. The amount of people in the good accessibility group is now static because of the 15 minutes limit. All checkpoint routes now have more than 15 minutes to a general hospital and hence, in the intermediate group (with < 15 minutes), there will only be people that does not have to pass through a checkpoint.

This means that on a bad day with much traffic or restrictions, a total of more than 754000 people (~32% of the West Bank population) lives more than 15 minutes from a general hospital and 322000 (~47.3%) of them live more than 30 minutes from a general hospital.

It may not be completely realistic to assume 2 hours delay at each checkpoint for every person that wants to pass. But the purpose of the chart is to show how the amount of people with bad accessibility increases with delay at checkpoints.

Cases of No Routes

Of the 48 localities that have no route to a general hospital, most are located in Hebron, Jenin and Qalqiliya. Focusing on the affected population, Qalqiliya is the governorate that is most affected. 40% of the people with no access to hospitals are living in Qalqiliya. After Qalqiliya comes Hebron and Jenin with 19% each. Qalqiliya is a governorate strongly affected by the Segregation Wall that is zigzagging through Qalqiliya to encircle the larger settlement enclaves. In Hebron, this inaccessibility could be explained by the large amount of barriers and that there are generally more localities to be shut out from the accessibility. Barriers are probably not the big problem in Jenin as the governorate only has 14 of them. It is more likely that the inaccessibility is due to limitations in the road system, either in the original shape file or in the real road network. All localities in Tulkarm governorate have a route to a general hospital which means that Tulkarm has an overall good accessibility, both concerning "no access" and also the estimated travel time.

Correlation plots

The strongest relationship was found to be the one between average travelling time and average no of checkpoints per route (Figure 4.7). The r-value is 0.81 which can be considered a strong relationship. This is perfectly logic as more checkpoints should increase the average travel time for the governorates. In this case, the travel time for a route with a checkpoint is the basic value that is depending on distance and road speeds plus the number of checkpoints multiplied by 15 minutes. The more checkpoints you have on the routes, the more will the average time be.

The second strongest correlation is between average travel time and average distance to general hospital (Figure 4.8). The r-value was 0.8 which can be interpreted as a strong relationship. This is completely understandable as the travelling time is very much dependant on distance. The distance is in turn probably affected by barriers which makes the route longer than it would be without barriers.

Next important feature is the availability of facilities represented by the number of general hospitals (per km^2) in each governorate (Figure 4.9). The r-value for this relationship is 0.55 which is a bit weaker than previous, but still a relationship. The Availability of Hospitals is probably also connected to the route distance. A high density of hospitals would probably decrease the route lengths which in turn would decrease the travelling time. In addition to density, the position of Hospitals in comparison to the localities is a determining factor. It is however realistic to assume that Hospitals are built mainly in areas with high population density.

The number of barriers per locality is related to Average Travel Time with a strength of 0.43 (Figure 4.10). This is a fairly high relationship which means that more barriers per locality and governorate lead to longer travelling times. It should be noted that the barriers are placed strategically so it has not only to do with the number, it is also the position. Since the purpose of barriers is to limit mobility for the population and to regulate the traffic, it is realistic to assume that the barriers are placed around localities. However, the barriers increase the route

length and may change the route to go more on low speed roads, two changes that both are likely to increase the Average Travel Time.

5.2.3 Case Study

The route analysis gave a result that showed an example of the intra city accessibility. Ramallah - Bethlehem may be an extreme example because much of the increased travel time is due to the Segregation Barrier. The Israeli Physical Obstructions does, in this case, increase the travelling time with approximately 100%, when assuming no delay at checkpoints. It is however likely to find some delay at checkpoints so the time for going to Ramallah from Bethlehem (or the other way around) can be approximated to be around one hour at least. Since there are two checkpoints, it can be difficult to assume the delay, it is not certain that there will be delay or the same delay at both checkpoints.

The distance is almost double for Scenario 1 compared to the one with Scenario 3. This is not only affecting travel time but also energy consumption which secondarily increases travel cost and has environmental impacts. For Scenario 2, all barriers and checkpoints closed, there are no routes at all. This means that it can be impossible to travel from Bethlehem to Ramallah on days with complete closure.

The distance of the route going through Jerusalem is only 3.4 km longer than the Euclidean distance, which is a small, almost negligible, difference. The actual route that most Palestinians have to take is however 24.7 km longer than the Euclidean distance.

Chapter 6: Conclusions and final remarks

From the result of this study, it can be said that the Israeli physical obstructions have a large negative effect on the Palestinian accessibility. For example, 48 communities were found to have no accessibility to general hospitals for scenario 1. When removing all barriers and checkpoints, there were only 5 communities left that had no accessibility. The remaining 43 communities' inaccessibility was all due to Israeli physical obstructions.

Comparing Scenario 3 with scenario 1, it is obvious that the number of people with good accessibility decreases while the number of people with bad accessibility increases when adding barriers and delay at checkpoints. However, over 1.2 million people still have a good accessibility even if the checkpoint delay is assumed to be over two hours. This is probably due to the clustering of people in cities where the availability of hospitals is higher, travel distance is relatively short and few obstacles are present.

Checkpoints increases travel time while barriers increases route distances which secondarily increases travel time, travel cost and pollution. Other factors limiting the accessibility are the extent and quality of the road network and the availability of hospitals.

It is realistic to say that most Palestinians residing outside of the main cities live under very uncertain mobility conditions due to Israeli physical obstructions such as barriers, permanent checkpoints and temporary checkpoints. 285000 of the West Bank population reside in insecurity whether they will even be able to reach the hospital in time due to delay at checkpoints. This uncertainty increases the problem, especially for people in urgent need of health care. It is also likely that many people in need of health care avoid travelling to hospitals due to the risk of being detained for hours. This causes people wait until their problem becomes really urgent, and if they then get delayed in transit to the hospital, their situation may be fatal.

The Separation barrier affects the accessibility as it cuts into the West Bank between villages and forces people to take longer routes. One example is Qalqiliya that has the wall around the only entrance to the city. In Qalqiliya, more than 10000 people have no accessibility to general hospitals. Most probably, this is due to the separation barrier.

If the occupation was ended (Scenario 3), the situation would be improved significantly. There would still be risk of traffic congestions but this is the same case as in any major urban centre in the world. The accessibility could be enhanced by extending and improving the road network and by increasing the number of hospitals.

Compared to previous research from the beginning of the 20th century, the situation seems to have improved a bit, with less delay and more checkpoints open. However, with the Israeli occupation infrastructure, the situation can change rapidly. Closing all checkpoints and road gates (scenario 2) will leave people with a limited regional mobility (see map 4.2) and with an extremely limited intra-regional mobility (see section 4.5). It is all in the hands of the occupation power.

Accessibility is not only important for people's health; it is a crucial factor for the quality of life. A fifteen minutes trip to the next city can become a two hours trip with the wrong conditions. The ability to plan for the day is lost due to the uncertainties and the risk of being delayed is likely to stop people from travelling unless it is absolutely necessary. Because of this, families are scattered, dreams are broken and hope is replaced by despair.

Although the Israeli physical obstructions are presented as security features to protect the Israeli population, they also constitute a security risk for the Palestinian population. The question that should be asked is maybe how many lives they save, compared to how many lives they destroy?

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Appendix 1

GIS-data from ARIJ GIS database

Layer	Quantity	Description	Origin	Updated
Checkpoint	66	Manned by soldier	OCHA	sep-09
Earthmound	230	A pile of earth	OCHA	
Earthwall	43	Set of earthmounds along a road*	OCHA	
Green line	-	The 1949 armistice line		
Green line Checkpoint	8	Checkpoint along the green line (into Jerusalem) Permit needed*	OCHA	
Hospitals	56	Both Special Hospitals and General, Private and Governmental	Palestinian Ministry of Health	2006
Israeli Bypass roads		Roads built for Israeli Military and Settlers		
Palestinian Builtup areas	2725			
Palestinian localities	668	Point layer containing localities and also projected population for the years 1997-2010	ARIJ and PCBS	dec-07
Road system from Spot 2004	21756	Main, regional, main urban and secondary roads.	Digitized by ARIJ from satellite image	
Roadbarrier	70	Fences along Israeli Bypass roads*	OCHA	
Roadblock	68	Concrete blocks*	OCHA	
Roadgate	97	Metal gate, often manned by IDF*	OCHA	
Segregation Barrier	767 km	The Barrier/Wall around the West Bank	Israeli Ministry of Defense	2007
Trench	19	A ditch used to prevent from entering a road	OCHA	
Wall gate	113	Passages in the Separation wall for Palestinians with permits		
Wb areas a, b, c, nature	232	Oslo agreement areas and Nature reserve		
West bank district	11	Governorates		
Settlements	199	Israeli Settlements		
Aerial Photos mosaic		Aerial Photographs of the West Bank, 0.75 m resolution		2007
Passages	24	E.g. Viaducts		

Appendix 2

Example of a questionnaire

Bethlehem

This questionnaire is for collecting information for my Degree Thesis in Physical Geography at Lund University of Sweden. It is about accessibility to health care and higher education in the West Bank.

If you could answer my questions, it would be very helpful for my study. Thank you.

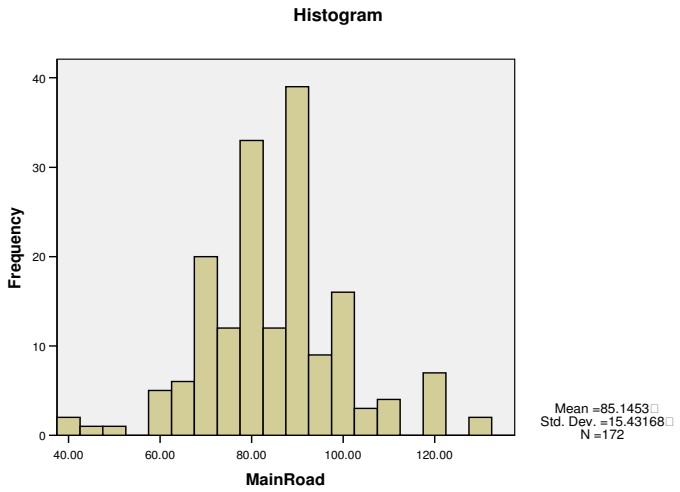
Lina Eklund

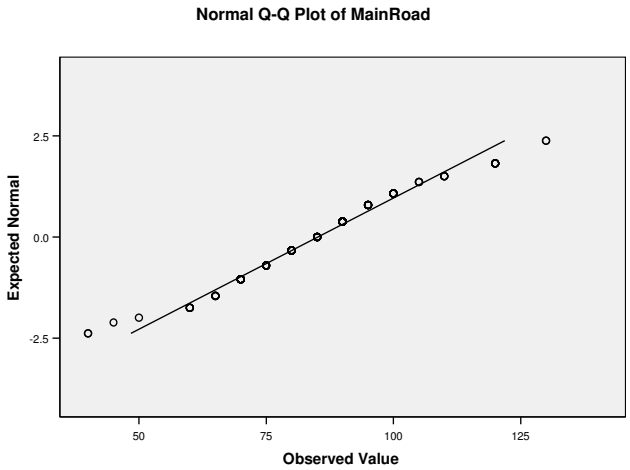
1. When travelling longer distances (e.g. to other cities) do you usually go by bus/car/service taxi/taxi/other?
2. How long time does it take (without delay at checkpoints) to travel from the city center to…
    i. Ramallah?
    ii. Nablus?
    iii. Hebron/Al Khalil?
    iv. Jericho/Ariha?

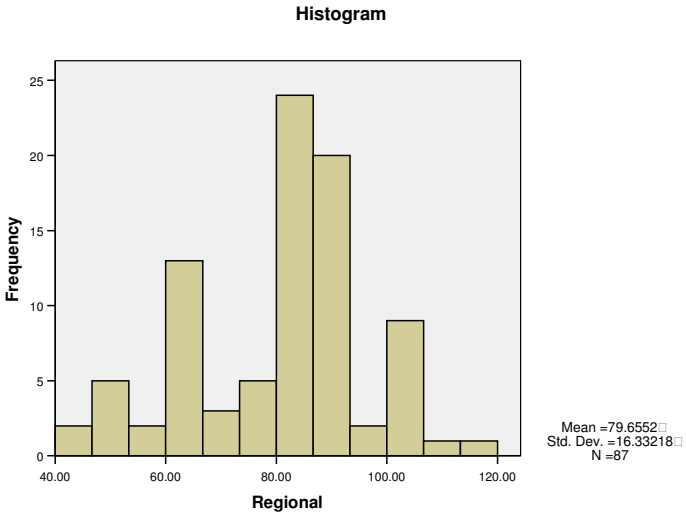
3. Are there bus tours to…
    i. Ramallah?
    ii. Nablus?
    iii. Hebron/Al Khalil?
    iv. Jericho/Ariha?
4. What is the longest time you have had to wait at a checkpoint?
5. What is the shortest time you have had to wait at a checkpoint?
6. Which are the closest hospitals? Where?
7. How long time does it take to travel from here to the closest hospital?
8. Which are the closest universities? Where?
9. How long time does it take to travel from here to the closest university?

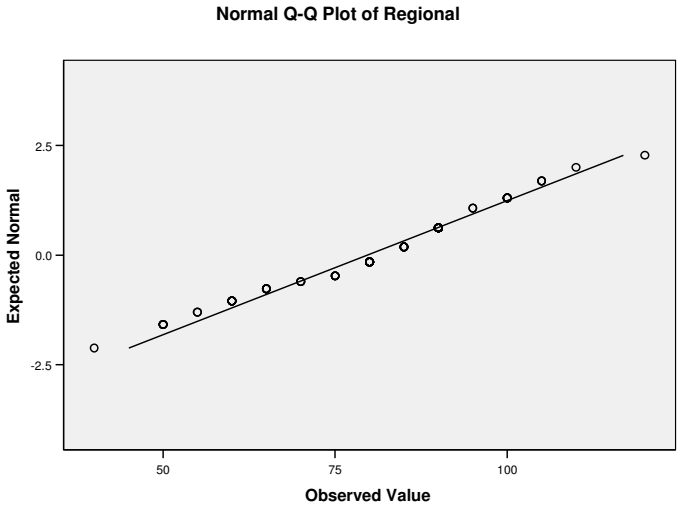
Appendix 3

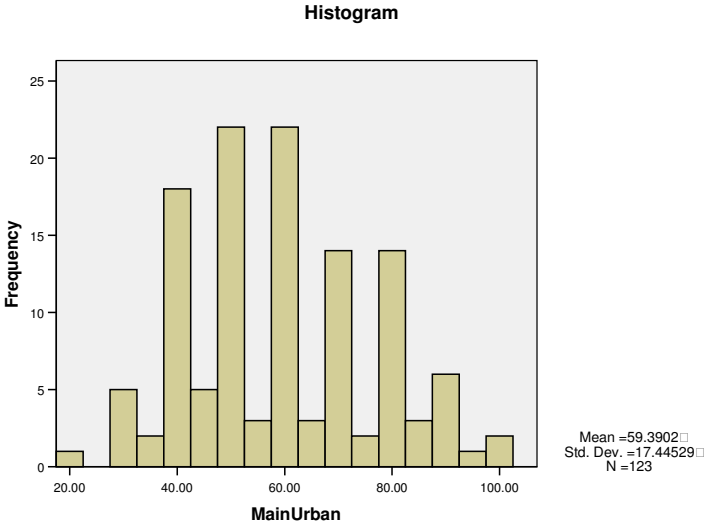
Normal plots for the speed groups

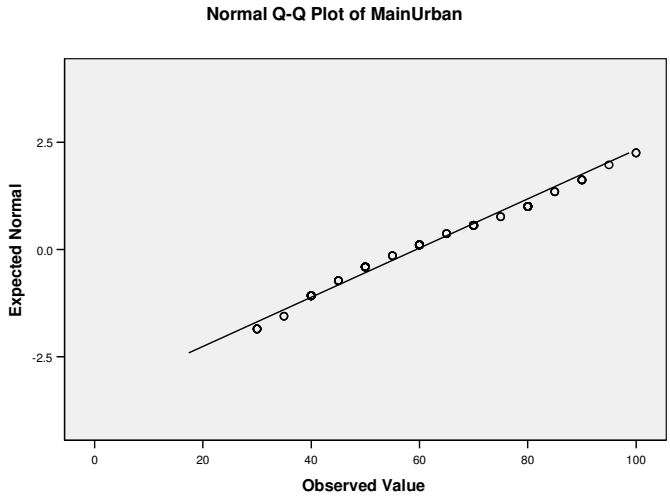


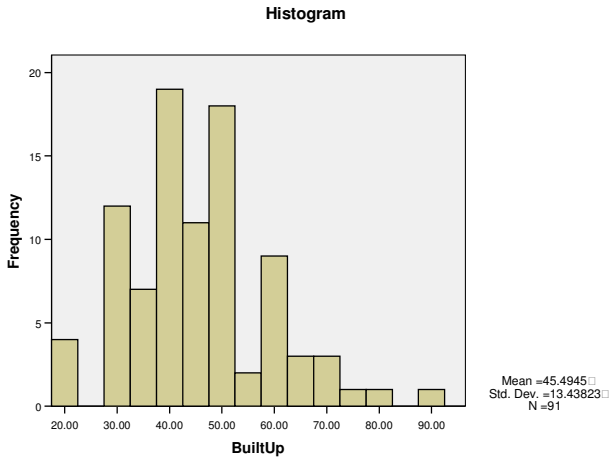







Histogram
Frequency
MainUrban
Mean =59.3902
Std. Dev. =17.44529
N =123


Normal Q-Q Plot of MainUrban
Expected Normal
Observed Value


Histogram
Frequency
BuiltUp
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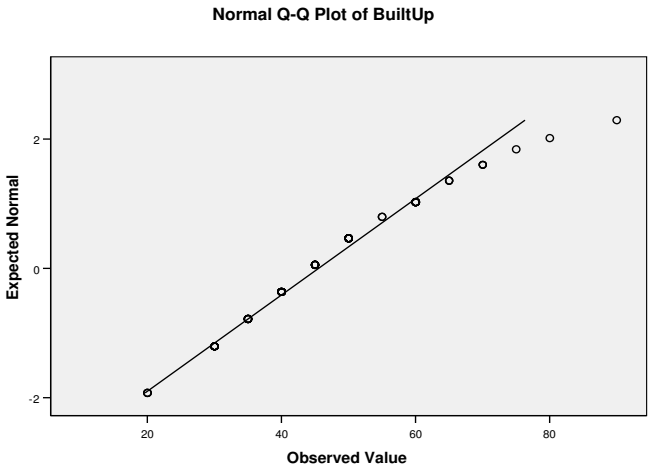
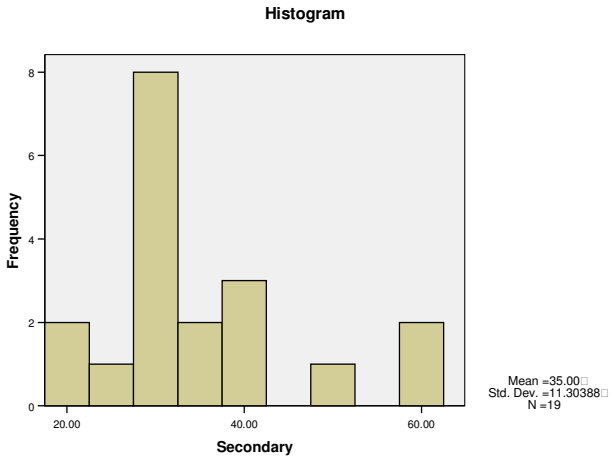
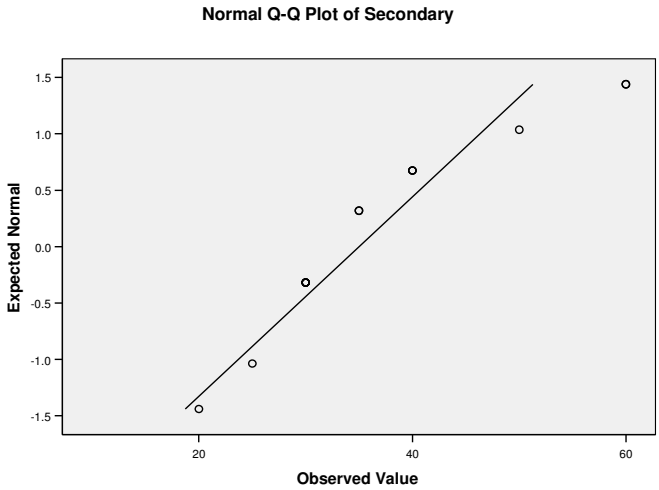
Std. Dev. =13.43823
N =91


Normal Q-Q Plot of BuiltUp
Expected Normal
Observed Value





Appendix 4

ANOVA output

Tests of Between-Subjects Effects					
Dependent Variable:Speed					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	129320.795[a]	3	43106.932	154.527	.000
Intercept	1138474.465	1	1138474.465	4081.131	.000
Road_type	129320.795	3	43106.932	154.527	.000
Error	143943.628	516	278.961		
Total	2690000.000	520			
Corrected Total	273264.423	519			

Tests of Between-Subjects Effects

Dependent Variable:Speed

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	129320.795[a]	3	43106.932	154.527	.000
Intercept	1138474.465	1	1138474.465	4081.131	.000
Road_type	129320.795	3	43106.932	154.527	.000
Error	143943.628	516	278.961		
Total	2690000.000	520			
Corrected Total	273264.423	519			

a. R Squared = .473 (Adjusted R Squared = .470)

Appendix 5

Results from Independent Sample t-tests

Independent Sample t-test for Main Road within Builtup-area and Outside of builtup area.

Group Statistics

	Groups	N	Mean	Std. Deviation	Std. Error Mean
MainRoad	1.00	170	84.8824	15.26834	1.17103
	2.00	17	78.5294	13.31877	3.23028

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MainRoad	Equal variances assumed	.860	.355	1.653	185	.100	6.35294	3.84350	-1.22978	13.93567

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
	Equal variances assumed	.860	.355	1.653	185	.100	6.35294	3.84350	-1.22978	13.93567
	Equal variances not assumed			1.849	20.448	.079	6.35294	3.43599	-.80434	13.51022

Independent Sample t-test for Main Urban Road within builtup-area and Outside of builtup area.

Group Statistics

	Groups2	N	Mean	Std. Deviation	Std. Error Mean
MU_road	1.00	122	59.0574	17.12053	1.55002
	2.00	84	46.0119	13.72667	1.49770

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MU_road	Equal variances assumed	6.700	.010	5.813	204	.000	13.04547	2.24405	8.62096	17.46998
	Equal variances not assumed			6.053	199.234	.000	13.04547	2.15538	8.79518	17.29576

Independent Sample t-test for Regional Roads within builtup-area and Outside of builtup area.

Group Statistics

	Groups3	N	Mean	Std. Deviation	Std. Error Mean
Regional	1.00	87	79.6552	16.33218	1.75099
	2.00	7	39.2857	7.31925	2.76642

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Regional	Equal variances assumed	3.704	.057	6.462	92	.000	40.36946	6.24707	27.96224	52.77668
	Equal variances not assumed			12.330	11.640	.000	40.36946	3.27399	33.21150	47.52742

Independent Sample t-test for Secondary Road within builtup-area and outside of builtup area.

Group Statistics

	Groups4	N	Mean	Std. Deviation	Std. Error Mean
Secondary	1.00	19	35.0000	11.30388	2.59329
	2.00	10	37.0000	11.83216	3.74166

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Secondary	Equal variances assumed	.042	.839	-.446	27	.659	-2.00000	4.48606	-11.20464	7.20464
	Equal variances not assumed			-.439	17.683	.666	-2.00000	4.55249	-11.57672	7.57672

Comparison of means between Main Road and Main Urban Road

Group Statistics					
	Road_type	N	Mean	Std. Deviation	Std. Error Mean
Speed	1.00	190	84.4211	15.40225	1.11740
	2.00	207	53.9614	17.30673	1.20290

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Speed	Equal variances assumed	5.341	.021	18.460	395	.000	30.45970	1.65001	27.21580	33.70360
	Equal variances not assumed			18.552	394.631	.000	30.45970	1.64181	27.23191	33.68749

Comparison of means between Main Road and Regional Road

Group Statistics					
	Road_type	N	Mean	Std. Deviation	Std. Error Mean
Speed	1.00	190	84.4211	15.40225	1.11740
	3.00	94	76.6489	19.06960	1.96688

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Speed	Equal variances assumed	7.772	.006	3.690	282	.000	7.77212	2.10600	3.62663	11.91760
	Equal variances not assumed			3.436	154.784	.001	7.77212	2.26212	3.30350	12.24073

Comparison of means between Main Road and Secondary Road

Group Statistics					
	Road_type	N	Mean	Std. Deviation	Std. Error Mean
Speed	1.00	190	84.4211	15.40225	1.11740
	4.00	29	35.6897	11.31719	2.10155

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Speed	Equal variances assumed	2.622	.107	16.363	217	.000	48.73140	2.97811	42.86168	54.60111
	Equal variances not assumed			20.474	45.530	.000	48.73140	2.38014	43.93908	53.52371

Comparison of means between Main Urban Road and Regional Road

Group Statistics

	Road_type	N	Mean	Std. Deviation	Std. Error Mean
Speed	2.00	207	53.9614	17.30673	1.20290
	3.00	94	76.6489	19.06960	1.96688

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Speed	Equal variances assumed	1.042	.308	-10.206	299	.000	-22.68758	2.22304	-27.06238	-18.31279
	Equal variances not assumed			-9.840	165.149	.000	-22.68758	2.30555	-27.23975	-18.13542

Comparison of means between Main Urban Road and Secondary Road

Group Statistics					
	Road_type	N	Mean	Std. Deviation	Std. Error Mean
Speed	2.00	207	53.9614	17.30673	1.20290
	4.00	29	35.6897	11.31719	2.10155

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Speed	Equal variances assumed	7.873	.005	5.517	234	.000	18.27170	3.31192	11.74670	24.79669
	Equal variances not assumed			7.546	48.643	.000	18.27170	2.42146	13.40468	23.13871

Comparison of means between Regional Road and Secondary Road

Group Statistics					
	Road_type	N	Mean	Std. Deviation	Std. Error Mean
Speed	3.00	94	76.6489	19.06960	1.96688
	4.00	29	35.6897	11.31719	2.10155

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Speed	Equal variances assumed	9.338	.003	10.967	121	.000	40.95928	3.73478	33.56529	48.35327
	Equal variances not assumed			14.230	80.045	.000	40.95928	2.87839	35.23115	46.68741

Appendix 6

Output tables from Closest Facility Analyses

Bethlehem Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
0	Abu Nujeim - AL Yamama Hospital	11	1	9799,0	11
9406	Ad Doha - Beit Jala Government Hospital	3	0	1751,0	3
8426	Ad Duheisha Camp - Beit Jala Government Hospital	2	0	1222,9	2
0	Al 'Asakira - Beit Jala Government Hospital	8	0	6098,5	8
1475	Al 'Aza Camp - Beit Jala Government Hospital	3	0	2322,8	3
0	Al A'zazima - AL Yamama Hospital	30	0	29929,2	30
0	Al Beida - Beit Jala Government Hospital	6	0	3080,2	6
0	Al Fureidis - Beit Jala Government Hospital	9	0	7215,0	9
52	Al Haddadiya - Beit Jala Government Hospital	14	0	10485,8	14
0	Al Halqum - AL Yamama Hospital	16	0	15528,0	16
0	Al Hujeila - Beit Jala Government Hospital	12	0	8636,1	12
0	Al 'Iqab - Beit Jala Government Hospital	10	0	7954,4	10
9426	Al Khadr - AL Yamama Hospital	3	0	1671,8	3
380	Al Khas - Beit Jala Government Hospital	10	0	7486,9	10
0	Al Khushna - Beit Jala Government Hospital	14	0	9879,3	14
976	Al Maniya - AL Yamama Hospital	15	0	15454,4	15
417	Al Manshiya - AL Yamama Hospital	17	0	15909,6	17
775	Al Ma'sara - AL Yamama Hospital	13	0	11570,7	13
10371	Al 'Ubeidiya - Beit Jala Government Hospital	14	0	11793,7	14
0	Ar Rawa'in - AL Yamama Hospital	27	0	26617,4	27
1401	'Arab ar Rashayida - AL Yamama Hospital	22	0	22460,2	22
3532	Artas - Beit Jala Government Hospital	2	0	1590,0	2
3604	Ash Shawawra - Beit Jala Government Hospital	13	0	9304,5	13
0	Ath Thabra - AL Yamama Hospital	9	1	7656,5	8
2538	'Ayda Camp - Beit Jala Government Hospital	4	0	2639,4	4
3826	Battir - AL Yamama Hospital	22	0	22290,6	6
10613	Beit Fajjar - AL Yamama Hospital	11	0	11704,6	11
5223	Beit Falouh - Beit Jala Government Hospital	9	0	6979,4	9
11339	Beit Jala - Beit Jala Government Hospital	4	0	2740,2	4
11927	Beit Sahur - Beit Jala Government Hospital	5	0	3323,3	5
1186	Beit Ta'mir - Beit Jala Government Hospital	10	0	6989,4	10
24367	Bethlehem - Beit Jala Government Hospital	4	0	1995,6	4
0	Bureid'a - Beit Jala Government Hospital	7	0	4286,2	7
3253	Dar Salah - Beit Jala Government Hospital	12	0	9549,6	12
0	Dhahrat an Nada - Beit Jala Government Hospital	6	0	3667,7	6
0	Fakht al Jul - Beit Jala Government Hospital	10	0	7788,7	10
0	Harmala - Beit Jala Government Hospital	8	0	6763,0	8
4628	Hindaza - Beit Jala Government Hospital	2	0	1146,8	2
5353	Husan - AL Yamama Hospital	18	0	19367,6	5

1438	Jurat ash Sham'a - AL Yamama Hospital	11	0	10900,1	11
0	Khallet 'Afana - AL Yamama Hospital	10	0	7493,7	10
0	Khallet al Balluta - AL Yamama Hospital	9	0	10033,2	9
392	Khallet al Haddad - AL Yamama Hospital	15	0	12602,3	15
558	Khallet al Louza - Beit Jala Government Hospital	9	0	4659,2	9
0	Khallet al Qaranin - Beit Jala Government Hospital	9	0	7416,0	9
0	Khallet Hamad - Beit Jala Government Hospital	5	0	3168,7	5
179	Khallet Sakariya - AL Yamama Hospital	10	0	10971,3	10
0	Khirbet ad Deir - Beit Jala Government Hospital	14	0	12074,2	14
0	Khirbet an Nahla - AL Yamama Hospital	9	1	7723,4	9
0	Khirbet Tuqu' - AL Yamama Hospital	14	0	14694,8	14
438	Kisan - AL Yamama Hospital	17	0	17673,0	17
661	Marah Ma'alla - AL Yamama Hospital	11	0	10651,2	11
1273	Marah Rabah - AL Yamama Hospital	17	0	16167,9	17
6584	Nahhalin - AL Yamama Hospital	14	0	15502,9	7
0	Rakhme - Beit Jala Government Hospital	6	0	4734,3	6
0	Ras al Wad - Beit Jala Government Hospital	9	0	6957,2	9
8565	Tuqu' - Beit Jala Government Hospital	16	0	13171,1	16
0	Umm al Qasseis - Beit Jala Government Hospital	10	0	7634,5	10
0	Umm 'Asla - Beit Jala Government Hospital	14	0	9844,3	14
911	Umm Salamuna - AL Yamama Hospital	10	0	10450,6	10
0	Wadi al 'Arayis - Beit Jala Government Hospital	17	0	13029,6	17
745	Wadi an Nis - AL Yamama Hospital	11	0	10804,0	11
1126	Wadi Fukin - AL Yamama Hospital	20	0	21936,7	8
0	Wadi Muhammad - AL Yamama Hospital	18	0	16237,5	18
1369	Wadi Rahhal - AL Yamama Hospital	8	1	6757,5	8
0	Wadi Umm Qal'a - Beit Jala Government Hospital	6	0	2980,4	6
6066	Za'tara - Beit Jala Government Hospital	11	0	8789,2	11

Hebron Governorate

Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
0	'Abda - Hebron Government Hospital	14	0	11557,3	13
0	Abu al 'Asja - Hebron Government Hospital	20	0	14726,3	11
0	Abu al Ghuzlan - Hebron Government Hospital	25	0	19078,7	16
0	Abu Suhweila - Hebron Government Hospital	27	1	25984,7	27
775	Ad Deirat - Hebron Government Hospital	15	0	13532,8	15
0	Ad Duweir - Hebron Government Hospital	13	0	9781,7	13
0	Ad Duwwara - Al Ahli Hospital	18	0	13218,9	11
28052	Adh Dhahiriya - Hebron Government Hospital	26	0	20138,5	18
0	Al A'lqa El Fouqa - Hebron Government Hospital	14	0	11606,3	14
7741	Al 'Arrub Camp - AL Yamama Hospital	10	0	11742,6	10
0	Al Baqqar - Al Ahli Hospital	12	0	7561,9	12
0	Al Bireh - Hebron Government Hospital	26	1	27045,9	24
2513	Al Burj - Hebron Government Hospital	29	1	28150,8	27
592	Al Buweib - Hebron Government Hospital	16	0	12136,7	15
503	Al Faqir - Hebron Government Hospital	21	0	20892,3	21

6380	Al Fawwar Camp - Hebron Government Hospital	10	0	8618,6	10
1245	Al Heila - Hebron Government Hospital	14	0	8906,9	12
0	Al Hijra - Hebron Government Hospital	7	0	6085,1	7
0	Al Jab'a - AL Yamama Hospital	16	0	17075,6	14
3647	Al Karmil - Hebron Government Hospital	21	0	18190,5	21
0	Al Khamajat - Al Ahli Hospital	9	0	6503,2	9
0	Al Kum - Hebron Government Hospital	18	0	14693,4	18
1877	Al Majd - Hebron Government Hospital	19	1	19534,0	19
0	Al Muntar - Hebron Government Hospital	14	0	12422,0	14
0	Al Muwarraq - Hebron Government Hospital	20	0	15466,6	20
0	Al 'Uddeisa - Al Ahli Hospital	20	0	14555,9	10
403	An Najada - Hebron Government Hospital	24	0	22865,3	24
327	'Anab al Kabir - Hebron Government Hospital	30	1	31802,6	26
0	Ar Rakeez - Hebron Government Hospital	25	0	22678,7	25
3198	Ar Ramadin - Hebron Government Hospital	33	1	34063,6	28
0	Ar Rifa'iyya - Hebron Government Hospital	14	0	12613,9	14
3850	Ar Rihiya - Hebron Government Hospital	10	0	8897,0	10
557	'Arab al Fureijat - Hebron Government Hospital	38	1	39748,7	27
19154	As Samu' - Hebron Government Hospital	20	0	18103,5	18
0	As Simiya - Hebron Government Hospital	23	0	20803,4	14
1876	As Sura - Hebron Government Hospital	14	0	11611,9	14
8590	Ash Shuyukh - Al Ahli Hospital	14	0	11288,3	7
0	At Tabaqa - Hebron Government Hospital	12	0	10931,5	12
318	At Tuwani - Hebron Government Hospital	21	0	20828,6	21
792	Az Zuweidin - Hebron Government Hospital	20	0	18510,5	19
19578	Bani Na'im - Hebron Government Hospital	15	0	9378,0	12
2111	Beit 'Amra - Hebron Government Hospital	14	0	9972,0	14
954	Beit ar Rush al Fauqa - Hebron Government Hospital	23	1	24193,5	23
363	Beit ar Rush at Tahta - Hebron Government Hospital	22	1	22916,2	22
7861	Beit 'Awwa - Hebron Government Hospital	19	0	17895,0	19
1764	Beit 'Einun - Al Ahli Hospital	16	0	12720,9	5
6361	Beit Kahil - Al Ahli Hospital	6	0	5115,4	6
2503	Beit Maqdum - Al Ahli Hospital	18	0	19520,1	18
310	Beit Mirsim - Hebron Government Hospital	27	1	26966,7	27
10611	Beit Ula - Al Ahli Hospital	16	0	12931,3	14
13207	Beit Ummar - AL Yamama Hospital	15	0	15080,2	11
0	Bir Musallam - Al Ahli Hospital	11	0	13631,7	11
0	Birin - Hebron Government Hospital	11	0	9010,1	9
0	Biyar al 'Arus - Hebron Government Hospital	12	0	9273,0	12
1557	Deir al 'Asal al Fauqa - Hebron Government Hospital	22	1	22030,6	22
541	Deir al 'Asal at Tahta - Hebron Government Hospital	21	1	21083,1	21
262	Deir Razih - Hebron Government Hospital	10	0	8484,9	10
6080	Deir Samit - Hebron Government Hospital	15	0	12860,0	15
625	Hadab al 'Alaqa - Hebron Government Hospital	19	0	13955,2	17
1870	Hadab al Fawwar - Hebron Government Hospital	7	0	6579,8	7
21571	Halhul - Al Ahli Hospital	5	0	3976,6	5
52	Hamrush - AL Yamama Hospital	17	0	14489,8	17

0	Haribat An Nabi - Hebron Government Hospital	24	0	26230,9	24
159038	Hebron (Al Khalil) - PRCS -Muhamad ali Muhtaseb Hospital	3	0	2162,3	3
869	Hitta - Al Ahli Hospital	25	0	14630,9	24
0	Humsa - Hebron Government Hospital	17	0	13724,7	17
0	Hureiz - Hebron Government Hospital	11	0	8605,9	11
18533	Idhna - Al Ahli Hospital	13	0	15579,5	13
1623	Imreish - Hebron Government Hospital	13	0	11153,1	13
0	'Irqan Turad - AL Yamama Hospital	16	0	15095,5	16
0	Iskeik - Hebron Government Hospital	20	0	14645,8	20
0	I'zeiz - Hebron Government Hospital	17	0	15308,6	17
243	Jala - AL Yamama Hospital	32	0	24538,3	28
0	Jurun al Louz - Al Ahli Hospital	21	0	15126,1	11
265	Khallet al 'Aqed - Hebron Government Hospital	16	0	12469,8	16
1377	Khallet al Maiyya - Hebron Government Hospital	17	0	13656,2	16
0	Khallet 'Arabi - Hebron Government Hospital	11	0	8739,5	11
1066	Khallet Salih - Hebron Government Hospital	20	0	17694,0	20
6488	Kharas - Al Ahli Hospital	20	0	11636,4	20
0	Khashem al Karem - Hebron Government Hospital	24	0	23390,3	24
0	Khirbet Bism - Hebron Government Hospital	9	0	9356,8	9
0	Khirbet Abu Hamid - Hebron Government Hospital	15	0	12146,7	15
257	Khirbet ad Deir - AL Yamama Hospital	29	0	22547,5	24
0	Khirbet al Hasaka - Al Ahli Hospital	5	0	3912,3	5
0	Khirbet al Kharba - Hebron Government Hospital	24	0	21562,8	22
0	Khirbet al Mantara - AL Yamama Hospital	20	0	15706,8	17
0	Khirbet Al Maq'ura - Hebron Government Hospital	24	0	21922,9	24
0	Khirbet ar Rahwa - Hebron Government Hospital	37	1	39502,1	26
93	Khirbet Asafi - Hebron Government Hospital	25	0	23216,7	24
0	Khirbet At Tabban - Hebron Government Hospital	27	0	23319,3	27
0	Khirbet At Tawamin - Hebron Government Hospital	25	0	25217,2	25
0	Khirbet Deir Shams - Hebron Government Hospital	27	0	20163,4	19
0	Khirbet Jamrura - Al Ahli Hospital	13	0	16187,3	13
0	Khirbet Mushrif - AL Yamama Hospital	26	0	21369,3	22
361	Khirbet Salama - Hebron Government Hospital	12	0	11792,7	12
0	Khirbet Sarura - Hebron Government Hospital	24	0	21986,6	23
0	Khirbet Shwaika - Hebron Government Hospital	31	0	22255,1	22
58	Khirbet Zanuta - Hebron Government Hospital	30	0	27910,2	18
0	Khurisa - Hebron Government Hospital	15	0	11235,1	14
3353	Khursa - Hebron Government Hospital	13	0	11525,3	13
0	Kureise - Hebron Government Hospital	15	0	10262,5	15
751	Kurza - Hebron Government Hospital	22	0	15778,5	13
0	Kuziba - AL Yamama Hospital	15	0	14485,6	15
4	Maghayir Al 'Abeed - Hebron Government Hospital	28	0	24054,4	28
447	Ma'in - Hebron Government Hospital	22	0	19367,4	22
209	Marah al Baqqar - Hebron Government Hospital	17	0	12896,8	17
4227	Nuba - Al Ahli Hospital	22	0	18494,5	20
0	Qafan al Khamis - Al Ahli Hospital	21	0	14818,9	14
1120	Qalqas - Hebron Government Hospital	9	0	5043,3	6

0	Qawawis - Hebron Government Hospital	23	0	22526,3	23
0	Qila - Al Ahli Hospital	23	0	17251,1	21
0	Qinan an Najma - Hebron Government Hospital	11	0	10246,0	11
0	Qinan An Namir - Al Ahli Hospital	24	0	16341,7	13
0	Qinan Jaber - Hebron Government Hospital	21	0	17207,9	21
0	Qurnet ar Ras - Hebron Government Hospital	16	0	11850,5	16
0	Rafada - Hebron Government Hospital	11	0	6613,2	11
0	Safa - AL Yamama Hospital	20	0	15388,7	16
17590	Sa'ir - Al Ahli Hospital	12	0	9470,4	9
0	Shamaliyyat Al Hawa - Al Ahli Hospital	15	0	11074,5	13
1512	Shuyukh al 'Arrub - AL Yamama Hospital	12	0	12830,5	12
833	Sikka - Hebron Government Hospital	20	1	18975,7	20
0	Somara - Hebron Government Hospital	26	1	28349,1	22
0	Suba - Al Ahli Hospital	18	0	17956,2	14
13028	Surif - AL Yamama Hospital	22	0	18641,2	16
10330	Taffuh - PRCS -Muhamad ali Muhtaseb Hospital	6	0	4781,7	6
13996	Tarqumiya - Al Ahli Hospital	14	0	10699,8	12
615	Tarrama - Hebron Government Hospital	10	0	7815,8	10
0	Tarusa - Hebron Government Hospital	14	0	11466,7	14
0	Tawas - Hebron Government Hospital	16	1	16110,2	16
69	Umm Al Butm - AL Yamama Hospital	18	0	18255,3	16
832	Umm Lasafa - Hebron Government Hospital	19	0	15012,5	19
45	Wadi al Kilab - Hebron Government Hospital	30	0	22054,6	21
0	Wadi ar Rim - Al Ahli Hospital	28	0	18606,0	18
0	Wadi as Sada - Hebron Government Hospital	15	0	11993,6	15
697	Wadi ash Shajina - Hebron Government Hospital	9	0	9144,2	9
126	Wadi 'Ubeid - Hebron Government Hospital	13	0	11766,2	13
0	Wadih - Hebron Government Hospital	15	0	12683,3	15
47446	Yatta - Hebron Government Hospital	15	0	13011,6	15
826	Zif - Hebron Government Hospital	10	0	7489,5	10

Jenin Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
200	'Aba - Al Razi hospital	6	0	3957,8	6
0	Ad Damayra - Al Razi hospital	11	0	9548,8	11
4961	'Ajja - Al Razi hospital	17	0	18458,2	17
2121	Al 'Araqa - Dr. Khalil Soliman Hospital (Jenin)	15	0	11394,9	15
456	Al 'Asa'asa - Al Razi hospital	17	0	19291,5	17
1138	Al 'Attara - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	22	0	16581,8	22
3337	Al Fandaqumiya - Al Razi hospital	19	0	21135,1	19
1031	Al Hashimiya - Dr. Khalil Soliman Hospital (Jenin)	11	0	8580,2	11
2022	Al Jalama - Al Razi hospital	9	0	7471,8	9
32	Al Jameelat - Al Razi hospital	6	0	4791,9	6
61	Al Jarba - Al Razi hospital	14	0	10568,7	14
4649	Al Judeida - Al Razi hospital	24	0	20254,7	24
499	Al Khuljan - Al Razi hospital	24	1	23004,4	24
43	Al Kufeir - Al Razi hospital	16	0	11493,0	16
0	Al Manshiya - Dr. Khalil Soliman Hospital (Jenin)	10	0	7020,8	10
170	Al Mansura - Al Razi hospital	11	0	11080,9	11
2375	Al Mughayyir - Al Razi hospital	17	0	11461,9	17
289	Al Mutilla - Al Razi hospital	19	0	13569,7	19
16075	Al Yamun - Dr. Khalil Soliman Hospital (Jenin)	12	0	10194,4	12
3622	'Anin - Dr. Khalil Soliman Hospital (Jenin)	18	0	17633,4	18
1838	'Anza - Al Razi hospital	16	0	16949,9	16
946	Ar Rama - Al Razi hospital	19	0	20562,7	19
0	'Arab as Suweitat - Al Razi hospital	3	0	1629,9	3
794	'Arabbuna - Al Razi hospital	14	0	12324,6	14
9734	Arraba - Al Razi hospital	13	0	11923,4	13
1959	'Arrana - Al Razi hospital	7	0	5874,1	7
68	As Sa'aida - Dr. Khalil Soliman Hospital (Jenin)	15	0	13819,4	15
1715	Ash Shuhada - Al Razi hospital	15	0	10655,7	15
363	At Tarem - Dr. Khalil Soliman Hospital (Jenin)	17	0	12493,0	17
2144	At Tayba - Dr. Khalil Soliman Hospital (Jenin)	19	0	16597,2	13
3597	Az Zababida - Al Razi hospital	13	0	9222,3	13
755	Az Zawiya - Al Razi hospital	21	0	19712,6	20
0	Barghasha - Al Razi hospital	11	0	9037,9	11
1420	Beit Qad - Al Razi hospital	8	0	6732,4	8
1282	Bir Al Basha - Al Razi hospital	9	0	7936,9	9
5578	Birqin - Dr. Khalil Soliman Hospital (Jenin)	7	0	4584,0	7
0	Dahiyat Sabah al Kheir - Al Razi hospital	6	0	4603,4	6
5468	Deir Abu Da'if - Al Razi hospital	10	0	8009,3	10
878	Deir Ghazala - Al Razi hospital	11	0	9748,2	11
356	Dhaher al 'Abed - Al Razi hospital	22	1	22879,6	22
2439	Fahma - Al Razi hospital	17	0	15492,9	17
362	Fahma Al Jadida - Al Razi hospital	14	0	12940,4	14
3402	Faqqu'a - Al Razi hospital	13	0	11382,8	13

415	Imreiha - Al Razi hospital	17	1	18172,5	17
8333	Jaba' - Al Razi hospital	20	0	21226,2	20
2345	Jalbun - Al Razi hospital	14	0	12541,4	14
1954	Jalqamus - Al Razi hospital	13	0	7662,2	13
38272	Jenin - Al Razi hospital	1	0	1047,6	1
10176	Jenin Camp - Dr. Khalil Soliman Hospital (Jenin)	3	0	1537,8	3
5051	Kafr Dan - Dr. Khalil Soliman Hospital (Jenin)	9	0	5933,7	9
1122	Kafr Qud - Dr. Khalil Soliman Hospital (Jenin)	10	0	7573,7	10
7226	Kafr Ra'i - Al Razi hospital	20	0	18270,4	20
0	Khirbet Abu 'Anqar - Al Razi hospital	14	0	12259,3	14
7	Khirbet Al Muntar Al Sharqiya - Al Razi hospital	22	0	22138,2	22
0	Khirbet Marah Ar Raha - Al Razi hospital	23	0	17000,8	23
47	Khirbet Mas'ud - Al Razi hospital	23	1	22667,6	23
0	Khirbet Sab'ein - Al Razi hospital	8	0	4751,9	8
55	Khirbet Suruj - Dr. Khalil Soliman Hospital (Jenin)	18	0	13614,5	18
2361	Kufeirit - Al Razi hospital	16	0	16148,1	16
0	Mantiqat al Heish - Al Razi hospital	19	0	14742,6	19
0	Mashru' Beit Qad - Al Razi hospital	10	0	8723,7	10
6825	Meithalun - Al Razi hospital	20	0	16239,5	20
1581	Mirka - Al Razi hospital	13	0	11397,0	13
2343	Misliya - Al Razi hospital	14	0	10568,6	14
691	Nazlat ash Sheikh Zeid - Al Razi hospital	18	0	18401,8	18
18837	Qabatiya - Al Razi hospital	8	0	7160,7	8
0	Qeiqis - Al Razi hospital	23	1	24095,8	23
3086	Raba - Al Razi hospital	20	0	15448,4	20
3081	Rummana - Dr. Khalil Soliman Hospital (Jenin)	15	0	13691,6	15
3991	Sanur - Al Razi hospital	18	0	14324,0	18
5685	Silat adh Dhahr - Al Razi hospital	20	0	22533,8	19
9246	Silat al Harithiya - Dr. Khalil Soliman Hospital (Jenin)	12	0	10158,1	12
730	Sir - Al Razi hospital	20	0	15024,2	20
4794	Siris - Al Razi hospital	23	0	19021,1	23
0	Tannin - Al Razi hospital	13	0	6940,4	13
234	Telfit - Al Razi hospital	16	0	12258,9	16
981	Ti'innik - Dr. Khalil Soliman Hospital (Jenin)	13	0	11371,7	13
901	Tura Al Gharbiya - Al Razi hospital	19	0	20575,4	19
170	Tura Ash Sharqiya - Al Razi hospital	18	0	19159,6	18
971	Umm at Tut - Al Razi hospital	11	0	5507,2	11
547	Umm Dar - Al Razi hospital	22	1	22284,5	22
0	Umm Qabub - Al Razi hospital	13	0	11237,7	13
403	Wad ad Dabi' - Al Razi hospital	6	0	4913,7	6
121	Wadi Du'oq - Al Razi hospital	10	0	9435,2	10
13384	Ya'bad - Al Razi hospital	16	0	16857,9	16
926	Zabda - Al Razi hospital	20	1	21236,8	20
1898	Zububa - Dr. Khalil Soliman Hospital (Jenin)	15	0	13419,8	15

Jericho Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
3934	Al 'Auja - New Jericho Hospital	15	1	17201,9	12
3546	Al Jiftlik - Al Wattani Hospital	27	1	33867,1	27
295	An Nabi Musa - New Jericho Hospital	9	1	8567,1	9
1188	An Nuwei'ma - New Jericho Hospital	7	0	6158,6	7
6851	Aqbat Jaber Camp - New Jericho Hospital	5	0	4318,4	5
1357	Az Zubeidat - Al Wattani Hospital	30	1	40121,8	30
8	Deir Hajla - New Jericho Hospital	9	1	10302,7	7
0	Deir Quruntul - New Jericho Hospital	6	0	4350,9	6
783	'Ein ad Duyuk al Fauqa - New Jericho Hospital	9	0	6232,6	9
0	'Ein ad Duyuk at Tahta - New Jericho Hospital	6	0	4220,9	6
3017	'Ein as Sultan Camp - New Jericho Hospital	5	0	4167,4	5
1029	Fasayil - New Jericho Hospital	21	1	25403,7	18
17515	Jericho (Ariha) - New Jericho Hospital	2	0	1299,5	2
193	Marj al Ghazal - Al Wattani Hospital	29	1	39459,2	29
683	Marj Na'ja - Al Wattani Hospital	31	1	41888,3	31

Jerusalem Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
9721	Abu Dis - Beit Jala Government Hospital	23	1	18658,2	8
15874	Al 'Eizariya - Beit Jala Government Hospital	23	1	18572,7	7
0	Al 'Isawiya - Al Makassed Islamic Charitable Hospital	4	0	3025,6	4
3805	Al Jib - Al-Goaba Geriattric Hospital	5	0	4154,4	5
2052	Al Judeira - Al-Goaba Geriattric Hospital	2	0	1570,9	2
626	Al Ka'abina (Tajammu' Badawi) - New Jericho Hospital	19	1	21928,5	7
2860	Al Qubeiba - Al-Goaba Geriattric Hospital	29	0	24846,2	11
233	An Nabi Samwil - Al-Goaba Geriattric Hospital	9	0	8147,7	7
10864	'Anata - Arab Medical Care specialized hospital	18	1	17704,5	7
18356	Ar Ram & Dahiyat al Bareed - Arab Medical Care specialized hospital	12	0	8755,1	4
650	'Arab al Jahalin - Beit Jala Government Hospital	21	1	16649,4	12
0	As Sawahira al Gharbiya - Al Makassed Islamic Charitable Hospital	13	0	6977,2	13
5229	As Sawahira ash Sharqiya - Beit Jala Government Hospital	18	1	15181,2	11
0	As Suwwana - Augusta Victoria Hospital	1	0	710,0	1
0	Ash Shayyah - Augusta Victoria Hospital	3	0	1537,3	3
0	At Tur - Al Makassed Islamic Charitable Hospital	2	0	916,0	2

0	Ath Thuri - Augusta Victoria Hospital	8	0	4665,7	8
3068	Az Za'ayyem - Al Makassed Islamic Charitable Hospital	3	0	1326,2	3
0	Bab as Sahira - St. Joseph Hospital	3	0	1425,7	3
3589	Beit 'Anan - Al-Goaba Geriattric Hospital	25	0	21820,2	14
1461	Beit Duqqu - Al-Goaba Geriattric Hospital	35	0	30708,0	11
0	Beit Hanina - Al-Goaba Geriattric Hospital	5	1	5266,3	5
966	Beit Hanina al Balad - Al-Goaba Geriattric Hospital	4	1	3955,1	4
629	Beit Ijza - Al-Goaba Geriattric Hospital	32	0	27956,9	8
1708	Beit Iksa - Al-Goaba Geriattric Hospital	9	1	8352,2	9
0	Beit Safafa - St. Joseph Hospital	9	0	8669,0	8
3505	Beit Surik - Al-Goaba Geriattric Hospital	32	0	27167,6	10
6129	Biddu - Al-Goaba Geriattric Hospital	30	0	25764,4	9
4343	Bir Nabala - Al-Goaba Geriattric Hospital	3	0	2315,6	3
5654	Hizma - Arab Medical Care specialized hospital	16	1	14892,9	8
2870	Jaba' - Arab Medical Care specialized hospital	13	0	10005,6	7
64	Jaba' (Tajammu' Badawi) - Arab Medical Care specialized hospital	13	1	10560,7	7
0	Jabal al Mukabbir - St. Joseph Hospital	15	0	13294,4	13
0	Jerusalem (Al Quds) - St. Joseph Hospital	4	0	3505,5	4
0	Kafr 'Aqab - Arab Medical Care specialized hospital	7	0	4830,1	7
328	Kharayib Umm al Lahim - Al-Goaba Geriattric Hospital	34	0	26634,9	18
1305	Mikhmas - Khalid Surgical Hospital	13	1	13461,5	10
1063	Qalandiya - Al-Goaba Geriattric Hospital	2	0	1420,2	2
7962	Qalandiya Camp - Arab Medical Care specialized hospital	9	0	6123,7	5
5823	Qatanna - Al-Goaba Geriattric Hospital	31	0	26964,6	13
2141	Rafat - Al Sheikh Zayed Hospital	7	1	4922,7	22
0	Ras al 'Amud - Al Makassed Islamic Charitable Hospital	6	0	2917,8	6
0	Sheikh Jarrah - St. Joseph Hospital	0	0	210,1	15
0	Shu'fat - St. Joseph Hospital	4	0	3406,3	4
0	Shu'fat Camp - Arab Medical Care specialized hospital	21	1	19980,3	5
0	Silwan - Augusta Victoria Hospital	5	0	3111,2	5
0	Sur Bahir - St. Joseph Hospital	10	0	11061,0	9
0	Wadi al Joz - Augusta Victoria Hospital	2	0	1289,9	2

Nablus Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
0	Ad Dawa - Al Wattani Hospital	18	1	16471,0	17,72
986	Al 'Aqrabaniya - Al Wattani Hospital	11	0	13993,7	11,25
2448	Al Badhan - Al Wattani Hospital	7	0	7860,0	7,00
0	Al Juneid - Al Itihad Hospital	3	0	2457,2	3,08
2427	Al Lubban ash Sharqiya - Al Sheikha Fatmeh Hospital	19	0	16678,7	6,58
0	Al Mas'udiya - Al Itihad Hospital	19	0	14265,4	18,53
298	'Ammuriya - Al Sheikha Fatmeh Hospital	23	0	20574,4	10,77
1522	An Naqura - Al Itihad Hospital	14	0	10674,2	12,80
1561	An Nassariya - Al Wattani Hospital	13	0	16958,6	13,34
8056	Aqraba - Al Wattani Hospital	17	1	16663,7	16,98
15	Ar Rajman - Al Wattani Hospital	16	1	15660,2	16,23
2356	As Sawiya - Al Sheikha Fatmeh Hospital	19	0	15078,3	8,24
2330	'Asira al Qibliya - Al Wattani Hospital	12	1	13961,0	12,42
7441	'Asira ash Shamaliya - St. Luke's Hospital (ev. Mission)	12	1	7567,9	11,89
11431	'Askar Camp - Al Wattani Hospital	3	0	2220,3	2,79
5538	'Awarta - Al Wattani Hospital	8	1	7624,7	7,52
2610	'Azmut - Al Wattani Hospital	4	0	3909,3	4,32
15007	Balata Camp - Al Wattani Hospital	2	0	1902,4	2,27
3432	Beit Dajan - Al Wattani Hospital	29	0	24047,7	11,06
10182	Beit Furik - Al Wattani Hospital	8	1	6656,8	7,83
1105	Beit Hasan - Al Wattani Hospital	15	0	19014,6	15,27
3102	Beit Iba - Al Itihad Hospital	7	0	4679,9	7,37
2778	Beit Imrin - Al Itihad Hospital	18	0	12335,2	17,14
1042	Beit Wazan - Al Itihad Hospital	5	0	3682,2	4,72
8941	Beita - Al Wattani Hospital	12	1	13524,3	11,75
2218	Bizzariya - Al Zakah Hospital	18	0	16077,6	17,83
2274	Burin - Al Wattani Hospital	9	1	9511,6	8,84
3615	Burqa - Al Itihad Hospital	21	0	13213,9	7,23
2179	Deir al Hatab - Al Wattani Hospital	5	0	4675,4	5,06
2423	Deir Sharaf - Al Itihad Hospital	11	1	8218,1	9,50
2067	Duma - Al Sheikha Fatmeh Hospital	20	0	16078,4	16,87
3918	'Ein Beit el Ma Camp - St. Luke's Hospital (ev. Mission)	9	1	5308,1	9,35
330	'Ein Shibli - Al Wattani Hospital	15	0	19347,1	15,35
2305	'Einabus - Al Wattani Hospital	9	1	10391,1	9,19
5486	Huwwara - Al Wattani Hospital	7	1	8532,4	6,99
498	Ijnisinya - Al Itihad Hospital	13	0	8075,7	12,63
756	'Iraq Burin - Al Itihad Hospital	5	0	4024,7	4,79
457	Jalud - Al Sheikha Fatmeh Hospital	8	0	7252,6	8,06
6131	Jamma'in - Al Wattani Hospital	15	1	15323,9	14,89
1380	Jurish - Al Sheikha Fatmeh Hospital	16	0	11531,2	16,10
2414	Kafr Qallil - Al Wattani Hospital	5	0	3146,0	4,74
0	kh Al Murassas - Al Wattani Hospital	14	0	16479,5	13,68
0	Khirbet Al Marajim - Al Sheikha Fatmeh Hospital	21	0	15883,0	17,68

0	Khirbet Sarra - Al Sheikha Fatmeh Hospital	9	0	7167,3	8,84
0	Khirbet Tall Al Ghar - Al Wattani Hospital	13	0	15307,2	12,51
0	Khirbet Tana - Al Wattani Hospital	22	1	14013,4	17,83
1728	Madama - Al Wattani Hospital	10	1	11543,8	9,58
2346	Majdal Bani Fadil - Al Sheikha Fatmeh Hospital	18	0	13586,6	18,42
124215	Nablus - Rafidia Hospital	4	0	2532,0	3,78
388	Nisf Jubeil - Al Itihad Hospital	16	0	11173,1	15,94
1117	Odala - Al Wattani Hospital	10	1	8359,6	9,89
1588	Osarin - Al Wattani Hospital	18	1	16802,2	16,18
7021	Qabalan - Al Sheikha Fatmeh Hospital	17	0	13698,7	12,11
2285	Qaryut - Al Sheikha Fatmeh Hospital	5	0	4852,8	5,43
1683	Qusin - Al Itihad Hospital	7	0	6361,6	7,41
4310	Qusra - Al Sheikha Fatmeh Hospital	15	0	10723,2	15,00
4138	Rujeib - Al Wattani Hospital	4	0	3340,1	4,00
2575	Sabastiya - Al Itihad Hospital	15	0	10249,1	15,03
4986	Salim - Al Wattani Hospital	6	0	5441,6	6,00
2523	Sarra - Al Itihad Hospital	9	0	6859,1	8,17
2781	Talfit - Al Sheikha Fatmeh Hospital	11	0	8048,1	10,60
26	Tall Al Khashaba - Al Wattani Hospital	22	1	18843,4	21,70
2339	Talluza - Al Wattani Hospital	11	0	11866,4	11,41
4278	Tell - Al Itihad Hospital	6	0	5167,4	5,89
2877	'Urif - Al Wattani Hospital	13	1	13331,7	12,55
100	Yanun - Al Wattani Hospital	17	1	15525,8	16,75
2052	Yasid - St. Luke's Hospital (ev. Mission)	23	1	17694,9	21,09
2809	Yatma - Al Sheikha Fatmeh Hospital	17	0	12634,9	11,41
44	Za'tara - Al Wattani Hospital	10	1	12704,7	10,17
1847	Zawata - Al Itihad Hospital	7	0	4505,3	6,91
2083	Zeita Jamma'in - Al Wattani Hospital	17	1	17135,1	16,89

Qalqiliya Governorate

Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
734	Al Funduq - UNRWA Qalqilia Hospital	14	1	17021,0	12
263	Al Mudawwar - UNRWA Qalqilia Hospital	19	1	16912,2	10
1137	An Nabi Elyas - UNRWA Qalqilia Hospital	6	1	5173,6	6
215	'Arab ar Ramadin al Janubi - Dr. Darwish Nazal Hospital.	2	0	1131,7	2
7594	'Azzun - UNRWA Qalqilia Hospital	9	1	9345,3	9
1596	Baqat al Hatab - Al Zakah Hospital	20	1	18314,0	19
981	Beit Amin - UNRWA Qalqilia Hospital	20	1	17947,9	12
614	Falamya - Al Zakah Hospital	16	1	16824,3	16
623	Far'ata - Al Wattani Hospital	17	1	18401,0	14
2086	Hajja - UNRWA Qalqilia Hospital	16	1	18755,0	14
2319	Immatin - UNRWA Qalqilia Hospital	17	1	19545,8	13
831	'Isla - UNRWA Qalqilia Hospital	9	1	7556,4	9
0	'Izbat Abu Hamada - Al Zakah Hospital	29	1	23062,6	28
306	'Izbat al Ashqar - UNRWA Qalqilia Hospital	20	1	17961,4	12
225	'Izbat at Tabib - UNRWA Qalqilia Hospital	7	1	6264,6	7

109	'Izbat Jal'ud - UNRWA Qalqilia Hospital	24	1	19879,5	7
701	'Izbat Salman - UNRWA Qalqilia Hospital	22	1	18358,1	7
2810	Jayyus - UNRWA Qalqilia Hospital	12	1	12629,9	12
2058	Jinsafut - UNRWA Qalqilia Hospital	15	1	16801,4	14
2133	Jit - Al Wattani Hospital	16	1	20152,1	10
831	Kafr Laqif - UNRWA Qalqilia Hospital	12	1	12987,6	11
2824	Kafr Qaddum - Al Wattani Hospital	19	1	24346,5	12
3807	Kafr Thulth - UNRWA Qalqilia Hospital	14	1	13374,8	13
434	Khirbet Sir - UNRWA Qalqilia Hospital	10	1	11094,2	10
40530	Qalqiliya - Dr. Darwish Nazal Hospital.	2	0	1811,5	2
2699	Sanniriya - UNRWA Qalqilia Hospital	17	1	16807,7	17

Ramallah Governorate

Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
1319	Abu Qash - Arab Medical Care specialized hospital	7	0	6417,4	7
5819	Abu Shukheidim - Arab Medical Care specialized hospital	12	0	10094,8	12
1959	'Abud - Ramallah Government Hospital	33	0	32064,0	23
2932	'Abwein - Al Sheikha Fatmeh Hospital	15	0	11161,7	13
1163	'Ajjul - Al Sheikha Fatmeh Hospital	24	0	21872,5	24
4713	Al Am'ari Camp - Arab Medical Care specialized hospital	5	0	2656,4	5
35910	Al Bireh - Khalid Surgical Hospital	2	0	986,8	2
7344	Al Jalazun Camp - Arab Medical Care specialized hospital	8	0	5753,7	7
1093	Al Janiya - Ramallah Government Hospital	20	0	15835,4	11
1387	Al Lubban al Gharbi - Ramallah Government Hospital	32	0	31964,6	26
0	Al Mazra'a al Qibliya - Arab Medical Care specialized hospital	12	0	10951,2	12
4225	Al Mazra'a ash Sharqiya - Al Sheikha Fatmeh Hospital	9	0	7267,2	9
1223	Al Midya - Ramallah Government Hospital	30	1	25111,0	23
2226	Al Mughayyir - Al Sheikha Fatmeh Hospital	11	0	9483,7	11
502	An Nabi Salih - Ramallah Government Hospital	31	0	28717,4	18
0	'Arura - Al Sheikha Fatmeh Hospital	17	0	14184,4	16
1364	At Tayba - Al Sheikha Fatmeh Hospital	13	0	14987,5	19
1276	At Tira - Al-Goaba Geriattric Hospital	8	0	10253,4	8
2134	'Atara - Al Sheikha Fatmeh Hospital	13	0	16047,4	13
708	Badiw al Mu'arrajat - Khalid Surgical Hospital	20	1	22874,0	18
5184	Bani Zeid - Al Sheikha Fatmeh Hospital	34	0	24943,6	23
7247	Beit Liqya - Al-Goaba Geriattric Hospital	15	0	16622,5	15
2584	Beit Sira - Al-Goaba Geriattric Hospital	15	0	18827,7	15
812	Beit 'Ur al Fauqa - Ramallah Government Hospital	29	0	22693,6	9
4109	Beit 'Ur at Tahta - Ramallah Government Hospital	24	0	18686,8	13
6395	Beitillu - Ramallah Government Hospital	24	0	19544,5	17
2014	Beitin - Khalid Surgical Hospital	6	1	4229,7	6
18575	Beituniya - Ramallah Government Hospital	2	0	878,1	2
1599	Bil'in - Ramallah Government Hospital	15	0	13021,6	15
4257	Bir Zeit - Arab Medical Care specialized hospital	11	0	9705,0	11
1315	Budrus - Ramallah Government Hospital	34	1	27258,8	27
579	Burham - Arab Medical Care specialized hospital	14	0	12304,7	14

1964	Burqa - Khalid Surgical Hospital	9	1	8009,2	20
3310	Deir Abu Mash'al - Ramallah Government Hospital	33	0	31254,1	24
0	Deir 'Ammar - Ramallah Government Hospital	22	0	18499,7	15
1724	Deir 'Ammar Camp - Ramallah Government Hospital	22	0	18087,0	15
1871	Deir as Sudan - Al Sheikha Fatmeh Hospital	19	0	22850,5	19
4937	Deir Dibwan - Khalid Surgical Hospital	9	1	7283,0	8
1945	Deir Ibzi' - Ramallah Government Hospital	8	0	6900,0	8
3746	Deir Jarir - Al Sheikha Fatmeh Hospital	9	0	11761,4	9
826	Deir Nidham - Ramallah Government Hospital	31	0	28277,1	21
1826	Deir Qaddis - Ramallah Government Hospital	24	0	19760,7	17
2723	Dura al Qar' - Arab Medical Care specialized hospital	10	0	7285,0	8
1473	'Ein 'Arik - Ramallah Government Hospital	5	0	4370,5	5
763	'Ein Qiniya - Ramallah Government Hospital	22	0	19930,7	8
0	'Ein Samiya - Al Sheikha Fatmeh Hospital	19	0	16657,6	19
668	'Ein Siniya - Arab Medical Care specialized hospital	11	0	8689,6	9
2819	'Ein Yabrud - Khalid Surgical Hospital	7	1	6132,5	7
0	Jammala - Ramallah Government Hospital	24	0	19349,3	17
139	Jibiya - Arab Medical Care specialized hospital	16	0	14081,7	15
1613	Jifna - Arab Medical Care specialized hospital	9	0	6874,3	8
697	Jilijliya - Al Sheikha Fatmeh Hospital	10	0	7963,8	8
1638	Kafr 'Ein - Al Sheikha Fatmeh Hospital	31	0	22015,8	22
2620	Kafr Malik - Al Sheikha Fatmeh Hospital	15	0	17633,2	15
3525	Kafr Ni'ma - Ramallah Government Hospital	12	0	10315,3	12
4898	Kharbatha al Misbah - Al-Goaba Geriattric Hospital	13	0	15337,5	13
2675	Kharbatha Bani Harith - Ramallah Government Hospital	20	0	16881,2	13
0	Khirbet Kafr Sheiyan - Arab Medical Care specialized hospital	7	0	4817,0	7
3456	Kobar - Arab Medical Care specialized hospital	15	0	13157,9	15
4778	Mazari' an Nubani - Al Sheikha Fatmeh Hospital	21	0	16324,1	20
4299	Ni'lin - Ramallah Government Hospital	27	1	22617,1	20
1136	Qaddura Camp - Arab Medical Care specialized hospital	2	0	1451,7	2
2741	Qarawat Bani Zeid - Al Sheikha Fatmeh Hospital	29	0	20029,4	24
4607	Qibya - Ramallah Government Hospital	31	0	27688,6	24
25812	Ramallah - Arab Medical Care specialized hospital	2	0	1052,3	2
2469	Rammun - Khalid Surgical Hospital	17	1	14490,3	17
2382	Rantis - Ramallah Government Hospital	34	0	31914,2	27
1563	Ras Karkar - Ramallah Government Hospital	18	0	14331,9	11
3574	Saffa - Ramallah Government Hospital	22	0	17246,3	16
793	Shabtin - Ramallah Government Hospital	24	0	21962,1	17
4227	Shuqba - Ramallah Government Hospital	26	0	24035,6	19
5756	Silwad - Al Sheikha Fatmeh Hospital	11	0	12817,6	11
359	Silwad Camp - Al Sheikha Fatmeh Hospital	9	0	11700,9	9
4922	Sinjil - Al Sheikha Fatmeh Hospital	5	0	3523,0	3
970	Surda - Arab Medical Care specialized hospital	5	0	3722,0	5
3512	Turmus'ayya - Al Sheikha Fatmeh Hospital	2	0	1140,3	2
575	Umm Safa - Al Sheikha Fatmeh Hospital	14	0	18808,1	14
606	Yabrud - Al Sheikha Fatmeh Hospital	10	0	11761,0	10

Salfit Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
4692	Az Zawiya - UNRWA Qalqilia Hospital	26	1	25386,3	21
7960	Biddya - UNRWA Qalqilia Hospital	21	1	21231,8	21
3194	Bruqin - Al Wattani Hospital	28	1	30554,9	26
0	Dar Abu Basal - Al Wattani Hospital	23	1	25598,1	22
3154	Deir Ballut - UNRWA Qalqilia Hospital	31	2	31759,9	25
3106	Deir Istiya - UNRWA Qalqilia Hospital	24	1	25841,8	21
1348	Farkha - Al Wattani Hospital	29	1	29845,0	20
3071	Haris - Al Wattani Hospital	23	1	24916,2	21
900	Iskaka - Al Wattani Hospital	20	1	20483,3	13
11	'Izbat Abu Adam - Al Wattani Hospital	24	1	27669,8	22
4496	Kafr ad Dik - Al Wattani Hospital	30	1	32150,1	27
223	Khirbet Qeis - Al Sheikha Fatmeh Hospital	24	0	17860,6	19
0	Khirbet Susa - Al Wattani Hospital	28	1	31008,2	26
3206	Kifl Haris - Al Wattani Hospital	25	1	21724,0	20
1967	Marda - Al Wattani Hospital	17	1	18325,1	17
1977	Mas-ha - UNRWA Qalqilia Hospital	24	1	23520,8	19
3752	Qarawat Bani Hassan - UNRWA Qalqilia Hospital	25	1	24138,0	24
1128	Qira - Al Wattani Hospital	22	1	19252,5	21
1837	Rafat - UNRWA Qalqilia Hospital	28	1	28398,2	3
8682	Salfit - Al Wattani Hospital	25	1	25465,5	16
2498	Sarta - UNRWA Qalqilia Hospital	24	1	23566,9	24
1600	Yasuf - Al Wattani Hospital	18	1	18572,0	14

Tulkarm Governorate					
Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
252	'Akkaba - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	24	0	19381,2	24
156	Al Haffasi - Al Zakah Hospital	14	0	10799,0	12
926	Al Jarushiya - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	3	0	2101,9	3
2558	Al Masqufa - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	6	0	4431,6	6
931	An Nazla al Gharbiya - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	14	0	13300,1	14
338	An Nazla al Wusta - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	17	0	16165,9	17
1503	An Nazla ash Sharqiya - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	19	0	17499,4	19
7274	'Anabta - Al Zakah Hospital	12	0	10249,2	12
536	Ar Ras - Al Zakah Hospital	10	1	9576,7	10
8969	'Attil - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	9	0	8010,5	9
6554	Bal'a - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	12	0	11389,5	12
4070	Baqa ash Sharqiya - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	16	0	14053,9	16
4956	Beit Lid - Al Zakah Hospital	15	0	14871,6	15
8179	Deir al Ghusun - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	6	0	5525,1	6
0	Dhinnaba - Al Zakah Hospital	7	0	3874,6	7
3076	Far'un - Al Zakah Hospital	7	0	5266,4	7
2644	Iktaba - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	3	0	1813,4	3

0	'Izbat Abu Khameish - Al Zakah Hospital	12	0	9272,1	12
0	'Izbat al Khilal - Al Zakah Hospital	14	0	7334,2	14
0	'Izbat Shufa - Al Zakah Hospital	7	0	5663,2	7
401	Kafa - Al Zakah Hospital	6	0	4047,3	6
1446	Kafr 'Abbush - Al Zakah Hospital	18	1	15797,3	18
4043	Kafr al Labad - Al Zakah Hospital	14	0	12181,6	14
2406	Kafr Jammal - Al Zakah Hospital	14	1	14608,9	14
0	Kafr Rumman - Al Zakah Hospital	14	0	12518,0	14
1109	Kafr Sur - Al Zakah Hospital	10	1	10708,8	10
1070	Kafr Zibad - Al Zakah Hospital	14	1	13502,0	14
0	Khirbet at Tayyah - Al Zakah Hospital	4	0	2974,2	4
291	Khirbet Jubara - Al Zakah Hospital	7	0	6783,0	7
260	Kur - Al Zakah Hospital	13	1	13690,2	13
0	Nazlat Abu Nar - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	15	0	13458,5	15
2316	Nazlat 'Isa - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	16	0	14482,6	16
6430	Nur Shams Camp - Al Zakah Hospital	6	0	4568,7	6
8323	Qaffin - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	18	0	16766,1	18
1792	Ramin - Al Zakah Hospital	22	0	16501,4	15
754	Saffarin - Al Zakah Hospital	11	0	11864,8	11
2906	Seida - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	20	0	17169,6	20
2177	Shufa - Al Zakah Hospital	11	0	10899,5	10
0	Shwaika - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	0	0	111,7	0
50912	Tulkarm - Al Zakah Hospital	1	0	851,6	1
10560	Tulkarm Camp - Al Zakah Hospital	3	0	1668,3	3
2831	Zeita - Dr. Thabet Thabet Martyr Hospital (Tulkarem Hosp)	13	0	11644,6	13

Tubas Governorate

Pop.	Route	Time Sc.2 (min)	Checkpoints	Total Distance (m)	Time Sc. 3 (min)
100	Al 'Aqaba - Al Wattani Hospital	25	0	24130,9	25
145	Al Farisiya - Al Wattani Hospital	32	0	42409,5	32
355	Al Malih - Al Wattani Hospital	31	1	30617,9	31
6275	'Aqqaba - Al Razi hospital	19	0	14274,4	19
523	Ath Thaghra - Al Wattani Hospital	20	0	20694,5	20
1569	Bardala - Al Wattani Hospital	38	0	49687,9	38
1114	'Ein el Beida - Al Wattani Hospital	37	0	48294,3	37
5474	El Far'a Camp - Al Wattani Hospital	14	0	14055,2	14
202	Ibziq - Al Razi hospital	29	0	19371,4	29
294	Kardala - Al Wattani Hospital	39	0	49728,9	39
127	Khirbet Humsa - Al Wattani Hospital	22	0	28199,2	22
0	Khirbet Tell el Himma - Al Wattani Hospital	38	0	48695,9	38
677	Ras al Far'a - Al Wattani Hospital	15	0	14898,3	15
43	Salhab - Al Razi hospital	23	0	16398,5	23
10345	Tammun - Al Wattani Hospital	20	0	20178,8	20
2385	Tayasir - Al Wattani Hospital	22	0	22023,2	22
15480	Tubas - Al Wattani Hospital	18	0	18521,3	18
2616	Wadi al Far'a - Al Wattani Hospital	10	0	11462,5	10

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