



**An-Najah National University
Faculty of Engineering
Urban Planning Department**

**Graduation Project 2
" Nablus as a Transit city"
"Converting Nablus City into a Transit Oriented City"**

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Abstract

Transit oriented development is an approach that sets criteria to develop cities and countries in an environmental and social aspects. The first part of this report provides a general view of transit oriented development and transit oriented communities. summarizes TOD definition, history, standards, principles, and benefits and bad impacts. It also provides some information on public transportation in general and in Palestine in specific. Moreover, it describes the planning and design of a transit oriented community with its components and features. Planning and design includes both detailed and general guideline.

The second part of the project provides a full comprehensive diagnosis for the city of Nablus by studying the current situation of transportation with the importance of the city. The diagnosis provides information about the importance of Nablus city and its effects and influence on West Bank. Also, it provides information about roads, topography, land use, and demography. After the diagnosis, analysis was made to find the shortage in service and the needs. A short strategic plan that provides the main aims, goals, and strategies was prepared. Its main needs are : Equity, Stewardship, Integration, Accountability, Residential Diversity, Mix of Commercial, Usable Open Space, Complete Streets, and Intermodal Connectivity. The resulted issues that need to be solved are: A need for traffic calming and safety requirements in residential areas. Low accessibility levels between residential neighborhood. Air and noise pollution on main roads. A shortage in parking. The diversity in vehicles classification on each route. A need for various routes for regional services. High traffic congestion on main connecting roads. Streets landscaping needs. The unsuitable terminals locations. City topography transportation issues. The absence of public transportation. And Car dependency. The vision statement is : Vision statement: A PROSPEROUS SUSTAINABLE MODEL FOR DEVELOPING A TRANSIT ORIENTED CITY.

After the strategic analysis, a transit plan was prepared by preparing many ideas and choosing the most suitable one. The transit plan was prepared to achieve high accessibility that the residents and the un-residents do not need to ride many transit modes. The plan consists of bus routes (main routes that lie from east to west to serve main areas on Rafedia street and Haifa and Faisal streets, local streets that serve local residential areas) that arrive to main areas in the city with three main routes and other local routes that are connected with the main routes. Each route has specific stops with timetables that show the times that each bus arrive the stops. Main routes are divided into two types, some stop only on main stops and others stop every 700 meters. Other than the master plan, there are the terminals for buses, the project also provides detailed designs for these terminals with specifying the roads that each route use to reach the terminals. The outside terminals are also planned in the given places by Nablus municipality with the roads that each route have. This project can convert Nablus city from car dependency to public transportation dependency by providing the ease of movement, each person can ride the nearest local bus to reach the main routes that reach all main activities such as Najah Academy, Old campus, Hijjawi college, and other activities. However, the project does not only focus on transit, but also it provides a full view on the high quality of life enhancement. This is provided by preparing a detailed plan for the central business district. The CBD's plan changed some roads from vehicular roads into pedestrian roads and gave some roads new movement direction. Pedestrian zones are the focus point in the CBD planning to make it more

pedestrian friendly by providing special roads for pedestrian and lanes for bicycles. Also, the project will provide a plan for terminals locations and private cars parking. These parking and terminals will have detailed designs given by this project. In this project, there are three categories in chapter 4 that conclude the main needed results. These categories are used in ordering the final results in chapter 5.

الإهداء

بسم الله الرحمن الرحيم

(وَقُلْ اَعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ)

اهدي مشروعني هذا الى الله ورسوله صلى الله عليه وسلم

كما اهديه الى من قال فيهم الله تعالى : " وَقَضَىٰ رَبُّكَ أَلَّا تَعْبُدُوا إِلَّا إِيَّاهُ وَبِالْوَالِدَيْنِ إِحْسَانًا "

الى رمز العطاء والبر والاحسان إلى من علمني العطاء بدون انتظار .. إلى من أحمل اسمه بكل افتخار .. أرجو من الله أن يمد في عمرك لتري ثماراً قد حان قطافها بعد طول انتظار وستبقى كلماتك نجوم أهدي بها اليوم وفي الغد وإلى الأبد.. الى قدوتي في العلم والاجتهاد

"والدي العزيز"

الى الصدر الحاني.. والقلب الكبير.. إلى ملاكي في الحياة .. إلى معنى الحب وإلى معنى الحنان والتفاني .. إلى بسملة الحياة وسر الوجود .. إلى من كان دعائها سر نجاحي وحنانها بلسم جراحي إلى أعلى الحباب .. الى من سهرت الليالي وشاركتني لحظات تعبي ودراستي

"أمي الحبيبة"

الى هدية الله.. إلى الروح التي سكنت روحي.. الى من اعطى حياتي معنى اخر.. الى من كان سنداً في جميع مراحل هذا المشروع وقدم العون دون تعب.. الى من قال به الله تعالى " وَاللَّهُ جَعَلَ لَكُمْ مِنْ أَنْفُسِكُمْ أَزْوَاجًا "

"خطيبي الغالي"

إلى سندي وقوتي وملذي بعد الله.. إلى من آثرني على أنفسهم.. إلى من علموني علم الحياة.. إلى من أظهروا لي ما هو أجمل من الحياة

"إخوتي"

إلى الأخوات اللواتي لم تلدهن أمي .. إلى من تحلو بالإخاء وتميزوا بالوفاء والعطاء إلى ينابيع الصدق الصافي إلى من معهم سعدت ، وبرفقتهم في دروب الحياة الحلوة والحزينة سرت إلى من كانوا معي على طريق النجاح والخير

"اخواتي وصديقاتي"

الشكر والتقدير

لابد لنا ونحن نخطو خطواتنا الأخيرة في الحياة الجامعية من وقفة نعود إلى أعوام قضيناها في رحاب الجامعة مع أساتذتنا الكرام الذين قدموا لنا الكثير بأذنين بذلك جهودا كبيرة في بناء جيل الغد لتبعث الأمة من جديد...

وقبل أن أمضي، أقدم أسمى آيات الشكر والامتنان والتقدير والمحبة إلى الذين حملوا أقدس رسالة في الحياة...

إلى الذين مهدوا لنا طريق العلم والمعرفة...

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و الى كل من: الدكتور عماد دواس والدكتور ايهاب حجازي والدكتور خالد الساحلي والدكتور فادي حسونة على كرمهم في تقديم المساعدة

و بلدية نابلس على توفيرها المعلومات اللازمة

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كما اشكر جميع زملائي وزميلاتي على جميع النصائح والمساعدات العلمية والعملية

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Chapter one: INTRODUCTION

1.1 Overview

Transit oriented development is an approach to deal with transportation planning of a community to decrease car ownership and increase the reliance on public transportation. This leads to a decrease in traffic flow. Which in turn decreases air pollution, time delays, oil consumption, noise, and streets defects. Transit cities are mainly composed of many levels of transit stations with high densities around them. Also, land uses around stations need to be mixed. There are many design guidelines for transit cities, such as pedestrian crossroads, tree strips, colors, elevations, ramps, and many other detailed and general guidelines. Also, there are many TOD principles and standards. Some of them are: the city needs to enhance walkability and bikeability, the density near stations needs to be high, different roads types need to be connected to enhance accessibility. Palestinian cities have some privacy when planning for transportation. Because of many reasons. One main reason is cities forms that are specified by Israeli powers and natural topography.

1.2 Existing Problem

Palestinian cities suffer from serious traffic problems. Nablus city is one of the most active cities in Palestine, and because of its typology and its form, it has many traffic problems that lead to many disasters every day.

1.3 Research Question

The project's research questions are:

- What is a transit oriented city? And what are the transit city parameters?
- What is the importance of Nablus city, what are Nablus city's features?
- How will transit Nablus city be, what are its main details and designs?

1.4 Objectives and Motivations

The main goal of this study is to set a methodological framework for Palestinian cities to enhance high quality of life by building a model for sustainable cities depending on transit oriented development.

Other objectives:

- To solve traffic congestion on Nablus city's roads
- To make life easier when visiting Nablus city
- To decrease environmental impacts in Nablus city
- To gain more knowledge on transportation planning and smart growth

1.5 Public transportation in Palestine

In Palestine, transport sector is a single mode system, all movements, people and goods, depend on road transportations inside and outside the west bank. The existing infrastructure has been damaged by Israeli military. This makes it in need of considerable improvement. Land transportation in the west bank includes two transport sections, the road networks and public and private internal transport. The road network is divided into main, regional, local, and bypass roads.. The ministry of transport is the responsible for organizing the internal transport. It issues regulations to control the traffic and promotes safety. The total length of roads in Palestine is 6874 km they are divided as following: 936 km of main roads, 782 km regional roads, 4150 local roads, 974 km bypass. The statistics of ministry of transport indicate that there are 9139 public cars, 909 public buses, 128 companies for renting cars, 459 taxi offices, and 97 public transport companies. Private cars have a rate of 67.0% then the commercial ones which comprise 17.8%, then public cars (shared-taxis or taxis) which have a rate of 7.4%. This sector faces a lot of problems. For example, the buses are outdated (more than 30 years in service. There is no rail nor air transportation in Palestinian areas, in the past, there was a railway called Hejaz railway which linked Palestine with ottoman and Hejaz areas. There was also two airports one is Qalandya airport and the other is Yasir Arafat international airport in Gaza strip.(Reema 2011)

1.6 Study area

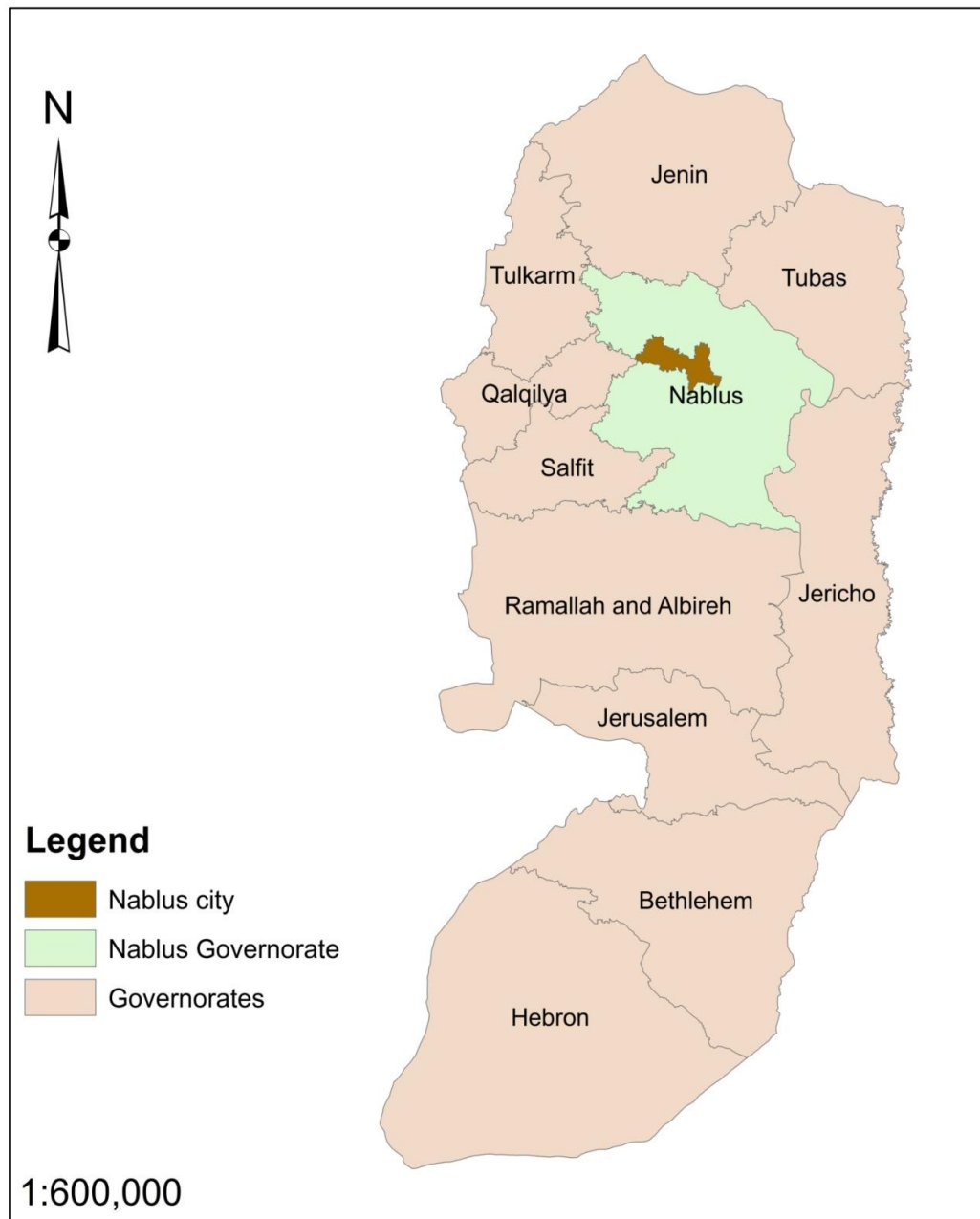
Physical profile for Nablus city:

Nablus area: Nablus city lies in a strategic position at a junction between two ancient commercial roads; one linking the coast to the Jordan valley, the other linking Nablus to the Galilee in the north, and the Negev to the south through the mountains. The entire Nablus district is 605 square kilometers, while Nablus city is 28.57 square kilometers. Nablus is surrounded by mountains on all sides. The length of the mountain chain is about 65 km from north to south. Its width is about 55 km from west to east. Ebal, the northern mountain, is the highest peak in this chain at 940 meters, while Gerizim, the southern mountain, is 881 meters high. The city lies along the narrow and fertile valley between the two mountains.

Nablus city Location:

Nablus governorate which an area of 605 km² is located in the northern part of West Bank, approximately 65 kilometers north of Jerusalem. Nablus city is located in the north western part of the governorate connected to the boundaries of Qalqilyah governorate boundaries as shown in map (1).

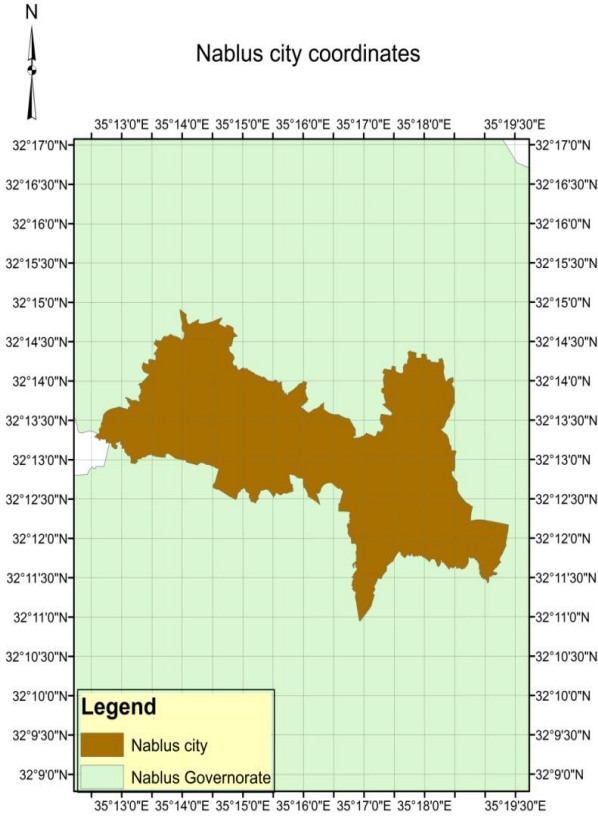
West Bank governorates



Map 1 Nablus governorate location

The city of Nablus was founded in 72 CE by Romans. By 480 CE Christianity was flourishing in Nablus and by the end of 6th century, Nablus was considered a major site in Holy Land. Arab Islamic rule that came shortly afterwards led to the city being dubbed "Little Damascus". The 19th century brought with it economic prosperity for this area with traditional industries including the production of olive oil soap and cotton processing. Trade expanded toward new frontiers of Trans Jordan, Egypt and Syria, establishing the area as a manufacturing and agricultural heartland. Nablus continued to be a city of economic importance in the 20th century for Palestinians (OCHA, 2005). The historic Old City of Nablus is filled with important cultural and religious sites. Such sites included 9 historic mosques, 18 Islamic monuments, Ayyubid mausoleum and a 17th-century church. Cultural sites include Ottoman-era structure including two major market places, Turkish bath house, olive-oil soap factories and over two thousand historic houses and places (www.nablus.org). Visible Roman ruin also lie outside the Old City and Roman-era aqueduct system runs under the city, part of which had recently been preserved by the Nablus Municipality and opened for visitors. There are also a few monuments within the Old City dating back to the Byzantine era and Crusader period (OCHA, 2005).

Nablus city is located in 32.2203° N, 35.2789° E as map (2) shows.

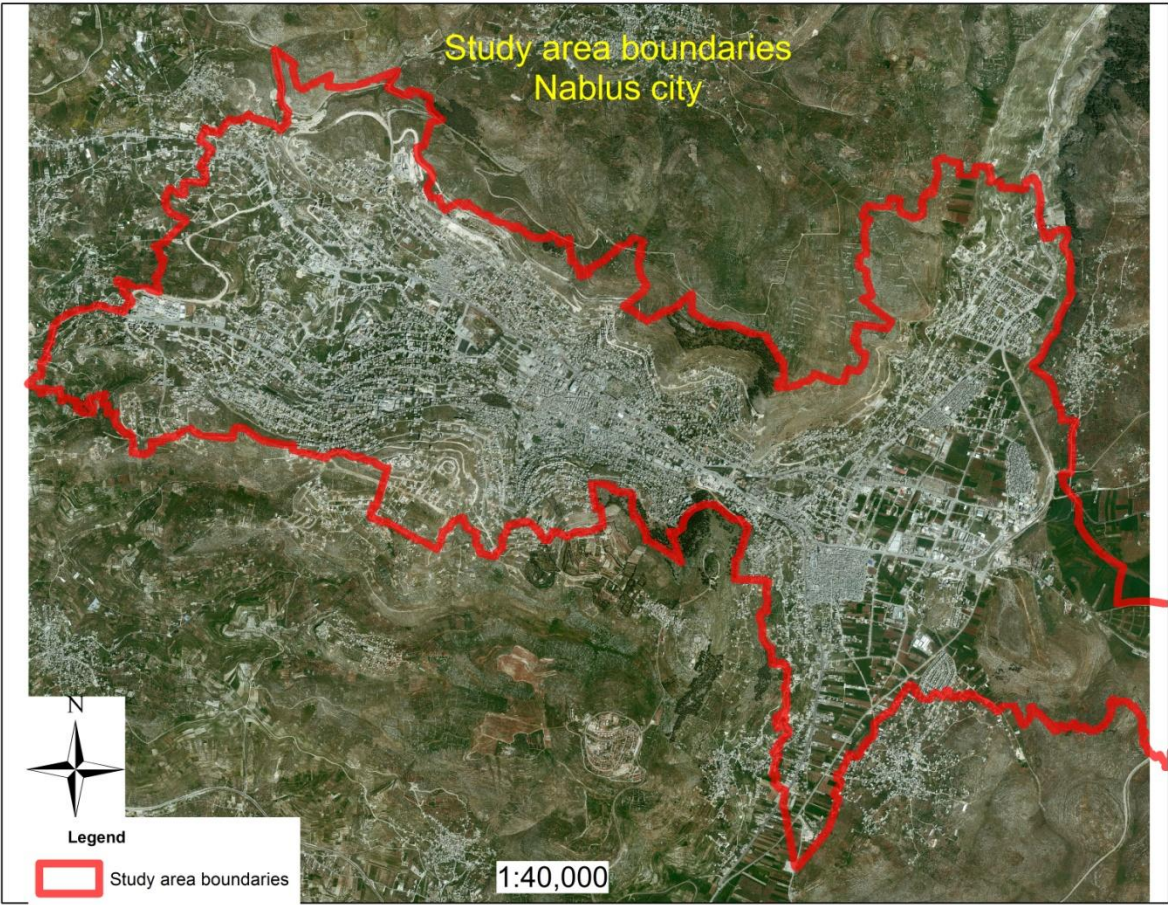


Map 2 Nablus city coordinates

During the beginning of the British Mandate, one weekly train was operated from Haifa to Nablus via Afula and Jenin. The railway was destroyed during the 1948 Arab–Israeli War, and the route of the line bisected by the Green Line.

The main Beersheba–Nazareth road running through the middle of the West Bank ends in Nablus, although thoroughfare of local Arabs is severely restricted. The city was connected to Tulkarm, Qalqilya and Jenin by roads which are now blocked by the Israeli West Bank barrier. From 2000 until 2011, Israel maintained checkpoints such as Huwwara checkpoint which effectively cut off the city, severely curtailing social and economic travel.^[95] From January 2002, buses, taxis, trucks and private citizens required a permit from the Israeli military authorities to leave and enter Nablus. Since 2011, there has been a relaxation of travel restrictions and the dismantlement of some checkpoints.

Study area boundaries are the master plan boundaries for Nablus city as shown in map (3)



Map 3 Study area Nablus city

1.7 Project importance

The importance of this project will be outlined in the resulted buses routes plan for the city of Nablus which is expected to decrease the traffic volumes on main roads which will in its turn enhance high quality of life. Also, in pedestrian friendly planning for the city CBD and the parking management. This project will be the first in its type because it deals with planning the city to become a transit city that respects environment.

1.8 Report Organization

This report is arranged as following: Section 1 introduces an introduction with the problem and the research questions of this report. Section 2 presents the study background. Section 3 presents the study area diagnosis and data collection. Section 4 presents analysis and strategic planning. Section 5 presents plan preparation and detailed planning.

Chapter two: LITERATURE REVIEW

2.1 General information:

Transit oriented community, what are transit oriented communities, , and what are their components, standards, principles, and trends. What is transit oriented development?? " What is a transit oriented city? And what are the transit city parameters?"

2.1.1 Transit oriented cities definition and history,

The current urban expansion occurring in cities, especially in large cities, is leading to long distances for people to travel every day, in order to reach the places of work, shopping, etc. This is now resulting in high rates of car ownerships. As the number of cars increases in each city, the congestion on roads also increases, leading to air pollution, economic losses, time delays, and various negative effects. Therefore, a need for intelligent solutions arise. These effects can develop to make dangerous urban problems, so that people can't live in the city anymore. One of the suggested solutions for urban transportation problems is the smart growth. Smart growth can be defined as *"a range of development and conservation strategies that help protect our natural environment and make our communities more attractive, economically stronger, and more socially diverse."*(Edmonton 2015) .Smart growth can be achieved in several aspects. One of these aspects is to transfer a community to become a transit oriented community. So, what is a transit oriented community? Transit-oriented communities are places that are planned to rely less on automobile by increasing density, mixed use buildings, pedestrian safety enhancement, and mobility management.(Translink ca 2011) They do not lack private vehicles. They only have multi-transportation modes. Which means that the rider has different choices to travel from one place to another. Each type of these modes is connected with others so that people can use different modes in one trip, like walking, biking, and riding a taxi. This is needed to be supported by concentrating shops, houses, and employment along a network of walkable and bikeable streets. (Edmonton 2015). The beginning of transit was in eighties of the last century, the first person talked about it was Calthrope in his book "the new American metropolis" in 1993, a student of the environmental sustainability movement, he developed TOD to address the ecology of communities. It was generally defined as "a mixed-use community that encourages people to live near transit services and to decrease their dependence on driving." It was a theory that cared much about social aspect of the community. (Estate et al. 2009)

2.1.2 Transit oriented community standards and principles

From the definition above, there are many standards and principles should be considered while planning a transit oriented community. TOD standards are summarized in eight main concepts of transit cities. They are: developing neighborhoods that promote walking, as walking is the healthiest transport modes, giving priority for cycling on motorized transport modes,

design streets and blocks to be dense, concentrate development in areas of good public transport, designing areas to be mixed use areas, increasing density near the stations and corridors, decreasing commutes within regions, and planning for parking and managing its needs. Other than these standards, there are many principles that should be followed when planning a transit oriented community, the most important principles are: transit vision statement and public participation. Other principles are: develop the area around, plan for parking, design the area around to be a livable place, make retail development market driven "not transit driven", plan the uses to be mixed-use buildings and allow for variety and complexity, depend on buses, encourage people from different economic levels to live around transit stations, and engage corporate.(Dunphy et al. 2003). Also, consider the time needed to plan great places, put programs for spaces use, invest in maintaining spaces, plan public spaces for human needs, consider safety as an important aspect in planning, create connections between spaces, design streets to be pedestrian friendly by designing sidewalks and crosswalks, and integrate transit and transit facilities into the urban pattern (Jacobson & Forsyth 2008). Many other features needed to be available in the transit oriented cities, these are: mixed use development, high quality pedestrian crossings, narrow streets, tapering of buildings as they become more distant from the public transport node, and reduced amounts of parking for personal vehicles.(Ali & Abdela 2012) **High quality transit, parking and car use management, centres and vibrant ground floors, public spaces, and collective identity are also needed.(Dunphy et al. 2003).** The main elements should be available in a transit city are: enhanced environment and mobility, suburban areas that can be alternatives for living, revitalization of public, public safety, public recreation areas. (Ali & Abdela 2012)

Another thing is that, there are three main terms needed to be understood in transit oriented development other than standards and principles. These terms are the 3ds which are: density, diversity and design. Density is meant to have high densities near the transit stations. Diversity is the mixed uses around transit stations in order to decrease distances. Design is the approach to design the nearby areas to be pedestrian and friendly. Moreover, there are some trends that push transit oriented development forward. These trends are: environment, demography, traffic, and economy (Ali & Abdela 2012). Also, there are many secondary factors affect the ability of transit oriented development to stimulate land use. The main factor is the policies of local government that provide guidelines for site design, zoning around stations, and agencies. The strong institutions, some individual politics, supportive communities, transit services, available developable land, real estate markets, and parking management are other important factors that affect TOD.(Ali & Abdela 2012)

2.2 Advantages and disadvantages

How does TOD affect the city, whether negatively or positively, and who is responsible for achieving tocs? And what is public transportation? What are the specifications of Palestinian cities? “forms, types”

If a city is converted into a transit city according to TOD principles and standards efficiently, the city will benefit greatly. The benefits of TOD is that it increases transportation choices, decreases auto trips and personal transportation costs, enhances easy access to daily needs, improves health through increased physical activity, increases transit ridership and revenue, more efficient use of infrastructure like sewers and other services, reduces air pollution and energy use, and revitalization of neighbourhoods, reduces rates of vehicle miles travelled (VMT) and helps relieve traffic congestion shorter commutes, enhances public safety, decreases infrastructure costs, attracts younger populations, conserves resources, land and open space, encourages walking, increases property values, and promotes healthier lifestyles (Illinois Regional Transportation Authority 2011). On the other hand, TOD has some bad impacts on cities. TOD can increase the costs of housing in the area of development, because the area will be rehabilitated by specifying different uses in each building which increases the demand on houses by different social classes. This increase in demand increases the costs, then it affects the low-income people who were living in the development area. In the other hand, it can benefit these low-income people because it decreases the distances for the workers to reach their employment centres. Also, there are many challenges can be faced when implementing TOD in cities. These challenges may be in transport and land use development which can be summarized by speed and scale. Challenges in planning and procedures which are: regulatory framework and coordination between stakeholders. Challenges in economy and market which can be the financial risk or high initial investment costs. And cultural challenges: public resistance and negative attitudes towards high densities around transit stations, or environmental and physical challenges like noise and contaminated sites.(Ali & Abdela 2012)

Different community agencies are responsible in the TOD process, these are called TOD stakeholders which are the following: local government is responsible for regulatory framework development, public-private cooperation, and operating local jurisdictions. Transit agencies are also stakeholders in TOD process, they offer transit services, coordinate with residents and private partnership, plan in an integrated aspect for transportation. There is also community groups who are responsible for organizing local residents and business participation. Businesses, residents, central and regional government, and developers also play an important role in TOD process.

2.2.2 Public transportation modes

Public transportation modes are the main component of any transit city, and converting a city into a TOC requires different transportation modes. Public transportations are various and different. Different modes can be found in each community and people switch from one to another depending on the purpose of the trip or the required place. Public transport vehicles are: taxis, buses, trains, trams, boats, and planes. Taxis are vehicles to hire people from one point to another according to the passenger demand, they can hire 4 passengers but not 4 trips at the same time. Taxis can be one of the following: private hire vehicles, taxi buses that have multi stops and multi-independent passengers, limousines which are specialized for operation by pre-booking, and public hire which are licensed for hiring people throughout communities. As for buses, omnibus, multi bus, or auto bus, They are vehicles that carry large numbers of people. They have specific route to run on, and sometimes run on a schedule. Each bus type serve for specific distance. Most of buses types charge a fare such as city transit buses and inter-city transit, while others do not charge a fare such as school buses. Trains consist of a series of vehicles run along a rail track. There are many types of trains which are: commuter, intercity, and high-speed rail, tram and light rail, freight train, rail cars, and rapid transit.(Org n.d.) There are two important terms in public transportation. They are: interchanges and timetables. Interchanges are places where riders switch from one transport to another. Timetables are schedules provided by operators to enable passengers plan their trips, they are often supplemented by maps and fare schemes.

2.3 TOD planning:

How should transit oriented cities be designed and planned? " What are the main transit components a Palestinian transit city should contain?"

2.3.1 Transit oriented cities design,

In order to achieve the required standards mentioned before, transit city`s streets should be designed to enhance safety for all types of users in different ages, by designing streets with crossing, sidewalks, and stops. They should be with narrow lanes and slow designs. Bike and pedestrian access should be considered also when designing and planning by providing wide sidewalks curbs, signs, bike lanes, safe parking, and Wheelchairs passages. Security and safety should be enhanced by lighting and street visibility for all users. And Public spaces are an important component in transit stations, they are useful for residents and visitors, these public spaces should be attractive, comfortable, and accessible. Community participation is also needed her to find the community needs in order to have a successful transit oriented city. Parking demand and supply studies are to be analyzed in the study area to provide suitable places for parking with access to enhance mobility and accessibility between private cars and public transit. Innovative parking management is required here. Parking is not only for cars, but also for bicycles. So, parking is needed to be effectively managed. The block size should be small enough for quick pedestrian access. Land uses are to be managed and planned carefully, because uses around stations work together to enhance required density and diversity. The land

use mix includes also residential mix, by providing a broad range of housing types. The streets should be designed with connections, a grid network is needed here. These connections are to be accessed by surrounding areas. Barrier-free access are needed to attract people to navigate the transit station. And there are transportation facilities to be planned and designed, which are, taxis, busses, rail, bikes, stations, and stops. The stops and stations are to be concentrated in the centre. (Council 2006)

2.3.2 Transit oriented cities morphology

So, transforming a city into a transit oriented city depends mostly on planning public transportation in a way that encourages residents and visitors to rely more on transit than on private vehicles. Public transportation needs suitable stations allocation relevant to station type. The streets around transit station should be surrounded by primary and secondary streets. Primary streets are to be used by main transit vehicles traveling between main stations. Secondary streets are used by secondary vehicles to connect surrounding areas with the station, vehicles on secondary streets can be taxis, minibuses, or private cars. Figure (1) shows streets around transit station and how transit and people reach the required station.

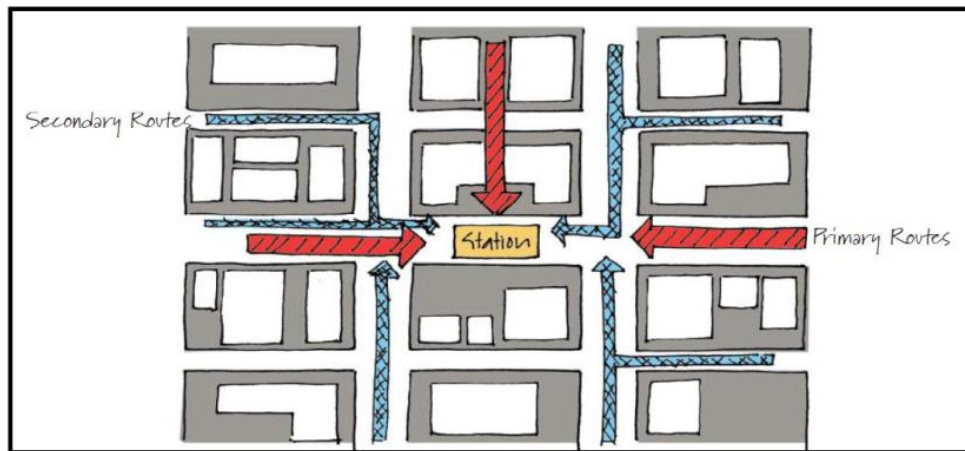


Figure 1 Streets around transit station

Moreover, parking design should enhance safety for pedestrians by providing crossings, specific entrance, and green elements. The location of parking should be located to minimize conflict with pedestrian. Figure (2) shows the green strips in parking and walking and cars access.

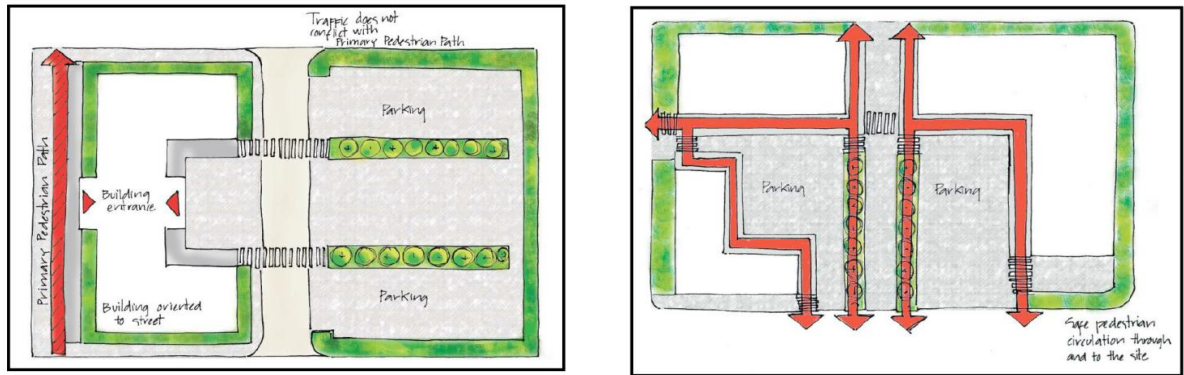


Figure 2 Parking design

In order to plan TOCs, there are three TOD scales needed to be understood. These scales are, regional, corridor, and station area level. These three scales should be coordinated. Figure (3) shows the three scales of tod planning.

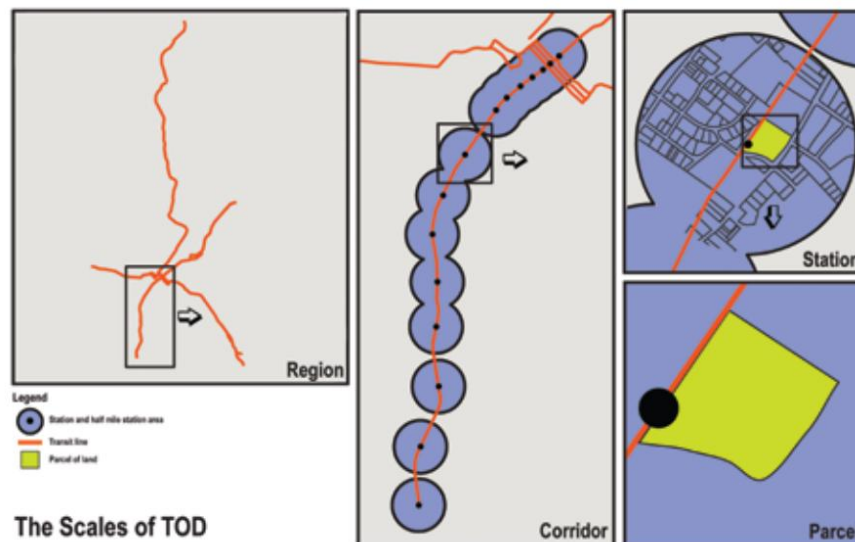


Figure 3 TOD scales

In addition, three main components in transit oriented cities form the requirements of planning for transit cities. Stations, corridors, and circulation. Stations are the places of interchanges between transit modes, stations are divided into local, major, and regional stations. Station area is divided into three divisions. They are, transit core which is a quarter mile area around the station, transit neighbourhood which is half a mile area extending beyond transit core, and transit supportive area which extends beyond transit neighbourhood with half a mile area. As shown in figure (4) that shows the areas around stations and allocation.

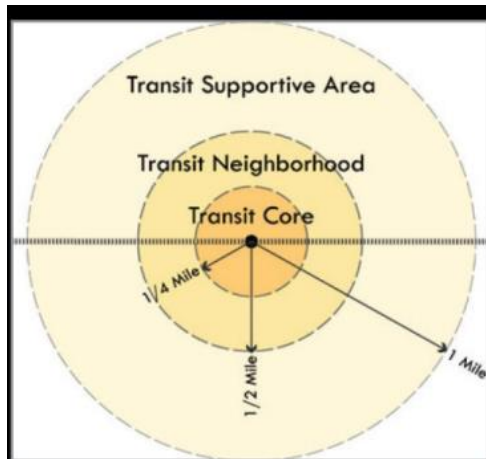


Figure 4 areas around stations

The first very important component is circulation. Circulation forms in transit oriented cities are classified into three categories, local circulation, major circulation, and global circulation. These components are shown in figure (5) that shows the roads and stations classifications in transit oriented city and how the local roads are connected together, then they are connected with collective roads which are connected to arterial road that is connected to the regional road. This shows the hierarchy in roads from the local level to regional level.

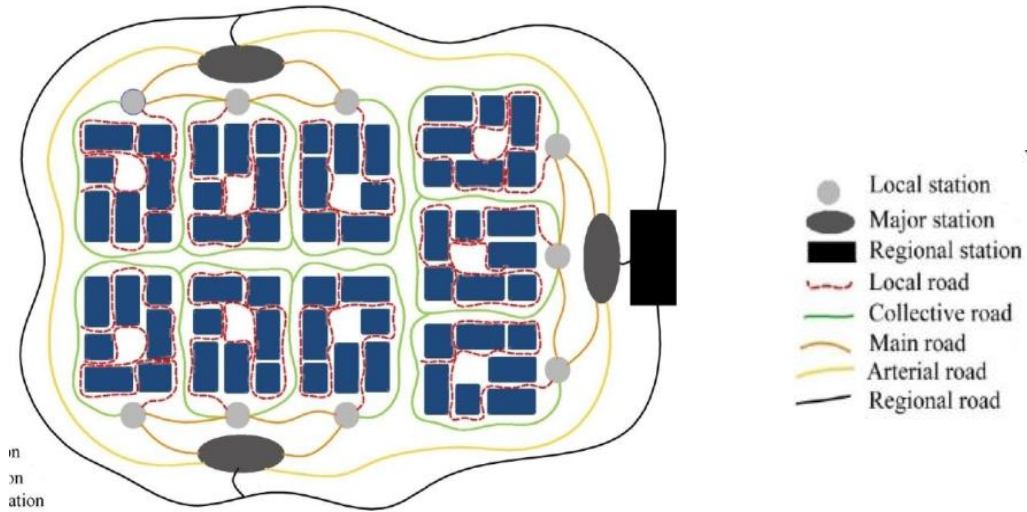


Figure 5 Circulation forms

For the first level of circulation, Local circulation is the circulation that connects dwellings with neighbourhoods within one district. This grade of circulation has the following characteristics: in this level of circulation, we deal with district level, each district is divided into many neighbourhoods. Collective street serves the district with stations within specific distances. The passenger travels by walking from dwellings to stations and then travels by a local public transportation to transit between the rest neighbourhoods. The vehicles used in this level can be taxis, minibuses, or private cars. All these vehicles stop only on neighbourhood stations which are local stations. Figure (6) shows the relationship between stations. Each local station is located in a neighbourhood and connected with the nearby station with roads and corridors, they can be connected by steps from each one to the second or at a specific station they meet with all other stations.

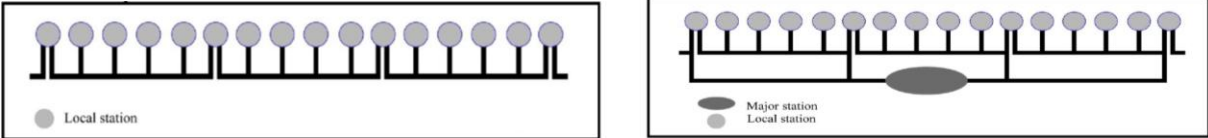


Figure 6 the complete trips of between neighborhoods circulation (local circulation)

And for the second level, major circulation, in this level of circulation the passenger is called regional passenger and stations are major stations. The passenger travels from local stations to major station using different vehicles types. Then he takes transit from the major station to travel to another district station. Public taxis, microbuses, minibuses, and private vehicles are the vehicles types that can be used in this level. Figure (7) shows the relationship between stations in major circulation. The relationship is explained by grouping all local stations in each neighbourhood into one group and connected directly with major stations that are connected together by main roads that collect transit from major stations into arterial roads.

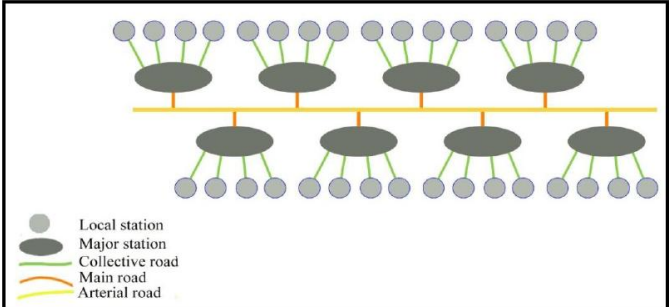


Figure 7 major circulation

The third level, regional circulation (global circulation), this level connects districts with regional stations that serve the city as a whole, these stations may connect the city parts or the city with surrounding villages and communities. The regional passenger arrives to the regional station by global transportation modes. Transportation means can be minibuses (8 – 10 seats), minibuses (24 seats), buses (48 seats), private vehicles, or trains. Figure (8) shows the relationship between stations in regional circulation. Regional stations are connected by roads that connect major stations with regional ones.

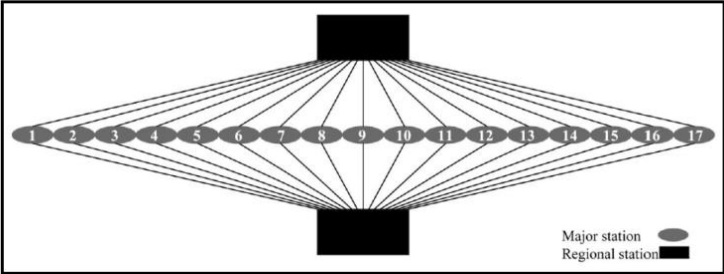


Figure 8 regional circulation

Streets relationships with stations is as figure (9) shows. It shows how the central business district is connected with activity centres by transit corridors with stations allocated between them.

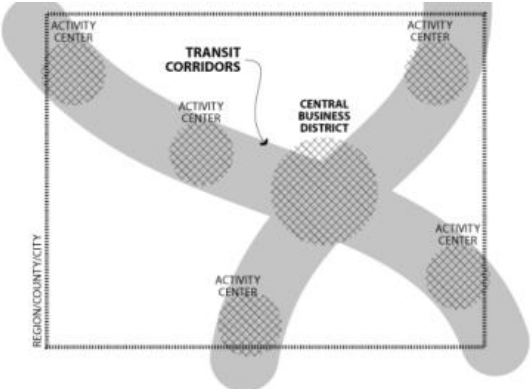


Figure 9 relationship between transit stations

For the second important component, transit station can be a bus stop, streetcar, or rails whether intercity, commuter, heavy, or light rails. Distances between stations differ from transit type to another. Figure (10) shows the required distance between commuter or heavy rail stations is 5 to 15 miles, while the distance between light rail stations is 1 to 2 miles, and for busses it should be from 1/2 to 1 mile. This means that in the same distance, the number of stations for busses is higher than for rails. If rails are the suitable transit mode in a city, then the number of switches between stations is lower than when busses are the transit mode.

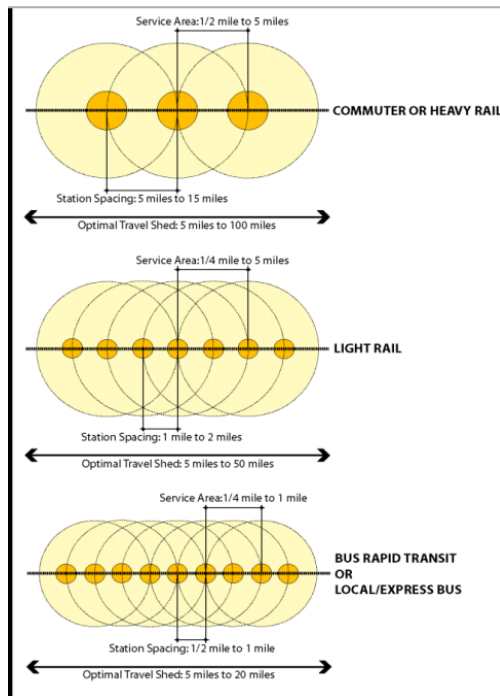


Figure 10 stations distribution

And the third component, transit corridors, are the area surrounding stations along transit lines that are walkable. Corridors are defined differently according to the transit mode. For example, for light and heavy rails, corridors are a half mile radius around rail stations. While for streetcar stations, the corridor is three blocks on each side of station. Corridors are classified in three types. Destination connector connectors link residential neighbourhoods to multiple activity centres, commuter corridors generally serve only one major activity centre – typically the central business district, and district circulator facilitate movement within an “activity node”.(Centre for Transit-Oriented Development 2011)

2.4 Case studies:

2.4.1 Case study (1): (Goltsman et al. N.d.)

Denver city in Colorado, united states. Denver city is a great example of transit cities. The council prepared plans for transit stations and corridors. The city contains light rail in west corridor, gold corridor, southwest corridor, southeast corridor, and i-225 corridor. Commuter rail in east corridor, north corridor, and us 36 corridor. Bus rapid transit goes to the north western part of the city. It has 32 major stations, and 9 corridors. Figure (11) shows Denver's transit plan



Figure 11 Denver's city transit plan (City and County of Denver 2006)

Other examples of transit oriented cities: in Latin America: Guatemala City, Guatemala. In North America: San Francisco Bay Area, New Jersey, Vancouver, Ontario, in Asia and Oceania: Hong Kong, in Europe: Paris, France.

2.4.2 Case study (2): (Ali & Abdela 2012)

This case study is about making Gaza city a model for transit oriented cities in Palestine. It shows the methodology for TOD. As a beginning, the project started by data collection stage. Data collected are classified into two resources. The first are Preliminary resources: collected through questionnaires, semi-structured interviews, and computerized stimulation tools that make spatial analysis. The second are Secondary resources: such as research papers, thesis, books, journals, reports, statistics and web pages. Then, in the second stage, the city was analyzed using Depth map and GIS applications. Depth map was used to make space syntax analysis for roads, in this theory, spaces are broken into components to be analyzed and represented as maps of colors that describes the integration and connectivity. They used two space syntax analytical approaches. These are integration which measure how many turns are needed to be made to reach from a street segment to all other street segments in the network, using shortest paths. And connectivity which measures distances. They divided transportation into three categories, public transportation, private transportation, and pedestrians. The aim was the allocation of major and local transit stations. They found which roads have the highest values in integration and connectivity so that they can decide where to allocate major and local stations. Then they used GIS application with many layers of population, buildings, and streets to specify the exact location of each station. The allocation of station had many criteria to follow according to population and transit needs, criteria are: vacant parcels, streets integration, streets connectivity, streets width, universities campuses, services building and institutions, population density, and influence: This methodology resulted in figure (14) that shows the criteria used in the allocation of stations.

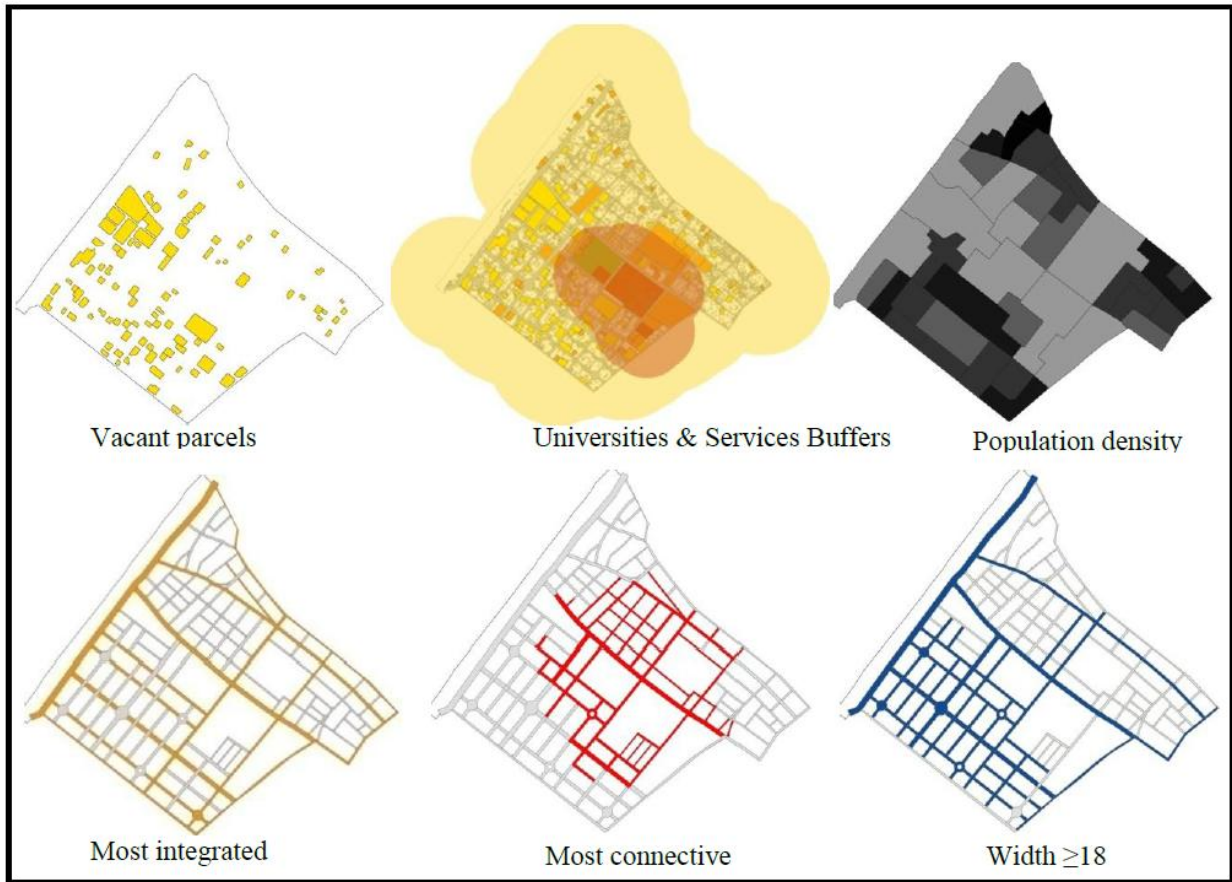


Figure 14 criteria used in station allocation

The final result was to allocate four major stations as figure (15) shows. And 19 local stations as figure (16) shows.



Figure 15 major stations allocation

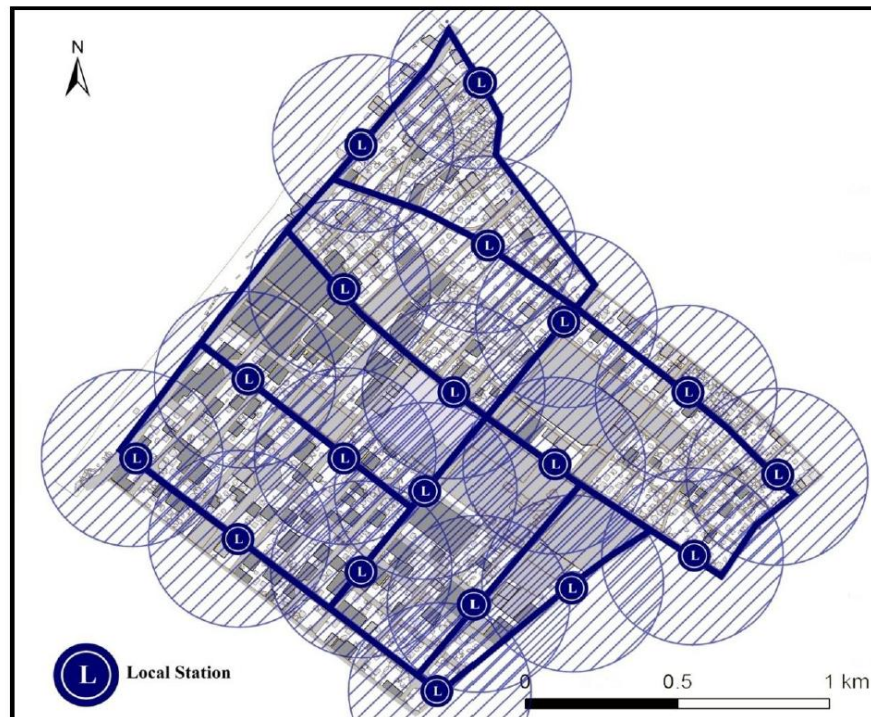


Figure 16 local stations allocation

Chapter three: Study area diagnosis and data collection

3.1 Nablus city importance: "Why Nablus city for the project!!"

3.1.1 The importance of Nablus city at the National level:

Nablus city has a large scope of influence " as it is one of the largest and important cities in Palestine" that includes the total area and all communities in the northern region of the West Bank as it forms the main urban system in this region. The region includes Nablus, Qalqilyah, Tulkarem, Jenin, Tubas, and Salfit governorates. The city gained its importance due to many factors (geographical location and historical, political, and economic importance) that led to the city transformation into a commercial and an administration centre. It is to be said that the city historical administrative boundaries were not the same during different periods (British, Jordaian, Israeli). Nowadays it has an influence on about 1120.491 person which means a 39.14% of West Bank residents.

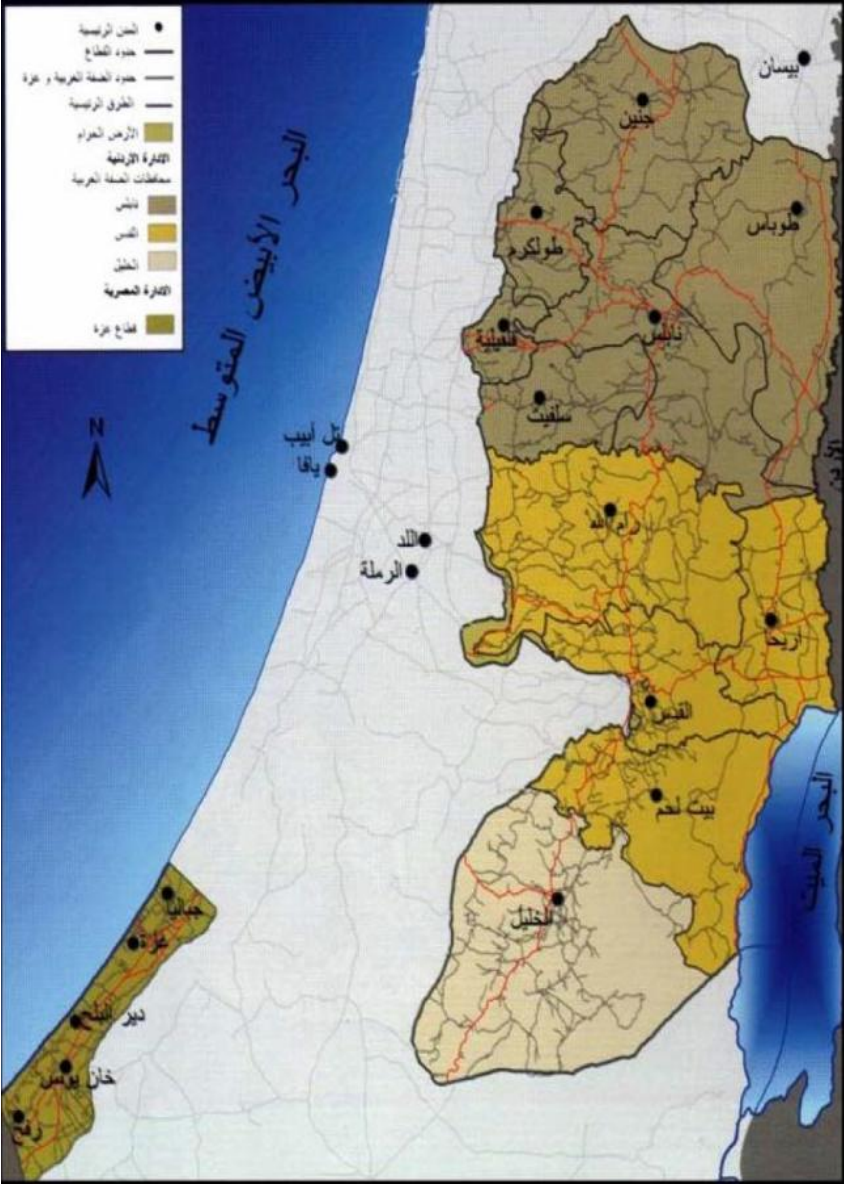
The Governorate of Nablus has a population of about 356,129 people¹. It is considered a main economic center. Also, there are many important agencies and institutions that have regional effects such hospitals, banks and universities like An-Najah National University. As a result, Nablus became a destination for large number of peoples who travel to the city every day so large number of vehicles enters the city daily; which causes an increasing traffic congestion on the major roads. Shared taxis and vehicles, which are used by people who can't provide their own transportation, form a high percentage of the entering vehicles.

Over the time, Palestine passed through many occupying periods starting with the British period and ending with Israeli period. Palestine was classified differently during each interval. Starting with the British period, Nablus lied in the middle eastern part of Palestine, it boundaries included the eastern valleys connecting the city directly with Jordan " which means that it was a link between Palestine and Jordan". we can find the limits of Nablus governorate boundaries in map (4) which shows Palestinian boundaries during the British governance period. We find that Nablus governorate had the largest area and was a dominant governorate which led to high numbers of trips towards the city.



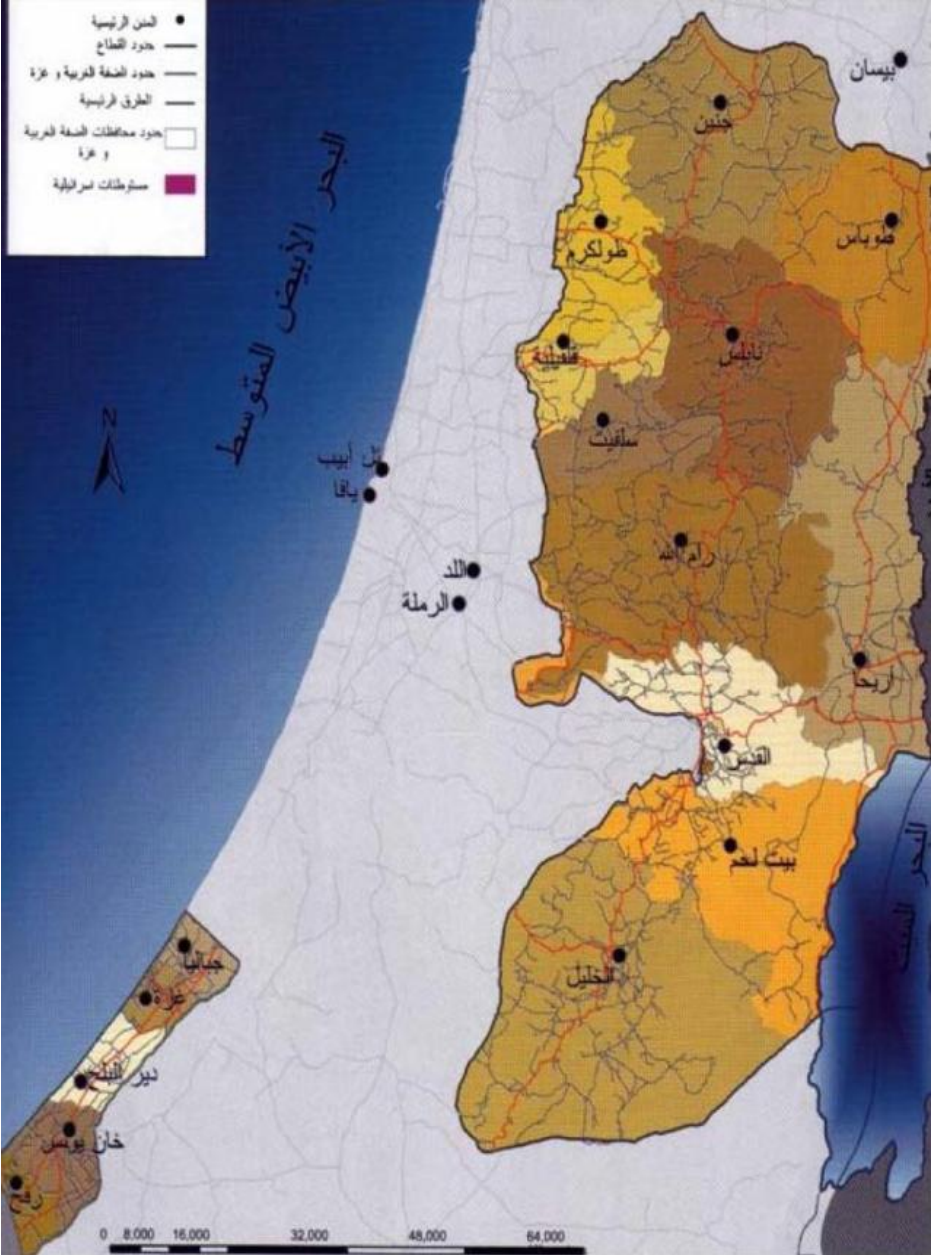
Map 4 Palestine division during the British governance period

In the Jordanian period, Palestine was divided into three parts, West Bank, Gaza, and Israeli territories. Nablus governorate was located in the northern part of the West Bank. West Bank in its turn was divided into three regions as shown in map (5), Nablus as the northern region, Jerusalem the middle region, and Hebron as the southern region. The administration boundaries of Nablus city included the whole northern part (Tulkarem, Qalqilyah, Jenin, Tubas, and Salfit). Nablus city location was in the middle on the governorate boundaries. This location gave the city a high importance as being the northern region. All people from the northern cities depended on Nablus city in administrative issues. These people passed through Nablus streets daily and monthly which gave high importance to Nablus city.



Map 5 West Bank divisions during Jordanian period

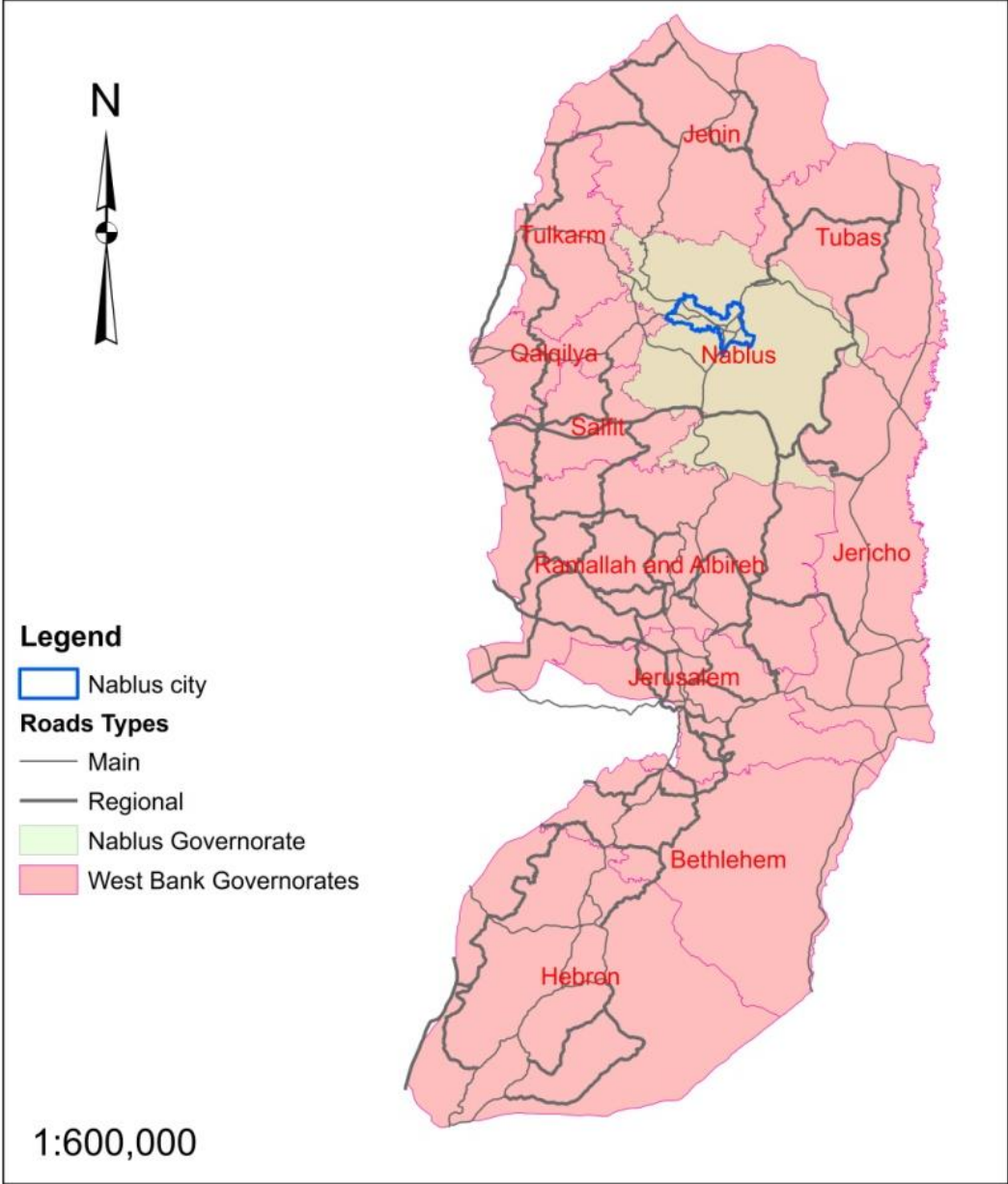
In the Palestinian period "up to now" Nablus governorate location is the middle part of the northern region as shown in map (6), its boundaries lie on an area of 605 km². Nablus now is the capital city of the northern part of West Bank. This gave it an importance because many main services are located their leading to high numbers of daily visitors. High number of visitors means high numbers of vehicles on roads and high numbers of trips through Nablus city.



Map 6 West Bank division during Palestinian period

The distribution of regional and main roads in West Bank is shown in map (7). This map shows that the connecting roads in Nablus governorate are main and regional. However, regional roads lie in the southern part of Nablus Governorate. Only main roads lie through Nablus city.

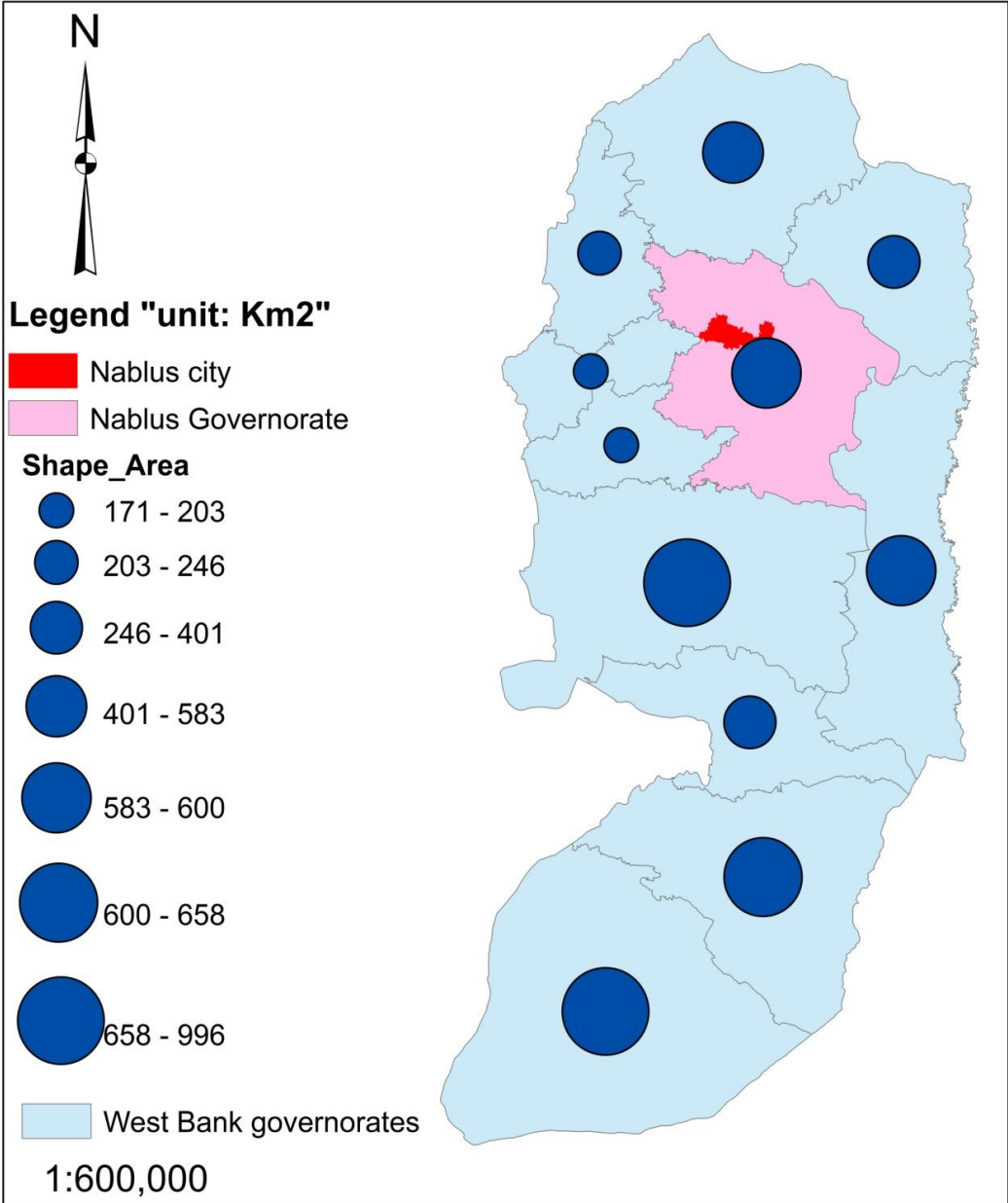
West Bank governorates connected by main and regional roads " Nablus governorate location"



Map 7 Regional and main roads in the West Bank

Nablus governorate has an area of 605 km² which forms about 11% of West Bank area, it is the fourth largest governorate in West Bank after Hebron, Ramallah and Al-Beirah, and Bethlahem Governorates. This gives the city an important because it has a direct influence on a large area of the West bank as shown in map (8) and chart (1).

Nablus governorate area in comparison to other west bank governorates



Map 8 West Bank governorates area

- Jenin Governorate
- Qalqiliya Governorate
- Ramallah and Albireh Governorate
- Bethlehem Governorate
- Jericho Governorate
- Tubas Governorate
- Tulkarm Governorate
- Nablus Governorate
- Jerusalem Governorate
- Hebron Governorate
- Salfit Governorate

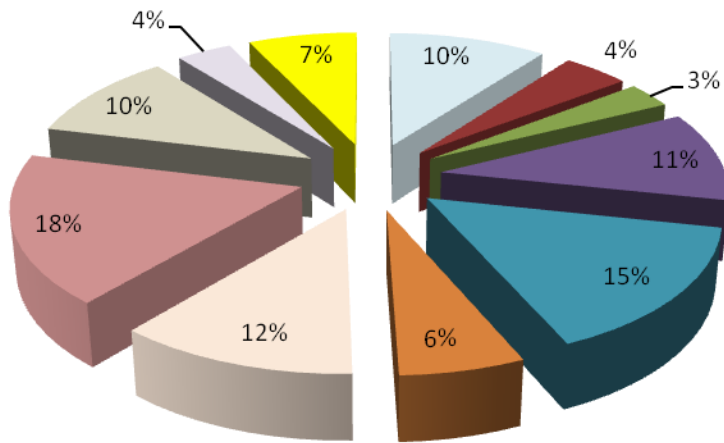
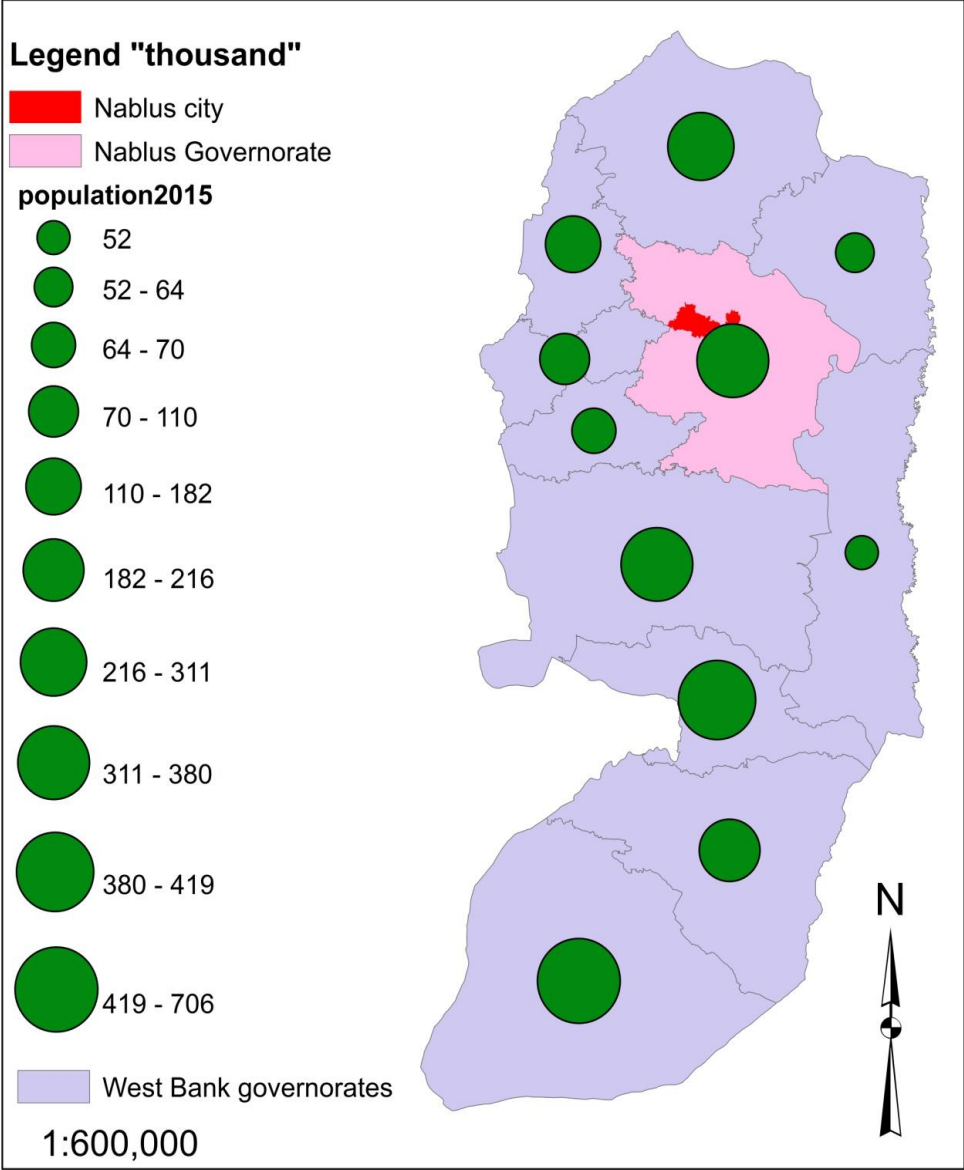


Chart 1 West Bank governorates areas

Nablus governorate has a population of 380,961 which forms about 14% of West Bank population, it is the third largest governorate in West Bank after Hebron, and Jerusalem Governorates according to Palestinian statistics bureau, 2015. This gives the city an important because it has a direct influence on a large population of the West bank as shown in map (9) and chart (2).

Nablus governorate population "2015" in comparison to other west bank governorates



Map 9 West Bank Governorate population

population

- Jenin Governorate
- Qalqiliya Governorate
- Ramallah and Albireh Governorate
- Bethlehem Governorate
- Jericho Governorate
- Tubas Governorate
- Tulkarm Governorate
- Nablus Governorate
- Jerusalem Governorate
- Hebron Governorate
- Salfit Governorate

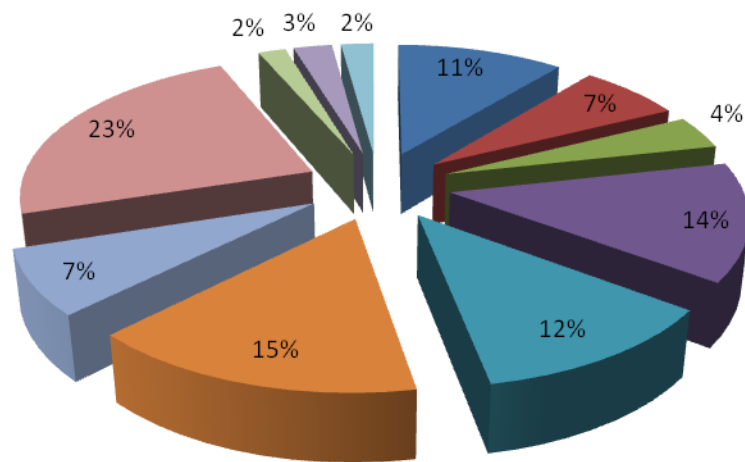
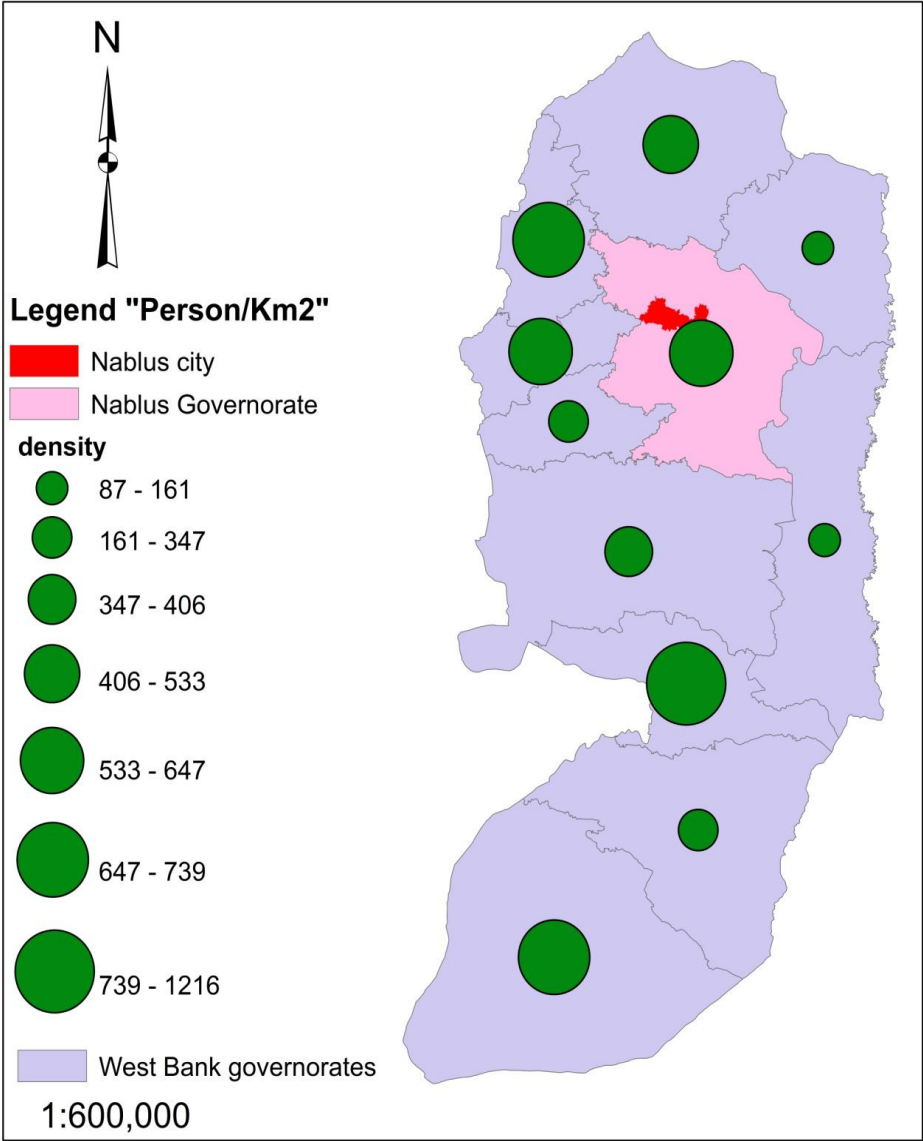


Chart 2 West Bank governorates population

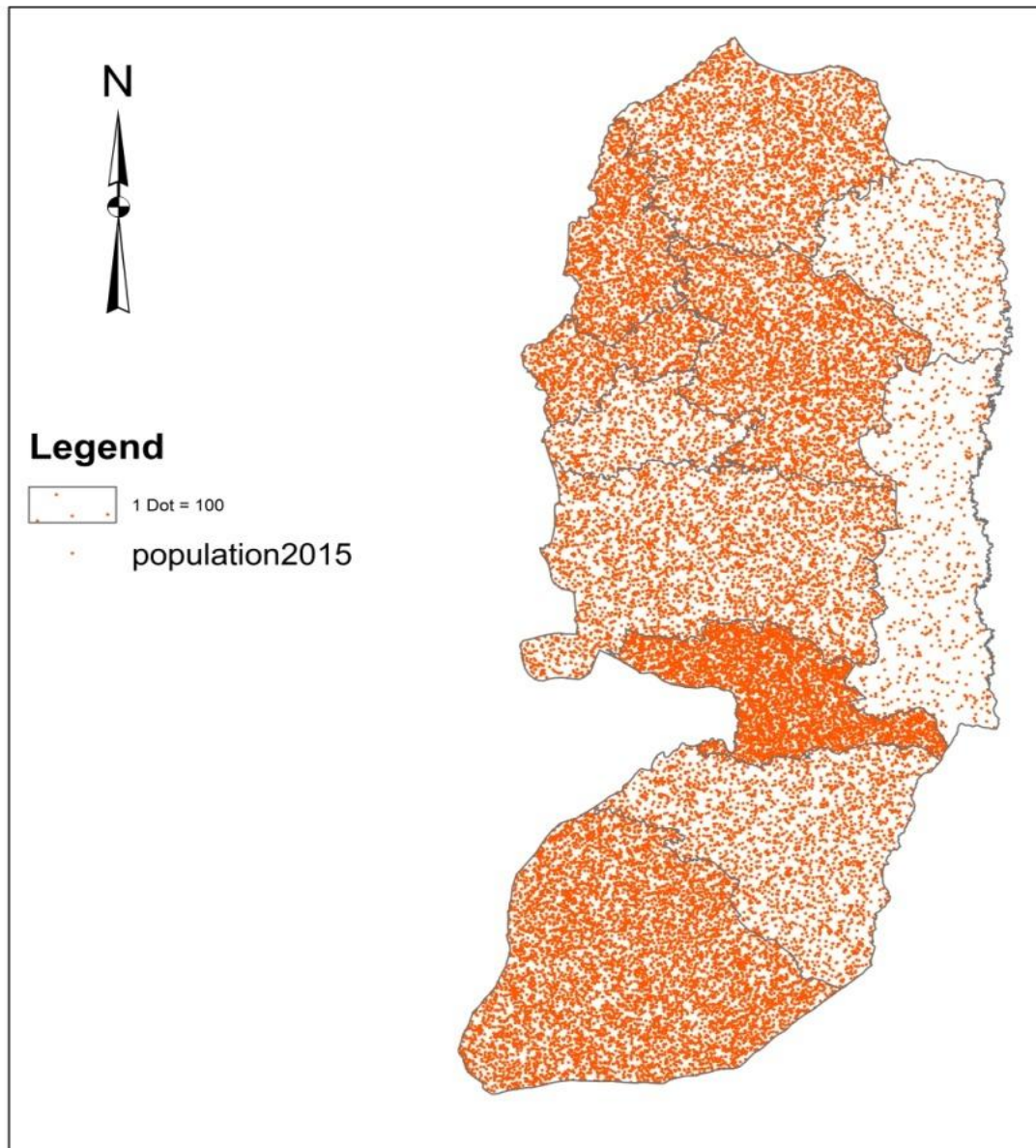
Nablus governorate has a density of 629.6876033 person per km² it is the second largest governorate in West Bank after Ramallah and Al-Beirah Governorates. This gives the city an important because it has a direct influence on a large population of the West bank as shown in maps (10,11).

Nablus governorate density in comparison to other west bank governorates



Map 10 West Bank governorates density

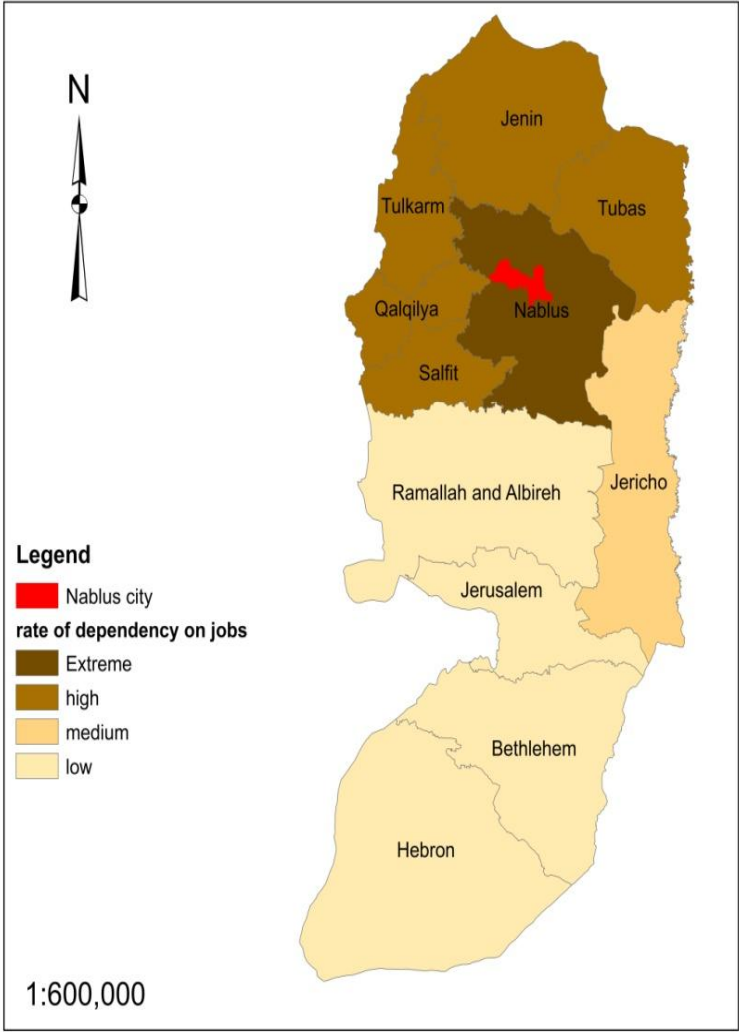
Nablus governorate density in comparison to other west bank governorates



Map 11 West Bank governorates point density

Nablus governorate is one of the main governorates in providing jobs for other governorates “especially in the city”. Qalqilyah, Tulkarem, Jenin, Salfit, and Tubas, depend heavily on Nablus jobs. Jericho also depends on Nablus city jobs but not in the same dependency of northern governorates. Southern governorates depend on some jobs but not heavily in Nablus city as shown in map (12). Main attractive jobs are: An-Najah University, Hijjawi college, Paltel, and many other companies. Dependency on Nablus jobs gives the city an importance which leads to high traffic on Nablus roads and high dependency of Nablus transportation.

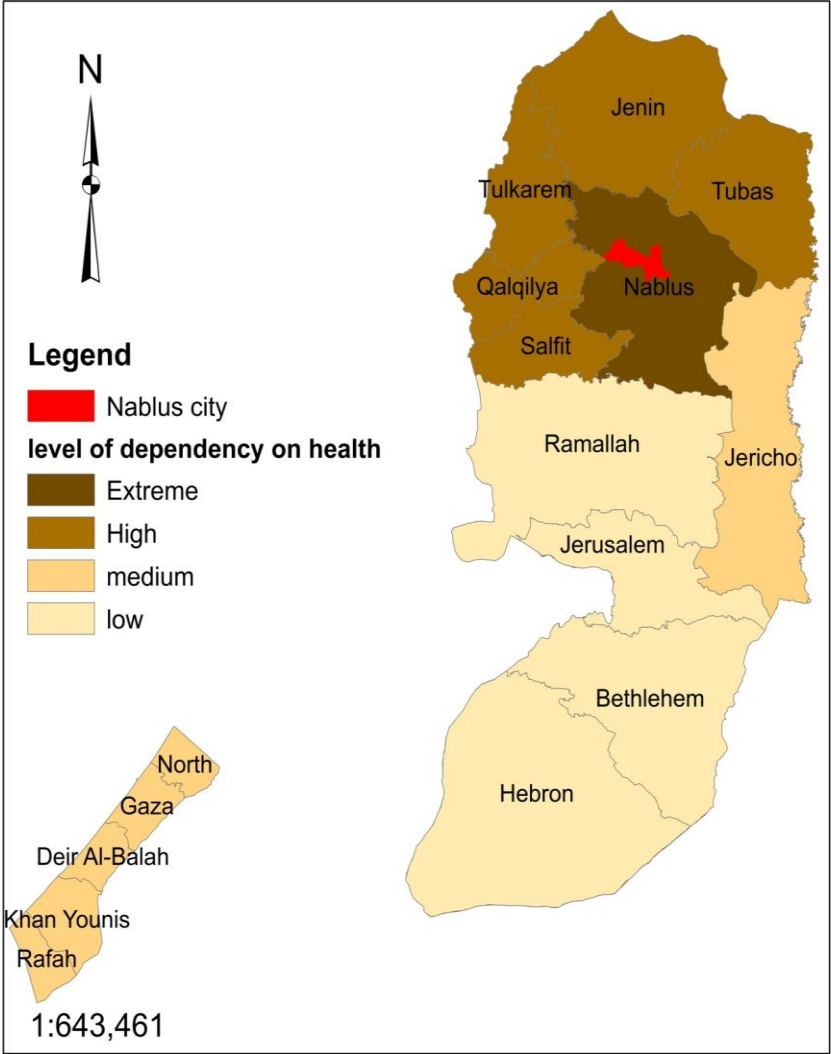
Governorates classification according to their dependency on Nablus city jobs



Map 12 West Bank governorates dependency on Nablus jobs

Nablus governorate is one of the main governorates in providing health services for other governorates since there are many governmental hospitals. Qalqilyah, Tulkarem, Jenin, Salfit, and Tubas, depend heavily on Nablus city. Jericho also depends on Nablus city health services but not in the same dependency of northern governorates. Southern governorates depend on some health services but not heavily in Nablus. Gaza also depends on national health services in Nablus city as they forward some serious cases to Nablus hospitals as shown in map (13). Main hospitals are: Rafidia hospital, and An-Najah University hospital. Dependency on Nablus gives the city an importance which leads to high traffic on Nablus roads and high dependency of Nablus transportation.

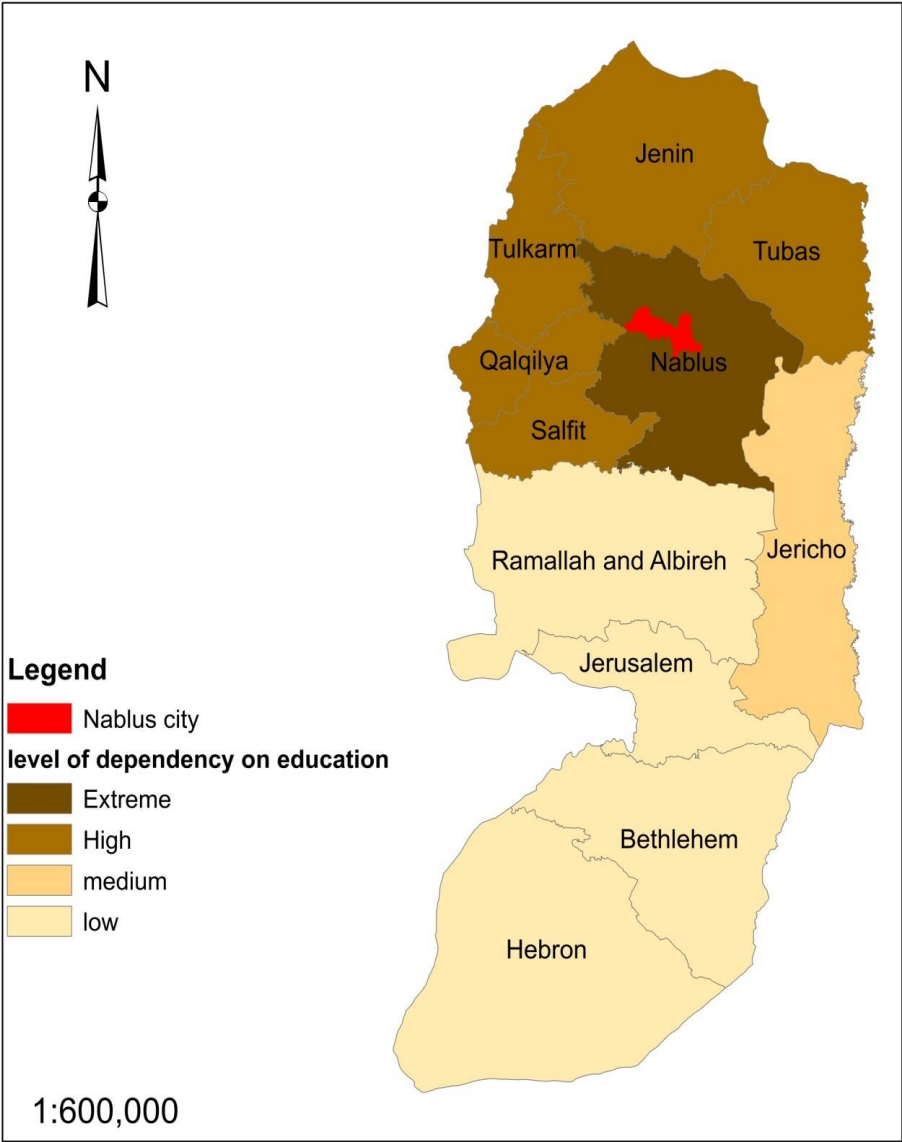
Governorates classification according to their dependency on Nablus city health services "Hospitals"



Map 13 West Bank governorates dependency on Nablus health service

Nablus governorate is one of the main governorates in providing education services for other governorates since there are the two campuses of An-Najah National University “new and old campuses” and Hisham Hijawi college. Qalqilyah, Tulkarem, Jenin, Salfit, and Tubas, depend heavily on Nablus city. Jericho also depends on Nablus. Southern governorates depend lightly on Nablus education services as shown in map (14). Dependency on Nablus gives the city an importance which leads to high traffic on Nablus roads and high dependency of Nablus transportation.

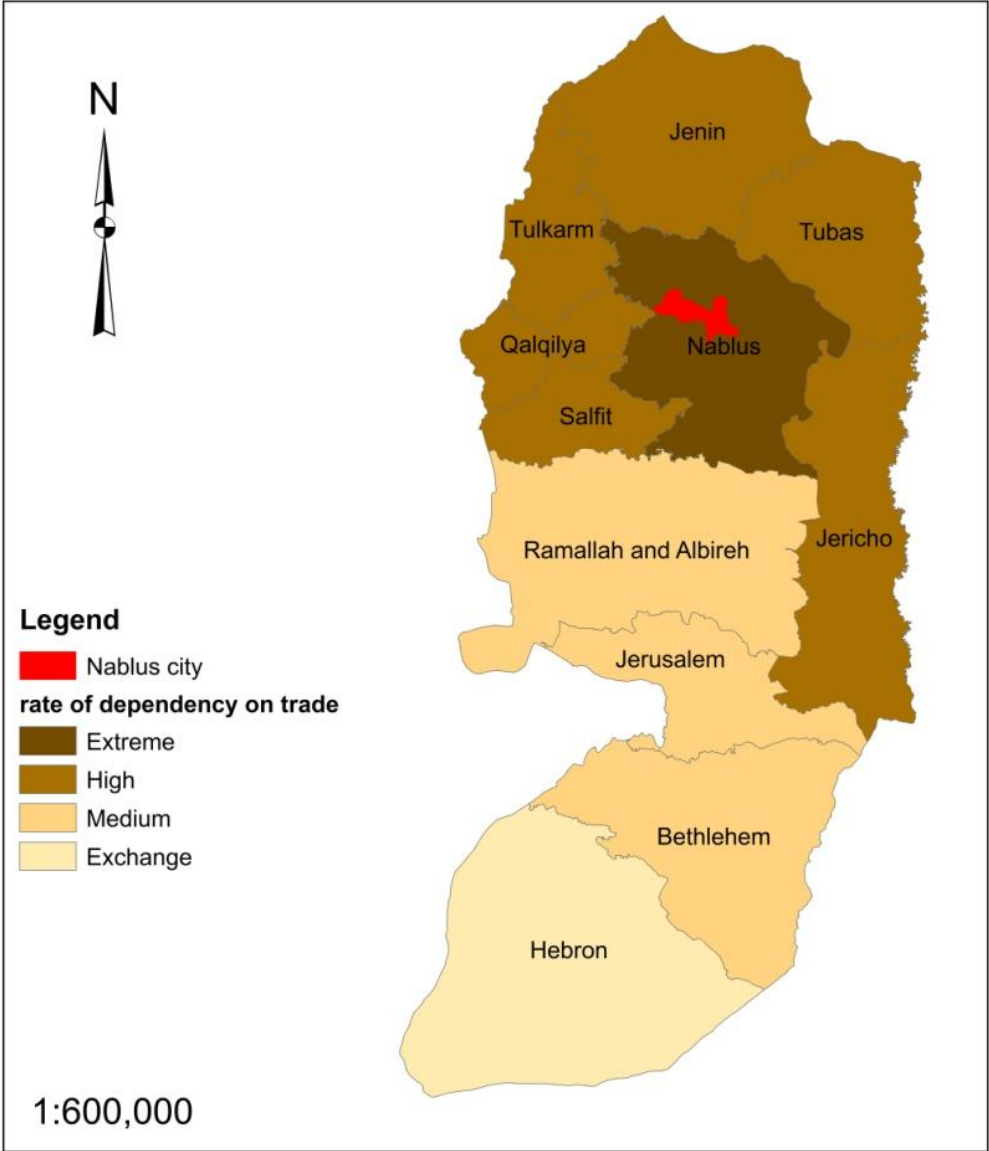
Governorates classification according to their dependency on Nablus city Education "Universities and Colleges"



Map 14 West Bank governorates dependency on Nablus education services

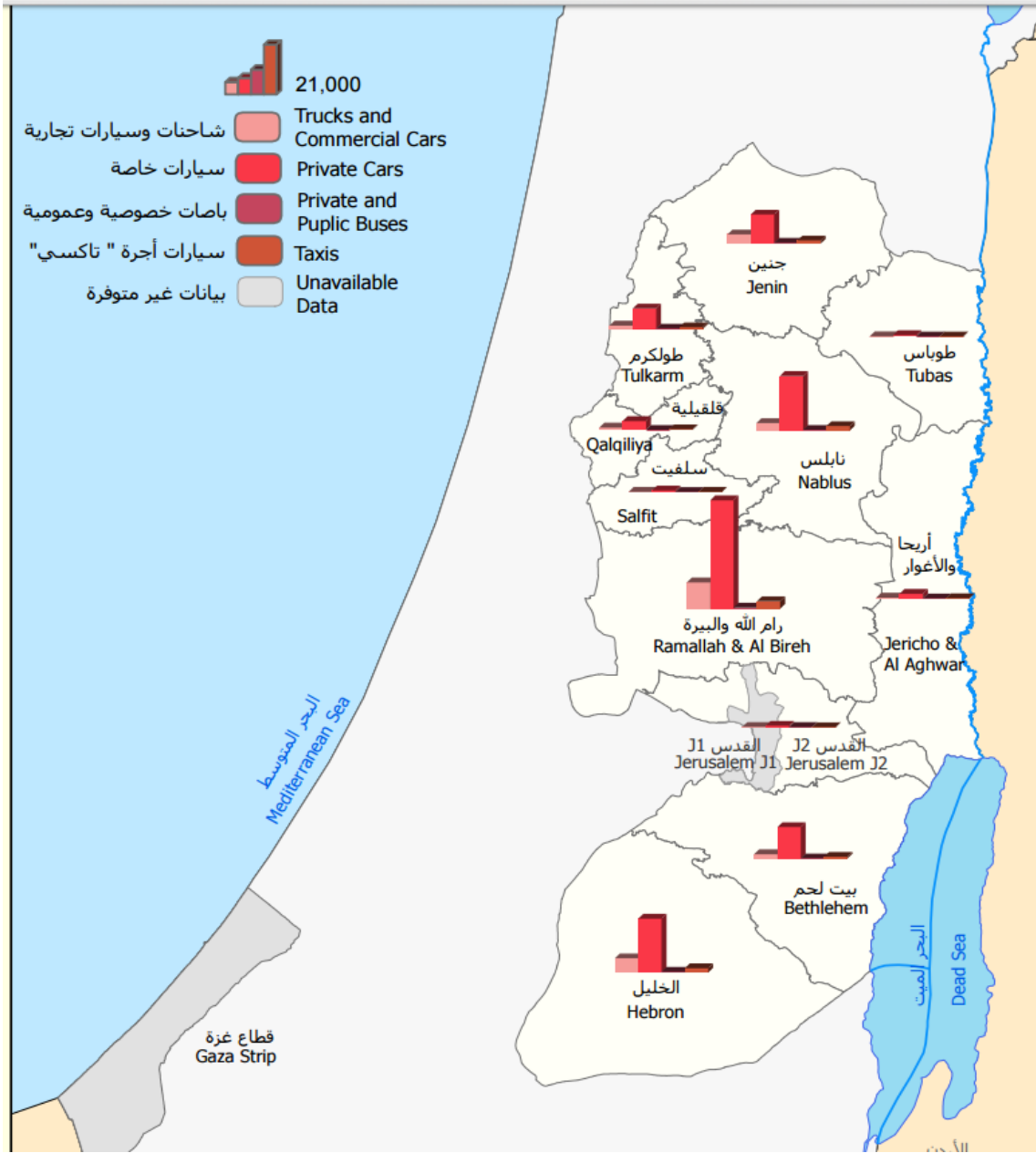
Nablus governorate is one of the main governorates in providing trade facilities for other governorates. All governorate depend on Nablus trade. Only Hebron exchange trade with Nablus as shown in map (15). Depending on trade means high traffic on Nablus roads leading to high trips through Nablus.

Governorates classification according to their dependency on Nablus city trade



Map 15 West Bank governorates dependency on Nablus trade

Nablus governorate is in the second place in the number of vehicles after Ramallah. Private cars have the highest percentage with 81% in Nablus as shown in map (16) and chart (3). This means that the city has high numbers of vehicles and high traffic on roads which means that it has an importance and needs to be studied. "Palestinian central bureau of statistics 2014"



Map 16 Licensed road vehicles in Palestine by governorate and type of vehicle, 2014

The increase in population led to an increase in the necessity of city expansion and therefore an increase in the distances. To meet the daily needs, people used to travel and move from place to another daily which forced them to use vehicles and to own at least one car specially those who live far from daily needs. This led to an increase in roads width and areas and the city lost large areas of greenery and trees. This forced planners and stakeholders to prioritize roads network to provide shared taxis along roads to provide services to residential areas. The percentage of Private cars is 81% and only 6.5% are shared taxis as shown in chart (3). This led to high carbon emissions and high fuel consumption. In addition to noise pollution caused by multi types of vehicles on each road. Shared taxis are not enough as their distribution is not suitable on residential areas, for example, Tell and new Nablus areas are not served by enough taxi. Also, residential areas are not connected which forces people to use many transportation modes to arrive in the high congestion on roads.

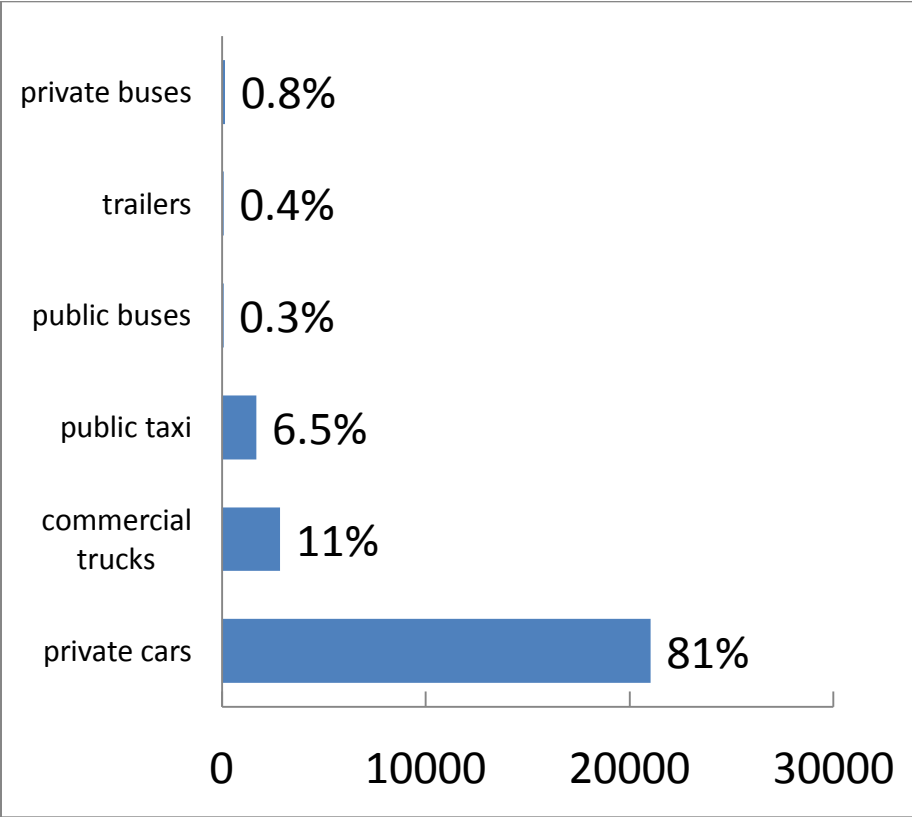
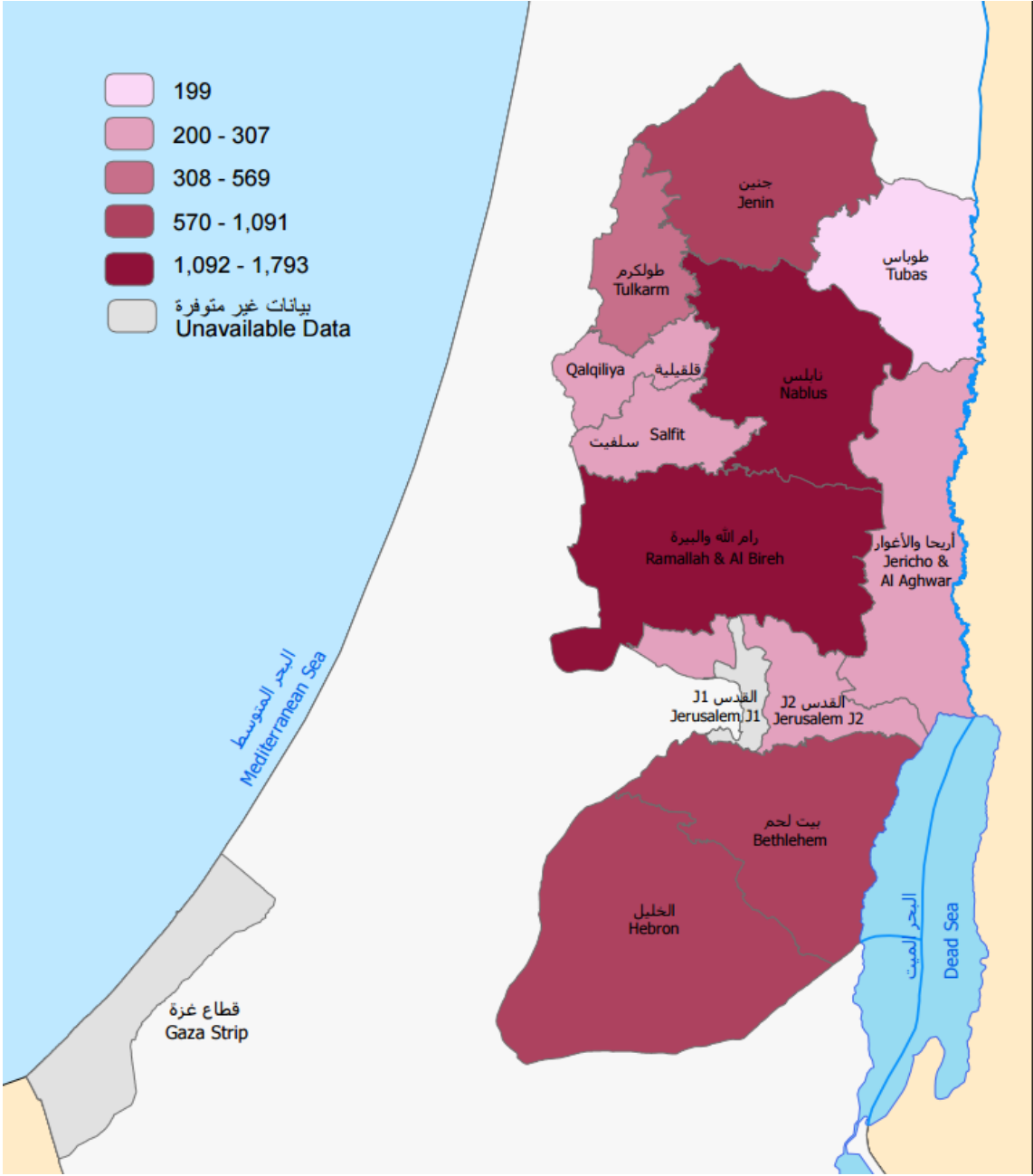


Chart 3 Vehicles classification

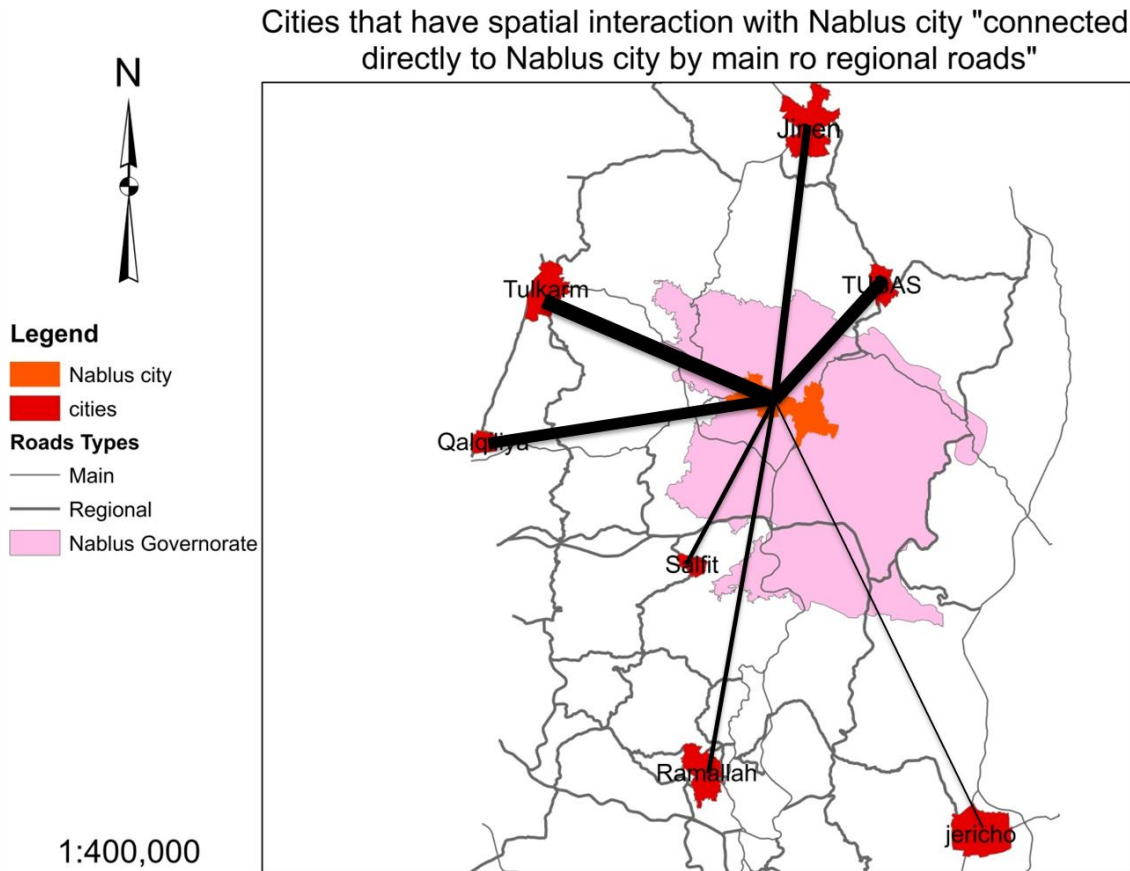
Both Nablus and Ramallah governorates have the highest counts of accidents in the West Bank as shown in map (17). This gives a priority to Nablus city to have a traffic solution.



Map 17 Number of registered road traffic accidents in Palestine by governorate, 2014

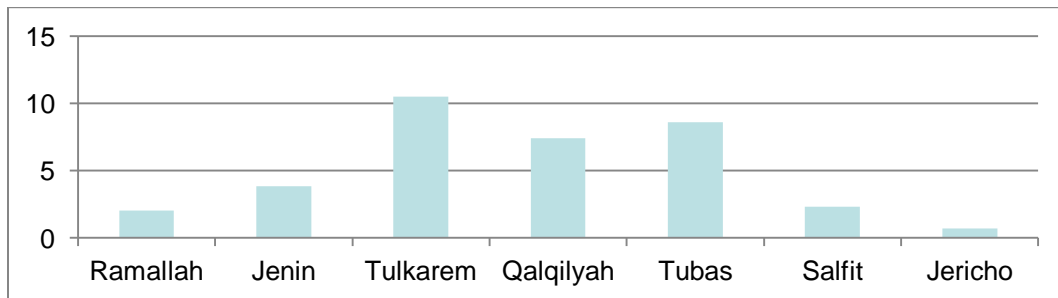
3.1.2 The importance of Nablus city on the Regional level:

The importance of Nablus city influences the main cities in West Bank. All Qalqilyah, Tulkarem, Jenin, Tubas, Salfit, Ramallah and Jericho have direct relationship with Nablus city and Direct transportation services. By measuring the spatial interaction between Nablus city and other cities, Tulkarem has the highest spatial interaction with Nablus city (10.52), than Tubas (8.62), Qalqilyah (7.41), Jenin (3.83), Salfit (2.31) Ramallah (2) and Jericho (0.69) as shown in map (18) and chart (4). This also shows the importance of Nablus city on the regional level and how much they depend on Nablus city and use its roads.

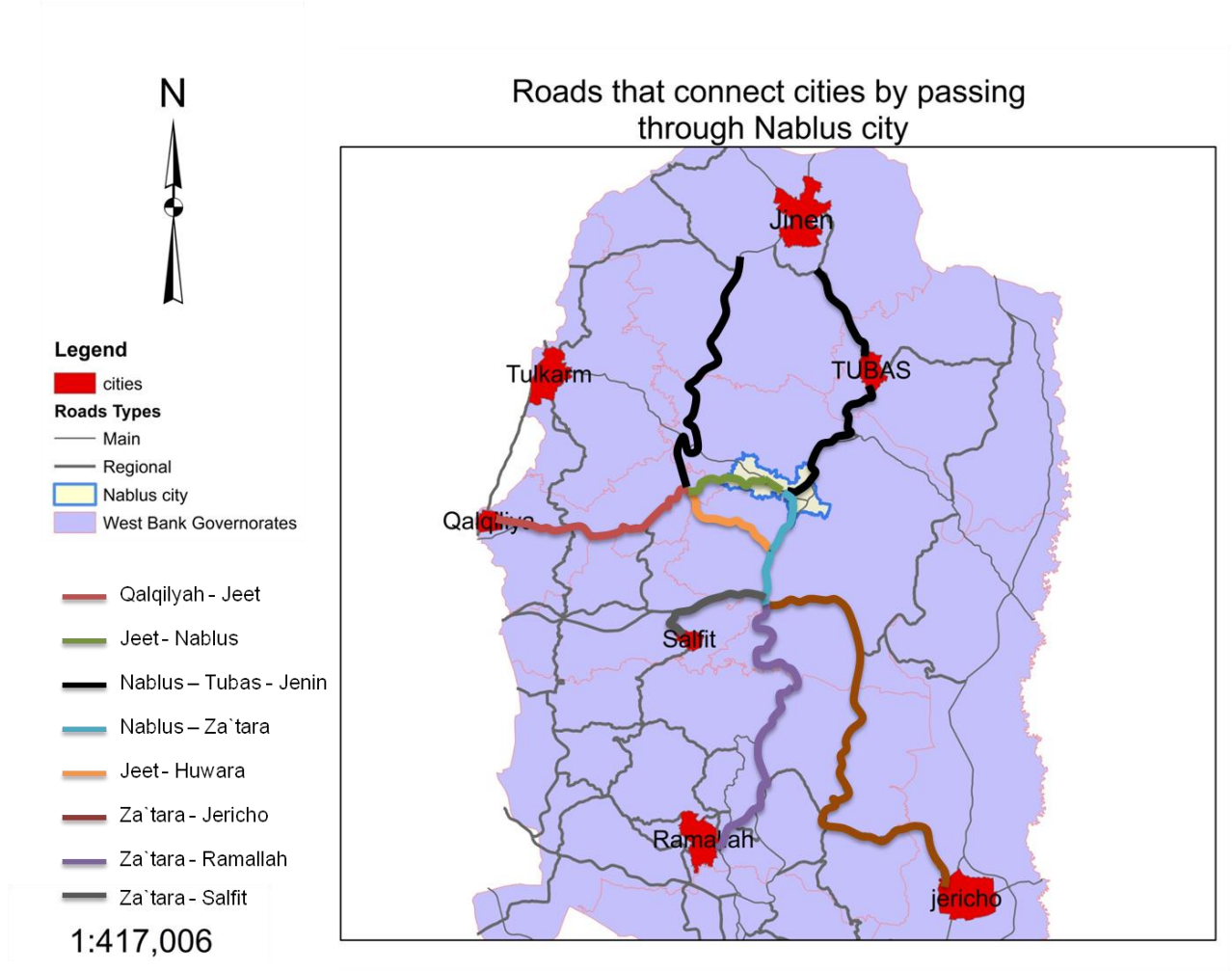


Map 18 Spatial interaction between West Bank cities and Nablus city

Chart 4 Spatial interaction between West Bank cities and Nablus city

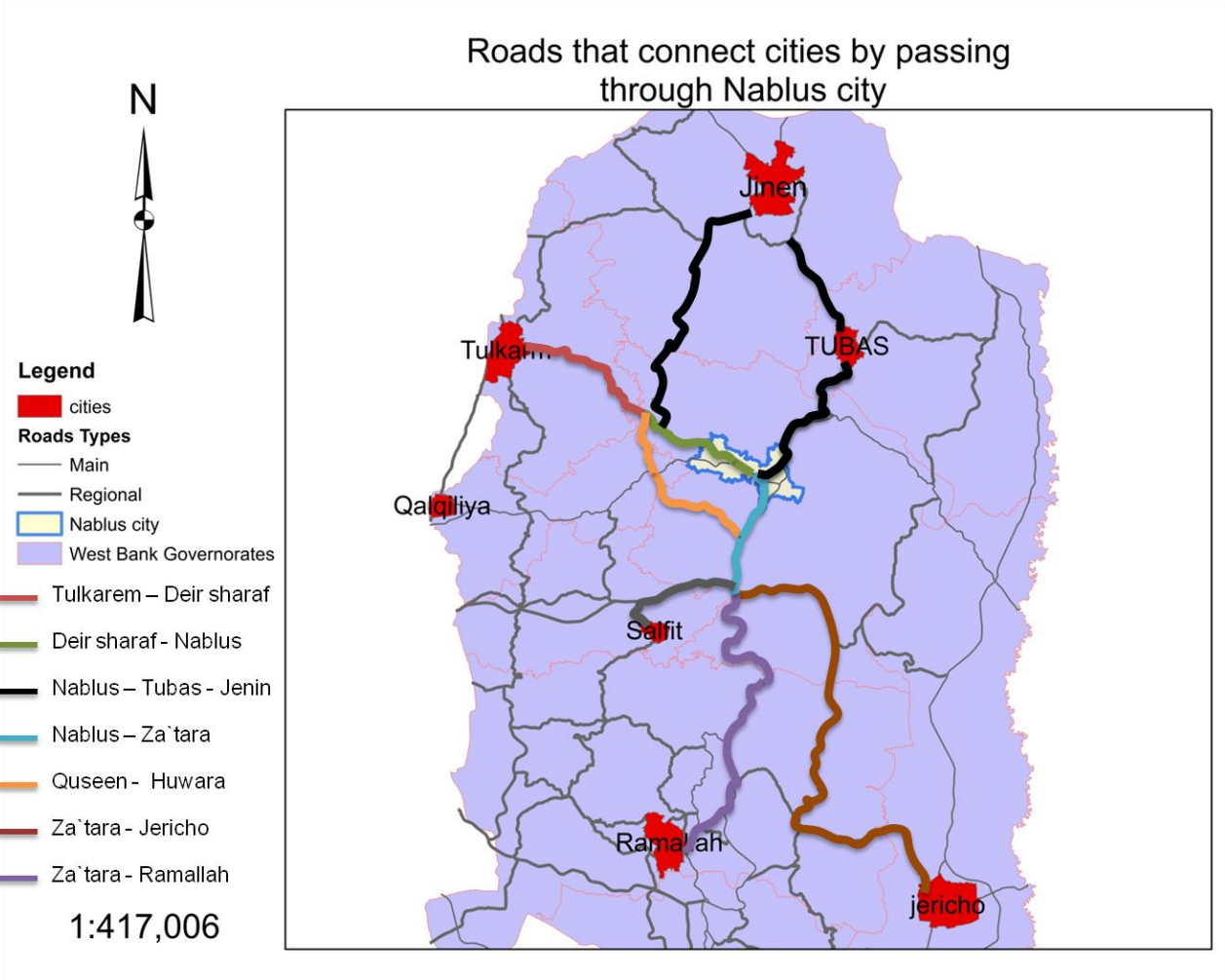


Map (19) shows that Nablus city is a link between West Bank cities. When someone needs to travel from Qalqilyah to any other city other than Tulkarem by shared taxis, he needs to pass through Nablus city because he rides a taxi from Qalqilyah to Nablus, then he stops in Nablus and rides another taxi from Nablus to his orientation. Except if he wants travel by his car he can go directly from Qalqilyah to the south by paasing by Jeet. And from their or from Nablus towards Huwara and to Za`tara.



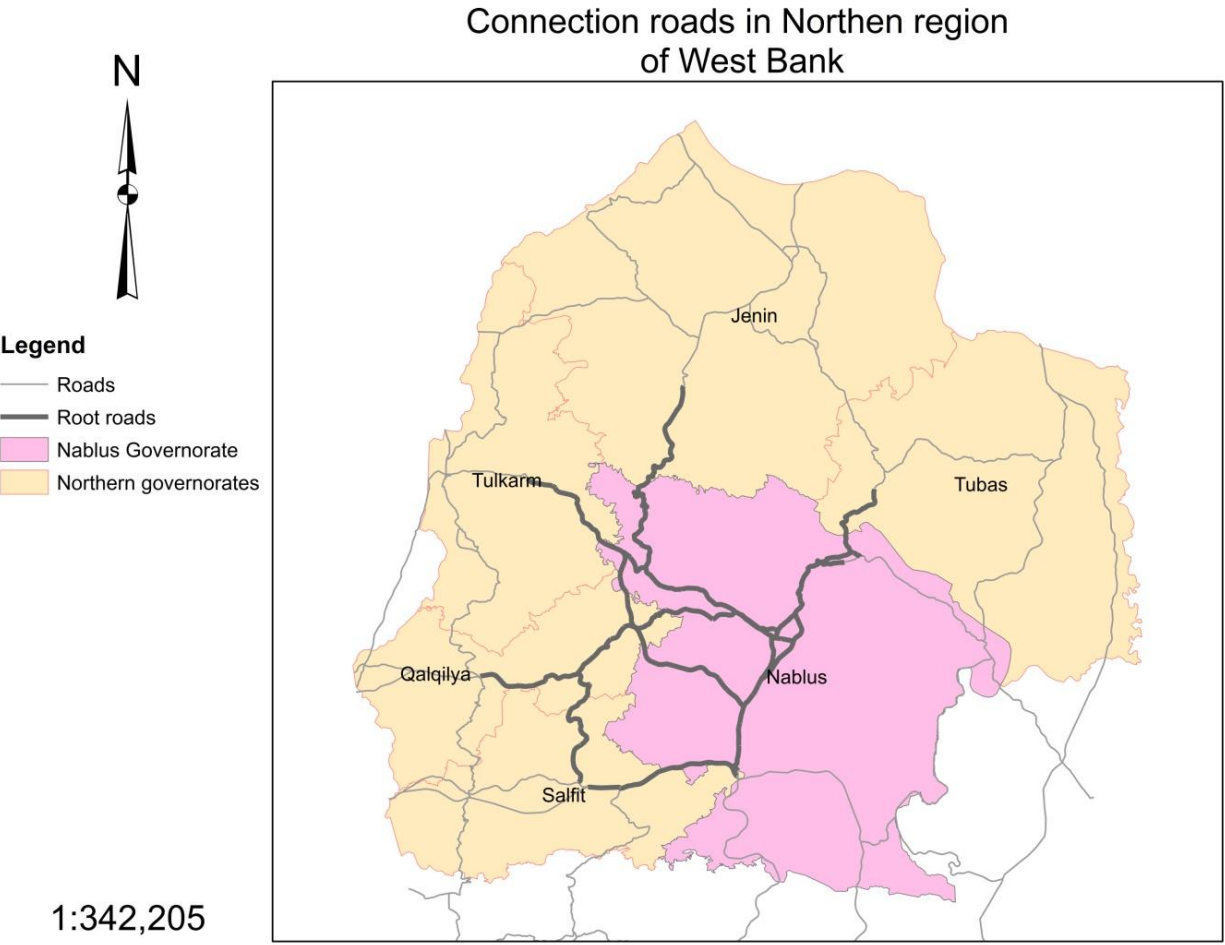
Map 19 Roads between West Bank cities

Map (20) shows that Nablus city is a link between West Bank cities. When someone needs to travel from Tulkarem to any other city other than Qalqilyah by shared taxis, he needs to pass through Nablus city because he rides a taxi from Tulkarem to Nablus, then he stops in Nablus and rides another taxi from Nablus to his orientation. Except if he wants travel by his car he can go directly from Tulkarem to the south by paasing by Jeet. And from their or from Nablus towards Huwara and to Za`tara.



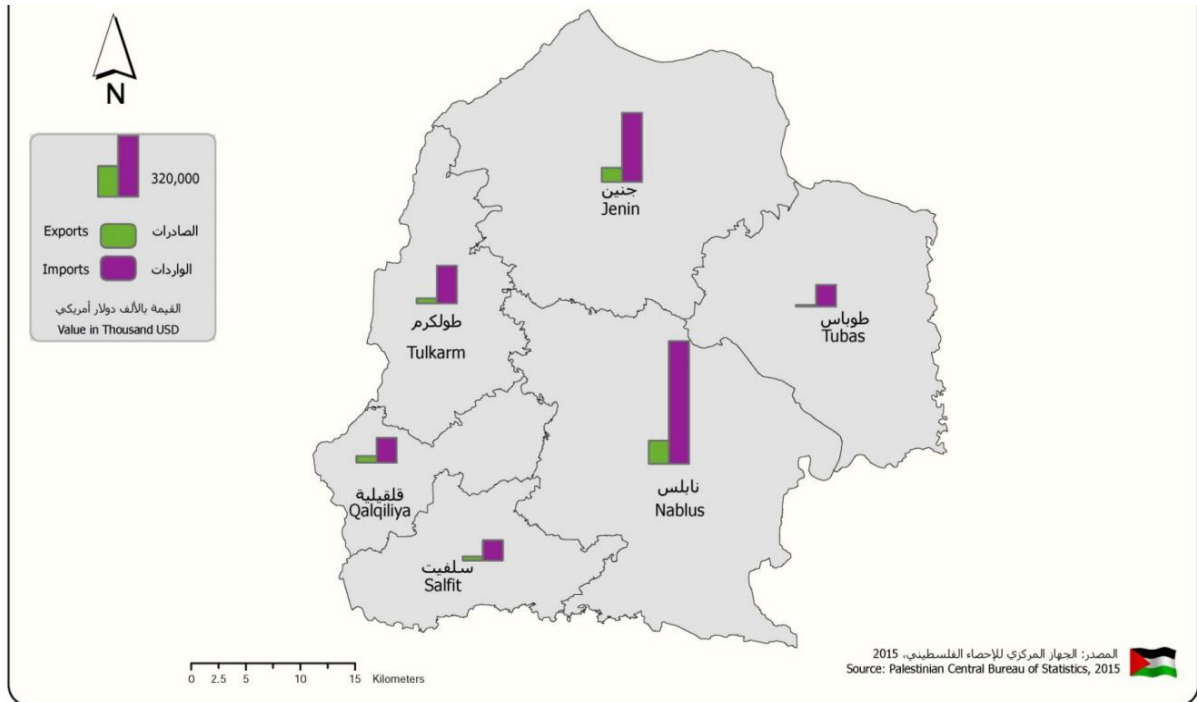
Map 20 Roads between West Bank cities

Map(21) shows that Nablus roads form a link between North cities and communities because of its location in the center of the northern region. Which means that it is a focal city in the West Bank.



Map 21 Link roads in the north region of West Bank

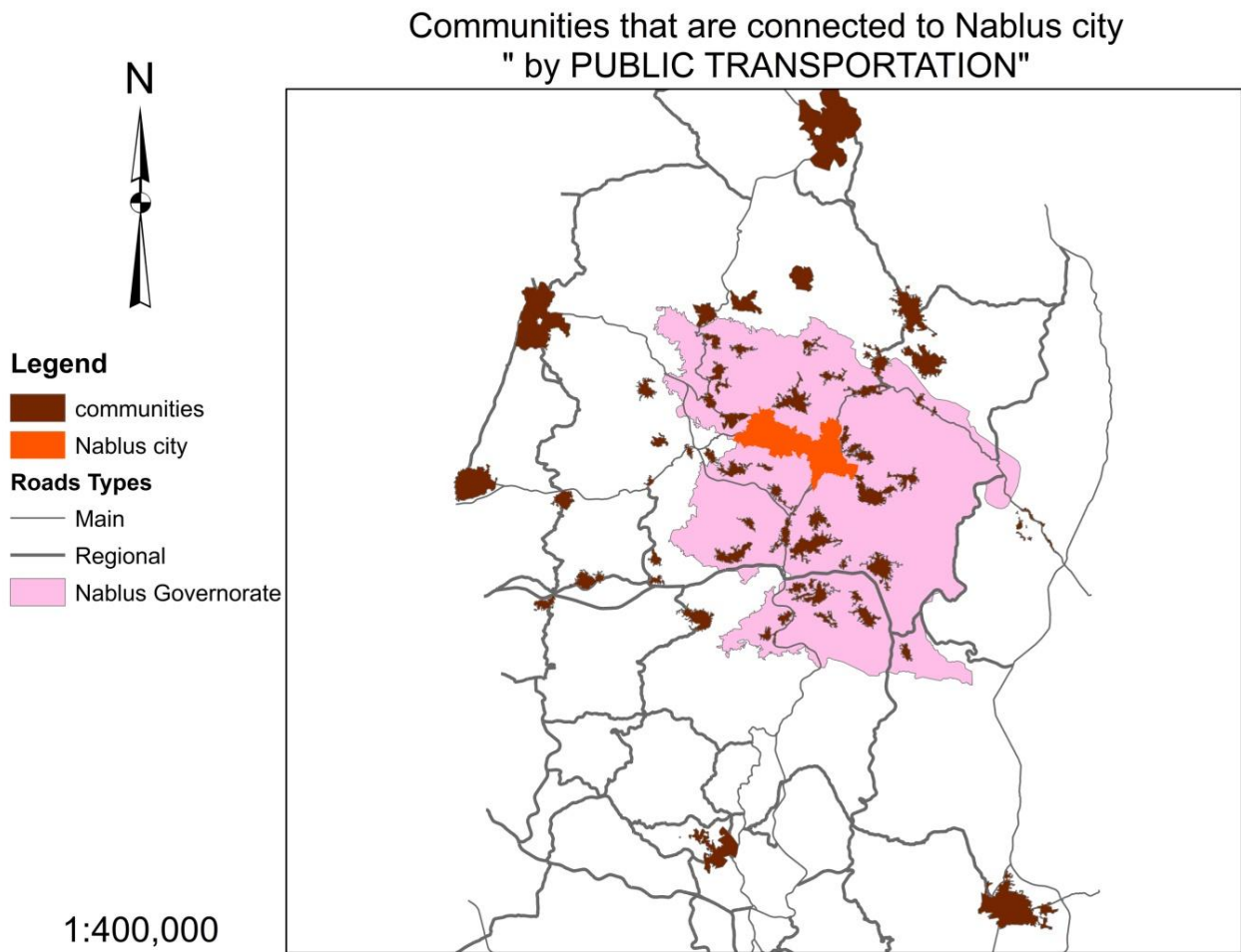
Map (22) shows the value of registered exports and imports in the West Bank northern governorates, 2013. It shows that Nablus has the highest on imports and exports in the northern region. Which means that is has a high importance between northern cities. And transportation forms about 44% of Nablus local production which gives transportation a high importance for Nablus city.



Map 22 value of registered exports and imports in the West Bank northern governorates, 2013

3.1.3 The importance of Nablus city on the Sub-Regional level

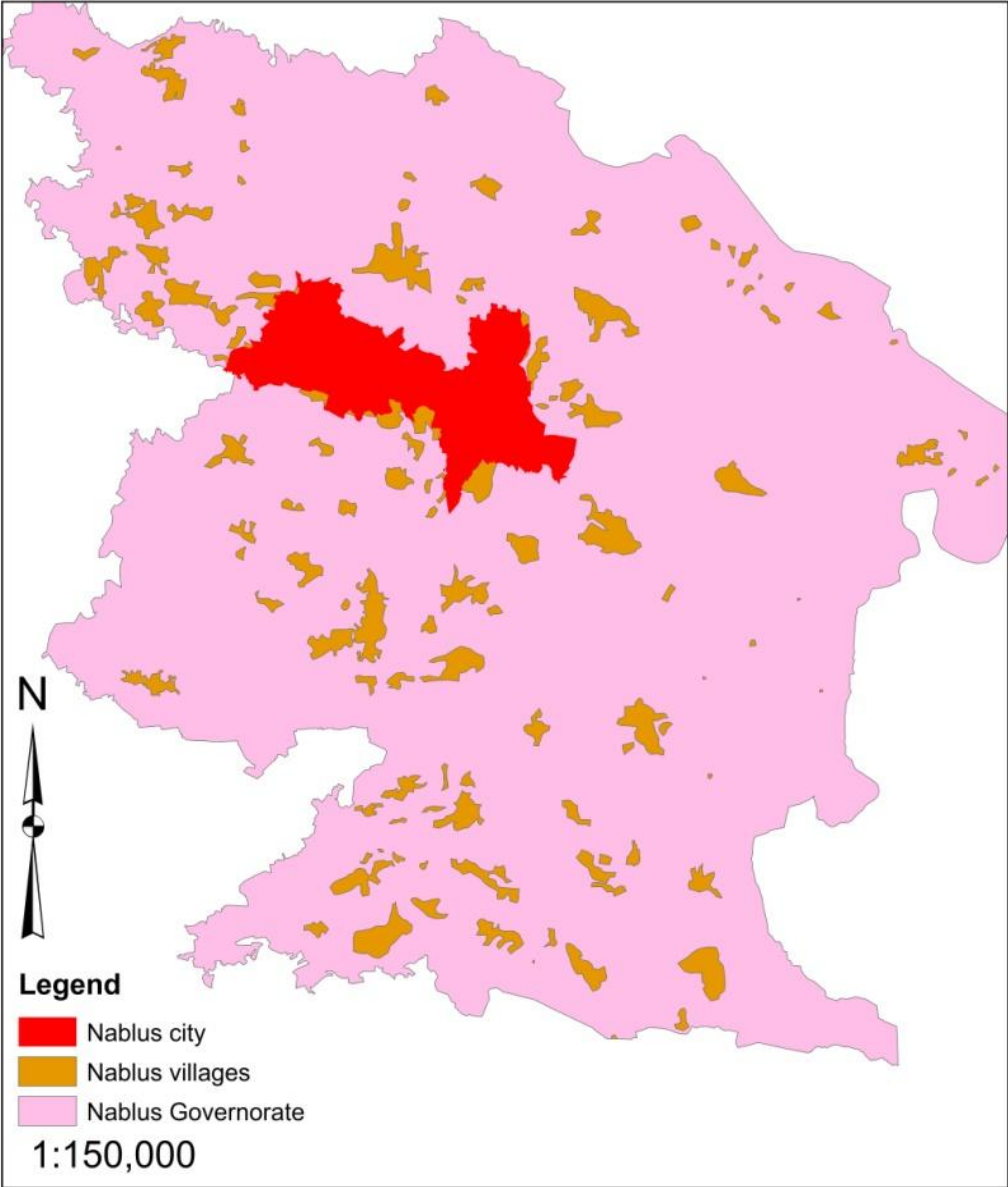
Map (23) shows the communities that have direct shared taxis towards Nablus city, they are the main cities and communities inside Nablus governorates with some communities outside its boundaries. These communities are: Tubas, Beit Dajan, Qusrah, Joreesh, Talloza, Beta, Al-Bathan, Der Istia, Kfl Hares, Hares, Mardah, Beit Forik, Salem, Bedia, Qabalan, Al Sawieh, Kafr Al Dik, Doma, Yetma, Deir Al Hatab, Al Lubbn, Oreef, Ainabos, Salfit, Aljftlek, Jalood, Talfit, Qariot, Alfar'a and Azmoot, Jenin, Jericho, Ramallah, Qalqilia, and Tulkarm, Yasid, Burqa, Sarrah, Tel, Beit Lid, Beit Eiba, Jaba, Al Fandaqumiya, Silet al Daher, Jeet, Hajjah, Jnesenia, Asira al Shamaliya, Sanor, Sabastiya, Beit Imreen, Sanour, Kafr Quddum, and Maithaloon .



Map 23 Communities that are directly connected by taxis to Nablus city

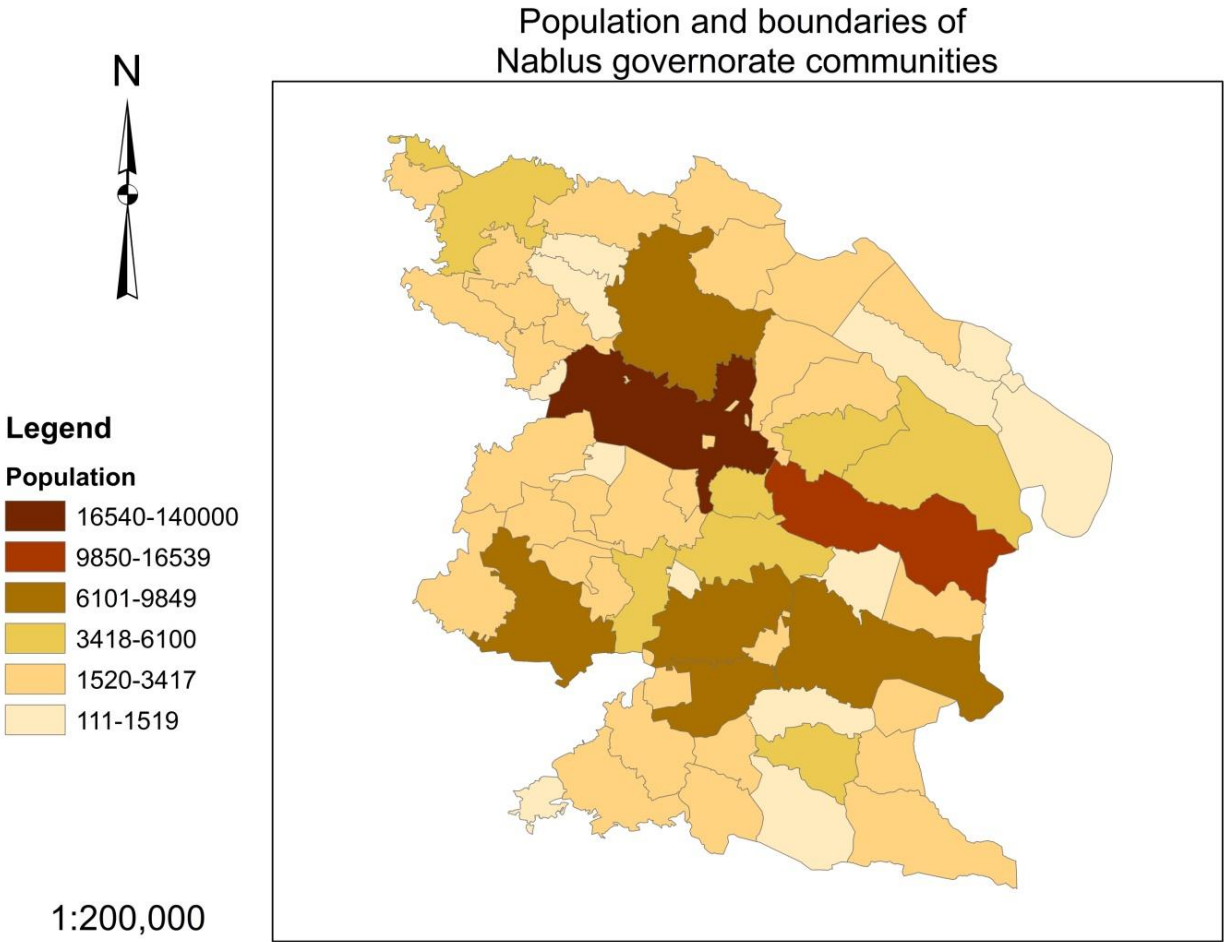
Nablus city is located in the north eastern part of the governorate as shown in map (24). It is surrounded by many communities, such as: Beit Iba, Sarra, Roujeeb, etc. the distances between it and the governorate communities vary according to communities locations.

Nablus city location inside Nablus governorate
"its location between the governorate villages"



Map 24 Nablus governorate communities

Map (25) shows the population of each community in Nablus governorate. It is shown that Nablus city has the highest population with about 148,000 person.



Map 25 Nablus governorate communities population

Map (26) shows the roads inside Nablus governorate. We can find that there are five types of roads. They are : Regional, Main, Dirt, Local, and Settlement roads. Main and Local roads are the only two types that lie inside the city boundaries. Other types are distributed in the governorate with regional roads only in the southern part.

Nablus governorate roads lie nearly in all directions to provide the service inside and outside the governorate. This network is a main part of the West Bank roads network. By focusing on the details, we can notice that the network is guided by the mountainous topography that gave it the suitable shape of arterial roads. Map (27) shows that there is a main axis that extends towards Dir Sharaf where there are two directions one towards Tulkarem and the other is towards Jenin. Also, there is a main road that extends towards west to connect Nablus with Qalqilyah governorate. Other main roads are extended in the east, one is directed to the north and the other is to the south. Then we can call Nablus roads network a topographic network as it fits the topography.

Nablus governorate roads are classified according to its capacity, ability to intake transportation modes and the conditions of the outer surface of the road. There are four types:

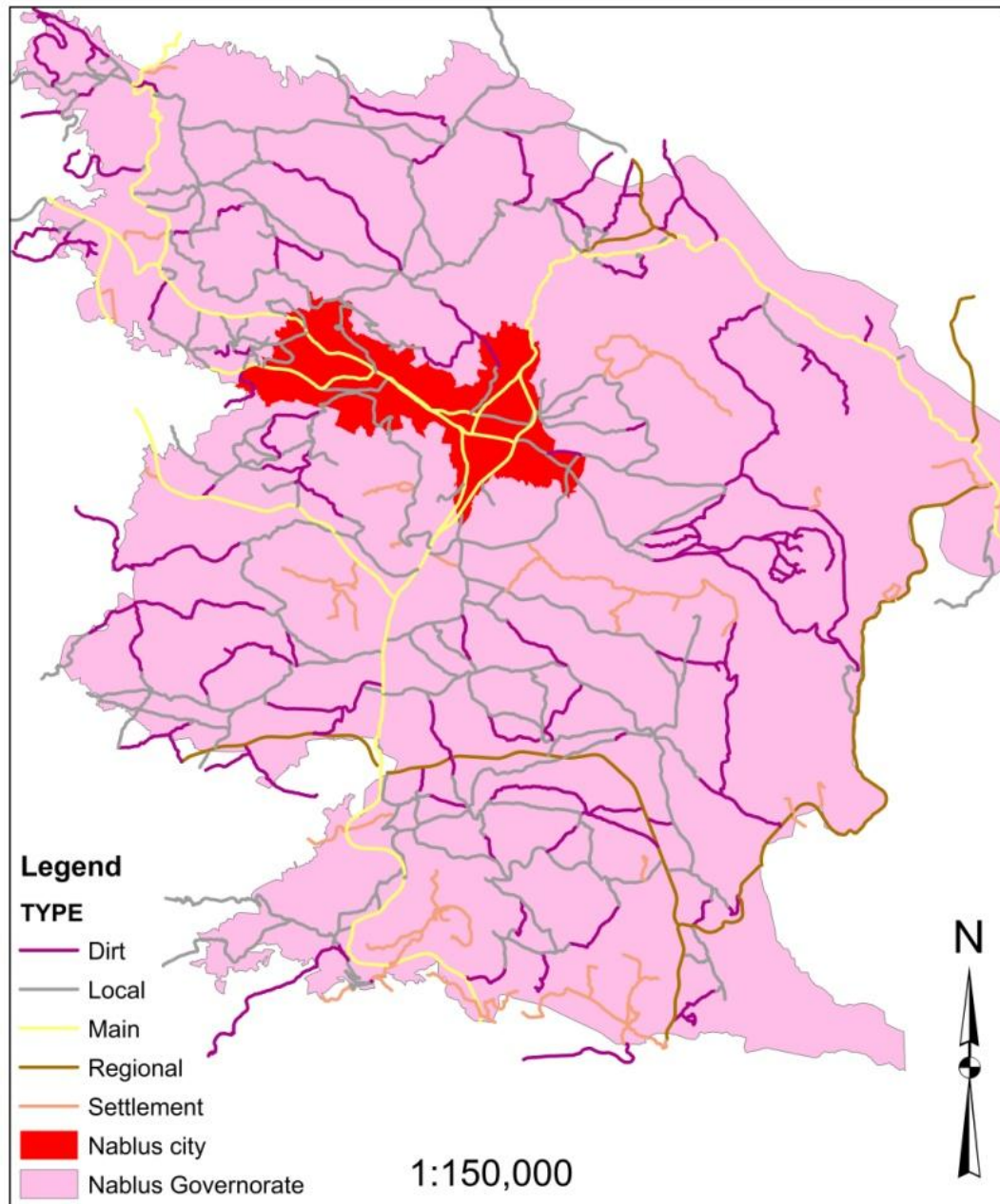
1- main roads that connect West Bank cities together, these roads have two lanes, one for each direction which means that only one car or two can pass through the road like Nablus-Qalqilyah road, or they have two lanes for each side like roads that connect the south eastern or north eastern communities with Nablus city.

2- secondary roads that connects many communities together such as the road that extends from Nablus-Jenin road to Sabastia and Beit Imreen, these roads can't bear high traffic volumes and are not given the same attention as main roads

3- local roads (residential roads) that connects parts inside the city together

4- roads that connect communities without passing through the main city

Nablus governorate roads
"roads that connect Nablus governorate communities"



Map 26 Nablus governorate roads types

Chart (5) shows the spatial interaction between main communities in Nablus governorate and Nablus city. Zawata, Jeet, and Sabastyah have the highest spatial interaction.

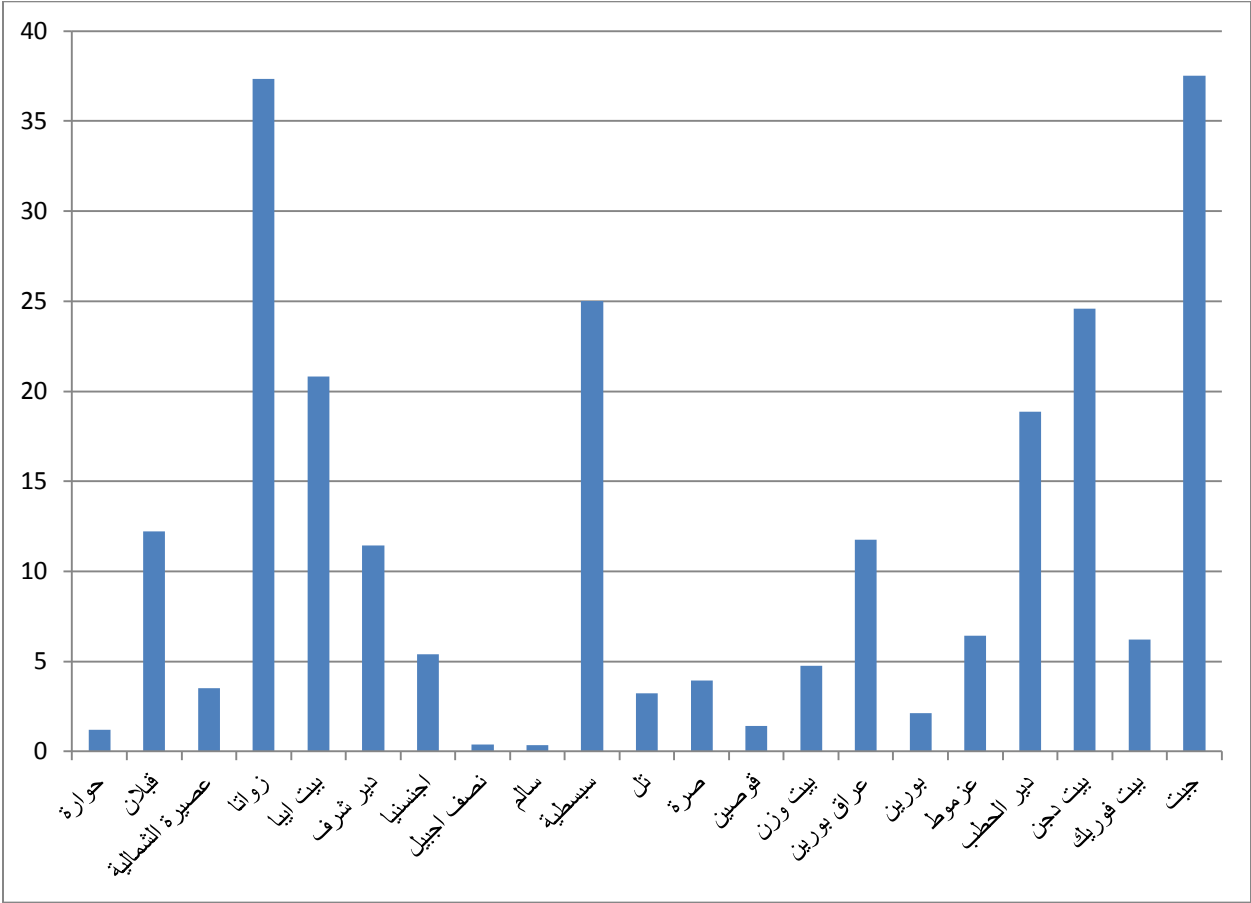
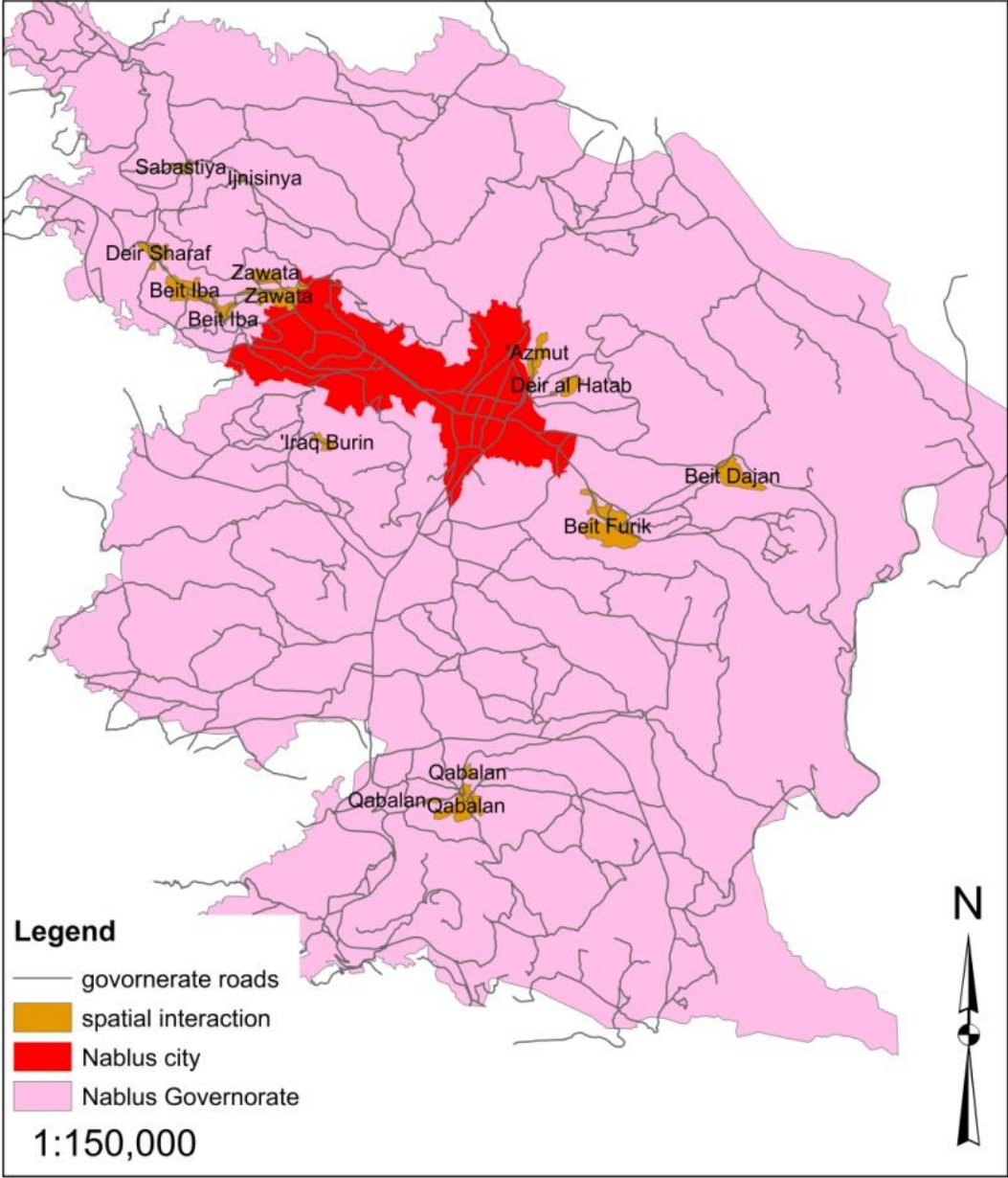


Chart 5 Spatial interaction between Nablus communities and Nablus city

Map (27) shows the communities that have the high spatial interaction with Nablus city which means that they depend mostly on Nablus city.

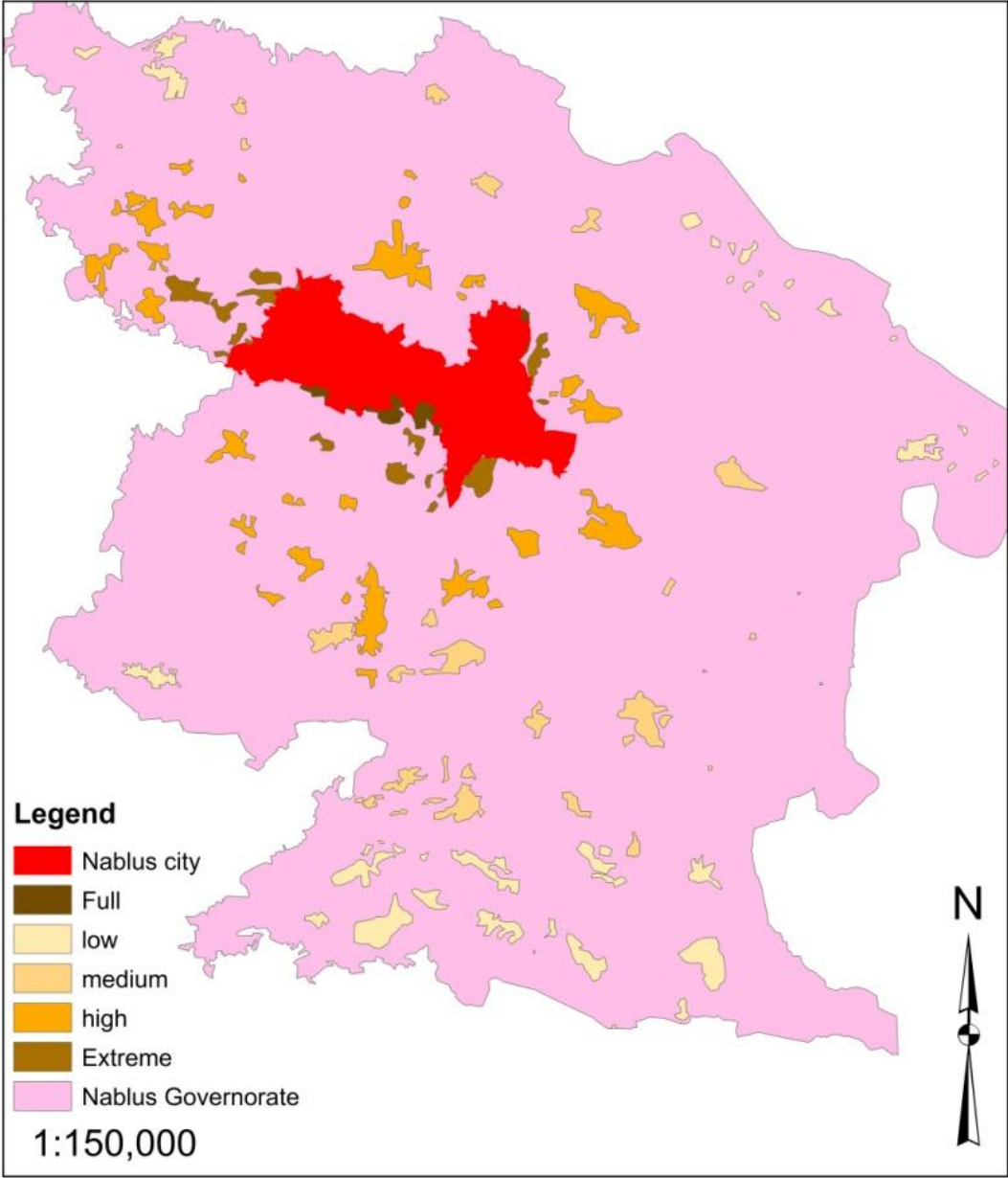
Communities that have high spatial interaction with Nablus city



Map 27 Communities with high spatial interaction values

The spatial interaction and the community dependency on Nablus city decrease as the distance between them increases. Map (28) shows communities classification according to the level of dependency on Nablus city services. All near communities, such as Rujib, Beit Iba, Beit Wazan, etc, depend heavily on Nablus city services and they form an orientation for the city future expansion.

Level of the governorate communitites dependency on Nablus city services



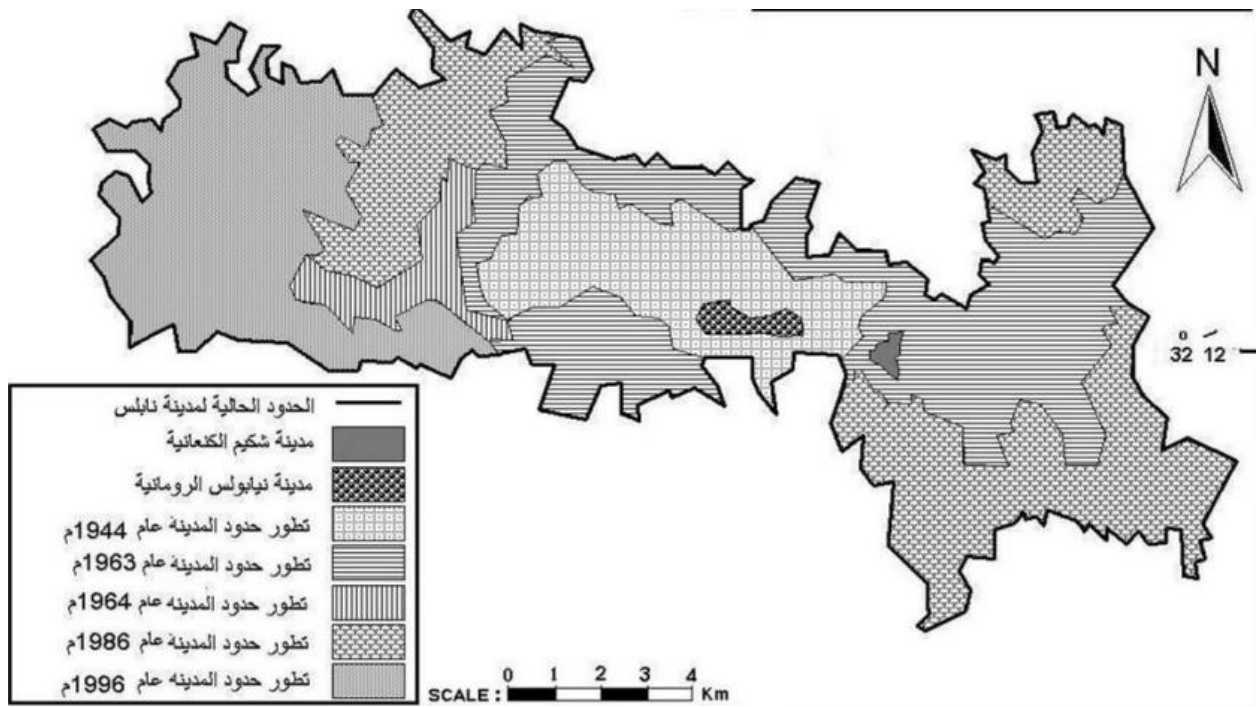
Map 28 Communities classification according to dependency on the city services

3.1.4 The importance of Nablus city on the Local level

Historical expansion of the city of Nablus. “ Nablus municipality”

City expansion: Nablus city has the highest population "149,772" among West Bank cities and considered as the major regional urban center in the northern part of the West Bank. Population density is high in Nablus city compared to the other cities where the population has increased dramatically while the expansion of urban area has been limited. The main reason is attributed to topography as Nablus city is located between steep mountains that constitute physical barriers for urban expansion. In 1989 Nablus built-up density was 150 m² /capita. A significant difference in density was encountered between 1989 and 2000, in the year 2000 the built-up density in Nablus became 78m² /capita. After the establishment of the PNA, new Master plans were developed in most cities. However, the population commitment to municipality regulations varied from one city to another (World Bank, 2003). The satellite images for the years 1944 and 2000 showed that the urban areas increased while the agricultural areas declined within the city boarder.

Map(29) shows the historical periods for Nablus city expansion from 1944 till 1996. The expansion is guided towards the west and between the mountainsides.



Map 29 Historical expansion of the city of Nablus. “ Nablus municipality”

Nablus city expansion during the years

Map (30) shows the boundaries for Nablus city in 1944. It shows that it was small and concentrated in one area.



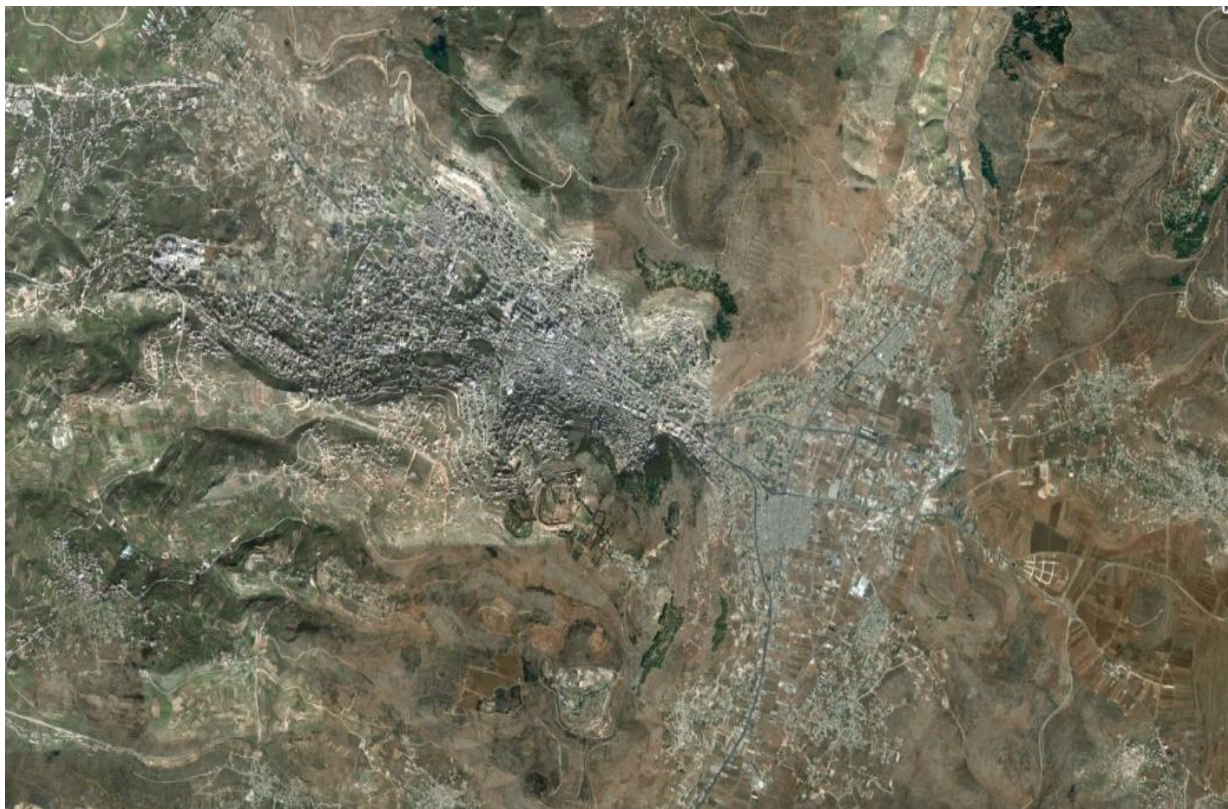
Map 30 Nablus aerial photo 1944 "Atlas of Palestine "Arij"

Map (31) shows Nablus city in 1997. It shows the expansion towards the east and the west. The city topography guided the expansion to be along main roads.



Map 31 Nablus aerial photo 1997 "Atlas of Palestine "Arij"

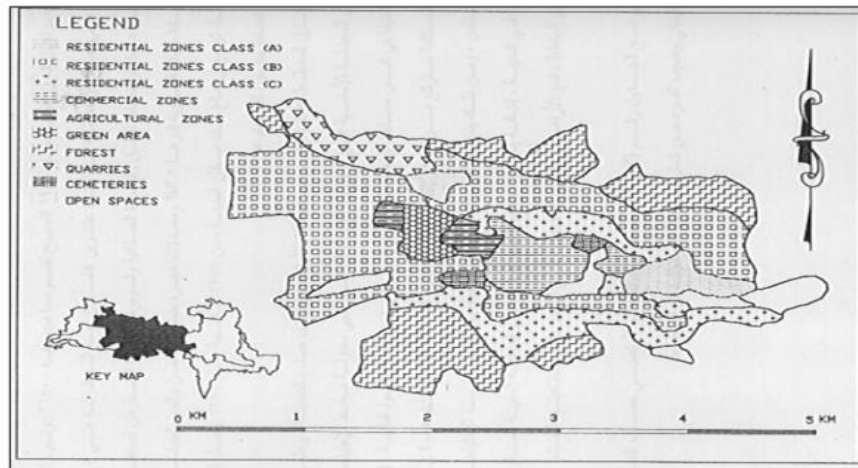
Map (32) shows the city in 2016. It shows the city expansion with its surrounding. The city expansion continued in the east and west along main roads and between mountainsides.



Map 32 Nablus city aerial photo 2016 "google map"

Previous master plans:

In 1946, a general master program was prepared for Nablus city and returned the only program until 1995. There was some detailed master plans with the general master plan. Map (33) shows the master plan for Nablus city in 1961 that included land uses without roads. We can notice that roads were not from the main issues because vehicles were limited and walking was the main method used for short trips.



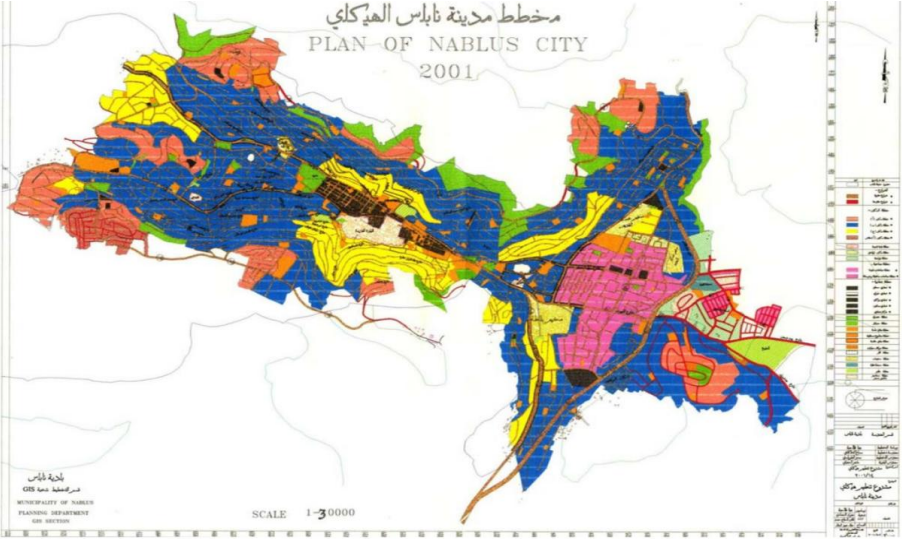
Map 33 Nablus master plan 1961

In 1995, a master plan was prepared for Nablus city to provide services that will be enough until 2015. Map (34) shows the master plan for Nablus city in 1995. It shows that roads have priorities and the plan put some local solutions for movement and circulation to cover the city needs. It provided some projects such as a ring road to minimize the traffic on Faisal street and to construct new secondary linear, transverse roads to provide movements inside the city parts, and to make roads for residential areas.

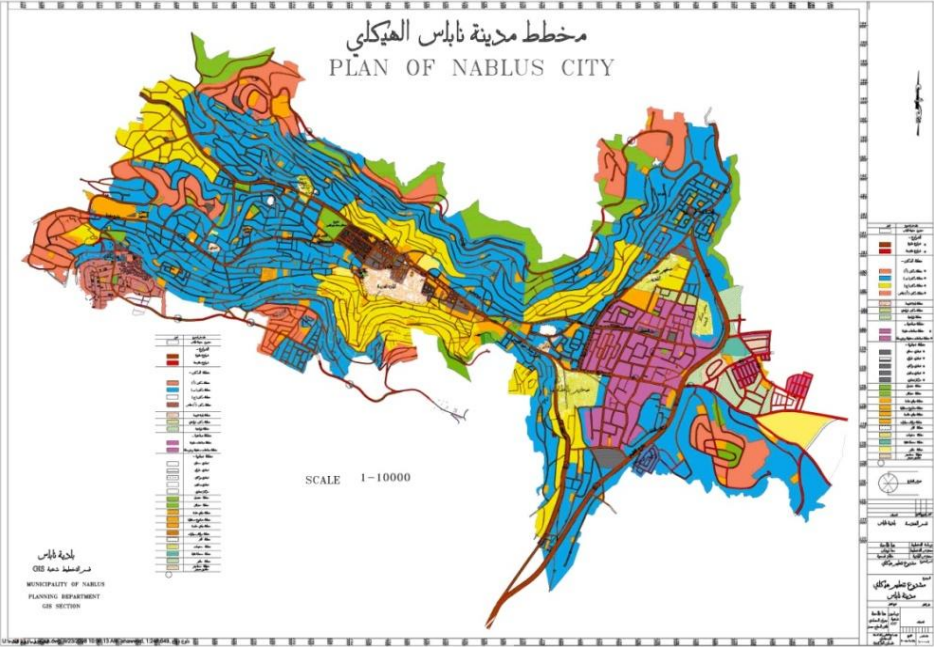


Map 34 Nablus master plan 1995

Maps (35,36) show the master plan for Nablus city in 2001 and 2011. They show that the city limits stood constant but with some modification in details. Roads in both had the same aims that were in 1995. They form modification plans for 1995 master plan to fit people needs in their times.

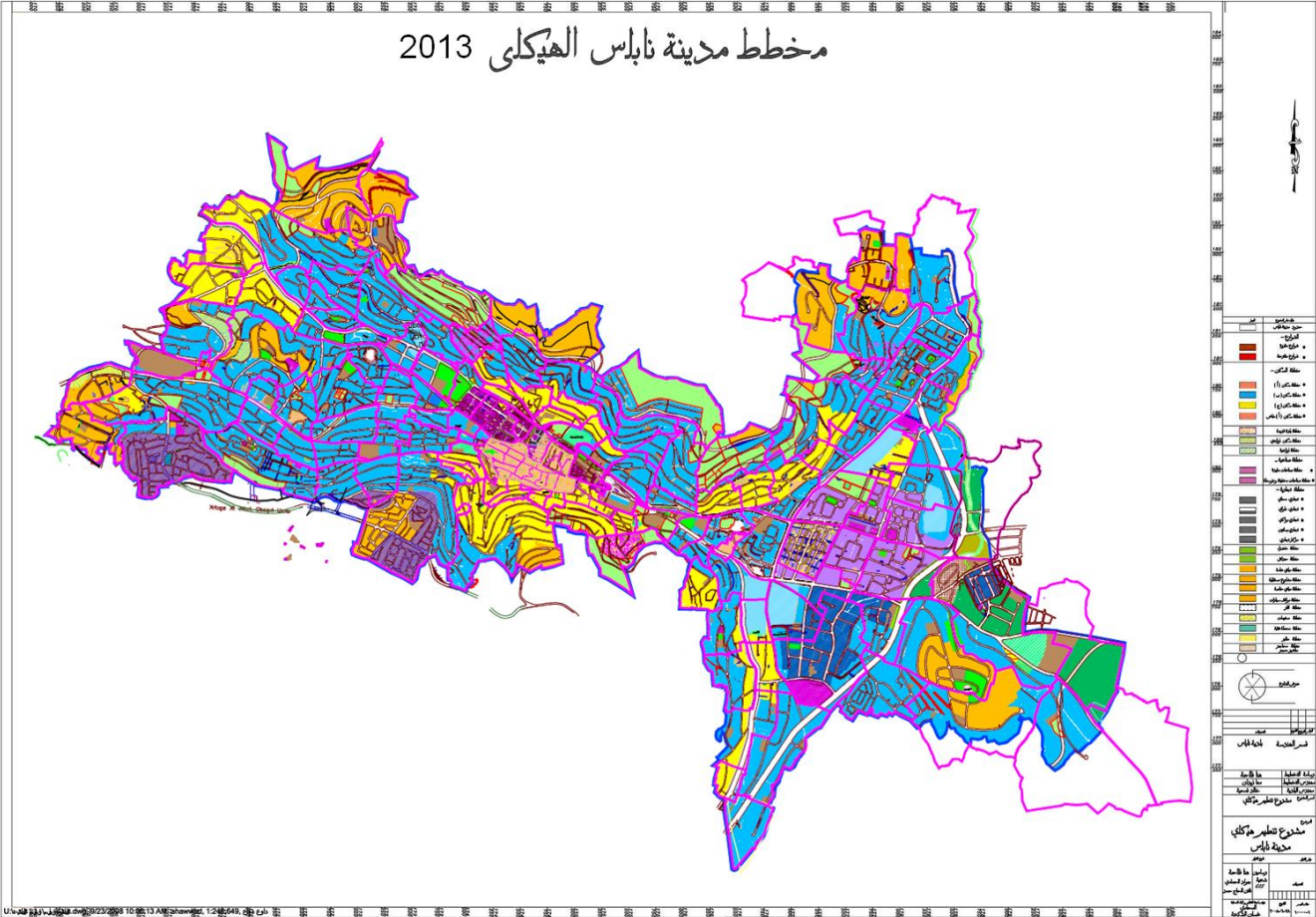


Map 35 Nablus master plan 2001



Map 36 Nablus master plan 2011

Map (37) shows the last edited master plan for Nablus city in 2013. The latest master plan provides 21% of the city area for roads and 55% for residential areas as shown in chart (6).



Map 37 Nablus master plan 2013

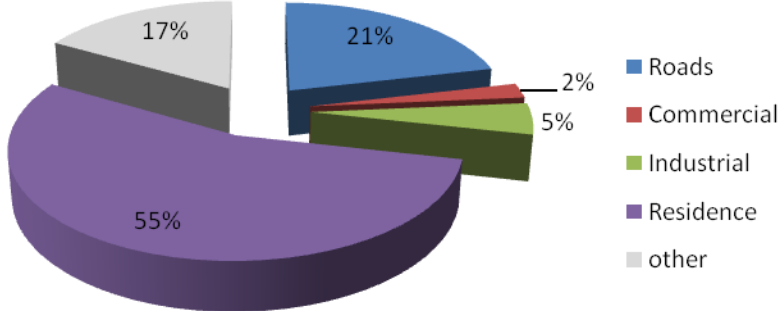
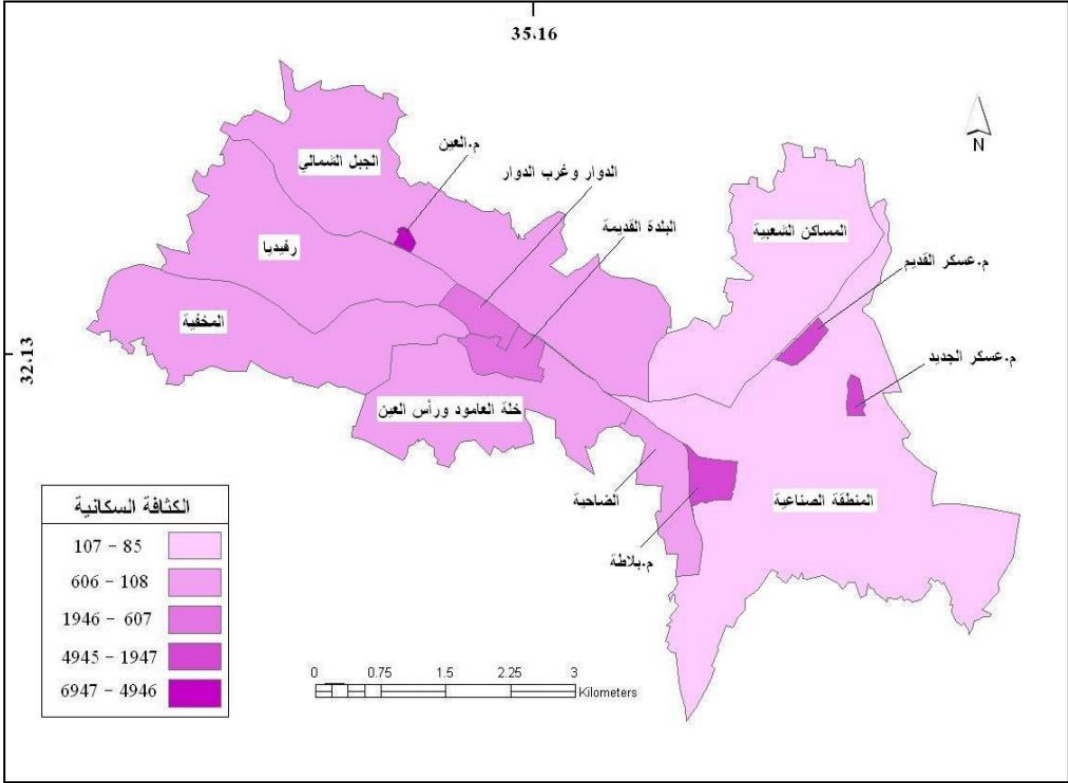


Chart 6 Land use in 2013

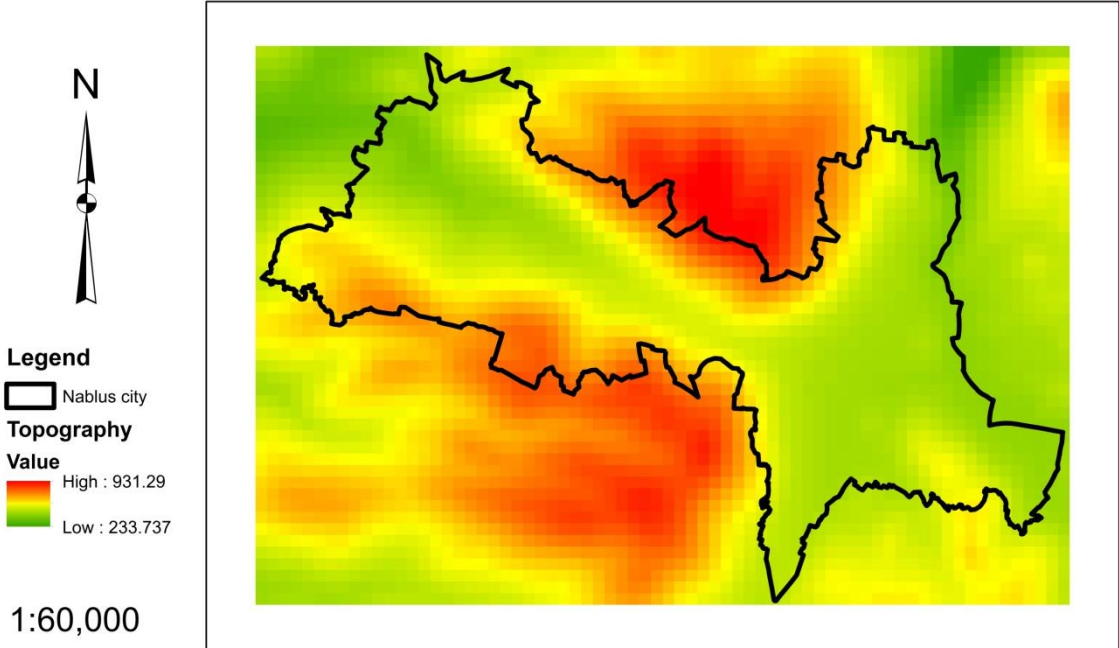
To understand the expansion and the amount of transit needed in Nablus city we need to study the density in each neighborhood. Map (38) shows the density in Nablus city according to each neighborhood. It is shown that camps have the highest densities. Then the western parts have high densities. We can understand that transit is needed more in the western part of the city, the CBD, and the old town.



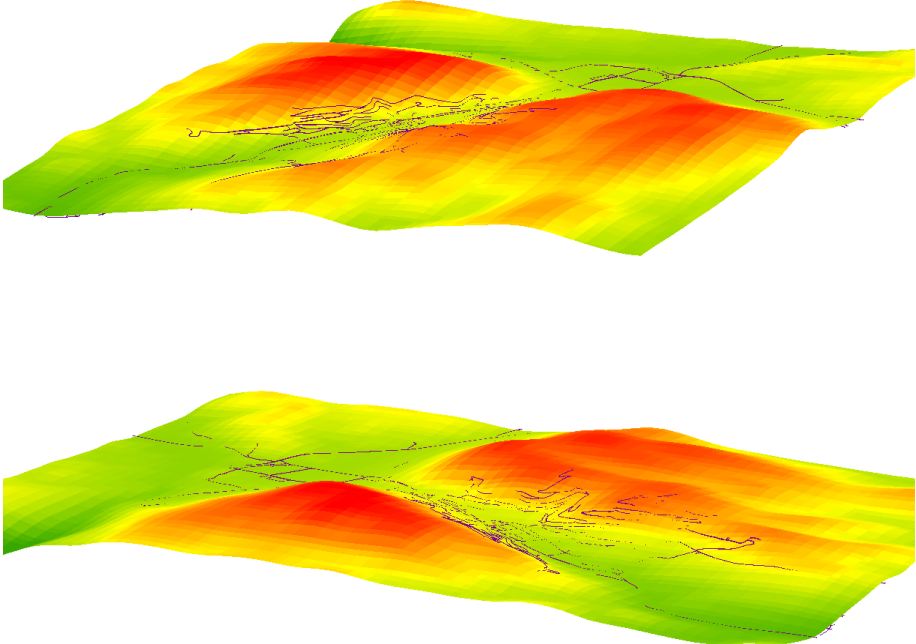
Map 38 Nablus city neighborhoods density

Map (39) shows Nablus city Topography. The city lies between two mountains, Eibal and Jerzim. The buildings lie along roads that lie along the valley between the two mountains.

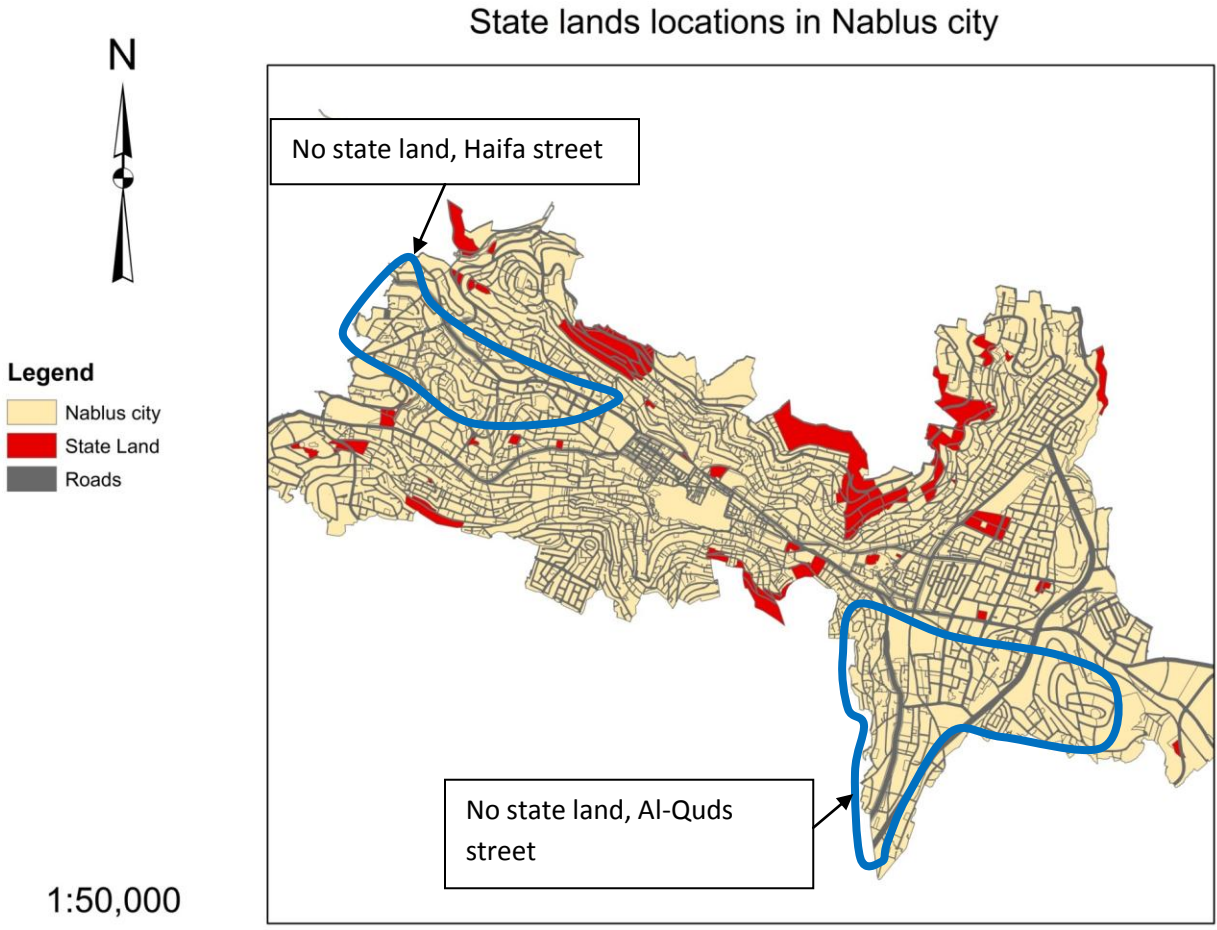
Nablus city topography



Map 39 Nablus city topography

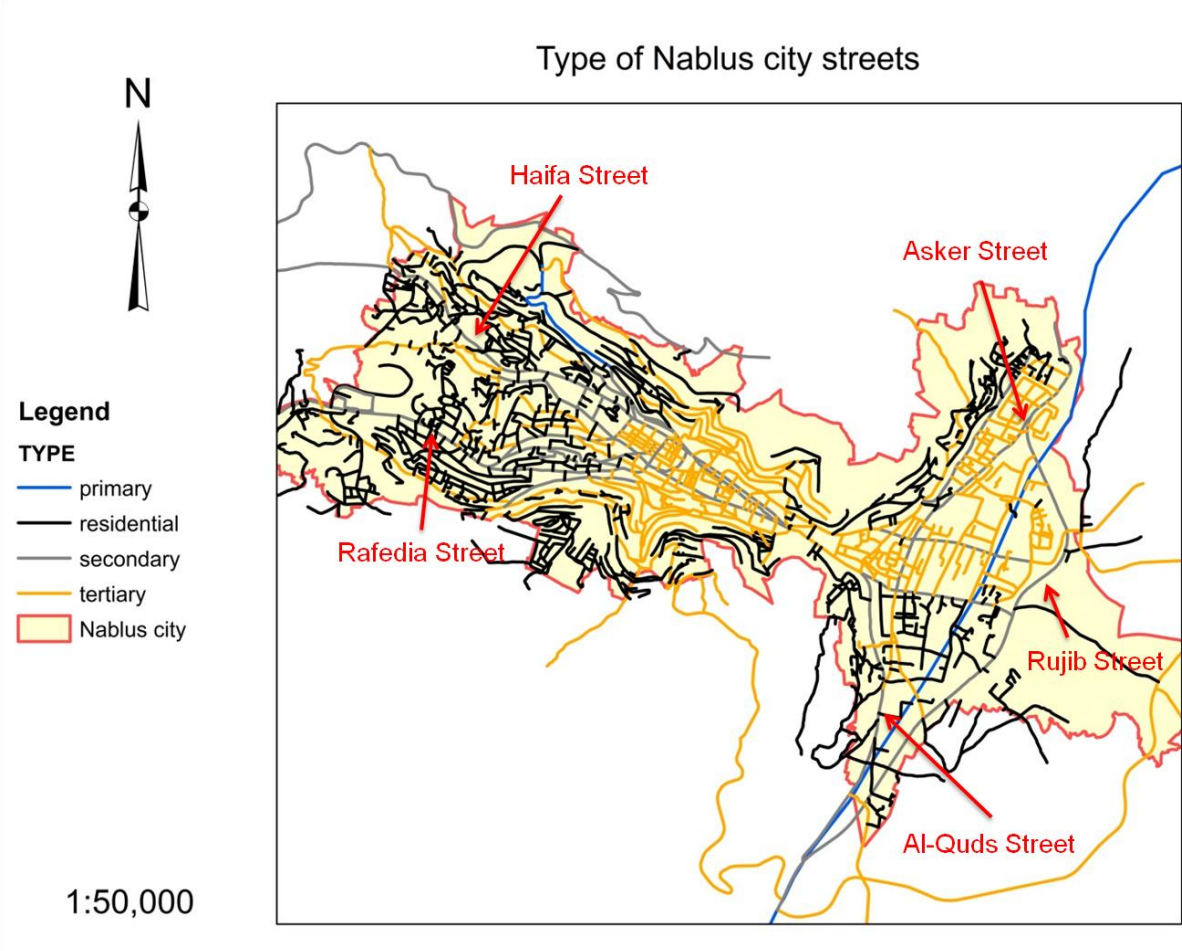


Map (40) shows the locations of state lands. These state lands can be used to allocate stations for public transportation. We can find that there would be enough places for stations except in some areas like Haifa and Al-Quds streets.



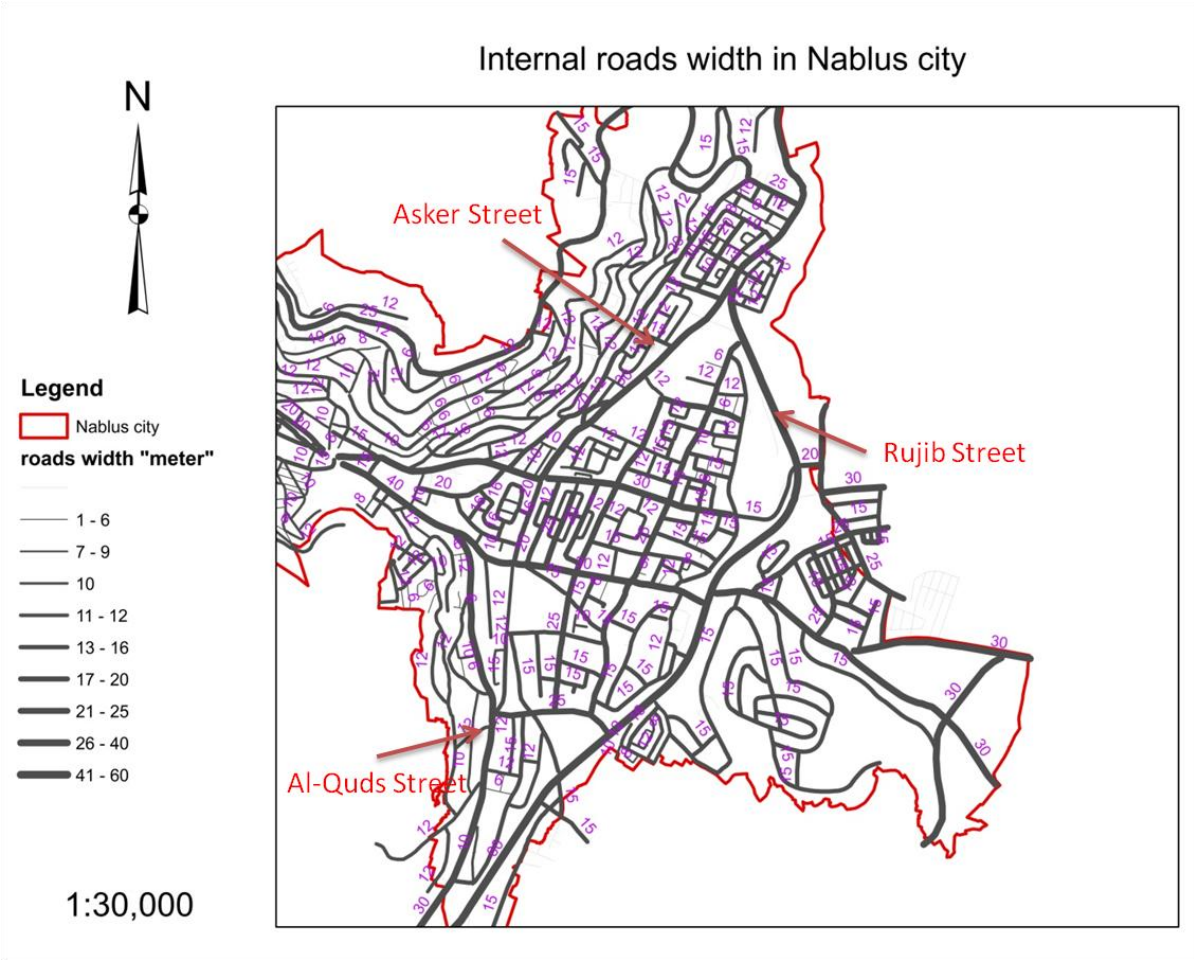
Map 40 State land locations

Nablus city streets are classified into four types as shown in map (42) which are: primary, residential, secondary, and tertiary roads. only two roads are primary and the roads that connect the city with the outside are secondary "Haifa, Rafedia, CBD, Asker, Rujib and Alquds streets". Residential roads are distributed in the western part of the city and with some of them in the north eastern and south eastern parts. Tertiary roads are concentrated in the CBD and the surrounding, also in the eastern part "commercial and industrial areas".



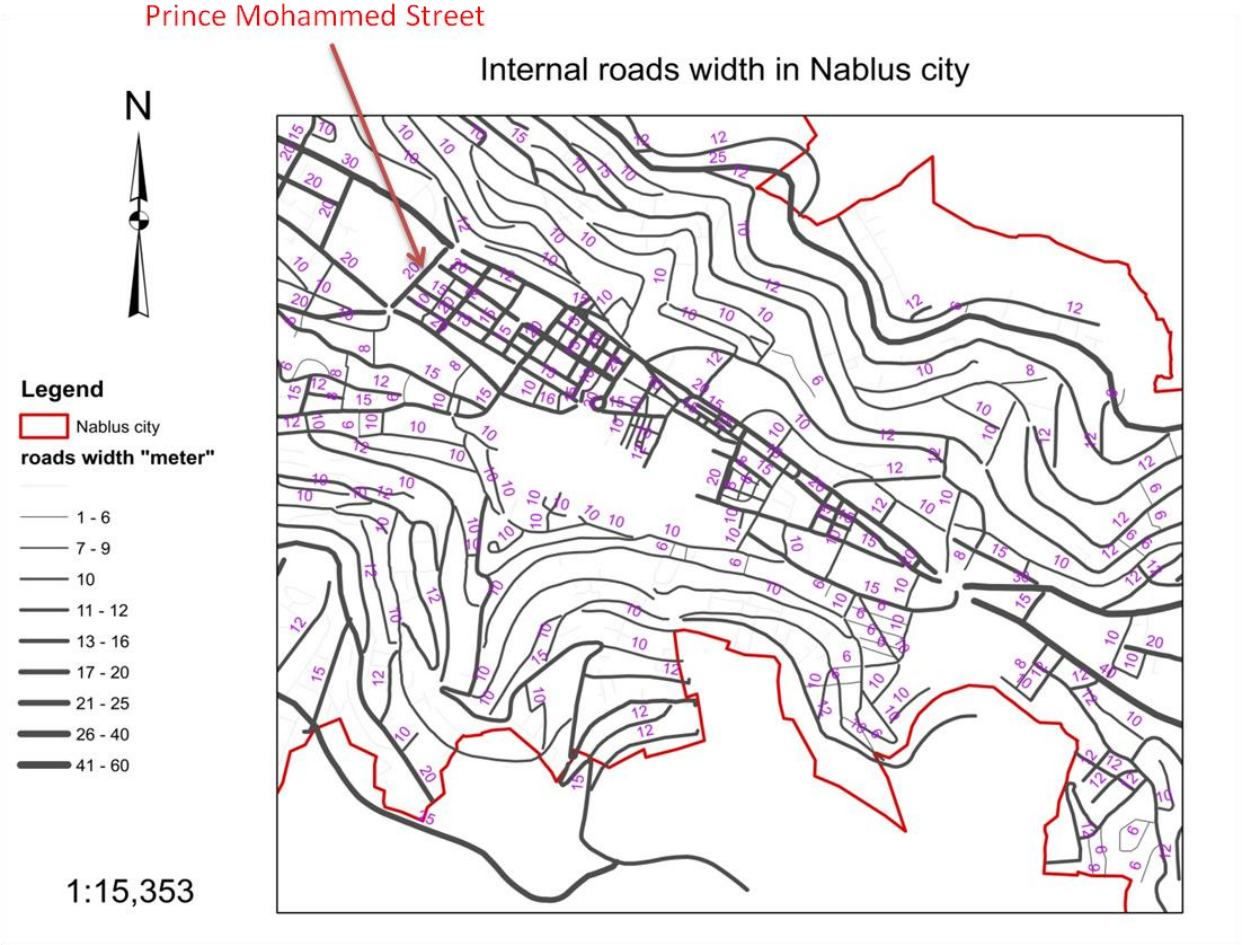
Map 42 Nablus city Streets types

Nablus city roads width vary from 4 to 60 meters as shown in maps (43,44,45). Only roujib roads has a width of 60 meters. Roads in the eastern part of the city have width of 6, 12, and 15. Only Asker road has a width of 30m and Al-Quds street has a width of 30m.



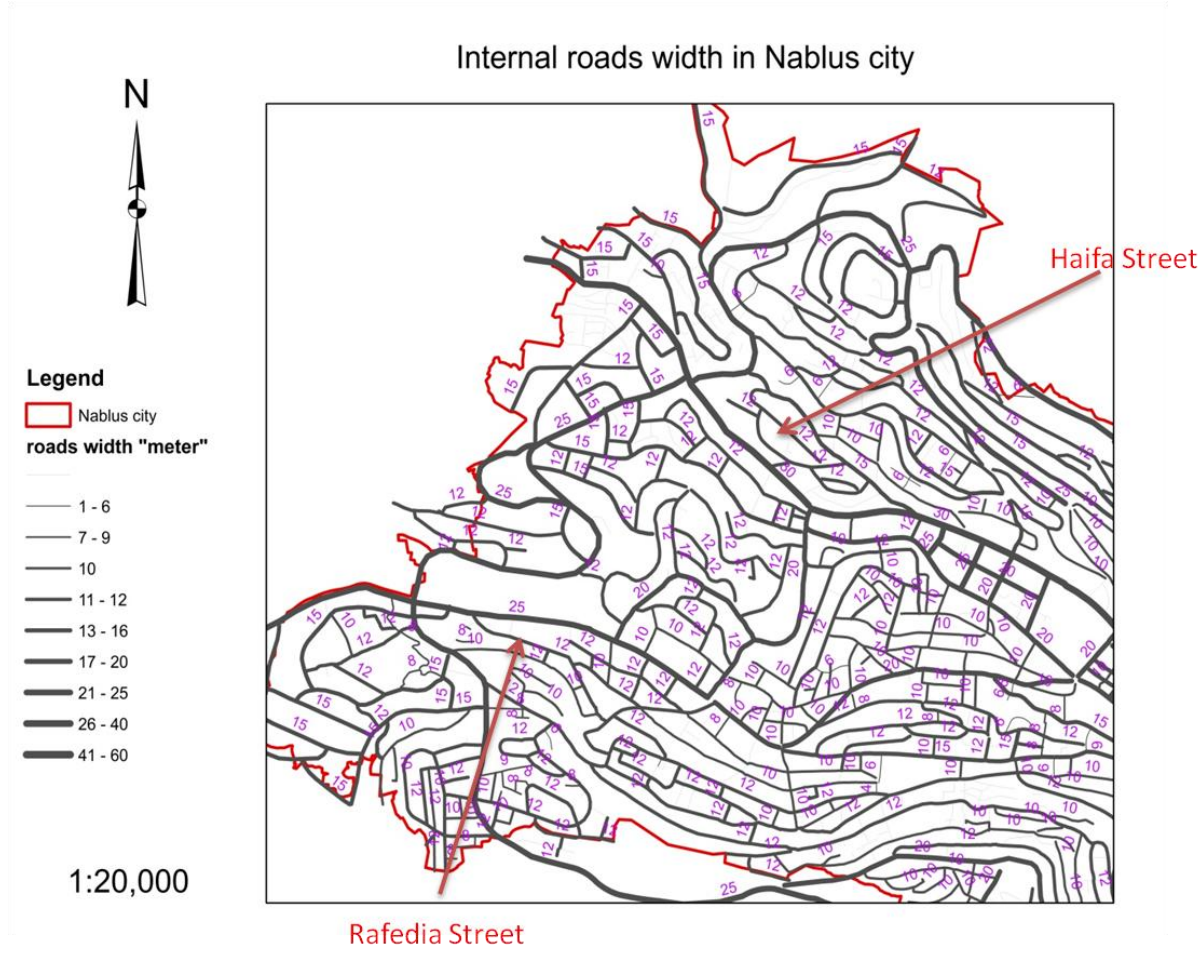
Map 43 Nablus city eastern part roads width

Roads in the middle part "mainly the CBD" vary from 10 to 15. Only the roads Prince Mohammed and three other roads, have width of 20 meters and they can't be widened.



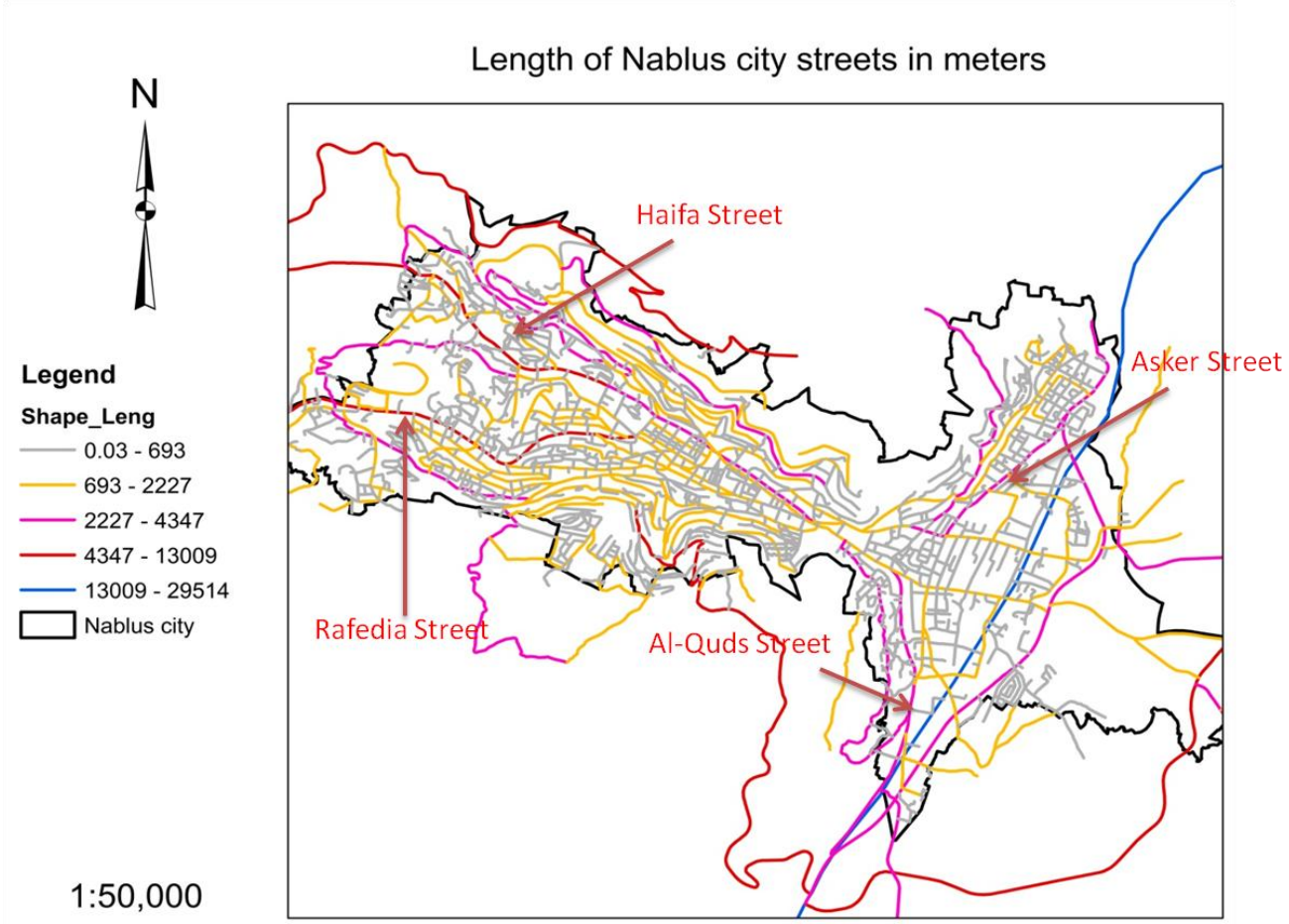
Map 44 Nablus city middle part roads width

Roads in the western part vary from 10 to 30 meters. Rafedia street has a width of 25 meters "limited width" and Haifa street has a width of 30 meters



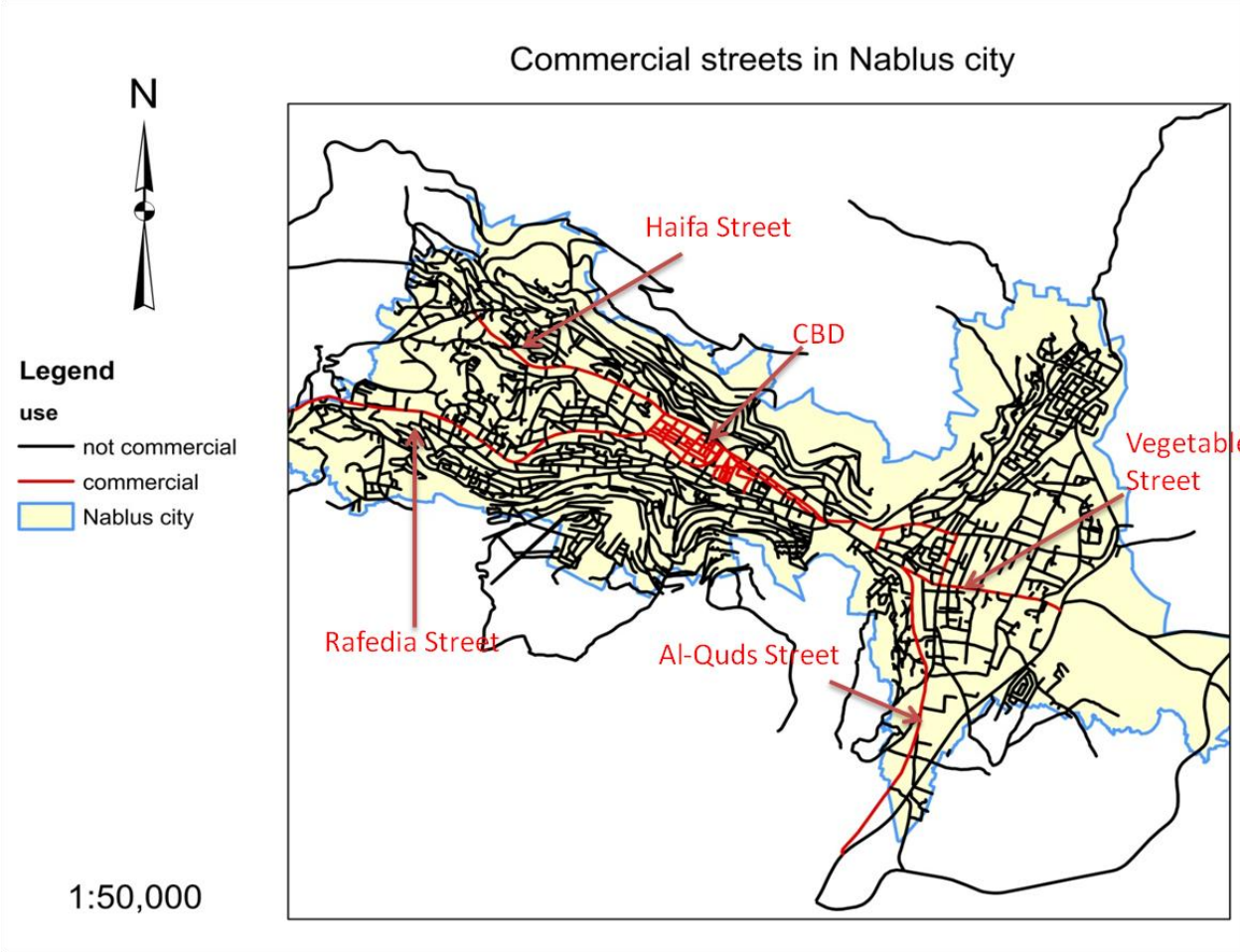
Map 45 Nablus city western part roads width

Map (46) shows the length of streets in Nablus city. Rafedia and Haifa streets lie from the western entrances towards the CBD. Then, there are Asker and Alquds streets are also long as they connect the eastern parts with Faisal street



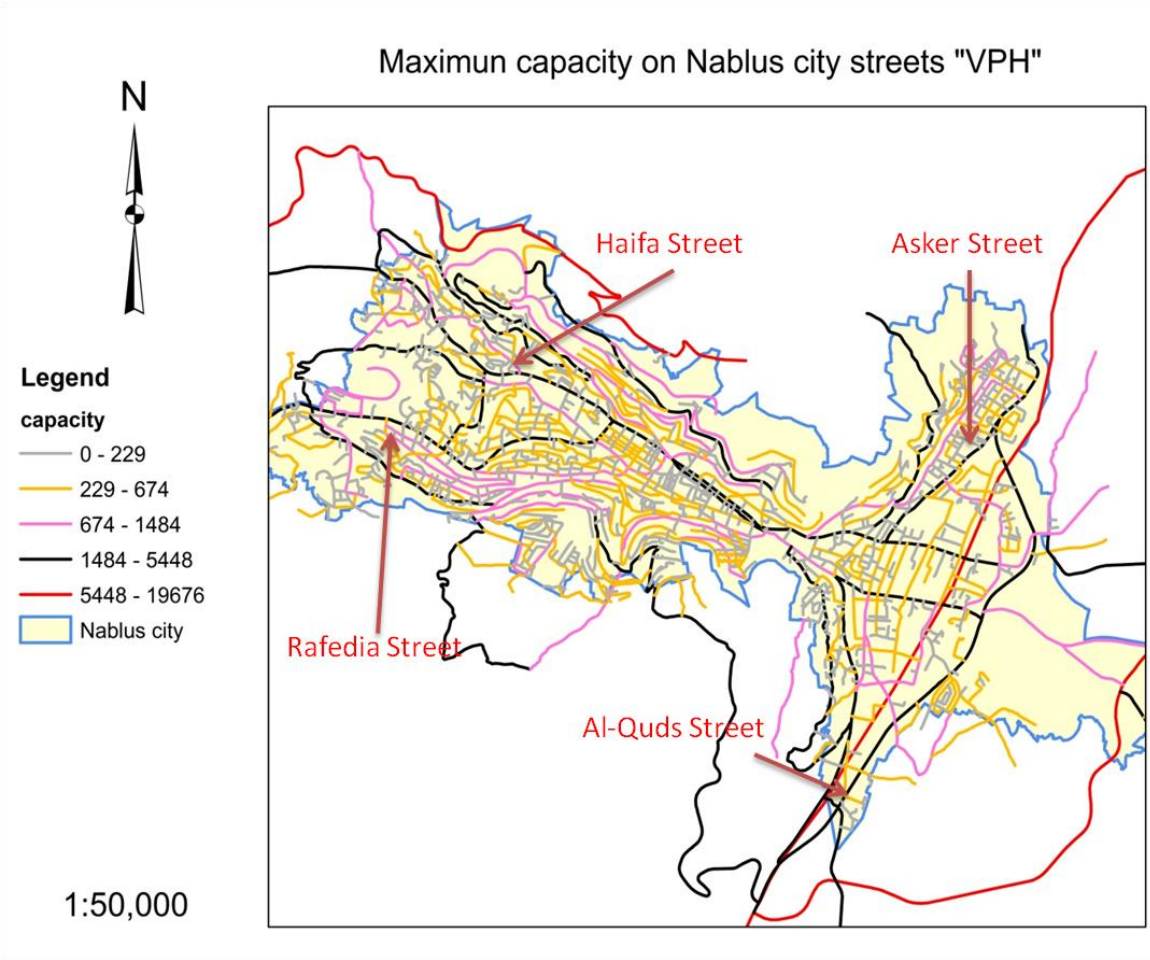
Map 46 Nablus city roads length

Map (47) shows commercial streets in Nablus city. commercial areas lie along Rafedia, Haifa, Al-Quds, Amman, and Vegetable streets.



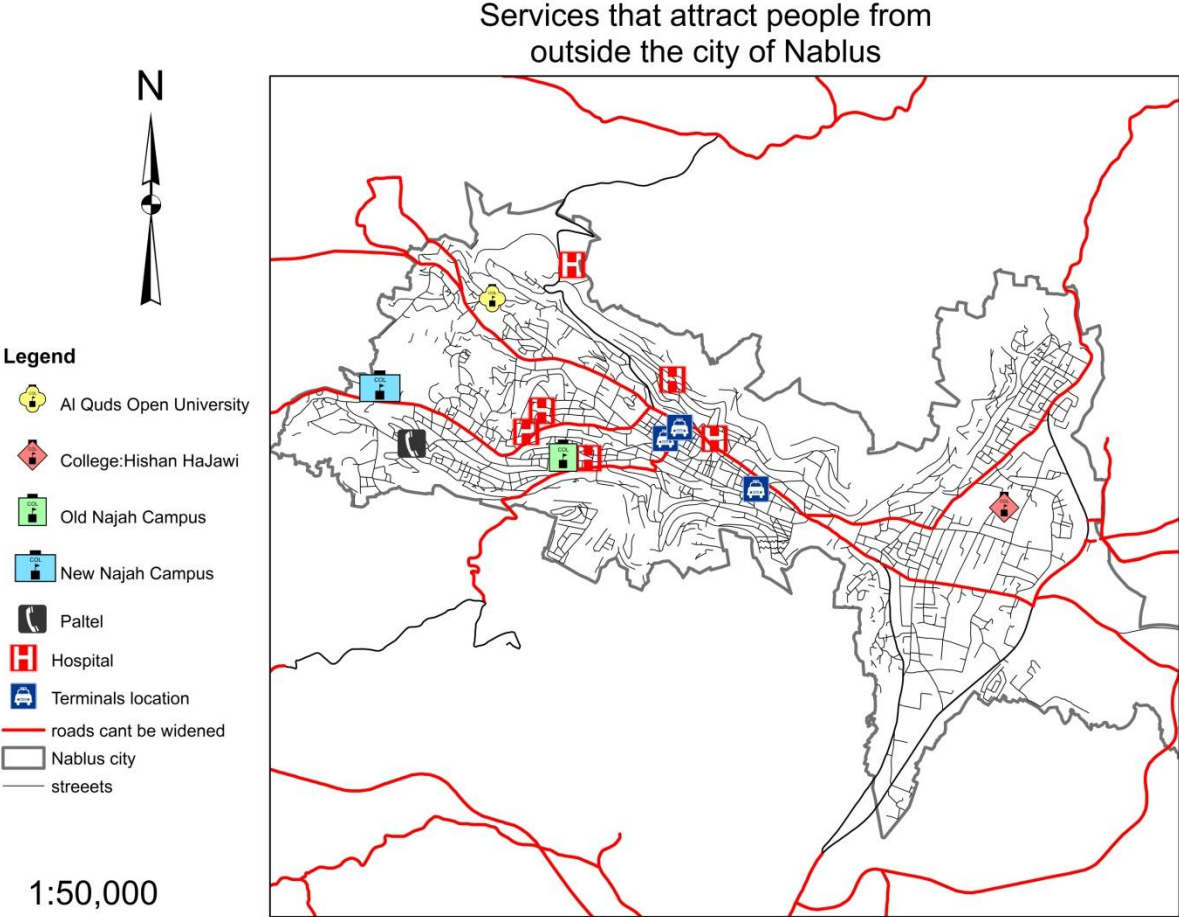
Map 47 Nablus city commercial streets

Map (48) show the maximum capacity that Nablus streets can bear. Main roads (Rafedia, Haifa, Asker, Al-Quds streets) in Nablus city have high capacities. Which means that they can be used as main corridors in a transit oriented city.



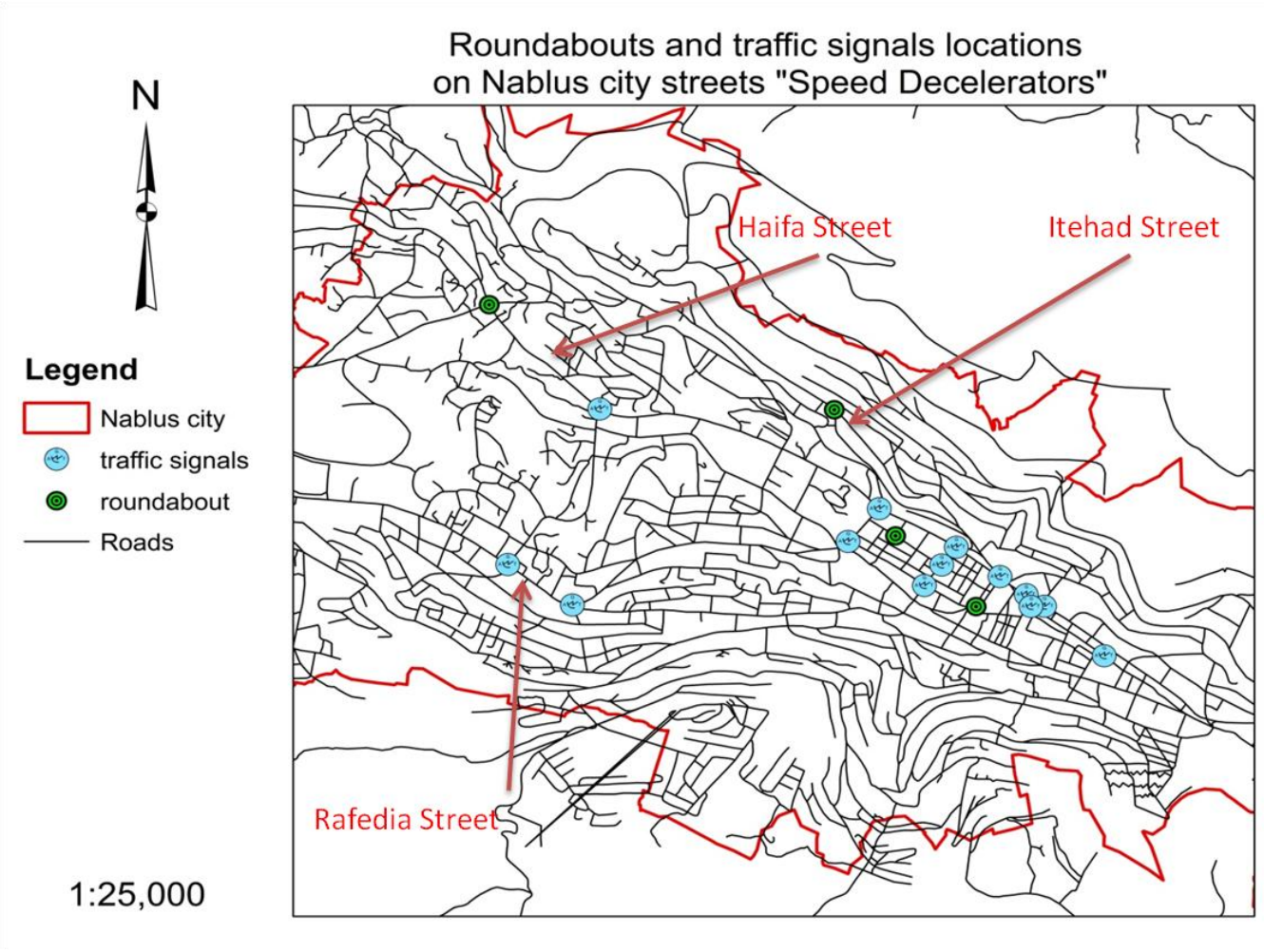
Map 48 Nablus city roads capacity

Map (49) shows the location of main attractive services in Nablus (they attract people from outside Nablus city to work or to get services which lead to high traffic on their surrounding roads). These services are : Hospitals, Old and New Najah campuses, Hisham Hijawi college, Paltel building, Al-Quds open University, and shared taxis terminals



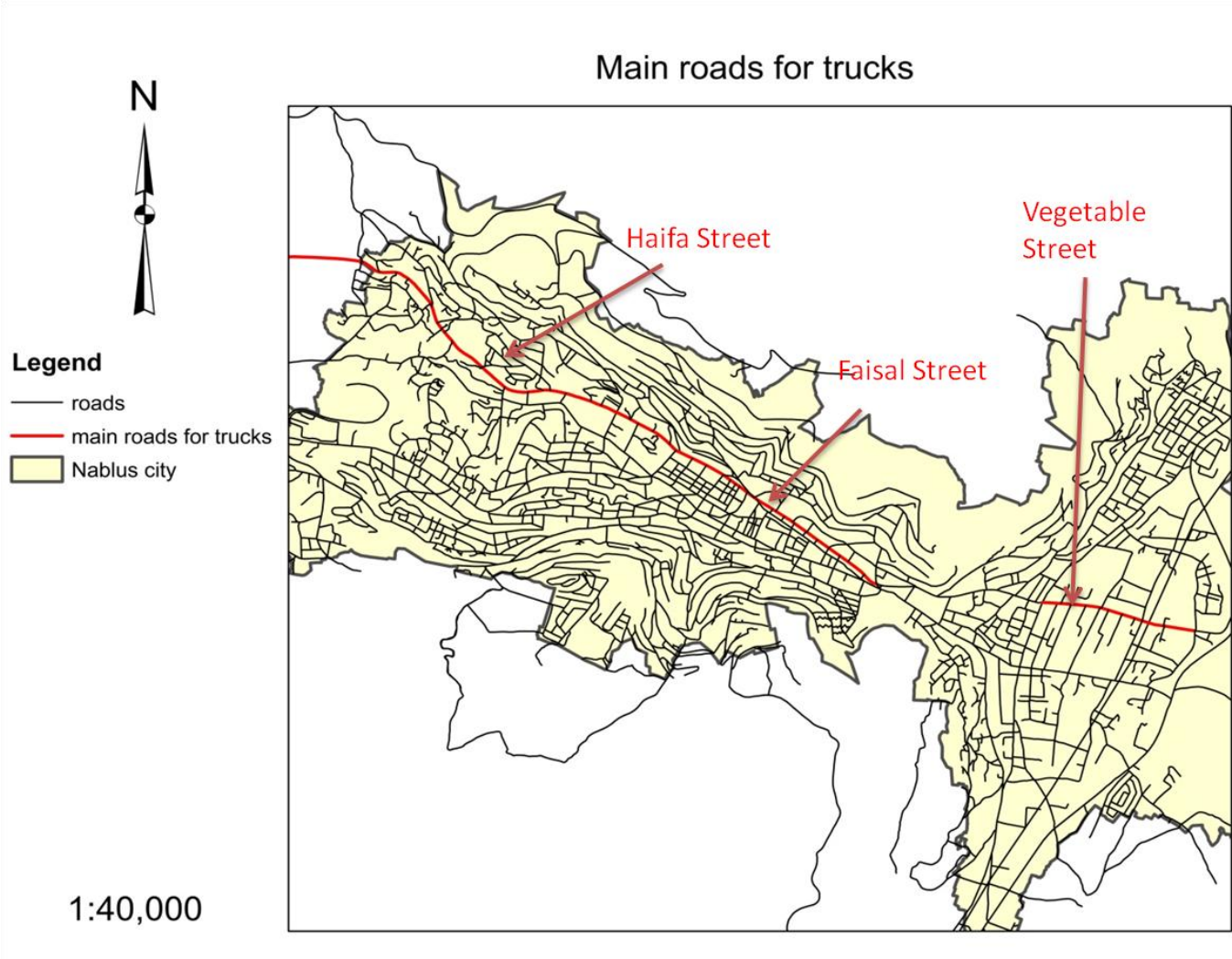
Map 49 Nablus city attractive regional services

Map (50) shows the locations of traffic signals(thirteen traffic signals, 10 of them are located in the CBD and two on Rafedia atreet, only one is on Haifa street) and roundabouts (there are four roundabouts, two in the CBD, one on Heifa street, and one on Itehad street) in the city. The location of traffic signals in the CBD might not be needed in a transit oriented city. This means that they need to be reallocated. More roundabouts are needed for dangerous intersections.



Map 50 Nablus city traffic signals and roundabout locations

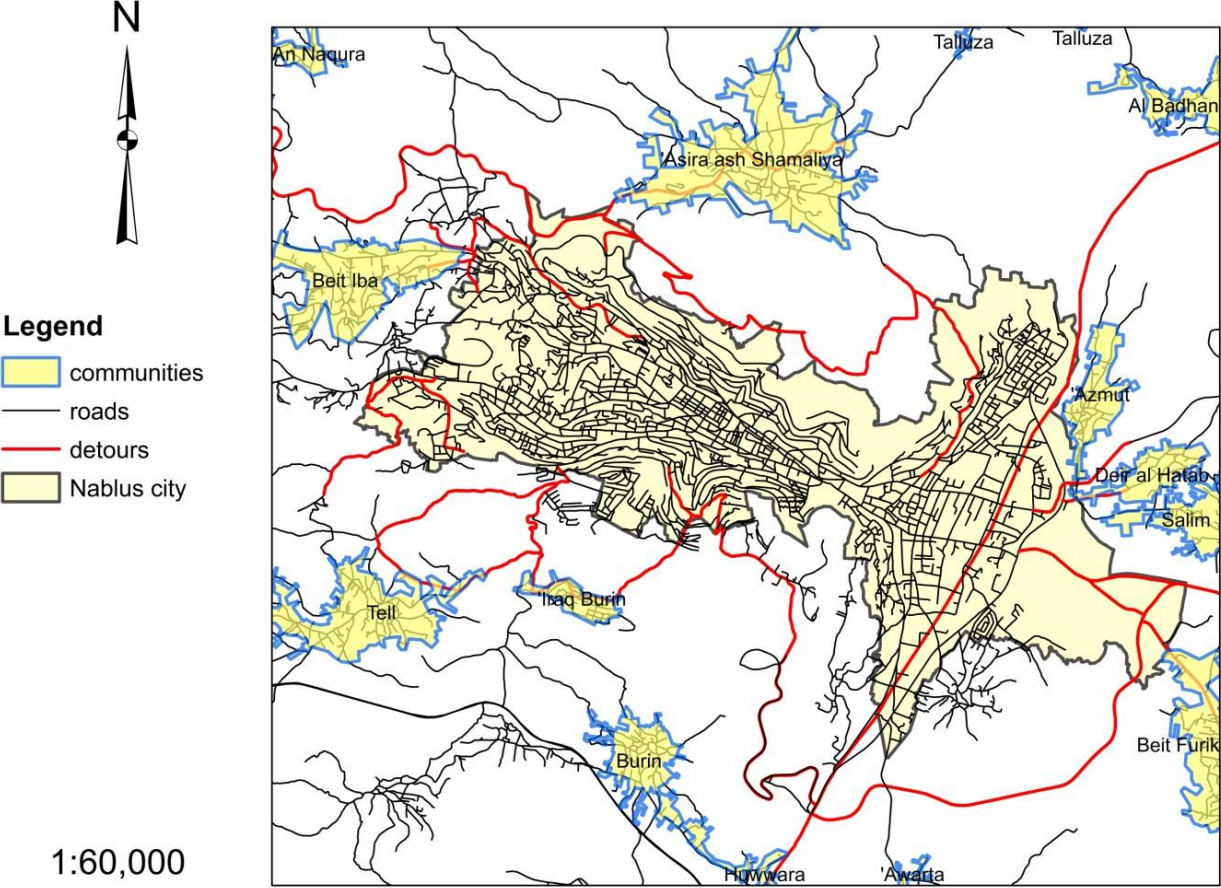
Map (51) shows the roads that trucks use frequently. These roads are: Haifa, Faisal, and Vegetable streets. Faisal street is an important street in the city because it connects the two sides of the city (eastern with western) as a result of the city topography. This causes high traffic volumes on Faisal street and high delays. This is considered a negative and needs to be solved.



Map 51 Nablus city roads used by trucks

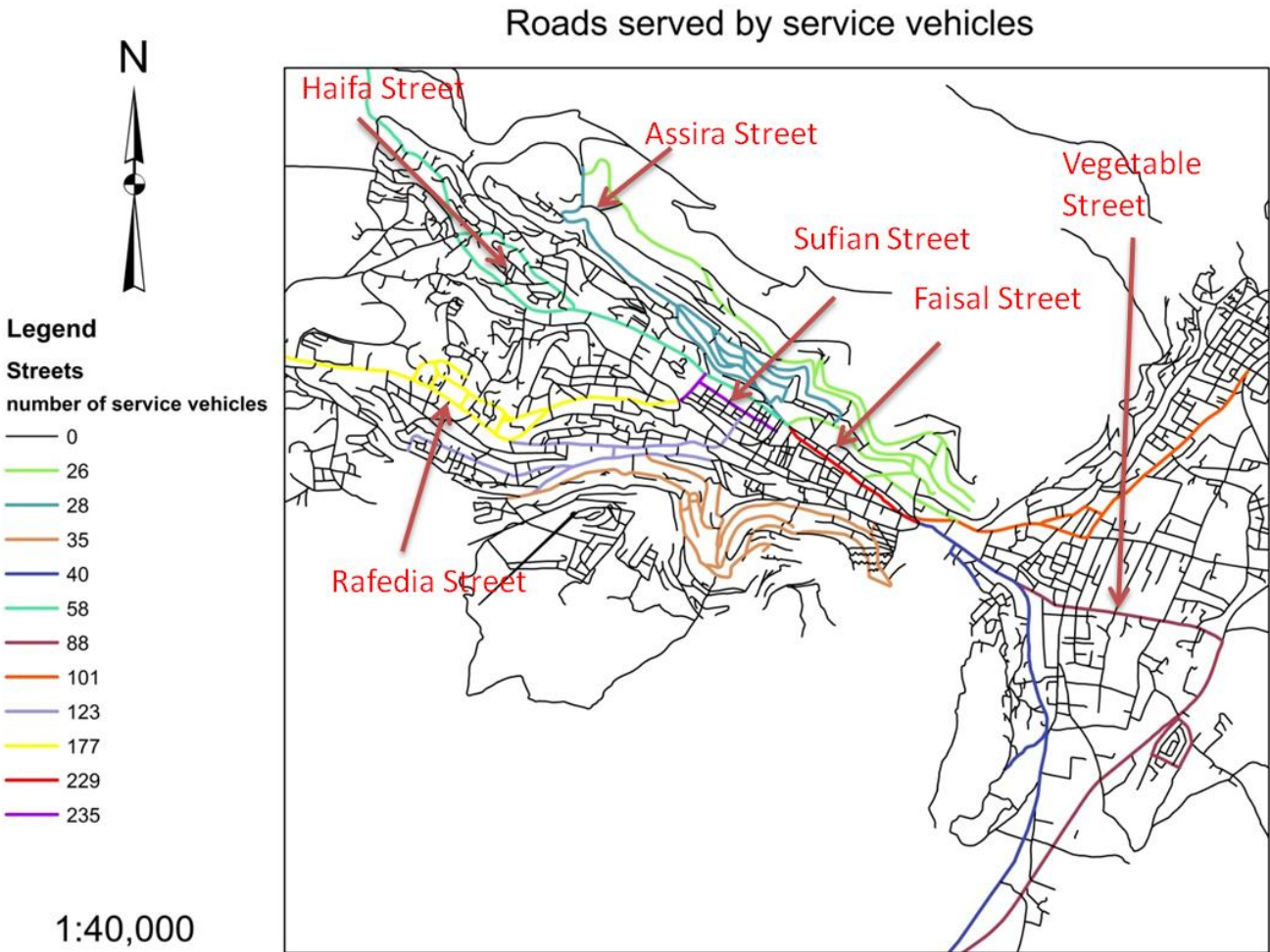
Map (52) shows that there are detours in Nablus city that can be used to minimize traffic on main roads. These roads are used mainly in emergency cases. Such as, Israeli checkpoints.

Roads used for entrances closure cases



Map 52 Nablus city detours

Map (53) the following map shows the routes for internal shared taxis and the number of shared taxis on each route. They are nearly distributed to all areas in the city but they do not reach each road or each house " a shortage in service". Also, they show that all trips start from one terminal located in the CBD and there is no direct connection between areas. " If someone needs to go from Rafedia to Assira, He needs to travel from Rafedia to CBD and then from CBD to Assira". 235 taxi pass through Prince Mohammed and Sufian streets towards different orientations. On Faisal street, 229 vehicles.

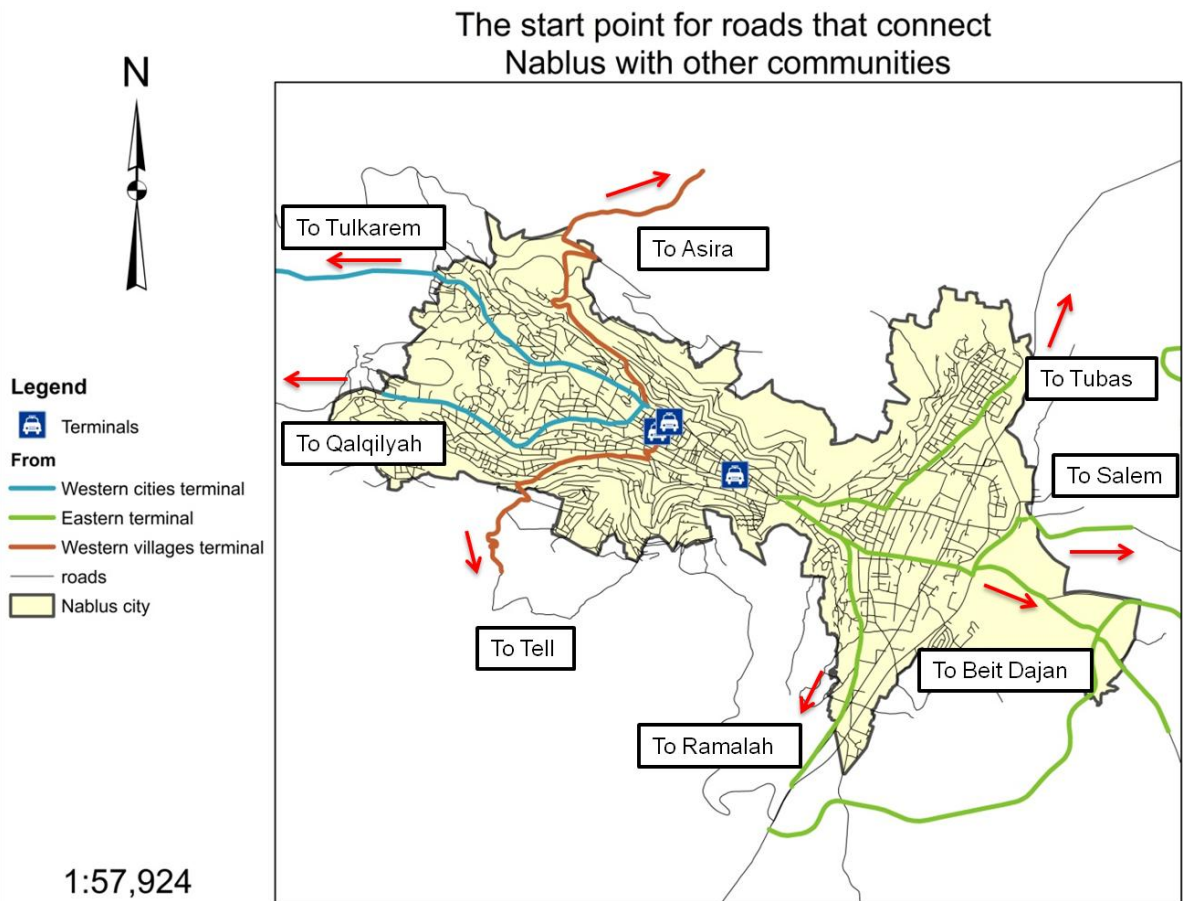


Map 53 Nablus city served by shared taxis

3.3 Internal and external shared taxi movements analysis

Nowadays, there are three terminals for public transportation for external lines. The first one is the Eastern Terminal, which serves the following lines (Tubas, Beit Dajan, Qusrah, Joreesh, Talloza, Beta, Al-Bathan, Der Istia, Kfl Hares, Hares, Mardah, Beit Forik, Salem, Bedia, Qabalan, Al Sawieh, Kafr Al Dik, Doma, Yetma, Deir Al Hatab, Al Lubbn, Oreef, Ainabos, Salfit, Aljftlek, Jalood, Talfit, Qariot, Alfar'a and Azmoot). The second is the Western Terminal that serves the following Towns: (Jenin, Jericho, Ramallah, Qalqilia, and Tulkarm). The last one is Western Terminal that serves the following villages (Yasid, Burqa, Sarrah, Tel, Beit Lid, Beit Eiba, Jaba, Al Fandaqumiya, Silet al Daher, Jeet, Hajjah, Jnesenia, Asira al Shamaliya, Sanor, Sabastiya, Beit Imreen, Sanour, Kafr Quddum, and Maithaloon).

Map (54) shows the roads used by each terminal taxi. It shows that for external shared taxis, only main roads are used which means high taxis concentration on these roads and high traffic volume (then high carbon emissions). This needs to be solved also. Because the location of terminals is unsuitable as it forces taxis to go through main roads.



Map 54 Nablus city routes for external shared taxis

Table (1) shows the numbers of vehicles in each terminal and the number of available spaces.

Table 1 Terminals vehicles counts

Terminal	Vehicle Type	Number of registered vehicles	Number of available Spaces	Type of ownership	Storage Facility
Western Terminal (Serving Towns)	Shared Taxis	325	30	Municipality	No Special Storage area, as a result buses park out of the terminal
	Buses	48	8	Municipality	No special storage area
Western Terminal (Serving Villages)	Shared Taxis	151	25	Municipality	No special storage area
	Buses	25	12		
Eastern Terminal	Shared Taxis	297	65		
	Buses	64	19		

Such data were obtained from Traffic Counts was done by Traffic Engineering Laboratory Students. Tables (2,3,4,5) show the volume of traffic on two main roads Faisal and Haifa streets. We can notice the high volumes on Faisal street that have a minimum value of about 1000 vehicles per line per hour.

Table 2 Traffic Volume on Haifa Street (Eastbound Direction) (Eman, Maram, Bilal n.d.)

Time	Volume (veh/hr)
7:00-8:00	1200
8:00-9:00	722
11:00-12:00	542
12:00-1:00	538
1:00-2:00	612
2:00-3:00	582
3:00-4:00	658

Table 3 Traffic Volumes on Haifa Street (Westbound Direction) (Eman, Maram, Bilal n.d.)

Time	Volume (veh/hr)
7:00-8:00	685
8:00-9:00	655
11:00-12:00	530
1:00-2:00	646
2:00-3:00	649
3:00-4:00	684

Table 4 Traffic Volume on Faisal Street (Eastbound Direction) (Eman, Maram, Bilal n.d.)

Time	Volume (veh/hr)
7:00-8:00	2072

12:00-1:00	1730
1:00-2:00	1911
2:00-3:00	3148
3:00-4:00	1767
4:00-5:00	1482

Table 5 Traffic Volume on Faisal Street (Westbound Direction) (Eman, Maram, Bilal n.d.)

Time	Volume (veh/hr)
7:00-8:00	2036
8:00-9:00	1452
11:00-12:00	1287
12:00-1:00	1465
1:00-2:00	1154
2:00-3:00	792
3:00-4:00	1338
4:00-5:00	1217

Accumulation Study

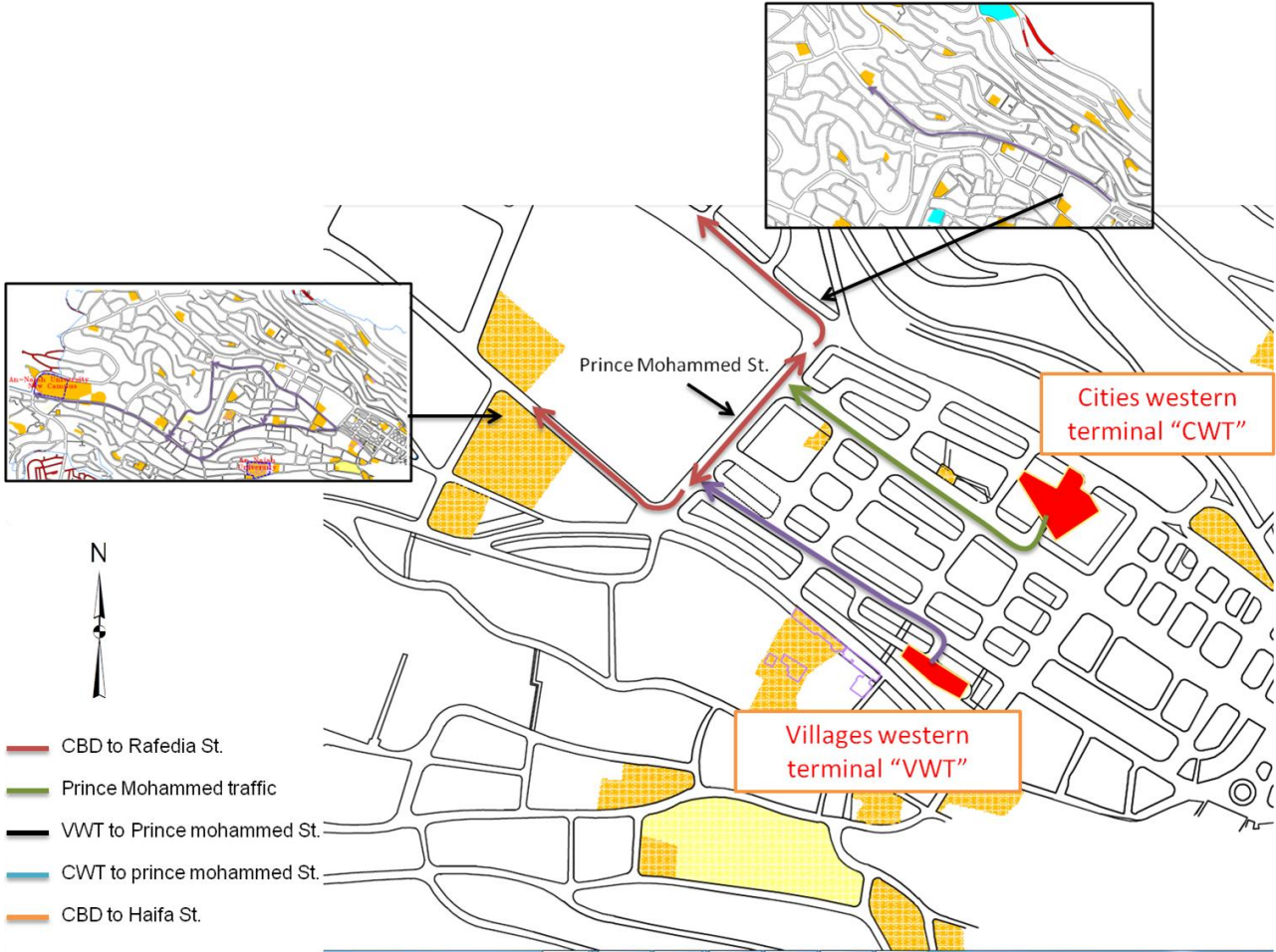
Data collected from accumulation study were used to find the peak hour for entering and leaving vehicles for each terminal. Table (6) summarizes peak hour and peak hour volume for inbound and outbound vehicles in each terminal.

Table 6 Peak Hour and Peak Hour Volume for Inbound and Outbound Vehicles in Each Terminal (Eman, Maram, Bilal n.d.)

Terminal	Inbound		Out bound	
	Peak Hour	Peak Hour Volume	Peak Hour	Peak Hour Volume
Western (Towns)	7:15-8:15	122	3:00-4:00	83
Western(Villages)	2:45-3:45	174	2:00-3:00	180
Eastern	1:30-2:30	225	2:30-3:30	225

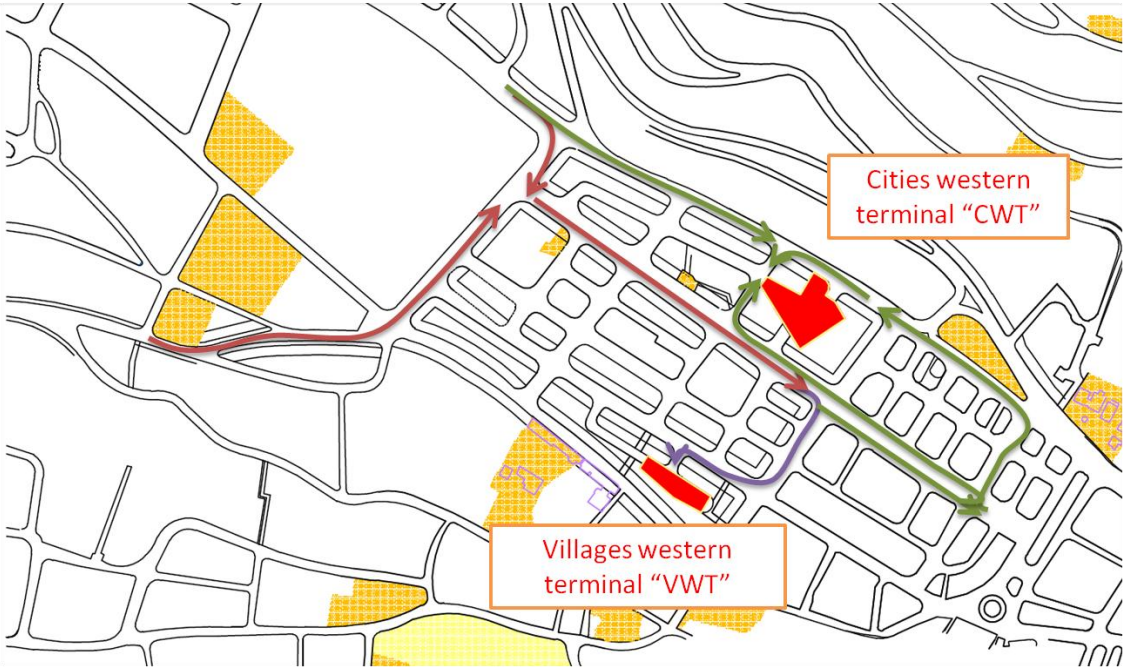
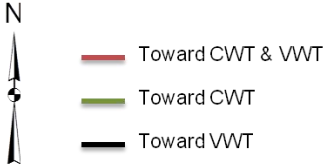
About 62.3% of Nablus visitors travel to Nablus daily and 15.6% weekly, 22.1% travel to Nablus according to their needs. 73.8% of them use shared taxis, 13.5% use mini buses.

Map (55) shows traffic movements outward from western terminals. It shows that vehicles start from terminals towards Prince Mohammed street, then, vehicles towards Tulkarem and near communitites pass through Haifa and Assira streets. Vehicles towards Qalqilyah and near communities pass through Rafedia street.



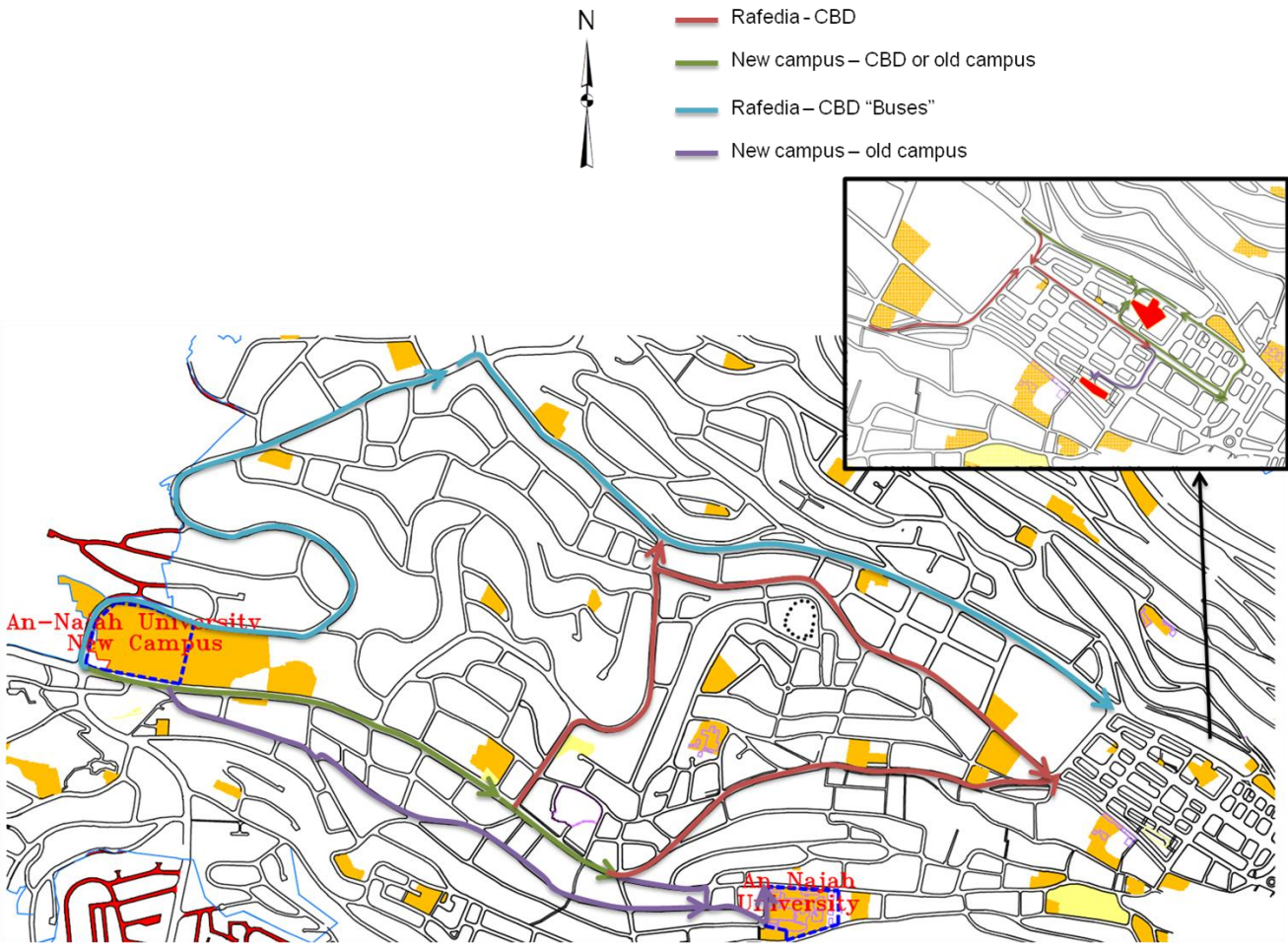
Map 55 traffic movements outward from western terminals

Map (56) shows traffic movements towards from western terminals. It shows that vehicles towards villages western terminal pass through Prince Mohammed and Sufian streets and those towards cities western terminal go through Prince Mohammed and Sufian or Haifa streets.



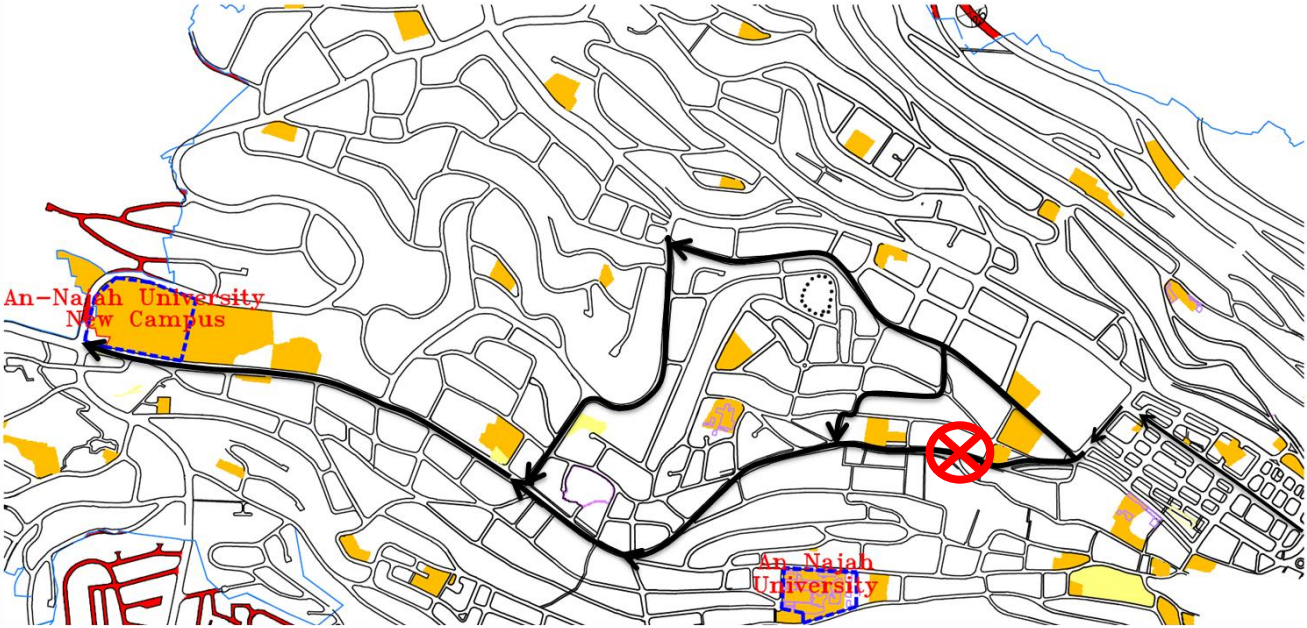
Map 56 traffic movements towards from western terminals

Map (57) shows Traffic movements from new Najah campus to CBD and Old Najah campus. It shows that shared taxis pass through Rafedia street or they can detour from Tunis street. Buses travel from Rafedia to the CBD from the detour as shown by the map. It also shows the route between the new and old Najah campus.



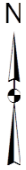
Map 57 Traffic movements from new Najah campus to CBD and Old Najah campus

Map (58) shows Traffic movements from CBD to new Najah campus. The main connecting road is Rafedia street. Vehicles travel through Tunis street or through a detour towards the beginning of Rafedia street.

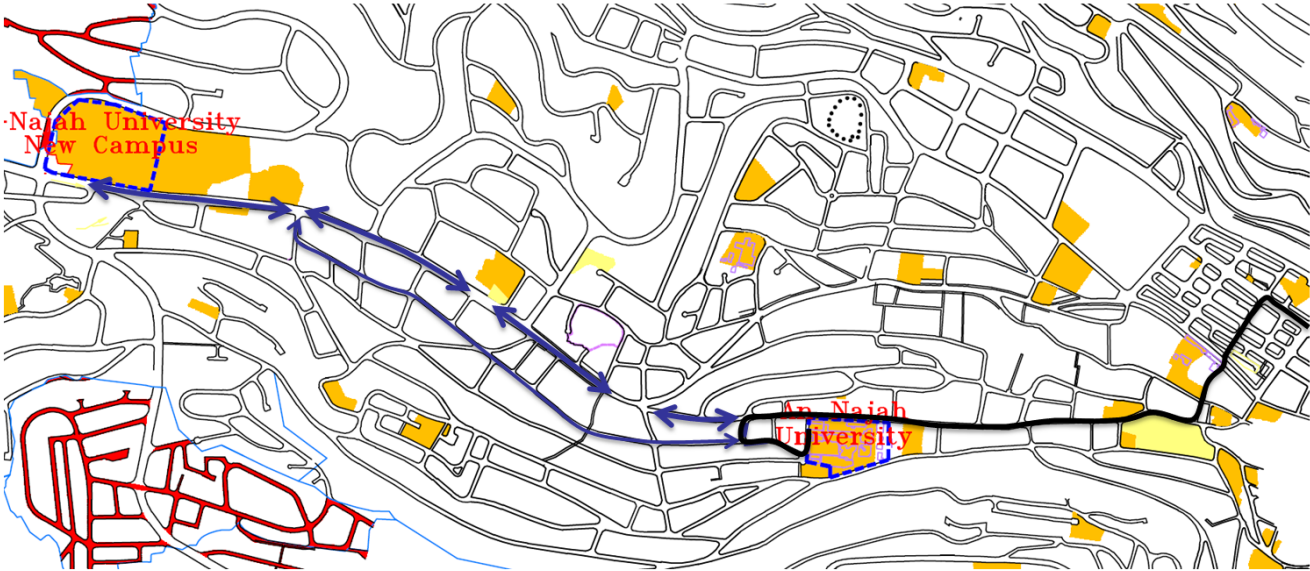


Map 58 Traffic movements from CBD to new Najah campus

Map (59) shows Traffic movements to and from old Najah campus. It shows that Rafedia street and Old Najah street are the main roads used by vehicles from and toward old Najah campus.

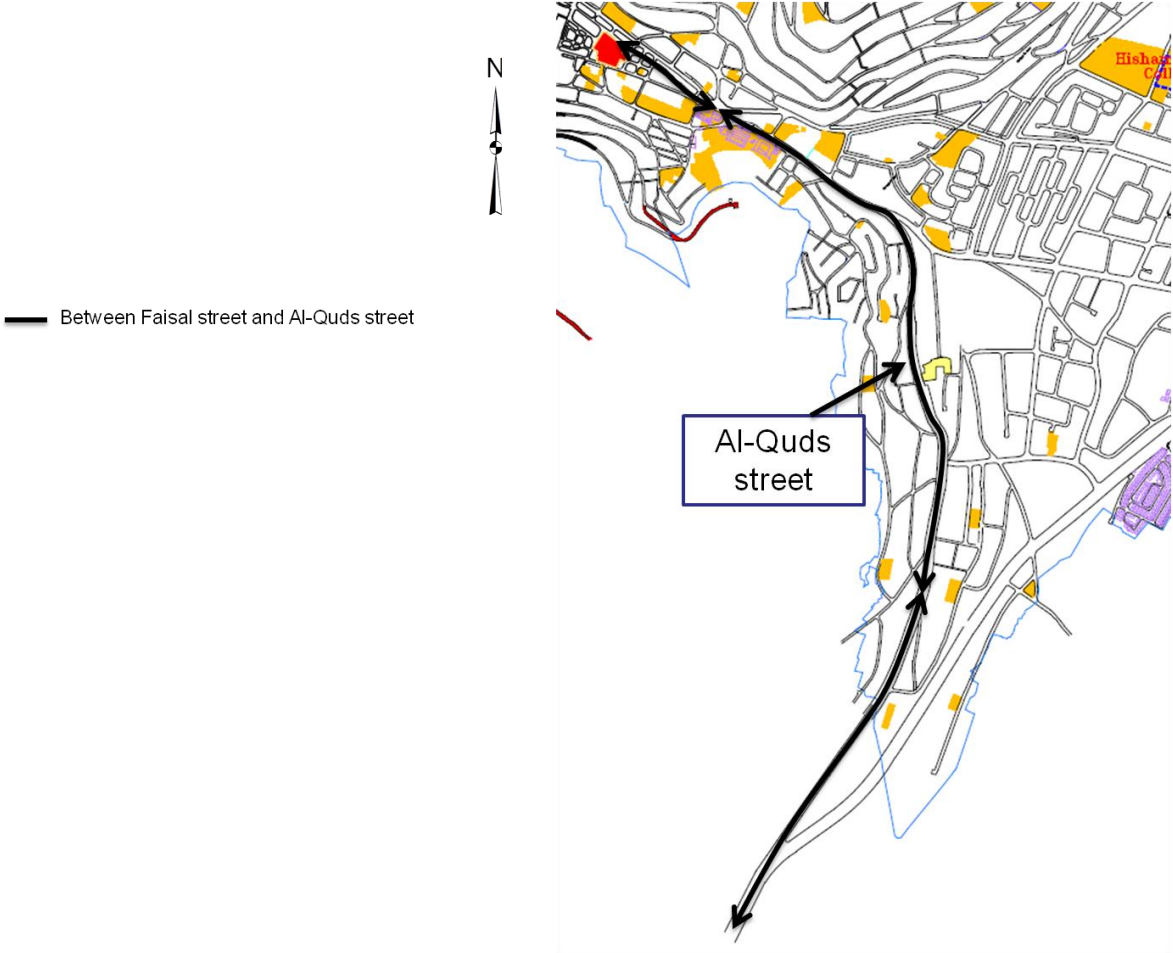


- Between An-Najah campuses
- Between old campus and CBD



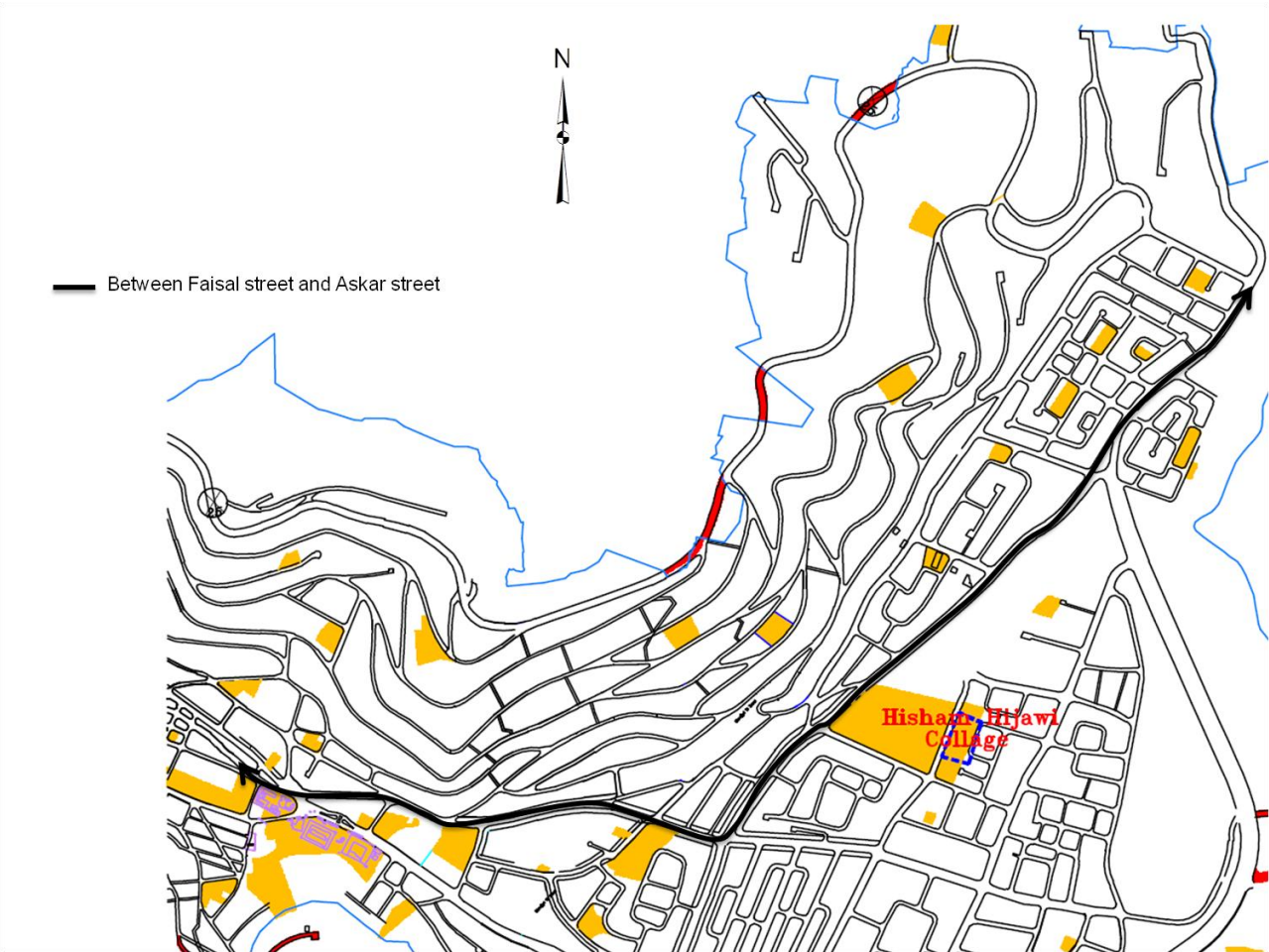
Map 59 Traffic movements to and from old Najah campus

Map (60) shows Traffic movements on Al-Quds Street “ between eastern terminal and south-eastern communities”.



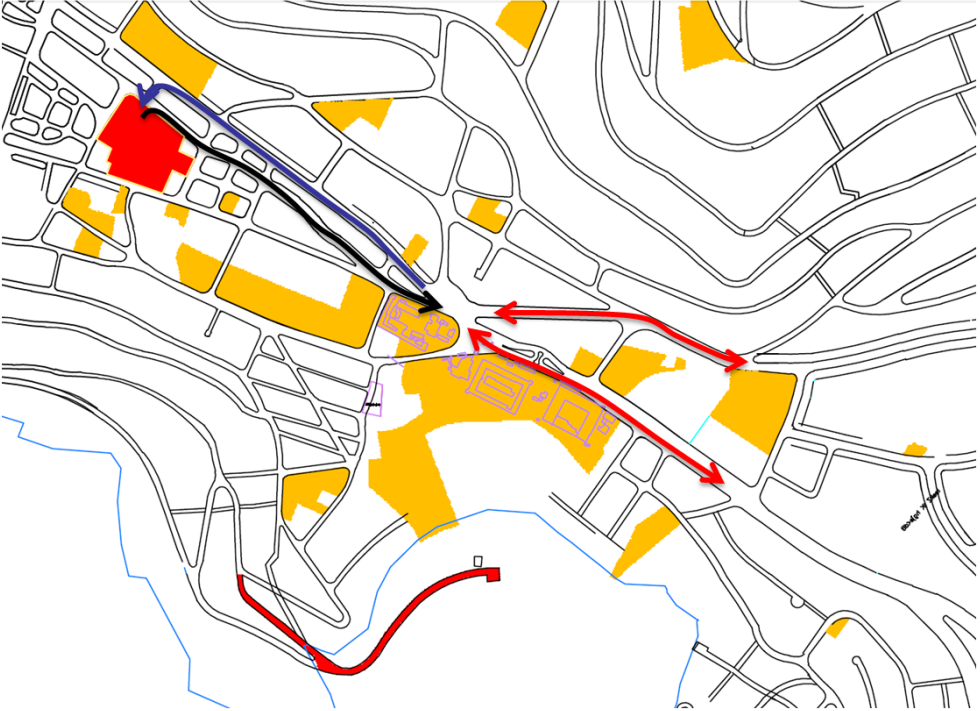
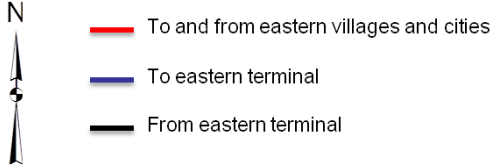
Map 60 Traffic movements on Al-Quds Street

Map (61) shows Traffic movements on Askar Street. “ between eastern terminal and north-eastern communities”.



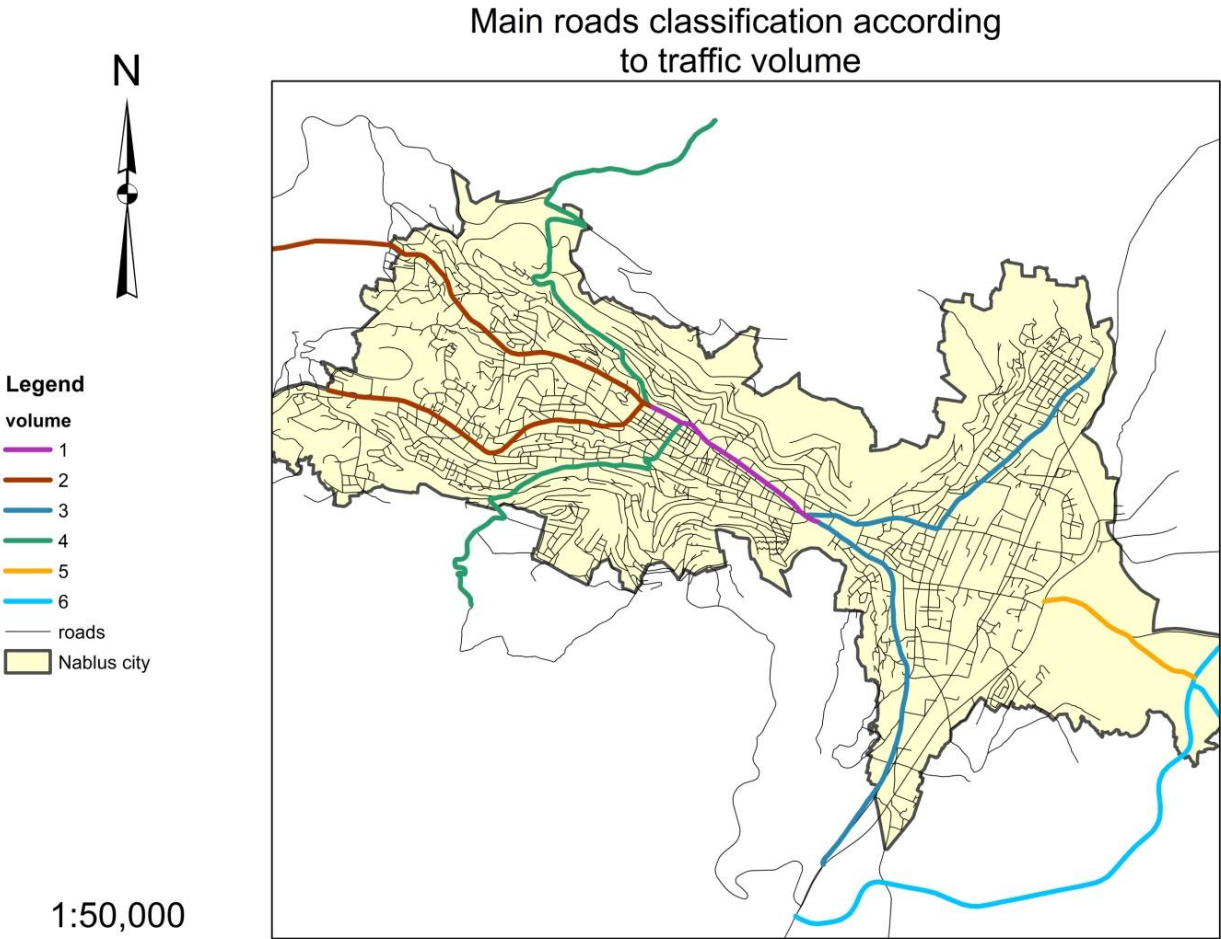
Map 61 Traffic movements on Askar Street

Map (62) shows Traffic movements from and to eastern terminal on Faisal street from eastern communities.



Map 62 Traffic movements from and to eastern terminal on Faisal street from eastern communities

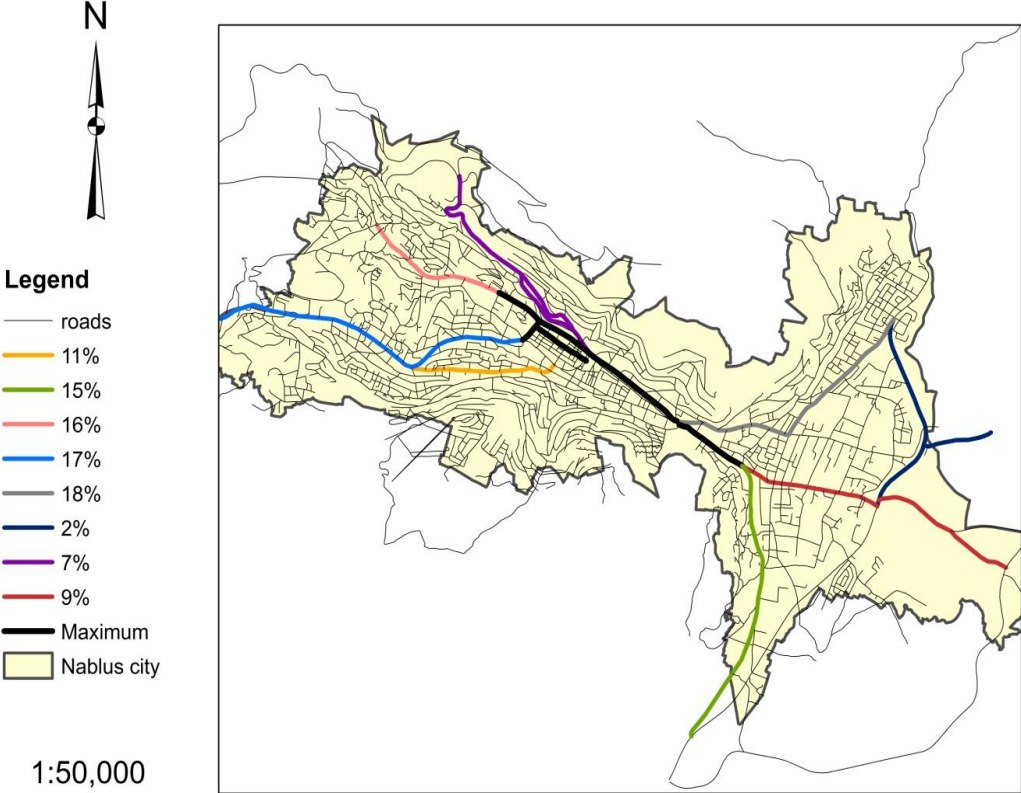
Map (63) shows traffic volume levels on main roads (internal and external shared taxis and cars). Faisal street has the highest volume, then Rafedia and Haifa streets, Asker and Al-Quds streets, Assira and Tell streets.



Map 63 Traffic volume levels on main roads

Map (64) shows shared taxis distribution on roads by percentage, Faisal street and parts of Al-Quds and Haifa streets and Sufian street and Prince Mohammed street are used as pass by roads for shared taxis to other orientations, Asker street is the road with the highest shared taxis percentages, then there is rafedia, Haifa, Al-Quds, Old Najah, streets.

Public transportation Percentages on Main Roads



Map 64 Shared taxis distribution on roads by percentage

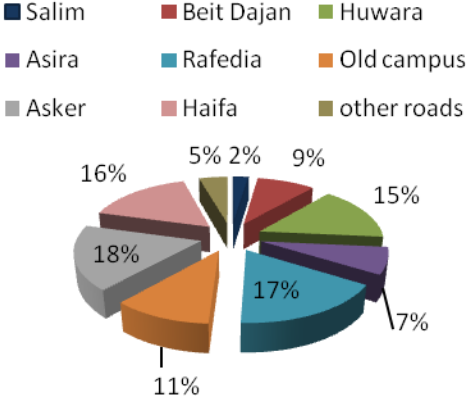
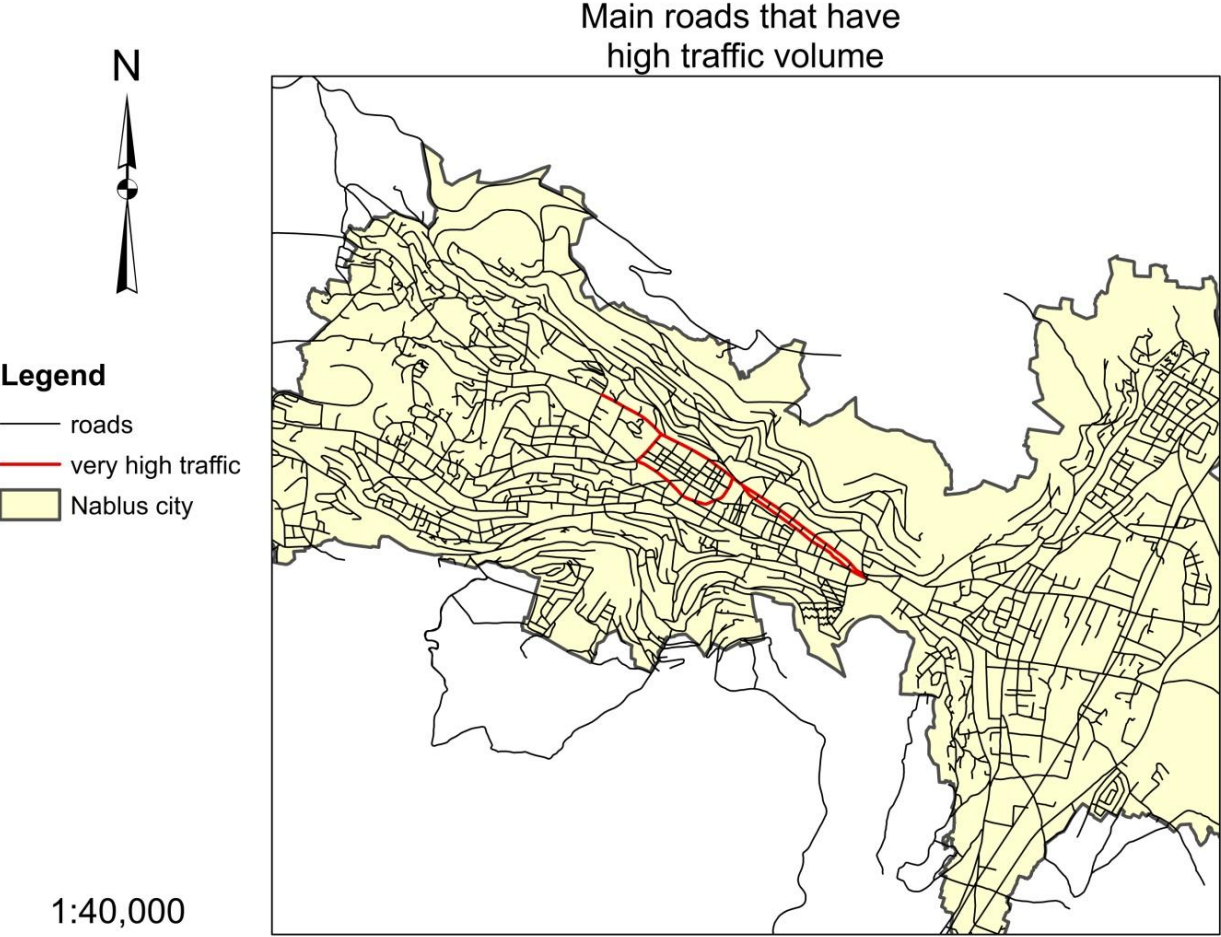


Chart 7 Shared taxis distribution on roads by percentage

Map (65) shows the roads that have high traffic volumes that lead to congestions. Faisal, Ghernata, and Prince Mohammed streets have the highest volumes that lead to high delays and high carbon emissions. Haifa, Rafedia, Al-Quds, Asker streets also have high traffic volumes because they are the city entrances.



Map 65 Roads that have high traffic volumes

3.4 Demographic profile:

Chart (8) shows the population in Nablus during the years 2007-2016. The population in 2016 is expected to be about 153,000 person and about 187,000 in 2026. This means that there is an increase in population during years even if this increase is declining as shown in charts (9)

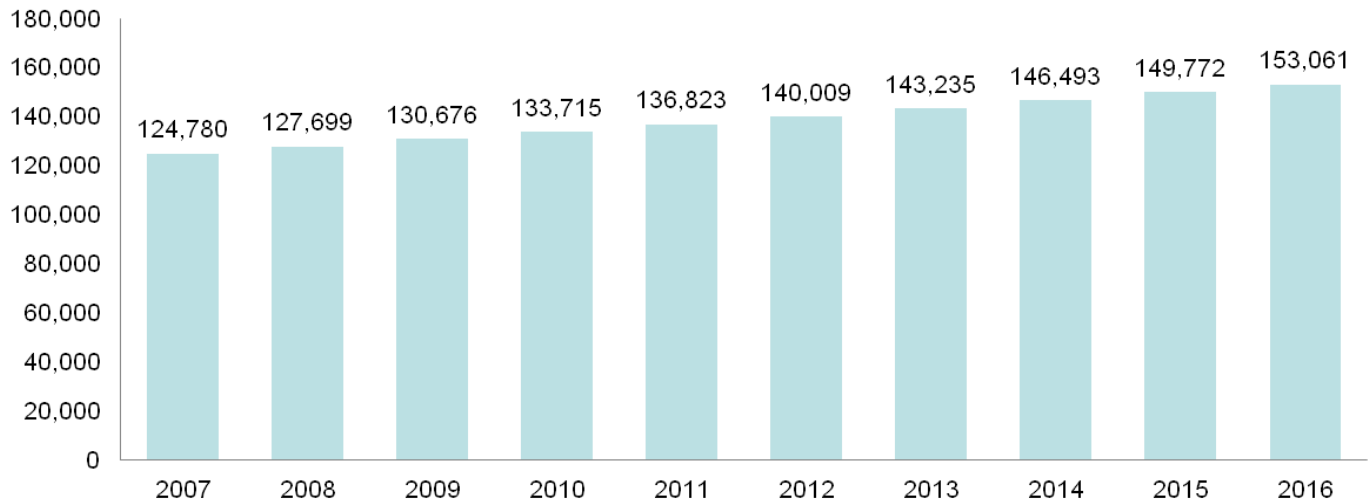


Chart 8 Nablus city population by years

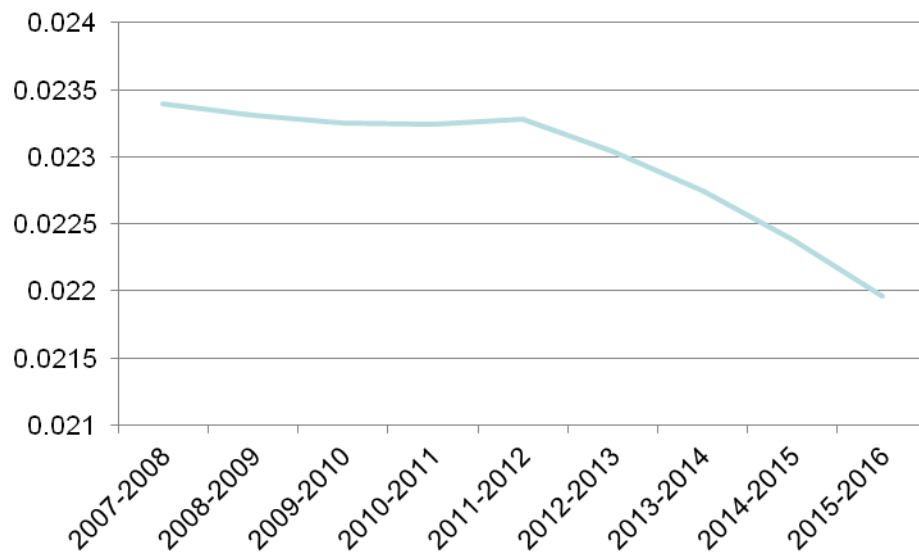


Chart 9 Growth rate in Nablus city

Using the factor 1.23 as the increase factor for vehicles in Palestine, it is expected to have a large increase in vehicles and specially private vehicles in Nablus city after 10 years as shown in chart (10).

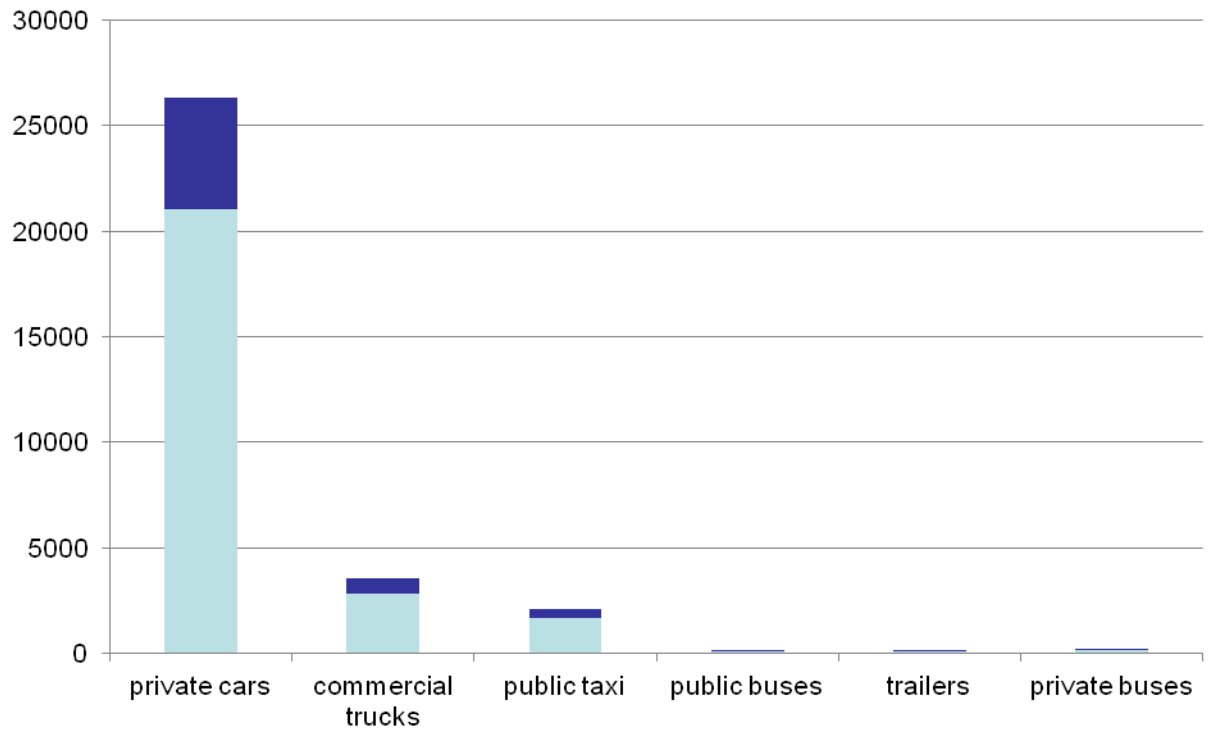


Chart 10 Growth in vehicles in 2026

Chapter four: ANALYSIS AND STRATEGIC PLANNING

4.1 SWOT Analysis:

4.1.1 Strength Map (66)

1. The location of some attractive services on main roads and the ability to be reached by different roads. Universities and hospitals form an attractive services that attract people from outside the city of Nablus to visit Nablus daily or weekly. These services cause high volumes on streets which gives public transportation high priority on roads.

2. The availability of shared taxis in the main areas of the city. This availability can be utilized by using some of these shared taxis and by utilizing the routes plans for residential areas.

3. The availability of state lands in some areas. These lands can be used for public station and parking.

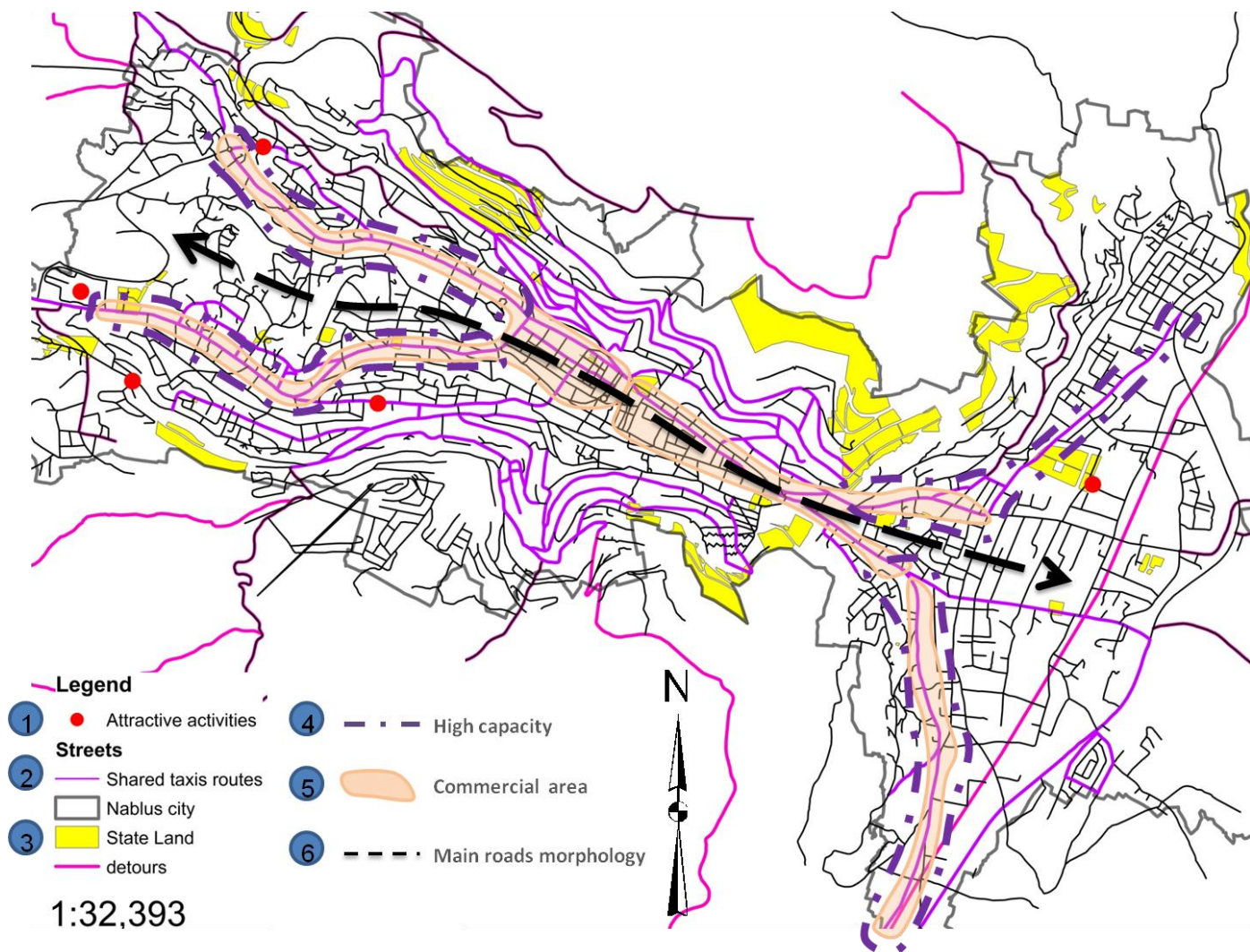
4. High capacity for some streets. High capacity streets can be used as arterial roads (corridors) that link minor streets together.

5. Commercial uses lie on main roads “Rafedia and Haifa streets”. Commercial streets are useful for transit oriented cities to enhance mixed use around public stations.

6. Main roads lie along the city from east to west “availability of main roads nearly in all parts of the city”. All city parts are served by roads which means that public transportation can be available in all residential areas.

7. The availability of detour roads. These roads can be used to minimize traffic on main roads when traveling to communities outside Nablus city.

Map (66) shows spatial allocation for positive points



Map 66 Strength map

4.1.2 Weaknesses map (67)

1. The location of terminals inside the CBD. The location of terminals inside the CBD is not suitable because they force vehicles to reach the CBD in order to ride a shared taxi. This causes high traffic volumes and congestion on CBD roads with high carbon emissions.

2. Main and secondary streets are NARROW and can't be widened. Many roads such as Rafedia street and CBD streets have limited width with no future expansion because buildings lie directly on roads sides and some streets have no sidewalks.

3. High traffic "very long delay periods" on Faisal street and some main streets. Faisal street is used by nearly all vehicles to move from east to west or the opposite. This causes high volumes on streets with delays and carbon emissions which cause negative effects on psychological issues for people.

4. Trucks pass through the CBD. Trucks that pass through Faisal street cause high volumes and can affect the street surface. Also, they stop beside some shops which cause high periods of stops on streets "zero flow".

5. The absence of state lands in some areas. Some areas do not have state lands, this means that there will be a need for other solutions for the place of stations.

6. The concentration of traffic signals in the CBD. Traffic signals are needed on many other streets, and as the CBD is required to have limited traffic volumes with no delays, the location of traffic signals are not suitable.

7. The use of some secondary "residential roads" as pass by roads. High traffic for pass by vehicles on residential roads minimize safety and cause noise which cause a decline in the quality of life for residential areas which need safety and clean environment.

8. The absence of speed calming on residential roads. Residential areas need to be safe to encourage people to live there and to have clean psychological thoughts.

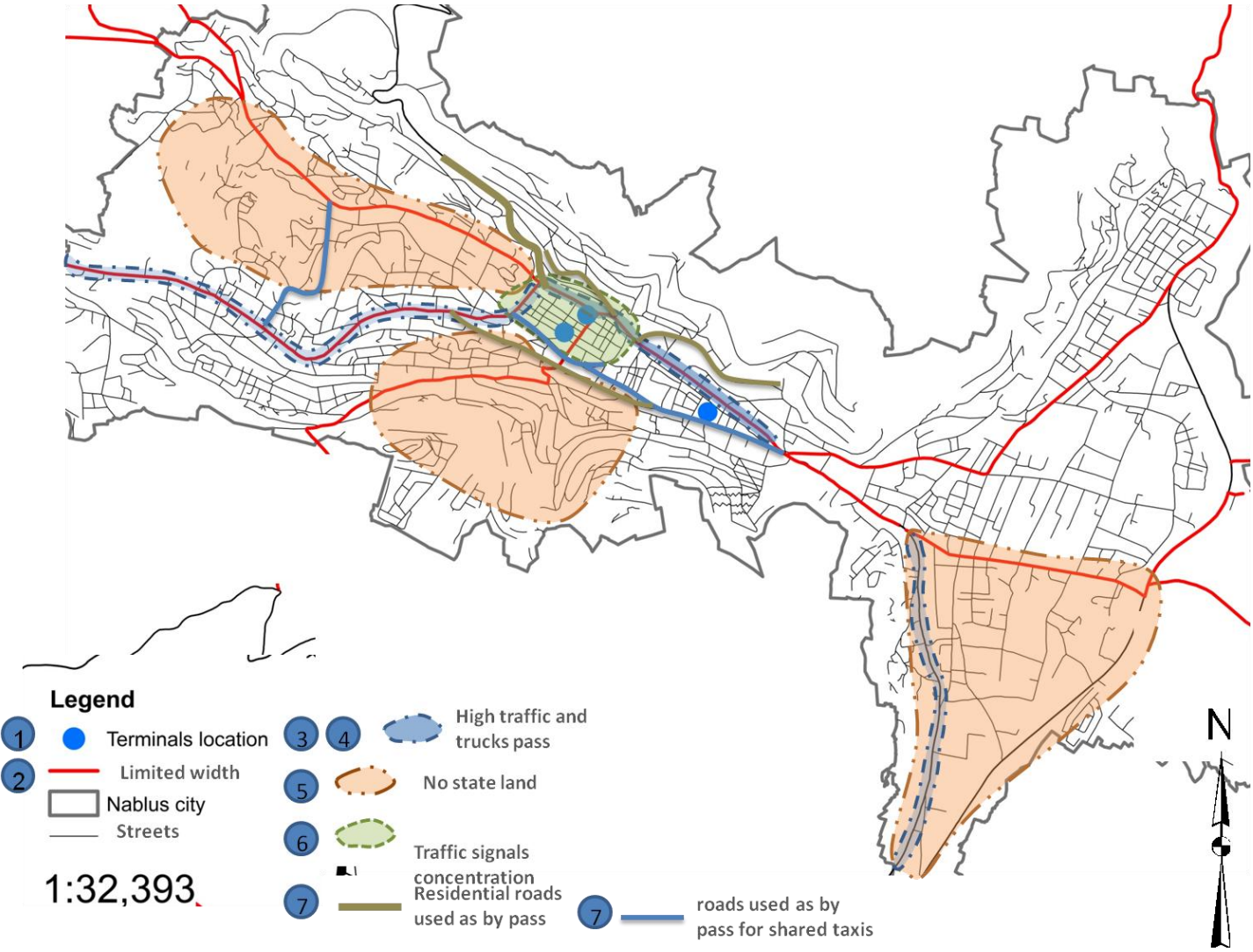
9. No public transportation available in the city. This can make some difficulties for a transit city because public transportation plans will be zero start plans.

10. High percentage of private vehicles on Nablus roads "81%". There will be a difficulty in persuading people to minimize their dependency on cars because they are already available. Then we need persuading developments to encourage people to use public transportation.

11. **High pollution in the CBD and some residential areas “ high carbon emission”**. High traffic volumes means high fuel consumption and high carbon emissions on streets used by all people which leads to dangerous diseases.

12. **A lack in greenery on streets “aesthetic views”**. People need green areas to feel comfort and to enhance high life quality. Greenery has high effects on feelings and serenity.

Map (67) shows spatial allocation for positive points



Map 67 Weaknesses map

4.2 Main Goals:

Economic Benefits :

- Reduced development and service costs
- Consumer transportation cost savings
- Increased costs to provide public services
- More efficient transportation

Social Benefits

- Improved transportation options and choices
- Community cohesion
- Increased physical activity and health
- Congestion reduction

Environmental Benefits

- Green space
- Reduced air pollution
- Reduced resource consumption
- Reduced water pollution
- Reduced “heat Island” effect

4.3 Main needs:

- **Equity:** Connecting all residents to opportunities such as good jobs, transportation choices, safe and stable housing, a range of parks and natural areas, and vibrant open spaces.
- **Stewardship:** Using resources prudently to help ensure the region’s financial, social and environmental sustainability now and for future generations.
- **Integration:** Aligning and coordinating policies, plans, resources, and actions.
- **Accountability:** Identifying appropriate indicators and measuring outcomes to evaluate the effectiveness of goals and policies
- **And:**
- **Residential Diversity, Mix of Commercial, Usable Open Space, Complete Streets, and Intermodal Connectivity**

These aims can be achieved by : The integration of transit and land use as it is a key component in moving the region forward by:

- Reducing sprawl and protecting existing neighborhoods
- Reducing commute times and traffic congestion
- Improving environmental quality and open space preservation
- Encouraging pedestrian activity and discouraging automobile dependency

After analyzing the city and its streets with strength and weaknesses points, we need to specify issues for transportation and streets to be the main fields for solutions and to give orientations for the implementation projects and scenarios: These issues are:

1. **A need for traffic calming and safety requirements in residential areas**, enhance safety and security to all the city residents and visitors by reducing speeds in residential areas and some safety requirements constructions such as sidewalks and crossings because vehicles travel with high speeds on residential roads.

2. **Low accessibility levels between residential neighborhood**. As it is aimed to connect all city parts and to achieve high levels of accessibility. People use many vehicles to travel from one neighborhood to another because there are no direct connections between residential areas.

3. **Air and noise pollution on main roads**. As it is aimed to protect the surrounding environment. High pollution and carbon emissions on main roads such as Faisal, Rafedia, Haifa, and Ghernata streets.

4. **A shortage in parking**. As it is aimed to provide enough areas for parking. There is a need for public parking for terminals, internal shared taxis, and private cars.

5. **The diversity in vehicles classification on each route**. Many types of vehicles travel along roads, trucks, buses, taxis, and cars, use the same lane which causes high congestions and delays.

6. **A need for various routes for regional services**. Regional attractive services need to be accessible from different orientations. For example, to travel towards New Najah campus, you need to reach the CBD then to the campus. It is needed to reach the campus from different areas without the need to reach the CBD.

7. **High traffic congestion on main connecting roads**, and a need to minimize the time needed between areas. High traffic volumes and delays on main roads such as Faisal street, Rafedia street, etc. This causes dangerous situations on main intersections.

8. **Streets landscaping needs**, to achieve psychological comfort for riders. It is essential to have suitable environmental appearance to enhance high quality of life by improving the psychological aspects for people.

9. **The unsuitable terminals locations**. The current locations for terminals are unsuitable because they force all vehicles to travel towards the CBD which causes high traffic volumes and congestion on CBD streets.

10. **City topography transportation issues**. The city topography forms a challenge for transportation. Roads follow the topography to fit it and to save the natural views.

11. **The absence of public transportation.** As it is aimed to minimize the dependency on private cars and to provide public transportation with a high dependency on them. enhance the availability of public transportation in all areas

12. **Car dependency.** As people prefer to ride their own vehicles because of delays and the lack in shared taxis. High numbers of private vehicles pass on Nablus streets because of the absence of public transportation.

From these issues, the vision statement needs to be:

4.4 Vision statement:

❖ A PROSPEROUS SUSTAINABLE MODEL FOR DEVELOPING A TRANSIT ORIENTED CITY

This vision has four elements which are:

A PROSPEROUS, WALKABLE, DIVERSE, DISTINCTIVE, AND GREEN city

These elements mean:

➤ A Prosperous city is a city that attracts jobs, growth, and investment. which means:

- Energizing the Commercial Core
- A Comprehensive Retail Strategy
- Clean and Safe

➤ An interconnected city which means easily accessible neighborhoods by using multilevel stations

➤ A Walkable city:" PUTTING PEDESTRIANS FIRST, Walkability is a key ingredient to a successful urban environment. It enhances public safety, fosters personal interactions, and increases economic vitality. Which means:

An Outstanding Pedestrian Environment

- Building On Transit
- Bicycle City
- Park The Car Once

➤ A Diverse City: BEING A SOCIALLY AND ECONOMICALLY INCLUSIVE PLACE.

Downtowns thrive on diversity of people and opportunity. Attracting more jobs, residents, amenities and visitors is key to the future Nablus. Which means:

- Downtown Living
- A Family-Friendly Place
- Embracing Adjacent Neighborhoods

➤ A Distinctive city : CULTIVATING A MOSAIC OF URBAN DISTRICTS

➤ A Green city: BUILDING A GREENER Nablus which means: Sustainable Use of Resource

Vision statement and elements can be classified into three categories in order to specify strategies that are to be used in projects and programs preparation. **Transit oriented Nablus means three categories: "These categories are to be achieved by the final results in details by dividing the results into result A, result B, and result C"**

✓ First: " Result A in chapter 5" Dependency on transit which means the need for connected zones and multimodal transit. Strategies:

1- Reduce Auto Dependency and depend on walking, biking, and public transportation by:

- Integrated, balanced transportation system
- Expanded mobility options

2- Promote Transit Usage by:

- Transit access to major destinations
- Integrate transit network

3- Reduce Conflicts Between Modes by:

- Safety
- Equitable allocation of street space

4- Enhance Links by:

- Connected neighborhood
- Multiple route choices

5- Support multimodal access by:

- hierarchy of access
- parking facilities

✓ Second: "Result B in chapter 5" Pedestrian friendly which means Auto-free zones or Pedestrian streets. Strategies:

1- Introduce Bike Friendly Streets:

- Connected bike network
- Safe facilities

2- Make Nablus Walkable Circulation:

- Safe, convenient, and comfortable place to walk
- Walking the mode of choice for short trips

3- Encourage livable communities

✓ Third: " Result C in chapter 5" Parking which means Off and on street parking and Terminals and stations. Strategies:

1- Manage Parking Facilities :

- Less traffic
- More parking options

Chapter five: PLAN PREPARATION AND DETAILED PLANNING

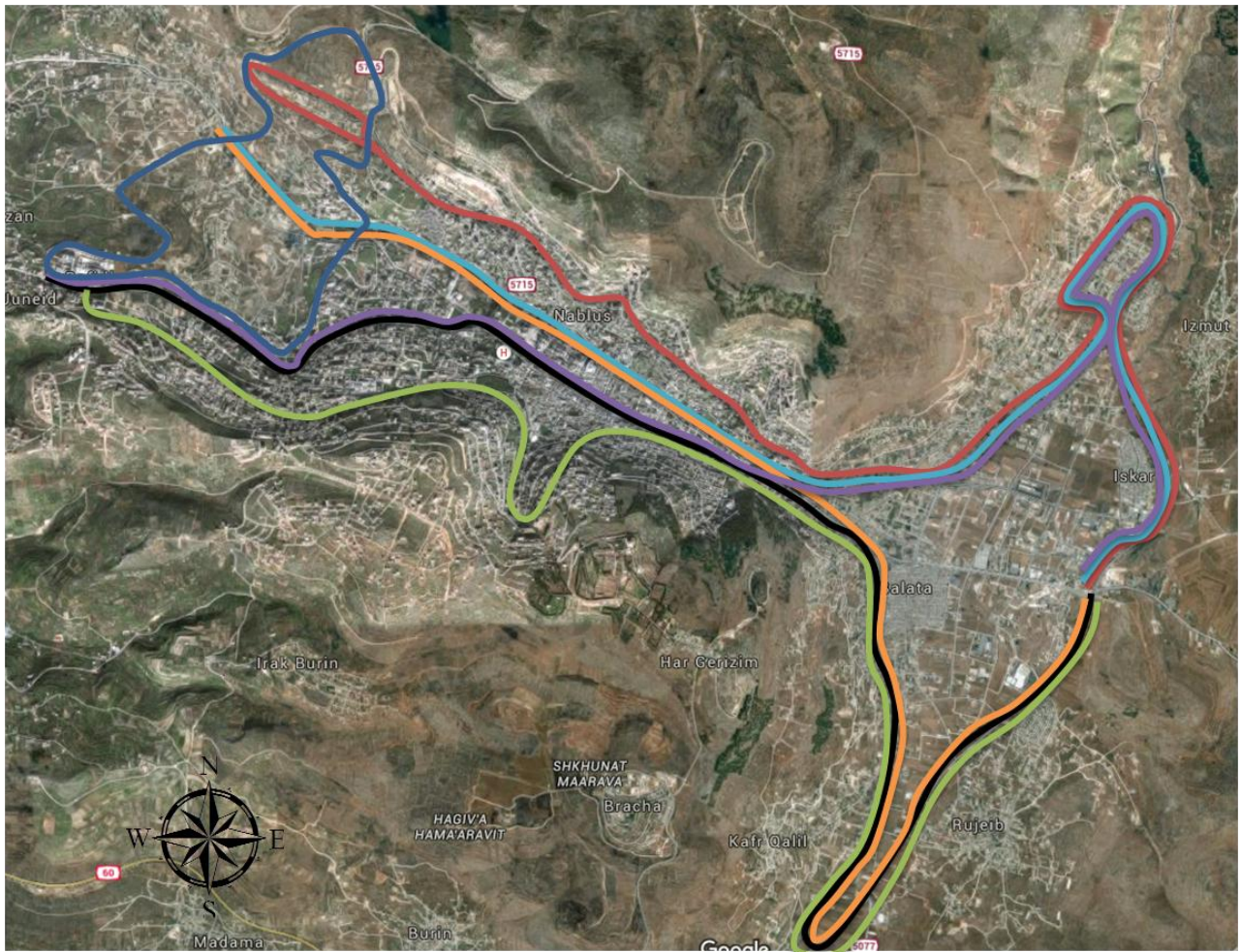
5.1 Introduction:

Planning for transit Nablus:

How was the transit Nablus planned????!

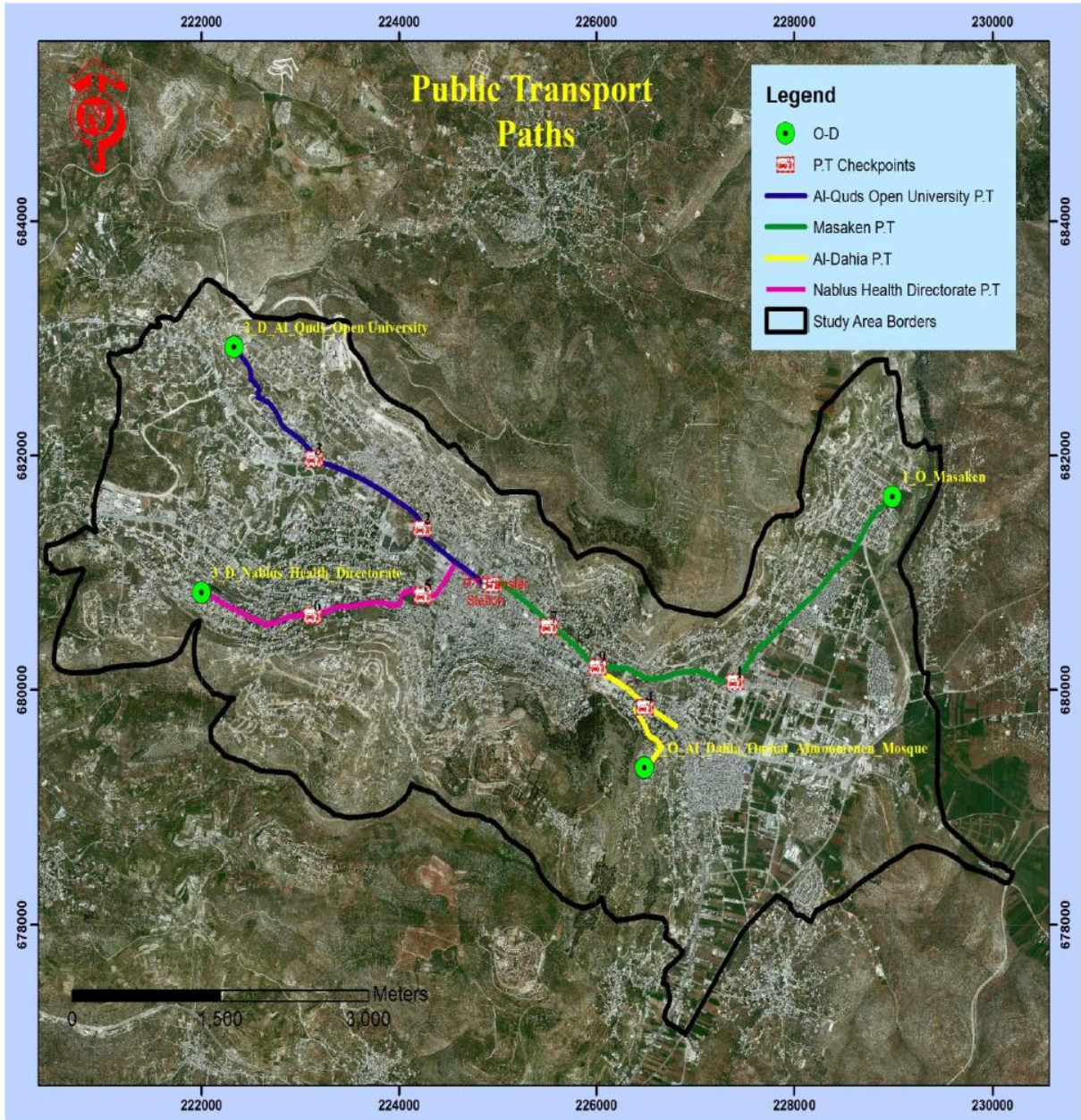
The main idea from this project is to make Nablus city as a model for a prosperous sustainable city that enhances high quality of life. To do so, we have to make a combination between all transportation components which are vehicles movements, vehicles parking, and pedestrians. The project results will be classified into three parts: dependency on transit, planning for pedestrian friendly CBD, and parking management.

The main idea for the plan is to connect all main activities by one route. As the city has a linear morphology, main roads are linear that extend from east to west, and main activities lie along main roads, the main corridors are planned to be on main roads. The first Idea was to provide citizens with transit service by having routes that travel in all the city. Map (68) shows the first idea. The idea was to provide routes that connect the western and eastern parts of the city with direct routes. As shown in the map (68), there are routes extend from the east to different areas in the west so that each part in the east is connected directly with each part in the west.

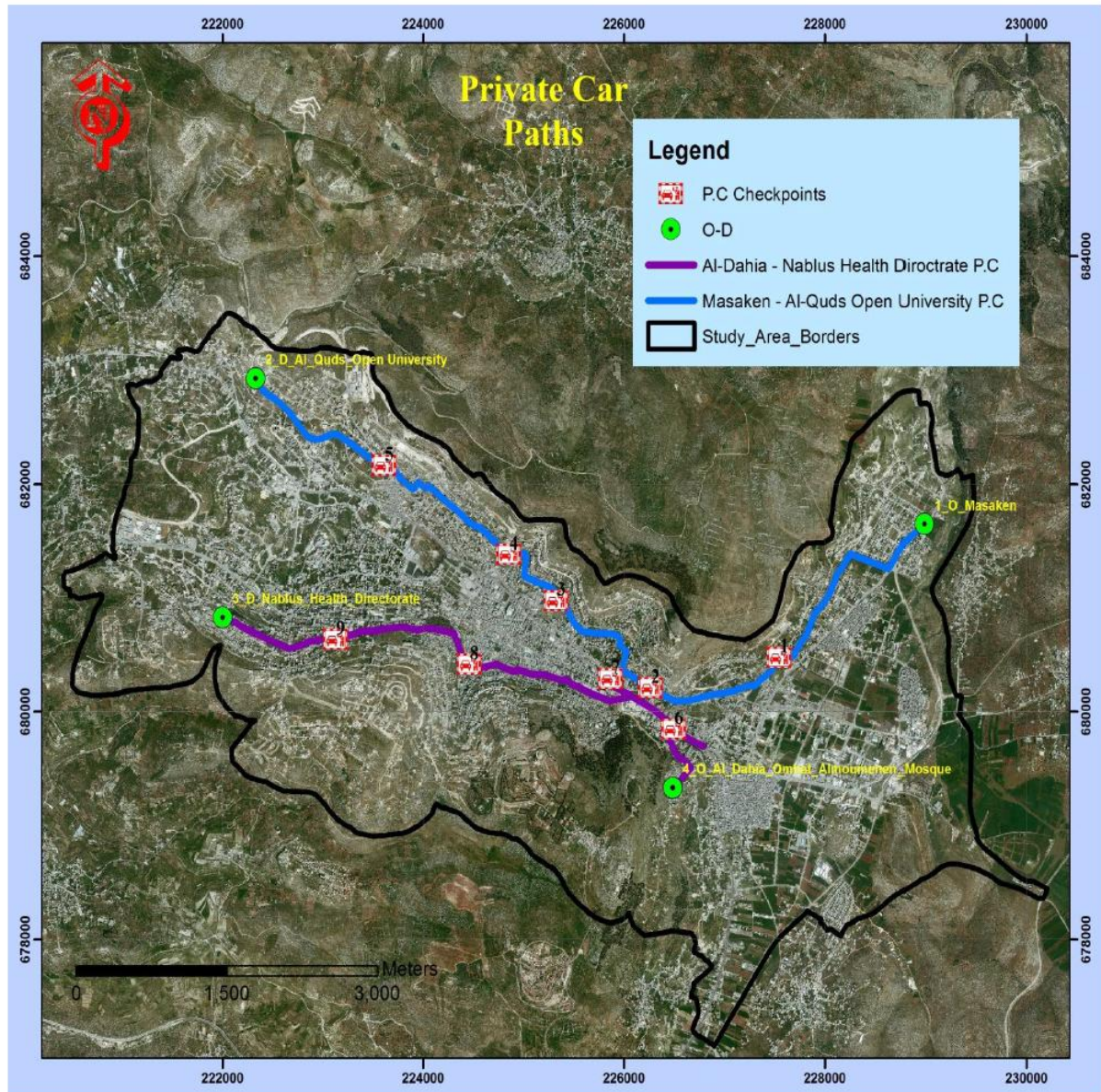


Map 68 First routes plan idea

But this plan was not very suitable because each trip needs long times. This led to a new idea that will provide accessibility to all areas and activities in short trips length. Depending on maps (69,70), the most known roads for shared taxis are the main roads and the roads that are used for private cars are local roads, these main roads are to be used as main corridors. And depending on the existing shared taxis roads, local corridors are to be on these local roads. To provide suitable service, local corridors are to be as loops with two sub corridors. These local corridors are planned according to the existing shared taxis roads and the city zones as shown in map (71). By studying the roads that serve the zones, these roads are reclassified into bus routes as map (71) shows. And so is the plan prepared.


















Map 69 Existing public transport paths (Jaber et al. 2015)



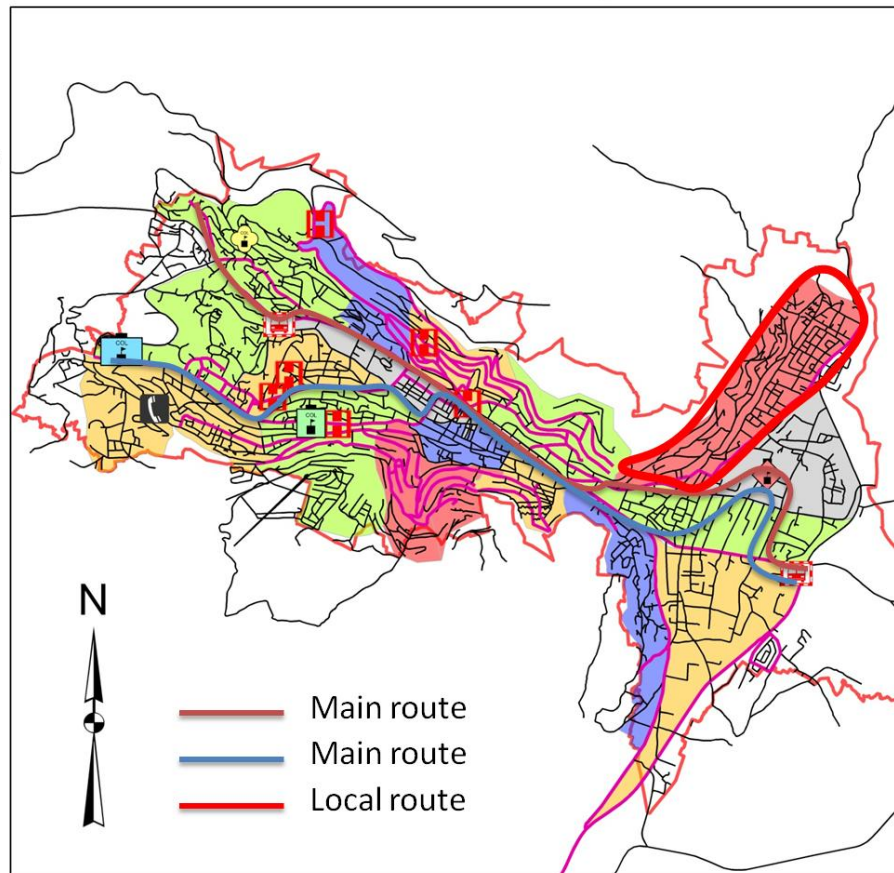
Map 70 Existing car paths (Jaber et al. 2015)

What affected the routes plan??!

Legend

-  external bus terminals
-  Al Quds Open University
-  College:Hishan HaJawi
-  Old Najah Campus
-  New Najah Campus
-  Paltel
-  Hospital
- Population 2016
-  1220 - 2709
-  2709 - 5956
-  5956 - 8777
-  8777 - 11742
-  11742 - 15558
-  Nablus city
-  Shared taxis roads
-  Roads

1:50,000



Map 71 Factors taken into consideration for routes plan

Planning a transit city does not mean that the city will be only for transit with bad environment. Transferring Nablus city into a transit city that depends on buses will decrease the number of vehicle that pass on each road because each bus can carry a large number of people. In order to strengthen the environment and to enhance better environment together with the results of transit usage, some roads need to be specialized for pedestrians. In this project, the CBD is taken as a detailed area to change the use from vehicles to pedestrians. The new plan for Nablus CBD will have new roads classifications according to the type of traffic (buses, cars, bicycles, or pedestrians). Also, there will be some details about how each street type will be by preparing some detailed plans and sections. This plan helps in enhancing high quality of life in the CBD for all people so that they will be able to reach about 90% of the CBD areas by cars but they only cannot park on streets, they have to park in given areas that are distributed in the CBD. Also, the car driver can park in the parking areas and move to his destination by foot. This will enhance high levels of service for cars and pedestrians. This is because the vehicles

roads within the CBD were chosen carefully to provide the ability to reach nearly all places by cars, however, few roads are for vehicles.

To enhance a better quality of life, the most important part in the CBD which is called by the citizens Al-Duwwar is changed into a pedestrian zone with greenery to enhance high levels of safety and comfort for people, this is because most of the CBD`s buildings are shops. Also, there were three terminals for shared taxis within the boundaries of the CBD. Two of them are for western communities and one for eastern communities. Those which were for western communities are changed into public open spaces to provide green areas and more spaces for walking and picnics. The eastern terminal is changed into a private car parking for cars in the eastern area of the CBD.

There are two suggested locations for shared taxis that travel outside the city by Nablus municipality, one in the west (at the end of Tunis street) and the other in the east near the industrial area. The location of one of the internal buses terminals (eastern buses terminal) was affected by the location of the eastern external shared taxis terminal. The other internal buses terminal (western buses terminal) was located near the New Najah campus because many buses can reach it and most of buses pass near it. According to the location of each terminal, the buses that park in each terminal was determined by classifying the eastern routes to park in the eastern terminal and the western routes in the western terminal.

Private cars parking need to be distributed in the whole city. There are five important places in the city to be mentioned here. Two of them are to be allocated beside the internal buses terminals in the east and the west of the city. The other three parking are in the CBD. There locations were chosen to provide parking that are reachable by cars from all sides. This idea was enhanced by locating the first one in the east of the CBD (the current location of the eastern outside shared taxis terminal), the second in the middle of the CBD (the existing parking building used by shared taxis and private cars), and the third in the west of the CBD. This is because the CBD has a linear morphology that extends from east to west.

5.2 Results:

The three mentioned categories in chapter four are to be applied by:

5.2.1 Result A: Applying the "Dependency on transit"

The main result from this project is a transit plan for the city of Nablus. This plan shows the buses routes on Nablus roads. According to previous diagnosis and analysis, the following plan ,map (72), was prepared to achieve the required goals and needs. All routes timetables are in appendix 1.

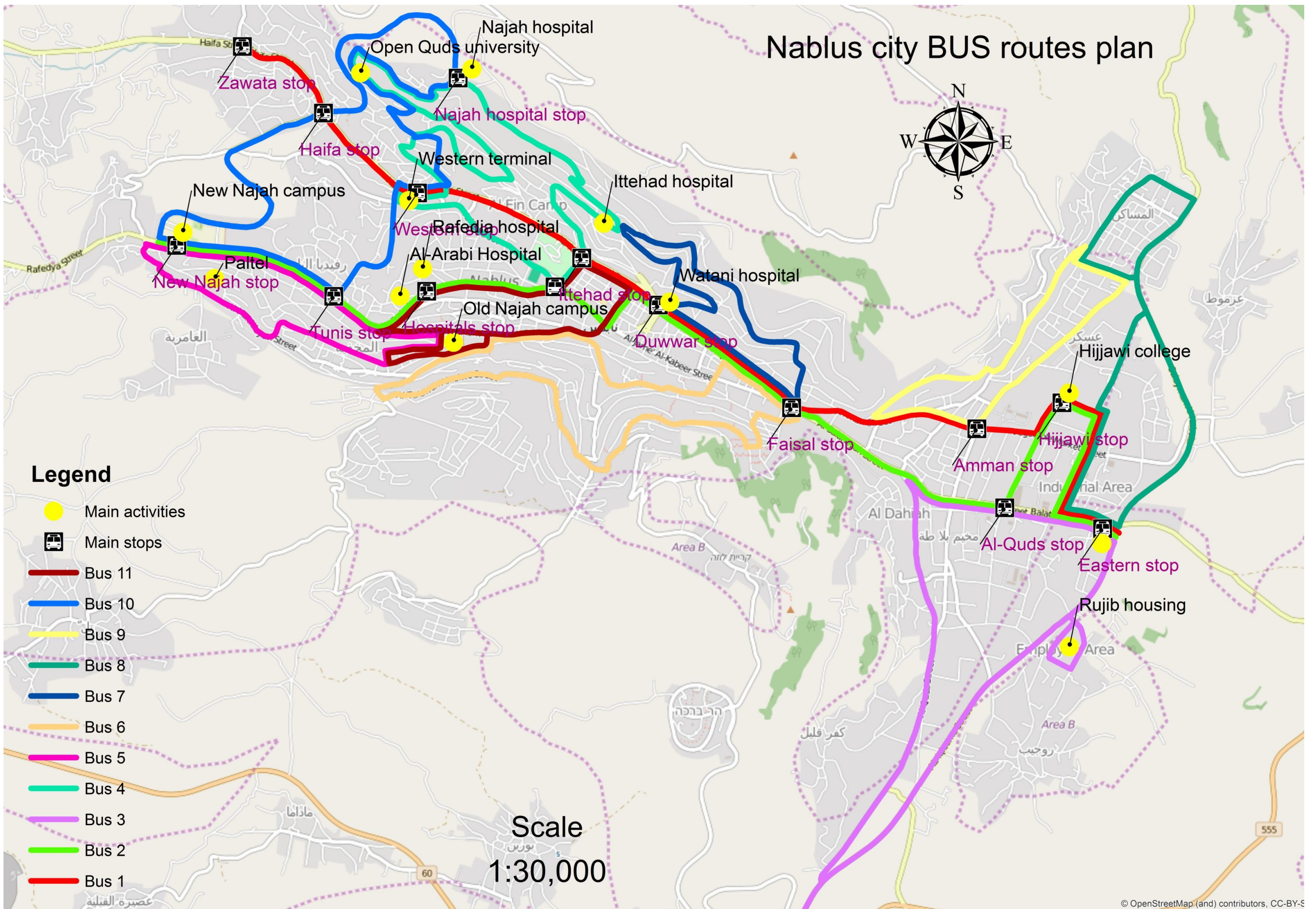
Nablus city BUS routes plan



Legend

- Main activities
- Main stops
- Bus 11
- Bus 10
- Bus 9
- Bus 8
- Bus 7
- Bus 6
- Bus 5
- Bus 4
- Bus 3
- Bus 2
- Bus 1

Scale
1:30,000



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The main idea from this plan is to provide high levels of service for all people equally. It was affected by the city morphology that extends from the east to the west. Two main corridors were set at the beginning to connect the city parts together. Then, a third main corridor. All other local corridors were allocated by studying the current shared taxis routes and the most accessible roads for all people (roads that are most accessible by all people). This helps people to arrive main activities without a need to ride many different transport modes.

After preparing the plan and deciding which roads each bus should travel through the day, each route was studied according to its specialties to find the suitable frequency. Each route has two sub-routes, each of them starts in a given stop and travels in a trip with a given places for stops and a given time. There is a difference between these two sub-routes, one of them starts before the other with a given time. Each sub-route has its own timetable and called according the route. For example, Bus 9 route 2. For each route, the average hourly volume and the peak hour volume of shared taxis that travels to the route area was found from the average annual daily shared taxis counts that were taken from a previous study (Jaber et al. 2015). Peak hour volume was calculated as a 10% of the average annual daily shared taxis volume. And the rest are calculated for the rest of the day hours. According to the peak hour volumes, the numbers and types of buses were defined. If the number is large, buses from 50 seats are to be used. The number of buses was found by using the following equations:

Equation 1 Number of needed buses

$$\text{Number of buses} = \frac{\text{Service per hour} * \text{trip length}}{60}$$

Equation 2 Service per hour

$$\text{Service per hour} = \frac{\text{Number of people in peak hour}}{\text{Number of seats}}$$

Main corridors are the main streets (bus1, bus2 and bus10). Local corridors are: bus 3, bus 4, bus 5, bus 6, bus 7, bus 8, bus 9, and bus 11. On main corridors, there are main stops. And on local corridors there are local stops. Buses stop for 2 min on local stops and 3 min on main stops. Table (7) shows the main features for each bus route that are resulted from previous equations.

Table 7 Buses routes features

Corridors classification	Bus #	Average Annual Daily Traffic	NO. buses	No. passengers
Main	bus 1	6863	20	50
Main	bus 2	8310	30	50
Local	bus 3	2231	20	50
Local	bus 4	618	13	20
Local	bus 5	361	6	20
Local	bus 6	1327	10	50
Local	bus 7	3741	18	50
Local	bus 8	870	14	20
Local	bus 9	1181	16	20
Main	bus 10	1534	20	50
Local	bus 11	1936	10	50

From there, we have the number of buses and the type of needed buses for each route in peak hours and other times. The number of buses needed in each hour is then divided by 2 to find the number for each sub route in each route. According to the needed number of buses, the frequency is determined by calculating the number of buses in an hour and then dividing the 60 min on the number of buses. According to this, the timetable is prepared. For local routes, There is a stop at each 400 meters, the bus stops for 2 min at each stop and for 3 min at stops that are on main streets (main stops). (50 is the speed that will be used for traveling "50 km/hr").

Trip length calculations:

Equation 3 Trip length calculations for local corridors

$$\text{Trip length (min)} = \text{Trip length (meters)} * 1000/50 + \text{number of stops} * 2$$

Equation 4 Number of needed stops

$$\text{Number of stops} = \text{Trip length (meters)} / 400$$

For main corridors (bus 1, bus 2, and bus 10), the time (trip length) is calculated in a different way. First, the main stops locations are defined according to main activities locations. The distance between each two stops was calculated and so is the time by using the following equations:

Equation 5 Trip length for main corridors

$$\text{Trip length (min)} = \text{Trip length (meters)} * 1000/50 + \text{number of stops} * 3$$

Timetables were then prepared. For main corridors, by finding the trip length between each two stops, and the frequency for the route the timetable was prepared starting from 6:30 am at the first point and for the next stop, the trip length between the first stop and the second was added to the starting time. And by repeating the calculations to the rest of stops we had the first trip for a sub route. To complete the timetable for the rest of the day, the frequency time was added to the time that was calculated in the previous time.

For local corridors, the starting time was specified according to the main corridor that it starts from. The starting time is :

Equation 6 Starting time calculations for local corridors

$$\text{The main bus arrival time} - 2\text{min} - \text{local corridor trip length}$$

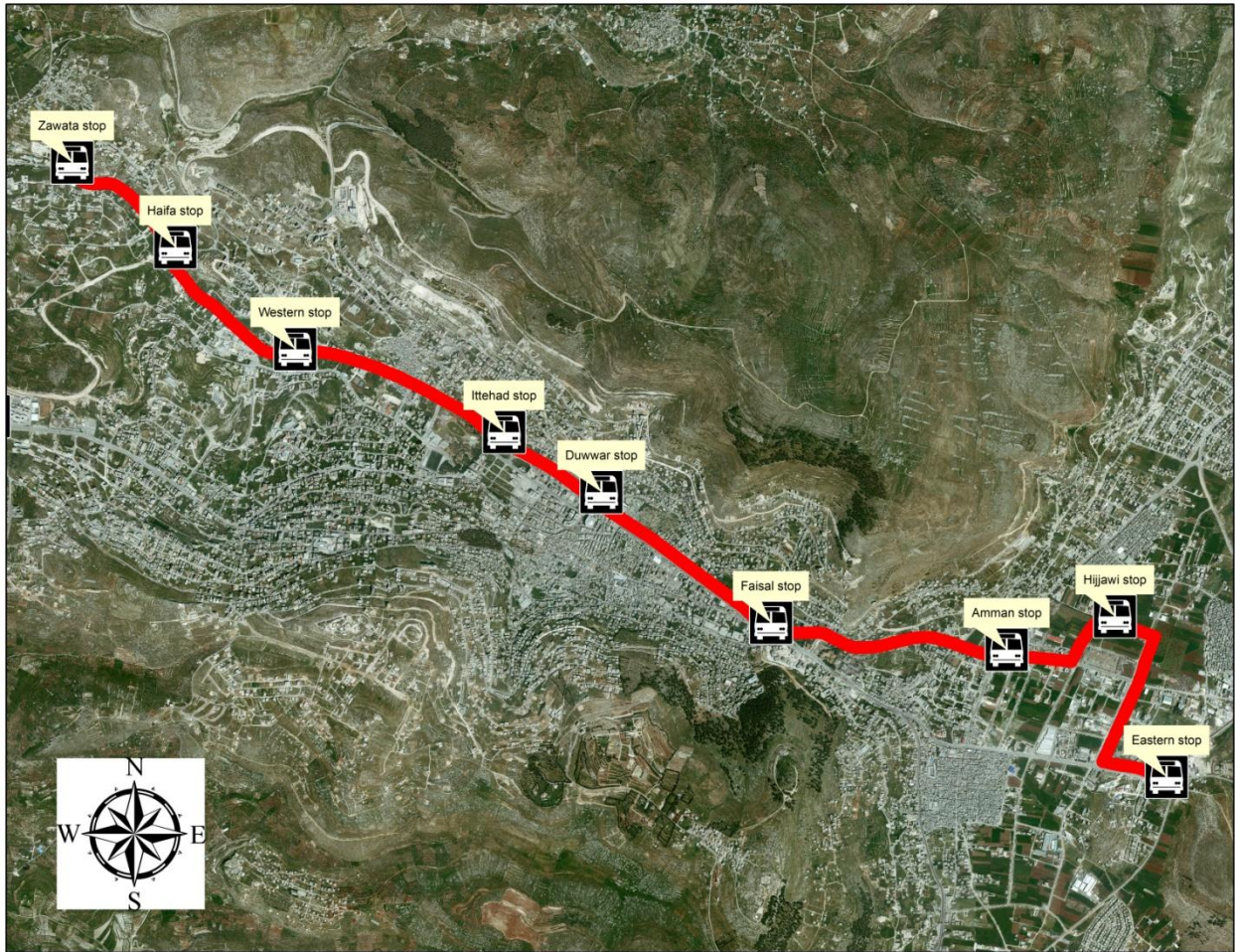
After calculating the starting time for the local corridor, the times for the rest of point are calculated by adding the required time between each two stops and other 2 min to the time between the previous two stops. To complete the timetable, the frequency time is added to each time between the trip time in the previous time.

To enhance high levels of services, main and local stops are distributed on roads. Main stops have a specific design, the design is to have two places for parking, each of them is on one side of the road. This makes the stops to be one on the left side and another on the right side. Each side will have spaces for two buses, three cars, bikes parking, a small shop, and wide sidewalk to enhance high levels of safety. In this case, each bus stops in the stop according to its timetable, people get off the bus to ride another bus. To do so, when the person get off from his bus, he can wait on his place for the other bus that stops on the same place, or they can pass through the street to the other street side to ride on the buses that stop in the other site. Each stop has a sign that shows which buses stop in each stop and at what times, this can help people to plan their trips. Buses have the priority to pass through the street before other types of vehicle, for this, some signs can be used to give them the priority.

Bus routes were divided into two classifications, Main and local routes. Three routes are main, Bus 1, Bus 2, and Bus 10. The rest bus routes are local routes (Bus 3, Bus 4, Bus 5, Bus 6, Bus 7, Bus 8, Bus 9, and Bus 11).

Main routes connect main activities in Nablus city, Bus 1 route lies from East (near the suggested eastern terminal from Nablus municipality) to West (near Zawata). Map (73) shows bus 1 route. Bus 1 stops 9 times. Starting from east at eastern stop, it stops at Hijjawi stop, Amman stop, Faisal stop, Duwwar stop, Ittehad stop, western stop, Haifa stop, and finally Zawata stop. This route connects the eastern part with western part of Nablus city by 20 buses that run in both directions. The trip length is **1 hr and 16 min (9166 m)** with a 3 min stop on each main stop, then the bus takes a rest for 14 minutes and returns to its starting point from the same route with the same features. To provide full services, not all buses start from one point, however, there are two starting points. One in the east and the other in the west. The first trip starts at 6:27 am with a bus from the east and another from the west. Because the main activities on this route are important (especially the eastern and western terminals) and according to the number of shared taxis in peak hours (686 shared taxi) that used to pass on this route (Jaber et al. 2015) the frequency for buses from east and west are given as following: in peak hours (7:00-8:30 and 12:50-15:30) buses start at each 10 min, in the rest of the day buses start at each 20 min. This gives high levels of services, as nearly the buses are available on streets all over the day with a suitable frequency. Buses travel with a speed of 50 km/hr. The frequency and times that buses start from each stop and at what times they are at each stop are provided in appendix (1).

This route provides the service for people by riding one bus with no need to change the transport to arrive from the east to west or vice versa.

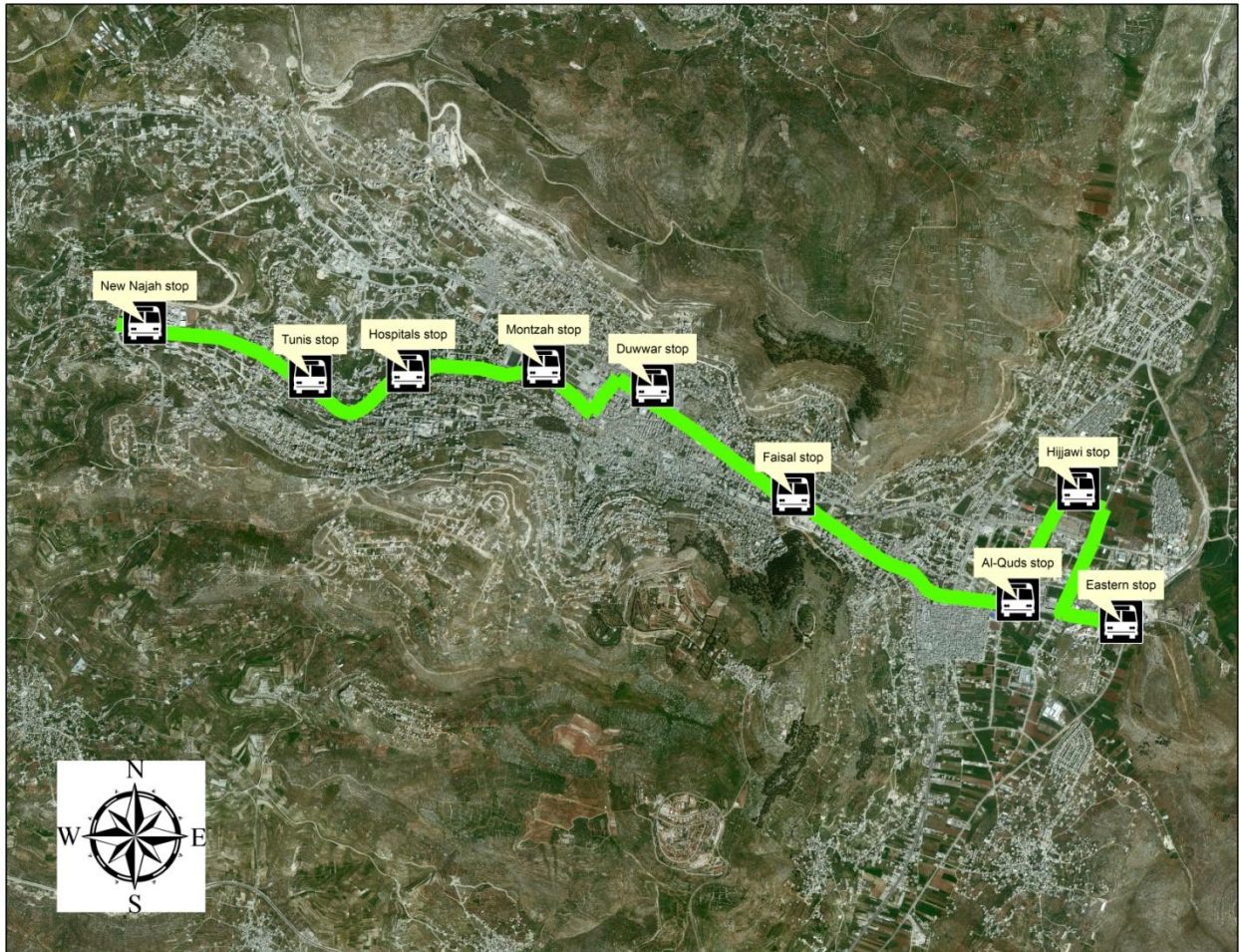


Map 73 "main routes" Route 1 with its stops

Bus 2 route lies from East (near the suggested eastern terminal from Nablus municipality) to West (near New Najah campus "Academeyah"). Map (74) shows bus 2 route. Bus 2 stops 9 times. Starting from east at eastern stop, it stops at Hijjawi stop, Al-Quds stop, Faisal stop, Duwwar stop, Montazah stop, Hospitals stop, Tuniss stop, and finally New Najah campus stop. This route connects the eastern part with western part of Nablus city by 30 buses that run in both directions. The trip length is **1 hr and 22 min** (9166 m) with a 3 min stop on each main stop, then the bus takes a rest for 10 min and returns to its starting point from the same route with the same features. To provide full services, not all buses start from one point, however, there are two starting points. one in the east and the other in the west. The first trip starts at 6:30 am with a bus from the east and another from the west. Because the main activities on this route are important (especially the eastern terminal and New Najah campus) and according to the number of shared taxis in peak hours (830 shared taxi) that used to pass on this route (Jaber et al. 2015) the frequency for buses from east and west are given as following: in peak hours (7:00-8:30 and 12:50-15:30) buses start at each 5 min, in the rest of the day buses start at

each 15 min. This gives high levels of services, as nearly the buses are available on streets all over the day with a suitable frequency. Buses travel with a speed of 50 km/hr. The frequency and times that buses start from each stop and at what times they are at each stop are provided in appendix (1).

This route provides the service for people by riding one bus with no need to change the transport to arrive from the east to west or vice versa.



Map 74 "main routes" Route 2 with its stops

Another important route that has the same path as bus 2, is bus 12. This bus route travels along bus 2 path but with a stop at each 700 meters for 2 minutes.

Bus 10 route differs from bus 1 and 2. It forms a route that has a loop direction not linear as bus 1 and 2. It starts from New Najah Campus and returns to it. Or from New Najah hospital. Map (75) shows bus 10 route. Bus 10 stops 12 times. This route got his importance newly because of the new Al-Quds Open University location, New Najah hospital, and suggested new location for western terminal that is for shared taxis that travels outside the city. This route will form an important route between these activities because many students need to travel from new Najah campus to western terminal and between the campus and the hospital. The trip length is 49 min (11052 m) with a 3 min stop on each





main stop, then the bus takes a rest for 11 min at its starting point. The first trip starts at 6:32 am with a bus from the New Najah campus stop and another from the Najah hospital stop. Because the main activities on this route are important and according to the number of shared taxis in peak hours (613 shared taxi) that used to pass on this route (Jaber et al. 2015) the frequency for buses from both starting points are given as following: in peak hours (7:00-8:30 and 12:47-15:30) buses start at each 5 min, in the rest of the day buses start at each 20 min. This gives high levels of services, as nearly the buses are available on streets all over the day with a suitable frequency. Buses travel with a speed of 50 km/hr. The frequency and times that buses start from each stop and at what times they are at each stop are provided in appendix (1).

This route provides the service for people by riding one bus with no need to change the transport to arrive from the east to west or vice versa.

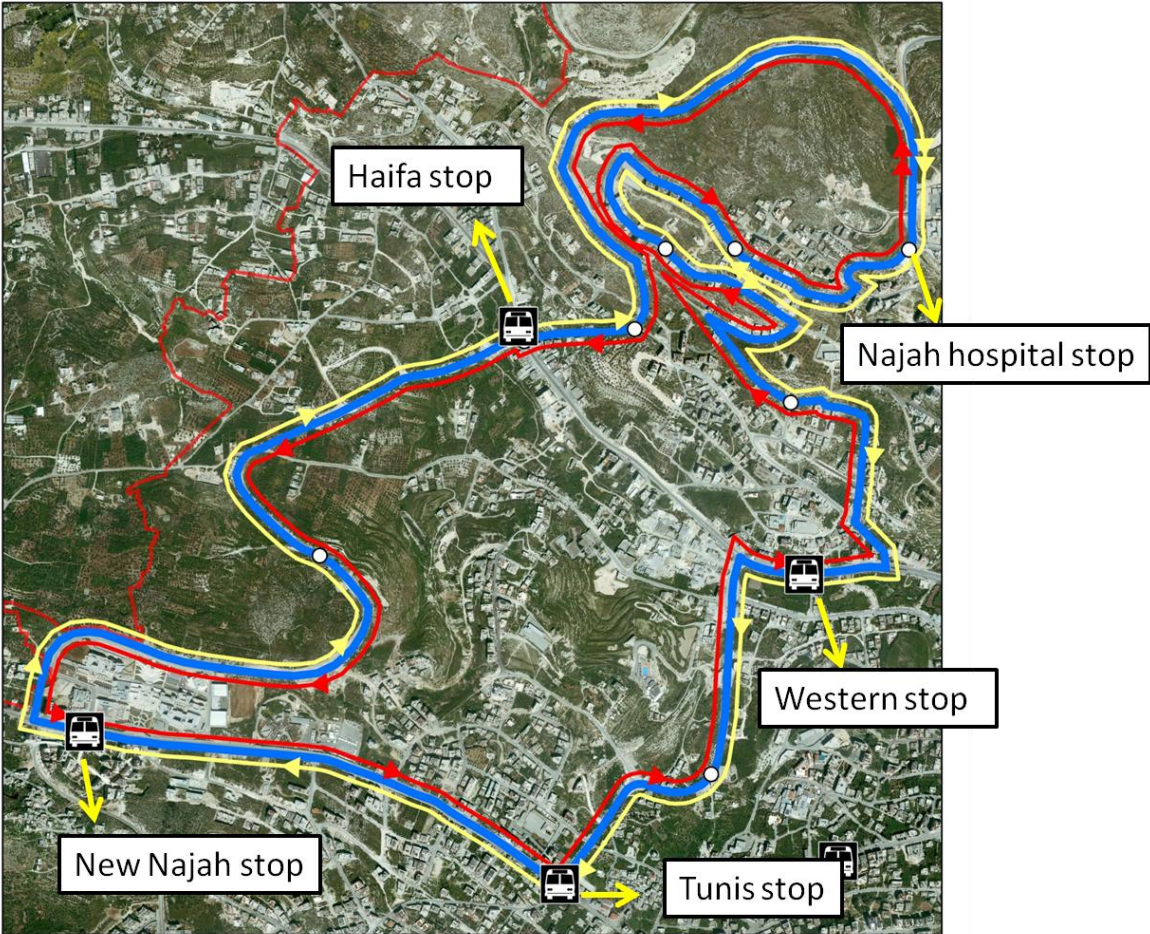
Bus 10 routes



Legend

-  Main stops
-  route 1
-  route 2
-  Bus 10

1:12,500



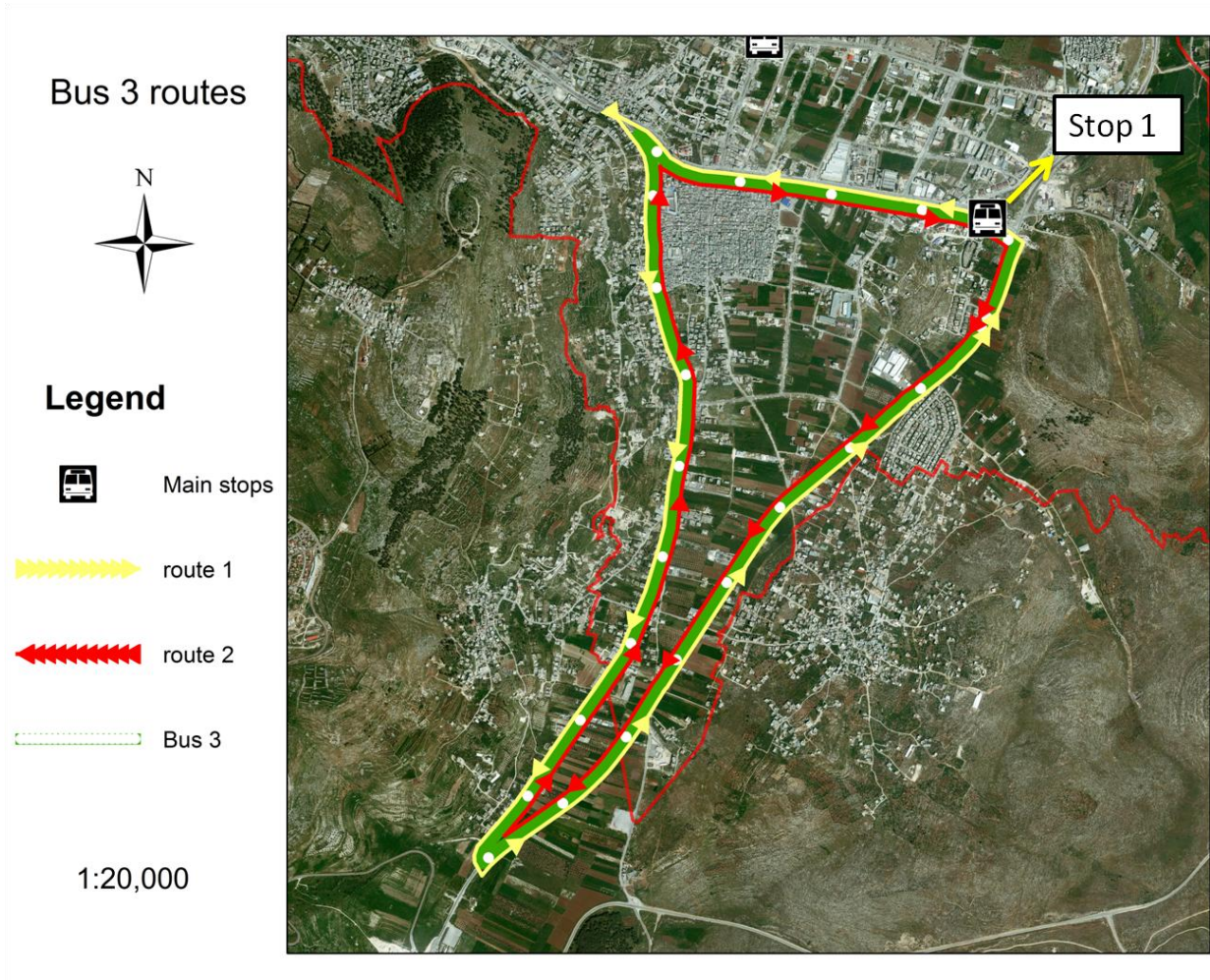
Map 75"main routes" Route 10 with its stops

Local routes:

Local routes are the local corridors that are connected directly with main corridors. Each local route has a timetable in appendix 1 and a number of stops as maps () show.

Bus 3:

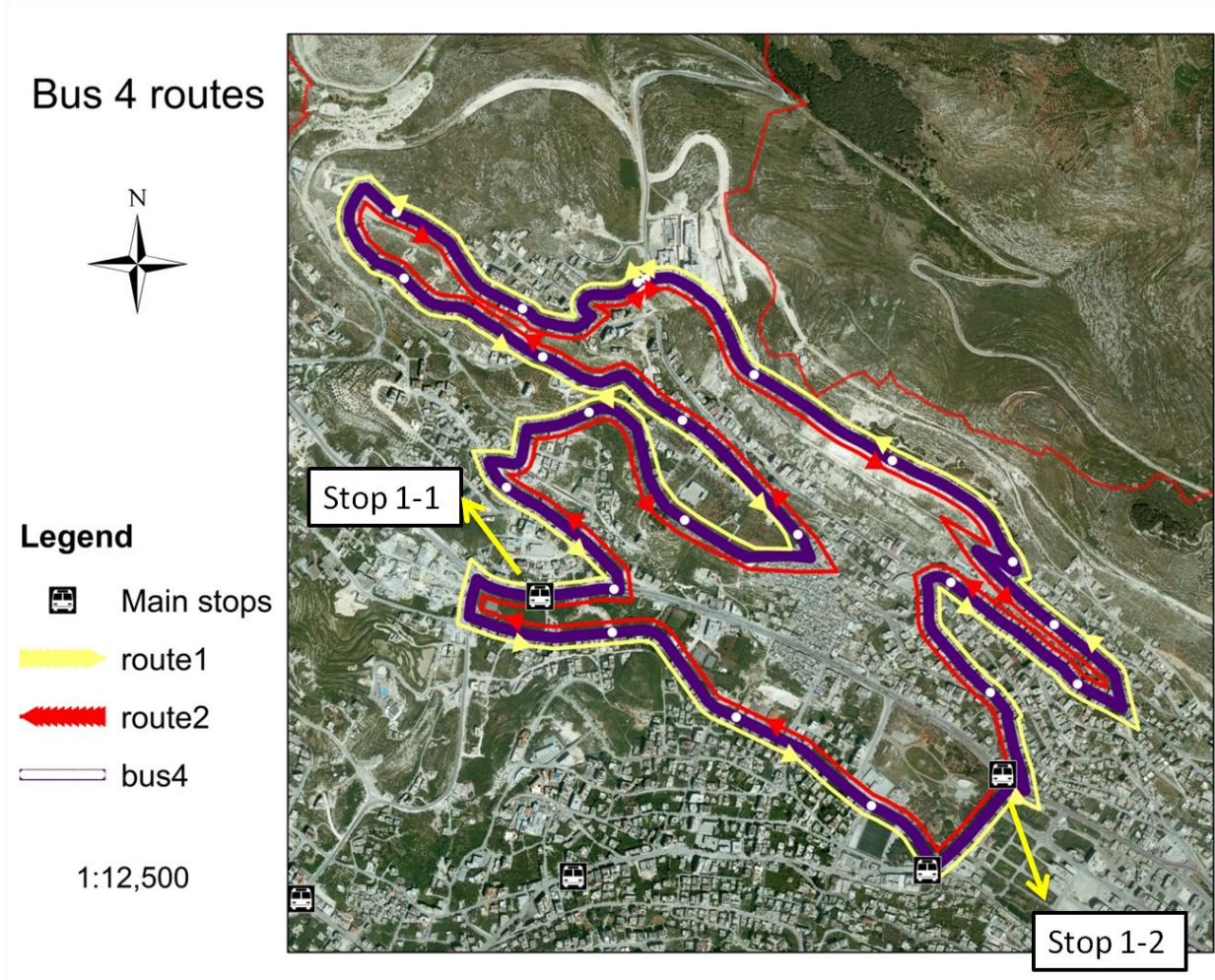
Map (76) shows bus 3 that has 23 stops, trip length :62 min, number of riders in peak hour: 885, number of buses: 20 buses (50 riders type).



Map 76 Bus 3 routes

Bus 4

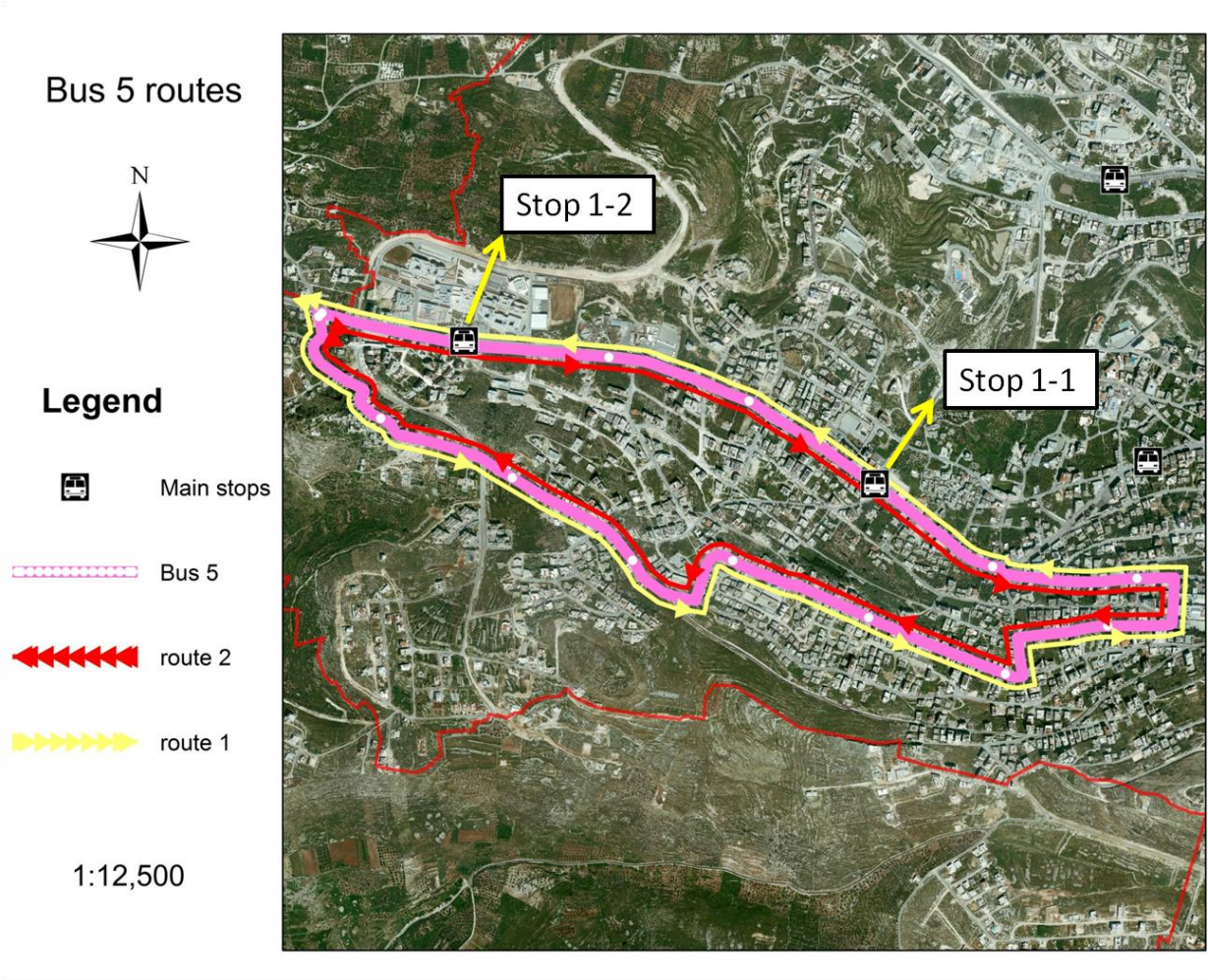
Map (77) bus 4 that has 24 stops, trip length :62 min, number of riders in peak hour: 247, number of buses: 13 buses (20 riders type).



Map 77 Bus 4 routes

Bus 5

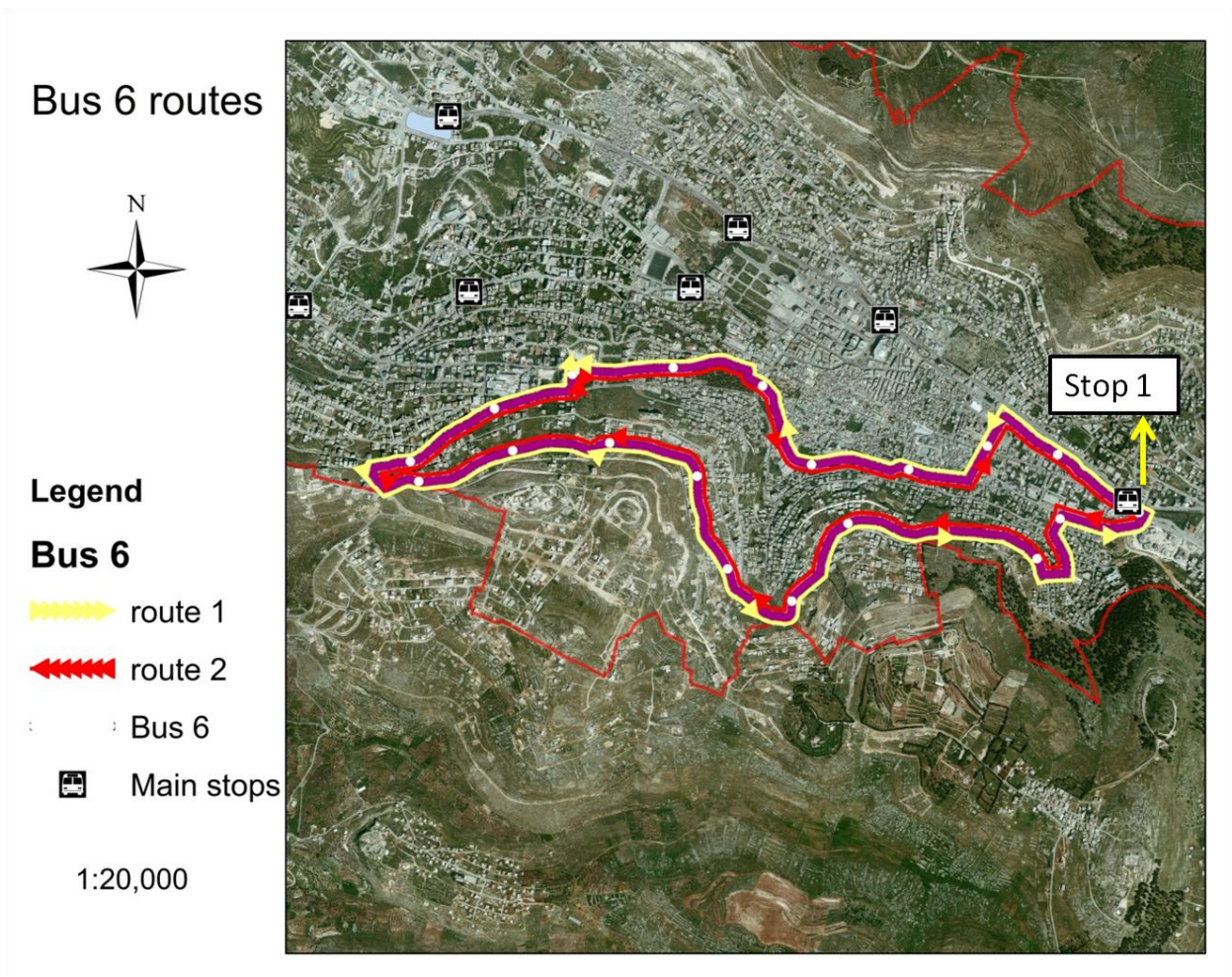
Map (78) shows bus that 5 has 13 stops, trip length :36 min, number of riders in peak hour: 144, number of buses: 6 buses (20 riders type).



Map 78 Bus 5 routes

Bus 6

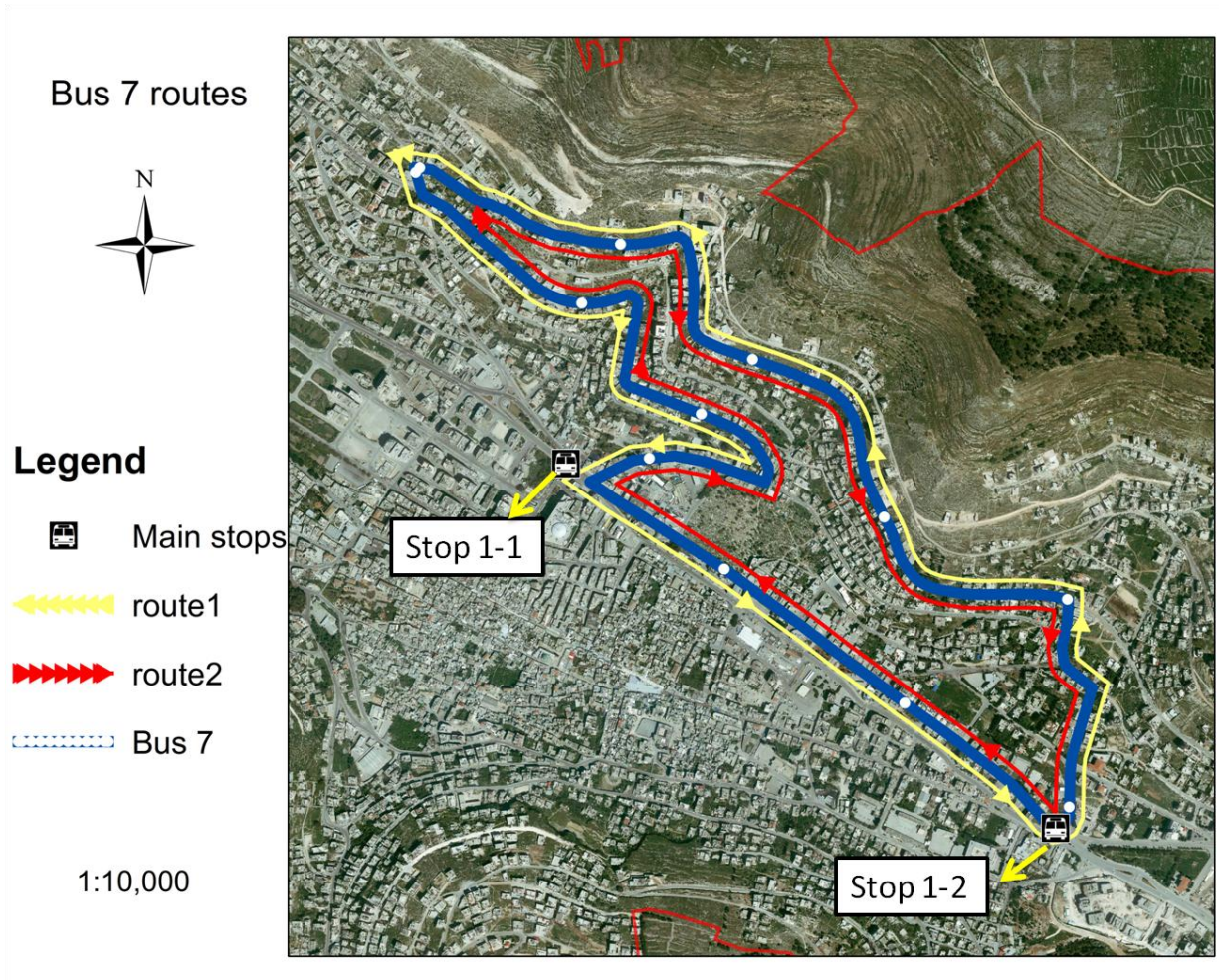
Map (79) shows bus 6 that has 21 stops, trip length :57 min, number of riders in peak hour: 530, number of buses: 10 buses (50 riders type).



Map 79 Bus 6 routes

Bus 7

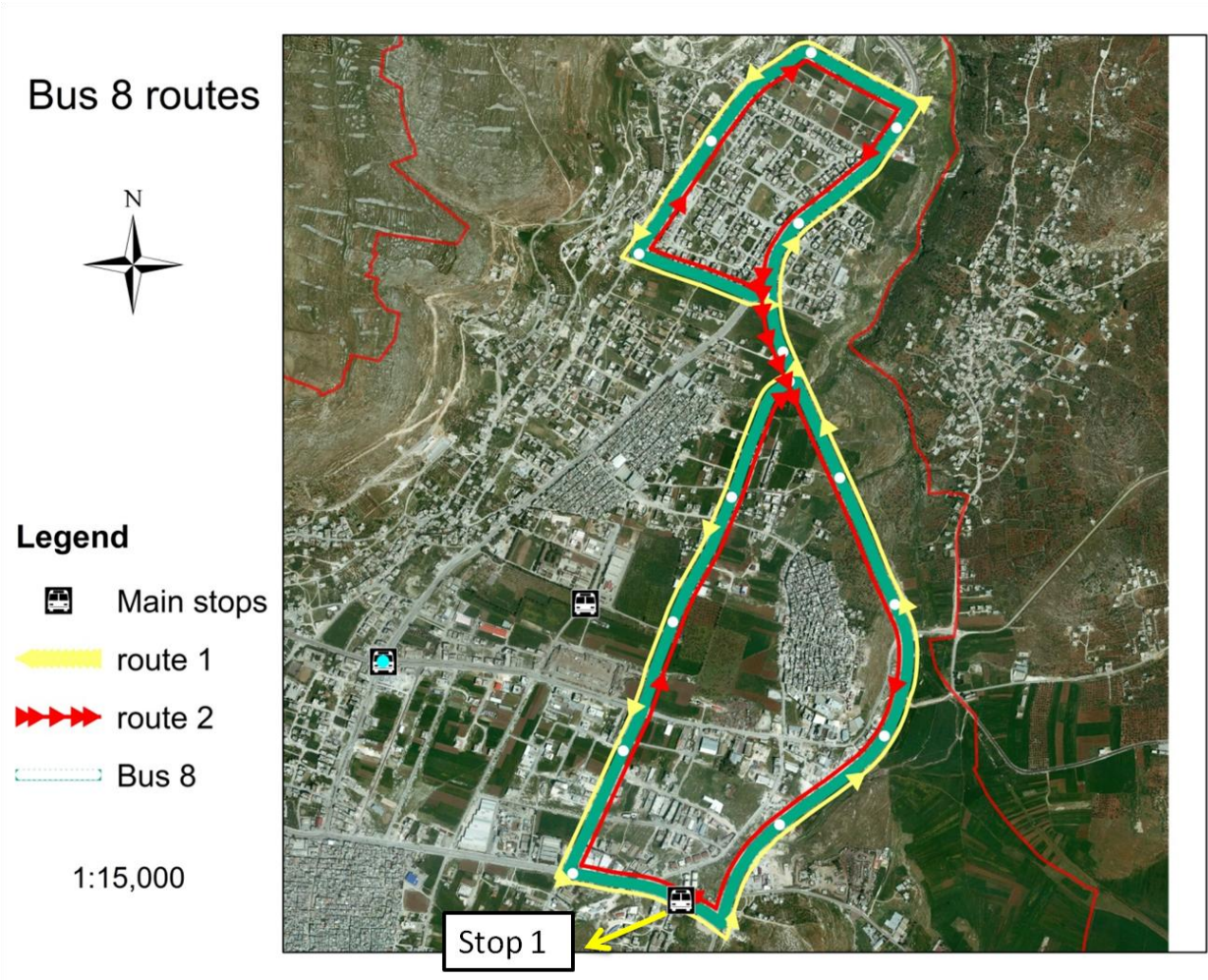
Map (80) bus 7 that has 12 stops, trip length :63 min, number of riders in peak hour: 1496, number of buses: 18 buses (50 riders type).



Map 80 Bus 7 routes

Bus 8

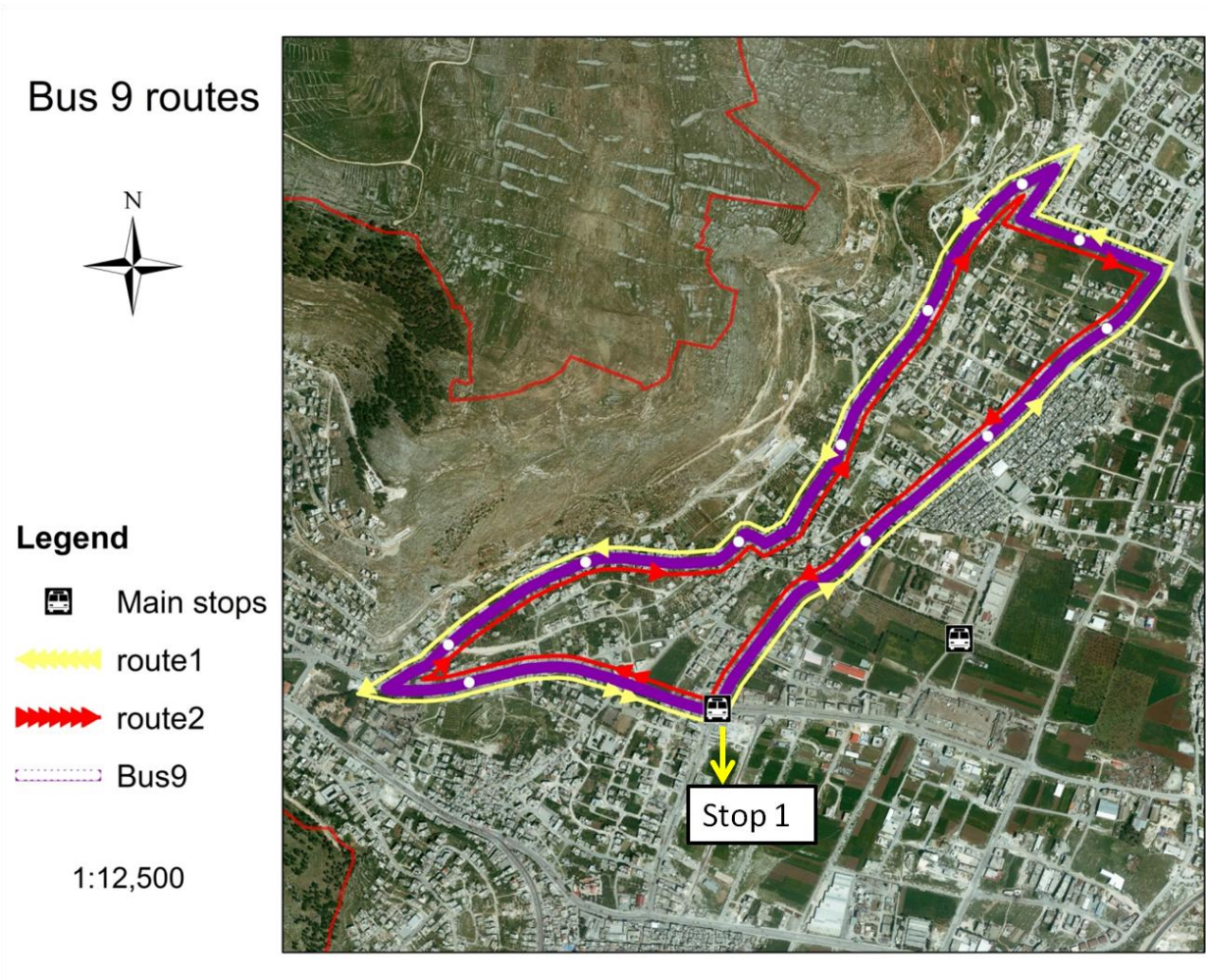
Map (81) shows bus 8 that has 17 stops, trip length :47 min, number of riders in peak hour: 3480, number of buses: 14 buses (20 riders type).



Map 81 Bus 8 routes

Bus 9

Map (82) shows bus 9 that has 14 stops, trip length :40 min, number of riders in peak hour: 472, number of buses: 16 buses (20 riders type).



Map 82 Bus 9 routes





Bus 11

Map (83) shows Bus 11 that has 14 stops, trip length :37 min, number of riders in peak hour: 774, number of buses: 10 buses (50 riders type).

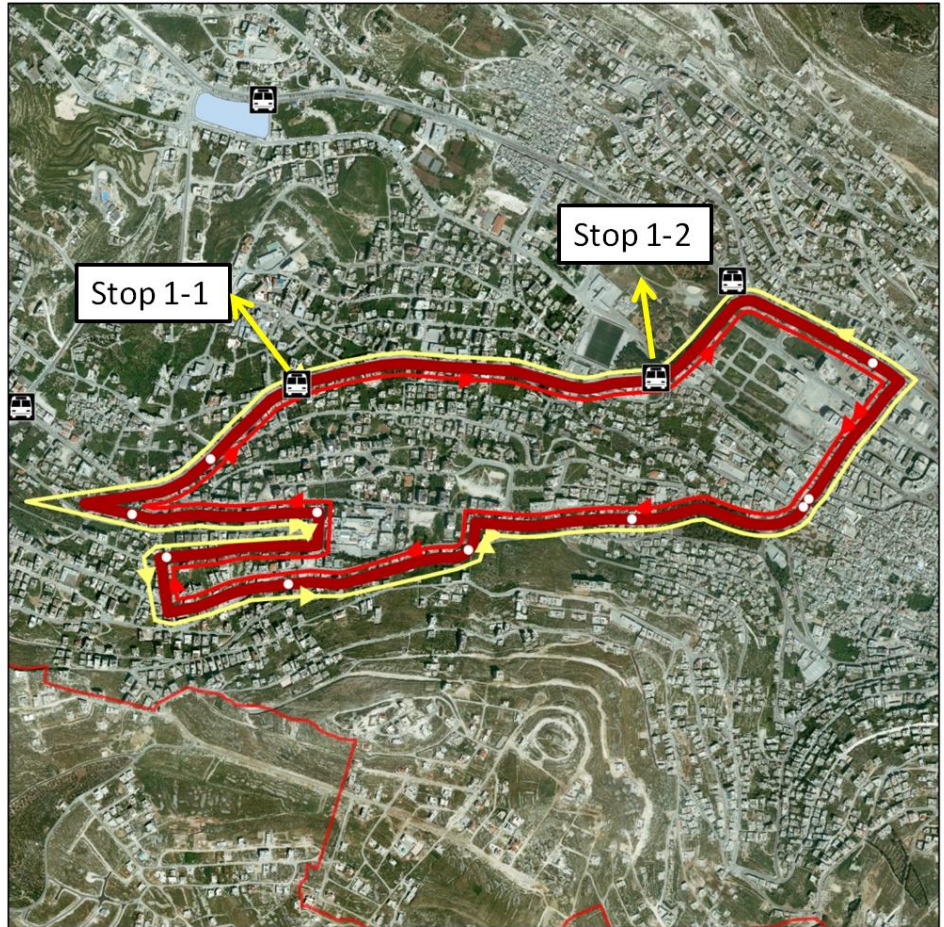
Bus 11 routes



Legend

-  Main stops
-  route 1
-  route 2
-  bus 11

1:12,500



Map 83 Bus 11 routes

Map (84) shows the roads that shared taxis that travels outside the city use to arrive the eastern and western terminals that were suggested by Nablus municipality. The location of terminals are shown with the route that shared taxis use from each of them to its orientation. All north eastern communities pass through the path "To Asker" such as Tubas and some of its communities, taxis that travel to sothern communities such as Ramallah, pass through " To Huwara" path. Assira Al-Shamaleyah and its surrounding have special path that is " To North Assira", Tulkarem and Jenin with their surroundings use " To Tulkarem path", Qalqilyah and the western areas use " To Qalqilyah" path, and the suthern communities use " To tell" path.

Routes to outside Nablus city



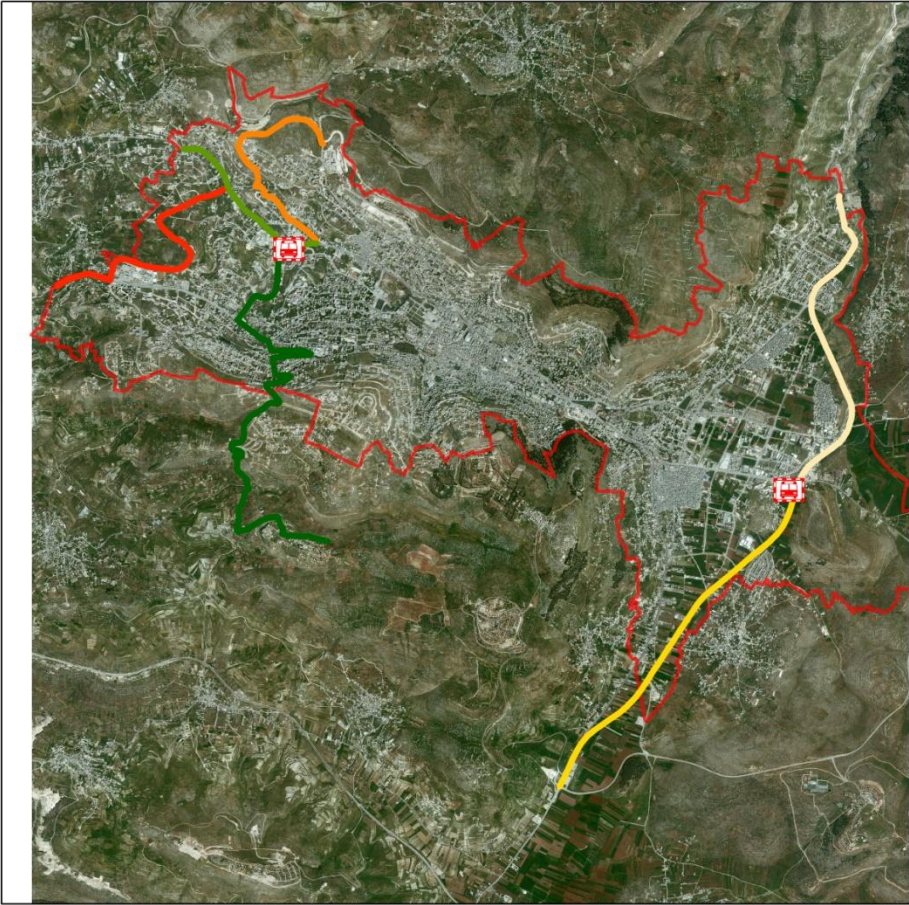
Legend

 external bus terminals

Routes

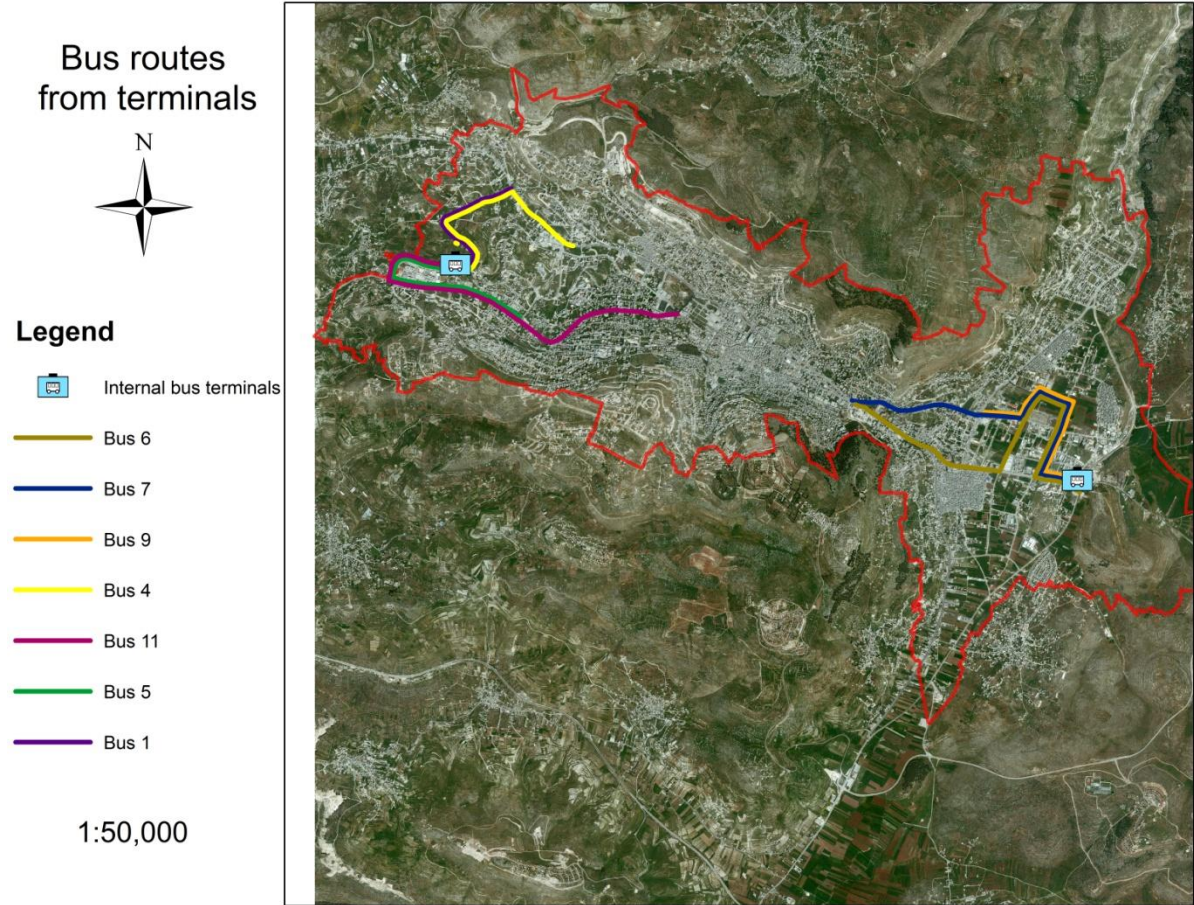
-  To Asker
-  To North Assira
-  To Huwara
-  To Qalqilyah
-  To Tell and
-  To Tulkarem

1:50,000



Map 84 Shared taxis routes towards outside the city

Map (85) shows the routes that each bus pass before its trip start from the its terminal to its route start (starting stop). This map is prepared to manage the buses so that their routes are known from the beginning. This helps in not using unknown roads and all buses will be in specified roads. Also, cars owners will know which roads are full with buses.



Map 85 Bus routes from terminals

5.2.2 Applying " Pedestrian friendly" Central Business District Traffic planning

To show the roads details, Nablus central business district is taken to prepare details on it.

One of the main aims for this project is to make Nablus city a friendly city to encourage people to walk. To show that planning a transit city does not mean that the city is only for vehicles but also it provides pedestrian services.

Map (86) shows the transportation modes within the CBD that are: buses, private cars, and pedestrians and bicycles . This maps shows how the three modes can be achieved in the same area.

All the CBD roads are now used by vehicles, but in this project, only specific roads that are well connected are to be used by vehicle (buses or cars). And most of the roads are for pedestrians. This makes Nablus city has a pedestrian friendly CBD. And the service is completed by providing three cars parking located in the west, east, and the middle of the CBD with accessible roads so that the cars can arrive the parking from any area they come from, they park and walk to their destination.




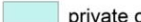
CBD Routes



Legend

Routes

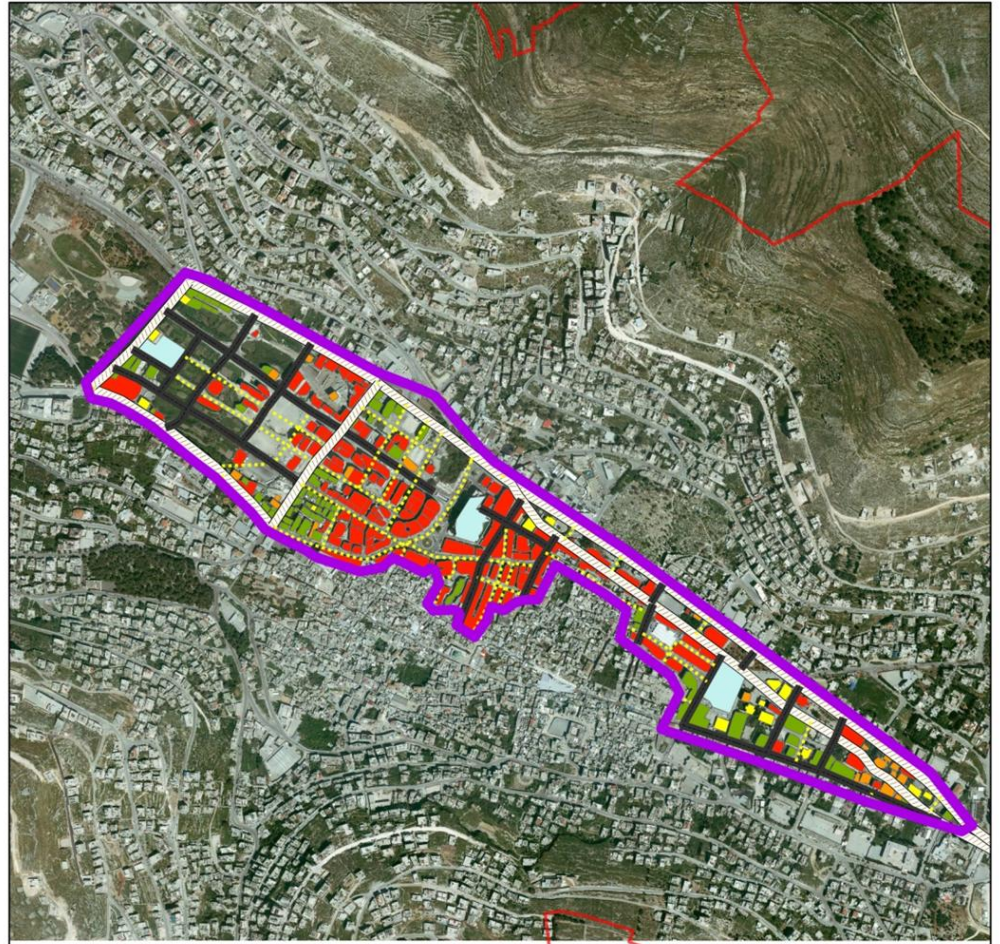
use

-  Walking
-  Buses
-  Private cars
-  private car stops

CBD buildings uses

-  Commercial
-  Industrial
-  Management
-  Public
-  Residential
-  CBD boundaries

1:10,000








Map 86 Central business district routes

Map (87) shows the main part of the city center. It shows the where each transportation mode can pass (buses, private cars, pedestrian, and bicycles).

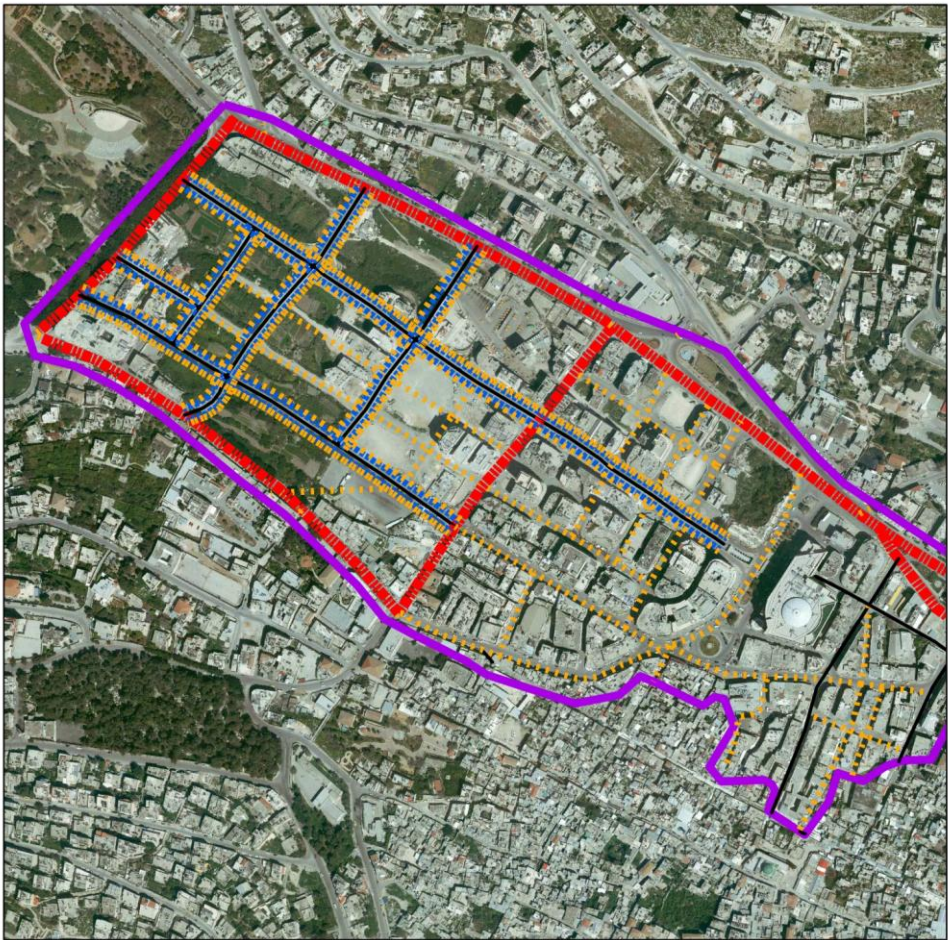
CBD routes



Legend

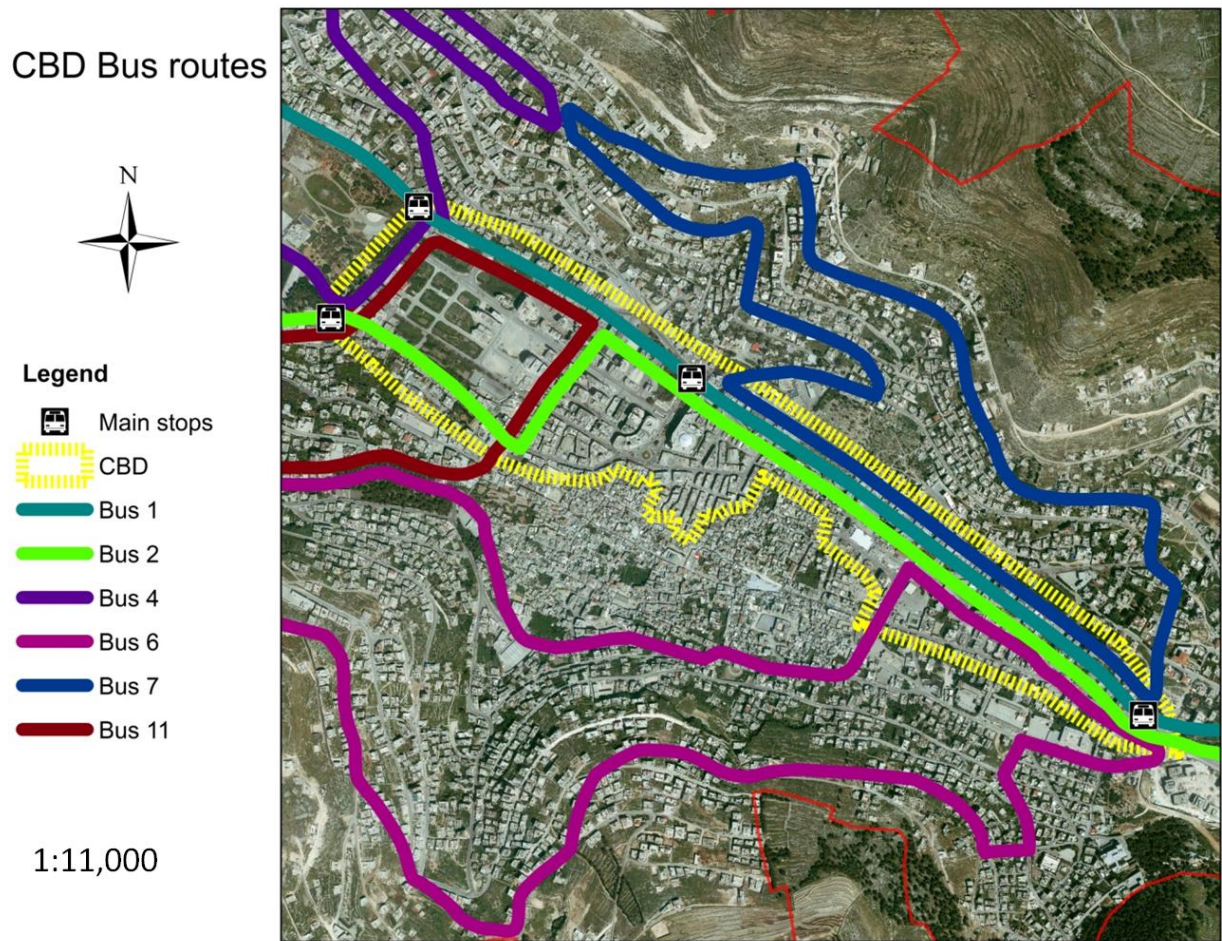
-  Pedestrian paths
-  Bus routes
-  Bicycle routes
-  Private cars routes
-  CBD boundaries

1:5,000



Map 87 Central business district main part routes

Map (88) shows the buses routes that pass through the CBD.



Map 88 CBD buses routes

CBD roads details and traffic directions:

Figure (17) shows the CBD roads and the pedestrian zones with the open areas and the car parking.

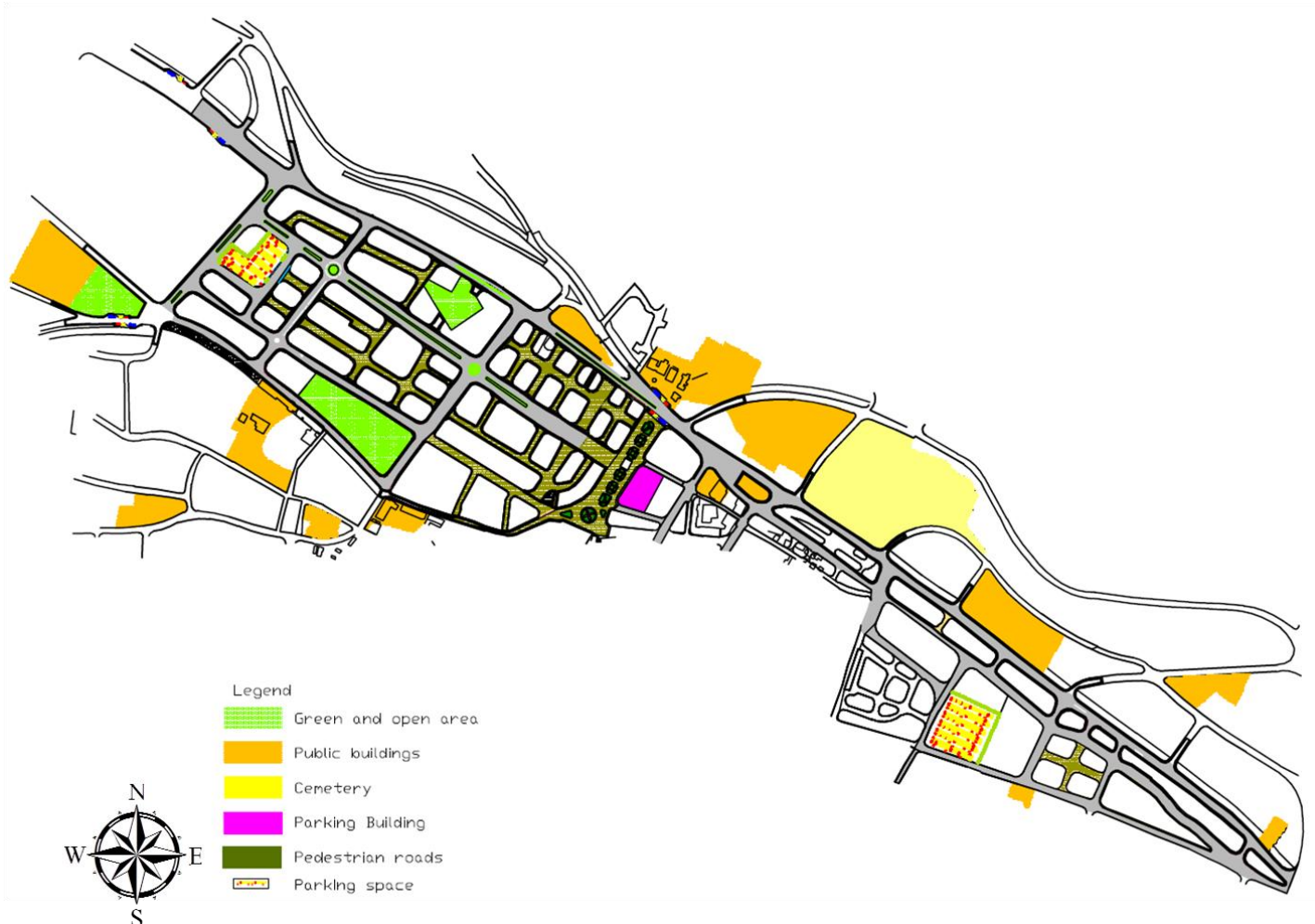
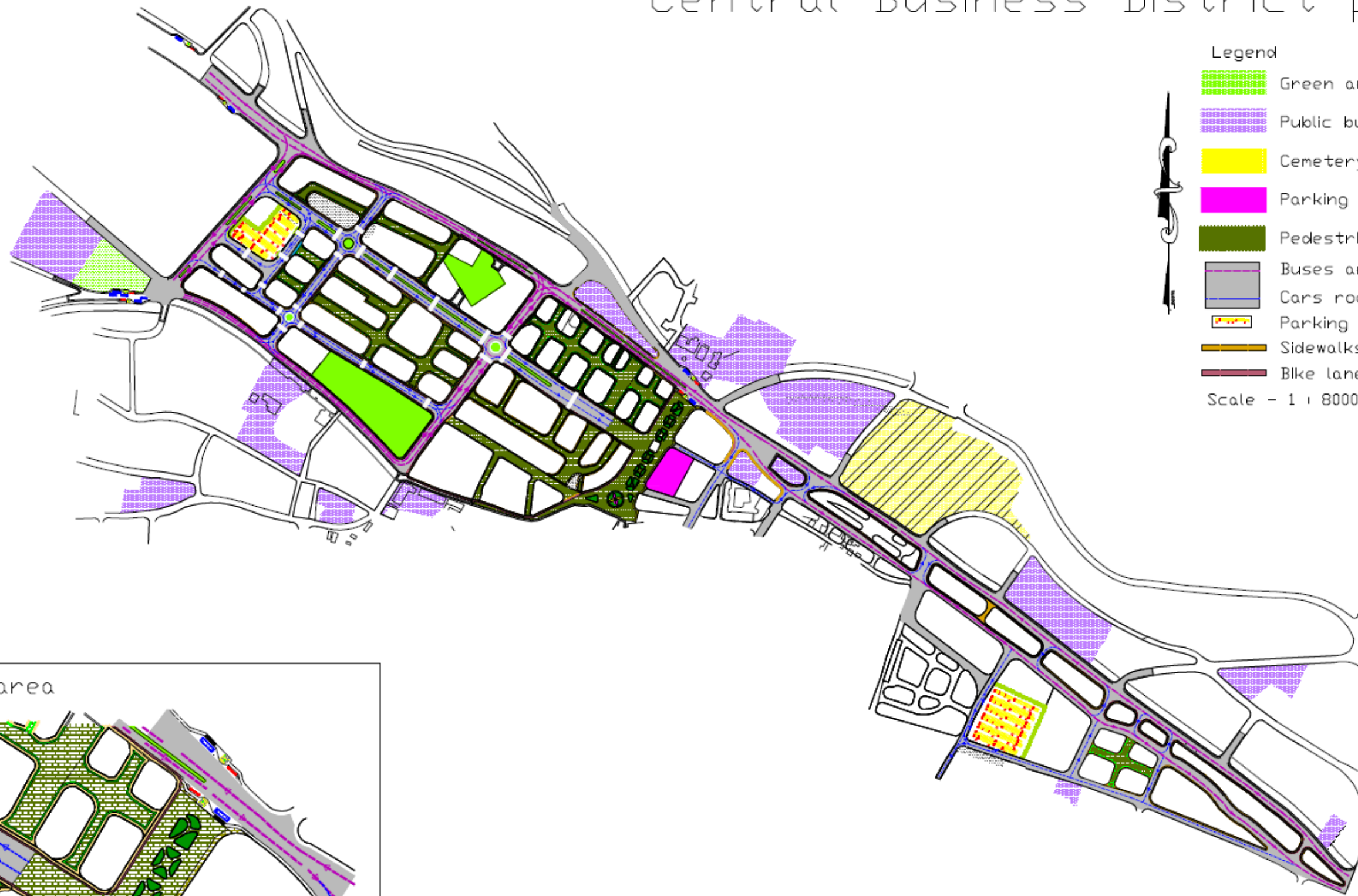


Figure 17 Nablus City Central Business District

Central Business District plan



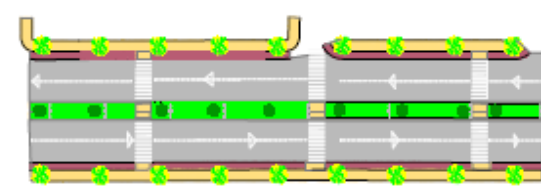
Legend

-  Green and open area
 -  Public buildings
 -  Cemetery
 -  Parking Building
 -  Pedestrian roads
 -  Buses and cars roads
 -  Cars roads
 -  Parking space
 -  Sidewalks
 -  Bike lanes
- Scale - 1 : 8000

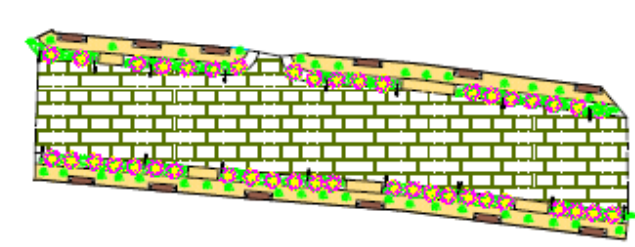
Duwwar area



Vehicles streets details



Pedestrian streets details



Traffic direction in the CBD is shown in the following maps:

Because the CBD is large, it is divided into many parts to show the details of traffic movements. All parts 1, 2, and 3 are shown in figures (18,19,20,21)

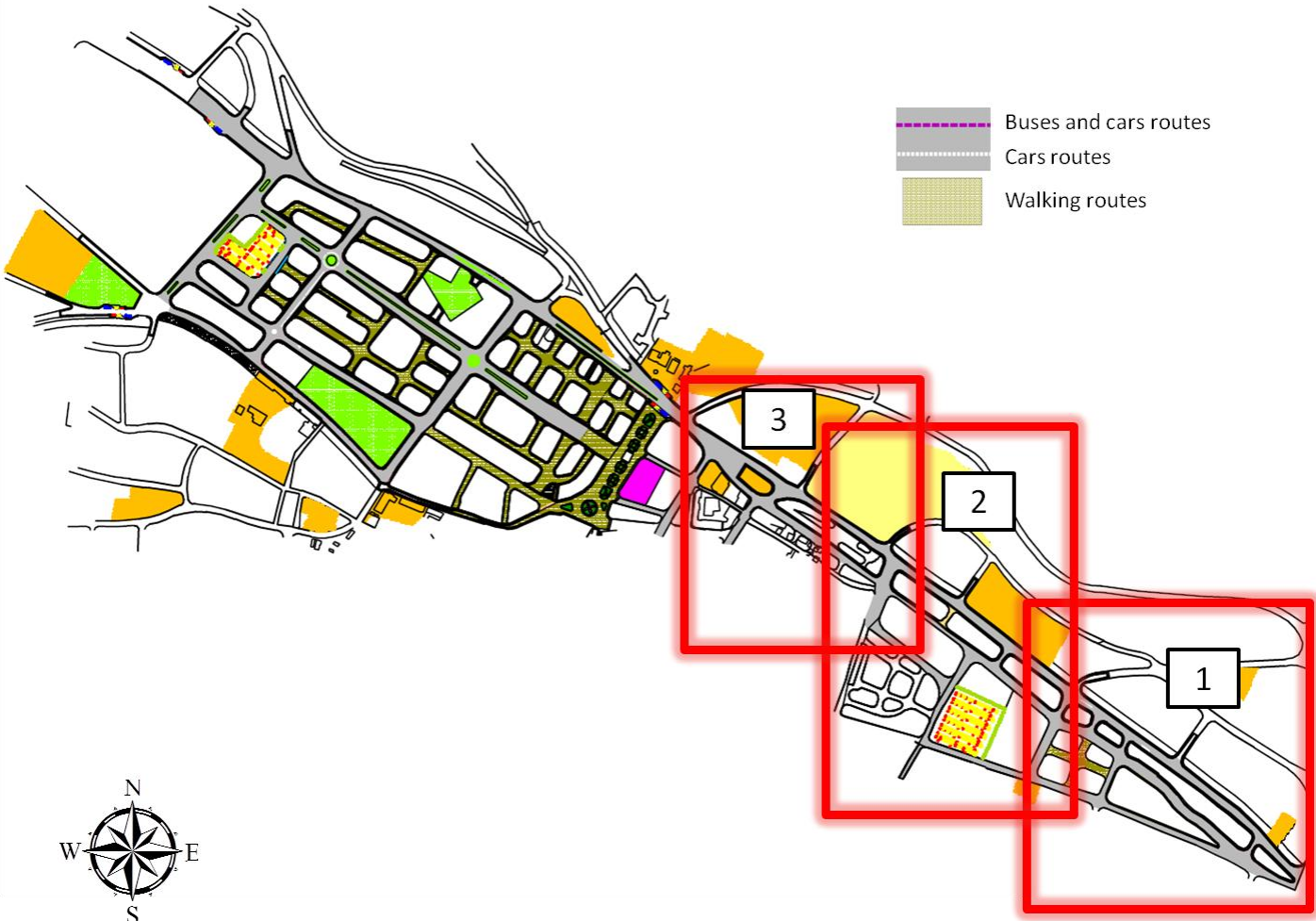


Figure 18 CBD routes details

Figure (19) shows traffic directions in area 1 from figure (18). They are: buses, private cars, and pedestrians.

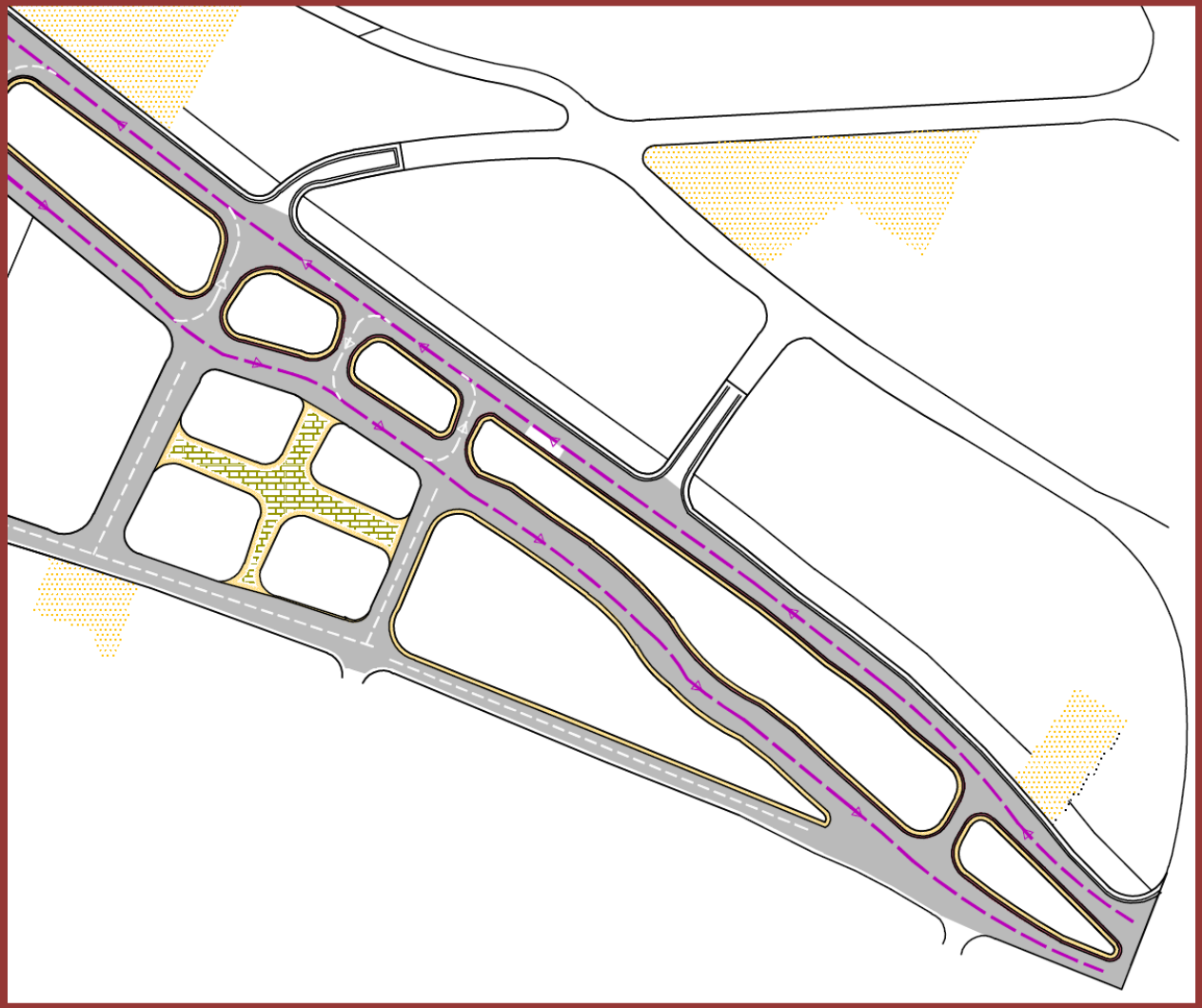


Figure 19 Part of CBD routes traffic movements directions

Figure (20) shows traffic directions in area 2 from figure (18). They are: buses, private cars, and pedestrians.

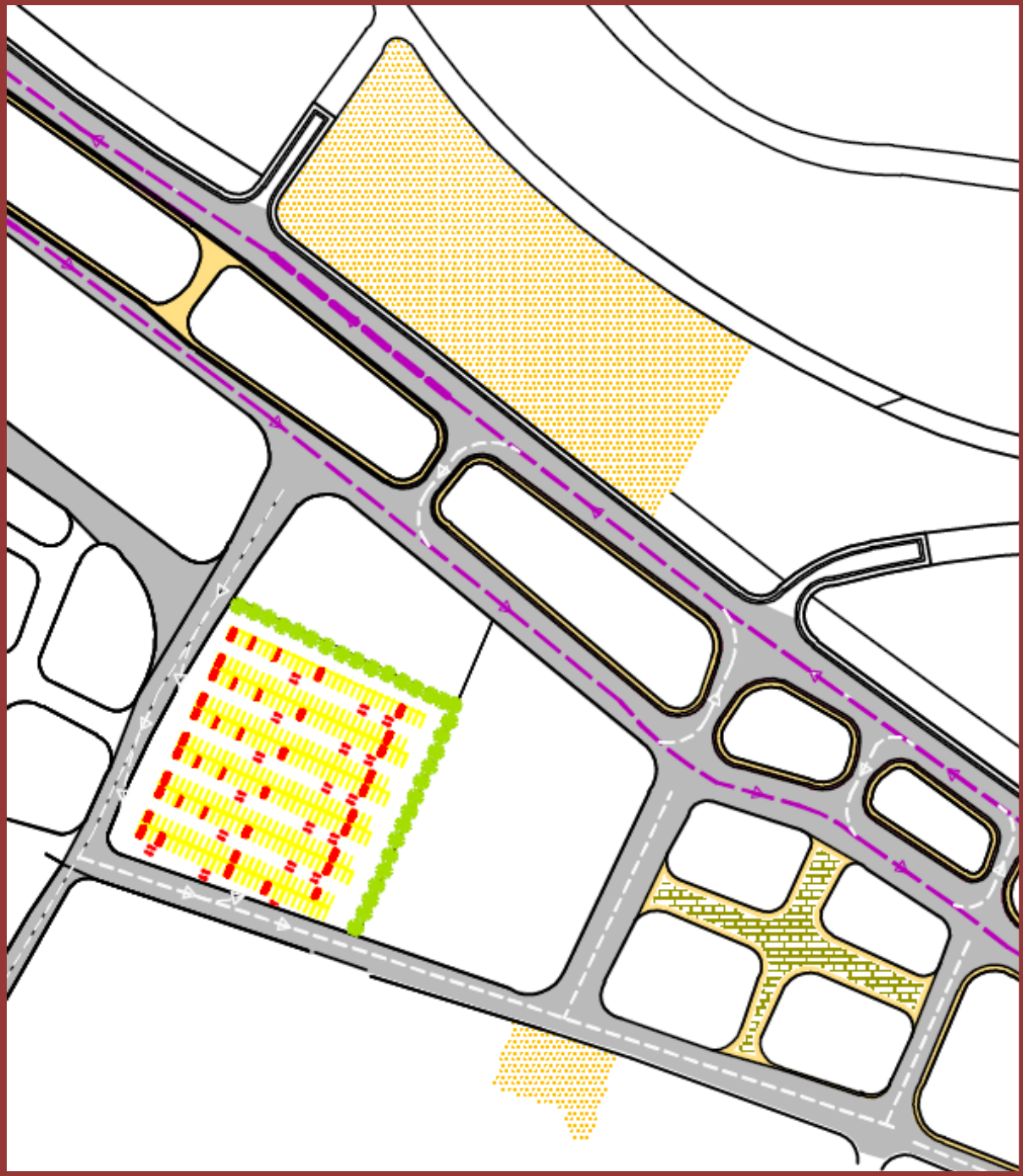


Figure 20 Part of CBD routes traffic movements directions

Figure (21) shows traffic directions in area 3 from figure (18). They are: buses, private cars, and pedestrians.

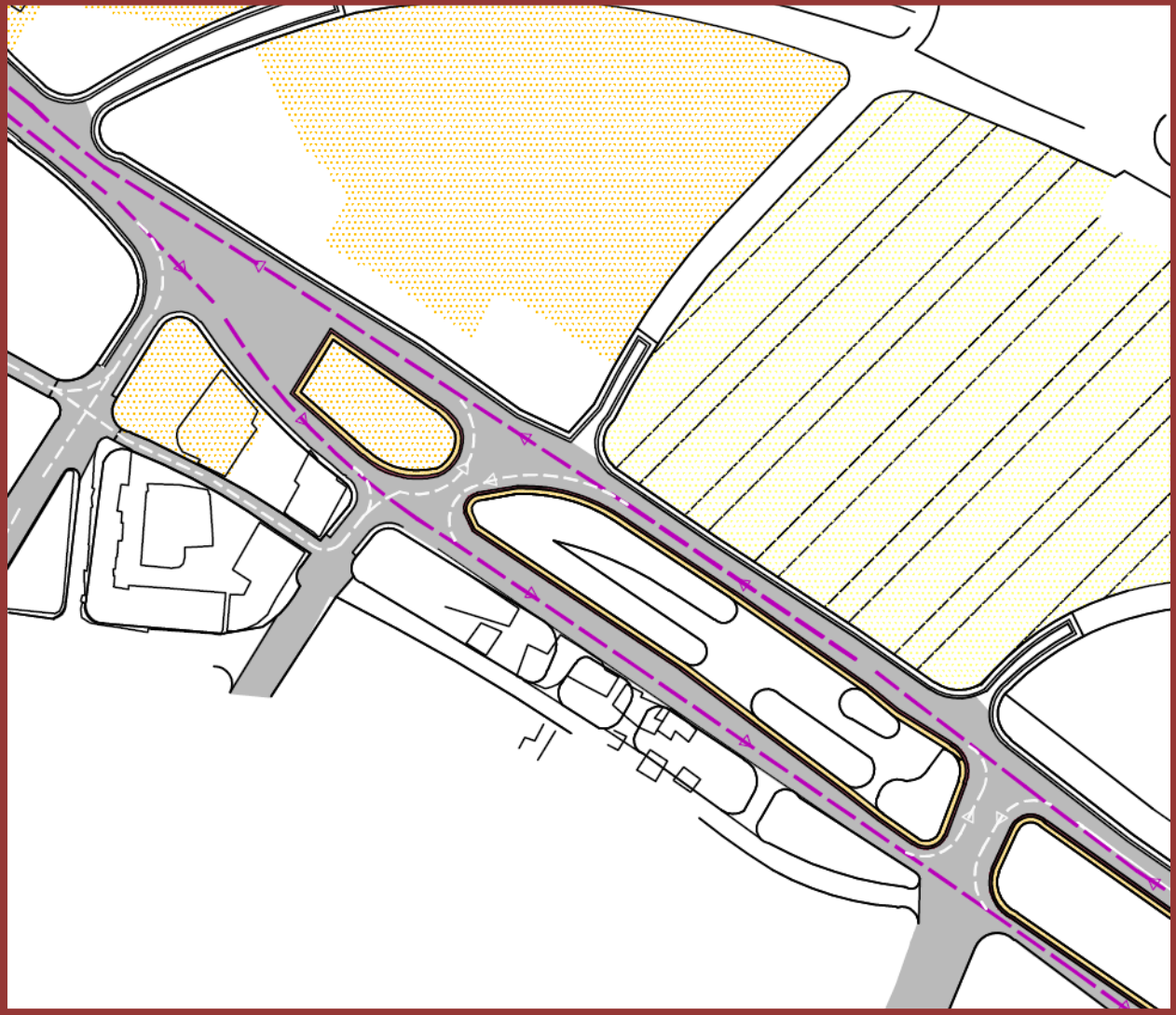


Figure 21 Part of CBD routes traffic movements directions

Figure (22) shows the CBD roads details. There are lanes for vehicles, sidewalks, and plants in the middle.

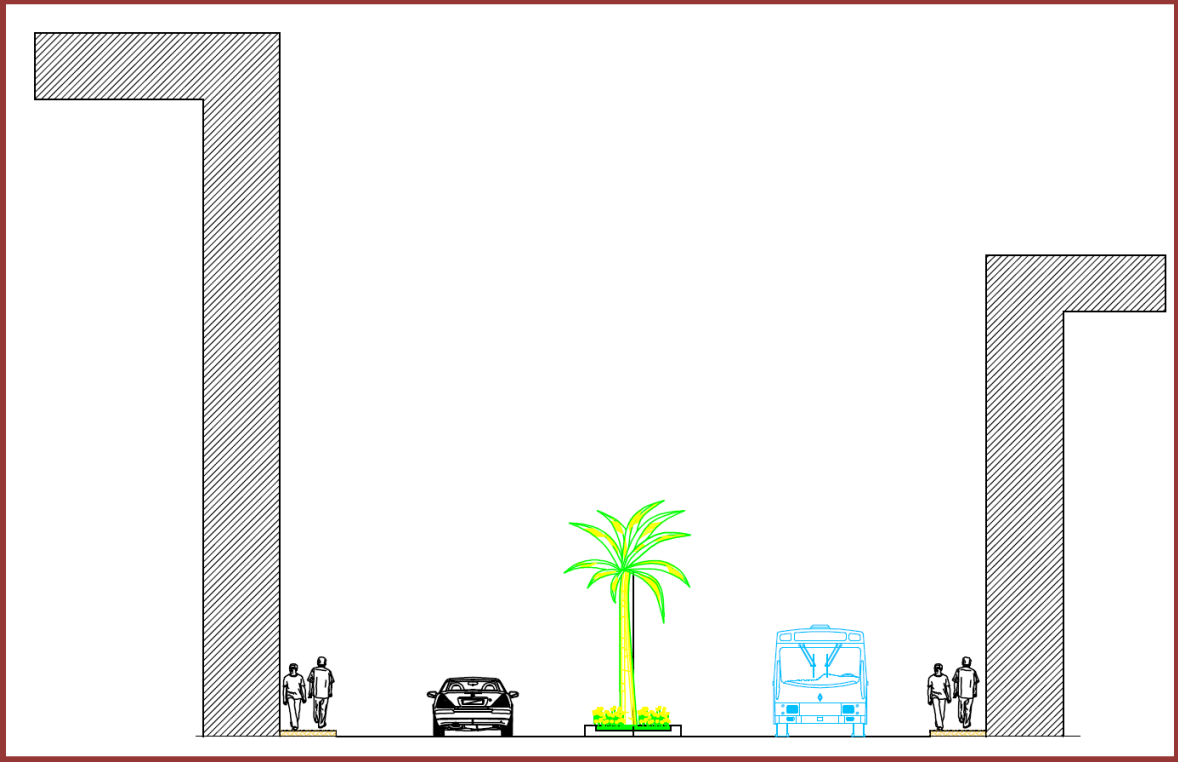


Figure 22 Vehicles roads section

Planning the CBD to be a pedestrian friendly.

Figure (23) shows the three divisions for the main part of the CBD.

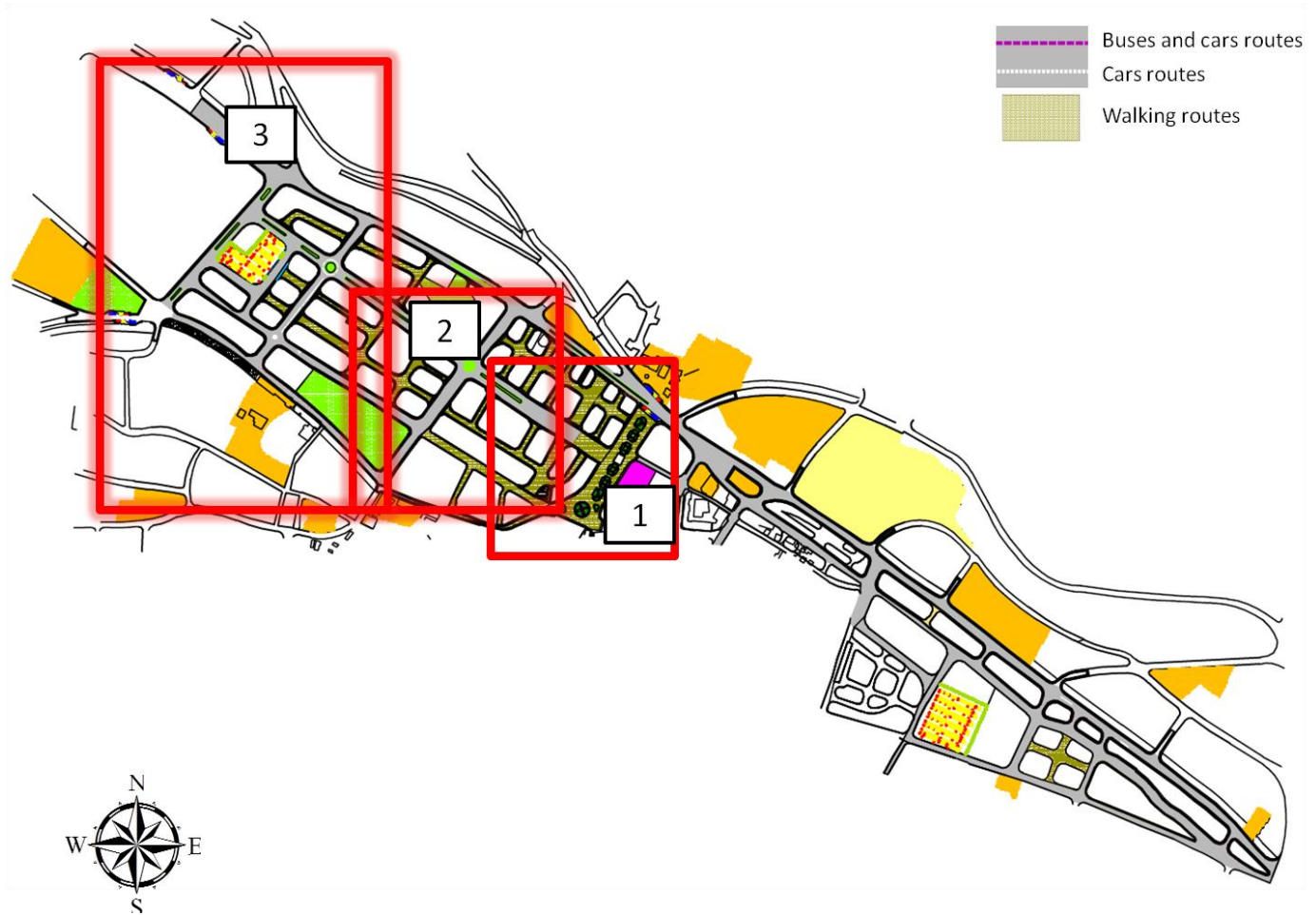


Figure 23 CBD routes details

Figure (24) shows traffic directions in area 1 from figure (23). They are: buses, private cars, and pedestrian zones. Also, it shows the new design for the "Duwwar" area that became completely for pedestrians with green areas and only emergency services are able to enter the area.

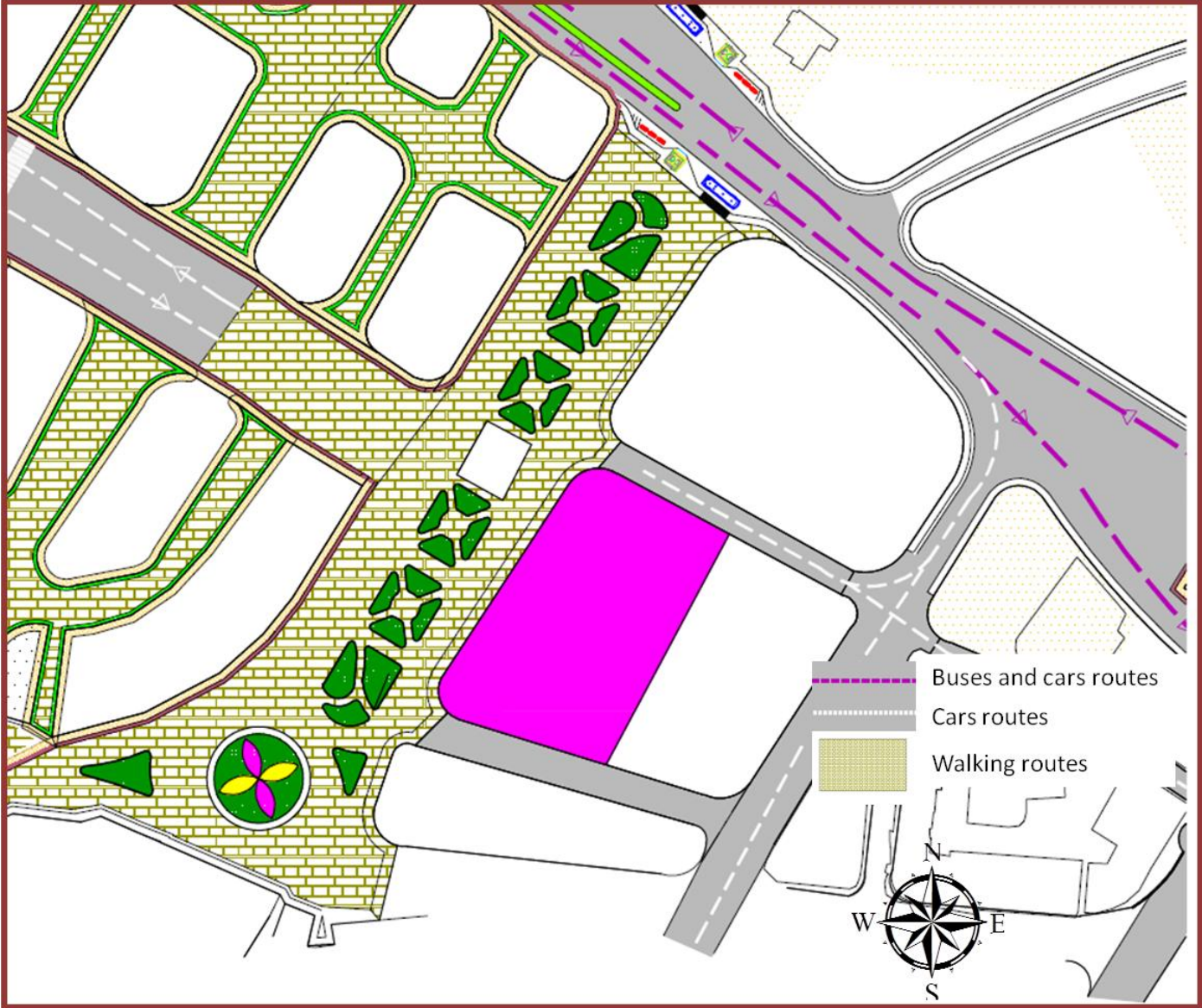


Figure 24 Main area in CBD traffic movements and pedestrian zones

Figure (25) shows traffic directions in area 2 from figure (23). They are: buses, private cars, and pedestrian zones.

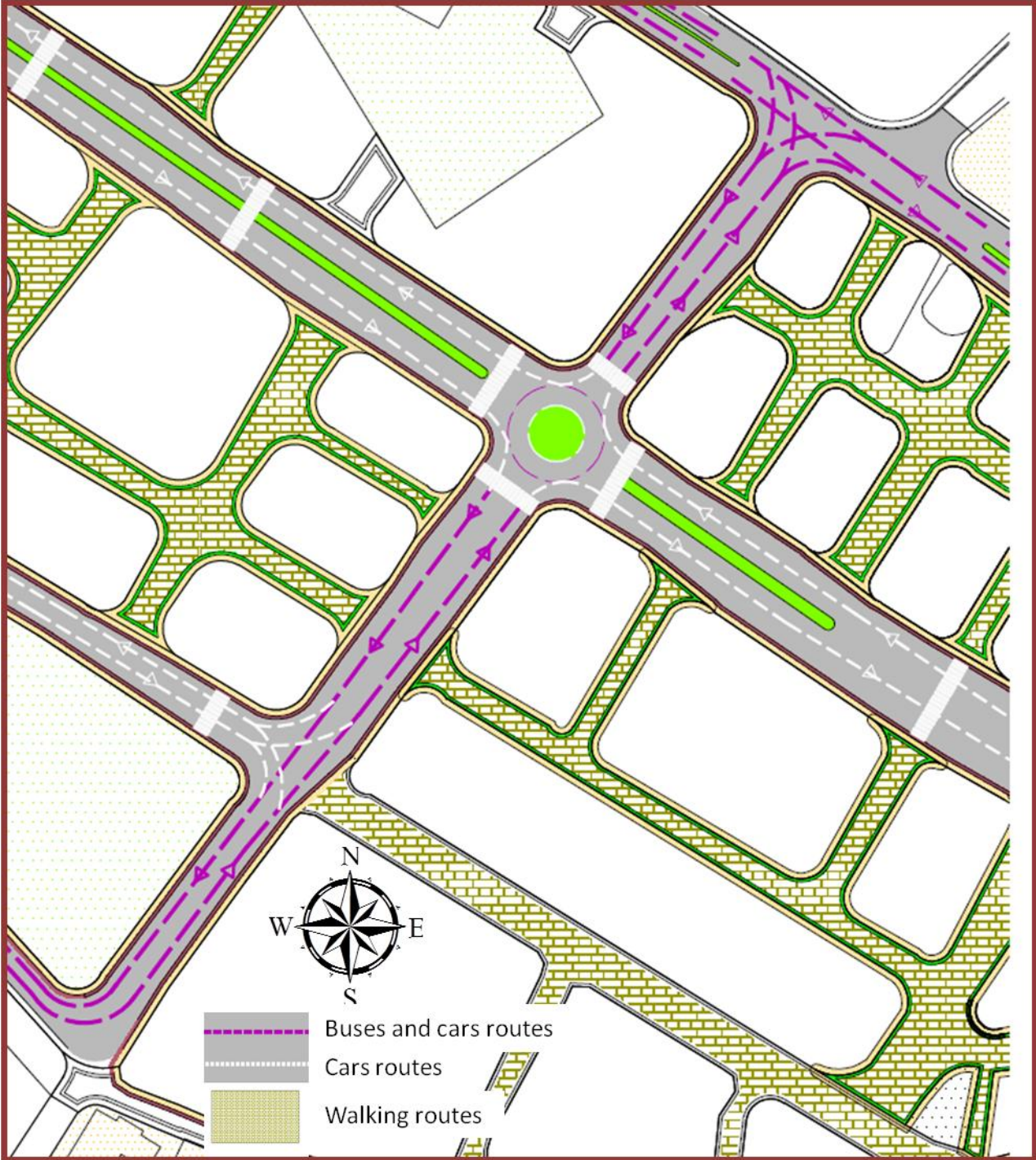


Figure 25 Part of CBD roads traffic movements and pedestrian zones

Figure (26) shows traffic directions in area 3 from figure (23). They are: buses, private cars, and pedestrian zones.

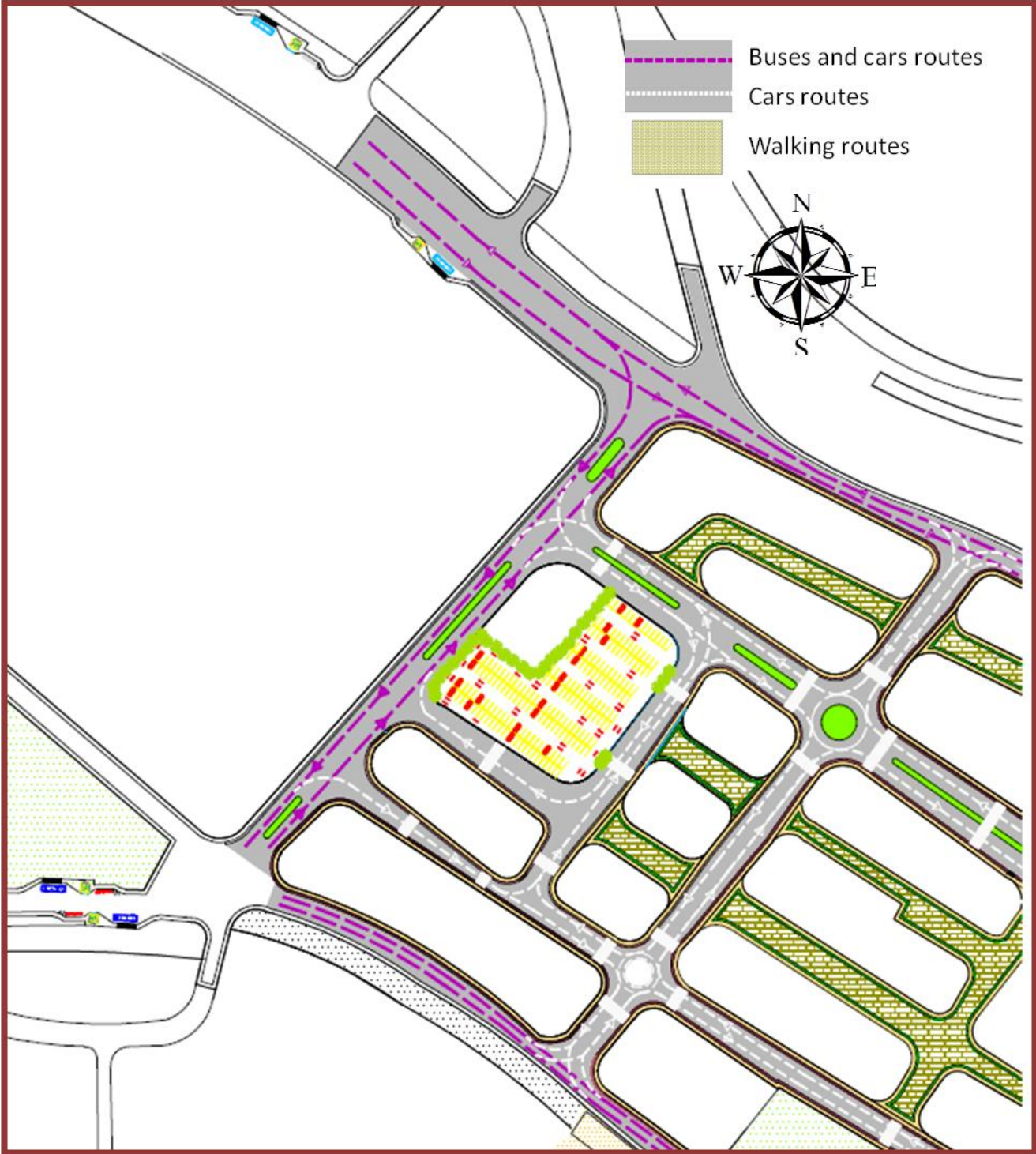


Figure 26 Part of CBD roads traffic movements and pedestrian zones

Vehicles Roads Details

The vehicle roads have the following details: 2 meters sidewalks, 1 meter for bicycles, and a greenery in the middle with a width that vary according to the road width.

Figures (27,28) shows the roads features with sidewalks and bikes lanes.

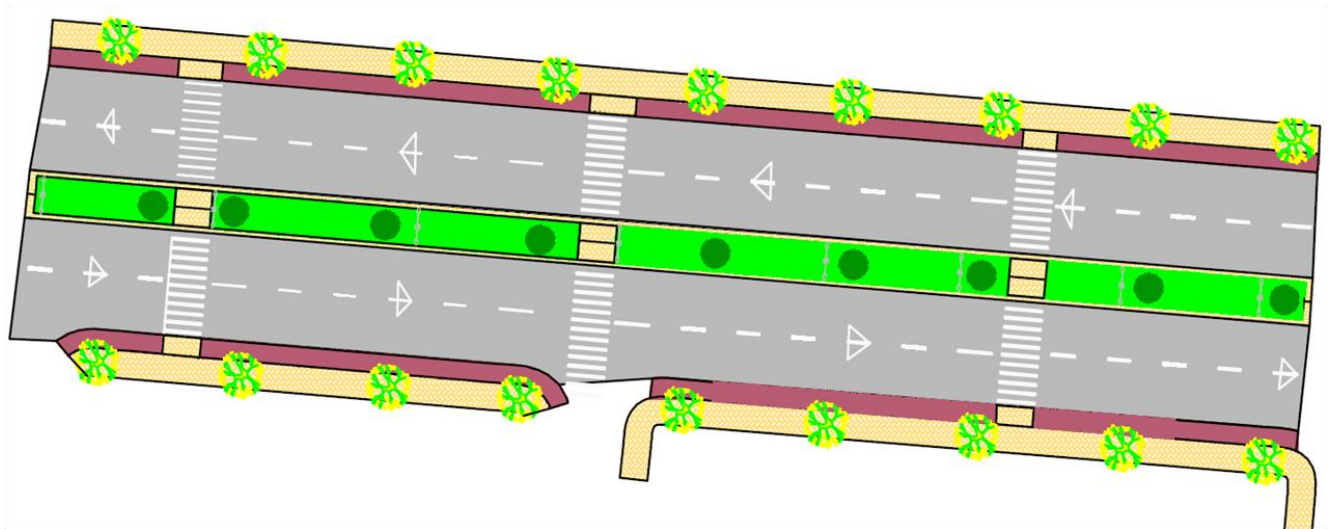


Figure 27 Details for a part of vehicles roads

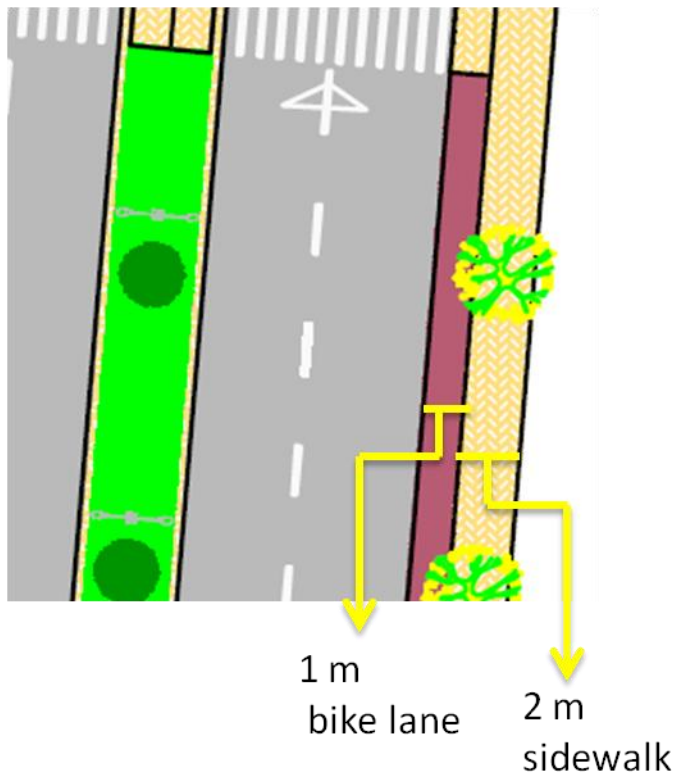


Figure 28 Roads features

Figure (29) shows a section for the CBD roads that includes sidewalks, bikes lanes, vehicles lanes, and greenery sides with the sunshade umbrellas on sidewalks.

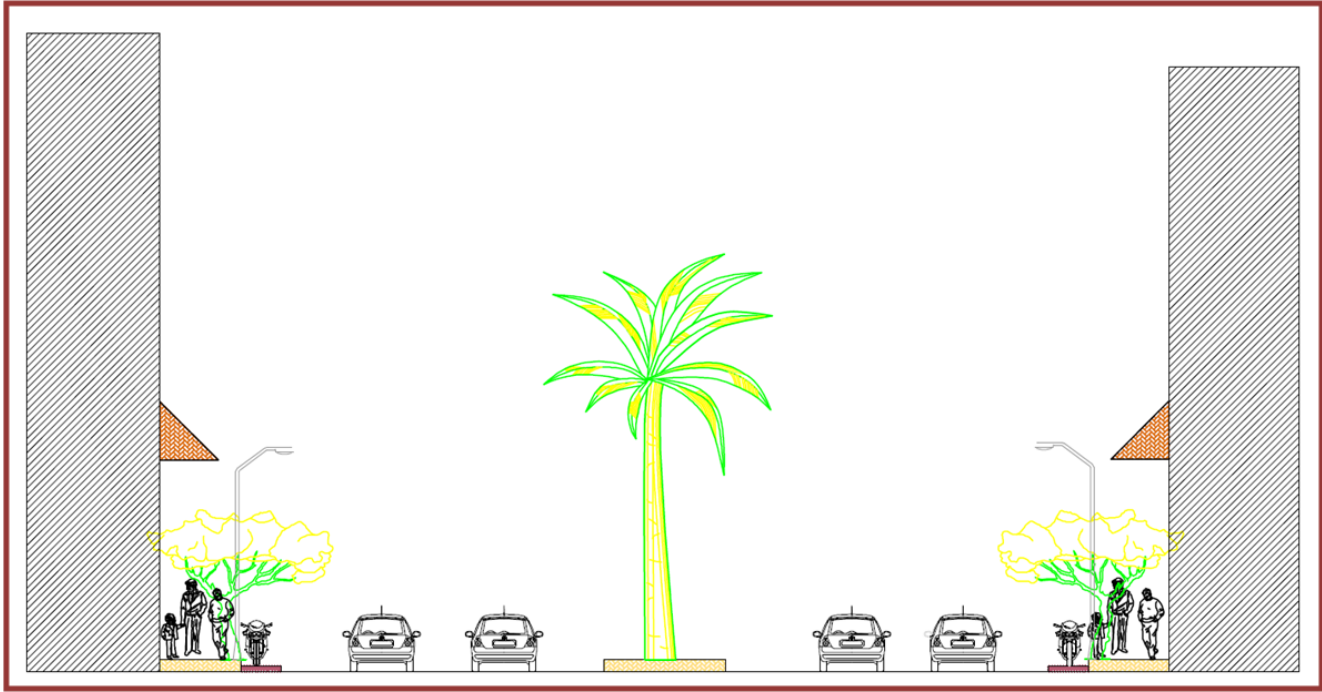


Figure 29 CBD vehicles roads section

Pedestrian Roads Details

Figure (30) shows the pedestrian roads details that consists of existing sidewalks which will be used for streets furniture (seats and containers), special lanes for greenery, and the pedestrian street itself.

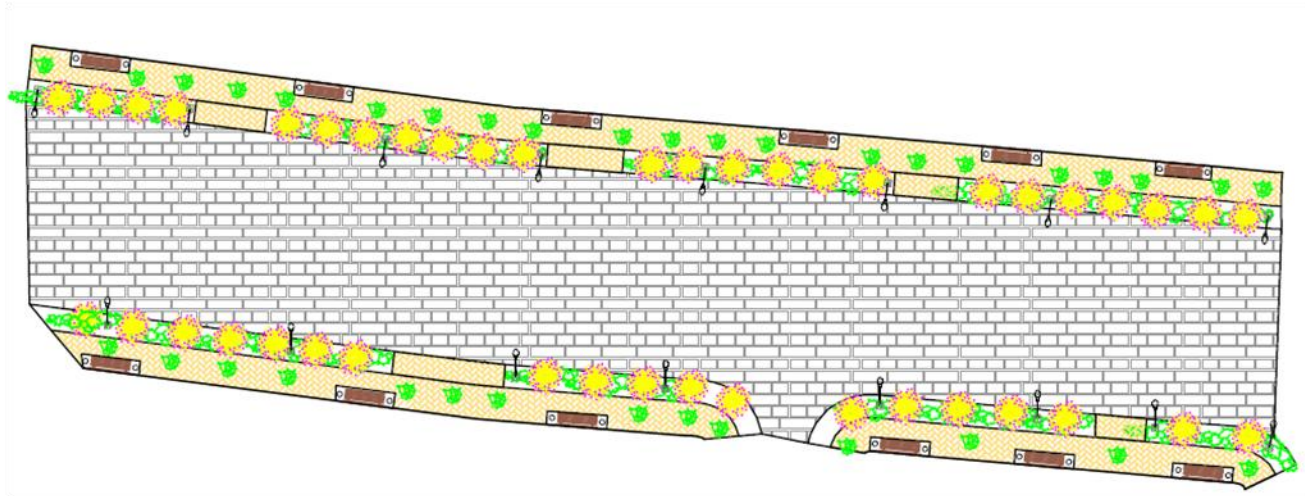


Figure 30 Pedestrian roads details

Figure (31) shows a section for a pedestrian road (sidewalks, greenery, lights, and umbrellas).

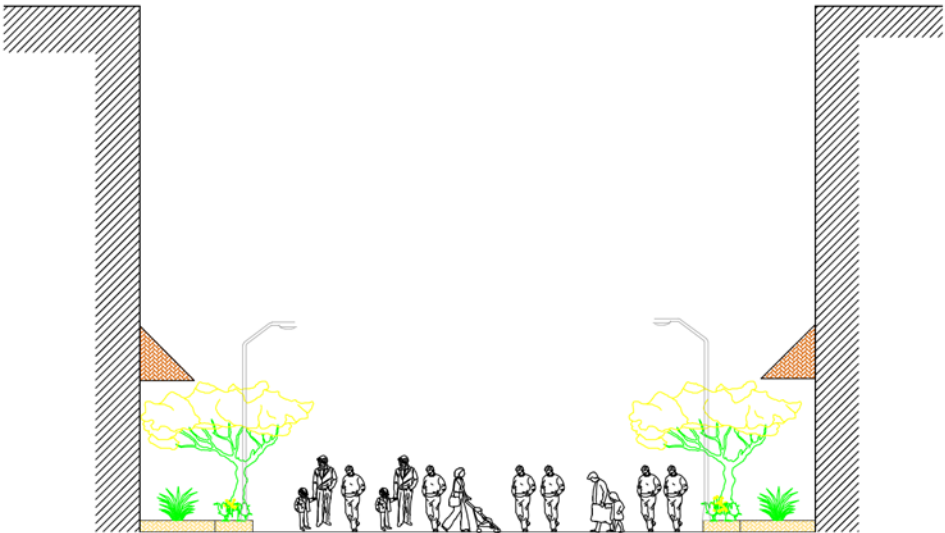


Figure 31 Pedestrian roads section

Figure (32) shows a view in the CBD for a building on a pedestrian road. It shows that the buildings views will be much more green.

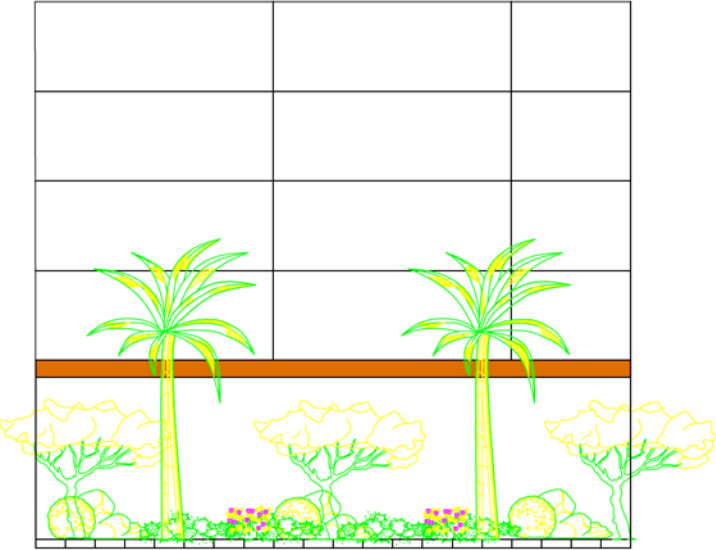


Figure 32 A view for a building on a pedestrian road

Sidewalks Details

Figures (33-36) CBD sidewalks details with street furniture (seats, containers, trees, and lights).



Figure 33 Sidewalk details

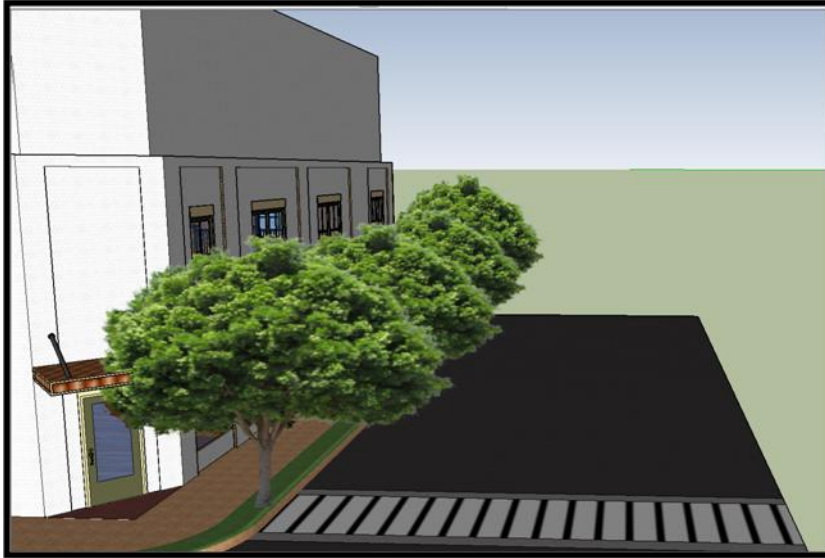


Figure 34 Sidewalk details



Figure 35 Sidewalk details

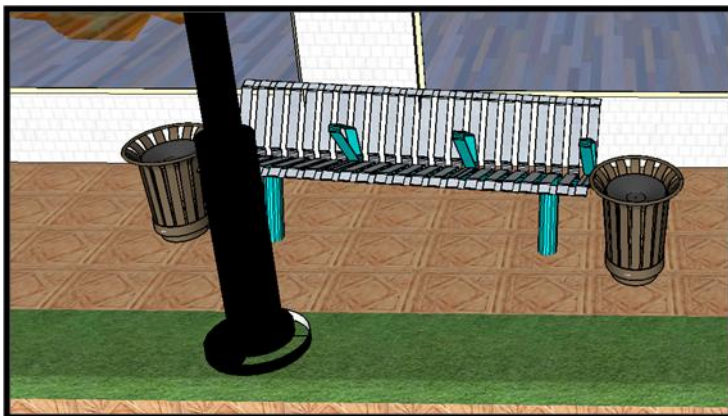


Figure 36 Sidewalk details

Open Spaces and Pedestrian zones Details

Figure (37) shows the pedestrian roads and the open spaces within the CBD. Areas 1 and 2 are open spaces, these areas are now used as terminals for western communities shared taxis. They are to be changed into open spaces with greenery and corridors for people to have picnics.



Figure 37 CBD pedestrian zones and open areas

Figure (38) shows a suggested open space in the area 1 in figure (37). In this space, only pedestrian movements are accepted with large areas of greenery. Also, there will be areas for playing and setting.

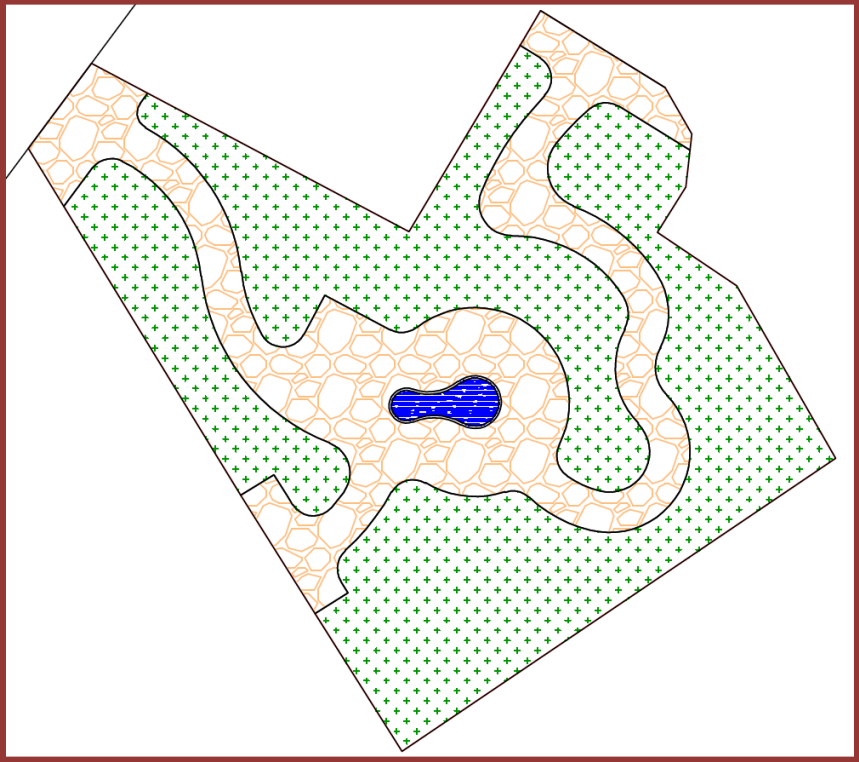


Figure 38 An open space in the CBD

Figure (39) shows a suggested open space in the area 2 in figure (37). In this space, only pedestrian movements are accepted with large areas of greenery. Also, there will be areas for playing and setting.

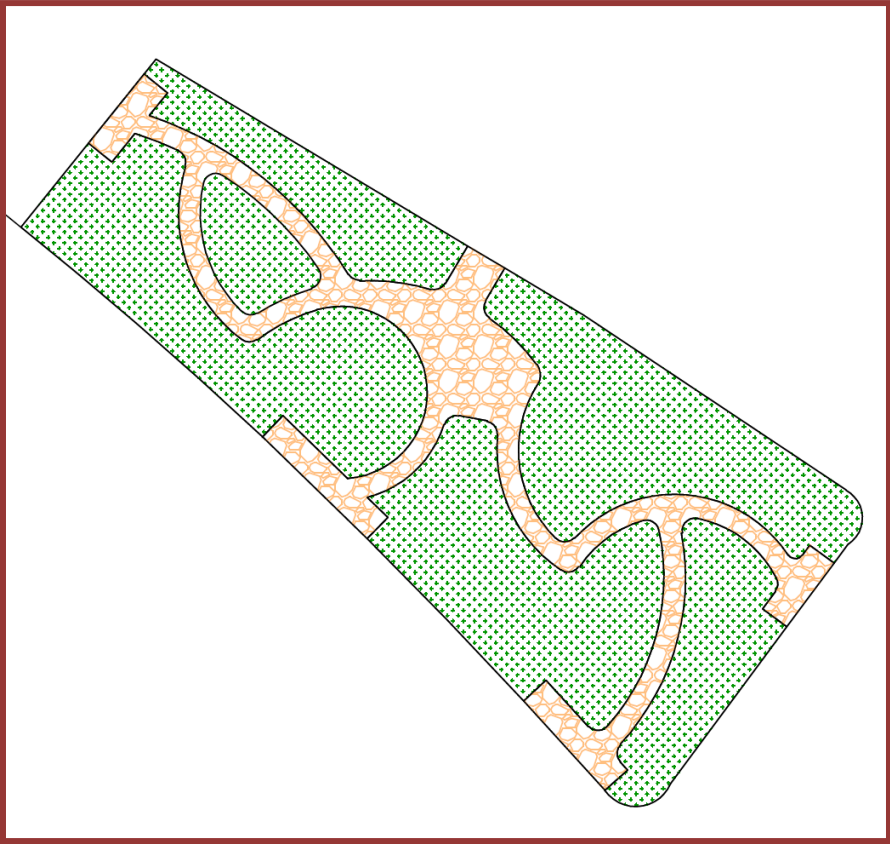


Figure 39 An open space in the CBD

Local corridors details

Figure (40) shows the details for a part in local areas. To achieve high accessibility levels with high levels of safety and green areas, the following design is suggested to be applied in local areas to force vehicles to travel with a suitable speed.

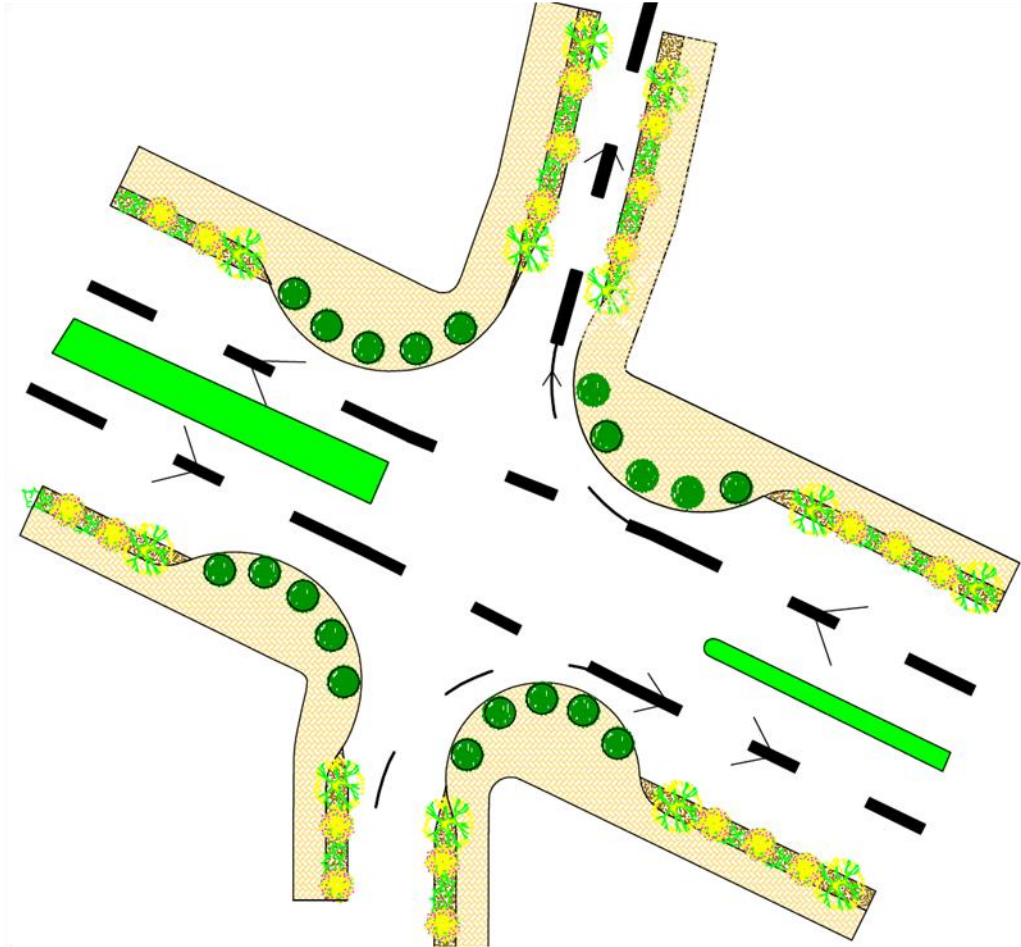
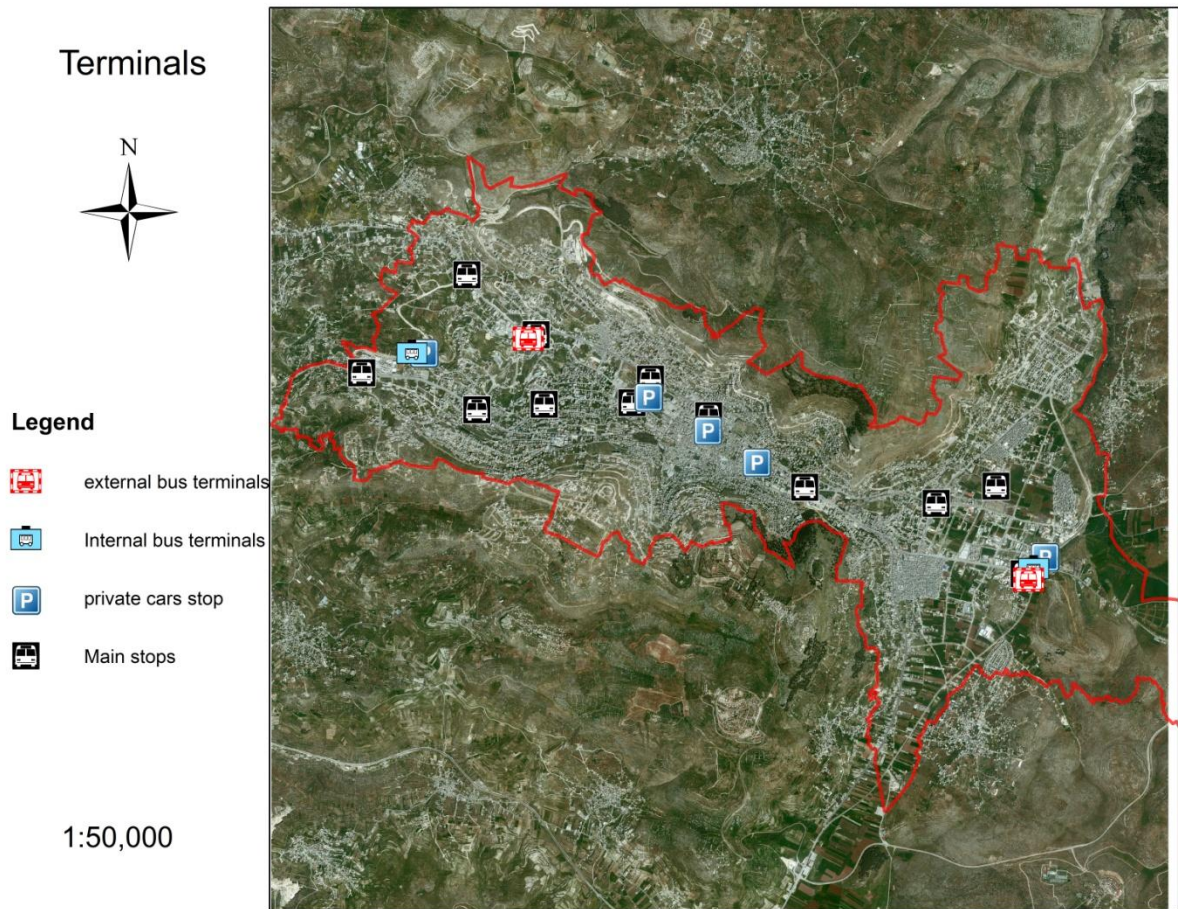


Figure 40 Local road details

5.2.3 Parking:

Map (89) shows the parking locations. These parking are in three categories: outside shared taxis terminals (to outside the city), internal buses terminals (within the city boundaries), private cars parking, and main buses stops on main roads.



Map 89 Terminals locations

Internal buses terminals

Buses need places to park in during the periods that they do not work. Two terminals are suggested, one in the east near the suggested outside shared taxis terminal and in the west near the New Najah Campus. These terminals are designed to provide suitable spaces for buses, accessible roads, service areas (bus maintenance, fuel supplier, and bathrooms), and greenery.

Eastern bus terminal detailed plan :

This terminal is designed to provide spaces for buses in the east. Its area will be 1.3 Km², the available spaces are 90, and the needed spaces are 90. The routes that will park in it are shown in table (8). And the terminal design is shown in figure (41).

Table 8 Buses that park in buses terminal 1

Bus route Number	Number of needed buses	Type of buses according to number of passengers
bus 9	16	20
bus 8	14	20
bus 7	18	50
bus 6	10	50
bus 3	20	50
bus 1	6	50
bus 2	6	50

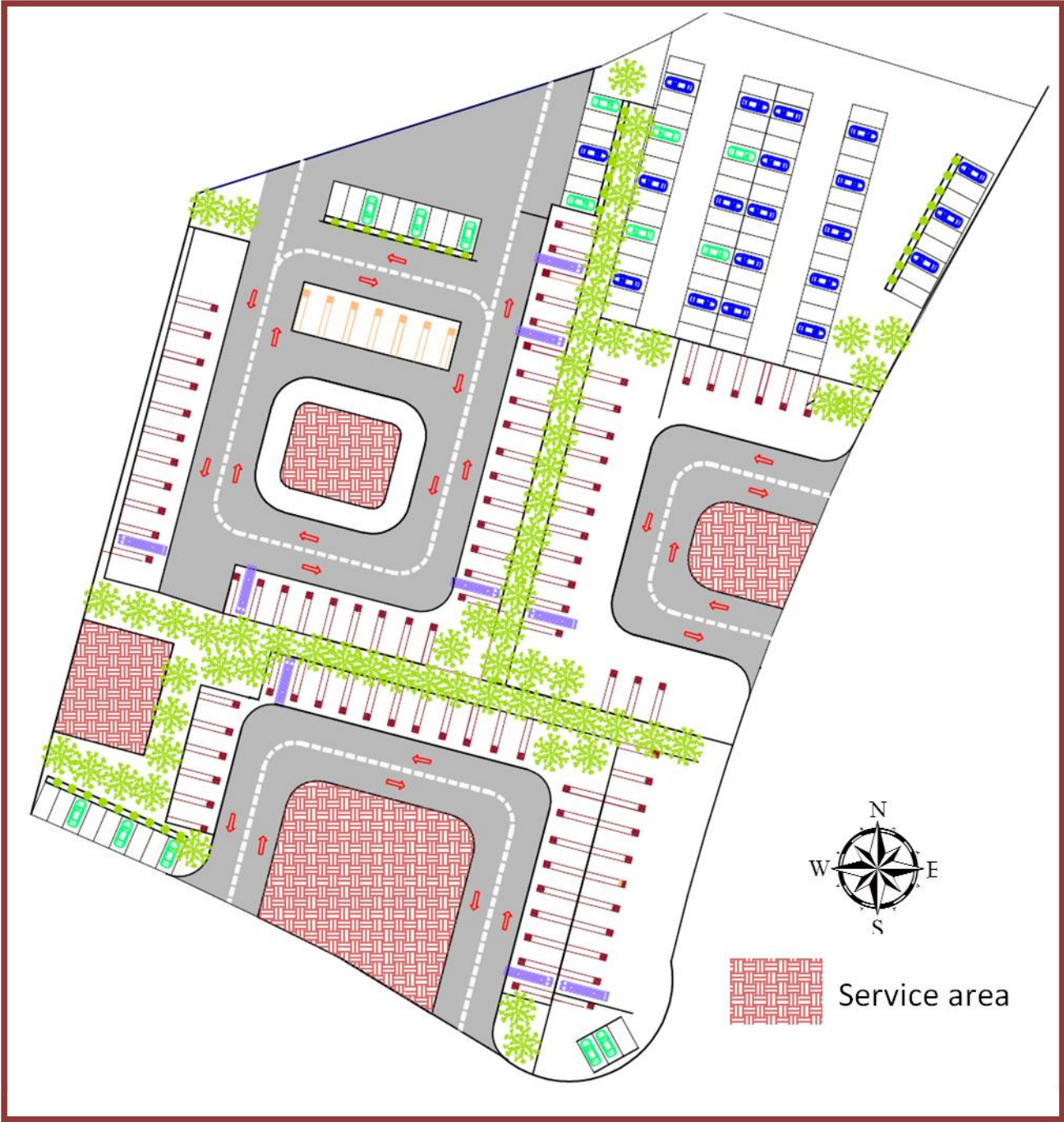


Figure 41 Eastern buses terminal design

Buses movements When arriving at the eastern bus terminals

Buses need a rest after each complete trip, so the eastern terminal will also be used for parking during working hours by some routes and their movements are shown in figure (42).

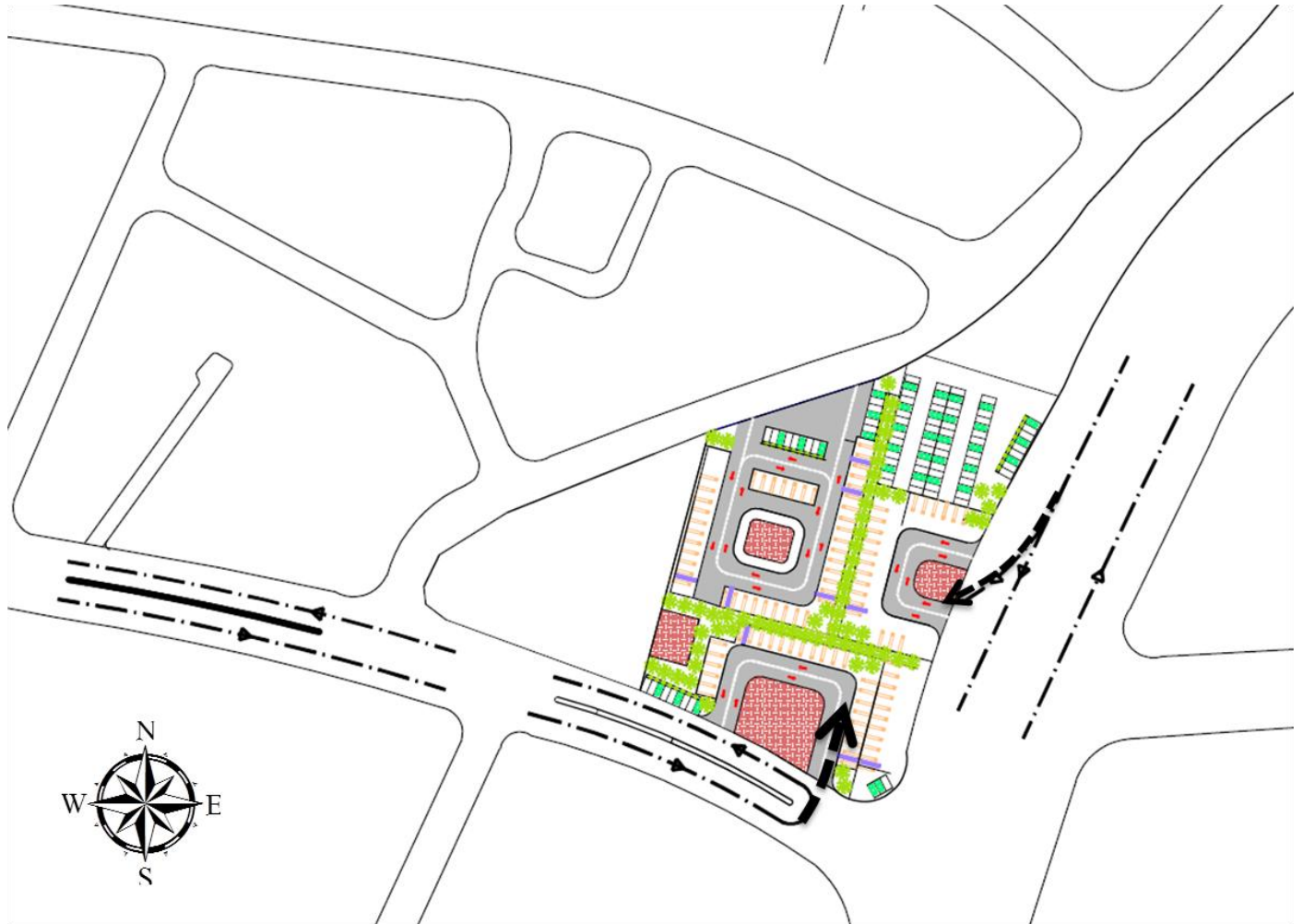


Figure 42 Buses movements When arriving at the eastern bus terminals

Western bus terminal detailed plan

This terminal is designed to provide spaces for buses in the West. Its area will be 1.6 Km², the available spaces are 120, and the needed spaces are 82. The routes that will park in it are shown in table (9). And the terminal design is shown in figure (43).

Table 9 Buses that park in buses terminal 2

Bus route No.	Number of needed buses	Type of buses according to number of passengers
bus 5	6	20
bus 4	13	20
bus 2	19	50
bus 11	10	50
bus 10	20	50
bus 1	14	50

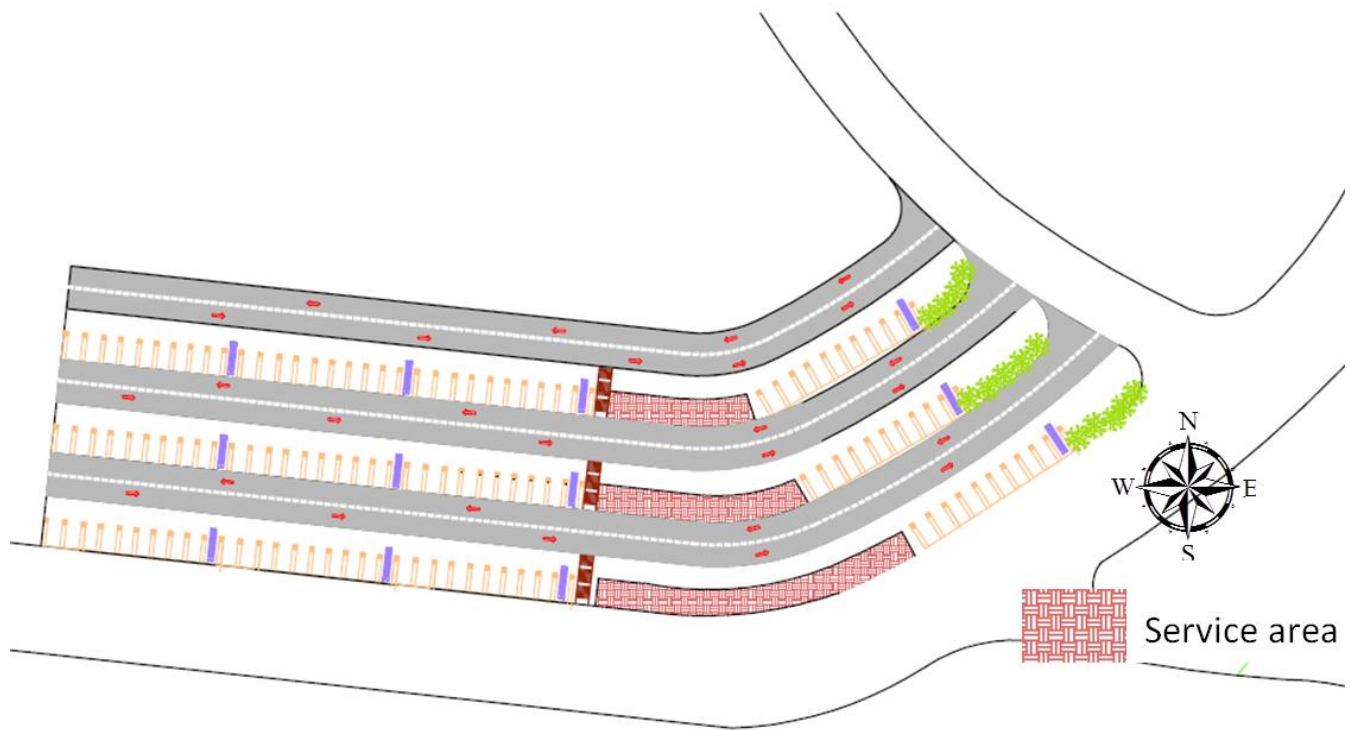


Figure 43 Western buses terminal design

The terminal area has a difficult contour. This problem was solved by designing the terminal to be in three levels with a street (10 m width), parking spaces, greenery, and service areas as shown in figure (44). Each level is connected by stairs with the upper level.

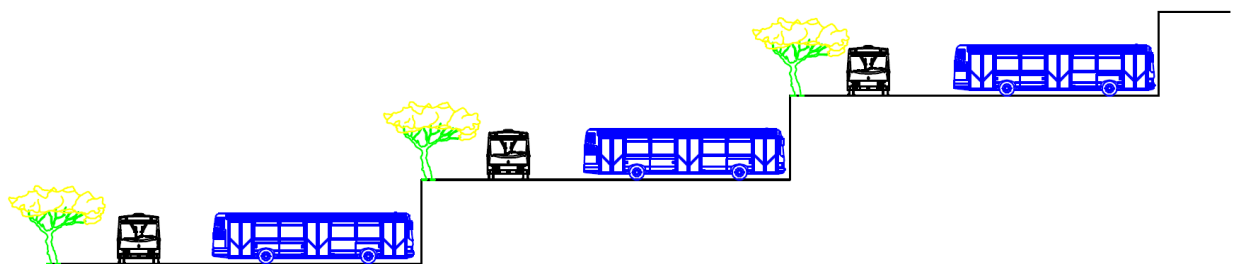


Figure 44 Western buses terminal section

The western terminal, unlike the eastern, needs some services because it is a new development area. For this, a mosque, health center, coffee shop or restaurant, private car parking, offices, green area, and shops are planned to be around the terminal. As shown in figure (45)

Western Bus terminal area, needed land uses

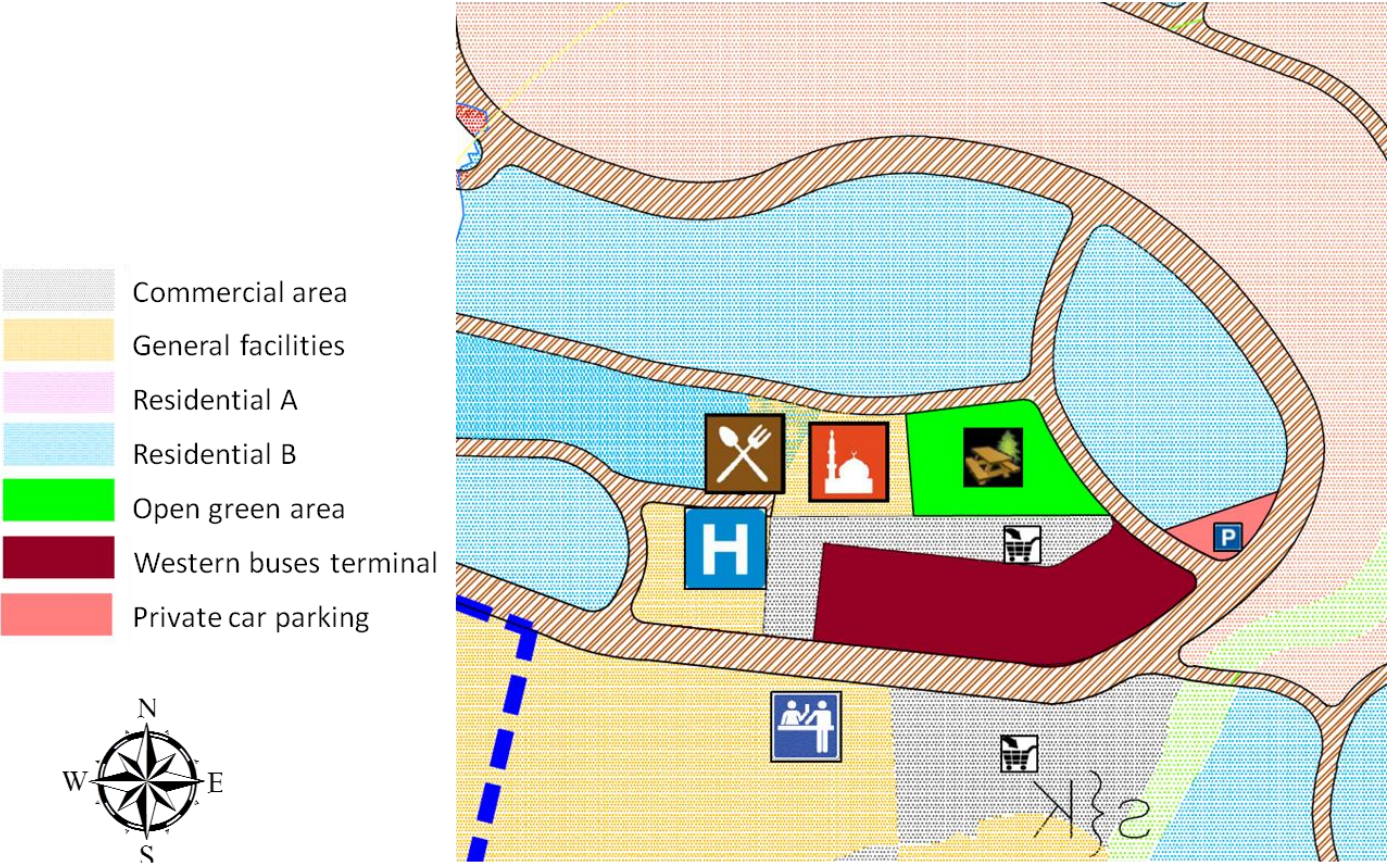


Figure 45 Western buses terminal surrounding

Also, near the New Najah Campus, we need an area for buses to park in after each trip. Figure (46) shows the parking location for Bus 2 that is beside the Najah Campus and the buses movements in one of the most active areas (near the New Najah Campus). And figure (47) shows the parking details.

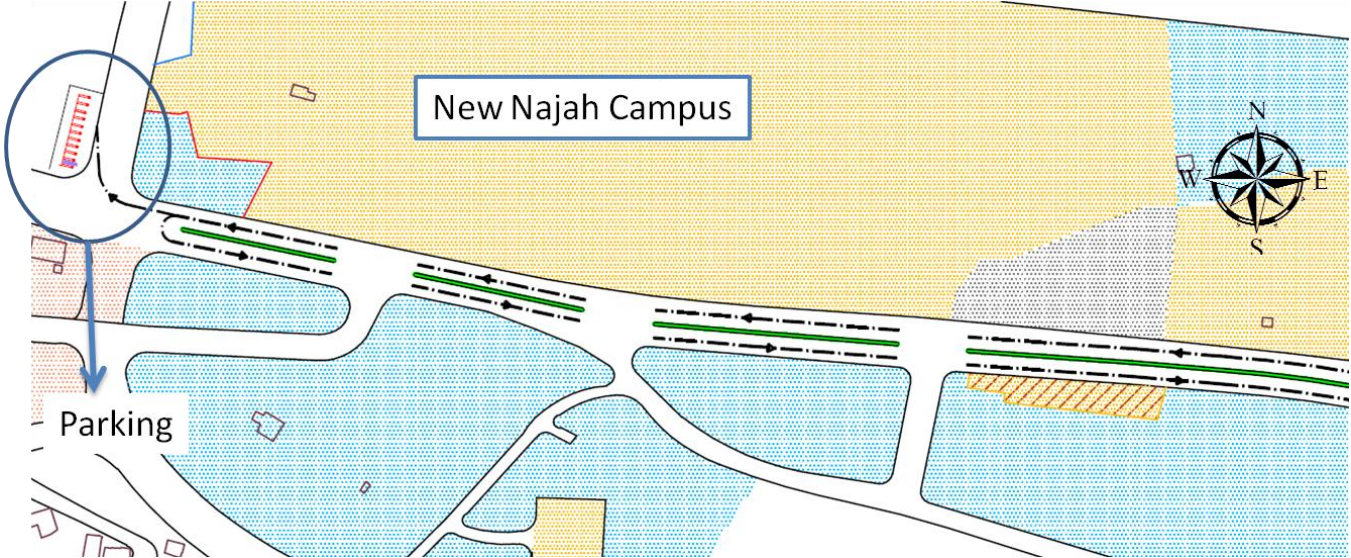


Figure 46 Bus 2 parking for rests

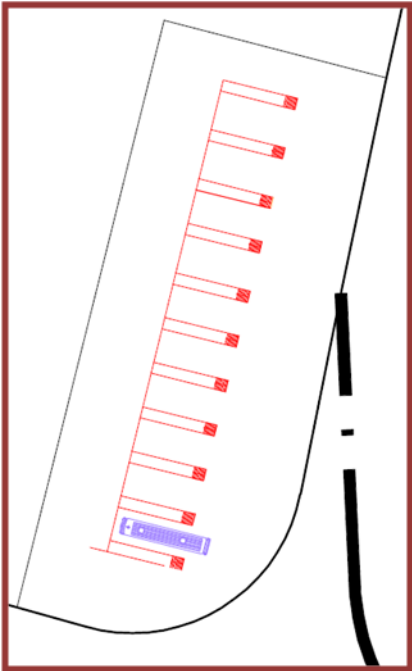


Figure 47 An example of buses parking for rests

External shared taxis terminals

Nablus municipality provided suggested places for new terminals for shared taxis that travel from Nablus to other communities. Two terminals are suggested, one in the east for eastern communities and one in the west for western communities.

Eastern external shared taxis terminal is planned to have an area of 1.3 Km². According to Nablus municipality, about 300 spaces are needed in the eastern terminal. The terminal is designed to provide 520 spaces divided into three stories. The terminal has four stories, the ground, first, and second floors are for shared taxis. The third floor is for shops. The second floor can be used for private cars for some years because it provides more spaces than needed. Figures (48-51) show the designs for the terminal building.

Ground floor :

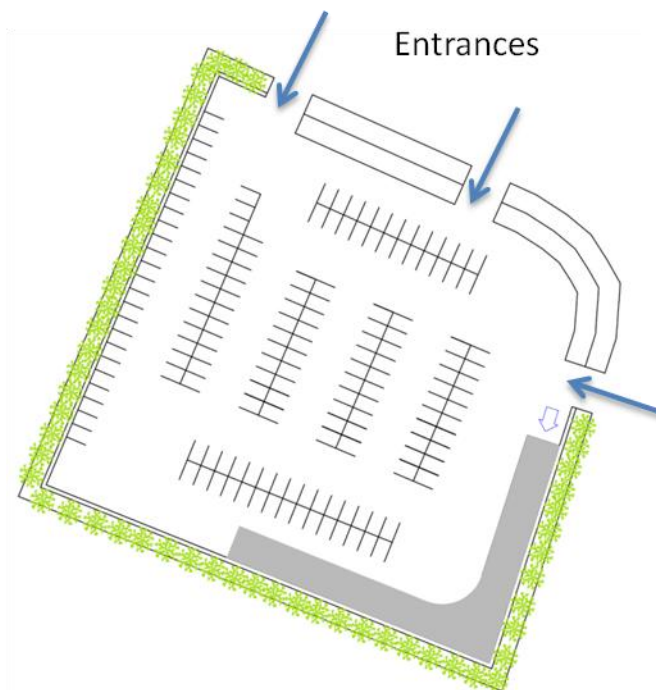


Figure 48 Eastern external shared taxis terminal ground floor

First floor :

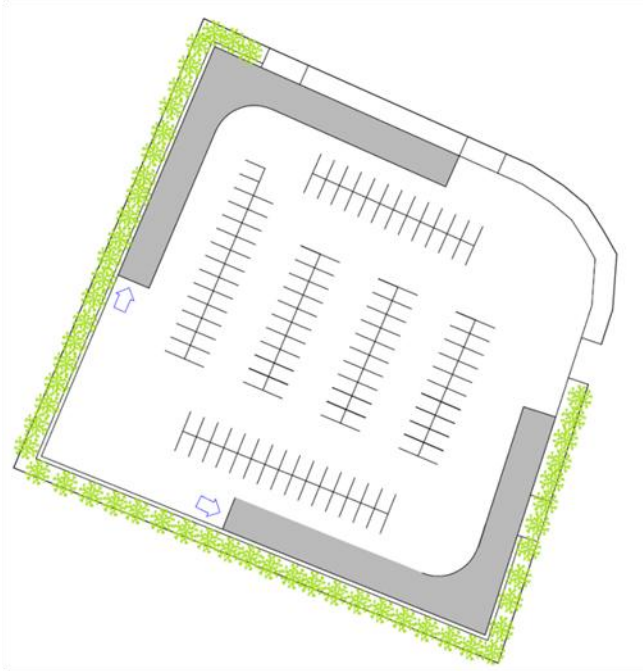


Figure 49 Eastern external shared taxi terminal first floor

Second floor :

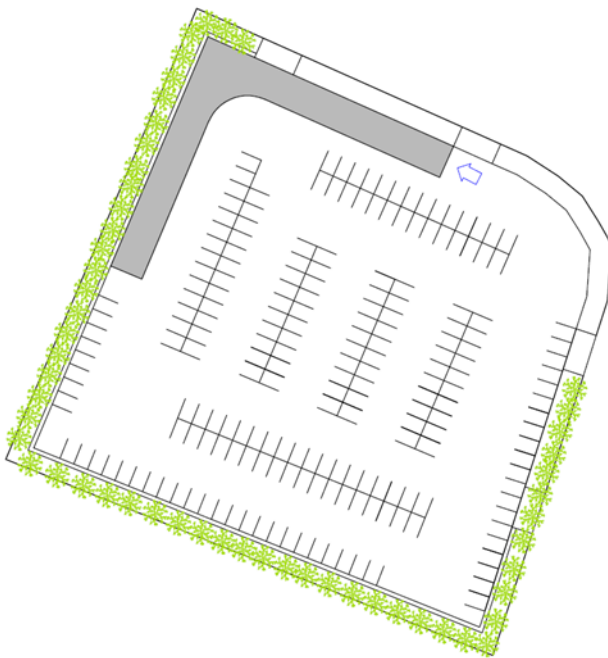


Figure 50 Eastern external shared taxi terminal second floor

Third floor :

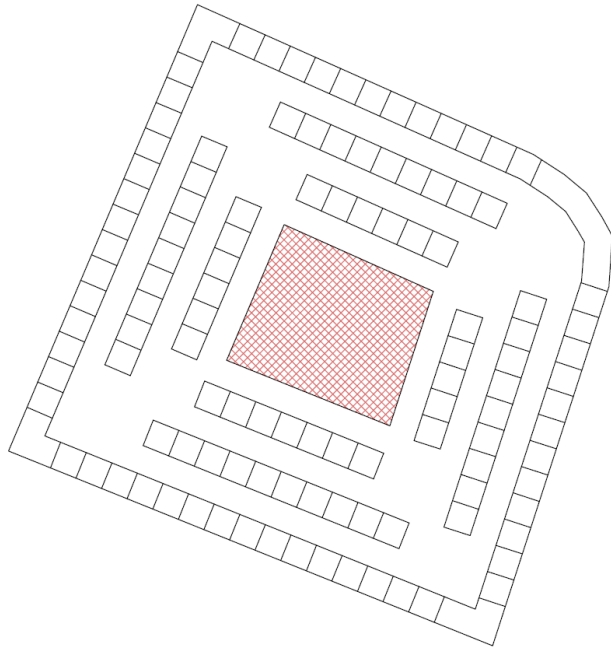


Figure 51 Eastern external shared taxis terminal third floor

Western external shared taxis terminal is planned to have an area of 1.55 Km². According to Nablus municipality, about 200 spaces are needed in the eastern terminal. The terminal is designed to provide 720 spaces divided into three stories. The terminal has four stories, the ground, first, and second floors are for shared taxis. The third floor is for shops. The second floor can be used for private cars for some years because it provides more spaces than needed. Figures (52-55) show the designs for the terminal building.

Ground floor :

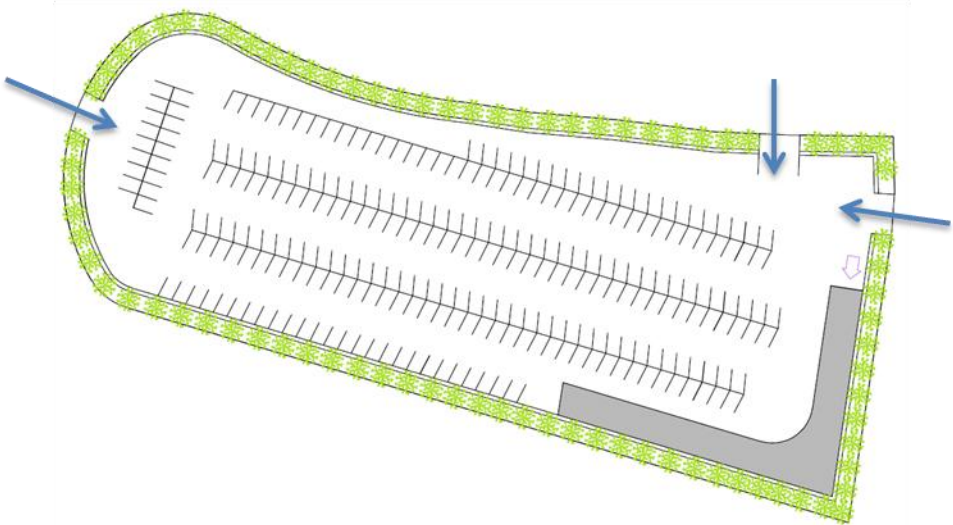


Figure 52 Western external shared taxis terminal ground floor

First floor :

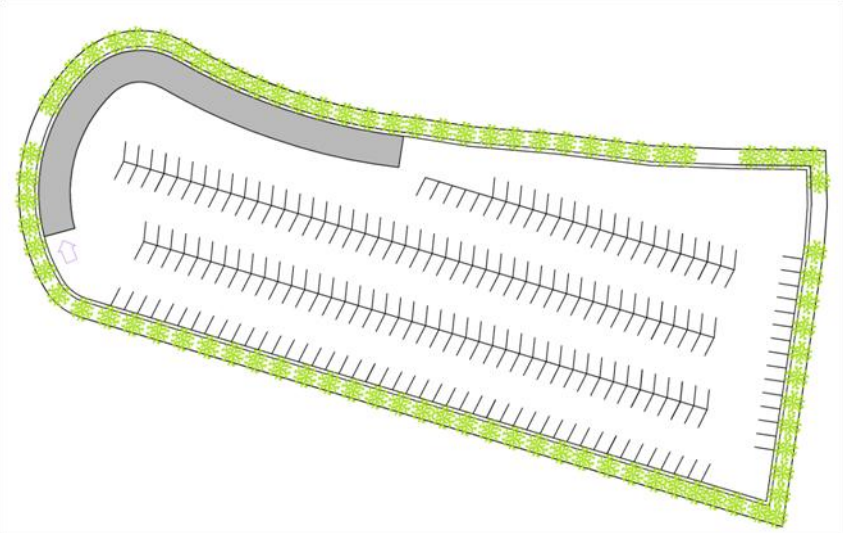


Figure 53 Western external shared taxis terminal first floor

Second floor :

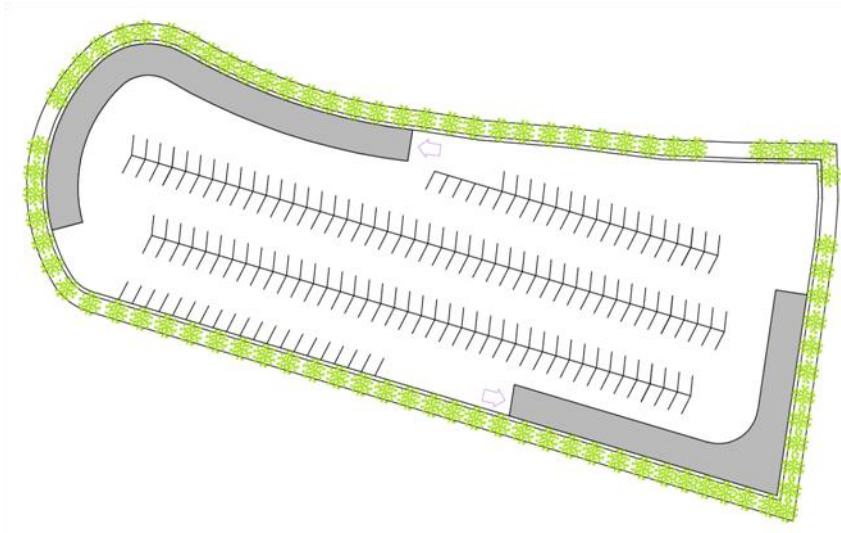


Figure 54 Western external shared taxis terminal second floor

Third floor :

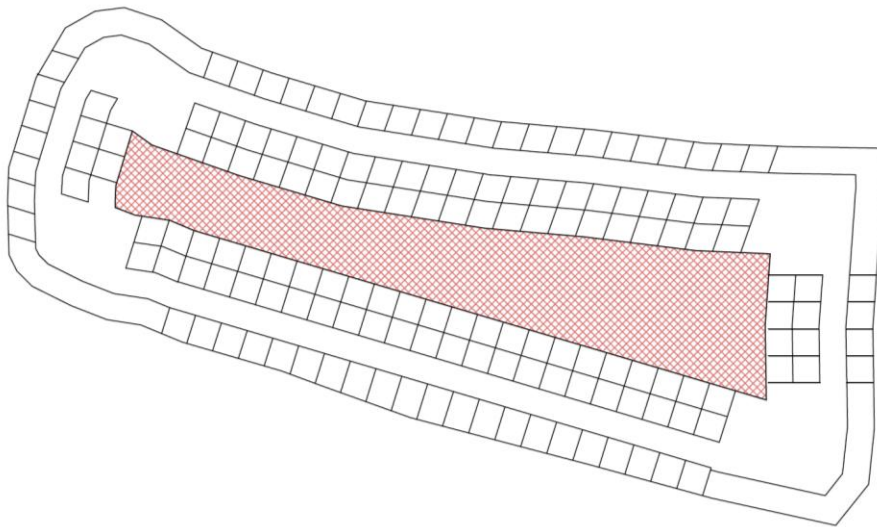


Figure 55 Western external shared taxis terminal third floor

Off street buses stops

Each route has off street buses stops to stop for 2 or 3 minutes so that people can move from one bus to another according to their destinations. So, buses need places to stop in so that people can leave it to ride another bus that goes to other places than the previous. In each stop area there will be two stops, each of them will have buses parking, cars parking, bikes parking, and sidewalks.

Figures (56,57,58) show an example of main buses stops on main corridors

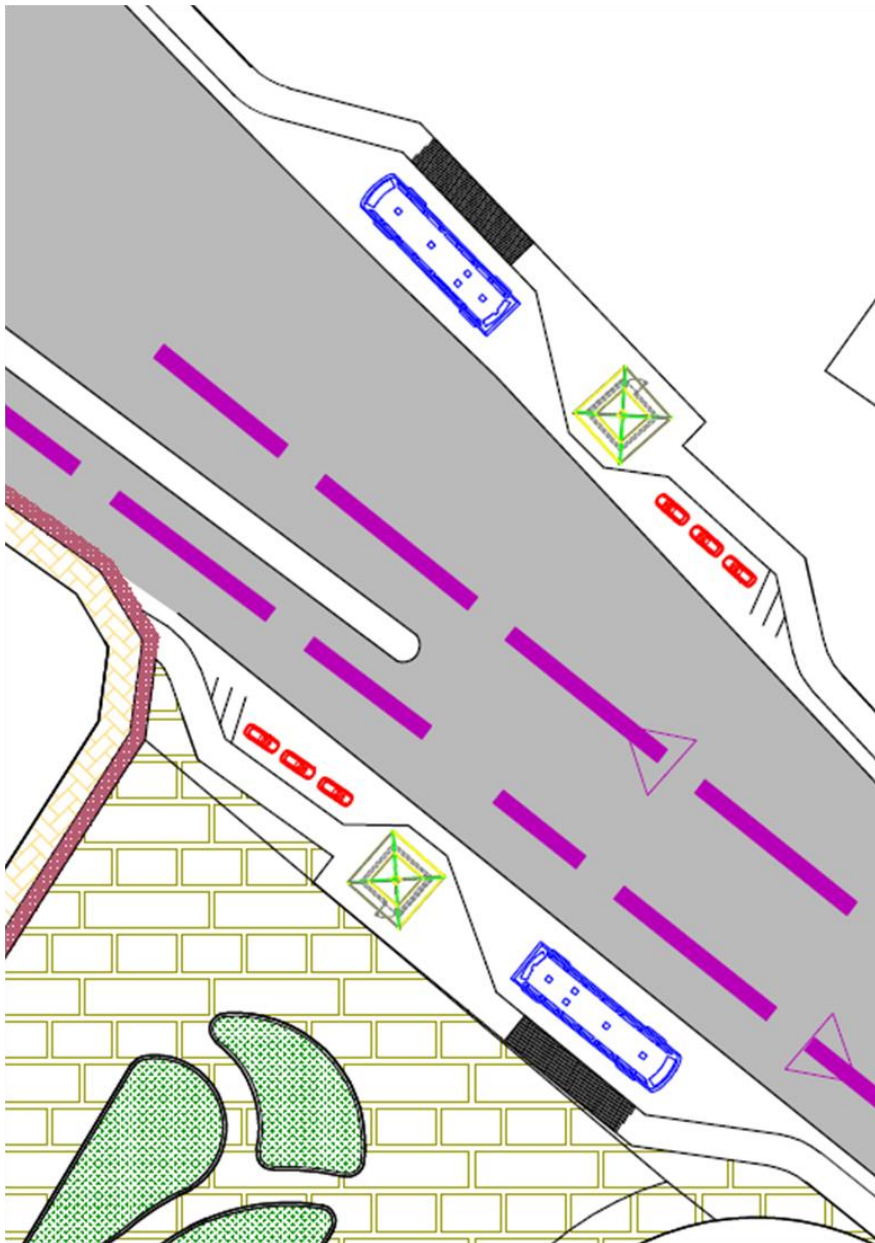


Figure 56 An example of an on street bus stop

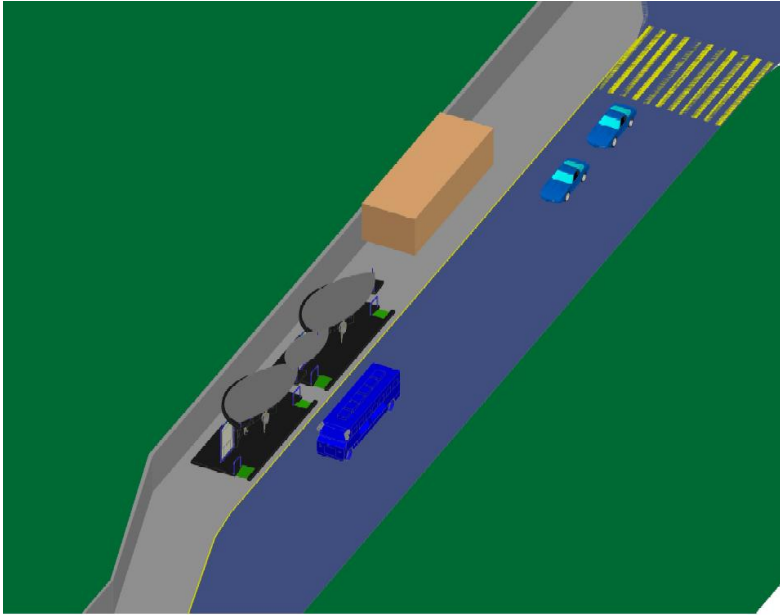


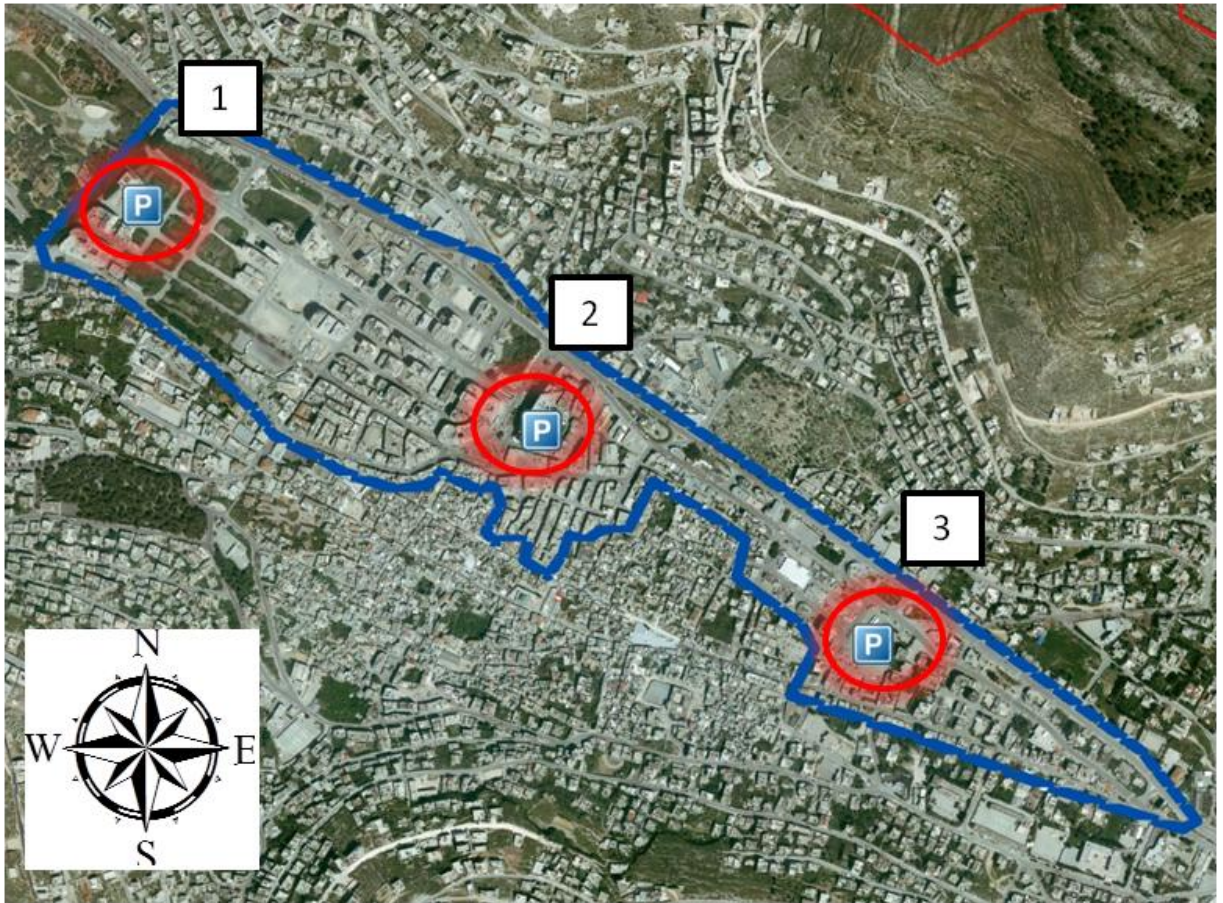
Figure 57 On street bus stop design



Figure 58 On street bus stop design

Private cars parking

Map (90) shows parking locations inside the CBD. As the CBD will be more walkable, we need places for cars to park in and then people go to their destinations by walking or biking. Cars can reach many places but they cannot park there, they need to park in the parking.



Map 90 CBD private cars parking

Parking 1

Figure (59) shows the traffic movements towards parking 1.



Figure 59 Traffic movement towards car parking 1

Figure (60) shows the design for parking 1 and the traffic movements in the surrounding area.

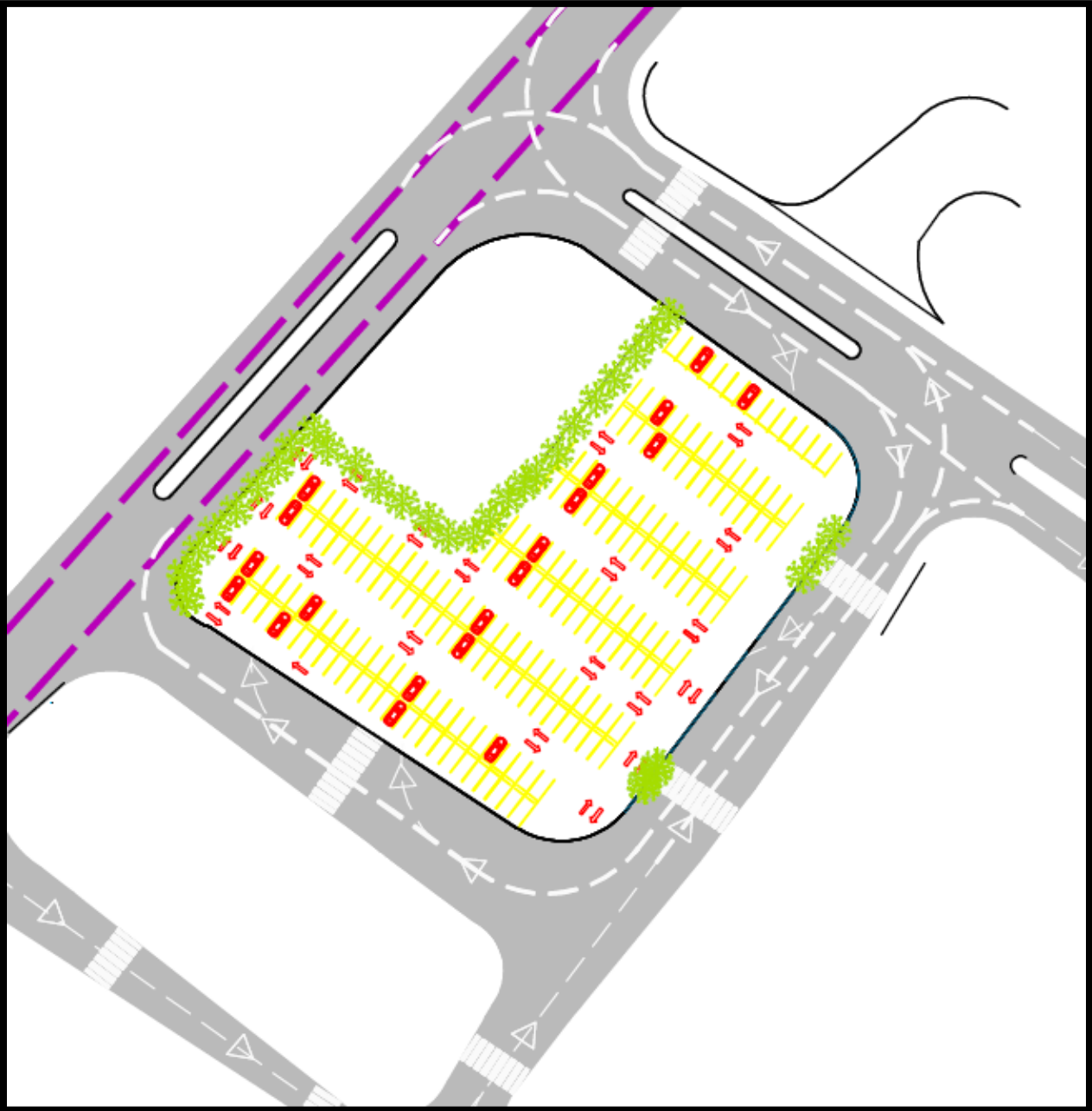


Figure 60 Car parking 1 details and cars movements

Parking 2

Parking 2 is an existing building that has many stories which are used now by shared taxis and private cars.

Figure (61) shows the traffic movements towards parking 2.



Figure 61 Traffic movement towards car parking 2

Parking 3

Figure (62) shows the traffic movements towards parking 3.



Figure 62 Traffic movement towards car parking 3

Figure (63) shows the design for parking 1 and the traffic movements in the surrounding area.



Figure 63 Car parking 2 details and cars movements

Project Expected Impacts

From this project, there are some expected impacts which will develop the city and increase the quality of life.

The expected results are:

- ❖ There will be a decrease in traffic volume because the plan is expected to encourage people to use public transportation instead of their cars because the service will be provided all over the day and in all places. This is because it is planned for people to have the service with less than 400 meters. Then they only need to walk for about 100 to 400 meters maximum.

Also, the volume will decrease because the small (4 riders) shared taxis will be replaced by large (20 or 50 seats) buses. As 1 Bus of 50 seats equals 12 shared taxis and 1Bus of 20 seats equals 5 shared taxis.

For example, on Rafedia Street instead of 800 shared taxi per hour, only 30 bus will be on the street and not all of them in the same time.

- ❖ There will be a decrease in fuel consumption, carbon emissions, and noise. Because the number of vehicles will decrease on each road.

- ❖ The Quality of life is expected to be increased because the central business district will be pedestrian friendly. Also, green areas in the CBD and on the roads sides will provide high levels of comfort and safety that help in protecting the environment. The residential areas will be safe because of speed calming techniques that will be used and the low volumes of traffic in them. And, the main aim will be achieved because there will be an ease of accessibility to main activities and to all other activities so that people have many choices to travel from one place to another.

Conclusion and recommendations

In conclusion, Nablus city now has a plan for transit that was prepared depending on a comprehensive diagnosis and analysis that gave the vision. This vision was used to show the final goal. The vision talks about dependency on transit, pedestrian friendly, and parking management. A buses routes plan is now prepared with timetables for each route. A detailed plan for the CBD routes is also prepared to manage the vehicles movements within it. The CBD routes plan shows which roads are for buses, private cars, bicycles, and pedestrians. Parking is managed by dividing them into three types, internal buses terminals, outside shared taxis terminals, and private cars parking. Internal buses terminals are two, one in the east and the other in the west. Each terminal has its information to show which buses park in it and how each bus reach the terminal. Outside shared taxis terminals locations are given by Nablus municipality, a suggested design is given for each, each of them will be a large building with three stories of parking and one storey for shops and some needed uses like restaurants and health centers. Private cars parking are to be allocated in all the city parts, but for details, only the CBD parking are given the designs. These parking are allocated in the east, middle, and west of the CBD. Each parking has a design that fits its location and a map that shows how to reach each parking. From this project we have: a transit plan for the city with timetables, a CBD plan for routes so that people can walk and bike safely, and parking management plan.

I recommend to study this project because it is expected to be useful for all people (citizens and visitors). Some routes need some modifications to be more efficient. Also, there are some requirements for the timetables to be studied such as the signals, signs, pedestrians and their effects on routes times. I also recommend to plan more for parking in local areas.

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