T.C.
HASAN KALYONCU UNIVERSITY
GRADUATE OF
NATURAL & APPLIED SCIENCES

IMPACT OF ‘‘TRAFFIC MANAGEMENT’’ALTERNATIVES ON INTERSECTION CAPACITY: KAHRAMANMARAŞ

MASTER’S OF SCIENCE THESIS
in
CIVIL ENGINEERING

BY
GOKCEN OZTURK

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Supervisor: Assist. Prof. Dr. Şafak TERCAN

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NATURAL & APPLIED SCIENCES

DEPARTMENT OF CIVIL INTERSECTION

Impact Of Geometric Design On Intersection Capacity:Kahramanmaraş**.**

GOKCEN OZTURK

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Approval of the Graduate School of Science Sciences

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Yüksek lisans tezi olarak sunduğum "IMPACT OF TRAFFIC MANAGEMENT ALTERNATIVES ON INTERSECTION CAPACITY:KAHRAMANMARAŞ." başlıklı çalışmanın tarafımca, bilimsel ahlak ve geleneklere aykırı düşecek bir yardıma başvurmaksızın yazıldığını ve yararlandığım eserlerin kaynakçada gösterilenlerden oluştuğunu ve bunlara atıf yapılarak yararlanmış olduğumu belirtir ve onurumla doğrularım

Tarih:
GÖKÇEN ÖZTÜRK
İmza

ÖZET

TRAFİK YÖNETİMİ ALTERNATİFLERİNİN KAVŞAK KAPASİTESİNE ETKİSİ: KAHRAMANMARAŞ

GÖKÇEN ÖZTÜRK

İnşaat Mühendisliği Anabilim Dalı
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Kentlerimizdeki nüfus artışı ve dolayısıyla araç sahipliliği artışı kent merkezlerinde mevcut olan yolların kapasitelerinin yetersiz kalmasına sebep olmaktadır. Trafik yönetimi; kentlerdeki mevcut yol ağının daha verimli bir şekilde kullanılması için yapılan planlama, kontrol ve uygulamaları içermekte olan disiplinler arası bir konudur.Bu proje ilede, trafik akımı ve kavşak dizaynı simülasyonu için geliştirilmiş olan yazılımlar kullanılarak mevcut kavşak kapasitelerindeki artış ve bu kapasite artışının emisyonlar ve gürültü gibi çevresel etkileri incelenecektir. Kavşaklardaki kapasite artışı 5 farklı geometrik tasarımla simule edilecektir.

Bu alternatifler kavşağın bulunduğu bölgeye uygun olarak VISSIM Ssimulasyon Pprogramı ile değerlendirilmiştir.ve her sinyalize kavşak için en yüksek kapasite artışını sağlayan alternatif bulunmuştur. Bu alternatiflerden Kahramanmaraş Büyükşehir Belediyesi tarafından arazide uygulanmış ve yeni geometrik düzenleme ilede kavşak sayımları yapılmıştır.Simulasyon sonuçları ile yeni geometrik düzenlemeden sonraki kavşak sayımları sonuçlarıyla %93 uyumlu olduğu hesaplanmıştır. Elde edilen bulgular, özellikle karar vericilere, kentlerimizde hangi projeleri uygulamaları gerektiği konusunda yol gösterici olmuştur.

Anahtar Kelimeler: Kavşak kapasitesi, Geometric dizayn, trafik yönetimi, VISSIM , bekleme süreleri

ABSTRACT

IMPACT OF TRAFFIC MANAGEMENT ALTERNATIVES ON INTERSECTION CAPACITY:

KAHRAMANMARAŞ

Gökçen ÖZTÜRK

Department of Civil Engineering

MSc. Thesis

Supervisor :Assist. Prof. Dr. Şafak Tercan

The capacity of existing roads of city centers remains insufficient due to the increasing of population and correspondingly increasing the number of vehicles in our cities. For this reason, the mentality of ’Traffic Management becomes crucial to operating an optimum level capacity of a network of existing roads in our cities. Traffic Management that contains planning, control, and control implementations is an interdisciplinary topic to use a more efficiently network of roads in cities.It will be investigated impacts of environmental like emissions and noises which are due to enhancing the capacity of existing signalized intersection by using the developed software that is for traffic flow and intersection design and simulation.The capacity of intersections will be executed to simulate by VISSIM with 5 diffirent alternatives.

These alternatives will have been evaulated according to where intersection is by VISSIM that is a simulation program. One of these alternatives was implemented by KMM (Kahramanmaraş Metropolitan Municipal) on the site, after that this alternative was compared between simulation results and new traffic counts that was renewed with new geometricric design. According to these results, the new geometric design with the simulation is 93% compatible.This project will been anticipated to be guiding for especially administrator. Especially, positive effects of the alternatives will be seen and assisted healtier investment before any high cost investments like a underpass, interchange etc will not be constructed in points that is insuffient capacity.

Keywords:intersection capacity, geometric design, traffic management, emissions,delay times VISSIM

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CONTENTS

LIST OF FIGURE

Page

LIST OF GRAPH

Page

LIST OF TABLE

Page

LIST OF SYMBOLS AND ABBREVIATIONS

g,	Duration of the green period [seconds]
f_w	Adjustment factor lane width
f_{HV}	Adjustment factor heavy vehicles
f_g	Adjustment factor for grade
f_p	Adjustment factor for parking facilities
f_{bb}	Adjustment factor for bus blockage
f_a	Adjustment factor for area type
f_{radius}	Adjustment factor the radius of the turning movement
f_{comp}	Adjustment factor for the percentage of turning traffic
f_{pp}	Adjustment factor for giving way to
C	pedestrians Cycle time [seconds]
C_{entry}	Entry capacity (veh/h)
β	Influence of the number of lanes of the circulatory
q_{circ}	Circulating flow (veh/h)
α	Influence of pseudo conflict
q_{exit}	Exiting flow (veh/h)
y	Influence of the number of lanes of the entry
$t_{c,T}$	Adjustment factor for each part of a two-stage gap acceptance process, (1.0 for first or second stage; 0.0 if only one stage) (s), and
$t_{3,LT}$	Adjustment factor for intersection geometry (0.7 for minor-street left-turn movement at three-leg intersection; 0.0 otherwise) (s).
C_m	Capacity of Movement
C_p	Potential Capacity
EBT-L-R	Eastbound through-Lef t-Right
WBT-L-R	Westbound through-Left-Right
NBT-L-R	Northbound through-Left-Right
SBT-L-R	Southbound through-Left-Right
VOC	Volatile organic compounds
PLT	Prohibitting left turn
LT	Left Turn
RT	Right Turn
SO	Signal Optimization
KMM	Kahramanmaraş Metropolitan Municipalty
PCU	Passenger car Unit

INTRODUCTION

"Traffic management" applications are very important for the efficient using of the existing capacity on urban roads.Traffic management; contains horizontal and vertical markings along the way one-way, duplex applications, parking restrictions and parking policies, from editing, management of signalized intersection at-grade intersections and covers subjects like this. In this study, signalized intersections are capable of various traffic management's applications that apply the effects , correspondingly the junction consists of environmental and economic effects will be examined.

In the study. The construction of new roads in our cities which has been completed their construction and in the center of town that has been historical monuments in many neighborhoods is very difficult. Traffic Management is becoming crucial to operate an optimum level capacity of network of existing roads in our cities. Traffic Management that contains a simple STOP sign where is placed, or line of road, policies of parking place, modeling of grade intersections, management of signalized intersections, intelligent transportations system and so forth includes lots of themes. At least 3 intersections are detected to increase the capacity of junctions in which are used alternatives traffic management methods are used. The alternatives are;

•To change geometrical design at intersection,

•Optimization of intersection signal timing,

•Prohibiting left turn at intersections,

•To add right turn models for intersections,

•To add left turn models for intersections,

The implementation area is chosen in Kahramanmaraş in that population is over 500.000.These alternatives will be first deciphered on the computer with VISSIM simulation model. The data is obtaied from KMM by simulation programmes such as delay times, signal times, the number of vehicles and others. According to these data will be estimated Carbon emissions and environtmental values for each intersection, after these which implementations are indicated more efficiency for increasing capacity and decreasing emissions. Alternative implementation and alternative economical analysis will be made.

In city center, capacity of intersections are approached or exceeded,

- •The current situation in examined intersections were obtained by the metropolitan municipality of Kahramanmaraş VISSIM program using simulation and counts verifications are provided.
- •The above-stated to designated junctions VISSIM program with alternative traffic management project individually in computer environment will be simulated again.
- •Simulated intersections, implemented the project to signal the delay times, waiting times, car numbers, speed and other data are obtained.
- •Such as no intersection; optimization of geometric design, signal duration respectively, left-turn lever to right turns and intersection approach ban in the park will be an implementation of the ban and it will be again for each intersection alternatives.
- •Then the maximum capacity in the traffic light of the increase in data on projects for CO2 emissions will be calculated.
- •This will create the capacity increase emissions decrease and economic gains, the amount of spent fuel is considered the account.
- •As a result of carbon emission reductions and energy efficiency from intersections potential is determined. (UTA logistic journal, 2003)

In addition, the amount of total greenhouse gas emission has been reached 409 million tons in 2010 in terms of CO2 equivalent from 187 million tons that had enhanced 119,9 % in 1990. This amount was estimated 4,9 ton/per in 2010 while equivalent CO2 emission had been estimated 3,4 ton/per in1990. (Inventory of Greenhouse gas, 2010, TUIK), this situation indicates to take in consideration this environmental factors while our country is developing. .(UTA Logistics journal,2003)

The total emissions of 2010 caused by 722% energy, 9% waste, 13% industrial waste, and 7% the agricultural sector. Greenhouse gas emissions reached for per person in 1990 from 3.39 tons CO2-equ to 5.4 tons CO2-equ in 2010. However, this value is well below the value of 9,83 tons CO2 equ./ per. in OECD (Organisation for Economic Co-operation and Development), and close to the world average that is 4,29tons.Transport sector caused by greenhouse gasses in the energy sector in 2009, contributed to % 17,04 and in percent share in national total emissions 12.83%. The total amount of greenhouse gas emissions caused by the transport sector 47.4 tons CO2-

equivalent.In the transport sector, the highest source of greenhouse emission caused by road transport that's emission of proportion is 85%. Highway-derived CO2 equivalent emissions of the total share in the transport sector in 1990, when 93% percent of a value of 85% in 2009 declined, the share of total emissions of airlines with a 3% rate would be increased by 11%. The Interstate continues to show a steady increase in a number of emissions.(UTA Logistics journal) Nowadays, contemporary cities have been achieving to decrease adverse effects of traffic by using many implementations that are integrated with their systems. However, traffic management implementations in Turkey is not scholarly, they are made arbitrary notations. Thus, adverse effects of traffic in our cities have been reached the highest level. The alternative that will be chosen provides the highest capacity enhancing for each signalized intersection. Likewise, it will be estimated amount of CO2 according to delay times that takes from simulation program for whole alternatives. .(UTA Logistics journal,2003)

Signals, in other words, illuminated signs, that ensure a safe and orderly flow at intersections traffic control equipment on roads. Firstly, the signals are founded in the form of a manually managed semaphores in 1868 in London, the traffic signals are used to ensure their appearance the night lighted by kerosene lamps. Red and green light signals facility was established in 1914, in the U.S. in Cleveland and they have used also yellow lights in 1920 in Detroit, the signals are started to used in European countries in 1924. After 1950, the used of traffic lights showed great to spread around the world. The establishment of a signalization institution in any location is intended to carry out at least one of the following .(UTA Logistics journal,2003)

- •Intersect streams or delays due to the geometric properties of jams and avoid blockages,
- •Transport with other vehicles or safe located With pedestrian flows provide a transitional scheme and accident points reduce the chances,
- •Transportation and keeping in mind the pedestrian density, current aspects of the transition as a time or priority, while compliant to deploy,
- •A route with the volume of traffic on the installed shipping by stopping time the ability to switch to traffic and pedestrian roads.

The intersections management is applied at urban signalized intersections in that implementations were adopted in Turkey by drivers and pedestrians. However, this method usually ignores intersection efficiency and capacity, and mostly this is a single signal circuit operated throughout the day. Therefore the delay time is increased, correspondingly the rate of emission increases. Generally the long delay times are affected adversely to the drivers such as the drivers are waiting at a road of the intersection,if there are no other vehicles on the roads of the intersection, the drivers feel uncomfortable from this situation is emerged discontentedness. In the face of these complaints communicated to the local administrations, it is tried to be solved by the inadequate people who are not experts on the subject but to deal with it. .(UTA Logistics journal,2003)

LITERATURE REVIEW

Jing Zao researched on Displaced left-turn (DLT) intersections that resolve the conflict between left turn and opposing- through movements at the pre-signal are probably the most extensively used innovative intersection designs. Congestion is a problem at intersections for this problem there was conventionally solved by the signal control which included two general approaches: one was the stage- based method, the other was the group-based method. (Zhao at all; 2013)

The transportation is grown day by day, so protected left-turn may not be sufficient to avoid long delays.In the other hand traffic conditions are mainly adjusted signal timings to reduce harmful impacts. Consequently the intersection capacity is being considered various innovative intersection designs.The new design systems are contained median u-turn intersections, jug-handle, super street intersection, quadrant roadway, bow ties, displaced left-turn intersection, tandem intersection,but the displaced left-turn is rapidly becoming worldwide. (Teply.at all, 2008)

The displaced left-turn intersections are based on conventional optimization procedure is trial and error. DLT intersection is first reputed, the layout including lane markings is determined, and the signal timing is then calculated.The performance of the intersection depends on his / her experience that is revised the intersection until the performance of the intersection is satisfactory.there are two types DLT intersection systems that are one of continuous flow intersection(CFI), The parallel flow intersection (PFI), CFI: To other side left turn movement replaced across opposing way.PFI: the transition area is placed on taking possession of the left turn, the main purpose of DLT is reducing the capacity of the intersection.In this distinct design system 9 types are found for 4 leg intersections that are called from type 0 to type 10, type 0 is the conventional intersection design.Optimization design is type3 by VISSIM with DLT method, consequently DLT design is outperformed according to other designs.The capacity of improving is 79,5 % according to conventional design.While DLT design is reducing air pollution, to increasing driving comfort. (Zhao at all, 2015)

Jiaming Wu and others observed contraflow left-turn lane (CLL) design at signalized intersection that was evaluated unconventional impacts by them in China where has been applied numerous solutions to increase the operational performance of the signalized intersections with heavy left-turn demand. The CLL is proposed by

Jiaming Wu and others. This design Type has implemented some intersections in the city of Handan, China. The basic idea of the CLL is to improve the capacity of intersections that have got heavy left-turn demand. The CLL design is affected by the timing of the pre- signals and location.The CLL that is applied at an intersection with leading left turn phases and heavy left-turn demand. The design is placed median openings and pre-signals in the upstream of the stop bar to allow left turning vehicles to enter the contraflow left turn lanes thus there are two more lanes for left turn, increasing capacity of left turn movement at the intersection. (Wu.at all, 2016)

The proposed delay method is solved with based on VISSIM. Consequently the CLL design and tandem designs outperformed conventional left turn lane design, the CLL design generated less delay to both the left turning and though vehicles as compared with the tandem design. The field observations of the study are displayed, the median openings are used U-turns by some drivers hence U- turns may be blocked at median openings for safety at the intersections. (Wu at all, 2016)

Guohua Song and friends investigated on the intersections one of the biggest emission is caused from buses and public transportation. Delay correction models are constructed for adjusting emission factors for each type of intersections and distinct numbers of stops. Existing researches indicates that where the public transportation is improved, traffic congestion as well as vehicle emissions and energy consumptions are reduced.Intersections are important emission emitters in a road network.Driving characteristics at intersections are explored based on VSP(Vehicle Specific Power) distribution.The buses at intersections develop effective emission control strategies.The running process of the buses is divided 4 driving modes that are included idling, cruising, deceleration and acceleration.In field traffic the parameters are collected, that are delay time and a number of stops they are related to vehicle emission that is analyzed by vehicle emission and traffic simulation models of VISSIM. (Song at all, 2015)

Yukimasa Matsumoto and friends investigated there are short distances between intersections and presence of long signal cycles that are typical characteristics for roads in Japan. These characteristics may cause traffic congestion and induce redundant vehicle movements such as acceleration/deceleration and long idling times around signalized intersections. These studies suggest that the signal information effectively changes drivers' behaviors and it is possible to reduce the number of CO_2 emissions from vehicles approaching signalized intersections.The main aim is reduced CO_2

emission from providing information to drivers using a microscopic traffic simulation.The observation environment and vehicle movements are reproduced by VISSIM, which is a microscopic traffic simulation tool o software (Matsumoto, at all, 2014)

Ning Wu and friends investigated Capacity at signalized intersections depends on existing geometric, control, weather, and other conditions. The proposed model can be used for generating a database of saturation flow rates using historical or online detector data with respect to different geometrical and traffic conditions such as the geometric design of intersections, proportion of heavy vehicles, time interval under consideration weather influence, and so on.For capacity estimation, the model is also applicable for data from the over saturated situation and from actuated or coordinated traffic signals.End of the calculating of capacity at signalized intersection estimates queue lengths under unsaturated situations, the estimated queue length at the end of green time.Based on the queue theory at signalized intersections, relationships between capacity and stochastic characteristics of signalized intersections are investigated.It can be seen that the capacity and the characteristics of signalized intersections can be estimated by measuring the cycle overflow probability. (Wu at all,2016)

The model is validated and verified by a simulation study. In the next step an investigation will be conducted applying the model to on-line collected at real intersections (fixed-time, actuated or coordinated) in order to estimate the variation of capacities and delays and to investigate the stochastic characteristics of the queueing systems for actuated or coordinated signals. (Wu at all, 2016)

Joewono Prasetijo investigated to regulate intersections. Unsignalized intersection is built to regulate the low volume of traffic flow. There are two methods for calculating unsignalized intersections. The gap-acceptance method: it has a simple concept that depends on drivers decision to accept or reject a gap before committing the vehicular movements, the conflict method; it is proposed to assist the current methods that consist a conflict area in the intersection.when the conflict method is verified as capable of assisting the gap-acceptance approach.The outcomes of the conflict method are comparable with HCM 2000 using field data.Traffic conflicts between vehicular movements are created when two or more roads crossed each other.Such conflicts can stir up delay, traffic congestion and possibility of road accidents. (Prasetijo at all, 2012)

Qinrui Tang and friends investigated the effect of turn left at intersections.The direct left turn increases the delays and causes more accidents in certain conditions.

When we are prohibiting left turns could increase the capacity of intersections and reduce the delays.Existing studies show that removing left turn from some intersections reduces the average delays.Two alternatives are found that is infrastructure construction and signal adjustment. (Tang at all, 2016)

The most familiar infrastructure solution is called Michigan U-turn construction.That is calculated by stochastic user equilibrium (SUE) by focusing on delays travel times, the travel time, and the accident rates.In this intersection this kind of method is approved to be safety but delays always did not improve. The other alternatives are continuous flow intersections and jughandle intersections for infrastructure construction the all of the methods have just affected at intersections and their costs are higher 49% than conventional intersections. (Tang at all, 2016)

Moreover infrastructure is not the effect of efficiency for linked roads. If the prohibiting turn left is chosen that is built no extra infrastructure at intersections. Then three consequential right turns, or a detour advance or detour afterward would be alternatives. When the left turn is prohibited is determine, signal timing is readjusted. The prohibiting left turn is reduced travel time and the method is adapted for traffic control systems when the network oversaturated. Left turns are prohibited from increasing the capacity of road networks, to reduce delays time and to increase efficiency. Stochastic User Equilibrium (SUE) establishes between supply model and demand model. **Supply model's** main task is to indicate signal timing, **Demand model** provides to find the shortest paths Origin-Destination (OD) pairs.in the result prohibiting some of the left turns indeed reduces travel timing. (Choudur at all, 2016)

Janusz Chodur and friends investigated some intersections data that are affected the capacity of intersections such as the saturation flow is evaluated for of capacity at signalized intersections.When the location changes, intersections of forms is unique according to the traffic of distinct needs and types of driver behavior, so rural intersection design and urban intersection design show different between each other. At the rural intersection, more emphasis is put on dynamics but at an urban intersection, on the efficiency of service of different road users, The rural intersection needs to improve safety.In rural areas, their unsignalized intersections that typically feature one entry lane of the lower class road.Rural roads have higher operating speeds, the slow-down stretch is longer, and in urban areas have longer queues.Traffic control via signals is used increasingly more often at rural intersections. At comparable demand flows and intersection design, traffic performance at urban intersections would be better than rural intersections. on the lanes traffic across is carrying out rural intersections the average saturation flows have much lower (even up approx % 30) than urban intersections (Chodur at all, 2011).

Thoralf Knote investigated preference intersections that are significant elements of road networks.that intends the necessity of methodologies for the analytical determination of capacity of minor traffic streams. The general procedures are presented in the Highway Capacity Manual (HCM 2000) and in German, Handbuch für dies Strassenverkehrsanlagen(HBS 2001).The capacity is calculated by HCM 2000 that is based on capacity adjustment factor for impeding effects of higher ranked traffic streams(f_x), the potential capacity of the minor traffic stream x (veh/h)(c_{p-x}) that is $c_x = f_x . c_{p-x}$ potential capacity of minor traffic stream depends on conflicting flow rate for minor traffic stream x (veh/h),(V_{c-x}) ,cruical gap for minor traffic stream x(s), (t_{c-x}) and follow up time for minor traffic stream x(s), (t_{f-x}). The vehicles in higher ranking traffic streams are considered twice, the first part of the conflicting flow rate and secondly through their contribution to the probability of the queue-free state. Base on an inward analysis of intersections between different traffic streams a good approximation for a more detailed determination of conflicting flow rates for streams of different rank has been developed using simulations and regression analyses. (Thoralf, 2011)

Karl Bang and friends investigated the deterministic methods for calculation of signal timing and traffic performance measures for isolated, fixed time signalized intersections documented in the new manual.(STA 2013a) and applied in the CAPCAL 4 software (Linse 2013).The use of methods is mandatory projects for the Swedish Transport Administration (STA). The CAPCAL 4 software focus on to detailed modelling of saturation flow for opposed lanes,short lane utilisation and contribution to approach bottleneck capacity,inter- green times and minimum green periods and their application in the signal timing process,procedures for finding the critical conflict point between conflicting traffic movements as a basis for determination of optimal signal timing.the capacity of signalized intersections approach is a function of a number of lanes that depend on their traffic flow, directional distribution, saturation flow and green time ratio.**Saturation flow**: (s) for a signalized line is defined as stationary traffic flow at queue discharge. Many factors are effects: 1) Geometric design, 2) Ratio of left and right turning traffic,3) Degree of conflict with opposing vehicle movements and /or pedestrian flows at crosswalks that have green in the same phase.Simulation methods can be used to model the performance of complex, signal control strategies and systems that cannot handle. (Bang at all, 2016)

Microsimulation software (VISSIM, AIMSUM) consists probabilistic request and driver behavior variables for modeling the variability and uncertainty of traffic process. Simulation models require validated detailed input data.It is difficult to estimate saturation flow, capacity, and volume to capacity ratio since the simulated queue discharge is normally based on car-following models. (AKÇELİK , 2016)

Ch. Ravi Sekhar investigated impacts of the fuel consumption of vehicles that are idling time in Ahmedabad India by VISSIM. The fuel consumption of the vehicles is increasing day by day because of enhancing trip lengths, personal mode of transport, congested intersections. Heterogeneous traffic on Indian roads associate transient transport and existence of motorized and non- motorized vehicles having diverse static and dynamic brings in the need for a carefully developed simulation.VISSIM could consist stochastic , time step based, microscopic traffic flow simulation program to the highway and urban operations.It uses to analysis roads car-following model.VISSIM is a powerful software tool for traffic simulation which could handle large networks and also bash up the Indian traffic scenario satisfactorily, however, in adjustment, the parameters of vehicles and kind of drivers are to be fine-tuned. (Sekhar at all, 2013)

Samia Boubaker and friends investigated environmental impacts of intersection types.The energy consumption and environmental problems are depended on hybridization level's fleet and intersection type on vehicle consumption and pollution increasing day by day at signalized intersection and roundabout.Instantaneous fuel consumption and emission models are coupled with a simulation of urban mobility(SUMO), that is based on microscopic car-following models.SUMO road networks include intersections, junctions, and traffic lights.To estimate fuel consumption and emisions, the microscopic tool that integrates a ınstantaneous consumption and emission model are coupled with SUMO. Many factors affect the rate of fuel consumtion when they categorized into four general groups, they are vehicle, environment, driver and traffic conditions. **Instantaneus consumption model** is used to calculate the ınstantaneous energy, consumption of each vehicle on a road section then The fuel consumption per unit of time (f_t(mL/s)) and the tractive force (R_t (kN)) is calculated with this model by some complex formulas.Hybrid electric vehicles(HEV) are one solution for the world's need for cleaner and more fuel-efficient vehicles.(.Brubaker at all, 2016) This a vital technology for the automative sector. The importance of the intersection is reducing fuel consumption and vehicle emissions. Hybridization technology also considers an important solution in reducing consumption and emission. (Boubaker at all, 2016)

Kirti Bhandari observed to estimate Carbon Footprint of Fuel loss at intersections in Delhi.thus they observed some intersections to determine the amount of Greenhouse gasses that are six gasses (like a carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride). The transportation sector is one of GHG emissions in Delhi (Bhandari 2013). The walking, and cycling contribute emissions at transportation but they are negligible due to another source of emissions are observed this study shows during idling of vehicles contribute 9% emissions of the total emissions from transportation in Delhi. Consequently, this study gives some offers for drivers and policymakers that are in Delhi. (Bhandari at all, 2013)

- The bus drivers turn off their buses when they arrive at loading or unloading areas.
- The roads should be separate bus lanes/busways from major arterials
- To increase non- motorized modes like a cycle and cycle rickshaws at transportation
- Traffic education should be put in for all of the school levels.
- The government should enforce the policy that no vehicles will remain idle at intersections for more than 3 minutes.(Bhandari at all 2013).

Jing Zhao's another study is observed for capacity with a short part of the lane that has been chosen certain length from the lane. Highway capacity manual (HCM) 2010 diverse factors were considered to adjust the base saturation flow rate for capacity analysis of signalized intersections.Short lane is lane with limited length.The Minimal length of short is stated in many design manuals. The upstream short lane may have a substantial impact on capacity that positively related with effective green time and negatively related with the short lane length. For good operation purpose, the short lane length should generally be no less than 100 m. With consideration of short lane, there may exist an optimal cycle length for maximum capacity. There are some factors for this type modeling which are related driver behavior, and local traffic condition such as basic saturation rate, space headway queuing vehicles, vehicles arrival distribution and so forth. (Zhao at all, 2013)

Hyeong-jun investigated traffic congestion at intersections in Korea. Nowadays many countries are handling with severe daily congestion that causes huge economic and social loss. In Korea the economic loss approximately $ 14,4 trillion in 2007.(Hyeung at all, 2012).

The real-time control method is with VANETs. The traffic congestion is a problem that is resolved by real-time control, the time of day (TOD), fixed time control methods.**The time of day control method** pursues a predefined signal timing plan hour /day. **The fixed time control** method uses a signal timing by the administrator.**The real-time control method** analyzes traffic information acquired by sensors and builds a proper signal timing control. On basis of VANETs is working with on real-time control system that estimates the queue lengths in each lane, determine cycle lengths, and green splits for a traffic signal controller. (Yang at all, 2012)

The first algorithm estimates the queue lengths, the second algorithm estimates to determine cycle lengths, and green splits for a traffic signal controller on basis of the first algorithm.the total waiting queue length is shortened compared to random control.

Srinivas Mandavilli investigated emission rates that have been estimated by microscopic simulations programs such as SIDRA. Conventional intersections force vehicular traffic to slow down and stop in varying models and contribute enhancing in vehicular emission. Modern roundabout performed better than the substantial intersections. The traffic flow data of intersections extracts from tapes and using SIDRA(signalized and un-signalized intersection design and research aid) software.Vehicle emissions contain CO(carbon monoxide), CO_2(carbon dioxide), NO_x(oxides of nitrogen), PM_{10} (particulate matter) and (HC) hydrocarbons or VOC (volatile organic compounds) that affect long-term on air pollutant.SIDRA uses a 4-mode elemental model for estimating fuel consumption,operating costs and pollutant emissions. The SIDRA method emphasizes the consistency of capacity and performance analysis method for roundabouts,sign-controlled and signalized intersections. (Mandavilli at all, 2007)

Article Gerard Aguilar Ubiergo investigated environmental impacts of signalized intersections in India. Eco-driving and eco- routing are driving system. Eco-routing contains choosing the way that will consume to be minimum emission levels and to use the least energy on this route. Eco –driving should be eco-friendly style. If the drivers haves some information that should be regulated according to the upcoming signal status their driving’s style is changing such as to avoid hard braking and accelerating, thereby decreasing energy consumption and pollutant emissions. The mainly aim is to be improved green-driving strategy. (Uberigo at all, 2016)

VISSIM is designed intersections by software. Traffic flow is approved via VISSIM. Under same traffic volumes, there are placed two different signs at intersections that are affected differently from this situation. The yield sign that is meaning no compulsory rule about stopping at intersections, thus conflict areas are increased more than at stop sign intersections.VISSIM gives opportunities to evaluate which models are available for distinct traffic signs, light settings, traffic marking.

Nicolla Sacco (2014) investigated optimal design of traffic lights at intersections.The optimal Design of traffic light settings prospects in general that all the data are known and constant for each design reference period, the omission of uncertainness of incoming flows or of other intersections characteristics, such as the saturation flows or lost time.(Sacco, 2014).

PROJECT AIM AND STUDY AREA

3.1 Project Aim

This study will determine the environmental and economic impacts of the various types of junctions in the urban centers, and the administrators are informed which projects are more suitable by these impacts. This study will lead to making new scholarly studies that will be done using software. this study is intended to increase the capacity, driving comfort, to reduce energy consumption and traffic accidents in this region for the kind of intersection

3.2 Study Area and Data Collection

3.2.1 Study Area

This study is observed how to affect traffic management implementations on the capacity of the junctions. These accounts are made of the micro-simulation program. According to the data obtained from the program improvements will be made. The intersection is the most efficient and easiest way to regulate the levels of progress must be provided services within the city required. Video feeds from intersections stop times and vissim simulation program of emission and fuel consumption are to be calculated and assessed.

Kahramanmaraş, that is a city in Mediterranean region of Turkey, Its population is 1.096.610 by 2015 population census, 196.390 vehicles are registered to traffic from Tuik by 2015 data.The neighbours of Kahramanmaraş are big industrial cities that are Gaziantep, Adana, and Kayseri. Hence the capacity of existing roads of the city center is remained insufficient due to the increasing of population and correspondingly increasing the number of vehicles in Kahramanmaraş day by day. Some problems like traffic congestion, insufficient capacity of intersections, lack of traffic signs and so forth includes lots of themes, due to three intersections that were chosen from the city center and to be making intersections arrangements by using a simulation software program that is VISSIM.

The intersections that are written by below

•Dental hospital intersection,

•Kahramanmaraş Police Department intersection

•Kahramanmaraş Municipal Intersection

There are four lanes at Dental hospital intersection, however three phases are operated at the intersection.The existing situation is useless for the vehicles that are passing from the East to the North, because the vehicles might not be from the on existing circumstance therefore The arrangements are executed to the vehicles come from the north to the east the west.

The unusable directions reveal an unfavorable situation for the vehicles at the intersection A large area of the East is dysfunctional, at the same time the vehicles that use this route increases day by day due to its connection with the city center and Gaziantep freeway and the capacity of the intersection thus it should be arranged geometrically. In the same time a vast area is using for parking lots on the road.This situation is illustrated whole directions, sketch of the intersection on Figure 1-2

Figure 1: Photo of Dental Hospital intersection

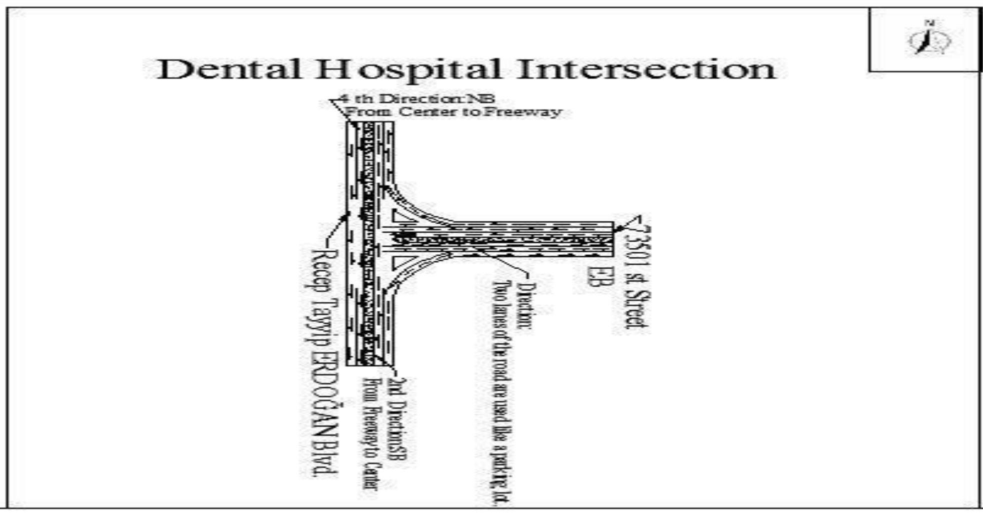

Figure 2: Sketch of demonstrated Dental Hospital intersection

Kahramnamaraş Police Department intersection connects 4 streets that are Kuddusi Father and the Lady Zübeyde , Azerbaijan Boulevards.The intersection is also operated with two-way for each street also one way that is one phase to pass by vehicles from Kuddusi Father to The Lady Zübeyde The service level is calculated as VISSIM and E the capacity of intersection vehicles on the rush hour at intersection and the rush hour is between 16:45 and 17:45. And the current situation needs to be regulated. The satellite picture belongs to the Police Department intersection is shown in Figure 4.Figure 3 demonstrates the skecth of the Police Department intersection.

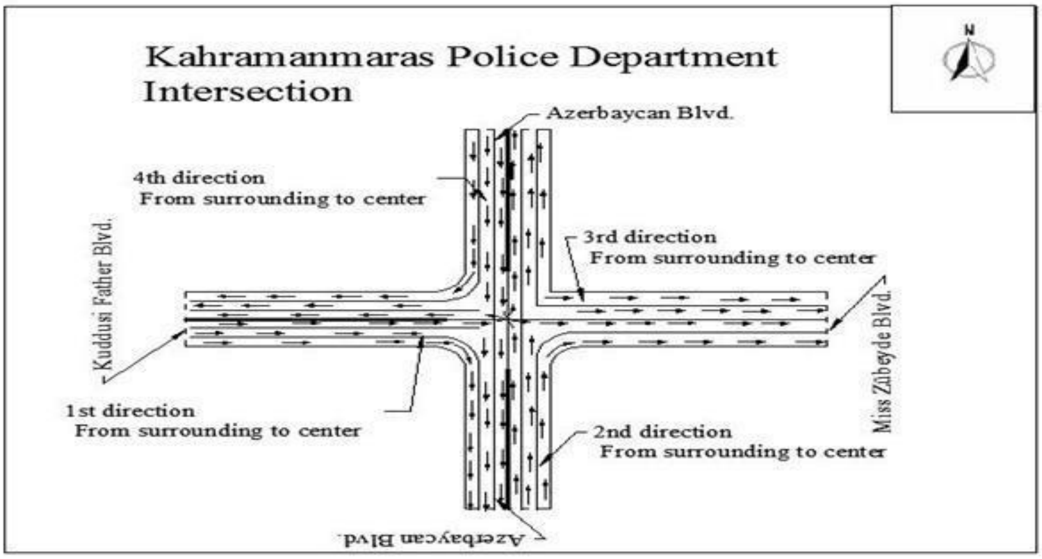

Figure 3:Sketch of demonstrated The Police Department Intersection

Figure 4: Photo of Police Department intersection

Kahramnamaraş Municipal Department intersection connects 4 streets that are Sandalzade and the Government, Azerbaijan Boulevards.The intersection is also operated with two-way for each street.The service level is calculated as VISSIM and F the capacity of intersection vehicles on the rush hour at intersections and the rush hours are between 16:45 and 17:45. And the current situation needs to be regulated. The satellite picture belongs to the Municipal intersection is shown in Figure 6.Figure 5 demonstrates the skecth of the Municipal Intersection.

The vehicles, pedestrian counts of crossroads are counted. VISSIM is transferred for realistic appraisal. The number of pedestrians and the distribution of pedestrian counts on the Municipal and Police intersections Figures 9 and 10 are shown them.

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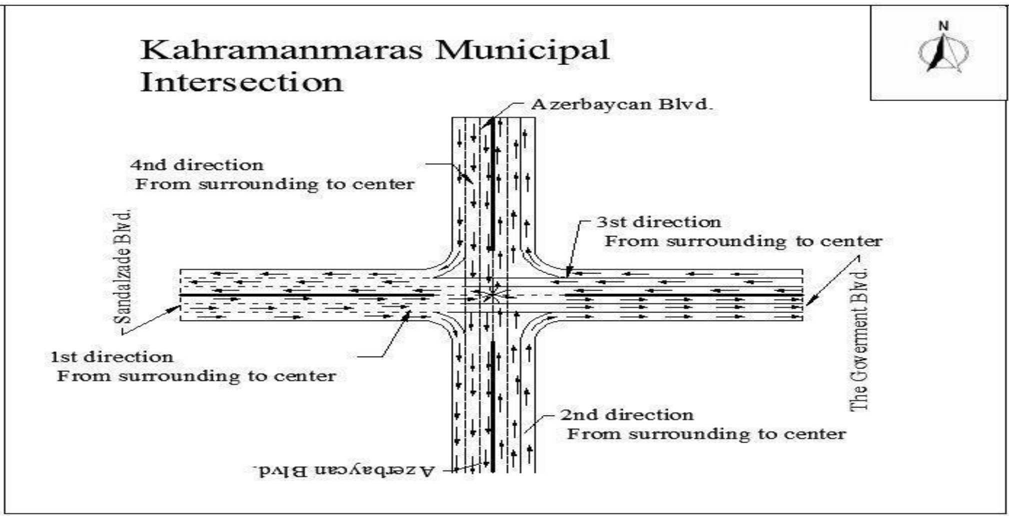


Figure 5:Sketch of Municipal Intersection

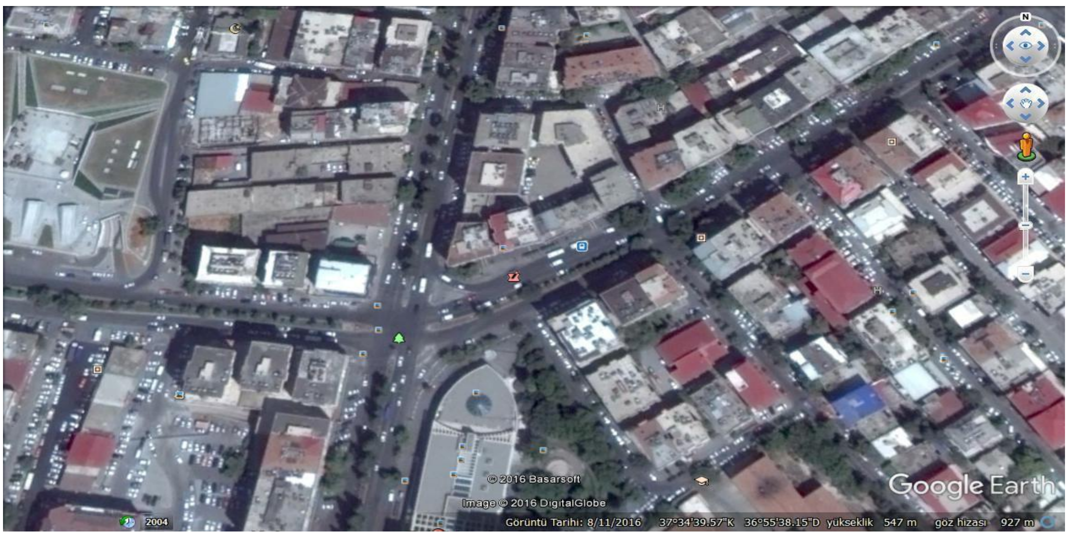


Figure 6: Photo of Municipal Intersection

3.2.2 Data Collection

In Turkey, the Metropolitan Municipalities make intersection counts several times a year by assigning special personnel for the automatic or count of the existing signal systems in order to increase the efficiency of urban intersections. Convenient count must be made covering morning and evening traffic peak hours throughout the day that is a weekday that can not be a formal vacation day on normal weather conditions

Traffic counts provide main data for speed and vehicles composition, intelligent transport systems, and transport projects.Nowadays, magnetic loop detectors are often used to count vehicles passing over them. Vision-based video monitoring systems are more proficiency than earlier procedures. In addition to vehicle counts, gives information about distinctive traffic parameters such as vehicle compositions, lane changes, parking areas etc., can be measured in such type of systems.

In metropolitan areas, there can need for factors about vehicle classes that use a particular highway or a street. A classification and counting system like the one recommended here can supply remarkable data for particular decision makers

It is based to know the magnitude of traffic factor required or to be collected, which will then determine its quality and type of vehicle composition be illustrated. Traffic counting separates two main categories, namely; manual counts and automatic counts. There is no different variation between the two methods but, the economic used or selected a feasible method of traffic counting is a function of the level of traffic flow and the desired parameter quality.Manual counts: this method is most general methods to collect traffic flow. The method comprises of allocating a person or more that depends on requirements of the area. At intersection sites, the traffic on each arm should be counted and recorded respectively for each movement. The lanes significance that traffic on roads with more than one lane is counted and classified by direction of traffic flow. Automatic counts: primarily vehicle presence and road occupancy has been performed on or near the surface of the road from history to today The last exploration of new electromagnetic spectra and wireless communication media in during the last year, has shown traffic detection to become in a non-interruptive fashion, at locations above or to the side of the roadway. Pavement-based traffic detection currently relatively cost-effective, will be awarded as evil race in the coming years from detectors that are enfranchised from the road surface.

The most generally used detector types are:

•Pneumatic tubes

•Inductive loops.

•Weigh-in-Motion Sensor types.

•Micro-millimetre wave Radar detectors.

•Video Camera.

The data is obtained from KMM which has traffic counts done by video camera.

A number of vehicles that are displayed alteration for passing over the each road therefore the counts methods are indicated which methods are feasible for the roads. Video camera method is used to count pedestrians and vehicles at the intersection after the record on counting area with different aspect cameras , the checklists are set by counting.Detailed counting lists are illustrated from section appendix and from app1 to app12. The peak hour of the city and the intersection are designated according to the results of the counting that is indicated the vehicles class Entire aspects are observed by three cameras that are replaced to each aspect areas at the intersection. The video camera recordings are made on weekdays and a non-precipitation day is selected from 6.30 am to 6.30 pm, and then the record is analyzed and counted. In the table 2 to table 4 for studied intersection that is demonstrated countings of rush hours The figure 7-10 are shown sketch of the studied intersections are shown.In figure 9: at the dental junction , the peak hours are from 16: 45 to17: 45 and the flow directions are from north to south, and also an inverse situation that is valid at this intersection. However there is no some flows like from east to west and inverse condition.It is a critical intersection for Kahramnaaraş because of location that is a thoroughfare for coming from Gaziantep.Figure 5 The Police Department Intersection that is operated like four-leg intersection that is one way for the east-west direction the other streams are operated like two way in figure 6 Municipal Intersection that is signalized and 4-leg junction that operates two-way for each leg and there are three lanes on the legs is demostrated.

Table 1: The traffic counts on 26/02/2016 for Police Department Intersection' stream 1-2-4

	RELIGION:		POLICE DEPARTMENT INTERSECTION			
	GROUP:					
	SHOOTING DATE		26.02.2016			
	SHOOTING TIME		**VOLUME OF EACH STREAM**			***TOTAL***
			1-3	**1-2**	**1-4**	***1.STREAM***
THE NUMBER OF VEHİCLES ON PEAK HOUR	16:45	17:00	**176**	**111**	**58**	**345**
	17:00	17:15	**122**	**62**	**43**	**227**
	17:15	17:30	**173**	**71**	**42**	**286**
	17:30	17:45	**191**	**68**	**33**	**292**
			2-4	**2-3**	**2-1**	***2.STREAM***
	16:45	17:00	**62**	**5**	**24**	**91**
	17:00	17:15	**52**	**6**	**24**	**82**
	17:15	17:30	**65**	**9**	**22**	**96**
	17:30	17:45	**51**	**3**	**18**	**72**
			4-2	**4-1**	**4-3**	***4.STREAM***
	16:45	17:00	**122**	**35**	**47**	**204**
	17:00	17:15	**132**	**49**	**58**	**239**
	17:15	17:30	**152**	**54**	**59**	**265**
	17:30	17:45	**107**	**26**	**60**	**193**

Table 2 The traffic counts on 29/05/2015 for Municipal Intersection’ stream 1-2-3-4

	RELIGION:		MUNICIPAL INTERSECTION				
	GROUP:						
	SHOOTING DATE		29.05..2016				
THE NUMBER OF VEHİCLES ON PEAK HOUR.	**SHOOTING TIME**		**VOLUME OF EACH STREAM**				***TOTAL***
			1,3	**1,2**	**1,4**		
	16:45	17:00	**61**	**34**	**93**		**188**
	17:00	17:15	**58**	**32**	**95**		**185**
	17:15	17:30	**61**	**34**	**98**		**193**
	17:30	17:45	**51**	**30**	**91**		**172**
			2,4	**2,3**	**2,1**		
	16:45	17:00	**100**	**7**	**15**		**122**
	17:00	17:15	**102**	**7**	**18**		**127**
	17:15	17:30	**104**	**7**	**19**		**130**
	17:30	17:45	**110**	**9**	**15**		**134**
			3,1	**3,2**	**3,4**		
	16:45	17:00	**37**	**33**	**27**		**97**
	17:00	17:15	**39**	**27**	**34**		**100**
	17:15	17:30	**40**	**36**	**24**		**100**
	17:30	17:45	**37**	**32**	**37**		**106**
			4,2	**4,1**	**4,3**		
	16:45	17:00	**94**	**10**	**0**		**104**
	17:00	17:15	**94**	**4**	**0**		**98**
	17:15	17:30	**90**	**3**	**0**		**93**
	17:30	17:45	**89**	**3**	**0**		**92**

Table 3: The traffic counts on 24/02/2016 for Dental Intersection’ stream1-2-4

	REGION:		DENTAL HOSPITAL INTERSECTION			
	GROUP:					
	SHOOTTING TİME:		24.02.2016			
	SHOOTTING DATE		**1-2**	**1-3**	**1-4**	***1.STREAM***
THE NUMBER OF VEHİCLES ARE ON PEAK HOUR	16:45	17:00	**121**	**0**	**32**	**153**
	17:00	17:15	**135**	**0**	**32**	**167**
	17:15	17:30	**142**	**0**	**37**	**179**
	17:30	17:45	**138**	**0**	**37**	**175**
			2-1	**2-3**	**2-4**	***2.STREAM***
	16:45	17:00	**109**	**0**	**216**	**325**
	17:00	17:15	**144**	**0**	**246**	**390**
	17:15	17:30	**147**	**0**	**251**	**398**
	17:30	17:45	**162**	**0**	**269**	**431**
			4-1	**4-2**	**4-3**	***4.STREAM***
	16:45	17:00	**0**	**262**	**0**	**262**
	17:00	17:15	**0**	**265**	**0**	**265**
	17:15	17:30	**0**	**274**	**0**	**274**
	17:30	17:45	**0**	**272**	**0**	**272**

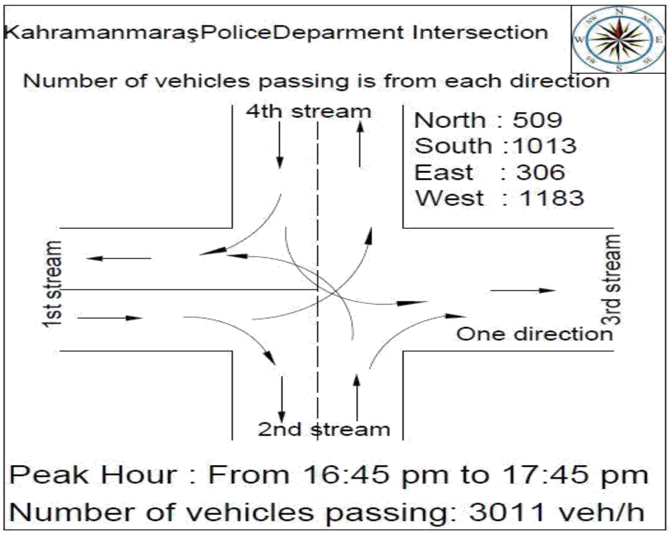


Figure 7: All streams and directions in Police Department Intersection

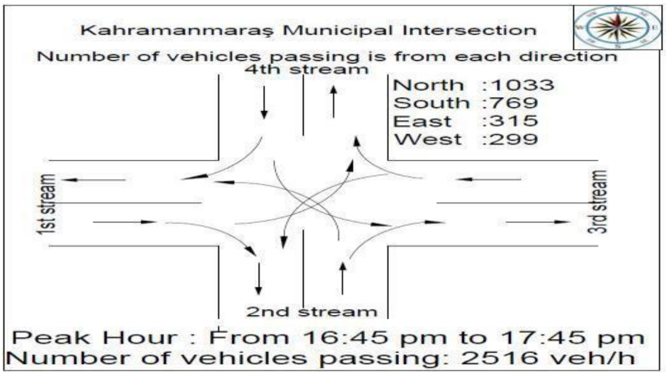


Figure 8: All streams and directions in Municipal Intersection

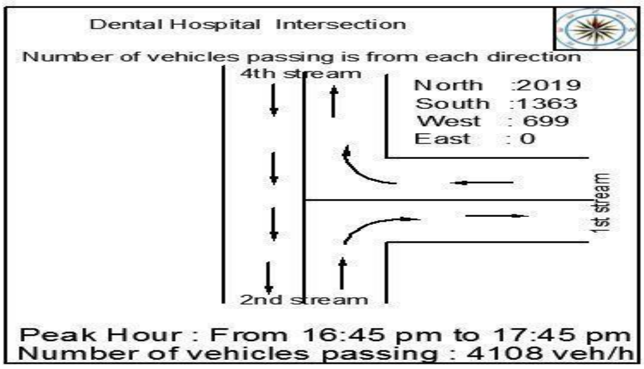


Figure 9: All streams and directions in Dental Hospital Intersection

METHODOLOGY

4.1 VISSIM Methodology

The traffic volumes augment at intersections hence the congestion consists at traffic. The VISSIM, SIDRA and the other software programs improve an analysis of intersections this software programs ensured effective control at intersections or roads.hence VISSIM is used in this study.The inputs are for VISSIM. They are road network construction, signal timing vehicle composition input, flow input.The basic data input of VISSIM:

Road Network Construction: the road network is constructed in stiff convenience with a base map. Scale needs to be significant before creating and connecting lines. Vehicle driving route also needs to be effectuated through of time.

Signal timing: the phase is designated by the signal lamp on the road section.signal timing should be stable in signal controller first and then locate the signal lamp in the proper road section. In this way, the flow can be inspected.

Vehicle Composition Input: the vehicle composition should be generated before inputting vehicles in the convenient road section.

Flow Input: the ratio of the left car, straight-car, right- car and the flow of approach are premised when organizing flow in VISSIM.

The main output data of VISSIM is vehicle average delay, travel time, queue length, stops and etc. To acquire these data adjustments like locating detectors should be done before which is rather a problem.

The aim of the traffic count; is acquired the entire approach of the intersections by laying the cameras that can see the arms. Traffic volumes of the intersection are specified by traffic count.After that is determined volumes. The data will be used for VISSIM is a scale simulation software that is united roads of entire users and their interactions, such as exclusive vehicle traffic, logistics services, public transport, pedestrians and bike drivers. In the software as a highway simulation;

•Modeling of different intersection geometries

•Modeling the interaction between different modes of transport

•Analysis of queuing and shock wave effect

PTV Vissim quick start: creating a network and starting simulation

Quick start shows you the most important steps for describing base data, design a network, making the essential settings for simulation, and starting simulation.

The intersections are estimated by VISSIM that is o-actuated simulation by passing the following the stages that are taken from PTV (PTV User Manual)

1.Opening Vissim and saving a new network file

2.Defining simulation parameters

3.Defining desired speed distribution.

4.Defining vehicle types.

5.Defining vehicle compositions

6.Loading the project area map as a background image.

7.Positioning, scaling and saving the background.

8.Drawing links and connectors for lanes and crosswalks

9.Entering vehicle inputs at the end points of the network If you are using pedestrian simulation: defining pedestrian flows at crosswalks

10.Entering routing decisions and the corresponding routes. If you are using pedestrian simulation, you can also specify the following for pedestrians.

11.Defining changes to the desired speed

12.Editing conflict areas at non-signalized intersections. You may enter priority rules for special cases.

13.Defining stop signs at non-signalized intersections

14.Defining SC with signal groups, entering or selecting times for fixed time controllers, e.g. VAP or RBC

15.Inserting signal heads

16.Creating detectors at intersections with traffic-actuated signal control.

17.Inserting stop signs for right turning vehicles at red light

18.Entering priority rules for left turning vehicles in conflict at red light and crosswalks.

19.Defining dwell time distributions.

20.Defining PT lines

21.Activating evaluations, e.g. travel times, delays, queue counter, measurements.

22.Performing simulations.

The studied intersections are analyzed by VISSIM 9 student version that is transferred respectively whole data of the intersection The end of the simulation is evaluated the performance of the intersection.

4.1.1 VISSIM data Input

The land observations, base maps, satellite photos are used on this work, the segment road widths, count of public transport, the rate of the vehicle types based on the investigations of the first state of the work interchanged to the VISSIM Simulation context.

The traffic road properties are indicated according to the simulation. The overall entries in the simulation are based on the counts. The counts are made in 15 minute periods. The maximum stream is transferred in VISSIM.

The percentage of the passing vehicles are indicated for each route and transferred to VISSIM The vehicles compositions are arranged as to counts lists.The signal timing, public transportation system, The heavy vehicles, the counts of the pedestrians are indicated to analyze by VISSIM Whole things are written to the program, and the node is punctuated for the evaluation there are two types marking methods that are polygon and rectangle.The node evaluation is taken by VISSIM.The node evaluation is estimated the condition of the intersections the results are about delay times, stops times, LOS, LOS Val, the quantity of emissions.

4.1.2 VISSIM data Output

The list of data that can be obtained from the Vıssım 9-student program is as follows.

Delay Avg (All), Stops Avg (All),Speed Avg (All),Delay Stop Avg(All),Dıst Tot(All),Trav Tm Tot(All),Delay Tot (All),Stops Tot (All),Delay Stop Tot(All),Veh Act (All),VehArr(All), DelayLatent, DemandLatent, Qlen, Qlenmax, Vehs(All), Pers(All), Los(All), Losval(All), Vehdelay(All), Persdelay(All), Stop delay (All), Stops(All) ,EmıssıonsCO, EmıssıonsNOx, Emıssıons VOC.

Three intersections that are Dental Hospital, Municipal, Police Department Intersection observed by Vıssım9.Each intersection is estimated performing with a simulation that is dedicated critical data to improve new solutions for the problems of the intersection.In this study the existing situation is evaluated by Vıssım after that is produced new solutions like a dedicated left turn lane and signal optimization. The suggestions are supplied to compare entire circumstances at each intersection.

Figure 9 is shown Police Department Intersection,.figure 10 is demonstrated Municipal Iıntersection , figure 11 is shown Dental Intersection from the screenshot of Vıssım.

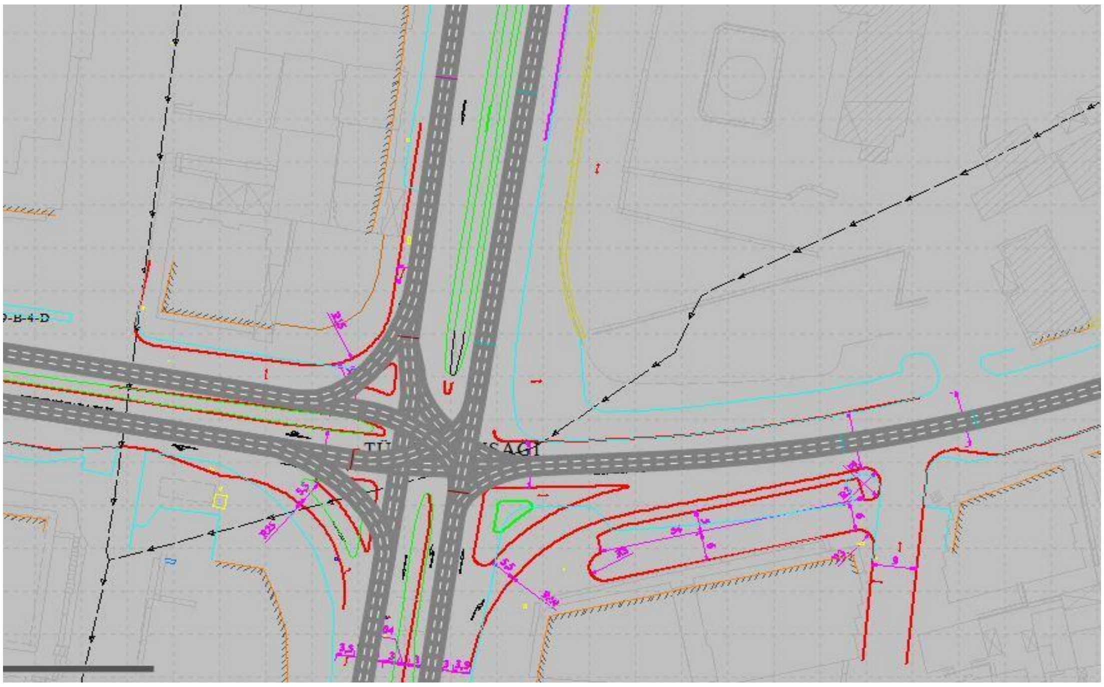


Figure 10: The demonstrated Police Department Intersection

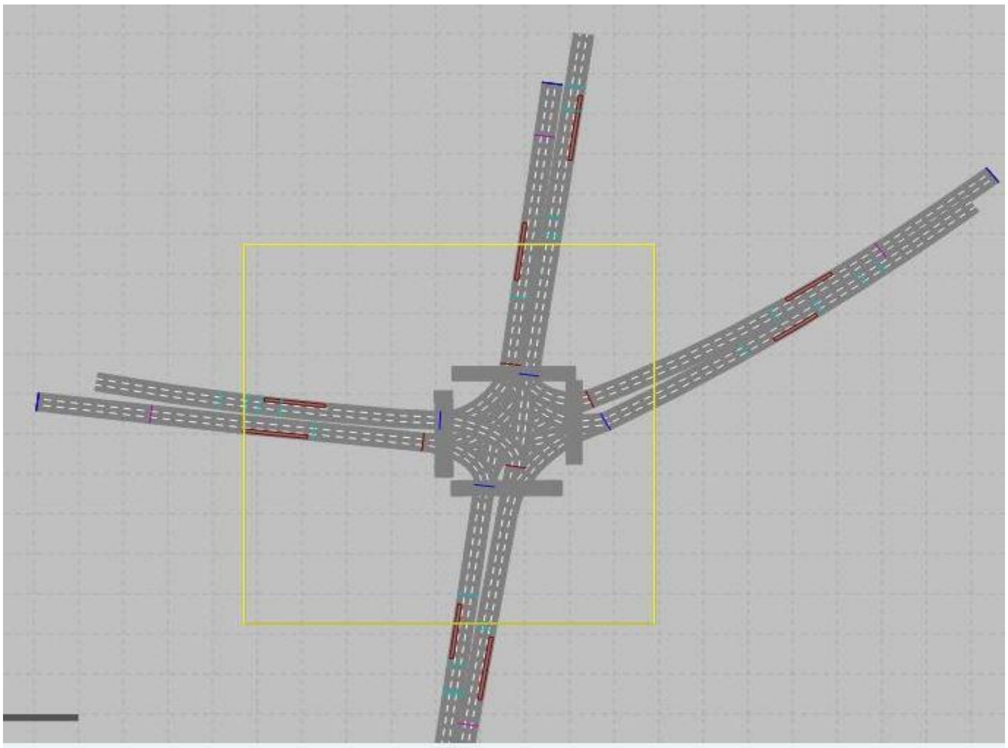


Figure 11: The demonstrated Municipal Intersection

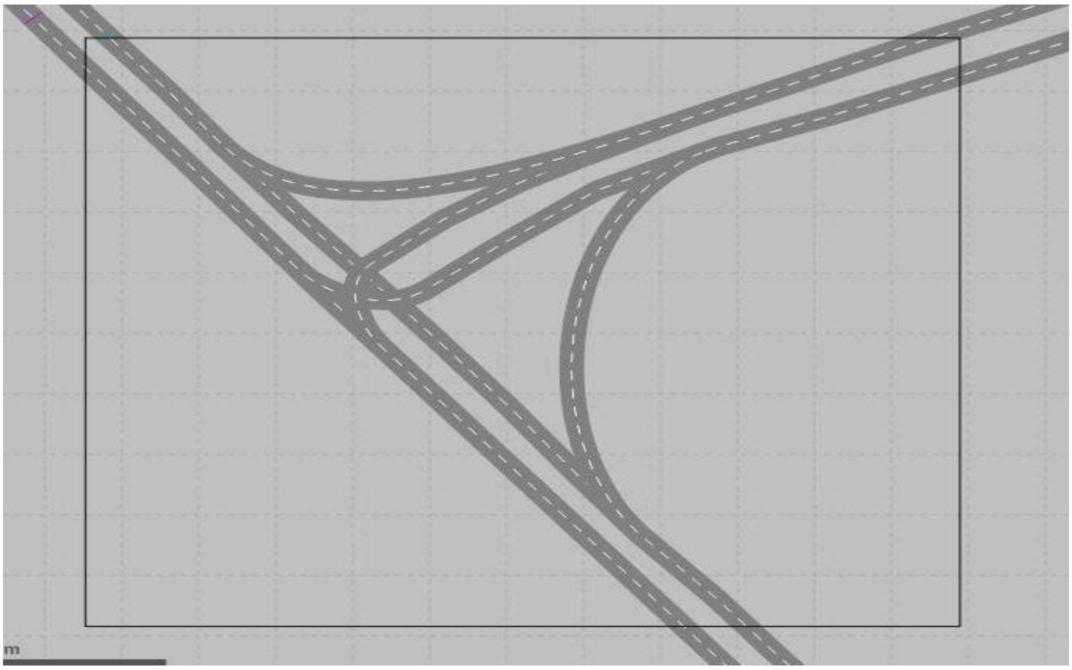


Figure 12: The demonstrated Dental Intersection

4.2 Emissions Methodology

The transportation activities are improving in Central Europe countries and Turkey day by day. Between 1970 and 1997 transportation activities were increased about 3,3% in [passenger-km] that were determined. Between 1997, and 2020, for the transportation activities that are an anticipated increase. 3,0 %. The using car that is anticipated reduction that will be from %5,7 to, 4,2 % in the same period. The rate of transportation by an automobile that was 36 % in 1986 this rate reached 60% in, 2002, it foresees to reach 80% in 2020.In the sector of transportation, the rate of greenhouse gas is emitted 17 % in 2000. For 2000 the rate of greenhouse gas emissions of distribution is showed at table 2 according to the sectors.

To reduce CO emissions that are emitted from road vehicles,

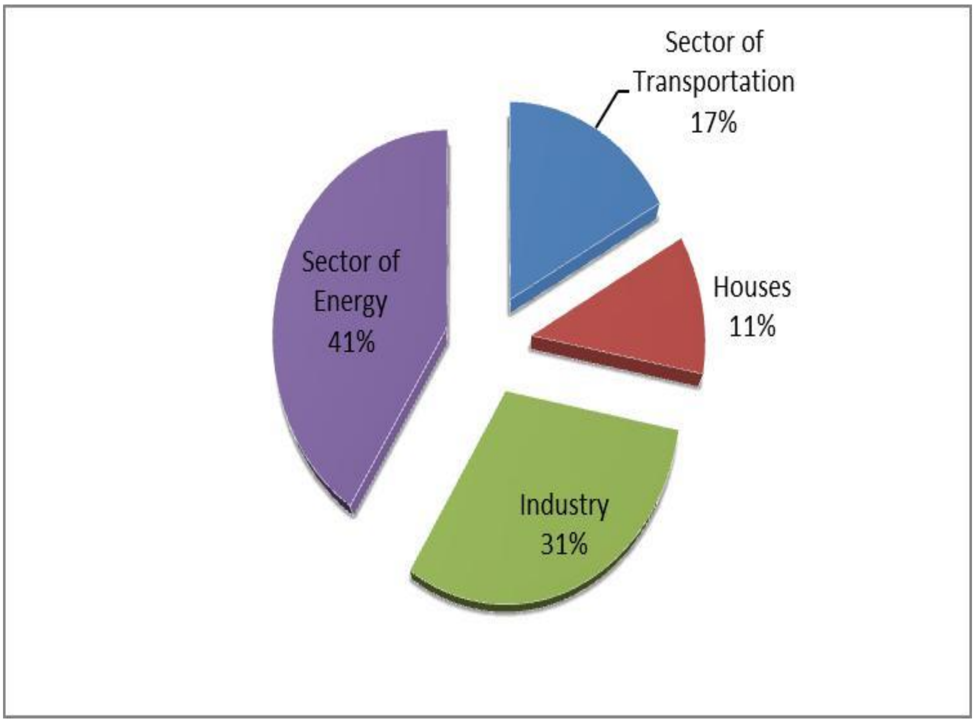
•Reduction of fuel consumption of vehicles that are new to traffic

•To arrange traffic flows

•The use of alternative fuels with lower greenhouse gas emissions

•The use of alternative approaches to transportation planning.

Table 4: The rate of CO_2 emissions distribution according to the sectors for Turkey in 2000



Vissim 9 Student version is given amounts of emissions for each direction and calculated total amounts of emissions for each direction. In EnViVer, detailed computations of CO_2, NOx and PM10 emissions in the area being studied are prepared in a graphical or tabular format for an easy-to-understand result. Otherwise, users have the choice of creating different views of the analyses whether the representation of the total sum or different types of emissions for the entire network or as base maps, which indicate the spatial distribution of the emissions. On this basis, various traffic planning or management methods can be studied in the simulation for their emissions-reducing factors and compared with each other.The table 6-7-8 that are shown whole amounts of emissions

4.2.1 Amounts of Existing Emission for Intersection

VISSIM is calculated amounts of emissions for each direction at the studied intersection.Entire values are demonstrated in table 6-7-8

4.2.1.1 The police department ıntersection

Table 5: Amount of Entire Emissions for Police Department Intersection.

1 Movement	Emıssıons CO(g/year)	Emıssıons NOX(g/year)	Emıssıons VOC(g/year)	Fuel Consumption(lt)
W(1),S(2)	14,471	2,816	3,354	0,78
W(1),E(3)	25,658	4,992	5,946	1,39
W(1),N(4)	11,908	2,317	2,76	0,64
S(2),W(1)	1,235	0,24	0,286	0,07
S(2),E(3)	4,387	0,854	1,017	0,24
S(2),N(4)	36,646	7,13	8,493	1,98
N(4),W(1)	45,604	8,873	10,569	2,46
N(4),S(2)	35,701	6,946	8,274	1,93
N(4),E(3)	22,154	4,31	5,134	1,20
1	197,765	38,478	45,834	10,69

4.2.1.2 The Municipal intersection

Table 6: Amount of Entire Emissions for Municipal Intersection

1 Movement	Emıssıons CO(g/year)	Emıssıons NOX(g/year)	Emıssıons VOC(g/year)	Fuel Consumption(lt)
N(4),W(1)	29,084	5,659	6,741	1,57
N(4),S(2)	43,182	8,402	10,008	2,34
N(4),E(3)	33,368	6,492	7,733	1,80
W(1),S(2)	15,736	3,062	3,647	0,85
W(1),E(3)	5,051	0,983	1,171	0,27
W(1),N(4)	59,747	11,625	13,847	3,23
E(3),W(1)	34,888	6,788	8,086	1,89
E(3),S(2)	27,092	5,271	6,279	1,47
E(3),N(4)	16,559	3,222	3,838	0,90
S(2),W(1)	11,007	2,142	2,551	0,59
S(2),E(3)	31,548	6,138	7,312	1,70
S(2),N(4)	12,733	2,477	2,951	0,69
1	319,992	62,259	74,161	17,30

4.2.1.3 The dental ıntersection

Table 7: Amount of Entire Emissions for Dental Intersection

1 Movement	Emıssıons CO(g/year)	Emıssıons NOX(g/year)	Emıssıons VOC(g/year)	Fuel Consumption(lt)
E(1),S(2)	0	0	0	0,00
E(1),N(4)	53,146	10,34	12,317	2,87
S(2),E(1)	23,854	4,641	5,528	1,29
S(2),N(4)	47,444	9,231	10,996	2,57
N(4),E(1)	12,123	2,359	2,81	0,65
N(4),S(2)	52,421	10,199	12,149	2,84
1	189,022	36,777	43,808	10,22

IMPLEMENTATION

5.1 The Capacity of The Intersection

5.1.1 The Capacity of Signalized Intersection in Kahramanmaraş

The definition of the capacity that is defined in HCM 2000: The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a specified time period under given roadway, geometric, traffic, environmental, and control conditions; usually expressed as vehicles per hour, passenger cars per hour, or persons per hour. (HCM 2000)

Capacity at signalized intersection depend on concept saturation flow and saturation flow rate Highway Capacity manual has indicated the capacity of a potentiality is the maximum hourly rate at which persons or vehicles logically can be anticipated to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.

Vehicle capacity is the maximum number of vehicles that can pass a determined point during a specified period under substitution roadway, traffic, and control conditions. This assumes that there is no effective from downstream traffic operation, such as the backing up of traffic into the analysis point.

The capacity analysis observes segments or points (such as signalized intersections) of an opportunity under uniform traffic, roadway, and control conditions. These conditions determine capacity; therefore, segments with different prevailing conditions will have distinct capacities.

- Base conditions for intersection approaches include the following:
- Lane widths of 3.6 m,
- Level grade,
- No curb parking on the approaches,
- Only passenger cars in the traffic stream,
- No local transit buses stopping in the travel lanes,
- Intersection located in a noncentral business district area, and
- No pedestrians.

In most capacity analyses, prevailing conditions wander from the main conditions, and computations of capacity, service flow rate, and level of service must include settings. Prevailing conditions are generally categorized as a roadway, traffic, or control.Capacity at intersections is described for each lane group. The lane group capacity is the maximum hourly rate at which vehicles can reasonably be expected to pass through the intersection under prevailing traffic, roadway, and signalization conditions. The flow rate is generally measured or projected for a 15-min period, and capacity is stated in vehicles per hour (veh/h) (HCM 2000).

Traffic conditions contain volumes on each approach, the distribution of vehicles by movement (left, through, and right), the vehicle type distribution within each movement, the location and use of bus stops within the intersection area, pedestrian crossing flows, and parking movements on approaches to the intersection. Roadway conditions include the basic geometrics of the intersection, involving the number and width of lanes, grades, and lane use allocations (including parking lanes). Signalization conditions include a full definition of the signal phasing, timing, and type of control, and an evaluation of signal progression for each lane group. The analysis of capacity at signalized intersections focuses on the calculation of saturation flow rates, capacities, v/c ratios, and level of service for lane groups.It is thus common that the real relationship wanders from country to country but also varies over time. First of all the composition of the traffic changes but also traffic behavior is totally distinct. In western world people tend to drive faster and keep less distance between the bumpers of each other cars (HCM2000). Table 8 is shown values of PCU.

It was observed that an increasing traffic stream that moves in free flow attains a higher capacity than a decreasing traffic stream moving from a congested situation into a free flow situation. LOS depends on whole values that are flow conditions, v/c limit, Service volume (veh/h/lane), Speed (km/h), Density (veh/km) that are demonstrated in Table 9.

Table 8: Values of PCU

Values of PCU	
Car	1
Motorcycle	0,5
Bicycle	0,2
LCV	2,2
Bus, Truck	3,5
3-wheeler	0,8

Table 9: LOS for Signalized Intersection(Rijn, 2004-12)

LOS	Flow conditions	*v/c* limit	Service volume (veh/h/lane)	Control Delay(s)	Density (veh/km)
A	Free	0.35	700	=< 10	< 20
B	Stable	0.54	1100	>10-20	< 30
C	Stable	0.77	1550	>20-35	<50
D	High density	0.93	1850	>35-55	65
E	Near capacity	1.00	2000	>55-80	110
F	Breakdown	Unstable		>80	>110

When the situation close to the saturation level, the queue will continue improving during the first part of the green light period.

The capacity of a single lane is the maximum number of vehicles that can pass the stop line of a lane. The base saturation flow (S_0) is 1900 veh/h.

The saturation flow (s) is affected by the multiplication of geometric and traffic situations as lane width, parked vehicles, turning movements etc. and the green time ratio (g/C).

Entire factors are computed with below Figure15 that is taken profit by HCM 2000 on table 10-22 and page 360

Whole data has been extracted from the Vissim simulation program. the capacity of the junction is made with HCM2000.The formulas of the factors are taken from the figure 15, Entire factors are computed to calculate saturation flow.End of these calculations Saturation flow is multiplied by green time ratio(g_i/C) like formula 6,

The capacity of signalized intersection for Police Department and Municipal Intersection account methods with HCM table 7 and chapter 16, and Entire the other redirects were calculated that computed queue lengths and delays, stops, capacities and saturation flows by Vissim Dental Intersection is an unsignalized intersection thus the capacity computation is used dissimilar method from signalized intersection,however HCM leads to computing capacity of unsignalized intersection .

Each factor is computed with formulas and the results are enrolled to excel, and multiplied whole factors and base saturation and a number of the lane to computed saturation flow.

5.1.2 The Capacity of The Unsignalized Intersection

Three types unsigalized intersections that are two-way stoped control (TWSC).All way stopped control and roundabouts. At TWSC intersections, drivers on the controlled approaches are vital to select gaps in the major street flow through which to carry out crossing or turning maneuvers on the basis of deliverance. In the presence of a queue, each driver on the controlled approach must also use some time to move into the front-of-queue position and prepare to evaluate gaps in the major street flow. Therefore, the capacity of the controlled legs is based on three factors: the distribution of gaps in the major street traffic stream, driver attitude in selecting gaps through which to carry out the desired maneuvers, and the follow-up time required by each driver in a queue.

The basic capacity model expects that gaps in the conflicting stream are stochastic distributed. When traffic signals on the major street are within 0.4 km of the subject intersection, flows may not be random but will likely have some platoon structure(Rijn, 2004).

The capacity of T intersection is assumed according to the volume of each stream. The streams are shown for T intersection on figure 15. the capacity of the unsignalized intersection is evaluated with critical gap acceptance figure 14 is demonstrated to reckon volumes for each movement.The movements are perceived for current conditions according to studied intersection.V_4,(EBT), V_7(SBT), V_9(NBT) are reckoned with used the formulas on figure 14. On figure 18 that is used for interpreting LOS with Delay Times.

5.2 To Estimate First Capacity of the Studied Intersections

5.2.1 The Dental Intersection

The vissim might analyze unsignalized and signalized intersection.However the computation differs from signalized intersection multiplications.The Dental Intersection is elected to analyze a sample that is unsignalized one.The capacities have estimated formulas 7-8-9 and the results are indicated on table 14 The capacities are respectively 128 veh/h, 149 veh/h, 175 veh/h.The vissim outputs are shown in table 15

Table 10: All Capacities for Dental Intersection

The first situation	Cp (Veh/h)	Cm (veh/h)
EBT	128	200
NBT	149	189
SBT	174	254

Table 11: VISSIM outputs for Existing geometric design at Dental Intersection

Movement	Los(All)	Delay(S).	Veh.Stops(S)	Stops(S)..
1,2	LOS_F	0	0	0
1,4	LOS_D	31,69	17,02	3,63
2,1	LOS_A	3,5	1,52	0,48
2,4	LOS_E	37,05	22,2	4,72
4,1	LOS_A	8,43	4,99	1
4,2	LOS_A	0,03	0	0
1	LOS_C	14,98	8,45	1,82

5.2.2 Police Department Intersection

The intersection is evaluating the first situation, that is considered geometrical design, signalization, the location of the intersection.Its existing situation is simulated VISSIM 9 (Student Version) and computed PHF is 0,92 that is ratio therefore there is no unit.

Entire setting factors are estimated with figure 15 after that estimated saturation flows that are indicated on table 10.The saturation flows are 4124 veh/h, 3151 veh/h ,3129 veh/h Police department Intersection of capacity is computed with Formula 6 , cycle length is 100 seconds for existing situation, g/C ratio is 0,30 for EBT , 0,19 for NBT, 0,36 for SBT, and The capacity of each directions are demostrated on table 11, ICU(intersection capacity utilization)is %89,8

Table 12: All Saturation Flows, Capacities, ICU are for Police Department Intersection

Situation	Existent	Saturation Flow Rate (veh/h)	Capacity of Intersection(veh/h)	ICU
Direction	EBT	4124	1237	%89,8
	NBT	3151	599	
	SBT	3129	1126	

Table 13: VISSIM outputs for Existing Geometric Design at Police Department Intersection

MOVEMENT	Queue length (m)	Queue length max. (m)	LOS	Delay(s).	Stops(s).	Stops (s)
W(1),S(2)	224,31	323,53	A	9,91	3,65	0,31
W(1),E(3)	206,66	428,03	D	50,31	41,44	1,14
W(1),N(4)	206,66	428,03	D	48,53	42,4	1,29
S(2),W(1)	76,47	159,36	B	15,94	13,82	1
S(2),E(3)	47,47	221,19	C	20,87	15,98	0,67
S(2),N(4)	76,47	221,19	D	53,69	43,49	1,05
N(4),W(1)	149,61	234,24	F	82,1	75,67	1,76
N(4),S(2)	181,87	234,24	E	70,25	63,37	1,44
N(4),E(3)	181,87	183,09	E	60,1	53,65	1,15
1	147,73	428,03	E	55,4	47,99	1,19

LOS, Queue Length, Control Delay, Stops are estimated by Vissim that is microsimulation program..The level of service: E, queue length: 147,73 m, Control Delay: 55,4 s/veh, stop: 47,99 s/veh, The whole results are indicated table 12, Some variations are supplied for intersection and observed capacity, queue length, LOS, delays. Whole innovations that are a signal optimization, dedicated left turn, dedicated right turn and prohibiting left turn.

5.2.3 Municipal Department Intersection

The calculated adjustment factors are written to estimate capacity, all of the factors are distinct for each intersection, PHF is 0,92 for entire lanes.

The saturation flow rates are 3243 veh/h ,2647 veh/h ,3280 veh/h 3820 veh/h.The results are illustrated on table 13 The capacities respectively 486 veh/h, 397 veh/h, 955 veh/h, 947 veh/h that are shown on table 13 Municipal Intersection of capacity is computed with Formula 6, the cycle length is 100 seconds for existing situation, g/C ratio is respectively 0.15,0.25 for each direction.The vissim program outputs are demonstrated on table 14.The rate of utilization is %80,0

Table 14: All Saturation Flows, Capacities, ICU are for Municipal Intersection

Situation	Existent	Saturation Flow Rate veh/h	Capacity of IntersectionVeh/h)	ICU
	EBT	3243	486	%80,0
	WBT	2647	397	
	NBT	3820	955	
	SBT	3787	947	

Table 15: VISSIM outputs for Existng Geometric Design at Municipal Intersection

MOVEMENT	Queue Length(m)	Queue length max. (m)	LOS(ALL)	Veh delay (veh/s).	Veh Stops (veh/s).	Stops (veh/s).
N(4),W(1)	155,87	206,2	LOS_D	39,48	36,12	1,63
N(4),S(2)	155,87	206,2	LOS_D	42,73	40,14	1,1
N(4),E(3)	155,87	206,2	LOS_C	34,8	32,49	0,89
W(1),S(2)	161,13	198,19	LOS_F	145,18	136,99	2,3
W(1),E(3)	102,72	198,19	LOS_F	95,51	90,58	1,74
W(1),N(4)	161,13	198,19	LOS_F	119,32	103,09	1,92
E(3),W(1)	94,5	228,65	LOS_F	80,34	74,63	1,53
E(3),S(2)	94,5	228,65	LOS_F	105,41	89,85	2,27
E(3),N(4)	63,9	141,64	LOS_D	47,72	38,14	1
S(2),W(1)	76,55	225,77	LOS_F	95,27	86,35	2
S(2),E(3)	76,55	139,94	LOS_C	25,61	18,83	1,75
S(2),N(4)	76,55	225,77	LOS_F	92,23	84,93	1,85
1	109,11	228,65	LOS_F	80,6	73,28	1,64

ALTERNATIVES SOLUTIONS

6.1 The Impact of The Geometrical Design at unsignalized intersection

6.1.1 Dental Hospital Intersection

Dental Hospital was an unsignalized intersection that is recovered a roundabout intersection.Roundabouts are popular alternatives of traffic control in many countries. Its capacity is usually larger than for unsignalized intersections and the delays are in general less than for signalized intersections. Its most popular aspect is the reduction of traffic accidents, although that depends, like the capacity, mightily on traffic rules.The capacity of the roundabout hinges also on its geometrical design

The most popular roundabout is characterized by the fact that the circulating traffic has right of way, Consequently, the effectively conflicting flow consists of the actually conflicting flow and a part of the exiting. The geometrical design determines the distance between the entry and the final point where the ordinance to leave the roundabout to occur explicitly.Figure 12 is shown vehicle circulation according to each arm on Dental Intersection.

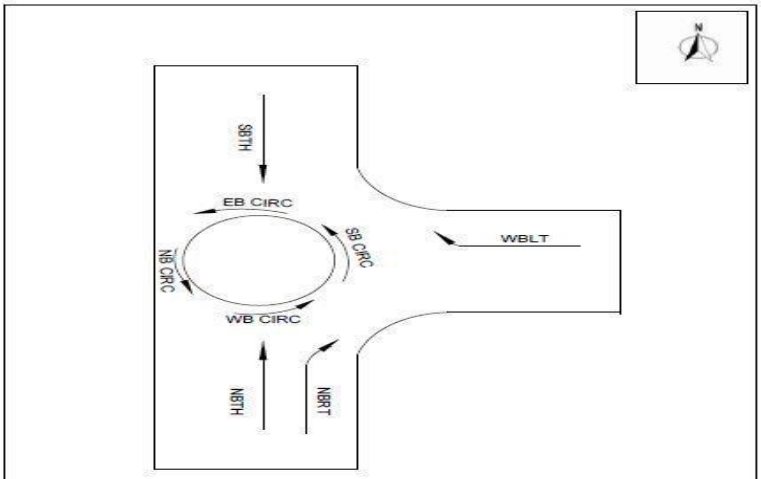


Figure 13: The circulatory and the entry for Dental Intersection

Table 15 is shown the results of the capacity that is computed like an unsignlized intersection.

Table 16: The capacity of the renovated Dental Intersection

The last situation	
EBT	401
SBT	269
NBT	555

VISSIM 9 that is a micro-simulation program hence it is working with detailed data thus it gives detailed results that are shown by the table 15-17.

Table 17: The outputs from VISSIM at the Dental Intersection as roundabout.

MOVEMENT	LOS	Delay(s)	Stops(s)	Stops(s).
1;2	A	4,26	2,88	0,63
1;4	A	1,39	0,83	0,22
2;1	A	0,05	0	0
2;4	A	8,08	5,83	1,29
4;1	A	1,76	0,78	0,5
4;2	A	2,58	1,52	0,39
1	A	2,45	1,57	0,38

Table 18: The quantity of the greenhouse emissions at roundabout Dental Intersection

Movement	Emıssıons CO(g/year)	Emıssıons NOX(g/year)	Emıssıons VOC (g/year)	Fuel Consumption(lt)
1;2	13,395	2,606	3,105	0,73
1;4	25,681	4,997	5,952	1,39
2;1	13,05	2,539	3,024	0,71
2;4	9,099	1,77	2,109	0,49
4;1	3,261	0,634	0,756	0,18
4;2	24,523	4,771	5,683	1,33
1	89,018	17,32	20,631	4,82

6.2 The Impact of Signal optimization at the Intersections in Kahramanmaraş

The goal of this state is to estimate a viable signal timing plan for the intersection. The signal timing plan is necessary to estimate delay. Note that the signal timing plan estimated using the method defined below is not certainly the optimal timing plan. The timing plan is anticipated in five substeps: phasing plan development, calculation of critical sum, estimation of total lost time, cycle length estimation, and effective green time estimation.

Congestion on the rural highways is very sparse. Congestion in the urban areas is on the other hand very accustomed. Most of that congestion relates to the many intersections in urban areas.

Traffic lights are loaded at intersections to enhance the road safety or solve certain problems with the count to capacity and delays. Traffic lights have major handicaps; it is, thus, recommendable to study the inferences of the setup in detail before any ultimate decision is received.

Whether the problem is that the delays are too long, there is only a commitment of the flow on the base approaches.If the trouble is also the building up of queues on the minor approach(es), there is also a capacity problem. This base both on the flow of the mainstream and the ones on the minor approaches (John van Rijn, 2004).The length of the queues might be so large that another intersection or an exit is blocked.

Busses or trams could not be delayed at the intersection.The first factor of attention the delay. The number of stops and the time a vehicle ought to wait at a traffic light before it can pass an intersection impacts the delay.

The queue length can be predicated in the number of vehicles or in meters. But most traffic engineers are interested to find out if the queue is blocking another intersection, and thus the queue length is generally stated in meters. The total length in meters hinges on the number and composition of vehicles and the average distance between two vehicles. When the composition of the vehicles is known it is relatively easy to designate the average vehicle length Under normal circumstances (no congestion) the total number of vehicles in the queue (N) is equal to number of vehicles attaining during the yellow and red period [r (sec)] Because the vehicles have a certain dimension, the location where the vehicles have to stop moves backwards. And therefore the vehicles have to stop earlier as the queue grows. Thus the number of vehicles arriving at the junction accelerates. It is, therefore, necessary to correct the number of vehicles in the queue (Rijn, 2004). Basically, there are two types of traffic lights:

1.Statical traffic light

2.Dynamic traffic lights

On the contrary stationary traffic lights do not react to the traffic condition. Regardless whether there are vehicles in one of the arms of the intersection, it will signal that vehicles might pass or have to stop. Dynamic traffic lights do react on the traffic circumstances and it will change its green, yellow and red periods on basis of real traffic requirements. Most traffic lights are of the stationary type in low-income countries. The following formulas to compute parameters of the traffic light, like delay, queue length and capacity are based on these kinds of intersections. Dynamic traffic lights are generally based on computations with models.

The traffic condition influences the factors of interest remarkable. The queue length, the average delay time etc are considerably longer when the traffic is obstructed. Unless determined distinctly the notations are applicable to free-flow situations. Handicaps negative results of traffic lights are among others:

•The main streams that had precedence out of the traffic lights will encounter delays

•Traffic lights might result in assumed rat-routing effects.

•Road users get angered because they have to wait

•In general, it enhances the average delay of all road users

•Head tail accidents may occur.

Advantages but there are also reasons for installation of traffic lights. The first reason in this working area is that vehicles on the minor approaches have to wait to cross or merge in the mainstream. The higher the flow of the mainstream, the longer it gets on average before a gap occurs that is long enough to cross. If there is not adequate space between the lanes of the base approaches, the gap has to become in both streams synchronically, which makes the delay lop-sided execute longer.

All factors are calculated with HCM 2000 for signalized intersections, the factors are indicated on Appendix section.From App 11 to App 14 all factors are dedicated to calculate capacity.

6.2.1 Police Department

Cycle length is 120 seconds according to the first situation at Police Department Intersection.g/C ratios are 0.28, 0,23,0.36 for each direction(EBT, NBT,SBT) and end of the processing capacity is shown in table 20. When cycle length is changed at an intersection, there is little changes for whole results that are demonstrated on table 18-20.

Table 19: The impact of signal optimization to capacity at Police Department Intersection.

Situation	**Signal Optimization**	**Saturation Flow**	**Capacity of Intersection**	**ICU**
Direction	EBT	4124	1155	**89,8%**
	NBT	3151	725	
	SBT	3129	1126	

Table 20: The impact of signal optimization at Police Department Intersection.

Signalization	**Queue length(m)**	**Queue length max.(m)**	**LOS**	**veh delay(s).**	**veh Stops(s).**
W(1),S(2)	323,5	LOS_A	5,84	2,16	0,80
W(1),E(3)	428,05	LOS_C	21,44	16,67	1,46
W(1),N(4)	428,05	LOS_B	12,17	9,25	0,57
S(2),W(1)	264,74	LOS_C	32,47	28,26	0,26
S(2),E(3)	154,12	LOS_B	14,81	12,82	0,06
S(2),N(4)	264,74	LOS_E	59,39	49,73	2,47
N(4),W(1)	183,11	LOS_C	34,8	29,55	0,95
N(4),S(2)	234,26	LOS_E	74,82	66,07	2,46
N(4),E(3)	234,26	LOS_E	74,54	68,08	1,88
1	428,05	LOS_E	45,21	38,75	10,92

Table 21: The Emissions at the intersection after Signal Optimization at Police Department Intersection.

Signallization	**Emıssıons CO(g/year)**	**Emıssıons NOX(g/year)**	**Emıssıons VOC (g/year)**	**Fuel Consumption(lt)**
W(1),S(2)	14,757	2,871	3,42	0,80
W(1),E(3)	27,036	5,26	6,266	1,46
W(1),N(4)	10,604	2,063	2,458	0,57
S(2),W(1)	4,886	0,951	1,132	0,26
S(2),E(3)	1,219	0,237	0,283	0,06
S(2),N(4)	45,708	8,893	10,593	2,47
N(4),W(1)	17,488	3,402	4,053	0,95
N(4),S(2)	45,483	8,849	10,541	2,46
N(4),E(3)	34,788	6,769	8,062	1,88
1	201,972	39,296	46,809	10,92

6.2.2 Municipal Intersection

Cycle length is 120 seconds according to the first situation at Municipal Intersection. g/C ratio is 0,17 for EBT,WBT and 0,25 for SBT.and NBT. g/c and saturation flow are multiplied and after this process, the capacity is computed. This process is stated on table 21.

Table 22: The impact of signal optimization for capacity at Municipal Intersection

Situation	**Existent**	**Saturation Flow rate**	**Capacity of Intersection**	**ICU**
Direction	EBT	3158	537	**81,9%**
	WBT	2610	444	
	NBT	3830	958	
	SBT	3639	910	

Table 23: The VISSIM outputs at Municipal Intersection.

Signalization	Queue length(m)	Queue length max.(m)	LOS	veh delay(s).	veh Stops(s).	Stops(s).
W(1),S(2)	154,77	198,18	LOS_F	155,33	146,89	2
W(1),E(3)	154,77	198,18	LOS_F	113,97	110,11	1,59
W(1),N(4)	154,77	198,18	LOS_F	143,11	127,44	1,7
S(2),W(1)	161,26	225,77	LOS_F	80,65	74,66	1,64
S(2),E(3)	105,83	139,94	LOS_D	36,85	32,4	0,67
S(2),N(4)	161,26	225,77	LOS_E	73,58	65,85	1,7
E(3),W(1)	102,45	228,65	LOS_D	52,6	50,27	1,15
E(3),S(2)	102,45	228,65	LOS_F	93,75	80,13	1,78
E(3),N(4)	57,92	136,19	LOS_D	38,69	29,08	0,8
N(4),W(1)	72,31	200,75	LOS_C	34,42	31,95	0,88
N(4),S(2)	72,31	200,75	LOS_D	43,76	41,08	0,88
N(4),E(3)	72,31	200,75	LOS_D	50,36	47,67	0,89
1	109,09	228,65	LOS_E	74,57	68,35	1,34

Table 24: The VISSIM greenhouse emissions at Municipal Intersection.

Signalization	Emıssıons CO(g/year)	Emıssıons NOX(g/year)	Emıssıons VOC (g/year)	Fuel Consumption(lt)
W(1),S(2)	24,415	4,75	5,658	1,32
W(1),E(3)	43,091	8,384	9,987	2,33
W(1),N(4)	29,024	5,647	6,727	1,57
S(2),W(1)	22,451	4,368	5,203	1,21
S(2),E(3)	8,518	1,657	1,974	0,46
S(2),N(4)	58,383	11,359	13,531	3,16
E(3),W(1)	21,554	4,194	4,995	1,16
E(3),S(2)	20,659	4,02	4,788	1,12
E(3),N(4)	13,753	2,676	3,187	0,74
N(4),W(1)	10,403	2,024	2,411	0,56
N(4),S(2)	39,42	7,67	9,136	2,13
N(4),E(3)	14,727	2,865	3,413	0,80
1	306,391	59,613	71,009	16,57

6.3 The Impact of controlled ‘‘Right Turn’’ Lane at an intersection for Kahramanmaraş

6.3.1 Police Department Intersection

The right turn lanes are extended for each leg, The capacities and saturation flows are observed for this changes in the same time each right turn lane have enhanced the capacities, however, ICU is decreased adjustment factors are changed with new lanes.

Table 25: The impact of dedicated right turn for capacity at Poice Department Intersection.

Situation	**Add right turn**	**Saturation Flow (veh/h)**	**Capacity (veh/h)**	**ICU**
Direction	EBT	4346	1216,88	**76,2%**
	EBR	1360	380,80	
	NBT	3183	732,09	
	NBR	1520	349,60	
	SBT	3158	1136,88	
	SBR	1490	536,40	

Table 26: The results of dedicated right turn at Police Department Intersection.

(Right Turn)	**Queue length(m)**	**Queue Max(m)**	**LOS**	**veh delay.(s)**	**veh Stops.(s)**	**Stops(s)**
W(1),S(2)	218,78	332,27	LOS_A	4,61	0,89	0,25
W(1),E(3)	210,88	427,62	LOS_C	30,18	27,91	1,09
W(1),N(4)	210,88	427,62	LOS_B	19,81	17,71	1,2
S(2),W(1)	83,45	264,57	LOS_D	35,06	31,33	1
S(2),E(3)	50,33	134,66	LOS_C	20,83	2,96	1,5
S(2),N(4)	83,45	264,57	LOS_D	44,07	33,49	0,74
N(4),W(1)	163,88	262,78	LOS_E	56,6	49,36	2,08
N(4),S(2)	92,42	196,46	LOS_C	23,8	9,87	2,79
N(4),E(3)	163,88	262,78	LOS_E	61,77	53,02	2,07
1	136,63	427,62	LOS_D	37,18	29,06	1,4

Table 27: The emissions results of dedicated right at Police Department Intersection

Right Turn	Emıssıons CO (g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (it)
W(1),S(2)	13,347	2,597	3,093	0,72
W(1),E(3)	16,874	3,283	3,911	0,91
W(1),N(4)	6,821	1,327	1,581	0,37
S(2),W(1)	7,054	1,373	1,635	0,38
S(2),E(3)	2,674	0,52	0,62	0,14
S(2),N(4)	48,73	9,481	11,294	2,63
N(4),W(1)	25,841	5,028	5,989	1,40
N(4),S(2)	17,435	3,392	4,041	0,94
N(4),E(3)	26,959	5,245	6,248	1,46
1	165,721	32,243	38,408	8,96

6.3.2 Municipal Intersection

The capacities and saturation Flows are changed in the same time each right turn(RT) lanes have enhanced the capacities, however ICU is decreased adjustment factors are changed with new lanes.

Table 28: The capacity variations at the Municipal Intersection.

Situation	LT	Saturation Flow Rate(veh/h)	Capacity of Intersection	ICU
Direction	EBT	3607	541	70,8%
	EBL	842	126	
	WBT	3714	557	
	WBL	382	57	
	NBT	3820	955	
	NBL	1550	388	
	SBT	4833	1208	
	SBL	715	179	

Table 29:VISSIM outputs for dedicated right turn at Municipal Intersection

RT	Q.length(m)	LOS	Control Delay (s)	Veh Stops(s).	Stops(s).
N(4),W(1)	105,97	A	5,41	1,47	0,67
N(4),S(2)	147,24	D	35,34	32,6	0,96
N(4),E(3)	147,24	C	33,02	30,75	0,89
W(1),S(2)	144,83	C	24,94	9,4	3,5
W(1),E(3)	57,68	F	102,57	94,52	2,23
W(1),N(4)	144,83	F	106,68	91,85	2,88
E(3),W(1)	140,13	F	82,44	77,35	1,72
E(3),S(2)	140,13	F	89	77,23	1,8
E(3),N(4)	94,36	C	24,73	6,86	2,86
S(2),W(1)	53,38	F	98,26	93,26	2,29
S(2),E(3)	74,74	A	4,42	0,46	0,22
S(2),N(4)	74,74	F	97,11	90,12	1,96
1	102,29	E	64,39	56,06	1,93

Table 30: The emissions results for dedicated right turn at Municipal Intersection

Right Turn	Emıssıons CO (g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (lt/veh:year)
N(4),W(1)	7,441	1,448	1,724	0,95
N(4),S(2)	31,083	6,048	7,204	2,78
N(4),E(3)	11,986	2,332	2,778	2,06
W(1),S(2)	17,634	3,431	4,087	0,85
W(1),E(3)	51,479	10,016	11,931	0,42
W(1),N(4)	38,048	7,403	8,818	3,27
E(3),W(1)	36,895	7,178	8,551	2,00
E(3),S(2)	21,63	4,208	5,013	1,17
E(3),N(4)	15,231	2,963	3,53	0,82
S(2),W(1)	15,739	3,062	3,648	0,40
S(2),E(3)	7,794	1,516	1,806	1,68
S(2),N(4)	60,375	11,747	13,993	0,65
1	315,316	61,349	73,077	17,05

6.1 The Impact of dedicated ‘‘Left Turn’’ Lane at an intersection for Kahramanmaraş

6.1.1 Police Department Intersection

The utmost lanes are dedicated left turn lane that is almost 80 m.The capacities and saturation flows are changed in the same time each Left turn pockets have enhanced the capacities, however ICU is decreased adjustment factors are changed with new lanes.

The capacity is computed by formula 3 and than The dedicated left turn is impressed the capacity of ithe intersecton,these changes of the capacity of the Police Department intersection are indicated by the table 32, The table 33-34 demostrate other changes after the intersection is dedicated left turn

Table 31:The capacity for dedicated left turn at Police Department Intersection

Situation	PLT	Saturation Flow Rate (veh/h)	Capacity of Intersection(veh/h)	ICU
Direction	EBT	4123	1237	70,8%
	EBL	1520	456	
	NBT	4843	823	
	NBL	338	57	
	SBT	4751	1805	
	SBL	135	51	

Table 32:VISSIM outputs for LT Circumstance at Police Department Intersection

LT	Queue length(m)	LOS	Control Delay(s)	Veh Stops(s)	Stops(s)
W(1),S(2)	218,03	B	16,55	6,9	1,91
W(1),E(3)	197,8	C	26,48	17,91	2,25
W(1),N(4)	207,91	C	24,89	2,42	1
S(2),W(1)	36,56	D	37,99	35,4	2
S(2),E(3)	65,79	A	9,08	0,44	0,4
S(2),N(4)	95,02	D	49,3	43,38	0,88
N(4),W(1)	164,5	D	46,68	29,6	4,57
N(4),S(2)	119,75	D	41,01	12,34	5,06
N(4),E(3)	75	B	17,15	5,86	2,21
1	131,15	C	33,57	19,5	2,8

Table 33: The Emissions for LT Circumstance at Police Department Intersection

4)Left turn	Emıssıons CO (g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (it)
W(1),S(2)	15,46	3,01	3,58	0,84
W(1),E(3)	21,13	4,11	4,89	1,14
W(1),N(4)	5,15	1,00	1,19	0,28
S(2),W(1)	1,91	0,37	0,44	0,10
S(2),E(3)	7,35	1,43	1,70	0,40
S(2),N(4)	34,20	6,65	7,93	1,85
N(4),W(1)	42,84	8,34	9,93	2,32
N(4),S(2)	31,82	6,19	7,37	1,72
N(4),E(3)	19,25	3,75	4,46	1,04
1	179,11	34,85	41,51	9,68

6.1.2 Municipal Intersection

The new left turn lanes are dedicated according to pass a number of the utmost vehicles for turn left , their lengths are almost 80 m.The capacities and saturation flows are changed in the same time each lane , the dedicated turn left have enhanced the capacities, however ICU is decreased adjustment factors are changed with new lanes.

The capacity is computed by formula 3 and than The dedicated left turn(LT) is impressed the capacity of ithe intersecton,these changes of the capacity of the Municipal intersection are indicated by the table 35, The table 36-37 demostrate other changes after the intersection is dedicated left turn.

Table 34: The capacity variation for dedicated left turn at Municipal Intersection.

Situation	**LT**	**Saturation Flow (h/veh)**	**Capacity (h/veh)**	**ICU**
|	EBT	3607	541	**70,8%**
	EBL	842	126	
	WBT	3714	557	
	WBL	382	57	
	NBT	3820	955	
	NBL	1550	388	
	SBT	4833	1208	
	SBL	715	179	

Table 35: VISSIM for dedicateted LT circumstance at Municipal Intersection

4)Left turn	**Queue length(m)**	**LOS**	**Control delay(s)**	**Veh.Stops(s)**	**Stops(s)**
W(1),S(2)	117,06	F	101,09	82	8,33
W(1),E(3)	148,03	D	37,03	32,66	2
W(1),N(4)	146,44	F	127,86	108,31	4,15
S(2),W(1)	61,38	F	117,63	95,27	3,2
S(2),E(3)	114,58	E	77,64	57,88	3,5
S(2),N(4)	166,71	F	101,44	90,21	2,89
E(3),W(1)	123,41	D	39,41	31,51	1,88
E(3),S(2)	69,53	E	60,78	46,57	1,8
E(3),N(4)	75,78	B	11,13	4,36	3
N(4),W(1)	49,35	B	17,96	16,58	0,67
N(4),S(2)	79,21	D	41,86	38,12	1,12
N(4),E(3)	0	A			
1	95,96	E	65,74	56,06	2,44

Table 36 The emissions for dedicated LT circumstance at Municipal Intersection

4)Left turn	**Emıssıons CO (g/year)**	**Emıssıons NOX (g/year)**	**Emıssıons VOC (g/year)**	**Fuel Consumption(lt)**
W(1),S(2)	6,727	1,309	1,559	0,36
W(1),E(3)	11,581	2,253	2,684	0,63
W(1),N(4)	34,399	6,693	7,972	1,86
S(2),W(1)	12,47	2,426	2,89	0,67
S(2),E(3)	4,136	0,805	0,959	0,22
S(2),N(4)	82,168	15,987	19,043	4,45
E(3),W(1)	25,14	4,891	5,826	1,36
E(3),S(2)	18,769	3,652	4,35	1,02
E(3),N(4)	14,582	2,837	3,379	0,79
N(4),W(1)	2,972	0,578	0,689	0,16
N(4),S(2)	50,67	9,859	11,743	2,74
N(4),E(3)	0	0	0	0,00
1	263,619	51,291	61,096	14,25

6.2 The Impact of Prohibiting ‘‘Left Turn’’ at intersection in Kahramanmaraş

6.2.1 Police Department Intersection

The left turn is prohibiting for each direction and to observed Capacities and saturation Flows alterations.

The capacity is computed by formula 3 and then The Prohibiting left turn is impressed the capacity of the intersection,these changes of the capacity of the Police Department Intersection. are indicated by the table 38, The table 39-40 demonstrate other changes after the intersection is dedicated left turn

Table 37: Capacity of PLT Alternative at Police Department Intersection

Police Department Intersection				
Situation	**PLT**	**Saturation Flow**	**Capacity of Intersection**	**ICU**
Direction	EBT	4535	1497	**65,1%**
	NBT	4751	1140	
	SBT	4756	1522	

Table 38: VISSIM outputs for PLT alternative at Police Department Intersection

5) PLT	**Queue length(m)**	**LOS(ALL)**	**Delay(s)**	**Veh Stops(s)**	**Stops(s)**
W(1),S(2)	221,07	LOS_B	14,81	4,63	1,17
W(1),E(3)	195,86	LOS_C	34,19	23,55	1
S(2),W(1)		LOS_C	20,09	15,4	3
S(2),N(4)	49,61	LOS_E	60,65	49,99	1
N(4),S(2)	96,83	LOS_D	43,94	37,3	1,07
N(4), E(3)		LOS_E	66,01	57,3	1,82
1		LOS_D	48,18	38,84	1,34

Table 39: Emissions for PLT Alternative at Police Department Intersection

PLT	Emissions CO(g/year)	Emissions NOX(g/year)	Emissions VOC(g/year)	Fuel Consumption (lt)
W(1),S(2)	21,359	4,156	4,95	1,16
W(1),E(3)	28,841	5,611	6,684	1,56
S(2),W(1)	1,302	0,253	0,302	0,07
S(2),N(4)	38,736	7,537	8,977	2,09
N(4),S(2)	20,652	4,018	4,786	1,12
N(4),E(3)	73,815	14,362	17,107	3,99
1	184,716	35,939	42,81	9,99

6.2.2 Municipal Intersection

The left turn is prohibiting for each direction and to observed Capacities and saturation Flows alterations.

The capacity is computed by formula 3 and then The Prohibiting left turn (PLT) is impressed the capacity of the intersecton, these changes of the capacity of the Municipal Intersection. are indicated by the table 38, The table 39-40 demonstrate other changes after the intersection is dedicated left turn

Table 40:Capacity of PLT Alternative at Municipal Intersection

	Municipal Intersection			
Situation	**PLT**	**Saturation Flow Rate**	**Capacity of Intersection**	**ICU**
	EBT	3750	563	**52,1%**
	WBT	3928	589	
	NBT	3820	955	
	SBT	3782	946	

Table 41: VISSIM outputs for PLT Alternative at Municipal Intersection

PLT	Queue length(M)	LOS	Delay(S).	Stops(S).	Stops(S/veh).
W(1),S(2)	112,49	D	37,02	29,81	1,29
W(1),E(3)	147,22	E	78,44	70,42	1,59
S(2), E(3)		D	52,82	40,78	1,67
S(2),N(4)		F	92,28	84,04	1,95
E(3),W(1)	112,49	D	54,14	47,62	1,07
E(3),N(4)	164,62	A	3,61	0,7	0,23
N(4),W(1)	69,98	A			
N(4),S(2)		D	39,9	36,89	0,97
1	56,96	E	53,52	47,34	1,25

Table 42: Emissions for PLT Alternative at Municipal Intersection

PLT	Emıssıons CO (g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (lt)
W(1),S(2)	43,006	8,367	9,967	2,32
W(1),E(3)	65,178	12,681	15,106	3,52
S(2),E(3)	5,099	0,992	1,182	0,28
S(2),N(4)	88,548	17,228	20,522	4,79
E(3),W(1)	45,49	8,851	10,543	2,46
E(3),N(4)	22,699	4,416	5,261	1,23
N(4),W(1)	0	0	0	0,00
N(4),S(2)	54,09	10,524	12,536	2,93
1	324,114	63,061	75,117	17,53

CONCLISONS – RESULTS

The main purpose of this study is to examine the alteration of capacities when solving the problems of the three junctions in Kahramanmaras. As the stated in the above sections, there are four arrangements for signalized intersection that are for Police Department ve Municipal Intersection;

Signal optimization,

The controlled right turn lane,

The dedicated left turn lane,

The prohibiting left turn.

The arrangements are analyzed by VISSIM 9. The table 44-46 is indicated the results of the whole circumstances for the studied signalized intersections.the table 48 is indicated the results of the unsignalized intersection in that is made a geometrical alteration.that has converted a roundabout.

Singal optimization is improved control delay and stops interval at the intersection, the control delay times and stops are changed approximately %10 -%20 at studied intersections.The capacity percentage of the change is approximately %10 -% 13 between. The dedicated lane for a right turn and the left turn have changed the increases of the capacity change to be favorable for the same directions, new lanes are supplemented to increase the capacity of the junction.and then the average of the capacity is changed 38%-55% between at the studied intersections.The change is not the same proportion because of other factors like the number of the pedestrian of crossing over etc.The capacity is affected by movements, geometric design, vehicles composition, the number of vehicles and location. hence each factor is examined separately to improve the capacity.This study is observed vehicle movements that are chosen the way.The prohibiting left turn that is prevented the movements, the dedicated right and left turn lane is improved the movements.

The prohibiting left turn is reached the capacity at studied the intersection in this study.The rate of the change is approximately %45-%54 on the capacity. Capacity change rate that is 172 % for Geometrical Design on Dental intersection.The signal optimization is changed rate of 2-10% on studied signalized intersection. The capacity is affected rates of 44-50 % on studied intersection. If the intersection is dedicaed left turn capacity is capacity changed rates of 17-54 % .

The PLT is ensured cleared profit for the intersection, the arrangement is advanced for Intersection Capacity Utilization (ICU) that is changed %22,3 – 24,7 at the studied intersection.

The dedicated lane for right turn is effective for the studied intersections but this arrangement is not as effective as the dedicated lane for the left turn. The variability of the left turn movement has affected the capacity. The change of the capacity is affected the traffic condition at the intersection, if the capacity is changed the positive, the positive changes are supplied for traffic condition at the intersection.The level of the service, Control Delay, Stops, queue length are affected affirmative. These entire results are affected by the capacity.

On this study, there is a unsignalized intersection that is the Dental Intersection. The geometrical design of the dental intersection is altered. End of the alteration is varied %50 on the average at the intersection. The geometrical alteration is crucial for the capacity at a unsignalized intersection. The capacity is affected by other factors that are vehicles composition, the number of the vehicles.and conflict areas.

This study was carried out according to the data of the 2016 counting. During the study, it was proposed to arrange on the municipal intersection and it was proposed to add a right turn lane to the south and east directions according to the physical conditions of the intersection and it was accepted by the municipality. And the municipal intersection was selected as the control point and the results were compared and the results were compared after the counting. The results are also compared in tables 49-50.

7.1 Dental Hospital Intersection

Table 43: The results for Dental Intrsection Designed as Roundabout

	Direction	Capacity(veh/h)	CapacityChanges(%)	LOS	ControlDelay(s/veh)	Stops(s)	ICU
ExistingSituation	EBT	128					
	NBT	149		C	15	8,45	97,90%
	SBT	174					
Design Situation	EBT	401					
	NBT	269	90%	A	3	1,57	%75.8
	SBT	555					

Table 44 : The decrease in Emissions at Dental Intersection

en ta l Intersect ion	Greenhouse emission	Emıssıons CO (g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (lt/veh:yeaar)
	First Situation	189,02	3,678	43,81	10,24
	The last situation	89,02	1,732	20,63	4,82

7.2 Police Department Intersection

Table 45: The results for the geometric deisgn alternatives at Police Department Intersection .

	Direction	SaturationFlow,veh/h	Capacity(veh/h)	CapacityChanges(%)	LOS	ControlDelay(s)	Stops(s)	Q.Length(m)	ICU
Existing Situation	EBT	4124	1155		E	55,4	47,99	146,68	89,80%
	NBT	3151	599						
SO	EBT	4124	1237	9%	E	45,21	38,85	147	89,80%
	NBT	3151	725						
	SBT	3129	1126						
RT	EBT	4346	1216,88	50%	D	37,18	29,06	136,65	76,20%
	NBT	3183	732,09						
	SBT	3158	1136,88						
	EBR	1360	380,8						
	NBR	1520	349,6						
	SBR	1490	536,4						
PLT	EBT	4535	1497	45%	D	48,18	38,84	146,5	65,10%
	NBT	4751	1140						
	SBT	4756	1522						
LT	EBT	4123	1237	54%	C	33,57	19,5	131,15	70,80%
	NBT	4843	823						
	SBT	4751	1805						
	EBL	1520	456						
	NBL	338	57						
	SBL	135	51						

Table 46 : The decrease in Emissions at Police Department Intersection

Police Department Intersection	Greenhouse emission	Emıssıons CO(g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (lt/veh:year)
	First Situation	197,77	3,848	45,83	10,71
	SO	201,97	3,930	46,81	10,94
	LT	179,11	3,485	41,51	9,70
	PLT	184,72	3,594	42,81	10,00

7.3 Municipal Intersection

Suggestions were presented to administor when a thesis was written at the Municipal intersection. These innovations are dedicated right turn lane for most congested lane, and the signal optimization at this junction. After these arrangements, the counts were renewed at the intersection.where the capacity changes observed. The traffic counts are done again. All rsults are demostrtd in table 49-50 and the diffirence are between simulation results and new design results in table 51.After the traffic counts obtained from tehe new goemetric design it has been observed that the capacity of the Municipal Intersection is changed %17 and the LOS is obtained as E.

The intersection was simulated with the new traffic counts. The results of the new version of intersection were compared with those of the results of simulation at 2016 counting.

Table 47: The results for geometric Design alternatives at Municipal Intersection

MunicipalIntersection	Direction	(veh/h)FlowSaturation	(veh/h)Capacity	(%)ChangesCapacity	LOS	Delay(s)Control	(s)Stops	(m)Length.Q	ICU
ExistingSituaion	EBT	3158	474		F	80,6	73,28	109,11	74,30%
	NBT	3830	996						
	SBT	3639	910						
	WBT	2610	392						
SO	EBT	3158	537						
	NBT	3830	958	3%	E	74,57	68,35	109,09	74,30%
	SBT	3639	910						
	WBT	2610	444						
RT	EBT	3649	620						
	NBT	3801	950	44%	E	64	56	102	71%
	SBT	3823	956						
	WBT	3008	511						
	EBR	842	143						
	WBR	903	153						
	NBR	1395	349						
	SBR	1292	323						
PLT	EBT	3750	750	38%	E	53,52	47,34	98,49	52,10%
	WBT	3928	786						
	NBT	3820	1146						
	SBT	3782	1135						
LT	EBT	3607	541						
	NBT	3820	955	45%	E	65,74	56,06	95,96	70,80%
	SBT	4833	1208						
	WBT	3714	557						
	EBL	842	126						
	WBL	382	57						
	NBL	1550	388						
	SBL	715	179						

Table 48: Emissions reductions at Municipal Intersection

Intersection	FirstGreenhouse Situation emission	Emıssıons CO(g/year)	Emıssıons NOX (g/year)	Emıssıons VOC (g/year)	Fuel Consumption (lt/veh:year)
Municipal		319,99	62,26	74,16	17,33
	SO	306,39	59,61	71,01	16,59
	RT	315,32	61,35	73,08	17,08
	LT	263,62	51,29	61,10	14,27
	PLT	324,11	63,06	75,12	17,55

Table 49: The results of Municipal Intersection with the new design for RT Lane

MunicipalIntersection	Direction	SaturationFlow(veh/h)	Capacity(veh/h)	Capacity Changes(%)	LOS	Control Delay(s)	Stops(s)	Q Length(m)	ICU
Simulation Results For RT Lane	EBT	3205	544,85	23%	E	62,55	62,55	93,28	67,40%
	NBT	2986	746,5						
	SBT	4843	1210,75						
	WBT	2669	453,73						
	WBR	1395	237,15						
	NBR	903	225,75						
Results For Rt Lane	EBT	2481	421,77						
	NBT	2984	746	17%	E	65,26	65,26	88,21	75,10%
	SBT	3464	866						
	WBT	2729	463,93						
	WBR	1395	237,15						
	NBR	903	225,75						

Table 50: Emissions reductions at Municipal Intersection after counting

Municipal Intersection	Greenhouse Emission	Emissions CO(g/year)	Emissions NOX (g/year)	Emissions VOC (g/year)	Fuel Consumption (lt)
	New Design Results For RT Lane	260,24	50,63	60,31	14,09
	The Sımulatıon Results For RT Lane	243,28	47,33	56,38	13,17

The all tables are arranged graphs that are shown below.the directions are given numbers which are demostrated on figure 13.

Table 51: The Diffirence of alternatives

Municipal Intersection	**Capacity Changes (%)**	**LOS**	**Control Delay(s)**	**Stops (s)**	**Q.Length (m)**
The Sımulatıon Results For RT Lane					
New Design Results For Rt Lane	15%	E	95%		

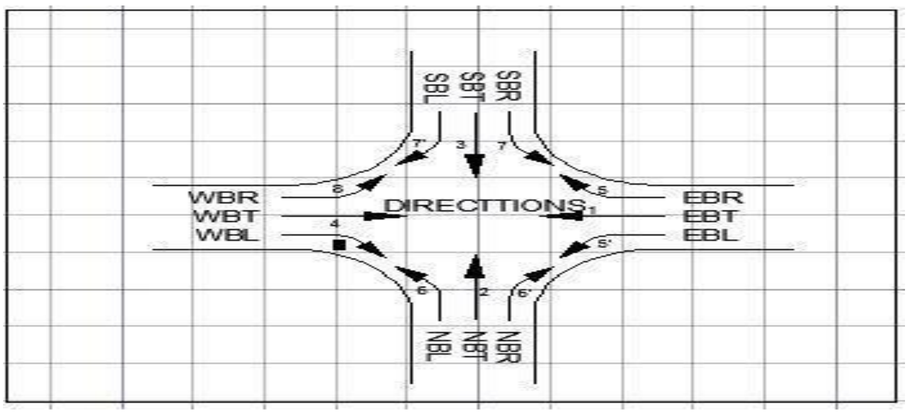
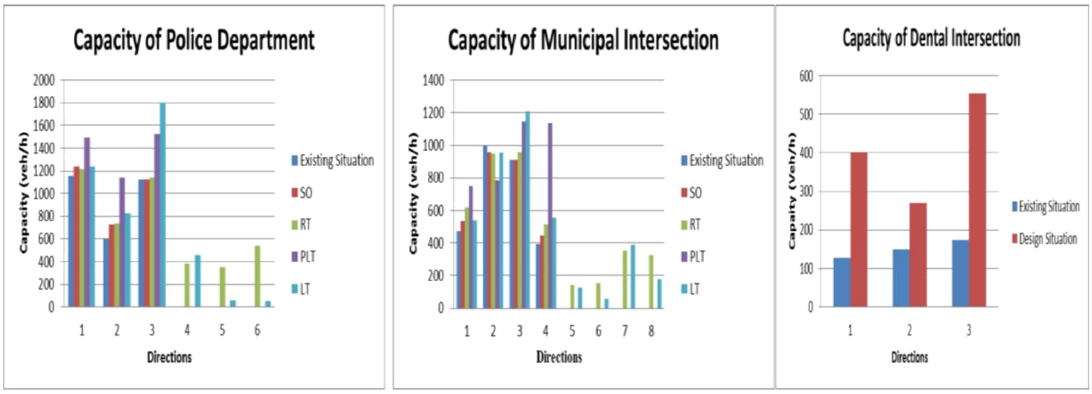
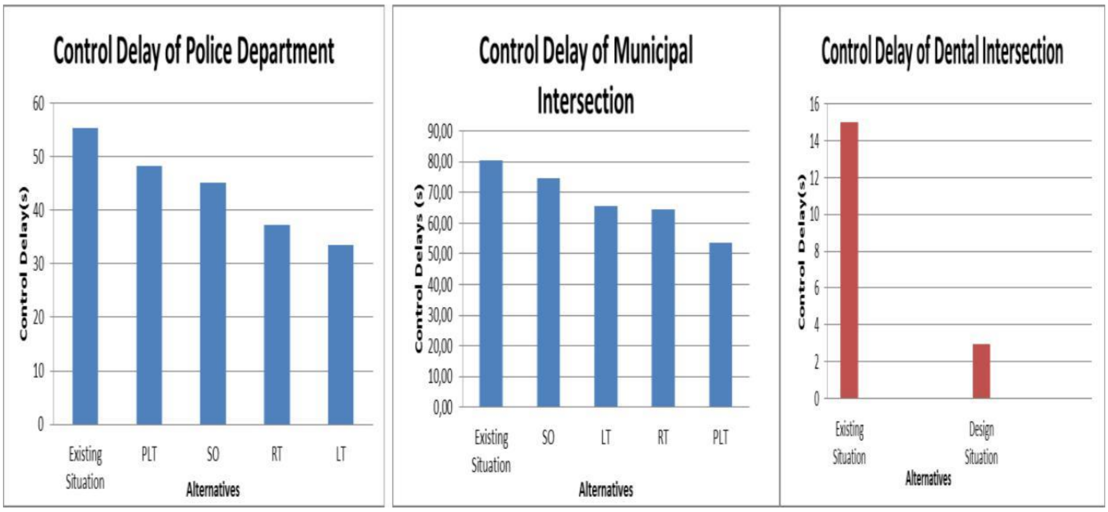


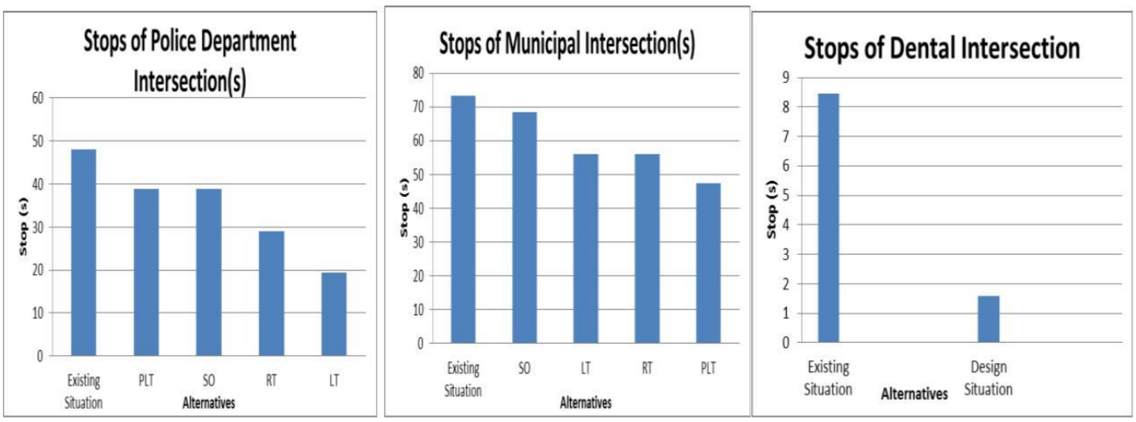
Figure 14: Numbering of directions



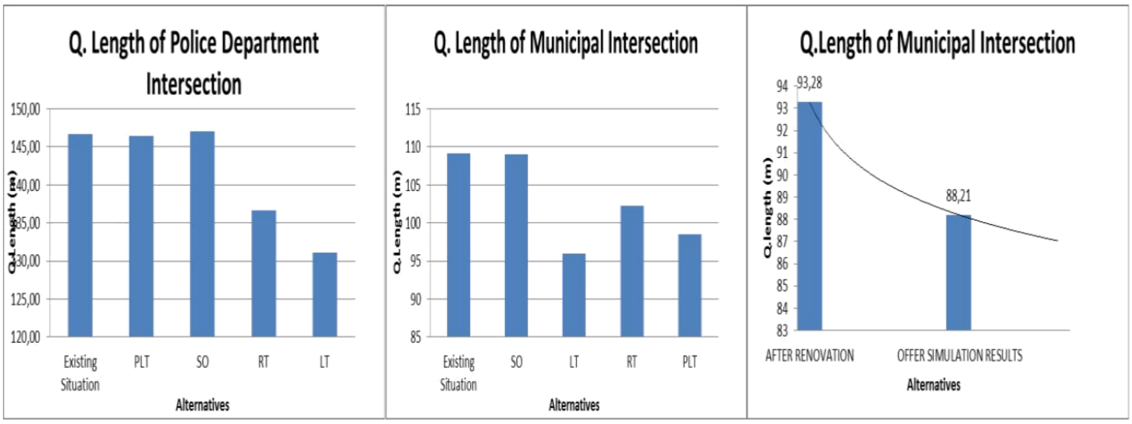
Graph 1 : The Capacity amounts are for each alternatives on intersections.



Graph 2: The Control Delay amounts for each alternatives on intersections

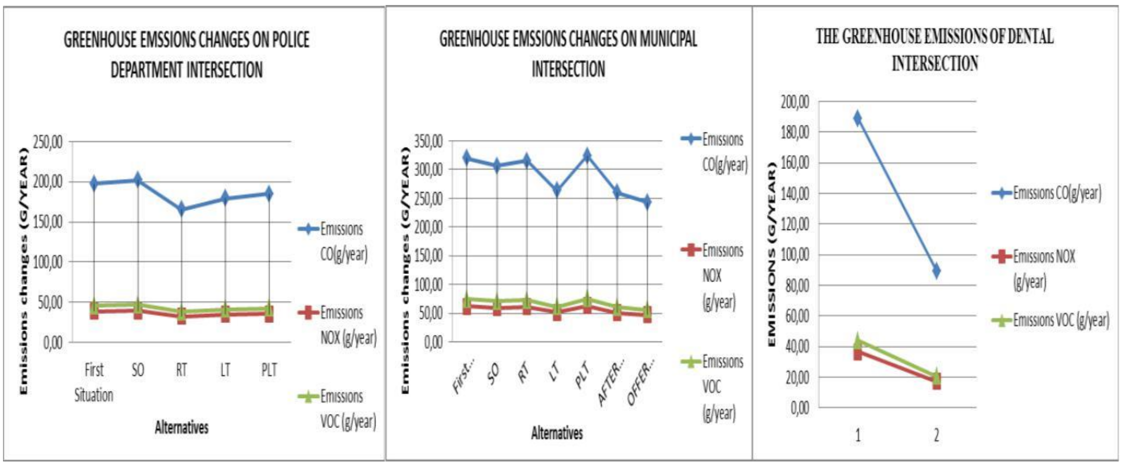


Graph 3: The graph of the stops are for each alternatives on intersections

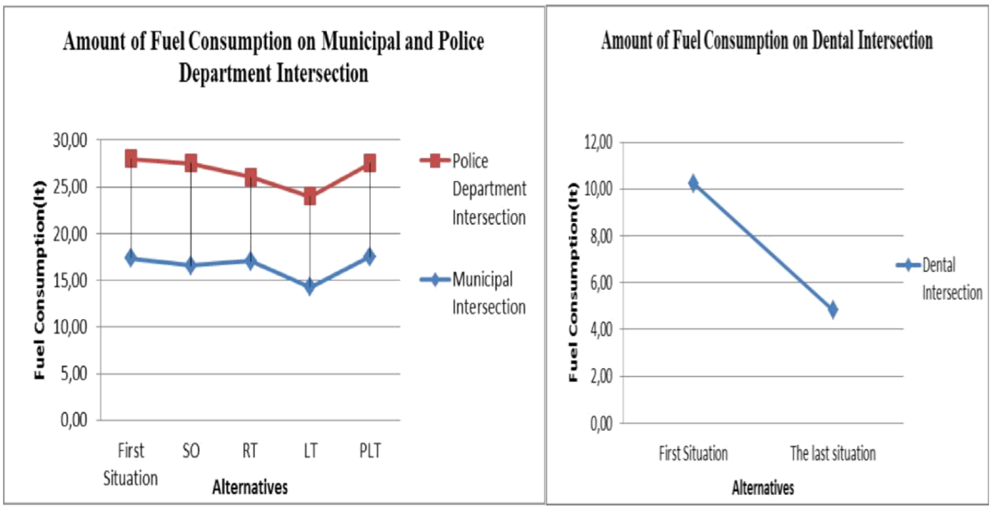


Graph 4: The queue lengths are for each alternatives on intersections

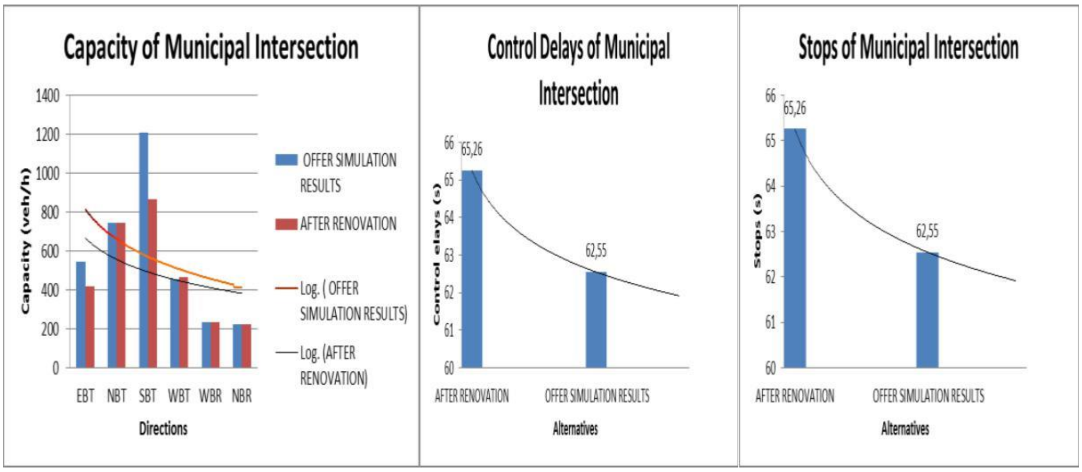
The urban transportation is crucial for the cities, hence the traffic condition might be arranged. The intersection is an important part of road transportation. So that in the world, many researchers are engaged in scientific studies about the intersection. Problems of the transportation do not only affect people, they can not be ignored by environmental influences. According to 2000 data by Tuik in Turkey, The environmental of the effect of the transportation is computed 17 %. This result is involved in the entire transportation types.The road transportation affects this rate of %95 at Tuik 2010.On the table 45-47-49 are indicated to compare indirect greenhouse emissions at the intersection. The max. alteration of the emissions is to become the proportion of the alteration over the % 50 at the Dental Intersection. This study will be lead new comprehensive studies in Turkey. they will be innovative and progressive studies.



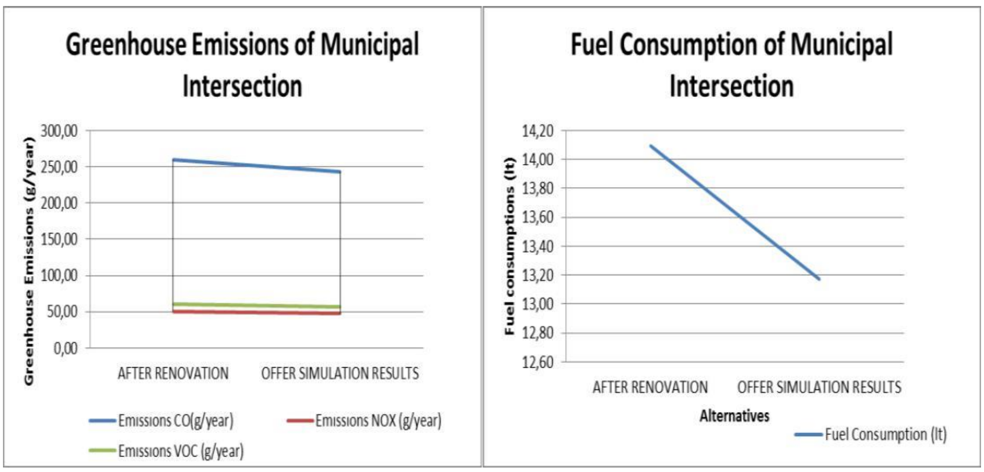
Graph 5: The Greenhouse Emissions for each alternatives on intersections



Graph 6: The Fuel Consumption for each alternatives on intersections



Graph 7: The vissim outputs for each alternatives on intersections



Graph 8: The Fuel Consumption and greenhouse emissions for each alternatives on intersections

APPENDIX

Appendix 1: The full counting list of Municipal Intersection of the first direction

SHOOTING TIME		**AUTOMOBILE**				**TRUCK, MIDIBUS**				**TAXİ**				**SHUTTLE BUS**				**PUBLIC TRANSPORT**				**SHUTTLE BUS, TRUCK,**				**VOLUMES OF EACH STREAM**				***TOTAL***
		1-3	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		***1. STREAM***
07:00	07:15	17	15	26		4	3	8										1	11	6		1	1			**23**	**30**	**40**		**93**
07:15	07:30	20	18	32		5	4	9										2	10	5		2	1	1		**29**	**33**	**47**		**109**
07:30	07:45	39	17	22		16	3	3										4	7	4		2	1	3		**61**	**28**	**32**		**121**
07:45	08:00	37	17	38		8	4	11										2	7	4		2	3			**49**	**31**	**53**		**133**
08:00	08:15	42	13	37		16	6	5										2	8	3		1	2	1		**61**	**29**	**46**		**136**
08:15	08:30	39	8	39		15	4	4		2								3	10	3			2			**59**	**24**	**46**		**129**
08:30	08:45	37	7	35		14	5	3		1								2	9	2		1	1	1		**55**	**22**	**41**		**118**
08:45	09:00	32	8	30														3	8	2		2	1			**37**	**17**	**32**		**86**
12:00	12:15	33	23	36		1	2	3				2						2	10	3		4				**40**	**35**	**44**		**119**
12:15	12:30	31	22	32		3	4	2		1	1							3	8	2		3	1	1		**41**	**36**	**37**		**114**
12:30	12:45	27	15	28		4	2	3		1								2	7	2		2		2		**36**	**24**	**35**		**95**
12:45	13:00	21	8	23		3	3	2										2	6	3		2		1		**28**	**17**	**29**		**74**
16:30	16:45	34	12	69		6	4	11			1							10	13	7			2	1		**50**	**32**	**88**		**170**
16:45	17:00	40	14	72		7	5	13		1								12	14	8		1	1			**61**	**34**	**93**		**188**
17:00	17:15	42	16	80		6	4	10		1								8	12	5		1				**58**	**32**	**95**		**185**
17:15	17:30	48	20	86		5	3	8										7	10	4		1	1			**61**	**34**	**98**		**193**
17:30	17:45	40	18	80		4	2	5										6	8	5		1	2	1		**51**	**30**	**91**		**172**
17:45	18:00	36	14	72		5	3	4										7	7	4			1			**48**	**25**	**80**		**153**
18:00	18:15	30	8	60		3	4	2										5	6	4		1		1		**39**	**18**	**67**		**124**
18:15	18:30	27	7	45		4	3	1										4	7	3		1	1	1		**36**	**18**	**50**		**104**

Appendix 2: The full counting list of Municipal Intersection of the second direction

		AUTOMOBILE			TRUCK, MIDIBUS			TAXİ			SHUTTLE BUS			PUBLIC TRANSPORT			SHUTTLE BUS, TRUCK,			VOLUME OF EACH STREAM			*TOTAL*
		2-4	**2-3**	**2-1**	**2-4**	**2-3**	**2-1**	**2-4**	**2-3**	**2-1**	**2-4**	**2-3**	**2-1**	**2-4**	**2-3**	**2-1**	**2-4**	**2-3**	**2-1**	**2-4**	**2-3**	**2-1**		***2. STREAM***
07:00	07:15	43	9	4	17	1								2						**62**	**10**	**4**		**76**
07:15	07:30	50	8	11	15															**65**	**8**	**11**		**84**
07:30	07:45	90	4	25	33												2			**125**	**4**	**25**		**154**
07:45	08:00	77		20	10	1														**87**	**1**	**20**		**108**
08:00	08:15	87	4	12	13									2						**102**	**4**	**12**		**118**
08:15	08:30	91	5	11	14									1						**106**	**5**	**11**		**122**
08:30	08:45	88	4	20	15															**103**	**4**	**20**		**127**
08:45	09:00	78	3	15	14															**92**	**3**	**15**		**110**
12:00	12:15	103	5	12	18	1	1													**121**	**6**	**13**		**140**
12:15	12:30	95	4	15	14	1	2													**109**	**5**	**17**		**131**
12:30	12:45	80	2	10	9		1													**89**	**2**	**11**		**102**
12:45	13:00	72	4	21	12	1	2													**84**	**5**	**23**		**112**
16:30	16:45	74	6	14	19	1														**93**	**7**	**14**		**114**
16:45	17:00	80	5	15	20	2														**100**	**7**	**15**		**122**
17:00	17:15	84	6	18	18	1														**102**	**7**	**18**		**127**
17:15	17:30	85	5	19	19	2														**104**	**7**	**19**		**130**
17:30	17:45	90	7	15	20	2														**110**	**9**	**15**		**134**
17:45	18:00	88	5	19	14	1														**102**	**6**	**19**		**127**
18:00	18:15	70	3	14	14		2													**84**	**3**	**16**		**103**
18:15	18:30	73	2	12	12		1													**85**	**2**	**13**		**100**

Appendix 3: The full counting list of Municipal Intersection of the third direction

SHOOTING TIME		**AUTOMOBILE**			**TRUCK, MIDIBUS**			**TAXİ**			**PUBLIC TRANSPORT**			**SHUTTLE BUS, TRUCK,**			**VOLUME OF EACH STREAM**			***TOTAL***
		3-1	**3-2**	**3-4**	**3-1**	**3-2**	**3-4**	**3-1**	**3-2**	**3-4**	**3-1**	**3-2**	**3-4**	**3-1**	**3-2**	**3-4**	**3-1**	**3-2**	**3-4**	***3. STREAM***
07:00	07:15	13	6	2	1	4	2	1					7	1			**16**	**10**	**11**	**37**
07:15	07:30	14	9	3	2	6	4					8					**16**	**23**	**7**	**46**
07:30	07:45	17	15	13	2	4	6			1			19				**19**	**19**	**39**	**77**
07:45	08:00	18	16	12	4	6	7						20				**22**	**22**	**39**	**83**
08:00	08:15	22	18	15	4	3	6						20				**26**	**21**	**41**	**88**
08:15	08:30	19	16	14	3	4	5						18				**22**	**20**	**37**	**79**
08:30	08:45	16	13	11	2	3	2						18				**18**	**16**	**31**	**65**
08:45	09:00	11	9	9	3	2	3						17				**14**	**11**	**29**	**54**
12:00	12:15	22	14	18	2	3	4						20				**24**	**17**	**42**	**83**
12:15	12:30	21	16	19	3	4	3						15				**24**	**20**	**37**	**81**
12:30	12:45	24	19	19	4	3	2						16				**28**	**22**	**37**	**87**
12:45	13:00	26	19	21	5	4	3										**31**	**23**	**24**	**78**
16:30	16:45	29	23	21	6	4	5						9				**35**	**27**	**35**	**97**
16:45	17:00	32	22	23	5	3	4					8					**37**	**33**	**27**	**97**
17:00	17:15	33	22	22	6	5	5						7				**39**	**27**	**34**	**100**
17:15	17:30	35	24	21	5	4	3					8					**40**	**36**	**24**	**100**
17:30	17:45	34	26	22	3	6	5						10				**37**	**32**	**37**	**106**
17:45	18:00	32	25	21	4	6	6						9				**36**	**31**	**36**	**103**
18:00	18:15	29	22	19	4	3	5						9				**33**	**25**	**33**	**91**
18:15	18:30	24	18	14	3	5	5					7					**27**	**30**	**19**	**76**

Appendix 4: The full counting list of Municipal Intersection of the fourth direction

SHOOTING TIME		AUTOMOBILE				LORRY,PANELVAN, MIDIBUS				PUBLIC TRANSPORT				SHUTTLE BUS, TRUCK				VOLUME OF EACH STREAM				*TOTAL*
		4-2	**4-1**	**4-3**		**4-2**	**4-1**	**4-3**		**4-2**	**4-1**	**4-5**		**4-2**	**4-1**	**4-3**		**4-2**	**4-1**	**4-3**		***4.STREAM***
07:00	07:15	19	1			12				14								**45**	**1**	**0**		**46**
07:15	07:30	24	4			11	2			12								**47**	**6**	**0**		**53**
07:30	07:45	30	3			12	1			13								**55**	**4**	**0**		**59**
07:45	08:00	26	4			8				10								**44**	**4**	**0**		**48**
08:00	08:15	42	2			5				14								**61**	**2**	**0**		**63**
08:15	08:30	39	2			6				12								**57**	**2**	**0**		**59**
08:30	08:45	36	4			4	2			11								**51**	**6**	**0**		**57**
08:45	09:00	33	8			3	1			10								**46**	**9**	**0**		**55**
12:00	12:15	41	8			4				11								**56**	**8**	**0**		**64**
12:15	12:30	33	6			6				10								**50**	**6**	**0**		**56**
12:30	12:45	27	4			6				9								**44**	**4**	**0**		**48**
12:45	13:00	29	2			8				8								**46**	**2**	**0**		**48**
16:30	16:45	57	6			20				6								**83**	**0**	**0**		**83**
16:45	17:00	62	10			24				8								**94**	**10**	**0**		**104**
17:00	17:15	65	4			19				10								**94**	**4**	**0**		**98**
17:15	17:30	63	3			18				9								**90**	**3**	**0**		**93**
17:30	17:45	60	3			17				12								**89**	**3**	**0**		**92**
17:45	18:00	61	4			16				11								**88**	**4**	**0**		**92**
18:00	18:15	66	4			15				14								**95**	**4**	**0**		**99**
18:15	18:30	67	3			14				11								**92**	**3**	**0**		**95**

Appendix 5: The full counting list of Police Department Intersection of the first stream

SHOOTING TIME		**AUTOMOBILE**				**TRUCK, MIDIBUS**				**TAXİ**				**SHUTTLE BUS**				**PUBLIC TRANSPORT**				**SHUTTLE BUS, TRUCK,**				**VOLUME OF EACH STREAM**				***TOTAL***
		1-3	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		**1-3**	**1-2**	**1-4**		***1.STREAM***
07:00	07:15	87	34	8		40	13	5		2								20	1	2		4				**153**	**48**	**15**		**216**
07:15	07:30	99	57	10		44	49											34	3	1		4	5			**181**	**114**	**11**		**306**
07:30	07:45	106	58	17		42	52	2		2	1							34	4	1		5	6			**189**	**121**	**20**		**330**
07:45	08:00	112	60	18		47	41	3		1		1						32	3	1		4	5			**196**	**109**	**23**		**328**
08:00	08:15	138	88	24		43	30	4			1	1			1			36	1	2		3	4			**220**	**125**	**31**		**376**
08:15	08:30	142	104	21		38	32	5		1	2	1			1			40	2	2		4	3			**225**	**144**	**29**		**398**
08:30	08:45	103	100	35		30	23	4			1				1			31	4	1		1	2			**165**	**131**	**40**		**336**
08:45	09:00	107	124	36		26	21	3		1								25	3	1		2	1			**161**	**149**	**40**		**350**
12:00	12:15	93	65	45		16	6	4				1						24	3	3		1	1			**134**	**75**	**53**		**262**
12:15	12:30	102	64	48		14	8	3		1		1						18	4	3		2	1			**137**	**77**	**55**		**269**
12:30	12:45	48	44	36		8	6	6				1		1				20	2	2		2				**79**	**52**	**45**		**176**
12:45	13:00	42	38	32		7	5	4		1		1		1				16	2	1		1	1			**68**	**46**	**38**		**152**
16:30	16:45	109	80	35		28	19	6		1								29	1	2		1	1	1		**168**	**101**	**44**		**313**
16:45	17:00	112	87	48		32	21	6										30	2	2		2	1	2		**176**	**111**	**58**		**345**
17:00	17:15	86	49	36		10	11	6		1								25	1	1			1			**122**	**62**	**43**		**227**
17:15	17:30	127	58	35		16	10	5		1	1							28	1	2		1	1			**173**	**71**	**42**		**286**
17:30	17:45	138	44	28		19	22	2		1		1						30	1	1		3	1	1		**191**	**68**	**33**		**292**
17:45	18:00	142	47	25		21	20	2		2	1	1						28	1	1		2	1			**195**	**70**	**29**		**294**
18:00	18:15	113	64	35		14	12	11		3	1							30	2	3		3	2			**163**	**81**	**49**		**293**
18:15	18:30	109	56	38		15	11	12		4	1	1						34	3	2		2	1			**164**	**72**	**53**		**289**

Appendix 6: The full counting list of Police Department Intersection of the second stream

SHOOTING TIME		**AUTOMOBILE**				**TRUCK, MIDIBUS**				**TAXİ**				**SHUTTLE BUS**				**PUBLIC TRANSPORT**				**SHUTTLE BUS, TRUCK,**				**VOLUME OF EACH STREAM**				***TOTAL***
		2-4	**2-3**	**2-1**		**2-4**	**2-3**	**2-1**		**2-4**	**2-3**	**2-1**		**2-4**	**2-3**	**2-1**		**2-4**	**2-3**	**2-1**		**2-4**	**2-3**	**2-1**		**2-4**	**2-3**	**2-1**		***2.STREAM***
07:00	07:15	25	4	8		7	1	6											1	1				2		**32**	**6**	**17**		**55**
07:15	07:30	19	5	8		7	3	6			1							2		1		1	2	3		**29**	**11**	**18**		**58**
07:30	07:45	35	7	14		6	4	7												1			2	3		**41**	**13**	**25**		**79**
07:45	08:00	32	10	15		7	5	9											1	2		1	3	4		**40**	**19**	**30**		**89**
08:00	08:15	48	6	26		6	2	8				1												3		**54**	**8**	**38**		**100**
08:15	08:30	50	8	19		4	2	6				2											1	3		**54**	**11**	**30**		**95**
08:30	08:45	44	4	25		8	1	4		1		2										2	1	7		**55**	**6**	**38**		**99**
08:45	09:00	40	3	24		6	2	7		3		1										2	1	8		**51**	**6**	**40**		**97**
12:00	12:15	55	3	41		5	3	6														3	1	3		**63**	**7**	**50**		**120**
12:15	12:30	60	5	31		7	5	7		1												4	2	4		**72**	**12**	**42**		**126**
12:30	12:45	41	5	23		4		2			1	1						2	2			1		1		**48**	**8**	**27**		**83**
12:45	13:00	47	6	21		6	3	3				1						1				2	2			**56**	**11**	**25**		**92**
16:30	16:45	50	3	21		3		4										2	2	3		2	1	3		**57**	**6**	**31**		**94**
16:45	17:00	50	2	20		7		4										3	1			2	2			**62**	**5**	**24**		**91**
17:00	17:15	46	3	18		4		4				1							2			2	1	1		**52**	**6**	**24**		**82**
17:15	17:30	56	4	18		6	1	2				1							3			3	1	1		**65**	**9**	**22**		**96**
17:30	17:45	44	2	12		4		3				2							1			3		1		**51**	**3**	**18**		**72**
17:45	18:00	64	4	20		8	2	4				2							2			2	2	1		**74**	**10**	**27**		**111**

Appendix 7: The full counting list of Police Department Intersection of the fourth stream

SHOOTING TIME		**AUTOMOBILE**			**TRUCK, MIDIBUS**			**TAXİ**			**SHUTTLE BUS**			**PUBLIC TRANSPORT**			**SHUTTLE BUS, TRUCK,**			**VOLUMES OF EACH STREAM**			***TOTAL***
		4-2	**4-1**	**4-3**	**4-2**	**4-1**	**4-3**	**4-2**	**4-1**	**4-3**	**4-2**	**4-1**	**4-3**	**4-2**	**4-1**	**4-3**	**4-2**	**4-1**	**4-3**	**4-2**	**4-1**	**4-3**	***4.STREAM***
07:00	07:15	46	3	8	1	3	9				1			14	5		4	2		**66**	**13**	**17**	**96**
07:15	07:30	50	5	10	10	2	4				1			14	6		3	1		**78**	**14**	**14**	**106**
07:30	07:45	84	3	14	18	2	5							22	3	6	13		1	**137**	**8**	**26**	**171**
07:45	08:00	90	4	22	20	3	7	1		1				25	4	8	16		1	**152**	**11**	**39**	**202**
08:00	08:15	88	8	42	11	2	4	2		1				13	6	3	6	1	1	**120**	**17**	**51**	**188**
08:15	08:30	90	12	48	13	4	7	2		1				12	7		5	1		**122**	**24**	**56**	**202**
08:30	08:45	57	7	21	8	4	2	1	1	1				11	7	3	2	2	1	**79**	**21**	**28**	**128**
08:45	09:00	44	6	18	6	3	1	1	1	1				12	6	4	1	1	2	**64**	**17**	**26**	**107**
12:00	12:15	69	15	15	6	3	6							15	4	4	1	3	3	**91**	**25**	**28**	**144**
12:15	12:30	72	18	17	7	4	5			1				15	3	3	2	2	4	**96**	**27**	**30**	**153**
12:30	12:45	54	13	16	6	3	3							8	3	2		2	3	**68**	**21**	**24**	**113**
12:45	13:00	42	12	14	5	2	3							7	2	2	1	2	1	**55**	**18**	**20**	**93**
16:30	16:45	86	20	34	10	2	3							12	4	2	1	3	2	**109**	**29**	**41**	**179**
16:45	17:00	90	24	36	12	3	5							18	5	3	2	3	3	**122**	**35**	**47**	**204**
17:00	17:15	92	34	43	16	4	6	1		1				20	7	4	3	4	4	**132**	**49**	**58**	**239**
17:15	17:30	104	38	46	20	5	7	1	1					23	8	3	4	2	3	**152**	**54**	**59**	**265**
17:30	17:45	83	17	51	12	4	4							10	3	2	2	2	3	**107**	**26**	**60**	**193**
17:45	18:00	87	16	62	14	5	3	2	1					13	3	3	2	2	1	**118**	**27**	**69**	**214**
18:00	18:15	105	9	40	5	2	4							11	2	2	1	1	1	**122**	**14**	**47**	**183**
18:15	18:30	108	7	36	6	3	5							13	2	2	1	1	1	**128**	**13**	**44**	**185**

Appendix 8: The full counting list of Dental Intersection of the first stream

SHOOTING TIME		**AUTOMOBILE**				**TRUCK, MIDIBUS**				**TAXİ**				**SHUTTLE BUS**				**PUBLIC TRANSPORT**				**SHUTTLE BUS, TRUCK,**				**VOLUMES OF EACH STREAM**				***TOTAL***
		1-2	**1-3**	**1-4**		**1-2**	**1-3**	**1-4**		**1-2**	**1-3**	**1-4**		**1-2**	**1-3**	**1-4**		**1-2**	**1-3**	**1-4**		**1-2**	**1-3**	**1-4**		**1-2**	**1-3**	**1-4**		***1.STREAM***
07:00	07:15	6	1	4		3	0	1		0	0	0		0	0	0		0	0	0		0	0	0		9	1	5		15
07:15	07:30	13	0	3		4	0	2		0	0	0		0	0	0		0	0	0		0	1	0		17	1	5		23
07:30	07:45	14	0	6		4	1	3		0	0	0		0	0	0		0	0	0		0	0	0		18	1	9		28
07:45	08:00	12	1	6		4	0	2		0	0	0		0	0	0		0	0	0		0	1	0		16	2	8		26
08:00	08:15	17	0	5		3	1	4		0	0	0		0	0	0		0	0	0		0	1	0		20	2	9		31
08:15	08:30	19	0	4		5	2	3		0	0	1		0	0	0		0	0	0		0	0	0		24	2	8		34
08:30	08:45	21	1	7		6	2	5		1	0	0		0	0	0		0	0	0		0	1	0		28	4	12		44
08:45	09:00	16	0	6		6	2	4		0	0	0		0	0	0		0	0	0		0	1	0		22	3	10		35
12:00	12:15	41	1	8		5	0	4		0	0	0		0	0	0		0	0	0		0	1	2		46	2	14		62
12:15	12:30	48	1	10		8	1	5		0	0	0		0	0	0		0	0	0		0	0	0		56	2	15		73
12:30	12:45	53	3	13		10	1	4		0	0	0		0	0	0		0	0	0		1	0	2		64	4	19		87
12:45	13:00	56	2	11		12	2	5		0	0	0		0	0	0		0	0	0		2	1	1		70	5	17		92
16:30	16:45	94	1	30		12	1	4		0	0	0		0	0	0		1	0	0		1	0	1		108	2	35		145
16:45	17:00	110	1	23		9	1	3		2	0	0		0	0	0		0	0	0		0	2	2		121	4	28		153
17:00	17:15	122	2	20		12	3	4		1	0	0		0	0	0		0	0	0		0	2	1		135	7	25		167
17:15	17:30	128	4	25		14	1	3		0	0	0		0	0	0		0	0	0		0	1	3		142	6	31		179
17:30	17:45	125	3	27		12	2	5		0	0	0		0	0	0		0	0	0		1	0	0		138	5	32		175
17:45	18:00	116	2	29		9	3	6		0	0	0		0	0	0		0	0	0		2	0	0		127	5	35		167
18:00	18:15	103	3	21		7	2	7		1	0	0		0	0	0		0	0	0		1	0	0		112	5	28		145
18:15	18:30	98	1	19		8	3	5		1	1	0		0	0	0		0	0	0		1	1	2		108	6	26		140

Appendix 9: The full counting list of Dental Intersection of the second stream

SHOOTING TIME		**AUTOMOBILE**				**TRUCK, MIDIBUS**				**TAXİ**				**SHUTTLE BUS**				**PUBLIC TRANSPORT**				**SHUTTLE BUS, TRUCK**				**VOLUMES OF EACH STREAMS**				***TOTAL***
		2-1	**2-3**	**2-4**		**2-1**	**2-3**	**2-4**		**2-1**	**2-3**	**2-4**		**2-1**	**2-3**	**2-4**		**2-1**	**2-3**	**2-4**		**2-1**	**2-3**	**2-4**		**2-1**	**2-3**	**2-4**		***2.STREAM***
07:00	07:15	48	0	136		8	0	23		0	0	0		0	0	3		0	0	8		0	0	0		**56**	**0**	**170**		**226**
07:15	07:30	52	0	124		7	0	26		0	0	0		0	0	4		0	0	9		0	0	0		**59**	**0**	**163**		**222**
07:30	07:45	59	0	153		12	0	31		0	0	0		0	0	3		0	0	10		0	0	0		**71**	**0**	**197**		**268**
07:45	08:00	43	0	141		8	0	18		0	0	0		0	0	3		0	0	7		0	0	2		**51**	**0**	**171**		**222**
08:00	08:15	53	0	148		11	0	21		0	0	0		0	0	3		0	0	9		0	0	2		**64**	**0**	**183**		**247**
08:15	08:30	56	0	149		14	0	26		0	0	0		0	0	2		0	0	10		0	0	0		**70**	**0**	**187**		**257**
08:30	08:45	58	0	164		11	0	26		0	0	0		0	0	1		0	0	7		0	0	0		**69**	**0**	**198**		**267**
08:45	09:00	53	0	181		6	0	30		0	0	0		0	0	3		0	0	7		0	0	0		**59**	**0**	**221**		**280**
12:00	12:15	50	0	123		6	0	24		0	0	0		0	0	3		0	0	7		0	0	0		**56**	**0**	**157**		**213**
12:15	12:30	56	0	131		8	0	28		0	0	0		0	0	4		0	0	8		0	0	0		**64**	**0**	**171**		**235**
12:30	12:45	53	0	134		8	0	21		0	0	0		0	0	3		0	0	8		0	0	0		**61**	**0**	**166**		**227**
12:45	13:00	59	0	130		11	0	27		0	0	0		0	0	2		0	0	7		0	0	0		**70**	**0**	**166**		**236**
16:30	16:45	48	0	137		9	0	16		0	0	0		0	0	2		0	0	6		0	0	1		**57**	**0**	**162**		**219**
16:45	17:00	89	0	169		18	0	36		0	0	0		0	0	2		2	0	9		0	0	0		**109**	**0**	**216**		**325**
17:00	17:15	127	0	196		16	0	38		0	0	0		0	0	3		1	0	9		0	0	0		**144**	**0**	**246**		**390**
17:15	17:30	132	0	201		15	0	43		0	0	0		0	0	0		0	0	7		0	0	0		**147**	**0**	**251**		**398**
17:30	17:45	141	0	206		21	0	47		0	0	0		0	0	3		0	0	13		0	0	0		**162**	**0**	**269**		**431**
17:45	18:00	120	0	179		16	0	36		0	0	0		0	0	4		1	0	11		0	0	0		**137**	**0**	**230**		**367**
18:00	18:15	51	0	166		9	0	16		0	0	0		0	0	3		0	0	7		1	0	0		**61**	**0**	**192**		**253**
18:15	18:30	53	0	143		7	0	17		0	0	0		0	0	3		0	0	6		0	0	0		**60**	**0**	**169**		**229**

Appendix 10: The full counting list of Dental Intersection of the fourth stream

SHOOTING TIME		**AUTOMOBILE**				**PANELVAN, MIDIBUS**				**TAXI**				**SHUTTLE BUS**				**PUBLIC TRANSPORT**				**TRUCKS**				**VOLUMES OF EACH STREAMS**				***TOTAL***
		4-1	**4-2**	**4-3**		**4-1**	**4-2**	**4-3**		**4-1**	**4-2**	**4-3**		**4-1**	**4-2**	**4-3**		**4-1**	**4-2**	**4-3**		**4-1**	**4-2**	**4-3**		**4-1**	**4-2**	**4-3**		***4.STREAM***
07:00	07:15	0	124	0		0	20	0		0	0	0		0	1	0		0	5	0		0	2	0		**0**	**152**	**0**		**152**
07:15	07:30	0	122	0		0	19	0		0	0	0		0	0	0		0	4	0		0	2	0		**0**	**147**	**0**		**147**
07:30	07:45	0	128	0		0	2	0		0	0	0		0	2	0		0	5	0		0	1	0		**0**	**138**	**0**		**138**
07:45	08:00	0	131	0		0	3	0		0	0	0		0	1	0		0	4	0		0	0	0		**0**	**139**	**0**		**139**
08:00	08:15	0	150	0		0	26	0		0	0	0		0	1	0		0	5	0		0	0	0		**0**	**182**	**0**		**182**
08:15	08:30	0	140	0		0	28	0		0	0	0		0	2	0		0	0	0		0	3	0		**0**	**173**	**0**		**173**
08:30	08:45	0	158	0		0	34	0		0	0	0		0	2	0		0	4	0		0	2	0		**0**	**200**	**0**		**200**
08:45	09:00	0	157	0		0	35	0		0	0	0		0	2	0		0	5	0		0	1	0		**0**	**200**	**0**		**200**
12:00	12:15	0	178	0		0	32	0		0	0	0		0	3	0		0	4	0		0	1	0		**0**	**218**	**0**		**218**
12:15	12:30	0	172	0		0	28	0		0	0	0		0	2	0		0	5	0		0	0	0		**0**	**207**	**0**		**207**
12:30	12:45	0	197	0		0	34	0		0	0	0		0	4	0		0	6	0		0	3	0		**0**	**244**	**0**		**244**
12:45	13:00	0	208	0		0	41	0		0	0	0		0	5	0		0	5	0		0	4	0		**0**	**263**	**0**		**263**
16:30	16:45	0	210	0		0	45	0		0	0	0		0	5	0		0	6	0		0	5	0		**0**	**271**	**0**		**271**
16:45	17:00	0	203	0		0	46	0		0	0	0		0	4	0		0	7	0		0	2	0		**0**	**262**	**0**		**262**
17:00	17:15	0	206	0		0	48	0		0	0	0		0	3	0		0	6	0		0	2	0		**0**	**265**	**0**		**265**
17:15	17:30	0	217	0		0	45	0		0	0	0		0	4	0		0	7	0		0	1	0		**0**	**274**	**0**		**274**
17:30	17:45	0	219	0		0	40	0		0	0	0		0	3	0		0	6	0		0	4	0		**0**	**272**	**0**		**272**
17:45	18:00	0	223	0		0	51	0		0	0	0		0	2	0		0	6	0		0	1	0		**0**	**283**	**0**		**283**
18:00	18:15	0	202	0		0	31	0		0	0	0		0	2	0		0	5	0		0	2	0		**0**	**242**	**0**		**242**
18:15	18:30	0	200	0		0	32	0		0	0	0		0	1	0		0	6	0		0	2	0		**0**	**241**	**0**		**241**

Appendix 11: The Calculated Factors For Capacity of Signalized Intersection at Existing Situation

Police Department Intersection(Existing Situation)					Municipal Intersection (Existing Situation)			
Calculated Factors	**Directions**	**EBT**	**SBT**	**NBT**	**EBT**	**WBT**	**SBT**	**NBT**
	f_w	0,94	0,94	0,94	0,94	0,94	0,94	0,94
	f_{HV}	0,97	0,97	0,97	0,97	0,97	0,97	0,97
	f_g	1	1	1	1	1	1	1
	f_p	0,8	0,8	0,8	0,8	0,8	0,8	0,8
	f_a	1	1	1	1	1	1	1
	f_{LU}	0,91	0,91	0,91	0,91	0,91	0,91	0,91
	f_{LT}	0,999	0,994	0,951	0,977	0,952	0,994	0,993
	f_{RT}	0,997	0,995	0,981	0,977	0,993	0,995	1
	f_{lpb}	1	1	1	1	1	1	1
	f_{Rbp}	1	1	1	1	1	1	1
	f_i	0,63	0,63	0,59	0,61	0,60	0,63	0,63

Appendix 12: The Calculated Factors For Capacity of Signalized Intersection at Design Situation

		Police Department Intersection (RT)						Municipal Intersection(RT)							
	Directions	**EBT**	**EBR**	**SBT**	**SBR**	**NBT**	**NBR**	**EBT**	**EBR**	**WBT**	**WBR**	**SBT**	**SBR**	**NBT**	**NBR**
Factors Calculated	f_w	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94
	f_{HV}	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97
	f_g	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_p	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8
	f_{bb}	0,96	1	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96
	f_a	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_{LU}	0,91	0,85	0,995	1	0,91	1	0,91	1	0,91	0,91	0,91	1	0,91	1
	f_{LT}	0,995	1	1	1	0,998	1	0,97	1	0,996	0,977	0,993	1	0,993	1
	f_{lpb}	0,995	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_{Rbp}	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_i	0,63	0,44	0,54	0,60	0,57	0,60	0,61	0,60	0,62	0,45	0,63	0,60	0,63	0,60

Appendix 13: The Calculated Factors For Capacity of Signalized Intersection at Design Situation

Calculated Factors		Police Department (LT)						Municipal Intersection (LT)							
	Directions	**EBT**	**EBL**	**SBT**	**SBL**	**NBT**	**NBL**	**EBT**	**EBL**	**WBT**	**WBL**	**SBT**	**SBL**	**NBT**	**NBL**
	f_w	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94
	f_{HV}	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97
	f_g	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_p	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8
	f_{bb}	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96
	f_a	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_{LU}	0,91	1	0,91	0,95	0,91	1	0,91	0,91	0,91	1	0,91	1	0,91	1
	f_{LT}	0,995	0,993	0,993	1	1	0,10	1	1	1	0,95	1	0,995	1	0,545
	f_{RT}	0,994	1	1	0,265	0,992	1	0,946	0,95	0,931	1	0,32	1	0,993	1
	f_{lpb}	1	1	1	1	1	1	1	1	1	0,944	1	0,993	1	1
	f_{Rbp}	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	f_i	0,63	0,70	0,63	0,18	0,63	0,07	0,60	0,61	0,59	0,63	0,20	0,69	0,63	0,38

Appendix 14: The Calculated Factors For Capacity of Signalized Intersection at Design Situation

	Police Department Intersection (PLT)				Municipal Intersection (PLT)			
Calculated Factors	Directions	EBT	SBT	NBT	EBT	WBT	SBT	NBT
	f_w	0,94,	0,94	0,94	0,94,	0,94,	0,94,	0,94,
	f_{HV}	0,97	0,97	0,97	0,97	0,97	0,97	0,97
	f_g	1	1	1	1	1	1	1
	f_p	0,8	0,8	0,8	0,8	0,8	0,8	0,8
	f_{bb}	0,96	0,96	0,96	0,96	0,96	0,96	0,96
	f_a	1	1	1	1	1	1	1
	f_{LU}	0,91	0,91	0,91	0,91	0,91	0,91	0,91
	f_{LT}	1	1	1	1	1	1	1
	f_{RT}	0,948	0,993	0,993	0,974	0,953	0,993	0,993
	f_{lpb}	1	1	1	1	1	0,789	1
	f_{Rbp}	1	1	1	1	1	1	1
	f_i	0,64	0,63	0,63	0,66	0,65	0,53	0,67

Appendix 15: The Calculated Factors For Capacity of Signalized Intersection at Renovation Situation

		Municipal Intersection(Recounted Results)					
	Directions	**EBT**	**WBT**	**WBR**	**SBT**	**NBT**	**NBR**
Calculated Factors	f_w	0,91	0,91	0,94	0,94	0,94	0,94
	f_{HV}	0,97	0,97	0,97	0,97	0,97	0,97
	f_g	1	1	1	1	1	1
	f_p	0,8	0,8	0,8	0,8	0,8	0,8
	f_{bb}	0,96	0,96	0,96	0,96	0,96	0,96
	f_a	1	1	1	1	1	1
	f_{LU}	0,91	0,91	1	0,91	0,91	1
	f_{LT}	0,978	0,976	1	0,995	0,99	1
	f_{RT}	0,966	1	0,85	0,977	1	0,85
	f_{lpb}	0,8	0,726	1	0,775	0,695	1
	f_{Rbp}	1	1	1	1	1	1
	f_i	0,47	0,44	0,60	0,48	0,44	0,60

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