CALIBRATION OF DELAY FORMULAS FOR SATURATED AND UNSATURATED SIGNALIZED INTERSECTIONS IN ISTANBUL

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Submitted to the Institute for Graduate Studies in Science and Engineering in partial fulfillment of the requirements for the degree of Master of Science

Graduate Program in Civil Engineering Boğaziçi University 2006

ACKNOWLEDGEMENTS

I am truly thankful to my thesis supervisor Prof. Dr. Gökmen Ergün for his support, guidance, insight and patience throughout my graduate study and in the preparation of this dissertation.

I would also thank to my wife Yeşim for her support in all means and patience during this study. Her precious tolerance, support and encouragement were essential for completion of this dissertation.

I would like to express my gratitude to my parents Ersan Coşkun and Zeynep Coşkun for their continuous support throughout my life. Their contribution is the most important brick in the success throughout my education.

ABSTRACT

CALIBRATION OF DELAY FORMULAS FOR SATURATED AND UNSATURATED SIGNALIZED INTERSECTIONS IN ISTANBUL

In order to minimize delay incurred at signalized intersections and provide the intended improvements, the calculation of delay should have good correlation with the actual delay times.

This study is aimed to provide calibration for various delay formulas in order to adapt them to the local conditions in Istanbul. Delay formulas of Highway Capacity Manual (HCM) (1997 and 2000) and Percentile Delay Method (PDM) were tested for validity at unsaturated signalized intersections. These formulas and Akcelik's overflow delay formula were studied for an oversaturated intersection. The delay estimates were compared with field measurements and calibration models were generated for those formulas. Signal 97, Signal 2000 and Synchro 6 softwares were used for analysis of intersections and MS Excel was used for statistical analysis.

As a result of the analysis of unsaturated intersections, HCM 1997 delay formula underestimated the delay compared to the actual delay measurements. HCM 2000 delay formula overestimated the delay through analysis by Signal 2000 and Synchro softwares. Both HCM 1997 and HCM 2000 delay estimates resulted with good relationship with the field measurements with coefficient of determination (R^2) values around 0.85. The PDM has resulted with a poor relation with R^2 value of 0.51.

The analyses of the oversaturated intersection included testing the effects of queue length on HCM field measurement method for control delay, calculation of delay using HCM formulas (1997 and 2000) and PDM through computer softwares, and calculation of delay manually using HCM 2000 and Akcelik formulas and comparison of these delay estimates with the actual delay. The results of the analyses showed that the field delay measurement tends to be misleading for long queue lengths. Manual computation with HCM 2000 formulation resulted with delay estimates closest to the actual delay incurred among the other estimates.

ÖZET

ISTANBUL'DAKİ DOYGUN VE DOYGUN OLMAYAN SİNYALİZE KAVŞAKLAR İÇİN GECİKME FORMÜLLERİNİN KALİBRASYONU

Sinyalize kavşaklarda yaşanan gecikmelerin en aza indirilmesi ve amaçlanan iyileştirmelerin sağlanabilmesi için gecikme hesaplamalarının gerçekteki gecikme süreleri ile iyi bir korelasyona sahip olması gerekir.

Bu çalışma, çeşitli gecikme formüllerinin İstanbul'daki yerel şartlara uyarlanmaları için kalibrasyonlarının sağlanmasını amaçlamaktadır. Highway Capacity Manual (HCM) (1997 ve 2000) gecikme formüllerinin ve Percentile Delay Method (PDM) yönteminin doygun olmayan kavşaklardaki geçerlilikleri test edilmiştir. Bu formüller ve Akcelik'in aşırı akım gecikme formülü bir doygun kavşak üzerinde etüt edilmiştir. Gecikme hesaplamaları ile sahadaki gecikme ölçümleri karşılaştırılmış ve bu formüller için kalibrasyon modelleri geliştirilmiştir. Kavşakların analizleri için Signal 97, Signal 2000 ve Synchro 6 programları, istatistiksel analiz için MS Excel kullanılmıştır.

Doygun olmayan kavşakların analizlerinin bir sonucu olarak, HCM 1997 gecikme formülünün gecikme tahminleri, gerçek gecikmelerin altında çıkmıştır. Signal 2000 ve Synchro programları ile yapılan analizler neticesinde HCM 2000 formülü gecikmeyi fazla tahmin etmiştir. HCM 1997 ve HCM 2000 gecikme tahminlerinin her ikisi de doygun olmayan kavşaklardaki saha ölçümleri ile 0,85 civarında bir R²'ye sahip iyi bir ilişki göstermiştir. PDM yöntemi sonuçları, 0,51'lik R² değeri ile zayıf bir ilişki göstermiştir.

Doygun kavşak üzerine yapılan analizler içerisinde kuyruk uzunluğunun HCM kontrol gecikmesi saha ölçüm metoduna etkisinin test edilmesi, HCM formülleri (1997 ve 2000) ve PDM kullanılarak bilgisayar programları ile gecikme hesaplaması, HCM 2000 ve Akcelik formülleri ile gecikmenin elle hesaplanması ve bu hesaplamaların gerçek gecikme ile karşılaştırılması bulunur. Analizlerin sonuçları uzun kuyruklarda arazi gecikme ölçümlerinin yanıltıcı olabileceğini göstermiştir. HCM 2000 formülünün elle uygulanması gerçek gecikmelere diğerleri içerisinde en yakın gecikme tahminlerini verdiği görülmüştür.

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LIST OF SYMBOLS/ABBREVIATIONS

С	Capacity
С	Cycle Length
d_1	Uniform Control Delay
d_2	Incremental Delay
d ₃	Initial Queue Delay
Ε	End Gain
gi	Effective Green Time
Gi	Green Interval
Н	Saturation Headway
Κ	Incremental Delay Factor
L	Upstreaming Filtering/Metering Adjustment Factor
r _i	Effective Red Time
R _i	Red Interval
R^2	Coefficient of Determination
S	Saturation Flow Rate
V	Flow Rate
Х	Volume-to-Capacity Ratio
Y	Change and Clearance Interval
$\Phi_{\rm i}$	Phase
EB	Eastbound
HCM	Highway Capacity Manual
LOS	Level of Service
NB	Northbound
OD	Overflow Delay
PDM	Percentile Delay Method
PF	Progression Factor
SB	Southbound
UD	Uniform Delay
WB	Westbound

1. INTRODUCTION

Vehicles in traffic flow are delayed by a combination of factors including interactions with other vehicles and pedestrians, and regulatory devices such as traffic signs and signals. In order to evaluate the improvements in traffic flow, effects of various regulatory devices on delays require to be estimated.

Optimization of the signal times at signalized intersections is important for efficient operation of traffic movements and reduction of the time lost in traffic. Optimization mainly depends on minimization of the delay through alterations in cycle time and green time allocated to signal phases. The calculation of delay in this process should have good correlation with real life delay times in order to provide the intended improvements when implemented.

In this study, field delay measurements were collected at saturated and unsaturated signalized intersections to calibrate delay formulas of HCM 1997, HCM 2000 and Percentile Delay Method.

1.1. Problem Statement

1.1.1. City of Istanbul and Traffic Statistics

Istanbul is one of the ten most populous cities of the world [1]. According to the Turkish Statistics Institution, the estimated population of Istanbul for mid-year 2006 is 11,622,000. The population estimates of Turkish Statistics Institution shows that the percentage of population of Istanbul over the total population of Turkey has increased from 14.7 per cent in year 2000 to 15.9 per cent in 2006 and it is estimated to reach 16.7 per cent by the year 2010 [2].

The large size of population reflects in to a large size of traffic that increases by years. According to the Turkish Statistics Institution, as of December 2005, the number of vehicles registered in Istanbul was around 2.16 million which constitute 21 per cent of the total registered vehicles in Turkey. The average number of new vehicles registered in 2005

was 432 out of which 244 are new passenger cars [3]. This indicates seven per cent increase in the number of vehicles in year 2005. Although it is lower than the average annual increase of 12.2 per cent in number of vehicles registered in Istanbul in the last five years, if this annual rate of increase (seven per cent) in number of vehicles remains the same, the number of vehicles will be doubled in the next 10 years.

1.1.2. Definition of Traffic Congestion

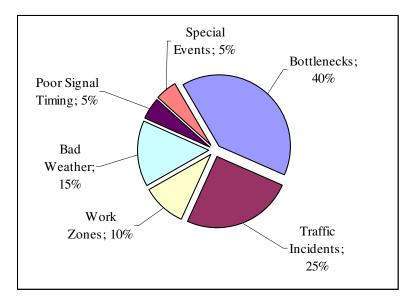
There are different definitions of traffic congestion in the literature. The Federal Highway Administration (FHWA) of USA defines the congestion as [4]

"Congestion occurs when the free flow of traffic on a roadway is impeded due to excess vehicle demand, construction, maintenance, traffic incidents, weather, or other road conditions and events."

According to a study performed by Bertini (2005), transportation professionals and academics define the congestion by different measures. The responses relate the congestion to speed (28 per cent of the respondents), volume (19 per cent), time (18 per cent), and level of service (LOS) (15 per cent). 16 per cent of the survey respondents have mentioned cycle failures as the main source of congestion [5].

1.1.3. Reasons of Congestion

Traffic congestion is caused by various reasons. According to the study of FHWA the most important reason of traffic congestion in USA is bottlenecks (40 per cent) [4]. As shown on Figure 1.1, five per cent of traffic congestion in urban areas can be attributed to poor signal timing [4].



Source: FHWA [4]

Figure 1.1. Causes of traffic congestion in USA

1.1.4. Results of Congestion

Regardless of the cause of traffic congestion, the results of it reflect in the country resources in terms of excessive consumption of fuel and loss of productivity due to excessive trip durations. According to the study performed by Texas Transportation Institute in the 85 urban areas in 2003, congestion costs over \$63 billion or \$384 per person in wasted time and extra fuel [4]. According to the Congestion Management System 2005 Status Report of New York Metropolitan Transportation Council [6], the cost of congestion in the New York Metropolitan region is \$26 million per day (or \$9.36 billion per year). The study performed by Ergün (2005) [7] shows that the cost of congestion in Istanbul in terms of additional fuel and time consumption is \$3.12 billion per year.

Traffic congestion does not only cause loss of country resources in terms of fuel; it also increases the air pollution due to the increased pollutant exhaust emission (especially CO, NOx) and therefore has an important role in global warming. Carbon monoxide and hydrocarbon emissions are higher in congested traffic due to the lower speeds [8]. The effect of pollutant emissions on the air quality and climate change has been an important issue of the European Conference of Ministers of Transport [9], [10]. In addition to these macro level problems, congestion affects drivers and riders in terms of time losses and psychological distortion.

1.1.5. Measurement of Congestion

There are various measures used for determining the magnitude of congestion. Bertini's study [5] shows that the most of the responses for the measures of congestion are related to the actual travel time. The respondents have indicated that the congestion can be measured by delay (29 per cent), LOS (20 per cent), travel time (14 per cent), volume-tocapacity ratio (14 per cent), speed (13 per cent), queue length (four per cent), and density (one per cent) [5].

Annual delay per capita in Istanbul due to the traffic congestion is estimated to be 73.9 hours/capita in the study of Ergün (2005) [7]. The same statistics for New York Metropolitan Region is defined as 54.75 hours/capita [6]. Thus, citizens of Istanbul experience 35 per cent more traffic delay in average than the citizens of New York Metropolitan Region.

The actual travel time or the delay in the desired travel time is the mostly used quantitative measure of congestion. However, the study of Bertini indicates that half of the respondents find the measurements of congestion "accurate" (18 per cent) or "somewhat accurate" (33 per cent) [5].

1.1.6. Effects of Traffic Signals in Congestion

Urban street network includes streets (links) and intersections (nodes) where vehicles compete with conflicting traffic and pedestrian flows. Therefore, traffic need to be controlled by means of traffic control devices in order to provide the necessary right-ofways required by the traffic flow patterns, to control the speed of the vehicles and to provide safe environment to the users like pedestrians, drivers and passengers. These traffic control devices create an interrupted traffic flow on urban streets, and thus cause delays on the trips of the users. A common type of such devices is traffic signals at intersections where vehicular traffic and pedestrian flows conflict in space and time. Increasing delay at signalized intersections has positive relationship with the increase in traffic congestion. Figure 1.1 shows that five per cent of the congestion in United States is due to poor signal timing. Although its contribution to the traffic congestion is not very much (five per cent), optimization of traffic signals can result with good improvements in local traffic congestion and savings in terms of fuel and time consumption. The signal optimization project performed by Ergün, Bayraksan and Coşkun (1999) shows that efficient operation of traffic signals provides benefits in terms of decrease in delay and therefore in cost of fuel and time consumption [11].

1.1.7. Calculation of Delay and Need for Calibration

Optimization of traffic signals depends upon calculation and minimization of delay at signalized intersections. There have been various formulas developed throughout the years for the calculation of delay at signalized intersections. These formulas have been developed and improved through field surveys and empirical studies. Therefore, they are generated for the local conditions of the country of their origin.

In order to achieve desired improvements at signalized intersections, the calculation of delay by using these formulas should represent the actual delay incurred at the intersection. This study is aimed to address this problem by testing the validity of widely used Highway Capacity Manual delay formulas and Percentile Delay Method of Synchro Software, and calibrating these delay formulas to use them at the local cases in Istanbul. The formulas were created considering the conditions of U.S.A. and therefore required to be calibrated for the conditions of Istanbul.

1.2. Goals and Objectives

The main goal of the thesis is to test the validity of HCM 1997, HCM 2000 and Percentile Delay Method delay formulations at unsaturated and saturated signalized intersections for local conditions in Istanbul. In order to achieve this ultimate goal, the following objectives were set.

• To do a through literature review on existing delay formulations at signalized intersections

- To collect delay data for unsaturated and saturated conditions
- To calculate the delay for all intersections, for which the data were obtained, using various delay formulations by utilizing computer programs and compare the results with the field measurements.
- To discuss the applicability of various delay formulations and study relationships with actual conditions.

An oversaturated intersection, Dolmabahce Intersection, was studied in order to develop the arrival and departure flow diagrams, to analyze the development of queue, to calculate the delay through the flow diagrams, field study, and delay formulas manually and by means of software programs, and to analyze and compare the results of these calculations.

2. LITERATURE REVIEW

The calculation of delay at signalized intersections is related to many parameters. A summary of the definitions for the terms and parameters used in this study are given below.

2.1. Terms and Definitions

The definitions of the basic terms used in the analysis of signalized intersections are as follows [12], [13]:

- Cycle: Cycle is one complete rotation of signal indications for all traffic approaches.
- *Cycle Length:* Cycle length is the time for a sequence of indicators in a complete cycle. It is expressed in seconds and given the symbol "C".
- *Interval:* It is the period of time during which a signal indicator (red, yellow and green) at an intersection remains unchanged. There exist four types of intervals in a cycle of signals:
 - *Change Interval:* The yellow indication between red and green intervals is called change interval.
 - Clearance Interval: After all change interval, a short period during which all movements at the intersection face red indication is applied. This interval is called clearance or all-red interval. The change interval and clearance interval are used for clearance of the intersection from conflicting movements. The period for the total of the change interval and the clearance interval is called "change and clearance" interval and used in the calculations with symbol "Y".
 - *Green Interval:* It is the time of "green" indication for a particular phase of movements and is shown with the symbol "G_i".

- *Red Interval:* The time for "red" indication for a given movement or set of movements is called red interval and is given the symbol "R_i".
- *Phase:* The total of time allocated for green interval and change and clearance interval for a given set of movements that receive right-of-way simultaneously is called a "phase". Phases are shown by symbol "Φ_i"
- *Lost Time:* It is the time lost during which the intersection is not effectively used by any movements.
- *Start-up Lost Time:* This period occurs between the clearance interval and green interval for a movement due to the time spent by the first few vehicles in a standing queue for starting up and passing the intersection line.
- *Clearance Lost Time:* The portion of the clearance interval during which the vehicles do not pass the intersection is called "clearance lost time".
- *End Gain:* The portion of the yellow interval used by some vehicles as an extension to green interval is called "end gain". This term is also named as extension of effective green is given the symbol "e".
- *Total Lost Time:* The total of start-up lost time and clearance lost time for a specific movement is called total lost time.
- *Effective Green Time:* Effective green time, called by symbol "g_i", is the time that is effectively available for a movement and is calculated as the green interval plus the change-and-clearance interval minus the total lost time for a designated movement.
- *Effective Green Ratio:* It is the ratio of effective green time to the cycle length, g_i/C.
- *Effective Red Time:* Effective red time is the time during which a specific movement or a set of movements is effectively not permitted to move. It is the time calculated as effective green time subtracted from the cycle length and is shown by "r_i".

- *Headway:* The time elapsed for a vehicle passing the curb line. The first headway is the time elapses between the start of the green indication and the first vehicle crossing the curb line. The other headways are calculated as the time between the successive vehicles crossing the curb line. As a common practice headways are measured as the rear wheels of the vehicles cross the curb line.
- *Saturation Headway:* The headway between the vehicles standing in a queue waiting for the green indication levels generally after the fourth or fifth vehicle. This level headway is called as saturation headway and shown as "h" in the equations of signalized intersection analysis.
- *Saturation Flow Rate:* Saturation flow rate is the number of vehicles in a single lane that can cross the curb line during an hour of green time. The vehicles are assumed to cross with the saturation headway and therefore the saturation flow rate, "s", is calculated in vehicles per hour of green per lane as follows:

$$s = \frac{3600}{h} \tag{2.1}$$

2.2. Measures of Effectiveness

The signalized intersections are analyzed for the quality of service by means of various measures of effectiveness. These measures are used in capacity analysis and simulation models in order to quantify the operation of the intersection. The most common measures of effectiveness are [13]:

- Length of Queue
- Number of Stops
- Delay

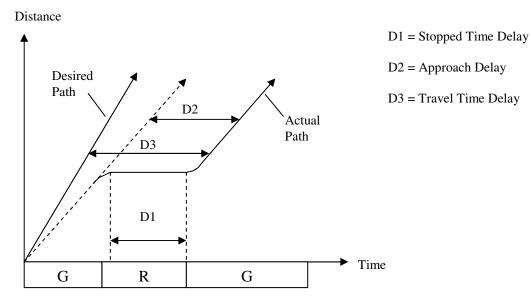
Length of Queue: The length of queue at any given time is an important measure of effectiveness especially for the intersections that are close to adjacent intersection.

The number of Stops: The number of stops made is used especially for air quality calculations.

Delay: Delay is the most commonly used criterion that is described by the amount of time consumed in traversing the intersection. Delay is calculated in many ways and is named differently for each way of calculation [13]:

- *Stopped Time Delay* is the time that a vehicle stopped while waiting to pass the intersection
- Approach Delay is the total time consumed while decelerating from the ambient speed to stop, the time of stopping at the intersection and the time spent for accelerating back to the ambient speed after start-up. This delay is named as "Control Delay" in Highway Capacity Manual ("HCM 2000") published by Transportation Research Board [12].
- *Travel Time Delay* is defined as the difference between the total time actually spent to traverse the intersection and the driver's desired total time to traverse the intersection.
- *Time-in-Queue Delay* is the time starting from a vehicle joining the queue at the intersection to its discharge through the curb line.

The delay measurements described above give different results for a given intersection depending on the conditions of intersection. The difference of the figures measured at an intersection for these items are illustrated on Figure 2.1 [13].

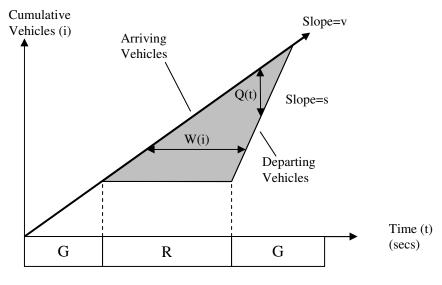


(Source: [13], pg 413)

Figure 2.1. Illustration of delay measures at an intersection

The concept of delay is better explained with the flow rate of the vehicles coming to the intersection and the saturation flow rate of the vehicles leaving the intersection when the phase turns to green. Vehicles arriving at the intersection with flow rate of v, pass the intersection without interruption at green phase if a queue does not exist. The vehicles start to accumulate and create queue at the intersection as the indicator turns to red. The number of vehicles in the queue increases at a rate of v until the indicator turns to green. As the phase turns to green for the approach, the vehicles start to leave the intersection with the saturation flow rate of s. Figure 2.2 shows the relationship between the flow rates and delay and queue length [13].

The total time for a vehicle (i) to traverse the intersection is shown as W(i) on Figure 2.2. The area shaded on the figure is the aggregate delay of the vehicles passing at this specific period of time. Aggregate delay is expressed in vehicle-hours (or vehicle-seconds or vehicle-minutes). The average individual delay is the average time consumed by any vehicle during a specific period. It is calculated as the aggregate delay divided by the number of vehicles that traverse the intersection during that period.



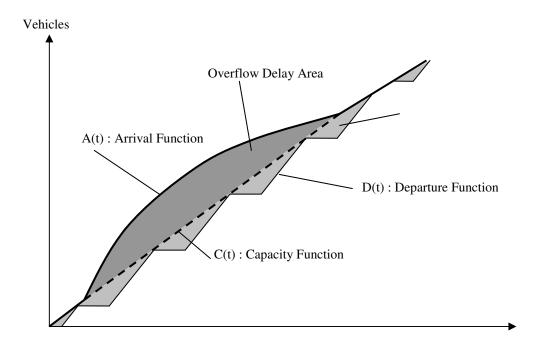
(Source: [13], pg 414)

Figure 2.2. Delay and queue length

The total number of vehicles queued at time t is shown as Q(t) on Figure 2.2. The figure shows the case in which the queue can be completely served during one green period and the vehicles do not wait for more than one red period. The delay calculated at these cases, where the saturation flow rate can catch up with the actual flow rate during one green period, is called *Uniform Delay*.

In the other cases, where some of the vehicles have to wait in the queue for more than one red period, overflow occurs. In these cases, the total delay has another component in addition to uniform delay, which is called *Overflow Delay*. Figure 2.3 shows the uniform and overflow components of delay. The area between the capacity function and departure function is uniform delay; and the area between the arrival function and capacity function is the overflow delay [13].

HCM 2000 [12] classifies the figures calculated for control delay and sets the Level of Service (LOS) criteria for the signalized intersections. The criteria based on the average control delay per vehicle are listed in Table 2.1. LOS A describes operations with very low delay up to 10 seconds per vehicle, which means that the progression is very favorable and most of the vehicles arrive at the intersection when the indicator is green. LOS F states the operation with an average control delay of over 80 seconds per vehicle which is not acceptable to most drivers.



(Source: [13], pg 415)

Figure 2.3. Uniform and overflow delay

LOS	Control Delay per Vehicle (sec/veh)				
А	≤ 10				
В	$> 10 \text{ and } \leq 20$				
С	> 20 and ≤ 35				
D	> 35 and ≤55				
Е	> 55 and ≤80				
F	> 80				

Table 2.1. LOS criteria for signalized intersections

(Source: [12], Ch. 16, pg 2)

2.3. Queuing and Delay at Signalized Intersections

Traffic flows interfere at merging points or intersections in a network. Therefore, the journey of a vehicle is interrupted at such points. The delay caused by these interruptions and consequent queues have been a popular research subject throughout the history. Gazis have summarized and explained the development of theories for calculation of delays and queues in Reference [14].

The researches on calculation of queues and delays are based on theory of stochastic processes. The basics of the queuing theories created are that the vehicles arrive to an intersection by an arrival function and depart by a departure function. When the number of vehicles arrived at a moment cannot depart, the queue starts to occur. Therefore, the main assumptions made for these researches are about the arrival functions and departure functions.

The vehicles in a traffic flow arrive the intersection at different t_1 , t_2 , t_3 ,, t_r , times. Therefore, we can define the headway or gap between two successive vehicles as,

$$G_r = t_r - t_{r-1} \tag{2.2}$$

Most of the traffic studies assume that the successive headways are independent and identically distributed random variables. If the probability function of successive gaps of a random arrival process is denoted as $\varphi(G)$, the probability density function for the gap G₁ at t=0 where the measurements start, $\varphi_0(G)$, is defined as follows:

$$\varphi_0(G) = \frac{1}{\mu} \int_0^\infty \varphi(x) dx \tag{2.3}$$

Where μ is the mean headway given by

$$\mu = \int_{0}^{\infty} G\varphi(G) dG \tag{2.4}$$

The most widely used form of $\varphi(G)$ in traffic studies is negative exponential where

$$\varphi(G) = \varphi_0(G) = \frac{1}{\mu} \exp\left(-\frac{G}{\mu}\right)$$
(2.5)

Theoretical justifications for this density function were made by Weiss and Herman (1962), Breiman (1963) and Theden (1964) [14]. The study of Weiss and Herman assumes that the vehicles travel at a constant speed v which is sampled from probability density function f(v) and this function is not a delta function. Furthermore, it assumes that when a

vehicle reaches a slower vehicle, it can pass the vehicle immediately without any delay [14].

Miller (1961) has introduced the concept of traveling queue as another contribution to the theory [14]. He observed that the limitations of passing a vehicle create platoons of vehicles traveling at the speed of leader vehicle. This observation eliminates the assumption of Weiss and Herman mentioned above. Instead of using individual vehicles in Equation 2.5, he assumes that the successive queues are independent and gap between queues follows a negative exponential distribution.

In order to describe the situation at points where the movement of a vehicle is impeded by a conflicting vehicle flow, the concept of "gap acceptance" is introduced. It defines the situation where the driver waits before passing or merging a conflicting flow until he finds the headway between two successive vehicles in that flow is acceptable to him for movement. Gap acceptance is the main assumption used for analysis of unsignalized intersections controlled by yield or stop sign. Although it is defined as a step function which is equal to *zero* for gaps lower than acceptable gap, the functions that can be generated for gap acceptance is heavily dependent on situation that need field observations.

In the cases of signalized intersections, the gap acceptance is not included since the gap between the sequence of conflicting flows of vehicles are defined by signal settings. Therefore, in order to calculate the expected delay for a single stream at a signalized intersection, it is required to specify the arrival process, the signal settings and the departure process.

Many of the studies for estimating the delay at signalized intersections assume a simple Poisson process of arrival. This assumption is observed to be reasonably satisfactory for light traffic conditions where there is no platoon created by a close upstream signalized intersection [14]. The interactions between the vehicles are neglected in light traffic conditions where Poisson process is acceptable. For heavy traffic a "compound Poison process" is considered instead of simple Poison [14].

The signal settings of an intersection can be specified through the distribution of total cycle length to the green phase where the vehicles are free to move and the red (and yellow) phase where the vehicles are stopped. It can be assumed that the departure intervals of vehicles are independent and identical random variables. However, it can be further assumed for a single lane of traffic that the departure headways are identical and correspond to a saturation flow rate. The effect of start-up loss incurred by the first vehicle can be accommodated by increasing the value for the length of red phase somewhat. The vehicles making right or left turns will have a different departure function than the vehicles moving straight. Therefore, it is reasonable to divide the movements in classes and assume that the departure times will be identically distributed independent random variables for each class if the classes do not interfere.

The signalized intersections are complicated compared to the classical queuing theory due to the fact that no service is possible during the red phase. Another difference from the classical queuing theory is that the vehicles do not necessarily depart at the order of arrival. Therefore, the analysis of delay at signalized intersection focuses on aggregate delay incurred by all vehicles during the cycle length instead of an individual vehicle. Besides its difficulty to be calculated due to the red phase, the total delay is important for use in improvement of the system.

The queuing process at a traffic signal creates a queue length of Q(t) at a time of t. Therefore, the total delay during a cycle length of T is,

$$W = \int_{0}^{T} Q(t) dt$$
 (2.6)

Let A(t) be the function for number of vehicles arriving to the intersection. For an analysis period of one cycle length *T* starting at the beginning of the red phase, no departures will be possible during (O,R), where *R* is the length of red phase, and the departure process will be unrestricted during (R,T). The calculations for total delay incurred by the vehicles are described below for different arrival and departure functions [14].

Let us assume that A(t) is a Poisson process with $E[A(t)]=\lambda t$ and the vehicles depart from the queue at a constant time of s. If we define the total delays for the red phase and green phase as W₁ and W₂ respectively, the total delay for the total cycle length will be:

$$W = W_1 + W_2$$
 (2.7)

Where

$$W_1 = \int_0^R [Q(0) + A(t)] dt$$
 (2.8)

$$W_2 = \int_R^T Q(t) dt \tag{2.9}$$

The expected values for Equation 2.8 and 2.9 are derived as follows:

$$E[W_1] = RE[Q(0)] + \frac{1}{2}\lambda R^2$$
(2.10)

$$E[W_2] = \frac{sE[Q(R) - Q(T)]}{2(1 - \lambda s)^2} + \frac{sE[Q^2(R) - Q^2(T)]}{2(1 - \lambda s)}$$
(2.11)

If we further assume that the queue is in statistical equilibrium where average number of arrivals per cycle is less than the number of vehicles that can be served during the green phase, i.e. $\lambda T < (T - R)/s$, the expected total delay per cycle can be obtained as,

$$E[W] = \frac{2\lambda R}{2(1-\lambda s)} \left[R + \frac{2}{\lambda} E[Q(0)] + s\left(1 + \frac{1}{1-\lambda s}\right) \right]$$
(2.12)

In order to generalize the Equation 2.12, Gazis assumes that the arrival process is that postulated by Darroch (1964) while the departure times remain constant [14]. Assuming that the arrivals occur at random during *h* interval, we have $E[A(t)]=\lambda t$. If it is further assumed that *s* is a multiple of *h*, Equation 2.12 generalizes to,

$$E[W] = \frac{\lambda R}{2(1-\lambda s)} \left[R + \frac{2}{\lambda} E[Q(0)] + s \left(1 + \frac{1}{1-\lambda s}\right) \right]$$
(2.13)

If the arrivals are binomial with h=s, the Equation 2.13 takes a special simplified form of,

$$E[W] = \frac{\lambda R}{2(1-\lambda s)} \left[R + \frac{2}{\lambda} E[Q(0)] + 2s \right]$$
(2.14)

If we further simplify the problem by assuming that the vehicles arrive at constant intervals of $1/\lambda$, we can obtain the equation for a minimum possible delay at an intersection:

$$E[W] = \frac{\lambda R}{2(1-\lambda s)} (R+s)$$
(2.15)

If we compare Equation 2.15 with Equation 2.13, we can regard the second term in Equation 2.13 is delay due to the overflow from the previous cycle and the forth term as delay due to randomness.

The above equations assume that the departure process is constant. We may consider randomness in departure due to different driver behaviors and interference between the straight through movement and turning vehicles. In that regard, let us assume that the departure times are independent, identically distributed random variables with a mean value of *s* and a coefficient of variation *C*. Let us also assume a Poisson arrival process. In this case, the expected delay during green phase, $E[W_2]$, changes while the expected delay during the red phase, $E[W_1]$, is same with Equation 2.10 since it is independent of departure process. The results of computations yield to a total expected delay during one cycle as,

$$E[W] = \frac{\lambda R}{2(1-\lambda s)} \left[R + \frac{2}{\lambda} \left(1 + \frac{(1-\lambda s)(1-C^2)}{2} \right) E[Q(0)] + s \left(1 + \frac{1+\lambda sC^2}{1-\lambda s} \right) \right]$$
(2.16)

2.4. Calculation of Delay

In addition to the theoretical studies mentioned in Section 2.3, delay at signalized intersections is studied by various scientists for many years as a measure of efficiency at a signalized intersection. Most of the recent formulations for calculation of delay at signalized intersections are based on the formula generated by Webster, which was initially published in 1958.

2.4.1. Webster's Formulation

Webster's original formula is an empirical formula that applies to the vehicles arriving randomly at fixed-cycle traffic signals. The formula was obtained by computer simulation assuming random arrivals and gives the average delay per vehicle. Webster's delay formula is [15]:

$$d = \frac{C(1-\lambda)^2}{2(1-\lambda x)} + \frac{x^2}{2q(1-x)} - 0.65 \left(\frac{C}{q^2}\right)^{1/3} x^{(2+5\lambda)},$$
(2.17)

Where

C=cycle length, sec λ=proportion of effective green time in a cycle length; g/c q=flow rate (vehicle/sec) s=saturation flow rate (vehicle/sec) x=degree of saturation; q/λs

When we reorganize the formula for the basic parameters used in analysis of intersections, the formula results as follows:

$$d = \frac{C(1 - \frac{g}{C})^2}{2\left(1 - \frac{v}{s}\right)^2} + \frac{\left(\frac{vC}{sg}\right)^2}{2v\left(1 - \frac{vC}{sg}\right)} - 0.65\left(\frac{C}{v^2}\right)^{\frac{1}{3}}\left(\frac{vC}{sg}\right)^{\left(2 + 5\frac{g}{C}\right)},$$
 (2.18)

Where

C=Cycle Length g=Effective Green Time v=Flow Rate s=Saturation Flow rate

The first part of Webster's delay formula calculates the average uniform delay in seconds. This part of the formula is used for uniform delay calculation without any significant change in the later studies.

The second term accounts for the randomness of the arrivals. The third term is adopted for adjustment for the field observations made. The adjustment provides five per cent to 15 per cent decrease in the calculated delay.

Webster's formula considers the situations where the intersection is not over saturated; i.e. v/c (flow rate to capacity rate) ratio is below one. Although the second term of Webster's formula seems to account for overflow delay as it is added to the uniform delay, actually the term gives negative results for intersections with v/c ratio over one. In fact, the second term accounts for the individual cycle failures within an analysis period.

2.4.2. Overflow Delay Formulation

Since Webster's formula didn't count for the overflow delay, a new formulation is required for oversaturated intersections. Figure 2.4 illustrates the situation where the flow rate is over the rate that the signal can accommodate. As shown in the figure, the total delay is divided into two sections, uniform delay and overflow delay.

For calculation of the uniform delay part for the total delay at oversaturated intersections, the first term of Webster's formula can be used. When (v/s) is substituted with (g/C)(v/c) and v/c is taken as equal to one since only the uniform delay part is calculated (see Figure 2.4), the equation results as;

$$UD = \frac{C[1 - (g/C)]}{2}$$
(2.19)

Overflow delay is dependent on the period of oversaturation. As the length of the oversaturation period increases, the delay of the vehicles added to the queue increases. The overflow delay area shown on Figure 2.4 is the aggregate overflow delay and is calculated as follows for the time between time T_1 and T_2 .

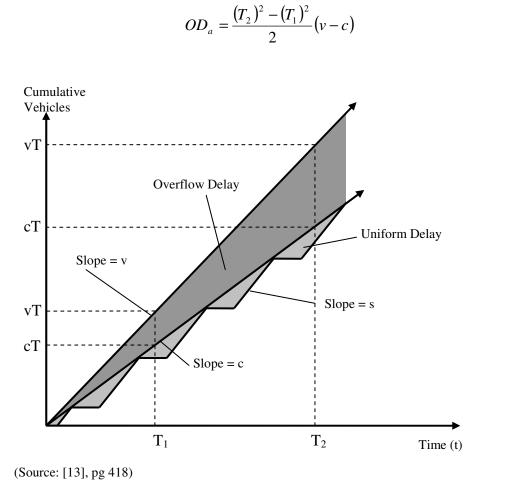


Figure 2.4. Overflow delay

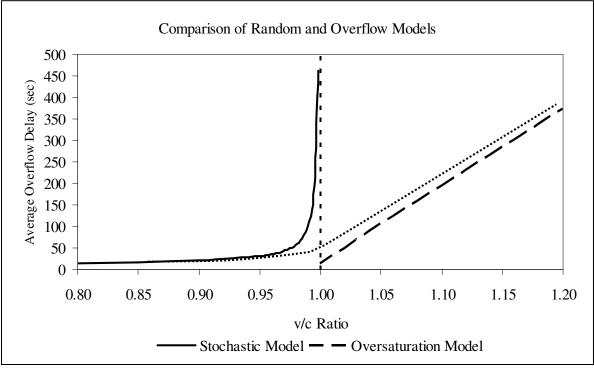
In order to find the average overflow delay, the aggregate delay is divided to the total number of vehicle discharged during the period, $c(T_2-T_1)$:

$$OD = \frac{(T_1 + T_2)}{2} [(v/c) - 1]$$
(2.21)

The researches show that for the intersections with v/c below 0.80-0.85, the stochastic model generated by Webster results with very close delay figures with the ones actually measured on the field. Also, the overflow delay formula explained above

(2.20)

represents the field data for the v/c of over 1.15-1.20 [13]. However, the most of the intersections have a v/c ratio between 0.80-1.20 where both models do not have good representation. Figure 2.5 shown below illustrates the situation [13].



(Source: [13], pg 419)

Figure 2.5. Comparison of random and overflow models

The illustration in Figure 2.5 initiated the researches for development of formulas for combination of these two models. The formulas created had to be asymptotic to the oversaturation model for high v/c ratios and to the stochastic model for low v/c ratios as the dotted line shown on Figure 2.5.

2.4.3. TRANSYT Delay Formulation

One of the models was created as part of the TRANSYT signal optimization program in 1979 [13]. The simplified form of the overflow delay formula is shown below. The result of this formula should be added to the uniform delay to find the total delay.

$$OD = \frac{15T}{v}(v-c) + \sqrt{(v-c)^2 + \frac{240v}{T}}$$
(2.22)

Where

OD=Overflow delay, sec/veh T=Time, minutes v=Flow Rate, vph c=Capacity, vph

The later versions of the program have improved this formulation. However, the latest version of the program uses the HCM 2000 formulation for overflow delay.

2.4.4. Akcelik's Delay Formulation

Another formula was generated by Akcelik for the intersections in Australia [13]. The formula generated in 1980 is as follows:

$$OD = \frac{T}{4} \left[\left(v/c - 1 \right) + \sqrt{\left(v/c - 1 \right)^2 + \frac{12\left(v/c - v_0/c \right)}{cT}} \right]$$
(2.23)

Where

 $v_0/c = 0.67 + s(g/600)$ T=Time, hours v=Flow Rate, vph c=Capacity, vph s=Saturation Flow Rate, vphg

2.4.5. Highway Capacity Manual Formulation

The control delay formula of HCM [12] is composed of three parts: Uniform Control Delay (d_1), Incremental Delay (d_2) due to random arrivals or oversaturation and Initial Queue Delay (d_3) for the delay effect of the queue at the beginning of the analysis period. Therefore, the control delay formula of HCM is:

$$d = d_1(PF) + d_2 + d_3 \tag{2.24}$$

Where, PF is the progression adjustment factor to accommodate the effects of the signal progression.

2.4.5.1. <u>Uniform Delay Component, d_1 </u>. The uniform control delay component of the formula accounts for the uniform delay assuming uniform arrivals and stable unsaturated flow. The formula which is based on the first part of Webster Formula is as follows:

$$d_{1} = \frac{0.5C \left(1 - \frac{g}{C}\right)^{2}}{1 - \left[\min(1, X)\frac{g}{C}\right]}$$
(2.25)

Where

d₁=Uniform control delay (s/veh)C=Cycle length (s)g=Effective green time for lane group (s)X= v/c ratio for the lane group

The Progression Adjustment Factor (PF) used in the delay formula to account for the effects of the signal progression on the calculated delay is determined according to the following formula:

$$PF = \frac{(1-P)f_{PA}}{1-\left(\frac{g}{C}\right)}$$
(2.26)

Where

PF=Progression Adjustment Factor

P=Proportion of vehicles arriving on green

g/C=proportion of green time

fPA=supplemental adjustment factor for platoon arriving during green

Progression adjustment factors for different g/C ratios and different arrival types are listed in Table 2.2 [12].

Green Ratio			Arrival	Туре		
(g/C)	AT 1	AT 2	AT 3	AT 4	AT 5	AT 6
0.20	1.167	1.007	1.000	1.000	0.833	0.750
0.30	1.286	1.063	1.000	0.986	0.714	0.571
0.40	1.445	1.136	1.000	0.895	0.555	0.333
0.50	1.667	1.240	1.000	0.767	0.333	0.000
0.60	2.001	1.395	1.000	0.576	0.000	0.000
0.70	2.556	1.653	1.000	0.256	0.000	0.000
f_{PA}	1.00	0.93	1.00	1.15	1.00	1.00

Table 2.2. Progression adjustment factors (PF)

(Source: [12], Ch. 16, pg. 20)

2.4.5.2. Incremental Delay, d_2 . The incremental delay component accounts for the delay due to the non-uniform arrivals, temporary cycle failures (random delay) and sustained periods of oversaturation (oversaturation delay). Incremental delay is calculated according to the following formula:

$$d_{2} = 900T \left[(X-1) + \sqrt{(X-1)^{2} + \frac{8klX}{cT}} \right]$$
(2.27)

Where

d₂=Incremental delay (s/veh)

T=Duration of analysis period (h)

k=Incremental delay factor depending on the controller settings

l=Upstream filtering/metering adjustment factor

c=Lane group capacity (vph)

X = v/c ratio for the lane group

The adjustment term, k, is introduced in the equation to incorporate the effect of the controller type on the delay. The factor is equal to 0.50 for the pretimed signal controls, whereas the factor is below 0.50 for the actuated controls to reflect the ability of these controls to change the controller settings according to the demand, and therefore reduce the incremental delay.

Table 2.3 provides the values for k factor depending on the degree of saturation at the intersection and the unit extension of the controller.

	Degree of Saturation (X)						
Unit Extension (s)	≤0.50	0.60	0.70	0.80	0.90	≥1.0	
≤2.0	0.04	0.13	0.22	0.32	0.41	0.50	
2.5	0.08	0.16	0.25	0.33	0.42	0.50	
3.0	0.11	0.19	0.27	0.34	0.42	0.50	
3.5	0.13	0.20	0.28	0.35	0.43	0.50	
4.0	0.15	0.22	0.29	0.36	0.43	0.50	
4.5	0.19	0.25	0.31	0.38	0.44	0.50	
5.0	0.23	0.28	0.34	0.39	0.45	0.50	
Pretimed or							
Nonactuated Movement	0.50	0.50	0.50	0.50	0.50	0.50	
(Source: [12], Ch. 16, pg. 22)							

Table 2.3. k-Values for different degree of saturation and unit extensions

The upstream adjustment factor, l, in the equation incorporates the effects of metering arrivals from upstream signals. For the isolated intersections, the factor equals to 1.0.

2.4.5.3. <u>Initial Queue Delay, $d_{3.}$ </u> Existence of queue at the beginning of the analysis period which is remaining from the previous period causes additional delays to the vehicles arriving during the period since first the vehicles in this queue need to clear the intersection. In order to define the reflection of this queue to the vehicles arriving during the period of analysis, the following formula is used.

$$d_{3} = \frac{1800Q_{b}(1+u)t}{cT}$$
(2.28)

Where

d₃=Initial queue delay (s/veh)
Q_b=Initial queue at start of period T (veh)
c=Lane group capacity (vph)
T=Duration of analysis period (h)
t=duration of unmet demand in T (h)
u=delay parameter

The parameters *t* and *u* are determined according to the following equations:

$$t = 0 \text{ if } Q_b = 0, \text{ else } t = \min\left\{T, \frac{Q_b}{c[1 - \min(1, X)]}\right\}, \text{ and}$$
 (2.29)

$$u = 0 \text{ if } t < T \text{ , else } u = 1 - \frac{cT}{Q_b [1 - \min(1, X)]}$$
(2.30)

Where

X = v/c ratio for the lane group

2.4.6. Computer Programs Used

2.4.6.1. <u>TEAPAC/SIGNAL 97 and TEAPAC/SIGNAL 2000.</u> One of the computer programs used for the purpose of this thesis was TEAPAC created by Strong Concepts Inc. [16]. Signal 97 and Signal 2000 are two modules generated for analysis and design of signalized intersection in accordance with HCM 1997 and HCM 2000 respectively. Signal 2000 is an updated version of Signal 97 to include the changes made in HCM 2000 version.

Both of the programs use the formulas and methodologies set out by HCM 1997 and HCM 2000 for analysis of signalized intersections.

2.4.6.2. <u>Synchro 6.</u> Synchro Version 6 (build 612) [17], created by Trafficware Corporation was also used for evaluation of the intersection data collected. The program utilizes HCM 2000 formulation and Percentile Delay Method for calculation of delay at signalized intersections. Both of the methods were executed for comparison with the actual field measures.

The basic premise of the Percentile Delay Method is that traffic arrivals will vary according to a Poisson distribution. The Percentile Delay Method calculates the vehicle delays for five different scenarios and takes a volume weighted average of the scenarios. The five scenarios are the 10th, 30th, 50th, 70th, and 90th percentile scenarios. If traffic is observed for 100 cycles, the 90th percentile would be the 90th busiest, the 10th percentile

would be the 10th busiest, and the 50th percentile would represent average traffic. It is assumed that each of these scenarios will be representative for 20 per cent of the possible cycles.

The traffic volumes for each scenario are adjusted up or down according to the following formulas. The expected number of vehicles, λ , is the hourly flow rate divided by the number of cycles per hour.

$$\lambda = v * \frac{C}{3600} \tag{2.31}$$

Where

v = Volume (vph) C = Cycle Length (s)

The variance, or standard deviation, in traffic is the square root of the expected number of vehicles for a Poisson arrival.

$$\rho = \text{Sqrt}(\lambda) = \text{standard deviation in expected arrivals per cycle}$$
 (2.32)

The expected number of vehicles for a given percentile can be calculated using a Poisson distribution. This is given by the formula:

$$vP = (\lambda + z\rho) * \frac{3600}{C}$$
 =volume for percentile P (2.33)

Where

C= Cycle Length

z is the number of standard deviations needed to reach a percentile from the mean. It can be determined from Table 2.4.

Percentile	Z
10	-1.28
30	-0.52
50	0
70	0.52
90	1.28

Table 2.4. z values for different percentiles

The simplified formula to determine adjusted volumes is thus:

$$vP = v + \left[z * \sqrt{(v * C/3600)}\right] * \frac{3600}{C}$$
(2.34)

_

with $vP \ge 0$

3. METHODOLOGY

In order to achieve the goals of this study the data required were collected. Data collection was performed in two ways: The intersection data of the previous studies were gathered and reorganized and data at an oversaturated intersection were collected through site surveys. The data of previous studies included the studies made by (i) Ozdemir (2001) [18]; (ii) Ergun, Bayraksan, and Coskun (2000) [19]; and (iii) Ergun (2006) [20].

The studies from which the data were obtained were with small sample sizes which indicate dependence on local conditions of intersections, weather conditions, surveyor, characteristics of the users of the intersection at that specific time, and similar factors. Therefore, one of the targets of this thesis was to collect as many data as possible in order to be more representative of real life delay occurrences at signalized intersections in Istanbul.

The intersections studied, as per the objective of this thesis, are the intersections for which field delay studies were conducted. Since the aim of this thesis is to analyze the relationship between the field measurements and calculations, the intersection data archive was reviewed to select the available data and suitable intersections.

The data collected included traffic flow volumes, existing signal timings, heavy vehicle percentages, lost time data, and the actual delay values measured in the field. The data gathered from the review of available data included 38 delay studies conducted for different approaches of different intersections with different locations and signal parameters.

The available data for analysis were mainly unsaturated intersections. All of the available studies for oversaturated intersections were either too oversaturated so that the end of the queue cannot be observed or the oversaturation was due to the spill back effect of the downstream intersection. Besides these unfavorable conditions, policemen were regulating the traffic at some of these intersections which means that the signals cannot be tested for these intersections. Therefore, in order to evaluate the oversaturated

intersections, a field measurement survey was conducted for Dolmabahce Intersection in Istanbul.

After collection of the field data and field delay measurements, the software programs Signal 97, Signal 2000 and Synchro 6 were used to obtain the delay estimates by various delay formulas. The calculated delay and actual field measurements are then compared and linear regression is used to seek the relationship between the field values and calculated values.

The delay measurements of the oversaturated intersection were also compared with the delay calculation from the arrival-departure curves.

3.1. Measurement of Delay

For the measurement of delay in the field, the procedure described in HCM 2000 [12] for field measurement of control delay was used. Accordingly the physical data about the intersection geometry, signal parameters and traffic parameters were obtained. These data included number of lanes, cycle length, approaches and estimated free flow speed. The number of vehicles in queue was recorded at regular intervals throughout the survey time. The intervals were selected so that they were not an integer divisor of the cycle length.

The other information recorded while counting the number of vehicles in queue included end of queue at each cycle, total arriving vehicles, total stopping vehicles. The measurement of delay in the field depends on the assumption that the vehicles counted in the queue at the end of the count interval experience delay throughout the interval. The acceleration – deceleration delay correction factor (CF) is also calculated and applied in the calculation of the control delay.

3.2. Assumptions

The calculation of delay at the intersections studied requires some assumptions. The following assumptions were made for the indicated parameters.

3.2.1. Saturation Headway

The headway measured as the part of the study of Ozdemir [18] was assumed to be valid for all intersections studied. Therefore, the headway of 1.904 seconds was used for the objectives of this thesis. HCM uses default headway as 1.895 seconds which corresponds to 1,900 vphpl saturation flow rate.

3.2.2. Saturation Flow Rate

Based on the same study of Ozdemir [18], the saturation flow rate was used in the calculations as 1,891 vphpl. The HCM 2000 default value for saturation flow rate is 1,900 vphpl.

3.2.3. Lost Time

The study performed by Ozdemir [18] showed that the average start up lost time was 2.3 seconds, and the clearance lost time was 1.3 seconds. Based on these findings, the total lost time was taken as 3.6 seconds for the purpose of this thesis.

3.3. Analysis of Data

The intersection data were applied to obtain the results of delay calculations based on different models using different traffic analysis programs. These programs were *Signal 97*, which applies Highway Capacity Manual 97 formulation; *Signal 2000*, which implements HCM 2000 formulation; and Synchro, which provides calculations using both HCM 2000 formulation and Percentile Delay Method.

The applicability of the formulas to the oversaturated intersections was tested through analysis of the data collected from the oversaturated Dolmabahce Intersection. The queuing profile of the intersection was generated and the formulas were applied to the data obtained from the intersection.

The results of the calculations were compared with the actual delay measured in the field to find the validity of the models for the Istanbul. The relationship between the model

results and actual measurements were analyzed by linear regression in order to create a formula for modification of the models to reflect the actual case in Istanbul. In this process, the Statistical Data Analysis tools of MS Excel were used.

The data obtained for the oversaturated intersection was also applied into the software programs and the results of the programs were obtained. Also time dependent queuing behavior of the observed approach was analyzed and the delay was calculated from the arrival and departure flows diagram created. The delay was measured in the field for two separate periods and the results of delay calculations through various methods were compared and analyzed.

4. DATA COLLECTION

In this study 38 intersection approaches from previous studies and one approach from the oversaturated Dolmabahce Intersection were analyzed. The existing intersection data used in these analyses were collected from three previous studies done in 2001 [18], 2000 [19] and recently in 2006 [20].

The study done in year 2001 [18] examined four intersections, namely Sarayburnu, Ahırkapı, Akmerkez and Silivrikapı intersections. The purpose of the study was to optimize the signaling parameters. However, delay studies were also conducted at two of these intersections, which were Sarayburnu and Ahırkapı intersections. The data for the purpose of this thesis were available for these two intersections. The delay measurements performed for these intersections included both before and after optimization situations. Therefore, the data available from this study included 14 approaches.

The data collected in the study conducted in year 2000 were for Silivrikapı intersection. This study also included optimization and resulted with two alternatives of optimized signal phases. As a result, delay field surveys were performed for three signaling situations and therefore provided delay data for 12 approaches.

The intersection data collected in 2005 includes five intersections (Unverdi, Yayla, Kocasinan Girisi, Sirinevler and UEFA Intersections) and 12 approaches.

The data obtained from these studies provided 38 approaches for which all the signal parameters, intersection characteristics, and traffic flow characteristics as well as control delay measured in the field were available. The data collected at these intersections were reorganized for analysis. The approaches that were analyzed were numbered and listed in Table 4.1.

	Intersection	Data Nr	Analysis Daried	Approach
Number	Name	– Data Nr.	Analysis Period	Approach
		1	AM PEAK (Existing)	EB
		2	AM PEAK (Optimized)	EB
		3	AM PEAK (Existing)	WB
1109	Sarauburny Intersection	4	AM PEAK (Optimized)	WB
1109	Sarayburnu Intersection	5	PM PEAK (Existing)	EB
		6	PM PEAK (Optimized)	EB
		7	PM PEAK (Existing)	WB
		8	PM PEAK (Optimized)	WB
		9	AM PEAK (Existing)	SB
	Ahırkapı Intersection – A	10	PM PEAK (Existing)	SB
1100		11	PM PEAK (Optimized)	SB
1102		12	AM PEAK (Existing)	NB
	Ahırkapı Intersection – B	13	PM PEAK (Existing)	NB
		14	PM PEAK (Optimized)	NB
		15	OFF-PEAK	WB
11(0)		16	OFF-PEAK	EB
1162A	Unverdi Intersection	17	OFF-PEAK	NB
		18	OFF-PEAK	SB
1163	Varia Internetion	19	OFF-PEAK	EB
1105	Yayla Intersection	20	OFF-PEAK	WB
1164	Kocasinan Girisi	21	OFF-PEAK	EB
1164	Intersection	22	OFF-PEAK	WB
1165		23	OFF-PEAK	EB
1165	Şirinevler Intersection	24	OFF-PEAK	WB
1426		25	OFF-PEAK	EB
1426	UEFA Intersection	26	OFF-PEAK	WB
		27	OFF-PEAK (Existing)	SB
		28	OFF-PEAK (Existing)	WB
		29	OFF-PEAK (Existing)	NB
		30	OFF-PEAK (Existing)	EB
		31	OFF-PEAK (Optimized – Alt1)	SB
1115	Cilizzation Intersection	32	OFF-PEAK (Optimized – Alt1)	WB
1115	Silivrikapı Intersection	33	OFF-PEAK (Optimized – Alt1)	NB
		34	OFF-PEAK (Optimized – Alt1)	EB
		35	OFF-PEAK (Optimized – Alt2)	SB
		36	OFF-PEAK (Optimized – Alt2)	WB
		37	OFF-PEAK (Optimized – Alt2)	NB
		38	OFF-PEAK (Optimized – Alt2)	EB

Table 4.1. Summary intersection data worksheet

The Dolmabahce Intersection was selected for oversaturated intersection analysis. The camera record of the intersection was obtained for the evening peak period. The traffic data and delay measurements were then collected from the camera record in accordance with the HCM procedures as explained in Section 3. The data collected at Dolmabahce Intersection included arrival rates and departure rates for southbound approach, volumes of eastbound and westbound traffic, control delays incurred by the southbound approach, signal parameters and the intersection geometrical data.

In order to analyze the development of queue and delay at oversaturated intersection approaches, the field survey started at 16:30 just before the start of the peak period and the start of the queue. The vehicles arriving to and departing from the intersection were counted for every 10 seconds in order to develop the arrival and departure pattern for the southbound approach which was studied. The vehicles departing from the other approaches were also counted for every 10 seconds.

The length of the queue of southbound approach has grown beyond the range of observations in 30 minutes after the start of the study. Therefore, the study period was limited to 30 minutes field study since it was impossible to count the arriving vehicles.

Delay measurement in field was made for two separate 10-min periods in the study period in order to evaluate the effect of queue length in delay calculation and measurement. The first survey was done for the duration between the 1:30 and 11:30 minutes (survey period 1) and the second survey was conducted for the between 16th and 26th minutes (survey period 2) of the counting period. The field delay study procedure described in HCM 2000 was implemented for the purpose of this measurement. Count interval was selected as 15 seconds which is not an integer divisor of the cycle length. The delay measurement information collected for two periods were applied in the field control delay calculation procedure described in HCM 2000. The data and calculations for the two periods are shown in Table 4.2 and 4.3.

Intersec Survey I Crossin Observe	Period: g Street	s:	AM Pe	ak ()		Off Pe	ak ()		08.05. PM Pe		
Approad No. Of L Survey Survey	.anes (L Count In Time =	.)	3 (I) = <i>min.</i>	15	sec.	Free F Clock	Time:	16:30	-	16:40	
Cycle Le	engtn (C	<i>;) =</i>	110	Sec.			∕ <i>Yello</i> и N T E F			48/2	
Clock Time	Cycle No	1	2	3	4	5	6	7	8	9	10
16:30	1	38	48	60	72	59	47	24			
	2	32	50	61	67	67	55	45			
16:35	3	45	54	59	68	64	47	34	24		
	4	48	55	71	71	59	37	18			
	5	38	57	66	78	71	58	41			
16:40	6	38	54	66	74	59	41	27	20		
	7	20	20	20	9	0					
	8										
	9										
	10										
то	TALS :	259	338	403	439	379	285	189	44	0	0
Total Ve				-		2336		(sum To	itals row)		
No. Of (V _{tot} =	Cycles 3 354 354	Survey	ed (N _c	,) =	5.45		(Survey	Time / C	ycle Len	gth)	
V _{stop} = Fraction Avg. No	of Veh.		• •		1. ch Cyc		(V _{stop} / V 21	(_{tot}) .63	(V _{stop} / (N _c x L))	
AccDe Time in	c. Delay	Corre	ction F		CF) =	-1	(I x (π V _i			. –//	
Correcti Control		-1.00 Vah			(CF x F)						
Control	Delay /	ven.	=	88.08	sec.		(Time in	Queue/\	/eh. + Co	orrection)	

Table 4.2. Intersection control delay worksheet for survey period Nr. 1

Intersec Survey Crossin Observe	Period: g Street		AM Pe	Off Pe	ak ()		08.05. PM Pe	2006 eak (x)			
Approad No. Of L Survey	ch & Lar anes (L Count In	ne Grou .) =	ір: З	Southb	ound (te <i>sec.</i>	Free F	sea) Flow Sp Time:			<i>km/h</i> 16:59	
Cycle Le				sec.			/Yellow				
					COU	NT II	NTEF	VAL	1	1	
Clock Time	Cycle No	1	2	3	4	5	6	7	8	9	10
16:46	1	14	23	33	39	49	59	45			
	2	48	68	77	88	85	83	77			
16:51	3	67	71	71	71	105	109	101	86		
	4	72	79	79	95	107	97	88			
	5	83	81	88	94	103	97	84			
16:56	6	76	66	66	95	95	69	51	34		
	7	34	34	34	34	34	34	18	4	0	
	8										
	9										
	10										
то	TALS :	394	422	448	516	578	548	464	124	0	0
Total Ve					_{iq}) =	3494		(sum Tc	otals row)		
No. Of (V _{tot} =	380	Survey	ed (N	,)=	5.45		(Survey	Time / C	ycle Leną	gth)	
V _{stop} = Fraction Avg. No				-		00 /a –	(V _{stop} / V 23			N - y T \\	
Avg. No AccDe		•••			-	e = -1	23	.22	(V _{stop} / (in _c x ∟))	
Time in	-			124.13	-	•	(I x (HV	_a / V _{tot}) x	0.9)		
Correcti	ion =	-1.00	sec.		(CF x F)	/S)					
Control	Delay /	Veh.	=	123.13	sec.		(Time in	Queue/\	/eh. + Co	prrection)	

Table 4.3. Intersection control delay worksheet for survey period Nr. 2

5. DATA ASSESSMENT

The data collected was used in Signal97, Signal2000, and Synchro 6 computer programs for analysis of the situation at the intersections and calculation of the control delay according to different delay formulas. Signal97 program uses the HCM 1997 formula and provides the delay results accordingly. Signal 2000 program uses HCM 2000 delay formula for calculation of delay. Synchro 6 program can provide results for delay calculation using both HCM 2000 formulation and Percentile Delay Method. The data were analyzed using both methods. The results of HCM 2000 formulation were compared with the ones obtained from Signal 2000 in order to evaluate any difference, if there were, between two applications of the same formulation. The outputs of the program runs for the intersections analyzed are provided in the Appendices.

The computer analyses were also compared for calculation of approach v/c ratios. Since the v/c ratio is directly related to the average delay on the approach, the differences on delay calculation outcomes were expected to be reflected to the v/c calculations of the programs.

5.1. Evaluation of Validity of Formulas

5.1.1. Unsaturated Intersections

The results of different delay calculations and the actual field measurement were used in assessment of relationships between the actual delays measured in the field and the estimated delays. The list of the program outputs and field measurements are summarized in Table 5.1. For the purpose of evaluating the relationship between the actual field data and computer calculations through regression analysis, Statistical Data Analysis tools of MS Excel were used.

Intersection Nr.	Data Nr.	Field	Signal 97	Signal 2000	Synchro HCM	Synchro PDM*
	1	4.70	4.80	7.50	4.50	3.30
	2	3.87	3.60	6.20	3.50	2.50
	3	9.82	8.00	13.10	9.30	9.70
	4	5.93	6.10	10.70	7.10	7.30
1109	5	8.87	9.00	15.10	9.50	9.80
	6	6.09	6.30	11.60	6.70	6.80
	7	4.88	4.50	7.80	4.70	4.80
	8	3.80	3.20	6.10	3.30	3.40
	9	11.39	7.90	10.60	7.70	7.20
	10	12.86	9.70	14.60	9.10	9.30
	11	12.77	9.60	13.40	8.90	9.20
1102	12	2.35	5.50	9.40	5.20	5.40
	13	4.35	4.40	7.80	4.20	4.30
	14	4.21	4.30	7.10	4.10	4.20
	15	67.68	115.70	128.80	99.10	97.40
	16	26.73	44.10	49.50	54.00	52.50
1162A	17	36.99	55.80	67.90	49.80	51.30
	18	53.28	77.00	103.30	128.10	126.40
11.02	19	24.66	20.00	21.80	21.60	22.00
1163	20	9.54	18.90	19.60	19.60	19.50
1164	21	8.46	6.30	6.70	10.00	36.90
1164	22	11.34	9.60	12.40	11.70	12.60
1165	23	5.04	4.50	4.90	4.80	4.90
1165	24	1.53	12.60	13.30	11.40	11.50
1406	25	13.14	12.00	12.80	12.60	12.90
1426	26	7.11	7.50	8.10	20.60	190.50
	27	14.55	15.10	15.30	14.70	14.80
	28	28.81	29.30	34.50	31.10	23.20
	29	11.48	13.70	13.50	13.00	13.30
	30	39.46	30.80	37.70	32.70	20.70
	31	6.81	9.40	9.60	9.50	9.60
1115	32	19.83	21.50	35.10	24.00	17.60
1115	33	6.21	8.50	8.30	8.40	8.60
	34	28.41	22.20	35.90	26.50	21.30
	35	8.39	10.90	10.30	10.30	10.30
	36	32.41	29.70	34.20	30.80	20.90
	37	8.98	10.30	9.70	9.70	9.90
	38	37.15	37.50	52.30	41.40	32.00

Table 5.1. Delay measurements and calculations (sec/veh)

* PDM: Percentile Delay Method

The results of the analysis of the intersections were applied paired t-test in order to test the hypothesis that the means are not different at 95 per cent confidence level. The test for delay estimates according to HCM 1997 using Synchro 97 software and according to HCM 2000 using Signal 2000 resulted with the rejection of the hypothesis (P-value 8.74×10^{-06}). Also, the test for estimates of HCM 2000 formula by Signal 2000 and Synchro

HCM rejected the hypothesis (P-value 0.04). The hypothesis were not rejected by the other tests.

It was seen from the analyses that the estimates of HCM 1997 and HCM 2000 were different, although there is no change in delay formulation of HCM 1997 and HCM 2000. The differences between HCM 1997 and HCM 2000 regarding analysis of signalized intersections are [21];

- New adjustment factors are added for pedestrians and bicyclists in HCM 2000
- A back-of-queue model is developed in HCM 2000
- Saturation flow rate adjustment for protected plus permitted left turns from a shared lane now requires to be divided for protected and permitted.

The difference between the analyses made using Singal 97 and Signal 2000 were due to the new back-of-queue model developed in HCM 2000. Table 5.1 shows that the estimates of HCM 2000 formula using Synchro HCM method and using Signal 2000 were also different despite the fact that both apply HCM 2000. The main reason for this difference is that Synchro HCM method doesn't consider initial queue delay component of HCM formula since it includes a measure for queue interaction to solve the intersections on an arterial. In addition to this difference, the platoon factor used does not match HCM, the input data are different and there are rounding differences [17].

The differences between the field measurement and computer calculations for some of the data were over 50 per cent of the field measurements. Especially data numbers 12, 20, and 24 shows differences more than 100 per cent of the actual field data. The comparison for data number 24 indicates a possible error in field measurement of delay for westbound approach in Sirinevler Intersection. Despite these high differences, all the data obtained were included in the analysis. Only one data item (#26) was not included in analysis of Synchro Percentile Delay Method outcomes due to the unreasonable difference with the actual field measurement (2579 per cent).

The Percentile Delay Method of Synchro software estimates delay using five different scenarios of the 10th, 30th, 50th, 70th, and 90th percentiles. The program assumes that each of these scenarios would be representative for 20 per cent of the possible cycles and takes a volume weighted average of the scenarios.

As mentioned above, the results of the computer simulations were also compared for consistency of the v/c ratios obtained shown in Table 5.2. The comparison showed that the v/c ratios calculated by different programs were similar although there were differences in delay estimates. It could be concluded from this comparison that the calculation of adjusted volumes and capacities were similar, and therefore the differences in delay estimates were not due to the calculation of adjusted volumes and capacities.

The delay estimates were analyzed for representation of the field delay measurements. The data numbers 15, 16, 17 and 18, which were obtained for Unverdi Intersection (Intersection Nr. 1162), were excluded from the evaluation since the intersection was saturated. The evaluation of delay estimates for this intersection is done in Section 5.1.2

As the first step of statistical analysis, linear relationship was assumed for the regression analyses of the delay estimates and actual delay measured. A linear relationship would allow developing an adjustment coefficient for the delay estimates. This assumption was tested for each regression model through analysis of the distribution of residuals. Residuals were randomly distributed for all of the regression models, which indicated that the assumption of linear relationship can be accepted valid. Therefore, nonlinear regression was not considered necessary.

Intersection Nr.	Data Nr.	Signal 97	Signal 2000	Synchro HCM	Synchro PDM*
	1	0.34	0.31	0.28	0.29
	2	0.32	0.29	0.26	0.28
	3	0.72	0.71	0.74	0.74
1109	4	0.68	0.67	0.70	0.70
1109	5	0.80	0.78	0.77	0.77
	6	0.75	0.73	0.73	0.73
	7	0.37	0.37	0.38	0.38
	8	0.35	0.34	0.36	0.36
	9	0.27	0.23	0.24	0.24
	10	0.76	0.70	0.69	0.69
1102	11	0.79	0.72	0.72	0.72
1102	12	0.67	0.63	0.62	0.62
	13	0.41	0.39	0.38	0.38
	14	0.43	0.40	0.39	0.39
	15	1.15	1.18	1.08	1.08
11624	16	0.92	0.95	0.93	0.93
1162A	17	0.95	1.00	0.96	0.96
	18	1.01	1.09	1.18	1.18
1163	19	0.66	0.68	0.67	0.67
1103	20	0.56	0.57	0.57	0.57
1164	21	0.52	0.53	0.78	1.00
1164	22	0.44	0.45	0.45	0.45
1165	23	0.34	0.35	0.34	0.34
1165	24	0.58	0.59	0.45	0.45
1406	25	0.69	0.71	0.70	0.70
1426	26	0.66	0.67	0.91	1.37
	27	0.61	0.61	0.59	0.59
	28	0.58	0.64	0.48	0.55
	29	0.49	0.48	0.48	0.48
	30	0.35	0.42	0.21	0.34
	31	0.58	0.58	0.57	0.57
1115	32	0.65	0.83	0.56	0.65
1115	33	0.47	0.45	0.46	0.46
	34	0.38	0.53	0.29	0.42
	35	0.50	0.45	0.44	0.45
	36	0.56	0.61	0.42	0.51
	37	0.44	0.38	0.38	0.38
	38	0.46	0.54	0.30	0.43

Table 5.2. Volume/capacity ratios obtained from different programs

* PDM: Percentile Delay Method

5.1.1.1. <u>Analysis of Signal 97 Program Delay Estimates.</u> The results obtained by HCM 1997 formulation from Signal 97 analysis were compared with the actual field measurements for searching a linear relationship. Accordingly, linear regression analysis was applied to the delay estimates of Signal 97. The analysis provided the results shown in Table 5.3.

Regression Stati	stics							
Multiple R	0.9356							
R Square	0.8753							
Adjusted R Square	0.8714							
Standard Error	3.6409							
Observations	34							
ANOVA								
	df	SS	MS	F	Sig. F			
Regression	1	2978.06	2978.06	224.66	5.08E-16			
Residual	32	424.19	13.26					
Total	33	3402.26						
		Standard			Lower	Upper	Lower	Upper
	Coef.	Error	t Stat	P-value	95%	95%	95.0%	95.0%
Intercept	-0.79	1.08	-0.73	0.4689	-2.98	1.40	-2.98	1.40
Signal 97	1.069	0.07	14.99	5.08E-16	0.92	1.21	0.92	1.21

Table 5.3. Regression analysis of delay estimates of Signal 97

The resulting regression model had a coefficient of determination, R^2 , of 0.8753 which denotes a very good relationship. The F-test of the model showed that the relationship was valid with a significance of F-value of 5.08×10^{-16} . Since the relationship was only for one variable, the significance of the coefficient was the same with significance of F-value as shown by the t-test of the coefficient.

The t-test for the intercept indicated that the intercept was not significant. Therefore, the intercept was not significantly different than zero.

It could be interpreted from the regression model that Signal 97 underestimated the delay by 6.9 per cent compared to the actual field delays for the data analyzed. Therefore, the results of the Signal 97 calculations can be adjusted with the following formula to represent the actual field data. The relationship is also shown on Figure 5.1:

$$y = -0.79 + 1.069x \tag{5.1}$$

Where

x= Signal 97 Estimate

y= Actual Delay

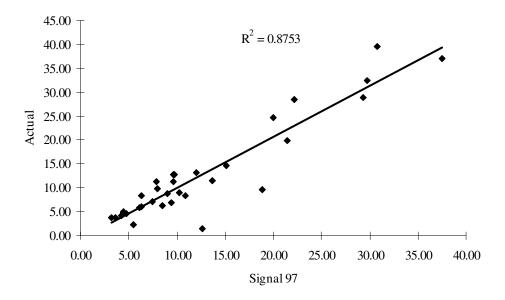


Figure 5.1. Relationship between Signal 97 estimate and actual delay

The study conducted in year 2001 by Ozdemir [18] has analyzed four intersections by using Signal97 which applied HCM 97 formulas and procedures for the calculation of control or approach delay. According to the comparison of the field delay measurement and HCM 97 delay estimation in that study, there was a strong correlation between the two values with an R^2 of 0.936. The analysis concluded that the intercept was insignificant and the estimates of the HCM 97 formula calculated using Signal 97 software were 14.5 per cent lower than the actual field data.

Field Delay Measurement =
$$-0.933 + 1.145 *$$
 (HCM97 Delay Estimate) (5.2)

According to a similar analysis conducted at an intersection in 2000 by Ergun [19], the field delay measurement and HCM97 delay estimates had the following relationship with an R^2 of 0.940. The intercept in this analysis was found to be significant at a confidence level of 97 per cent.

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As it is seen from the above equations, the analyses of the same parameters in two separate studies have resulted that the delay estimates of HCM 97 were below the actual field measurement by 14.5 - 22 per cent.

5.1.1.2. <u>Analysis of Signal 2000 Program Outputs.</u> Linear regression analysis for relationship between HCM 2000 delay estimates from calculations of Signal 2000 and the actual field delay measurements provided the results summarized in Table 5.4.

Regression Stati	stics							
Multiple R	0.9264							
R Square	0.8583							
Adjusted R Square	0.8539							
Standard Error	3.8814							
Observations	34							
ANOVA								
	df	SS	MS	F	Sig. F			
Regression	1	2920.18	2920.18	193.84	3.97E-15			
Residual	32	482.08	15.07					
Total	33	3402.26						
		Standard			Lower	Upper	Lower	Upper
	Coef	Error	t Stat	P-value	95%	95%	95.0%	95.0%
Intercept	-0.58	1.14	-0.51	0.6121	-2.91	1.74	-2.91	1.74
Signal 2000	0.818	0.06	13.92	3.97E-15	0.70	0.94	0.70	0.94

Table 5.4. Regression analysis of delay estimates of Signal 2000

The linear regression model for the delay estimates of Signal 2000 showed that the relationship was significant according to the F-test. The R^2 obtained for the relationship was 0.8583 which also indicated that there was a very good relationship. The t-test for the intercept and coefficient results that the intercept was not significantly different than zero. Therefore, it could be interpreted that Signal 2000 overestimated delay using HCM 2000 method and the delay estimates of Signal 2000 can be adjusted with a coefficient of 0.818. The relationship between the Signal 2000 calculation and actual field data was as in the formulation given below and shown on Figure 5.2.

Where

x= Signal 2000 Estimate

y= Actual Delay 45.00 $R^2 = 0.8583$ 40.00 35.00 30.00 Actual 25.00 20.00 ٠ 15.00 10.00 5.00 0.00 0.00 20.00 30.00 40.00 60.00 10.00 50.00 Signal 2000

Figure 5.2. Relationship between Signal 2000 estimate and actual delay

5.1.1.3. <u>Analysis of Synchro Program HCM Outputs.</u> The relationship between delay estimates obtained by using the HCM 2000 option of Synchro Program and actual delay measurement on the field was analyzed. The results of the analysis are shown in Table 5.5.

Regression Stati	stics							
Multiple R	0.9205							
R Square	0.8473							
Adjusted R Square	0.8425							
Standard Error	4.0297							
Observations	34							
ANOVA								
	Df	SS	MS	F	Sig. F			
Regression	1	2882.62	2882.62	177.52	1.33E-14	-		
Residual	32	519.64	16.24					
Total	33	3402.26						
		Standard			Lower	Upper	Lower	Upper
	Coef.	Error	t Stat	P-value	95%	95%	95.0%	95.0%
Intercept	-0.39	1.18	-0.33	0.7447	-2.79	2.01	-2.79	2.01
Synchro HCM	0.956	0.07	13.32	1.33E-14	0.81	1.10	0.81	1.10

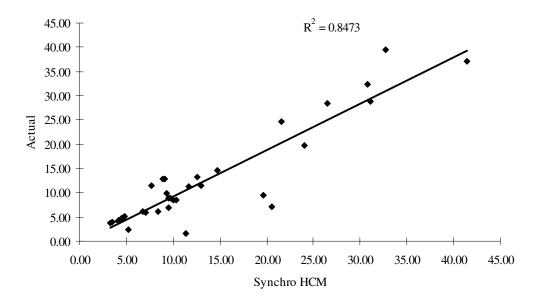
Table 5.5. Regression analysis of delay estimates of Synchro HCM

The analysis resulted with an R^2 value of 0.8473 which indicated a very good relationship. The F-test for the regression model also showed that the relationship was significant where the significance of F-value was 1.33×10^{-14} . The intercept included in the regression model was found to be insignificant as a result of the corresponding t-test and therefore could be accepted as zero. The results of the regression analysis showed that the HCM method of Synchro slightly overestimated the delay compared to the field value. The formula to adjust the Synchro HCM delay calculations to reflect the actual condition is as follows. The visual interpretation of the relationship is also provided in Figure 5.3.

$$y = -0.39 + 0.956x \tag{5.5}$$

Where

x= Synchro HCM Estimate



y= Actual Delay

Figure 5.3. Relationship between Synchro HCM estimate and actual delay

5.1.1.4. <u>Analysis of Synchro Program Percentile Delay Method Outputs.</u> The delay estimates obtained from applying the data available to the Percentile Delay Method (PDM) of Synchro were compared with the actual field data. The data item #26 was excluded from the analysis due to the unreasonable difference between the field measurement and program output (2579 per cent). The outcomes of the regression analysis conducted are given in Table 5.6.

Regression Stati	stics							
Multiple R	0.7121							
R Square	0.5071							
Adjusted R Square	0.4912							
Standard Error	7.3248							
Observations	33							
ANOVA						_		
	df	SS	MS	F	Sig. F			
Regression	1	1710.94	1710.94	31.89	3.36E-06			
Residual	31	1663.25	53.65					
Total	32	3374.19						
		Standard			Lower	Upper	Lower	Upper
	Coef.	Error	t Stat	P-value	95%	95%	95.0%	95.0%
Intercept	1.56	2.32	0.67	0.5065	-3.17	6.28	-3.17	6.28
Synchro PDM	0.880	0.16	5.65	3.36E-06	0.56	1.20	0.56	1.20

Table 5.6. Regression analysis of delay estimates of Synchro PDM

As it is seen from the summary of the regression analysis, the coefficient of determination, R^2 value, of 0.5071 was obtained which showed a poor relationship. On the other hand, the F-test showed a significant relationship at a significance level of 3.36×10^{-6} . The intercept was found to be insignificant. Therefore, it was seen that Synchro PDM method has overestimated the delay at signalized intersections by 12 per cent at this significance and relationship levels. The equation for adjustment of the Synchro PDM delay estimates for representing the actual field delay is shown below. The visual interpretation of relationship is shown in Figure 5.4.

$$y = 1.56 + 0.880x \tag{5.6}$$



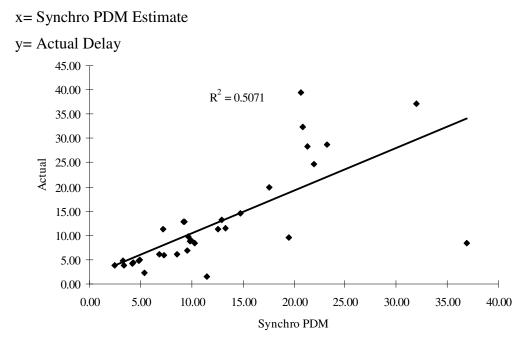


Figure 5.4. Relationship between Synchro PDM estimate and actual delay

The results of the regression analyses for the four delay estimates are summarized below in Table 5.7. The relations of the delay estimates with the actual delay are illustrated in Figure 5.5. According to these results of the regression analyses, delay estimates obtained by using Signal 97 which is based on HCM 1997 formulation showed the highest coefficient of determination with the actual delay compared to the other methods. The results also indicate that the delay estimates obtained from Signal 97 program were below the field measurement whereas the estimates of other methods were over the actual field delay.

Table 5.7. Summary of the regression analyses

	R Square	Significance F	Coefficient	Intercept
Signal 97	0.8753	5.08E-16	1.069	-0.79
Signal 2000	0.8583	3.97E-15	0.818	-0.58
Synchro HCM	0.8473	1.33E-14	0.956	-0.39
Synchro PDM	0.5071	3.36E-06	0.880	1.56

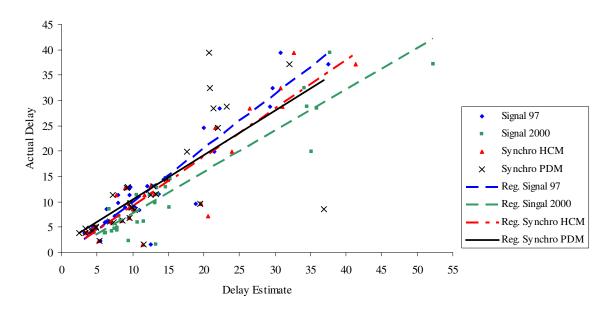


Figure 5.5. Summary of the delay estimates using different computer programs

5.1.2. Oversaturated Intersection Delay Analysis

In order to analyze the development of queue and delay at oversaturated intersection approaches, the field survey of the Dolmabahce Intersection, which was selected for analysis, started at 16:30 just before the start of the peak period and the start of the queue. The data collected at Dolmabahce Intersection included arrival rates and departure rates for southbound approach, volumes of eastbound and westbound traffic, control delays incurred by the southbound approach, signal parameters and the intersection geometrical data. The layout of the intersection studied is shown in Figure 5.6.

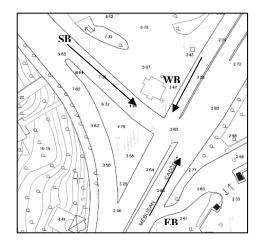


Figure 5.6. Layout of Dolmabahce Intersection

The vehicles arriving to and departing from the intersection were counted for every 10 seconds in order to develop the arrival and departure pattern for the southbound approach which was studied. The vehicles departing from the other approaches were also counted for every 10 seconds. The traffic flow pattern shown below on Figure 5.7 was obtained for the approach which indicates a typical oversaturated intersection performance. The traffic flow obtained was very similar to the theoretical oversaturated intersection flow diagram shown on Figure 2.4.

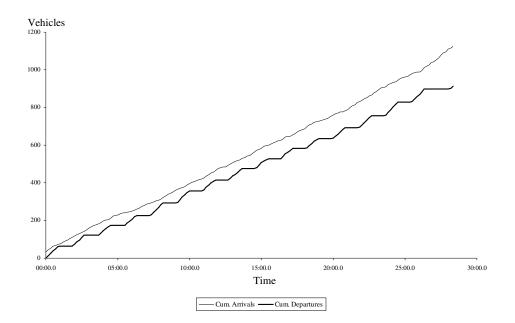


Figure 5.7. Traffic flow pattern for southbound approach of Dolmabahce Intersection

Field delay survey was also performed for two separate 10 minutes durations within the counting period. The first survey was done for the duration between the 1:30 and 11:30 minutes (survey period 1) and the second survey was conducted for the between 16th and 26th minutes (survey period 2) of the counting period. The aim of this was to test the sensitivity of the control delay field measurement method to the length of queue.

The delay was also calculated from the arrival and departure functions (Figure 5.7) and this calculation was used as comparison basis for the field delay measurements. The calculation of average delay using this graph was done by determining the area between the arrival and departure functions and dividing that by the departing vehicles within the period. This calculation method is named as "graph" method from this point forward.

The results of the field delay surveys and the graph calculations obtained for survey periods 1 and 2 and shown in Table 5.8. The average delay for the whole duration of study was also calculated from the graph and shown in the same table.

	Delay Measurements (sec/veh)								
	Survey (01:30-	Period 1 -11:30)	Survey (16:00	Whole Survey (00:00-30:00)					
Approach	Field	Graph	Field	Graph	Graph				
SB	88.08	83.57	123.13	187.22	142.29				

Table 5.8. Delay measurements through field surveys and flow diagrams

As it is seen from Table 5.8, the field studies were close to match for the first survey period whereas the delay measurements through two different ways resulted with a considerable difference (34 per cent) for the survey period 2. HCM [12] states that the field surveys for control delay measurement are not very reliable for the cases where the average number of vehicles in the queue is over 30 per lane. This limit was exceeded many times during the second survey period. Based on the above-mentioned suggestions of HCM [12], it could be concluded that the control delay field survey for the second survey period may be misleading. Therefore the measurement through calculation of the area on the flow diagram, which was directly obtained from the arrival and departure rates of the traffic flow, could be accepted as more reliable for comparison with the delay estimates of formulas.

The overall study period at Dolmabahce intersection was limited at 30 minutes due to the extensive length of the queue at the end of the period which made it impossible to continue counting the length of queue and the arrival of vehicles. The average delay per vehicle for this period was measured as 142.29 seconds from the area between the arrival and departure graphs on Figure 5.7.

The data collected were implemented to the software programs and the results shown in Table 5.9 were obtained for the delay on the intersection approaches.

	Delay Calculations (sec/veh)								
Approach	Graph	Signal 97	Signal 2000	Synchro HCM	Synchro PDM				
SB*	142.29	59.02	122.40	61.20	61.60				
EB	-	129.60	170.60	151.20	149.00				
WB	-	30.04	32.90	31.40	31.90				

Table 5.9. Delay calculations of the software programs

* Approach used for oversaturated field delay study

As it is shown in Table 5.9 the delay estimates obtained from the computer analyses were below the average delay calculated from the graph. This result was contrary to the analyses of the unsaturated intersections shown in Section 5.1.1 which indicated that the delay estimates were over the field measurements (except HCM 1997 estimates). The analysis for the other oversaturated intersection data (Unverdi Intersection, Intersection Number 1162A) in Section 5.1.1 resulted that the analysis for the southbound approach of Dolmabahce Intersection.

The analyses performed using Signal 97 and Synchro resulted with substantially different (about 100 per cent) delay calculations than Signal 2000 for the oversaturated approaches. It was seen from the reports of the programs (see Appendices A, B, C and D) that the methods except Signal 2000 did not consider the initial queue delay component of HCM formula.

The data were also applied manually to the HCM delay formula in order to calculate the initial delay component (d_3) of the formula and add to the values obtained from Signal 97 and Synchro HCM method. The other components of the formula were also calculated in order to compare with computer analyses and actual field data. The equations for calculation of d_1 , d_2 , and d_3 components of HCM delay formula were given in previous sections as Equations (2.25), (2.27) and (2.28) respectively.

The manual calculation of delay components of HCM delay formula have resulted with the delay components shown in Table 5.10 for southbound approach of the analyzed intersection.

Analysis Period (minutes)	d ₁	d ₂	d ₃	Total Delay	Field Measured Delay	Delay from Graph
01:30 - 11:30	28.0	37.4	16.6	81.9	88.08	83.57
16:00 - 26:00	28.0	105.2	41.4	174.6	123.13	187.22
00:00 - 30:00	28.0	77.8	27.3	133.2	-	142.29

Table 5.10. Average delay for SB approach by manual HCM delay calculation (sec/veh)

The result of the manual delay calculation using HCM formula has resulted with a delay figure relatively close to the delay measurements from the graph. The delays calculated for different periods were below the actual delay. The underestimation of the HCM formula manual calculation was in the range of 1.99 per cent for the first survey period, 6.74 per cent for the second period and 6.38 per cent for the whole survey. Table 5.11 indicates that the difference between the calculation using HCM formula and field measurement increased with the increasing oversaturation.

When the d_3 component obtained from the manual calculation was added to the results of the Signal 97 and Synchro HCM calculations, the total delay equaled to 86.32 and 88.50 sec/veh respectively.

The delay estimates according to the Percentile Delay Method of Synchro software were similar to the estimates of the same software using HCM 2000 formula.

In order to test its validity, the data were applied also to Akcelik's overflow delay formula shown in Equation 2.23. The calculated overflow delay using Akcelik's formula was added to the uniform delay formula result obtained in HCM delay calculation (d_1) and the average delay per vehicle for the period was obtained as shown in Table 5.11.

Analysis Period (minutes)	Uniform Delay (sec/veh)	Overflow Delay (sec/veh)	Total Delay (sec/veh)	Delay from Graph
01:30 - 11:30	28.0	22.3	50.3	83.57
16:00 - 26:00	28.0	62.4	90.4	187.22
00:00 - 30:00	28.0	45.9	73.9	142.29

Table 5.11. Manual calculation of delay using Akcelik's overflow delay formula

As it is seen from Table 5.11, Akcelik's formula underestimated the delay by 40 per cent to 52 per cent of the actual delay. The total delay did not include an initial queue delay component and therefore it was below the estimates of HCM formula. However, comparison of the overflow delay components of two formulas shows that Akcelik's formula has resulted with lower figures.

The results of all measurements and calculations explained above are summarized below in Table 5.12.

Table 5.12. Delay measurements and estimates for the oversaturated approach

	Delay (sec/veh)										
Analysis Period	Field	Graph	Signal 97*	Signal 2000	Synchro HCM*	Synchro PDM*	HCM Manual	Akcelik Manual			
01:30 - 11:30	88.08	83.57	-	-	-	-	81.9	50.3			
16:00 - 26:00	123.13	187.22	-	-	-	-	174.6	90.4			
00:00 - 30:00	-	142.29	86.32	122.40	88.50	88.90	133.2	73.9			

* Including Initial Queue Delay Component

6. SUMMARY AND CONCLUSIONS

The study included analysis of 38 approaches for unsaturated intersections and one oversaturated intersection. The data collected were analyzed using computer programs and delays were calculated using HCM 1997, HCM 2000 and Synchro PDM delay formulas. The estimates of these formulas were then compared with the actual field measurements. The comparisons were tested for linear regression and accordingly calibration models were obtained for these delay formulas. The conclusions obtained from the analyses are given below.

6.1. Unsaturated Intersections

The results of the field delay measurements and data analyses for the intersections analyzed under the scope of this thesis were described in Section 5. Accordingly, the following conclusions can be made for the analysis of the unsaturated intersections:

- The summary shown in Table 5.7 indicates that the coefficient of determination for the estimates of HCM 1997 by Signal 97 software was higher than the other estimates. It also shows that HCM 97 formulation underestimates the delay which was the results of the studies by Ozdemir and Ergun in years 2001 and 2000 respectively [18, 19] as well.
- The delay estimates of HCM 97 can be adjusted to reflect the field delay by using the coefficient of 1.069.
- The analysis of two different softwares, namely Signal 2000 and Synchro, using the HCM 2000 formulation resulted with different relations with the field data although both resulted with overestimation. The correction coefficients to represent the field delay for Signal 2000 and Synchro HCM estimates were found as 0.818 and 0.956 respectively. The main reason for this difference is that Synchro HCM method doesn't include Queue Delay since it includes a measure for queue interaction to solve the intersections on an arterial. In addition to this difference, the platoon factor used does not match HCM and Signal 2000 factors.

• The analysis of the intersections using Percentile Delay Method (PDM) of Synchro software resulted delay estimates with a poor relationship to the actual delay with a coefficient of determination (R²) of 0.5071. The F-test for the regression model resulted that there was a significant relation between the actual condition and delay estimates of PDM in which the delay estimates required to be multiplied by 0.88 in order to represent the actual delay. The creators of the software recommend this method as a better method for coordination of arterials and analysis of actuated signals. Also, it is noted in the manual of the software that the accuracy of the HCM method of Synchro is higher for delay estimates [17].

6.2. Oversaturated intersections

The conclusions of the analysis of the oversaturated intersections are as follows:

- The control delay field survey procedure described in HCM 2000 [12] resulted with delay figure close to the delay calculated from the arrival and departure rates of the vehicles when the queue length is not beyond 30 vehicles per lane. The result of the field measurement of control delay has departed from the actual delay, which was calculated from the arrival & departure graphs, as the queue length increased.
- Synchro intersection analysis program does not allow for an input of initial queue. This is because the software is aimed to be used for coordination of a series of intersections on an arterial and uses a measure for queue interaction to solve the intersections on the arterial.
- HCM 97 and HCM 2000 estimates for delay at the oversaturated approaches were found to be different using Signal software. The reason for this is that Signal 97 does not calculate initial queue component of HCM delay formula. According to the manual of Signal 97, the software uses Transyt formula for intersections with v/c ratio above 1.00 [22].
- The HCM 2000 analysis made for Unverdi intersection resulted with delay estimates over the actual delay measurements, whereas the Signal 2000 calculation for Dolmabahce intersection has underestimated the delay compared to the actual delay.

- Manual calculation of delay using HCM delay formula has resulted with delay estimates that were 1.99 6.74 per cent lower than the actual delay measurements.
- Akcelik's delay formula has underestimated the overflow delay by 40-50 per cent compared to the field measurements.

APPENDIX A: OUTPUTS OF THE SIGNAL 97 ANALYSIS

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EB Approach
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VOLEAN COSEUN THESIS 02/25/06 INT 1163 - YAYLA - OFF-PEAK 14:28:33 EXISTING SIGNAL97/TEAPAC[Ver 1.00] - HCM Input Worksheet Intersection # 163 - . Area Location Type: NONCED Rey: VOLUMES -- > 263 185 jj 123 j | WIDTHS 0.0 11 0.0 j 16.0 j LANES w Ì Ì Ì 0 j 1 | 83 0.0 - 011 λ $/1\lambda$ 1 Ŋ, 70926.0 2 L. I. 0 0.0 0 / 0 0.0 0 North £ ÷ 901 23.0 2 X. L I 41 12.0 1 N 11 I. I 1 120 | 163 0.0 | 16.0 | 1 | 27 j П 71 Phasing: SEQUENCE 0.0 PERMSV N N N N OVERLP Y Y Y Y Ϊİ. Ũ. LEADLAC LC LD 11 II. Appr Grade & Beavy Veh. Adj.Pkg Bus Pk.Hr.Factor Conf.Ped Actuated Arr.Type LT peds/hr RT 7H LT RT TH LT **S**. **BT** LT LOC - Mh TH 19ha BT TH -0 0.96 0.96 0.96 0.96 0.95 0.95 0.0 6.5 6.1 18.3 ЯO 0 0-3 3 $\mathbf{3}$ 8B ы ы ы 15.6 11.5 2.0 0 ō--3 3 3 WB 0.0 во ы ы ы 3.7 10.4 6.7 0 0 0.83 0.83 0.83 0--3 NВ 0.0 \mathbf{NO} ы ы ы 3 Ъ. $\mathbf{E}\mathbf{B}$ 0.0 2.4 9.1 2.0 во Q 0 0.92 0.92 0.92 0-ы ы 3 3 3 ы 8q 71 | LG/** -Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 | A. * * * 1 1 I ÷ * * ++++| /1с÷. * ** <++++| w. Í. Borth $< \pm$ j ****> ÷ 1 j++++ * * ÷ j++++ Т v * * * I. - W c/c=0.273 | c/c=0.159 | c/c=0.455 | c/c=0.000 | c/c=0.000 | c/c=0.000 | н C= 78.0 sec = 88.6% Y=10.0 sec = 11.4% Ped= 0.0 sec = 0.0% C= 88 sec

VOLKAN COSKUN THESIS 02/25/06 INT 1163 - YAYLA - OFF-PEAK 14:28:33 EXISTING SIGNAL97/TEAPAC[Ver 1.00] - HCM Volume Adjustment Worksheet Flow Lane Adj. Prop. of Myt. Appr Vol PHF Group -Myt Rate Flow LT RT ----vph ____ \mathbf{vph} vph_ $\begin{smallmatrix}&0&0..00&0..00\\595&0..32&0..22\end{smallmatrix}$ 123 0.96 SB-RT 128-----SB-7H 263 0.96 274 LT+TH+RT SB-LT 185 0.96 193 0 0.00 0.00 -----83 0.95 27 0 0.00 0.00 WB-RT -----833 0.00 0.10 WB-7H 709 0.95 746 TH+RT WB-LT 0 0.95 0 $0 \ 0.00 \ 0.00$ -----27 0.83 NB-RT 33NB-7H 163 0.83 196 LT+TH+RT 145 0 0.00 0.00 NB-LT 120 0.83 -41 0.92 45 EB-RT \mathbf{RT} 45 0.00 1.00 979 0.00 0.00 0 0.00 0.00 901 0.92 979 EB-TH TH 0 0.92 EB-LT 0 -----SICNAL97/TEAPAC[Ver 1.00] - HCM Saturation Flow Adjustment Worksheet Lane Adjustment Factors Adj. Ap Group Ideal L ----– Sat- \mathbf{pr} Hymts Satfl n Lane Heavy Ar Lane Right Left Adj flow \mathbf{ch} Bus pephq - Width Vehs Grade Parkq Block Loc Util Turn Turn Fact vphq -----____ SB-LT+TH+RT 1891 1 1.133 0.908 1.000 1.000 1.000 1.0 1.00 0.871 0.984 1.00 1668 TH+RT 1891 2 1.033 0.893 1.000 1.000 1.000 1.0 0.95 0.984 1.000 1.00 3265 WB-NE-LT+TH+RT 1891 1 1.133 0.923 1.000 1.000 1.000 1.0 1.00 0.888 0.981 1.00 1723 EB-BTP. EB-TH

VOLEAN COSEUN THESIS 02/25/06 INT 1163 - YAYLA - OFF-PEAK 14:28:33 EXISTING. SICMAL97/TEAPAC[Ver 1.00] - HCM Capacity Analysis Worksheet Adj LT Adj Flow Green Lane V/C Crit Ap. Lane Group Phase Flow Satfl Ratio Ratio Group Ratio Lane $\mathbf{p}\mathbf{r}$ ch. Rate Hyts туре Rate v/s g/C Capac v∕a Grpvph. --------------vphg ----vph . _ 1668 5.95 0.3570.163 271 2.196÷ SB-LT+TH+RT 833 3265 0.255 0.458 1495 0.557WB- TH+RT 374 0.217 0.276 476 0.786 1723NB-LT+TH+RT ÷. 0.7650.029 1200 EB-45 1569 0.038 **FT** 9793238 0.302 0.458 1483 0.660 EB-÷ TH ____ Cycle Length, C 88 sec. Ye = Sum crit(v/s) 0.876 Lost Time Per Cycle, L 9.1 sec $Xe = Ye \times C/(C-L) 0.977$ SICMAL97/TEAPAC[Ver 1.00] - HCM Level-of-Service Worksheet Vol Green Unif Progr Lane Calib Incr Lane Lan Lane λp. Ratio Delay Fact Croup Term q/C dl PF Capac k Crp Appr Appr LOS Dalay LOS Delay d2 Croup pr Group Ratio PF Capac k g/C Delay ch . Hyts v/ e -- sec/v -----vph. sec/v sec/v - sec/v ____ -----------SB-LT+TH+R7 2.196 .163 36.8 1.00 271 0.500 549.94 586.8 F -> 586.8 F .458 17.4 1.00 1495 0.500 WB- TH+RT 0.557 1.50 18.9 \mathbf{B} - 34 18.9 В MB-LT+TH+RT 0.786 . 276 29.4 1.00 476 0.500 12.30 41.7 D+41.7 D+ - 36 .765 2.5 1.00 1200 0.500 18.5 1.00 1483 0.500 2.6 0.0380.06 EB-**FT** A \mathbf{EB} -TH 0.660 . 458 18.5 2.3220.9 C+- 24 20.0 C+Cycle= 88" 0.960 ----Int Total F

02/25/06 VOLEAN COSEUN THESIS INT 1163 - YAYLA - OFF-PEAK 14:28:33 EXISTING SIGNAL97/TEAPAC[Ver 1.00] - Capacity Analysis Summary Intersection Averages for Int # 163 - . Degree of Saturation (v/c) 0.96 Vehicle Delay 141.9 Level of Service F Sq 71 | Phase 1 | Phase 2 | Phase 3 | LC/** -----÷ * * А. 1 ÷ $\star \star$ ++++1 н /1js:≉ * *> «++++İ w. 1 e. I. н 4 to 日本本本地。 North * * 1++++ ÷ v * \mathbf{W} c/c=0.273 | c/c=0.159 | c/c=0.455 | 1 | C= 24.0" | C= 14.0" | C= 40.0" Y+R= 3.0" | Y+R= 4.0" | Y+R= 3.0" OFF- 0.04 | OFF-30.74 | OFF-51.14 | C- 88 sec C- 78.0 sec - 88.6% Y-10.0 sec - 11.4% Ped- 0.0 sec - 0.0% g/C (Width/) | Service Rate| Adj| | HCM | L | 90% Max | Lane Group | Lanes | Reqd Used | GC (vph) GE |Volume | v/c | Delay | S | Queue | 586.8 SB Approach F |LT+TH+RT| 16/1 |0.421 |0.163 | 78 | 258 | 595 |2.196 | 586.8 |*F | 646 ft| MB Approach 41.7 D+ |LT+TH+RT| 16/1 |0.306 |0.276 | 312 | 476 | 374 |0.786 | 41.7 |*D+| 347 ft| WB Approach 18.9 B | TH+RT| 26/2 |0.313 |0.458 | 1400 | 1495 | 833 |0.557 | 18.9 | B | 296 ft| 20.0 C+ EB Approach | 12/1 |0.146 |0.765 | 1195 | 1200 | | 23/2 |0.352 |0.458 | 1388 | 1483 | 45 |0.038 | 979 |0.660 | 2.6 | A | 25 ft| 20.9 |*C+| 342 ft| RT. I TH L

VOLKAN COSEUN THESIS 02/25/06 INT. 1164 - KOCASINAN GIRISI - OFF-PEAK 14:49:18 EXISTING SIGNAL97/TEAPAC[Ver 1.00] - HCM Input Worksheet Intersection # 164 - . Area Location Type: NONCED Key: VOLUMES -- > 143 jj 0 j WIDTHS 127 0.0 14.0 0.0 jj LANES 1 1 w II. 0 1 j 0 jj 298 8.2 1 X. 11 I Ν /1N848 25.0 2 I Ĩ. 0.0 0 / 142 0 0.0 0 £ Binetch ÷ 1 988 23.0 $\mathbf{2}$ ſ Y, L 0 0.0 0 Ν П I. I. 0 0 0 Phasing: SEQUENCE 131 1 1 0.0 0.0 j 0.0 PERMSV NNNN 11 0 0 Í. Ø. OVERLP YYYY 11 1 LEADLAC LD LD 11 Appr Grade * Beavy Veh. Adj.Pkg Bus Pk.Hr.Factor Conf.Ped Actuated Arr.Type peds/hr RT TH LT RT TH LT -----<u>۹</u>. BT LT LOG No. Bb TH BT TH LT $\begin{array}{ccc} 0.0 & 11.1 \\ 5.7 & 0.0 \end{array}$ 0.0 4.7 0 0.94 0.94 0.94 0-3 8B ю Ũ В ы B 3 11.70 0.97 0.97 0.97 0-3 3 $\mathbf{3}$ **WB** 0.0 0.0ю 0 ы и и 0.0 0 0.90 0.90 0.90 0.0 0.00 0-MB 0.0 NO ы ы - 19 3 З. 3 3 EB 0.0 0.0 4.3 4.9 ю 0 0 0.88 0.88 0.88 0-19 ы Я 3 38 Sq 13 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 1 **/** * * 1 * ++++| ++++| **** /1 $\pm p$ - A. 1 **** North ***** |++++» c/c=0.200 | c/c=0.122 | c/c=0.567 | c/c=0.000 | c/c=0.000 | c/c=0.000 1 L 1 I. II. j OFF- 0.0% j OFF-24.4% j OFF-40.0% j OFF- 0.0% j OFF- 0.0% j OFF- 0.0% j C- 90 sec G- 80.0 sec - 88.9% Y-10.0 sec - 11.1% Pad- 0.0 sec - 0.0%

02/25/06 VOLEAN COSEUN THESIS INT. 1164 - KOCASINAN GIRISI - OFF-PEAK 14:49:18 EXISTING SIGNAL97/TEAPAC[Ver 1.00] - HCH Volume Adjustment Worksheet Flow Prop. of Appr Myt. Lane Adj -Myt Vol PHF Rate Group Flow LT RT ____ vph. vph. vph. 0 0.94 0 0 0.00 0.00 SB-RT 0 0.94 152 1.00 0.00 0 LT+TH SB-TH SB-LT 143 0.94 1520 0.00 0.00 -----WB-RT 298 0.97 307307 0.00 1.00 \mathbf{BT} 874 0.00 0.00 WB-TH 848 0.97 874 TH WB-LT 0 0.97 - 0 -----0 0.00 0.00 0 0.00 0.00 1284 0.13 0.00 0.0.88 0 EB-BT ЕВ-ТН 988 0.88 1123 LT+TH EB-LT 142 0.88 161 $0 \ 0.00 \ 0.00$ SIGNAL97/TEAPAC[Ver 1.00] - HCH Saturation Flow Adjustment Worksheet Adj Aр Lana Adjustment Factors Group Ideal L ---pēr Satch. Hymts Satfl n Lane Beavy Bus Ar Lane Right Left Adj flow pophg - Width Vehs Grade Parkg Block Loc Otil Turn Turn Fact vphg -----1900 1 1.067 0.900 1.000 1.000 1.000 1.0 1.00 1.000 0.952 1.00 1737 SB-LT+TH 1900 1 0.873 0.895 1.000 1.000 1.000 1.0 1.00 0.850 1.000 1.00 1263 WB-BT 1900 2 1.017 0.946 1.000 1.000 1.000 1.0 0.95 1.000 1.000 1.00 3472 WB-TH EB-LT+TH 1900 2 0.983 0.958 1.000 1.000 1.000 1.0 0.95 1.000 0.994 1.00 3380 SIGNAL97/TEAPAC[Ver 1.00] - HCH Capacity Analysis Worksheet LT. Adj Adi Flow Green V/C Crit Ap. Lane Lane Group Phase Flow Satfl Ratio Ratio Group Ratio Lane pæch туре g/CHyts Rate Rate Capad v/a Crp. **V/6** vph. vphq vph. _ 17.370.087 0.244 425 0.358 SB-LT+TH 152÷. 307 0.243 0.803 1263 1014 0.303 \mathbf{BT} WB-0.252 874 0.570 1979 WB-TH 347.2 0.442 1284 33800.380 0.726 2452 0.524 EB-LT+TH * Cycle Length, C 90 sec Ye = Sum crit(v/s) 0.467 Lost Time Per Cycle, L 2.7 sec $Xe = Ye \times C/(C-L) = 0.482$

	NOLKAN COSEUN THESIS 02/25/06 ENT. 1164 - KOCASINAN GIRISI - OFF-PEAK 14:49:18 EXISTING RICNAL97/TEAPAC [Ver 1.00] - HCM Level-of-Service Worksheet													
Ap Lane pr Group ch Hvts	vol	Green Ratio q/C	Unif Delay di	Progr Fact PF	Lane Group Capac	Calib Term k	Incr Delay d2	Lane Croup Delay	Crp L08	Appr Delay sec/v	Appr Los			
SB-LT+TH WB- RT WB- TH	0.358	. 803	2.3	1.00	1014	0.500	0.77	3.1	2		с			
EB-LT+TH									>		A A			
Cycla= 90" Int Total	0.461								>	9.2	A			

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02/25/06
VOLEAN COSEUN THESIS
                                                                                    14:49:18
INT. 1164 - KOCASINAN GIRISI - OFF-PEAK
EXISTING
SIGNAL97/TEAPAC[Ver 1.00] - Capacity Analysis Summary
Intersection Averages for Int # 164 - .
Degree of Saturation (V/c) 0.46 Vehicle Delay 9.2 Level of Service A
Sq 13 | Phase 1 | Phase 2 | Phase 3 |
**/**
              ÷ A
              * ++++j
                                             ++++i
 /1
              \pm 2e
                                            《古古古古】
                     Т
                         A
  1
                     j****
  1****>
North |
                                   1++++>
  1
       | c/c=0.200 | c/c=0.122 | c/c=0.567 |
| c= 18.0" | c= 11.0" | c= 51.0" |
       Y+R- 4.0" | Y+R- 3.0" | Y+R- 3.0"
                                                 OFF- 0.04 | OFF-24.44 | OFF-40.04 |
       C- 90 sec C- 80.0 sec - 88.9% Y-10.0 sec - 11.1% Fed- 0.0 sec - 0.0%
| Lane |Width/| g/C | Service Rate| Adj| | HCM | L |90% Max|
| Group | Lanes| Reqd Used | GC (vph) GE |Volume| v/c | Delay | S | Queue |
                                                                        30.5 C
SB Approach
|LT+TH | 14/1 |0.204 |0.244 | 238 | 425 | 152 |0.358 | 30.5 | C | 153 ft|
                                                                         9.6 A
WB Approach
   | 8/1 |0.343 |0.803 | 1006 | 1014 | 307 |0.303 | 3.1 | A | 81 ft|
| 25/2 |0.312 |0.570 | 1941 | 1979 | 874 |0.442 | 11.8 |*B+| 243 ft|
    \mathbf{RT}
1
    TH
Í.
                                                                         6.3 A
EB Approach
|LT+TH | 23/2 |0.417 |0.726 | 2452 | 2452 | 1284 |0.524 | 6.3 |*A | 226 ft|
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02/25/06 VOLEAN COSEUN THESIS INT 1165 - SIRINEVLER - OFF-PEAK 15:15:30 EXISTINC SIGNAL97/TEAPAC[Ver 1.00] - HCM Input Worksheet Intersection # 165 - . Area Location Type: NONCED Rey: VOLUMES -- > 11 62 j θį 309 jj WIDTHS 1 0.0 j 0.0 jj 29.5l LANES \mathbf{W} 0 jj 2 0 I 240 0.0 - 0 11 X. 1 N l L $I \Lambda$ 770 23.7 $\mathbf{2}$ 1 0.0 0 / 0 ſ Õ, 0.0 0 North. 809 23.72 N, I I Ô. 0.0 0 N 11 I. I Û. 0 0 SEQUENCE 13 Phasing: н 0.0 j 0.0 0.0 PERMSV NNNN н Ûİ. 0 Ũ, 0 WERLP YYYY I LEADLAC LD LG 1 11 I I. Appr Grade & Beavy Veh. Adj.Pkg Bus Pk.Hr.Factor Conf.Ped Actuated Arr.Type peds/hr RT 7H LT RT TH LT -Q, \mathbf{RT} тн LT LOC Bha Яb RT тн \mathbf{LT} 1.6 1.9 0 $0 \ 0.78 \ 0.90 \ 0.91$ -5.0 0.00-3 3 3. 8B NO ы 191 19 0 0.90 0.91 0.90 0-3 WB. 5.0 3.8 3.10.0 \mathbf{BO} 0 ы ы ы 3 $\mathbf{3}$ $0 \ 0.90 \ 0.90 \ 0.90$ 0.0 0.0 0.00.00 0-3 3 3 **NB** 190 ю и и 0.Õ Õ. 0 0.90 0.90 0.90 ō--3 3 3.0 0.0 EB -7.0 NO ввы - 3 Sq 13 | **/LG ---Phase 1 Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 ÷. ÷ I. 1 ****j ÷ I. **《**生生生生】 /1÷p. 1 1 II. North 计合合合数 1++++> I. L н н. н 1 c/c=0.189 | c/c=0.589 | c/c=0.111 | c/c=0.000 | c/c=0.000 | c/c=0.000 | L jc= 0.0" L н OFF-76.74 | OFF- 0.04 | OFF-62.24 | OFF-76.74 | OFF-76.74 | OFF-76.74 | C- 90 sec C- 80.0 sec - 88.9% Y-10.0 sec - 11.1% Ped- 0.0 sec - 0.0%

02/25/06 VOLKAN COSEUN THESIS INT 1165 - SIRINEVLER - OFF-PEAK 15:15:30 EXTRETISC. SIGNAL97/TEAPAC[Ver 1.00] - HCH Volume Adjustment Worksheet Flow ad j Prop. of Appr Myt. Lane RT Vol PHF Flow LT -Myt Rate Group vph – vph. \mathbf{vph} SB-RT 0 - 0.78Ŭ, 0 0.00 0.00 0 0.90 0 LT+TH 340 1.00 0.00 SB-TH SB-LT 309 0.91 0 0.00 0.00 340 -0 0.00 0.00 WB-RT 240 0.90 267 _ WB-7H 770 0.91 846 TH+RT 1113 0.00 0.24 0 0.90 0 0.00 0.00 WB-LT -0 ----- $\begin{smallmatrix}&0&0.00&0.00\\899&0.00&0.00\end{smallmatrix}$ 0.0.90 0 EB-RT 809 0.90 899 EB-TH TH EB-LT 0 0.90 0 0 0.00 0.00 -----SIGMAL97/TEAPAC [Ver 1.00] - HCM Saturation Flow Adjustment Worksheet Ър Lane Adjustment Factors Adj Group Ideal L pæ-Satch. Wymts Satfl n Lane Heavy Bus Ar Lane Right Left Adj flow pephg - Width Vehs Grade Parkg Block Loc Otil Turn Turn Fact vphg _ 1891 2 1.092 0.981 1.025 1.000 1.000 1.0 0.95 1.000 0.952 1.00 3757 SB-LT+TH WB-TH+RT 1891 2 0.995 0.968 0.975 1.000 1.000 1.0 0.95 0.964 1.000 1.00 3254 1891 2 0.995 0.971 1.030 1.000 1.000 1.0 0.95 1.000 1.000 1.00 3575 EB-TH SIGNAL97/TEAPAC[Ver 1.00] - HCH Capacity Analysis Worksheet LT Adj Adj Green Lane v/c Crit Άp. Lane Flow Group Satfl Group Phase Flow Ratio Lane pr-Ratio Ratio \mathbf{ch} Hyts туре **Bate** Rate v/s g/C Capac v∕a \mathbf{Crp} vph vphg vph. 37.57 0.090 0.233 ÷ SB-LT+TH 340 277 0.3880.342 0.592 1927 0.578WB-TH+RT 11133254 899 3575 0.251 0.737 2634 0.341 ÷ EB-TH Cycle Length, C 90 sec Lost Time Per Cycle, L 2.7 sec Ye = Sum crit(v/s) 0.342 Хс - Тс и С/(С-L) 0.353

EXIS	TINC .											
SIGN	al97/7ej	APAC [Ve	r 1.00]	- HCP	t Level	l-of-S	ervice	Workshe	et			
ap pr sh	Lane Croup Hvts	Ratio v/c	Ratio g/C	Delay di	Fact PF	Сточр Сарад	Tern k	Incr Delay d2 sec/v	Croup Delay	Crp LOS		Apps LOS
	T+TH							1.29			20.4	
	TH+RT		. 592		1.00	1927	0.500		12.6	B+		
5B-	тн а= 90"	0.341					0.500		4.5	A		À

02/25/06 VOLEAN COSEUN THESIS INT 1165 - SIRINEVLER - OFF-PEAK 15:15:30 EXISTING SIGNAL97/TEAPAC[Ver 1.00] - Capacity Analysis Summary Intersection Averages for Int # 165 - . Degree of Saturation (V/c) 0.46 Vehicle Delay 12.1 Level of Service B+ 8q 13 | Phase 1 | Phase 2 | Phase 3 | **/LG ------ \pm ÷ **** /1≪****j $\pm 2e$ Ì. North 1 计合计合数 1++++> | c/c-0.189 | c/c-0.589 | c/c-0.111 | | c- 17.0" | c- 53.0" | c- 10.0" | Y+R= 4.0" | Y+R= 3.0" | Y+R= 3.0" | OFF=76.7% | OFF= 0.0% | OFF=62.2% C- 90 sec G- 80.0 sec - 88.9% Y-10.0 sec - 11.1% Fed- 0.0 sec - 0.0% | Lane |Width/| g/C | Service Rate| Adj| | HCM | L |90% Max| | Group | Lanes| Reqd Used | GC (vph) GE |Volume| v/c | Delay | S | Queue | | HCM | L | 90% Max| 30.4 C SB Approach |LT+TH | 30/2 |0.188 |0.233 | 574 | 877 | 340 |0.388 | 30.4 | C | 165 ft| WB Approach 12.6 B+ | TH+RT| 24/2 |0.387 |0.592 | 1897 | 1927 | 1113 |0.578 | 12.6 |*B+| 289 ft| 4.5 A EB Approach | TH | 24/2 |0.311 |0.737 | 2634 | 2634 | 899 |0.341 | 4.5 |*A | 151 ft|

02/25/06 VOLEAN COSEUN THESIS INT 1426A - UEFA ANITI - OFF-PEAK 15:26:16 EXISTINC. SIGNAL97/TEAPAC[Ver 1.00] - HCM Input Worksheet Intersection # 26 - . Area Location Type: NONCED Rey: VOLUMES -- > 34 || 91 j 97 WIDTHS 1 1 0.0 j 11.8 j 0.0 [] LANES v I. 1 j 0 0 11 I. 212 0.0 0 λ. 11 ١ /11 1060 21.32 0 0.0 0 / 65 0.0 0 North ÷ £ 2 886 22.6 Y l L 243 0.0 $0 = \lambda$ 11 I. I. 0 Û. 0 Phasing SEQUENCE 12 н 1 0.0 j 0.0 j PERMSV NNNN OVERLP YYYY 0.0 j I 11 0 0 Ô. 11 1 1 II. LEADLAG LD LD I 11 I Appr Grade & Beavy Veh. Adj. Pkg Bus Pk. Hr. Factor Conf. Fed Actuated Arr. Type peds/hr RT TH LT RT TH LT LT LOC RT 8 \mathbf{RT} тн Bha Яb тн \mathbf{LT} 2.9 0 0.83 0.83 0.83 0--3 0.0 4.4 Õ, \mathbf{R} 8B 4.1 190 ы ы В 12. 0-WB 0.0 4.3 4.0 6.2 190 0 0 0.86 0.86 0.86 B - 19 В 3 3. 3 $\begin{smallmatrix} 0 & 0.90 & 0.90 & 0.90 \\ 0 & 0.77 & 0.77 & 0.77 \end{smallmatrix}$ 0.0 0.0 0.0 0.0 во Û. 0и и 3 3 3 NB ы 0.0 4.6 2.0O. $\mathbf{0}$ -- \mathbf{R} 3. \mathbf{R} EB 2.1 190 H. 19 19 Sq 12 | **/** ----Phase 1 Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 | 1 * * * ٨ ٨ 1 ****1 * * * ++++| 1 $\|<^{\pm}$ /1* ** a * * * * İ <++++| ****1 1 w I j et e tas North j **** 1 w c/c=0.189 | c/c=0.067 | c/c=0.644 | c/c=0.000 | c/c=0.000 | c/c=0.000 1 I OFF- 0.04 | OFF-23.34 | OFF-32.24 | OFF- 0.04 | OFF- 0.04 | OFF- 0.04 | C= 90 sec C- 81.0 sec = 90.0% Y- 9.0 sec = 10.0% Fed= 0.0 sec = 0.0%

02/25/06 VOLEAN COSEUN THESIS INT 1426A - UEFA ANITI - OFF-PEAK 15:26:16 EXISTINC SIGNAL97/TEAPAC[Ver 1.00] - HCM Volume Adjustment Worksheet Flow Prop. of Appr Myt. Lane Adj Group BT Vol. PHF Rate Flow LT -Myt. .____. vph. \mathbf{vph} vph----____ _ 97 0.83 SB-RT 117SB-TH 91 0.83 110 LT+TH+RT SB-LT 34 0.83 41 -0 0.00 0.00 WB-RT 212 0.86 247 0 0.00 0.00 WB-TH 1060 0.86 1233 LT+TH+RT 1556 0.05 0.16 65 0.86 76 0 0.00 0.00 WB-LT -243 0.77 0 0.00 0.00 EB-RT 316 886 0.77 1151 TH+RT 1467 0.00 0.22 EB-TH 0 0.77 EB-LT 0 _ 0 0.00 0.00 SIGNAL97/TEAPAC [Ver 1.00] - HCM Saturation Flow Adjustment Worksheet Adjustment Factors Adj. Ap Lane Group Ideal L -Satpæ. ch. Hvmts Satfl n Lane Heavy Bus Ar Lane Right Left Adj flow pephy - Width Vehs Grade Parky Block Loc Util Turn Turn Fact vphy SB-LT+TH+RT 1891 1 0.993 0.961 1.000 1.000 1.000 1.0 1.00 0.841 0.992 1.00 1507 WB-LT+TH+RT 1891 2 0.955 0.960 1.000 1.000 1.000 1.0 0.95 0.976 0.998 1.00 3208 EB-TH+RT 1891 2 0.977 0.961 1.000 1.000 1.000 1.0 0.95 0.968 1.000 1.00 3263 SIGNAL97/TEAPAC[Ver 1.00] - HCH Capacity Analysis Worksheet Adj Flow v/c Crit **Ар** Lane LT Adj Green Lane př Group Phase FLOW 8atf[Ratio Ratio Group Ratio Lane \mathbf{ch} Hvt.s туре Rate Rate ∇ / σ g/C Capac v/a Crp vph. vphq vph. SB-LT+TH+RT 268 1507 0.178 0.192 290 0.924 * WB-LT+TH+RT 1556 32080.485 0.737 2363 0.658 ÷ 0.450 0.648 1467 3263 2114 0.694 EB- TH+BT Cycle Length, C 90 sec Lost Time Per Cycle, L 6.4 sec Ye = Sum crit(v/s) 0.663 Xe = Ye x C/(C-L) 0.714

INT	AN COSE 1426A - TING			off-pi	BAK							/25/06 26:16
SIG	al97/Te	APAC [Ve	r 1.00]	– нс	H Level	1-of-8	arvice	Workshe	et			
Ap pr ch	Lane Group Hyts	Ratio v/ c	Ratio g/C	Dəlay di	Fact PF	Стоир Сарас	Term k	Incr Delay d2 sec/v	Croup Delay	Crp L08	Appr Delay sec/v	Appr LOS
	T+TH+RT T+TH+RT						0.500	1.45	7.5	> A		-
	TH+RT	0.694				2114				в+		A B+
	le= 90" Total	0.696								>	14.8	B+

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02/25/06
VOLKAN COSEUN THESIS
INT 1426A - UEFA ANITI - OFF-PEAK
                                                                                      15:26:16
EXISTINC
SIGNAL97/TEAPAC[Ver 1.00] - Capacity Analysis Summary
Intersection Averages for Int # 26 - .
Degree of Saturation (v/c) 0.70 Vehicle Delay 14.8 Level of Service B+
Sq 12 | Phase 1 | Phase 2 | Phase 3 |
**/** ------
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            w
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  Ì.
                               w.
North
                                    计合合合合数
                                    j * * * *
  127
       | c/c=0.189 | c/c=0.067 | c/c=0.644 |
| c= 17.0" | c= 6.0" | c= 58.0" |
| Y+R= 4.0" | Y+R= 2.0" | Y+R= 3.0" |
       OFF- 0.0% | OFF-23.3% | OFF-32.2%
       C- 90 sec C- 81.0 sec - 90.0% Y- 9.0 sec - 10.0% Fed- 0.0 sec - 0.0%
| Lane |Width/| g/C | Service Rate| Adj| | HCM | L |90% Max|
| Group | Lanes| Reqd Used | GC (vph) GE |Volume| v/c | Delay | S | Queue |
                                                                         72.2 E
SB Approach
[LT+TH+RT] 12/1 |0.283 |0.192 | 105 | 279 | 268 |0.924 | 72.2 |*E | 277 ft]
WB Approach
                                                                          7.5 A
[LT+TH+RT] 21/2 [0.508 [0.737 ] 2363 ] 2363 ] 1556 [0.658 ] 7.5 ]*A ] 262 ft]
                                                                         12.0 B+
EB Approach
| TH+RT| 23/2 |0.477 |0.648 | 2111 | 2114 | 1467 |0.694 | 12.0 |*B+| 331 ft|
```

VOLEAN COST INT # 2204 EXISTING (:	- DOL	MABAB	CE -	PM PEA	ĸ							/18/06 44:21
SICHAL97/T	EAPAC	Ver 1	00]	- нсм	Input	Work	sheet					
Intersection	on # 2	04 -							Area Loca	tion ?	Туре:	CBD
		0 0.0 0.0	0.0	 210 28.	2 jj				E		VOLUMES WII V	S > DTHS LANES
	l	<u> </u>	0	i	3 	<u>۱</u>	0	0.0	0	•		
		/				_	910	21.0) 2	•		
0	0.0	· ·		+		/	0	0.0) 0	•	Borth	
1976	35.5	3 -	_								I	
0	0.0	<u> </u>		¦¦ .	0 i -	, , , , , , , , , , , , , , , , , , ,	, 0.0	i	Phasing	SEQ PER		11 אאא
		ļ			0 j I	o i i	0	i		OVE LEAI	RLP Y DLAC	TD TD
Appr Grade	∿ Be	avy V	eh.	Adj. Pk	g Bus	Pk. J	Ir. Fac	tor	Conf. Ped	Actua	ted Ari	. туре
- 9	RT	тн	LT	Loc B	ns Hib	RT	тн	LT	peds/hr	RT TH	LT RT	TH L7
SB -10.0 WB 0.0		0.0		NO NO		0.90			0- 0-	и и и и		3 3 3 3
NB 0.0 EB 0.0	0.0		0.0		0 0	0.90	0.90	0.90		и и и и	ы 3	3 3 3
 Sq 11 Pi	hase 1	 · I	Phase	2	Phas	• 3	Pha		Phase	5 1	Phace	. 6 1
/	+			 I						i		·
卒	+ +>		4	****								
North		++	++>							ļ		
) c/c=0;			
j ¥+3	R- 4.0	" j Y	+R= 4		Y+R=	0.0"	Y+B-	0.0	C= (Y+R= (OFF= (Y+R= (
C=11/									7.0% Pec			0.09

VOLKAN COSEUN THESIS 05/18/06 INT # 2204 - DOLMABAHCE - PM PEAK 21:44:21 EXISTING (SIGNAL 97) SIGNAL97/TEAPAC[Ver 1.00] - HCM Volume Adjustment Worksheet Flow Adj Prop. of Appr Mort. Lang Vol PHF Flow -Mrt. Rate Group LT. - FT vphvph \mathbf{vph} ----------_ 0 0.00 0.00 0.0.90 SB-BT Ð, -----0.0.90 0.0.00 0.00 SB-TH Ð. ____ SB-LT 2102 0.90 2336 2336 1.00 0.00 \mathbf{LT} 0.0.96 0 0 0.00 0.00 WB-RT ____ WB-TH 910 0.96 948 TH 948 0.00 0.00 WB-LT 0.0.96 0 0 0.00 0.00 ____ EB-RT 0.0.82 Õ 0 0.00 0.002410 0.00 0.00 EB-TH 1976 0.82 2410 TH 0.0.82 0 0.00 0.00 EB-LTÐ. _____ SIGNAL97/TEAPAC[Ver 1.00] - HCM Saturation Flow Adjustment Worksheet Adjustment Factors Adj Ър. Lane Group Ideal L - $\mathbf{p}\mathbf{\bar{r}}$ Sat- \mathbf{ch} Hvmts Satfl n Lane Heavy Bus Ar Lane Right Left Adj flow pephg - Width Vehs Grade Parkg Block Loc Util Turn Turn Fact vphg -----1891 3 0.913 0.965 1.030 1.000 1.000 0.9 0.97 1.000 0.950 1.00 4272 SB- \mathbf{LT} 1891 2 0.950 0.940 1.000 1.000 1.000 0.9 0.95 1.000 1.000 1.00 2887 WB-TH. 1891 3 0.994 0.947 1.000 1.000 1.000 0.9 0.91 1.000 1.000 1.00 4375 EB-TH SIGNAL97/TEAPAC[Ver 1.00] - HCH Capacity Analysis Worksheet Lane LT Adj Adj Flow Green Lane V/C Crit Ap Satfl př Group Phase Flow Ratio Ratio Group Ratio Lane g/C \mathbf{ch} Hyts туре **Rate** Rate ∇ / σ Capac v/a \mathbf{Crp} vph vphvphg 2189 2336 427.2 0.547 0.5121.067 ÷ SB- \mathbf{LP} Pri. 948 2887 0.328 0.425 0.773WBтн 1226 2410 4375 0.551 0.425 1858 1.297 EB-TH * Cycle Length, C 114 sec Lost Time Per Cycle, L 7.2 sec Ye = Sum crit(v/s) 1.098 Xe = Ye x C/(C-L) 1.172

INT	AN COSE # 2204 STING (S				/18/06 :44:21							
sice	WL97/TE	APAC [Ve	r 1.00]	– нс	I Level	l-of-Se	rvice	Workshe	et			
	Group Hyts	Ratio v/ c	Ratio g/C	Delay di	Fact PF	Стоор Сарас	Tern k	Incr Delay d2 sec/v	Group Delay	crp Los	Appr Delay	Appr LOS
SB-	LT	1.067						40.07		Е		_
WB-	тн	0.773	. 425	28.1	1.00	1226	0.500	4.78	32.9	С		
EB-	тн	1.297					0.500	137.80	170.6	F		-
	e=114" Total	1.116								-		F F

VOLEAN COSEUN INT # 2204 - EXISTING (SIG	DOLMABABCE - PR	4 PEAK			/18/06 : 44:21
		Evaluation of 1	Intersection Per	formance	
	etion # 204 -				
Sq 11 Phas	se 1 Phase 3	2			
í ı +	- - -> <+-	+++			
North	++++» 				
G= 5 Y+R=	1971 - 1977 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 - 1976 -				
C-114 e				Ped- 0.0 sec -	
MVMT TOTALS Param:Units	RT TH LT	RT TH LT	RT TH LT	EB Approach RT 7H LT	Fotal
g/C RadgC: 9 g/C Used: 9	0 0 2336 0/0 0/0 28/3 0 0 57 0 0 51 0 0 2189	0 41 0	0 0 0	0 57 0 0 42 0	5694
SV @E: vph	0 0 2189	0 1226 0	0 0 0	0 1858 0	5273
Sve Lvl:LOS Deg Sat:v/c Avg Del:s/v Tot Del:min # Stops:veh		0 120 0	0.00 0.00 0.00 0.0 0.0 0.0 0 0 0 0 0 0	0.0129.6 0.0 0 1301 0	F 1.12 84.2 1997 1389
Max Que:weh Max Que: ft	0 0 104 0 0 889		0 0 0 0	0 206 0 0 1772 0	345 1772
APPR TOTALS Param:Units	SB Approach		NB Approach	EB Approach	Int Fotal
AdjVol: vph	2336	948	0	2410	5694
Sve Lvl:L08 Deg Sat:v/c Avg Del:s/v Tot Del:min # Stops:veh	E 1.07 59.2 576 584	C 0.77 30.4 120 203	0.00 0.0 0 0	F 1.30 129.6 1301 602	F 1.12 84.2 1997 1389
Max Que:wah Max Que: ft	104 889	35 448	0 0	206 1772	345 1772

APPENDIX B: OUTPUTS OF THE SIGNAL 2000 ANALYSIS

VOLKAN COSKUN THI INT 1109 - SARAYI OPTIMUN		- AH PE	AE								03/24 21:24	
SI CHAL2000/TEAPA	C[Ver 2	2.60.07] - 1	EM D	nput	Works	heet					
Intersection # 10	09 -						A	rea L	ocati)	on Typ	e: NOR	ICBD
!	0	0 1		Н	ļ				Кау	: VOL	UMES - WID78	
	0.0 0		0.0	ii	ļ					v		INES
¦	, i	, i	Ň	li	١.	0	0.0	0		,	iN	
	<u></u>	I	`			1503	22.1	2		,	1	
0 0.0	0 /		+		7	0	0.0	0			rth	
418 19.7	2		١			,						
169 0.0	0 \		` 108	I		, 8		Phanis		SEQUEN	-	11
	 !	i i	0.0	19		0.0 0	i i	FUEDL	- I	PERMSV	ัทท YY	и и
	l		0	i	۴ i		i			LEADLA) LD
		SB			WB			NB			EB	
	RT		LT	RT	TH	LT	RT	нь 7н	LT	R7	TH	LT
Heavy veh, %HV Pk-hr fact, PHF	.0	. 0	 .0 90	. 0	1.9	.0 .90	25.0	.0:		12.4	4.5	.0
Protimed on Act		P	P	P	P	P	P	P	P	P	P	P
Strtup lost, 11 Ext eff grn, e	$2.3 \\ 2.7$	2.3 2 2.7 2	. 7	2.3 2.7	$2.3 \\ 2.7$		$2.3 \\ 1.7$	2.3 1.7	$2.3 \\ 1.7$	2.3 2.7	$2.3 \\ 2.7$	$2.3 \\ 2.7$
Arrival typ, AT	3	3	3	2	2	2	3		3	2	2	2
Ped vol, vped Bike vol, vbic		0 0			0			0			0 0	
Parking locatns Park movrs, Nn		ыс 0			ю 0			ыо 0			190 0	
Bus stops, NB		Ő			0			ŏ			ŏ	
Crade, %C		. 0			3.7			-8.4			.0	
		~							F			
Sq 11 Phase 1 **/**	Fi	1259 Z	B	*N2.99	<u>ا</u> د	Pha	so 4 	Phi	250 5	P.	n259 (•
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	l	<+++	+ 		l							
 North <+ -	 > ++++	l>	l		ĺ			1				l
	+ +++4 +		l							Ì		İ
c= 75" c= 13.0"												
T+R= 3.0												

VOLKAN COSKUN TH INT 1109 - SARAY OPTIMUH		- AH	PEAK								03/2) 21:2	
SIGNAL2000/TEAPA	C[Ver	2.60.	07] -	HCM V	olume	Adju	st & S:	atfle	W WOI	ksheet		
Volume		SB			WB			NB			EB	
Adjustment	RT	78	LT	RT	TH	LT	RT	TH	L7	RT	тн	LT
Volume, V	0	0	0	-	1503	0	8	0	108	169	418	0
Pk-hr fact, PHF	. 00	.00		. 90			.73		.73		. 92	. 92
Adj mv flow, vp	0	0	0		1670	0	11		148	184	454	0
Lane group, LG					TH		RT-	TH+I	æ		RT+TH	
Adj LG flow, v Prop LT, PLT					1670			159 931			638 . 000	
Prop RT, PRT					. 000			. 951			. 288	
Saturation		SB			WB			NB			EB	
Flow Rate	RT	7H	LT	RT	TH	LT	RT	TH	LT	RT	тн	LT
Base satflo, so					1891			1891			1891	
Number lanes, N					2			2		_	2	
Lane width, fW Heavy veh, fHV					.968 .981			. 928 . 847			. 92.8 . 937	
Grade, fq					.981 .982			. 847 . 030			.937	
Parking, fp					. 000			. 000			. 000	
Bus block, fbb					. 000			. 000			. 000	
Area type, fa Lane util, fLU					. 000 . 950			. 000 . 950			. 000 . 950	
Lane util, fLU Left-turn, fLT					. 950			. 950			. 950	
Right-turn, fRT					. 000			990			. 957	
PedBike LT, fLpb					. 000			. 000			. 000	
PedBike RT, fRpb					. 000			. 000			. 000	
Local adjustent Adj satflow, s					. 000 3352			. 000 2750			. 000 2989	
			====									
SIGNAL2000/TEAPA Capacity	C[Ver	2.60. SB	07] -	нсм с	apacit WB	y an	d Los i	forks NB	heet		EB	
Analysis	RT	78	LT	RT	TH	LT	RT	78	LT	RT	TH	LT
						===			====			
Lane group, LC				-	TH 1 CT A		RT-	FTH+I A FO	a c		ET+TH COO	
Adj Flow, v Satflow, s					1670 3352		ę	159 2750			638 2989	
Lost time, tL					3.6			3.6			3.6	
Effect green, g					55.4			12.4			55.4	
Grn ratio, g/C					.739 2476			. 165 AFE			.739	
LC capacity, c v/c ratio. X					2476			455 349			2208 .289	
Flow ratio, v/s					. 498			.058			. 213	
Crit lane group					*			*				
Sun crit v/s, To		.556		Total	lost.	L		7.2				
Crit v/e, Xe		.615			,							

VOLKAN COSKUN THESIS INT 1109 - SARAYBURNU - AM PEAK OPTIMUM

SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay		SB			WB			NB			EB	
and LOS	RT	TH	LT	RT	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT
Lane group, LC					TH		RT-	-TH+LJ		E	T+TH	
Adj Flow, v					1670			159			638	
LG capacity, c					2476			455		2	22:08	
v/c ratio, X					. 674			349			289	
Grn ratio, g/C					.739			165			739	
Unif delay, dl					5.1		2	17.7			3.3	
Iner calib, k					. 50			. 50			. 50	
Incr delay, d2					1.5			2.1			. 3	
Queue Delay, d3					. 0			. 0			. 0	
Unif delay, dl*					. 0			. 0			. 0	
Prog factor, PF					1.81		-	00		1	. 81	
Contrl delay, d					10.7		2	29.8			6.2	
Lane group LOS					B+			C			A	
Final Queue, Obi					0			0			0	
Appr dalay, dA					10.7		2	29.8			6.2	
Approach LOS					B+			C			A	
Appr flow, vA					1670			159			638	
	- 1											
Intersection:	De lay		10.8	108		B+						

03/26/06

21:24:28

VOLKAN COSKUN THESIS INT 1109 - SARAYBURNU - AH PEAK OPTIMUH

SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Back of Queue Worksheet

Queues in	58 BT 78 L/T				WB			NB			EB.	
Worst Lanes	RT	TH	\mathbf{LT}	\mathbf{RT}	TH	\mathbf{LT}	RT	78	LT	RT	тн	LT
Lane group, LG					TH		RT-	TH+L	I.	1	RT+TH	
Init queue, ObL					0			0			0	
In flow, vL					879			84			336	
In satflow, sL					1764			1448			1573	
In capacity, cL					1303			239			1162	
Flow ratio, yL					. 498			058			.213	
v/c ratio, XL					. 674			349			.289	
Effect green, g					55.4			12.4		-	55.4	
Grn ratio, g/C					. 739			165			. 739	
Upstr filter, I					1.00			L.00			1.00	
Grn arrivals, P					. 50			. 17			. 4.9	
Platn ratio, Rp					. 68			L.00			. 67	
Prog factr, PF2					1.45		1	L.00			1.78	
Queue (1st), Q1					13.8			1.5			4.1	
Queue factr, kB					1.21			. 37			1.12	
Queue (2nd), Q2					2.4			. 2			. 5	
Avg queue, Q					16.2			1.7			4.6	
90% factor, fB					1.52			85		-	1.70	
90% queue, Qp					24.6			3.2			7.8	
Avg spacing, Lh					25.3			27.7			26.0	
Avail storg, La					0			0			0	
Avg distance					409			48			119	
Avg ratio, RQ				. 00			.00			. 00		
90% distance				622			89			203		
90% ratio, RQp					. 00			.00			. 00	

03/26/06

21:24:28

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VOLKAN COSKUN THESIS
                                                      03/26/06
INT 1109 - SARAYBURNU - AH PEAK
                                                      21:24:28
OPTIMUH
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 109 -
    Degree of Saturation (v/c) 0.55 Vehicle Delay 10.8 Level of Service B+
Sq 11 | Phase 1 | Phase 2 |
**/**
                      1
    ZIV – L
                   <++++
             North |
           +>|++++>
        -64 - L
 1
        +
           + [++++
    +
           + | v
                      1
    | g/c=0.173 | g/c=0.733 |
    | G= 13.0" | G= 55.0" |
    | T+R= 3.0" | T+R= 4.0" |
    | OFF= 0.0% | OFF=21.3% |
    C= 75 sec G= 68.0 sec = 90.7% T= 7.0 sec = 9.3% Fed= 0.0 sec = 0.0%
|Lane |Width/| g/C |Service Rate| Adj| | BCH |L|Queue |
| Group | Lanes| Reqd Used | 0C (vph) 0E [Volume] v/c | Delay | S [Model 1]
                                              29.8 C
NB Approach
_____
[RT+TH+LT] 20/2 [0.124 [0.165 ] 277 ] 455 ] 159 [0.349 ] 29.8 [ C ] 89 ft]
WB Approach
                                              10.7 B+
_____
TH | 22/2 |0.521 |0.739 | 2470 | 2476 | 1670 |0.674 | 10.7 | B+| 622 ft|
EB Approach
                                               6.2 A
[RT+TH | 20/2 |0.267 |0.739 | 2194 | 2208 | 638 |0.289 | 6.2 | A | 203 ft]
```

VOLKAN COSKUN TE INT 1109 - SARAY EIISTING		- AH PI	LAK							03/2 21:1	
SIGNAL2000/TEAPA	C[Ver	2.60.07] - нсм :	Input I	Works	heet					
Intersection # 1	.09 -					A	rea L	ocati	on Typ	e: NO	NCBD
	0 0.0	0.0						Ка у	: VOL I V	UMES - WIDT Li	
	o i i	٥i	0 11	- ر	0	0.0	0				
	1		/		1503	22.1	2		/	IV	
	===									ļ	
0 0.0	0 /		+	· /	0	0.0	0		Ю	rth I	
418 19.7	2	-	_							I	
169 0.0	0 \	п	<u>۱</u>	l	/						
	·)	ii	108 0.0 1		8 0.0	1	Phasi		sequen Permsv		11 N N
	į	ii.	οį	2	0	-			OVERLP		
		11				I			LEADLA	C L	D LD
		SB		WB			NB			EB	
	RT	7H	LT RT	TH	LT	RT	TH.	LT	RT	TH	LT
Heavy veh, SHV	. 0	. 0		1.9	.0	25.0	===== A	17.6	12.4	4.5	. 0
Pk-hr fact, PHF	. 90		90 .90	.90	. 90	.73		.73		.92	. 92
Pretimed or Act	Р 2.3	P	P P	P	P	P	P	Р 2.3	P	Р 2.3	P
Strtup lost, l1 Ext eff grn, e			2.3 2.3 2.7 2.7	$2.3 \\ 2.7$	$2.3 \\ 2.7$	2.3 1.7	2.3 1.7	$\frac{2.3}{1.7}$		$\frac{2.3}{2.7}$	$\frac{2.3}{2.7}$
Arrival typ, AT	3		3 2		2	3	3	3	2	2	2
Ped vol, vped		0		0						0	
Bike vol, vbic		ŏ		ŏ			õ			õ	
Parking locatns		NO		ю			мо			80	
Park movrs, Nn		0		0			0			0	
Bus stops, NB Grade, %G		0 .0		0 3.7			0 -8.4			0 . 0	
Sq 11 Phase 1 **/**	. E	² hase 2	Phase	3	Ph a	se 4	Ph	ase 5	P.	hase	6
			1	ļ			1				
l zix l		<+++	+i						Ì		I I
	İ		ļ	į			ļ		İ		į
North <+	 ++ <+	+>		l							l
	+ [+++		i				i				l
+	+ 1	v	1								1
C= 75" G= 16.0 T+R= 3.0											

VOLKAN COSKUN THE INT 1109 - SARAYE EIISTING		- AH 1	PEAK								03/20 21:14	
SIGNAL2000/TEAPAC	(Ver)	2.60.	07] -	HCM V	olume	Adju	st & S:	atflo	W Wol	kshee t		
Volume		SB			WB			НΒ			EB	
Adjustment	RT	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT	RT	TH	LT
				=====								
Volume, V	0	0	0	197	1503	0	8	0	108	169	418	0
			.00	. 90		. 90	.73		.73		. 92	. 92
Adj mv flow, vp	0	0	0	0	1670	0	11	0	148	184	454	0
Lane group, LG Adj LG flow, v Prop LT, PLT Prop RT, PRT					TH 1670 .000 .000			TH+1 159 .931 .069	л		FT+TH 638 .000 .288	
Saturation		SE WB T TH LT RT TH LT						NB			EB	
Flow Rate	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
Base satflo, so					1891			1891			1891	
Number lanes, N					2			2			2	
Lane width. fW					. 968			. 928			. 928	
Heavy yeh, fHy					. 981			. 847			. 937	
Grade, fg					. 982			.030			. 000	
Parking, fp					. 000			. 000			. 000	
Bus block, fbb				1	. 000		1	.000		1	. 000	
Area type, fa				1	. 000			. 000			. 000	
Lane util, fLU				-	. 950		_	. 950			. 950	
Left-turn, fLT				1	L. 000			. 956		1	. 000	
Right-turn, fRT				1	. 000			990			. 957	
PedBike LT, fLpb				1	L. 000		1	. 000		1	. 000	
PedBike RT, fRpb				1	L. 000		1	. 000		1	. 000	
Local adjustent				1	. 000		1	000		1	. 000	
Adj satflow, s					3352			2750		-	2989	
SIGNAL2000/TEAPAC Capacity	[Ver :	2.60. SB	07] -	нем с	apaci WB	ty an	d Los I	Works NB	sheet		EB	
Analysis	RT	TH	\mathbf{LT}	\mathbf{RT}	TH	LT	RT	TH	LT	RT	TH	LT
Lane group, LC					TH		RT-	+TH+1 - 5 0	a r		ET+TH	
Adj Flow, v					1670			159			638	
Satflow, s					3352			2750			2989	
Lost time, tL					3.6			3.6			3.6	
Effect green, g					52.4			15.4			52.4 coo	
Grn ratio, g/C					. 699			.205			. 699	
LC capacity, c					2342			565			2088	
v/c ratio, X					.713			. 281			. 306	
Flow ratio, v/s					. 498			. 058			.213	
Crit lane group					*			*				
Sum crit v/s, Te Crit v/c, Xe		.556		Total	llost	, Г		7.2				
									====			

VOLEAN COSEUN TH INT 1109 - SARAY EXISTING		AH I	PEAK								03/26 21:14	
SIGNAL2000/TEAPA	C[Ver 2	. 60. 0	07] -	нсм Сар	pacity	y an	d LOS W	forksl	neet			
Delay and LOS		SB			WB			NB			EB	
and Los	RT	7H	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
Lane group, LC					TH		ET-	-TH+LC	P		er+TH	
Adj Flow, v	1670 159							638				
LC capacity, c	2342 565						2088					
v/c ratio, X		.713			. 281			. 306				
Grn ratio, g/C				. 699			. 205		. 699			
Unif delay, dl				6	5.8		25.1		4.3			
Iner calib, k					.50		. 50			. 50		
Incr delay, d2					L.9			1.2		. 4		
Queue Delay, d3					. 0			. 0		. 0		
Unif delay, dl*					. 0			. 0		. 0		
Prog factor, PF					65			L.00		1.65		
Contrl delay, d					3.1		3	26.4		7.5		
Lane group LOS					B+ 0			C+ 0			А 0	
Final Queue, Qbi					<u>.</u>							
Appr delay, dA				12	3.1		-	26.4			7.5	
Approach LOS					B+		-	C+			A	
Appr flow, vA				10	670			159			638	
Intersection:	Delay	1	2.5	LOS		B+						
							=====			=====		===

VOLKAN COSEUN TH INT 1109 - SARAY EIISTING		PEAK								03/26 21:14		
SI GHAL2000/TEAPA	c[Ver 2.60.	07] -	HCM Ba	ick of	Quer	ue Worl	csheet	t				
Queues in	SB			WB			NB			EB		
Worst Lanes	RT TH	\mathbf{LT}	\mathbf{RT}	TH	LT	RT	TH	LT	RT	TH	LT	
Lane group, LC				TH		RT-	-TH+L(F	1	RT+TH		
Init queue, QbL				0			0			0		
In flow, vL				879			84		336			
In satflow, sL								1573				
In capacity, cL		1233					297 058		1099			
Flow ratio, yL								.213				
v/c ratio, XL			.713			.281 15.4			. 306 52 . 4			
Effect green, g			52.4			15.4		52.4				
Grn ratio, g/C Upstr filter, I			1.00			1.00		1.00				
						.21			.47			
Grn arrivals, P Platn ratio, Rp			. 47			.21			. 47			
Prog factr, PF2				1.33			1.00			1.63		
-			-	4.6	1.5			4.4				
Queue (1st), Q1 Queue factr, kB			-	.4.6			.43		4.4			
Queue (2nd), 02				2.7					.5			
Avg queue, Q				7.4				4.8				
wy queue, v							1.6			4.0		
90% factor, fB			1	. 52		1	.86			1.69		
90% queue, Qp			26.3			3.0				8.2		
Avg spacing, Lh			25.3			2	27.7		26.0			
Avail storg, La				0		0				0		
Avg distance				439		45			126			
Avg ratio, RQ				. 00		.00				. 00		
90% distance				666		84			212			
90% ratio, RQp				. 00		.00			. 00			
					==				=====			

```
VOLKAN COSKUN THESIS
                                                      03/26/06
INT 1109 - SARAYBURNU - AH PEAK
                                                     21:14:46
EIISTING
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 109 -
    Degree of Saturation (v/c) 0.58 Vehicle Delay 12.5 Level of Service B+
Sq 11 | Phase 1 | Phase 2 |
**/** --
    1
             - 1
    /1
                   <++++
    North |
        <+ +> ++++>
 +
           + |++++
   +
           + | v
                      | c/c=0.213 | c/c=0.693 |
    | G= 16.0" | G= 52.0" |
    | T+R= 3.0" | T+R= 4.0" |
    | OFF= 0.0% | OFF=25.3% |
    C= 75 sec C= 68.0 sec = 90.7% T= 7.0 sec = 9.3% Fed= 0.0 sec = 0.0%
|Lane |Width/| g/C |Service Rate| Adj |
                                          | BCH | L | Queue |
| Group | Lanes | Regd Used | @C (vph) @E [Volume | v/c | Delay | S [Model 1]
                                             26.4 C+
NB Approach
_____
[RT+TH+LT] 20/2 [0.124 [0.205 ] 400 ] 565 ] 159 [0.281 ] 26.4 [ C+] 84 ft]
WB Approach
                                              13.1 B+
_____
| TH | 22/2 |0.521 |0.699 | 2323 | 2342 | 1670 |0.713 | 13.1 | B+| 666 ft |
                                              7.5 A
EB Approach
_____
[RT+TH | 20/2 |0.267 |0.699 | 2062 | 2088 | 638 |0.306 | 7.5 | A | 212 ft]
```

VOLKAN COSKUN TE INT 1109 - SARAY OPTIMUH		PEAK			03/26/06 21:33:07
SI (MAL2000/TEAPA	C[Ver 2.60.)	07] - НСМ Inp	ıt Workshe	et	
Intersection # 1	109 -			Area Locatio	п Туре: NONCBD
1	l	1 11		Ee y:	
	0 i 0 0.0 j 0.0	i 0 ii 0.0			WID7HS V LANES
	oj o			0.0 0	
'	7 1	' \ ''			zix
				22.1 2	
0 0.0	0 /	+ /		0.0 0	North
1473 19.7	2				I
134 0.0	0 \ 1		1 1		
			1 21 1	Phasing: S P	EQUENCE 11 EFMSV NNNN
	i i	j 0 j 2			VERLP Y Y T Y EADLAG LD LD
	1 1		1 1	L	EADLAG LD LD
	SB		(B	NB	EB
	RT 7H		CH LT	RT 7H L7	RT TH LT
Heavy veh, SHV	.0.0	.0 .0 1	4.0	4.8 .0 1.4	3.7 .9 .0
Pk-hr fact, PHF Pretimed or Act		.90 .96 .1 P P	P P	.85 .85 .85 P P P	.87.87.87 PPPP
Pretimed or Act Strtup lost, 11 Ext eff grn, e	2.3 2.3 2.7 2.7	2.3 2.3 2	3 2.3	2.3 2.3 2.3	2.3 2.3 2.3 2.3 2.7 2.7 2.7
Arrival typ, AT	3 3				2 2 2 2
Fed vol, vped	0		 0	0	0
Bike vol, vbic	0		0	0	0
Parking locatns Park mnyrs, Nn	NО 0	1	90 0	NО 0	190 0
Bus stops, NB Grade, 9G	0		0	0 -8.4	0
Sq 11 Phase 1	l Phase :	2 Phase 3	Phase	4 Phase 5	Phase 6
	1	1	1		
in l	<+-	+++	l		
			l		
	+> ++++>	Ì	ļ		į į
	+ ++++ + v		l	ļ	
⊂ 82" ⊂ 12.0)" c= 63.0	0″∣c= 0.0′	' c= 0).0" c= 0.0"	c= 0.0″ I
).0" Y+R= 0.0"	

VOLKAN COSKUN TH INT 1109 - SARAY OPTIMUH		- PH :	PEAK								03/2 21:3		
SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Volume Adjust & Satflow Worksheet													
Volume		SB			WB			NB			EB		
Adjustment	RT	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT	RT	TH	LT	
volume. V		 0			859	0	21	0	216		1473		
·	100	100	.00	0 .96		0 .96	21 . 85	11	216		.87	0 . 87	
Adj my flow, vp	. 00	.00	.00	. 50	895	. 20	25	. 89	254		1693	. 0	
Lane group, LG					TH		PT	+TH+1	æ		RT+TH		
Adj LG flow, v					895 . 000			279 .910			1847		
Prop LT, PLT Prop RT, PRT					. 000			.910			.000		
								. 0 20			. 065		
Saturation		SB			WB			NВ			EB		
Flow Rate	RT	TH	LT	RT	THE	LT	RT	78	LT	RT	тн	LT	
Base satflo, so					1891			1891			1891		
Number lanes. N					2			2			2		
Lane width, fW					. 968			. 928			. 92.8		
Heavy veh, fHV					. 986			. 983			. 989		
Grade, fg					. 982		1.030			1.000			
Parking, fp Bus block, fbb					1.000 1.000			1.000			1.000		
Area type, fa					. 000		1.000			1.000			
Lane util, fLU					.950			. 950			. 950		
Left-turn, fLT					. 000			. 956		1	. 000		
Right-turn, fRT					. 000			. 987			. 987		
PedBike LT, fLpb					. 000			. 000			. 000		
PedBike RT, fRpb Local adjustent					. 000 . 000			. 000 . 000			000		
Adj satflow, s					3368			. 000 3187			32.57		
									====				
SIGNAL2000/TEAPAC [Ver 2.60.07] - HCM Capacity and LOS Worksheet Capacity SB WB NB EB													
Analysis	RT	78	LT	RT	TH	LT	RT	TH	LT	RT	тн	LT	
			====	=====					====	=====	=====	====	
Lane group, LG					TH		RT	+TH+1	æ		RT+TH		
Adj Flow, v Satflow, s		895 3368					279			1847			
Lost time, tL					3.6		3187 3.6				32.57 3.6		
Effect green, g		3.6 63.4					3.6			63.4			
Grn ratio, g/C					778		.139				.773		
LC capacity, c				2604				443			2518		
v/c ratio, X					. 344			. 630			.734		
Flow ratio, v/s Crit lane group					. 255			. 088			.567		
Inter group													
Sun crit v/s,Tc	0	. 655		Total	lost,	, L		7.2					
Crit v/c, Xc		. 718											
				=====					====	=====			

VOLKAN COSKUN THESIS INT 1109 - SARAYBURNU - PH PEAK OPTIMUM

SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay		SB			WB			NB			EB	
and LOS	RT	TH	\mathbf{LT}	RT	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT
	=====			=====			=====			=====		===
Lane group, LG					TH		RT-	TH+LT		RT+TH		
Adj Flow, v					895		279			1847		
LG capacity, c					2604			44.3			2518	
v/c ratio, X					. 344		. 630					
Grn ratio, g/C					.773			139			.773	
Unif delay, d1					2.9		3	3.3			4.9	
Incr calib, k					. 50			. 50			. 50	
Incr delay, d2					. 4			6.6			1.9	
Queue Delay, d3					. 0			. 0			. 0	
Unif delay, d1*					. 0			. 0			. 0	
Prog factor, PF					1.99		1	00			1.99	
Contrl delay, d					6.1		4	l0.0			11.6	
Lane group LOS					A			D+			B+	
Final Queue, Qbi					0			0			0	
Appr delay, dA					6.1		4	0.0			11.6	
Approach LOS					A			D+			B+	
Appr flow, vA					895			279			1847	
Intersection:	Delay		12.6	LOS		B+						
				=====		===			===	=====		===

03/26/06

21:33:07

VOLKAN COSKUN TH INT 1109 - SARAY				03/26/06 21:33:07			
OPTIMUH							
SI CHAL2000/TEAPA	.c[Ver 2.60.07] -	HCM Back of Qu	eue Worksheet				
Queues in	SB	WB	NB	EB			
Worst Lanes	RT TH LT	RT TH LT	RT 7H L7	RT TH LT			
Lane group, LG		TH	FT+TH+LT	RT+TH			
Init queue, QbL		0	0	0			
In flow, vL		471	147	972			
In satflow, sL		1773	1678	1714			
In capacity, cL		1371	233	1325			
Flow ratio, yL		. 266	. 088	. 567			
v/c ratio, XL		. 344	. 630	.734			
Effect green, g		63.4	11.4	63.4			
Crn ratio, g/C		.773	.139	.773			
Upstr filter, I		1.00	1.00	1.00			
Grn arrivals, P		. 52	. 14	. 62			
Platn ratio, Rp		. 67	1.00	. 80			
Prog factr, PF2		1.91	1.00	1.33			
Queue (1st), Q1		6.3	3.2	15.4			
Queue factr, kB		1.33	. 39	1.30			
Queue (2nd), Q2		.7	. 6	3.3			
Avg queue, Q		7.0	3.8	18.8			
			1.73	1.51			
90% factor, fB		1.62					
90% queue, Qp		11.4	6.6 25.3	28.4 25.2			
Avg spacing, Lh		25.2 0	25.3	25.2			
Avail storg, La		177	95	472			
Avg distance		.00	.00				
Avg ratio, RQ 90% distance		.00	166	.00			
		287	166				
90% ratio, RQp		. 00	.00	. 00			
1							

```
03/26/06
VOLKAN COSKUN THESIS
                                                     21:33:07
INT 1109 - SARAYBURNU - PH PEAK
OPTIMIN
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 109 -
    Degree of Saturation (v/c) 0.61 Vehicle Delay 12.6 Level of Service B+
Sg 11 | Phase 1 | Phase 2 |
**/** -
    /1
                  <++++|
             North |
       <+ +> ++++>
 1 1
       + + |++++
           + | v
        | c/c=0.146 | c/c=0.768 |
    | G= 12.0" | G= 63.0" |
    | T+R= 3.0" | T+R= 4.0" |
    | OFF= 0.0% | OFF=18.3% |
    C= 82 sec G= 75.0 sec = 91.5% T= 7.0 sec = 8.5% Ped= 0.0 sec = 0.0%
|Lane |Width/| g/C |Service Rate| Adj | | BCH |L|Queue |
| Group | Lanes | Reqd Used | 0C (vph) 0E [Volume | v/c | Delay | S [Model 1]
                                             40.0 D+
NB Approach
_____
[RT+TH+LT] 20/2 |0.166 |0.139 | 181 | 443 | 279 |0.630 | 40.0 | D+| 166 ft]
                                             6.1 A
WB Approach
| TH | 22/2 |0.321 |0.773 | 2595 | 2604 | 895 |0.344 | 6.1 | A | 287 ft]
EB Approach
                                             11.6 B+
-----
[RT+TH | 20/2 |0.590 |0.773 | 2506 | 2518 | 1847 |0.734 | 11.6 | B+| 714 ft]
```

VOLKAN COSKUN THESIS INT 1109 - SARAYBURN	U - PH PEAK				03/26/06 21:30:34
EIISTING					
SIGNAL2000/TEAPAC [Ve	r 2.60.07] - F	KM Input 1	Worksheet		
Intersection # 109 -			3	irea Location	Type: NONCBD
		н т		Ke y:	VOLUMES >
	i 0 i 0 1 0.0 i 0.0				WIDTHS V LANES
	i o i o	ii -			
<u></u> ' ,	' ' ' \	н х	0 0.0	0	zis
,	· ·		859 22.1	2	1
0 0.0 0	, .		0 0.0	0	 North
	· ·	-		-	1
1473 19.7 2	- 、	1	/		
134 0.0 0	v n È	т і т	í I		
	216 0.0	0	21 (Phasing: SE	EQUENCE 11 ERMSV NNNN
		2			ZERLP YYYY
	i ii	i i	i	LE	EADLAG LD LD
	SB	WB		NB	EB
R	T 7H LT	RT TH	LT RT	7H L7	RT TH LT
Heavy veh, SHV .	0.0.0	.0 1.4	.0 4.8	.0 1.4	3.7 .9 .0
Pk-hr fact, PHF .9			.96 .85		.87 .87 .87
Pretimed or Act : Strtup lost, 11 2.		рр 2.32.3	P P 2.3 2.3		ррр 2.3 2.3 2.3
Ext off grn, o 2.	7 2.7 2.7	2.7 2.7	2.7 1.7		2.7 2.7 2.7
Arrival typ, AT	3 3 3	2 2	2 3	33	2 2 2
Ped vol, vped	0	0		0	0
Bike vol, vbic	0	0		0	0
Parking locatns Park mnyrs, Nn	NO	ыс 0		NO O	NO 0
Bus stops, NB	ŏ	0		0	ů ů
Grade, 96	. 0	3.7		-8.4	. 0
Sq 11 Phase 1	Phase 2 E	Phase 3	Phase 4	Phase 5	Phase 6
I I	I	 			
		1		!	<u>i</u> i
	<++++				
	i	i		i	i i
North <+ +> +		ļ		!	
				1	
					·····
C= 83" C= 16.0" ·	e~ £0.0° i e~	- 0.0° i	e= 0.0"	G= 0.0"	G= 0.0"
j T+R= 3.0" j					

VOLKAN COSKUN THI INT 1109 - SARAYI EXISTING		- PH :	PEAK								03/2 21:3		
SIGNAL2000/TEAPA	C[Ver 3	2.60.	07] -	HCM V	olume	Adju	st & S:	atflo	W WOI	kshee'	t.		
Volume		SB			WB			ЯΒ			EB		
Adjustment	RT	TH	\mathbf{LT}	\mathbf{RT}	TH	LT	RT	TH	LT	RT	TH	\mathbf{LT}	
Volume. V		 0	0		859	0	21	0	216	124	1473	0	
Pk-hr fact. PHF							. 85		.85	. 87	.87	. 87	
Adj mv flow, vp	0	0	0	0	895	0	25	0	254		1693	0	
Lane group, LG Adj LG flow, v				тн 895			ET+TH+LT 279			RT+TH 1847			
Prop LT, PLT					. 000			. 910			. 000		
Prop RT, PRT					. 000			090			. 083		
Saturation Flow Rate	RT	SB TH	LT	RT	WB Th	LT	RT	nb 7H	17	RT	EB TH	LT	
FICW RECO								2.8. 					
Base satflo, so					1891		1	L 8 91			1891		
Number lanes, N					2			2			2		
Lane width, fW				.968			. 928			. 92.8			
Beavy veh, fHV					. 986		.983			. 989			
Grade, fg Parking, fp				. 982				.030		1.000			
Bus block, fbb				1.000 1.000				1.000			1.000		
Area type, fa					. 000			.000			1.000		
Lane util, fLU					. 950			. 950			. 950		
Left-turn, fLT				1	. 000			956			1.000		
Right-turn, fRT					. 000		. 987			. 987			
PedBike LT, fLpb				1	. 000		1.000			1.000			
PedBike RT, fRpb				1	. 000		1	.000		1.000			
Local adjustent					. 000		1	.000			1.000		
Adj satflow, s					3368		2	3187			32.57		
SIGNAL2000/TEAPA	C[Ver :	2.60. SB	07] -	нсм с	apaci WB	ty and	d LOS 1	forks NB	heet		ЕВ		
Analysis	RT	TH	\mathbf{LT}	\mathbf{RT}		LT	RT	TH	LT	R/T	THE	LT	
Lane group, LC					 ТН		FT-	-TH+1	==== Л		RT+TH		
Adj Flow, v					895			279			1847		
Satflow, s					3368		2	3187			32.57		
Lost time, tL					3.6			3.6			3.6		
Effect green, g					60.4		-	15.4			60.4		
Grn ratio, g/C				.728				. 186			.728		
LC capacity, c				2451				591			2370		
v/c ratio, X					. 365			47.2			.779		
Flow ratio, v/s				. 266				. 088			.567		
Crit lane group											-		
Sum crit v/s, Ic		.655		Total	1~-+	т. Т.		7.2					
Crit v/c, Xe	0	. 635 . 717		TOCET	10.56	, ц		r. 2					

03/26/06 VOLKAN COSKUN THESIS INT 1109 - SARAYBURNU - PH PEAK 21:30:34 EIISTING SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet Delay \mathbf{SB} WB NВ EB and 108RT TH \mathbf{LT} \mathbf{RT} TΗ LT RT TH LT RT TH LT ----- -----_____ Lane group, LG FT+TH+LT RT+TH TH 895 Adj Flow, v 279 1847 LC capacity, c 2451 591 2370. 365 .472 v/c ratio, X .779 Grn ratio, g/C .728 . 186 .728 Unif delay, dl 4.2 30.2 7.1 Incr calib, k . 50 . 50 . 50 . 4 Incr delay, d2 2.72.6 . 0 . 0 Queue Deley, d3 . 0 Unif delay, d1* . 0 . 0 . 0 1.00 1.76 1.76 Prog factor, PF

7.8

A

0

_

A

 \mathbf{B} +

7.8

895

14.6 LOS

32.9

 \mathbf{C}

0

_

 \mathbf{C}

32.9

279

----- -----

Contrl delay, d

Lane group LOS

Final Queue, Qbi

Appr delay, dA

Approach LOS

Appr flow, vA

Intersection:

Delay

15.1

В

0

.....

В

15.1

1847

	ESIS									03/26	
INT 1109 - SARAYI	BURNU - PH F	EAK								21:30): 34
EIISTING											
SICHAL2000/TEAPA	c[Ver 2.60.0	- [7]	HCM B:	ack of	Quer	ue Worl	csheet	5			
Queues in	SB			WB			NB			EB	
Worst Lanes	RT TH	\mathbf{LT}	\mathbf{RT}	TH	LT	RT	TH	LT	RT	TH	LT
Lane group, LC				TH		FT-	-TH+LC		I	HT+TS	
Init queue, GbL				0			0			0	
In flow, vL				471			147 678		-	972	
In satflow, sL				1773		-	1714				
In capacity, cL				311			-	1247			
Flow ratio, yL v/c ratio, XL			-	266		.088				567	
			. 365			15.4					
Effect green, g			60.4 .728			15.4			60.4 728		
Grn ratio, g/C Upstr filter, I			-	. 00			.00			1.00	
Grn arrivals. P			н.	.49		.19			-	.54	
Platn ratio. Ro				. 49		-	. 19			. 84	
Prog factr, PF2			1	. 69					-	1.26	
Queue (1st), Q1				6.9			3.0		-	17.7	
Queue factr, kB							.48		-	1.26	
Ousue (2nd), 02			-	.7			. 4			4.0	
Avg gueue. 0				7.5			3.4		2	21.7	
90% factor, fB			1	L. 61			75		1	1.51	
90% queue, Qp			1	12.1			6.0		1	32.7	
Avg spacing, Lh			2	25.2		2	25.3		2	25.2	
Avail storg, La				0			0			0	
Avg distance				190			87			547	
Avg ratio, RQ				. 00			.00			. 00	
90% distance				306	152				82.4		
90% ratio, RQp				. 00			.00		. 00		
		===									

```
VOLKAN COSKUN THESIS
                                                 03/26/06
INT 1109 - SARAYBURNU - PH PEAK
                                                 21:30:34
EIISTING
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 109 -
    Degree of Saturation (v/c) 0.63 Vehicle Delay 14.6 Level of Service B+
Sq 11 | Phase 1 | Phase 2 |
**/** --
      _____
              ____
                    ZIN L
            <++++
 North |
       <+ +> ++++>
        + + |++++
 +
          + | v
    | g/c=0.193 | g/c=0.723 |
    | C= 16.0" | C= 60.0" |
    | T+R= 3.0" | T+R= 4.0" |
    | OFF= 0.0% | OFF=22.9% |
    C= 83 sec C= 76.0 sec = 91.6% T= 7.0 sec = 8.4% Fed= 0.0 sec = 0.0%
|Lane |Width/| g/C |Service Rate| Adj | | BCH |L|Queue |
| Group | Lanes | Reqd Used | GC (vph) GE [Volume] v/c | Delay | S [Model 1]
                                          32.9 C
NB Approach
_____
[RT+TH+LT] 20/2 [0.169 [0.186 ] 344 ] 591 ] 279 [0.472 ] 32.9 [ C ] 152 ft]
WB Approach
                                          7.8 A
_____
| TH | 22/2 |0.323 |0.728 | 2424 | 2451 | 895 |0.365 | 7.8 | A | 306 ft |
EB Approach
                                          15.1 в
_____
[RT+TH | 20/2 |0.591 |0.728 | 2341 | 2370 | 1847 |0.779 | 15.1 | B | 824 ft]
```

VOLKAN COSKUN THE: INT 1102 - AHIRKAN EXISTING			03/26/0 21:50:0	
SIGNAL2000/TEAPAC	[Ver 2.60.07] - HCM I	nput Worksheel	t.	
Intersection # 103	2 -		Area Location Type: NONCE	Ð
	44 366 0 .0 21.3 0.0 0 2 0		Eay: Volomes : Widths V Lane	
¦		\ 0 0	.0 0 . /l\	
	• •	0 0	.0 0	
0 0.0) / +		.00 North	
0 0.0) \	. /		
0 0.0 0			Phasing: SEQUENCE 7: PERMSV N N N I OVERLP Y Y T I LEADLAG LG L	N Y
	SB RT TH LT RT	WB TH LT I	NB EB RT 7H L7 R7 TH L7	
Pretimed or Act Strtup lost, 11 Ext eff grn, e	2.3 5.5 .0 .0 .93 .93 .93 .90 P P P P 2.3 2.3 2.3 2.3 2.7 2.7 2.7 2.0 2 2 2 3	.90 .90 .1 P P 2.3 2.3 2	.0 .0 .8 .0 .0 .4 84 .84 .90 .90 .9 P P P P P P .3 2.3 2.3 2.3 2.3 2.3 .0 2.0 1.7 2.0 2.0 2.0	0 0 P 3
Ped vol, vped	 0 0	0	0 0 0 0	-
Bike vol, vbic Parking locatns Park mnvrs, Nn	0 NO 0	ю ю	0 0 NO NO 0 0	
Bus stops, NB Grade, 9G	_	0.0	0 0	
Grada, «G			.0 .0	=
Sq 71 Phase 1 LC/**	Phase 2 Phase	3 Phase -	4 Phase 5 Phase 6	ī
North +	+ + + + <+ + ▼ 			
			0" C= 0.0" C= 0.0" 0" Y+R= 0.0" Y+R= 0.0"	

VOLKAN COSKUN TH	ESIS										03/2	
INT 1102 - AHIRK Existing	API-A	- AH 1	PEAK								21:5	0:00
SI (NAL2000/TEAPA	c[ver :	2.60.	07] -	HCM V	olume	Adju	st é S	atflo	w Wor	ksheet		
Volume		SB			WB			ΝВ			EB	
Adjustment	RT	78	LT	RT	TH	LT	RT	TH	LT	R7	TH	LT
	44	366	0	0	0	0		0	248	0	0	0
Pk-hr fact, PHF	. 93			. 00		. 00	. 84	.84	. 84	. 00	. 00	. 00
Adj mv flow, vp	47	394	0	0	0	0	0	0	2.95	0	0	0
Lane group, LG		ET+7H 441							LT 295			
Adj LG flow, v Prop LT, PLT		.000						1	.000			
Prop RT, PRT		. 107							.000			
Saturation		SB			WB			NB			EB	
Flow Rate	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
Base satfle, so		1891							1891			
Number lanes, N		2							1			
Lane width, fW		. 955						1	. 037			
Heavy veh, fHV		. 951							. 992			
Grade, fg		. 000							.000			
Parking, fp Bus block, fbb		.000							.000			
Area type, fa		.000							.000			
Lane util, fLU		. 950						_	.000			
Left-turn, fLT	1	. 000							. 950			
Right-turn, fRT		. 984							.000			
PedBike LT, fLpb		. 000							.000			
PedBike RT, fRpb		. 000							.000			
Local adjustent Adj satflow, s		.000 3211							.000			
Adj Sacilow, S		5611							1040			
SIGNAL2000/TEAPA	c[Ver)	2.60.	97] -	нем са	apaci)	ty an	d Los 1	Norks	heet			
Capacity		SB			WB			NB			EB	
Analysis	RT	78	LT	RT	\mathbf{TH}	\mathbf{LT}	RT	TH	LT	RT	TH	\mathbf{LT}
Lane group, LC		RT+7H							 L7			
Adj Flow, v		441							2.95			
Satflow, s		3211							1848			
Lost time, tL		3.6							3.6			
Effect green, g		45.4							24.4			
Grn ratio, g/C		. 5 90							. 317			
LC capacity, c		1893							585			
v/c ratio, X		. 233							.504			
Flow ratio, v/s Crit lane group		. 137							.160			
Sum crit v/s, Ic	0	. 000		Total	lost,	L		0.0				
Crit v/c, Xe		. 000										

	OLKAN COSKUN THESIS NT 1102 - AHIRKAPI-A - AM PEAK MISTING												
SIGNAL2000/TEAPA	C[Ver 2.6	0.07] -	- нем с	apacit	ty an	d Los I	Works	heet					
Delay	s	в		WB			ИВ			EB			
and LOS	RT T	H LT	RT	TH	LT	RT	TH	LT	RT	тн	LT		
		=====	=====			=====			=====				
Lane group, LC	PT+							LT					
Adj Flow, v	44							295					
LG capacity, c	189							585					
v/c ratio, X	.23	-						. 5 04					
Grn ratio, g/C	. 5 9							. 317					
Unif delay, dl	7.							21.4					
Incr calib, k	. 5							. 50					
Incr delay, d2	-							3.1					
Queue Delay, d3	-							.0					
Unif delay, d1*								.0					
Prog factor, PF	1.3							1.00					
Contrl delay, d	10.	_						24.5					
Lane group LOS	в							C+					
Final Queue, gbi		0						0					
Appr delay, dA	10.	6	24.5										
Approach LOS	в	+					C+						
Appr flow, vA	44	1					2.95						
Intersection:	De lav	16.2	LOS		в								

VOLKAN COSKUN THESIS 03/26/06 INT 1102 - AHIRKAPI-A - AH PEAK 21:50:00 EIISTING SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Back of Queue Worksheet EB Cueues in SB WB. NB Worst Lanes RT TH LT RT TH LT RT TH LT RT TH LT _____ Lane group, LG RT+7H LT Init queue, QbL 0 0 232 2.95Ln flow, vL 1690 1848 In satflow, sL Ln capacity, cL 996 585 .137 .160 Flow ratio, yL v/c ratio, XL .233 . 504 Effect green, g 45.4 24.4Grn ratio, g/C . 5 90 .317 Upstr filter, I 1.00 1.00 .39 Grn arrivals, P .32 . 67 1.00 Platn ratio, Rp 1.40 ${\bf 1.00}$ Prog factr, PF2 Queue (1st), Q1 3.3 5.1 Queue factr, kB 1.02. 70 .7 Queue (2nd), Q2 . 3 3.6 5.8 Avg queue, Q _ _ _ 1.74 1.66 90% factor, fB 90% queue, Qp 6.3 9.7 Avg spacing, Lh 25.8 25.1 Avail storg, La 0 - 0 Avg distance 93 147 .00 . 00 Avg ratio, RQ 90% distance 163 243 90% ratio, RQp .00 . 00

```
03/26/06
VOLKAN COSKUN THESIS
INT 1102 - AHIRKAPI-A - AH PEAK
                                                             21:50:00
EIISTING
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 102 -
    Degree of Saturation (v/c) 0.34 Vehicle Delay 16.2 Level of Service B
Sq 71 | Phase 1 | Phase 2 | Phase 3 |
LG/** ---
               1 + +
     | + +
     ZIN L
               |<+ +
                  Ψ.
 1
     North |
         \ll +
          ÷
 1 1
               | g/c=0.325 | g/c=0.584 | g/c=0.000 |
     | G= 25.0" | G= 45.0" | G= 0.0" |
| T+R= 3.0" | T+R= 4.0" | T+R= 0.0" |
     | OFF= 0.0% | OFF=36.4% | OFF= 0.0% |
     C= 77 sec   G= 70.0 sec = 90.9% T= 7.0 sec = 9.1% Pad= 0.0 sec = 0.0%
           _____
| Lane |Width/| g/C | Service Rate| Adj | | BCH | L | Queue |
| Group | Lanes| Reqd Used | @C (vph) @E |Volume| v/c | Delay | S [Model 1]
                                                    10.6 B+
SB Approach
_____
[RT+TH | 21/2 |0.198 |0.590 | 1831 | 1893 | 441 |0.233 | 10.6 | B+| 163 ft|
                                                     ____
                                                    24.5 C+
NB Approach
-----
| LT | 13/1 |0.236 |0.317 | 468 | 585 | 295 |0.504 | 24.5 | C+| 243 ft|
                                       _____
```

VOLKAN COSKUN THE INT 1102 - AHIRKA OPTIMUN				03/26/06 22:02:19
SICHAL2000/TEAPAC	[Ver 2.60.07] - HCM	Input Works	heet	
Intersection # 10	12 -		Area Locatio	n Type: NONCBD
l	45 1410 0	!	Ke y:	VOLUMES >
	0 21.3 0.0 0	i		V LANES
i		\	0.0 0	zix
		0	0.0 0	
	0/+	/ 0	0.0 0	North
	• \	i , 7		
0 0.0	ii 115 j			REQUENCE 71 REPMSV NNNN
		0 0	i c	VERLP YYIY ZEADLAG LGLD
			· -	
	SB RT TH LT RT	WB TH LT	NB RT 7H L7	EB RT TH LT
Heavy veh, SHV	.0 2.1 .0 .0		.0 .0 2.6	.0.0.0
Pk-hr fact, PHF Pretimed or Act	.88 .88 .88 .90 P P P P	P P	.81 .81 .81 P P P	.90.90.90 PPP
Strtup lost, l1 Ext eff grn, e	2.3 2.3 2.3 2.3 2.3 2.3 2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7	2.3 2.3 2.0 2.0	2.3 2.3 2.3 2.0 2.0 1.7	2.3 2.3 2.3 2.0 2.0 2.0
	2 2 2 3	3 3	3 3 3	3 3 3
Ped vol, vped Bike vol, vbic	0	0 0	0	0 0
Parking locatns	NO	ю	NO	190
Park mnvrs, Nn Bus stops, NB	0	0	0	0
Grada, 96	.0	.0	. 0	.0
Sq 71 Phase 1 LG/**	Phase 2 Phas	e 3 Pha:	se 4 Phase 5	Phase 6
.	1++ 1		1	
- qx - į	i<++ i	į		i i
				i i
North <+ +				
c= 71" c= 16.0"	' c= 48.0" c=	' 0.0" α=	ا 0.0" c= 0.0"	' G= 0.0"
	T+R= 4.0" T+R=			

VOLKAN COSKUN TH INT 1102 - AHIRK OPTIMUN		PHI	PEAK								03/26 22:00	
SIGNAL2000/TEAPA	c[Ver 2	.60.1	07] -	HCM V	olume	Adju	st & S:	atflo	w Wor	kshee t		
Volume		SB			WB			NB			EB	
		TH		RT	TH	LT	RT	TH	LT	RT	TH	LT
Volume, V	45 1				0	0			115		0	0
Pk-hr fact, PHF				. 00	. 00						. 00	11
Adj my flow, vp				Õ	0	0			142	Õ	. ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	0
Lane group, LG		T+TH							LT			
Adj LG flow, v Prop LT, PLT		653 000						-	142			
Prop RT, PRT	-	031							.000			
		051										
Saturation		SB			WB			ИВ			EB	
Flow Rate	RT		ĿŦ	RT	TH TH	LT	RT		LT	87	TH	LT
Base satflo, so	1	891							1891			
Number lanes, N		2							1			
Lane width, fW		955						_	. 037			
Heavy veh, fHV		980 000							.975 .000			
Grade, fg Parking, fp		000 000							.000			
Bus block, fbb		000							.000			
		000							.000			
Area type, fa Lane util, fLU		950						_	. 000			
Left-turn, fLT	1.	000							. 950			
Right-turn, fRT		995						1	. 000			
PedBike LT, fLpb	1.								. 000			
PedBike RT, fRpb	1.	000							. 000			
Local adjustent		000							.000			
Adj satflow, s		347							1815			
SIGNAL2000/TEAPA Capacity	C[Ver 2	.60.) SB	07] -	нем с	apaci) WB	ty an	d Los 1	Works NB	heet		EB	
Analysis	RT	78	\mathbf{LT}	RT	TH	LT	RT	TH	LT	RT	TH	LT
				=====								
Lane group, LC		T+TH							LT			
Adj Flow, v Satflow, s		.653 347							142 1815			
Lost time, tL		3.6							3.6			
Effect green, g		8.4							15.4			
Grn ratio, q/C	-	682							.217			
LG capacity, c		282							3.94			
v/c ratio, X		724							. 360			
Flow ratio, v/s		494							. 078			
Crit lane group												
Sum crit v/s, Te		000		Total	lost	т.		0.0				
Crit v/c. Xe		000		an ann Air Bhaile.	and the stage			• · •				
	-											

03/26/06 VOLKAN COSKUN THESIS 22:02:19 INT 1102 - AHIRKAPI-A - PH PEAK OPTIMUH SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet SB ЯΒ Del sy WB EB. and LOS RT TH \mathbf{LT} \mathbf{RT} TH \mathbf{LT} \mathbf{RT} TH LT RT TH \mathbf{LT} _____ Lane group, LG RT+TH LT Adj Flow, v 1653 142 LC capacity, c 394 2282.724 .360 v/c ratio, X Grn ratio, g/C .682 .217Unif delay, di Incr calib, k 23.6 7.1 . 50 . 50 Incr delay, d2 2.62.0 Queue Delay, d3 . 0 ..0 Unif delay, d1* . 0 .0 Prog factor, PF 1.59 1.00 Contrl delay, d 13.4 26.2 Lane group LOS B+ C+ 0 Final Queue, Gbi 0 ----Appr delay, dA 13.4 26.2Approach LOS B+ \mathbf{C} 1653 142 Appr flow, vA _____

B+

Intersection: Delay 14.4 LOS

VOLKAN COSKUN THI INT 1102 - AHIRKI OPTIMUN	API-A - PH PEAK			03/26/06 22:02:19
SIGNAL2000/TEAPA	[Ver 2.60.07] -	HCM Back of Que	we Worksheet	
Queues in	SB	WB	NB	EB
Worst Lanes	RT 7H LT	RT TH LT	RT 7H L7	RT TH LT
Lane group, LC	FT+7H		 L7	
Init queue, QbL	0		0	
In flow, vL	870		142	
In satflow, sL	1762		1815	
Ln capacity, cL	1201		394	
Flow ratio, yL	. 494		. 078	
v/c ratio, XL	. 724		. 360	
Effect green, g	48.4		15.4	
Grn ratio, g/C	. 682		. 217	
Upstr filter, I	1.00		1.00	
Grn arrivals, P	.45		. 22	
Platn ratio, Rp	.67		1.00	
Prog factr, PF2	1.29		1.00	
Queue (1st), Q1	14.0		2.4	
Queue factr, kB	1.10		. 50	
Queue (2nd), Q2	2.7		. 3	
Avg queue, Q	16.7		2.7	
90% factor, fB	1.52		1.79	
90% queue, go	25.3		4.8	
Avg spacing, Lh	25.3		25.4	
Avail storg, La	0		0	
Avg distance	422		68	
Avg ratio, RQ	.00		. 00	
90% distance	640		121	
90% ratio, ROp	.00		. 00	

```
VOLKAN COSKUN THESIS
                                                         03/26/06
INT 1102 - AHIRKAPI-A - PH PEAK
                                                         22:02:19
OPTIMUH
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 102 -
    Degree of Saturation (v/c) 0.70 Vehicle Delay 14.4 Level of Service B+
Sq 71 | Phase 1 | Phase 2 | Phase 3 |
LG/**
              | + +
    1 + +
     ZIN - İ
              _<+ +
 V.
              L
              North |
        <+
              +
    +
              1
                        I.
    | g/c=0.225 | g/c=0.676 | g/c=0.000 |
     | c= 16.0" | c= 48.0" | c= 0.0" |
    | T+R= 3.0" | T+R= 4.0" | T+R= 0.0" |
     | OFF= 0.0% | OFF=26.8% | OFF= 0.0% |
    C= 71 sec C= 64.0 sec = 90.1% T= 7.0 sec = 9.9% Fed= 0.0 sec = 0.0%
| Lane |Width/| g/C | Service Rate| Adj | | BCH | L | Queue |
| Group | Lanes| Reqd Used | @C (vph) @E |Volume| v/c | Delay | S [Model 1]
SB Approach
                                                13.4 B+
[RT+TH | 21/2 | 0.514 | 0.682 | 2266 | 2282 | 1653 | 0.724 | 13.4 | B+| 640 ft]
NB Approach
                                                26.2 C+
_____
| LT | 13/1 |0.149 |0.217 | 271 | 394 | 142 |0.360 | 26.2 | C+| 121 ft|
```

Volkan Coskun The: INT 1102 - Ahirkan Eiisting		K			03/26/06 21:59:16
SIGNAL2000/TEAPAC	[Ver 2.60.07]	- HCM Input	Worksheet		
Intersection # 103	2 -	•		Area Locatio	on Type: NONCED
I	1 1	11 1		Бе у	: VOLUMES >
		0.011 1			WID7HS V LANES
		°¦¦ ∖-	0 0.0) 0	zis
,	/ I	`	0 0.0) 0	
0 0.0		+ /	0 0.0) 0	 North
	'				I
0 0.0		۱ I	/		
0 0.0	0 \ II II	115 0	o	Phasing: 3	SECUENCE 71
	- i i 1	3.1 j 0.0 j		I	PERMSV NNNN
			1		LEADLAG LG LD
	SB RT TH L	WB T RT TH	LT RI	NB 7H L7	EB RT TH LT
Heavy veh, AHV Pk-hr fact, PHF	.0 2.1 .	0.0.0 8.90.90	.00. .9081		0.0.0.0 .90.90.90
Pretimed or Act Strtup lost, 11	P P	P P P	P B	Р Р	P P P 2.3 2.3 2.3
Ext off grn, o	2.7 2.7 2.	7 2.0 2.0	2.3 2.1		2.3 2.3 2.3
Arrival typ, AT	2 2	2 3 3	3 3	3 3 3	3 3 3
Ped vol, vped	0	0		0	0
Bike vol, vbic Parking locatns	0 ок	0 жи		0 MO	0 1940
Park movrs, Nn	0	0		0	0
Bus stops, NB Grade, %G	.0	.0		.0	.0
 Sq 71 Phase 1 LC/**	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
1 I	+ +	I I		l	I I
i i	+ + <+ +				
	v	i i			i i
North <+				i i	
				}	
 c= 92" c= 20.0"			<i>c</i> = 0.01	· · · · · · · · · · · · · · · · · · · ·	· · · · · ·
					" Y+R= 0.0"

VOLKAN COSKUN TH INT 1102 - AHIRK EIISTING		PEAK								03/2) 21:5	
SIGNAL2000/TEAPA	c[Ver 2.60.	07] -	HCM V	olume	Adju	st & S	atfle	W Wor	kshee t		
Volume	SB			WB			NB			EB	
Adjustment	RT 7H		RT	TH	LT	RT	TH	LT	RT	TH	LT
Volume. V	45 1410		0	0	0	0	0	115		0	0
Pk-hr fact, PHF		. 88									. 00
Adj mv flow, vp	51 1602	0	0	0	0	0	0	142	0	0	0
Lane group, LC	FT+7E							LT			
Adj LG flow, v	1653							142			
Prop LT, PLT	. 000						1	. 000			
Prop RT, PRT	.031							. 000			
Saturation	SB			WB			NB			EB	
Flow Rate	RT TH	LT	RT	TH	LT	RT	78	LT	RT	TH	LT
Base satflo, so	1891							1891			
Number lanes, N	2							1			
Lane width, fW	. 955							037			
Heavy veh, fHV	. 980							. 975			
Grade, fg	1.000							. 000			
Parking, fp	1.000							. 000			
Bus block, fbb Area type, fa	1.000 1.000							. 000			
Afes type, fs Lane util. fLU	. 950										
Left-turn. fLT	1.000						-	. 950			
Right-turn, fRT	.995						1	. 000			
PedBike LT, fLpb	1.000							. 000			
PedBike RT, fRpb	1.000						1	. 000			
Local adjustent	1.000						1	. 000			
Adj satfĺow, s	3347							1815			
		====						====			

SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Capacity		SB			WB			NB			EB			
Analysis	RT	TH	\mathbf{LT}	\mathbf{RT}	TH	\mathbf{LT}	RT	78	LT	RT	TH	LT		
	=====			=====		===	=====			=====				
Lane group, LG	1	RT+TH							LT					
Adj Flow, v		1653							1.42					
Satflow, s	1	3347							1815					
Lost time, tL		3.6							3.6					
Effect green, g	1	65.4							19.4					
Grn ratio, g/C		711							211					
LC capacity, c	2	237.9		383										
v/c ratio, X		695							.371					
Flow ratio, v/s		4.94							.078					
Crit lane group														
Sum crit v/s, Ic		. 000		Total	lost,	L.		0.0						
Crit v/e, Xe		. 000												

VOLKAN COSKUN THESIS 03/26/06 21:59:16 INT 1102 - AHIRKAPI-A - PH PEAK EIISTING SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet ΝВ Del sy SB WB. EB and LOS RT TH \mathbf{LT} \mathbf{RT} TH LT RT TH LT \mathbf{RT} TH LT _____ Lane group, LC RT+TH LT Adj Flow, v 1653142LC capacity, c 237.9383 v/c ratio, X .371 .695 Grn ratio, g/C Unif delay, dl Incr calib, k .711 .2117.6 31.1 . 50 . 50 Incr delay, d2 1.7 2.7 . 0 Queue Delay, d3 ..0 Unif delay, d1* . 0 .0 Prog factor, PF 1.69 1.00 Contrl delay, d 14.6 33.8 Lane group LOS B+ \mathbf{C} Final Queue, gbi 0 0 Appr delay, dA 14.6 33.8 Approach LOS B+ C Appr flow, vA 1653 142____ Intersection: Delay 16.1 LOS B

VOLKAN COSEUN TH INT 1102 - AHIRE EXISTING				03/26/06 21:59:16
SIGNAL2000/TEAPA	c[Ver 2.60.07] -	HCM Back of Que	we Worksheet	
Queues in	SB	WB	NB	EB
Worst Lanes	RT TH LT	RT TH LT	RT 7H L7	RT TH LT
Lane group, LG	RT+7H		LT	
Init queue, QbL	0		0	
In flow, vL	870		142	
In satflow, sL	1762		1815	
In capacity, cL	1252		383	
Flow ratio, yL	. 494		.078	
v/c ratio, XL	. 695		.371	
Effect green, g	65.4		19.4	
Grn ratio, g/C	.711		.211	
Upstr filter, I	1.00		1.00	
Grn arrivals, P	.47		.21	
Platn ratio, Rp	.67 1.37		1.00	
Prog factr, PF2				
Queue (1st), Q1	17.4 1.36		3.1 .59	
Queue factr, kB	1.36		. 59	
Queue (2nd), Q2			 3.5	
Avg queue, Q	20.4		3.3	
90% factor, fB	1.51		1.75	
90% queue, go	30.7		6.0	
Avg spacing, Lh	25.3		25.4	
Avail storg, La	0		0	
Avg distance	515		88	
Avg ratio, RQ	.00		. 00	
90% distance	777		153	
90% ratio, ROp	.00		. 00	

```
VOLKAN COSKUN THESIS
                                                       03/26/06
INT 1102 - AHIRKAPI-A - PH PEAK
                                                       21:59:16
EIISTING
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 102 -
    Degree of Saturation (v/c) 0.67 Vehicle Delay 16.1 Level of Service B
Sq 71 | Phase 1 | Phase 2 | Phase 3 |
LG/** ---
              | + +
    | + +
    I \Lambda
              |≪+ +
    | V
 North |
              1 1
         +
              +
    | g/c=0.217 | g/c=0.707 | g/c=0.000 |
    | c= 20.0" | c= 65.0" | c= 0.0" |
    | T+R= 3.0" | T+R= 4.0" | T+R= 0.0" |
    | OFF= 0.0% | OFF=25.0% | OFF= 0.0% |
    C= 92 sec G= 85.0 sec = 92.4% T= 7.0 sec = 7.6% Ped= 0.0 sec = 0.0%
| Lane |Width/| g/C | Service Rate | Adj | | BCH | L | Queue |
| Group | Lanes | Reqd Used | 0C (vph) 0E [Volume] v/c | Delay | S [Model 1]
                                    _____
                                               14.6 B+
SB Approach
|RT+TH | 21/2 |0.534 |0.711 | 2324 | 2379 | 1653 |0.695 | 14.6 | B+| 777 ft|
            -----
NB Approach
                                               33.8 C
_____
| LT | 13/1 |0.201 |0.211 | 165 | 380 | 142 |0.371 | 33.8 | C | 153 ft|
```

VOLKAN COSKUN THE INT 1102 - AHIRKA EIISTING		PEAK							03/2 22:1	
SIGNAL2000/TEAPAC	[Ver 2.60.	07] - нсм	Input	Worksh	pet					
Intersection # 10)2 -				A	rea L	ocati	on Typ	e: NO	NCBD
!	0 367		ļ				Ке у	: VOL	UMES WIDT	
).0 j 19.7	j 0.0 jj	l					v		HS ANES
	0 2	0	<u>ر</u>	0	0.0	0				
	/ 1	1		 0	0.0	0		/	11	
81 0.0	·== 0 /		,	0				No	i eth	
		*		-				10	l	
0 14.7	1	1	I	1						
57 0.0			1542	0		Phasi	ng: .	SEQUEN	CE.	11
	1	i 0.0 i: I 0 I	21.1 j 2 j	0.0 j			-	PERMSV	ии	ы и Т Y
			fi	l v i				LEADLA		G LD
	SB RT TH	LT R	WB F TH	LT	RT	nb Th	LT	RT	EB Th	LT
Hezvy veh, AHV	.0 5.4	.0 .	0.0	.0		1.8	.0	14.0	.0	 . 0
Pk-hr fact, PHF	.90 .90	.90 .9		. 90	.96	.96	. 96	.88	. 88	. 88
Pretimed or Act Strtup lost, 11	P P		P P	Р	P	P	P	P	P	P
	2.3 2.3 1.7 1.7	2.3 2.1 1.7 1.1		2.3 1.7	2.3 1.7	2.3 1.7	$2.3 \\ 1.7$	$\frac{2.3}{1.7}$	$2.3 \\ 1.7$	$\frac{2.3}{1.7}$
Arrival typ, AT	2 2		· 1. · 3 3	3	2	2	2	3	3	3
Ped vol, vped Bike vol, vbic	0		0			0			0	
Parking locatns	ю		ыõ			NO			190	
Park movrs, Nn	0		0			0			0	
Bus stops, NB	0		0			0			0	
Grade, 9G	.0		.0			. 0			-1.4	
Sq 11 Phase 1 LG/**	Phase	2 Pha	se 3	Ph as	no 4	Ph	250 5	P	hase	6
1 +						!				l
in i i		i				i		i i		
l l v	^	1				į –		I		Ì
	1++++	!				!				
North +	1					1				
' i +	i v	i				i		i		i
c= 77" c= 59.0" T+R= 3.0"										

VOLKAN COSKUN TH INT 1102 - AHIRK EIISTING		- AH	PEAK								03/20 22:17	
SI (BAL2000/TEAPA	- F	a 70	071		-1	.	- -					
18	civer	2.60.	0/] -	HCM V	orume	Aaju	st a s	atiio	WOI	Ksnee t		
Volume		SB			WB			NB			EB.	
Adjustment	RT	78	LT	RT	TH	LT	RT	78	LT	RT	TH	LT
Volume, V		367	0	0	0	0		1542	0	57	0	81
	. 90			.00			.96					. 88
Adj mv flow, vp			Ő	. ° °		Õ		1606	0	65	0	92
		 7H						78			PTH+L3	
Lane group, LC Adj LC flow, v		408						1606			157	E
Prop LT, PLT		.000						.000			586	
Prop RT, PRT		.000						.000			414	
Saturation		SB			WB			NB			EB	
Flow Rate	RT	78	\mathbf{LT}	\mathbf{RT}	TH	LT	RT	TH	LT	RT	TH	LT
				=====			=====	=====				
Base satfle, so		1891						1891		-	1891	
Number lanes, N		2						2			1	
Lane width, fW		. 928						.952			. 090	
Heavy veh, fHV		. 94 9						.982			945	
Grade, fg		. 000									. 007	
Parking, fp		. 000					-	. 000			000	
Bus block, fbb		. 000									. 000	
Area type, fa		. 000						.000			. 000	
Lane util, fLU		. 950 . 000						.950			. 000 . 972	
Left-turn, fLT Right-turn, fRT		. 000						. 000			972	
PedBike LT, fLpb		. 000					-	.000			. 944	
PedBike RT, fRpb		. 000					-	. 000			000	
Local adjustent		. 000						. 000			000	
Adj satflow, s		3165					-	3359			1799	
				=====								
SIGNAL2000/TEAPA Capacity Analysis	C[Ver BT	2.60. SB 7H	07] - LT	HCM C	apaci) WB TH	ty and	d LOS RT	Worksi NB 7H	heet L7	BT	EB TH	LT
								3.A ======		R.1		
Lane group, LG	_	78						78		RT	TB+L3	r
Adj Flow, v		408						1606			157	
Satflow, s		3165						3359			1799	
Lost time, tL		3.6						3.6			3.6	
Effect green, g		58.4						58.4			L1.4	
Grn ratio, g/C		. 758						.758			148	
LC capacity, c		2400						2547			2 66	
v/c ratio, X		. 170						.631		-	.590	
Flow ratio, v/s		.129						. 478			. 087	
Crit lane group								*			*	
Sum crit v/s,Tc Crit v/c, Xc	0	.565 .624		Total	lost,	, ц		7.2				

VOLKAN COSKUN THESIS 03/26/06 INT 1102 - AHIRKAPI-B - AM PEAK 22:17:15 EIISTING											
SI (NAL2000/TEAPA	C[Ver 2.6	0.07] -	нсмс	apacit	ay an	d Los i	Works	heet			
Delay	s	-		WB			NB			EB	
and LOS	RT 7	H LT	RT	тн	LT	RT	TH	LT	RT	TH	LT
	7						7H			TH+L3	_
Lane group, LG Adj Flow, v	40						1606		DOI:4	157	E.
LG capacity, c	240						2547			2.66	
v/c ratio, X	.17						631			590	
Grn ratio, g/C	.75				.758				148		
Unif delay, d1	2.	6					4.3		2	30.6	
Iner calib, k	. 5	0					. 50			. 50	
Incr delay, d2		2					1.2			9.3	
Queue Delay, d3		0					. 0			. 0	
Unif delay, d1*		0					. 0			. 0	
Prog factor, PF	1.9	-					1.90		1	L. 00	
Contrl delay, d	5.	1					9.4		2	39.9	
Lane group LOS		A					A			D+	
Final Queue, Qbi		0					0			0	
Appr delay, dA	5.						9.4		2	39.9	
Approach LOS Appr flow, vA	40						A 1606			D+ 157	
Appr How, WA	40	•					1000			TBI	
Intersection:	De lev	10.8	LOS		B+						

VOLKAN COSKUN TH INT 1102 - AHIRK EXISTING				03/26/06 22:17:15
SI (MAL2000/TEAPA	c[Ver 2.60.07] -	HCM Back of Que	we Worksheet	
Queues in	SB	WB	NB	EB
Worst Lanes	RT 7H LT	RT TH LT	RT TH L7	RT TH LT
Lane group, LG	78		78	RT+TH+LT
Init queue, QbL	0		0	0
Ln flow, vL	215		845	157
In satflow, sL	1666		1768	1799
In capacity, cL	1263		1341	2 66
Flow ratio, yL	.129		. 47 8	. 087
v/c ratio, XL	. 170		. 631	. 590
Effect green, g			58.4	11.4
Grn ratio, g/C	. 758		.758	. 148
Upstr filter, I	1.00		1.00	1.00
Grn arrivals, P	. 51		. 52	. 15
Platn ratio, Rp	. 67		. 69	1.00
Prog factr, PF2	1.95		1.54	1.00
Queue (1st), Q1	2.5		12.9	3.1
Queue factr, kB	1.21		1.26	. 41
Queue (2nd), Q2	. 2		2.1	. 6
Avg queue, Q	2.7		15.0	3.7
90% factor, fB	1.79		1.52	1.74
90% queue, Qp	4.9		22.9	6.4
Avg spacing, Lh	25.8		25.3	25.9
Avail storg, La	0		0	0
Avg distance	70		379	96
Avg ratio, RQ	.00		.00	. 00
90% distance	126		578	166
90% ratio, RQp	.00		.00	. 00

```
VOLKAN COSKUN THESIS
                                                     03/26/06
INT 1102 - AHIRKAPI-B - AH PEAK
                                                     22:17:15
EIISTING
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 102 -
    Degree of Saturation (v/c) 0.54 Vehicle Delay 10.8 Level of Service B+
Sq 11 | Phase 1 | Phase 2 |
LG/** ---
           _
    ÷
             1
                      1
       ÷
             1
    1
71N - E
      +
             v
             1 ^
 1
             |++++
                      1
North |
          ÷
             ÷
             |++++
    1
                      | V
    ÷
                      | g/c=0.766 | g/c=0.156 |
    | G= 59.0" | G= 12.0" |
    | T+R= 3.0" | T+R= 3.0" |
    | OFF= 0.0% | OFF=80.5% |
    C= 77 sec G= 71.0 sec = 92.2% T= 6.0 sec = 7.8% Fed= 0.0 sec = 0.0%
|Lane |Width/| g/C |Service Rate|Adj| | BCH |L|Queue |
| Group | Lanes | Reqd Used | QC (vph) QE [Volume] v/c | Delay | S [Model 1]
SB Approach
                                              5.1 A
_____
| TH | 20/2 |0.191 |0.758 | 2391 | 2400 | 408 |0.170 | 5.1 | A | 126 ft|
NB Approach
                                              9.4 A
-----
| TH | 21/2 |0.505 |0.758 | 2543 | 2547 | 1606 |0.631 | 9.4 | A | 578 ft |
                                              _
                                             39.9 D+
EB Approach
[RT+TH+LT] 15/1 |0.170 |0.148 | 116 | 258 | 157 |0.590 | 39.9 | D+| 166 ft]
```

VOLKAN COSKUN TH INT 1102 - AHIRE OPTIMUN		EAK			03/26/06 22:25:16
SIGNAL2000/TEAPA	c[ver 2.60.0	7] - HCM In	nput Worksl	neet	
Intersection # 1	.02 -			Area L	ocation Type: NONCBD
	 0 1409 0.0 19.7 0 2	0.0 jj	 		Kay: VOLOMES > WIDTHS V LANES
¦		, "II	\ 0	0.0 0	/i\
	· ·	`	0	0.0 0	//(
81 0.0	0 /	+	/ 0	0.0 0	 North
0 14.7	1				===
162 0.0	 	0 90 0.0 21. 0			ng: SEQUENCE 11 PERMSV NNNN OVERLP YYTY LEADLAG LG LD
	SB RT 7H	LT RT	WB TH LT	nb Rt 7h	EB L7 R7 TH LT
Heavy veh, SHV	.0 2.1	.0 .0	.0.0	.0 1.9	0. 0. 0. 0.
Pk-hr fact, PHF Pretimed or Act	P P	P P	P P	P P	.93 .92 .92 .92 P P P P
Strtup lost, l1 Ext eff grn, e	2.3 2.3 1.7 1.7	2.3 2.3	1.7 1.7		2.3 2.3 2.3 2.3 1.7 1.7 1.7 1.7
Arrival typ, AT		2 3		2 2	2 3 3 3
Ped vol, vped	0		0	0	0
Bike vol, vbic Parking locatns	0 NO		0 000	0 NO	0 190
Park mnyrs, Nn Bus stops, NB	0		0 0	0	0
Grade, %G	. ŏ		.ŏ	.ŏ	-1.4
Sq 11 Phase 1 LC/**	Phase 2	l Phase	3 Pha	se 4 Ph	ase 5 Phase 6
. +	-		-		
ZIN İ +	İ.		i	Ì	i i
v ^ North +			Ì	ļ	i i
North +					
			0" C=	0.0" 1 ~~	0.0" c= 0.0"
					= 0.0" Y+R= 0.0"

VOLKAN COSKUN TH INT 1102 - AHIRK OPTIMUN		- PH	PEAK								03/2 22:2	
SI (MAL2000/TEAPA	cíver	2.60.	071 -	HCM V	oluma	۵din	st 6 8	atfloo	Wor	k shoot.		
Volume Adjustment		SB 78			WB TH		BT	nb 7h		87	EB TH	
Adjustment			LT	RT		LT			LT	N.T.		LT
Volume, V		1409	0	0	0	0	0	906	0	162	0	81
Pk-hr fact, PHF				. 00			.93			. 92	. 92	. 92
Adj mv flow, vp	0	1601	0	0	0	0	0	97.4	0	176	0	88
Lane group, LG Adj LG flow, v		7H 1601						7H 974		BOD-	PTH+L! 2.64	T.
Prop LT, PLT		.000						. 000			333	
Prop RT, PRT		. 000						. 000			667	
Saturation		SB			WB			NB			EB	
Flow Rate	RT	TH	LT	\mathbf{RT}	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT
Base satflo, so Number lanes, N		1891 2						1891 2			1891	
Lane width, fW		. 928						. 952		1	1.090	
Heavy yeh. fHV		. 97 9						. 981			000	
Grade, fg		. 000						. 000			007	
Parking, fp		. 000					1	. 000		1.	000	
Bus block, fbb	1	. 000					1.000			1.	000	
Area type, fa		. 000					1	1.000			000	
Lane util, fLU		. 950						. 950			.000	
Left-turn, fLT		. 000						. 000			984	
Right-turn, fRT		. 000						. 000			910	
PedBike LT, fLpb		. 000						. 000			000	
PedBike RT, fRpb		. 000						. 000			.000	
Local adjustent Adj satflow, s		. 000						.000			000	
Adj satilow, s		3267						3335			1858	
SIGNAL2000/TEAPA	C[Ver	2.60. SB	07] -	нем с	apaci) WB	ty an	d Los	Worksh NB	leet		EB	
Analysis	RT	78	\mathbf{LT}	RT	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT
Lane group, LG		TH						TH		RT	FIR+L	T
Adj Flow, v		1601						97.4 2055			264	
Satflow, s Lost time, tL		3267 3.6						3355 3.6		-	1858 3.6	
Effect green, g		з. в 51. 4						з.в 51.4			э.ь 12.4	
Grn ratio, q/C		51.4 .724						51.4 .724		-	175	
LG capacity, c		2365						2429			324	
v/c ratio. X		. 677						. 401			815	
Flow ratio, v/s		. 490						.290			142	
Crit lane group		÷									÷	
Sum crit v/s, Ic	 r	0.632		Total	lost	т.		7.2				
Crit v/c, Xc	-	. 704		and the second state	2026			· · · ·				
									===			

 VOLKAN COSKUN THESIS
 03/26/06

 INT 1102 - AHIRKAPI-B - PH PEAK
 22:25:16

 CPTIMUM
 SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

 Delay
 SB
 WB
 NB
 EB

Deley		38			n 15			BIB .		123 H			
and LOS	RT	TH	\mathbf{LT}	RT	TH	\mathbf{LT}	RT	TH	LT	RT	TH	LT	
	=====			=====			=====						
Lane group, LG		TH						TH		RT	FIR+L3		
Adj Flow, v		1601						974			2.64		
LG capacity, c	2	2365					1	2429			32.4		
v/c ratio, X		.677					. 401				815		
Grn ratio, g/C		724						.724			175		
Unif delay, dl		5.3						3.8		2	28.2		
Incr calib, k		. 50						. 50			. 50		
Incr delay, d2		1.6						. 5			L9.8		
Queue Delay, d3		. 0						. 0					
Unif delay, d1*		. 0						. 0			. 0		
Prog factor, PF		1.74						1.74			L. 00		
Contrl delay, d		LO. 8						7.1			18.0		
Lane group LOS		B+						A			D		
Final Queue, Qbi		0						0			0		
Appr delay, dA		10.8						7.1			18.0		
Approach LOS		B+						2			в		
Appr flow, vA	-	1601						97 1			264		
APPL LION, W													
Intersection:	Delev		13.0	LOS		B+							

VOLKAN COSKUN TH INT 1102 - AHIRK OPTIMUH				03/26/06 22:25:16
SI (MAL2000/TEAPA	c[Ver 2.60.07] -	HCM Back of Que	we Worksheet	
Queues in	SB	WB	NB	EB
Worst Lanes	RT TH LT	RT TH LT	RT 7H LT	RT TH LT
Lane group, LC	78		78	RT+TH+LT
Init queue, QbL	0		0	0
Ln flow, vL	843		513	264
In satflow, sL	1719		1766	1858
Ln capacity, cL	1245		1278	324
Flow ratio, yL	. 490		. 2 90	. 142
v/c ratio, XL	. 677		. 401	. 815
Effect green, g	51.4		51.4	12.4
Grn ratio, g/C	. 724		. 724	. 175
Upstr filter, I	1.00		1.00	1.00
Grn arrivals, P	.48		.48	. 17
Platn ratio, Rp	. 67		. 67	1.00
Prog factr, PF2	1.42		1.65	1.00
Queue (1st), Q1	12.8		6.5	5.0
Queue factr, kB	1.13		1.15	. 44
Queue (2nd), Q2	2.3		. 8	1.6
Avg queue, Q	15.0		7.2	6.6
90% factor, fB	1.52		1.62	1.63
90% queue, go	22.9		11.7	10.8
Avg spacing, Lh	25.3		25.3	25.0
Avail storg, La	0		0	0
Avg distance	381		183	165
Avg ratio, RQ	.00		.00	. 00
90% distance	580		296	270
90% ratio. ROp	.00		.00	. 00

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VOLKAN COSKUN THESIS
                                                          03/26/06
INT 1102 - AHIRKAPI-B - PH PEAK
                                                          22:25:16
OPTIMUH
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 102 -
    Degree of Saturation (v/c) 0.60 Vehicle Delay 13.0 Level of Service B+
Sq 11 | Phase 1 | Phase 2 |
LG/** ---
       ____
                 ____
        ٠
                        I.
    1
    1 +
              1
/IN 1 +
             Т
              1 ^
 | | V
                        A.,
 1
    |++++
                        North |
           ÷
               ÷
              1++++
           +
              1 V
     | a/c=0.732 | a/c=0.183 |
     | G= 52.0" | G= 13.0" |
| T+R= 3.0" | T+R= 3.0" |
     j OFF= 0.0% j OFF=77.5% j
    C= 71 sec C= 65.0 sec = 91.5% T= 6.0 sec = 8.5% Ped= 0.0 sec = 0.0%
| Lane |Width/| g/C | Service Rate| Adj | | BCH | L | Queue |
| Group | Lanes| Reqd Used | @C (vph) @E |Volume| v/c | Delay | S (Model 1)
                                                 10.8 B+
SB Approach
_____
TH | 20/2 |0.511 |0.724 | 2360 | 2365 | 1601 |0.677 | 10.8 | B+| 580 ft |
                                                  7.1 A
NB Approach
_____
| TH | 21/2 |0.328 |0.724 | 2427 | 2429 | 974 |0.401 | 7.1 | A | 296 ft |
EB Approach
                                                  48.0 D
_____
[RT+TH+LT] 15/1 |0.210 |0.175 | 195 | 324 | 264 |0.815 | 48.0 | D | 270 ft]
                                               _____
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03/26/06 VOLKAN COSKUN THESIS INT 1102 - AHIRKAPI-B - PH PEAK 22:22:49 EIISTING SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Input Worksheet Intersection # 102 -Area Location Type: NONCBD Be y: VOLUMES -- > н 1 0 11 WIDTHS 0 j 1409 j 0.0 j 19.7 j 0.0 || LANES W. 0-1 0 || 2 | 0 0.0 0 X. I N1 ٨. 0 0.0 0 1 ____ н 81 0.0 0 / 0 0.0 0 North ÷ Į. _____ 1 14.7 1 -0 1 1 λ, 162 0.0 0 Ŋ, 11 н 906 0 | 0 SEQUENCE 11 1 Phasing: 11 0.0 j 21.1 j 0.0 | PERMSV NNNN 0 j 2 0 [OVERLP YYYY 11 L 11 LEADLAG LG LD I. ĺ I \mathbf{SB} WB ΝВ EB RT TH: \mathbf{LT} \mathbf{RT} TH \mathbf{LT} RT TH. LT RT TH LT _____ _____ ____ ____ ____ ____ _____ _____ . 0 . 0 . 0 . 0 . 0 . 0 .0 .0 . 0 . 0 Heavy veh, SHV 2.11.9 . 88 . 90 . 90 . 90 . 93 . 92 Pk-hr fact, PHF . 88 . 93 . 92 . 92 .88 .93 P P P P P P P Pretimed or Act P P P P P Strtup lost, 11 2.32.3 2.3 2.3 2.32.32.32.3 2.3 2.32.32.3Ext off grn, e 1.7 1.7 1.7 1.71.71.7 1.7 1.7 1.7 1.71.7 1.7 $\mathbf{2}$ $\mathbf{2}$ $\mathbf{2}$ $\mathbf{2}$ Arrival typ, AT 3 Ъ. \mathbf{R} $\mathbf{2}$ $\mathbf{2}$ 3. 3 3 Ped vol, vped 0 0 0 0 0 Bike vol, vbic 0 0 0 Parking locatns 190 NO NO 1905 Park myrs, Nn 0 0 0 0 Bus stops, NB 0 0 0 0 . 0 Grade, %G . 0 . 0 -1.4 _____ ____ _____ _____ Sq 11 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 Ĩ LG/** ÷ /1N÷ 1 * * * * North | 707 0.0" | c= 92"| c= 70.0" | c= 16.0" | c= 0.0" | c= 0.0" | c= 0.0" | c= | T+R= 3.0" | T+R= 3.0" | T+R= 0.0" | Y+R= 0.0" | Y+R= 0.0" | Y+R= 0.0" |

VOLKAN COSKUN TH	ESIS										03/2	
INT 1102 - AHIRKJ EIISTING	AP I-B	- PH	PEAK								22:2	2:49
SIGNAL2000/TEAPA	C[Ver	2.60.	07] -	HCM V	olume	Adjust	6 S	atflow	Wor	ksheet		
Volume		SB			WB			NB			EB	
Adjustment	RT	TH	\mathbf{LT}	RT	TH	LT	RT	78	LT	RT	TH	LT
									===			
Volume, V		1409	0	0	0	0	0	906	0	162	0	81
Pk-hr fact, PHF				. 00				. 93		. 92		. 92
Adj mv flow, vp	0	1601	0	0	0	0	0	97.4	0	176	0	88
Lane group, LG		TH						78			TB+L	7
Adj LG flow, v		1601						97 4			264	
Prop LT, PLT		.000						. 000			333	
Prop RT, PRT		. 000						. 000			667	
Saturation		SB			WB			NB			EB	
Flow Rate	BT	78	LT	BT	TH	LT	BT	78	137	87	TH	LT
									===			
Base satflo, so		1891						1891		1	1891	
Number lanes, N		2						2			1	
Lane width, fW		. 928						. 952		1.	090	
Heavy veh, fHV		. 97 9						. 981			000	
Grade, fg		000						L.000			007	
Parking, fp		. 000						L.000			000	
Bus block, fbb		. 000						L.000			000	
Area type, fa		. 000									000	
Lane util, fLU		. 950						. 950			000	
Left-turn, fLT		. 000						1.000			984	
Right-turn, fRT PedBike LT, fLpb		. 000						L.000 L.000		-	910 000	
PedBike ET, fRpb											000	
Local adjustent								L.000			000	
Adj satflow, s		3267						3355			1958	
	_											
SIGNAL2000/TEAPA	ClVer	2.60.	071 -	HCM C:	apacit	ty and	LOS	Worksh-	eet			
Capacity		SB			WB			NB			EB	
Analysis	RT	TH	LT	RT	TH	LT	RT	78	LT	RT	TH	LT
Lane group, LG		TH						78		RT	TH+L'	T
Adj Flow, v		1601 3267						974 3355			264 1858	
Satflow, s Lost time, tL		32.67						3355			3.6	
Effect green, g		5. 6 69. 4						5.6 69.4			5.6 15.4	
Grn ratio, q/C		.754						ьэ.4 .754		-	167	
LC capacity, c		2464						./54 2531			311 B11	
v/c ratio. X		.650						.385			849	
Flow ratio, v/s		.490						. 290		-	142	
Crit lane group											anesa. ÷	
groap												
Sun crit v/s, Ic	đ	.632		Total	lost	L		7.2				
Crit v/c, Xc	-	. 686			- and the second second	_						

VOLKAN COSKUN THESIS INT 1102 - AHIRKAPI-B - PH PEAK EIISTING

SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay		SB		WB			NB			EB	
and LOS	RT	7H LT	RT	THE	LT	RT	TH	LT	RT	TH	LT
Lane group, LG		78					TH		RT	FIR+L3	
Adj Flow, v	16						97.4			2.64	
LC capacity, c	24						2531			311	
v/c ratio, X	. 6						. 385			849	
Grn ratio, g/C	.7	54					. 754			167	
Unif delay, dl	5	. 4					3.9		2	37.2	
Incr calib, k		50					. 50			. 50	
Incr delay, d2	1	. 3					. 4		2	24.0	
Queue Delay, d3		. 0					. 0			. 0	
Unif delay, d1*		. 0					. 0			. 0	
Prog factor, PF	1.	88				1	1.88			L. 00	
Contrl delay, d	11	. 6					7.8		6	51.2	
Lane group LOS		B+					A			E+	
Final Queue, Qbi		0					0			0	
Appr delay, dA	11	. 6					7.8		(61.2	
Approach LOS		B+					A			E+	
Appr flow, vA	16	01					974			2 64	
Intersection:	Delay	14.9	LOS		B+						

03/26/06

22:22:49

VOLKAN COSKUN THE INT 1102 - AHIRKS EXISTING				03/26/06 22:22:49
SIGNAL2000/TEAPAG	[Ver 2.60.07] -	HCM Back of Que	we Worksheet	
Queues in	SB	WB	NB	EB
Worst Lanes	RT 7H LT	RT TH LT	RT 7H L7	RT TH LT
Lane group, LC	78		78	RT+TH+LT
Init queue, QbL	0		0	0
In flow, vL	843		513	2 64
In satflow, sL	1719		1766	1858
Ln capacity, cL	1297		1332	311
Flow ratio, yL	. 490		.290	.142
v/c ratio, XL	.650		. 385	. 849
Effect green, g	69.4		69.4	15.4
Grn ratio, g/C	. 754		. 754	.167
Upstr filter, I	1.00		1.00	1.00
Grn arrivals, P	. 52		. 50	. 17
Platn ratio, Rp	.69		. 67	1.00
Prog factr, PF2	1.50		1.78	1.00
Queue (1st), Q1	15.5		8.1	6.5
Queue factr, kB	1.39		1.42	. 51
Queue (2nd), Q2	2.5		. 9	2.1
Avg queue, Q	18.0		9.0	8.7
90% factor, fB	1.51		1.58	1.59
90% queue, Qp	27.3		14.2	13.8
Avg spacing, Lh	25.3		25.3	25.0
Avail storg, La	0		0	0
Avg distance	456		226	217
Avg ratio, RQ	.00		.00	. 00
90% distance	690		359	344
90% ratio, RQp	.00		.00	. 00

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03/26/06
VOLKAN COSKUN THESIS
INT 1102 - AHIRKAPI-B - PH PEAK
                                                      22:22:49
EIISTING
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 102 -
    Degree of Saturation (v/c) 0.58 Vehicle Delay 14.9 Level of Service B+
Sq 11 | Phase 1 | Phase 2 |
LG/** ---
    ÷
             +
    /1
       ÷
    w.
 1++++
North |
          ÷
             |++++
 ÷
    1
          +
             | V
                       | g/c=0.761 | g/c=0.174 |
    | G= 70.0" | G= 16.0" |
    | T+R= 3.0" | T+R= 3.0" |
    | OFF= 0.0% | OFF=79.3% |
    C= 92 sec C= 86.0 sec = 93.5% T= 6.0 sec = 6.5% Ped= 0.0 sec = 0.0%
| Lane |Width/| g/C | Service Rate| Adj | | BCH | L | Queue |
| Group | Lanes | Reqd Used | GC (vph) GE [Volume] v/c | Delay | S [Model 1]
SB Approach
                                              11.6 B+
_____
| TH | 20/2 |0.532 |0.754 | 2425 | 2464 | 1601 |0.650 | 11.6 | B+| 690 ft|
NB Approach
                                              7.8 A
_____
| TH | 21/2 |0.361 |0.754 | 2493 | 2531 | 974 |0.385 | 7.8 | A | 359 ft |
                                              61.2 E+
EB Approach
_____
[RT+TH+LT] 15/1 |0.251 |0.167 | 74 | 299 | 264 |0.849 | 61.2 | E+| 344 ft]
```

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
Intersection # 162 - Area Location Type: NORCED $\begin{vmatrix} 26 & 428 & 179 & & & Koy: VOLDES > I WIDTES 0.0 & 34.5 & 0.0 & & V & LARES 0.0 & 34.5 & 0.0 & & V & LARES 0.0 & 34.5 & 0.0 & & V & LARES 0.0 & 34.5 & 0.0 & & V & LARES 0.0 & 34.5 & 0.0 & V & VLARES 0.0 & 1 & V & V & VLARES 174 & 0.0 & 0 & / + / 278 & 0.0 & 0 & Horth 175 & 25.3 & 2 & V & V & V 184 & V & V & V & V & V & V & V & V & V 184 & V & V & V & V & V & V & V & V & V & $	INT 1162A - UNVERDI - OFF-DEAR 22:52:51						
Image: Second	SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Input Worksheet						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Intersection # 162 - Area Location Type: NONCBD						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	i .	0.0 j 34.5 j	179 0.0		Key :	WIDTHS	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	¦	i i	ii v	0 23.0	1		
174 0.0 0 + + 278 0.0 0 North 725 25.3 2 -			` -	564 24.0	2		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			+ /				
3 16.0 1 1 261 361 143 Phasing: SEQUENCE 77 1 10 0.1 34.5 0.0 0 0VERLD Y Y Y 1 11 0 3 0 0VERLD Y Y Y 1 11 1 1 1 1 1 1 1 Barry veh, 4EV 15.4 2.6 3.4 .0 9.2 4.0 2.8 4.2 13.8 .0 7.5 4.0 Dk-hr fact, DHF .95 .95 .95 .96 .96 .93 .93 .91 .93	725 25.3		х I	,			
KT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT St	3 16.0	 	261 361 0.0 34.5 0 3	143 0.0	DE	ERLP YYYY	
KT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT TH LT RT St		ap	80		ыль	70	
Baavy veh, 4HV 15.4 2.6 3.4 .0 9.2 4.0 2.8 4.2 13.8 .0 7.5 4.0 Dk-hr fact, DHF .95 .95 .96 .96 .93 .93 .91 .93 .93 .93 .93 .93 .93 .93 .93 .93 .93 .93 .93 .93 .93 .93 <		RT TH L	T RT TH	LT RT	TH LT	RT TH LT	
Pretimed or Act P						.0 7.5 4.0	
Ded vol, vpad 0 0 0 0 0 Bak vol, vbic 0 0 0 0 0 0 Dark moves, He 0 0 0 0 0 0 Dark moves, He 0 0 0 0 0 0 Bus stops, NB 0 0 0 0 0 0 Grade, %G .0 .0 .0 .0 .0 .0	Pretimed or Act	P P	D D D	D D	P P	D D D	
Ded vol, vpad 0 0 0 0 0 Bak vol, vbic 0 0 0 0 0 0 Dark moves, He 0 0 0 0 0 0 Dark moves, He 0 0 0 0 0 0 Bus stops, NB 0 0 0 0 0 0 Grade, %G .0 .0 .0 .0 .0 .0	Ext off grn, o	2.3 2.3 2. 1.7 1.7 1.	3 2.3 2.3 7 1.7 1.7	1.7 1.7	1.7 1.7	2.3 2.3 2.3 1.7	
Bike vol, vbic 0 0 0 0 0 Parking locatns NO NO NO NO NO Park moves, NB 0 0 0 0 0 Bus stops, NB 0 0 0 0 0 Grade, NG .0 .0 .0 .0 .0	Arrival typ, AT	3 3	3 3 3	3 3	3 3	3 3 3	
Darking locatns NO NO NO NO NO NO Park moves, Hm 0 0 0 0 0 Bus stops, NB 0 0 0 0 0 Grade, NG .0 .0 .0 .0 .0	Ped vol, vped Bike vol, vbic	-	-			1	
Bus stops, NB 0 0 0 0 0 0 Sq 77 Phase 1 Phase 2 Phase 3 Phase 4 Phase 5 Phase 6 **/**	Parking locatns						
Grade, $3G$.0 .0 .0 .0 .0 Sq 77 Phase 1 Phase 2 Phase 3 Phase 4 Phase 5 Phase 6 **/**		-	-		-	•	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$.0	.0		. 0	.0	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$							
. * * * **** **** **** / \ <* * *> <****		Dhase 2	Phase 3	Phase 4	Phase 5	Phase 6	
/ \ <* * *>	1 * * * * *	•			!	!!!	
i i i v i **** i <td></td> <td></td> <td>~****</td> <td></td> <td></td> <td>1</td>			~****			1	
Horth <* * * > ****> **** **** ****> v v * * * v v c- 90" G- 12.0" G- 17.0" G- 21.0" G- 28.0" G- 0.0" G- 0.0"	I I V		****	<u> </u>	ļ	i i	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	North		i V I	****>	1		
C- 90" C- 12.0" C- 17.0" C- 21.0" C- 28.0" C- 0.0" C- 0.0"		**** * * *	****	****	i .	i i	
	<u> </u>	1 ****	I V		l	<u> </u>	

VOLKAN COSKUN THE											03/2	
INT 1162A - UNVER EXISTING	RDI - «	off - Di	EAK								22:5	2:51
SIGNAL2000/TEADA	C[Ver :	2. 60. (07] -	HCM V	olume	Adju	st s S	atílo	W Woz	ksheet		
Volume		SB			WB			MB			EB	
Adjustment	RT	TH	LΤ.	RT	TH	LT	RT		LT	RT		LT
				0			143				725	
Pk-hr fact, PHF	. 95	. 95	. 95	. 96	.96	.96	. 93	. 93	. 93	. 91	. 91	. 91
Adj my flow, vp	27	451	188				154	388	281	0	7 97	191
Lane group, LG					TH+LT			 +78+1			TH+LT	
Adj LC flow, v	RT	+TH+L 666	E.		278 878			+TH+1 823	ar -		тн+ыт 988	
Prop LT, PLT		200			. 330			.341			.198	
Prop RT, PRT		.041			. 000			.187			. 000	
Saturation		SB			WB			яв			EB	
Firm Rate	RT	88 78	1. T	RT		Т. Т. Т	BT		1.7	RT		LT
Base satflo, so					1891			1891			1891	
Humber lanes, N		3			2			3			2	
Lane width, fW		. 983		1	. 000			.983		1	. 0.22	
Beavy veh, fHV		. 968			. 930			.933			. 936	
Crade, fg		.000			. 000		-	.000			. 000	
Parking, fp	1.	.000			. 000			.000			. 000	
Bus block, fbb		.000		-	. 000		-	.000		-	. 000	
Area type, fa		.000		-	. 000		-	.000			. 000	
Lane util, fLU		. 910			. 950			.910			. 950	
Left-turn, fLT		. 986			. 984			.983			. 990	
Right-turn, fRT DedBike LT, fLpb		.994 .000			.000			.972			. 000 . 000	
PedBike RT. fRpb		.000			. 000		-	.000			. 000	
Local adjustmit				-	. 000		-	.000			. 000	
Adj satflow, s		4814			3288		-	4525		-	3403	
Adj skillow, s					Provides and provide						NA ARE DO INC.	
SICMAL2000/TEADA Capacity Analysis	-	2.60. SB TH	07]-	HOM C	apa cit MB 7H	:yan LT	d LOS	Works NB TH	heet LT	RT	EB TH	LT
Analysis					ан. 							
Lane group, LC	RT	+TR+L	r		TH+LT		RT	+78+1	ar 👘	1	TH+LT	
Adj Flow, v		666			878			823			988	
Satilov, s		4814			3288			4525			3403	
Lost time, tL		3.6			3.6			3.6			3.6	
Effect green, g		11.4		-	20.4			16.4			27.4	
Grn ratio, g/C		.127			. 227			.182			. 304	
LC capacity, c		610			745			824			1036	
v/c ratio, X		.092			. 179			.999			. 954 noo	
Flow ratio, v/s		.138			. 267			.182			. 290	
Crit lane group												
Sum crit v/s,Yc Crit v/c, Xc		. 878		Total	lost,	L		14. 4				
crit v/e, xe	1	. 045										

VOLKAN COSKUN THESIS INT 1162A - UNVERDI - OFF-DEAK EXISTING

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay and LOS	SB RT TH LT		WB RT 7H LT		FT	NB TH	LT	RT	EB Th	LT		
					CH+LT			78+14			r#+LT	
Lane group, LC		TH+L3		-			B.1 7					
Adj Flow, v		666 GBG			878 245			823 824			988	
LC capacity, c		610			745						1036	
-	1.				179		-	999			954	
Crn ratio, g/C				-	227			182			304	
	3				34.8		-	6.8			30.7	
Incr calib, k		. 50			.50			. 50			. 150	
	6				94.0		-	a. 1		1	18.8	
Queue Delay, d3					. 0			. 0			. 0	
Unif delay, di*		. 0			. 0			. 0			. 0	
	1			-	L.00		-	00			L. 00	
	10			1.	28.8			57.9		4	49.5	
Lane group LOS		F			F			E			D	
Final Queue, Gbi		14			33			0			0	
Appr delay, dA	10			1:	28.8			7.9			49.5	
Approach LOS		F			F			E			D	
Appr flow, vA		666			878			823			988	
Intersection:	Delay	\$ 	35.4	LOS		F						

03/26/06 22:52:51 VOLKAN COSKUN THESIS INT 1162A - UNVERDI - OFF-DEAK EXISTING

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Back of Queue Worksheet

Queues in		SB			WB			ЫB			EB	
Worst Lanes	RT	TH	LΤ.	RT	7 8	LT	RT	TH	LT	RT	TH	LT
Lane group, LC	RT				TH+LT		RT-	FIRT C	T		IH+LT	
Init queue, GbL		0			0			0			0	
In flow, vL		244			462			301			520	
In satflow, sL	-	17.63			1731			1657			17:91	
In capacity, cL		223			392			302			545	
Plow ratio, yL		138			. 267			182			. 290 . 954	
v/c ratio, XL		092			. 179			.999				
	1				20.4			16. 4			27.4	
Crn ratio, g/C		127			. 227			.182			. 304	
Opstr filter, I		. 00			1.00			1.00			1.00	
Crn arrivals, P		. 13			.23			.18			. 30	
Platn ratio, Rp		. 00			1.00			1.00			1.00	
Prog factr, DF2		L. OO			1.00		1.00		1.00			
Queue (1st), Q1		6.1			11.6			7.5			12.7	
Queue factr, kB		. 40			.59			. 49			. 75	
Queue (2nd), Q2		5.0			11.7			4.3			5.6	
Avg queue, Q		1.1		23.2		11.8			18.3			
90% factor, fB		l. 55		1.50		1.55			1. 51			
90% queue, Qp	1	7.3			35. 0			18.3			27.7	
Avg spacing, Lh	2	15.5			26.1		1	26.1			26.0	
Avail storg, La	0		0 0				0			0		
<i>k</i> vg distance		283		607			308		476			
Avg ratio, RQ		. 00		.00		. 00		. 00				
90% distance		440			91.3			47.7			721	
90% ratio, RQp		. 00			.00			. 00			. 00	

03/26/06

22: 52: 51

VOLKAN COSKUN THESIS 03/26/06 INT 1162A - UNVERDI - OFF-DEAK 22: 52: 51 EXISTING SIGNAL2000/TEADAC[Ver 2.60.07] - Capacity Analysis Summary Intersection Averages for Int # 162 -Degree of Saturation (v/c) 1.05 Vehicle Delay 85.4 Level of Service P Sq77 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | **/** -. ^ I ^ I - 11 ****1 **** | * * * ****| **** 1.0 to the <**** IN121 ****1 w. *8*4 н North | 1**** <* * *p] 1**** **** * * inter **** 1 V. 127 - 12 | G/C-0.133 | G/C-0.189 | G/C-0.233 | G/C-0.311 | G 12.0" | G 17.0" | G 21.0" | G 28.0" Y+R= 3.0" | Y+R= 3.0" | Y+R= 3.0" | Y+R= 3.0" | | OFF= 0.0% | OFF=16.7% | OFF=38.9% | OFF=65.6% | | Lane |Width/| g/C | Service Rate| Adj | | HCH | L | Queue | Group | Lanes| Reqd Used | @C (vph) @E [Volume] v/c | Delay | S [Hodel 1] SB Approach 103.3 - F[R7+78+LT] 35/3 [0.217 [0.127] 55 [610] 666 [1.092] 103.3 [*F] 440 ft] 67.9 E HB Approach [RT+TH+LT] 35/3 [0.250 [0.182] 397] 824] 823 [0.999] 67.9 [*E] 477 ft] WB Approach 128.8 F [7H+LT] 24/2 [0.326 [0.227] 457] 745] 878 [1.179] 128.8 [*F] 913 ft] EB Approach 49.5 D | TH+LT| 25/2 |0.343 |0.304 | 823 | 1036 | 988 |0.954 | 49.5 |*D | 721 ft|

VOLKAN COSKUN THE INT. 1163 - YAYLA EXISTINC					03/26/06 22:57:00
SIGNAL2000/TEADAG	[Ver 2.60.07] ·	- HCM Input W	forksheet		
Intersection # 16	53 -		i	Area Locatio	п Туре: МОНСВО
	0.0 16.0 0	 85 .0		Key :	VOLOHES > WIDTHS V LANES
1	0 j 1 j	°	83 0.0	0	ż
	/ I '	· ·	709 26.0	2	
0 0.0	• • / •	· , -	0 0.0	0	l North
					1
901 23.0	2	\ I	/		
41 12.0		20 163 .0 16.0 0 1	27 0.0 0	, p o	EQUENCE 71 ERMSV NNNN VERLD NNNY EADLAG LCLD
	SB RT TH LT	WB RT TH	LT RT	NB TH LT	EB RT 7H LT
Heavy veh, AHV Pk-hr fact, PHF	6.5 6.1 18.4 .96 .96 .96	15.7 11.6 .95 .95	.0 3.7	10.4 6.7	2.4 9.1 .0 .92 .92 .92
Pretimed or Act	P P P	P P	p p		P P P
	2.3 2.3 2.3 2.3 2.7 2.7 2.7	2.3 2.3 1.7 1.7	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$		2.3 2.3 $2.31.7$ 1.7 1.7
Arrival typ, AT	3 3 3		3 3		3 3 3
Ped vol, vped Bike vol, vbic	0	0		0	0 0
Parking locatns	ю	NO		90	NO
Park mnvrs, He	0	0		0	0
Bus stops, NB Grade, %G	0 .0	0 .0		0 . 0	.0
Sq 71 Phase 1 LG/**	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
- 1	1*** 1	^ I ++++		!	!!!
ziv i	<* * *»	++++ <++++		i	
	i v i	i i		1	1 1
i i ^ Horth <* * * ++++ * * * v * * *		****, ****			
C- 88" C- 24.0" Y+R= 3.0"	G= 14.0" Y+B= 4.0"	G= 40.0" Y+R= 3.0"	C= 0.0" Y+R= 0.0"	G= 0.0" T+R= 0.0"	G= 0.0" Y+R= 0.0"

VOLKAN COSEUN THE INT. 1163 - YAYLA EXISTING		"F-DEA	K									6/06 7:00
SIGNAL2000/TEADAG	[Ver	2. 60.	07] -	нсм у	olume	Adju	ist s	Satfl	ow Wo:	rksheel	t	
Volume Adjustment	RT	SB TH			WB 7H	LT	R	NB 7 TH			E8 71	LŦ
Volume, V	123	263	185	83	709	0	21	7 163	120	41	901	0
Dk-hr fact, DHF Adj mv flow, vp	. 96	. 96	. 96	.95	.95	. 95	. 8.	3 .83 3 196	. 83 145		. 92 979	. 92
	120	4.74	1.25		/4/0			3 176	145	40	2/2	v
Lane group, LC	RI	*****	T		RT+TH		1	RT+TH+:		RT		
Adj LG flow, v		595			833			37.4			979	
Prop LT, PLT		.324			. 000			.388		. 000		
Prop RT, PRT		.215			. 104			.088		1.000	. 000	
Saturation		SB			WB			NB			EB	
Flow Rate	RT			RT		LŦ			LT			LT
Base satflo, so		1891			1.891			1891			1891	
Humber lanes, N								1891			1891	
Lane width, fW	1	1 .133		1	. 033			1.133		1.000		
Beavy yeb, fBV		. 908		-	. 893			.923			.917	
				1	. 000			1.000		1.000	1.00	
Grade, fg Parking, fp	1			1	. 000			1.000		1.000		
Bus block, fbb		000		-	000			1.000		1.000		
Area type, fa		.000		-	. 000			1.000		1.000		
Lane util, fLU		.000			. 950			1.000		1.000		
Left-turn, fLT Right-turn, fRT		.984 .971		-	. 000 . 984			.981 .988		1.000		
PedBike LT, fLpb		.000			. 204			1.000		1.000		
PedBike R7, fRpb				-	. 000			1.000		1.000		
Local adjustmnt	1			-	. 000			1.000		1.000		
Adj satilow, s		1859			3262			1917		1570	3238	
SIGNAL2000/TEADAC	[Ver	2. 60.	07] -	ном с	apacij	ty an	d L0	8 Work:	sheet			
Capacity Analysis	RT	8B 78	147	RT	WB 7H	LT	R	ИВ Г ТН		RT	EB 7H	LT

Capacity		зB			₩B			HB.			EB	
Analysis	RT	TH	LT	RT	TH	LT	RT	тн	LT	RT	TH	LT
Lane group, LC	RT	+TH+L(RT+TH		RT	+TH+1/	r i	RT	TH	
Adj Flow, v		595			833			37.4		45	979	
Satflow, s		1859			3262			1917		1570	3238	
Lost time, tL		3.6			3.6			3.6		3.6	3.6	
Effect green, g		14.4			39.4		1	23.4		66.4	39.4	
Grn ratio, g/C		.164			. 448			.266		.755	. 4 4 8	
LG capacity, c		304			1461			510		1184	1450	
v/c ratio, I	1.	. 9157			. 570			.733		. 0.38	. 675	
Flow ratio, v/s		. 320			. 255			.195		. 029	. 302	
Crit lane group		•						*			*	
Sum crit v/s,Yc	0	.818		Total	lost,	L		10.8				
Crit v/c, Xc		. 932										

VOLKAN COSEUN THESIS INT. 1163 - YAYLA - OFF-DEAK EXISTING

SICNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay and LOS	87	8B 78	17	BT	NB 78	LP	RT	NB TH	1.77	BT	EB 78	LŦ
Lane group, LC	RT+	TH+L	2		RT+TH		RT	TH+L		RT	TH	
Adj Flow, v		595			833			37.4		45	979	
LC capacity, c		304			1461			510		1184	1450	
v/c ratio, I	1.	957			. 570			733		. 038	. 675	
Grn ratio, g/C		164			. 448			266		.755	. 4 48	
Unif dalay , di	3	6.8			18.0		1	89. 5		2.7	19.2	
Incr calib, k		. 50			.50			. 50		. 50	. 50	
Incr delay, d2	44	2.5			1.6			9.0		.1	2.5	
Queue Delay, d3		. 0			. 0			. 0		. 0	. 0	
Ünif delay, di∗		. 0			. 0			. 0		. 0	. 0	
Prog factor, PF	1	. 00			1.00			L. 00		1.00	1.00	
Contrl delay, d	47	9.3			19.6		1	88. 5		2.8	21.8	
Lane group LOS		F			В			D+		A	C+	
Final Queue, Qbi		73			0			0		0	0	
Appr dalay, dA	47	9.3			19.6			38. 5			20.9	
Approach LOS		F			в			D+			C+	
Appr flow, vA		595			833			37.4			1024	
Intersection:	Delay	13	19.4	L08		F						

03/26/06 22:57:00 VOLKAN COSEUN THESIS INT. 1163 - YAYLA - OFF-DEAK EXISTING

SIGNAL2000/TEARAC[Ver 2.60.07] - HCM Back of Queue Worksheet

Queues in		SB			WB			NB			EB	
Worst Lanes	RT	TH	LT	RT		\mathbf{LT}	RT	TH	LT	RT	TH	LP
Lane group, LC	RT+	TH+L3			RT+TH		RT	FTH+L(RT	TH	
Init queue, GbL		0			0			0		0	0	
Ln flov, vL		595			438			37.4			515	
In satilow, sL		859			1717			1917		1570		
In capacity, cL		304			769			510		1184		
Flow ratio, yL		320			. 255			195		.029		
v/c ratio, XL		957			. 570			733		. 038		
Effect green, g		4.4			39.4			83. 4		66.4		
Grn ratio, g/C		164			. 448			266		.755		
Upstr filter, I		00			1.00			L. 00		1.00		
Grn arrivals, P		. 16			. 45			. 27			. 45	
Platn ratio, Rp		00			1.00			L. 00		1.00		
Prog factr , PF 2		00			1.00			L. 00		1.00		
Queue (1st), Q1		415			7.9			8. 3		. 3	10.0	
Queue factr, kB		. 49			. 94			.70		1.27		
Queue (2nd), 92	- 3	7.3			1.2			1.7		. 0	1.8	
Avg queue, Q	5	1.9			9.2		3	LO. 1		. 3	11.8	
90% factor, fB	1	. 50			1.58		1	1.57		1.97	1.55	
90% queue, Qp	7	7.8			14.5		3	L5. 8		. 6	18.3	
Avg spacing, Lh	2	6.5			26.8			86. B		25.4	26.4	
Avail storg, La		0			0			0		0	0	
Avg distance	1	377			245			2.65		-8	311	
Avg ratio, RQ		. 00			.00			. 00			. 00	
90% distance	2	0.65		388			415			16	481	
90% ratio, RQp		. 00		.00			. 00			. 00	. 00	

03/26/06

22: 57: 00

VOLKAN COSKUN THESIS 03/26/06 INT. 1163 - YAYLA - OFF-DEAK 22:57:00 EXISTING SICNAL2000/TEADAC[Ver 2.60.07] - Capacity Analysis Summary Intersection Averages for Int # 163 -Degree of Saturation (v/c) 0.91 Wehicle Delay 119.4 Level of Service P ____ Sq 71 | Dhase 1 | Dhase 2 | Dhase 3 | LG/** ------* * * A 1 1 * * * ++++] 1 * * * <* * *> ~++++ IN727 . 1. - 1 Horth | <* * *>| 1***** 11 j++++ | |++++ * * * | 1 1 ****1 I V | G/C-0.273 | G/C-0.159 | G/C-0.455 | | G= 24.0" | G= 14.0" | G= 40.0" | | Y+R= 3.0" | Y+R= 4.0" | Y+R= 3.0" | OFF- 0.04 | OFF-30.74 | OFF-51.14 | C- 38 sec C- 78.0 sec - 88.6% ¥-10.0 sec - 11.4% Ped- 0.0 sec - 0.0% | Lane |Width/| g/C | Service Rate| Adj | | HCH | L | Queue | | Group | Lanes| Reqd. Used | 9C (vph) 6E |Volume| v/c | Delay | S |Hodel 1| SB Approach 479.3 F -----[RT+TH+LT] 16/1 |0.387 |0.164 | 94 | 294 | 595 |1.957 | 479.3 |*F |2065 ft] **HB Approach** 38.5 D+ [RT+TH+LT] 16/1 [0.284 [0.266] 332] 510] 374 [0.733] 38.5 [*D+] 415 ft] WB Approach 19.6 B _____ [R7+7H | 26/2 |0.313 |0.448 | 1361 | 1461 | 833 |0.570 | 19.6 | B | 388 ft] _ __ __ __ __ ___ __ __ __ ____ _ EB Approach 20.9 C+ | RT | 12/1 |0.146 |0.755 | 1176 | 1184 | 45 |0.038 | 2.8 | & | 16 ft| j 7H | 23/2 |0.352 |0.448 | 1350 | 1450 | 979 |0.675 | 21.8 |∗C+| 481 ft|

VOLKAN COSEUN THE INT. 1164 - ROCAS EXISTING		OFF-PEAK			03/26/06 23:00:26
SIGNAL2000/TEADAC	: TVer 2.60.071	- HCM Input	Worksheet		
Intersection # 16				rea Locatio	а Туре: ЮОНСВО
1	1 1	шт		Eey:	VOLUMES >
j o	.0 j 14.0 j	343 0.0			WIDTHS V LANES
i		, ii , -	298 8.2	1	
		`	848 25.0	2	1
142 0.0		+ /	0 0.0	0	North
988 23.0	2	<u>х</u> і	,		
0 0.0	`		0 0.0	DI OT	EQUENCE 13 ERMSV HNNN VERLP YYYY
	I 11	1 1	l	L	EADLAC LD LD
		WB 7 RT 7H	LT R7	NB TH L7	EB Rt Th Lt
Heavy veh, %HV Pk-hr fact, PHF	4.7 .0 11.	1 11.7 5.7	.0.0	.0.0	.0 4.3 4.9
Protimad or Act	D D	р р р	D D	D D	D D D
Strtup lost, 11 Ext eff grn, e	2.3 2.3 2.	3 2.3 2.3	2.3 2.3 1.7 1.7	$2.3 \ 2.3 \ 1.7 \ 1.7$	2.3 2.3 2.3 $2.31.7$ 1.7 1.7
Arrival typ, AT					3 3 3
Ded vol, vped Bike vol, vbic	0	0		0 0	0
Parking locatns	NO	но		BO	но
Dark mnyrs, Ne Bus stops, NB	0	0		0	0
Crade, %C	. ŏ	. ŏ		. ŏ	. ŏ
Sq 13 Phase 1 **/**	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
1++^		+ ^ + ++++		!	!!
//\ + ++++		+ ++++ <+ <****			

North 	****;- 	++++> 		 	
C= 90" G= 18.0" Y+R= 4.0"					G= 0.0" Y+R= 0.0"

VOLKAN COSKUN TH INT. 1164 - KOCA											03/2	6/06
EXISTING	SIDUAN	GIRIS	1 - (IFF-PEA							2310	01 26
SICNAL2000/TEADA	C [Ver	2. 60.	07] -	HCM 7	/olume	Mju	st s S	atflo	w Wor	ksheet		
Volume Adjustment	RT	SB 7H			WB Th			NB TH	LT	RT	eb Th	LT
Volume V					848						988	1.42
Volume, V Pk-hr fact, PHF	. 94	. 94	. 94	. 97	. 97	. 97	. oõ	. 00	. 00	. 88		
Adj mv flow, vp	0	0	365	307	874	0	0	0	0	0	1123	161
Lane group, LC Adj LC flow, v		7H+LT 365		RT 307	TH						18+LT 1284	
Prop LT, PLT		.000		.000							.125	
Prop RT, PRT		.000		1.000	. 000						. 000	
Saturation Plow Rate	ĸī	SB 7H	17	RT	WB TH	LŦ	RT	NB TH	LT	RT	eb Th	LŦ
Base satflo, so Number lanes, N		1891 1		1891	1891						1891 2	
Lane width. fW	1	.067		. 873							. 983	
Beavy veh, fBV		. 900		. 895	. 946						958	
Grade, fg		.000		1.000						-	. 000	
Parking, fp		.000		1.000							. 000	
Bus block, fbb		.000		1.000						-	. 000	
Area type, fa Lane util, fLU		.000		$1.000 \\ 1.000$. 000 . 950	
Left-turn, fLT		. 952		1.000							. 994	
Right-turn, fR7		.000		. 850	1.00					1	. 000	
PedBike L7, fLpb		.000		1 ,000						-	. 800	
PedBike RT, fRpb		.000		1.000							. 000	
Local adjustmnt		.000		1.000						-	. 000	
Adj satilow, s		1729		1257	3456						3364	
SIGNAL2000/TEADA	C [Ver	2. 60. 8B	07] -	ном (Capacit WB	ty an	d LOS 1	Works NB	həət		EB	
Analysis	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
Lane group, LC		TH+LT		BT	7H						re+LT	
Adi Flow, v		365		307	874						1284	
Satflov, s		1729		1257							3364	
Lost time, tL		4.6		4.6	3.6						3.6	
Effect green, g		17.4		71.4							64.4	
Crn ratio, g/C		.193 334		. 793	. 560 1985						.716 2407	
LC capacity, c v/c ratio. X		098 .098		. 308							.533	
Flow ratio, v/s		. 211		. 244							. 382	
Crit lane group		*									*	
Sume crit v/s,Yc Crit v/c. Xc	0	. 593		Total	l lost,	, L		8.2				

VOLKAN COSEUN THESIS 03/26/06 INT. 1164 - KOCASINAN CIRISI - OFF-DEAK 23:00:26 EXISTINC SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet Delav WB NB SB EB

Delay		зB			WB			ыв			EB	
and LOS	RT	78	17	RT	TH	LT	RT	TH	17	RT	TH	LT
Lane group, LC	1	H+LT		RT	TH						rs+lt	
Adj Flow, v		365		307	874						1284	
LG capacity, c		334		997	1935						2407	
v/c ratio, I	1.	0.93		. 308	.452						.533	
Crn ratio, g/C		193		. 793	. 560						.716	
Unif delay, dl	3	6.3		2.5	11.7						5.9	
Incr calib, k		. 50		.50	.50						. 50	
Incr delay, d2	7	6.4		. 8	. 8						. 9	
				. 0							. 0	
		. 0		. 0	. 0						. 0	
Proq factor, DF											1.00	
Contri delay, d	11	2.7		3.3	12.4						6.7	
Lane group LOS		F		A	B+						A	
Final Queue, Gbi		8		0	0						0	
Appr delay, dA	11	2.7			10.1						6.7	
Approach LOS		F			B+						A	
Appr flow, vA		365			1181						1284	
Intersection:	Delay	2	1.8	LOS		C+						

VOLKAN COSKUN THESIS 03/26/06 INT. 1164 - KOCASINAH GIRISI - OFF-DEAK 23:00:26 EXISTING SIGNAL2000/TEARAC[Ver 2.60.07] - HCM Back of Queue Worksheet Queues in SB WB-**BIB** EB RT TH LT Worst Lanes RT TH LT \mathbf{RT} TH LT RT TH \mathbf{LT} __ __ ___ __ __ __ __ ___ __ __ ___ Lane group, LG TH+LT RT TH+LT TH Init queue, goL 0 - 0 0 0 Ln flow, vL 365 307 460 676 1729 1257 1819 1770 In satflow, sL 334 In capacity, cL 997 1018 1267 .244 .253 Flow ratio, yL .211 . 382 v/c ratio, XL 1.093 .308 .452 .533 71.4 50.4 Effect green, g 17.4 64.4 Grn ratio, g/C .193 .793 .560 .716 Opstr filter, I $1.00 \ 1.00$ 1.001.00 . 19 .79 .56 Grn arrivals, P .72Platn ratio, Rp 1.00 1.00 1.00 1.00 Prog factr, DF2 1.00 1.00 1.00 1.00 Queúe (lst), Ql Queue factr, kB 9.1 2.1 - 6.87.81.14 1.16 1.35. 53 7.2.5 .9 Queue (2nd), Q2 1.5 2.6 7.7 Avg queue, Q 16.3 9.8 _____ 90% factor, fB 1.52 1.80 1.61 1.58 90% queue, Qp 4.7 12.4 24.8 14.6 Avg spacing, Lh Avail storg, La 26.726.8 25.9 25.7 0 49 0 0 Avg distance 436 70 199 238 Avg ratio, RQ . 00 1.42 .00 . 00 90% distance 662 125 320 376 90% ratio, RQp . 00 2.55 .00 . 00 -----_____ ____

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VOLKAN COSKUN THESIS
                                                        03/26/06
INT. 1164 - KOCASINAN GIRISI - OFF-DEAK
                                                        23:00:26
EIISTINC.
SICNAL2000/TEADAC[Vor 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 164 -
    Degree of Saturation (v/c) 0.56 Vehicle Delay 21.8 Level of Service C+
Sq13 | Phase 1 | Phase 2 | Phase 3 |
**/** -------
                _ __ __ __
                         ____
                             ^ I
    |+ + ^ |*
                       1 *
                       1 +
    | + + ++++| *
                             ++++
/|\|<+ +≻ |<*
                       <+>
                            <****
              1 1
                       ....
 1
North |
                       ++++>
             *****
                                 1
 1
              1
                        н.
                                 н
              | G/C=0.200 | G/C=0.122 | G/C=0.567 |
    jC= 18.0" jC= 11.0" jC= 51.0" j
    | Y+R= 4.0" | Y+R= 3.0" | Y+R= 3.0" |
    | OFF-60.0% | OFF-84.4% | OFF- 0.0% |
    C- 90 sec   G- 80.0 sec = 88.9% Y-10.0 sec = 11.1% Ped= 0.0 sec = 0.0%
|Lane |Width/| g/C |Service Rate|Adj| | HCH |L|Queue|
j Group | Lanes| Reqd Used | 9C (vph) 8E [Volume] v/c | Delay | S [Hodel 1]
                                               112.7 F
SB Approach
   | TH+LT| 14/1 |0.304 |0.193 | 130 | 327 | 365 |1.093 | 112.7 | F | 662 ft|
WB Approach
                                                10.1 B+
                _____
 RT | 8/1 |0.345 |0.793 | 987 | 997 | 307 |0.308 | 3.3 | A | 125 ft|
| 78
      | 25/2 |0.313 |0.560 | 1892 | 1935 | 874 |0.452 | 12.4 |*B+| 320 ft|
EB Approach
                                                 6.7 A
         TH+LT 23/2 0.419 0.716 2407 2407 1284 0.533 6.7 * 1376 ft
I.
```

VOLKAN COSKUN THESIS INT. 1165 - SIRINEVLER - OFF-DEAK EXISTING	03/26/06 23:03: 41
SICHAL2000/TEADAC[Ver 2.60.07] - HCM Input	Worksheet
Intersection # 165 -	Area Location Type: NONCED
62 0 309 0.0 29.5 0.0	I WIDTHS V LANES
	240 0.0 0 .
/ \ -	/l\ 770 23.7 2 l
0 0.0 0 / + /	 0 0.0 0 North
809 23.7 2	1
/ I I	
0 0 0.0 0.0	
	· · · · · · · · · · · · · · · · · · ·
SB WB	NB EB
RT TH LT RT TH	
Heavy veh, 4HV 1.6 .0 1.9 3.8 3.1 Pk-hr fact, PHF .78 .90 .91 .90 .91	.0 .0 .0 .0 .0 3.0 .0
Pretimed or Act P P P P	
Strtup lost, 11 2.3 2.3 2.3 2.3 2.3	
Ext off grn, e 1.7 1.7 2.7 1.7 1.7 Arrival typ, AT 3 3 3 3 3	1.7 1.7 1.7 1.7 1.7 1.7 1.7 3 3 3 3 3 3 3 3 3 3 3 3
Ped vol, vped 0 0 Bike vol, vbic 0 0	
Darking locatns NO NO	
Dark movrs, He 0 0 Bus stops, NB 0 0	
Bus stops, NB 0 0 Grade, NG -5.0 5.0	• •
Sg -1 Dhase 1 Dhase 2 Dhase 3	i Dhana 4 i Dhana 5 i Dhana 6 i
/	
. i + ++++i + i + + ++++	
/// <+ <++++ <+ <+ +>	i i i
North ++++> ++++>	i i i i
C- 90" C- 53.0" C- 10.0" C- 17.0"	· · · · · · · · · · · · · · · · · · ·
	Y+R= 0.0" Y+R= 0.0" Y+R= 0.0"

VOLKAN COSKUN TR	RSTS										03/2	6/06
INT. 1165 - SIRI ELISTING		- OP	P-PEA	K							23:0	
SIGNAL2000/TEADA	C[Ver :	2. 60.	07] -	HOM V	olume	Adj u	st s S	atflo	w Wor	ksheet		
Volume		SB			WB			ЯB			EB	
Adjustment		TH							LT	RT	TH	LT
Volume, V Pk-hr fact, PHF	70	0 90	309	240	770	90 90	0 . 00	0	0		809 .90	0 . 90
Adj my flow, vp		. 90	240	267	246 846	. 50			.00		899	. 50
		~							~~~~			
Lane group, LC		H+LT			RT+TH						78	
Adj LC flow, v		340			1113						899	
Prop LT, PLT	1.				. 000						. 000	
Prop RT, DRT		000			. 240						. 000	
Saturation		SB			WB			ЯВ			EB	
Flow Rate	RT	TH	LT	RT		LT	RT	TH	LT	RT	28	LT
	1				1891						1891	
Number lanes, N		2			2						2	
Lane width, fW		.0.92 .9.81			. 995						. 995	
Beavy veh, fBV Grade, fg		.981 .025			. 968 . 975						. 971 . 030	
Parking, fp		000			. 275						. 000	
Bus block, flb		000			. 000						. 000	
Area type, fa		000		-	. 000					-	. 000	
Lane util, fLU		950			. 950						. 9150	
Left-turn, fLT		952		1	. 000					1	. 000	
Right-turn, fRT	1.	000			. 964					1	. 000	
DedBike LT, flpb	1.	000		-	. 000						. 000	
PedBike RT, fRpb		000			. 000						. 000	
Local adjustmit		000		-	. 000					-	. 000	
Adj satflow, s		37157			3254						3575	
SIGNAL2000/TEADA	C[Ver :		07] -	нсмс		ty an	d LOS		heet			
Capacity Analysis	RT	SB TH	147	RT	WB 7H	LT	RT	NB TH	LT	BT	EB TH	LT
Lane group, LG		H+LT			RT+TH						78	
Adj Flow, v Satflov, s		340 3757			$1113 \\ 3254$						899 3575	
Lost time, tL	-	4.6			3254						3575	
Effect green, q		4.0			52.4						а.е 65.4	
Grn ratio, q/C		182			. 582						.727	
LC capacity, c		685			1894						2598	
v/c ratio, I		4.96			. 588						. 346	
Flow ratio, v/s		0.90			. 342						. 251	
Crit lane group		*									*	
Sum crit v/s,Yc	0.	342		Total	lost.	L		8.2				
Crit v/c, Xc		376										

VOLKAN COSKUN THESIS INT. 1165 - SIRINEVLER - OFF-DEAK EXISTING

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay and LOS	RT	SB TH	LT	RT	WB Th	LT	RT	ИВ ТН	LT	RT	eb Th	LT
Lane group, LC	-	H+LT			RT+TH						TH	
Adj Flow, v		340			1113						899	
LG capacity, c		685			1894					-	1598	
v/c ratio, I		4.96			. 588						346	
Crn ratio, g/C		182			. 582						7 27	
Unif delay, di	3	3.1			11.9						4.5	
Incr calib, k		. 50			.50						. 50	
Incr delay, d2		2.6			1.3						. 4	
Queue Delay, d3		. 0			. 0						. 0	
Unif delay, di*		. 0			. 0						. 0	
Prog factor, DF	1	00			1.00						L. 00	
Contri delay, d	3	5.6			13.3						4.9	
Lane group LOS		D+			B+						A	
Final Queue, Gbi		0			0						0	
Appr delay, dA	3	5.6			13.3						4.9	
Approach LOS		D+			B+						A	
Appr flow, vA		340		_	1113						899	
Intersection:	Delay]	13.3	LOS		B+						

03/26/06 23:03:41

VOLKAN COSKUN THE	28I8			03/26/06
INT. 1165 - SIRIN	EVLER - OFF-D	EAK		23:03:41
EXISTING				
SIGNAL2000/TEADAC	IVer 2.60.071	- HCM Back of Cus	eue Worksheet	
		-		
Queues in	SB	WB	NB	EB
Worst Lanes	RT TH L	r rt th Lt	RT TH LT	RT TH LI
Lane group, LC	TH+LT	RT+TH		TH
Init queue, ObL	0	0		0
In flow, vL	179	586		473
In satflow, sL	1978	1713		1882
In capacity, cL	361	997		1367
Plow ratio, yL	.090	. 342		. 251
v/c ratio, XL	. 4.96	. 588		. 346
Effect green, g	16.4	52.4		65.4
Crn ratio, g/C	.182	. 582		.727
Opstr filter, I	1.00	1.00		1.00
Grn arrivals, P	. 18	.58		. 73
Platn ratio, Rp	1.00	1.00		1.00
Prog factr, PF2	1.00	1.00		1.00
Queue (1st), Q1	4.0	9.3		4.3
Queue factr, kB	. 56	1.14		1.42
Queue (2nd), Q2	. 5	1.6		.7
Avg queue, Q	4.6	10.9		5.1
90% factor, fB	1.70	1.56		1.68
90% queue, Qp	7.8	16.9		8.5
Avg spacing, Lh	25.3	25.5		25.5
Avail storg, La	0	0		0
Avq distance	115	277		129
Avg ratio, RQ	. 00	.00		. 00
90% distance	1.96	432		217
90% ratio, RQp	. 00	.00		. 00

```
VOLKAN COSKUN THESIS
                                                                 03/26/06
INT. 1165 - SIRINEVLER - OFF-DEAK
                                                                 23:03:41
EIISTINC
SICNAL2000/TEADAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int 🛊 165 -
     Degree of Saturation (v/c) 0.48 Vehicle Delay 13.3 Level of Service B+
Sq-1 | Phase 1 | Phase 2 | Phase 3 |
**/** --
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North |++++>
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 1
                11
     | G/C=0.589 | G/C=0.111 | G/C=0.189 |
     | C= 53.0" | C= 10.0" | C= 17.0" |
| Y+R= 3.0" | Y+R= 3.0" | Y+R= 4.0" |
     j off= 0.09 j off=62.28 j off=76.78 j
     C- 90 sec C- 80.0 sec - 88.9% Y-10.0 sec - 11.1% Ped- 0.0 sec - 0.0%
| Lane |Width/| g/C | Service Rate| Adj | | HCH | L | Queue |
| Group | Lanes| Reqd Used | 0C (vph) 0E |Volume| v/c | Delay | S |Hodel 1|
                                          ____
SB Approach
                                                      35.6 D+
         | TH+LT| 30/2 |0.188 |0.182 | 313 | 685 | 340 |0.496 | 35.6 | D+| 196 ft|
                                                       13.3 B+
WB Approach
    (RT+TH | 24/2 |0.387 |0.582 | 1859 | 1894 | 1113 |0.588 | 13.3 | B+| 432 ft|
EB Approach
                                                       4.9 A
| TH | 24/2 |0.311 |0.727 | 2598 | 2598 | 899 |0.346 | 4.9 | A | 217 ft|
```

VOLKAN COSKUN 71 INT. 1426A - UE		- OFF-DEAL	ĸ						03/26/06 23:06:45
EXISTING									
SIGNAL2000/TEAD	AC[Ver 2.	60.07] - 1	HCM Input	Worksh	eet				
Intersection #	26 -				A	rea L	ocatio	п Туре:	NONCED
	0.0 j 11	91 j 34 L.8 j 0.0	ii i				Key :		HES > NIDTHS LANES
	i	1 0		21.2	0.0	0			
	/	1 \		1060	21.3	2		- 7	1
0 0.0	 0 /	+	,		0.0	0		i Bori	th
886 22.6	·		-					I	
		\		1					
243 0.0	• \	•	i • i	•		Phasis		EQUENCI	
		0.0 0		0.0				ERMSV VERLD	н н н н ү ү ү ү
	I	11	I I	I			Ľ	EADLAC	PD FD
		SB	WB			ИВ			EB
	R7	7H L7	RT 7H	LT	RT		LT	RT	TH LT
Beavy yoh SRV	4.1 4	1.4 2.9	4.3 4.0	6.2	2.0	2. 0	2. 0		4.6 2.0
Pk-hr fact, PHF Pretimed or Act	.83 . P		.86 .86 D D		. 86 P		.86 P	.77 . P	דד. דד. ע ע
Strtup lost, 11	2.3 2	2.3 2.3			2.3		2.3		2.3 2.3
Ext off grn, o Arrival typ, AT	2.7 2	1.7 2.7	1.7 1.7	1.7	1.7	1.7		1.7	1.7 1.7
Arrival typ, AT	3	3 3	3 3	3	3	3	3	3	3 3
Ped vol, vped Bike vol, vbic		0 0	0			0			0 0
Parking locaths		ыõ	жÖ			190			но
Park movrs, He		0	0			0			0
Bus stops, NB		0	0			0			0
Grade, %G		.0	.0			. 0			.0
8q 12 Dhase 1 **/**	L Dha	259 2 I	Phase 3	Phae	e 4	Pha	299 5	Ph	299 6
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North	!	1++						!	ļ
		++· 	•• I			I I		I	
C= 90" C= 17.0		6.0° I O	58.0"	G-	0.0*	1 C-	0.0*	 1 C-	0.0"
		2.0" Y							

VOLKAN COSKUN THE	2818										03/2	6/06
INT. 1426A - UEFS	ANIT	τ - α	FF-PE	AK							2310	
EXISTING												
		o	07 1	TRADE IN						den en Merrer an Ale		
SICHAL2000/TEADA	claer	2.60.1	07] -	HADRE V	VOLUMO	Jealla	st s s	atiio	W WOE	Keneet		
Volume		SB			WB			ЯВ			EB	
Adjustment	RT	TH	LT	RT		LT	RT	TH	LT	RT	TH	LT
Volume, V	97			212	1060	65	0	0	0	243	886	0
Pk-hr fact, DHP		. 83					. 00			. 77	. 77	
Adj mv flow, vp	117	110	41	247	1233	76	0	0	0	316	1151	0
Lane group, LC	RT	+TH+L	7	R	I+TH+L	Ŧ					RT+TH	
Adi 16 flow. v		2.68	-		1556	-					1467	
Prop LT, PLT		.153			. 049						. 000	
Prop RT, DRT		.437			. 159						. 215	
Saturation		SB			WB			ЯB			EB	
Flow Rate	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
Base satflo, so		1891			1891						1891	
Number lanes, N		1			2						2	
Lane width, fW		. 9:93			. 955						. 977	
Beavy veh, fBV		. 961			. 960						.961	
Crade, fg		.000			1.000							
Parking, fp		.000			1.000						000	
Bus block, fbb		.000			1.000						000	
Area type, fa		.000		1	1.000					1	000	
Lane util, fLU		.000			. 950						. 9150	
Laft-turn, fLT		. 9:92			. 998						. 000	
Right-turn, fR7		. 941			. 97.6						. 968	
	1				1.000						000	
PedBike R7, fRpb		.000			1.000						. 000	
Local adjustmit		.000		3	1.000					1	000	
Adj satflow, s		1686			3208						3263	

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Capacity		SB			WB			ЯB			EB	
Analysis	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	78	LT
Lane group, LG	RT	+TH+L(E.	RT	FIH+LI					1	RT+TH	
Adj Flow, v		2.68			L55-6						1467	
Satflow, s	1	1686		1	3208						3263	
Lost time, tL		3.6			3. 6						3.6	
Effect green, g	1	17.4			654						57.4	
		.193			727						. 638	
LC capacity, c		326		1	2331						2081	
v/c ratio, I		. 822			668						705	
Plow ratio, v/s		.159			485						. 450	
Crit lane group		*			*							
Sum crit v/s,Yc	0.	. 64.4		Total	lost,	L		7.2				
Crit v/c, Xc		.700										

VOLKAN COSEUN THESIS 03/26/06 INT. 1426A - UEFA ANITI - OFF-DEAK 23:06:45 EXISTING SICNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet SB. WB. MB. EB Delay. and LOS RT TH LT RT TH LT RT TH LT RT TH \mathbf{LT} ----------------Lane group, LC RT+TH+LT RT+TH+LT RT+TH Adj Flow, v 2.68 155.6 1467 LC capacity, c 326 23312081.822 v/c ratio, I . 668 .705 .193.727. 638 Grn ratio, g/C Unif delay, di Incr calib, k 34.8 6.5 10.7 . 150 .50 . 150 Incr delay, d2 Queue Delay, d3 20.3 1.5 2.0. 0 . 0 . 0 Unif delay, di* . 0 ...0 . 0 Prog factor, DF 1.00 1.001. 00 Contri delay, d 55.2 8.112.8Lane group 108 Ett B# A. Final Queue, Qbi 0 0 0 _ _ _ _ _ _ _ . _ Appr delay, dA 55.2 s.112.8 Approach LOS E+ A **B**# 1467 Appr flow, vA 2.681556 _ _____ _____

B+

Intersection: Delay 14.0 LOS

156

VOLKAN COSKUN THESIS 03/26/06 INT. 1426A - UEFA ANITI - OFF-DEAK 23:06:45 EXISTING. SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Back of Queue Worksheet SB WB. MB. EB Queues in RT LT LT TH LT RT TH Worst Lanes TH \mathbf{RT} TH RT LT Lane group, LC RT+TH+LT RT+TH+LT RT+TH 0 Init queue, GoL Θ. 0 Ln flow, vL 819 7722.68In satflow, sL 1686 1688 1717326 In capacity, cL 12271095 Plow ratio, yL .159 .485 . 450 v/c ratio, XL .822 . 668 .705 17.4 Effect green, g 65.4 57.4 Grn ratio, g/C .1.93 .727. 638 Opstr filter, I 1.001.001.00Grn arrivals, P . 19 .73 . 64 1.00 Platn ratio, Rp 1.00 1.00 Prog factr, PF2 1.00 1.00 1.00 Queúe (1st), Q1 Queue factr, kB 6.4 10.9 12.7. 52 1.321.22 Queue (2nd), 92 1.9 2.5 2.7kvg queue, Q 8.3 13.4 15.4 ____ ____ 90% factor, fB 1.59 1.531.5290% queue, Qp 13.3 20.5 23.5 Avg spacing, Lh Avail storg, La 25.6 25.6 25.6 0 Θ 0 *k*vg distance 213343 395 Avq ratio, RQ . 00 .00 . 00 90% distance 340 52.6 602 90% ratio, RQp . 00 . 00 .00

```
VOLKAN COSKUN TRESIS
                                                        03/26/06
INT. 1426A - UEFA ANITI - OFF-DEAK
                                                        23:06:45
EXTSTINC.
SIGNAL2000/TEADAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 26 -
    Degree of Saturation (v/c) 0.70 Vehicle Delay 14.0 Level of Service B+
Sq 12 | Dhase 1 | Dhase 2 | Dhase 3 |
**/** ---
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 W.
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              North |
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              1
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 1
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    1
                                 н
    | G/C=0.189 | G/C=0.067 | G/C=0.644 |
    j C= 17.0" j C= 6.0" j C= 58.0" j
    | Y+R- 4.0" | Y+R- 2.0" | Y+R- 3.0" |
     | OFF= 0.0% | OFF=23.3% | OFF=32.2% |
    C- 90 sec   G- 81.0 sec = 90.0% Y- 9.0 sec = 10.0% Ped= 0.0 sec = 0.0%
|Lane |Width/| g/C | Service Rate| Adj | | HCH | L | Queue |
| Group | Lanes| Reqd Used | 0D (vph) 0E [Volume] v/c | Delay | S [Hodel 1]
SB Approach
                                                55.2 E+
              [RT+TH+LT] 12/1 |0.194 |0.193 | 268 | 318 | 268 |0.822 | 55.2 |*E+| 340 ft]
WB Approach
                                                8.1 A
     [RT+TH+LT] 21/2 |0.471 |0.727 | 2331 | 2331 | 1556 |0.668 | 8.1 |*A | 526 ft]
                  EB Approach
                                               12.8 B+
                 [RT+TH | 23/2 |0.439 |0.638 | 2081 | 2081 | 1467 |0.705 | 12.8 | B+| 602 ft]
```

VOLKAN COSEUN TH				_								6/06
INT. 1115 - SILI CICLE LENGTH 51				ĸ							23:1	.6:14
CICLE LENGTH 51	- NEW (COUNTS	5									
SI (MAL2000/TEAPA	C[Ver 2	2.60.1	- [70	нсм п	nput	Works	heet					
Intersection # 1	15 - 13	115 8:	LIVRI	KAP I			А	rea I	ocati	on Typ	e: NC	NCBD
.	1			11	i				Ke v	vol.	UMES	>
i	50 j	848	j O	ii –	i				-		WIDT	'HS
	0.0 j s									v	L	ANES
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33 0.0	0 \	i		1	i İ	1						
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	1	I		I.	2	0				OVERLP		
										LEADLA	GL	D LD
		SB			WB			NB			EB	
	RT	TH	LT	\mathbf{RT}	TH	LT	RT	TH	LT	RT	TH	LT
	4.0	4.7	. 0	1.4	. 0			5.8	.0	6.1		
Heavy veh, SHV Pk-hr fact, PHF	4.0	4.7	.0	1.4	. 89	.0 .89	. 91	5.8 .91	.91	.94	.0 .94	.0 .94
Pretimed or Act	P	P	. 0 2 P	. U D	P	P	P	P	P	P	P	P
Strtup lost, 11	2.3		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Ext off grn, o	2.7	2.7		.7		. 7	2.7	2.7	2.7	2.2	2.2	2.2
Arrival typ, AT	3	3	3	3	3	3	3	3	3	3	3	3
Fed vol, vped		20			20			20			20	
Bike vol, vbic		0			0			0			0	
Parking locatns		ю			ю			NO			80	
Park movrs, Nn		0			0			0			0	
Bus stops, NB Grade, %G		-4.7			0.7			2.1			0	
									====		=====	
Sg 17 Phase 1	 i pi	hame '	2 1	Pha ea	3 1	Ph a	na <i>I</i>	1 24			heen	6 I
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+	i		j **	**	l			i		i		i
1 +	D.		B	v				I.				ļ
c= 51" c= 26.5		10.	н. 10 (с		6		0.01	1	 A A		•	0e - 1
C= 51" G= 26.5 T+R= 4.0	~ G= " T41	10.0 R= 2.0	or i a Dr i a	- 5. +R= 3.	.0° .5°	GE Y+R=	0.0*	G= Y45	0.0 = 0.0	- G= - Y4	е В= 0	0~ j
					·							

VOLKAN COSKUN THE											03/26	
INT. 1115 - SILIV				AK							23:10	5:14
CYCLE LENGTH 51 -	NEW	COUNTS	5									
SIGNAL2000/TEAPAC	Frank	a .co .	N7 1	-		ъ. д			. Standard			
STURREZOUD/TERFAL	foer.	A.80.0	87 - F	THE Y	o r une	Maja	st a o	ACTION	WOIKS	anee c		
Volume		SB			WB			NB			EB.	
Adjustment	RT	78	LT	BT	TH	LT	BT	78	1.7	BT	TH	LT
Volume, V	50	848	0	143	113	125	0	710	0	33	0	35
Pk-hr fact, PHF	. 89	.89	. 89	. 89	. 89	. 89	. 91	. 91	. 91	. 94	. 94	. 94
Adj my flow, vp		953	0	161	127	140	0	780	ō	35	0	37
Lane group, LG		RT+TH		RT	+TH+L	T		78		RT	+TH+LS	r
Adj LC flow, v		1009			428			780			72	
Prop LT, PLT		. 000			. 327			. 000			. 514	
Prop RT, PRT		.056			. 376			. 000			. 486	
Saturation	_	SB	_		WB	_		NB		_	EB.	_
Flow Rate	RT	TH	LT	\mathbf{RT}	TH	LT	RT	TH	LŦ	RT	TH	LT
Base satflo, so		1891			1891			1891			1891	
Number lanes. N		1891			1891			2			1891	
Lane width. fW		. 955			. 957			. 97 2			. 873	
Heavy veh. fHV		.955			. 995			. 945			. 971	
Grade, fo		.023			.997			. 98.9			000	
Parking, fp		. 000			. 000			. 000			. 000	
Bus block, fbb		.000			. 000			. 000			. 000	
Area type, fa		. 000		-	. 000		1	. 000			. 000	
Lane util, fLU		.950		-	. 950		1	. 950			. 000	
Left-turn, fLT		.000			. 984			. 000			. 975	
Right-turn, fRT		.992			.944		1	. 000			.934	
PedBike LT, fLpb		.000			. 000		1	. 000			. 000	
PedBike RT, fRpb	_	.999			. 988		1	. 000		-	. 970	
Local adjustent	1	.000		1	. 000		1	. 000		1	. 000	
Adj satflow, s	_	3325		-	3127			3265			1418	
SIGNAL2000/TEAPAC	[Ver	2.60.0	971 -	HCM P	ed-Bi	ke LT	Effec	ts Wos	rksheet			
								_		_		
Input/Calculation					SB		ň	в	В	B		EB
					.0		====== F	= === ^		0		
Effective ped gre Conflicting ped v					. 0		5. 2	-	-	0		10.0 20
		, vpec			. 000		204.00	-	. 00		102.	
Ped flow rate, Vp Avg. ped occupance		- الد مست			. 000		204.00 .10	-	. 00			051
Avg. ped occupance Opposing queue cl					. 000		. 00					000
Opposing queue q					. 000		.00	-				000
opposing queue g Ped occ after que					.000		. 00	-	. 00			051
Opposing flow rat					. 000			2 0	. 00	0		. 051 0
Relevant occupance					. 000		.10	1 00	. 00			. 051
# receiving lanes					000.			2	. 00	0		2
<pre># turning lanes,</pre>					ŏ			1		0		1
Adjustment factor					. 000		. 93	-	. 00	500 C		969
Proportion left t					. 000		. 32	-				514
Prop L7 in prot p					. 000		1.00		. 00			000
Ped-bike adjust f					. 000		1.00	-	. 00			000
		,p.				===	I.00					

03/26/06 VOLKAN COSKUN THESIS INT. 1115 - SILIVRIKAPI - OFF-PEAK 23:16:14 CYCLE LENGTH 51 - NEW COUNTS SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Ped-Bike RT Effects Worksheet Input/Calculation SB WB MB EB
 Effective ped green time, gp
 26.5
 10.0
 .0
 5.0

 Conflicting ped volume, Vped
 20
 20
 0
 20

 Conflicting bike volume, Vbic
 0
 0
 0
 20

 Ped flow rate, Vpedg
 38.491
 102.000
 .000
 204.000

 Avg ped occupancy, OCCpedg
 .019
 .051
 .000
 .102

 Effective bike green time, g
 26.9
 8.4
 .0
 4.9

 Bike flow rate, Vbicg
 .000
 .000
 .000
 .000

 Avg bike occupancy, OCCbicg
 .000
 .000
 .000
 .000

 Avg bike occupancy, OCCr
 .019
 .051
 .000
 .000

 Avg bike occupancy, OCCr
 .019
 .051
 .000
 .102

 # receiving lanes, Nrec
 2
 2
 0
 2

 # turning lanes, Nturn
 1
 1
 0
 1

 Adjustment factor, ApbT
 .988
 .969
 .000
 .939

 Prop R7 in prot phase, PRA
 .000
 .000
 .000
 .970</td SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet Capacity SB WB NB EB Analysis RT 7H LT RT TH LT RT 7H LT R7 TH LT
 Lane group, LG
 RT+TH
 RT+TH+LT
 TH
 RT+TH+LT

 Adj Flow, v
 1009
 428
 780
 72

 Satflow, s
 3325
 3127
 3265
 1418

 Lost time, tL
 3.6
 3.6
 3.6
 3.6

 Effect green, g
 26.9
 8.4
 26.9
 4.9

 Grn ratio, g/C
 .527
 .165
 .527
 .096

 LG capacity, c
 1754
 515
 1722
 136

 v/c ratio, X
 .575
 .831
 .453
 .529

 Flow ratio, v/s
 .303
 .137
 .239
 .051

 Mains group, LG
 RT+TH
 RT+TH+LT

 Adj Flow, v
 1009
 428

 Satflow, s
 3325
 3127

 Lost time, tL
 3.6
 3.6

 Effect green, g
 26.9
 8.4

 Grn ratio, g/C
 .527
 .165

 LG capacity, c
 1754
 515

 v/c ratio, X
 .575
 .831

 Flow ratio, v/s
 .303
 .137

 Crit lane group
 *
 *
 Sum crit v/s, Te 0.491 Total lost, L 10.8 Crit v/c, Xe .623

VOLKAN COSKUN THESIS INT. 1115 - SILIVRIKAPI - OFF-PEAK CYCLE LENGTH 51 - NEW COUNTS

SIGNAL2000/TEAPAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay		SB			WB			NB			EB	
and LOS	RT	TH	LT	RT	тн	LT	RT	TH	LT	RT	TH	LT
			===			===	=====					
Lane group, LC	F	T+TH		RT	+TH+LT			TH		RT-	FIR+LS	r
Adj Flow, v	1	009			42.8			780			72	
LC capacity, c	1	754			515		1	1722			136	
v/c ratio, X		57 5			. 831			453			. 52.9	
Grn ratio, g/C		527			.165			527			. 096	
Unif delay, dl		8.2			20.6			7.5			22.0	
Iner calib, k		. 50			. 50			. 50			. 50	
Incr delay, d2		1.4			14.4			. 9			L4.0	
Queue Deley, d3		. 0			. 0			. 0			. 0	
Unif delay, d1*		. 0			. 0			. 0			. 0	
Prog factor, PF	1	00		-	1.00		1	L.00		-	L. 00	
Contrl delay, d		9.6			35.1			8.3			35.9	
Lane group LOS		A			D+			A			D+	
Final Queue, Qbi		0			0			0			0	
Appr delay, dA		9.6			35.1			8.3			35.9	
Approach LOS		A			D+			A			D+	
Appr flow, vA	1	009			42.8			780			72	
Intersection:	Delay	1	4.7	LOS		B+						

03/26/06

23:16:14

VOLKAN COSEUN TH INT. 1115 - SILI CICLE LENGTH 51	VRIKAPI - OFF-PE	AE		03/26/06 23:16:14
SIGNAL2000/TEAPA	c[Ver 2.60.07] -	HCM Back of Que	ue Worksheet	
Queues in	SB	WB	ИВ	EB
Worst Lanes	RT TH LT	RT TH LT	RT TH LT	RT TH LT
Lane group, LC	RT+7H	RT+TH+LT	78	RT+TH+LT
Init queue, QbL	0	0	0	0
In flow, vL	531	22.5	411	72
In satflow, sL	1750	1646	1718	1418
Ln capacity, cL	923	271	906	136
Flow ratio, yL	. 303	.137	. 239	. 051
v/c ratio, XL	. 57 5	. 831	. 453	. 529
Effect green, g	26.9	8.4	26.9	4.9
Grn ratio, g/C	. 527	.165	. 527	. 096
Upstr filter, I	1.00	1.00	1.00	1.00
Grn arrivals, P	. 53	.16	. 53	. 10
Platn ratio, Rp	1.00	1.00	1.00	1.00
Prog factr, PF2	1.00	1.00	1.00	1.00
Queue (1st), Q1	5.1	3.1	3.6	1.0
Queue factr, kB	.73	. 31	.72	. 19
Queue (2nd), Q2	1.0	1.2	. 6	.2
Avg queue, Q	6.1	4.3	4.2	1.2
90% factor, fB	1.65	1.71	1.72	1.89
904 queue, Qp	10.0	7.4	7.2	2.2
Avg spacing, Lh	20.9	20.1	21.2	20.6
Avail storg, La	0	0	0	0
Avg distance	127	87	89	24
Avg ratio, RQ	.00	. 00	.00	. 00
90% distance	209	149	152	46
90% ratio, RQp	.00	. 00	.00	. 00

```
03/26/06
VOLKAN COSKUN THESIS
INT. 1115 - SILIVRIKAPI - OFF-PEAK
                                                    23:16:14
CICLE LENGTH 51 - NEW COUNTS
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 115 - 1115 SILIVRIKAPI
    Degree of Saturation (v/c) 0.58 Vehicle Delay 14.7 Level of Service B+
Sg 17 | Phase 1 | Phase 2 | Phase 3 |
**/**
    | * *
           |
|
|
                  A 1
                               /i\ i<* *
| | ▼
                  ****
                               <****
                               ****
                  v |****
    ÷
North |
                      j ****
          ÷
 +
                      D V
             in.
    | g/c=0.520 | g/c=0.196 | g/c=0.098 |
    | G= 26.5" | G= 10.0" | G= 5.0" |
    j T+R= 4.0" j T+R= 2.0" j T+R= 3.5" j
    | OFF= 0.0% | OFF=59.8% | OFF=83.3% |
    C= 51 sec G= 41.5 sec = 81.4% T= 9.5 sec = 18.6% Pad= 0.0 sec = 0.0%
| Lane |Width/| g/C | Service Rate| Adj | | BCH | L | Queue |
| Group | Lanes | Regd Used | 0C (vph) 0E [Volume | v/c | Delay | S [Model 1]
                                             9.6 A
SB Approach
_____
[RT+TH | 21/2 | 0.319 | 0.527 | 1754 | 1754 | 1009 | 0.575 | 9.6 |*A | 209 ft |
NB Approach
                                             8.3 A
_____
| TH | 22/2 |0.260 |0.527 | 1722 | 1722 | 780 |0.453 | 8.3 | A | 152 ft|
WB Approach
                                             35.1 D+
_____
[RT+TH+LT] 21/2 |0.165 |0.165 | 428 | 515 | 428 |0.831 | 35.1 |*D+| 149 ft]
             ____
                                  35.9 D+
EB Approach
|RT+TH+LT| 8/1 |0.098 |0.096 | 70 | 125 | 72 |0.529 | 35.9 |*D+| 46 ft|
```

VOLKAN COSKUN THE									03/2	
INT. 1115 - SILIV CICLE LENGTH 82 -									23:1	9:03
SI (NAL2000/TEAPAC		-	Input 1	Works						
Intersection # 11	5 - 1115 SI	ILIVRIKAPI			A	rea L	ocatio	ю Тур	e: NO	NCBD
	58 794 .0 21.3	0.0 ji					Ke y:	VOL V	UMES WIDT L	
	0 2	i ii	۰. ۱	136	0.0	0		_	•	
	/ 1	١		98	21.4	2			IV I	
34 0.0	== 0 /	+	1	127	0.0	0		Ио	l rth	
0 8.2	1		:						I	
28 0.0	 0 \ II	\ 	1	/						
	11	j 0 j 7	28 j	0 0.0		Phasi		equen Permev		17 เหต
			2 j	0	-			VERLP EADLA		N N D LD
			•		•		_		_	
	SB RT 7H	LT RT	WB Th	LT	RT	nb Th	LT	RT	EB TH	LT
Heavy veh, SHV	.0 3.5	.0 1.5		. 0	. 0	4.9	.0	7.1	. 0	. 0
Pk-hr fact, PHF Pretimed or Act	.97.97 PP	.97 .96 P P	.96 P	.96 P	.99 P	. 99 P	.99 P	. 97 P	. 97 P	. 97 P
Pretimed or Act Strtup lost, l1 Ext eff grn, e	2.3 2.3 2.7 2.7	2.3 2.3 2.7 .7	. 7		$2.3 \\ 2.7$	2.3 2.7	2.3 2.7	$\frac{2.3}{2.2}$	2.3 2.2	2.3 2.2
Arrival typ, AT	3 3	3 3	3	3	3	3	3	3	3	3
Ped vol, vped Bike vol, vbic	20 0		20 0			20 0			20	
Parking locatns Park movrs, Nn	NÖ		ы ОК			NO O			ыс 0	
Bus stops, NB Grade, %G	0 -4.7		0			0 2.1			0 .0	
	-4.,					2.1 			. v	
 Sq 17 Phase 1	Phase 2	2 Phase	3 1	Ph a:	so 4		250 5	P	hase	6 1
/		·	<u>`</u>							
. * * /1\ <* *	**	***	ļ			l		İ		
	**	·** ^ ****				ļ		ļ		
North +	v		ļ			ļ		ļ		
	 B.	**** B. V	l			l				
C= 82" C= 47.5" T+R= 4.0"										
	m.e									

VOLKAN COSKUN THE INT. 1115 - SILIV		σ	er_ne	a ur							03/2	
CYCLE LENGTH 82 -				840.							2011	21.00
SICNAL2000/TEADAC	(Ver	2. 60.	07] -	RCM V	olume	ad jus	it a S	atflo	W WOII	sheet		
Volume		8B 78			WB 78			ЯВ			EB	
Adjustment	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
Volume, V	58		0	136	98	127	0	728		28	0	34
Pk-hr fact, PHF	. 97	. 97		.96	.96		. 99		. 99	. 97		. 97
	60		0	142		132		735	0	29	0	35
Lane group, LC		RT+7H		RT	+TH+L	Ŧ		TH		RT	+TH+L	7
Adj 16 flow, v		879			376			735			64	
Prop LT, PLT		.000			. 351			.000			.547	
Drop RT, DRT		.068			. 378			.000			. 453	
Saturation Flow Bate	RT.	SB TH	147	RT	NB 7H	TAP	BT	NB TH	1.7	BT	eb Th	LT
FICH NECH				n.r.			- Dell			n.:		
Base satflo, so		1891			1891			1891			1891	
Number lanes, N		2			2			2			1	
Lane width, fW		. 955			. 957			. 97 2			. 873	
Beavy veh, fHV		. 968			. 989			.953			. 969	
Grade, fg		.023			. 997			.989		1	. 000	
Parking, fp	1	.000		1	. 000		1	.000		1	. 000	
Bus block, fbb		.000		1	. 000		1	.000			. 000	
Area type, fa		.000			. 000		1	.000		1	. 000	
Lane util, fLU		. 950			. 950			.950			. 000	
Left-turn, fLT	1	.000			. 983		1	.000			. 978	
Right-turn, fRT		. 990			. 943		1	.000			. 939	
PedBike LT, flpb		. 000		1	. 000		1	.000		1	. 000	
DedBike RT, fRpb		. 999			. 990		1	.000			. 968	
Local adjustmnt	1	.000		1	. 000		1	.000		1	. 000	
					3108			8998			1416	

SICHAL2000/TEADAC[Ver 2.60.07] - HCM Ded-Bike L7 Effects Worksheet

Input/Calculation	SB	WB	NB	EB
Effective ped green time, gp	. 0	7.0	. 0	18.0
Conflicting ped volume, Vped	0	20	0	20
Ded flow rate, Vpedg	.000	234.286	. 000	91.111
Avg. ped occupancy, OCCpedg	.000	. 117	. 000	.046
Opposing queue clear time, gq	.000	. 000	. 000	.000
Opposing queue g ratio, gg/gp	.000	. 000	. 000	.000
Ded occ after queue, OCCpedu	.000	. 117	. 000	.046
Opposing flow rate, Vo	0	0	0	0
Relevant occupancy, OCCr	.000	. 117	. 000	.046
<pre># receiving lanes, Nrec</pre>	0	2	0	2
# turning lanes, Hturn	0	1	0	1
Adjustment factor, Apb7	.000	. 930	. 000	.973
Proportion left turns, PLT	.000	. 351	. 000	.547
Prop LT in prot phase, PLTA	.000	1.000	. 000	1.000
Ped-bike adjust factor, fLpb	.000	1.000	. 000	1.000

VOLKAN COSKUN THESIS INT. 1115 - SILIVRIKADI - OFF-DEAK CYCLE LENGTH 82 - NEW COUNTS

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Ded-Bike R7 Effects Worksheet

Input/Calculation	SB	WB	NB	EB
Effective ped green time, gp	47.5	18.0	. 0	7.0
Conflicting ped volume, Vped	20	20	0	20
Conflicting bike volume, Vbic	0	0	0	0
Ped flow rate, Vpedg	34.526	91.111	.000	234.286
kvg ped occupancy, OCCpadg	.017	. 046	.000	. 117
Effective bike green time, q	47.9	16.4	. 0	6.9
Bike flow rate, Vbicg	.000	. 000	.000	. 000
Avg bike occupancy, OCCbicg	.000	. 000	.000	. 000
Relevant occupancy, OCCr	.017	. 046	.000	. 117
# receiving lanes, Nrec	2	2	0	2
# turning lanes, Hturn	1	1	0	1
Adjustment factor, ApbT	. 990	. 973	.000	. 9:30
Proportion right turns, PR	.068	. 378	.000	. 453
Prop RT in prot phase, DRA	.000	. 000	.000	. 000
Ped-bike adjust factor, fRpb	. 99 9	. 990	.000	. 968

SICHAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Capacity		SB			WB	WB		NB			EB	
Analysis	RT	TH	LT	RT	TH	LT	RT	TH	LT	BT	TH	LT
Lane group, LG	RT+TH			RT+TH+LT			TH			RT+TH+LT		
Adj Plow, v		879		376			735			64		
Satflov, s		3364		3108			3293			1416		
Lost time, tL	3.6			3.6			3.6			3.6		
Effect green, g	47.9			16.4			47.9			6.9		
Crn ratio, g/C	.584			. 200			.584			. 084		
LC capacity, c	3	1965		622			1924			119		
v/c ratio, I		.447		. 605			.382			. 538		
Plow ratio, v/s		.261		. 121			.223			.045		
Crit lane group		*		*				*				
Sum crit v/s,Ye	Ο.	4.27		Total.	lost,	L		10.8				
Crit v/c, Xc		. 4.92										

03/26/06

23:19:03

VOLKAN COSKUN THESIS INT. 1115 - SILIVRIKADI - OFF-DEAK CYCLE LENGTH 82 - NEW COUNTS

SICHAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay and LCS	RT	8B 78	ы	BT	WB 7H	LT	RT	NB TH	LT.	BT	EB Th	T.P	
KING DOO				n.r		Lat			101	n.:			
Lane group, LC	RT+TH			RT+TH+LT			TH			RT+TH+LT			
Adj Flow, v	879			376			735			64			
LC capacity, c	1965			62.2			1924			119			
v/c ratio, I		447		. 605			.382			. 538			
Grn ratio, g/C		584		. 200			.584			. 084			
Unif delay, di		9.6		29.8			9.1			36.0			
Incr calib, k		. 50		.50			. 50			. 50			
Incr delay, d2	.7			4.3			. 6			16.3			
Queue Delay, d3		. 0		. 0			. 0			.0			
Unif delay , di*	.0			. 0			. 0			.0			
Prog factor, PP		00		1.00			1.00			1.00			
Contri delay, d		0.3		34.2			9.7			52.3			
Lane group LOS		B+		с			A			D			
Final Queue, Qbi		0		0			0			0			
Appr delay, dA		10.3			34.2			9.7			52.3		
Approach LOS	B+			С			A			D			
Appr flow, vA	879			376			735			64			
Intersection:	Delay	1	5.8	LOS		В							

03/26/06 23:19:03 VOLKAN COSKUN THESIS INT. 1115 - SILIVRIKADI - OFF-DEAK CYCLE LENGTH 82 - NEW COUNTS

SICNAL2000/TEADAC[Ver 2.60.07] - HCM Back of Queue Worksheet

Queues in Worst Lanes	SB RT TH	LA T	WB RT TH LT			RT	NB F7 T8 L7			eb Rt 7H L			
Lane group, LC	RT+TH		RT	RT+TH+LT			TH			RT+TH+LT			
Init queue, ObL	0		0			0			0				
Ln flov, vL	463			198	387					64			
In satflow, sL	1770		1636			1733			1416				
In capacity, cL	1034			327			101.3			119			
Flow ratio, yL	.261			. 121		.223			. 045				
v/c ratio, XL	. 447			. 605			.382			. 538			
Effect green, g	47.9			16.4			47.9			6.9			
Grn ratio, g/C	. 584			. 200			.584			. 084			
Opstr filter, I	1.00			1.00		1.00			1.00				
Crn arrivals, D	. 58		.20			. 58			. 08				
Platn ratio, Rp	1.00			1.00		1.00			1.00				
Prog factr, PF2	1.00		1.00			1.00			1.00				
Queue (1st), Q1	5.9		4.1			4. 7			1.4				
Queue factr, kB	1.10			. 49			1.08			. 24			
Queue (2nd), 92	. 9			.7		. 7			. 3				
Avg queue, Q	6.8			4.8		5.4			1.7				
90% factor, fB	1.63			1.69		1.67			1.86				
901 queue, Qp	11.1			8.1		9.0				3.1			
Avg spacing, Lh	20.7		20.2			21.0				20.6			
Avail storg, La	0			0		0			0			0	
Avg distance	141			97		113			34				
Avg ratio, RQ	. 00			.00		. 00			. 00				
90% distance	229			165		189			64				
90% ratio, RQp	. 00		.00			. 00			. 00				

03/26/06

23:19:03

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VOLKAN COSKUN TRESIS
                                                          03/26/06
INT. 1115 - SILIVRIKADI - OFF-DEAK
                                                          23:19:03
CYCLE LENCTH S2 - NEW COUNTS
SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary
Intersection Averages for Int # 115 - 1115 SILIVRIKAPI
    Degree of Saturation (v/c) 0.46 Vehicle Delay 15.8 Level of Service B
Sq17 | Phase 1 | Phase 2 | Phase 3 |
**/** ------
                   ^ I
     1 * *
    1 * *
                    ****
. | * * |
/|\ |<* * |
| | ▼ |
                    -ennenj
                    ****
                    - y | ****
North |
| |
           +
                        j * * * *
           +
           +
                          - 721
     | C/C=0.579 | C/C=0.220 | C/C=0.085 |
     j G 47.5" j G 18.0" j G 7.0" j
     | Y+R= 4.0" | Y+R= 2.0" | Y+R= 3.5" |
     j off= 0.0% j off=62.8% j off=87.2% j
     C- 82 sec   G- 72.5 sec - 88.4% Y- 9.5 sec - 11.6% Ped- 0.0 sec - 0.0%
|Lane |Width/| g/C |Service Rate|Adj| | HCM |L|Queue|
| Group | Lanes | Reqd Used | 0C (vph) 0E |Volume | v/c | Delay | S |Hodel 1
                                                 10.3 B+
SB Approach
           [R7+7H | 21/2 |0.309 |0.584 | 1947 | 1965 | 879 |0.447 | 10.3 |*B+| 229 ft]
NB Approach
                                                 9.7 A
   | TH | 22/2 |0.278 |0.584 | 1904 | 1924 | 735 |0.382 | 9.7 | A | 189 ft|
WB Approach
                                                34.2 C
                                               _
[RT+TH+LT] 21/2 |0.195 |0.200 | 397 | 622 | 376 |0.605 | 34.2 |*C | 165 ft]
EB Approach
                                                 52.3 D
[RT+TH+LT] 8/1 |0.147 |0.084 | 4 | 97 | 64 |0.538 | 52.3 |*D | 64 ft]
```

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Input Worksheet Intersection # 115 - 1115 SILIVEIRAPI Area Location Type: MOHCED 1 50 874 0 Beay: VOLUMES> WIDTES 1 0.0 21.3 0.0 / / WIDTES 1 0.0 21.3 0.0 / / / / / / / / /	VOLKAN COSEUN THE INT. 1115 - SILIV EXISTING		EAK			03/26/06 23:10:06
Image: Second	SIGNAL2000/TEADAC	[Ver 2.60.07] -	- HOM Input !	Worksheet		
i 50 874 0 i	Intersection # 11	5 - 1115 SILIVE	RIKADI	1	area Locatio	а Туре: ЮНСВО
i i i ii \ 134 0.0 0 . //\		50 j 874 j 00 j 21.3 j 0.			Key :	WID78S
		i i	ii v	134 0.0	0	
0 8.2 1		/)	· ·	115 21.4	2	
0 8.2 1	31 0.0	• / ·	· ،		-	
39 0.0 0 1 0 711 0 Phasing: SEQUENCE 17 1 0.0 12.3 0.0 0 21 0 0VERLP Y Y Y 1 1 0 21.0 0 0VERLP Y Y Y Y 1 1 1 1 1 1 0VERLP Y Y Y Y Bary veh, 4EV 4.0 4.8 .0 .8 .9 .8 .0 4.8 .0 2.6 .0 6.5 Dk-hr fact, DHF .89 .89 .94 .94 .87 .87 .87 .87 .83	0 8.2					l
I I	39 0.0	• \ •.	0 711	0 0.0	, D	ERMSV HNNN
RT TH LT RT RT<			1 1	° i		
Beavy veh, 4HV 4.0 4.8 .0 .8 .9 .8 .0 4.8 .0 2.6 .0 6.5 Pk-hr fact, DHF .89 .89 .94 .94 .94 .87 .87 .87 .83<		RT TH LT	RT TH		TH LT	RT TH LT
Pretimed or Act D		4.0 4.8 .0	.8.9	.8 .0	4.8.0	2.6 .0 6.5
Bike vol, vbic 0 0 0 0 0 Parking locatns NO NO NO NO NO Dark movrs, Hm 0 0 0 0 0 Bus stops, NB 0 0 0 0 0 Grade, %G -4.7 .7 2.1 .0	Pretimed or Act Strtup lost, 11 Ext eff grn, e	p p p 2.3 2.3 2.3 3.0 3.0 3.0	D D 2.3 2.3 .7 .7	D D 2.3 2.3 .7 3.0	P P 2.3 2.3 3.0 3.0	P P P 2.3 2.3 2.3 1.7 1.7 1.7
Parking locatns BO HO BO HO Park movrs, Hm 0 0 0 0 Bus stops, NB 0 0 0 0 Grade, *G -4.7 .7 2.1 .0 Sq 17 Phase 1 Phase 2 Phase 3 Phase 4 Phase 5 Phase 6 **/**						
Bus stops, NB 0 0 0 0 0 Crade, 3G -4.7 .7 2.1 .0 Sq 17 Phase 1 Phase 2 Phase 3 Phase 4 Phase 5 Phase 6 **/**	Parking locatns	80	но		190	но
Sq 17 Phase 1 Phase 2 Phase 3 Phase 4 Phase 5 Phase 6 **/**	Bus stops, NB	ō	0		ō	ō
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	•	-4.7			2.1	.0
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Horth + v ****	/l_i<*_*					
	ii ^ Northi +	v ,	****			

VOLKAN COSKUN THE INT. 1115 - SILIV EXISTING		I - 01	F-DE	AK							03/20 23:10	
SICNAL2000/TEADAC	[Ver	2. 60. 0	- [7	HOM V	olumə	Adju	ist s S	atflo	w Wori	ksheet		
Volume Adjustment	ĸī	SB 7H		RT	WB 7H			NB TH	LT	RT	eb Th	LT
Volume, V Pk-hr fact, PHF	50 . 89	874 . 89 982	0 89 .	134 .94	115 .94	126 .94	0	711 .87	0	39	0 . 83	31 . 83 .37
Lane group, LC Adj LC flow, v		RT+TH 1038			+ TH+L 399	T		TH 817			+TH+L4 84	F
Prop LT, PLT Prop RT, PRT		.000 .054			. 336 . 358			.000 .000			.440 .560	
Saturation Flow Rate		SB TH	ы	RT	WB 7H	LT		nb Th	LT	RT		LT
Base satflo, so		1891			1891			1891			1891	
Number lanes, N Lane width, fW		2 . 955			2 . 957			2			1	
Lane width, fw Heavy veh, fHV		. 955 . 955			. 957 . 992		.972			. 873 . 959		
Grade, fq	.955			. 992			. 989			1.000		
Parking, fp	1.000			1.000				.000			. 000	
Bus block, fbb	1.000				. 000			.000			. 000	
Area type, fa Lane util, fLU	1.000			-	. 000 . 950		1	.000			. 000 . 000	
Left-turn, fLT		.000		. 983			1	.000			. 978	
Right-turn, fR7		. 992		. 94.6				.000			. 924	
PedBike 17, flpb	-	.000		1.000			1.000			1.000		
PedBike R7, fRpb Local adjustmit		. 999 . 000			. 990 . 000		1.000			.978		
Adi satflow, s		3323			3130		3296			1.000		
SICHAL2000/TEADAC	[Ver	2. 60. (- 170	нсм р	ed-B1	ke Lī	Effec	ts Wo	rkshe	ot		
Input/Calculation					SB		W	в		ЯΒ		EB
Effective ped gre Conflicting ped v					. 0		12.			.0		17.5
Ped flow rate. Vp		, vper			0 000.		133.33	-	_	000	93	. 429
Avg. ped occupanc	y, ≦œ				.000		. 06			000		.046
Opposing queue cl	ear t	ine, ç			.000		. 00			000		. 000
Opposing queue g					.000		. 00	-		000		.000
	d occ after queue, OCCpedu posing flow rate, Vo				.000		. 06	7 0		000		.046
	levant occupancy, OCCr				.000			ā -		000		.046
<pre># receiving lanes</pre>	ceiving lanes, Nrec				0			2		0		2
<pre># turning lanes, 1</pre>	ning lanes, Nturn stment factor, Apb7			0			1					1
Adjustment factor Proportion left t				.000						.000 .973		
	LT in prot phase, PLT			.000						000 1.000		
	d-bike adjust factor, fLpb				.000						.000 1.000	
								-				

VOLKAN COSKUN TRESIS INT. 1115 - SILIVRIKADI - OFF-DEAK EXISTING

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Ped-Bike RT Effects Worksheet

Input/Calculation	SB	WB	HB	EB
Effective ped green time, gp	40.5	17.5	. 0	12.0
Conflicting ped volume, Vped	20	2.0	0	20
Conflicting bike volume, Vbic	0	0	0	0
Ded flow rate, Vpedg	39.506	91.429	. 000	133.333
Avg ped occupancy, OCCpadg	.020	. 04.6	. 000	. 067
Effective bike green time, g	41.2	15.9	. 0	11.4
Bike flow rate, Vbicg	.000	. 000	. 000	. 000
Avq bike occupancy, OCCbicq	.000	. 000	. 000	. 000
Relevant occupancy, OCCr	.020	. 04.6	. 000	. 067
# receiving lanes, Nrec	2	2	0	2
# turning lanes, Hturn	1	1	0	1
Adjustment factor, Apb7	.988	. 97 3	. 000	. 960
Proportion right turns, DR	.054	. 358	. 000	. 560
Prop RT in prot phase, DRA	.000	. 000	. 000	. 000
Ped-bike adjust factor, fRpb	.999	. 990	. 000	. 978

SICHAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Capacity		SB			WB			MB			EB	
Analysis	RT	TH	LT	RT	TH	LT	RT	тн	LT	RT	TH	LT
Lane group, LC	1	RT+TH		RT	FB+LT			TH		RT-	TH+LT	
Adj Flow, v	3	10 38			399			817			84	
Satflow, s	2	3323		1	3130			3296		1	400	
Lost time, tL		3.8			3.6			3.8			3.6	
Effect green, g		41.2			L5., 9		i.	41.2			1.4	
Crn ratio, g/C		.515			199			.515			1.42	
LC capacity, c	3	1711			62.2			1698			199	
v/c ratio, I		. 607			641			. 481			422	
Flow ratio, v/s		.312			127			.248			060	
Crit lane group		*			*						*	
Sum crit v/s,Yc	0	.500		Total	lost.	L		11.0				
Crit v/c, Xc		580				_						

03/26/06

23:10:06

VOLKAN COSKUN THESIS INT. 1115 - SILIVRIKADI - OFF-DEAK EXISTING

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet

Delay and LOS	RT	SB TH	LT	RT	NB Th	LT	RT	NB TH	LT	RT	eb Th	LT
Lane group, LC	R'	C+7H		B7	+TH+L/	 P		TH		RT4	-TH+10	
Adj Flow, v		038		399			817			84		
LC capacity, c		1711			622		,	L698			199	
v/c ratio, I	_	607			. 641			481			422	
Grn ratio, q/C		515			. 199			515		-	1.42	
Unif delay, di		3.7			29.4			2. 5		5	1.3	
Incr calib, k		50			.50			.50			. 50	
Incr delay, d2		1.6		5.0			1.0			6.4		
Queue Delay, d3		. 0		. 0			. 0				. 0	
Unif delay, di*		. 0		. 0				. 0			. 0	
Prog factor, DF	1.	.00			1.00		1	L. 00			. 00	
Contri delay, d	19	5.3			34.5		3	L3. 15		2	7.7	
Lane group 108		в			С			B+			D+	
Final Queue, Gbi		0			0			0			0	
Appr delay, dA	1!	5.3			34.5			L3. 5		3	87.7	
Approach LOS		в			С			B+			D+	
Appr flow, vA	10	038			399			817			84	
Intersection:	Delay	1	8.7	LOS		в						

03/26/06 23:10:06

VOLKAN COSKUN TRESIS INT. 1115 - SILIVRIKADI - OFF-DEAK EXISTING

SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Back of Queue Worksheet

Queues in Worst Lanes	SB RT TH LT	WB RT TH LT	NB RT TH LT	EB RT TH LT		
Lane group, LC	RT+TH	RT+TH+LT	TH	RT+TH+LT		
Init queue, GbL	0	0	0	0		
Ln flow, vL	546	210	430	84		
In satilow, sL	1749	1647	1735	1400		
In capacity, cL	901	327	894	199		
Plow ratio, yL	. 312	. 127	.248	. 060		
v/c ratio, XL	. 607	. 641	. 481	. 422		
Effect green, g	41.2	15.9	41.2	11.4		
Grn ratio, g/C	. 515	. 199	. 51.5	.142		
	1.00	1.00	1.00	1.00		
Grn arrivals, P	. 51	.20	.51	. 14		
Platn ratio, Rp	1.00	1.00	1.00	1.00		
Prog factr, PF2	1.00	1.00	1.00	1.00		
Queue (1st), Q1	8.6	4.3	6.2	1.7		
Queue factr, kB	. 98	.48	.97	. 34		
Queue (2nd), 92	1.5	.8	. 9	. 2		
Avg queue, Q	10.0	5.1	7.0	1.9		
90% factor, fB		1.68	1.62	1.84		
90% queue, Qp	15.7	8.6	11.4	3.6		
kvg spacing, Lh	25.7	25.1	25.7	25.6		
Avail storg, La	0	0	0	0		
<i>k</i> vg distance	258	128	181	50		
Avg ratio, RQ	. 00	.00	. 00	. 00		
90% distance	404	215	294	92		
90% ratio, RQp	. 00	.00	.00	. 00		

03/26/06 23:10:06 VOLKAN COSKUN THESIS 03/26/06 INT. 1115 - SILIVRIKADI - OFF-DEAK 23:10:06 RITSTIC. SIGNAL2000/TEADAC[Ver 2.60.07] - Capacity Analysis Summary Intersection Averages for Int # 115 - 1115 SILIVRIKAPI Degree of Saturation (v/c) 0.56 Vehicle Delay 18.7 Level of Service B ____ Sq17 | Phase 1 | Phase 2 | Phase 3 | **/** ---^ I 1 . * * 1 **** * * 1 **** **** V [**** + North | 1 1**** + 1 1 1 + 1 V. 1 н | C/C=0.506 | C/C=0.219 | C/C=0.150 | j C= 40.5" j C= 17.5" j C= 12.0" j | Y+R= 4.5" | Y+R= 2.0" | Y+R= 3.0" | | OFF=99.4% | OFF=56.3% | OFF=80.6% | |Lane (Width/) g/C |Service Rate|Adj| |HCH |L|Queue| j Group j Lanesj Reqd Used j 9C (vph) 9E (Volumej v/c j Delay j S (Hodel 1) 15.3 B SB Approach - -- --- --- ---(RT+TH | 21/2 |0.350 |0.515 | 1665 | 1711 | 1038 |0.607 | 15.3 |*B | 404 ft) **HB** Approach 13.5 B+ | 7H | 22/2 |0.295 |0.515 | 1651 | 1698 | 817 |0.481 | 13.5 | B+| 294 ft| 34.5 C WB Approach [RT+TH+LT] 21/2 [0.195 [0.199] 411 [622] 399 [0.641] 34.5 [*C] 215 ft] 37.7 D+ EB Approach [RT+TH+LT] 8/1 |0.158 |0.142 | 64 | 184 | 84 |0.422 | 37.7 |*D+| 92 ft]

Volkan Coskun The INT 2204 - Dolmae Existing				05/17/06 12:59:14
SICNAL2000/TEADAC	[Ver 2.60.07] -]	HCM Input Worksh	hest	
Intersection # 20	4 -		Area Location S	туре: СВО
	0 0 2102		-	VOLUMES > WIDTHS V LANES
		II \ •	0.0 0	
	7 I I V	910	21.0 2	4
0 0.0		/ 0	0.0 0	i North
		·	0.0 0	l
	3 \	1 7		
00.0	` ii o I II 0.0	0 0 0 0.0 0.0 0 0 0	DER OVE	DENCE 11 MEV HINININ RLP YYYY DLAG LD LD
	SB RT TH LT	NB RT 7H LT		eb Rt Th Lt
Heavy veh, AHV Pk-hr fact, PHP		.0 6.4 .0 .96 .96 .96		.05.6.0 82.82.82
Pretimed or Act	D D D	D D D	D D D	D D D
Strtup lost, 11 Ext eff grn, e	2.3 2.3 $2.32.7$ 2.7 2.7	2.3 2.3 2.3 2.3 2.7 2.7 2.7		3 2.3 2.3
			3 3 3	3 3 3
Ped vol, vped Bike vol, vbic	0 0	0 0	 0	00
Parking locatns	жo	но	90	но
Park movrs, He Bus stops, NB	0	0	0 0	0
Grade, %C	-10.0	.0	. 0	.0
Sq 11 Phase 1	Phase 2 1	Phase 3 Phas	se 4 Phase 5	Phase 6
'! <u>+</u>	!!!	1	!!!	I
/i、	«++++			ł
		1		į
North	++++>			
				ł
			0.0" G= 0.0" 0.0" T+R= 0.0"	

VOLKAN COSEUN THI INT 2204 - DOLMAJ EXISTING		- DM	DEAK								05/1 12:5	
SIGNAL2000/TEADA	C[Ver	2. 60.	07] -	HOM V	olume	A dju	st s S	atflo	w Wor	ksheet	6	
Volume Adjustment	RT	SB 7H	и	RT	WB TH	LT	RT	nb Th	LT	RT	eb Th	LT
Volume, V	0		2102	0	910	0	0	0	0		1976	0
Pk-hr fact, PHF Adj my flow, vp	. 90 0	. 90	. 90 2336		. 96 948	.96 0	. 00 . 0	. 00 0	. 00 . 0		. 82 2410	. 82
Adj mv flow, vp			2336		948			• 			2410	0
Lane group, LG			LT		TH						TH	
Adj LČ flow, v			2336		948						2410	
Prop LT, PLT			.000		. 000						. 000	
Prop RT, PRT			.000		. 000						. 000	
Saturation Flow Bate		SB 78			WB		- 2 1,220	NB			EB	-9-1
Plow Rate	RT	218	LT	RT	TH	LT	RT	TH	LT.	RT	TH	LT
Base satflo, so			1891		1891						1891	
Number lanes, N			3		2						В	
Lane width, fW			. 913		. 950						. 994	
Beavy veh, fBV Grade, fg			.965 .030		. 940 . 000						.947 1.000	
Grade, Ig Darking, fp			.030		.000						1.000	
Bus block, fhb		_	.000		. 000						1.000	
Area type, fa			. 900	-	. 900						.900	
Lane util, fLU			. 970		. 950						. 910	
Left-turn, fLT			. 950		. 000						1.000	
Right-turn, fR7			.000		. 000						1.000	
DedBike LT, fLpb DedBike RT, fRpb			.000	-	. 000 . 000						1.000	
Local adjustmnt			.000		. 000						1.000	
Adi satflow, s			4271		2888						4377	
SIGNAL2000/TEADA	-	SB	-		WB	-		ЯВ			EB	
Analysis	RT	TH		RT	TH	LT	RT	TH	LT	RT	TH	LT
Lane group, LC			147		 7H						78	
Adi Flow, v			2336		2H 948						2410	
Satflow, s			4271		2888						4377	
Lost time, tL			3.6		3.6						3.6	
Effect green, g			58.4		48.4						48.4	
Grn ratio, g/C			.512		. 425						.425	
LG capacity, c v/c ratio. X			2188		1226.773						1858 1.297	
V/C Fatio, I Flow Fatio, V/S			.068 .547		. 773 . 328						. 551	
Crit lane group			*								*	
Sum crit v/s,Yc Crit v/c. Xc		.098		Total	lost,	L		7.2	_			

VOLKAN COSKUN THESIS 05/17/06 INT 2204 - DOLMABARCE - DM PEAK 12:59:14 EXISTING SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Capacity and LOS Worksheet Delay. SB NB. WB. EB. and 108TH LT RT TH LT TH LT RT RT ET. TH LT -----____ Lane group, LG LT TH 行用 -Adj Flow, v 2336 948 2410 21881226 1858 LC capacity, c v/c ratio, X .773 1.068 1.297 . 512 Grn ratio, g/C . 425 . 425 Unif delay, di 27.8 28.1 32.8 Incr calib, k . 50 .50 . 50 Incr delay, d2 40.3 4.8 137.8 . 0 . 0 Queue Delay, d3 54.3 Unif delay, di* Prog factor, DF . 0 . 0 . 0 1.00 1.00 1.00 Contri delay, d 122.4 32.9 170.6 Lane group LCS F - C. F Final Queue, Qbi 70 0 1.38 Appr delay, dA 122.4 32.9 170.6 Approach LOS F - C E. 2336 Appr flow, vA 948 2410 Delay 127.9 LOS F. Intersection: _____ SIGNAL2000/TEADAC[Ver 2.60.07] - HCM Initial Queue Delay Worksheet Durat, 7 0.25 h SB. WB. **BIB** EB Cycle, C 114 s RT TH LT RT TH LT RT . TH LT RT TH LT _ Lane group, LC LT TH TH Init queue, gb 33 0 - 0 Grn ratio, g/C .512.425 .425 1.30 v/c ratio, Ĩ .77 1.072188 Adj capacity, c 1226 1858 Durtn unmet, t Case number, 1 . 25 .00 . 00 5 1 - 2 Delay param, u 1.00 .00 . 00 . 0 Queue delay, d3 54.3 . 0 27.8 **Unif delay, di**★ . 0 . 0 .00 Last depart, To . 28 . 00 70 Final queue, Qbi 0 1.38

VOLKAN COSKUN TRESIS 05/17/06 INT 2204 - DOLMABANCE - DM DEAK 12:59:14 EXISTING SIGNAL2000/TEADACIVer 2.60.071 - HCM Back of Cueue Worksheet Queues in EB SB ₩B. MB Worst Lanes RT 7H LT RT TH LT RT TH LT RT TH LT -------_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ ----Lane group, LG LT Init queue, GbL 11 In flow, vL 848 In satflow, sL 1468 78 TH 0 0 4.99 883 15201603 Ln capacity, cL Flow ratio, yL v/c ratio, XL 752 .578 645 681 . 328 . 551 1.128 58.4 -512 .773 48.4 1.297 Effect green, g Grn ratio, g/C Upstr filter, I 48.4 .512. 425 .425 1.00 1.00 1.00 .42 . 42 Grn arrivals, P . 51 .51 1.00 1.00 Platn ratio, Rp 1.00 1.00 Drog factr, DF2 1.001.00 26.9 13.5 Queue (1st), Q1 28.01.10 . 99 Queue factr, kB 1.03 Queue (2nd), Q2 23.0 2.9 29.2Q evenp pvA 49.9 16.5 57.1 ____ ------90% factor, fB 1.50 1.52 1.50 25.0 74.9 901 queue, Qp 85.7 Avg spacing, Lh Avail storg, La 25.5 0 26.025.8 0 0 1275 427 Avy distance 1476 Avq ratio, RQ . 00 .00 . 00 90i distance 1912 649 2214. 00 . 00 90% ratio, R<u>O</u>p .00 -------

VOLKAN COSKUN THESIS 05/17/06 INT 2204 - DOLMABANCE - DM DEAK 12:59:14 EXISTINC. SIGNAL2000/TEADAC[Ver 2.60.07] - Evaluation of Intersection Performance Intersection # 204 -Sq 11 | Phase 1 | Phase 2 | **/** -+ L н 71N - 1 +** ~++++1 1 1 1 North i |++++> 1 1 1 | C/C=0.509 | C/C=0.421 | | G= 58.0" | G= 48.0" | Y+R- 4.0" | Y+R- 4.0" | | OFF= 0.0% | OFF=54.4% | C-114 sec C-106.0 sec = 93.0% Y- 8.0 sec = 7.0% Ped= 0.0 sec = 0.0% MVMT TOTALS SB Approach WB Approach HB Approach EB Approach Int RT TH LT RT TH LT RT TH LT RT TH LT Total Param: Units Ad1Wol: vph 0 0 2336 0 948 0 0 0 0 0 2410 0 5694 Wid/In: ft/# 0/0 0/0 28/3 0/0 21/2 0/0 0/0 0/0 0/0 0/0 36/3 0/0 g/C Rqd8C:\ 0 0 62 0 41 0 0 0 0 0 57 g/C Used:\ 0 0 51 0 42 0 0 0 0 0 42 0 g/C Used: A 0 SV 9E: vph 0 0 2116 0 1226 0 0 0 0 0 1858 0 5200 F Svc Lv1:L08 62 F E HCM Dal:s/v 0.0 0.0122.4 0.0 32.9 0.0 0.0 0.0 0.0 0.0170.6 0.0 127.9 0 0 1191 0 130 0 0 0 0 0 1713 0 3034 0 0 584 0 203 0 0 0 0 0 602 0 1389 Tot Del:min # Stops:veh _____ ____ Queue 1:veh 0 0 75 0 25 0 0 0 0 0 86 0 86 Queue 1: ft 0 0 1912 0 649 0 0 0 0 0 2214 0 2214

VOLKAN COSKUD INT 2204 - DA EXISTING	N THESIS XIMABARCE - DM	DEAK			05/17/04 12:59:14
SIGNAL2000/T	EADAC [Ver 2.60.	07] - Evaluatio	n of Intersecti	on Performance	
APDR TOTALS Daram:Units	SB Approach	WB Approach	NB Approach	EB Approach	Int Total
kdjVol: vph	2336	948	0	2410	5694
Svc Lv1:L08	F	сс		F	F
Deg Sat:v/c	1.07	0.77	0.00	1.30	1.12
	122.4	32.9	0.0	170.6	127.9
fot Delimin	1191	130	0	1713	3034
\$ Stops:veh	584	203	ō	602	1389
Queue liveh	75	25	0	86	86
Queue 1: ft	1912	649	0	2214	2214
-					

APPENDIX C: OUTPUTS OF THE SYNCHRO HCM ANALYSIS

EBT 1801 3.0 0% 3.6 0.05	EBR 1991 3.6	WBL 1801 3.6	44 1891 3.0	NBL 1901 3.3	NBR			
1991 3.0 0% 3.6 0.95	1991	1801	44 1891 3.0	1991				
1801 3.0 0% 3.6 0.95			1891 3.0	1891	1001			
1801 3.0 0% 3.6 0.95			3.0		1001			
0% 3.6 0.05	3.6	3.6		21.125	I COM I			
3.6 0.05			10 mm m	25,25	3.6			
0.95				-8%				
			3.6					
			0.95					
80.0			1.00					
1.00				0.96				
					8			
454		0		148	11			
4%	12%	0%	2%	18%	25%			
2			2	1				
0.19			00.52	00.05				
A			A.	- C				
alaw.		0.2	н	CMLIM	anivraS fo lov		4	
0			8	um of k	nst time (s)		7.2	
		1162						
	018 1.00 018 418 0.02 454 55 583 4% 2 520 524 0.70 2 100 0.19 0.28 4.2 1.00 0.3 4.5 A 4.5 A 4.5 A	3018 1.00 3018 418 169 0.92 0.92 454 184 55 0 583 0 4% 12% 2 2 52.0 52.4 52.0 52.4 0.70 4.0 2109 0.19 0.28 4.2 1.00 0.3 4.5 A 4.5 A 4.5 A	3018 1.00 3018 418 169 0.02 0.02 418 169 0.02 0.02 418 184 0 55 0 0 418 184 0 55 0 0 418 12% 019 0 52.0 52.4 0.70 0.10 0.10 0.10 0.10 0.10 0.128 4.2 4.2 1.00 0.3 4.5 A 4.5 A 4.5 A 9.2 ratio 0.63 0 75.0	3018 3222 1.00 1.00 3018 3222 418 169 0 418 169 0 0.92 0.92 0.90 0.90 454 184 0 1670 55 0 0 0 583 0 0 1670 4% 12% 0% 2% 2 2 2 2 52.0 52.0 52.0 52.0 52.4 52.4 52.4 52.4 0.70 0.70 4.0 4.0 209 2251 0.19 c0.52 0.19 c0.52 0.100 1.00 0.3 2.3 4.5 9.3 A A A A 4.5 9.3 A A 4.5 9.2 H natio 0.63 9 75.0 8 2ation 51.8% 10	S018 3222 2943 1.00 1.00 0.98 3018 3222 2943 418 169 0 1503 108 0.92 0.92 0.90 0.90 0.73 454 184 0 1670 148 55 0 0 0 7 583 0 0 1670 152 4% 12% 0% 2% 18% 2 2 1 5 0 0 7 583 0 0 1670 152 4% 18% 2 1 52.0 52.0 16.0 52.4 15.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 <td>S018 3222 2943 1.00 1.00 0.96 3018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.90 0.73 0.73 454 184 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 52.0 52.0 16.0 52.4 52.4 15.4 0.70 0.21 4.0 4.0 3.0 2109 2251 604 0.19 c0.52 c0.05 0.128 0.74 0.25 4.2 7.1 25.0 1.0 1.00 1.00 0.3 2.3 1.0 4.5 9.3 26.0 A A A</td> <td>8018 3222 2943 1.00 1.00 0.96 8018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.73 0.73 454 418 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 1 5 0 52.0 52.0 16.0 524 52.4 52.4 52.4 15.4 0.70 0.70 0.70 0.70 0.21 4.0 3.0 21.00 2251 604 0.10 0.19 c0.52 c0.05 0.28 0.74 0.25 4.2 7.1 25.0 1.00 1.00 1.00 0.3 2.3 1.0 4.5 9.3 26.0 A A C HCM Level of Service ratio 0.63 0.75.0 Sum of lost time (s)<td>N018 3222 2943 1.00 1.00 0.96 N018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.73 0.73 454 184 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 1 55 0 52.0 52.0 16.0 52.4 52.4 52.0 52.0 16.0 52.4 52.4 0.70 0.70 0.21 4.0 3.0 21.0 2251 604 0.19 60.52 0.19 c0.52 c0.05 0.128 0.74 0.25 4.2 7.1 25.0 1.0 1.00 1.00 1.00 1.00 1.00 0.3 2.3 1.0 4.5 9.3 28.0 A A 4.5 9.3 28.0 A A 4.5 9.3 28.0 A A</td></td>	S018 3222 2943 1.00 1.00 0.96 3018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.90 0.73 0.73 454 184 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 52.0 52.0 16.0 52.4 52.4 15.4 0.70 0.21 4.0 4.0 3.0 2109 2251 604 0.19 c0.52 c0.05 0.128 0.74 0.25 4.2 7.1 25.0 1.0 1.00 1.00 0.3 2.3 1.0 4.5 9.3 26.0 A A A	8018 3222 2943 1.00 1.00 0.96 8018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.73 0.73 454 418 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 1 5 0 52.0 52.0 16.0 524 52.4 52.4 52.4 15.4 0.70 0.70 0.70 0.70 0.21 4.0 3.0 21.00 2251 604 0.10 0.19 c0.52 c0.05 0.28 0.74 0.25 4.2 7.1 25.0 1.00 1.00 1.00 0.3 2.3 1.0 4.5 9.3 26.0 A A C HCM Level of Service ratio 0.63 0.75.0 Sum of lost time (s) <td>N018 3222 2943 1.00 1.00 0.96 N018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.73 0.73 454 184 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 1 55 0 52.0 52.0 16.0 52.4 52.4 52.0 52.0 16.0 52.4 52.4 0.70 0.70 0.21 4.0 3.0 21.0 2251 604 0.19 60.52 0.19 c0.52 c0.05 0.128 0.74 0.25 4.2 7.1 25.0 1.0 1.00 1.00 1.00 1.00 1.00 0.3 2.3 1.0 4.5 9.3 28.0 A A 4.5 9.3 28.0 A A 4.5 9.3 28.0 A A</td>	N018 3222 2943 1.00 1.00 0.96 N018 3222 2943 418 169 0 1503 108 8 0.92 0.92 0.90 0.73 0.73 454 184 0 1670 148 11 55 0 0 0 7 0 583 0 0 1670 152 0 4% 12% 0% 2% 18% 25% 2 2 1 1 55 0 52.0 52.0 16.0 52.4 52.4 52.0 52.0 16.0 52.4 52.4 0.70 0.70 0.21 4.0 3.0 21.0 2251 604 0.19 60.52 0.19 c0.52 c0.05 0.128 0.74 0.25 4.2 7.1 25.0 1.0 1.00 1.00 1.00 1.00 1.00 0.3 2.3 1.0 4.5 9.3 28.0 A A 4.5 9.3 28.0 A A 4.5 9.3 28.0 A A

1109 - Sarayburnu Intersection - AM Peak, Existing

9: Int								09.04.200
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Movement	EBT	EBR	WBL		NBL	NBR		
Lane Configurations	11×			- † †	<u> 117</u>			
deal Flow (vphpi)	1891	1891	1801	1891	1891	1891		
Lane Wildth	3.0	3.6	3.6	3.0	3.3	3.6		
Grade (%)	0%			4%	-8%			
Total Lost time (s)	3.6			3.6	3.6			
ane Util, Factor	0.95			0.95	0.97			
Frt	0.96			1,00	0.99			
Fit Protected	1.00			1.00	0.96			
Satd. Flow (prot)	3018			3222	2943			
Fit Permitted	1.00			1.00	0.96			
Satd. Flow (perm)	3018			3222	2943			
Volume (vph)	418	160	0	1503	108	8		
Peak-hour factor, PHF	0.92	0.92	0.90	0.90	0.7-3	0.73		
Adj. Flow (vph)	454	184	0	1670	148	11		
RTOR Reduction (vph)	48	0	0	0	8	0		
Lane Group Flow (vph)	590	0	0	1670	151	0		
Heavy Vehicles (%)	4%	12%	0%	2%	18%	25%		
Turn Type								
Protected Phases	2			2	1			
Permitted Phases								
Actuated Green, G (s)	55.0			55.0	18.0			
Effective Green, g (s)	55.4			55.4	12.4			
Actuated g/C Ratio	0.74			0.74	0.17			
Clearance Time (s)	4.0			4.0	3.0			
Lane Grp Cap (vph)	2229			2390	487			
vis Ratio Prot	0.20			c0.52	00.05			
vis Ratio Perm								
vio Ratio	0.28			0.70	0.31			
Uniform Delay, di	3.2			5.3	27.5			
Progression Factor	1.00			1.00	1.00			
noremental Delay, d2	0.3			1.8	1.7			
Delay (s)	3.5			7.1	29.2			
Level of Service	A			A.	C			
Approach Delay (s)	3.5			7.1	29.2			
Approach LOS	A			A.	C			
intersection Summary								
HCM Average Control E)elay		7.6	H	ICM Let	vel of Service	A	
HCM Volume to Capacit	ty natio -		0.63					
Actuated Cycle Length (75.0			ost time (s)	7.2	
Intersection Capacity Ut	itzation		51.8%	H	SU Levi	el of Service	A	
			15					
Analysis Period (min) Critical Lane Group			15				~	
Baseline ISBAK INC.								Synchro 6 Rep: Page

1109 - Sarayburnu Intersection - AM Peak, Optimum

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HCM Signalized int 3: Int									09.04.2006
	+	.	*	+	1	<u>^</u>			
Movement	EBT	EBR	WBL	WET	NBL	NBR			
Lane Configurations	- † ₽-			- <u>††</u>	<u>' 11'</u>				
Ideal Flow (vphpi)	1891	1891	1801	1891	1891	1801			
Lane Width	3.0	3.6	3.6	3.0	3.3	3.6			
Grade (%)	0%			4%	-8%				
Total Lost time (s)	3.6			3.6	3.6				
Lane Util, Factor	0.95			0.95	0.97				
Frt	0.99			1.00	0.99				
Fit Protected	1.00			1.00	0.96				
Satd. Flow (prot)	3271			3254	3433				
Fit Permitted	1.00			1.00	0.96				
Satd. Flow (perm)	3271			3254	3433				
Volume (voh)	1473	134	0	859	216	21			
Peak-hour factor, PHF	0.87	0.87	0.96	0.96	0.85	0.85			
Adi, Flow (voh)	1693	154	0	895	254	25			
RTOR Reduction (vph)		0	õ	0	9	0			
Lane Group Flow (vph)		0	ō	895	27.0	ō			
Heavy Vehicles (%)	1%	4%	0%	1%	1%	5%			
Turn Type									
Protected Phases	2			2	1				
Permitted Phases					-				
Actuated Green, G (s)	60.0			60.0	16.0				
Effective Green, g (s)	60.4			60.4	15.4				
Actuated g/C Ratio	0.73			0.78	0.19				
Clearance Time (s)	4.0			4.0	3.0				
Lane Grp Cap (vph)	2390			2368	637				
	0.58			0.28	00.08				
wis Batto Perm									
wo Ratio	0.77			0.38	0.42				
Uniform Delay, d1	7.0			4.2	29.9				
Progression Factor	1.00			1.00	1.00				
Incremental Delay, d2	2.5			0.5	2.1				
Delay (s)	9.5			4.7	31.9				
Level of Service	A			A	C				
Approach Delay (s)	0.5			4.7	31.9				
Approach LOS	A			A	C.				
Internetien Burneren									
Intersection Summary									
HCM Average Control (10.2	H	ICM Le	vel of Service		В	
HCM Volume to Capaci			0.70					_	
Actuated Cycle Length			83.0			ost time (s)	7		
Intersection Capacity U	ilzator		58.7%		DU Levi	el of Service		В	
Analysis Period (min) c Critical Lane Group			15						
Baselne ISBAK INC.								Syn	ohro 6 Repo Page

1109 - Sarayburnu Intersection - PM Peak, Existing

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9: Int								09.04.200
	ţ	~	*	÷	~	م ر		
Movement	EBT	EBR	WBL	WET	NBL	NBR		
Lane Configurations	11Þ			- 44	- 1 17			
ideal Flow (vohol)		1891	1801	1891		1801		
Lane Width	3.0	3.6	3.6		2.3	3.6		
Grade (%)	0%			4%	-8%			
Total Lost time (s)	3.6			3.6				
Lane Util, Factor	0.95				0.97			
Frt	0.99				0.00			
Fit Protected	1.00				0.96			
Satd. Flow (prot)	3271			3254				
	1.00				0.96			
Satd. Flow (perm)	3271			3254				
		184	0	859	216	21		
Volume (vph) Peak-hour factor, PHF	0.07	0.87	0.96		0.85	0.85		
Adi. Flow (vph)	1993	154	0.96	895	254	25		
Act, How (vpn) RTOR Reduction (vph)	1693	164	0	896 0	254	25		
Lane Group Flow (vph)			0	995		0		
	1639				27.0			
	1%	4%	0%	1%	12.	5%		
Turn Type	_			2				
Protected Phases	2			2	1			
Permitted Phases								
Actuated Green, G (s)	63.0			63.0	12.0			
Effective Green, g (s)	63.4				11.4			
Actuated g/C Ratio	0.77			0.77	0.14			
Clearance Time (s)	4.0			4.0	3.0			
Lane Grp Cap (vph)	2529			2516	477			
	00.58			0.28	00.08			
vis Ratio Perm								
wo Ratio	0.73				0.57			
	4.8				33.0			
Progression Factor	1.00				1.00			
incremental Delay, d2	1.9			0.4	4.8			
Delay (s)	6.7			3.3	37.8			
Level of Service	A.			A.				
Approach Delay (s)	6.7			3.3	37.8			
Approach LOS	A			A	D			
Intersection Summary								
							-	
HCM Average Control D)elay		8.8		ICM Lev	el of Service	A	
HCM Volume to Capaci			0.70					
Actuated Cycle Length (82.0			est time (s)	7.2	
Intersection Capacity Ut	lizator	1	58.7%	н		a of Service	В	
Analysis Period (min)			15					
Critical Lane Group								
Baseline SBAK INC							8	ynchro 6 Rep Page

1109 - Sarayburnu Intersection - PM Peak, Optimum

1102: Int								09.04.200
	٠	~	~	t	Ļ	~		
Movement	EBL.	EBR	NBL	NET	SBT	SBR		
Lane Configurations			- N	- †	_ ff⊁			
ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891		
Lane Wildth	3.6	3.6	3.9	3.3	3.2	3.6		
Total Lost time (s)			3.3		3.3			
Lane Util, Factor			1.00		0.95			
Frt			1.00					
Fit Protected			0.95		1.00			
Satd. Flow (prot)			1838	1792				
Fit Permitted			0.95		1.00			
Satd. Flow (perm)			1838	1792				
Volume (vph)	0	0	248	1375	366	44		
Peak-hour factor, PHF		0.92	0.84		0.90	0.79		
Adj. Flow (vph)	0	0	295	1432	407	56		
RTOR Reduction (vph)	0	0	0		14	0		
Lane Group Flow (vph)	0	0	295	1432	449	0		
Heavy Vehicles (%)	- 0%	- 0%	1%	2%	-6%	2%		
Turn Type			Prot					
Protected Phases			1	12	2			
Permitted Phases								
Actuated Green, G (s)			25.0		45.0			
Effective Green, g (s)			24.7	77.0				
Actuated g/C Ratio			0.32	1.00	0.59			
Clearance Time (s)			3.0		4.0			
Lane Grp Cap (vph)			590					
wis Ratio Prot			0.16	08.90	0.14			
ws Ratio Perm								
wo Ratio			0.50	0.80	0.24			
Uniform Delay, d1			21.2		7.4			
Progression Factor			1.27	1.00	1.00			
Incremental Delay, d2			2.4	3.1	0.3			
Delay (s)			29.3	3.1	7.7			
Level of Service			C	A				
Approach Delay (s)	0.0			7.6				
Approach LOS	A.			A.	A.			
Intersection Summary								
HCM Average Control D)olav		7.8	н	CMLe	el of Service	A	
HCM Volume to Capacit			0.80				••	
Actuated Cycle Length (77.0	8	um of h	ost time (s)	0.0	
Intersection Capacity Ut		1	76.0%			al of Service	D	
Analysis Period (min)			15				-	
Critical Lane Group								
a onecarciale croep								
Baseline								Synchro 6 Repo

1102 A - Ahırkapı Intersection - A, AM Peak, Existing

★ BL 991 4.4 1% 3.3 .00	EBR 1991 3.6	NBL 1891 3.6	1891 3.3 0%	\$8T 1891 3.0	> SBR 1891 3.6		
991 4.4 1% 3.3	1891	1891	++ 1891 3.3	1691	1891		
991 4.4 1% 3.3			1891 3.3	1891			
4.4 1% 3.3			3.3				
1% 3.3	3.6	3.6		3.0	(D. (C)		
3.3					- C- C- C- C- C- C- C- C- C- C- C- C- C-		
			976	0%			
.00			8.3	3.3			
			0.95				
.94			1.00	1.00			
.97			1.00	1.00			
194			3405	3194			
.97			1.00	1.00			
194			3405	3194			
81	57	0	1542	367	0		
.88	0.88	0.06			0.90		
92	65	0	1908	408	0		
33	0	õ	0	0	ŏ		
124	Ū.	ō	1606	406	ŏ		
0%	14%	0%	2%		0%		
2			1	1			
-							
2.0			50.0	59.0			
8.0			3.0	3.0			
17.2			2506	2435			
			THE REPORT OF THE	and the			
45			0.62	0.17			
9.7							
5.4							
5.1							
51							
124				· · ·			
ay 🛛		6.9	H	ICM Lev	el of Service	A.	
atio		0.59					
		77.0					
ation	i J		11	CU Leve	al of Service	D	
		15					
	07 94 81 88 92 93 124 0% 2 2 0% 2 2 0% 2 2 0% 1.7 .15 3.0 07 .15 3.0 07 .45 9.7 .00 5.4 5.1 D 5.1 D 5.1 D 5.1 .00 .00 .00 .00 .00 .00 .00	07 94 81 57 88 0.88 92 65 33 0 124 0 0% 14% 2 2 0 1.7 .15 3.0 273 .07 .45 9.7 .00 5.4 5.1 D 5.1 D 5.1 D	07 104 81 57 0 88 0.88 0.96 92 65 0 33 0 0 124 0 0 124 0 0 124 0 0 125 0 143, 0%, 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3	.97 1.00 '94 3405 81 57 0 1542 .88 0.88 0.96 0.96 92 85 0 1606 33 0 0 0 124 0 0 1606 0% 14% 0% 2% 2 1 1 2 2 1 1 2 2 1 30 1606 0% 14% 0% 2% 2 1 1 5 2.0 50.0 1.7 58.7 .15 0.76 3.0 3.0 273 2596 .07 c0.47 .45 0.62 .07 .0.62 .07 c0.47 .1 .1 .00 1.00 .2 .2 .145 0.52 .2 .4 .1 5.2 .2 .4 <	.97 1.00 1.00 '94 3405 3194 81 57 0 1542 367 .88 0.88 0.96 0.96 0.90 92 85 0 1606 408 33 0 0 0 0 92 85 0 1606 408 33 0 0 0 0 92 85 0 1606 408 33 0 0 0 0 124 0 0 1606 408 0% 14% 0% 2% 5% 2 1 1 1 1 2.0 58.0 59.0 59.0 1 1.7 58.7 58.7 58.7 58.7 3.0 3.0 3.0 3.0 3.0 2.73 2596 2435 .07 c0.47 0.13 .45	97 1.00 1.00 '94 3405 3194 '81 57 0 1542 357 0 .88 0.88 0.96 0.96 0.90 0.90 92 65 0 1606 408 0 33 0 0 0 0 0 124 0 0 1606 408 0 2 1 1 1 1 2.0 50.0 50.0 1 1 2.0 50.0 50.0 1 1 2.0 50.0 50.0 1 1 2.0 50.0 50.0 1 1 2.0 50.0 50.0 1 1 2.0 50.0 50.0 1 1 2.0 50.0 50.0 1 1 3.0 3.0 3.0 3.0 1 0.73 2596 24.35	97 1.00 1.00 194 3405 3194 81 57 0 1542 367 0 .88 0.88 0.96 0.90 0.90 90 92 65 0 1606 408 0 33 0 0 0 0 124 0 0 1606 408 0 00 14% 09% 2% 5% 09% 2% 1

1102 B - Ahırkapı Intersection - B, AM Peak, Existing

HCM Signalized intr 1102: Int			· · · · · · · · · · · · · · · · · · ·					09.04.200
	٨	~	٠,	Ť	Ļ	7		
Movement	EBL	EBR	NBL	NET	SBT	SBR		
Lane Configurations	_		- M	- *	11-			
ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891		
Lane Width	3.6	3.6	3.9	3.3	3.2	3.6		
Total Lost time (s)			3.3	3.3	3.3			
Lane Util, Factor			1.00	1.00	0.95			
Frt			1.00	1.00	0.90			
Fit Protected			0.95	1.00	1.00			
Satd. Flow (prot)			1802	1792	3351			
Fit Permitted			0.95	1.00	1.00			
Satd. Flow (perm)			1802	1792	3351			
Volume (vph)	0	0	115	87.2	1410	45		
Peak-hour factor, PHF	0.92	0.92	0.81		0.88	0.80		
Adi. Flow (vph)	0	0	142	938	1602	56		
RTOR Reduction (vph)	õ	Ŭ,	0	0	3	0		
Lane Group Flow (vph)	ō	õ	142	938	1655	õ		
Heavy Vehicles (%)	0%	0%	396	2%	2%	095		
Turn Type			Prot					
Protected Phases			1	12	2			
Permitted Phases								
Actuated Green, G (s)			20.0	92.0	65.0			
Effective Green, g (s)			19.7	92.0	65.7			
Actuated g/C Ratio			0.21	1.00	0.71			
Clearance Time (s)			3.0		4.0			
Lane Grp Cap (vph)			386	1702	2393			
wis Ratio Prot				00.52				
ws Ratio Perm								
wh Batin			0.37	0.52	0.69			
Uniform Delay, d1			30.8	0.0	7.4			
Progression Factor			1.35	1.00	1.00			
Incremental Delay, d2			2.5	1.0	1.7			
Delay (s)			44.2	1.0	9.1			
Level of Service			D	A	4			
Approach Delay (s)	0.0			6.7	9.1			
Approach LOS	Δ			Δ.				
Intersection Summary								
HCM Average Control D)elay 👘		8.2	H	ICM Let	vel of Service	A	
HCM Volume to Capaci			0.65					
Actuated Cycle Length (92.0			ost time (s)	3.3	
Intersection Capacity Ut	ilzator	1 1	60.3%	ŀ	CU Levi	al of Service	В	
Analysis Period (min)			15					
 Critical Lane Group. 								
•								
Baseline								Synchro 6 Repor

1102 A - Ahırkapı Intersection - A, PM Peak, Existing

								09.04.200
	هر	~	-	Ť	Ļ	~		
Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations	- Y7			- † †	- 1 1-			
ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891		
Lane Wildth	4.4	3.6	3.6	3.3	3.0	3.6		
Grade (%)	- 1%			0%	0%			
Total Lost time (s)	3.3			3.3	3.3			
Lane Util, Factor	1.00			0.95	0.95			
Frt	0.92			1.00	1.00			
Fit Protected	0.98			1.00	1.00			
Satd. Flow (prot)	1864			3405	3298			
Fit Permitted	0.98			1.00	1.00			
Satd. Flow (perm)	1864			3405	3298			
Volume (vph)	- 81	162	0	906	1409	0		
Peak-hour factor, PHF	0.71	0.93	0.93	0.93	0.88	0.89		
Adj. Flow (vph)	114	174	0	974	1601	0		
RTOR Reduction (vph)	54	0	ō	0	0	ō		
Lane Group Flow (vph)	234	0	0	074	1601	ō		
Heavy Vehicles (%)	0%	0%	0%	2%	2%	0%		
Turn Type								
Protected Phases	2			1	1			
Permitted Phases				-				
Actuated Green, G (s)	16.0			70.0	70.0			
Effective Green, g (s)	15.7			69.7	69.7			
Actuated g/C Ratio	0.17			0.76	0.7.6			
	3.0			3.0	3.0			
Lane Grp Cap (vph)	318			2580	2491			
	of 18				r0.49			
vis Batio Perm								
vio Ratio	0.74			0.38	0.64			
Uniform Delay, d1	36.2			3.8	5.3			
Progression Factor	1.00			1.00	0.83			
noremental Delay, d2	14.1			0.4	0.9			
Delay (s)	50.3			4.2	5.3			
Level of Service	D			A	A			
Approach Delay (s)	50.3			4.2	5.3			
Approach LOS	D			4	4			
	-			• •	••			
Intersection Summary								
HCM Average Control D			9.4	H	ICM Le	vel of Service	A	
HCM Volume to Capacit	ty natio		0.66					
Actuated Cycle Length (92,0			ost time (s)	6.6	
intersection Capacity Ut	lization	1 1	60.9%	18	CU Levi	el of Service	в	
			15					
Analysis Period (min) Critical Lane Group								

1102 B - Ahırkapı Intersection - B, PM Peak, Existing

HCM Signalized Inte	ersect	ion Ca	apacity	/ Analy	818			
1102: Int								09.04.2006
	هر	* *	\neg	Ť	Ŧ	~		
Movement	EBL	EBR	NBL	NBT		SBR		
Lane Configurations			- N	- †	- 1 1+-			
ideal Flow (vphpi)	1891	1891	1801	1891	1891	1891		
Lane Width	3.6	3.6	3.9	3.3	3.2	3,6		
Total Lost time (s)			3.3	3.3	3.3			
Lane Util, Factor			1.00	1.00				
Frt			1.00	1.00	0.99			
Fit Protected			0.95		1.00			
Satd. Flow (prot)			1802	1792				
Fit Permitted			0.95		1.00			
Satd. Flow (perm)			1802					
Volume (vph)	0	0	115		1410	45		
Peak-hour factor, PHF		0.92	0.81		0.88	0.80		
Adj. Flow (vph)	0	0	142		1602	56		
RTOR Reduction (vph)	0	0	0	0	3	0		
Lane Group Flow (vph)	0	0	142		1655	0		
Heavy Vehicles (%)	- 0%	- 0%	- 3%	2%	2%	0%		
Turn Type			Prot	_	_			
Protected Phases			1	12	2			
Permitted Phases								
Actuated Green, G (s)			16.0		48.0			
Effective Green, g (s)			15.7		48.7			
Actuated g/C Ratio			0.22	1.00	0.69			
Clearance Time (s)			3.0		4.0			
Lane Grp Cap (vph)			398	1792				
vis Ratio Prot			0.08	00.52	00.49			
vis Ratio Perm								
wo Ratio Uniform Delay, di			0.36	0.52	0.7.2 6.9			
			23.4		6.9 1.00			
Progression Factor Incremental Delay, d2			1.35	1.00	1.00			
Delay (s)			2.3	1.0				
Letay (s) Level of Service			33.8 C		8.9 A			
Approach Delay (s)	0.0		100	5.8 	8.9			
Approach LOS	a u			a.a A	0. M A			
	<i></i>							
Intersection Summary								
HCM Average Control D			7.5	H	ICM Lev	el of Service	A	
HCM Volume to Capacit			0.66					
Actuated Cycle Length ((8)		71.0			ost time (s)	3.3	
Intersection Capacity Ut	lization	1	60.3%	В	CU Leve	al of Service	В	
Analysis Period (min) c Critical Lane Group			15					
o Critical Lane Group								
Baseline ISBAK INC.								Synchro 6 Report Page 1

1102 A - Ahırkapı Intersection - A, PM Peak, Optimum

								09.04.20
	٠	5	٦.	t	Ļ	~		
Movement	EBL.	EBR	NBL	NET	SBT	SBR		
Lane Configurations	- Y			- † †	- 1 1-			
ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891		
LaneWidth	4.4	3.6	3.6	8.3	3.0	3.6		
Grade (%)	- 1%			0%	0%			
Total Lost time (s)	3.3			3.3	3.3			
Lane Util, Factor	1.00			0.95	0.95			
Frt	0.92			1.00	1.00			
Fit Protected	80.0			1.00	1.00			
Satci, Flow (prot)	1864			3405	3296			
Fit Permitted	0.98			1.00	1.00			
Satd. Flow (perm)	1864			3405	3298			
Volume (vph)	81	162	0	906	1409	0		
Peak-hour factor, PHF	0.71	0.93	0.93	0.93	0.88	0.88		
Adi. Flow (vph)	114	174	0		1601	0.00		
RTOR Reduction (vph)	47	0	ŏ	0	0	ō		
Lane Group Flow (vph)	241	0	ō	074	1601	ő		
Heavy Vehicles (%)	0%	0%	0%	2%	2%	0%		
Turn Type		2 - 200			- 1986 - 1997			
Protected Phases	2			1	1			
Permitted Phases								
Actuated Green, G (s)	13.0			52.0	52.0			
Effective Green, g (s)	12.7				51.7			
Actuated g/C Ratio	0.18			0.73	0.73			
Clearance Time (s)	3.0			3.0	3.0			
Lane Grp Cap (vph)	333			2470	2304			
	ooo o0.13				00.49			
ws Habo Prot	eutra			0.23	00.49			
wo natio nwimi wo Ratio	0.72			0.39	0.67			
Uniform Delay, d1	27.5			3.7	5.1			
Progression Factor	1.00			1.00	1.11			
Incremental Delay, d2	12.9			0.5	1.0			
Delay (s)	40.4			4.1	6.7			
Level of Service	40.4 D			4.1 A	A.			
	40.4			4.1	8.7			
Approach Delay (s)	40.4 D			4.1	6.7 A			
Approach LOS	U.			A	A			
Intersection Summary								
HCM Average Control D			9.2	н	ICM Le	vel of Service	A	
HCM Volume to Capaci			0.68					
Actuated Cycle Length			71.0	5	um of I	ost time (s)	6.6	
		1	50.3%			el of Service	В	
Intersection Capacity U								
			15					

1102 B - Ahırkapı Intersection - B, PM Peak, Optimum

											26.03	
	کر	-+	\mathbf{r}	*	+	۰.		•	<u>/*</u>	\≁	Ļ	\checkmark
Movement	EBL.	EBT	EBR	WEL.	WBT	WBR	NBL.	NBT	NBR	SEL.	SBT .	SEP
Lane Configurations					नाम		_	- 11-			tr⊢	
Ideal Flow (vphpi)	1891	1891	1801	1891	1891	1891	1891	1801	1801	1891	1801	1891
Lane Width	3.6	2.5	3.6	3.6	3.2	3.6	3.6	3.3	3.6	3.6	3.2	3.6
Grade (%)		0%			1%			2%			-5%	
Total Lost time (s)		3.6			3.6			3.6			3.6	
Lane Util, Factor		1.00			0.95			0.95			0.95	
Frt		0.92			0.95			1.00			0.00	
Fit Protected		0.98			O OR			1.00			1.00	
Satd. Flow (prot)		1439			3148			327.5			3326	
Fit Permitted		0.96			0.98			1.00			1.00	
Satd. Flow (perm)		1439			3148			327.5			3326	
			P1.91	1000		1.8.1						P.C
Volume (vph)	31	0	39	126	115	184	0	711	0	0	874	50
Peak-hour factor, PHF	0.83	0.83	0.83	0.94	0.94	0.94	0.87	0.87	0.87	0.69	0.89	0.89
Adj. Flow (vph)	37	0	47	134	122	143	0	817	0	0	982	- 56
RTOR Reduction (vph)	0	40	0	0	96	0		0	0	0	5	0
Lane Group Flow (vph)	0	44	0	0	303	0	0	817	0	0	1033	6
Heavy Vehicles (%)	6%	0%	3%	1%	1%	1%	- 0%	5%	0%	- 69%	- 5%	- 4%
Turn Type	Split			Split								
Protected Phases	3	3		2	2			1			1	
Permitted Phases												
Actuated Green, G (s)		12.0			17.5			41.0			41.0	
Effective Green, g (s)		11.4			15.9			41.9			41.9	
Actuated g/C Ratio		0.14			0.20			0.52			0.52	
Clearance Time (s)		3.0			2.0			4.5			4.5	
Lane Grp Cap (vph)		205			626			1715			1742	
w's Ratio Prot		00.03			00.10			0.25			00.91	
vis Ratio Perm												
wo Ratio		0.21			0.48			0.48			0.50	
Uniform Delay, d1		30.3			28.4			12.1			18.2	
Progression Factor		1.00			1.00			1.00			1.00	
incremental Delay, d2		2.4			2.7			1.0			1.5	
Delay (s)		32.7			31.1			13.0			14.7	
Level of Service		C			C			B			в.	
Approach Delay (s)		32.7			31.1			13.0			14.7	
Approach LOS		oer C			ан.н С			B			- 14.7 B	
Approach LOS		G			G			в			в	
Intersection Summary												
HCM Average Control D)elev		17.5	H	ICM Le	vel of St	ervice		B			
HCM Volume to Capacit			0.51									
			80.0	8	sum of I	ost time	(5)		10.8			
			51.2%	H	CU Lev	al of Ser	Nice		A			
Actuated Cycle Length (
Actuated Cycle Length (Intersection Capacity Ut			15									
Actuated Cycle Length (

1115 - Silivrikapı Intersection - Off-peak, Existing

	4							_				
	هر	+	\mathbf{P}	*	•	٠.	\sim			\mathbf{F}	÷	~
	EBL.	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	88T	SE
ane Configurations		- 4 -			-tt-			11			- 1 1+-	
	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	180
Lane Width	3.6	2.5	3.8	3.6	3.2	3.6	3.6	3.3	3.6	3.6	3.2	- 3
Grade (%)		0%			1%			2%			-5%	
Total Lost time (s)		3.6			3.6			3.6			3.6	
Lane Util, Factor		1.00			0.95			0.95			0.95	
Frt		0.93			0.94			1.00			0.99	
Fit Protected		0.07			0.98			1.00			1.00	
Satd. Flow (prot)		1469			3160			3244			3325	
Fit Permitted		0.97			0.98			1.00			1.00	
Satd. Flow (perm)		1469			3160			3244			3325	
Volume (vph)	35	0	- 33	125	113	143	0	710	0	0	848	{
	0.94	0.94	0.94	0.89	0.89	0.89	0.91	0.91	0.91	0.89	0.89	0.8
Adj. Flow (vph)	37	0	35	140	127	161	0	780	0	0	953	- 1
RTOR Reduction (vph)	0	32	0	0	134	0	0	0	0	0	9	
Lane Group Flow (vph)	0	40	0	0	294	0	0	780	0	0	1000	
Heavy Vehicles (%)	0%	0%	6%	- 0%	- 0%	1%	- 6%	6%	0%	- 69%	5%	4
	Split			Split								
Protected Phases	3	3		2	2			1			1	
Permitted Phases												
Actuated Green, G (s)		5.0			10.0			26.5			26.5	
Effective Green, g (s)		4.9			8.4			28.9			26.9	
Actuated g/C Ratio		0.10			0.16			0.53			0.53	
Clearance Time (s)		3.5			2.0			4.0			4.0	
Lane Grp Cap (vph)		141			520			1711			1754	
vis Ratio Prot		o0.03			00.09			0.24			00.30	
vis Ratio Perm												
vio Ratio		0.29			0.56			0.46			0.57	
Uniform Delay, d1		21.4			19.6			7.5			8.1	
Progression Factor		1.00			1.00			1.00			1.00	
incremental Delay, d2		5.0			4,4			0.9			1.4	
Delay (s)		28.5			24.0			8.4			9.5	
Level of Service		C			C			A			A	
Approach Delay (s)		28.5			24.0			8.4			9.5	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control De	alav:		12.4	ŀ	ICM Le	vel of S	envice		В			
HCM Volume to Capacity	ratio		0.53						_			
Actuated Cycle Length (s			51.0	8	ar of I	ost time	(5)		10.8			
Intersection Capacity Util			50.5%			el of Ser			A			
Analysis Period (min)			15									
Critical Lane Group												

1115 - Silivrikapı Intersection - Off-peak, Optimum C=51

28 0.97 29 0 7%	WEL 1801 3.6 1801 3.6 1801 0.06 132 0.06 132 0.05 132 0.05 132 0.05 132 2 2	WBT 411- 1891 3.2 1% 3.6 0.95 0.94 0.98 3126 0.98 326 226 226 226 226 226 226 226 226 226	*. WBR 1891 3.6 1991 3.6 0.96 142 0 0 2%	NEL 1801 3.6 0.00 0 0.00 0 0.00 0 0.00 0 0.00 0 0 0 0 0 0 0 0 0 0 0 0	► NBT 44- 1891 3.3 29% 3.6 0.95 1.00 3275 1.00 3275 1.00 3275 728 0.99 735 0.99 735 0.99 735 0.99 735 0.99 1.00 3275 1.00 3275	0 0,00 0,00 0,00 0,00 0,00 0,00 0,00 0	SBL 1891 3.5 0 0.07 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SBT 1891 3.2 -5% 3.6 0.95 0.99 1.00 3358 7.04 0.97 872 4% 1 47.5 47.9 0.58 4.0	3.0 50 0.00 60 () ()
1891 3.6 28 0.97 29 0 0	1891 3.6 127 0.96 132 0 0 0 0,0 5 pit	411- 1991 3.2 1% 3.6 0.95 0.94 0.98 3126 26 28 3126 28 32 32 32 32 32 32 32 32 32 32 32 32 32	1991 3.6 136 0.96 142 0 0	1891 3.6 0.09 0 0 0	41- 1891 3.3 9.6 0.95 1.00 3275 728 0.99 735 5% 1 47.5 47.5 0.58	1891 3.6 0 0.99 0 0 0 0	1891 3.6 0 0.07 0 0 0 0	111- 1291 3.2 -5% 3.6 0.95 0.99 1.00 3358 7.94 0.97 87.9 4% 1 47.5 47.9 0.58	189 3) 5 0.9 6
3.6 3.6 0.97 29 0 0	127 0.96 132 0 0 0 0 0 0 8pit	1801 3.2 1% 3.6 0.95 0.94 0.98 3126 0.98 326 0.98 326 0.98 326 0.98 326 226 226 326 226 226 226 226 226 226	3,6 136 0,96 142 0	3.6 0.00 0 0	1891 3.3 2% 3.6 0.95 1.00 3275 1.00 3275 728 0.99 735 0.99 735 0.99 735 5% 1 47.5 47.9 0.58	3,6 0,99 0 0 0	0 0.07 0 0	1891 3.2 -5% 3.6 0.95 0.99 1.00 3358 1.00 3358 794 0.97 819 7 872 4% 1 47.5 47.5 47.9 0.58	3) 0.9 9
3.6 3.6 0.97 29 0 0	127 0.96 132 0 0 0 0 0 0 8pit	3.2 1% 3.6 0.95 0.94 0.98 3126 0.98 3126 98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	3,6 136 0,96 142 0	3.6 0.00 0 0	3.3 2% 3.6 0.95 1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	3,6 0,99 0 0 0	0 0.07 0 0	3.2 -5% 3.6 0.95 0.99 1.00 3358 1.00 3358 794 0.97 819 7 872 4% 1 47.5 47.5 47.9 0.58	58 0.97 60 (
28 0.97 29 0 0	127 0.95 132 0 0 0 0 0 8pit	1% 3.6 0.95 0.94 0.98 3126 0.98 3126 0.98 3126 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	136 0.96 142 0	0,99	2% 3.6 0.95 1.00 3275 1.00 3275 728 0.99 735 0.99 735 0.99 735 1 47.5 47.9 0.58	000000000000000000000000000000000000000	0 0.w 0 0	-5% 3.6 0.95 0.99 1.00 3358 1.00 3358 794 0.97 879 495 7 872 4% 1 47.5 47.9 0.58	0.97 60 (
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	3.6 0.95 0.94 0.98 3126 0.98 3126 0.98 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	3.6 0.95 1.00 1.00 3275 1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	3.6 0.95 0.99 1.00 3358 1.00 3358 794 0.97 879 495 495 475 47.5 47.5 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	0.95 0.94 0.98 3126 0.98 3126 0.98 3126 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	0.95 1.00 1.00 3275 1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	0.95 0.99 1.00 3358 1.00 3358 794 0.97 879 879 4% 1 47.5 47.5 47.5 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	0.94 0.98 3126 0.98 3126 98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	1.00 1.00 3275 1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	0.99 1.00 3358 1.00 3358 794 0.97 879 879 4% 1 47.5 47.5 47.9 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	0.98 3126 0.98 3126 98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	1.00 3275 1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	1.00 3358 1.00 3358 794 0.97 879 7 872 4% 1 47.5 47.9 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	3126 0.98 3126 98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	3275 1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.5 0.58	0.99 0 0	0.07 0 0 0	3358 1.00 3358 794 0.97 819 7 872 4% 1 47.5 47.5 47.9 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	0.98 3126 98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	1.00 3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	1.00 3358 794 0.97 872 4% 1 47.5 47.9 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	3126 98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	3275 728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	3358 794 0.97 819 7 872 4% 1 47.5 47.9 0.58	0.07 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	98 0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	728 0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	794 0.97 819 7 872 4% 1 47.5 47.5 47.9 0.58	0.97 60 0
0.97 29 0 0	0.06 132 0 0 0 0 0 0 5 9 1	0.96 102 111 265 2% 2 18.0 16.4 0.20 2.0 625	0.96 142 0	0.00 0 0 0	0.99 735 0 735 5% 1 47.5 47.9 0.58	0.99 0 0	0.07 0 0 0	0.97 819 7 872 4% 1 47.5 47.5 47.9 0.58	60 0 0
29 0 0	132 0 0% Split	102 111 265 2% 2 18.0 16.4 0.20 2.0 625	142 0	0	735 0 735 5% 1 47.5 47.9 0.58	000	0 0	819 7 872 4% 1 47.5 47.9 0.58	
0	0 0 0% Split	111 265 2% 28 18.0 16.4 0.20 2.0 625	0	ŏ	0 735 5% 1 47.5 47.9 0.58	0	0 0	7 872 4% 1 47.5 47.9 0.58	0
Ō	0 OK. Split	265 2% 18.0 16.4 0.20 2.0 625	0	0	735 5% 1 47.5 47.9 0.58	0	0	872 4% 1 47.5 47.9 0.58	6
	ov. Split	2% 2 18.0 16.4 0.20 2.0 625			5% 1 47.5 47.9 0.58			4% 1 47.5 47.9 0.58	0%
7%	Split	2 18.0 16.4 0.20 2.0 625	2%	0%	1 47.5 47.9 0.58	0%	09%	1 47.5 47.9 0.58	0%
		18.0 16.4 0.20 2.0 625			47.5 47.9 0.58			47.5 47.9 0.58	
	2	18.0 16.4 0.20 2.0 625			47.5 47.9 0.58			47.5 47.9 0.58	
		16.4 0.20 2.0 625			47.9 0.58			47.9 0.58	
		16.4 0.20 2.0 625			47.9 0.58			47.9 0.58	
		0.20 2.0 625			0.58			0.58	
		2.0 625							
		625			4.0			AL 17.	
					1913			1962	
		00.08			0.22			o0.26	
		0.42			0.38			0.44	
		28.7			9.1			9.6	
		1.00			1.00			1.00	
								10.3	
								В	
					9.7				
		C			A			В	
14.8	L	ICML-	val of S	arvina		R			
		aum of l	ost time	0.04		10.8			
				- N. K.					
	14.8 0.43 82.0 18.3% 15	0.43 82.0 S 18.3% II	2.1 30.8 C 30.8 C 14.8 HCM Le 0.43 82.0 Sum of I 18.3% ICU Lev	2.1 30.8 C 30.8 C 14.8 HCM Level of S 0.43 82.0 Sum of lost time 18.3% ICU Level of Ser	2.1 S0.8 C S0.8 C 14.8 HCM Level of Service 0.43 82.0 Sum of lost time (s) 18.3% ICU Level of Service	2.1 0.6 30.8 0.7 C A 30.8 0.7 C A 30.8 0.7 C A 14.8 HCM Level of Service 0.43 82.0 Sum of lost time (s) 18.3% ICU Level of Service	2.1 0.6 30.8 0.7 C A 30.8 0.7 C A 30.8 0.7 C A 14.8 HCM Level of Service B 0.43 82.0 Sum of lost time (s) 10.8 18.3% ICU Level of Service A	2.1 0.6 30.8 0.7 C A 30.8 0.7 C A 14.8 HCM Level of Service B 0.43 82.0 Sum of lost time (s) 10.8 18.3% ICU Level of Service A	2.1 0.6 0.7 30.8 9.7 10.3 C A B 30.8 9.7 10.3 C A B 30.8 9.7 10.3 C A B 0.43 82.0 Sum of lost time (s) 10.8 18.3% ICU Level of Service A

1115 - Silivrikapı Intersection - Off-peak, Optimum C=82

HCM Signalized Inte 3: Int											27.0	3.200
	Ē	1	ſ	ي.	Ļ	J.	۶	1	4	4	×	Þ
Movement	NBL.	NBT	NBR	SBL	88T	SBR	NEL		NER	SWL		
Lane Configurations		411-			4件+			-41	r		- 4° †-	
ideal Flow (vphpl)	1891	1891	1801	1891	1891	1891	1891	1891	1801	1891	1891	1891
Lane Wildth	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.8	4.8	3.6	3.6	4.8
Total Lost time (s)		3.6			3.6			3.6	3.6		3.6	
Lane Util, Factor		0.91			0.91			0.95	1.00		0.95	
Frt		0.97			0.99			1.00	0.85		1.00	
Fit Protected		0.98			0.99			0.99	1.00		0.98	
Satd. Flow (prot)		4623			4835			3302	1822		3293	
Fit Permitted		0.98			0.99			0.99	1.00		0.98	
Satd. Flow (perm)		4623			4835			3392	1822		3293	
Volume (vph)	261	361	143	179	428	26	174	725	3	278	564	(
Peak-hour factor, PHF	0.93	0.93	0.93	0.95	0.95	0.95	0.91	0.91	0.91	0.96	0.96	0.98
Adj. Flow (vph)	281	388	154	198	451	27	191	797	3	290	588	(
RTOR Reduction (vph)	0	42	0	0	-5	0	0	0	0	0	0	(
Lane Group Flow (vph)	0	781	0	0	661	0	0	088	3	0	878	(
Heavy Vehicles (%)	-3%	4%	14%	3%	3%	15%	4%	8%	0%	4%	- 9%	- 09
Turn Type	Spit			Split			Split		Free	Split		Free
Protected Phases	2	2		1	1		4	4		3	3	
Permitted Phases									Free			Free
Actuated Green, G (s)		17.0			12.0			28.0	00.00		21.0	
Effective Green, g (s)		16.4			11.4			27.4	90.0		20.4	
Actuated g/C Ratio		0.18			0.13			0.90	1.00		0.23	
Clearance Time (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		842			612			1033	1822		746	
vis Ratio Prot		00.17			00.14			00.29			00.27	
ws Ratio Perm									0.00			
wo Ratio		0.93			1.08			0.96	0.00		1.18	
Uniform Delay, d1		36.2			39.3			30.7	0.0		34.8	
Progression Factor		1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2		17.8			59.8			19.3	0.0		93.3	
Delay (s)		54.0			99.1			50.0	0.0		128.1	
Level of Service		D			F			D	A.		F	
Approach Delay (s)		54.0			99.1			49.8			128.1	
Approach LOS		D			F			D			F	
Intersection Summary												
HCM Average Control D	ielev.		81.1	H	ICM Le	el of B	ervice		F			
HCM Volume to Capacit	y ratio		1.03									
Actuated Cycle Length (90.0	5	um of h	ost time) (s)		14.4			
Intersection Capacity Ut		1	00.4%		OU Levi				E			
Analysis Period (min)			15									
o Critical Lane Group												
o oneos care circip												
Baseline SBAK NC										Syn	ehro 6	Repo Page

1162 A - Unverdi Intersection - Off-peak

1163 - Yayla Intersection - Off-peak

HCM Signalized Inte 1163: Int											26.03	1.2006
	۰	-	\mathbf{b}	*	•	۰.		•	مەر مەر	`≁	Ļ	~
Movement	EBL	EBT	EBR	WEL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBIR
Lane Configurations	_	- 11-	- r		<u></u>						÷-	-
and the second sec	1891	1891	1801	1891	1891	1891	1891	1891	1891	1891	1891	1891
Lane Width	3.6	3.5	3,6	3.6	3.9	3,6	3.6	4.8	3,6	3.6	4.8	3.6
Total Lost time (s)		3.6	3.6		3.6			3.6			3.6	
Lane Util, Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.98			0.99			0.97	
Fit Protected		1.00	1.00		1.00			0.98			0.98	
Satd. Flow (prot)		3260	1576		3251			1918			1863	
Fit Permitted		1.00	1.00		1.00			0.98			0.98	
Satd. Flow (perm)		3260	1576		3251			1918			1863	
Volume (vph)	0	901	41	0	709	83	120	163	27	185	263	123
Peak-hour factor, PHF	0.92	0.92	0.02	0.95	0.95	0.95	0.83	0.83	0.83	0.96	0.96	0.96
Adj. Flow (vph)	0	979	45	0	746	87	145	196	33	193	27.4	1.28
RTOR Reduction (vph)	0	0	11	0	10	0	0	4	0	0	11	0
Lone Group Flow (vph)	0	979	34	0	823	0	0	37.0	0	0	584	0
Heavy Vehicles (%)	-0%	- 9%	2%	- 0%.	12%	16%	7%	10%	4%	18%	6%	6%
Turn Type		-	pt+ov		-		Split			Split		
Protected Phases		3	3.1		3		1	1		2	2	
Permitted Phases												
Actuated Green, G (s)		40.0	67.0		40.0			24.0			14.0	
Effective Green, g (s)		39.4	66,4		39.4			23.4			14.4	
Actuated g/C Ratio		0.45	0.75		0.45			0.27			0.16	
Clearance Time (s)		3.0			3.0			3.0			4.0	
Lane Grp Cap (vph)		1460	1189		1456			510			305	
vis Ratio Prot		o0.30	0.02		0.25			00.19			00.91	
vis Ratio Perm												
wo Ratio		0.67	0.03		0.57			0.73			1.92	
Uniform Delay, d1		19.2	2.7		18.0			29.4			36.8	
Progression Faster		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		2.5	0.0		1.6			8.7			423.8	
Delay (s)		21.6	2.8		19.6			38.1			460.6	
Level of Service		C	A		В			D			F	
Approach Delay (s)		20.8			19.6			38.1			460.6	
Approach LOS		C			В			D			F	
Intersection Summary												
HCM Average Control Di	olav		115.3	F	ICM Le	vel of S	ervice		F			
HCM Volume to Capacity			0.92									
Actuated Cycle Length (s			88.0	5	arn of l	ost time	- 655		10.8			
Intersection Capacity Util		n	70.5%			el of Sei			C			
Analysis Period (min)	_		15						-			
o Critical Lane Group			1000									
а оператовна спор												
Baseline										,Qura	ohro 8 P	Papert

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3.6	→ EBT 41 1901 3.5	₩BT		\	4		
991 3.6	+11- 1891	- † †	WER	(CIC)			
3.6	1891				SER		
3.6			C	- N			
	100 A 100 A	1801	1891	1891	1891		
		3.8	2.5	4.2	2.5		
	3.6		3.6		3.6		
		0.95		1.00			
88	0,88	0.07					
181	1123	87.4	307	365	135		
0	0		60	0	0		
0	1284	874	247	385	135		
5%.	4%	6%		1126	5%		
hot			pt+ov		Free		
2	23	3	3.1	1			
	0.68		0.80		1.00		
					1344		
		0.25	0.20	00.21	~ ~ ~		
		r	0.04	4.00			
					0.1		
	13.6	9.9					
	в	A.		E			
		~ ~		LOOP ALL NO	and and Channeline		
ay natio:		0.94		TUM LET			
				are of h	ant time (ch	10.0	
ation					and the second sec		
NUMBER OF T						-	
	is1 0 5% Yot 2	0.09 3201 0.66 2252 142 088 58 0.88 161 1123 0 0 0 1284 5% 4% 700 2 2 3 62.0 60.8 0.68 0.83 0.68 0.78 10.0 1.00 0.3.7 13.6 8 13.6 8 13.6	3301 3465 0.66 1.00 2252 3465 142 088 849 .88 0.88 0.97 161 1123 874 0 0 0 0 1284 874 0 0 0 0 1284 874 0 0 0 0 1284 874 5% 4% 6% 700 0 0 62.0 51.0 60.8 50.4 0.68 0.56 3.0 1653 1940 60.09 0.25 60.43 0.78 0.45 10.0 11.7 1.00 1.00 3.7 0.8 13.6 12.4 8 8 13.6 9.0 8 A 4.4 4.4 9.0 8 A 4.4	0.99 1.00 1.00 3391 3465 1260 0.66 1.00 1.00 2252 3465 1260 142 988 848 298 88 0.88 0.97 0.97 161 1123 874 307 0 0 0 60 0 1284 874 247 5% 4% 6% 12% 700 0 0 60 0 1284 874 247 5% 4% 6% 12% 700 0 0 60 0 1284 874 247 5% 4% 6% 12% 12% 0 0 0 0 60 0 1284 874 247 5% 4% 6% 12% 12% 0 0 0 0 60 0 1284 874 247 5% 4% 6% 12% 100 112% 0.68 0.56 0.80 3.0 1653 1940 1014 c0.09 0.25 0.20 c0.43 0.78 0.45 0.24 10.0 11.7 2.1 1.00 1.00 1.00 3.7 0.8 0.6 13.6 12.4 2.7 B B A 13.6 9.9 B A 13.6 9.9 B A 13.6 9.9 B A	0.99 1.00 1.00 0.95 3201 3465 1260 1726 0.66 1.00 1.00 0.95 2252 3465 1260 1726 142 968 848 298 343 58 0.68 0.97 0.97 0.94 161 1123 874 307 365 0 0 0 60 0 0 1284 874 247 365 5% 4% 6% 12% 11% rot pt+ov 2 2 3 3 3 1 1 62.0 51.0 72.0 18.0 60.8 50.4 72.4 18.4 0.68 0.56 0.90 0.20 3.0 4.0 1653 1940 1014 353 o0.09 0.25 0.20 o0.21 o0.43 0.78 0.45 0.24 1.03 10.0 11.7 2.1 35.8 1.00 1.00 1.00 1.00 3.7 0.8 0.6 57.0 13.6 12.4 2.7 92.8 B B A F 13.6 9.9 67.8 B A E 13.6 9.9 67.8 B A E	0.99 1.00 1.00 0.95 1.00 3391 3465 1260 1726 1344 0.66 1.00 1.00 0.95 1.00 2252 3465 1260 1726 1344 142 988 848 298 343 127 .88 0.88 0.97 0.97 0.94 0.94 161 1123 874 307 365 135 0 0 0 60 0 0 0 1284 874 247 365 135 5% 4% 6% 12% 11% 5% Prot pt+ov Free 2 2.3 3 3.1 1 Free 62.0 51.0 72.0 18.0 90.0 60.8 5% 2 2.3 3 3.1 1 1 100 1.00 1.00 1.00 1.00 1.00 1.00 <td>0.99 1.00 1.00 0.95 1.00 3391 3465 1260 1726 1344 0.66 1.00 1.00 0.95 1.00 2252 3465 1260 1726 1344 142 988 848 298 343 127 .85 0.88 0.97 0.97 0.94 0.94 161 1123 874 307 365 135 0 0 0 60 0 0 0 1284 874 247 365 135 0 0 0 60 0 0 1284 874 247 365 135 140 pt+ov Free 2 2.3 3 1 1411 551 72.0 18.0 90.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0</td>	0.99 1.00 1.00 0.95 1.00 3391 3465 1260 1726 1344 0.66 1.00 1.00 0.95 1.00 2252 3465 1260 1726 1344 142 988 848 298 343 127 .85 0.88 0.97 0.97 0.94 0.94 161 1123 874 307 365 135 0 0 0 60 0 0 0 1284 874 247 365 135 0 0 0 60 0 0 1284 874 247 365 135 140 pt+ov Free 2 2.3 3 1 1411 551 72.0 18.0 90.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0

1164 - Kocasinan Girisi Intersection - Off-peak

1165 – Sirinevler Intersection – Off-peak

								26.03.200
	ھر	-+	+	٩	۰,	~		
Vovernent	EBL.	EBT	WBT	WBR	SBL	88R		
ane Configurations	-	- 44-1	hte.	- F	- W.			
	1891	1891	1891	1891	1891	1891		
ane Width	3.6	3.6	3.6	3.6	4.4	4.4		
Brade (%)		-7%	5%		-5%			
Total Lost time (s)		3.6	3.6	3.6	3.6	3.6		
ane Util, Factor		0.95	0.91	0.91	1.00	0.95		
Frt		1.00	1.00	0.85	1.00	0.85		
Fit Protected		1.00	1.00	1.00	0.95	1.00		
Batd, Flow (prot)		3610	3258	1371	1966	1671		
Fit Permitted		1.00	1.00	1.00	0.95	1.00		
Batd. Flow (perm)		3610	3258	1371	1966	1671		
Volume (vichi)	0	809	779	221	309	62		
Peak-hour factor, PHF		0.90	0.91	0.90	0.91	0.78		
Adj. Flow (vph)	0	800	846	246	340	79		
RTOR Reduction (voh)	ō	0	0	45	0	71		
Lane Group Flow (vph)	ō.	899	846	201	340	e		
Heavy Vehicles (%)	0%	3%	3%	4%	2%	2%		
Turn Type				pt+ov		ustorn		
Protected Phases		12	1	1.8	3			
Permitted Phases					-	2		
Actuated Green, G (s)		66.0	59.0	74.0	17.0	10.0		
Effective Green, g (s)		65.4	52.4	73.4	17.4	0.4		
Actuated g/C Ratio		0.73	0.58	0.82	0.19	0.10		
Clearance Time (s)		1999 B	3.0		4.0	3.0		
Lane Grp Cap (vph)		2623	1807	1118	380	175		
vis Ratio Prot			00.26		00.17			
s's Batio Perm		Control de la co	Service Based	0.00	Service 1.4	0.00		
vis Ratio		0.34	0.45	0.18	0.89	0.05		
Uniform Delay, d1		4.5	10.6	1.8	35.4	36.3		
Progression Factor		1.00	1.00	1.00	1.00	1.00		
noremental Delay, d2		0.4	0.8	0.4	26.0	0.5		
Delay (s)		4.8	11.4	21	61.4	36.8		
Level of Service		A.	B		F	D		
Approach Delay (s)		4.8	9.3	~	56.8	<u> </u>		
Approach LOS		4.0	A.		F			
		-						
ntersection Summary								
HCM Average Control De	alay		15.9	H	ICM Le	vel of Servic	xe B	
HCM Volume to Capacity			0.52					
Actuated Orcie Length (s			90.0			ost time (s)	7.2	
	iz ati on	1	48.9%	H	CU Levi	el of Service) A	
ntersection Capacity Util								
ntersection Capacity Util Analysis Period (min) Critical Lane Group			15					

ISBAK INC.

Synchro 6 Report Page 1

3: Int											20,00	.2006
	کر	→	\mathbf{b}	*	+	فر		*	, * *	\≁	Ļ	~
Movement	EBL.	EBT	EBR	WEL	WBT	WBR	NEL	NBT	NBR	SBL	SBT	SEF
Lane Configurations	_	† ⊁-			- - 11 +-				_	· ·	- * -	
ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891
Lane Width	3.6	3.5	3.8	3.6	3.5	3.6	3.6	3.6	3.8	3.6	3.6	3.6
Total Lost time (s)		3.6			3.6						3.6	
Lane Util, Factor		0.95			0.95						1.00	
Frt		0.97			0.98						0.94	
Fit Protected		1.00			1.00						0.99	
Satd. Flow (prot)		3295			3324						1701	
Fit Permitted		1.00			0.73						0.99	
Satd. Flow (perm)		3295			2424						1701	
Volume (rph)	0	886	243	65	1060	212	0	0	0	34	91	- 97
Peak-hour factor, PHF	0.77	0.77	0.77	0.86	0.86	0.86	0.00	0.90	0.90	0.83	0.83	0.83
Adj. Flow (vph)	0	1151	316	76	1233	247	0	0	0	- 41	110	117
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1467	0	0	1556	0	0	0	0	0	268	0
Heavy Vehicles (%)	2%	5%	2%	6%	4%	4%	2%	2%	2%	3%	4%	- 4%
Turn Type				Prot						Split		
Protected Phases		3		2	23					1	1	
Permitted Phases												
Actuated Green, G (s)		58.0			64.0						18.0	
Effective Green, g (s)		57.4			61.8						17.4	
Actuated g/C Ratio		0.64			0.69						0.19	
Clearance Time (s)		3.0									3.0	
Lane Grp Cap (yph)		2101			1708						329	
vis Ratio Prot		0.45			00.04						00.16	
vis Ratio Perm					00.58							
vic Ratio		0.70			0.91						0.81	
Uniform Delay, d1		10.6			11.8						34.8	
Progression Factor		1.00			1.00						1.00	
Incremental Delay, d2		2.0			8.8						19.5	
Delay (s)		12.6			20.6						54.2	
Level of Service		B			-C-						D	
Approach Delay (s)		12.6			20.6			0.0			54.2	
Approach LOS		B			-C-			A			D	
Intersection Summary												
HCM Average Control D			19.8			vel of S	-					
HCM Volume to Capacit			0.89			YELULO	er vi vie		В			
Actuated Cycle Length (90.0	-		ost time	. Carl		10.8			
Intersection Capacity Ut			99.2%			est ume el of Sei			10.8 F			
			15	1	GU Lev	el of del	NICE		-			
Analysis Period (min) c Critical Lane Group			15									
o Grindal Lane Group												
											-	
Baseline ISBAK INC										Sync	shro 6 F	Report

1426 - UEFA Intersection - Off-peak

	٨	_	-	*	5	1		
Vievoment	FRI	EBT	WBT	WBR	SBL	SRB		
ane Configurations	EDL	444	44	TIDN	NNN	26M		
deal Flow (vphpl)	1891	1891	1891	1891	1891	1891		
are Width	3.6	3.9	3.5	3.6	31	3.6		
Grade (%)		0%	0%	0.0	-10%	0.0		
Total Lost time (s)		3.6	3.6		3.6			
ane Util, Factor		0.91	0.95		0.94			
Frt		1.00	1.00		1.00			
Fit Protected		1.00	1.00		0.95			
Satd, Flow (prot)		452.9	3017		4347			
Fit Permitted		1.00	1.00		0.95			
Satd, Flow (perm)		452.9	3017		4347			
Volume (vph)	0	197.6	910	0	2102	0		
Peak-hour factor, PHF	0.82	0.82	0.96	0.96	0.90	0.90		
Adi, Flow (vph)	0	2410	948	0	2338	0		
RTOR Reduction (rph)	õ	0	0	õ	0	ŏ		
Lane Group Flow (vph)	Ŭ,	2410	948	õ	2336	ŏ		
Heavy Vehicles (%)	0%	6%	6%	0%	4%	0%		
Tum Type								
Protected Phases		2	2		1			
Permitted Phases		-	2					
Actuated Green, G (s)		48.0	48.0		58.0			
Effective Green, g (s)		48.4	48.4		58.4			
Actuated g/C Ratio		0.42	0.42		0.51			
Clearance Time (s)		4.0	4.0		40			
Lane Grp Cap (vph)		1923	1281		2227			
dis Batio Prot		00.53	0.31		c0.54			
n's Ratio Perm		00.00	0.01		00.04			
/o Ratio		1.25	0.74		1.05			
Uniform Delay, d1		32.8	27.5		27.8			
Progression Factor		1.00	1.00		1.00			
noremental Delay, d2		118.4	3.9		23.4			
Delay (s)		151.2	31.4		61.2			
Level of Service		F	C		E			
Approach Delay (s)		151.2	31.4		61.2			
Approach LOS		F	C		E			
••		E.	<u>с</u>					
Intersection Summary								
HCM Average Control D			94.4	H	ICM La	vel of Service	F	
HCM Volume to Capaci			1.14					
Actuated Cycle Length (114.0			ost time (s)	7.2	
Intersection Capacity Ut	tilization	7	93.9%	- 1	CULev	el of Service	F	
Analysis Period (min)			15					

2204 – Dolmabahce Intersection – PM Peak

APPENDIX D: OUTPUTS OF THE SYNCHRO PDM ANALYSIS

		The second	×		~	ي الشر
		*		1.0.1	•	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	† }		21.00 million		ΥY.	
Ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891
Lane Width (m)	3.0	3.6	3.6	3.0	3.3	3.6
Grade (%)	- 0%			4%.	-8%	
Storage Length (m)		0.0	0.0		0.0	0.0
Storage Lanes		0	0		2	0
Total Lost Time (s)	3.6	3.6	3,8	3.6	3.6	3.6
Leading Detector (m)	15.0			15.0	15.0	
Trailing Detector (m)	0.0	2 P	-	0.0	0.0	
Turning Speed (k/h)		15	25		25	15
Satd. Flow (prot)	3019	0	0	3222	2946	0
Fit Permitted			-		0.956	-
Satd. Flow (perm)	3019	0	0	3222	2946	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	184				9	
Link Speed (Wh)	50			50	50	
Link Distance (m)	268.6			273.8		
Travel Time (s)	19.3			19.7	15.8	
Volume (vph)	418	169	0	1503	108	8
Confl. Peds. (#/hr)						
Confi, Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.90	0.90	0.7.3	0.73
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	12%	0%	2%	18%	25%
Bus Blockages (#'hr)	0	0	0	0	0	0
Parking (#/hr)	_	-	_	_		_
Mid Block Traffic (%)	0%			0%	0%	
Lane Group Flow (voh)	638	0	0	1670	150	0
Turn Type	Activity of		-	1.00	1.121.00	-
Protected Phases	2			2	1	
Permitted Phases	1			-		
Detector Phases	2			2	1	
				4.0	4.0	
Minimum Initial (s)	4.0					
Minimum Split (s)	21.0			21.0	16.0	
Total Split (s)	56.0	0.0	0.0	56.0	19.0	0.0
	74.7%	0.0%	0.0%	74.7%		0.0%
Yellow Time (s)	3.0			3.0	2.0	
Al-Fied Time (s)	1.0			1.0	1.0	
Leadflag	Leg			Lag	Lead	
Lead Lag Optimize?	Yes			Yes	Yes	
Recall Mode	Max			Max	Mex	
Act Effot Green (s)	524			52.4	15.4	
Actuated g/C Ratio	0.70			0.70	0.21	
wo Ratio	0.29			0.74	0.26	
Control Delay	3.3				24.9	
Queue Delay	0.0				0.0	
Total Delay	3.3			9.7	24.9	
LOS	A				C	
Approach Dielay	3.3				24.9	
Approach LOS	A			A .		
Approach 505 Queue Length 50th (m)					9.7	
Queue Length 95th (m) Queue Length 95th (m)					14.0	
Queue Lengin 95m (m) Internal Link Dist (m)					195.2	
nnewaa caak caat (a)	294.5			249.8	1645x.27	
Baseline						

1109 - Sarayburnu Intersection - AM Peak, Existing

Lanes, Volumes, Tir 3: Int	nings							09.04.2006
	+	` *	*	÷		*		
Lane Group	EBT	EBR	WBL	WET	NBL	NBR		
Turn Bay Length (m)								
	2165			2251	612			
Starvation Cap Reducts				0				
Spillback Cap Reductn Storage Cap Reductn				0	0			
	0.29			0.74				
	O LE N			0.74	0.20			
Intersection Summary								
Area Type: Of Oycle Length: 75	her							
Oycle Length: 75 Actuated Cycle Length: 7	TE							
Offset: 0 (0%), Reference	ro orito r	nhaso 9	- COW D	and St	Startio	f Groon		
Natural Cycle: 60	ana sa p		alas tertiti i da	a nan man na g				
Control Type: Pretimed								
Maximum v/o Ratio: 0.74								
Intersection Signal Delay	p: 9.0					ion LOS:A		
Intersection Capacity Ut		n 51.8%		IC	3U Levi	el of Service A		
Analysis Period (min) 15								
Colling and Charges and								
Splits and Phases: 3:								_
1 of	┺.	Q						
19 s	55 s -							
Baseline ISBAK INC.							s	ynchro 6 Report Page 2

.anes, Volumes, T 3: Int							
	-+	~	*	+	~	ه	
				WET	NEL	NBR	
ane Group ane Configurations	EBT 112	EBR	WBL	- 本作	- NY	INDEX.	
al Flow (vohol)	1891	1891	1891	1891	1891	1891	
eWidth (m)	3.0	3.6	3.6	3.0	3.3	3.6	
de (%)	0%	0.0	-976	4%	-8%	0.0	
rage Length (m)	Sec.	0.0	0.0	4.20	0.0	0.0	
age Lanes		0.0	0.0		2	0.0	
i Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	
ding Detector (m)	15.0	000		15.0	15.0	0.00	
(ing Detector (m)	0.0			0.0	0.0		
ning Speed (k/h)	and the	15	25	1999 - 1997	25	15	
td. Flow (prot)	3019	0	0	3222	2946	0	
Permitted					0.956	-	
td. Flow (perm)	3019	0	0	3222	2946	0	
ant Turn on Red		Yes	-			Yes	
td. Flow (RTOF)	184				9		
k Speed (k/h)	50			50	50		
k Distance (m)	268.6			273.8	219.2		
vel Time (s)	19.3			19.7	15.8		
lume (vph)	418	169	0	1503	108	8	
infl. Peds. (#/hr)							
nii. Bikes (#/hr)							
sk Hour Factor	0.02	0.92	0.90	0.90	0.7:3	0.73	
wth Factor	100%	100%	100%	100%	100%	100%	
awy Vehicles (%)	4%	12%	0%	2%	18%	25%	
Blockages (#hr)	0	0	0	0	0	0	
rking (#/hr)							
Block Traffic (%)	0%			0%	0%		
he Group Flow (vph)	638	0	0	1670	159	0	
n Type							
fected Phases	2			2	1		
mitted Phases							
ector Phases	2			2	1		
nimum initial (s)	4.0			4.0	4.0		
nimum Split (s)	21.0			21.0	16.0		
tal Split (s)	59.0	0.0	0.0	59.0	16.0	0.0	
and the second se	78.7%	0.0%	0.0%	78.7%		0.0%	
liew Time (s)	3.0			3.0	2.0		
-Red Time (s)	1.0			1.0	1.0		
adilag	Lag				Lead		
ad Lag Optimize?	Yes				Yes		
eal Mode	Max			Max	Mex		
t Effot Green (s)	55.4				12.4		
tuated p/C Ratio	0.74				0.17		
Ratio	0.28				0.32		
introl Delay	2.5				28.0		
eue Delay	0.0				0.0		
tal Delay	2.5				28.0		
6	A				0		
proach Delay	25				28.0		
proach LOS	A				C		
eue Length 50th (m					10.2		
eue Length 95th (m)					14.7		
əmal Link Dist (m)	244.6			249.8	195.2		
Saseline BAK INC.							

1109 - Sarayburnu Intersection - AM Peak, Optimum

Lanes, Volumes, Timings				
<u>3: Int</u>				09.04.2008
-+	$\sim -$	÷ ~	*	
	EBR WBL	WET NEL	NBR	
Turn Bay Length (m)				
Base Capacity (vph) 2278		2380 405		
Starvation Cap Reductn 0		0 0		
Spillback Cap Reductn 0 Storage Cap Reductn 0		0 0		
Reduced vio Ratio 0.28		0.70 0.92		
Intersection Summary			•	
Area Type: Other				
Orcle Length: 75				
Actuated Ovela Length: 75				
Offset: 0 (0%), Referenced to ph	hase 2:EBW B	and 6; Start	of Green	
Natural Cycle: 60				
Control Type: Pretimed				
Maximum Vo Ratio: 0.70		1-1		
Intersection Signal Delay:7.4 Intersection Capacity Utilization	53 (ABC		otion LOS:A	
Analysis Period (min) 15	51,8%	ICU La	Vel of Service A	
Anayes Period (min) is				
Splits and Phases: 3: Int				
* ₀1 * ₀2				
16 s 59 s				
Baseline ISBAK INC.				Synchro 6 Report Page 2

3: Int							09.04.
	-+	\mathbf{h}	*	•		, * *	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	11Þ			- † †	<u> </u>	-	
Ideal Flow (vphpi)	1891	1891	1801	1891	1691	1891	
Lane Wildth (m)	3.0	3.6	3.8	3.0	3.3	3.6	
Grade (%)	0%			4%	-8%		
Storage Length (m)		0.0	0.0		0.0	0.0	
Storage Lanes		0	0		2	0	
Total Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	
Leading Detector (m)	15.0			15.0	15.0	THE STORE	
Trailing Detector (m)	0.0			0.0	0.0		
Turning Speed (Wh)	100 CW	15	25		25	15	
Batcl. Flow (prot)	3269	0		3254	3433	0	
Fit Permitted		v	W	0.00	0.056	w.	
Satd. Flow (perm)	3269	0	0	3254	3433	0	
	020010	Vois I		0204	9433	Yes	
Right Turn on Red		195				Yes	
Batd, Flow (RTOR)	30				11		
Link Speed (k/h)	50			50	50		
Link Distance (m)	268.6			273.8	219.2		
Travel Time (s)	19.8			19.7	15.8		
Volume (vph)	1473	134	0	859	216	21	
Confi. Peds. (#/hr)							
Confl. Bikes (#/hr)							
Peak Hour Factor	0.87	0.87	0.96	0.96	0.85	0.85	
Growth Factor	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	1%	4%	0%	1%	1%	5%L	
Bus Blockages (#hr)	0	0	0	0	0	0	
Parking (#/hr)							
Mid Block Traffic (%)	0%			0%	0%		
Lane Group Flow (vph)	1847	0	0	895	27.9	0	
Turn Type		_				_	
Protected Phases	2			2	1		
Permitted Phases				-			
Detector Phases	2			2	1		
Minimum Initial (s)	4.0			4.0	4.0		
Minimum Solit (s)	64.0			64.0	19.0		
Total Split (s)	64.0	0.0	0.0	64.0	19.0	0.0	
	77.1%	0.0%		04.U. 77.1%		0.0%	
Total Split (%) Voltav Timo (d)		0.026	0.036			0.0736	
Yellow Time (s)	3.0			3.0	2.0		
All-Red Time (s)	1.0			1.0	1.0		
Lead Lag	Lag				Lead		
Lead Lag Optimize?	Yes				Yes		
Recal Mode	Max			Max	Max		
Act Effet Green (s)	60.4				15.4		
Actuated g/C Ratio	0.73				0.19		
vio Ratio	0.77				0.43		
Control Delay	9.8						
Queue Delay	0.0				0.0		
Total Delay	9.8			4.8	31.1		
LOS	A			A	C.		
Approach Delay	9.8			4.8	31.1		
Approach LOS	A				G		
Queue Length 50th (m					20.5		
Queue Length 95th (m					30.1		
	244.6				195.2		
and some full	an 1710)			and to the fail	a na an tha Tan Bia		
Rasolino							Synchro 6 R

1109 - Sarayburnu Intersection - PM Peak, Existing

Lanes, Volumes, T	imings									
3: Int									09.(M.2006
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	-	- 1	*	-	\mathcal{I}	/***				
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR				
Turn Bay Length (m)										
Base Capacity (vph)	2387			2368	646					
Starvation Cap Reduct				0						
Spillback Cap Reducts				0	0					
Storage Cap Reducts	0				0					
Reduced vio Ratio	0.77			0.38	0.43					
Intersection Summary										
	Diher									
Cycle Length: 83										
Actuated Oycle Length	: 83									
Offset: 0 (0%), Referen	reed to p	shase 2	EBW B	l and 6;	Start c	f Green				
Natural Cycle: 85										
Control Type: Pretimed										
Maximum v/o Ratio: 0.7							-			
Intersection Signal Del	ay: 10.3					ion LOS:				
Intersection Capacity U Analysis Period (min) 1		1.68.7%		R	SU Lev	el of Serv	ICP B			
Analysis Period (min) 1	D .									
Splits and Phases: 3	: Int									
a la la la la la la la la la la la la la										
1 el	− _{n2}									
19 s	64 s									
Baseline								Ser	ichro A	Report
ISBAK INC.										Page 2
										-9

3: Int							09.
		·	✓	•	~	, *	
ane Group	EBT	EBR	WBL	WBT	NEL	NBR	
ane Configurations	- 112- 112-		WEDL				
deal Flow (vphpi)	1891	1891	1891	1891	1891	1891	
ane Wildth (m)	3.0	3.6	3.6	3.0	3.3	3.6	
Grade (%)	0%	0.0	0.0	4%	-8%	0.0	
	W7a	0.0	0.0	976	-826	0.0	
Storage Length (m)		0.0	0.0 0		2	0.0	
Storage Lanes		3.6	3.6	3.6	3.6	3.6	
fotal Lost Time (s)	3.6 15.0	3.6	3.6	15.0	15.0	3.6	
eading Detector (m)							
Inailing Detector (m)	0.0		-	0.0	0.0		
Furning Speed (k/h)		15	25		25	15	
atd. Flow (prot)	3260	0	0	3254	3433	0	
It Permitted		_	_		0.056	-	
atd. Flow (perm)	3269	0	0	3254	3433	0	
light Turn on Red		Yes				Yes	
atd. Flow (RTOR)	38				11		
.ink Speed (k/h)	50			50	50		
ink Distance (m)	268.6			273.8	219.2		
ravel Time (s)	19.3			19.7	15.8		
(olume (vph)	1473	134	0	85/9	216	21	
Confi. Peds. (#/hr)							
Confl. Bikes (#/hr)							
eak Hour Factor	0.87	0.87	0.96	0.96	0.85	0.85	
rowth Factor	100%	100%	100%	100%	100%	100%	
leavy Vehicles (%)	1%	4%.	0%	1%	1%	5%	
us Blockages (#hr)	0	0	0	0	0	0	
arking (#/hr)							
(id Block Traffic (%)	0%			0%	0%		
ane Group Flow (vph)		0	0	895	27.9	0	
	1047	v	. U	ONIC	27.9		
um Type	2			2	1		
rotected Phases	z			2	1		
ermitted Phases				-			
Vetector Phases	2			2	1		
(inimum Initial (s)	4.0			4.0	4.0		
(inimum Split (s)	25.0		_	25.0	15.0		
otal Split (s)	67.0	0.0	0.0	67.0	15.0	0.0	
	81.7%	0.0%	0.0%		18.3%	0.0%	
(ellow Time (s)	3.0			3.0	2.0		
U-Red Time (s)	1.0			1.0	1.0		
eadfLag	Leg				Lead		
ead Lag Optimize?	Yes			Yes	Yes		
ecal Mode	Max			Max	Mex		
et Effet Green (s)	63.4			63.4	11.4		
otuated g/C Ratio	0.77			0.77	0.14		
o Ratio	0.73			0.36	0.57		
ontrol Delay	6.8				36.9		
Jueue Delay	0.0			0.0			
otal Delay	6.8			3.4	36.9		
08	A				D		
ppreach Delay	6.8				36.0		
pproach LOS	A				D		
pprodon Doo Dueue Length 50th (m)					21.4		
Sueue Length 95th (m)					31.7		
	244.6			24.4			
nema unk ust (m)	244.5			246.8	1645.2		
Baseline							Synchro 6

1109 - Sarayburnu Intersection - PM Peak, Optimum

Lanes, Volumes, Ti	mings						
3: Int							09.04.2006
		\mathbf{h}	*	+	\mathbf{h}	<u>م</u>	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	
Turn Bay Longin (m)							
	2536			2516	487		
Starvation Cap Reducts Spillback Cap Reducts	1 0			0	0		
Storage Cap Reducts	0				0		
Reduced v/c Ratio	0.73			0.36			
Intersection Summary							
	ther						
Cycle Length: 82	a un ser						
Actuated Cycle Length:	82						
Offset: 0 (0%), Reference	eed to p	ohase 2	EBW B	and 6;	Start o	of Green	
Natural Cycle: 60							
Control Type: Pretimed							
Maximum vio Ratio: 0.7							
Intersection Signal Dela						ion LOS:A	
Intersection Capacity Ut		n 68.7%		ю	SU Lev	el of Service B	
Analysis Period (min) 18	5						
Splits and Phases: 3:	int						
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Baselne							Synchro 6 Report
ISBAK INC.							Page 2

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Lane Group	EBL	EBR	NBL	NET	SBT	SBR
Lane Configurations			<u> </u>	- †	<u></u>	
Ideal Flow (vphpi)	1891	1891	1801	1891	1891	1891
Lone Width (m)	3.6	3.6	3.0	3.3	3.2	3.8
Grade (%)	0%		(e) (e)	- 6%	- 0%	
Storage Length (m)	0.0	0.0	0.0			0.0 0
Storage Lanes Total Lost Time (s)	3.3	3.3	1 3.3	3.3	3.3	3.3
Leading Detector (m)	0.0	0.0	15.0	15.0	15.0	-3-3
Trailing Detector (m)			0.0	0.0	0.0	
Turning Speed (k/h)	25	15	25	64. W	196 M	15
Satd. Flow (prot)	0	0	1838	1792	3195	0
Fit Permitted	-		0.950			-
Satd. Flow (perm)	0	0		1792	3195	0
Right Turn on Red		Yes				Yes
Satd, Flow (RTOR)					34	
Link Speed (k/h)	50			50	50	
	204.6			204.0	96.4	
Travel Time (s)	14.7			14.7	6.9	
Volume (vph)	0	0	248	1375	366	44
Corril, Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.02	0.92	0.84	0.06	0.90	0.79
	100%				100%	100%
Heavy Vehicles (%)	- 0%	- 0%	1%	2%	6%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%.			0%	0%	
Lane Group Flow (vph)	0	0	295	1432	463	0
Turn Type Protected Phases			Prot 1	12	2	
Protected Phases			1	12	2	
Permitted Phases Detector Phases			1	12	2	
Minimum Initial (s)			4.0	12	4.0	
Minimum Inipal (s) Minimum Solit (s)			8.0		20.0	
Total Split (s)	0.0	0.0	28.0	77.0	49.0	0.0
Total Split (%)			36.4%1			0.0%
Yellow Time (s)	0.0070		2.0		3.0	N 20 20
Al-Red Time (s)			1.0		1.0	
Lead Lag			Lead		Lag	
Lead Lag Optimize?			Yes		Yes	
Recall Mode			Max		Max	
Act Effot Green (s)				77.0		
Actuated o/C Ratio			0.32		0.59	
wo Ratio			0.50		0.24	
Control Delay			30.0	8.9	7.2	
Queue Delay			0.0		0.0	
Total Delay			30.0	8.9	7.2	
LOS			C		A.	
Approach Delay				12.5	7.2	
Approach LOS					A	
Queue Length 50th (m)				89.6		
Queue Length 95th (m)			58.0	174.1		
Internal Link Dist (m)	180.6			180.0	72.4	
Baseline						
ISBAK INC						

1102 A - Ahırkapı Intersection - A, AM Peak, Existing

Lanes, Volumes, Ti 1102: Int	mings	1					09.04.2006
	٠	~	~	1	Ļ	1	
Lane Group	EBL.	EBR	NBL	NET	-8BT	SBR	
Turn Bay Length (m)							
Base Capacity (vph)			500		1910		
Starvation Cap Reductr	1		0	0	0		
Spillback Cap Reducts Storage Cap Reducts				0	0		
Reduced vio Ratio				0.90			
Intersection Summary							
	7ther						
Cycle Length: 77							
Actuated Öycle Length: Offset: 12 (16%), Refer	Π			and and state			
Natural Cycle: 40	enced t	o pnase	86., 8 1 8	NT OT GR	neer		
Control Type: Pretimed							
Maximum v/o Ratio: 0.8							
Intersection Signal Dela	y: 11.4			li li	ntersect	ion LOS: B	
Intersection Capacity U	Ílzator	1 76.0%		L. IS	OU Lev	el of Service D	
Analysis Period (min) 1	5						
Splits and Phases: 1	102: Int		.				
N e1		 *	1 e2				
28 s		43					
Baseline							Synchro 6 Report
ISBAK INC.							Page 2

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		*		•	-	
Lane Group		EBR	NBL	NET	SBT	SBR
Lane Configurations Ideal Flow (vohol)	1891	1891	1891		- ++- 1891	1891
Lane Wildth (m)	4.4	3.6	1801	3.3	1891	3.6
Grade (%)	- 1%	0.0	3.0	a.a 0%	3.0 0%	3.0
Storage Length (m)	0.0	0.0	0.0	100 A 100		0.0
Storage Lanes	1	0	0			0
Total Lost Time (s)	3.3	3.3	3.3	3.3	3.3	3.3
Leading Detector (m)	15.0			15.0	15.0	
Trailing Detector (m)	0.0			0.0	0.0	
Turning Speed (k/h)	25	15	25			15
Satd, Flow (prot)	1795	0	0	3405	3194	0
Fit Permitted	0.972					
Satd. Flow (perm)	1795	0	0	3405	3194	0
Right Turn on Red		Yes				Yes
Satd, Flow (RTOR)	39					
Link Speed (k/h)	50			50	50	
Link Distance (m)	204.6			126.8		
Travel Time (s)	14.7			9.1 45.40	14.7	
Volume (vph) Confil Radia (Milaria	81	ଟ	0	1542	367	0
Confl. Peds. (#/hr)						
Confi. Bikes (#/hr) Peak Hour Factor	0.98	0.88	0.96	0.06	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	14%	095	2%	5%	0%
Bus Blockages (#hr)	0	0	0	0	0	0
Parking (#/hr)		0				
Mid Block Traffic (%)	0%.			0%	0%	
Lane Group Flow (vph)	157	0	0	1606	408	0
Turn Type	1.21		-			
Protected Phases	2			1	1	
Permitted Phases						
Detector Phases	2			1	1	
Minimum Initial (s)	4.0			4.0	4.0	
Minimum Split (s)	15.0			20.0	20.0	
Total Split (s)	15.0	0.0	0.0	62.0	62.0	0.0
	19.5%	0.0%	0.0%	80.5%	80.5%	0.0%
Yellow Time (s)	2.0			2.0	2.0	
Al-Fied Time (s)	1.0			1.0	1.0	
Lead'Lag	Lag				Lead	
Lead Lag Optimize?	Yes				Yes	
Recall Mode	Max				Mex	
Act Effot Green (s)	11.7				58.7	
Actuated g/C Ratio	0.15				0.7.6	
wo Ratio	0.51				0.17	
Control Delay	29.0			5.4		
Queue Delay	0.6			0.0		
Total Delay	29.6			5.4		
LOS	C				A	
Approach Delay	29.6			5.4		
Approach LOS	C				A	
Queue Length 50th (m)					8.7	
Oueue Length 95th (m) Internal Link Dist (m)					10.0	
imernai Link Liist (ni)	180.6			102.8	180.0	
Baseline ISBAK INC.						

1102 B - Ahırkapı Intersection - B, AM Peak, Existing

Lanes, Volumes, Tir	mings							
3: Int								09.04.2006
	ھر	7		1	Ļ	~		
Lane Group	EEIL.	EBR	NBL	NET	SBT	SBR		
Turn Bay Length (m)								
Base Capacity (vph)	306			2596				
Starvation Cap Reducts				0	0			
Spillback Cap Reducts	27			23	0			
Storage Cap Reducts Reduced vio Ratio	0.56				0.17			
	0.00			0.62	W.17			
Intersection Summary	_							
Area Type: O Cycle Length: 77	ther							
Actuated Oyole Length: 1	77							
Offset: 0 (0%), Reference	ere Sourd House	donana S	-001 0	hart of (ino oro			
Natural Cycle: 45	anne son li		alaa katila ji ka					
Control Type: Pretimed								
Maximum we Ratio: 0.63	2							
Intersection Signal Delay				li li	tersect	ion LOS:A		
Intersection Capacity Ut	Ization	n 76.0%		1	OU Levi	el of Service D		
Analysis Period (min) 15								
Splits and Phases: 3:	Int							_
laf _{e1}							2	
23							15+	
Baseline							3	ynchro 6 Report
ISBAK INC.								Page 2
								~

Lanes, Volumes, Ti 1102: Int	mings						09.0
1102.111	٨	`	~	t	Ļ	1	Ciel C
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	
Lane Configurations		-	- Y	- *	11+	-	
deal Flow (vphpl)	1891	1891	1891	1891	1891	1891	
ane Wildth (m)	3.6	3.6	3.9	3.3	3.2	3.6	
Snade (%)	0%			0%	0%		
Storage Length (m)	0.0	0.0	0.0			0.0	
Storage Lanes	0	0	1			0	
Total Lost Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	
eading Detector (m)			15.0	15.0	15.0		
Trailing Detector (m)			0.0	0.0	0.0		
Turning Speed (k/h)	25	15	25			15	
Satd. Flow (prot)	0	0	1802	1792	3351	0	
It Permitted	ω.	U	0.950	10,000	-000		
Satd. Flow (perm)	0	0	1802	1792	3351	0	
		Yes	1002	UT 1952	-0001	Yes	
Right Turn on Red		196				195	
Satd. Flow (RTOR)					0		
ink Speed (Wh)	50			50	50		
	204.6			204.0	96.4		
Travel Time (s)	14.7			14.7	6.9		
Volume (vph)	0	0	115	872	1410	45	
Confi, Peds. (#/hr)							
Confil, Bikes (#/hr)							
Peak Hour Factor	0.92	0.92	0.81	0.93	0.88	0.80	
Snowth Factor	100%	100%	100%	100%	100%	100%	
leavy Vehicles (%)	0%	- 0%	3%	2%	2%	0%	
Bus Élockages (#fr)	0	0	0	0	0	0	
arking (#/hr)						_	
Aid Block Traffic (%)	0%			0%	0%		
ane Group Flow (vph)	0	0	142	938	1658	0	
Turn Type	-		Prot				
Protected Phases			1	12	2		
Permitted Phases					-		
Detector Phases			1	12	2		
Minimum Initial (s)			4.0	1.2	4.0		
			8.0		20.0		
Minimum Split (s)				00.0		0.0	
Total Split (s)	0.0	0.0	23.0	92.0	69.0 75.000	0.0	
Total Split (%)	0.0%	0.025	25.0%1	outow.		0.0%	
Yellow Time (s)			2.0		3.0		
Al-Fied Time (s)			1.0		1.0		
eadLag			Lead		Lag		
ead Lag Optimize?			Yes		Yes		
Recall Mode			Max		Mex		
Act Effot Green (s)			19.7		65.7		
Actuated g/C Ratio			0.21		0.7.1		
io Ratio			0.37		0.69		
Control Dielay			45.0	2.4	9.3		
Queue Delay			0.0	0.0	0.0		
fotal Delay			45.0	2.4	9.3		
.08			D		A		
Approach Delay				8.0			
Approach LOS					A		
Queue Length 50th (m)			96 C	21.7			
Queue Length 95th (m)			20.0 m89.6				
	180.6		1110910	180.0			
navner one oast (m)	104.5			100.0	12.4		
Baseline SBAK INC.							Synchro 6

1102 A - Ahırkapı Intersection - A, PM Peak, Existing

Lanes, Volumes, Ti	mings							
1102: Int								09.04.2006
	٨	~	٢	t	Ļ	~		
Lane Group	EBL.	EBR	NBL	NET	-88T	SBR		
Turn Bay Length (m)								
Base Capacity (vph)			386	1792				
Starvation Cap Reductr	•		0	0				
Spillback Cap Reductn			0	0	0			
Storage Cap Reducts				0				
Reduced vio Ratio			0.37	0.52	0.69			
Intersection Summary								
	ther							
Cycle Length: 92								
Actuated Oycle Length:	92							
Offset: 12 (13%), Refer	enced t	o phase	96:, Sta	et of Gr	een 👘			
Natural Cycle: 45								
Control Type: Pretimed	_							
Maximum we Ratio: 0.6								
Intersection Signal Dela	y:8.8					ton LOS:A		
Intersection Capacity U Analysis Period (min) 11		n 60.3%		IR.	SU Lev	el of Service B		
m Volume for 95th pe			ia manita	e col line a	ana ina a	es ata sal		
m voorne or soor pe		- doene	IN COMUN	neurby (ninen ee	un agna.		
Splits and Phases: 1"	102: Int							
4+								
	ŧ۴.	2						
23 s	69 s							
Densite							~	unaless & Desires
Baseline ISBAK INC.							3	ynchro 6 Report Page 2

3: Int							09.04.
	هر	\mathbf{b}	۰	t	Ļ	~	
Lane Group	EBL	EBR	NBL	NET	SBT	SBR	
Lane Configurations	- Y			- † †	- 11-		
ideal Flow (vphpi)	1891	1891	1801	1891	1891	1891	
Lane Wildth (m)	4.4	3.6	3.6	3.3	3.0	3.8	
Grade (%)	- 1%			0%	0%		
Storage Length (m)	0.0	0.0	0.0			0.0	
Storage Lanes	1	0	0			0	
Total Lost Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	
Leading Detector (m)	15.0			15.0	15.0		
Trailing Detector (m)	0.0		_	0.0	0.0		
Turning Speed (k/h)	25	15	25			15	
Satd. Flow (prot)	1864	0	0	3405	3298	0	
Fit Permitted	0.981		_			_	
Satd. Flow (perm)	1864	0	0	3405	3298	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)	65						
Link Speed (k/h)	50			50	50		
Link Distance (m)	204.6			126.8	204.0		
Travel Time (s)	14.7	21.07107		9.1	14.7	-	
Volume (vph)	81	162	0	906	1409	0	
Confl. Peds. (#/hr)							
Confl. Bikes (#/hr)	20. TH 4			10. DOLD.			
Peak Hour Factor	0.71	0.98	0.93	0.93	0.88	0.88	
Growth Factor	100%	100%.	100%	100%	100%	100%	
Heavy Vehicles (%)	0%	0	0%	2%	2%	0%	
Bus Blockages (#'hr)		U	0	0	U		
Parking (#/hr)	0%			0%	0%		
Mid-Block Traffic (%)		0	0	974	1601	0	
Lane Group Flow (vph) Turn Type	22565	U.	9	974	1601	8	
Protected Phases	2			1	1		
Permitted Phases	2						
Detector Phases	2			1	1		
Minimum Initial (s)	4.0			4.0	4.0		
Minimum (filitiis) Minimum Spilitiis)	15.0			20.0	20.0		
Total Split (s)	10.0	0.0	0.0	78.0	73.0	0.0	
Contraction and the first	20.7%	0.0%		79.3%		0.0%	
Yellow Time (s)	20.7%	6.0 Xe	0.0736	2.0	2.0	0.000	
All-Red Time (s)	1.0			1.0	1.0		
Lead Lag	Lag				Lead		
Lead Lap Optimize?	Yes				Yes		
Recall Mode	Max				Max		
Act Effet Green (s)	15.7				69.7		
Actuated g/C Ratio	0.17			0.76	0.7.6		
vo Batio	0.77				0.64		
Control Delay	43.7			4.3	5.4		
Dueue Delay	0.0			0.0	0.0		
Total Delay	43.7			4.3	5.4		
108	D				A		
Approach Delay	48.7				5.4		
Approach LOS	D				A		
Dueue Langth 50th (m)					50.0		
Queue Length 95th (m)					55.3		
Internal Link Dist (m)	180.6				190.0		
Baseline SBAK INC.							Synchro 6 R Pr

1102 B - Ahırkapı Intersection - B, PM Peak, Existing

Lanes, Volumes, Tir	mings							
3: Int								09.04.2006
	٠	7	۲,	t	Ļ	~		
Lane Group	EBL.	EBR	NBL	NET	88T	88R		
Turn Bay Length (m)								
Base Capacity (vph)	372				2491			
Starvation Cap Reducts				0	11			
Spillback Cap Reductn	0			0	0			
Storage Cap Reducts Reduced vio Ratio	0 0.77				0.65			
	v. r.r			0.36	0.00			
Intersection Summary								
Area Type: O Oycle Length: 92	ther							
Actuated Cycle Length:	62							
Offset: 0 (0%), Reference	ne. Notite r	nina so 2		text of 0	Broon			
Natural Cycle: 60	a na an an an an an an an an an an an an		a na an an an an an an an an an an an an					
Control Type: Pretimed								
Maximum v/o Ratio: 0.7.	7							
Intersection Signal Dela	y:8.9					ion LOS:A		
Intersection Capacity Ut	İlzatior	n 60.3%		В	CU Lev	el of Service B		
Analysis Period (min) 18	5							
Splits and Phases: 3:	let.							
▼ g1 73 s							- ₆ 2	
12.5							100	
Danalina								Gunden & French
Baseline ISBAK INC.								Synchro 6 Report Page 2
na an an an an an an an an an an an an a								raye z

anes, Volumes, Ti 102: Int	mings	ļ					
192.101	٨	7	~	†	Ļ	7	
ane Group	EBL.	EBR	NBL	NBT	SBT	SBR	
ane Configurations			- N	- *	11+		
teal Flow (vphpi)	1891	1891	1801	1891	1891	1891	
ane Wildth (m)	3.6	3.6	3.9	3.3	3.2	3.6	
irade (%)	0%			0%	0%		
tonage Length (m)	0.0	0.0	0.0			0.0	
Itorage Lanes	0	0	1			0	
otal Lost Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	
eading Detector (m)			15.0	15.0	15.0		
railing Detector (m)			0.0	0.0	0.0		
urning Speed (k/h)	25	15	25			115	
atcl. Flow (prot)	0	0	1802	1792	3351	0	
It Permitted			0.950				
atcl. Flow (perm)	0	0	1802	1792	3351	0	
light Turn on Red		Yes				Yes	
atd. Flow (RTOR)					11		
ink Speed (k/h)	50			50	50		
and an owned over the other	204.6			204.0	96.4		
ravel Time (s)	14.7			14.7	6.9		
(olume (vph)	0	0	115	872	1410	45	
onfi, Peds. (#/hr)							
onii. Bikes (#/hr)							
eak Hour Factor	0.92	0.92	0.81	0.93	0.88	0.80	
	100%	100%	100%	100%	100%	100%	
eavy Vehicles (%)	0%.	0%	3%	2%	2%	0%	
us Blockages (#'hr)	0	0	0	0	0	0	
arking (#/hr)				_	_		
Id Block Traffic (%)	0%			- 0%	0%		
ane Group Flow (vph)	0	0	142	938	1658	0	
um Type			Prot				
rotected Phases			1	12	2		
emitted Phases							
etector Phases			1	12	2		
linimum Initial (s)			4.0		4.0		
linimum Split (s)	0.0	0.0	8.0 19.0	7.4.25		0.0	
otal Split (s) otal Split (%)	0.0	0.0	19.0 26.8%1	71.0 nn.ee	52.0 79.990	0.0%	
otal apit (%) allow Time (s)	0.0%	0.0%	26.8%1 2.0	0030%	73.2%	0.0%	
allow Time (s) Il-Red Time (s)			2.0		3.0		
ead'Lag			Lead		Lao		
ead Lag Optimize?			Yes		Yes		
eac Lag Optimize? Recall Mode			Max		Max		
iot Effot Green (s)			15.7	74.0	48.7		
ctuated o/C Ratio			0.22		+e.r 0.60		
lo Ratio			0.36		0.72		
ontrol Delay			34.6		9.2		
tueue Delay			0.0		0.0		
otal Delav			34.6	24	9.2		
08 09 89			04.0 C		A.Z		
poreach Delay			141	6.7	9.2		
pproach LOS				A.			
Queue Length 50th (m)			20.2	13.1			
Queue Length 95th (m)			m82.2				
	180.6				72.4		
reaction cause cause family	na wite				2 May 19		
Baseline BAK INC.							Sync

1102 A - Ahırkapı Intersection - A, PM Peak, Optimum

Lanes, Volumes, Ti 1102: Int	mings						09.04.20.06
	٠	$\mathbf{\tilde{s}}$	٦.	t	ł	~	
Lane Group	EBL	EBR	NBL	NET	SBT	SBR	
Turn Bay Length (m)							
Base Capacity (vph)			308		2302		
Starvation Cap Reductr	1		0				
Spillback Cap Reductn			0	0			
Storage Cap Reducts					0		
Reduced v/c Ratio			0.35	0.52	0.72		
Intersection Summary							
	Xiher						
Cycle Length: 71							
Actuated Oycle Length:	71						
Offset: 12 (17%), Refer	enced t	o phase	-6:, Ste	at of Gr	een		
Natural Cycle: 45							
Control Type: Pretimed							
Maximum Vo Ratio: 0.7							
Intersection Signal Dela	y: 8.2					ion LOS:A	
Intersection Capacity U	ilzator	0.8%		E H	SU Lev	el of Service B	
Analysis Period (min) 1	5						
m Volume for 95th pe	rcentile	drene	is mete	red by t	upstriea	m signal.	
Splits and Phases: 11	102: Int						
¶	_ ↓ †	ø2					
19 s	52.8						
Baseline ISBAK INC.							Synchro 6 Report Page 2

.anes, Volumes, T 8: Int							00.1
s. mu							
	۰	<u></u>	\neg	t	÷.	\checkmark	
ane Group	EBL	EBR	NBL	NBT	SIST	SBR	
ane Configurations	- Y			- † †	- 11-		
deal Flow (vphpl)	1891	1891	1891	1891	1891	1891	
ane Width (m)	4.4	3.6	3.6	3.3	3.0	3.6	
irade (%)	- 1%			0%	0%		
Storage Length (m)	0.0	0.0	0.0			0.0	
Stonage Lanes	1	0	0			0	
fotal Lost Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	
eading Detector (m)	15.0			15.0	15.0		
frailing Detector (m)	0.0			0.0	0.0		
urning Speed (Wh)	25	15	25			15	
atd. Flow (prot)	1864	0	0	3405	3298	0	
It Permitted	0.981		-				
atd. Flow (perm)	1864	0	0	3405	3288	0	
ight Turn on Red	1004	Yes		0400	0206	Yes	
		1952				195	
latd. Flow (RTOF)	57			100.00	1		
ink Speed (Wh)	50			50	50		
ink Distance (m)	204.6			126.8	204.0		
ravel Time (s)	14.7			9.1	14.7		
(olume (viph)	81	162	0	906	1409	0	
anti, Peds. (#/hr)							
onfi, Bikes (#/hr)							
eak Hour Factor	0.71	0.93	0.93	0.93	0.98	0.68	
rowth Factor	100%	100%	100%	100%	100%	100%	
eavy Vehicles (%)	0%	0%	0%	2%	2%	0%	
us Blockages (#/hr)	0	0	0	0	0	0	
arking (#/hr)		_	_				
id Block Traffic (%)	0%			0%	0%		
ane Group Flow (vph)		0	0	974	1601	0	
un Type		M	-				
rotected Phases	2			1	1		
ermitted Phases	-						
	2			1	1		
etector Phases					-		
(inimum initial (s)	4.0			4.0	4.0		
(inimum Split (s)	15.0			20.0	20.0		
otal Split (s)	16.0	0.0	0.0	55.0	55.0	0.0	
otal Split (%)	22.5%	0.0%	0.0%	77.5%.		0.0%	
ellow Time (s)	20			2.0	2.0		
I-Red Time (s)	1.0			1.0	1.0		
eadflag	Lag			Lead	Lead		
ead Lag Optimize?	Yes			Yes	Yes		
ecal Mode	Max			Max	Max		
ot Effot Green (s)	12.7			51.7	51.7		
stuated o/C Ratio	0.18			0.73	0.73		
a Ratio	0.76			0.39	0.67		
ontrol Delay	37.0			4.2	7.0		
ueue Delay	0.0			0.0	0.0		
ntal Delay	37.0			4.2	7.0		
Dai Delay DS	av.e D			4.2 A			
pproach Delay	37.0			4.2	7.0		
pproach LOS	D			A			
vieue Length 50th (m					48.6		
Queue Length 95th (m)	C				73.6		
rternal Link Dist (m)	180.6			102.8	180.0		
Baseline							Synchro
BAK INC.							

1102 B - Ahırkapı Intersection - B, PM Peak, Optimum

Lanes, Volumes, Til	mings							
3: Int	_							09.04.2006
	هر	<u>`</u>	\neg	t	Ļ	~		
Lane Group	EBL.	EBR	NBL	NET	88T	SBR		
Turn Bay Longth (m)								
Base Capacity (vph)	390			2479	2304			
Starvation Cap Reducts	i 0.			Ð	0			
Spillback Cap Reductn	0			0	0			
Storage Cap Reductn	0				0			
Reduced v/c Ratio	0.76			0.39	0.67			
Intersection Summary								
	iher							
Cycle Length: 71								
Actuated Cycle Length:	71				-			
Offset: 0 (0%), Reference	sed to p	phase 2	BBL, S	Start of (Breen			
Natural Cycle: 60								
Control Type: Pretimed Maximum v/s Ratio: 0.7								
Intersection Signal Dela						ion LOS:A		
Intersection Capacity Ut	ny.w.⊧ Naratar	- CO 264				el of Service B	5	
Analysis Period (min) 18		II OULSTA	11			er ut ciervicie c	•	
waaysa reasa (ang a	2							
Splits and Phases: 3:	Int							
↓† ₀1							10	
▼ β							15 s	
100.1							10.5	
Baseline								Synchro 6 Report
ISBAK INC.								Page 2

Lanes, Volumes, Ti	mings										00.00	
1115: Int	٠	-	~	¥	+	فر	~		<u>م</u> ر	4	26.00	3.2006
Lane Group	EE1	EBT	FBR	WEL	WBT	WBR	NBL	NBT	NBR	381	SET	SPP
Lane Configurations	-	<u>а</u>		The same	effte		11111	44-	19102010	-	- 10+	-
Ideal Flow (vohol)	1891	1891	1801	1891	1891	1901	1891	1801	1801	1891	1801	1801
Lone Width (m)	3.6	2.5	3.6	3.6	3.2	3.6	3.6	3.3	3.6	3.6	3.2	3.6
Grade (%)		0%			1%			2%			-5%	
Total Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Satd. Flow (prot)	0	1460	0	0	3161	0	0	3244	0	0	3326	0
Fit Permitted		0.975			0.984							
Satd. Flow (perm)	0	1469	0	0	3161	0	0	3244	0	0	3326	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		35			161						18	
Link Speed (Mh)		50			50			50			50	
Link Distance (m)		212.8			268.8			190.4			220.8	
Travel Time (s)		15.3			19.4			18.7			15.9	
Volume (vph)	35	0	-33	125	113	143	0	710	0	0	848	-50
Peak Hour Factor	0.94	0.94	0.94	0.99	0.89	0.89	0.91	0.91	0.91	0.89	0.89	0.89
Heavy Vehicles (%)	0%	0%	695	0%	0%	1%	0%	6%	0%	09%	-5%	4%
Lane Group Flow (vph)	0	72	0	0	428	0	0	780	0	0	1009	0
Turn Type	Split			Split								
Protected Phases	3	- 3		2	2			1			1	
Permitted Phases												
Minimum Split (s)	-5.0	5.0		10.0	10.0			20.5			20.5	
Total Split (s)	8.5	8.5	0.0	120	12.0	0.0	0.0	30.5	0.0	0.0	30.5	0.0
	16.7%		0.0%	23.5%		0.0%	0.0%	50.8%	0.0%	0.0%	50.8%	0.0%
Yellow Time (s)	2.5	2.5		2.0	2.0			2.0			2.0	_
Al-Red Time (s)	1.0	1.0		0.0	0.0			2.0			2.0	
Lead Lag				Leg	Lag			Lead			Lead	
Lead Lag Optimize?				Yes	Yes			Yes			Yes	
Act Effot Green (s)		4.9			8.4			26.9			28.9	
Actuated g/C Ratio		0.10			0.16			0.53			0.53	
we Ratio		0.42			0.65			0.46			0.57	_
Control Delay		21.3			17.6			8.6			9.6	
Queue Delay Total Delay		0.0			0.0			0.0			0.0	
LOS		21.3 C			17.6 B			8.6 A			9.6 A	
Approach Delay		21.3			17.6			8.6			9.6	
Approach LOS		21.8			17.6 B			8.6 A			A.U	
		7007										
Oueue Length 50th (m) Oueue Length 95th (m)		3.4 13.2			12.4 23.9			21.7 32.9			30.0 43.8	
Internal Link Dist (m)		188.8			244.8			166.4			196.8	
Turn Bay Length (m)		100.0			244.0			10004			InerOUG	
Base Capacity (vph)		173			855			1711			1763	
Starvation Cap Reducts		0			0.00			0			0	
Spillback Cap Reducts		0			Ŭ.			0			0	
Storage Cap Reducts		õ			õ			Ŭ.			õ	
Reduced vio Ratio		0.42			0.65			0.46			0.57	
Intersection Summary												
	ther											
Oyole Length: 51												
Actuated Ovcle Length:	51											
Offset: 0 (0%), Reference		nhase S	WET	Starts	nf Gree	n						
Natural Cycle: 40	a ana kai		a an an an an an Anna an Anna									
and the second second second second second second second second second second second second second second second												
Baselne										(Course	uninana 121 A	
ISBAK INC.										ayn	ehro 6 P	Heport Page 1
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												,

1115 – Silivrikapı Intersection – Off-peak, Optimum C=51

Lanes, Volumes, Timings 1115: Int		26.03.2006
Control Type: Pretimed		
Maximum v/o Ratio: 0.65		
Intersection Signal Delay: 11.1	Intersection LOS: 8	
Intersection Capacity Utilization 50.5%	ICU Level of Service A	
Analysis Period (min) 15		
Splits and Phases: 1115: Int		
↓ ↑ ↓ 1	* .	\mathbf{A}_{d}
30.5 e	12 *	BES

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	هر	-+	$\mathbb{P}_{\mathbb{P}}$	*	+	ه_		•	. /**	1	Ŧ	4
Lane Group	EBL	EBT	EBR	WBL.	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SEF
Lane Configurations					-41+			- 11-			<u></u> †}	-
	1891	1891	1891	1891	1891	1891	1891	1801	1891	1891	1891	1891
Lane Width (m)	3.6	2.5	3.6	3.6	3.2	3.6	3.6	3.3	3.6	3.6	3.2	3,6
Grade (%)		- 0%			1%			2%		~ ~	-5%	
Storage Length (m)	0.0		0.0 0	0.0		0.0	0.0 0		0.0 0	0.0 0		0.0
Storage Lanes Total Lost Time (s)	3.6	3.6	3,6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	0 3.6
	15.0	15.0	3.0	15.0	15.0	3.0	0.0	15.0	-3.9	0.0	15.0	0.0
Trailing Detector (m)	0.0	0.0		0.0	0.0			0.0			0.0	
Turning Speed (kh)	25		15	25		15	25		15	25	505 M	15
Satd. Flow (prot)	0	1470	0	0	3126	0		327.5	0	0	3350	0
Fit Permitted		0.973		Ť	0.983	-		567.5	-			
Satd, Flow (perm)	0	1470	0	0	3126	0	0	327.5	0	0	3359	0
Right Turn on Red	-		Yes			Yes			Yes	-		Yes
Satd. Flow (RTOR)		29			139						16	
Link Speed (k/h)		50			50			-50			50	
Link Distance (m)		212.8			268.8			190.4			220.8	
Travel Time (s)		15.3			19.4			13.7			15.9	
Volume (vph)	- 34	0	28	127	98	136	0	728	0	0	794	- 58
Confi. Peds. (#/hr)												
Conti, Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.06	0.96	0.96	0.99	0.99	0.99	0.07	0.97	0.97
	00%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%
Heavy Vehicles (%)	0%	0%	7%	0%	2%	2%	0%	5%	0%	- 69%	4%	- 0%
Bus Blockages (#hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)								_				
Mid Block Traffic (%)	-	0%	-	-	0%	-		0%	-		0%	
Lane Group Flow (vph)	0	64	0	0	376	0	0	735	0	0	87.9	0
	Split S	3		Split 2	2			1			1	
Protected Phases Permitted Phases	3	- 3		z	2			1			1	
Detector Phases	3	3		2	2			1			1	
Minimum Initial (s)	1.5	1.5		4.0	4.0			4.0			4.0	
Minimum Solit (s)	5.0	5.0		10.0	10.0			20.5			20.5	
Total Split (s)	10.5	10.5	0.0	20.0	20.0	0.0	0.0	51.5	0.0	0.0	51.5	0.0
a manual subject to be		12,8%		24,4%		0.0%	0.0%		0.0%		62.8%	0.0%
Yellow Time (s)	2.5	2.5		20	2.0			2.0			2.0	
Al-Fied Time (s)	1.0	1.0		0.0	0.0			2.0			2.0	
Lead'Lag				Lag	Lag			Lead			Lead	
Lead Lag Optimize?				Yes	Yes			Yes			Yes	
Recall Mode	Max	Max		Max	Mex			Max			Max	
Act Effot Green (s)		6.9			16.4			47.9			47.9	
Actuated g/C Ratio		0.08			0.20			0.58			0.58	
wo Ratio		0.43			0.51			0.38			0.45	
Control Delay		32.0			20.9			0.0			10.3	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		32.0			20.9			0.0			10.3	
LOS		C			<u> </u>			A.			В	
Approach Delay		32.0			20.9			9.9			10.3	
Approach LOS		0			C			A			B	
Queue Length 50th (m)		5.5			17.8			31.1			38.2	
Queue Length 95th (m)		17.7			31.4 244.8			42.5 166.4			51.5 196.8	
Internal Link Dist (m)					A REAL PROPERTY AND A REAL			A line line million				

1115 - Silivrikapı Intersection - Off-peak, Optimum C=82

Lanes, Volumes, Ti 1115: Int	mings										26.03	.20.06
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Lane Group	EBL	EBT	EBR	WEL.	WBT	WBR	NEL.	NBT	NBR	SBL.	SBT	SBR
Turn Bay Length (m)												
Base Capacity (vph)		150			736			1913			1969	
Starvation Cap Reductr	1	0			0			0			0	
Spillback Cap Fleductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.43			0.51			0.98			0.45	
Intersection Summary												
	/her											
Cycle Length: 82												
Actuated Oycle Length:	82											
Offset: 0 (0%), Referen	oed to p	ihase 2	WETL	, Start e	of Greek	Ti 👘						
Natural Cycle: 40												
Control Type: Pretimed												
Maximum Vo Ratio: 0.5												
Intersection Signal Dela	y:127					tion LOS						
Intersection Capacity Ut		148.3%		-	CU Lev	el of Sei	Nice A.					
Analysis Period (min) 1	5											
Splits and Phases: 11	115: Int										1	
↓† ₂₁						7.	ê.		4	nî 👘		
51.5+						201			100			
Baseline										Que	shro 6 P	Dominant
ISBAK INC.										- - - - - - - - - - -		lage 2

Lanes, Volumes, Til 1115: Int	mings	l.									26.0	3.2006
	٠	-+	\mathbf{r}	¥	+	فر	٩	*	<i>/</i> *	4	Ļ	~
Lane Group	EBL	EBT	EBR	WBL.	WBT	WBR	NBL	NBT	NBR	SBL	SBIT	SBR
Lane Configurations		-			-11+			- 1 1-			_ 11 ⊷	
Ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891
Lane Width (m)	3.6	2.5	3.6	3.6	3.2	3.6	3.6	3.3	3,6	3.6	3.2	3.6
Grade (%)		0%			125			2%			-5%	
Storage Length (m) Storage Lanes	0.0 0		0.0 0	0.0 0		0.0 0	0.0 0		0.0 0	0.0 0		0.0 0
Total Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Leading Detector (m)	15.0	15.0	0.0	15.0	15.0	3.0	3.6	15.0	3.9	3.5	15.0	-3.0
Trailing Detector (m)	0.0	0.0		0.0	0.0			0.0			0.0	
Turning Speed (wh)	25	TWO IN	15	25	THE M	15	25	nen he	15	25	w. w	15
Satd. Flow (prot)	0	1438	0	0	3145	0	0	327.5	0	0	3326	0
Fit Permitted		0.978	_		0.983	_						_
Satd. Flow (perm)	0	1438	0	0	3145	0	0	327.5	0	0	3326	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd, Flow (RTOR)		47			120						11	
Link Speed (k/h)		50			-50			-50			-50	
Link Distance (m)		212.8			268.8			190.4			220.8	
Travel Time (s)		15.3			19.4			18.7			15.9	
Volume (vph)	31	0	39	1:26	115	134	0	711	0	0	874	50
Cordi, Peds. (#/hr)												
Confl. Bikes (\$/hr)											_	
Peak Hour Factor	0.88	0.83	0.83	0.94	0.94	0.94	0.87	0.87	0.87	0.89	0.89	0.89
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%
Heavy Vehicles (%)	6%	0%	3%	1%	12	1%	0%	- 5%	- 0%	0%	- 5%	4%
Bus Blockages (#'hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr) Mid Block Traffic (%)		0%			0%			0%			0%	
Lane Group Flow (volt)	0	94 84	0	0	300	0	0	817	0	0	1038	0
Turn Type	Solt			Solt	09.9			017			10010	
Protected Phases	3	3		2	2			1			1	
Permitted Phases	1 -1 1			-								
Detector Phases	3	3		2	2			1			1	
Minimum Initial (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Minimum Split (s)	15.0	15.0		19.5	19.5			20.5			20.5	
Total Spitt (s)	15.0	15.0	0.0	19.5	19.5	0.0	0.0	45.5	0.0	0.0	45.5	0.0
the second second second second second second second second second second second second second second second se	8.8%	18.9%	0.0%	24.4%	24.4%	0.0%	0.0%	58.9%	0.0%	0.09%	58.9%	0.0%
Yellow Time (s)	20	2.0		20	2.0			2.5			2.5	
All-Red Time (s)	1.0	1.0		0.0	0.0			2.0			2.0	
Lead/Lag				Leg	Lag			Lead			Lead	
Lead Lag Optimize?				Yes	Yes			Yes			Yes	
Recall Mode	Max	Max		Max	Mex			Max			Max	
Act Effot Green (s) Actuated o/C Ratio		114			15.9			41.9			41.9	
Actuated g/C Ratio		0.14			0.20			0.52			0.52	
wo Habo Control Delay		0.34 20.7			23.2			0.46			14.8	
Oueue Delay		20.7			23.2			13.3			14.6	
Total Delay		20.7			23.2			13.3			14.8	
LOS		C			C			B			14.0 B	
Approach Delay		20.7			23.2			13.3			14.8	
Approach LOS		C			C			B			B	
Queue Length 50th (m)		5.3			20.8			40.8			56.0	
Queue Length 95th (m)		16.1			35.1			52.8			73.6	
Internal Link Dist (m)		198.8			244.8			166.4			196.8	
Baseline ISBAK INC.										Syn	ichro 6 i P	Report Page 1

1115 - Silivrikapı Intersection - Off-peak, Existing

Lanes, Volumes, Ti 1115: Int	mings										26.03	.2006
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Lane Group	EBL.	EBT	EBR	WBL	WBT	WBR	NBL.	NBT	NBR	SBL.	SBT	SBR
Turn Bay Length (m)												
Base Capacity (vph)		245			721			1715			1747	
Starvation Cap Reduct:		0			0			0			0	
Spillback Cap Reducts		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.34			0.55			0.48			0.59	
Intersection Summary												
) than											
Cycle Length: 80												
Actuated Oycle Length:	80											
Offset: 0 (0%), Referen	eed to p	hase 2	WBTL	, Start e	of Gree	п						
Natural Cycle: 60												
Control Type: Pretimed												
Maximum we Ratio: 0.5					_	_						
Intersection Signal Dela						tion LOS						
Intersection Capacity U		51.2%		1	CULAV	el of Sei	Nice A					
Analysis Period (min) 1	5											
the second second to the second second second second second second second second second second second second se	115: Int				_			_				
₩T a1					7	12		- 4	e d			
Baseline ISBAK NC.	-	-		-			-			Synt	shro 6 P P	Report lage 2

3: Int											27.00	3.2006
	'n	1	ſ	ي.	Ļ	الم	,	1	4	4	×	Ł
Lane Group	NBL.	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	· ·	414			-4 1 %-			-4†-	- r		- #*	
Ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891
Lane Wildth (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.8	4.8	3.6	3.6	4.8
Grade (%)		-0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		1	0		1
Total Lost Time (s)	3.6	3.6	3.8	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Leading Detector (m)	15.0	15.0		15.0	15.0		15.0	15.0	15.0	15.0	15.0	15.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Turning Speed (k/h)	25	4.00.000	15	25	4835	15	25	00.04	15 1822	25 0	0000	15 2143
Satd. Flow (prot) Fit Permitted		4622			4635		0	3391	1822	U	3293	2143
Satd. Flow (perm)	0	4622	0	0		0	0	3301	1822	0	0.084	2143
Sato, How (perm) Bight Turn on Red		40.22	Ves			Vas	0	0.091	Yes	U	0.29.5	2143 Yes
Satd. Flow (RTOR)		51	1,000		6	195			795			198
Link Speed (Wh)		50			50 - 50			50	125		50	
Link Distance (m)		228.0			200.8			231.1			235.3	
Travel Time (s)		16.4			14.5			16.6			16.0	
Volume (vph)	261	361	143	17.9	428	26	174	725	Э	278	564	0
Confi. Peds. (#/hr)		learner 1	1.419		46.0			12.0	1997	2.0	Contraction of the	
Conti. Bikes Ø/hr)												
Peak Hour Factor	0.93	0.93	0.03	0.05	0.05	0.05	0.91	0.01	0.91	0.96	0.06	0.06
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%.	4%.	14%	3%.	3%	15%	4%	8%.	0%	4%	0%	0%
Bus Blockages (#hr)	0	0	0	0	0	ō	0	0	0	0	0	0
Parking @/hth		_			_					-	_	
Mid Block Traffic (%)		0%			- 0%			0%			0%	
Lane Group Flow (vph)	0	823	0	0	666	0	0	088	3	0	87.8	0
Turn Type	Split			Split			Split		Free	Split		Free
Protected Phases	2	2		1	1		- 4	- 4		3	3	
Permitted Phases									Free			Free
Detector Phases	2	2		1	1		- 4	- 4		3	3	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		15.0	15.0		20.5	20.5		20.5	20.5	
Total Split (s)	20.0	20.0	0.0	15.0	15.0	0.0	31.0	31.0	0.0	24.0	24.0	0.0
and the second sec		22.2%	0.0%	16.7%		0.0%	34.4%		0.0%	26.7%		0.0%
Yellow Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
All-Red Time (s)	1.0	1.0			1.0		1.0			1.0	1.0	
Lead'Lag	Lag	Lag		Lead			Lag	Lag		Lead	Lead	
Lead Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	
Recall Mode	Max	Max		Max	Mex		Max	Max		Max	Max	
Act Effet Green (s)		16.4			11.4			27.4 0.30	90.0 1.00		20.4 0.23	
Actuated g/C Ratio		0, 16			1.08			0.96	0.00		1.18	
Wo Hatto Control Delay		0.98 52.5			97.4			0.96 51.3	0.00		1.18	
Control Delay Queue Delay		0.0			0.0			ыт.а 0.0	0.0		126.4	
Course Deray Total Delay		6.0 52.5			97.4			51.3	0.0		126.4	
LOS		Diana Diana			E E			D LO D	A.		F E	
Approach Delay		52.5			97.4			51.2			126.4	
Approach LOS		Diality D			E E			B1.2			120.4	
Queue Length 50th (m)		51.3			-49.8			92.4	0.0		-101.6	
Queue Length 95th (m)		#76.7			\$74.8			134.4	0.0		139.6	
Internal Link Dist (m)		204.0			176.8			207.1	0.0		211.3	
constraints react from four					1.1 (A. 14)			and all			and the set	

1162 A - Unverdi Intersection - Off-peak

Lanes, Volumes, Tir 3: Int	nings										97 P	1.2006
<u>o. m.</u>				_								
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Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWIT	SWR
Turn Bay Length (m)												
Base Capacity (vph)		884			618			1032	1822		746	
Starvation Cap Reducts		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced vio Ratio		0.98			1.08			0.96	0.00		1.18	
Intersection Summary												
	her											
Cycle Length: 90												
Actuated Cycle Length: I	90											
Offset: 60 (67%), Refere	noed t	o phase	a 6t, Sta	at of Gr	nee							
Natural Cycle: 100												
Control Type: Pretimed												
Maximum vio Ratio: 1.11												
Intersection Signal Delay	r: 80.3					ion LOS						
Intersection Capacity Ut	izatio r	00.4%		Ю	CU Levi	al of Sei	rvice E					
Analysis Period (min) 15												
 Volume exceeds cap 					nfinite.							
Queue shown is max												
# 95th percentile volum					may be	longer.						
Queue shown is max	imum i	after tw	o cycles	I.								
Splits and Phases: 3:	int					_						
₩ a1 №1 a2			🖌 🖬			- J	r _{et}					
15 x 21 x			- 194 74 -				<u>.</u>					
											-	
Baseline										Syn	ohro 6 i	Report
ISBAK INC.												age 2
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1163 - Yayla Intersection - Off-peak

1163: Int											- 1000 AND	3.2006
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Lane Group	EBL	EBT	EBR	WEL.	WBT	WBR	NBL.	NET	NBR	SEL.	SBT	SER
Lane Configurations	-	- 11-	- r		- † †+-	-		- 4 -	-		÷+-	-
Ideal Flow (vphpi)	1891	1891	1801	1891	1891	1891	1891	1891	1891	1891	1891	1891
Lane Width (m)	3.6	3.5	3,6	3.6	3.9	3.8	3.6	4.8	3.8	3.6	4.8	3.6
Grade (%)		- 0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Stonage Lanes	0		1	0		0	0		0	0		0
Total Lost Time (s)	3.6	3.6	3,6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Leading Detector (m)		15.0	15.0		15.0		15.0	15.0		15.0	15.0	
Trailing Detector (m)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Satd, Flow (prot)	0	3260	1576	0	3250	0	0	1918	0	0	1863	0
Fit Permitted								0.081			0.984	
Satd. Flow (perm)	0	3260	1576	0	3250	0	0	1918	0	0	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			415		18			-5			13	
Link Speed (Wh)		50			50			-50			50	
Link Distance (m)		232.0			249.6			161.6			147.2	
Travel Time (s)		16.7		_	18.0			11.6			10.6	
Volume (vph)	0	901	41	0	709	83	120	163	27	185	263	123
Comi. Peds. (#/hr)												
Confl. Bikes (#/hr)	_											_
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.83	0.83	0.83	0.96	0.96	0.96
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	- 9%	2%	- 0%	12%	16%	7%	10%	4%	18%	6%	695
Bus Blockages (#'hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		200										
Mid Block Traffic (%)	-	0%			0%			0%	-		0%	
Lane Group Flow (vph)	0	979	45	0	833	0	0	- 374	0	0	595	0
Turn Type		3	pt+ov 3-1		3		Split 1	1		Split	2	
Protected Phases		- 2			9			- E		2		
Permitted Phases Detector Phases		3	3.1		3		1	1		2	2	
Minimum Initial (s)		4.0	- 2 I		4.0		4.0	4.0		4.0	4.0	
Minimum Solit (s)		20.0			20.0		4.0 8.0	8.0		15.0	15.0	
Total Split (s)	0.0	43.0	70.0	0.0	43.0	0.0	27.0	27.0	0.0	18.0	18.0	0.0
Total Split (%)		48,0%			48,0%		30.7%.:				20.5%	0.0%
Yellow Time (s)	W.W.We	+0.925 2.0	8 M.O.26	0.076	2.0	WARDS -	2.0	2.0	0.000	20.0%	2.0	0.000
All-Red Time (s)		1.0			1.0		1.0	1.0		2.0	2.0	
Lead Lag		1.0			1.0			Lead		Lao	Lao	
Lead Lag Optimize?							Yes			Yes		
Recall Mode		Max			Max		Max	Max		Max	Max	
Act Effot Green (s)		39.4	66.4		39.4		AN UN	23.4		AP EX.	14.4	
Actuated o/C Ratio		0.45	0.75		0.45			0.27			0.16	
vo Ratio		0.67	0.10		0.57			0.7.8			1.98	
Control Delay		22.0	1.0		19.5			38.6			434.0	
Queue Delay		0.0	0.0		0.0			0.0			+0+.0	
Total Delay		22.0	1.0		19.5			38.6			434.0	
LOS		C	A		B			D			F	
Approach Delay		21.1			19.5			38.6			434.0	
Approach LOS					B			D			F	
Queue Longth 50th (m)		69.7	0.0		54,4			59.7			-163.6	
Queue Length 95th (m)		91.7	2.1		78.0			82.2			100.0	
Internal Link Dist (m)		208.0	I		225.6			137.6			123.2	
mannar eins east (m)		a.u.9. M						1997.18			10.25.25	
Baseline										Sum	ohro 6 P	Ronart
										1947 (19	ne li i da fet f	n a seguerar de la

Lanes, Volumes, Ti 1163: Int	mings	ł									26,03	2006
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Lane Group	EBL.	EBT	EBR	WBL.	WBT	WBR	NBL	NBT	NBR	SBL.	SBT	SBR
Turn Bay Length (m)												
Base Capacity (vph)		1460	1200		1465			514			316	
Starvation Cap Reducts	1	0	0		0			0			0	
Spillback Cap Reductn		0	0		0			0			0	
Storage Cap Reductn		0	0		0			0			0	
Reduced vio Ratio		0.67	0.04		0.57			0.73			1.88	
Intersection Summary												
	ther											
Cycle Length: 88												
Actuated Cycle Length:												
Offset: 20 (29%), Referenced to phase 6:, Start of Green												
Natural Cycle: 65												
Control Type: Pretimed	_											
Maximum vio Ratio: 1.8		_			_							
Intersection Signal Dela						tion LOS						
Intersection Capacity Ut		n 70,5%		-	CU Lev	el of Sei	rvice C					
Analysis Period (min) 18	5											
 Volume exceeds car 					minde.							
Queue shown is may # 95th percentile volum												
 Gueue shown is may 					rnay be	nonger.						
ADEDE SPRANT IS THE			о суроные	a.								
Splits and Phases: 11	163: Int											
		14									1	
\$ at		} + ₆₂		B	≯ ₈ 3							
27 s		18 s		4	5							
Baseline										Synt	shro 6 P	Report
ISBAK INC.												age 2

Lanes, Volumes, Ti	mings	1					
1164: Int							26.03.
	۲	-+	+	k_	`+	\rightarrow	
Lane Group	EBL.	EBT	WBT	WBR	SEL	SER	
Lane Configurations		_ +t†-	- † †	- r	- N	- C	
ideal Flow (vphpi)	1891	1891	1801	1891	1891	1891	
Lane Wildin (m)	3.6	3.5	3.8	2.5	4.2	2.5	
Grade (%)		- 0%	0%		0%		
Storage Length (m)	0.0			0.0	0.0	0.0	
Storage Lanes	0			1	1	1	
Total Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	
Leading Detector (m)	15.0	15.0	15.0	15.0	15.0	15.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	
Turning Speed (Mh)	25			15	25	15	
Satcl. Flow (prot)		3392	3465	1260	1726	1344	
Fit Permitted	-	0.660			0.050		
Batd. Flow (perm)	0	22/52	3465	1260	1726	1344	
Right Turn on Red			127-1712(2)	Yes	1.	Yes	
Batcl. Flow (RTOFI)				307		135	
Link Speed (k/h)		50	.50	-0647	50	1.015	
Link Speed (vin) Link Distance (m)			294.4		249.3		
and the second second second							
Travel Time (s)		16.9	21.2	proventing of the second	17.9		
Volume (vph)	142	988	848	298	343	127	
Confi. Peds. (#/hr)							
Confi, Bikes (#/hr)							
Peak Hour Factor	0.88	0.88	0.97	0.97	0.94	0.94	
	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	5%.	- 4%	695	12%	11%	5%	
Bus Blockages (#hr)	0	0	0	0	0	0	
Parking (#/hr)							
Mid-Block Traffic (%)		- 0%	0%		0%		
Lane Group Flow (Noh)	0	1284	874	307	365	135	
Turn Type	Prot			pt+ov		Free	
Protected Phases	2	23	3	3.1	1		
Permitted Phases	-					Free	
Detector Phases	2	23	3	3.1	1		
Minimum Initial (s)	4.0		4.0		4.0		
Minimum Split (s)	20.0		8.0		20.0		
Total Split (s)	14.0	00.0	54.0	76.0	22.0	0.0	
Contract of the second se		68.0 75.0%		76.0 84.4%			
		10.0%		64.4%		0.0%	
Yellow Time (s)	20		2.0		2.0		
All-Red Time (s)	1.0		1.0		2.0		
Lead Lag	Lag				Lead		
Lead Lag Optimize?	Yes				Yes		
Recall Mode	Max		Max		Max		
Act Effot Green (s)		60.8	50.4	724	18.4	90.0	
Actuated g/C Ratio		0.68	0.56	0.80	0.20	1.00	
vo Ratio		1.00	0.45	0.29	1.03	0.10	
Control Delay		36.9	12.6	0.9	94.3	0.1	
Queue Delay		0.0	0.0	0.0	0.0	0.0	
Total Delay		36.9	12.6	0.9	94.3	0.1	
.08		D	В	A	F	A	
Approach Delay		36.0	9.6		68.8		
Approach LOS		D			E		
Dueue Longth 50th (m)		-47.5		0.0	-72.1	0.0	
Oueue Length 95th (m)		#93.4			#128.8	0.0	
internal Link Dist (m)			270.4	-26	225.3	0.0	
noemer onk over (m)		211.2	270,4		665.3		
Baseline							Constant C.C.
ISBAK INC							Synchro 6 R Pa
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1164 - Kocasinan Girisi Intersection - Off-peak

Lanes, Volumes, Tin	nings						
1164: Int							26.03.200
	۲	-	+	×	\mathbf{F}	4	
	EBL	EBT	WBT	WBR	SEL	SER	
Turn Bay Length (m)							
Base Capacity (vph)		1283	1940	1074	353	1344	
Starvation Cap Reductn		0	0		0		
Spillback Cap Reducts		0	0	0	0	0	
Storage Cap Reducts						0	
Reduced v/c Ratio		1.00	0.45	0.29	1.03	0.10	
Intersection Summary							
Area Type: Of	her						
Cycle Length: 90							
Actuated Oycle Length: 9	0						
Offset: 22 (24%), Referen	nced t	o phas	e 2:EB1	TL and 6	it, Start	of Green	
Natural Cyclic: 65							
Control Type: Pretimed							
Maximum we Ratio: 1.03							_
Intersection Signal Delay						ion LOS: (al of Servic	
Intersection Capacity Util Analysis Period (min) 15	iz an or	1 84.27	•	18	SU LAV		09 E
 Volume exceeds cap 	n eithe u	en ren e i	in Hanner	edite al las is	elle lie		
Queue shown is max	auny, i	uju eu e i office fac	o mele	wuu diny i e			
 # 95th percentile volum 					nav ho	longer	
Queue shown is maxi					the off	weight .	
			er eilene				
Splits and Phases: 116	54: Int						
V. el .	8		₩,				
	¥ ₆ 2		-*	đ			
22.8	14.0		14.0				
Resolute							Synchro 6 Repor
ISBAK INC.							Page

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		-	-			
Lane Group	EBL	EBT	WBT	WBR	SBL	88R
Lane Configurations		11	<u></u> ††+		Y	
Ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891
Lane Width (m)	3.6	3.6	3.6 5%	3.6	4.4	4.4
Grade (%)		/ Xe	5/%		-5%	
Storage Length (m)	0.0			0.0	0.0	0.0
Storage Lanes	0			1	1	1
Total Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6
Leading Detector (m)		15.0	15.0	15.0	15.0	15.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0
Turning Speed (k/h)	25			15	25	15
Satd. Flow (prot)	0	3610	3258	1371	1966	1671
Fit Permitted					0.050	
Satd. Flow (perm)	0	3610	3258	137.1	1966	1671
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				248	_	79
Link Speed (Wh)		50	50		50	
Link Distance (m)			330.0		278.4	
Travel Time (s)	_	15.3	23.8		20.0	
Volume (vph)	0	809	770	221	309	62
Confl. Peds. (#/hr)						
Cord, Bikes (#/hr)			-			
Peak Hour Factor	0.90	0.90	0.91	0.90	0.91	0.78
	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	3%	3%	4%	- 2%	2%
Bus Blockages (#'hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid Block Traffic (%)		0%	0%		0%	
Lane Group Flow (vph)	0	800	848	246	340	79
Turn Type				pt+ov		ustom
Protected Phases		1.2	1	18	3	
Permitted Phases						2
Detector Phases		1.2	1	1.8	3	2
Minimum Initial (s)			4.0		4.0	4.0
Minimum Split (s)			20.0		8.0	8.0
Total Split (s)	0.0	69.0	56.0	77.0	21.0	13.0
Total Split (%)	0.0%	78,7%	62.2%	85.6%	23.3%	14.4%
Yellow Time (s)			2.0		2.0	2.0
Al-Red Time (s)			1.0		2.0	1.0
Lead'Lag			Lead			Lao
Lead Lag Optimize?			Yes			Yes
Recall Mode			Max		Max	Max
Act Effet Green (s)		65.4	52.4	78.4	17.4	
Actuated o/C Ratio		0.73	0.58	0.82	0.19	0.10
wo Ratio		0.34	0.45	0.21	0.89	0.32
Control Delay		4.9		0.7	63.1	13.1
Queue Delay		0.0	0.0	0.0	0.0	0.0
Total Delay		4.0	11.5	0.7	63.1	13.1
LOS		A.		a.r		
Approach Delay		4.9	9.1		53.7	
Approach LOS		4.9 A	м. н А		Dour D	
Queue Longth 50th (m)		26.0			60.9	0.0
				3.53		9.7
imernai Link Dist (m)		188.4	306.0		264,4	
Queue Length 95th (m) mernal Link Dist (m) Baseline SBAK INC.			58.4 306.0		#110.5 254.4	9.7

1165 – Sirinevler Intersection – Off-peak

Lanes, Volumes, Tit 1165: Int	mings							26.08.2006
	هر	+	+	۰.	4	1		
Lane Group	EBL.	EBT	WBT	W BR	SBL	SBR		
Turn Bay Longth (m)								
Base Capacity (vph)		2623	1807	1164	380	245		
Starvation Cap Reducts	l .	0	0		0	0		
Spillback Cap Reductn		0	0		0	0		
Storage Cap Reductn			0		0	0		
Reduced vio Ratio		0.34	0.45	0.21	0.89	0.32		
Intersection Summary								
	ther							
Cycle Length: 90								
Actuated Cycle Length:								
Offset: 34 (38%), Refere	encied t	o phas	e 6:, St	art of Gr	neen			
Natural Cycle: 40								
Control Type: Pretimed	_							
Maximum vio Ratio: 0.8						inn LOS:		
Intersection Signal Dela Intersection Capacity Ut						el of Serv		
Analysis Period (min) 18		n 46.974	•	n	GUILAV	el of Serv	109 A.	
 # 95th percentile volu: 		onde o	ana cite	CH DUD I	ones ho	longer		
Queue shown is may					n nagy long	even paper a		
			a alam					
	165: Int							
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Baselne							Sync	hro 6 Report
ISBAK INC.								Page 2

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Lane Group	EBL.	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	-88
Lane Configurations		- † 14-			-4 1 1-					-	₽	
deal Flow (vphpi)	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	1891	189
Lane Wildth (m)	3.6	3.5	3.8	3.6	3.5	3.8	3.6	3.6	3.8	3.6	3.6	- 3
Snade (%)		0%			- 0%			- 0%			0%	
Storage Length (m)	0.0		0.0	30.0		0.0	0.0		0.0	0.0		0
Storage Lanes	0		0	1		0	0		0	0		
Total Lost Time (s)	3.6	3.6	3.8	3.6	3.6	3.8	3.6	3.6	3.6	3.6	3.6	3
Leading Detector (m)		15.0		15.0	15.0					15.0	15.0	
Trailing Detector (m)		0.0		0.0	0.0					0.0	0.0	
Turning Speed (k/h)	25		15	25		15	25		15	25		1
Batd, Flow (prot)	0	3296	0	0	3325	0	0	0	0	0	1700	
Fit Permitted					0.727						0.992	
Satd. Flow (perm)	0	3296	0	0	2422	0	0	0	0	0	1700	
Right Turn on Red			No			No			No			- N
Satd, Flow (RTOR)												
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		137.4			176.2			250.3			228.1	
Travel Time (s)		0.0			12.7			18.0			16.4	
Volume (vich)	0	888	243	65	1060	212	0	0	0	34	91	5
Confi. Peds. (#/hr)	~	000	240	99	TWO O	212		v		24	9 I	
Conf. Peos. (#/fr) Conf. Bikes (#/hr)												
a second and second a second se					1991 - 1991 - 1991					a	1991 - 1992 - 1993	
Peak Hour Factor	0.77	0.77	0.77	0.88	0.86	0.86	0.90	0.90	0.90	0.83	0.83	0.8
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100
Heavy Vehicles (%)	2%	-5%	2%	6%	4%	4%	2%	2%	2%	3%	4%	- 4
Bus Blockages (#hr)	0	0	0	0	0	0	0	0	0	0	0	
Parking (#/hr)												
Mid Block Traffic (%)		0%			0%			0%			0%	
Lane Group Flow (vph)	0	1467	D.	0	1556	0	0	0	0	0	268	
Turn Type				Prot						Split		
Protected Phases		3		2	2.3					1	1	
Permitted Phases												
Detector Phases		- 3		2	2.3					1	1	
Minimum Initial (s)		5.0		1.0						5.0	5.0	
Minimum Split (s)		20.0		3.0						20.0	20.0	
Total Split (s)	0.0	61.0	0.0	8.0	69.0	0.0	0.0	0.0	0.0	.21.0	21.0	0
Total Split (%)	0.0%	67.8%	0.0%	8.9%	76.7%	0.0%	0.0%	0.0%	0.0%	23.3%	23.3%	0.0
Yellow Time (s)		2.0		2.0						2.0	2.0	
All-Red Time (s)		1.0		0.0						1.0	1.0	
Lead'Lag				Lag						Lead	Lead	
Lead Lag Optimize?				Yes						Yes		
Recall Mode		Max		Max						Max	Max	
Act Effet Green (s)		57.4		1.	61.8						17.4	
Actuated o/C Ratio		0.64			0.60						0.19	
vo Ratio		0.70			1.37						0.81	
Control Delay		12.0			190.5						55.8	
Dueue Delay		0.0			0.0						0.0	
Total Delay		12.0			190.5						55.8	
ICIA Delay		12.9 B			INVUS						00.0 F	
Approach Delay		12.9			190.5						55.B	
Approach LOS		B			F						E	
Queue Length 50th (m)		82.4			127.1						47.1	
Queue Length 95th (m)		79.2			165.3						\$76.4	
nternal Link Dist (m)		113.4			152.2			226.3			204.1	
Baseline SBAK INC.										Syn	ehro 6 I	Rep: Page

1426 - UEFA Intersection - Off-peak

Lanes, Volumes, Ti 3: Int	mings										26.03	2006
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Lane Group	EBL	EBT	EBR	WEL	WBT	WBR	NBL	NBT	NBR	SBL.	SBT	SBR
Turn Bay Length (m)												
Base Capacity (vph)		2102			1135						329	
Starvation Cap Reductr	1	0			0						0	
Spillback Cap Reductn		0			0						0	
Storage Cap Reducts Reduced v/c Ratio		0.70			0 1.37						0.81	
		0.70			1.47						0.81	
Intersection Summary												
	7ther											
Cycle Length: 90												
Actuated Cycle Length: Offset: 29 (32%), Refer	90			-	1916 - 1918							
Natural Cycle: 90	enced t	o phase	27WH	н с ало	et, 818	nt or rare	en					
Control Type: Pretimed												
Maximum v/o Ratio: 1.3												
Intersection Signal Dela		L		1	ntenseo	tion LOS	S: F					
Intersection Capacity U				- I	CU Lev	el of Sei	Nice F					
Analysis Period (min) 1	5											
 Volume exceeds ca 	pacity, (queue is	s theor	etically	infinite.							
Queue shown is may												
 # 95th percentile volu 					may be	longer.						
Queue shown is ma	ximum a	Stref MK	o oyolei	s.								
Splits and Phases: 3:	: Int											
		-									1	
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121 s	85	51 ÷										
Baseline										Sync	ohro 6 P	
ISBAK INC.											P	lage 2

Lanes, Volumes, Til 3: Int	annya					
	۶	→	+	۰.	7	7
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		<u></u>	- † †		_ <u>1</u> 446	
Ideal Flow (vphpi)	1891	1891	1891	1891	1891	1891
Lane Wildth (m)	8.6	3.9	3.5	3.6	3.1	3.6
Grade (%)		- 0%	0%		- 10%	
Storage Length (m)	0.0			0.0	0.0	0.0
Storage Lanes	0			0	3	0
Total Lost Time (s)	3.6	3.6	3.6	3.6	3.6	3.6
Leading Detector (m)		15.0	15.0		15.0	
Trailing Detector (m)		0.0	0.0		0.0	
Turning Speed (k/h)	25			15	35	15
Satd. Flow (prot)	0	4529	3017	0	4347	0
Fit Permitted	_				0.050	-
Satd. Flow (perm)	0	4529	3017		4347	0
Right Turn on Red				Yes		Yes
Satd, Flow (RTOR)					_	
Link Speed (Wh)		50	50		50	
Link Distance (m)			321.4		281.6	
Travel Time (s)	_	20.8	23.1	_	20.3	_
Volume (vph)	0	1976	910	0	2102	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.82	0.82	0.98	0.96	0.90	0.90
	100%		100%		100%	100%
Heavy Vehicles (%)	- 0%	6%	6%	0%	4%	0%
Bus Blockages (#'hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid Block Traffic (%)		0%	0%		0%	
Lane Group Flow (yph)	0	2410	948	0	2336	0
Turn Type						
Protected Phases		2	2		1	
Permitted Phases						
Detector Phases		2	2		1	
Minimum Initial (s)		4.0	4.0		4.0	
Minimum Split (s)		20.0	20.0		20.0	
Total Split (s)	0.0	52.0	52.0	0.0	62.0	0.0
Total Split (%)	0.0%	45.6%			54,4%	0.0%
Yellow Time (s)		2.0				
Al-Red Time (s)		2.0	2.0		2.0	
LeadLag		Lag	Lag		Lead	
Lead Lag Optimize?			Yes		Yes	
Recall Mode		Max			Max	
Act Effot Green (s)		48.4			58.4	
Actuated g/C Ratio			0.42		0.51	
wa Ratio			0.74		1.05	
Control Delay					61.6	
Queue Delay		0.0	0.0		0.0	
Total Delay		149.0	31.9		61.6	
LOS		F			E	
Approach Delay		149.0			61.6	
Approach LOS			C		E	
Queue Length 50th (m)		-250.5			-212.0	
Queue Length 95th (m)		1248.4			\$241.3	
internal Link Dist (m)		264.2	217.4		257.6	
Baseline						
ISBAK INC.						

2204 – Dolmabahce Intersection – PM Peak

Lanes, Volumes, Tir	mings							
3: Int								18.05.2006
	هر	+	+	۰.	4	~		
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR		
Turn Bay Length (m)								
Base Capacity (vph)		1923	1281		2227			
Starvation Cap Reducts		0	0		0			
Spillback Cap Reductn		0	0		0			
Storage Cap Reductn			0		0			
Reduced vio Ratio		1.25	0.74		1.05			
Intersection Summary								
	вD							
Cycle Length: 114								
Actuated Oycle Length:	114							
Offset: 0 (0%), Reference	ed to p	ihase 6	i: Start	of Gree	en i			
Natural Cycle: 120								
Control Type: Pretimed								
Maximum vio Ratio: 1.2	5							
Intersection Signal Dela				1	ntersect	ion LOS: P	F	
Intersection Capacity Ut	lization	03.04	-			el of Servic		
Analysis Period (min) 15			-					
 Volume exceeds cap 	nacity u	nieliei	s theor	oficially	infinite			
Queue shown is max								
# 95th percentile volum	ne exo	eeds or	paoity.	CLIEUE	may be	longer.		
Queue shown is max								
Splits and Phases: 3:	Int							
					\Rightarrow_{d}			_
- pi					- 7 g(2		_
523					02.5			
Baseline							Sy	nchro 6 Report
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