1991-03
Spring 1991

SMU Football Traffic Simulation

Allen Pitts
John Edleman

SMU FOOTBALL TRAFFIC SIMULA
SENIOR DESIGN
MAY 9, 1991

Allen Pitts
John Edleman

SMU FOOTBALL TRAFFIC SIMULATION
SENIOR DESIGN
MAY 9, 1991

Allen Pitts
John Edleman

Table of Contents

INTRODUCTION

Southern Methodist University, nationally known and referred to as SMU, has had a resurgence in it's football program since the programs reinstatement in 1989. SMU's football program was given the " DEATH PENALTY " by the National College Athletic Association (NCAA) in 1986 which banned SMU's football team from competing for 1 year and playing a limited, away games only, schedule in its second year of probation. SMU officials elected instead to not compete at all in the second year of the " DEATH PENALTY " probation and put its efforts into restructuring its student-athlete code and putting an end to the quasi-professional nature of athletics that were so relevant at SMU.

SMU officials decided that in order to give athletics at SMU a more amateurish affect,. the first step was to have a football team that played its college football games at a college football stadium. This was the topic of much conversation because SMU hadn't played football on campus since 1947. In 1948 SMU started playing its games in the Cotton Bowl at Fair Park. The increased capacity was the reason for the move. Then in 1978, citing lack of attendance and increased recruiting value by the fact that players would be playing in the same stadium as the Dallas Cowboys, so sentimently referred to as " America's Team " , SMU once again changed their playing venue, this time, to Texas Stadium in Irving. However, even before the NCAA handed down its probation to SMU, SMU's football team had gone downhill in success from its #1 national ranking in 1981 to one of the worst teams in the Southwest Conference.

This decline in the teams success directly correlated to a decline in attendance. The decline was easily explained by those knowledgeable in college athletics; people don't go to watch a losing team play, especially when they can see the game on television for free. This attitude was prevalent not only with the average fan, but also with SMU students who found that getting to Texas Stadium was a problem. A combination of these and other factors led to talk of possibly returning football to the SMU campus even before the NCAA's 1986 action.

The return of Mustang Madness to the Hilltop, to which SMU is commonly referred, created logistic questions in the minds of SMU officials. The first being, " Do we renovate the existing structure, Ownby Stadium, or do we tear it down and build a new stadium? " There was a lot of thought put into this question as well as conceptual blueprints. However, after checking with the city of University Park on zoning regulations, the only alternative was to renovate Ownby Stadium to meet the standards set by the NCAA regarding capacity of Division 1 stadiums. This lead to discussion between SMU and the NCAA regarding renovation constraints. The first being zoning and the second being cost. After reviewing the situation, the NCAA gave SMU a temporary injunction allowing the stadium to be smaller than standards specified. The standard set by the NCAA is 32,000 seats and they allowed SMU to only have 24,000 seats. This is however a temporary situation and the NCAA has given SMU until the 1994 season to comply with their standards for Division 1 football stadiums.

The second question that SMU officials had to address was " Where do we park all the cars and how do we get them around campus?". That question has yet to have been answered to the satisfaction of SMU officials. The procedure drawn up was done by the SMU Department of Public Safety (DPS) with respect to certain guidelines they had set up to deal with other campus activities. That action along with a Senior Design project similar to what we are doing here helped the SMU DPS create an initial routing of traffic to available parking areas on the SMU campus. In the 2 years since the implementation of this system, the SMU DPS has continuously refined their system to maximize the systems efficiency by minimizing the amount of time it takes the average car coming to a football game at SMU to find a parking space. The goal of this project is to assist the SMU DPS by resimulating the flow of traffic around the general vicinity of the SMU campus and make new suggestions as to where problems may occur and give recommendations on alleviating the problems. The success of this project hinges on our ability to change the assumptions made in the first simulation into supportable facts by using data obtained by the SMU DPS over the past two years.

PROJECT OUTLINE

The first half of this semester was devoted to finding a project to work on that would incorporate our ability to apply the education we have received in the field of Engineering Management as well as other areas of study to a real life situation that we may be presented with when we are in the working world. The project was intended to not only test our mechanical abilities, but to accustom us to presenting material to a group of people. We decided to do a simulation of traffic flow after talking to Dr. Barr and Don McClure, a former student who had done the original simulation. We first had to read through the original report to understand what would be involved. Secondly we made an outline of what needed to be done before we could do the simulation. This part of the project was a focal point because without a solid direction the project would not be done in a professional manner.

After setting the goals and deadlines for our project we needed to re-read the original simulation to acquire any relevant information and document it for our own simulation. We also had to acquire new information from SMU officials and any other related sources. The bulk of this process was done over a period of two weeks. The main sources of new information were Grady Newton, head of the SMU DPS, and Roland Rainey, Assistant Athletic Director in charge of operations. These men are the two people responsible for traffic flow and parking for SMU football games.

The next step of the project was to make an initial plan of action for our simulation. This included calculating how many cars would need to park, which streets would be rerouted from two-way to one-way, where to station DPS officers to override the traffic signals and other logistic problems. After we figured that out, we outlined and programmed in our initial configuration. Next we had to debug the program to make sure it was in working order.

After all of the previous steps were taken, we were ready to run our initial configuration. This was done and we analyzed the data produced by the simulation. We then took into account the problem areas that were highlighted by the simulation and made adjustments to the system. These adjustments were made until we felt we had sufficiently maximized our system.

When all the adjustments were made, we analyzed all of the data produced by the simulations and put our conclusions down on paper. After having organized these conclusions, we will present them later in this paper as our recommendations for implementation.

STATISTICS

The most important statistic for this simulation is the number of cars that are expected to come to an SMU football game. In order to come up with this number we need to know the number of people who attend SMU football games, the number of people that will be walking to the games, and the average number of people that will arrive per car to the games.

Ownby stadium has a capacity of 24,000 seats at this time. This capacity is going to have to be increased to 32,000 by 1994 in order for SMU to continue to play it's game at Ownby stadium. However, for the purposes of our simulation, we are only modeling a simulation for a proposed 24,000 people coming to a game. This is done for specific purposes. First, SMU does not have the parking spaces available for more cars. As it is, some people that wish to park in our system aren't able to due to lack of available parking. Second, the simulation language that we used, SLAM 2, is not powerful enough to handle any more entities than it is in our simulation. For future consideration, these constraints will be easily eliminated by an increase in available parking as well as a more powerful version the present simulation language.

The number of people who walk to the on-campus football games is a product of many different factors. First we have the SMU students who live on campus and attend the football games at Ownby stadium. This number includes all of the students living in the dormatories as well as the fraternity and sorority houses. This number is approximately 3,500 students. Second we have the students who live in the surrounding area of SMU and would walk instead of drive to the football games. This number is approximately 1,500. There will also be people who will decide to park on their own on the University Park and Highland Park streets surrounding the SMU campus. These people will be approximately 3,000 in number. Adding all of these people together, we come up with 8,000 people walking to SMU football games from campus and surrounding areas.

The number of people that arrive per car on average has been estimated by the SMU DPS at 2.5. This number was also suggested by Roland Rainey in the athletic department. This number was different than the 3.5 persons per car attending SMU football games at Texas stadium and the Cotton Bowl. However, since those two stadiums are quite a bit further away and people are not able to walk, it is understandable that more people would arrive, per car, to the football games. The difference in these two estimates cause an 1,800 car difference. We chose to assume that 2.5 people would arrive per car and that would then leave room for error if this estimate is low.

Given the number of people that attend an SMU football game, the number of people who walk to the games, and the number of people that arrive per car, we come up with the number of cars that we expect to enter our traffic flow and parking system. The total number of cars, 6,400, is the total number of people coming to a game, 24,000, minus the 8,000 people who do not enter the traffic flow or parking system, and we come up 16,000 people arriving by car. When we divide the 16,000 people arriving by car by 2.5 people per car, we come up with 6,400 cars that will enter into our traffic flow and parking system.

SYSTEM BOUNDARIES

The system boundaries for our simulation were chosen with three main concerns. First, we had to decide where the cars would be coming from by direction and actual street location. Through interviews with the SMU DPS to determine where most of the traffic problems have occurred in the past as well as where they feel most of the cars come from, we decided to make our initial configuration of streets from our outer boundaries and move into the middle of our system from there. Our second concern was to include all available and simulatable parking areas. This included parking lots on the north end of campus as well as parking structures on the other side of North Central Expressway (see Appendix A). Our third concern was to make the simulation as realistic as possible. Therefore our outer boundaries are; on the west, Hillcrest, on the south, Mockingbird, on the north we use a combination of Daniels, McFarlin, and Yale, and on the east we have the Central Expressway north bound access road as our boundary. Using these boundaries and a subset of all of the streets within the systems boundaries, we have been able to do a realistic simulation of the traffic flow arriving at SMU football games played at Ownby stadium.

The one parking spot that was not an actual parking lot was the parking on Bishop Blvd. However, due to the limited access to Bishop Blvd. , we were able to simulate those 250 parking spots as a parking structure instead of random curbside parking which we have left out of our model due to the complexity of modeling it.

TRAFFIC FLOW

Due to time constraints we were only able to simulate the flow of traffic arriving at SMU football games at Ownby stadium. This however did not keep us from considering the problem of traffic flow after the game is over and all of the people that we have helped park have to leave the SMU campus and surrounding areas. In an interview with Grady Newton, Captain of the SMU DPS, Captain Newton stated they are not as concerned with the flow of traffic after the game is over. Captain Newton mentioned that their initial responsibility is to get people safely to the game, then get people safely off the SMU campus. Captain Newton also mention the fact that while they are getting people on campus they are also directing them toward limited parking areas whereas when the game is over, they are directing people to exits which have no capacity.

DISTRIBUTION OF ARRIVING TRAFFIC

After deciding the boundaries of the system and the estimates of the general direction that the traffic was coming into our system, we had to decide the actual entry points into our traffic flow. Noting that approximately 50% of the traffic comes from the north , 30% comes from the east, 20% comes from the south, we were left with 0% coming from the west. This however was justified by the fact that traffic coming from the west would enter the system at one of two points; the intersection of Hillcrest and Daniels or the intersection of Bishop and Mockingbird. Therefore, our other entry points are at the intersection of University and Airline Extension as well as two points of entry at the intersection of Central Expressway and Yale Blvd. One of the two intersections is for traffic coming from the north down Central Expressway and the other is for traffic coming across Central Expressway at that same point. The latter is considered traffic coming from the east (see Appendix B).

DATA GATHERING

The most important part of creating a realistic simulation is coming up with realistic results that can be used to analyze a situation. In order to do this, we had to have the best possible information regarding our system of traffic flow and parking. This included knowing where traffic signals such as stop signs and traffic lights are, what the cycle time of the each traffic light is, how long it takes to travel, uninhibited, from one traffic signal to another and a distribution of which way people tended to proceed from a traffic signal. Some of this information was gathered from a previous simulation. The information gathered from the previous simulation was the cycle times for the stop lights in the simulation. All other data was gathered from interviews or actual observation. One example is travel time between traffic signals. There was one general assumption made; when there was a question to the percentage of people travelling but not parking , we used what we call a 70:30 rule. This means that 70% of the time people would avoid congested areas and 30% of the time people would head into congested areas.

PRESENT CONFIGURATION

With regard to the boundaries of the system being used in our traffic flow and parking system stated on page 7, the following streets and direction are blocked off to the general flow of traffic by either a barricade, a DPS officer or by a parking attendant. All of the streets inside of the boundaries set by Hillcrest on the west, Mockingbird on the south, Airline and Airline Extension on the east and Daniel on the north (see Appendix C). This means that there will be no random traffic flow inside of the campus. This allows the SMU DPS to devote more of their attention to events surrounding the game instead of having to keep such a close eye on campus. In addition to these people, There will also be parking staff at the Parking garage, the W-5 lot which is directly across Airline from Ownby stadium as well as parking staff at all 3 parking structures on the east side of North Central Expressway.

According to Captain Newton, the configuration of streets on campus has not been a focal point for his department in assisting traffic flow. This is one area we hope to exploit in our simulation. One problem Captain Newton addressed was his departments uncertainty in how to manage traffic with regards to traffic officers. He was committed to using traffic officers where ever it would expedite the flow of traffic however, that had not yet been one of their top priorities.

PROGRAMMING ASSUMPTIONS

In order to create a functional model it was necessary to make several assumptions during the programing phase. These assumptions include the following:

1. 10% of the traffic present in the system will not park.

2. Individuals who do not park will choose to avoid heavy traffic 70% of the time and will enter the flow of heavy traffic the remaining 30% of the time.

3. Cars will park in the first available space. It would be beyond the scope of this simulation to model the decision making process of each individual.

4. Motorists will be informed when lots are full and re-routed to the next available parking lot that is not full.

5. Cars not finding a place to park will be stored in a queue to monitor how many people do not find parking.

6. 10% of the traffic present in the system has special parking privileges and will attempt to park in special areas before parking in other lots.

ARRIVAL RATES

Using the five entries into the system ,described earlier, we used past records and information from the previous simulation to establish the arrival rates for the cars. These rates were developed to reflect a slow arrival rate before the games begins, peak arrival rates immediately before the game, followed by slowing arrival rates for laggards that arrive after the start of the game.

PROGRAMMING

Using the previous simulation as a base, we programmed in the current system of roads and intersections. The new simulation simplified many of the intersections with a combination of one way streets and use of barricades. While simultaneously simplifying the curent number of intersections we also supplemented the program by adding more intersections to increase the scope of of model boundaries and more accurately portray the system. These added intersections are illustrated in Appendix D.

INTERSECTIONS

Using constructs from the first simulation we modeled the current system using updated information. The addition of one way streets and police officers once again reduced the complexity of many of the intersections. The two intersection possibilities were either a stop sign or traffic light. The combination of these intersection routes all traffic through the system.

Stop Signs

Stop signs allow for several entities to arrive at approximately the same time and wait for their turn. In the SLAM II model this is accomplished by selecting entities at the intersection using designated parameters. For our purpose we choose the parameter that chooses the entity who has waited longest at the queue to go first, second , etc. This parameter specifications aligns with our goal to minimize time before parking by minimizing the time an entity waits at each stop sign. Once the entity has been selected it is routed through the intersection using a combination of both conditional and probabalistic branching.

Traffic Lights

Traffic lights are treated slightly differently that stop signs. Lights are turned "green" and "red" in SLAM II by using gates. A gate can be opened and closed to allow entities to flow through or be blocked. The gates are standardized throughout the program so that east-west lights turn green for 30 seconds followed by a 4 second delay, and then turn green for north and south lights and then this loop repeats itself. The Slam graphical representation of this system is shown in Appendix E. Traffic lights allow 20 entities to pass through the light during its green stage, and will back up entities at a red light. Once the entities pass through the light they are subject to both conditional and probabalistic branching as with stop signs.

PARKING QUEUES

All parking is routed to parking lots that are represented as queues in the SLAM II language. Each queue has a capacity that represents a specific parking lot, and once the capacity is exceeded it will not allow any more entities to park. These queues can be monitored to detect which fill up quickest and which ones fill up last.

ANALYSIS

In order to determine the most successful street configuration that minimizes the total time to park, we began our analysis of the system assuming all intersections were fully functional with no one way streets or police officers. Using the previous simulation we were able to look closely at the relationships between certain intersections and the flow of traffic. By analyzing the combination of wait times at stop signs and inability to fill parking queues quickly, we concluded that several steps are needed to create a flow of traffic that will both move quickly and smoothly through the network of streets.

Updating the model to include DPS current operational procedures, we discovered that while long waits seemed to be less likely there were still some congestion causing time delays filing each of the parking queues. This led us to question what was happening in the system that allowed smooth flow at intersections, yet did not fill parking areas effectively. The simulation targeted possible intersections where, although moderate wait times existed, the flow of traffic was not under control. The simulation identified that certain intersections, by allowing multiple choices slowed down the travel time to the parking lots. The specific intersections were located at: Yale and Dublin, University and Airline, and Airline and Dyer.

With the problem areas identified we explored different configurations centered around these intersections that would help the flow of traffic. The intersection of Airline and University created problems because the intersection was not regulated. With major sources of incoming traffic attempting to head toward the parking areas via Airline, large inefficient flows were developing at this intersection. We examined several avenues around this problem. Alternatives to this situation included rerouting traffic southbound on Airlne Ext. to the McFarlin and Airline intersection. This would split up entrances into the system and allow for better flow. Another possibility was to attempt to simulate a traffic light at this intersection to increase efficiency.

The next intersection we examined was Yale and Dublin. Currently this intersection includes three possible choices for a car to travel. The multiple choices cause short waits but are inefficient at getting people to the parking areas. There were several choices we could make to solve this problem. We could model the intersection as a traffic light. Alternatively we could also define Dublin as one way from Mockingbird to Yale. This solution would eliminate one decision from the intersection and generate a more uniform flow.

The last intersection we analyzed was the intersection of Airline and Dyer for southbound traffic. This intersection is not extremely complicated but currently contains no parking instruction to expedite the flow of traffic toward available parking areas. This can be solved by simply providing more information to the drivers on were to go in order to find parking. In the SLAM II this can be modeled by forcing all cars desiring parking to continue southbound only.

CONCLUSIONS

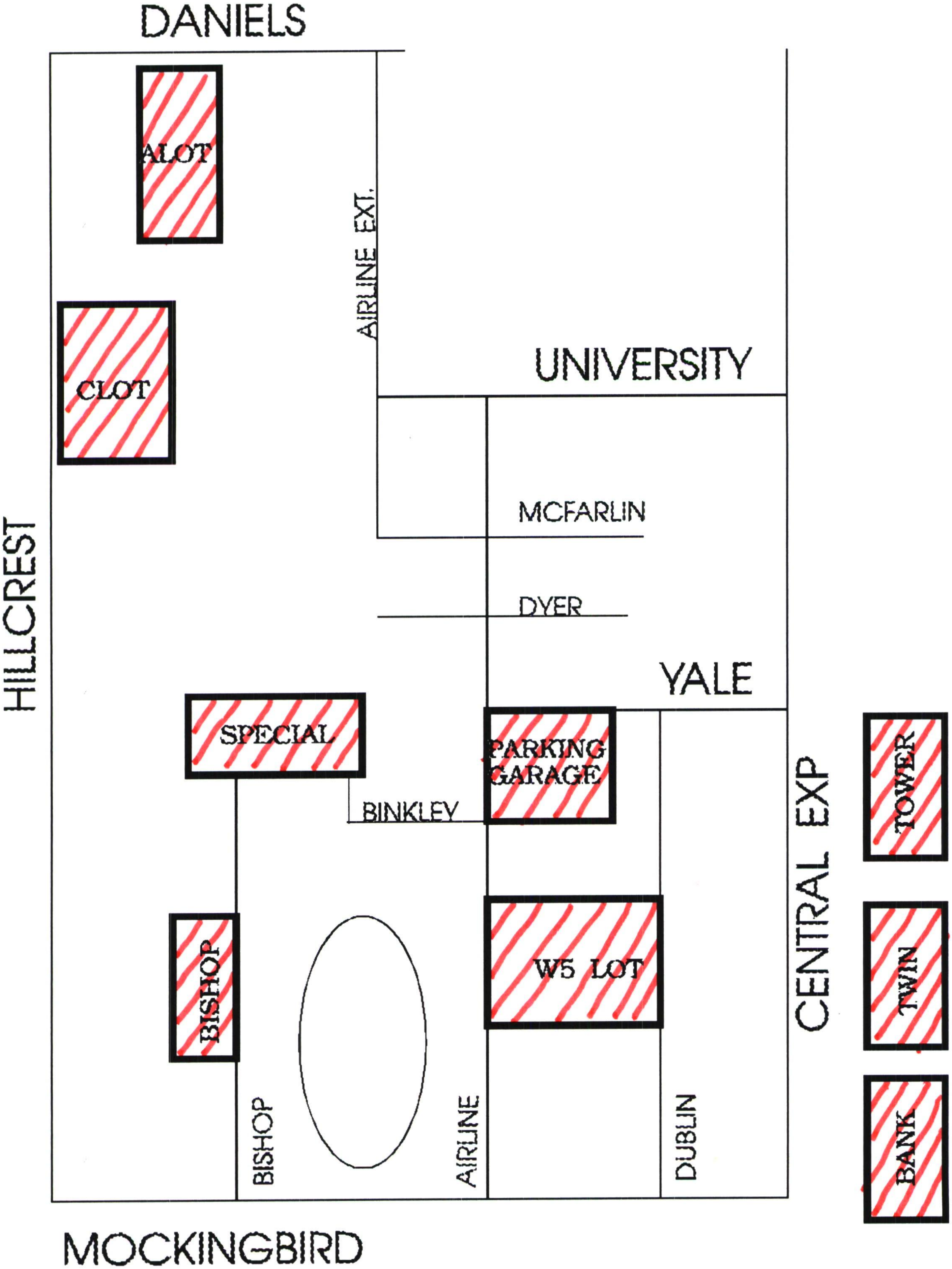
While analyzing these different street configurations, we tested different options using varying traffic loads and creation times. We choose to implement the street configuration that minimized the total time to park in all situations. While some configurations were superior to others our optimal solution was adaptable to many different situations. Our final choice for implementation provides for the following suggestions:

1. Make Dublin, from Mockingbird to Yale, a One-Way Street.
2. Guide drivers through campus by providing constant information concerning the best routes to parking areas .
3. Create a main thoroughfare from Daniels and Airline Ext. to McFarlin and Airline.
4. Use traffic officers to monitor the traffic and ensure proper flow.

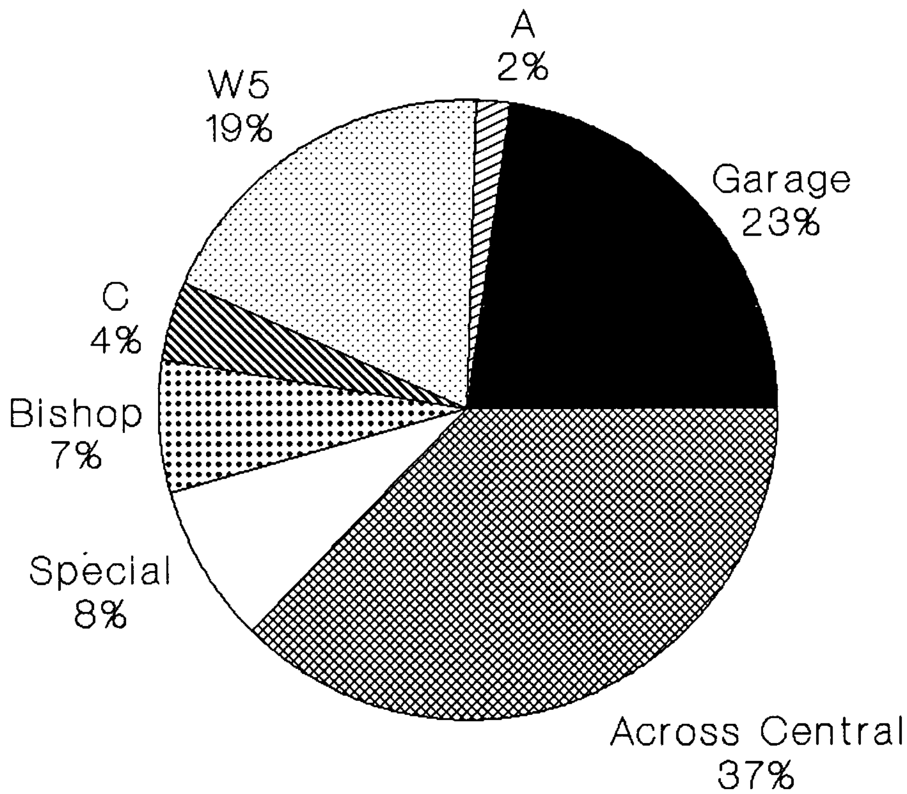
Using these suggestions we minimized the total time to park in a variety of different situations. We therefore conclude that the above configuration would alleviate many of SMU's current traffic problems (see Appendix F).

This implementation is not without flaw. As with any implementation of a new concept certain human elements must not be overlooked. This system does provide for large flows of traffic that minimize time to park, yet at the same time limits the drivers ability to choose. The disconcern that drivers will feel from the use of one-way streets and barricades is definitely a factor to consider upon implementing this system, even when the overall effect will be positive.

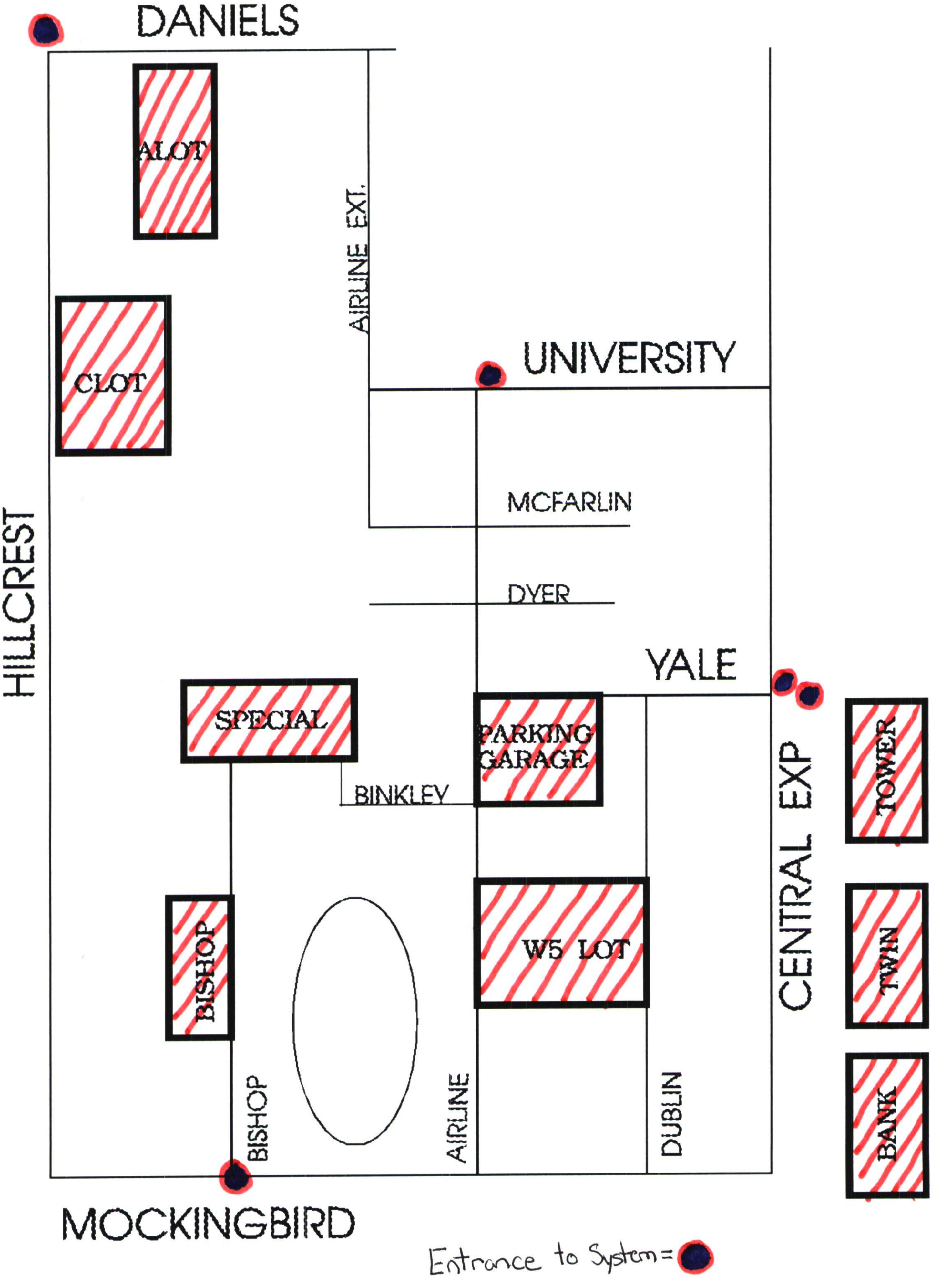
APPENDIX A


DANIELS
ALOT
AIRLINE EXT.
CLOT
UNIVERSITY
MCFARLIN
DYER
HILLCREST
YALE
SPECIAL
PARKING GARAGE
BINKLEY
CENTRAL EXP
TOWER
BISHOP
W5 LOT
TWIN
BISHOP
AIRLINE
DUBLIN
BANK
MOCKINGBIRD

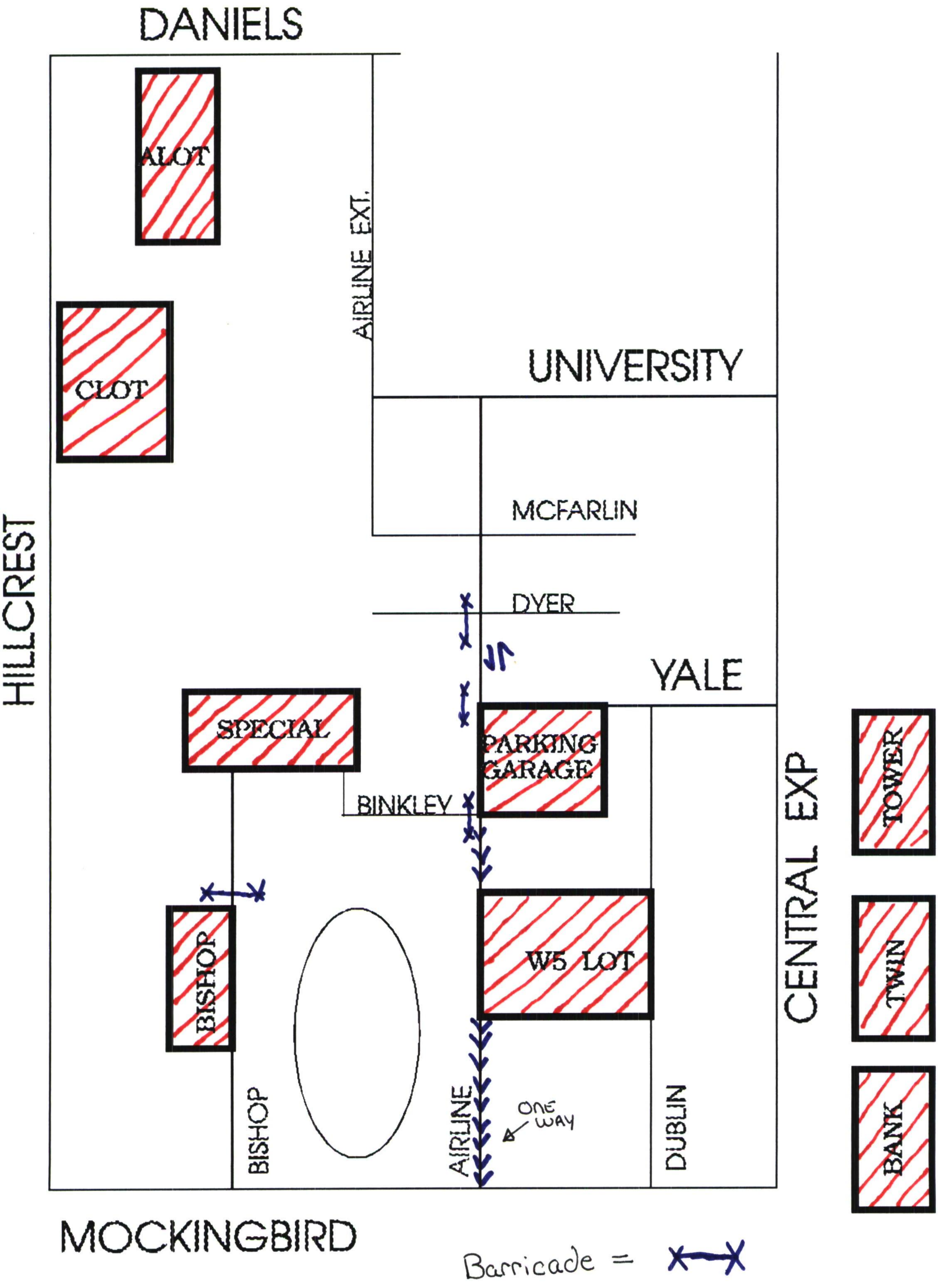
Percentage of Total Parking
Per Lot



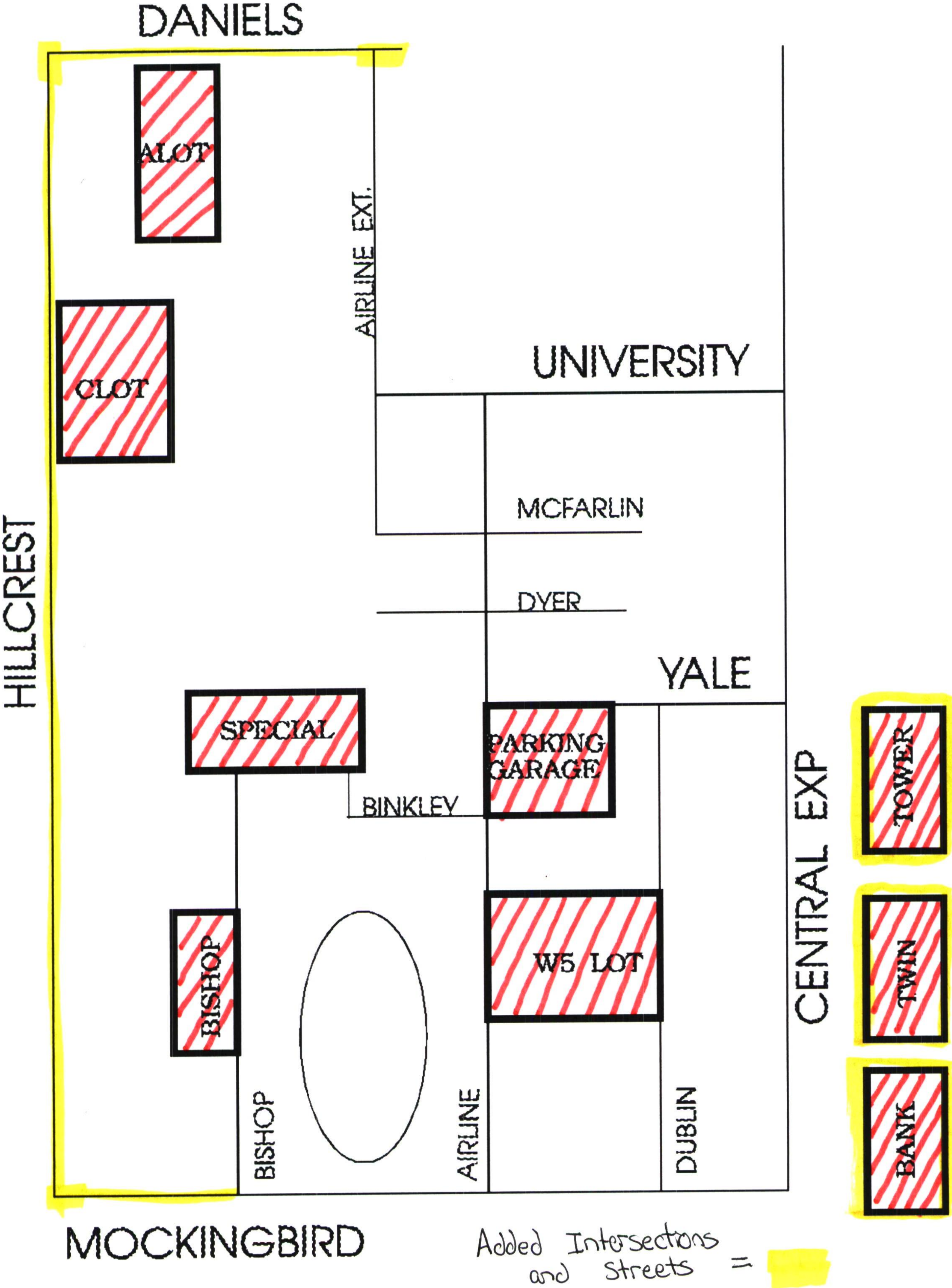
APPENDIX B


DANIELS
ALOT
AIRLINE EXT.
CLOT
UNIVERSITY
MCFARLIN
DYER
HILLCREST
YALE
SPECIAL
PARKING GARAGE
BINKLEY
CENTRAL EXP
TOWER
TWIN
BANK
BISHOP
W5 LOT
BISHOP
AIRLINE
DUBLIN
MOCKINGBIRD
Entrance to System =

APPENDIX C


DANIELS
ALOT
AIRLINE EXT.
CLOT
UNIVERSITY
MCFARLIN
HILLCREST
DYER
YALE
SPECIAL
PARKING GARAGE
BINKLEY
TOWER
CENTRAL EXP
BISHOP
W5 LOT
TWIN
BISHOP
AIRLINE
ONE WAY
DUBLIN
BANK
MOCKINGBIRD
Barricade =

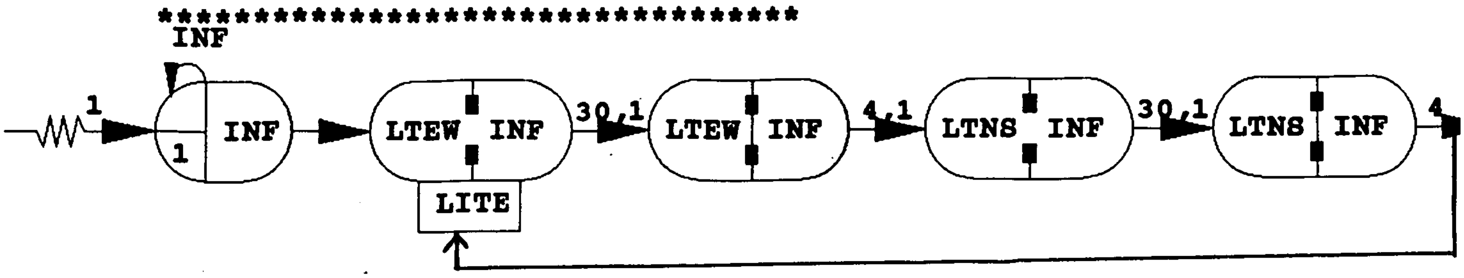
APPENDIX D



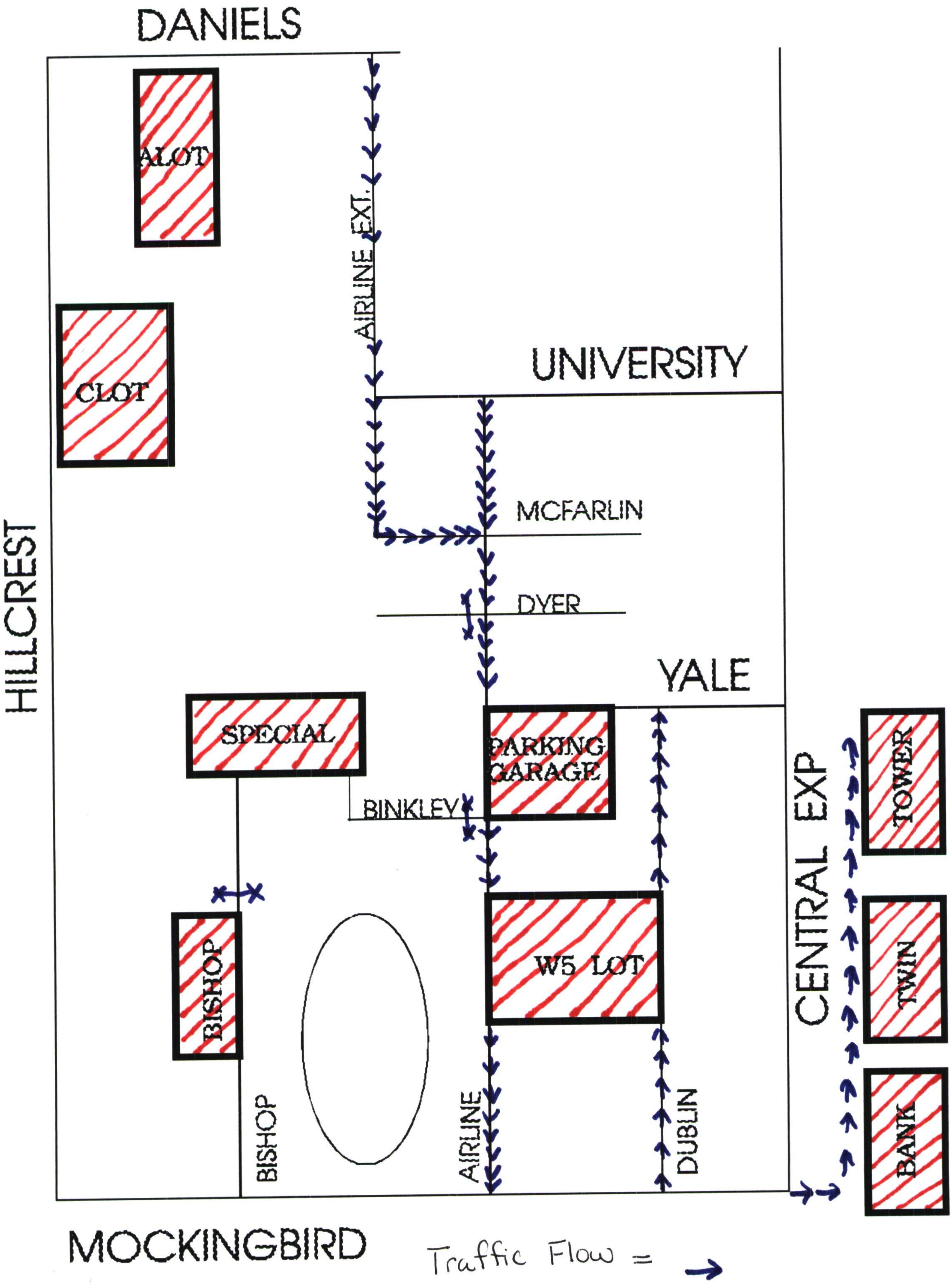
DANIELS
HILLCREST
ALOT
CLOT
AIRLINE EXT.
UNIVERSITY
MCFARLIN
DYER
YALE
SPECIAL
PARKING GARAGE
BINKLEY
BISHOP
W5 LOT
CENTRAL EXP
TOWER
TWIN
BANK
BISHOP
AIRLINE
DUBLIN
MOCKINGBIRD
Added Intersections and Streets =

APPENDIX E

**********TRAFFIC LIGHTS***********



APPENDIX F


DANIELS
ALOT
CLOT
AIRLINE EXT.
UNIVERSITY
MCFARLIN
DYER
YALE
HILLCREST
SPECIAL
PARKING GARAGE
BINKLEY
CENTRAL EXP
TOWER
BISHOP
W5 LOT
TWIN
BANK
BISHOP
AIRLINE
DUBLIN
MOCKINGBIRD
Traffic Flow =

APPENDIX G

```
GEN,KDT, SMU TRAFFIC ,04/10/88,1,Y,N,Y/N,N,Y,72;
 INIT,0,5400;
 INTLC,XX(1)=2;
SEEDS,0947665(1)/YES;
LIMITS,50,3,8002;
NETWORK;
 ;
 ;
 ;
 ;
        GATE/LTEW,CLOSE,21,23,24,26,28;
        GATE/LTNS,CLOSE,20,22,25,27,29;
 ;
 ;  **************************
 ;  ****  TRAFFIC LIGHTS  ****
 ;  **************************
 ;
       CREATE,,1,,1;
LITE   OPEN,LTEW;
         ACT,30;
       CLOSE,LTEW;
         ACT,4;
       OPEN,LTNS;
         ACT,30;
       CLOSE,LTNS;
         ACT,4,,LITE;
```

```
; *************************
; ****  PARKING QUEUES  ****
; *************************
;PGAR  COLCT(34),INT(1),PARKING GARAGE,10,40,40;
PGAR  QUEUE(11),,800;
;W5    COLCT(10),INT(1),W5 LOT ARRIVALS,10,40,40;
W5    QUEUE(12),,300;
OWNBY QUEUE(13),,200;
BISH  QUEUE(14),,200;
EBKP  QUEUE(15),,80;
WBKP  QUEUE(16),,170;
ARPK  QUEUE(17),,42;
UAPK  QUEUE(18),,200;
AEPK  QUEUE(19),,250;
; *************************
; ****  CREATE SECTION  ****
; *************************
      CREATE,XX(1),1,1,8000,1;
        ACT,,TNOW .LE. 1200 .OR. TNOW .GT.4500,A2;
        ACT,,TNOW .GT. 1200 .AND. TNOW .LT. 2400,A1;
        ACT,,TNOW .GE. 2400 .AND. TNOW .LE. 3600,A05;
        ACT,,TNOW .GT. 3600 .AND. TNOW .LE. 4500,A1;
A2    ASSIGN,XX(1)=2;
        ACT,,,CRTE;
A1    ASSIGN,XX(1)=1;
        ACT,,,CRTE;
A05   ASSIGN,XX(1)=.5;
CRTE  TERM;
;
      CREATE,XX(1),1,1,8000,1;
      GOON,1;
        ACT,,.85,PARK;
        ACT,,.15,TRAV;
PARK  ASSIGN,ATRIB(2)=1;
 ;        COLCT(49),TNOW,CARS PARKING;
        ACT,,,GASN;
TRAV  ASSIGN,ATRIB(2)=2;
;         COLCT(50),TNOW,CARS TRAVELLING;
        ACT,,,GASN;
;GASN  COLCT(48),TNOW,TOTAL CREATES;
GASN  GOON,1;
        ACT,,.35,MAGQ;
        ACT,,.25,YDGQ;
        ACT,,.20,MBGQ;
        ACT,,.10,AEGQ;
        ACT,,.10,UAGQ;
MAGQ  COLCT(10),INT(1),CARS TO MAQ2;
        ACT,,,MAQ2;
YDGQ  COLCT(34),INT(1),CARS TO YDQ2;
        ACT,,,YDQ2;
MBGQ  COLCT(48),INT(1),CARS TO MBQ4;
        ACT,,,MBQ4;
AEGQ  COLCT(49),INT(1),CARS TO AEQ1;
        ACT,,,AEQ1;
```

```
UAGQ  COLCT(50),INT(1),CARS TO UAQ2;
         ACT,,,UAQ2;
 ; ********************************
 ; ****  COLLECT NODE SECTION  ****
 ; ********************************
CEAS  COLCT(45),INT(1),EAST THRU CARS,10,10,10;
         ACT,,,TRM;
CSOU  COLCT(46),INT(1),SOUTH THRU CARS;10,10,10;
         ACT,,,TRM;
CWES  COLCT(47),INT(1),WEST THRU CARS;10,10,10;
TRM   TERM;
 ; ****************************************
 ; ****  STOP SIGN AT YALE AND AIRLINE  ****
 ; ****************************************
YAQ1  ASSIGN, ATRIB(3)=1;
YQ1   QUEUE(1),,20,BLOCK,YALE;
YAQ2  ASSIGN,ATRIB(3)=2;
YQ2   QUEUE(2),,20,BLOCK,YALE;
YAQ3  ASSIGN,ATRIB(3)=3;
YQ3   QUEUE(3),,20,BLOCK,YALE;
YAQ4  ASSIGN,ATRIB(3)=4;
YQ4   QUEUE(4),,20,BLOCK,YALE;
YALE  SELECT,LWF,,BLOCK,YQ1,YQ2,YQ3,YQ4;
      ACT,4;
      GOON,1;
         ACT,,ATRIB(3).EQ.1,GYA1;
         ACT,,ATRIB(3).EQ.2,GYA2;
         ACT,,ATRIB(3).EQ.3,GYA3;
         ACT,,ATRIB(3).EQ.4,GYA4;
GYA1  GOON,1;
         ACT,,ATRIB(2).EQ.1.AND.NNQ(11).LT.800,PGAR;
         ACT,12,,BAQ1;
GYA2  GOON,1;
         ACT,12,.7,BAQ1;
         ACT,12,.3,DAQ3;
GYA3  GOON,1;
         ACT,,ATRIB(2).EQ.1.AND.NNQ(11).LT.800,PGAR;
         ACT,15,.3,YDQ4;
         ACT,12,.7,BAQ1;
GYA4  GOON,1;
         ACT,,ATRIB(2).EQ.1.AND.NNQ(11).LT.800,PGAR;
         ACT,12,.5,BAQ1;
         ACT,15,.2,YDQ4;
```

```
             ACT,10,.3,DAQ3;
 ;
 ; *****************************************************************
 ; ****  LIGHT AT MOCKINGBIRD/AIRLINE, W5 LOT AND OWNBY PARKING ***
 ; ****  OFF OF MOCKINGBIRD                                    ***
 ; *****************************************************************
 ;
 ;
GMW5  GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.300,W5;
            ACT,,,MAQ1;
MAQ1  AWAIT(20/20),LTNS,,1;
      GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.300,W5;
            ACT,10,.8,OWMB;
            ACT,,.1,CEAS;
            ACT,,.1,CSOU;
OWMB  GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(13).LT.200,OWNBY;
            ACT,10,,MBQ2;
MAQ2  AWAIT(21/20),LTEW,,1;
      GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.300,W5;
            ACT,,.2,CSOU;
            ACT,30,.1,BAQ3;
            ACT,,.7,CEAS;
MAQ3  AWAIT(22/20),LTNS,,1;
      GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.300,W5;
            ACT,10,.8,OWMB;
            ACT,,.2,CEAS;
MAQ4  AWAIT(23/20),LTEW,,1;
      GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.300,W5;
            ACT,30,.1,BAQ3;
            ACT,,.2,CSOU;
            ACT,,.7,CEAS;

 ;
 ; ************************************************
 ; ****  TRAFFIC LIGHT AT BISHOP AND MOCKINGBIRD  ****
 ; ************************************************
 ;
MBQ2  AWAIT(24/20),LTEW,,1;
      GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(14).LT.200,BISH;
            ACT,,.2,CSOU;
            ACT,,.8,CWES;
MBQ3  AWAIT(25/20),LTNS,,1;
      GOON,1;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(14).LT.200,BISH;
            ACT,,ATRIB(2).EQ.1.AND.NNQ(13).LT.200,OWNBY;
            ACT,16,.9,MAQ4;
            ACT,,.1,CSOU;
```

```
MBQ4  AWAIT(26/20),LTEW,,1;
      GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(14).LT.200,BISH;
        ACT,16,.9,MAQ4;
        ACT,,.1,CSOU;
;
; ******************************************
; ****  STOP SIGN AT BINKLEY AND AIRLINE  ****
; ******************************************
;
BAQ1  ASSIGN,ATRIB(3)=1;
B1    QUEUE(5),,20,,BINK;
BAQ3  ASSIGN,ATRIB(3)=3;
B3    QUEUE(6),,20,,BINK;
BAQ4  ASSIGN,ATRIB(3)=4;
B4    QUEUE(7),,20,,BINK;
BINK  SELECT,LWF,,BLOCK,B1,B3,B4;
        ACT,4;
      GOON,1;
        ACT,,ATRIB(3).EQ.1,GBA1;
        ACT,,ATRIB(3).EQ.3,GBA3;
        ACT,,ATRIB(3).EQ.4,GBA4;
GBA1  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(15).LT.80,EBKP;
        ACT,,.2,WBKP;
        ACT,16,.8,GMW5;
GBA3  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(15).LT.80,EBKP;
        ACT,,.1,WBKP;
        ACT,12,.9,YAQ3;
GBA4  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(15).LT.80,EBKP;
        ACT,12,.5,YAQ3;
        ACT,16,.5,GMW5;
;
;
;
; ***************************************************
; ****  TRAFFIC LIGHT AT CORNER OF DYER AND AIRLINE  ****
; ***************************************************
;
DAQ1  AWAIT(27/20),LTNS,,1;
      GOON,1;
        ACT,12,ATRIB(2).EQ.1,YAQ1;
        ACT,12,.3,YAQ1;
        ACT,20,.6,DDQ4;
        ACT,,.1,CEAS;
DAQ2  AWAIT(28/20),LTEW,,1;
      GOON,1;
        ACT,12,ATRIB(2).EQ.1,YAQ1;
        ACT,10,.5,QMA3;
        ACT,,.1,CEAS;
        ACT,12,.4,YAQ1;
DAQ3  AWAIT(29/20),LTNS,,1;
```

```
             GOON,1;
               ACT,10,ATRIB(2).EQ.1,QMA3;
               ACT,10,.5,QMA3;
               ACT,15,.4,DDQ4;
               ACT,,.1,CEAS;
       DAQ4  GOON,1;
               ACT,12,ATRIB(2).EQ.1,YAQ1;
               ACT,10,.4,QMA3;
               ACT,12,.4,YAQ1;
               ACT,15,.2,DDQ4;
;
;  ****************************************
;  ****   STOP SIGN MCFARLIN AND AIRLINE   ****
;  ****************************************
;
QMA1   ASSIGN,ATRIB(3)=1;
MQ1    QUEUE(30),,20,,MCFN;
QMA2   ASSIGN,ATRIB(3)=2;
MQ2    QUEUE(31),,20,,MCFN;
QMA3   ASSIGN,ATRIB(3)=3;
MQ3    QUEUE(32),,20,,MCFN;
QMA4   ASSIGN,ATRIB(3)=4;
MQ4    QUEUE(33),,20,,MCFN;
MCFN   SELECT,LWF,,,MQ1,MQ2,MQ3,MQ4;
         ACT,4;
       GOON,1;
         ACT,,ATRIB(3).EQ.1,GMQ1;
         ACT,,ATRIB(3).EQ.2,GMQ2;
         ACT,,ATRIB(3).EQ.3,GMQ3;
         ACT,,ATRIB(3).EQ.4,GMQ4;
GMQ1   GOON,1;
         ACT,10,ATRIB(2).EQ.1,DAQ1;
         ACT,,.5,CEAS;
         ACT,12,.5,DAQ1;
;
;
GMQ2   GOON,1;
         ACT,,ATRIB(2).EQ.1,GMP1;
         ACT,15,.5,UAQ3;
         ACT,10,.5,DAQ1;
GMP1   GOON,1;
         ACT,10,.8,DAQ1;
         ACT,,.2,GMP2;
GMP2   GOON,1;
         ACT,,NNQ(17).LT.42,ARPK;
         ACT,15,,UAQ3;
GMQ3   GOON,1;
         ACT,,ATRIB(2).EQ.1,GMP3;
         ACT,15,.5,UAQ3;
         ACT,,.5,CEAS;
GMP3   GOON,1;
         ACT,,NNQ(17).LT.42,ARPK;
         ACT,15,,UAQ3;
GMQ4   GOON,1;
```

```
             ACT,,ATRIB(2).EQ.1,DAQ1;
             ACT,,.3,CEAS;
             ACT,15,.5,UAQ3;
             ACT,10,.2,DAQ1;
;
;
; ************************************************
; ****   INTERSECTION OF UNIVERSITY AND AIRLINE  ****
; ************************************************
;
UAQ2   ASSIGN,ATRIB(3)=2;
UQ2    QUEUE(35),,20,,UNIV;
UAQ3   ASSIGN,ATRIB(3)=3;
UQ3    QUEUE(36),,20,,UNIV;
UAQ4   ASSIGN,ATRIB(3)=4;
UQ4    QUEUE(37),,20,,UNIV;
UNIV   SELECT,LWF,,,UQ2,UQ3,UQ4;
         ACT,4;
       GOON,1;
         ACT,,ATRIB(3).EQ.2,GUA2;
         ACT,,ATRIB(3).EQ.3,GUA3;
         ACT,,ATRIB(3).EQ.4,GUA4;
GUA2   GOON,1;
         ACT,,ATRIB(2).EQ.1,GU21;
         ACT,,.5,CWES;
         ACT,15,.5,QMA1;
GU21   GOON,1;
         ACT,,NNQ(18).LT.200,UAPK;
         ACT,,NNQ(17).LT. 42,ARPK;
         ACT,15,.8,QMA1;
         ACT,8,.2,AEQ2;
GUA3   GOON,1;
         ACT,,ATRIB(2).EQ.1,GU31;
         ACT,,.5,CWES;
         ACT,,.5,CEAS;
GU31   GOON,1;
         ACT,,NNQ(18).LT.200,UAPK;
         ACT,,,AEQ2;
GUA4   GOON,1;
         ACT,,ATRIB(2).EQ.1,GU41;
         ACT,,.7,CEAS;
         ACT,15,.3,QMA1;
GU41   GOON,1;
         ACT,,NNQ(18).LT.200,UAPK;
         ACT,,NNQ(17).LT.42,ARPK;
         ACT,15,,QMA1;
;
;
;*******************************************
;****   INTERSECTION OF AIRLINE EXTENTION   ****
;****   AND DANIEL AVENUE.  ASSUME TRAFFIC ****
;****   ALREADY SOUTHBOUND ON AIRLINE EXT. ****
;*******************************************
;
```

```
 ;
 AEQ1  QUEUE(8),,,BLOCK;
       ACT,1;
       GOON,1;
          ACT,,ATRIB(2).EQ.1,GAE1;
          ACT,20,.3,QMA4;
          ACT,10,.7,UAQ4;
 GAE1  GOON,1;
          ACT,,NNQ(19).LT.250,AEPK;
          ACT,8,.8,QMA4;
          ACT,5,.2,UAQ4;
 AEQ2  QUEUE(9),,,BLOCK;
       ACT,1;
       GOON,1;
          ACT,,ATRIB(2).EQ.1,GAE2;
          ACT,,.8,CWES;
          ACT,10,.2,QMA4;
 GAE2  GOON,1;
          ACT,,NNQ(19).LT.250,AEPK;
          ACT,10,.9,QMA4;
          ACT,,.1,CWES;
 ;
 ;
 ; ********************************************
 ; ****  INTERSECTION OF DYER AND DUBLIN  ****
 ; ********************************************
 ;
 DDQ2  ASSIGN,ATRIB(3)=2;
 DQ2   QUEUE(38),,,,DYER;
 DDQ3  ASSIGN,ATRIB(3)=3;
 DQ3   QUEUE(39),,,,DYER;
 DDQ4  ASSIGN,ATRIB(3)=4;
 DQ4   QUEUE(40),,,,DYER;
 DYER  SELECT,LWF,,,DQ2,DQ3,DQ4;
       GOON,1;
         ACT,,ATRIB(3).EQ.2,GDD2;
         ACT,,ATRIB(3).EQ.3,GDD3;
         ACT,,ATRIB(3).EQ.4,GDD4;
 GDD2  GOON,1;
         ACT,15,.3,DAQ2;
         ACT,10,.7,YDQ1;
 GDD3  GOON,1;
         ACT,15,.5,DAQ2;
         ACT,,.5,CEAS;
 GDD4  GOON,1;
         ACT,,.3,CEAS;
         ACT,10,.7,YDQ1;
 ;
 ; ********************************************
 ; ****  INTERSECTION AT YALE AND DUBLIN  ****
 ; ********************************************
 ;
 YDQ1  ASSIGN,ATRIB(3)=1;
 Q1Y   QUEUE(41),,20,,YDUB;
```

```
YDQ2  ASSIGN,ATRIB(3)=2;
Q2Y   QUEUE(42),,,,YDUB;
YDQ3  ASSIGN,ATRIB(3)=3;
Q3Y   QUEUE(43),,20,,YDUB;
YDQ4  ASSIGN,ATRIB(3)=4;
Q4Y   QUEUE(44),,20,,YDUB;
YDUB  SELECT,LWF,,,Q1Y,Q2Y,Q3Y,Q4Y;
        ACT,4;
      GOON,1;
        ACT,,ATRIB(3).EQ.1,GYD1;
        ACT,,ATRIB(3).EQ.2,GYD2;
        ACT,,ATRIB(3).EQ.3,GYD3;
        ACT,,ATRIB(3).EQ.4,GYD4;
GYD1  GOON,1;
        ACT,,.6,GY12;
        ACT,,.4,GY13;
GY12  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.300,W5;
        ACT,,,CSOU;
GY13  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(11).LT.800,PGAR;
        ACT,22,,YAQ2;
GYD2  GOON,1;
        ACT,,ATRIB(2).EQ.1,GY21;
        ACT,22,.6,YAQ2;
        ACT,,.3,CSOU;
        ACT,10,.1,DDQ3;
GY21  GOON,1;
        ACT,,NNQ(11).LT.800,PGAR;
        ACT,,NNQ(12).LT.300,W5;
        ACT,,,CSOU;
GYD3  GOON,1;
        ACT,,ATRIB(2).EQ.1,GY31;
        ACT,22,.3,YAQ2;
        ACT,,.5,CEAS;
        ACT,10,.2,DDQ3;
GY31  GOON,1;
        ACT,,NNQ(11).LT.800,PGAR;
        ACT,10,,DDQ3;
GYD4  GOON,1;
        ACT,,ATRIB(2).EQ.1,GY41;
        ACT,,.7,CEAS;
        ACT,,.3,CSOU;
GY41  GOON,1;
        ACT,,NNQ(12).LT.300,W5;
        ACT,,,CSOU;
;
;
      ENDNETWORK;
FIN;
```

1

S L A M   I I   S U M M A R Y   R E P O R T

SIMULATION PROJECT SMU TRAFFIC BY KDT

DATE 4/10/1988 RUN NUMBER 1 OF 1

CURRENT TIME 0.5400E+04
STATISTICAL ARRAYS CLEARED AT TIME 0.0000E+00

STATISTICS FOR VARIABLES BASED ON OBSERVATION

	MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NO.OF OBS
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
CARS TO MAQ2	0.000E+00	0.000E+00	0.100E+05	0.000E+00	0.000E+00	1959
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
CARS TO YDQ2	0.000E+00	0.000E+00	0.100E+05	0.000E+00	0.000E+00	1376
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			

			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
EAST THRU CARS	0.190E+02	0.171E+02	0.897E+00	0.000E+00	0.820E+02	1696
SOUTH THRU CARS	0.169E+02	0.200E+02	0.118E+01	0.000E+00	0.194E+03	543
WEST THRU CARS	0.691E+02	0.742E+02	0.107E+01	0.400E+01	0.238E+03	67
CARS TO MBQ4	0.000E+00	0.000E+00	0.100E+05	0.000E+00	0.000E+00	1097
CARS TO AEQ1	0.000E+00	0.000E+00	0.100E+05	0.000E+00	0.000E+00	561
CARS TO UAQ2	0.000E+00	0.000E+00	0.100E+05	0.000E+00	0.000E+00	558

FILE STATISTICS

FILE NUMBER	ASSOC NODE LABEL/TYPE	AVERAGE LENGTH	STANDARD DEVIATION	MAXIMUM LENGTH	CURRENT LENGTH	AVERAGE WAIT TIME
1	YQ1 QUEUE	0.538	1.511	10	0	14.300
2	YQ2 QUEUE	0.000	0.000	0	0	0.000
3	YQ3 QUEUE	0.409	1.132	6	0	15.426
4	YQ4 QUEUE	0.000	0.000	0	0	0.000
5	B1 QUEUE	0.005	0.072	1	0	0.718
6	B3 QUEUE	0.152	0.571	6	0	3.435
7	B4 QUEUE	0.000	0.000	0	0	0.000
8	AEQ1 QUEUE	226.790	189.555	511	511	2183.009
9	AEQ2 QUEUE	0.000	0.000	0	0	0.000
10		0.000	0.000	0	0	0.000
11	PGAR QUEUE	118.203	113.989	332	332	1922.575
12	W5 QUEUE	249.861	89.035	300	300	4497.500
13	OWNB QUEUE	0.000	0.000	0	0	0.000
14	BISH QUEUE	161.933	63.028	200	200	4372.180
15	EBKP QUEUE	44.921	36.536	80	80	3032.134
16	WBKP QUEUE	6.669	6.435	19	19	1895.445
17	ARPK QUEUE	20.350	20.683	42	42	2616.390
18	UAPK QUEUE	138.645	73.411	200	200	3743.416
19	AEPK QUEUE	53.312	19.698	82	82	3510.815
20	MAQ1 AWAIT	0.080	0.301	2	0	12.000
21	MAQ2 AWAIT	3.687	5.245	20	0	10.784
22	MAQ3 AWAIT	0.000	0.000	0	0	0.000
23	MAQ4 AWAIT	0.983	1.872	11	0	6.622
24	MBQ2 AWAIT	0.074	0.298	2	0	12.839
25	MBQ3 AWAIT	0.000	0.000	0	0	0.000
26	MBQ4 AWAIT	2.223	3.344	20	0	10.964
27	DAQ1 AWAIT	0.419	1.190	9	0	10.240
28	DAQ2 AWAIT	0.000	0.000	0	0	0.000
29	DAQ3 AWAIT	0.000	0.000	0	0	0.000
30	MQ1 QUEUE	0.000	0.000	1	0	0.000
31	MQ2 QUEUE	0.000	0.000	0	0	0.000
32	MQ3 QUEUE	0.000	0.000	0	0	0.000
33	MQ4 QUEUE	0.000	0.000	0	0	0.000
34		0.000	0.000	0	0	0.000

35	UQ2	QUEUE	0.369	0.976	7	0	3.574
36	UQ3	QUEUE	0.000	0.000	0	0	0.000
37	UQ4	QUEUE	0.001	0.024	1	0	1.000
38	DQ2	QUEUE	0.000	0.000	0	0	0.000
39	DQ3	QUEUE	0.932	0.252	1	0	0.000
40	DQ4	QUEUE	4.708	5.541	13	1	5032.996
41	Q1Y	QUEUE	0.000	0.000	0	13	1588.999
42	Q2Y	QUEUE	622.521	481.606	1335	0	0.000
43	Q3Y	QUEUE	0.000	0.000	0	1335	2443.031
44	Q4Y	QUEUE	4.281	3.626	11	0	0.000
45			0.000	0.000	0	11	2101.407
46			0.000	0.000	0	0	0.000
47			0.000	0.000	0	0	0.000
48			0.000	0.000	0	0	0.000
49			0.000	0.000	0	0	0.000
50			0.000	0.000	0	0	0.000
51		CALENDAR	10.165	7.128	62	0	0.000
						7	0.967

SERVICE ACTIVITY STATISTICS

ACT NUM	ACT LABEL OR START NODE	SER CAP	AVERAGE UTIL	STD DEV	CUR UTIL	AVERAGE BLOCK	MAX IDL TME/SER	MAX BSY TME/SER	ENT CNT
0	YALE SELECT	1	0.260	0.44	0	0.00	320.00	264.00	
0	BINK SELECT	1	0.206	0.40	0	0.00	272.00	44.00	
0	MCFN SELECT	1	0.181	0.38	0	0.00	482.00	40.00	
0	UNIV SELECT	1	0.416	0.49	0	0.00	86.00	180.00	
0	AEQ2 QUEUE	1	0.006	0.08	0	0.00	2937.00	1.00	
0	YDUB SELECT	1	1.899	0.40	2	0.00	5046.00	20.00	

GATE STATISTICS

GATE NUMBER	GATE LABEL	CURRENT STATUS	PCT. OF TIME OPEN
1	LTEW	OPEN	0.4439
2	LTNS	CLOSED	0.4389

1

HISTOGRAM NUMBER45

EAST THRU CARS

```
OBS  RELA   UPPER
FREQ FREQ  CELL LIM 0         20        40        60        80        100
                    +    +    +    +    +    +    +    +    +    +    +
623 0.367 0.100E+02 +******************                                +
336 0.198 0.200E+02 +**********                        C               +
274 0.162 0.300E+02 +********                                  C       +
223 0.131 0.400E+02 +*******                                        C  +
158 0.093 0.500E+02 +*****                                           C +
 78 0.046 0.600E+02 +**                                               C+
  1 0.001 0.700E+02 +                                                  C
                                                                       C
```

APPENDIX H

```
GEN,JOHN AND ALLEN,SRDES,4/3/1991,1,Y,N,Y/N,N,Y,72;
INITIALIZE,,6000,Y;
INTLC,XX(1)=2;
SEEDS,0947665(1)/YES;
LIMITS,50,3,3650;
NETWORK;
;
;
;
;
      GATE/LTEW,CLOSE,21,23,24,26,28,30,32,34;
      GATE/LTNS,CLOSE,20,22,25,27,29,31,33,35;
;
; *********TRAFFIC LIGHTS**********
;*********************************
      CREATE,,1,,1;
LITE  OPEN,LTEW;
        ACT,30;
      CLOSE,LTEW;
        ACT,4;
      OPEN,LTNS;
        ACT,30;
      CLOSE,LTNS;
        ACT,4,,LITE;
;
;***********PARKING QUEUES**********
;***********************************
;PGAR  COLCT(34),INT(1),PARKING GARAGE,10,40,40;
PGAR  QUEUE(11),,822;
;W5    COLCT(10),INT(1),W5 LOT ARRIVALS,10,40,40;
W5    QUEUE(12),,683;
BISH  QUEUE(14),,250;
C     QUEUE(15),,150;
BANK  QUEUE(16),,422;
TWIN  QUEUE(17),,680;
TOWR  QUEUE(18),,250;
A     QUEUE(19),,62;
SPEC  QUEUE(13),,300;
OUT   QUEUE(37),,,;
;***********CREATE SECTION***********
;***********************************
      CREATE,XX(1),1,1,8000,1;
        ACT,,TNOW .LE. 1200 .OR. TNOW .GT. 4500, A2;
        ACT,,TNOW .GT. 1200 .AND. TNOW .LT. 2400, A1;
        ACT,,TNOW .GE. 2400 .AND. TNOW .LE. 3600, A05;
        ACT,,TNOW .GT.3600 .AND. TNOW .LE. 4500, A1;
A2    ASSIGN,XX(1)=2;
        ACT,,,CRTE;
A1    ASSIGN,XX(1)=1;
        ACT,,,CRTE;
A05   ASSIGN,XX(1)=.5;
CRTE  TERM;
```

```
;
      CREATE,XX(1),1,1,8000,1;
      GOON,1;
       ACT,,.80,PARK;
       ACT,,.10,TRAV;
       ACT,,.10,SPEL;
PARK  ASSIGN,ATRIB(2)=1;
;  COLCT(49),TNOW,CARS PARKING;
        ACT,,,GASN;
TRAV  ASSIGN,ATRIB(2)=2;
;  COLCT(50),TNOW,CARS TRAVELING;
        ACT,,,GASN;
SPEL  ASSIGN,ATRIB(2)=3;
        ACT,,,GASN;
;GASN  COLCT(48),TNOW,TOTAL CREATES;
GASN  GOON,1;
        ACT,,.4,DHGQ;
        ACT,,.15,CEQE;
        ACT,,.1,CEQN;
        ACT,,.2,MBGQ;
        ACT,,.15,UAGQ;
DHGQ  COLCT(10),INT(1),CARS TO DHQ2;
        ACT,,,DHQ2;
CEQE  COLCT(38),INT(1),CARS TO CEE1;
        ACT,,,CEE1;
CEQN  COLCT(48),INT(1),CARS TO CEN1;
        ACT,,,CEN1;
MBGQ  COLCT(49),INT(1),CARS TO MBQ3;
        ACT,,,MBQ3;
UAGQ  COLCT(50),INT(1),CARS TO UAQ3;
        ACT,,,UAQ3;
;
;***************COLLCET NODE SECTION*********
;********************************************
;
CEAS  COLCT(45),INT(1),EAST THRU CARS;10,10,10;
        ACT,,,TRM;
CSOU  COLCT(46),INT(1),SOUTH THRU CARS;10,10,10;
        ACT,,,TRM;
CWES  COLCT(47),INT(1),WEST THRU CARS;10,10,10;


TRM   TERM;








;*********STOP SIGN AT YALE AND AIRLINE****************
;*****************************************************
YAQ1  ASSIGN,ATRIB(3)=1;
YQ1   QUEUE(1),,20,BLOCK,YALE;
YAQ2  ASSIGN,ATRIB(3)=2;
YQ2   QUEUE(2),,20,BLOCK,YALE;

YALE  SELECT,LWF,,BLOCK,YQ1,YQ2;
        ACT,4;
      GOON,1;
        ACT,,ATRIB(3).EQ.1,GYA1;
        ACT,,ATRIB(3).EQ.2,GYA2;
```

```
GYA1  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(11).LT.822,PGAR;
        ACT,4,ATRIB(2).EQ.1.AND.NNQ(12).LT.683,BAQ1;
        ACT,4,ATRIB(2).EQ.3.AND.NNQ(13).LT.150,BAQ1;
        ACT,12,ATRIB(2).EQ.1,YDQ2;
        ACT,12,ATRIB(2).EQ.3,YDQ2;
        ACT,4,.2,BAQ1;
        ACT,12,.8,YDQ2;

GYA2  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(11).LT.822,PGAR;
        ACT,4,ATRIB(2).EQ.3,BAQ1;
        ACT,4,ATRIB(2).EQ.1,BAQ1;
        ACT,4,.2,BAQ1;
        ACT,12,.8,ADQ1;



;
;******************************************************************
;****  LIGHT AT MOCKINGBIRD /AIRLINE, W5 LOT AND OWNBY PARKING ***
;****  OFF OF MOCKINGBIRD                                      ***
;******************************************************************
;
;

MAQ3  AWAIT(20/20),LTNS,,1;
      GOON,1;
        ACT,5,ATRIB(2).EQ.1,DMGQ;
        ACT,5,ATRIB(2).EQ.3,DMGQ;
        ACT,,.2,DMGQ;
        ACT,,.8,MBQ2;

MAQ4  AWAIT(21/20),LTEW,,1;
      GOON,1;
        ACT,5,,DMGQ;
;
;**************************************************
;****  TRAFFIC LIGHT AT BISHOP AND MOCKINGBIRD  ****
;**************************************************
;
MBQ2  AWAIT(23/20),LTEW,,1;
      GOON,1;
        ACT,,.5,CSOU;
        ACT,4,.5,MHQ1;
MBQ3  AWAIT(22/20),LTNS,,1;
      GOON,1;
        ACT,,ATRIB(2).EQ.3.AND.NNQ(13).LT.150,SPEC;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(14).LT.250,BISH;
        ACT,5,ATRIB(2).EQ.1,MAQ4;
        ACT,5,ATRIB(2).EQ.3,MAQ4;
        ACT,5,.3,MAQ4;
        ACT,5,.7,MHQ1;
MBQ4  AWAIT(24/20),LTEW,,1;
      GOON,1;
        ACT,,ATRIB(2).EQ.3.AND.NNQ(13).LT.150,SPEC;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(14).LT.250,BISH;
        ACT,5,ATRIB(2).EQ.1,MAQ4;
        ACT,5,ATRIB(2).EQ.3,MAQ4;
        ACT,16,.9,MAQ4;
        ACT,,.1,CSOU;
```

```
;
;*******************************************
;****  STOP SIGN AT BINKLEY AND AIRLINE  ****
;*******************************************
;
BAQ1    GOON,1;
          ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.683,W5;
          ACT,,ATRIB(2).EQ.3.AND.NNQ(13).LT.150,SPEC;
          ACT,,ATRIB(2).EQ.3.AND.NNQ(12).LT.683,W5;
          ACT,5,,MAQ3;





;
;
;
;*******************************************************
;****  TRAFFIC LIGHT AT CORNER OF DYER AND AIRLINE  ****
;*******************************************************
;
ADQ2  AWAIT(25/20),LTNS,,1;
      GOON,1;
        ACT,4,ATRIB(2).EQ.1,YAQ1;
        ACT,4,ATRIB(2).EQ.3,YAQ1;
        ACT,.7,,CEAS;
        ACT,.3,,YAQ1;

ADQ1  AWAIT(27/20),LTNS,,1;
      GOON,1;
         ACT,.3,,QMA4;
         ACT,.7,,CEAS;

;
;*******************************************
;**** STOP SIGN AT MCFARLIN AND AIRLINE  ****
;*******************************************
;
QMA1  ASSIGN,ATRIB(3)=1;
MQ1   QUEUE(3),,20,,MCFN;
QMA2  ASSIGN,ATRIB(3)=2;
MQ2   QUEUE(4),,20,,MCFN;

QMA4  ASSIGN,ATRIB(3)=4;
MQ4   QUEUE(5),,20,,MCFN;
MCFN  SELECT,LWF,,,MQ1,MQ2,MQ4;
        ACT,4;
      GOON,1;
        ACT,,ATRIB(3).EQ.1,GMQ1;
        ACT,,ATRIB(3).EQ.2,GMQ2;
        ACT,,ATRIB(3).EQ.4,GMQ4;
GMQ1  GOON,1;
        ACT,4,ATRIB(2).EQ.1,ADQ2;
        ACT,4,ATRIB(2).EQ.3,ADQ2;
        ACT,4,.5,ADQ2;
        ACT,8,.5,GUA4;
;
;
GMQ2  GOON,1;
```

```
           ACT,4,ATRIB(2).EQ.1,ADQ2;
           ACT,4,ATRIB(2).EQ.3,ADQ2;
           ACT,4,.3,ADQ2;
           ACT,,.7,CEAS;

GMQ4  GOON,1;
           ACT,8,.2,GUA4;
           ACT,10,.5,AEQ2;
           ACT,,.3,CEAS;
;
;
;
;**************************************************
;****  INTERSECTION OF UNIVERSITY AND AIRLINE  ****
;**************************************************
;

UAQ3  ASSIGN,ATRIB(3)=3;
UQ3   QUEUE(6),,20,,UNIV;
UAQ4  ASSIGN,ATRIB(3)=4;
UQ4   QUEUE(7),,20,,UNIV;
UNIV  SELECT,LWF,,,UQ3,UQ4;
        ACT,4;
      GOON,1;
        ACT,,ATRIB(3).EQ.3,GUA3;
        ACT,,ATRIB(3).EQ.4,GUA4;


GUA3  GOON,1;
        ACT,8,ATRIB(2).EQ.1,QMA2;
        ACT,8,ATRIB(2).EQ.3,QMA2;
        ACT,10,.7,AEQ2;
        ACT,8,.3,QMA2;
GUA4  GOON,1;
        ACT,,.7,CEAS;
        ACT,10,.3,AEQ2;

;
;
;*********************************************
;****  INTERSECTION OF AIRLINE EXTENSION  ****
;****  AND DANIEL AVENUE. *******************
;*********************************************
;
;
AEGQ  AWAIT(26/20),LTEW,,1
      GOON,1;
        ACT,10,ATRIB(2).EQ.1,QMA1;
        ACT,10,ATRIB(2).EQ.3,QMA1;
        ACT,10,.3,QMA1;
        ACT,,.7,CEAS;

AEQ2  AWAIT(29/20),LTNS,,1
        ACT,,,CSOU;


;
;******************************************
;****  INTERSECTION AT YALE AND DUBLIN  ****
;******************************************
;
YDQ1  ASSIGN,ATRIB(3)=1;
```

```
Q1Y    QUEUE(8),,20,,YDUB;
YDQ2   ASSIGN,ATRIB(3)=2;
Q2Y    QUEUE(9),,,,YDUB;
YDQ3   ASSIGN,ATRIB(3)=3;
Q3Y    QUEUE(36),,20,,YDUB;

YDUB   SELECT,LWF,,,Q1Y,Q2Y,Q3Y;
         ACT,4;
       GOON,1;
         ACT,,ATRIB(3).EQ.1,GYD1;
         ACT,,ATRIB(3).EQ.2,GYD2;
         ACT,,ATRIB(3).EQ.3,GYD3;
GYD1   GOON,1;
         ACT,5,ATRIB(2).EQ.1,CE
         ACT,5,ATRIB(2).EQ.3,CE
         ACT,5,.7,CE;
         ACT,5,.3,YAQ2;

GYD2   GOON,1;
         ACT,5,,CE;

GYD3   GOON,1;
         ACT,5,,YAQ2;


;******************LIGHT AT MOCKINGBIRD***************
;****************** AND HILLCREST********************
;****************************************************

MHGQ   AWAIT(31/20),LTNS,,1;
       GOON,1;
         ACT,5,ATRIB(2).EQ.1,MBQ4;
         ACT,5,ATRIB(2).EQ.3,MBQ4;
         ACT,5,.5,MBQ4;
         ACT,,.5,CSOU;

MHQ1   AWAIT(28/20),LTEW,,1;
         ACT,,,CWES;


;*******************INTERSECTION OF*******************
;*******************DUBLIN AND MOCKINGBIRD*************
;
DMGQ   AWAIT(30/20),LTEW,,1;
       GOON,1;
         ACT,5,ATRIB(2).EQ.1.AND.NNQ(12).LT.683,W5Q;
         ACT,10,ATRIB(2).EQ.1.AND.NNQ(11).LT.822,PGQ;
         ACT,5,ATRIB(2).EQ.3.AND.NNQ(12).LT.683,W5Q;
         ACT,10,ATRIB(2).EQ.3.AND.NNQ(11).LT.822,PGQ;
         ACT,,ATRIB(2).EQ.1,ACRS;
         ACT,,ATRIB(2).EQ.3,ACRS;
         ACT,,,CEAS;

W5Q    GOON,1;
         ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.683,W5;
         ACT,2,ATRIB(2).EQ.1,PGQ;
         ACT,,ATRIB(2).EQ.3.AND.NNQ(12).LT.683,W5;
         ACT,2,ATRIB(2).EQ.3,PGQ;
         ACT,,,PGQ;


PGQ    GOON,1;
```

```
           ACT,,ATRIB(2).EQ.1.AND.NNQ(12).LT.822,PGAR;
           ACT,2,ATRIB(2).EQ.1,YDQ1;
           ACT,,ATRIB(2).EQ.3.AND.NNQ(12).LT.822,PGAR;
           ACT,2,ATRIB(2).EQ.3,YDQ1;
           ACT,,,YDQ1;

;******************ACROSS THE STREET PARKING*****
;************************************************
;
ACRS  GOON,1;
           ACT,10,ATRIB(2).EQ.1.AND.NNQ(16).LT.422,BANK;
           ACT,15,ATRIB(2).EQ.1.AND.NNQ(17).LT.680,TWIN;
           ACT,20,ATRIB(2).EQ.1.AND.NNQ(18).LT.250,TOWR;
           ACT,10,ATRIB(2).EQ.3.AND.NNQ(16).LT.422,BANK;
           ACT,15,ATRIB(2).EQ.3.AND.NNQ(17).LT.680,TWIN;
           ACT,20,ATRIB(2).EQ.3.AND.NNQ(18).LT.250,TOWR;
           ACT,,,OUT;

;**********************CENTRAL AND YALE*********
;************************************************

CEE1  AWAIT(32/20),LTEW,,1;
      GOON,1;
        ACT,5,ATRIB(2).EQ.1.AND.NNQ(11).LT.822,YDQ3;
        ACT,5,ATRIB(2).EQ.1.AND.NNQ(12).LT.683,YDQ3;
        ACT,5,ATRIB(2).EQ.3.AND.NNQ(11).LT.822,YDQ3;
        ACT,5,ATRIB(2).EQ.3.AND.NNQ(12).LT.683,YDQ3;
        ACT,,ATRIB(2).EQ.1,ACRS;
        ACT,,ATRIB(2).EQ.3,ACRS;
        ACT,,,YDQ3;

CEN1  AWAIT(33/20),LTNS,,1;
      GOON,1;
        ACT,5,ATRIB(2).EQ.1.AND.NNQ(11).LT.822,YDQ3;
        ACT,5,ATRIB(2).EQ.1.AND.NNQ(12).LT.683,YDQ3;
        ACT,5,ATRIB(2).EQ.3.AND.NNQ(11).LT.822,YDQ3;
        ACT,5,ATRIB(2).EQ.3.AND.NNQ(12).LT.683,YDQ3;
        ACT,,ATRIB(2).EQ.1,ACRS;
        ACT,,ATRIB(2).EQ.3,ACRS;
        ACT,,,YDQ3;

CE    AWAIT(34/20),LTEW,,1;
      GOON,1;
        ACT,,ATRIB(2).EQ.1,ACRS;
        ACT,,ATRIB(2).EQ.3,ACRS;
        ACT,,,CSOU;

;*************************LIGHT AT DAINIEL***********
;***********************AND HILLCREST***************
;
;
DHQ2  AWAIT(35/20),LTNS,,1;
      GOON,1;
        ACT,15,ATRIB(2).EQ.3,MHGQ;
        ACT,5,.6,CLOT;
        ACT,5,.4,ALOT;


CLOT  GOON,1;
        ACT,,ATRIB(2).EQ.1.AND.NNQ(15).LT.150,C;
        ACT,5,,AEGQ;

```

```
ALOT   GOON,1;
         ACT,,ATRIB(2).EQ.1.AND.NNQ(19).LT.62,A;
         ACT,10,ATRIB(2).EQ.1,MHGQ;
         ACT,10,,MHGQ;

;;
       ENDNETWORK;
FIN;
```

ARRAY STORAGE REPORT

DIMENSION OF NSET/QSET(NNSET):	32000
WORDS ALLOCATED TO FILING SYSTEM:	25550
WORDS ALLOCATED TO VARIABLES:	6388
WORDS AVAILABLE FOR PLOTS/TABLES:	62

1

S L A M   I I   S U M M A R Y   R E P O R T

SIMULATION PROJECT SRDES   BY JOHN AND ALLEN

DATE 4/ 3/1991   RUN NUMBER   1 OF   1

CURRENT TIME   .6000E+04
STATISTICAL ARRAYS CLEARED AT TIME   .0000E+00

STATISTICS FOR VARIABLES BASED ON OBSERVATION

	MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NO.OF OBS
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
CARS TO DHQ2	.000E+00	.000E+00	.100E+05	.000E+00	.000E+00	2334
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
CARS TO CEE1	.000E+00	.000E+00	.100E+05	.000E+00	.000E+00	931
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			
			NO VALUES RECORDED			

			NO VALUES RECORDED			
			NO VALUES RECORDED			
EAST THRU CARS	.877E+02	.950E+02	.108E+01	.100E+02	.461E+03	262
SOUTH THRU CARS	.120E+03	.137E+03	.115E+01	.140E+02	.507E+03	171
WEST THRU CARS	.499E+02	.472E+02	.947E+00	.600E+01	.289E+03	82
CARS TO CEN1	.000E+00	.000E+00	.100E+05	.000E+00	.000E+00	580
CARS TO MBQ3	.000E+00	.000E+00	.100E+05	.000E+00	.000E+00	1129
CARS TO UAQ3	.000E+00	.000E+00	.100E+05	.000E+00	.000E+00	877

FILE STATISTICS

FILE NUMBER	LABEL/TYPE	AVERAGE LENGTH	STANDARD DEVIATION	MAXIMUM LENGTH	CURRENT LENGTH	AVERAGE WAIT TIME
1	YQ1 QUEUE	10.756	7.757	20	1	79.381
2	YQ2 QUEUE	8.480	8.920	20	0	91.842
3	MQ1 QUEUE	8.639	7.684	20	7	102.641
4	MQ2 QUEUE	9.432	8.751	20	0	92.319
5	MQ4 QUEUE	1.376	1.870	9	0	94.866
6	UQ3 QUEUE	3.672	7.003	20	0	26.514
7	UQ4 QUEUE	.000	.000	0	0	.000
8	Q1Y QUEUE	.000	.000	0	0	.000
9	Q2Y QUEUE	.494	1.059	7	0	6.357
10		.000	.000	0	0	.000
11	PGAR QUEUE	530.052	294.292	822	822	3868.994
12	W5 QUEUE	382.279	309.763	683	683	3358.236
13	SPEC QUEUE	113.889	52.729	150	150	4555.554
14	BISH QUEUE	205.945	78.152	250	250	4942.668
15	C QUEUE	129.199	41.250	150	150	5167.974
16	BANK QUEUE	153.763	196.213	422	422	2186.210
17	TWIN QUEUE	156.724	260.425	680	680	1382.863
18	TOWR QUEUE	20.299	60.462	250	250	487.172
19	A QUEUE	56.011	14.610	62	62	5420.387
20	MAQ3 AWAIT	.071	.324	3	0	7.554
21	MAQ4 AWAIT	3.072	5.548	20	0	12.080
22	MBQ3 AWAIT	2.101	3.267	20	1	11.186
23	MBQ2 AWAIT	.101	.386	3	0	30.300
24	MBQ4 AWAIT	2.363	4.402	20	0	16.018
25	ADQ2 AWAIT	1.856	2.576	9	3	10.255
26	AEGQ AWAIT	2.810	5.213	20	0	17.639
27	ADQ1 AWAIT	.125	.409	4	0	8.644
28	MHQ1 AWAIT	.264	.583	4	0	19.348
29	AEQ2 AWAIT	.198	.504	3	0	10.147
30	DMGQ AWAIT	.127	.811	9	0	.488
31	MHGQ AWAIT	1.154	1.795	11	1	7.302
32	CEE1 AWAIT	1.604	2.613	17	0	10.335
33	CEN1 AWAIT	.927	1.650	12	1	9.590
34	CE AWAIT	.772	1.858	10	0	9.981
35	DHQ2 AWAIT	3.986	5.479	20	5	10.995
36	Q3Y QUEUE	4.843	7.188	20	0	36.502
37	OUT QUEUE	1.193	7.916	87	87	82.305
38		.000	.000	0	0	.000
39		.000	.000	0	0	.000
40		.000	.000	0	0	.000
41		.000	.000	0	0	.000
42		.000	.000	0	0	.000
43		.000	.000	0	0	.000
44		.000	.000	0	0	.000
45		.000	.000	0	0	.000
46		.000	.000	0	0	.000

47		.000	.000	0	0	.000
48		.000	.000	0	0	.000
49		.000	.000	0	0	.000
50		.000	.000	0	0	.000
51	CALENDAR	25.217	17.782	96	13	1.743

SERVICE ACTIVITY STATISTICS

ACT NUM	ACT LABEL OR START NODE	SER CAP	AVERAGE UTIL	STD DEV	CUR UTIL	AVERAGE BLOCK	MAX IDL TME/SER	MAX BSY TME/SER	ENT CNT
0	YALE SELECT	1	.910	.29	1	.00	35.00	3944.00	
0	MCFN SELECT	1	.798	.40	1	.00	54.00	3440.00	
0	UNIV SELECT	1	.554	.50	0	.00	54.00	1324.00	
0	YDUB SELECT	1	.841	.37	1	.00	32.00	1412.00	

GATE STATISTICS

GATE NUMBER	GATE LABEL	CURRENT STATUS	PCT. OF TIME OPEN
1	LTEW	OPEN	.4425
2	LTNS	CLOSED	.4400