SPECIAL EVENT TRAFFIC
KANSAS STATE UNIVERSITY STADIUM

by 1264

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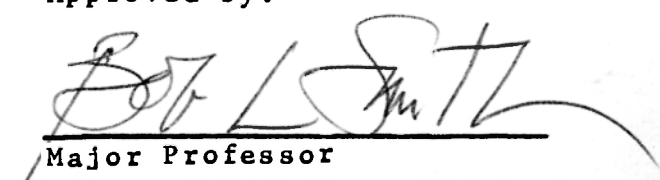

Major Professor

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Special thanks should go to Mr. Edward Yotter who piloted the plane and Mr. Jerry Murphy who assisted in taking pictures at the games.

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INTRODUCTION

Special event traffic is that traffic attracted to certain special social functions where these functions occur only a few times each year or only once in several years. These special events may be sports events, religious gatherings, political rallys, or any other event that infrequently attracts people. These special events may attract large numbers of people, therefore, a means of transportation must be provided. This transportation can be provided by private automobiles, public transit, or by walking.

This thesis deals with the transportation system for the new stadium at Kansas State University. The main goal of the new football stadium is to make the games as entertaining as possible. The transportation system for the stadium should enhance this goal. Certainly, the transportation system should not detract from this goal.

Need for the Study

One reason for this study was to furnish a guideline for the athletic department. This guideline suggests some physical improvements that need to be undertaken as well as improved methods of operation that will make the facility operate more efficiently.

Another reason for this study was to suggest some changes that the city, state, and other authorities need to make. Especially, to suggest some improvements that must be completed

if the stadium is to be expanded.

There was also a need for collecting design data. These data could be used for design purposes. In the expansion of the Kansas State University Stadium Facilities or for the design of similar facilities elsewhere, these data should be useful. One of the design elements considered to be important was the vehicle occupancy rate. Another important element was the capacities of the different systems elements. These elements included the street system, the lot entrances, the parking ticket sellers, and the parking attendants. Another important thing that needed to be found was the total number of cars that could be parked in the lots.

Another purpose of this study was to evaluate the present system of operation and to consider other means of bringing people to the stadium. In this investigation, it was the intended purpose to see if these alternatives would be practical and if so, to compare these alternatives.

Another reason for the study was to attempt to find out where the people come from and if they stop in Manhattan before and/or after the game. It was believed that this information could be obtained from an Origin Destination (O-D) study. If so, the information could be used as promotional propaganda provided the results showed the extent to which out-of-town people stopped and spent money in Manhattan.

Description of the Study Area

The main emphasis of the study was on the stadium parking lots and the lot entrances. (See Fig. 1) Also of interest

were the surrounding streets. The intersections considered important were: Claflin Road and Denison Avenue, Claflin Road and College Avenue, Claflin Road and North Manhattan Avenue, Kimball Avenue and Highway K-113, North Manhattan Avenue and Highway U.S.-24, College Avenue and Marlatt Avenue, Denison Avenue and Marlatt Avenue, Marlatt Avenue and Highway U.S.-24, and Browning Avenue and Claflin Road. (See Fig. 2 and 3) For the remainder of this paper street names will be used without "avenue," "street" or"road" as the case may be. For a more detailed map of the Manhattan street system, see Appendix A. The highway system serving Manhattan was also considered important because most of the people from outside of Manhattan would arrive by means of the highway (either by bus or car). (See Fig. 3)

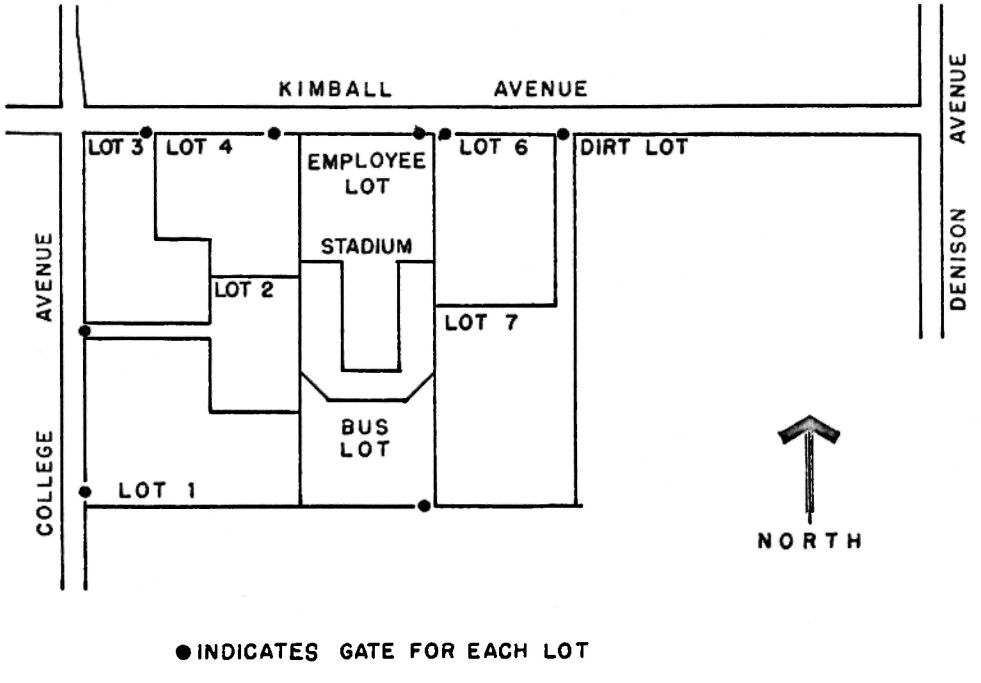


Fig. 1. Stadium Parking Lots and Lot Entrances.

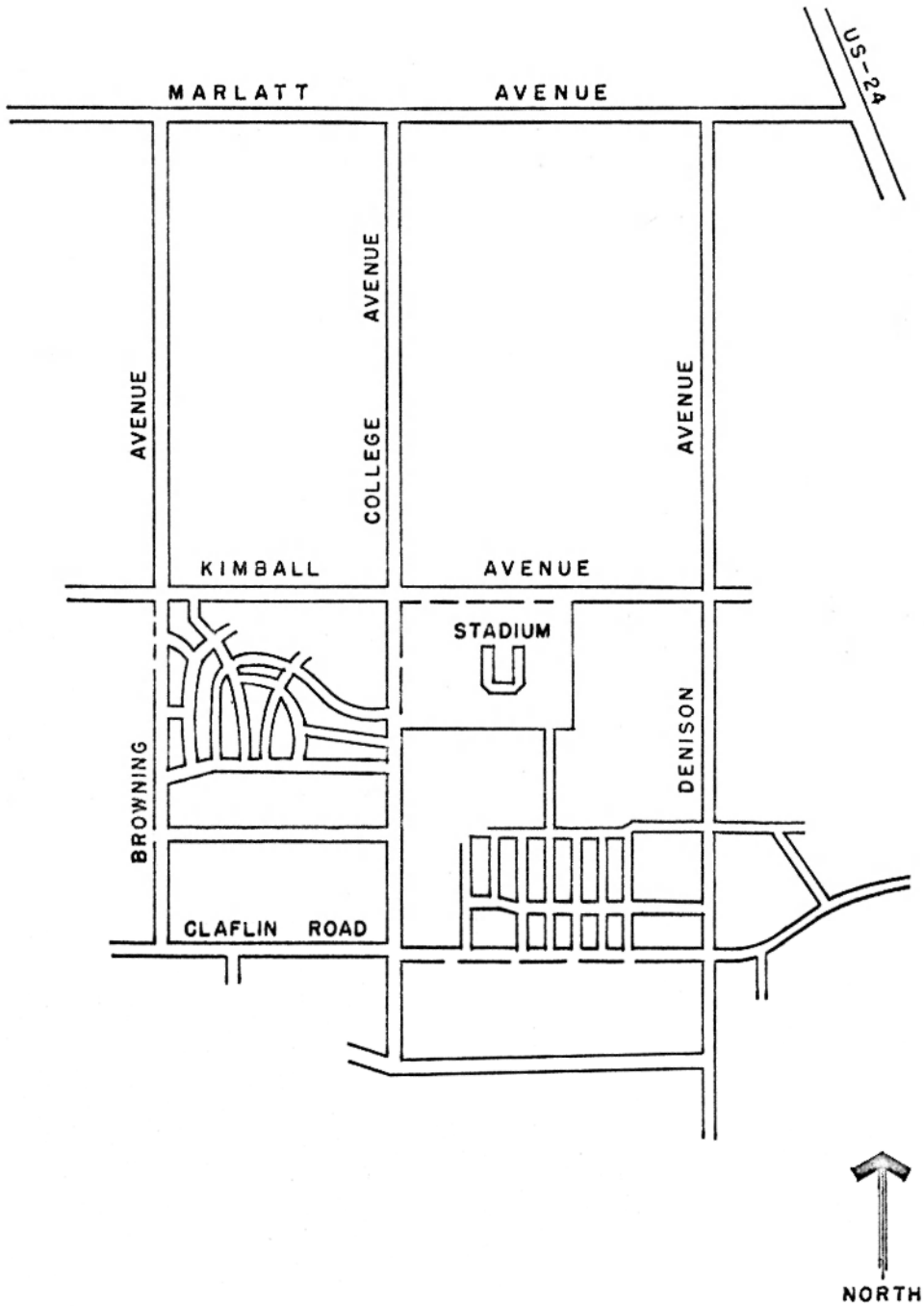


Fig. 2. The Surface Street System Surrounding the New Stadium.

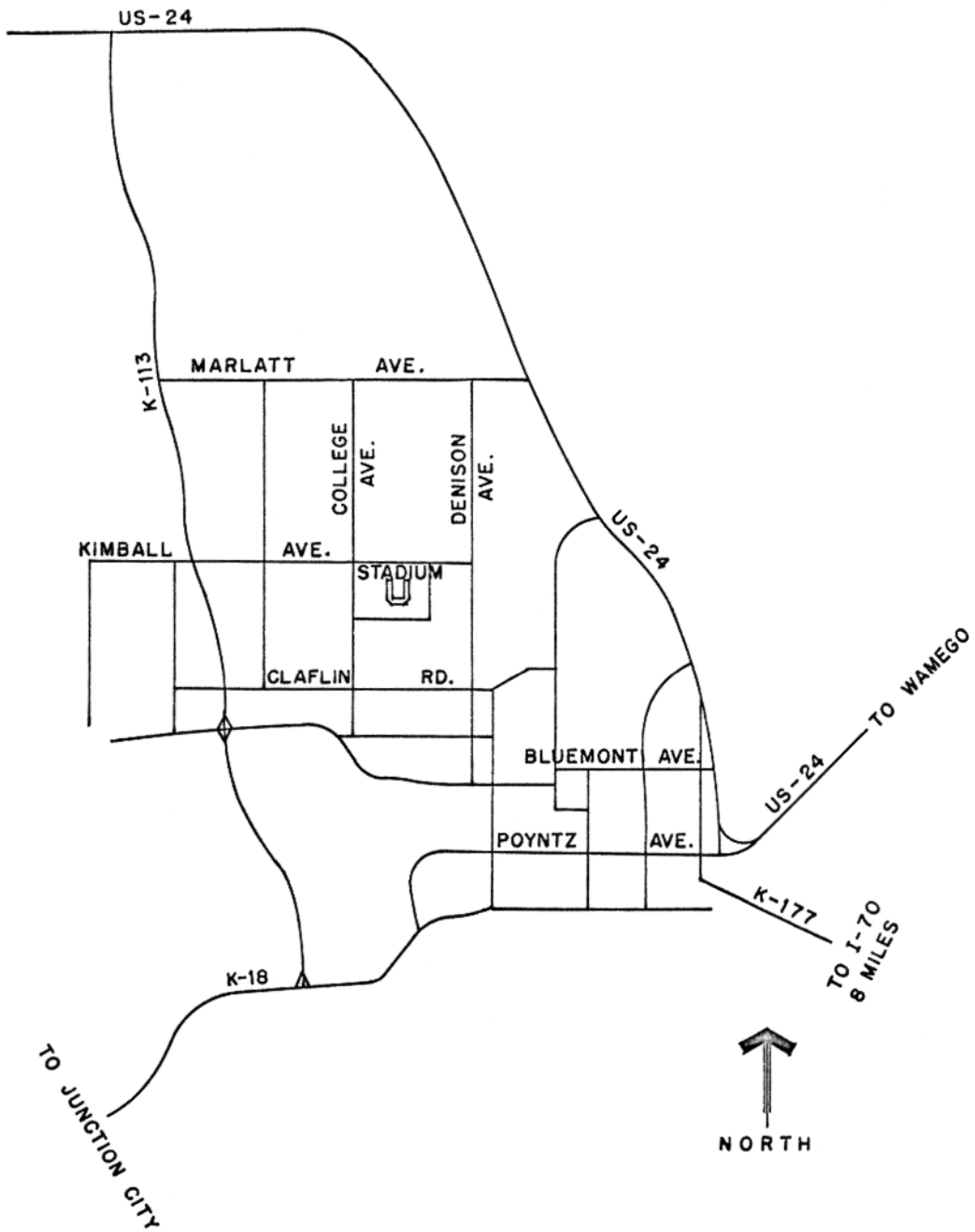


Fig. 3. Surrounding Highway System and Major Streets.

All of the games started at 1:30 P.M. In this report, the games will be referred to by number instead of by opponent. (See Table 1) The team's "won-loss" record and the opponent are two important determinants of the number of people that will come to watch a certain game. A list of opponents and the game scores is given in Table 2.

Table 1. Game Numbers, Opponents, and Attendance

Game Number	Opponent	*Attendance
1	Colorado State	22,641
2	Iowa State	**31,507
3	Missouri	26,449
4	Kansas	***35,937
5	Oklahoma State	17,645

*attendance figure furnished by the athletic ticket office
**included 8,800 band students most of which came by bus
***this was a capacity crowd

Table 2. Opponents and Game Scores

Opponent	Game Location	Opp.	K.S.
Colorado State	Manhattan	0	21
Penn State	Univ. Park	25	9
V.P.I.	Blacksburg	19	34
Iowa State	Manhattan	23	14
Colorado	Boulder	37	14
Missouri	Manhattan	56	20
Oklahoma	Norman	35	20
Nebraska	Lincoln	0	12
Kansas	Manhattan	38	29
Oklahoma State	Manhattan	14	21

PROCEDURE AND METHODS OF DATA COLLECTION

Vehicle Occupancy

In order to obtain the vehicle occupancy rates occupancy counts were made at the parking lot gates. (See Fig. 1) The counts were taken for thirty minute periods. The reason for this decision was to determine if the occupancy rate was different for different time periods. The occupancy counts were taken by people that were hired to do this. These people were positioned at the lot entrances to which they were assigned. They were each furnished a number of tally sheets which were made for this purpose only. They were instructed to count the people in each car as it entered the gate and put a mark on the tally sheet in the proper column indicating the number of people in the car. They used a different tally sheet every thirty minutes. The tally sheets had one section for students and one section for non-students. The counters were to separate the students and non-students by checking for student campus parking stickers on the cars. These occupancy counts were taken only before the game. The above procedure was used at all six gates (one, two, three, four, six, and seven; see Fig. 1) for games one and two. Gate number 5 was the entrance to the employee lot. Since the employees were to have arrived before the other gates opened, no data were gathered at gate 5. For game number three the above procedure was used at gates three, four, and six only.

At games four and five, five minute occupancy counts were taken at each of the six gates. This was done in order to

save on the cost of the data collection. The five minute counts were taken in the same manner as the thirty minute occupancy counts except that the counters changed tally sheets every 5 minutes instead of every 30 minutes. From the five minute occupancy count, it was possible to obtain a thirty minute occupancy count as well as the five minute vehicle count.

Vehicle Counts

Five minute vehicle counts were taken at the gates by hired personnel. These people were each furnished a hand counter and a tally sheet. They were positioned at the gates the same as the thirty-minute occupancy counters were. They were instructed to count the cars as they passed the gate and record the counter reading every five minutes. These five minute vehicle counts were taken both before and after each game. The pre-game counts were started about 11:30 A.M. and ended about game time. The post-game counts were started at the end of the game and continued until the lots were nearly empty. The above method was used at all six gates for the first three games. Before games four and five a five minute occupancy count was taken instead of a five minute vehicle count. It was possible to obtain the 5 minute vehicle count for the entering traffic from this five minute occupancy count. After games four and five, five minute vehicle counts of the exiting traffic was taken the same as for the other games.

Photographs Taken from Airplane

In order to locate the traffic bottle necks aerial pictures of trouble spots were taken. The airplane circled the area of the football stadium approximately once every five minutes. On each circling of the stadium, pictures were taken of the intersections and parking lots that were of interest. As the pictures were taken, the time of exposure and location was recorded.

At the first game, pictures were taken from twelve o'clock noon until one-thirty in the afternoon. These photographs were developed and made up in three inch by five inch black and white pictures. The weather did not permit the taking of pictures after the game.

At the second game, no pictures were taken before the game because of the weather. However, the weather cleared and pictures were taken during half-time. These pictures were used to determine the numbers of cars parked in each of the lots. Pictures were also taken of the nearby surface streets in order to determine the number of cars parked on them. Pictures were taken after the game from four-fifteen until five o'clock in the afternoon. These pictures were developed and processed as color slides which were much easier to view than were the black and white pictures.

No pictures were taken at the third game because of bad weather.

At the fourth game, pictures were taken both before and after the game. The picture taking did not begin as scheduled,

however, because of inclement weather. Pictures were taken from noon until two o'clock. After the game, pictures were taken from four-thirty until five o'clock at which time it was getting too dark to take pictures. These pictures were also developed as color slides.

Observations

The reason for including this as a means of data collection is that it was impossible to have organized data collecting systems for all the things in which this paper is concerned.

One of the things that was noticed by observation was the fact that the people selling parking tickets to cars as they entered the lots were required to place a ticket under the windshield wiper of each car. Placing a ticket under the windshield wiper of each car was a waste of time and served no purpose, therefore this practice should be eliminated.

It was noticed that the shuttle buses were having to "fight" the traffic too much since no special route was provided. Relatively few people used these buses. This may have been because no special route was provided, thus causing the buses to take too long getting to the stadium and back.

Another thing that was noticed was the fact that congestion resulted on K-177 south at the Missouri and K.U. games. This congestion backed traffic up to and on Interstate 70 which is ten miles south of the city.

Information from Connected Agencies

One of the things that was needed was the total attendance figures for the games. This was obtained from the KSU Athletic Department. The number of people that rode the shuttle buses was obtained from the bus companies. The city furnished information about street widths where needed.

O-D Study

A trial Origin-Destination (O-D) Study was conducted in an attempt to find out where people came from. It was also to find out if the out-of-town people stopped in Manhattan before and/or after the game. The Study was conducted by handing out questionnaires at the gates. At game number three, a trial run was made to see if the percentage of questionnaires returned was high enough to warrant handing out a much larger number at the fourth game. At the third game, 1,000 questionnaires were handed out. (See Appendix E) The questionnaires were a bright pink in color and were numbered with the number of the gate at which they were handed out. The questionnaires were distributed in lots one, three, four, and seven. They were given to approximately every third car. At gates one and seven the person handing out the questionnaires explained the purpose and importance of the questionnaire. At gate three, the questionnaire was handed to the drivers with no explanation. In lot four, the questionnaires were handed to the drivers after they were parked and the importance and purpose of the questionnaire was briefly

explained. The reason for handing the questionnaires out in three different ways was to determine which procedure gave the best return. But of the 1,000 questionnaires handed out, less than 50 were returned. With such a small return no valuable results could be obtained from the questionnaires, therefore no questionnaires were handed out at any of the remaining games. One thing that was thought to have had an effect on the return was that a large number of political papers were also handed out at this game. Another reason might have been the method of collection. The people were instructed to leave the questionnaires in the stadium after the game. The reason for this method of collection was because of the lack of money to do it some other way. On the day of this game, however, the wind was blowing very hard and people might not have left them because they thought that they might blow away. Some of the questionnaires might have blown away but in a search of the area downwind from the stadium very few were found. The above are only possible reasons for the low return. No one will ever know why the returns were so low.

EVALUATION OF THE DATA

Occupancy Rates

The occupancy count data were reduced to a usable form by hand. This was done by counting the marks on the tally sheets. By counting the marks one could find the number of cars that were in each category. The categories were one, two, three, four, five, six, seven, eight, nine, and greater than or equal to ten persons per vehicle. These reduced data were punched on IBM cards in a format that would work with a program that had been developed to do the needed calculations. The computer program is presented in Appendix B. The output from this program is in Appendix C.

It was found that the occupancy rate varied from game to game, but was about 3.2. (See Appendix C) For game number one, it can be seen that the average occupancy rate was 3.07 which is a little lower than the other occupancy rates. The probable reason for this was that in the occupancy count for this game all the cars that had more than four persons were considered to have only five persons in them. In the other four games, these cars were separated into six more categories: five, six, seven, eight, nine, and equal to or greater than ten persons per vehicle.

The occupancy data were evaluated by statistical tests. The method of statistical analysis used was taken from "Concepts and Methods of Experimental Statistics" by H. C. Fryer (10). The method used was the analysis of variance technique explained

in section 9.2 of the above reference. A level of significance of five percent was used for all of the statistical tests. The hypotheses tested were:

1. The occupancy rate for any lot equals the occupancy rate of any other lot.
2. The occupancy rates for any game equals the occupancy rate for any other game.
3. The occupancy rate for any time period equals the occupancy rate for any other time period.
4. The student occupancy rate equals the non-student occupancy rate.

It was concluded from the statistical tests that all hypotheses should be accepted.

Vehicle Counts

The vehicle counts were reduced by hand. This was done by taking the difference between the recorded counter readings and then putting the flow rates so obtained in a tabular form. The reduced data are presented in Appendix D. The data in Appendix D give the five minute vehicle flow rates (vehicles per five minutes). These flow rates are equal to the number of vehicles that enter the gates in a five minute period. All of the gates provide two traffic lanes, therefore all of the flows are for two lanes of traffic. The total flow rate in Appendix D is the sum of the individual gate flow rates. From Appendix D it can be seen that the maximum entering rate for a single gate is about 60 vehicles per min. (720 veh./hr.).

The maximum entering flow rate (total for all gates) is about 275 per 5 minutes (3300 veh./hr.). Also these data show that the maximum exiting rate for a single gate is about 125 veh./5 min. (1500 veh./hr.). The maximum exit flow rate (total for all gates) was about 625 veh./5 min. (7500 veh./hr.). The exiting flow rate is approximately twice as large as the entering flow rate. One reason for this is the fact that the entering cars must purchase tickets as they enter the gates.

Aerial Photos

The pictures taken of the traffic from the airplane provided an excellent record of what happened on the day of the game. From these prerecorded happenings it was easy to see what was taking place. A fifteen minute account of the traffic back-up taken from the photos for various games is presented below.

Game Number One
Colorado State at Manhattan
Final Score - K.S. 21 and Colorado State 0

The airplane was up by 12:00 noon. At this time, there seemed to be a lot of traffic on and around the campus, but it did not appear that this congestion was caused by a back-up from the stadium. By 12:15 P.M., traffic was backed up on Denison south to the intersection of Claflin. From this intersection, at this time, about 20 cars were backed up to the east as well as about 35 cars to the south. One reason for this congestion developing so early was the fact that the police officer responsible for directing the traffic at the intersection of Denison and Kimball was forming only one lane of traffic west on Kimball. The traffic from the south was having to share their moving time with the cars from the north. All other streets seemed to be operating normally.

By 12:30 P.M., conditions were much the same as they were at 12:15 P.M. At the intersection of North Manhattan and Claflin, a queue of about 30 cars was backed up on the south approach to this intersection. At the intersection of Kimball and Denison the officer had started forming two lanes of traffic. College south had about 50 cars starting to back up.

By 12:45 P.M., traffic was backed up on College south to the intersection of College and Claflin (two lanes). From this intersection, about 15 cars were backed up to the south, about 5 to the west, and approximately 20 to the east. Traffic was backed up Denison south to the intersection of Claflin

and east on Claflin to the intersection of North Manhattan and the south for about a block. By this time, a queue was starting to form at the intersection of North Manhattan Ave. and US-24. The reason for this queue forming was that the people could not turn onto Claflin at the intersection of Claflin and Manhattan. A queue was also starting to form on Kimball west of the stadium.

By 1:00 P.M., a queue was forming on US-24 at the intersection of Marlatt. Kimball traffic was backed up to K-113. This queue had about 50 cars backed up on K-113 (see Fig. 4). This situation is dangerous because K-113 is a two lane highway and this blocks the roadway. At this time, most of the other streets were the same as they were at 12:45 P.M.

By 1:15 P.M., Kimball traffic was not backed out on K-113. US-24 likewise had cleared out. College was no longer backed up to the intersection of Claflin. Denison south was still backed up to the intersection of Claflin and Claflin was still congested, but was not backed up to North Manhattan.

By 1:30 P.M., there was no noticeable congestion. However, a few cars were still arriving.

One thing that was noticed was the fact that only two of the four lanes on Kimball east of the stadium were used. The two south lanes could turn into gate number seven and the two north lanes into gate number six. Figure 5 shows how two lanes can turn into one gate. Plate number one also shows that when two lanes turn into one gate when there are

only two lanes of traffic, the facilities are not being fully utilized.

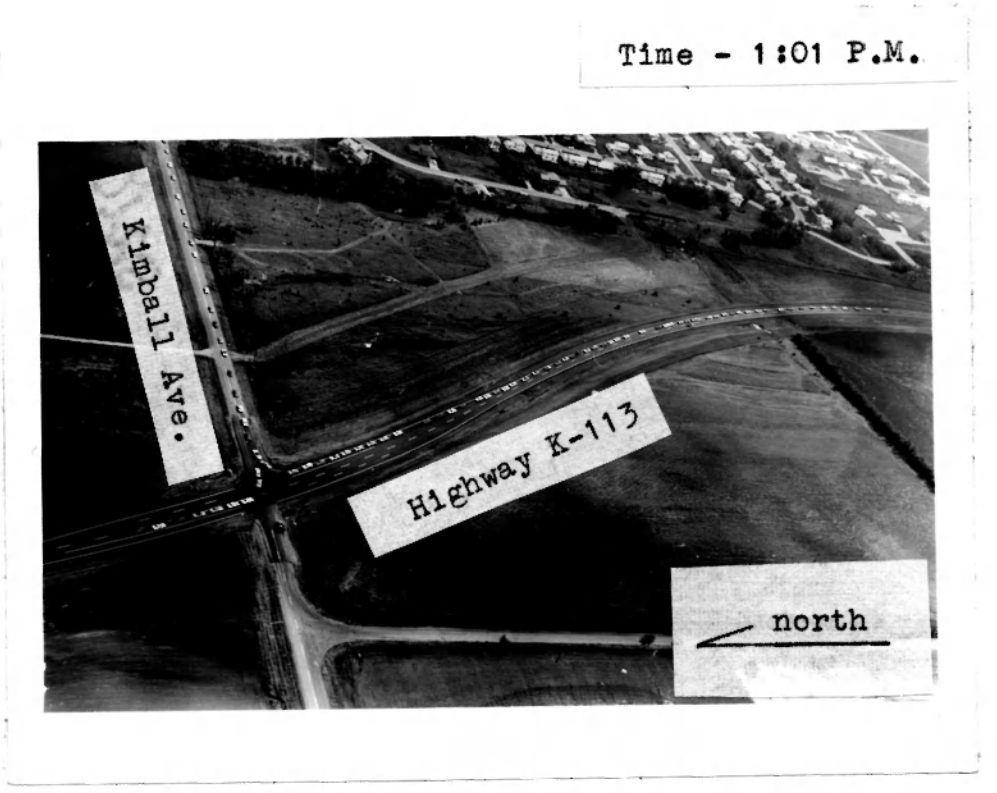


Fig. 4. Traffic Back-Up on K-113

EXPLANATION OF PLATE I

Fig. 5. Intersection of Kimball and Denison and gate 7 showing two lanes of traffic entering gate 7.

Fig. 6. Gate 6 with no cars entering shows the waste of entrance capacity.

PLATE I

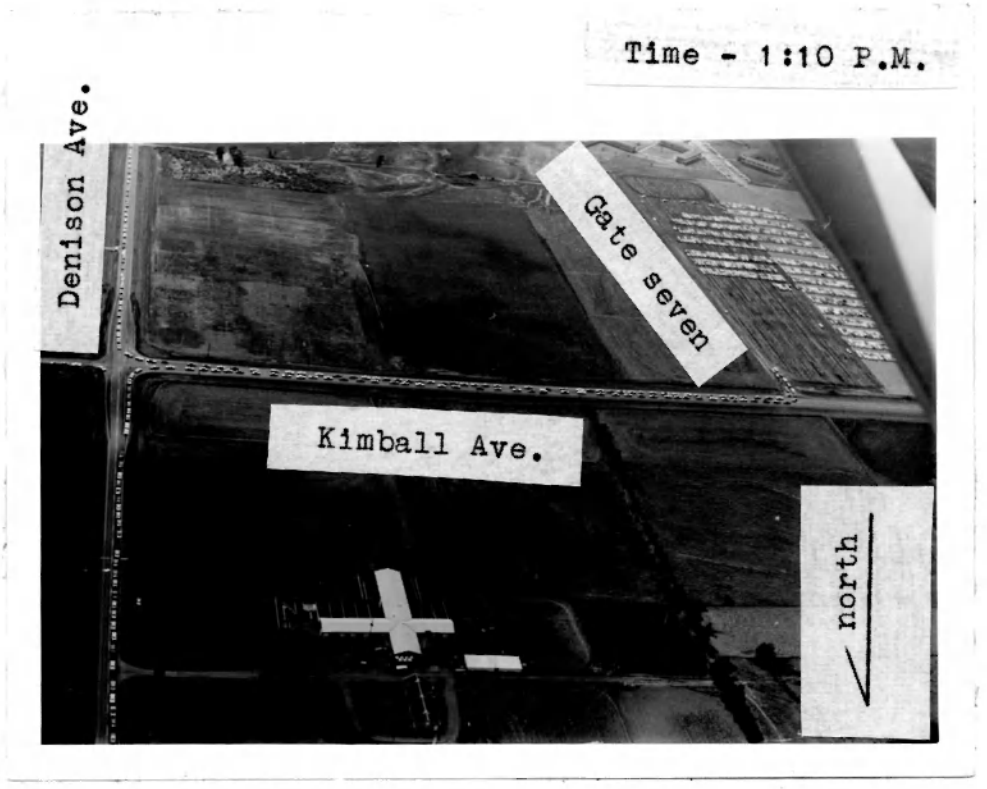


Fig. 5. Intersection of Kimball and Denison and gate 7

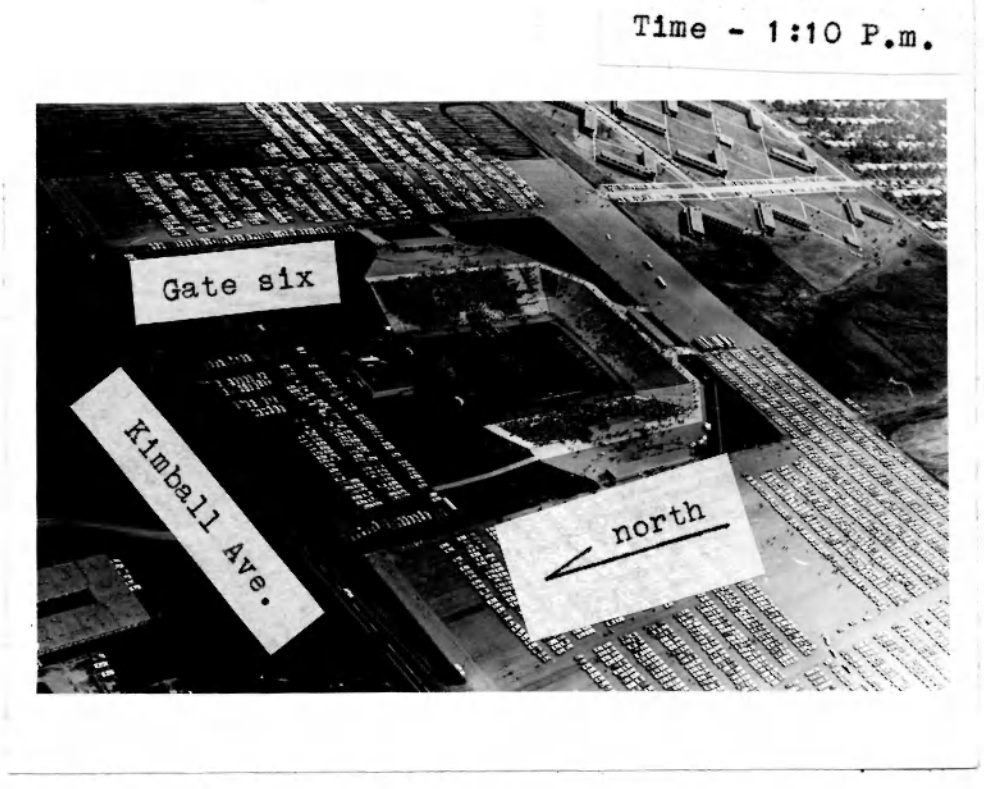


Fig. 6. Gate 6 with no cars entering

Game Number Two
Iowa State at Manhattan
Final Score - K.S. 14 and Iowa State 23

There were no pictures taken before this game. After the game, the traffic flow was very good. The results of this study show that the exiting rate was almost as great as the capacity of the street system leaving the stadium. One thing that was noticed was that for post-game traffic the officer at the intersection of College and Kimball was not allowing the cars that were west bound in the north lane of Kimball a free right turn. (See Fig. 11)

Game Number Four
Kansas at Manhattan
Final Score - K.S. 29 and Kansas 38

The weather did not permit the airplane to leave the ground until shortly before 12:00 noon. By 12:15 P.M., cars were backed up at the intersection of Kimball and Denison, south for about two blocks, and about 20 cars to the north. No cars were backed up at the intersection of College and Kimball. Gate one had cars backed up south for about two blocks. Claflin was jammed between Denison and Manhattan. About 40 cars were backed up to the southeast, at the intersection of US-24 and Marlatt.

By 12:30 P.M., the intersection of College and Kimball was backed up to the west for about two blocks and also to the north for about two blocks. Gate one was backed up College almost to Claflin. From the intersection of Denison and Kimball, cars were backed up south to Claflin. Also, at the intersection of Denison and Kimball cars were backed up north for about one block. Claflin was still jammed between Denison and Manhattan. US-24 was backed up from the intersection of Marlatt almost to the intersection of Manhattan.

By 12:45 P.M., gate one backed up to Claflin and east on Claflin for about one block. The intersection of College and Claflin was also backed up about one block to the south. The intersection of College and Kimball was backed up to K-113 and south on K-113 to the intersection of Claflin. Gate one was backed up about the same as before. The intersection of

Denison and Kimball traffic was backed up about the same as at 12:30 P.M. US-24 was backed up about one block past the intersection of Manhattan Avenue.

By 1:00 P.M., gate one was backed up on College to Claflin and then east on Claflin about one-fourth mile. K-113 was still backed up from Kimball to Claflin. College was backed up north from the intersection of Kimball to Marlatt. US-24 was backed up from Marlatt to about one block past the intersection of Manhattan. All other streets were about the same as before.

By 1:15 P.M., conditions had not changed much from those at 1:00 P.M.

By 1:30 P.M., Denison and Kimball were backed up south about a block and north about a half block respectively. Claflin was cleared out. Gate one was backed up about one block south on College. The intersection of College and Kimball was backed up to K-113, but was not backed out onto K-113. US-24 had cleared out by this time. Marlatt had also cleared out.

By 1:45 P.M., cars were still backed up east on Kimball from the intersection of Browning. Kimball was still backed up east from gates six and seven to the intersection of Denison. All other streets were cleared out.

By 2:00 P.M., all streets were back to normal.

There were several things that were found from the pictures that showed the causes of bottlenecks. A list of these points with pictures is included below:

1. At the intersection of Denison and Kimball, only one line of cars was turning from the south onto Kimball east. (See Fig. 7) The reason for this was that an officer was stopping the cars.
2. At the intersection of College and Kimball, cars were moving from only one direction at a time. The reason for this was that an officer at this intersection was stopping cars from one direction and letting cars go from the other direction. (See Fig. 8)
3. Kimball was backing traffic up to K-113. Also, cars were backed up K-113 almost a mile.
4. There were no cars backed up Denison to the intersection of Claflin, but there was a lot of congestion on Claflin. (See Fig. 9)
5. Lot number one was not full at 1:30 P.M.

The exiting traffic flow at game number four seemed to be moving very well. Few problems were found from the pictures. However, traffic was tied up for several hours after the game on and around the KSU Campus. This congestion never developed until after the light was so dim that the taking of pictures had been stopped and the plane was on the ground. Since there were no pictures, an accurate account of the traffic backup was impossible.

EXPLANATION OF PLATE II

Fig. 7. This figure shows the intersection of Denison and Kimball. It also shows that the officer at this intersection is not allowing both lanes of traffic from the south to turn west on Kimball.

Fig. 8. This figure shows the intersection of College and Kimball. It also shows that the officer at this intersection was letting cars go from only one direction at a time.

PLATE II

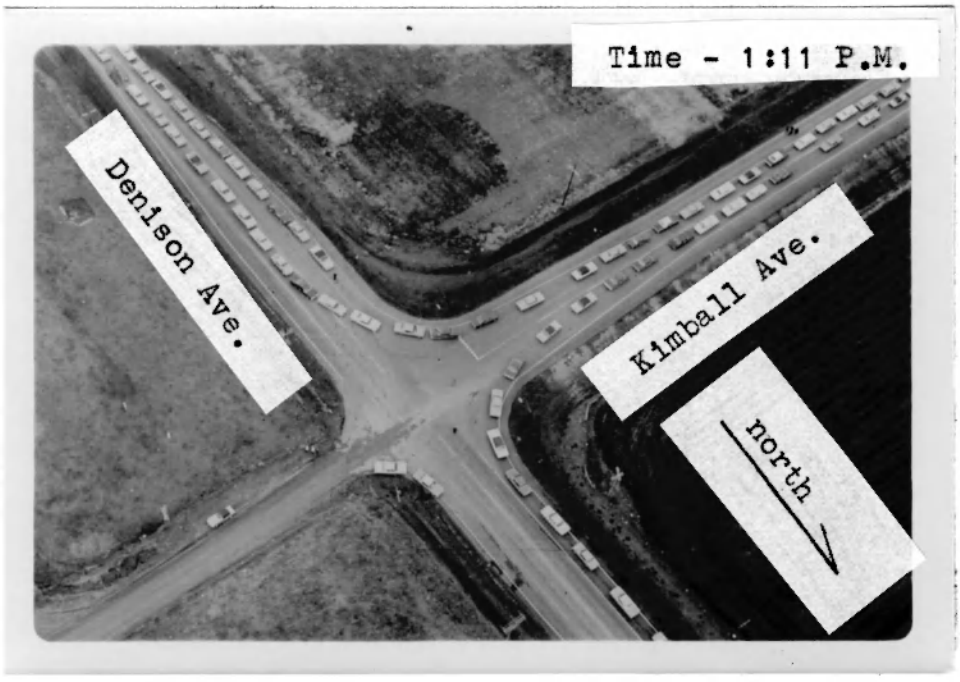


Fig. 7. Intersection of Denison and Kimball

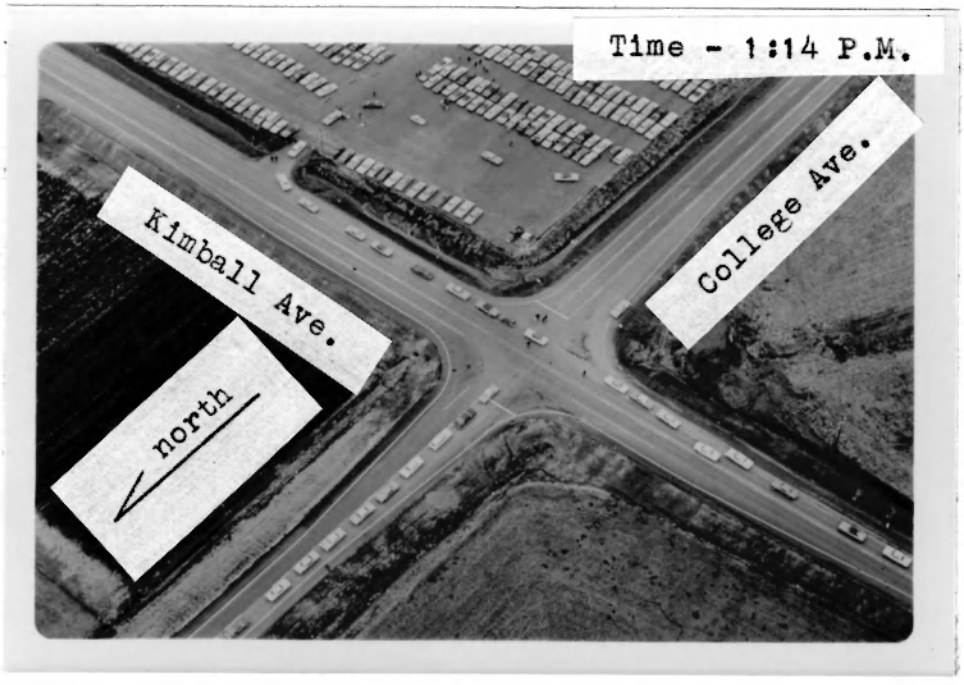


Fig. 8. Intersection of College and Kimball

EXPLANATION OF PLATE III

Fig. 9. This figure shows the intersection of Denison and Claflin. Note that Denison is not backed up to this intersection from the intersection of Denison and Kimball. There should be a free right turn for the east approach of this intersection. With a free right turn the traffic flow at this intersection would be improved considerably.

PLATE III

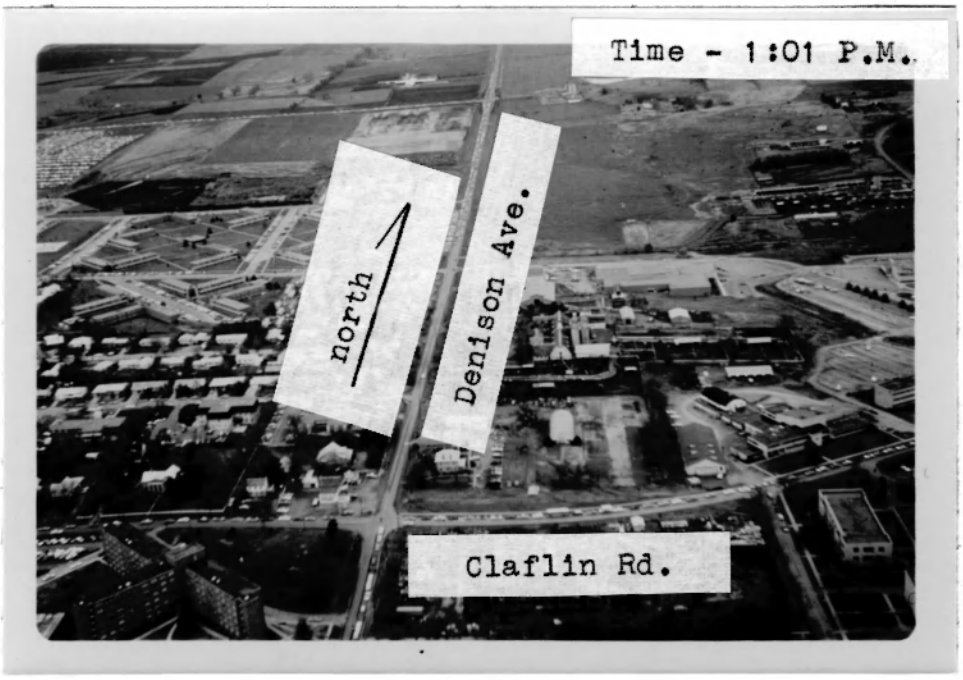


Fig. 9. Intersection of Denison and Claflin

Total Capacity of Surfaced Parking Lots Around the Stadium

The original stadium plans stated that the lots would accomodate 6,649 cars. The employee lot was supposed to hold 284 cars. The bus lot was supposed to hold approximately 200 buses. The only game at which all lots were filled was game number four. The number of cars that was counted entering the six paved lots was 5,554. The number that was counted from the photos was 5,812 cars in the paved lots. The number counted from the photos provided the best estimate because lot one was not full when the counting stopped. Some cars entered lot two after the counting had stopped. There were 43 buses parked in the bus lot and four buses were parked in the other lots. The employee lot contained 169 cars. As one can see the actual number of cars parked is less than the number suggested by the plans. It is believed that the planners did not allow for the traffic lanes when they calculated the capacity of the lots.

The parking lot lay-out plans prepared by Dr. B. L. Smith (Professor, Civil Engineering Department, Kansas State University) shows that there are spaces for approximately 6,000 cars in the six lots to be used by the fans. It would probably be possible to park this many cars in the paved lots if no spaces were wasted. The main waste of space is caused by cars that are allowed to park with too much side clearance between them and the next car. Some spaces were also wasted because the parking attendants allowed spaces to go unused. Some of the traffic lanes left between the parked cars were

much larger than they should have been. The parking lanes were layed out by the use of small pieces of flagging with nails driven in them. It was very difficult for the parking attendants to see these nails, therefore they parked cars in the wrong places.

Factors Limiting Capacity

The traffic directors were the people that were positioned at the intersections. These traffic directors were to keep the traffic moving in a safe manner, while at the same time minimizing traffic delay. One of the factors that limited the capacity of entering traffic was the traffic directors. For example, at the intersection of Denison and Kimball, the officer was allowing only one line of traffic from the south to turn onto Kimball. (See Fig. 7) The officer at the intersection of College and Kimball was allowing cars to move from only one direction at a time (See Figure 8). At the Denison and Claflin intersection the traffic director was letting traffic only move from one direction at a time. The West bound lane of Claflin should have had a free right turn onto Denison. (See Figure 9)

The exiting traffic operation worked very satisfactorily. The exit rate was almost equal to the estimated street capacity (1). The officer at the intersection of College and Kimball was not allowing the two north lanes on Kimball a free right turn onto College north as he should have been; otherwise everything appeared to be operating satisfactorily at this location.

Look at Overall Picture

The congestion that developed on K-177 south of the city at game three and four was a problem. A study of the downtown area was made by the Traffic Engineering Class, Fall 1968. In this study the routes for the stadium traffic were chosen and the capacities of the intersections on these routes were determined. It was assumed that the intersections were controlled by traffic officers, therefore the time given to each direction of movement had to be assumed. The result of this study showed that the overpass at the south edge of Manhattan was the limiting factor on the capacity. One solution to this problem would be to have part of the traffic from the east on I-70 go through Wamego.

The congestion that developed on US-24 at the intersection of Marlatt to the southeast was caused by the traffic having to make left turns at this intersection. At game number four traffic was backed up on US-24 from this intersection (Marlatt and US-24) to the intersection of US-24 and North Manhattan Avenue. A solution to this problem would be to have a traffic officer at this intersection break the traffic and allow these turns more time.

The congestion that developed on K-113 south of the intersection of Kimball was caused by a back up from the stadium. If the traffic director at College and Kimball would keep the traffic at this intersection moving it would

help the congestion on K-113. (See Fig. 4) Also, it is believed that Kimball should have two lanes of traffic east before the game and two west after the game.

Most of the other congestion could be reduced with the proper traffic direction.

O-D Study

No evaluation of the O-D Study data was attempted because of the small return of the questionnaires that were handed out. With such a small return no reliable results could have been obtained.

Parking on Other than Surfaced Lots Around the Stadium

At game number four, there was a significant number of cars that were parked on other than the surfaced stadium lots. There were approximately 513 cars in the dirt lot just east of lot seven. Approximately 462 cars were parked on the surface streets. Cars were also parked in other parking lots and open areas around the stadium. The approximate number of such cars was 636. This made a total of about 1,600 cars that were parked in other than the surfaced lots. Using an occupancy rate of 3.2, this means that over 5000 people, who drove to the stadium area, did not park in the surfaced stadium lots.

CONCLUSIONS

The results of the vehicle counts and the occupancy counts are listed below:

1. The occupancy rate found to exist by this study was approximately 3.2 persons per vehicle.
2. The maximum entering flow rate for one gate (2 lanes) was about 720 vehicles per hour.
3. For a single gate (2 lanes) the maximum exit rate was approximately 1500 vehicles per hour.
4. For all six gates the entering flow rate was approximately 3300 veh./hr. while the exit rate was about 7500 veh./hr.

The following is a list of the trouble spots found by this study:

1. the intersection of Denison and Kimball
2. the intersection of College and Kimball
3. the intersection of Claflin and Denison
4. traffic backed up on Highway U.S.-24
5. traffic backed up on Highway K-113
6. traffic backed up on Highway K-177 south of Manhattan
7. back up at the gates
8. lot one not filling on the day of game number 4 until after 2:00 P.M.
9. buses taking too long to get to the stadium
10. dirt lot not filling until after 2:15 P.M. on the day of game number 4

Below is a list of the reasons for the above trouble spots.

1. The problem at the intersection of Denison and Kimball was caused by the traffic officer at this intersection not letting both lanes of traffic on Denison south turn onto Kimball at the same time.
2. The trouble at the intersection of College and Kimball was that the traffic director at this intersection would not let traffic move from both directions at the same time.
3. The problem at Denison and Claflin was caused by the traffic officer not letting the cars on Claflin east have a free right turn as they should have had.
4. The traffic backing up on Highway U.S.-24 was caused by the fact that all the stadium traffic had to make left turns across the south bound traffic at the intersection of Marlatt and U.S.-24.
5. The back up on K-113 was partially caused by the traffic officer at the intersection of College and Kimball not giving full time to Kimball, but sharing it with College. Even if the intersection of College and Kimball were operated in the proper manner it is believed that traffic would still be backed up on K-113.
6. The traffic back up on K-177 south of the city was caused by the capacity of the overpass not being great enough to carry the traffic.

7. The back up at the gates was caused by the parking ticket sellers being required to place tickets under the windshield wipers of the cars. The back up wasn't too bad, but if the other bottlenecks were corrected, this would be the major problem area.
8. One reason for lot one taking so long to fill is because it is larger than any of the other lots. However, it is believed that with an improved method of ticket sales lot one could have been filled by game time.
9. The reason for the buses taking so long to get to the stadium was because they had to compete with the other traffic.
10. The reason for the dirt lot filling so late was because they waited about 30 minutes after lot seven filled before opening the dirt lot.

RECOMMENDATIONS

Professional Personnel Needs

The results of this study indicate the need to have someone (preferably a traffic engineer) observe the "total traffic" situation. If anything was causing trouble at one game, this person would be responsible to see that something was done before the next game to eliminate this problem if possible. Also, if someone was observing the traffic, he could suggest needed construction. If the operational procedure is changed from those of the past year to those suggested in this study, someone needs to see if the changes actually improve the operational characteristics of the system.

Needed Physical Improvements

Kimball needs to be two lanes wide in the direction of the heavy traffic flow between K-113 and College. This can be done by either making Kimball one way or by widening (preferably by widening). This would eliminate the back up on K-113. Denison between Kimball and Marlatt should be made one way. The streets that were one way toward the stadium before the games and one way away from the stadium after the game should remain so and are listed below.

1. Denison one way between Claflin and Kimball
2. College one way between Claflin and gate number one
3. College one way between Marlatt and Kimball
4. Kimball one way between Denison and gate number six
5. Kimball one way between College and gate number four.

The traffic operation and lane distribution around the stadium should work as shown in Fig. 10 and Fig. 11.

Entering (pre-game) Traffic Operation

At the intersection of Denison and Kimball the traffic directors need to keep two lanes of traffic turning from Denison south onto Kimball west. There should be two lanes turning from Denison north onto Kimball west.

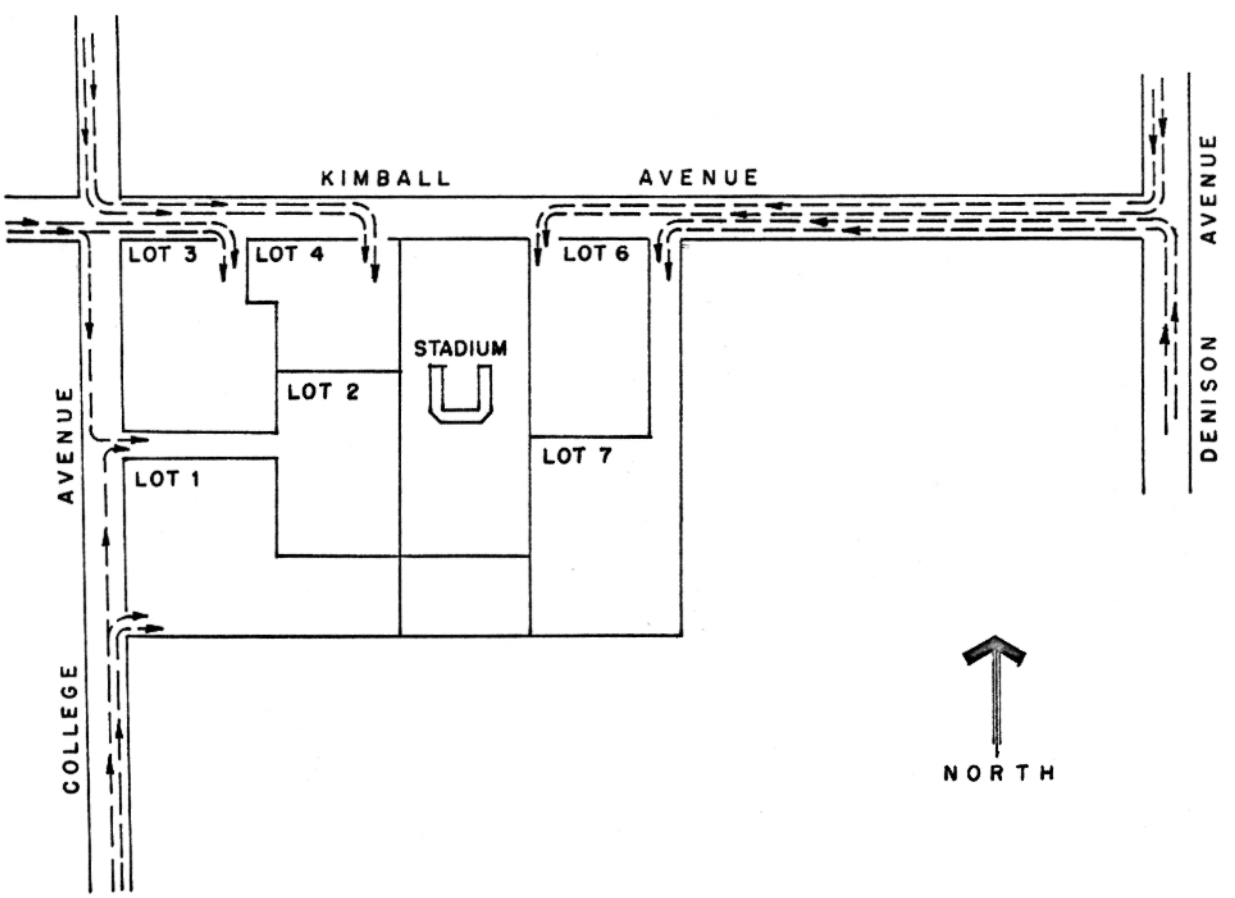


Fig. 10. Recommended Entering Flow Pattern

At the intersection of College and Kimball, the two lanes on College north should both turn left onto the two north lanes of Kimball. The two lanes on Kimball west should both be allowed to use the two south lanes on Kimball east of the intersection. The south lane on Kimball west should also be allowed to make a free right turn.

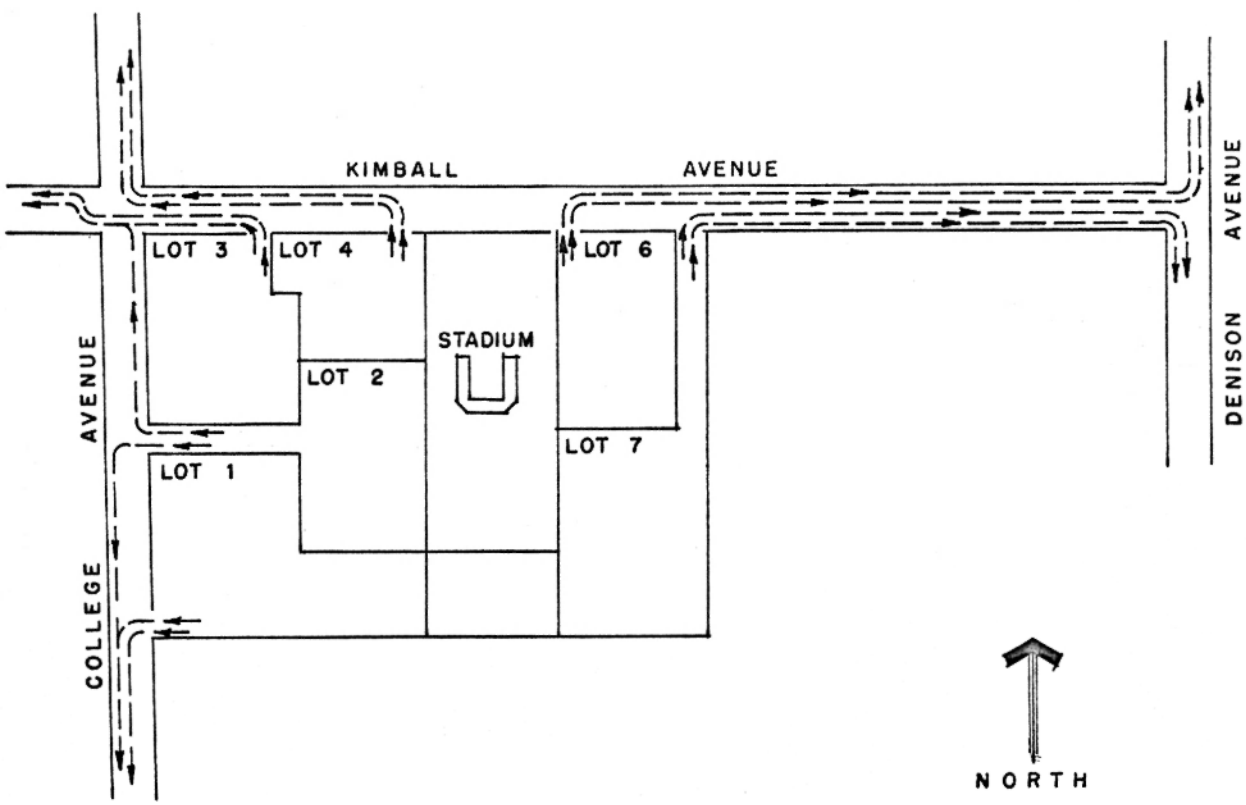


Fig. 11. Recommended Exiting Flow Pattern

At the intersection of Claflin and Denison, the cars on Claflin east should be given a free right turn onto the east lane of Denison north. All the other directions would then have to share the west lane.

At the intersection of U.S.-24 and Marlatt, there should be a highway patrol car and a highway patrolman directing the traffic. To do this some sort of system should be set up about a mile north of the intersection on U.S.-24 to warn the oncoming traffic that they might have to stop for the game traffic. The patrolman at this intersection should give as much time as possible to the left turning vehicles if they are backing up to the south.

One solution to the back-up on K-177 south of the city would be to set up a system by which some of the traffic on I-70 from the east would turn off at the Wamego exit and follow K-99 to U.S.-24 and U.S.-24 to Manhattan.

For the Nebraska games one should expect to have different problems than those that were present at the K.U. game. Most of the Nebraska fans will probably come to Manhattan by either K-113 or U.S.-24. The places to expect trouble spots to develop are listed below.

1. Intersection of US-24 and K-113
2. Intersection of US-24 and Marlatt
3. Intersection of K-113 and Marlatt
4. Intersection of K-113 and Kimball

Since these spots are expected to cause trouble there should be someone (preferably a traffic officer) located

at these points to direct the traffic.

Exiting (post-game) Traffic Operation

The exiting traffic should operate as shown in Fig. 11. Most of the movements are the reverse of the entering traffic movements. An exception to this rule is where two lanes form one lane of traffic instead of one lane forming two. This happens at both locations where the lot 2 traffic joins with the other traffic. (See Fig. 11) A traffic officer needs to be at these two locations to allocate moving time between the two traffic movements.

Lot Operation and Improvements

The parking ticket sales should be handled in some other manner. One thing that would speed up this operation would be to eliminate the placing of tickets under the windshield wipers of the cars. Another thing that might speed up the ticket sales would be to place signs along the approach streets in such a manner that the fans would see them just before arriving at the lot gates. These signs should tell the fans to have their money ready and the amount of the fee.

In the parking lots there should be a better method of marking the parking lanes than that used in the fall of 1968. The reason for this is that the parking attendants had trouble finding the markings therefore they parked cars in the wrong places wasting valuable parking space. These markers should be large enough that they can be seen by the parking attendants very easily.

The dirt lot east of lot 7 should be open as soon as lot 7 is full if a large crowd is expected.

Bus Service

A special route should be provided for buses as suggested by William Smith in his Master's Report "A Systems Approach to the Study of the Transportation Facilities Serving KSU Stadium." (1) This bus service could help traffic problems considerably. One thing that also needs to be done is to advertise this bus service so people will know that it is available.

Aerial Surveillance

The use of an airplane to watch for and locate the traffic tie-ups proved to be very efficient because from the air one can see the total picture. It would be very helpful to traffic movements if an airplane could be the master control for the traffic directors. When a problem is spotted from the airplane the traffic directors on the ground would be informed as to what they should do. The use of the airplane could also be tied in with a radio station and then the people in the cars could be directly informed of the traffic conditions that exist. All of the above recommendations of uses of the airplane would benefit the movement of traffic considerably.

In this study none of the above uses of the airplane were carried out. The only use made of the airplane was for the taking of photographs of the traffic tieups.

Aerial surveillance is used at the Municipal Stadium in Kansas City. A quote taken from the 1967 Municipal Stadium

Transportation Plan (11) is given below.

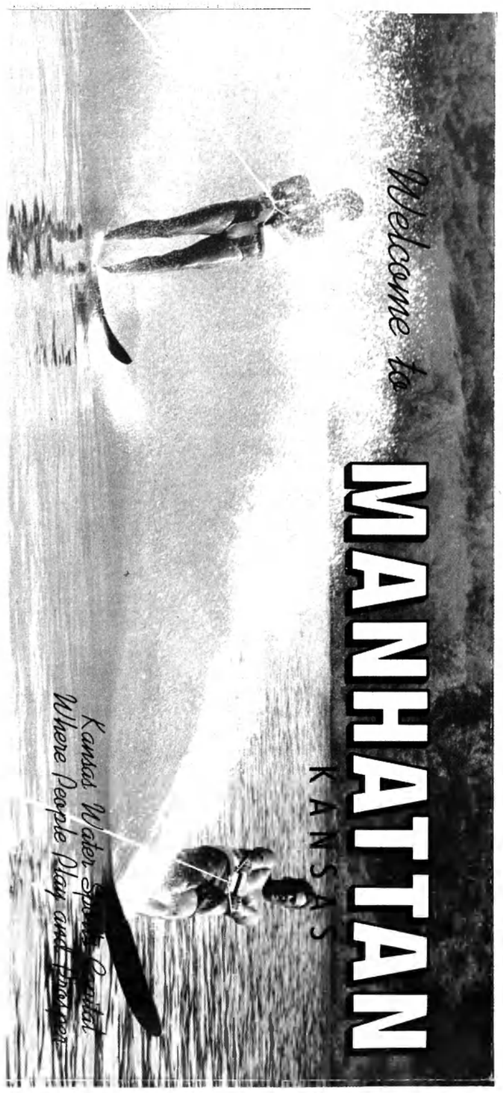
> The use of the helicopter by the Police Department and a local radio station effectively improved traffic operations in the vicinity of the Stadium. The broadcast before and after each game helped auto drivers to avoid potential congestion areas in advance of arriving at this point. The advice was current information and provided a valuable service. The traffic officer in the helicopter was also able to provide "eyes" for the men on the ground and enabled the Police Department to dispatch officers to clear potential congestion areas. The overhead control and advice should be continued and should be publicized so that all persons attending the game are aware of this valuable service.

The use of aerial surveillance (airplane or helicopter) would no doubt improve the traffic movement at KSU Stadium the same as it has at the Kansas City Municipal Stadium. As stated above this would provide "eyes from above" for the men on the ground. The use of a local radio station to inform the football fans of developing trouble spots would be helpful.

Improvements for Expansion of Stadium

The new stadium was constructed in such a manner that it could be expanded from a facility serving 35,000 people to one serving 50,000 people. The problem of getting these extra people to the stadium is one that needs more study. The study should be made well before the stadium is expanded. The results of this study indicate that unless some drastic improvements are made on the street system most of the additional people will have to come to the stadium by shuttle buses.

APPENDIX A



Manhattan -- The Complete Community

Settled in 1855, Manhattan has a population of 30,700 within the city and suburbs. This count includes 7500 of the 11,500 university students not counted in the annual census. In addition, several thousand soldiers and their families who do not reside in the city make Manhattan their shopping and entertainment "home town." Tuttle Lake developments and the rural area add to the total, placing 160,000 shoppers in the trade area served by Manhattan's downtown, Aggieville, and other shopping centers.

Manhattan is the home of Kansas State University, one of the outstanding educational institutions in the world. The fertile Kaw and Blue River Valleys topped by the fabulous Flint Hills with their unexcelled Bluestem grasses all contribute to the agricultural wealth and scenic beauty of the area. Manhattan is experiencing a sustained residential growth rapidly expanding into new areas at an undiminished pace.

What To See

SUNSET PARK & ZOO . . . located on a bluff overlooking the Wildcat Valley at the southwest edge of the city. (See city map, Index C-2). Sunset abounds with picnic areas and barbecue facilities, kiddie playgrounds, and shelter houses — free to all.

The zoo is considered one of the finest in the nation for a city of Manhattan's size. Peacocks roam the grounds; prairie dog village always presents a show for the youngsters; the bears, lions, and llama are only a few of the animals from far-off places that make their homes at Sunset Zoo. And of course, Manhattan's first resident, the buffalo, holds majestically forth in his quarters at the zoo.

CITY PARK . . . located between 11th and 14th streets on Poyntz Avenue. Manhattan's main street. (Index D-4). Here are horse shoe courts, baseball diamonds, picnic areas, tennis courts, children's play grounds, the historical attractions are located in the park, including a log cabin. Children gather by the dozens to try those zippy rocket slides.

WARNER MEMORIAL PARK . . . southwest of the city with entrances off Fourlane K-18 or K113. (Index B-3). Roadways allow visitors to capture the beauty of this rough, high terrain. Picnic facilities are there for those who want them.

Manhattan's many other smaller parks furnish picnic and playground areas, and can be found throughout the city.

the center of
historic, scenic, and
recreational treasures;

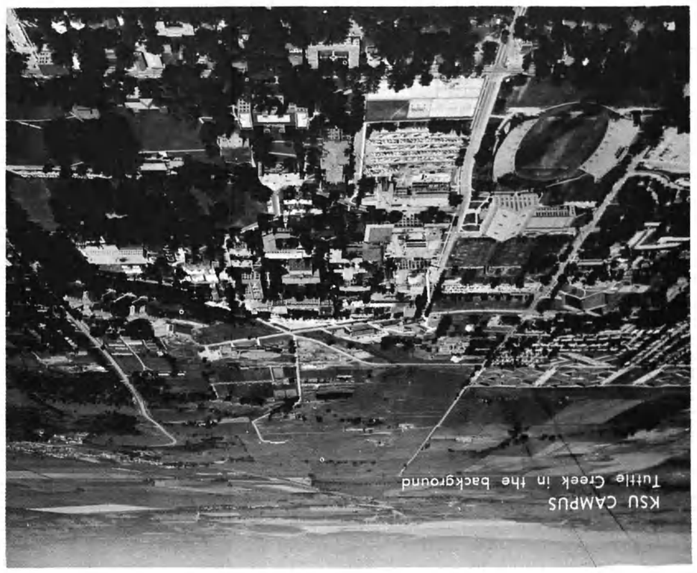
MUNICIPAL BUILDING . . . across the street from City Park on Poyntz Avenue . . . houses the Memorial Auditorium, the city offices, fire station, and the Riley County Historical Society Museum open to visitors without charge.

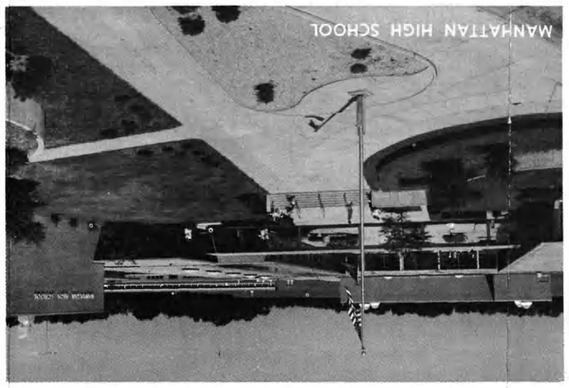
MANHATTAN MUNICIPAL AIRPORT . . . Halfway between Manhattan and the east entrance to Ft. Riley (Index B-9). It is served by a commercial airline and chartered plane service.

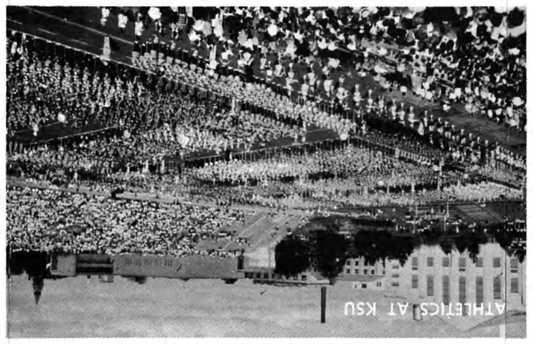
JOHNNY KAW . . . this modern addition to Kansas folklore has a 30-foot colored statue in the southeast corner of City Park.

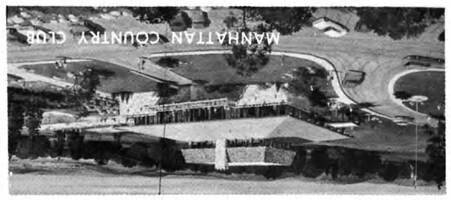
For information regarding Manhattan as a place to live, work, play, or hold a convention, write or phone

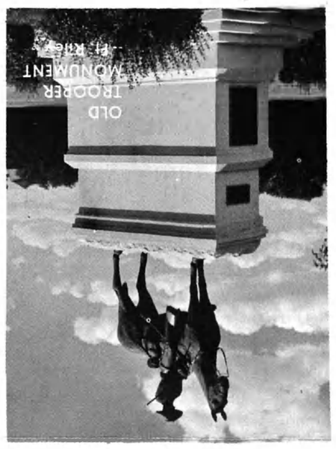
MANHATTAN CHAMBER OF COMMERCE
Manhattan, Kansas 66502

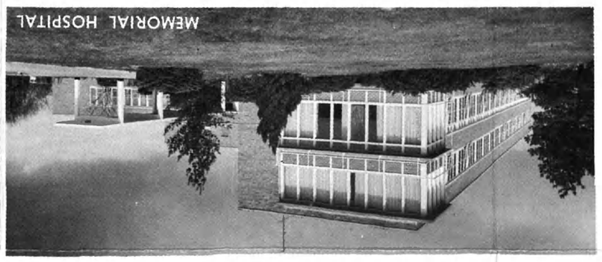


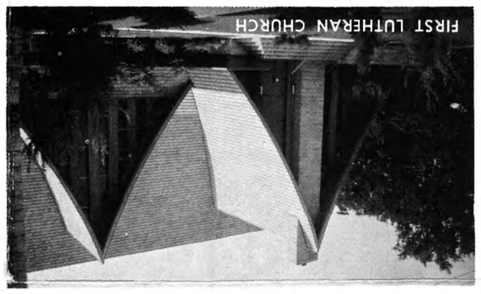


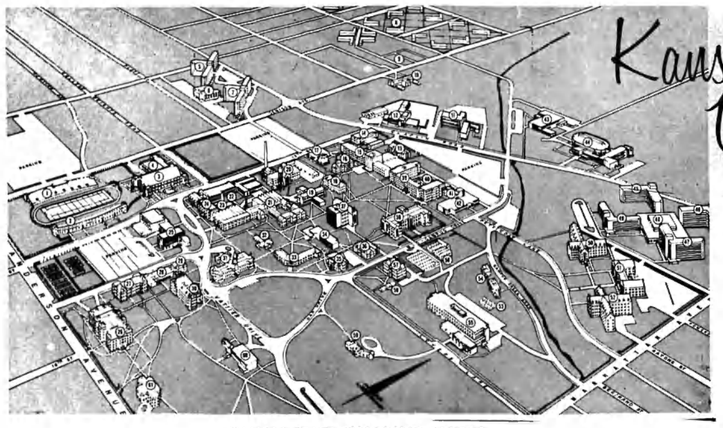












Kansas State University

KANSAS STATE UNIVERSITY CAMPUS

Kansas State University has an enrollment of 11,500 students. The 153-acre campus has many and varied attractions plus its scenic beauty. The University, the first officially established land grant school in the United States, is a member of the Big Eight Conference. Kansas State is known throughout the nation and the world for its important contributions to agriculture, engineering, veterinary medicine, home economics, and milling. Beyond the rolling campus, with its native limestone buildngs, are 3,930 acres of land belonging to the University and used for experimental work in agriculture.

AHEARN FIELD HOUSE . . . one of the largest iudoor sports arenas in the nation and the home of K-State's famous fighting Wildcats.

ANDERSON HALL . . . the oldest building on the campus and the administrative hub of the University.

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About Manhattan

Airport — Municipally owned, scheduled airline service. 5500 foot paved runway.
Altitude — 1,010 feet above sea level.
Area of City is 3,640.96 acres.
Assessed Valuation — $37,678,280.
Chamber of Commerce — Your workshop for community development
Churches — 32 churches, 31 denominations.
Employment — 11,283, all classifications.
Financial — Three banks. Total deposits $54,652,603. Three Savings & Loan Associations. Total assets $23,669,461. Home office of two Mutual Insurance Companies. Total assets $40,384,255.
Government — Commission-Manager.
Highways — Federal 24. State 177, 18. Interstate 79, 8 miles south.
Hospitals — Three. Total beds 250.
Housing — One hotel with 122 rooms .Ten motels with 190 rooms. 15 trailer parks.
Industry — 33 manufacturing firms.
Principal Manufactured Products — Dairy, bakery, farm machinery, feed processing, rock processing.
Library — Public. 42,000 volumes.
Information Sources: Newspapers — 1 daily, 1 weekly. Local radio stations — KMAN, KSAC and KSDB-FM. Television Channel 13 (From Topeka). Cable TV hookup adds 4 additional channels.
Parks — Twelve. Total 320 acres.
Population — 33,500 (includes 11,000 K.S.U. students not counted in annual census.)
Trade Area — 160,000.
Recreation — Tax supported.
Schools — Public, nine. Enrollment is approx. 5410. Two Parochial Schools. Total Enrollment 710.
Bible College — Approx. 100 enrollment.
Kansas State U. — Enrollment 11,000.
Transportation — 2 railroads, 3 highways, 2 bus lines, 7 truck lines, 1 airline.
Utilities — Natural gas consumers 7361. 9705 electricity consumers, 8706 residential and 999 commercial.
Telephones in Service — 16,201.

Industrial Development

Manhattan has taken a positive aggressive position relative to industrial development and research. The City, County and University officials are extremely interested and cooperative.

As partuers in progress, Manhattan voters have passed a levy, as authorized by the State Legislature, creating a fund to assist the city in attracting and locating industries.

A sizeable pool of industrious, readily trainable labor is always available. The quality of the labor force is among the highest in the nation. Also available, from the University, is qualified professional personnel in many fields related to industry: business, sciences, agriculture, milling, engineering, research and numerous other fields including a Triga Mark II Reactor for nuclear research aud computing centers utilizing 1410 and 1620 computers.

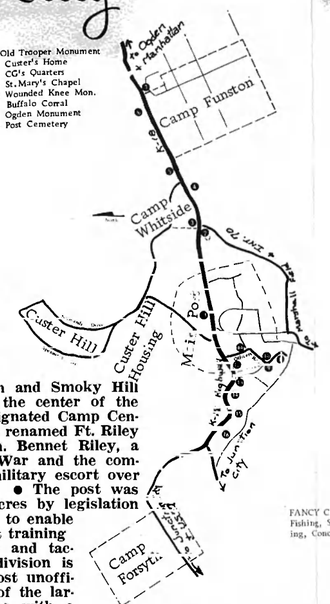
Local corporations have been formed to serve as a means to assist in construction of industrial and research iustallations. Plants can be developed through the revenue bond method or by private capital.

Sites for general industrial use or for research type industries can be arranged through the Chamber of Commerce.

Printed by Ag Press
Manhattan, Kansas

Fort Riley

1. Headquarters
2. Wyman Park
3. Irwin Hospital
4. 1st Capitol of Ks.
5. Packers Camp & Road
6. Gen. Leonard Wood WWI headquarters
7. Great War Memorial
8. Historic Museum
9. Old Trooper Monument
10. Custer's Home
11. CO's Quarters
12. St.Mary's Chapel
13. Wounded Knee Mon.
14. Buffalo Corral
15. Ogden Monument
16. Post Cemetery

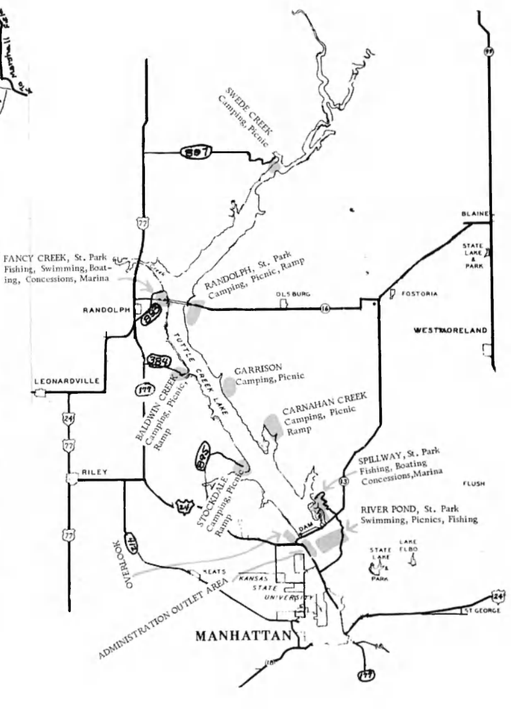


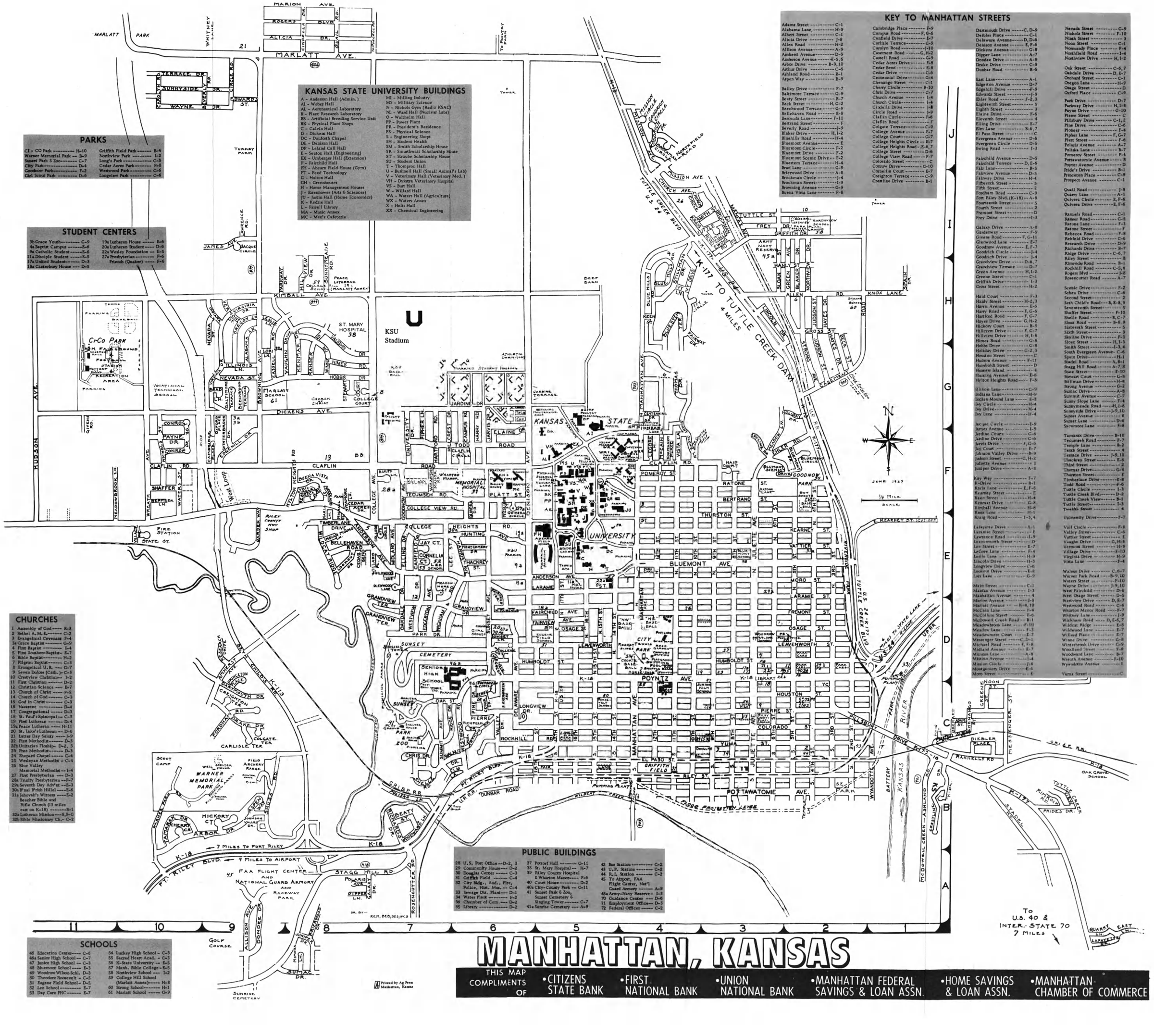
Historic Ft. Riley lies approximately eight miles southwest of Manhattan on K-18, a 4-lane highway. The post dates back to 1852 when it was established at the junction of the Republican and Smoky Hill rivers, thought to be the center of the United States, and designated Camp Center. A year later it was renamed Ft. Riley in honor of Maj. Gen. Bennet Riley, a hero of the Mexican War and the commander of the first military escort over the Santa Fe Trail. ● The post was increased to 100,000 acres by legislation of Congress in 1964, to enable a division to conduct training in modern weapons and tactics. When a full division is training here the post unofficially becomes one of the larger cities in Kansas with a population of near 24,000. ● Points of interest in and arouud Ft. Riley are Gen. Custer's home; the first State Capitol building; the buffalo corral; the Old Trooper Monument; St. Mary's Chapel, erected in 1855; the Ft. Riley Historical Museum; "Chief," the only living cavalry horse still on government rolls; the Post Cemetery; and many monuments and parks of historical interest. ● Signs have been erected at all points of entry and throughout the post to facilitate ease in touring the post. Two routes have been established: one tour of two hours covers the major points of historical interest; the other tour of four hours covers the historical tour plus several of the scenic drives on the post and affords the visitor with views of the weapons and equipment of a modern Army. Both tours start at the Post Headquarters on Kansas Highway K-18. ● Information concerning guided tours is available at the Visitor's Bureau, Headquarters, Fort Riley, Kans., 66442 or telephone BElmont 9-3435. An information booth to assist Fort Riley visitors is located on Kansas K-18, opposite Post Headquarters building.

Tuttle Creek Lake

One of the Midwest's most attractive and largest recreatiou lakes is Tuttle Creek Reservoir, located five miles north of Manhattan. With 16,000 surface acres of water and many bays and inlets, Tuttle Creek is a fisherman's haven, featuring catfish, bass, crappie, walleye and northern pike. Four of the 11 public use areas are operated by the State of Kansas and provide extra facilities such as warm water showers, change houses, and modern rest rooms.

A 4-lane highway leads from Manhattan to the dam and excellent state and federal highways lead to Tuttle Creek from every direction, including Interstate 70 only eight miles south of Manhattan.




KANSAS STATE UNIVERSITY BUILDINGS
A – Anderson Hall (Admin.)
AI – Weber Hall
AL – Aeronautical Laboratory
B – Plant Research Laboratory
BB – Artificial Breeding Service Unit
BK – Physical Plant Shops
C – Calvin Hall
D – Dickens Hall
DC – Danforth Chapel
DE – Denison Hall
DP – Leland Call Hall
E – Seaton Hall (Engineering)
EX – Umberger Hall (Extension)
F – Fairchild Hall
FH – Ahearn Field House (Gym)
FT – Feed Technology
G – Holton Hall
GH – Greenhouses
H – Home Management Houses
J – Eisenhower (Arts & Sciences)
JU – Justin Hall (Home Economics)
K – Kedzie Hall
L – Farrell Library
MA – Music Annex
MC – Men's Cafeteria
MI – Milling Industry
MS – Military Science
N – Nichols Gym (Radio KSAC)
NL – Ward Hall (Nuclear Labs)
O – Waltheim Hall
PP – Power Plant
PR – President's Residence
PS – Physical Science
S – Engineering Shops
SH – Student Health
SM – Smith Scholarship House
SR – Smurthwait Scholarship House
ST – Straube Scholarship House
SU – Student Union
T – Thompson Hall
U – Bushnell Hall (Small Animal's Lab)
V – Veterinary Hall (Veterinary Med.)
VH – Dykstra Veterinary Hospital
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W – Willard Hall
WA – Waters Hall (Agriculture)
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9a Catholic Student-----E-6
11a Disciple Student----E-5
17a United Student------ D-3
18a Canterbury House --- D-5
19a Lutheran House ----- E-6
20a Lutheran Student---- D-6
22a Wesley Foundation -- E-5
27a Presbyterian------- F-6
Friends (Quaker) ------ F-5
KEY TO MANHATTAN STREETS
Adams Street ---------- C-1
Alabama Lane ---------- H-9
Albert Street --------- C-1
Alicia Drive ---------- J-8
Allen Road ------------ H-2
Allison Avenue -------- A-9
Amherst Avenue -------- D-9
Anderson Avenue ------ E-5, 6
Arbor Drive ---------- B-9, 10
Arthur Drive ---------- C-6
Ashland Road ---------- B-1
Aspen Way ------------- B-9
Bailey Drive ---------- F-7
Baltimore Terrace ------ G-9
Beaty Street ---------- B-7
Beck Street ----------- H, G-2
Beechwood Terrace ------ G-9
Bellehaven Road ------- E-8
Bermuda Lane ---------- F-10
Bertrand Street ------- F
Beverly Road ---------- J-9
Blaker Drive ---------- H, I-2
Bluehills Road -------- H-4
Bluemont Avenue ------- E
Bluemont Circle ------- F-2
Bluemont Drive -------- F-2
Bluemont Scenic Drive -- F-2
Bluestem Terrace ------ H-4
Brad Lane ------------- G-9
Briarwood Drive ------- A-8
Brockman Circle ------- J-4
Brockman Street ------- I-3
Browning Avenue ------- G-9
Buena Vista Lane ------ F-8
Cambridge Place ------- F-9
Campus Road ---------- F, G-6
Canfield Drive -------- E-7
Carlisle Terrace ------ C-9
Carolyn Road ---------- J-10
Casement Road -------- G, H-2
Cassell Road ---------- G-9
Cedar Acres Drive ------ F-8
Cedar Bend ------------ E-8
Cedar Drive ----------- C-6
Centennial Drive ------ G-4
Chenango Street ------- C-1
Cherry Circle --------- B-10
Chris Drive ----------- C-7
Church Avenue --------- I-4
Church Circle --------- I-4
Cindella Drive -------- J-8
Circle Road ----------- J-9
Claflin Circle -------- F-6
Claflin Road ---------- F
Colgate Terrace ------- C-9
College Avenue -------- F-7
College Court --------- C-7
College Heights Circle -- E-7
College Heights Road - E-6, 7
College Street -------- D-6
College View Road ------ F-7
Colorado Street ------- C
Conrow Drive ---------- G-10
Corsellis Court ------- E-7
Creighton Terrace ----- C-9
Crestline Drive ------- B-1
Dartmouth Drive ------ C, D-9
Deibler Place --------- C-1
Delaware Avenue ------ D, D-6
Denison Avenue ------- E, F-6
Dickens Avenue -------- G-8
Dipper Lane ----------- A-7
Dondee Drive ---------- A-9
Drake Drive ----------- C-9
Dunbar Road ----------- B-6
East Lane ------------- A-1
Edgerton Avenue ------- D-7
Edgehill Drive -------- F-9
Edwards Street -------- J-9
Ehler Road ------------ F-2, 3
Eighteenth Street ------ 5
Eighth Street --------- 3
Elaine Drive ---------- F-6
Eleventh Street ------- 4
Elling Drive ---------- E-7
Elm Lane -------------- B-6, 7
El Paso Street -------- C
Evergreen Avenue ------ D-6
Evergreen Circle ------ D-6
Ewing Road ------------ I-3
Fairchild Avenue ------ D-5
Fairchild Terrace ----- D, E-6
Fair Lane ------------- B-5
Fairview Avenue ------- D-5
Fairway Drive --------- H-4
Fifteenth Street ------ 5
Fifth Street ---------- 2
Fordham Road ---------- C-9
Fort Riley Blvd. (K-18) --- A-8
Fourteenth Street ------ 5
Fourth Street --------- 2
Fremont Street -------- D
Frey Drive ------------ I-3
Galaxy Drive ---------- A-8
Gardenway ------------- F-9
Givens Road ---------- F, G-11
Glenwood Lane --------- E-7
Goodnow Avenue ------- E, F-7
Goodrich Circle ------- J-4
Goodrich Drive -------- J-4
Grandview Drive ------- D-6, 7
Grandview Terrace ----- D-7
Green Avenue ---------- H, I-2
Greene Street --------- C-1
Griffith Drive -------- I-3
Gross Street ---------- H-2
Haid Court ------------ F-3
Hanly Street ---------- H-2, 3
Harris Avenue --------- E-6
Harry Road ------------ F, G-6
Hartford Road --------- F, G-7
Hayes Drive ---------- G, H-2
Hickory Court --------- B-9
Hillcrest Drive ------- F, G-7
Hillview Drive -------- H, I-8
Himes Road ------------ G-8
Hobbs Drive ----------- G-8
Holiday Drive --------- G-2, 3
Houston Street -------- C
Hudson Avenue --------- F-11
Humboldt Street ------- D
Hunters Island -------- 4
Hunting Avenue -------- E-6
Hylton Heights Road---- F-8
Illinois Lane ---------- C-9
Indiana Lane ---------- H-9
Indian Mound Lane ------ E-8
Ivy Circle ------------ H-4
Ivy Drive ------------- H-4
Ivy Lane -------------- H-4
Jacque Circle --------- I-9
James Avenue ---------- I-9
Jardine Courts -------- G-6
Jardine Drive --------- G-6
Jarvis Drive ---------- F, G-6
Jay Court ------------- E-7
Johnson Valley Drive --- B-9
Judson Street --------- G, H-2
Juliette Avenue ------- 3
Juniper Drive --------- A-8
Kay Way --------------- F-7
K-Drive --------------- B-1
Karla Lane ------------ E, F-8
Kearney Street -------- E
Keen Street ----------- H-8
Kenmar Drive ---------- G-8
Kimball Avenue -------- H-8
Knox Lane ------------- H-1
Knox Road ------------- I-3, 4
Lafayette Drive ------- A-1
Laramie Street -------- I
Lawrence Road --------- I-9
Leavenworth Street ----- D
Lee Street ------------ E-7
LeGore Lane ----------- F-4
Leslie Lane ----------- H-9
Lincoln Drive --------- H-3
Longview Drive -------- C-6
Loukonl Drive --------- E-8
Lori Lane ------------- G-9
Main Street ----------- C-1
Manlax Avenue --------- I-3
Manhattan Avenue ------ 4
Marion Avenue --------- J-8
Marlatt Avenue ------ K-4, 10
McCain Lane ----------- F-4
McCollum Street ------- I-6
McDowell Creek Road --- B-1
Meadowbrook Lane ------ F-10
Meadow Lane ---------- F-3
Meadowmere Court ------ E-7
Messenger Street ------ C, D-1
Michael Road --------- F, F-8
Midland Avenue -------- E-7
Mimosa Lane ----------- A-8
Mission Avenue -------- I-4
Mission Circle -------- J-4
Montgomery Drive ------ E-6
Moro Street ----------- E
Nevada Street --------- G-9
Nichols Street -------- F-10
Ninth Street ---------- 3
Noon Street ----------- C-1
Normandy Place ------- F-4
Northfield Road ------- I-4
Northview Drive ------ H, I-2
Oak Street ---------- C-6, 7
Oakdale Drive -------- D, E-7
Orchard Street -------- C-1
Oregon Lane ----------- H-9
Osage Street ---------- D
Oxford Place ---------- C-9
Park Drive ------------ D-7
Parkway Drive -------- H, I-8
Payne Drive ----------- G-10
Pierre Street --------- C
Pillsbury Drive ------ C-1, 2
Pine Drive ------------ C-6
Pioneer --------------- F-4
Pipher Lane ---------- F, G-7
Platt Street ---------- F-6
Polaris Avenue -------- A-7
Polilska Lane --------- B-7
Pomeroy Street -------- F-4
Pottawatomie Avenue ---- B
Poyntz Avenue --------- D
Pride's Drive --------- B-1
Princeton Place ------- C-9
Prospect Avenue ------- C-1
Quail Road ------------ J-8
Quarry Lane ----------- A-1
Quivera Circle ------- E, F-6
Quivera Drive -------- E, F-6
Ramsels Road ---------- C-1
Ramser Road ----------- G-8
Ratone Lane ----------- F-3
Ratone Street --------- F
Rebecca Road ---------- F-8
Rehfeld Drive --------- C-6
Research Drive -------- D-9
Richards Drive -------- B-7
Ridge Drive ---------- C-6, 7
Riley Street ---------- B
Rimrock Road ---------- B-1
Rockhill Road ------- C-5, 6
Rogers Blvd ----------- J-8
Rosencutter Road ------ A-7
Scenic Drive ---------- F-2
Scheu Drive ----------- C-6
Second Street --------- 2
Seth Child's Road---B, E-8, 9
Seventeenth Street ----- 5
Shaffer Street -------- F-10
Shelle Road ---------- B, C-7
Sloat Road ---------- B-8, 9
Sixteenth Street ------- 5
Sixth Street ---------- 3
Skyline Drive --------- F-5
Sloan Street ---------- H, I-3
Smith Street ---------- I-3, 4
South Evergreen Avenue- C-6
Spain Drive ----------- H-1
Stadel Road ---------- A, B-1
Stagg Hill Road ------- A-7, 8
State Street ---------- F-10
Stewart Court --------- G-8
Stillman Drive -------- H-4
Strong Avenue --------- G-2
Sumac Drive ----------- A-8
Summit Avenue --------- C-7
Sunny Slope Lane ------ F-4
Sunnymeade Road ---- H, I-8
Sunnyside Drive ---- J-9, 10
Sunset Avenue --------- 5
Sunset Lane ----------- D-6
Sycamore Lane --------- F-8
Tamarak Drive --------- B-10
Tecumseh Road --------- F-7
Temple Lane ----------- F-2
Tenth Street ---------- 4
Terrace Drive ------- J-9, 10
Thackrey Street ------- E-6
Third Street ---------- 2
Thomas Drive ---------- G-4
Thurston Street -------- E
Timberlane Drive ------- E-8
Todd Road ------------- F-6
Tuttle Circle --------- I-3
Tuttle Creek Blvd. ----- D-2
Tuttle Creek View ------ B-1
Tuttle Street---------- I-3
Twelfth Street -------- 4
University Drive -------- F-7
Vail Circle ----------- F-8
Valley Drive ---------- C-6
Vattier Street -------- E
Vaughn Drive ---------- G, H-8
Vermont Street -------- H-9
Village Drive --------- E-10
Virginia Drive -------- H-9
Vista Lane ------------ F-4
Walnut Drive ------- C, G-7
Warner Park Road ---- B-9, 10
Waters Street ---------- F-10
Wayne Drive ------- J-9, 10
West Fairchild -------- D-6
West Osage Street ------ D-5
Westview Drive ------- D, E-7
Westwood Road --------- C-6
Wharton Manor Road ---- F-7
Whitney Lane ---------- J-9
Wickham Road ---- D, E-6, 7
Wildcat Ridge --------- E-8
Wildwood Lane --------- E-7
Willard Place --------- E-7
Winne Drive ----------- G-8
Winterbrook Drive ------ G-9
Woodland Street ------- F-8
Woodward Lane -------- B-7
Wreath Avenue -------- F-10
Wyandotte Avenue ------ I
Yuma Street ----------- C
CHURCHES
1 Assembly of God ---- E-3
2 Bethel A. M. E.------ C-2
3 Evangelical Covenant F-4
3a Grace Baptist ------- G-9
4 First Baptist -------- E-4
5 First Southern Baptist- E-7
6 Bible Baptist-------- H-2
7 Pilgrim Baptist------ C-3
8 Evangelical U. B. ---- C-7
9 Seven Dolors (Cath.)- C-3
10 Crestview Christian-- I-2
11 First Christian ------ D-2
12 Christian Science ---- E-7
13 Church of Christ ----- F-8
14 Church of God ------- C-3
15 God in Christ -------- C-3
16 Nazarene ------------ D-4
17 Congregational ------ D-3
18 St. Paul's Episcopal -- C-3
19 First Lutheran ------ D-4
19a Peace Lutheran ----- H-11
20 St. Luke's Lutheran -- D-6
21 Latter Day Saints ---- J-9
22 First Methodist ------ D-3
22b Unitarian Fleship- D-2, 3
23 Free Methodist------ D-3
24 Shepard Chapel ------ C-4
25 Wesleyan Methodist - C-4
26 Blue Valley
Memorial Methodist -- I-4
27 First Presbyterian --- D-3
28a Trinity Presbyterian --F-7
29a Seventh Day Adv'st --E-3
30a B'nai B'rith Hillel ----E-6
31a Jehovah's Witness ----E-2
Beecher Bible and
Rifle Church (13 miles
east on K-18) --------B-1
32a Lutheran Mission---B, D-C
32b Bible Missionary Ch.- C-2
PUBLIC BUILDINGS
28 U. S. Post Office --D-2, 3
29 Community House---- D-2
30 Douglas Center ------ C-3
31 Griffith Field ------- C-6
32 City Bldg., Aud., Fire, Police, Hist. Mus. -- C-4
33 Sewage Dis. Plant---- D-1
34 Water Plant --------- F-2
36 Chamber of Com.----- D-2
35 Library ------------- D-2
37 Potter Hall -------- G-11
38 St. Mary Hospital -- H-7
39 Riley County Hospital & Wharton Manor----- F-6
40 Court House--------- D-2
40a City-County Park -- G-11
41 Sunset Park & Zoo, Sunset Cemetery & Singing Tower ------ C-7
41a Sunrise Cemetery --- A-9
42 Bus Station --------- C-2
43 U.P. Station -------- C-2
44 R.I. Station -------- C-2
45 To Airport, FAA Flight Center, Nat'l Guard Armory ------- A-9
45a Army-Navy Reserve-- I-3
70 Guidance Center ---- D-6
71 Employment Office--- D-3
72 Federal Offices ----- C-2
SCHOOLS
46 Education Center----- C-6
46a Senior High School -- C-7
47 Junior High School --- C-3
48 Bluemont School------ E-3
49 Woodrow Wilson Schl. D-3
50 Theodore Roosevelt -- C-5
51 Eugene Field School -- D-5
52 Lee School ---------- E-7
53 Day Care PHC -------- E-7
54 Luckey High School -- C-3
55 Sacred Heart Acad. -- C-3
56 K-State University --- E-5
57 Manh. Bible College-- E-5
58 Northview School ---- I-2
59 College Hill School (Marlatt Annex)------ H-8
60 Strong School-------- H-1
61 Marlatt School ------ G-9
MANHATTAN, KANSAS
THIS MAP COMPLIMENTS OF
•CITIZENS STATE BANK
•FIRST NATIONAL BANK
•UNION NATIONAL BANK
•MANHATTAN FEDERAL SAVINGS & LOAN ASSN.
•HOME SAVINGS & LOAN ASSN.
•MANHATTAN CHAMBER OF COMMERCE
Printed by Ag Press Manhattan, Kansas
JUNE 1967
¼ MILE SCALE
To U.S. 40 & INTER. STATE 70 7 MILES

APPENDIX B

```
    1 FORMAT(15F4.0)
    2 FORMAT(4I5)
    3 FORMAT(4A4)
    4 FORMAT(3A4)
   20 FORMAT(/4H LOT,I4)
   21 FORMAT(4A4,2(F8.0,F9.0,F10.4))
   22 FORMAT(6X,5HTOTAL,5X,2(F8.0,F9.0,F10.4))
   23 FORMAT(/9H ALL LOTS)
   24 FORMAT(12H TIME PERIOD,I4,2(F8.0,F9.0,F10.4))
   25 FORMAT(32X,7HOVERALL)
   26 FORMAT(5X,8HNO. CAR=F7.0,4X11HNO. PEOPLE=F7.0,4X10HOCCUPANCY=F7.4)
   27 FORMAT(20X,11HGAME NUMBER,I4,5X,3A4)
   28 FORMAT(//25X,8HSTUDENTS,17X,12HNON-STUDENTS)
   29 FORMAT(/16X,2(3X,24H CARS   PEOPLE OCCUPANCY))
C      MAXIMUM NUMBER OF OCCUPANTS/CAR CAN NOT EXCEED 15
      DIMENSION SO(15),FO(15)
C      MAXIMUM NUMBER OF TIME PERIODS IS 6
C      MAXIMUM NUMBER OF LOTS IS 10
      DIMENSION DATE(3)
      DIMENSION SCAR(6,10),TOTS(6,10),FCAR(6,10),TOTF(6,10),TITLE(4)
C      READ NUMBER OF LOTS,NUMBER OF TIME PERIODS AND THE MAXIMUM NUMBER
C    * OF OCCUPANTS/CAR,GAME NUMBER
      READ 2,NLOT,NTIME,NCLAS,NGAME
C    * READ DATE IN COLUMNS 1-12
      READ 4,(DATE(I),I=1,3)
      PUNCH 27,NGAME,(DATE(I),I=1,3)
      PUNCH 28
      PUNCH 29
      DO 15 K=1,NLOT
      FTO=0.
      STO=0.
      FTO=0.
      STO=0.
      PUNCH 20,K
      DO 10 I=1,NTIME
C    * READ TIME PERIOD IN COLUMN 1-16
      READ 3,(TITLE(J),J=1,4)
C    * READ DATA
      READ 1,(SO(J),J=1,NCLAS)
      READ 1,(FO(J),J=1,NCLAS)
C      OCCUPANCY BY TIME PERIOD AND LOT
      SCAR(I,K)=0.
      TOTS(I,K)=0.
      FCAR(I,K)=0.
      TOTF(I,K)=0.
      DO 11 J=1,NCLAS
      FCAR(I,K)=FCAR(I,K)+FO(J)
      SCAR(I,K)=SCAR(I,K)+SO(J)
      AJ=J
      TOTF(I,K)=TOTF(I,K)+AJ*FO(J)
      TOTS(I,K)=TOTS(I,K)+AJ*SO(J)
   11 CONTINUE
      IF(SCAR(I,K)) 32,32,31
   32 SOCC=0.
      GO TO 34
   31 SOCC=TOTS(I,K)/SCAR(I,K)
   34 IF(FCAR(I,K))33,33,30
   33 FOCC=0.
      GO TO 35
```

```
   30 FOCC=TOTF(I,K)/FCAR(I,K)
C     TOTAL OCCUPANCY BY LOT
   35 STO=TOTS(I,K)+STO
      FTO=TOTF(I,K)+FTO
      STC=SCAR(I,K)+STC
      FTC=FCAR(I,K)+FTC
      PUNCH 21,(TITLE(J),J=1,4),SCAR(I,K),TOTS(I,K),SOCC,FCAR(I,K),
     1TOTF(I,K),FOCC
   10 CONTINUE
      IF(STC)12,12,13
   12 STA=0.
      GO TO 14
   13 STA=STO/STC
   14 IF(FTC)16,16,17
   16 FTA=0.
      GO TO 18
   17 FTA=FTO/FTC
   18 PUNCH 22,STC,STO,STA,FTC,FTO,FTA
   15 CONTINUE
C     OCCUPANCY BY TIME PERIODS
      PUNCH 23
      DO 45 I=1,NTIME
      FLC=0.
      SLC=0.
      FLO=0.
      SLO=0.
      DO 40 K=1,NLOT
      SLO=TOTS(I,K)+SLO
      FLO=TOTF(I,K)+FLO
      SLC=SCAR(I,K)+SLC
   40 FLC=FCAR(I,K)+FLC
      IF(FLC)41,41,42
   41 FLA=0.
      GO TO 43
   42 FLA=FLO/FLC
   43 IF(SLC)46,46,47
   46 SLA=0.
      GO TO 45
   47 SLA=SLO/SLC
   45 PUNCH 24,I,SLC,SLO,SLA,FLC,FLO,FLA
C     OVERALL OCCUPANCY
      ST=0.
      FT=0.
      SC=0.
      FC=0.
      DO 60 K=1,NLOT
      DO 60 I=1,NTIME
      ST=TOTS(I,K)+ST
      FT=TOTF(I,K)+FT
      SC=SCAR(I,K)+SC
   60 FC=FCAR(I,K)+FC
      FA=FT/FC
      SA=ST/SC
      PUNCH 22,SC,ST,SA,FC,FT,FA
      TF=ST+FT
      TC=SC+FC
      AVG=TF/TC
      PUNCH 25
      PUNCH 26,TC,TF,AVG
```

APPENDIX C

GAME NUMBER 1 SEPT 21,1968

	STUDENTS			NON-STUDENTS		
	CARS	PEOPLE	OCCUPANCY	CARS	PEOPLE	OCCUPANCY
LOT 1						
11=30 TO 12=00	12.	32.	2.6667	44.	117.	2.6591
12=00 TO 12=30	63.	217.	3.4444	180.	541.	3.0056
12=30 TO 1=00	84.	298.	3.5476	262.	807.	3.0802
1=00 TO 1=30	72.	217.	3.0139	288.	852.	2.9583
TOTAL	231.	764.	3.3074	774.	2317.	2.9935
LOT 2						
11=30 TO 12=00	0.	0.	0.0000	38.	105.	2.7632
12=00 TO 12=30	2.	9.	4.5000	138.	439.	3.1812
12=30 TO 1=00	4.	11.	2.7500	239.	752.	3.1464
1=00 TO 1=30	1.	2.	2.0000	160.	534.	3.3375
TOTAL	7.	22.	3.1429	575.	1830.	3.1826
LOT 3						
11=30 TO 12=00	8.	21.	2.6250	16.	50.	3.1250
12=00 TO 12=30	8.	22.	2.7500	67.	180.	2.6866
12=30 TO 1=00	28.	85.	3.0357	236.	748.	3.1695
1=00 TO 1=30	22.	66.	3.0000	201.	557.	2.7711
TOTAL	66.	194.	2.9394	520.	1535.	2.9519
LOT 4						
11=30 TO 12=00	11.	35.	3.1818	77.	214.	2.7792
12=00 TO 12=30	20.	61.	3.0500	144.	435.	3.0208
12=30 TO 1=00	28.	80.	2.8571	109.	330.	3.0275
1=00 TO 1=30	40.	137.	3.4250	99.	270.	2.7273
TOTAL	99.	313.	3.1616	429.	1249.	2.9114
LOT 6						
11=30 TO 12=00	90.	288.	3.2000	30.	88.	2.9333
12=00 TO 12=30	131.	416.	3.1756	66.	200.	3.0303
12=30 TO 1=00	114.	368.	3.2281	103.	325.	3.1553
1=00 TO 1=30	54.	173.	3.2037	145.	431.	2.9724
TOTAL	389.	1245.	3.2005	344.	1044.	3.0349
LOT 7						
11=30 TO 12=00	20.	61.	3.0500	4.	13.	3.2500
12=00 TO 12=30	110.	346.	3.1455	71.	208.	2.9296
12=30 TO 1=00	178.	587.	3.2978	84.	264.	3.1429
1=00 TO 1=30	186.	590.	3.1720	74.	212.	2.8649
TOTAL	494.	1584.	3.2065	233.	697.	2.9914
ALL LOTS						
TIME PERIOD 1	141.	437.	3.0993	209.	587.	2.8086
TIME PERIOD 2	334.	1071.	3.2066	666.	2003.	3.0075
TIME PERIOD 3	436.	1429.	3.2775	1033.	3226.	3.1229
TIME PERIOD 4	375.	1185.	3.1600	967.	2856.	2.9535
TOTAL	1286.	4122.	3.2053	2875.	8672.	3.0163

OVERALL

NO. CAR= 4161. NO. PEOPLE= 12794. OCCUPANCY= 3.0747

GAME NUMBER 2 OCT. 12,1968

	STUDENTS			NON-STUDENTS		
	CARS	PEOPLE	OCCUPANCY	CARS	PEOPLE	OCCUPANCY
LOT 1						
11=30 TO 12=00	36.	111.	3.0833	71.	232.	3.2676
12=00 TO 12=30	64.	232.	3.6250	195.	636.	3.2615
12=30 TO 1=00	85.	298.	3.5059	218.	672.	3.0826
1=00 TO 1=30	18.	50.	2.7778	49.	133.	2.7143
TOTAL	203.	691.	3.4039	533.	1673.	3.1388
LOT 2						
11=30 TO 12=00	0.	0.	0.0000	54.	170.	3.1481
12=00 TO 12=30	1.	7.	7.0000	146.	474.	3.2466
12=30 TO 1=00	0.	0.	0.0000	279.	996.	3.5699
1=00 TO 1=30	0.	0.	0.0000	125.	423.	3.3840
TOTAL	1.	7.	7.0000	604.	2063.	3.4156
LOT 3						
11=30 TO 12=00	0.	0.	0.0000	29.	83.	2.8621
12=00 TO 12=30	8.	25.	3.1250	68.	221.	3.2500
12=30 TO 1=00	9.	28.	3.1111	231.	716.	3.0996
1=00 TO 1=30	5.	14.	2.8000	205.	565.	2.7561
TOTAL	22.	67.	3.0455	533.	1585.	2.9737
LOT 4						
11=30 TO 12=00	4.	12.	3.0000	75.	216.	2.8800
12=00 TO 12=30	15.	46.	3.0667	175.	543.	3.1029
12=30 TO 1=00	10.	25.	2.5000	278.	848.	3.0504
1=00 TO 1=30	3.	8.	2.6667	117.	345.	2.9487
TOTAL	32.	91.	2.8438	645.	1952.	3.0264
LOT 6						
11=30 TO 12=00	80.	232.	2.9000	37.	114.	3.0811
12=00 TO 12=30	102.	345.	3.3824	57.	204.	3.5789
12=30 TO 1=00	154.	511.	3.3182	102.	328.	3.2157
1=00 TO 1=30	64.	173.	2.7031	45.	141.	3.1333
TOTAL	400.	1261.	3.1525	241.	787.	3.2656
LOT 7						
11=30 TO 12=00	84.	304.	3.6190	30.	117.	3.9000
12=00 TO 12=30	275.	922.	3.3527	57.	169.	2.9649
12=30 TO 1=00	273.	927.	3.3956	41.	125.	3.0488
1=00 TO 1=30	86.	300.	3.4884	9.	23.	2.5556
TOTAL	718.	2453.	3.4164	137.	434.	3.1679
ALL LOTS						
TIME PERIOD 1	204.	659.	3.2304	296.	932.	3.1486
TIME PERIOD 2	465.	1577.	3.3914	698.	2247.	3.2192
TIME PERIOD 3	531.	1789.	3.3691	1149.	3685.	3.2071
TIME PERIOD 4	176.	545.	3.0966	550.	1630.	2.9636
TOTAL	1376.	4570.	3.3212	2693.	8494.	3.1541

OVERALL

NO. CAR= 4069. NO. PEOPLE= 13064. OCCUPANCY= 3.2106

GAME NUMBER 3 OCT. 26,1968

	STUDENTS			NON-STUDENTS		
	CARS	PEOPLE	OCCUPANCY	CARS	PEOPLE	OCCUPANCY
LOT 3						
11=30 TO 12=00	0.	0.	0.0000	9.	27.	3.0000
12=00 TO 12=30	3.	7.	2.3333	38.	112.	2.9657
12=30 TO 1=00	7.	18.	2.5714	117.	414.	3.5385
1=00 TO 1=30	31.	73.	2.3548	334.	1015.	3.0389
TOTAL	41.	98.	2.3902	498.	1568.	3.1500
LOT 4						
11=30 TO 12=00	5.	12.	2.4000	53.	178.	3.3585
12=00 TO 12=30	16.	38.	2.3750	184.	582.	3.1630
12=30 TO 1=00	13.	31.	2.3846	305.	970.	3.1803
1=00 TO 1=30	4.	10.	2.5000	147.	429.	2.9184
TOTAL	38.	91.	2.3947	689.	2159.	3.1335
LOT 6						
11=30 TO 12=00	61.	163.	2.6721	56.	205.	3.6607
12=00 TO 12=30	105.	321.	3.0571	106.	379.	3.5755
12=30 TO 1=00	135.	389.	2.8815	165.	589.	3.5697
1=00 TO 1=30	151.	456.	3.0199	198.	694.	3.5051
TOTAL	452.	1329.	2.9403	525.	1867.	3.5562
ALL LOTS						
TIME PERIOD 1	66.	175.	2.6515	118.	410.	3.4746
TIME PERIOD 2	124.	366.	2.9516	328.	1073.	3.2736
TIME PERIOD 3	155.	438.	2.8258	587.	1973.	3.3612
TIME PERIOD 4	186.	539.	2.8978	679.	2138.	3.1487
TOTAL	531.	1518.	2.8588	1712.	5594.	3.2679

OVERALL

NO. CAR= 2243. NO. PEOPLE= 7112. OCCUPANCY= 3.1711

GAME NUMBER 4 NOV. 16,1968

	STUDENTS			NON-STUDENTS		
	CARS	PEOPLE	OCCUPANCY	CARS	PEOPLE	OCCUPANCY
LOT 1						
11=00 TO 11=30	4.	12.	3.0000	24.	91.	3.7917
11=30 TO 12=00	11.	32.	2.9091	127.	407.	3.2047
12=00 TO 12=30	19.	69.	3.6316	280.	964.	3.4429
12=30 TO 1=00	6.	14.	2.3333	324.	1130.	3.4877
1=00 TO 1=30	6.	15.	2.5000	334.	1085.	3.2485
1=30 TO 2=00	4.	9.	2.2500	179.	562.	3.1397
TOTAL	50.	151.	3.0200	1268.	4239.	3.3431
LOT 2						
11=00 TO 11=30	2.	7.	3.5000	17.	45.	2.6471
11=30 TO 12=00	0.	0.	0.0000	62.	191.	3.0806
12=00 TO 12=30	1.	2.	2.0000	140.	449.	3.2071
12=30 TO 1=00	0.	0.	0.0000	171.	566.	3.3099
1=00 TO 1=30	1.	6.	6.0000	288.	1004.	3.4861
1=30 TO 2=00	0.	0.	0.0000	85.	259.	3.0471
TOTAL	4.	15.	3.7500	763.	2514.	3.2949
LOT 3						
11=00 TO 11=30	12.	44.	3.6667	4.	13.	3.2500
11=30 TO 12=00	12.	39.	3.2500	21.	61.	2.9048
12=00 TO 12=30	31.	97.	3.1290	82.	277.	3.3780
12=30 TO 1=00	100.	313.	3.1300	172.	597.	3.4709
1=00 TO 1=30	45.	131.	2.9111	131.	464.	3.5420
1=30 TO 2=00	0.	0.	0.0000	0.	0.	0.0000
TOTAL	200.	624.	3.1200	410.	1412.	3.4439
LOT 4						
11=00 TO 11=30	4.	9.	2.2500	49.	166.	3.3878
11=30 TO 12=00	6.	26.	4.3333	118.	391.	3.3136
12=00 TO 12=30	9.	48.	5.3333	267.	869.	3.2547
12=30 TO 1=00	0.	0.	0.0000	272.	867.	3.1875
1=00 TO 1=30	6.	22.	3.6667	138.	458.	3.3188
1=30 TO 2=00	0.	0.	0.0000	0.	0.	0.0000
TOTAL	25.	105.	4.2000	844.	2751.	3.2595
LOT 6						
11=00 TO 11=30	101.	281.	2.7822	72.	226.	3.1389
11=30 TO 12=00	63.	199.	3.1587	61.	207.	3.3934
12=00 TO 12=30	96.	294.	3.0625	114.	425.	3.7281
12=30 TO 1=00	164.	505.	3.0793	138.	461.	3.3406
1=00 TO 1=30	149.	451.	3.0268	158.	502.	3.1772
1=30 TO 2=00	0.	0.	0.0000	0.	0.	0.0000
TOTAL	573.	1730.	3.0192	543.	1821.	3.3536

LOT 7						
11=00 TO 11=30	68.	210.	3.0882	27.	82.	3.0370
11=30 TO 12=00	173.	528.	3.0520	92.	349.	3.7935
12=00 TO 12=30	153.	477.	3.1176	129.	438.	3.3953
12=30 TO 1=00	102.	315.	3.0882	130.	456.	3.5077
1=00 TO 1=30	0.	0.	0.0000	0.	0.	0.0000
1=30 TO 2=00	0.	0.	0.0000	0.	0.	0.0000
TOTAL	496.	1530.	3.0847	378.	1325.	3.5053

ALL LOTS						
TIME PERIOD 1	191.	563.	2.9476	193.	623.	3.2280
TIME PERIOD 2	265.	824.	3.1094	481.	1606.	3.3389
TIME PERIOD 3	309.	987.	3.1942	1012.	3422.	3.3814
TIME PERIOD 4	372.	1147.	3.0833	1207.	4077.	3.3778
TIME PERIOD 5	207.	625.	3.0193	1049.	3513.	3.3489
TIME PERIOD 6	4.	9.	2.2500	264.	821.	3.1098
TOTAL	1348.	4155.	3.0823	4206.	14062.	3.3433

OVERALL

NO. CAR= 5554. NO. PEOPLE= 18217. OCCUPANCY= 3.2800

GAME NUMBER 5 NOV. 23,1968

	STUDENTS			NON-STUDENTS		
	CARS	PEOPLE	OCCUPANCY	CARS	PEOPLE	OCCUPANCY
LOT 1						
11=30 TO 12=00	3.	11.	3.6667	49.	266.	5.4286
12=00 TO 12=30	16.	43.	2.6875	168.	732.	4.3571
12=30 TO 1=00	25.	94.	3.7600	182.	562.	3.0879
1=00 TO 1=30	10.	31.	3.1000	70.	186.	2.6571
TOTAL	54.	179.	3.3148	469.	1746.	3.7228
LOT 2						
11=30 TO 12=00	0.	0.	0.0000	24.	67.	2.7917
12=00 TO 12=30	0.	0.	0.0000	94.	308.	3.2766
12=30 TO 1=00	3.	6.	2.0000	257.	788.	3.0661
1=00 TO 1=30	0.	0.	0.0000	199.	607.	3.0503
TOTAL	3.	6.	2.0000	574.	1770.	3.0836
LOT 3						
11=30 TO 12=00	2.	5.	2.5000	13.	45.	3.4615
12=00 TO 12=30	8.	26.	3.2500	30.	126.	4.2000
12=30 TO 1=00	13.	35.	2.6923	75.	248.	3.3067
1=00 TO 1=30	17.	52.	3.0588	69.	204.	2.9565
TOTAL	40.	118.	2.9500	187.	623.	3.3316
LOT 4						
11=30 TO 12=00	4.	11.	2.7500	53.	180.	3.3962
12=00 TO 12=30	0.	0.	0.0000	131.	404.	3.0840
12=30 TO 1=00	0.	0.	0.0000	252.	760.	3.0159
1=00 TO 1=30	8.	23.	2.8750	122.	309.	2.5328
TOTAL	12.	34.	2.8333	558.	1653.	2.9624
LOT 6						
11=30 TO 12=00	30.	90.	3.0000	20.	80.	4.0000
12=00 TO 12=30	80.	253.	3.1625	38.	142.	3.7368
12=30 TO 1=00	77.	227.	2.9481	31.	100.	3.2258
1=00 TO 1=30	21.	64.	3.0476	19.	67.	3.5263
TOTAL	208.	634.	3.0481	108.	389.	3.6019
LOT 7						
11=30 TO 12=00	32.	103.	3.2188	14.	44.	3.1429
12=00 TO 12=30	120.	382.	3.1833	103.	360.	3.4951
12=30 TO 1=00	156.	485.	3.1090	141.	463.	3.2837
1=00 TO 1=30	24.	70.	2.9167	29.	83.	2.8621
TOTAL	332.	1040.	3.1325	287.	950.	3.3101
ALL LOTS						
TIME PERIOD 1	71.	220.	3.0986	173.	682.	3.9422
TIME PERIOD 2	224.	704.	3.1429	564.	2072.	3.6738
TIME PERIOD 3	274.	847.	3.0912	938.	2921.	3.1141
TIME PERIOD 4	80.	240.	3.0000	508.	1456.	2.8661
TOTAL	649.	2011.	3.0986	2183.	7131.	3.2666

OVERALL

NO. CAR= 2832. NO. PEOPLE= 9142. OCCUPANCY= 3.2281

APPENDIX D

Number of Cars by Time Period
for Game Number One

Time	Lot Number						
	1	2	3	4	6	7	Total
11:30-11:35	5	3	2	17	17	2	46
11:35-11:40	7	6	1	9	14	3	40
11:40-11:45	10	9	4	13	20	1	57
11:45-11:50	18	3	5	10	19	2	57
11:50-11:55	4	8	4	18	27	9	70
11:55-12:00	17	9	9	18	17	17	87
12:00-12:05	45	12	7	22	37	21	144
12:05-12:10	51	20	1	20	26	17	135
12:10-12:15	41	20	12	23	41	17	154
12:15-12:20	47	27	10	31	36	18	169
12:20-12:25	53	27	26	28	43	36	213
12:25-12:30	60	34	23	32	42	43	234
12:30-12:35	57	32	36	25	36	40	226
12:35-12:40	64	36	44	14	37	42	237
12:40-12:45	46	47	52	36	30	44	255
12:45-12:50	61	47	38	42	36	48	272
12:50-12:55	55	41	50	13	32	45	236
12:55- 1:00	54	43	54	2	41	39	233
1:00- 1:05	58	39	51	10	30	31	219
1:05- 1:10	58	30	34	45	20	35	222
1:10- 1:15	60	33	32	27	49	50	251
1:15- 1:20	70	37	34	36	54	50	281
1:20- 1:25	47	27	30	21		48	173
1:25- 1:30			31			42	73
1:30- 1:35						21	21
Total	988	590	590	512	704	721	4105
4:00- 4:05			28			27	55
4:05- 4:10	60		43		60	61	224
4:10- 4:15	76	10	34		56	35	211
4:15- 4:20	67	35	23	50	90	81	346
4:20- 4:25	65	38	65	99	97	162	526
4:25- 4:30	66	106	93	107	97	167	636
4:30- 4:35	125	92	100	94	80	173	664
4:35- 4:40	148	72	73	80	84	145	602
4:40- 4:45	118	97	54	66	32	79	446
4:45- 4:50	80	46	5	25		19	175
4:50- 4:55			3	6		8	17
4:55- 5:00			2			6	8
Total	805	496	523	527	596	963	3910

Number of Cars by Time Period
for Game Number Two

Time	Lot Number						
	1	2	3	4	6	7	Total
11:30-11:35	20	3	3	2	15		43
11:35-11:40	8	9	4	14	17		52
11:40-11:45	27	6	5	16	28	20	102
11:45-11:50	17	9	4	9	19	17	75
11:50-11:55	9	14	5	13	17	21	79
11:55-12:00	23	15	5	21	15	35	114
12:00-12:05	35	15	11	15	13	56	145
12:05-12:10	41	12	5	26	12	42	138
12:10-12:15	42	28	12	33	48	44	207
12:15-12:20	44	20	11	35	47	49	206
12:20-12:25	32	30	25	26	27	41	181
12:25-12:30	63	36	9	33	30	63	234
12:30-12:35	53	33	29	59	39	43	256
12:35-12:40	56	43	37	37	47	32	252
12:40-12:45	66	37	34	66	55	58	316
12:45-12:50	46	45	43	44	40	39	257
12:50-12:55	47	57	47	46	57	53	307
12:55- 1:00	40	55	56	44	14	58	267
1:00- 1:05	44	30	53	59	13	67	266
1:05- 1:10	23	30	51	23	36	12	175
1:10- 1:15		40	56	21	27	4	148
1:15- 1:20		8	50	25	25		108
1:20- 1:25		17	37				54
Total	736	592	592	667	641	754	3982
3:55- 4:00				52	93		145
4:00- 4:05	63		52	67	101	88	371
4:05- 4:10	73	79	65	63	139	111	530
4:10- 4:15	68	96	56	75	136	132	563
4:15- 4:20	106	121	38	100	161	170	696
4:20- 4:25	141	95	61	75	109	159	640
4:25- 4:30	119	49	76	144	10	82	480
4:30- 4:35	87	76	54	103		31	351
4:35- 4:40		42	50	62		13	167
Total	657	558	452	741	749	786	3943

Number of Cars by Time Period
for Game Number Three

Time	Lot Number						
	1	2	3	4	6	7	Total
11:30-11:35	4	1	1	8	10	7	31
11:35-11:40	1	9		8	21	7	46
11:40-11:45	2	1	2	11	24	7	47
11:45-11:50	7	5	1	8	29	13	63
11:50-11:55	10	10	1	10	15	23	69
11:55-12:00	20	5	1	18	22	41	107
12:00-12:05	26	10	3	28	21	47	135
12:05-12:10	30	8	3	41	15	56	153
12:10-12:15	31	21	6	27	47	39	171
12:15-12:20	41	15	17	38	47	36	194
12:20-12:25	46	15	8	35	63	39	206
12:25-12:30	42	23	7	48	52	46	218
12:30-12:35	60	17	10	56	58	42	243
12:35-12:40	52	30	12	76	49	54	273
12:40-12:45	55	24	27	71	44	48	269
12:45-12:50	59	43	18	51	49	49	269
12:50-12:55	47	38	34	52	52	30	253
12:55- 1:00	48	43	75	55	73		294
1:00- 1:05	46	47	18	43	70		224
1:05- 1:10	54	47	52	48	73		274
1:10- 1:15	59	59	82	20	73		293
1:15- 1:20	47	58	23	33	38		199
1:20- 1:25	58	74	72	7	27		238
1:25- 1:30	41		46	11			98
Total	886	603	519	803	972	584	4367
3:45- 3:50	70					42	112
3:50- 3:55	53				63	107	223
3:55- 4:00	69			4	12	50	135
4:00- 4:05	22	8	2	1	22	10	65
4:05- 4:10	35	7	2	23	50	30	147
4:10- 4:15	67	38	26	46	85	40	302
4:15- 4:20	84	38	26	60	106	72	386
4:20- 4:25	99	65	25	61	130	89	469
4:25- 4:30	79	90	40	86	127	95	517
4:30- 4:35	121	127	100	112	102	75	637
4:35- 4:40	127	89	49	143	34	18	460
4:40- 4:45	97	57	24	31		3	212
4:45- 4:50	43	15	9	30			97
4:50- 4:55			11	8			19
Total	966	534	314	605	731	631	3781

Number of Cars by Time Period
for Game Number Four

Time	Lot Number						
	1	2	3	4	6	7	Total
11:00-11:05	5	4	8	15	61		93
11:05-11:10	3	3	1	9	22		38
11:10-11:15	2	2	2	11	35	8	60
11:15-11:20	3	1	1	9	24	25	63
11:20-11:25	11	2	1	5	16	34	69
11:25-11:30	4	7	3	4	15	28	61
11:30-11:35	11	7	8	26	15	36	103
11:35-11:40	7	7	3	24	34	36	111
11:40-11:45	18	8	9	14	18	42	109
11:45-11:50	26	6	7	16	14	34	103
11:50-11:55	47	13		21	25	60	166
11:55-12:00	29	21	6	23	18	59	154
12:00-12:05	47	16	7	30	10	66	176
12:05-12:10	31	21	14	32	16	49	163
12:10-12:15	46	16	15	53	25	32	187
12:15-12:20	58	30	6	51	68	48	261
12:20-12:25	59	33	33	53	55	43	276
12:25-12:30	58	25	38	57	36	44	258
12:30-12:35	60	19	45	52	64	50	290
12:35-12:40	52	31	34	26	63	39	245
12:40-12:45	72	35	49	60	29	51	296
12:45-12:50	37	23	43	55	64	48	270
12:50-12:55	54	31	51	28	33	39	236
12:55- 1:00	55	32	50	51	49	5	242
1:00- 1:05	72	57	56	38	65		288
1:05- 1:10	63	37	46	16	88		250
1:10- 1:15	45	32	46	34	64	Dirt	221
1:15- 1:20	42	51	26	38	69	Lot	226
1:20- 1:25	67	51	2	6	20	6	152
1:25- 1:30	51	61		12	1	33	158
1:30- 1:35	39	16				55	110
1:35- 1:40	44	28				55	127
1:40- 1:45	59	25				51	135
1:45- 1:50	41	16				60	117
1:50- 1:55						56	56
1:55- 2:00						53	53
2:00- 2:05						53	53
2:05- 2:10						27	27
2:10- 2:15						35	35
Total	1318	767	610	869	1116	1357	6037

Time	Lot Number						
	1	2	3	4	6	7	Total
4:20-4:25				15			15
4:25-4:30				5		36	41
4:30-4:35				5	4	56	65
4:35-4:40	69	9		5	41	82	206
4:40-4:45	111	32	35	8	54	84	224
4:45-4:50	90	64	39	57	118	82	450
4:50-4:55	120	84	66	62	89	96	517
4:55-5:00	135	108	42	89	144	103	621
5:00-5:05	158	101	87	74	116	104	640
5:05-5:10	156	81	52	106	123	146	664
5:10-5:15	87	35	37	88	135	82	464
5:15-5:20	133	110	33	55	104	70	505
5:20-5:25	111	79	14	60	59	60	383
5:25-5:30	40	21	5	19	62	61	208
5:30-5:35	17	18	2	27	8	71	143
5:35-5:40				12			12
5:40-5:45				11			11
5:45-5:50				15			15
Total	1227	742	412	713	1057	1133	5284

Number of Cars by Time Period
for Game Number Five

Time	Lot Number						
	1	2	3	4	6	7	Total
11:30-11:35	3		1	9	5	4	22
11:35-11:40	2	3	2	13	6	8	34
11:40-11:45	12	4	1	5	2	3	27
11:45-11:50	4	7	2	7	9	5	34
11:50-11:55	16	3	5	10	15	9	58
11:55-12:00	15	7	4	13	13	17	69
12:00-12:05	21	4	3	18	21	20	87
12:05-12:10	47	10	4	7	16	42	126
12:10-12:15	35	15	13	18	15	28	124
12:15-12:20	31	25	4	18	27	39	144
12:20-12:25	28	14	8	33	21	56	160
12:25-12:30	22	26	6	37	18	38	147
12:30-12:35	44	30	9	18	20	54	175
12:35-12:40	29	35	16	53	12	55	200
12:40-12:45	25	54	13	47	19	100	258
12:45-12:50	33	48	15	40	16	38	190
12:50-12:55	46	37	20	56	20	24	203
12:55- 1:00	30	56	15	38	21	26	186
1:00- 1:05	23	60	27	44	17	13	184
1:05- 1:10	19	58	16	32	9	11	145
1:10- 1:15	21	39	14	13	6	12	105
1:15- 1:20	8	23	17	13	3	6	70
1:20- 1:25	4	12	7	9	2	11	45
1:25- 1:30	5	7	5	19	3		39
Total	523	577	227	570	316	619	2832
3:50- 3:55					9		9
3:55- 4:00					11		11
4:00- 4:05	45	41	4	17	14	20	141
4:05- 4:10	100	97	12	21	49	88	367
4:10- 4:15	115	115	36	94	45	124	529
4:15- 4:20	106	107	67	117	48	131	576
4:20- 4:25	99	120	48	30	78	130	505
4:25- 4:30	61	88	14	13	59	61	296
4:30- 4:35		64	7	33	55		159
4:35- 4:40			1	21	6		28
4:40- 4:45				19	3		22
4:45- 4:50				12	5		17
Total	526	632	189	377	382	554	2660

APPENDIX E

PLATE IV

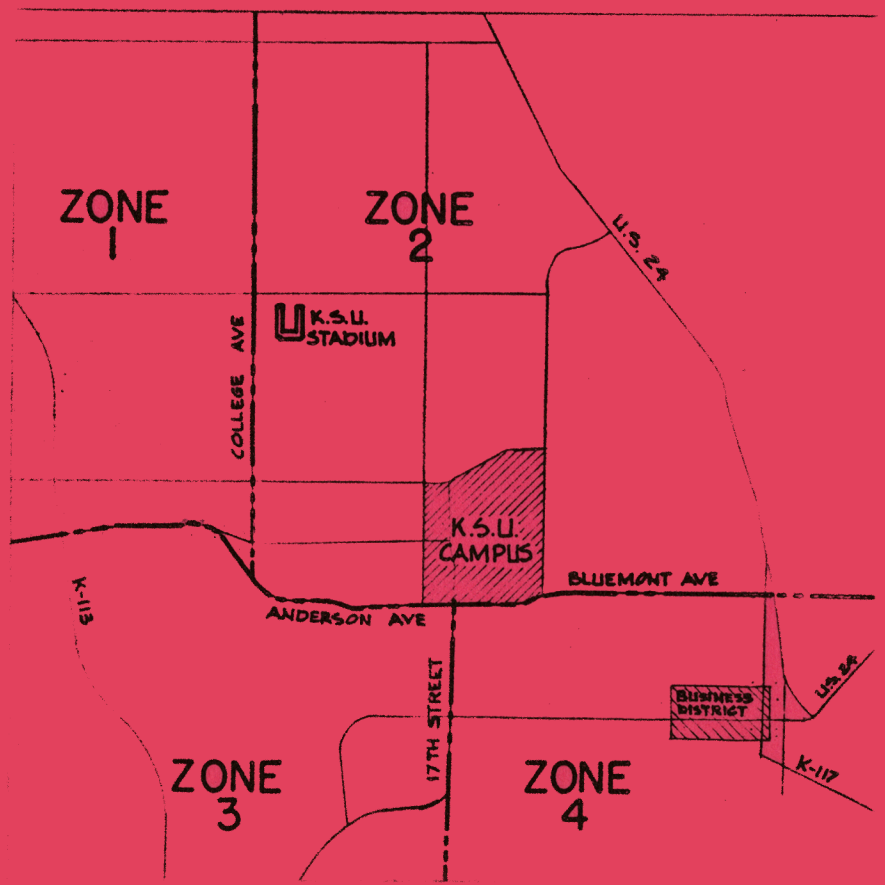
Traffic Survey Questionnaire

TRAFFIC SURVEY
Department of Civil Engineering
Kansas State University

Your cooperation in completing this questionnaire will be appreciated. Please fill out only the part that applies to you.

Please leave this questionnaire on your bleacher seat before you leave the game.

Thank you!



Manhattan Resident or KSU Student Living in Manhattan

1. Where in Manhattan do you live? (Refer to Map) Zone Number _____

2. Would you ride a bus to the games if good bus service were provided? ☐Yes No☐

3. Are you a KSU student? ☐Yes No☐

4. How many persons came to this game in your car? _____

Non-Resident of Manhattan

1. What is your home county and state?

_____

2. Did you stop in Manhattan before coming to this game? ☐Yes No☐

   If so, where? (Refer to Map) Zone Number ____

   Principal reason for stop (check one)
   ☐gas; ☐commercial lodging; ☐food;
   ☐visit; ☐other _____

3. Do you plan to stop in Manhattan after the game? ☐Yes No☐

   If so, where? (Refer to Map) Zone Number ____

   Principal reason for stop (check one)
   ☐gas; ☐commercial lodging; ☐food;
   ☐visit; ☐other _____

4. How many persons came to this game in your car? _____

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SPECIAL EVENT TRAFFIC
KANSAS STATE UNIVERSITY STADIUM

by

BENJAMIN FLOYD SPENCER

B. S., Kansas State University, 1968

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Civil Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1969

This thesis was concerned with the traffic operations for the new Kansas State University football stadium. The research for this report was conducted in the fall of 1968 which was the first season of operation for this facility. The purposes of the study were: 1) to collect and analyse data concerned with (a) the rates at which vehicles entered and left the stadium parking lots and (b) the vehicle occupancy rates (persons per vehicle), and 2) to evaluate the present system of traffic operation and suggest new methods of traffic control that would improve the operational characteristics of the system.

The methods of data collection were: 1) vehicle and vehicle occupancy counts taken at the different parking lot gates for each of the games, and 2) aerial photographs were taken of traffic trouble-spots.

The vehicle counts and occupancy counts were evaluated by the use of computer programs and statistical analysis. The occupancy rate found to exist by this study was 3.2 persons per vehicle. The maximum entering flow rate for one gate (2 lanes) was about 720 vehicles per hour. For a single gate (2 lanes) the maximum exit rate was approximately 1500 vehicles per hour. The total entering flow rate for all six gates was approximately 3300 vehicles per hour while the exit rate was about 7500 vehicles per hour.

The pictures taken of the traffic from the airplane provided an excellent record of what happened on the day of the

game. Ten trouble spots were identified by viewing the photographs. The probable causes of the problems and suggested improvements are included.

Some other operational improvements are also suggested.