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Post-investment analysis and decision making

James Clyde Sprague
Iowa State University

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POST-INVESTMENT ANALYSIS AND DECISION MAKING

by

James Clyde Sprague

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TABLE OF CONTENTS

INTRODUCTION

A recent report in the Wall Street Journal indicates that approximately 23 percent of the machine tools in the United States are over twenty years old and approximately 64 percent of the machine tools in the United States are over ten years old.

These statistics indicate that American industry should be making a more concerted effort to evaluate the economic feasibility of operating the present equipment in service. The corporation's goal should be to organize a workable program for replacing equipment before it becomes an expensive liability rather than an economic asset.

Too often the management of an apparently successful business has found itself in a position of near economic disaster due to continued use of obsolete equipment and poor production practices. These factors can be the cause of excessive costs in many areas of the company's operation, such as, personnel utilization, maintenance and operating procedures, and production quality.

Post-Investment Analysis, Managerial Control, and Capital Budgeting

A sound capital budgeting program should be an objective of every business organization. Competition is placing greater demands on the businessman of today than ever before. These demands suggest an investment program that is workable, flexible and consistent in its application to optimize company profits. A periodic post-audit of investments should do much to improve the stability of present investments and to insure more

accurate predictions of the performance of future investments.

To maximize the beneficial results of a capital budgeting program and post-investment analysis these two functions should be under the control of the same company personnel.

Some Advantages of a Good Post-Investment Analysis Program

Investment decisions are based on estimated income projections into the future. Such factors as the impact of technological change suggest that these estimates are very unlikely to be realized exactly, and may vary considerably from their initial predictions. A periodic post-audit should be of considerable assistance in pinpointing the weak links in the existing operations of the company. Action can then be taken to correct these operating deficiencies.

A careful study of investment results pays off in several ways. For example:

1. A periodic post-investment analysis will alert management to the problem areas within the corporation. Top management may have a tendency to be satisfied with an overall company operation that is meeting the required return on investment. A periodic post-audit may reveal that some operations are paying much better than expected while others are paying much less than expected. Why these conditions exist should be of vital concern to management.
2. A post-investment analysis allows a check on the personal bias of the investment analyst. Some analysts have a

tendency to overestimate the potential benefits of a project, while others may underestimate the benefits. The analyst should not be expected to be on the target in every individual case, but, he should be reasonably close to his estimates on the average. Systematic post-audits can be very beneficial in correcting any bias that may exist.

3. A careful post-investment analysis may result in increased productivity without any physical changes in the production system. The audit reminds production personnel that there was an objective set for the project and challenges them to meet this objective. A well organized post-audit can also point out the areas of weakness in the existing system. These weak points then can be re-examined to produce a more profitable outcome.
4. A post-investment analysis may be a psychological stimulus to plant and process improvements. If previous post-audits have indicated favorable results, management will be inclined to have added confidence in new investment predictions.
5. Decisions to expand existing facilities, or to add new facilities, often require considerable lead-time. A systematic post-investment analysis should be of considerable help in determining the proper lead time.

These are only a few of the many reasons why post-investment analyses should be considered as an integral part of the total capital budgeting system.

Timing of the Post-Investment Analysis

A post-investment analysis should not be considered on a new investment until after an initial operating period has elapsed. Most new operations experience some initial start-up problems that usually require some adjustments before the equipment can be considered as functioning properly. This period of time may vary with the type of investment and the corporation involved. However, the analyst should become familiar with the investment to be studied as early as conveniently feasible. An early development of a suitable model may save valuable time, expense, and problems in arriving at the necessary conclusions to be derived from the study. For example, data crucial to the success of the study may not be available from existing records. It is important to remember that the accountant organizes the records to produce the information required for accounting purposes. The analyst often needs this information in a different form. A brief initial survey of both individuals' needs may provide the data desired by both the accountant and the analyst at no additional cost; whereas, a few months delay in a survey of the records available may result in unnecessary data-gathering expense. In some instances the desired data on past operations for a post-audit may not be attainable under any conditions.

As the corporation gains more experience in the area of post-investment analysis the method of data collecting should become more systematic. Individuals, both within the investment analysis group and outside this particular study group, should become more keenly aware of the value of periodic post-audits and the particular information required

to conduct a post-audit. In many instances special forms can be developed and through a good orientation program the time to make a good post-audit can be cut to a minimum. The cost in respect to the benefits derived from a post-investment analysis should be relatively insignificant.

Objectives of the Study

The objectives of the study are three-fold:

1. to present a method of post-investment analysis which will be helpful for purposes of managerial control and decision making,
2. to stress to management the importance of post-investment analysis as a part of the overall capital budgeting system, and
3. to apply post-investment analysis to an existing investment.

DEVELOPING A MODEL FOR POST-INVESTMENT ANALYSIS

Developing a workable model for the analysis of an existing investment may be a difficult and time consuming task until the corporation has acquired a backlog of experience and data in this area of analysis.

There are many useful analytical tools available that can be used in a post-investment analysis, such as:

1. linear programming,
2. queueing theory,
3. dynamic programming,
4. inventory models,
5. correlation analysis,
6. analysis of variance,
7. plant layout techniques,
8. production control techniques.

The particular tool or combination of tools used in the analysis of a particular investment depends on the specific system being evaluated. However, the basic steps in a post-investment analysis should not vary significantly from the following:

1. obtain a clear understanding of the investment to be analyzed,
2. construct a model to represent this investment and its relationship to the total company operation,
3. test the model and the solution derived from the model,
4. establish proper controls over the model,
5. implement the changes to be made in the existing system.

Obtaining a Clear Understanding of the Investment to be Analyzed

In order to accomplish a successful post-investment analysis it is necessary to have a clear understanding of such basic factors as the objectives to be attained, the constraints involved, deadlines to be met and interrelationships between the specific investment under analysis and the organization as a whole. This initial step in the study is crucial to the success of the post-investment analysis, and these basic factors should be continually re-examined as the study progresses and additional information becomes available.

The investment under study may constitute only a small part of the entire organization. Therefore, it is important to remember that the welfare of the entire organization is the prime objective of the study. An improvement in the operation of the investment under analysis at the expense of some other operation may be more detrimental than beneficial to the long run objectives of the corporation. The overall corporate objective, whether it be one of profit maximization or otherwise, should be the guiding criterion in any post-investment analysis.

Developing a Model to Represent the Investment under Study

Once the analyst has obtained a clear definition and understanding of the investment to be analyzed a model should be developed. The model should abstract from the real world situation sufficiently to be workable and still capture the essence of the real problem it is designed to solve. This step may prove more difficult than one would initially estimate.

There may be a tendency on the part of the analyst to become too involved with the minute details of the practical operation in constructing the model; or the analyst may tend to over-simplify the model to the extent that it does not realistically portray the investment as it actually exists. The analyst should develop a model that will portray to management an understandable and realistic picture of the operating investment as it presently exists and the advantages that can be expected if the proposed changes are implemented.

Testing the Model

The proper criterion for judging the success or failure of a model is the models ability to simulate under test the system it is designed to represent with sufficient accuracy to permit sound decisions.

The following steps are suggested as a general method in testing the model:

1. The model should be initially tested with data for which the results can be readily checked. One should be doubly sure that all mathematical expressions are dimensionally correct and that the proper steps have been taken in the formulation of the model.
2. A systematic test should then be made using historical data to reconstruct the past. The performance of the model using past data can then be checked against the performance of the investment as it actually occurred.
3. The important parameters in the model can then be varied to

determine the effect on the system. This procedure can be continued until a realistic and suitable course of action has been determined.

A note of caution should be exercised at this point. Should there be any reason to suspect that past performance of the investment is not a good representation of future performance, one may want to continue the operation at status quo until new data can be collected and the model evaluated with this data.

Establishing Proper Controls over the Model

Because conditions are constantly changing in a real world situation, it is important to establish controls over the model and its solution.

To evaluate the effect of these real world changes it is necessary to determine the critical input parameters of the model. These are the parameters which cause a significant change in the output of the model with a minimum change in their input values.

The sensitivity to change of the critical input parameters may be determined through sensitivity analysis. Sensitivity analysis involves varying each critical parameter, individually, over a predetermined range of values in order to determine the degree of variation in the resulting output. From this, a procedure may be established for detecting statistically significant changes in each of these critical parameters. Once these controls have been established provision is made for adjusting the solution and consequent course of action whenever such changes are detected.

Implementing Changes in the Existing System

This stage of the post-investment analysis is perhaps the most critical stage in the entire study. The benefits of the study cannot be realized until the suggested changes have been implemented.

Both top management and operating personnel should be in agreement with the changes to be made if a successful improvement over the present operation is to be realized. Everyone associated with the investment should be made aware of the reasons for the changes and the benefits that should be expected. Careful records need to be maintained to determine whether the system is performing as predicted by the model. Should the performance of the investment be found to be unsatisfactory it is most important that additional changes be made under the direction of the investment analysis group. Only through good cooperation and voluntary feedback between production personnel and the staff personnel involved can a continuing program of post-investment analysis succeed.

A POST-INVESTMENT ANALYSIS OF THE MEMORIAL UNION PARKING RAMP

The Memorial Union parking ramp on the Iowa State campus was chosen as a vehicle within which to apply the principles of post-investment analysis.

The parking ramp is ideally suited to a post-investment analysis in that the investment constitutes a large sunk cost with little opportunity to reallocate part or all the resources committed. Under these conditions management is more likely to seek out every possible means to insure that the investment meets the initial expectations. A comprehensive study of every critical parameter should be one objective of every post-investment analysis, but unfortunately the investment is sometimes prematurely liquidated when the resources can be relatively easily reallocated.

Formulating a Procedure for Evaluating the Parking Ramp as an Investment

The first step in the analysis of the parking ramp was a familiarization of the overall operation of the ramp. This step involved an initial analysis of the following:

1. life of the ramp,
2. financing of the ramp,
3. operating procedures,
4. revenues,
5. operating costs,
6. required rate of return, and
7. melange effects of the ramp on the total operations of the

Memorial Union.

Life of the ramp

The ramp was opened for service on July 5, 1967. It has a total of 640 parking spaces, however, 620 vehicles are considered the maximum that can be parked due to the manner in which customers park. The ramp is estimated to have a service life of fifty years. This life span is somewhat longer than the average life of thirty years usually estimated for parking ramps, but may be realistic for a university environment.

Financing of the ramp

The parking ramp structure initially cost $1,165,366.27 and it was financed through a twenty year, 3 3/4 percent bank loan.

The land on which the ramp is located was deeded to the Memorial Union by the legislature, and is approximately one acre in area.

The value of this land is difficult to estimate as there have not been any land sales in this particular area for a number of years. A value has been estimated for the land by checking with the city assessors, real estate personnel and university personnel. This estimate is based on the following information.

Land is assessed by the city on a front footage basis. The assessment varies with the footage depth. For example:

1. 100 feet in depth is assessed at 100 percent of the front footage charge.
2. 90 feet in depth is assessed at 96 percent of the front footage charge.

3. 150 feet in depth is assessed at 115 percent of the front footage charge.

The 1961 assessment on the south side of Lincoln Way ranged from $200.00 per frontage foot at the Towers to $500.00 per frontage foot as one moves west into the business district. On this basis a reasonable value today for the frontage the ramp occupies would be approximately $500.00 per frontage foot.

Business frontage on Lincoln Way has recently marketed from as low as $400.00 to $500.00 per frontage foot to in excess of $1,000.00 per frontage foot. A reasonable real estate price for prime frontage is estimated as $800.00 per frontage foot.

In discussions with university personnel values from a minimum of $25,000.00 per acre to a maximum of $100,000.00 per acre were considered to be reasonable for this land.

The ramp presently employs 450 feet of frontage on Lincoln Way. This frontage could be reduced to 200 feet if entrance to the ramp were directly off of Lincoln Way.

Using the previous information the land cost was based on:

1. 200 feet of Lincoln Way frontage,
2. 125 percent factor for depth,
3. a conservative estimate of $400.00 per frontage foot.

Total land cost = (200 feet)($400.00)(125%) = $100,000.00

Operating procedures

The parking ramp is open 7 days a week throughout the year. An attendant is on duty from approximately 8 a.m. to 11 p.m. daily.

The single entrance to the ramp is controlled by two customer operated gates. Hourly and monthly customers automatically receive a time stamped ticket on entering the ramp. Employees and other credit card holders gain admittance to the ramp through the second gate by using a credit card to operate the gate.

The single exit from the ramp is controlled by the attendant from approximately 8 a.m. to 11 p.m. daily. An hourly customer leaving the ramp after the attendant in the evening is not charged. This policy does not, at present, constitute any appreciable loss in revenue.

The attendant checks the number of vehicles on the ramp at 8 a.m. in order to set the automatic counter in the ramp office. This counter is controlled by the entrance gates and automatically deducts one from the number of empty spaces remaining on the ramp each time a vehicle passes through either gate. Each hour the attendant adjusts the counter for the number of vehicles that leave the ramp during the hour.

Administrative duties regarding the ramp are handled by the regular Memorial Union staff.

Revenues

The revenue from the ramp during the past year shows a significant increase in ramp utilization over the first year of operation.

The total income for the first fiscal year (July 1, 1967 - June 30, 1968) was $42,313.01. The total income for the study year ending May 31, 1969, is $62,748.57. It is estimated that $12,862.89 of this increase is due to an increase in parking rates from $5.15 to $8.24 for monthly parkers and from $0.10 to $0.15 for the first hour for hourly parkers. The

remaining increase in revenue, amounting to $7,572.67, is due to an estimated increase of 18 percent in ramp utilization from the previous year.

Table 1. The gross income from the parking ramp for the operating period shown

Month	1967	1968	1969
January		$4,719.65	$6,520.53
February		4,626.64	5,903.01
March		4,969.69	6,431.66
April		4,873.62	6,378.89
May		4,673.77	5,814.62
June		3,234.83	
July	$ 252.11	2,404.31	
August	562.99	2,526.63	
September	2,546.25	6.175.07	
October	3,766.31	6,461.20	
November	3,770.29	4,560.66	
December	2,530.77	4,454.70	

The rate structure for the parking ramp effective July 1, 1968, is indicated in Table 2.

Table 2. The parking ramp rate structure effective July 1, 1968

Time	Rate
First hour	$0.15
Each additional hour	0.10
24 hours	1.00
48 hours	1.50
72 hours	2.00
7 days	3.00
14 days	5.00
1 month	8.24
Employees and other card holders	no charge

Prior to July 1, 1968, the charge for the first hour was $0.10 and the monthly rate was $5.15.

Operating costs

The operating costs for the fiscal year ending June 30, 1968 were as indicated in Table 3.

Table 3. The ramp operating costs for the fiscal year ending June 30, 1968

Labor	=	$12,382.41
Supplies	=	2,461.49
Repairs and maintenance	=	2,360.54
Administrative expense	=	1,215.97
Insurance	=	388.81
Group insurance	=	257.48
Legal and audit fees	=	91.00
Printing and advertising	=	80.00
Telephone	=	68.28
Office supplies	=	10.77
Freight and hauling	=	10.68
Miscellaneous	=	25.75
Total operating costs		$19,358.18
Sales tax		1,269.39
		$20,627.57

The annual operating costs over the life of the ramp should not change appreciably except for the effect of inflation. The ramp has very little equipment that is subject to mechanical failure. The repair and maintenance costs shown in Table 3 are mainly due to an addition to the ramp office. These costs, therefore, may be slightly higher than would be expected during the average year. A two percent growth rate was used in the analysis to offset increased expense due to inflation.

Required rate of return

The ramp investment was considered an essential addition to the overall operations of the Memorial Union. The ramp is a definite complement to the Union's guest room facilities, restaurant facilities, conference facilities, and to basically all of the Union's operations. However, the investment in the ramp should be supported by revenues from the ramp. Under these conditions a reasonable rate of return on the investment is considered to be in a range of five percent to eight percent.

Melange effects of the ramp on the total operations of the Memorial Union

The architects are presently studying the long range plans for the Memorial Union. These plans include an expansion of the food service facilities to accomodate the new Iowa State Center and campus expansion. Other additions that are contemplated are:

1. an expansion of the University Book Store;
2. additional guest rooms;
3. additional student office space;
4. additional student lounge area and food service space;
5. craft area for metal working, leather working and other crafts.

The total expansion is expected to be completed by the year 2000. The food service expansion should be in operation by 1975. This service will eliminate the 38 meters that presently exist between the Union and the ramp. The elimination of these meters will not affect the income from the ramp appreciably as the income from the meters is now included in the ramp's income. The completion date for the additional facilities has not been finalized.

DEVELOPING A MODEL

The development of a suitable model to realistically predict the status of the investment over the life of the ramp was the next step in the analysis.

Most investments have common features that help to simplify the analysis. They are:

1. initial capital invested in buildings, land, and equipment;
2. personnel organization;
3. administrative organization.

Each of these three component parts of the system should be studied in sufficient detail to determine if they are operating with the degree of efficiency required to produce the revenue expected. Any areas of weakness found should be thoroughly studied and recommendations should be made for improvement of the operation.

The ramp is operated by a single attendant each shift. The duties of this individual are reasonably straight forward and a significant improvement in this area of the operation cannot be expected.

The administration of the ramp is being performed in a satisfactory manner. An administrative charge, amounting to three percent of gross sales, is made by the Memorial Union.

The major portion of the investment is in the ramp structure. The operating equipment consists of entry gates, an elevator, and accessory equipment. Because of the nature of the structure and the very minor role of operating equipment, it is estimated that very little change will occur in maintenance costs over the life of the investment.

Thus, the major portion of the analysis involved a study of the present and projected utilization and income from the ramp. The basic steps in the analysis were:

1. To determine a suitable study period on which to base the analysis. A study period of one year from June 1, 1968, to May 31, 1969, was selected. The year was divided into time classifications over which the ramp was expected to undergo similar utilization and income.
2. To develop a method to determine the present utilization of the ramp during each classification for the three populations involved;
   a. hourly customers,
   b. monthly customers,
   c. employees and other credit card holders.
3. To develop a method to determine the future utilization and income from the ramp, based on the present trends and present rate structure.
4. To develop a method to determine the future utilization and income from the ramp based on changes in the rate structure.
5. To determine the income required over the life of the investment to meet the expected rate of return.
6. To determine the effect on utilization and income due to:
   a. the projected student enrollment growth rate;
   b. closing the parking lot, located between the Memorial Union and the women's gymnasium to visitors;

c. future expansion of the Memorial Union facilities.

Classification of Time Intervals to Determine Annual Utilization and Income

The study period from June 1, 1968, to May 31, 1969, was separated into classifications that were considered most likely to produce similar ramp utilization and income. These classifications are listed in Table 4.

Table 4. Classification of time intervals

Number	Classification	Number of days
1	Summer quarter class days (Monday through Friday)	58
2	Fall quarter class days (Monday through Friday)	58
3	Winter quarter class days (Monday through Friday)	56
4	Spring quarter class days (Monday through Friday)	54
5	Weekend days less weekend days during quarter-breaks and vacations	80
6	Quarter-breaks and vacations	59
	Total	365

Present Utilization of the Ramp by Each Population

A realistic estimate of the present utilization of the ramp by each population proved to be a difficult and time-consuming task. The data presented in Appendix A were used in this analysis. These data include:

1. the total ramp utilization (including all three populations) by hour from 8 a.m. to 11 p.m. daily;

2. the ramp utilization by employees and individuals who have credit cards. There are approximately 250 credit cards distributed.

The tickets for selected days, received by hourly customers on entering the ramp and submitted with payment on leaving the ramp were also used in the analysis.

Steps in the Analysis of the Present Ramp Utilization

The data, in Appendix A, showing total ramp utilization were analyzed as follows:

1. Chi-square tests were performed on the fall quarter data for selected hours to see if the data could be considered normally distributed
2. Analysis of variance tests were then performed to determine if the days in each classification were significantly different with respect to ramp utilization.
3. Multiple range tests were then performed on selected data. The results of the analysis of variance tests, multiple range tests, and the number of hourly and monthly customers that passed through the ramp each day were then studied to estimate the sample days most representative of total ramp utilization.
4. The distribution of the ramp utilization for these days was then determined for each population in each classification.

Chi-square testing for goodness of fit

The tables, in Appendix A, showing the ramp utilization for fall quarter were checked (using the Chi-square goodness of fit test) for several hours throughout the quarter to see how well the hourly distribution fit the normal distribution. The results indicate that the distribution of utilization by hour is not significantly different from the normal distribution at the 95 percent level of significance.

These results are presented in Table 5.

Table 5. The results of the Chi-square goodness of fit tests involving

Time of day	Number of observations	Degrees of freedom	Computed Chi-square	95% level of significance	Conclusions
10 a.m.	53	7	5.68	14.1	nonsignificant
12 noon	52	7	8.77	14.1	nonsignificant
2 p.m.	52	7	9.92	14.1	nonsignificant
4 p.m.	47	7	7.26	14.1	nonsignificant
6 p.m.	52	7	8.38	14.1	nonsignificant
10 p.m.	51	7	4.10	14.1	nonsignificant

Analysis of variance testing

Analysis of variance tests (hereafter referred to as analysis of variance or ANOV) were conducted on sample data from the tables in Appendix A to determine the days in each quarter for each classification that would best represent ramp utilization and income. The tests were run on sample days from each quarter as presented in Table 6.

The statistical model that best suits the data recorded is a three factor factorial associated with a completely randomized design involving one experimental unit per treatment combination. The appropriate

statistical model is as follows:

$$Y_{ijkl} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \gamma_k + (\alpha\gamma)_{ik} + (\beta\gamma)_{jk} + (\alpha\beta\gamma)_{ijk} + \epsilon_{ijkl}$$

$i = 1, \ldots, a$

$j = 1, \ldots, b$

$k = 1, \ldots, c$

$l = 1, \ldots, n$

a = the number of weeks being tested

b = the number of days being tested

c = the number of hours being tested

n = the number of observations per treatment

The computer program used for all analysis of variance testing was the ARDVARK program noted in Appendix C.

Table 6. Analysis of variance tests were run on the following samples from each classification

Classification	Year	Total days in classification	Number of days tested
Class days summer quarter	1968	58	10
Class days fall quarter	1968	58	50
Class days winter quarter	1969	56	40
Class days spring quarter	1969	54	30
Weekend days less weekend days during quarter-breaks and vacations	1968-69	80	50
Total*		306 days	

*ANOV tests were not run on the 59 days representing quarter-breaks and vacations.

Analysis of Variance Test Results

The analysis of variance test results indicate the following conclusions:

1. There are statistically significant differences at the 99 percent level between most weeks within each classification.
2. There are statistically significant differences at the 99 percent level between most days within each classification.
3. There are statistically significant differences at the 99 percent level between many hours throughout the day within each classification.
4. The week by day interaction is almost always significant at the 99 percent level within each classification.
5. The week by hour interaction is usually nonsignificant at the 95 percent level within each classification.
6. The day by hour interaction is usually nonsignificant at the 99 percent level within each classification.

The initial test results indicated that each classification would require some division and further testing before a representative sample of days could be determined to arrive at ramp utilization and income for the study period. The results of further testing concluded that a realistic representation of days could not be verified through statistical analysis. For statistical nonsignificance the days would almost need to be treated on an individual basis. This approach would prove to be quite expensive and the results would generate so many tables and figures that they would be practically meaningless.

The decision was, therefore, made to determine the most representative days within each classification based on four criteria.

1. analysis of variance tests,
2. multiple range tests,
3. the number of hourly and all other customers that pass through the ramp between 8 a.m. and 11 p.m. each day, and
4. judgment.

Analysis of variance tests

The standard ANOV tables are listed in Appendix B for selected test results. The F-ratios for the ANOV tests run are listed in tabular form for each classification in the discussion to follow.

Multiple range tests

The multiple range test used in this study is referred to as "Duncan's New Multiple Range Test." The test procedure is outlined in Appendix B.

The number of customers using the ramp each day

The number of customers using the ramp each day from 8 a.m. to 11 p.m. are grouped into two groups:

1. hourly customers;
2. all other customers (this group includes monthly customers, employees, and other credit card holders).

These values are listed, where available, in tabular form for each classification in the discussion to follow.

Class Days during the Summer Quarter of 1968

A limited amount of data, as listed in Appendix A, were available to estimate the present utilization for the class days during the summer quarter. A sample of 10 days out of a total of 58 days were used in the ANOV testing.

The F-ratios for the ANOV tests run are listed in Table 7.

Table 7. The F-ratios for the analysis of variance tests run on the following data (total vehicle utilization) on the class days during the summer quarter of 1968

Test number	Days tested	Number of weeks tested	Number of hours tested	F-ratios A	B	AB	C	AC	BC
1	Mon-Fri	2	16	(0.59)	68.75	7.35	50.98	(0.79)	2.30

Note: The F-ratios circled are nonsignificant at the 95 percent level.

The results of the ANOV testing for the class days during the summer quarter indicated that the weeks were not significant at the 95 percent level but that the days were highly significant at the 99 percent level.

In choosing the representative days Tables 7, 8, 9, and 10 were studied.

The representative days selected were August 7 and August 9.

Table 8. The week by day means for the sample data (total vehicle utilization) on class days during the summer quarter of 1968

Days	Weeks 1	2	Grand Means
Mon	62	71	67
Tues	76	88	82
Wed	(147)	106	125
Thurs	162	166	164
Fri	(85)	115	100
Grand Means	106	109	108

Note: The days circled are the representative day selected.

The standard error of the mean used in the multiple range test to compare week means for the class days of summer quarter is:

$$S_{\bar{x}} = \sqrt{\frac{\text{Mean square error}}{\text{No. of observations per treatment}}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{689}{80}} = \sqrt{8.62} = 2.94$$

The degrees of freedom (d.f.) on which this standard error is based = 60.

Table 9. The results of the multiple range test for the week means for the sample data (total vehicle utilization) on the class days during the summer quarter of 1968

P	2	
SSR	2.81	
LSR	8.26	
Weeks	1	2
Means	106	109

Note: Any two means not underscored by the same line are significantly different.

The standard error of the mean used in the multiple range test to

compare day means for the class days of summer quarter is:

$$S_x = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{689}{32}} = \sqrt{21.5} = 4.64$$

The d.f. on which this standard error is based = 60.

Table 10. The results of the multiple range test for the day means for the sample data (total vehicle utilization) on the class days during the summer quarter of 1968

P	2	3	4	5
SSR	2.81	2.9	3.06	3.13
LSR	13.04	13.46	14.12	14.52

Days	M	T	F	W	Th
Means	67	82	100	125	164

Note: Any two means not underscored by the same line are significantly different.

Class Days during the Fall Quarter of 1968

A sample of 50 days out of a total of 58 days were used in the ANOV testing for the class days of fall quarter.

The F-ratios for the different combinations of days tested are outlined in Table 11.

Table 11. The F-ratios for the analysis of variance tests run on the following data (total vehicle utilization) on the class days during the fall quarter of 1968

Test number	Days tested	No. of weeks tested	No. of hours tested	F-ratios A	B	AB	C	AC	BC
1	Mon-Sun	10	16	19.06	376.19	10.57	183.83	(0.67)	6.14
2	Mon-Fri	10	16	25.12	62.90	12.13	227.32	(1.20)	1.60
3	Mon-Fri	7	16	18.15	48.30	12.30	138.40	(1.00)	1.39
4	Mon-Fri	5	16	4.72	34.42	18.76	123.52	1.42	(0.89)
5	Mon-Fri	4	16	4.62	14.79	7.59	78.40	(1.04)	(1.20)
6	T,W,Th	8	16	9.43	(1.04)	19.31	110.54	(1.16)	(0.77)
7	T,W,Th	8	16	12.17	8.84	12.48	70.14	(0.76)	(0.74)
8	T,W,Th	4	16	16.19	61.50	17.76	113.06	1.54	2.15
9	T,W,Th	2	16	1.48	35.09	44.81	112.44	1.52	1.46
10	M,F	8	16	7.22	(1.65)	12.68	49.30	(0.89)	(0.22)
11	M,F	2	16	6.88	11.80	15.14	12.41	(0.80)	(0.81)
12	Mon-Fri	10	6	2.32	7.34	(1.35)	248.33	(1.34)	(0.71)
13	Mon-Fri	10	5	7.66	28.11	6.13	658.18	3.09	(1.03)
14	Mon-Fri	10	5	5.41	(1.21)	4.73	29.57	(0.75)	2.04
15	Mon-Fri	8	6	39.82	51.24	36.74	15.89	1.53	2.80
16	Mon-Fri	8	6	15.73	8.34	8.49	12.20	1.55	2.78
17	Mon-Fri	8	4	12.88	8.64	5.80	21.45	(0.95)	(0.54)

Note: The F-ratios circled are nonsignificant at the 95 percent level.

The results of the ANOV tests as outlined in Table 11 indicate that except for the AC and BC interaction most of the tests are highly significant. The best grouping of class days for this classification was considered to be:

1. group one - Mondays and Fridays;
2. group two - Tuesdays, Wednesdays, and Thursdays.

Having decided on the grouping of the class days the next step was to pick a representative day from each group. Tables 11, 12, 13, 14, 15, and 16 were studied for this purpose.

The representative days selected were Friday, September 27 and Wednesday, October 30.

Table 12. The week by day means for the sample data (total vehicle utilization) on class days during the fall quarter of 1968

Days	Weeks										Grand means
	1	2	3	4	5	6	7	8	9	10	
Mon	254	276	262	282	184	271	223	275	211	239	248
Tues	238	315	268	246	289	232	254	300	211	224	258
Wed	325	286	303	272	326	240	267	(274)	276	254	282
Thurs	318	294	277	236	223	281	215	235	265	301	264
Fri	247	255	(260)	165	207	265	155	229	215	223	222
Grand means	276	285	274	240	246	258	223	263	235	248	255

Note: The days circled are the representative days selected.

The standard error of the mean used in the multiple range test to compare week means for the class days of fall quarter is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1254}{80}} = \sqrt{15.68} = 3.96$$

The degrees of freedom on which this standard error is based = 540.

Table 13. The results of the multiple range test for the week means for the sample data (total vehicle utilization) on the class days during the fall quarter of 1968

P	2	3	4	5	6	7	8	9	10
SSR	2.77	2.92	3.02	3.09	3.15	3.19	3.23	3.27	3.29
LSR	10.97	11.56	11.96	12.24	12.47	12.63	12.79	12.95	13.03

Weeks	1	2	3	4	5	6	7	8	9	10
Means	223	235	240	246	248	258	263	274	276	285

Note: Any two means not underscored by the same line are significantly different.

The standard error of the mean used in the multiple range test to compare day means for the class days of the fall quarter is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1254}{160}} = \sqrt{7.85} = 2.80$$

The degrees of freedom on which this standard error is based = 540.

Table 14. The results of the multiple range test for the day means for the sample data (total vehicle utilization) on the class days during the fall quarter of 1968

P	2	3	4	5
SSR	2.77	2.92	3.02	3.09
LSR	7.76	8.18	8.46	8.65

Days	F	M	T	Th	W
Means	222	248	258	264	282

Note: Any two means not underscored by the same line are significantly different.

Tables 15 and 16 record the number of hourly customers and all other customers using the ramp on the days specified during fall quarter of 1968.

Table 15. The number of customers using the ramp on the days specified during the fall quarter of 1968

Week	Hourly customers		All other customers		Total	
	Monday	Friday	Monday	Friday	Monday	Friday
1	708	499	297	381	1005	880
2	404	414	294	383	698	797
3	298	(387)	315	(347)	613	(734)
4	294	281	333	322	627	603
5	269	404	289	366	558	770
6	466	556	345	403	811	959
7	315	425	312	380	627	805
8	372	454	292	426	664	880
9	167	374	345	180	512	554
10	230	290	292	304	522	594
Totals	3523	4084	3114	3492	6637	7576
Means	352	408	311	349	664	758

The grand mean for hourly customers = 380
The grand mean for all other customers = 330

Total = 710

Note: The day circled is the representative day selected for this group.

Table 16. The number of customers using the ramp on the days specified during the fall quarter of 1968

Week	Hourly customers			All other customers			Total customers		
	Tues	Wed	Thurs	Tues	Wed	Thurs	Tues	Wed	Thurs
1	452	393	360	336	487	253	788	880	613
2	320	340	328	315	315	332	635	655	660
3	316	376	284	369	309	318	685	685	602
4	256	340	375	287	352	330	543	692	705
5	401	550	293	311	257	355	712	807	648
6	262	266	415	347	323	362	609	589	777
7	324	336	250	368	392	398	692	728	648
8	418	(364)	213	360	(351)	349	778	(715)	562
9	216	386	369	387	312	348	603	698	717
10	223	---	243	305	---	---	528	---	---
Totals	3188	3351	3130	3385	3098	3045	6573	6499	5932
Means	319	372	313	339	344	338	657	722	659

The grand mean for hourly customers = 335
The grand mean for all other customers = 340

Total = 675

Note: The day circled is the representative day selected for this group.

Class Days during the Winter Quarter of 1969

A sample of 40 days out of a total of 56 days were used in the ANOV testing for the class days of winter quarter.

The F-ratios for the different combinations of days tested are outlined in Table 17.

Table 17. The F-ratios for the analysis of variance tests run on the following data (total vehicle utilization) on the class days during the winter quarter of 1969

Test number	Days Tested	No. of weeks tested	No. of hours tested	F-ratios A	B	AB	C	AC	BC
1	Mon-Sun	8	16	26.85	771.21	15.66	217.57	1.32	12.89
2	Mon-Fri	8	16	29.31	33.61	14.22	224.28	(0.95)	1.92
3	Mon-Fri	5	16	17.91	11.12	13.98	144.42	(0.84)	2.49
4	M,T,F	5	16	6.50	(1.00)	13.31	66.44	(0.43)	1.55
5	T,W,Th	5	16	32.49	15.82	12.42	132.16	(1.23)	2.77
6	W,Th	5	16	32.44	(1.00)	10.47	86.50	(1.20)	2.56
7	M,F	5	16	(2.40)	(1.66)	22.25	41.83	(0.83)	2.42

Note: The F-ratios circled are nonsignificant at the 95 percent level.

The results of the ANOV testing for the class days of winter quarter suggested the following grouping of days:

1. group one - Mondays, Tuesdays, and Fridays;
2. group two - Wednesdays and Thursdays.

In selecting a representative day for each group Tables 17, 18, 19, 20, 21 and 22 were studied.

The representative days selected were Tuesday, January 14 and Wednesday, January 29.

Table 18. The week by day means for the sample data (total vehicle utilization) on class days during the winter quarter of 1969

Days	Weeks								Grand
	1	2	3	4	5	6	7	8	means
Mon	211	338	328	312	267	317	357	266	299
Tues	297	305	366	334	(285)	307	352	327	322
Wed	299	294	427	349	331	347	(374)	318	342
Thurs	380	295	388	327	339	384	337	313	345
Fri	341	270	291	354	347	303	337	326	321
Grand means	305	300	360	335	314	331	351	310	326

Note: The days circled are the representative days selected.

The standard error of the mean used in the multiple range test to compare week means for the class days of the winter quarter is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1322}{80}} = \sqrt{16.53} = 4.07$$

The degrees of freedom on which this standard error is based = 420.

Table 19. The results of the multiple range test for the week means for the sample data (total vehicle utilization) on the class days during the winter quarter of 1969

P	2	3	4	5	6	7	8
SSR	3.77	2.92	3.02	3.09	3.15	3.19	3.23
LSR	11.27	11.88	12.29	12.58	12.82	12.98	13.15

Weeks	1	2	3	4	5	6	7	8
Means	300	305	310	314	331	335	351	360

Note: Any two means not underscored by the same line are significantly different.

The standard error of the mean used in the multiple range test to compare day means for the class days during the winter quarter is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1322}{128}} = \sqrt{10.03} = 3.21$$

The degrees of freedom on which this standard error is based = 420.

Table 20. The results of the multiple range test for the day means for the sample data (total vehicle utilization) on the class days during the winter quarter of 1969

P	2	3	4	5
SSR	2.77	2.92	3.02	3.09
LSR	8.89	9.37	9.69	9.92

Days	M	F	T	W	Th
Means	299	321	322	342	345

Note: Any two means not underscored by the same line are significantly different.

Table 21. The number of customer vehicles using the ramp on the days specified during the winter quarter of 1969

Week	Hourly customers			All other customers			Total customers		
	Mon	Tues	Fri	Mon	Tues	Fri	Mon	Tues	Fri
1	674	451	478	270	367	358	944	818	836
2	310	433	519	313	349	383	623	782	902
3	350	270	165	308	167	---	658	437	---
4	299	436	365	292	328	422	591	764	787
5	367	(358)	603	293	(342)	427	660	(700)	1030
6	227	295	754	346	320	431	573	615	1185
7	362	367	630	324	333	416	686	700	1046
8	355	313	722	365	343	447	720	656	1169
9	325	304	510	356	369	419	681	673	929
10	301	315	425	385	452	383	686	767	808
Totals	3570	3542	5171	3252	3370	3686	6822	6912	8692
Means	357	354	517	325	337	410			

The grand mean for the hourly customers = 409
The grand mean for all other customer = 357

Total = 766

Note: The day circled is the representative day selected for this group.

Table 22. The number of vehicles using the ramp on the days specified during the winter quarter of 1969

Week	Hourly customers		All other customers		Total customers	
	Wed	Thurs	Wed	Thurs	Wed	Thurs
1	454	635	376	381	830	1016
2	367	343	355	153	722	496
3	218	307	312	161	530	468
4	395	338	330	313	725	651
5	457	340	330	365	787	705
6	465	437	349	258	814	795
7	(412)	504	(360)	349	(772)	853
8	378	448	364	360	742	808
9	536	398	373	352	909	750
10	364	388	331	362	695	750
Totals	4046	4138	3480	3054	7526	7292
Means	405	414	348	305	753	729

The grand mean for hourly customers = 410
The grand mean for all other customers = 337

Total = 747

Note: The day circled is the representative day selected for this group.

Class Days during the Spring Quarter of 1969

A sample of 30 days out of a total of 54 days were used in the ANOV testing for class days of spring quarter.

The F-ratios for the different combinations of days tested are as outlined in Table 23.

Table 23. The F-ratios for the analysis of variance tests run on the following data (total vehicle utilization) on the class days during the spring quarter of 1969

Numb of tests	Days tested	No. of weeks tested	No. of hours tested	F-ratios A	B	AB	C	AC	BC
1	Mon-Sun	6	16	23.93	298.13	21.67	136.98	(0.77)	6.28
2	Mon-Fri	6	16						
3	Sat, Sun	6	16						

Note: The F-ratio circled is nonsignificant at the 95 percent level.

The results of the ANOV testing for the class days during spring quarter indicated that the grand means for Monday, Tuesday and Thursday are nonsignificant at the 95 percent level, whereas, Wednesday and Friday are significantly different at the 95 percent level from all other days of the week. The utilization on Wednesday is higher on the average for most days and the utilization on Friday is lower for most days.

The representative day selected was Monday, April 14.

Table 24. The week by day means for the sample data (total vehicle utilization) on class days during the spring quarter of 1969

Days	Weeks 1	2	3	4	5	6	Grand mean
Mon	361	(290)	260	269	283	195	276
Tues	318	287	254	312	236	283	282
Wed	331	311	283	237	267	323	292
Thurs	292	271	273	219	290	328	279
Fri	288	306	237	155	216	259	244
Grand means	318	293	261	239	259	278	273

Note: The day circled is the representative day selected.

The standard error of the mean used in the multiple range test to compare week means for the class days of the spring quarter is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1629}{80}} = \sqrt{20.36} = 4.51$$

The degrees of freedom on which this standard error is based = 320.

Table 25. The results of the multiple range test for the week means for the sample data (total vehicle utilization) on the class days during the spring quarter of 1969

P	2	3	4	5	6
SSR	2.77	2.92	3.02	3.09	3.15
LSR	12.49	13.17	13.62	13.94	14.21

Weeks	1	2	3	4	5	6
Means	239	259	261	278	293	318

Note: Any two means not underscored by the same line are significantly different.

The standard error of the mean used in the multiple range test to compare day means for the class days of the spring quarter is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1629}{96}} = \sqrt{16.95} = 4.12$$

The degrees of freedom on which this standard error is based = 320.

Table 26. The results of the multiple range test for the day means for the sample data (total vehicle utilization) on the class days during the spring quarter of 1969

P	2	3	4	5
SSR	2.77	2.92	3.02	3.09
LSR	11.41	12.03	12.44	12.73

Days	F	M	Th	T	W
Means	244	276	279	282	292

Note: Any two means not underscored by the same line are significantly different.

Table 27. The number of customers using the ramp on the days specified during the spring quarter of 1969

Week	Hourly customers					All other customers					Total customers				
	Mon	Tues	Wed	Thurs	Fri	Mon	Tues	Wed	Thurs	Fri	Mon	Tues	Wed	Thurs	Fri
1	688	583	539	399	412	360	374	391	350	406	1042	957	930	749	818
2	(418)	311	439	599	494	(348)	391	427	468	384	(766)	702	866	1067	842
3	246	402	339	377	318	383	366	396	347	393	629	768	735	724	711
4	266	490	325	367	408	357	366	436	369	316	623	856	761	736	724
5	353	367	506	394	406	374	378	392	333	432	727	745	898	727	840
6	421	354	484	659	445	355	340	352	351	377	776	694	836	1010	822
Totals	2392	2507	2632	2795	2483	2177	2215	2394	2218	2308	4563	4722	5026	5013	4757
Means	399	418	439	466	414	363	369	399	369	385	761	787	838	836	793

The grand mean for hourly customers on Monday, Tuesday and Thursday = 421
The grand mean for all other customers on Monday, Tuesday and Thursday = 367

Total = 788

Note: The day circled is the representative day selected for this classification.

Weekend Days Less Weekend Days during Quarter-Breaks and Vacations

A sample of 50 days out of a total of 80 days were used in the ANOV testing for weekend days less weekend days during quarter-breaks and vacations (hereafter referred to as weekend days).

The F-ratios for the ANOV tests run on this data are listed in Table 28.

Table 28. The F-ratios for the analysis of variance tests run on the following data (total vehicle utilization) for the weekend days

Quarter	Test no.	Days tested	No. of weeks tested	No. of hours tested	F-ratios A	B	AB	C	AC	BC
Summer	1	Sat	2	16	3.25			3.36		
Fall	2	Sat,Sun	10	16	8.12	31.78	8.19	12.87	(0.87)	3.60
Fall	3	Sat,Sun	7	16	9.90	31.15	4.03	12.09	(1.17)	3.31
Winter	4	Sat,Sun	8	16	26.34	(1.54)	5.40	25.20	1.50	5.10
Winter	5	Sat,Sun	5	16	7.48	17.85	3.38	17.88	(1.04)	6.07
Spring	6	Sat,Sun	6	16						

Note: The F-ratios circled are nonsignificant at the 95 percent level.

The results of the ANOV testing for the weekend days for the total study period resulted in grouping the weekend days into four groups for additional ANOV testing purposes. Three of these groups are outlined in Table 32, the fourth group constitutes the summer quarter data available.

The results of these tests are listed in Table 31.

Table 29. The F-ratios for the analysis of variance tests run on the grouped data (total vehicle utilization) for the weekend days

Group	Test number	Number of days tested	Number of hours tested	F-ratios B	C
1	1	18	16	2.97	40.25
2	2	15	16	(0.67)	11.82
3	3	15	16	5.96	8.59

Note: The F-ratio circled is nonsignificant at the 95 percent level.

In choosing representative days for this classification Tables 29, 30, 31 and 32 were studied.

The representative day selected in each group was:

1. group 1 - Sunday, April 20;
2. group 2 - Sunday, January 19;
3. group 3 - Saturday, November 2.

Table 30. The week by day means for the sample data (total vehicle utilization) on the weekend days

Quarter		Weeks 1	2	3	4	5	6	7	8	9	10	Grand means
Summer	Sat	33	41									37
	Sun											
Grand means		33	41									
Fall	Sat	126	196	139	194	118	118	205	(176)	104	174	155
	Sun	145	250	116	133	109	116	104	127	148	142	129
Grand means		135	173	127	163	113	117	155	152	126	158	
Winter	Sat	212	120	186	160	145	140	132	184			160
	Sun	181	154	178	156	168	(156)	138	178			164
Grand means		196	137	182	158	157	148	135	181			162
Spring	Sat	137	104	94	298	98	158					148
	Sun	126	(118)	124	112	99	133					118
Grand means		132	111	109	205	99	146					133

Note: The days circled are the representative days selected.

The standard error for group one is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{572}{288}} = \sqrt{1.985} = 1.41$$

The degrees of freedom on which this standard error is based = 255.

The standard error for group two is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{1190}{240}} = \sqrt{4.97} = 2.23$$

The degrees of freedom on which this standard error is based = 210.

The standard error for group three is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{2985}{240}} = \sqrt{12.44} = 3.53$$

The degrees of freedom on which this standard error is based = 210.

Table 31. The results of the multiple range tests for the day means for the sample data (total vehicle utilization) on weekend days for the period Sept. 1, 1968 - May 24, 1969

Group 1

P	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SSR		2.77	2.92	3.02	3.09	3.15	3.19	3.23	3.27	3.29	3.32	3.34	3.36	3.38	3.40	3.41	3.43	3.44
LSR		3.91	4.12	4.26	4.36	4.44	4.50	4.55	4.61	4.64	4.68	4.71	4.74	4.77	4.79	4.81	4.84	4.85
Means	94	98	99	104	104	104	109	112	116	116	118	118	118	120	124	126	126	217

Group 2

P	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SSR															
LSR		6.18	6.51	6.73	6.89	7.02	7.11	7.20	7.29	7.34	7.40	7.45	7.49	7.54	7.58
Means	132	133	133	137	138	139	140	142	145	145	148	150	154	156	156

Group 3

P	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SSR															
LSR		9.78	10.31	10.66	10.91	11.12	11.26	11.40	11.54	11.61	11.72	11.79	11.86	11.93	12.00
Means	158	160	168	174	176	178	178	181	184	186	194	196	205	212	298

Note: Any two means not underscored by the same line are significantly different.

Table 32. The number of vehicles using the ramp on the days specified during the weekend days

Group	Quarter	Sample Week		Hourly customers		All other customers	
				Sat.	Sun.	Sat.	Sun.
1	Fall	1	3	---	468	198	121
		1	3	---	468	198	121
		5	5	255	492	172	109
		6	6	197	584	182	137
		9	7	212	603	160	118
	Winter	2	8	213	485	187	123
	Spring	2	1	---	518	---	121
		3	2	160	(508)	146	(125)
		5	3	165	520	178	111
			4	---	475	---	107
			5	---	449	---	103
Totals				1202	5102	1223	1175
Means				201	510	175	118
2	Fall	3	1	472	547	200	126
			2	---	502	---	115
			4	---	582	---	128
			9	---	547	---	92
			10	---	453	---	114
	Winter	5	2	282	585	179	101
			4	---	(536)	---	(117)
		6	6	216	510	161	112
			7	---	532	---	112
		7		318	---	207	---
	Spring	1	6	237	430	189	116
Totals				1525	5334	936	1133
Means				305	533	156	113
3	Fall	2	4	347	---	205	---
		4		454	---	199	---
		7		453	---	203	---
		8		(349)	---	(202)	---
		10		264	---	---	---
	Winter	1	1	165	666	197	129
		3	3	228	538	226	106
		4		220	---	207	---
		8	5	195	610	181	120
			8	---	523	---	123
	Spring	6		306	---	201	---

Table 32 (Continued)

Group Quarter	Sample Week	Hourly customers		All other customers	
		Sat.	Sun.	Sat.	Sun.
Totals		2981	2315	1821	478
Means		298	579	202	120

Note: The days circled are the representative days selected in each group.

Quarter-Breaks and Vacations

The utilization of the ramp by hourly customers and monthly customers during quarter-breaks and vacations is far below average and is subject to large variations. For this reason ANOV tests were not run on this classification.

A representative day for this classification was selected by studying the tables in Appendix A and Table 33.

Table 33. The number of vehicles using the ramp during quarter-breaks and vacations and the income from hourly customers

Date	Day	Total customers	Hourly customers	All other customers	Employees only	Income hourly customers
Dec 22	Sun	250	224	26	15	$24.52
23	Mon	103	20	83	50	4.75
26	Thurs	81	14	67	65	7.47
27	Fri	277	187	90	71	64.26
28	Sat	67	21	46	25	5.87
29	Sun	197	179	18	10	53.02
Jan 2	Thurs	179	60	119		24.62
3	Fri	167	54	113		
Apr 4	Fri	260	104	156		37.19
5	Sat	106	32	74		11.31
7	Mon	390	168	222		
May 26	Mon	214	56	158	145	25.29
27	Tues	256	87	169	144	23.07
28	Wed	211	60	151	149	30.41
29	Thurs	205	71	134	118	23.63
31	Sat	107	47	160	158	23.28
					Total income =	$347.69

$$\text{Average income per day} = \frac{\$347.69}{14} = \$24.84$$

The representative day selected was Monday, May 26, 1969, with an income of $25.29 from hourly customers.

Employees and Other Credit Card Users

A check was made using a traffic counter, on employees and other credit card users (hereafter referred to as employees) using the ramp each quarter. As previously stated each individual (there are approximately 250 credit cards in use) issued a credit card is able to use the ramp free of charge. The ramp attendant records departure of credit card user vehicles.

A sample of the ramp utilization by these individuals is given in Appendix A.

The F-ratios for the ANOV tests run on this data are listed in Table 34.

Table 34. The F-ratios for the analysis of variance tests run on the ramp utilization data (Appendix A) for the employees

Quarter	Test no.	Days tested	No. of weeks tested	No. of hours tested	F-ratios A	B	AB	C	AC	BC
Summer	1	Mon-Fri	1	16		9.42		144.05		
Fall	2	Mon-Fri	2	16	76.61	2.48	7.10	303.15	(1.44)	(1.30)
Fall	3	Sat,Sun	2	16	40.90	115.79	19.95	24.17	(1.49)	29.47
Winter	4	Mon-Fri	1	16		8.58		108.67		
Spring	5	Mon-Fri	1	16		6.71		203.09		
Spring	6	Sat,Sun	1	16		(0.002)		(0.56)		
S,F,W,S*	7	Mon-Fri	5	16	72.66	(2.11)	8.07	730.53	1.37	(1.28)
F,S**	8	Sat,Sun	3	16	10.87	25.06	9.93	9.39	(0.51)	11.52

Note: The F-ratios circled are nonsignificant at the 95 percent level.

*Data from all four quarters were used in this test.

**Data from Fall and Spring quarters were used in this test.

Employee ramp utilization during class days

In choosing a representative day for the employees during class days the tables in Appendix A were studied in addition to Tables 34, 35, 36 and 37.

The representative day selected was Tuesday, December 17, 1968.

Table 35. The week by day means for the ramp utilization data on employee vehicles during class days for the study period June 1, 1968 - May 31, 1969

Days	Weeks							
	Summer	Fall	Fall	Winter	Spring	Fall	Fall	Spring
Mon	41	47	35	37	49			
Tues	34	45	45	(42)	46			
Wed	44	49	40	39	45			
Thurs	36	50	39	37	53			
Fri	40	46	41	30	48			
Sat						15	22	18
Sun						11	12	18
Grand means	39	40	37	48	47	13	17	18

Note: The day circled is the representative day selected.

The standard error of the mean used in the multiple range test to compare week means for the employees during class days is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n_i}} = \sqrt{\frac{28}{80}} = \sqrt{0.35} = 0.592$$

The degrees of freedom on which this standard error is based = 240.

Table 36. The results of the multiple range test for the week means for the sample data (employee vehicle utilization) on the class days during the study period

P	2	3	4	5
SSR	2.77	2.92	3.02	3.09
LSR	1.64	1.73	1.79	1.83

Weeks	1	2	3	4	5
Means	37	39	40	47	48

Note: Any two means not underscored by the same line are significantly different.

The standard error of the mean used in the multiple range test to compare day means for the employees during class days is:

$$S_{\bar{x}} = \sqrt{\frac{S}{n}} = \sqrt{\frac{28}{80}} = \sqrt{0.35} = 0.592$$

The degrees of freedom on which this standard error is based = 240.

Table 37. The results of the multiple range test for the day means for the sample data (employee vehicle utilization) on the class days during the study period

P	2	3	4	5
SSR	2.77	2.92	3.02	3.09
LSR	1.64	1.73	1.79	1.83

Days	1	2	3	4	5
Means	41	42	42	43	43

Note: Any two means not underscored by the same line are significantly different.

Employee ramp utilization during weekend days

The data on employees in Appendix A, plus the ANOV tests run on employees during the weekend days resulted in selecting Saturday, April 26, 1969 as a representative day for weekend days.

Employee ramp utilization during quarter-breaks and vacations

Analysis of variance tests were not run on this data. During the Christmas vacation employee utilization of the ramp fluctuated considerably from day to day. Employee utilization of the ramp during spring quarter-break was somewhat similar from day to day.

The representative day selected for employees during quarter-breaks and vacations was Monday, May 26, 1969. This is the same day used as a representative day for total ramp utilization during quarter-breaks and vacations.

TESTING THE MODEL

The total ramp utilization, as previously stated, is made up of three populations: hourly customers, monthly customers and employees. Table 38 gives a complete listing of the representative days selected within each classification. These representative days were used to proceed with the analysis of ramp utilization for each population.

Table 38. The days selected as most representative of the ramp utilization for the study period June 1, 1968 - May 31, 1969

Classification	Representative Days
Summer quarter class days	Wednesday - August 7, 1968 Friday - August 9, 1968
Fall quarter class days	Friday - September 27, 1968 Wednesday - October 30, 1968
Winter quarter class days	Tuesday - January 14, 1969 Wednesday - January 29, 1969
Spring quarter class days	Monday - April 14, 1969
Weekend days	Saturday - August 10, 1968 Saturday - November 2, 1968 Sunday - January 19, 1969 Sunday - April 20, 1969
Quarter—breaks and vacations	Monday - May 26, 1969

The Estimated Present Ramp Utilization by Population for Each Classification

The tables in Appendix A show total ramp utilization and the ramp utilization by employee vehicles.

Hourly customers

The utilization and income from hourly customers was determined by analysis of the customer tickets issued to hourly customers on entering the ramp and collected from the hourly customers on leaving the ramp. These tickets record:

1. date in and time in,
2. date out and time out, and
3. customer charges.

This data was analyzed by the computer program listed in Appendix C. Figure 1 is indicative of the information from this analysis. Additional computer output for the representative days is included in Appendix C.

HOURLY CUSTOMER ANALYSIS

DAY ANALYZED	09-27-68
CUMULATIVE CAR HOURS	2000.90
TOTAL HOURLY PARKERS	393.00
INCOME-FOR DAY-HOURLY TICKETS	185.35
INCOME FOR DAY-CALCULATED	187.70
ACTUAL INCOME-CALCULATED INCOME	-2.35
AVERAGE INCOME PER CUSTOMER	0.47
AVERAGE PARKING TIME/CUSTOMER	5.09
NO.OF HRLY CARS ON RAMP-9 HRS+	34.00
INCOME FROM 9-HOUR PLUS CARS	53.50
AVG INCOME FROM MOST HR PARKERS	0.37
AVG RAMP TIME FOR MOST HR PARKERS	2.65
TOTAL TIME FOR CARS PARKED 9 HRS+	1050.43

TIME PARKED=NO.OF CARS THAT PARK-X-HRS
% PARKED=% OF CARS THAT PARK X-HRS

HOUR RATES	0.	.15	0.	1	0.	0.	1	0.	0.	1	0.	0.	1	0

TIME	TIME IN	TIME OUT	RAMP LOAD	TIME PARKED	PERCENT PARKED	HOURS PARKED	REV	AVG REV
1	1	0	22	57.	14.50	120.47	6.00	0.05
2	0	0	23	104.	26.46	0.0	0.0	0.0
3	0	0	23	76.	19.34	0.0	0.0	0.0
4	0	0	23	48.	12.21	0.0	0.0	0.0
5	0	0	23	26.	6.62	0.0	0.0	0.0
6	0	0	23	31.	7.89	0.0	0.0	0.0
7	38	2	23	5.	1.27	257.83	25.50	0.10
8	35	3	59	6.	1.53	209.33	20.75	0.10
9	33	10	91	6.	1.53	108.02	14.35	0.13
10	30	11	114	3.	0.76	90.33	11.85	0.13
11	42	31	133	3.	0.76	119.67	16.30	0.14
12	49	31	144	1.	0.25	171.55	18.10	0.11
13	38	54	162	1.	0.25	75.77	11.30	0.15
14	26	71	146	2.	0.51	48.05	7.50	0.16
15	25	49	101	1.	0.25	75.92	7.90	0.10
16	15	46	77	4.	1.02	39.13	4.05	0.10
17	4	38	46	2.	0.51	157.32	7.90	0.05
18	16	5	12	3.	0.76	55.93	6.50	0.12
19	3	3	23	0.	0.0	25.30	1.75	0.07
20	5	4	23	0.	0.0	136.53	7.15	0.05
21	5	18	24	1.	0.25	201.88	12.75	0.06
22	2	4	11	0.	0.0	44.33	3.15	0.07
23	4	3	9	1.	0.25	63.57	4.90	0.08
24	0	0	10	0.	0.0	0.0	0.0	0.0
25	0	0	0	12.	3.05	0.0	0.0	0.0
					100.00	2000.93	187.70	

Figure 1. The computer analysis of hourly customer tickets for September 27, 1968

Monthly customers

Each monthly customer receives a ticket on entering the ramp. These tickets are collected by the attendant on leaving the ramp but the time of departure is not recorded on these tickets. Arrangements were made for the ramp attendant to maintain a separate record of monthly customer and employee vehicles leaving the ramp. This record is available from December 13, 1968, to May 31, 1969.

An estimate of the ramp utilization by monthly customer vehicles was made from this information and the record of employees entering the ramp during selected days.

Table 39 shows the ramp utilization for each population for the representative class days.

The mean total ramp utilization for these days is given in Figures 2, 3, 4, and 5.

Table 39. The ramp utilization by population for the representative class days

Date	Population	Time of day																Percent
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Utilization
Sept 27	Monthly	138	177	197	199	181	170	185	191	175	142	103	93	84	84	87	85	23
	Hourly	59	91	114	133	144	162	145	101	77	46	12	23	23	24	11	9	12
	Employees	46	73	79	83	73	65	78	73	60	39	19	19	15	10	7	6	8
	Total	243	341	390	415	398	397	378	353	306	228	134	135	122	118	104	100	43
Oct 30	Monthly	163	204	209	212	205	196	196	189	170	124	101	99	98	101	98	94	25
	Hourly	40	85	119	115	103	115	99	107	83	32	24	33	56	48	15	6	11
	Employees	70	80	84	86	72	84	86	87	78	63	31	31	29	28	24	19	10
	Total	273	369	412	413	380	395	381	383	331	219	156	163	183	177	137	119	46
Jan 14	Monthly	168	193	206	216	221	216	223	215	212	206	185	181	180	185	183	182	32
	Hourly	36	66	103	122	113	115	119	133	111	75	40	67	95	90	59	40	14
	Employees	46	73	96	84	61	69	82	66	66	41	10	19	19	5	5	5	8
	Total	250	370	405	422	396	400	429	414	389	322	235	267	294	280	247	227	54
Jan 29	Monthly	141	230	243	250	250	242	235	238	232	227	207	201	194	193	182	188	35
	Hourly	35	55	93	98	97	109	112	96	78	54	46	59	95	75	33	7	11
	Employees	46	73	74	77	93	91	96	98	81	62	16	24	37	38	22	20	10
	Total	222	358	410	425	440	442	451	432	392	343	269	284	326	306	237	215	56
Apr 14	Monthly	89	198	209	216	200	196	201	208	201	181	149	140	135	136	131	133	27
	Hourly	50	79	131	146	114	110	127	130	101	51	19	24	95	89	19	3	13
	Employees	46	73	72	68	46	77	72	65	45	36	3	1	5	9	3	1	6
	Total	185	350	412	430	360	383	400	403	347	268	171	165	235	234	153	137	46
Means	Monthly	140	200	213	219	211	204	208	208	198	176	149	143	138	140	136	136	28
	Hourly	44	75	112	123	114	122	120	113	90	52	28	41	73	65	27	13	12
	Employees	51	74	81	80	69	77	83	78	66	48	16	19	39	18	12	10	8
	Total	235	358	406	421	395	403	407	397	353	276	193	203	232	223	176	160	48

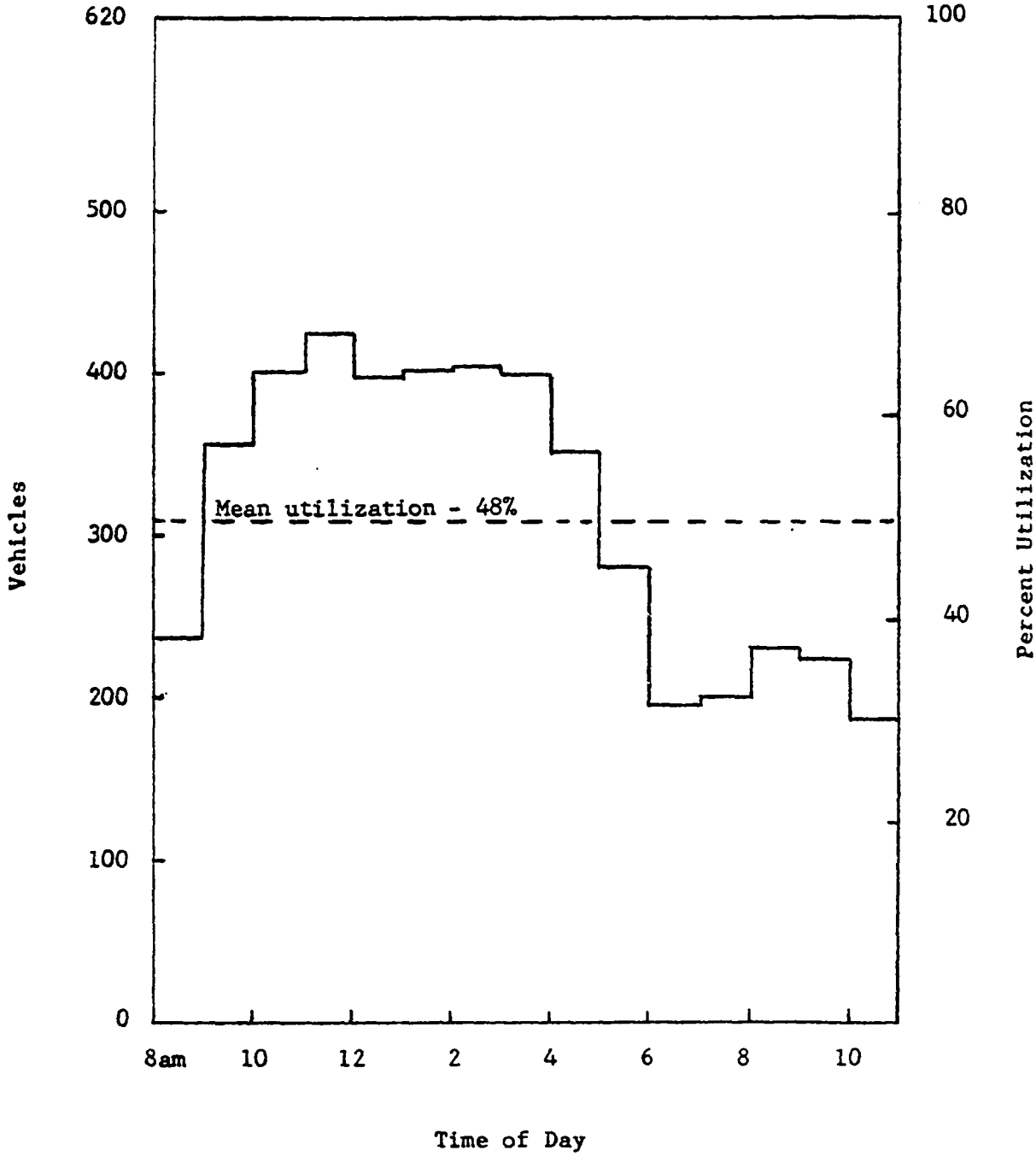

Figure 2. The estimated average total ramp utilization from 8 a.m. to 11 p.m. on the class days during the fall, winter and spring quarters

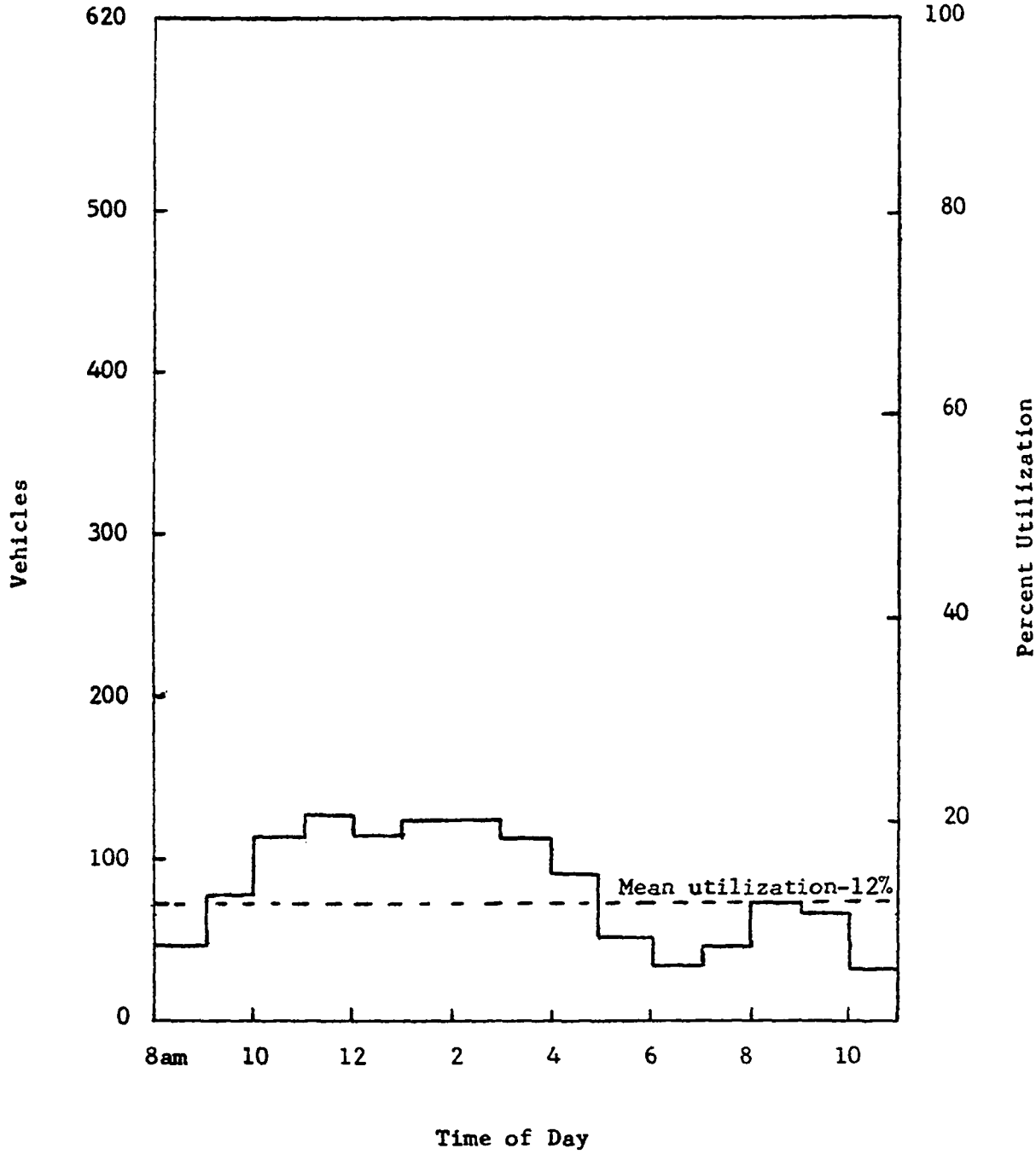

Figure 3. The estimated average ramp utilization for hourly customers from 8 a.m. to 11 p.m. on the class days during the fall, winter and spring quarters

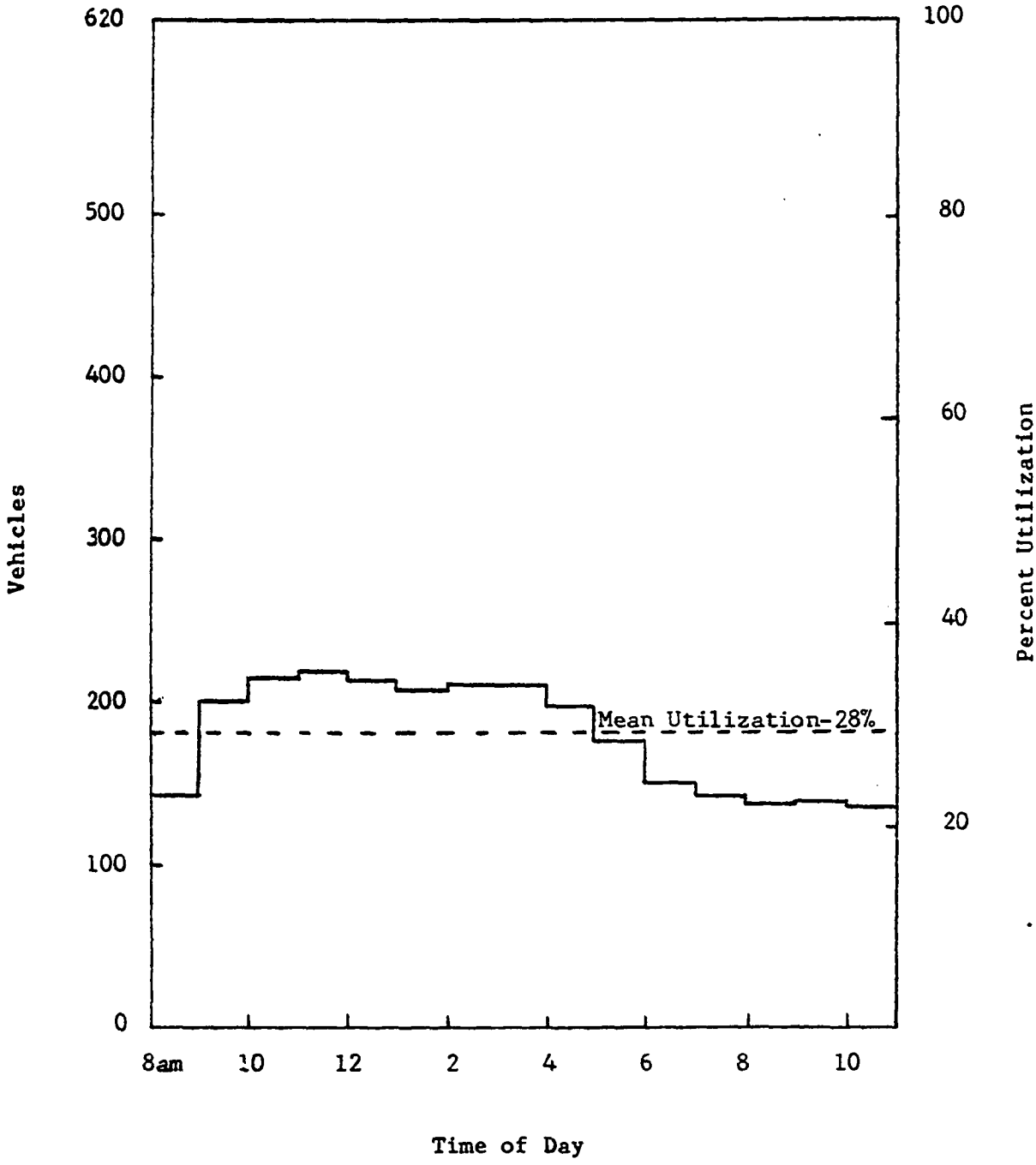

Figure 4. The estimated average ramp utilization for the monthly customers from 8 a.m. to 11 p.m. on the class days during the fall, winter and spring quarters

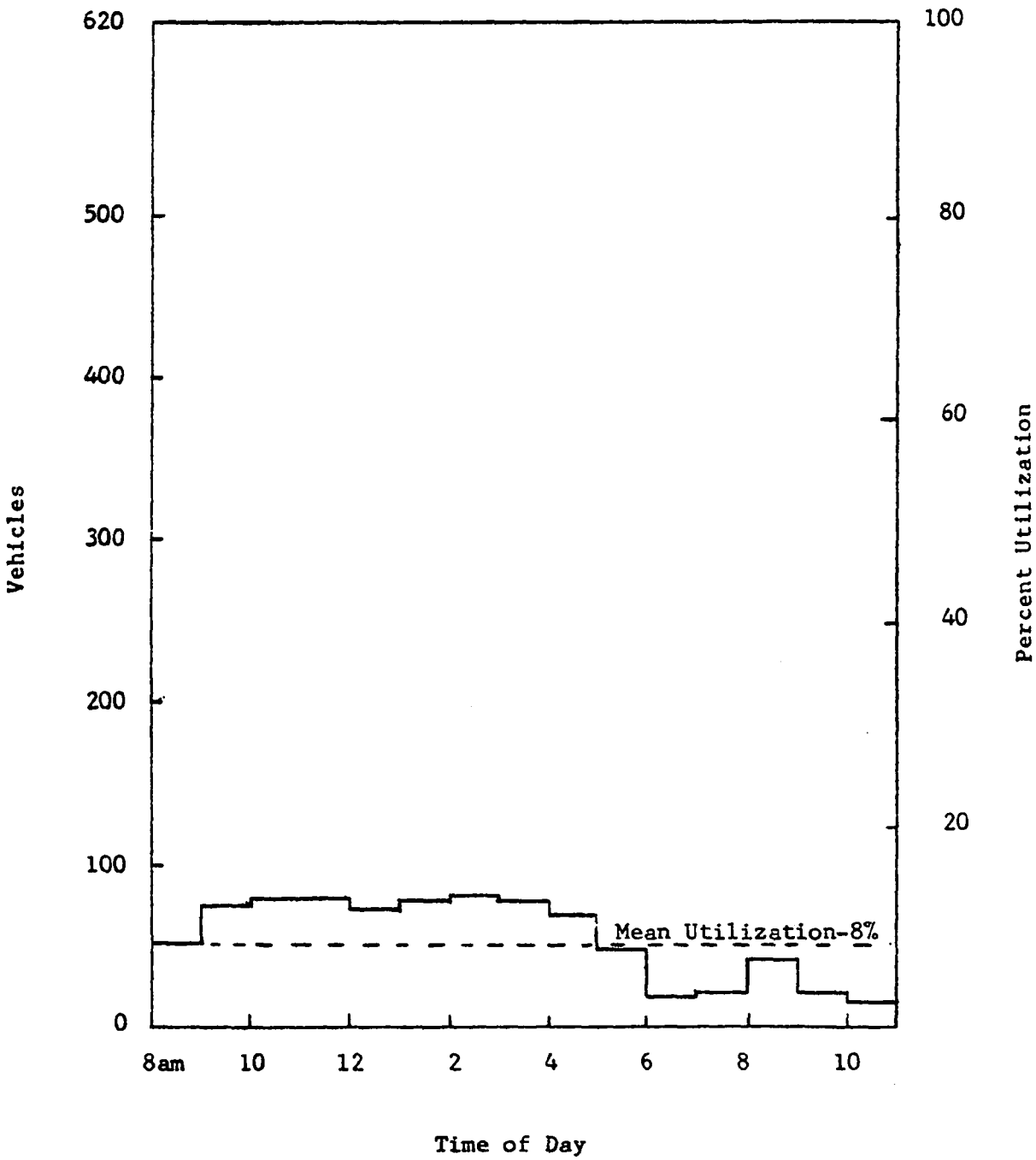

Figure 5. The estimated average ramp utilization for the employees from 8 a.m. to 11 p.m. on the class days during the fall, winter and spring quarters.

These figures and the ramp utilization tables in Appendix A display some interesting information regarding the ramp utilization.

1. The tables in Appendix A record the ramp utilization for a total of 276 days. Table 40 shows the number of days the ramp utilization reached a specified peak load.

Table 40. The number of days the peak ramp utilization reached the range of values indicated

Peak ramp utilization	Number of days	Percent of total days	Cumulative percent
Over 600 vehicles	1	0.36	0.36
550-600 vehicles	5	1.81	2.17
500-549 vehicles	7	2.54	4.17
450-499 vehicles	17	6.17	10.88
400-449 vehicles	38	13.75	24.63
350-399 vehicles	47	17.05	41.68
Below 350	161	58.32	100.00
Total days	276		

2. There is not a wide variation in the distribution of ramp utilization for each population.
3. The ramp load remains close to its maximum value between 10 a.m. and 3 p.m. daily for each population.
4. As indicated in Table 41 an average of 85 percent of the total monthly customers are on the ramp between 9 a.m. and 4 p.m.

Table 41. Ramp utilization by monthly customers as a percentage of total monthly customers from 9 a.m. to 4 p.m. for the representative class days

Representative day	Percent 9am	10	11	12	1pm	2	3	4	Totals	Means
Sept 27	71	79	80	72	68	74	77	70	591	74
Oct 30	82	84	85	82	78	78	76	68	633	79
Jan 14	77	82	86	89	86	89	86	85	680	85
Jan 29	92	97	100	100	97	94	95	93	768	96
Apr 14	88	93	96	89	87	89	93	89	724	91
Totals	410	435	447	432	416	424	427	405	3396	
Means	82	87	89	86	83	85	85	81		85

The Estimated Present Ramp Income by Population for Each Classification

The actual income from the ramp for the study period was $62,748.57.

The estimated income for the representative days selected is given in Table 42.

The estimated income differs from the actual income by $4,532.61 which is a percentage variance of 7.7 percent.

This error can be attributed to such factors as:

1. the difficulty in selecting representative days;
2. the small sample size of representative days selected;
3. an accurate record of the number of monthly customers and the income generated from these customers was not available; and
4. a separate record of income from hourly customers and monthly customers was not available for the first six months of the study period.

Table 42. The estimated income from the ramp for the study period June 1, 1968 - May 31, 1969

Representative days	Total days	Average no. of monthly customers	Daily income		Total daily income	Annual estimated income		
			Hourly	Monthly		Hourly	Monthly	Totals
Aug 7	29	60	150.35	16.26	166.61	4,360.15	471.54	4,831.69
Aug 9	29	60	61.80	16.26	78.06	1,792.20	471.54	2,263.74
Sept 27	25	250	185.35	67.75	253.10	4,633.75	1,693.75	6,327.50
Oct 30	33	250	147.20	67.75	214.95	4,857.60	2,235.75	7,093.35
Jan 14	33	250	189.90	67.75	257.65	6,266.70	2,235.75	8,502.45
Jan 29	23	250	161.85	67.75	229.60	3,722.55	1,558.25	5,280.80
Apr 14	54	225	175.90	60.40	236.30	9,498.60	3,261.60	12,760.20
Aug 10	22	60	23.65	16.26	39.91	520.30	357.72	878.02
Nov 2	22	250	148.10	67.75	215.85	3,258.20	1,490.50	4,748.70
Jan 19	18	250	48.90	67.75	181.65	880.20	1,219.50	3,269.70
Apr 20	18	225	49.25	60.40	109.65	886.50	1,087.20	1,973.70
May 26	59	Nil	25.29	0.00		1,492.11		1,492.11
Totals	365					42,168.86	16,083.10	58,251.96

Note: The actual income for the study period was $62,748.57. The income for hourly customers was, therefore, estimated to be $46,665.47.

The present income from hourly customers

The income from hourly customers for the study period was estimated to be $46,665.47. This income represents 74 percent of the total income for the period. The utilization of the ramp by hourly customers is estimated to be 25 percent of the total utilization.

The average parking times and the average income for hourly customers throughout the day for the representative days is given in Table 43.

The percentage of hourly customers that park for one hour, two hours, etc., for the representative days is given in Table 44.

It is interesting to note from these tables that an average of 51 percent of the hourly customers park for a maximum of two hours.

Table 43. The average parking times and the average income for hourly customers on the representative days selected

Classification	Day	Average parking time (Hours)		Average income (Dollars)	
		Short time parkers	Total parkers	Short time parkers	Total parkers
Summer quarter class days	Aug 7	3.67	4.33	$0.47	$0.50
	Aug 9	2.20	3.36	0.32	0.38
Fall quarter class days	Sept 27	2.65	5.09	0.37	0.47
	Oct 30	2.76	3.16	0.39	0.40
Winter quarter class days	Jan 14	2.85	5.22	0.39	0.51
	Jan 29	2.60	3.00	0.37	0.39
Spring quarter class days	Apr 14	2.68	3.19	0.37	0.41
Weekend days	Aug 10	1.63	2.20	0.25	0.28
	Nov 2	3.01	3.37	0.41	0.43
	Jan 19	1.42	2.10	0.25	0.28
	Apr 20	1.46	2.65	0.26	0.30
Means		2.45	3.43	0.35	$0.40

Note: Short time parkers do not include any vehicles parked 9 hours or over.

Table 44. The percentage of hourly parkers that park one hour, two hours, etc. for the representative days selected.

Classification	Day	The percentage of customers that park 1-hour	2-hours	3-hours	4-hours	over 4-hours
Summer quarter class days	Aug 7	17.94	15.61	13.95	10.30	42.20
	Aug 9	27.78	24.69	12.38	13.58	21.60
Fall quarter class days	Sept 27	14.50	26.46	19.34	12.21	27.49
	Oct 30	13.11	35.52	17.49	10.38	23.50
Winter quarter class days	Jan 14	10.37	26.06	18.62	13.56	31.39
	Jan 29	9.95	32.28	22.82	15.29	19.66
Spring quarter class days	Apr 14	10.85	34.87	22.40	9.24	22.64
Weekend days	Aug 10	28.92	40.96	13.25	9.64	7.23
	Nov 2	20.75	13.83	10.95	20.46	34.01
	Jan 19	37.79	43.60	8.72	1.16	8.73
	Apr 20	33.95	40.74	13.58	1.85	9.88
Means		20.53	30.42	15.77	10.69	22.58

The present income from monthly customers

The income from monthly customers for the study period was estimated to be $16,083.10. This income represents 26 percent of the total income for the period. The utilization of the ramp by monthly customers is estimated to be 58 percent of the total utilization.

Employees

Employees use the ramp free of charge. The utilization of the ramp by employees is estimated to be 17 percent of the total utilization.

ESTABLISHING PROPER CONTROLS OVER THE MODEL

The critical input parameters that should be considered in determining future ramp utilization and income are:

1. the rate of return desired,
2. the life of the investment,
3. parking rates,
4. average parking time for hourly customers
5. changes in operating costs,
6. changes in the distribution of ramp utilization, and
7. changes in parking spaces available elsewhere on campus.

The effect on ramp utilization and income of any significant changes in these factors can be analyzed by the computer programs listed in Appendix C.

Revenue Requirement Considerations

The average cost of money varies over time within any dynamic corporation. The present average cost of money to the Memorial Union is considered to be close to four percent. Use of four percent as the minimum attractive rate of return (MARR) would infer that management approves all projects with a prospective rate of return at least equal to the criteria (and thus, that there is no capital rationing); it is therefore recommended that a somewhat higher MARR value be used.

Sensitivity of revenue requirements to the rate of return

The revenue required to meet a return of four to eight percent is shown in Table 45. These rates of return are based on:

1. a ramp life of 50 years,
2. an increase in operating costs of 2 percent per annum, and
3. an estimated net salvage value for the land of $100,000.

The revenue requirements are calculated as follows:

1. The after tax cash flow required (ATCFR) = $1,265,366.27 $(a/p)^{i}_{50}$ - 100,00$(a/f)^{i}_{50}$ = K_1
2. Income tax = 0 = K_2
3. Operating costs = Annual equivalent operating costs + sales tax = K_3

Table 45. The revenue requirements from the ramp to meet the MARR specified (50 year life)

MARR (Percent)	ATCFR	Operating costs	Sales tax	Revenue requirements
4	58,248	27,759	2660	88,667
5	68,839	26,747	2956	98,542
6	79,931	25,861	3272	109,064
7	91,442	25,103	3604	120,149
8	103,257	24,449	3950	131,656

Sensitivity of revenue requirements to ramp life

The ramp life of 50 years used in this study may be high. Literature on parking ramps usually quote a ramp life of 25 to 30 years. Tables 45 and 46 give one an indication of the sensitivity of the revenue requirements to ramp life and rate of return.

The revenue requirements based on a 50 year life should be considered as being somewhat conservative.

Table 46. The revenue requirements from the ramp to meet the MARR specified (30 year life)

MARR (Percent)	ATCFR	Operating costs	Sales tax	Revenue Requirements
4	71,393	27759	3067	102,219
5	80,807	26747	3326	110,880
6	90,664	25861	3604	120,129
7	100,917	25103	3898	129,918
8	111,519	24449	4205	140,173

Monthly customer rate structure

Employees are estimated to require approximately 80 parking locations during peak loads. If the remaining 540 parking spaces available could be sold to monthly customers the cost per monthly parking space to meet the revenue requirements with MARR at 5 percent based on a 50 year life would be:

Revenue requirements = $98,542

Monthly rate per parking space $= \frac{\$98,542}{(12)(540)} = \underline{\$15.21}$

On this basis the present monthly rate of $8.24 may be considered low.

The Basis for the Projections of the Ramp Utilization and Income

There were several factors considered in arriving at a realistic ramp growth rate on which to base future utilization and income. These factors were:

1. student enrollment growth rate,
2. historical data on ramp utilization and income,
3. long range plans of the Memorial Union,

4. closing the parking lot between the Memorial Union and the women's gymnasium, and
5. future campus parking facilities.

Student enrollment growth rate

The projected student enrollment figures, from 1965-77 inclusive listed in Table 47 were obtained from the Office of Admissions and Records. These figures were established by the Office of Admissions and Records through a careful study of such factors as, historical data and high school enrollments throughout the state. These projections have proven to be reasonably accurate in the past. The remaining figures were estimated by the writer through extrapolation of past trends. According to the Office of Admissions and Records the student enrollment will level off at approximately 25,000 students about 1980. The extrapolation procedure estimates an enrollment of 25,200 students in 1980. This value has been assumed as the maximum student enrollment.

Table 47. The historical and projected student enrollment figures for the fall quarter of each year indicated

Year	Students	Percent increase
1965	14014	
1966	15128	7.94
1967	16841	11.32
1968	18100	7.47
1969	19150	5.80
1970	20100	4.96
1971	20700	2.98
1972	21300	2.89
1973	21900	2.81
1974	22500	2.73
1975	23100	2.66
1976	23600	2.16
1977	24100	2.11
1978	24500	1.65
1979	24900	1.63
1980	25200	1.20

Historical data on ramp utilization and income

An effort was made to determine the expected future growth rate for the ramp utilization based on historical ramp data. The second year of operation shows an estimated increase in utilization of 18 percent over year one. This growth is partially attributed to students becoming familiar with the ramp facilities. Tables 48 and 49 do not indicate any growth rate trends for the study period. Winter quarter shows a significant increase in utilization over fall quarter. However, spring quarter shows a drop in ramp utilization from winter quarter. The greater utilization occurring in the winter quarter is attributed to the colder weather conditions.

This information would indicate that the ramp has not been in operation for a long enough period of time to allow one to feasibly project future utilization based on historical data.

Table 48. The week means (total ramp utilization from 8 a.m. to 11 p.m.) for fall, winter, and spring quarters

Quarter	1	2	3	4	5	6	7	8	9	10
Fall	203	204	208	217	218	223	231	232	236	253
Winter	254	269	273	274	279	285	289	309		
Spring	213	218	229	240	241	264				

Table 49. The day means (total ramp utilization from 8 a.m. to 11 p.m.) for fall, winter, and spring quarters

Quarter	Day 1	2	3	4	5	6	7
Fall	129	155	222	248	258	264	282
Winter	160	164	299	321	322	342	345
Spring	118	148	244	276	279	282	292

Long range plans of the Memorial Union

The long range plans of the Memorial Union should have an effect on the ramp utilization.

Removal of parking meters

The income from the 38 parking meters east of the Memorial Union is included in the total ramp income. The removal of these meters is estimated to occur in 1974 or 1975. The sample data collected on the utilization of these meters is presented in Table 50.

Table 50. The number of meters utilized at the times specified

Date	Time of day																Means
	8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	
Oct 25								19	18								19
27								19	15	10							15
29									15	12							14
30													22	16		18	19
31				15	25	26											22
Nov 1									14	16				31			20
3								14									14
5										22							22
6														29			29
8		6	14							21							14
13														9			9
15								21									21
22									13								13
Dec 3								35									35
4											22	25					24
6										35							35
May 6	13	14	16	21	20	24	26	21	24	18	23						20
Means	13	10	15	18	23	25	26	18	20	18	23	25	22	21		18	20

The mean utilization per hour of these meters is estimated to be 20 vehicles during class days. The actual income from these meters averages $15.00 to $17.00 per day.

The ramp utilization during peak loads by hourly customers is expected to be approximately 200 vehicles by 1975. On this basis the removal of the meters should result in an increase in the ramp utilization by hourly customers during class days of approximately ten percent. This increase in utilization should result in an estimated three percent increase in ramp revenue. This assumption is based on the present mean ramp income of $0.133 from hourly customers as compared to the present meter rate of $0.10 per hour.

Additional guest rooms

The Memorial Union presently has 42 guest rooms. These rooms represent a dual advantage to the ramp utilization in that they not only increase the utilization by hourly customers but they also utilize the ramp overnight when the total utilization is low.

The present income from the ramp generated by room guests, based on the representative days, is given in Table 51. The income recorded includes all income from the tickets recording departure from the ramp on the day specified. For example, a ticket recording an entrance time dated the 14th and a departure time dated the 15th is recorded as income for the 15th.

The opening of the Iowa State Center should insure a high occupancy rate for the present guest rooms, and any additional guest rooms added.

Plans have not been finalized as to the number of additional guest rooms to be added, or when the guest rooms may be added.

Table 51. The ramp income from guest rooms for the representative days selected

Day	Income
Aug 7	$ 16.50
Aug 9	5.05
Sept 27	15.10
Oct 30	0.00
Jan 14	25.15
Jan 29	7.80
Apr 14	15.45
Aug 10	0.00
Nov 2	18.65
Jan 19	6.95
Apr 20	11.10
	$121.75

The following analysis is based on three assumptions:

1. The estimated ramp income per day per guest room is:

$$\frac{\$121.75}{(11)(42)} = \$0.263$$

2. Fifty additional guest rooms will be ready for use in 1980.

3. The income from the ramp in 1980 will be at least $90,000.

The increase in ramp income per year, by hourly customers, due to additional guest rooms will be:

($0.263) (50 rooms) = $13.15 per day

($13.15) (365 days) = $4,799.75

The additional guest rooms, based on the above assumptions, will represent a 5.3 percent increase in ramp income.

Other long range plans of the Memorial Union are either not expected to affect the ramp utilization appreciably, or have been accounted for

elsewhere. For example, additional student offices, book store expansion, and food service expansion is assumed to be accounted for by the additional ramp utilization due to student enrollment increases.

Closing the parking lot located between the Memorial Union and the women's gymnasium

The large parking lot located between the Memorial Union and the women's gymnasium, which holds in excess of 500 vehicles, is open to visitor parking. The use of this lot by visitors has a significant impact on the utilization of the ramp by hourly customers.

Table 52 shows a limited sample of data on the use of this lot by visitors. This data suggests that a large number of visitors now park in this lot who would probably park on the ramp if this lot were closed to visitors.

Table 52. The utilization of the parking lot between the Memorial Union and the women's gymnasium, by visitors at the times specified

Day	Date	Time of Day 8am	9	10	11	12	1pm	2	3	4	5	6	
Fri	May 6	27	60	80	81	46	53	41	46	40	16	5	
Wed	June 11			98	155	117	127			99		20	
Fri	June 13		97	110		86		97		48			
Mon	June 16	94											
Tues	June 24		85	96			77					15	
Wed	June 25		69		85								
Totals		121	311	384	321	249	257	138	46	187	16	40	2070
Means		61	78	96	107	83	86	69	46	62	16	13	65

There are several reasons why this lot should be closed to visitors. Such as:

1. The maintenance of this lot is entirely financed through parking fees and therefore should be reserved for university personnel.
2. The increased utilization of the ramp would allow the ramp to operate at a lower rate structure than will be necessary to meet the minimum attractive rate of return under the present conditions.
3. The utilization of the ramp during quarter-breaks and the summer quarter, when ramp utilization is low, would be significantly increased.

Table 52 indicates a mean utilization of 65 visitor vehicles between the hours of 8 a.m. and 6 p.m. Their average parking time is estimated to be 2.77 hours. This average parking time is based on the average parking time for hourly parkers (parking less than 9 hours) during class days.

Daily income from these hourly parkers is estimated to be:

$$\frac{717 \text{ vehicle hours}}{2.77 \text{ hours per vehicle}} \quad (\$0.38 \text{ per vehicle}) = \underline{\$98.36}$$

This income is estimated to occur for 226 days during the year (365 days less 59 days for quarter-breaks and vacations and 80 days for weekends).

$$\text{Annual estimated income} = (\$98.36)(226 \text{ days}) = \underline{\$22,229.36}$$

This income is 47.7 percent of the entire estimated income of $46,665.47 generated by the hourly customers during the year under stud

Future campus parking facilities

An extensive traffic and parking survey (3) of the Iowa State Camp was published in 1966. This survey indicates that there is presently a shortage of parking spaces on campus and that this situation is likely become more critical as time passes.

Table 53. Estimates of future campus parking permit demands*

	1967	1967	1970	1975
Faculty and staff	3,055	4,055	4,400	5,200
Students parking on campus	2,572	2,572	2,750	3,280
Total	5,627	7,627	7,150	8.480
Parking spaces available	4,083	4,083		

*Figures issued by the University Traffic Committee.

In order for future university constructed ramps to have any significant impact on the Memorial Union ramp present parking restrictions on students would have to be reduced considerably. This change in policy not likely to occur.

The construction of ramps on campus by the university would cost excess of $2,000.00 per vehicle space. In order for these ramps to be self supporting monthly parking rates would need to be:

Assumptions:

1. the cost of money is 5 percent,
2. the ramp life is 50 years,
3. operating expenses are $25,000 per year for a 600 vehicle ramp, and
4. the ramp cost equals $2,500 per vehicle space.

Annual revenue requirements:

$$\begin{aligned} \text{ATCFR} &= \$1{,}500{,}000(a/p)^{5\%}_{50} &&= \$77{,}170 \\ \text{Operating expenses} &&&= \underline{25{,}000} \\ & &&\underline{\$102{,}170} \end{aligned}$$

Annual revenue requirements per vehicle space $= \frac{102{,}170}{600} = \underline{\$170.29}$

These figures indicate that it would be necessary to charge a minimum monthly parking rate of $15.00 or that the university would need to subsidize the ramps. Neither alternative seems feasible at the present time.

THE ESTIMATED FUTURE RAMP UTILIZATION AND INCOME

The ramp utilization is expected to follow a growth rate for hourly customers (during class days each quarter) indicated as growth rate A in Table 54. This growth rate is slightly higher than the student enrollment growth rate because the parking problems on campus are expected to become more acute and the distance that students will have to travel to campus is expected to increase as the campus population increases. The additional increases in utilization in 1975, and 1980 are respectively due to the removal of the 38 parking meters west of the Memorial Union and the estimated additional guest rooms added to the Memorial Union.

The ramp utilization is expected to follow a growth rate for hourly customers during class days indicated as growth rate B in Table 54. This growth rate shows a sharp increase in ramp utilization by hourly customers from 1971 on. This increased growth rate is due to closing the parking lot located between the Memorial Union and the women's gymnasium to visitors. The number of vehicles in this lot on May 6, 1969 was used to arrive at the estimated 40 percent increase in ramp utilization by hourly customers in 1971. This estimate is considered to be conservative.

The ramp utilization is expected to follow a growth rate for employees and hourly customers on weekends and during quarter breaks and vacations indicated as growth rate C in Table 54. The utilization of the ramp by these classifications is expected to grow at approximately the same rate as the student enrollment growth rate.

Table 54. The estimated increase in ramp utilization over the life of the ramp

	Year											
	70	71	72	73	74	75	76	77	78	79	80	81
Growth rate A in percent	7	6	4	4	4	14	4	3	3	3	7	2
Growth rate B in percent	7	46	4	4	4	14	4	3	3	3	7	2
Growth rate C in percent	6	5	3	3	3	3	3	2	2	2	2	1

Note: The ramp utilization is expected to level off in 1981. The additional increases in growth rate "A" were due to the removal of the parking meters in 1975 and an estimated addition of 50 guest rooms to the Memorial Union in 1980.

The significant increase in growth rate "B" was due to the closing of the parking lot located between the Memorial Union and the women's gymnasium to visitors.

The Effect of Different Pricing Policies on the Ramp Income

In determining the income from the ramp over the life of the investment several pricing policies were considered.

Projections were made on the basis of the existing price structure and the present number of monthly customers. This policy was evaluated with and without the parking lot between the Memorial Union and the women's gymnasium being closed to visitors.

The hourly rate structure was then varied while holding the monthly rate at $8.24. The following increases were independently simulated.

1. The rate for the first hour was increased from $0.15 to $0.20.
2. The rate for the second hour was increased from $0.10 to $0.15.
3. The rate for the first hour was increased from $0.15 to $0.20 and the rate for the second hour was increased from $0.10 to 0.15.

The above increases were then independently simulated using a monthly rate of $10.30 and $12.36 respectively.

The hourly customers were then charged on a half hour basis rather than on an hourly basis. The following price structures were independently simulated.

1. The rate for the first half hour was set at $0.10.
   The rate for the second half hour was set at $0.05.
   The rate for each additional half hour was set at $0.05.
2. The rate for the first half hour was set at $0.10.
   The rate for the second half hour was set at $0.10.
   The rate for the third half hour was set at $0.05.
   The rate for each additional half hour was set at $0.05.
3. The rate for the first half hour was set at $0.10.
   The rate for the second half hour was set at $0.10.
   The rate for the third half hour was set at $0.10.
   The rate for the fourth half hour was set at $0.05.
   The rate for each additional half hour was set at $0.05.
4. The rate for the first half hour was set at $0.10.
   The rate for the second half hour was set at $0.10.
   The rate for the third half hour was set at $0.10.
   The rate for the fourt half hour was set at $0.10.
   The rate for each additional half hour was set at $0.05.

A nominal charge should be made to employees and other credit card holders using the ramp. This charge can either be made to the individual credit card holder or to the Memorial Union and considered as a fringe

benefit to the credit card holder. Five dollars and fifteen cents per month may be considered as a reasonable charge to these customers. This charge was arrived at on the following basis:

1. There are approximately 250 credit cards issued to employees and other individuals.
2. These customers presently utilize an average of 42 parking spaces on class days from 8 a.m. to 11 p.m.
3. These customers presently utilize approximately 90 parking spaces during peak loads on class days.
4. Using a MARR of four percent the break-even rental per parking space is $14.30.

On this basis a reasonable charge to employees is:

$$\left(\frac{90}{250}\right)\$14.30 = \$5.15 \text{ per month}$$

Monthly parkers versus hourly parkers

In an evaluation to determine the break-even point between hourly customers and monthly customers there are several factors that should be considered. They are:

1. The time of the day critical to this particular analysis is between 9 a.m. and 4 p.m. These are the hours of the day for which the ramp undergoes maximum utilization.
2. Class days during the fall, winter, and spring quarters are the critical days to be considered. It is on these days, during the hours of 9 a.m. and 4 p.m., that a monthly customer utilizing the ramp is most likely to result in a loss in revenue from hourly customers.

3. The rate structure is critical to the analysis.

4. It is assumed that an hourly customer who finds the ramp full represents revenue lost. The amount of revenue lost from hourly customers is the critical factor in determining the break-even point between hourly and monthly customers.

Table 55 indicates the percentage of customers who park one hour, two hours, etc. during the representative class days selected.

Table 55. The percentage of vehicles parked one hour, two hours, three hours, etc. during the class days indicated

Day	The percentage of customers that park the number of hours specified								
	1	2	3	4	5	6	7	8	9
Sept 29	14.50	26.46	19.34	12.21	6.62	7.89	1.27	1.53	10.18
Oct 30	13.11	35.52	17.49	10.38	6.28	4.10	1.37	3.55	8.20
Jan 14	10.37	26.06	18.62	13.56	5.85	4.52	3.72	2.39	14.91
Jan 29	9.95	32.28	22.82	15.29	7.04	5.34	1.94	0.97	4.37
Apr 14	10.85	34.87	22.40	9.24	5.08	2.54	4.39	3.00	7.63
Totals	58.78	155.19	100.67	60.68	30.87	24.39	12.69	11.44	45.29
Means	11.76	31.04	20.13	12.14	6.17	4.88	2.54	2.29	9.06

Table 56 indicates the average income per hour from hourly customers for the class days during the fall, winter and spring quarters for the hours specified.

Figures 6 and 7 are representative of the computer output in determining the future ramp utilization, income, trade-off between hourly and monthly customers and the suggested rates for monthly parkers.

The computer analysis maintains a constant rate for monthly customers until the ramp reaches maximum utilization for at least one hour of the

day. The program then calculates a new rate for monthly customers on the following basis:

1. The program calculates a day rate from the monthly rate in effect. For example, a monthly rate of $8.24 is equivalent to a day rate of $0.271.
2. The program then calculates an hourly rate for a monthly customer by dividing the day rate by the number of hours for which the ramp is operating at full capacity. For example, if the ramp were operating at full capacity for two hours each day the income per hour from monthly customers would be calculated as 0.271/2 = $0.136.
3. The calculated hourly rate for monthly customers is then increased by an amount representing the number of monthly parking spaces paid for but not utilized during the period of maximum utilization. It is assumed that the parking spaces not utilized by monthly customers are rented to hourly customers. Monthly customers generate income during the weekends and during class days (a total of 226 days per year). The ramp is estimated to reach maximum utilization only during the class days of fall, winter, and spring quarters (168 days per year). Therefore, the hourly rate for monthly customers is further increased the ratio of 226/168. For example, assume there are 250 monthly customers and a maximum of 225 parking spaces utilized by these customers during the two hours the ramp operates at maximum capacity. The hourly rate for monthly customers, using an hourly rate of $0.133 for hourly customers, would be:

$$(\$0.136)(1.35) + \frac{(250-225)(0.133)}{250} = \$0.197 \text{ per hour}$$

4. The hourly rate for monthly customers calculated is then compared to the average hourly rate for hourly customers from Table 56. If the hourly rate for monthly customers is below the hourly rate for hourly customers the rate for monthly customers is adjusted to make the two rates equivalent.

Table 56. The average income per hour from hourly customers entering the ramp at the time specified for the representative class days during the fall, winter, and spring quarters

Rate no.	Rate structure in dollars	The mean hourly income for times specified 9am	10	11	12	1pm	2	3	4	Grand means
	Hour rates									
1	0.15 0.10 0.10	.114	.126	.128	.130	.138	.152	.138	.126	.133
2	0.15 0.15 0.10	.122	.138	.142	.147	.156	.174	.162	.134	.147
3	0.20 0.10 0.10	.128	.142	.140	.148	.158	.176	.166	.154	.152
4	0.20 0.15 0.10	.136	.154	.154	.165	.176	.198	.190	.162	.167
	Half hour rates									
5	0.10 0.05 0.05	.106	.118	.120	.120	.126	.136	.126	.114	.121
6	0.10 0.10 0.05	.120	.132	.128	.138	.144	.158	.146	.134	.138
7	0.10 0.10 0.10 0.05	.128	.146	.144	.156	.164	.180	.168	.144	.154
8	0.10 0.10 0.10 0.10 0.05	.136	.154	.154	.168	.176	.196	.178	.146	.163

The ramp utilization base and hourly incomes used in the projections

January 29, 1969 shows the largest ramp utilization for monthly customers of the five representative class days.

Future ramp projections were based on the mean utilization during the class days selected except for monthly customers. January 29 was used as a basis for monthly customer utilization.

Future hourly income projections were based on the hourly incomes indicated in Table 57. The hourly income for class days during the year was assumed to experience the same growth rate. Either growth rate A or growth rate B from Table 54. All other classifications for hourly customers were assumed to experience growth rate C, in Table 54; the same growth rate as for employees.

The average hourly income between 9 a.m. and 4 p.m. for each rate structure was used in calculating the desired monthly income.

Table 58 indicates the total income from the ramp for selected years based on the rate structure stated. The rate of return on the investment is also listed for each rate structure.

The estimated incomes based on the various rate structures proposed (Rate 2 through Rate 8) assume inelastic demand over the price range considered.

Table 57. Estimated effect of various rate structures on annual revenues from hourly customers in each classification

Classification	Annual revenue in dollars for each rate							
	Rate-1	Rate-2	Rate-3	Rate-4	Rate-5	Rate-6	Rate-7	Rate-8
Class days - fall, winter, and spring quarters	32071.11	34910.62	35345.93	38426.59	29922.97	33255.86	36348.03	38835.38
Weekend days	6135.76	6723.54	6962.10	7552.19	5697.04	6430.09	7025.61	7465.00
Class days - summer quarter	6807.58	7338.64	7495.87	8031.75	6444.97	7078.72	7614.60	8068.65
Quarter-breaks and vacations	1651.02	1796.31	1826.03	1979.57	1542.05	1715.41	1868.95	1992.78
Total revenue from hourly customers	46665.47	50769.11	51629.93	55990.10	43607.03	48480.08	52857.19	56361.81

Table 58. The projected estimated annual revenue from the ramp for selected years using the rate structure indicated.

Rate	Growth rate	Annual revenue for the year indicated 1970	1972	1975	1978	1981	1985	Rate of return
1	A, C	65,937	70,870	78,788	85,525	93,403	93,403	3.50
2	A, C	70,321	75,686	84,296	91,623	100,188	100,188	4.04
3	A, C	71,239	76,692	85,439	92,882	101,578	101,578	4.16
4	A, C	75,897	81,811	91,296	99,368	108,797	108,797	4.75
5	A, C	62,670	67,280	74,682	80,980	88,347	88,347	3.13
6	A, C	67,875	72,998	81,220	88,215	96,393	96,393	3.70
7	A, C	72,551	78,136	87,099	94,726	103,640	103,644	4.34
8	A, C	76,296	82,252	91,811	99,945	109,454	109,454	4.79
1	B, C	65,937	88,175	98,769	107,785	115,339	115,339	5.19
2	B, C	70,321	94,492	106,010	115,813	124,107	124,107	5.67
3	B, C	71,239	95,762	107,457	117,411	125,963	125,963	5.77
4	B, C	75,897	102,490	115,173	125,967	135,301	135,301	6.43
5	B, C	62,670	83,468	93,373	101,803	108,751	108,751	4.75
6	B, C	67,875	90,952	101.949	111,309	119,155	119,155	5.41
7	B, C	72,551	97,705	109,693	119,896	128,565	128,565	5.97
8	B, C	76,296	103,130	115,916	126,799	135,980	135,980	6.48

Note: The same ramp utilization was assumed for each rate structure. The same average parking time per hourly customer was assumed for each rate structure.

YEAR	RAMP USAG	REVENUE	DEPN	INVEST TO PAY	EXPENSE	INT PAYMENT	CASH FLOW	PROFIT	USAGE HR	USAGE EMP	USAGE TOT	REV PER HOUR HR	REV PER MONTH MONTHLY CALC	REV PER MONTH MONTHLY PROP	REV PER MONTH EMP PROP	REVENUE PER YEAR PROPOSED MONTH	REVENUE PER YEAR PROPOSED EMPLOY	REVENUE PER YEAR PROPOSED TOTAL
1969	55	62749.	23307.	1218752.	21628.	45703.	41121.	-27889	123	80	453	0.133	0.011	8.24	5.15	16083.	15450.	62749.
1970	56	65937.	23307.	1195445.	22118.	44829.	43819.	-24317	131	84	465	0.133	0.011	8.24	5.15	16083.	15450.	81387.
1971	57	68846.	23307.	1172138.	22608.	43955.	46238.	-21024	138	88	476	0.133	0.011	8.24	5.15	16083.	15450.	84236.
1972	58	70870.	23307.	1148831.	23080.	43081.	47790.	-18598	143	90	483	0.133	0.011	8.24	5.15	16083.	15450.	86320.
1973	58	72972.	23307.	1125524.	23562.	42207.	49410.	-16104	148	92	490	0.133	0.011	8.24	5.15	16083.	15450.	88422.
1974	59	75155.	23307.	1102217.	24055.	41333.	51101.	-13539	153	94	497	0.133	0.011	8.24	5.15	16083.	15450.	90605.
1975	61	79788.	23307.	1078910.	24560.	40459.	54188.	-9578	174	96	520	0.133	0.011	8.24	5.15	16083.	15450.	94238.
1976	62	81198.	23307.	1055603.	25117.	39585.	56081.	-6810	180	98	528	0.133	0.011	8.24	5.15	16083.	15450.	96648.
1977	63	83602.	23307.	1032296.	25643.	38711.	57959.	-4058	187	99	536	0.133	0.011	8.24	5.15	16083.	15450.	99052.
1978	63	85525.	23307.	1008989.	26163.	37837.	59362.	-1782	192	100	542	0.133	0.011	8.24	5.15	16083.	15450.	100975.
1979	64	87504.	23307.	985682.	26694.	36963.	60809.	539	197	101	548	0.133	0.011	8.24	5.15	16083.	15450.	102954.
1980	65	89540.	23307.	962375.	27237.	36089.	62303.	2906	202	103	555	0.133	0.011	8.24	5.15	16083.	15450.	104990.
1981	66	93403.	23307.	939068.	27344.	35215.	65559.	7037	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1982	66	93403.	23307.	915761.	28345.	34341.	65059.	7410	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1983	66	93403.	23307.	892454.	28855.	33467.	64548.	7773	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1984	66	93403.	23307.	869147.	29376.	32593.	64027.	8126	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1985	66	93403.	23307.	845840.	29908.	31719.	63495.	8469	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1986	66	93403.	23307.	822533.	30450.	30845.	62953.	8801	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1987	66	93403.	23307.	799226.	31003.	29971.	62400.	9122	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1988	66	93403.	23307.	775919.	31567.	29097.	61836.	9432	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1989	66	93403.	23307.	752612.	32142.	28223.	61261.	9730	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1990	66	93403.	23307.	729305.	32729.	27349.	60674.	10018	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1991	66	93403.	23307.	705998.	33328.	26475.	60076.	10293	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1992	66	93403.	23307.	682691.	33939.	25601.	59465.	10557	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1993	66	93403.	23307.	659384.	34561.	24727.	59842.	10908	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1994	66	93403.	23307.	636077.	35196.	23853.	58207.	11047	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1995	66	93403.	23307.	612770.	35844.	22979.	57559.	11273	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1996	66	93403.	23307.	589463.	36505.	22105.	56898.	11486	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1997	66	93403.	23307.	566156.	37179.	21231.	56224.	11686	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1998	66	93403.	23307.	542849.	37866.	20357.	55537.	11873	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
1999	66	93403.	23307.	519542.	38568.	19483.	54836.	12045	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2000	66	93403.	23307.	496235.	39283.	18609.	54120.	12204	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2001	66	93403.	23307.	472928.	40013.	17735.	53391.	12348	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2002	66	93403.	23307.	449621.	40757.	16861.	52646.	12478	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2003	66	93403.	23307.	426314.	41516.	15987.	51887.	12593	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2004	66	93403.	23307.	403007.	42290.	15113.	51113.	12693	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2005	66	93403.	23307.	379700.	43080.	14239.	50323.	12777	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2006	66	93403.	23307.	356393.	43885.	13365.	49518.	12846	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2007	66	93403.	23307.	333086.	44707.	12491.	48696.	12898	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2008	66	93403.	23307.	309779.	45545.	11617.	47858.	12934	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2009	66	93403.	23307.	286472.	46400.	10743.	47003.	12953	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2010	66	93403.	23307.	263165.	47272.	9869.	46131.	12955	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2011	66	93403.	23307.	239858.	48161.	8995.	45242.	12940	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2012	66	93403.	23307.	216551.	49069.	8121.	44335.	12907	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2013	66	93403.	23307.	193244.	49994.	7247.	43409.	12855	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2014	66	93403.	23307.	169937.	50938.	6373.	42465.	12785	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2015	66	93403.	23307.	146630.	51900.	5499.	41503.	12697	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2016	66	93403.	23307.	123323.	52882.	4625.	40521.	12589	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
2017	66	93403.	23307.	100016.	53884.	3751.	39519.	12461	214	104	568	0.133	0.011	8.24	5.15	16083.	15450.	108853.
MARR EQUALS 3.50 PERCENT															MARR EQUALS	7.23	PERCENT	

Figure 6. The expected revenue and ramp utilization projections using rate 1 and growth rate A,C

YEAR	RAMP USAG	REVENUE	DEPN	INVEST TO PAY	EXPENSE	INT PAYMENT	CASH FLOW	PROFIT	USAGE HR	USAGE EMP	USAGE TOT	REV PER HOUR HR	REV PER MONTH MONTHLY CALC	REV PER MONTH MONTHLY PROP	REV PER MONTH EMP PROP	REVENUE PER YEAR PROPOSED MONTH	REVENUE PER YEAR PROPOSED EMPLOY	REVENUE PER YEAR PROPOSED TOTAL
1969	55	62749.	23307.	1218752.	21628.	45703.	41121.	-27889	123	80	453	0.133	0.011	8.24	5.15	16083.	15450.	62749.
1970	56	65937.	23307.	1195445.	22118.	44829.	43819.	-24317	131	84	465	0.133	0.011	8.24	5.15	16083.	15450.	81387.
1971	62	85486.	23307.	1172138.	23107.	43955.	62378.	-4683	191	88	529	0.133	0.011	8.24	5.15	16083.	15450.	100936.
1972	63	88175.	23307.	1148831.	23599.	43081.	64576.	-1811	198	90	538	0.133	0.011	8.24	5.15	16083.	15450.	103625.
1973	64	90970.	23307.	1125524.	24102.	42207.	66868.	1353	205	92	547	0.133	0.011	8.24	5.15	16083.	15450.	106420.
1974	65	93873.	23307.	1102217.	24616.	41333.	69257.	4616	213	94	557	0.133	0.011	8.24	5.15	16083.	15450.	109323.
1975	68	98769.	23307.	1078910.	25139.	40459.	73569.	9803	242	96	588	0.133	0.011	8.24	5.15	16083.	15450.	114219.
1976	69	101979.	23307.	1055603.	25740.	39585.	76238.	13346	251	98	599	0.133	0.011	8.24	5.15	16083.	15450.	117429.
1977	70	105213.	23307.	1032296.	26291.	38711.	78922.	16904	261	99	610	0.133	0.011	8.24	5.15	16083.	15450.	120663.
1978	71	107785.	23307.	1008989.	26831.	37837.	80954.	19810	268	100	618	0.133	0.011	8.24	5.15	16083.	15450.	123235.
1979	71	109806.	23307.	985682.	27363.	36963.	82443.	22172	269	101	620	0.133	0.133	8.24	5.15	16083.	15450.	125256.
1980	72	111822.	23307.	962375.	27905.	36089.	83917.	24520	267	103	620	0.133	0.133	8.24	5.15	16083.	15450.	127272.
1981	73	115339.	23307.	939068.	28502.	35215.	86837.	28314	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1982	73	115339.	23307.	915761.	29003.	34341.	86336.	28688	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1983	73	115339.	23307.	892454.	29513.	33467.	85825.	29051	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1984	73	115339.	23307.	869147.	30035.	32593.	85304.	29404	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1985	73	115339.	23307.	845840.	30566.	31719.	84773.	29746	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1986	73	115339.	23307.	822533.	31108.	30845.	84231.	30078	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1987	73	115339.	23307.	799226.	31661.	29971.	83678.	30399	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1988	73	115339.	23307.	775919.	32225.	29097.	83114.	30709	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1989	73	115339.	23307.	752612.	32800.	28223.	82538.	31008	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1990	73	115339.	23307.	729305.	33387.	27349.	81951.	31295	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1991	73	115339.	23307.	705998.	33986.	26475.	81353.	31571	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1992	73	115339.	23307.	682691.	34596.	25601.	80742.	31834	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1993	73	115339.	23307.	659384.	35219.	24727.	80120.	32085	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1994	73	115339.	23307.	636077.	35854.	23853.	79485.	32324	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1995	73	115339.	23307.	612770.	36502.	22979.	78837.	32550	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1996	73	115339.	23307.	589463.	37163.	22105.	78176.	32763	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1997	73	115339.	23307.	566156.	37837.	21231.	77502.	32963	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1998	73	115339.	23307.	542849.	38524.	20357.	76814.	33150	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
1999	73	115339.	23307.	519542.	39226.	19483.	76113.	33323	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2000	73	115339.	23307.	496235.	39941.	18609.	75398.	33481	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2001	73	115339.	23307.	472928.	40671.	17735.	74668.	33626	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2002	73	115339.	23307.	449621.	41415.	16861.	73924.	33756	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2003	73	115339.	23307.	426314.	42174.	15987.	73165.	33870	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2004	73	115339.	23307.	403007.	42948.	15113.	72390.	33970	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2005	73	115339.	23307.	379700.	43738.	14239.	71601.	34054	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2006	73	115339.	23307.	356393.	44544.	13365.	70795.	34123	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2007	73	115339.	23307.	333086.	45365.	12491.	69973.	34175	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2008	73	115339.	23307.	309779.	46203.	11617.	69135.	34211	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2009	73	115339.	23307.	286472.	47058.	10743.	68280.	34230	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2010	73	115339.	23307.	263165.	47930.	9869.	67409.	34232	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2011	73	115339.	23307.	239858.	48819.	8995.	66519.	34217	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2012	73	115339.	23307.	216551.	49727.	8121.	65612.	34184	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2013	73	115339.	23307.	193244.	50652.	7247.	64687.	34133	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2014	73	115339.	23307.	169937.	51596.	6373.	63743.	34063	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2015	73	115339.	23307.	146630.	52559.	5499.	62780.	33974	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2016	73	115339.	23307.	123323.	53541.	4625.	61798.	33866	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
2017	73	115339.	23307.	100016.	54542.	3751.	60797.	33739	266	104	620	0.133	0.133	16.18	5.15	31584.	15450.	146289.
MARR EQUALS 5.19 PERCENT															MARR EQUALS	8.82	PERCENT	

Figure 7. The expected revenue and ramp utilization projections using rate 1 and growth rate B,C

Recommendations for Future Action by the Memorial Union

The writer has several suggestions that may be of assistance to the Memorial Union in optimizing their investment in the parking ramp. These recommendations fall into the following basic categories:

1. accounting procedures,
2. ramp operation, and
3. pricing structure.

Accounting procedures

Problems were encountered in this study in that a good record of the number of monthly customers using the ramp was not available. If possible, a weekly average of monthly customers should be maintained. The income from monthly customers should be recorded separately from the income from hourly customers if this can be accomplished with little additional expense. This income should also be recorded as income on the same day as the income was generated.

Ramp operation

The present record of vehicles leaving the ramp should be continued. This information would be beneficial to any follow-up studies of the ramp operation.

When the ramp utilization reaches 100 percent for certain hours of the day some policy will need to be established to insure that monthly customers and employees can find a place to park. One approach to this problem would be to block off the desired number of top levels by a credit card controlled gate. Reserve signs could also be placed elsewhere in the

ramp if desired.

Pricing structure

The research conducted in this report and the computer program listed in Appendix C should be of some assistance in determining the optimum pricing structure to use for the MARR desired from the ramp investment.

If the ramp should follow the predicted growth rate A it will be necessary to implement a change in the rate structure. Management should find the computer programs a valuable asset in determining the best rate to use.

If the ramp reaches maximum capacity for some hours during the day a half hour rate structure may be desirable. Literature cited suggests that a half hour rate structure has been quite effective with other ramps in moving more customers through the ramp and thereby increasing revenue and diminishing the peak load problems.

Raising the number of monthly parkers to 300 should not cause any utilization problems for several years unless the parking lot between the Memorial Union and the women's gymnasium is closed. However, there is a possibility that this change in policy may not increase revenue. Many customers parking by the month may generate more revenue through hourly parking if monthly parking was not available. Management may find it desirable to vary the number of monthly parking spaces in order to determine the effect on total income.

SUMMARY

The objectives of this study were threefold:

1. to present a method of post-investment analysis which will be helpful for purposes of managerial control and decision making,
2. to stress to management the importance of post-investment analysis as a part of the overall capital budgeting system,
3. to apply post-investment analysis to an existing investment.

Management should be aware of the many advantages of post-investment analysis to the corporation and the responsibility of management in the success of such a program. The planning and direction of the entire capital budgeting program can only be a success if management fully understands the necessity of the program and gives it the support and direction it deserves. The validity of the estimates used in evaluating the critical input parameters will determine, to a large degree, the success of the analysis. Without the full cooperation of management in the development of these estimates the post-audit cannot hope to succeed. Policy changes are often necessary in accounting and production procedures to make data available. Management should be flexible and willing to implement these changes when and where necessary.

A capital investment program that does not include post-investment analysis as an integral part of the program may not take full advantage of the past experience available. In many instances this experience has been quite costly to the corporation and its shareholders. Such an investment should be utilized to its fullest extent. Unfortunately, the benefits of such a program may not always be immediately visible. In

facing the complex problems of today the manager may overlook the long range advantages of a good investment program. For this reason the initiation of such a program should be carefully preplanned and once installed it should be fully supported.

The post-investment analysis of the parking ramp should allow the Memorial Union to make future decisions regarding the ramp with a better understanding and with more confidence in the outcome of these decisions. The timing of these decisions, so critical to any investment, should also be better planned and thereby tend to more nearly optimize results.

Post-investment analysis allows management the necessary information to plan with confidence and to be readily aware of any changes in the input parameters critical to the success of the investment.

Management should not overlook the fact that post-investment analysis is not a one-shot survey but rather a continuing process in every dynamic corporation. The manager of today should be alert to every tool of analysis available that will add to the success of the corporation. However, management should remember that these tools are not a substitute for, but an aid to good management.

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APPENDIX A: RAMP UTILIZATION TABLES

Table 59. Ramp utilization by total vehicles at the times specified for August 1968

Date	Day	Time of Day 8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Total Customers Hourly	All others	Total
1	Th	68	91	102	103	92	97	106	89	76	62	36	36	27	29	32	27			
2	F	85	114	117	121	98	91	97	89	76	60	32	37	23	25	26	23			
3	Sa	30	35	40	48	48	39	27	27	27	23	27	16	13	13	13	13			
4																				
5	M	101	101	110	105	83	73	71	66	60	32	28	38	35	34	33	25			
6	Tu	56	100	108	120	108	104	106	99	115	67	36	39	29	33	31	29			
7	W	128	197	255	275	254	239	226	216	196	102	67	29	32	34	35	29			
8	Th	124	222	282	288	294	264	264	245	213	118	46	50	49	49	47	35			
9	F	101	160	172	163	152	98	101	88	84	57	32	34	29	32	32	32			
10	Sa	43	52	48	52	38	30	29	31	41	59	32	22	16	16	12	10			
11																				
12	M	99	99	119	120	110	99	92	111	70	39	30	33	32	30	29	23			
13	Tu	86	103	105	133	136	147	131	119	105	87	46	49	46	46	35	26			
14	W	93	145	154	156	168	166	160	152	119	92	61	61	57	46	38	31			
15	Th	108	195	222	234	239	274	265	240	187	178	179	91	93	60	54	39			
16	F	140	208	214	209	202	193	184	174	130	73	28	20	17	16	15	15			
17	Sa	39	54	59	70	78	75	50	36	30	31	34	30	22	25	15	10			
18																				
19	M	80	114	127	145	130	139	143	153	151	122	86	94	90	98	85	65			
20	Tu	80	121	141	154	144	159	173	176	201	163	117	114	109	104	92	83			
21	W	87	132	143	139	144	146	150	160	140	110	115	122	141	145	140	110			

Table 60. Ramp utilization by total vehicles at the times specified for September 1968

Date	Day	Time of Day 8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Total Customers Hourly	All others	Total
3	Tu	70	130	164	190	133	140	150	142	154	98	73	70	58	54	42	34	383	171	554
4	W	76	142	187	193	183	205	258	251	190	145	105	112	125	127	119	--	474	119	593
5	Th	120	206	247	252	207	256	322	237	311	177	93	100	133	93	88	67	743	217	960
6	F	160	257	295	326	241	252	282	--	180	105	68	112	134	90	45	46	659	230	889
7	Sa	80	149	182	215	179	181	177	190	150	130	120	114	222	220	94	124	409	152	561
8	Su	85	92	150	166	192	99	79	92	118	85	69	92	86	80	87	92	467	165	632
9	M	201	340	403	375	296	335	361	343	275	212	154	184	177	169	133	111	708	297	1005
10	Tu	186	309	360	360	345	333	361	300	284	200	135	150	147	125	107	103	452	336	788
11	W	177	310	375	381	373	393	401	402	379	367	312	339	384	393	108	104	393	497	890
12	Th	183	305	347	348	360	374	413	430	394	345	268	287	266	253	249	258	360	253	613
13	F	188	296	324	332	297	335	336	287	265	195	129	123	149	252	260	188	499	381	880
14	Sa	129	179	198	194	169	176	180	162	105	76	68	63	83	76	77	75		198	
15	Su	116	160	208	346	213	132	116	131	129	146	97	97	101	99	111	120	547	126	673
16	M	203	319	360	349	303	348	381	385	357	301	183	191	189	195	174	176	404	294	698
17	Tu	254	354	389	401	359	409	401	396	404	243	256	302	296	249	223	100	320	315	635
18	W	171	295	319	326	308	362	380	358	303	250	191	228	342	330	210	198	300	315	
19	Th	230	317	327	336	314	344	360	370	364	284	236	276	278	264	215	190	328	332	660
20	F	207	308	316	316	295	320	328	314	248	204	168	180	192	238	232	211	414	383	797
21	Sa	154	206	218	218	208	224	234	224	223	201	138	151	178	204	184	166	347	205	552
22	Su	137	191	178	209	167	124	133	139	138	178	114	120	140	144	141	144	502	115	617
23	M	206	316	341	342	319	335	359	340	316	266	181	180	177	182	170	168	298	315	613
24	Tu	201	329	349	360	319	318	326	333	313	292	250	155	180	209	204	148	316	369	685
25	W	184	356	397	402	383	399	414	400	366	324	206	227	266	220	184	173	376	309	685
26	Th	211	345	365	333	333	331	372	374	360	307	193	193	196	186	165	162	284	318	602
27	F	243	341	390	415	398	397	378	353	306	228	134	135	122	118	105	100	387	347	734
28	Sa	140	154	158	151	133	119	101	94	96	79	81	93	325	303	111	87	472	200	672
29	Su	103	95	172	216	182	115	105	98	77	94	83	80	98	104	112	117	468	121	589
30	M	153	295	330	345	340	315	344	345	345	299	228	234	239	249	230	223	294	333	627

Table 61. Ramp utilization by total vehicles at the times specified for October 1968

Date	Day	Time of Day 8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Total Customers Hourly	All others	Total
1	Tu	172	276	310	320	282	295	315	317	310	241	182	219	209	170	163	158	256	287	543
2	W	200	299	329	339	353	376	401	387	250	266	184	210	243	222	174	114	340	352	692
3	Th	187	313	325	339	305	312	348	327	263	221	181	171	140	127	109	107	375	330	705
4	F	202	207	214	234	193	116	136	157	155	220	167	165	135	121	115	109	281	322	603
5	Sa	155	204	227	225	250	281	290	289	280	187	147	122	107	118	103	112	454	199	653
6	Su	141	132	210	269	195	118	93	108	117	146	88	89	93	103	109	116	582	128	720
7	M	127	164	196	211	257	289	281	267	238	172	111	131	141	141	110	107	269	289	558
8	Tu	197	304	334	345	339	341	372	387	327	286	210	239	276	276	214	182	401	311	712
9	W	151	329	368	369	353	398	450	540	564	318	266	270	235	220	210	176	550	257	807
10	Th	138	267	281	301	271	283	318	299	257	214	148	152	174	183	160	123	293	355	648
11	F	125	276	306	310	280	300	320	297	230	149	100	131	163	114	114	95	404	366	770
12	Sa	131	166	173	156	113	96	91	89	81	76	76	70	85	146	169	170	255	172	427
13	Su	90	100	154	191	183	111	99	90	85	115	70	83	83	92	93	100	492	109	601
14	M	144	350	415	418	397	443	470	376	246	195	158	165	156	145	129	124	466	345	811
15	Tu	146	269	288	301	257	293	328	320	299	250	167	182	171	162	143	134	262	347	609
16	W	140	275	301	297	274	312	320	292	276	217	162	179	206	209	195	178	266	323	589
17	Th	161	319	374	379	353	370	410	410	347	254	203	212	238	195	151	122	415	362	777
18	F	166	328	402	431	409	423	432	413	269	171	104	91	152	161	156	126	556	403	959
19	Sa	130	140	156	153	127	134	121	105	99	96	92	121	134	128	87	63	197	182	349
20	Su	105	108	175	198	170	116	106	110	90	115	69	80	95	101	104	111	584	137	721
21	M	136	286	311	297	266	298	321	316	268	187	140	150	161	158	139	126	315	312	627
22	Tu	148	311	328	343	317	316	344	337	275	220	142	146	252	247	178	170	324	368	692
23	W	159	333	356	350	320	359	370	359	318	237	184	176	237	229	162	130	336	392	728
24	Th	156	293	314	324	346	278	293	268	246	205	130	130	139	120	103	90	250	398	648
25	F	122	247	259	244	163	157	149	144	127	100	72	99	107	130	176	189	425	380	805
26	Sa	112	128	145	185	271	325	333	329	313	259	150	118	98	104	171	246	453	203	656
27	Su	111	136	220	180	150	87	83	65	61	113	69	73	84	75	76	81	603	118	721
28	M	130	266	290	291	297	358	388	381	338	242	242	295	277	255	180	166	372	294	666
29	Tu	174	360	376	391	338	353	376	369	331	241	215	313	335	310	170	161	418	360	778
30	W	173	369	412	413	380	395	381	383	331	219	156	163	183	177	137	119	364	351	715
31	Th	152	287	308	319	288	288	296	284	237	196	152	170	202	203	187	183	213	349	562

Table 62. Ramp utilization by total vehicles at the times specified for November 1968

Date	Day	Time of Day 8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Total Customers Hourly	All others	Total
1	F	157	282	307	317	298	301	312	305	259	191	110	140	213	194	147	132	454	426	880
2	Sa	133	152	165	188	220	254	302	293	280	195	104	90	100	116	112	106	349	202	551
3	Su	123	153	201	228	172	100	98	94	102	143	80	98	112	106	111	118	485	116	601
4	M	145	264	286	295	271	275	292	280	251	193	135	144	149	145	129	120	167	345	512
5	Tu	134	264	285	294	273	275	298	291	276	189	152	143	142	132	118	108	216	387	583
6	W	146	330	374	388	362	394	398	385	339	270	182	188	212	174	149	125	386	312	698
7	Th	146	332	371	387	331	358	373	345	320	236	163	183	186	166	167	171	369	348	717
8	F	143	267	295	332	281	296	305	270	249	167	147	179	146	144	118	102	374	180	554
9	Sa	118	189	189	183	151	127	90	69	68	63	56	62	61	79	82	81	212	160	372
10	Su	107	115	168	196	192	125	132	129	120	171	122	131	190	195	138	138	547	92	639
11	M	172	277	306	314	298	312	319	310	281	215	174	182	168	170	162	160	230	292	522
12	Tu	184	283	306	287	295	312	304	281	213	165	163	175	173	166	141	138	223	305	528
13	W	166	285	318	326	283	333	400	390	324	238	178	181	166	161	161	158			
14	Th	211	337	342	351	332	344	359	365	339	286	244	290	286	284	232	214	243	--	--
15	F	196	298	324	325	286	294	300	289	273	211	145	133	145	138	112	105	290	304	594
16	Sa	172	229	295	294	274	248	229	209	113	103	104	108	99	110	100	99	264	--	--
17	Su	133	155	225	251	193	132	124	117	115	173	100	107	104	112	112	122	453	114	567
18	M	251	301	310	325	276	288	305	309	296	266	208	208	210	217	205	192	268	280	548
19	Tu	187	258	282	282	280	300	313	--	299	253	187	163	171	169	147	144	283	283	566
20	W	209	282	293	291	278	311	322	325	--	245	175	168	144	134	--	--	290	291	581
21	Th	195	224	190	--	--	--	--	--	--	--	--	--	--	--	--	--			
22	F	108	170	194	180	144	139	154	133	138	81	48	45	43	39	38	--	222	218	440
23	Sa	235	--	--	--	--	248	239	219	173	177	174	176	170	--	--	--			
24	Su	31	70	40	80	81	22	9	8	8	10	9	10	4	6	11	11	249	22	271
25	M	11	90	102	112	112	108	114	135	122	90	54	53	48	54	44	41	110	148	258
26	Tu	22	68	128	142	143	140	148	144	116	29	20	18	15	14	13	11	120	147	267
27	W	28	71	70	72	62	73	85	67	--	26	7	6	8	7	11	7	50	84	134
28	Th	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--			
29	F	34	50	56	61	42	57	59	55	52	34	12	9	4	5	5	--	41	56	97
30	Sa	24	38	41	42	29	21	27	21	10	10	11	11	7	9	9	5	34	66	100

Table 63. Ramp utilization by total vehicles at the times specified for December 1968

Date	Day	Time of Day																Total Customers		
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Hourly	All others	Total
1	Su	36	70	93	100	105	50	40	28	30	35	37	38	40	44	51	55	32	39	71
2	M	64	157	200	220	250	250	347	360	320	230	177	166	155	155	157	163	674	270	944
3	Tu	235	376	398	405	369	392	418	398	362	256	195	205	214	193	171	163	451	367	818
4	W	201	370	430	437	390	400	425	394	355	274	202	186	222	192	153	145	454	376	830
5	Th	220	387	469	484	514	474	493	505	485	347	245	318	381	373	216	169	635	381	1016
6	F	224	420	470	460	388	405	411	399	409	347	258	249	314	275	240	193	478	358	836
7	Sa	284	293	296	292	248	211	199	190	204	176	180	177	170	160	155	151	165	197	362
8	Su	125	195	201	237	240	234	251	230	209	171	117	128	132	137	137	149	664	129	793
9	M	203	360	444	463	423	448	479	469	400	314	246	247	239	225	229	226	310	313	623
10	Tu	230	338	378	394	359	357	392	372	326	250	188	182	346	331	270	167	433	349	782
11	W	177	340	350	367	343	374	410	393	327	261	232	251	280	245	189	171	367	355	722
12	Th	218	312	359	354	358	368	390	346	329	281	269	228	245	216	215	225	343	153	496
13	F	204	348	400	393	425	456	375	342	303	228	139	143	143	147	144	123	519	383	902
14	Sa	124	160	179	183	138	100	93	84	74	78	79	92	101	141	151	137	213	187	400
15	Su	115	175	204	247	218	141	147	150	155	176	114	106	112	124	133	140	585	101	686
16	M	185	335	370	377	322	352	374	373	289	275	340	346	254	234	226	215	350	308	658
17	Tu	231	340	347	368	340	378	369	327	270	211	250	244	207	200	185	172	270	167	437
18	W	206	337	363	374	313	342	362	352	310	251	195	278	297	323	201	186	218	312	530
19	Th	214	316	328	327	345	362	355	316	270	187	179	179	149	149	138	134	307	161	468
20	F	172	289	295	307	252	245	252	210	154	86	29	23	20	17	15	15	165		
21	Sa	48	51	52	55	45	28	27	27	26	28	27	24	22	27	26	22			
22	Su	16	9	50	74	64	16	10	7	5	1	4	2	2	--	--	--	224	26	250
23	M	24	49	47	57	50	62	66	69	40	14	--	--	5	--	--	--	20	83	103
24	Tu	27	28	29	27	28	22	17	16	14	14	18	17	13	--	--	--	7	31	38
25	W	Christmas																		
26	Th	15	30	38	43	24	33	40	34	28	18	4	6	7	8	9	8	14	67	81
27	F	15	60	63	70	56	44	67	60	50	31	22	30	31	137	184	150	187	90	277
28	Sa	43	37	43	37	34	33	30	27	25	24	27	23	24	24	23	--	21	46	67
29	Su	9	21	53	79	78	15	14	13	15	13	14	11	--	--	--	--	179	18	197
30	M	15	75	68	71	61	68	73	78	66	44	21	20	17	17	--	--	34	112	146
31	Tu	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--			

Table 64. Ramp utilization by total vehicles at the times specified for January 1969

Date	Day	Time of Day																Total Customers		
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Hourly	All others	Total
1	W	New Years																		
2	Th	10	54	57	70	46	58	55	52	47	28	0	13	5	16	21	18	60	119	179
3	F	16	60	74	78	78	96	98	94	101	78	71	64	55	58	57	--	54	113	167
4	Sa	40	42	44	43	40	36	33	47	34	29	33	35	38	35	39	35	32	49	81
5	Su	39	75	90	72	144	63	45	50	68	69	80	117	126	146	155	157	376	50	426
6	M	197	346	388	395	388	400	455	434	398	312	253	260	258	268	249	247	299	292	591
7	Tu	242	453	485	496	482	540	542	536	356	279	212	244	277	277	226	203	436	328	764
8	W	236	476	499	505	514	584	576	542	482	410	330	332	385	338	312	306	395	330	725
9	Th	234	350	435	469	445	433	462	463	438	402	343	368	376	356	323	318	338	313	651
10	F	217	344	376	398	363	385	398	382	330	285	224	243	238	203	144	121	365	422	787
11	Sa	198	225	244	256	224	198	185	179	168	150	163	211	193	156	121	102	228	226	454
12	Su	152	195	212	295	251	162	157	162	148	188	131	156	154	162	162	166	538	106	644
13	M	234	376	454	464	435	432	399	392	310	267	216	217	212	193	195	188	367	293	660
14	Tu	250	370	405	422	396	400	429	414	389	322	235	267	294	280	247	227	358	342	700
15	W	267	378	414	428	409	450	439	405	392	319	228	237	357	350	275	234	457	330	787
16	Th	234	373	392	403	373	380	415	416	392	326	241	255	282	283	247	225	340	365	705
17	F	222	369	388	406	435	414	420	404	364	292	214	285	321	435	372	330	603	427	1030
18	Sa	179	211	216	221	168	172	167	155	141	97	97	101	98	176	190	169	220	207	427
19	Su	130	145	190	266	220	120	153	138	119	166	121	140	134	148	150	162	536	117	653
20	M	224	326	346	347	348	338	359	357	312	243	196	185	179	167	180	166	227	346	573
21	Tu	218	366	375	395	400	362	389	385	355	271	173	176	182	177	167	161	295	320	615
22	W	200	297	411	425	388	409	430	386	355	290	243	331	388	336	221	190	465	349	814
23	Th	218	348	395	412	399	410	435	438	414	384	308	297	307	229	221	201	437	258	795
24	F	213	392	425	418	405	377	396	383	332	261	165	291	369	493	327	307	754	431	1185
25	Sa	156	169	194	185	160	133	115	100	87	93	93	97	105	214	221	200	282	179	461
26	Su	97	193	195	227	208	128	117	124	130	249	228	143	160	168	160	168	610	120	730
27	M	204	374	393	416	364	400	399	391	369	300	217	242	277	276	238	206	362	324	686
28	Tu	234	320	367	380	376	379	421	440	375	296	196	200	257	264	217	190	367	333	700
29	W	222	358	410	425	440	442	451	432	392	343	269	284	326	306	327	215	412	360	772
30	Th	251	370	402	402	410	437	514	492	458	405	291	375	409	382	280	262	504	349	853
31	F	217	387	427	446	425	401	380	351	269	219	142	227	270	232	229	219	630	416	1046

Table 65. Ramp utilization by total vehicles at the times specified for February 1969

Date	Day	Time of Day																Total Customers		
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Hourly	All others	Total
1	Sa	155	166	177	180	152	131	118	110	104	104	107	101	106	152	197	181	216	161	377
2	Su	120	140	175	232	204	117	102	96	103	184	153	164	171	177	171	182	510	133	643
3	M	218	349	375	383	347	353	372	360	314	246	273	327	317	312	183	170	355	365	720
4	Tu	227	348	358	378	374	374	395	388	363	291	239	267	313	286	221	198	313	343	656
5	W	217	372	408	422	405	425	436	432	399	290	203	234	291	244	181	180	378	364	742
6	Th	211	330	379	391	386	390	410	386	345	282	202	247	294	251	217	215	448	360	808
7	F	213	370	385	409	386	389	398	380	365	302	224	336	418	472	349	323	722	447	1169
8	Sa	165	185	186	186	148	143	219	141	134	101	114	111	124	132	114	92	318	207	525
9	Su	131	180	172	265	198	145	110	110	116	170	119	155	148	153	154	159	532	112	644
10	M	210	380	448	464	454	460	492	478	495	325	257	266	261	267	232	230	325	356	681
11	Tu	243	426	466	474	439	454	468	459	425	306	242	241	269	266	245	214	304	369	673
12	W	211	408	454	467	433	476	545	525	424	297	250	351	364	358	223	199	536	373	909
13	Th	215	366	397	412	382	404	418	479	484	316	254	315	303	230	216	196	398	352	750
14	F	215	350	364	382	333	334	356	343	302	226	153	217	287	277	138	115	510	419	929
15	Sa	149	172	171	166	137	110	103	104	102	92	112	169	175	122	122	109	195	181	376
16	Su	122	124	216	226	183	96	85	78	82	167	157	107	130	137	151	146	523	123	646
17	M	231	343	366	373	331	362	375	368	320	239	179	178	157	145	145	141	301	385	686
18	Tu	221	415	424	442	409	436	454	432	409	304	218	220	242	230	196	181	315	452	767
19	W	219	385	384	406	419	412	427	429	385	288	203	200	273	263	203	190	364	331	695
20	Th	217	308	380	389	364	359	386	362	334	259	230	353	336	326	233	178	388	362	750
21	F	217	410	457	468	447	452	473	429	397	305	223	212	198	181	182	172	425	383	808
22	Sa	209	249	269	267	249	189	154	146	141	137	132	132	131	177	189	173	260	222	482
23	Su	155	196	256	279	232	172	142	147	149	223	128	131	133	137	197	171	501	110	611
24	M	228	335	342	350	362	376	379	365	353	304	238	229	226	229	218	210	224	315	539
25	Tu	266	330	348	343	337	348	352	345	317	232	188	172	165	168	162	160	246	340	586
26	W	210	320	326	334	332	348	389	388	345	283	204	174	160	160	163	170	304	145	449
27	Th	234	336	365	365	389	388	398	364	308	243	220	212	222	193	194	174	320	457	777
28	F	192	296	400	396	325	283	267	342	207	145	107	122	114	105	96	93	400	276	676

Table 66. Ramp utilization by total vehicles at the times specified for March 1969

Date	Day	Time of Day																Total Customers		
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Hourly	All others	Total
1	Sa	70	66	73	85	90	63	53	53	50	40	23	23	19	21	26	27	172	81	253
2	Su	46	72	84	110	91	46	34	30	28	48	28	29	21	23	--	--	296	33	329
3	M	7	73	93	100	75	93	94	97	84	27	10	28	27	22	24	22	98	154	252
4	Tu	49	132	142	148	137	143	148	145	111	84	54	54	48	47	46	42	103	140	243
5	W	68	130	134	140	131	140	140	130	118	69	39	30	32	36	35	29	127	142	269
6	Th	59	99	140	147	123	146	147	139	--	46	57	54	46	29	36	30	186	143	329
7	F	41	86	164	168	136	140	144	148	145	109	82	86	79	52	48	45	165	140	305
8	Sa	67	81	119	143	140	100	99	72	70	62	33	31	36	46	44	--	188	56	244
9	Su	40	50	100	78	140	90	53	47	51	54	32	34	33	38	40	--	381	39	420
10	M	179	246	308	406	426	442	500	452	416	345	329	365	372	349	331	316	688	360	1042
11	Tu	185	423	475	474	445	449	478	487	315	258	166	177	212	200	186	165	583	374	957
12	W	200	417	450	441	417	465	510	490	374	290	190	216	271	250	162	157	539	391	930
13	Th	199	361	412	406	370	372	403	417	357	264	205	214	188	172	163	162	399	350	749
14	F	204	396	424	454	423	447	430	406	350	257	160	140	134	138	132	120	412	406	818
15	Sa	154	194	205	216	185	137	132	113	108	94	97	100	99	107	101	97	237	189	426
16	Su	109	140	169	226	187	111	100	93	94	85	80	115	133	127	124	118	518	121	639
17	M	174	320	337	358	315	309	348	330	299	224	167	192	246	256	178	165	353	394	747
18	Tu	197	353	442	462	414	426	465	465	422	288	210	292	322	287	228	188	504	389	893
19	W	210	422	456	464	440	450	394	375	354	282	216	242	293	253	234	180	422	413	835
20	Th	224	360	415	436	397	385	416	408	354	298	262	341	335	284	206	175	515	397	912

Table 67. Ramp utilization by total vehicles at the times specified for April 1969

Date	Day	Time of Day																Total Customers		
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Hourly	All others	Total
1	Tu	210	331	333	301	276	284	324	317	281	216	162	190	204	184	139	128	305	331	636
2	W	192	326	350	368	338	357	380	391	348	302	240	251	302	177	196	181	374	348	722
3	Th	184	369	354	358	318	318	313	--	165	86	50	38	29	22	22	20	377	376	753
4	F	28	95	98	101	90	98	90	87	83	68	48	35	25	27	22	--	104	156	260
5	Sa	40	43	40	49	35	28	25	26	20	18	26	28	23	17	20	--	32	74	106
6	Su	18	30	26	111	37	32	23	23	22	22	28	30	22	22	--	--	164	42	206
7	M	32	110	123	121	93	105	123	111	110	88	78	112	130	115	107	125	168	222	390
8	Tu	218	415	491	514	480	490	525	506	447	294	162	173	206	199	182	165	499	353	852
9	W	185	469	528	552	524	528	578	--	352	235	164	165	193	183	147	141	589	361	950
10	Th	232	328	372	370	345	339	360	346	307	259	217	230	230	212	198	195	387	373	760
11	F	198	387	516	508	463	451	473	399	342	249	164	163	184	181	141	138	476	426	902
12	Sa	117	143	155	155	142	109	101	90	77	50	55	68	84	97	120	112	247	202	449
13	Su	110	154	230	276	216	159	118	109	94	141	218	117	130	137	149	158	573	144	717
14	M	185	350	412	430	360	383	400	403	347	268	171	165	235	234	153	137	418	348	766
15	Tu	211	328	384	372	337	338	356	347	314	247	221	232	264	253	196	184	311	391	702
16	W	210	389	401	402	370	380	392	376	365	272	204	193	326	340	202	161	439	427	866
17	Th	192	320	385	380	363	425	440	355	300	223	157	139	162	163	166	166	599	468	1067
18	F	207	308	412	384	362	384	432	430	401	271	259	265	222	204	184	171	494	384	842
19	Sa	118	173	216	220	183	131	105	85	58	37	54	59	64	55	51	50			
20	Su	85	131	183	196	160	111	80	63	60	113	70	100	132	138	132	128	508	125	633
21	M	173	310	328	344	304	334	355	355	330	269	179	190	192	177	163	153	246	383	629
22	Tu	155	288	328	330	309	333	358	308	267	189	236	278	270	148	130	130	402	366	768
23	W	188	285	395	406	356	378	403	405	360	254	185	199	214	190	160	149	339	396	735
24	Th	172	341	372	366	318	333	359	357	325	221	180	236	251	200	179	163	377	347	724
25	F	177	344	370	370	303	312	330	307	267	211	152	135	142	149	115	104	318	393	711
26	Sa	115	157	176	173	136	105	110	100	73	57	51	52	48	51	51	53	160	146	306
27	Su	73	95	171	219	166	94	100	94	82	127	84	119	148	132	136	140	520	111	631
28	M	181	333	358	367	325	344	353	350	325	261	180	177	205	200	176	172	266	357	623
29	Tu	174	399	422	413	380	395	412	412	341	233	185	224	347	329	176	154	490	366	856
30	W	157	305	336	343	305	327	350	330	287	230	135	119	136	152	152	134	325	436	761

Table 68. Ramp utilization by total vehicles at the times specified for May 1969

Date	Day	Time of Day 8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11	Total Customers Hourly	All others	Total
1	Th	178	260	321	330	287	264	277	271	297	239	155	134	123	126	128	121	367	369	736
2	F	99	170	208	242	215	237	252	234	207	142	76	53	74	81	109	81	408	316	724
3	Sa	113	173	332	586	618	540	365	307	292	255	200	155	127	152	233	327	839	223	1062
4	Su	87	123	181	234	144	71	56	51	46	106	63	77	115	134	149	153	475	107	582
5	M	188	332	357	358	320	336	370	352	327	261	231	270	290	228	166	144	353	374	727
6	Tu	185	306	358	355	264	274	318	300	239	189	186	224	216	132	119	105	367	378	745
7	W	195	310	329	337	303	326	358	350	307	253	229	264	180	196	172	166	506	392	898
8	Th	184	364	407	424	397	324	410	396	344	244	198	216	226	206	155	152	394	333	727
9	F	185	339	388	394	338	359	362	324	280	143	61	57	69	70	52	37	406	432	840
10	Sa	103	133	144	152	148	130	117	87	67	56	50	91	89	89	68	47	165	178	343
11	Su	71	114	153	179	151	106	74	70	59	90	47	68	90	102	103	105	449	103	552
12	M	174	219	237	245	308	360	304	293	227	158	106	131	133	94	65	63	421	355	776
13	Tu	209	312	338	364	325	343	344	335	290	226	252	280	278	254	209	174	354	340	694
14	W	205	418	415	411	410	514	524	470	325	246	184	172	243	237	230	166	484	352	836
15	Th	212	370	429	452	454	448	437	425	365	298	205	242	290	208	212	206	659	351	1010
16	F	196	410	418	417	358	360	379	344	276	196	126	144	175	157	96	88	445	377	822
17	Sa	121	172	198	194	164	147	134	124	107	97	97	165	171	203	220	216	306	201	507
18	Su	106	139	220	236	183	120	107	116	59	208	83	95	102	118	116	120	540	116	656
19	M	196	278	286	288	307	332	325	--	293	199	178	165	169	163	158	152	285	305	590
20	Tu	208	155	387	394	364	363	369	346	299	239	196	203	195	179	163	159	312	332	644
21	W	198	364	374	403	408	419	459	482	331	298	211	194	225	217	205	158	507	330	837
22	Th	188	244	283	288	262	272	306	279	226	165	104	139	132	132	86	76	390	338	728
23	F	167	239	224	218	168	175	198	194	144	109	62	54	124	131	66	57	379	291	670
24	Sa	52	116	145	129	75	46	30	21	17	15	17	11	15	15	11	--	189	79	268
25	Su	33	80	132	42	104	49	31	29	20	20	19	18	17	12	18	20	306	42	348
26	M	70	83	98	97	68	87	93	88	75	48	33	35	32	19	23	22	56	158	214
27	Tu	68	96	106	110	98	105	111	116	100	69	30	65	64	32	32	23	87	169	256
28	W	66	55	67	74	67	89	88	86	68	67	9	5	2	3	6	5	60	151	211
29	Th	65	77	90	90	67	69	78	70	62	41	19	27	11	11	--	--	71	134	205
30	F																			
31	Sa	14	17	34	40	26	24	18	30	14	11	15	16	13	15	--	--	47	60	107

Table 69. Ramp utilization by employee vehicles (includes all vehicles entering by credit card) at the times specified for August 1968

Date	Day	Time of day															
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11
1	Th	82	98	101	105	93	104	109	103	93	82	54	58	54	57	59	58
2	F	83	96	95	103	85	95	109	100	88	80	50	53	50	52	53	48
3	Sa	31	36	36	46	41	34	29	29	27	24	24	28	25	27	30	33
4																	
5	M	73	89	91	90	78	91	95	94	91	75	56	54	51	55	56	52
6	Tu	83	90	93	99	87	100	107	104	99	83	60	57	49	51	52	47
7	W	83	101	104	111	94	102	108	105	103	88	61	54	52	54	54	50
8	Th	80	100	104	113	93	103	111	109	104	87	61	65	63	68	67	65
9	F	71	80	80	86	71	71	74	71	66	51	32	31	26	30	37	37
10	Sa	19	21	18	19	8	5	4	3	6	7	8	8	3	5	7	9
11	Su	4	8	30	33	38	36	36	34	34	34	34	40	41	45	47	48
12	M	53	67	71	75	52	55	59	55	51	40	38	8	5	7	9	10
13	Tu	42	57	62	68	54	51	59	57	55	31	4	5	1	1	1	1
14	W	62	73	74	79	58	62	68	66	58	31	11	10	11	13	12	10
15	Th	56	59	62	62	53	60	59	54	51	32	9	8	2	1	2	1
16	F	61	74	76	78	58	63	63	54	45	33	7	8	5	5	4	5
17	Sa	21	25	24	28	23	15	15	11	12	11	9	10	4	9	11	12
18																	
19	M	59	61	63	67	53	56	57	62	63	51	20	26	20	23	24	23
20	Tu	57	63	64	67	51	52	57	58	57	46	2	4	0	4	4	2
21	W	57	62	63	64	57	60	64	60	60	47	17	17	15	13	10	6

Table 70. Ramp utilization by employee vehicles (includes all vehicles entering by credit card) at the times specified for October 1968 and November 1968

Date	Day	Time of day															
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11
Oct 30	W	70	80	84	86	72	84	86	87	78	63	31	31	29	28	24	19
31	Th	64	74	80	82	66	72	73	71	65	53	19	20	14	15	8	4
Nov 1	F	70	82	85	88	68	72	73	80	66	47	19	37	38	41	17	9
2	Sa	37	45	51	56	42	37	36	29	26	19	15	16	16	19	16	15
3	Su	8	11	9	8	17	11	5	--	---	--	--	--	--	--	--	--
4	M	67	82	85	84	74	69	84	81	65	38	7	6	1	3	1	1
5	Tu	58	77	83	84	71	69	77	71	54	35	8	10	9	4	2	1
6	W	56	76	82	84	62	71	81	80	70	53	22	16	14	10	4	1
7	Th	63	78	78	84	63	73	81	76	74	48	17	14	17	13	12	7
8	F	56	71	76	78	59	60	65	63	55	35	16	18	8	27	27	24
9	Sa	24	34	31	34	18	13	8	3	4	3	2	2	20	20	16	7
10	Su	9	10	10	14	18	17	20	17	17	16	10	5	4	4	5	1
11	M	45	75	73	77	54	61	56	48	48	19	2	2	1	1	1	1
12	Tu	48	70	73	79	63	61	69	66	66	43	19	18	15	14	10	5
13	W	54	64	72	74	56	58	63	65	59	33	13	11	7	2	1	1
14	Th	52	65	68	75	63	57	60	61	56	38	9	6	4	1	1	1
15	F	52	69	73	76	57	62	55	55	58	44	13	10	11	11	5	4
16	Sa	27	37	40	40	36	18	14	11	9	5	6	6	25	26	23	23
17	Su	9	10	9	18	20	17	18	14	14	13	12	13	8	8	7	6
18	M	60	75	79	76	61	64	66	67	68	52	18	18	16	15	15	11

Table 71. Ramp utilization by employee vehicles (includes all vehicles entering by credit card) at the times specified for December 1968

Date	Day	Time of day															
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11
13	F	39	52	51	46	35	38	35	32	24	16	6	5	3	2	1	1
14	Sa	8	9	10	8	4	3	--	--	--	--	--	--	--	--	--	--
15	Su	4	10	12	11	14	12	12	10	9	6	4	1	2	1	1	1
16	M	43	67	65	67	50	51	59	54	46	18	20	19	14	10	9	3
17	Tu	48	73	74	78	66	68	81	73	60	39	19	19	18	10	7	6
18	W	39	70	70	73	68	60	67	68	56	36	8	6	2	1	1	1
19	Th	40	66	71	74	65	62	71	55	50	32	5	2	1	1	1	1
20	F	41	63	68	67	47	38	50	46	41	13	5	2	1	1	1	1
21	Sa	13	21	22	20	13	5	3	1	1	2	2	1	1	1	3	3
22	Su	5	6	5	6	6	7	2	1	2	3	3	2	1	1	1	1
23	M	19	23	23	22	10	10	19	19	14	6	2	1	1	--	1	1
24																	
25																	
26	Th	16	28	49	48	29	31	38	38	37	27	14	14	14	17	18	18
27	F	31	39	40	43	29	32	38	35	8	9	1	1	1	1	0	0
28	Sa	7	8	7	--	--	--	--	--	--	--	--	--	--	--	--	--
29																	
30	M	33	48	44	43	31	31	32	27	16	5	1	1	1	1	1	0

Table 72. Ramp utilization by employee vehicles (includes all vehicles entering by credit card) at the times specified for April 1969 and May 1969

Date	Day	Time of day															
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11
Apr 21	M	64	81	81	84	63	77	79	76	72	50	15	15	12	10	7	4
22	Tu	64	72	71	72	54	66	77	71	63	31	15	22	18	15	14	11
23	W	61	80	80	90	61	69	76	76	63	32	13	8	3	5	4	1
24	Th	64	80	85	90	72	84	86	78	71	44	19	16	17	15	15	10
25	F	64	72	78	82	62	66	71	69	64	46	18	18	15	18	12	12
26	Sa	27	30	33	34	27	17	15	12	12	9	9	12	11	12	11	10
27	Su	10	11	14	19	19	24	24	19	18	18	16	18	18	19	19	17
May 25	Su	8	8	9	14	15	15	13	7	8	10	8	3	4	6	8	8
26	M	68	81	82	47	38	53	58	47	23	0	0	0	0	0	0	0
27	Tu	64	75	79	79	49	63	70	68	54	31	0	0	0	0	0	0
28	W	63	76	79	79	55	70	66	59	45	8	8	2	1	2	4	2
29	Th	61	66	64	49	43	50	47	36	19	0	0	0	0	0	0	0
30																	
31	Sa	14	12	13	14	11	12	8	5	10	5	3	3	21	21	20	21

Table 73. The total number of vehicles leaving the ramp at the times specified for May, 1969

Date	Day	Time of day															
		8am	9	10	11	12	1pm	2	3	4	5	6	7	8	9	10	11
1	Th				37	46	11	3	2	2	0	1	4	8	22		
2	F				19	16	19	20	9	0	4	5	2	5	15		
3	Sa				48	42	16	117	2	2	1	4	1	16	15		
4	Su				80	114	104	8	3	0	1	0	10	9	9		
5	M				10	6	7	0	0	0	0	0	6	2	4		
6	Tu				25	7	6	2	0	1	0	2	7	2	8		
7	W				35	8	5	1	0	2	0	0	7	3	10		
8	Th				23	27	6	0	1	0	0	0	8	2	7		
9	F				20	18	11	0	3	1	0	0	5	2	18		
10	Sa				20	23	20	4	0	2	0	0	7	2	10		
11	Su				29	8	8	6	3	1	0	1	5	3	15		
12	M				14	3	3	0	1	0	0	0	6	0	6		
13	Tu				33	6	11	1	2	0	0	1	5	3	5		
14	W				114	37	20	2	2	0	0	0	12	6	6		
15	Th				129	24	23	3	1	0	0	7	11	21	9		
16	F				29	46	27	10	0	0	1	0	7	5	12		
17	Sa				25	7	10	3	1	1	0	3	7	6	5		
18	Su				38	75	72	10	1	3	0	2	7	3	2		
19	M				4	3	3	0	0	0	0	0	5	3	17		
20	Tu				15	3	10	0	0	1	1	1	5	3	15		
21	W				18	8	6	5	0	0	1	0	6	3	12		
22	Th				42	27	10	0	0	1	1	0	5	3	14		
23	F				24	11	7	3	1	0	0	2	7	10	43		
24	Sa				21	8	3	3	4	1	0	0	9	8	12		

APPENDIX B: SELECTED RESULTS OF STATISTICAL ANALYSES

Table 74. Results of the analysis of variance test on the sample data for the class days (total vehicle utilization) during the fall quarter of 1968

Source of variation	Degrees of freedom	Sum of squares	Mean square	F ratio	Table values for F at level of significance indicated	
					95%	99%
A	9	283,417	31,491	25.16	1.88	
B	4	315,486	78,871	62.90	2.21	
AB	36	547,432	15,206	12.13	1.39	
C	15	4,275,243	285,020	227.32	1.67	
AC	135	203,872	1,510	1.20	1.20	1.32
BC	60	120,392	2,007	1.60	1.32	1.47
Error	540	677,071	1,254			
Total	799	6,422,963				

Table 75. The week X hour means for the sample data on class days (total vehicle utilization) for the fall quarter of 1968

Hour	Week										Grand means
	1	2	3	4	5	6	7	8	9	10	
8 a.m.	187	213	209	183	148	151	144	157	143	186	172
9	312	319	337	278	268	308	294	313	291	296	302
10	362	342	368	302	297	356	314	339	322	319	332
11	359	346	370	315	307	365	312	346	339	321	338
12 noon	334	316	350	295	300	338	282	320	304	299	314
1 p.m.	354	357	356	283	322	368	282	339	320	319	330
2	374	370	370	309	348	392	295	351	333	336	348
3	352	365	360	306	358	362	285	344	314	327	337
4	319	335	322	265	323	287	247	299	287	286	297
5	264	256	283	249	228	217	190	218	211	223	234
6	200	207	193	188	167	159	134	175	156	181	176
7	217	235	178	200	185	166	140	216	167	192	190
8	225	259	188	193	198	185	179	242	167	188	202
9	238	255	183	178	187	174	177	228	152	184	196
10	171	211	166	158	162	155	152	164	136	162	164
11	153	175	150	142	137	137	141	152	125	155	147
Grand means	276	285	274	240	246	258	223	263	235	248	255

Table 76. The day X hour means for the sample data (total vehicle utilization) on class days for the fall quarter of 1968

Hour	Day					Grand means
	Mon	Tues	Wed	Thurs	Fri	
8 a.m.	162	180	167	178	175	172
9	288	306	318	312	285	302
10	324	333	355	335	314	332
11	324	340	359	342	326	338
12 noon	304	312	339	323	290	314
1 p.m.	331	325	372	328	294	330
2	352	343	392	354	300	348
3	334	333	390	347	283	337
4	292	303	340	313	238	297
5	228	233	271	255	184	234
6	171	187	202	192	128	176
7	186	202	216	206	138	190
8	183	218	247	211	152	202
9	181	205	234	198	161	196
10	156	166	169	174	154	164
11	148	140	148	162	136	147
Grand means	248	258	282	264	222	255

Table 77. Results of the analysis of variance test on the sample data (total vehicle utilization) for the class days during the winter quarter of 1969

Source of variation	Degrees of freedom	Sum of squares	Mean square	F ratio	95% significance level
A	7	271,281	38,754	29.31	2.01
B	4	177,775	55,555	33.61	2.21
AB	28	526,307	18,797	14.22	1.48
C	15	4,448,467	296,564	224.28	1.67
AC	105	131,756	1,255	0.99	1.24
BC	60	152,717	2,545	1.92	1.32
Error	420	555,361	1,322		
Total	639	6,263,666			

Table 78. Results of the analysis of variance test on the sample data (total vehicle utilization) for the class days during the spring quarter of 1969

Source of variation	Degrees of freedom	Sum of squares	Mean square	F ratio	95% significance level
A	5	318,062	63,612	47.66	2.10
B	4	129,457	32,364	24.25	2.21
AB	20	439,799	21,990	16.48	1.57
C	15	3,731,595	248,773	186.40	1.67
AC	75	98,784	1,317	0.99	1.27
BC	60	140,500	2,342	1.75	1.32
Error	300	400,395	1,335		
Total	479	5,258,593			

Multiple Range Tests

Multiple range tests can be used to compare means when one has not previously preplanned tests before receiving the data. Or when tests have been preplanned one can compare each treatment mean with each other treatment mean in the group.

The new multiple range test, as outlined by Duncan, David B. 1955 was used in this study. This test is one of several that can be used to determine if there is a significant difference within a group of means and which means in the group are significantly different.

The data necessary to perform the test are:

1. the means to be compared,
2. the standard error of each mean,
3. the degrees of freedom on which this standard error is based,
4. a table of values for Duncan's New Multiple Range Test.

The standard error of the mean is equal to:

$$S_{\bar{x}} = \sqrt{\frac{\text{Mean square error}}{\text{Number of observations per treatment}}} = \sqrt{\frac{E}{n_i}} = \sqrt{\frac{S}{n_i}}$$

The tests in this study were conducted at the 95 percent level of significance. The necessary steps in conducting the tests are:

1. Calculate the standard error ($S_{\bar{x}}$) of the mean.
2. Look up the significant studentized ranges (SSR), for the range of means involved (P), in the table of critical values at the 95 percent level.
3. Multiply the significant studentized range (SSR) by the standard error ($S_{\bar{x}}$) to form what may be called the least

significant ranges (LSR).

4. List the means in ascending order of magnitude.

5. Underscore with a line all means that indicate a nonsignificant difference.

Example:

1. The number of means to be tested = 5.

2. $S_{\bar{x}} = \sqrt{\frac{S}{n}} = \sqrt{\frac{1254}{160}} = \sqrt{7.84} = \underline{2.80}$

P	2	3	4	5
SSR	2.77	2.92	3.02	3.09
LSR	7.76	8.07	8.45	8.65

Days	F	M	Tu	Th	W
Means	242	245	249	254	256

APPENDIX C: LISTINGS OF PROGRAMS AND OUTPUT DATA

Post-Investment Analysis Program

The input data to this program is as follows:

Card no.	Variable name	Format	Comments
1	IIHR(I)	I3	The ramp load each hour for hourly customers (24 values).
2	MOO(I)	I3	The ramp load each hour for monthly customers (24 values).
3	IIEMP(I)	I3	The ramp load each hour for employees (24 values).
4	IITOT(I)	I3	The total ramp load each hour (24 values).
5	GROWTH(I)	F5.3	Growth rate A or B (15 values).
6	EXPAND(I)	F5.3	Growth rate C (15 values).
7	REVA(I)	F10.2	The initial annual revenue from hourly customers during the class days of fall, winter and spring quarters for each rate structure.
8	REVC(I)	F10.2	The initial annual revenue from hourly customers during the weekends for each rate structure.
9	REVD(I)	F10.2	The initial annual revenue from hourly customers during the class days of summer quarter for each rate structure.
10	REVE(I)	F10.2	The initial annual revenue from hourly customers during quarter-breaks and

Card no.	Variable name	Format	Comments
11	REVF(I)	F10.2	The initial annual revenue from employees for each rate structure.
12	RRMO(I)	F6.2	The revenue per month required from employees. RRMO(I) must equal $8.24.
13	RPHR(I)	F10.3	The mean revenue per hour from each hourly customer for each rate structure (Note Table 56).

The output data from the program is as follows:

Table heading	Comments
YEAR	The year under analysis.
RAMP USAGE	The percent utilization from 8 a.m. to 11 p.m.
REVENUE	The expected revenue per year.
DEPN	The depreciation per year.
INVEST TO PAY	The remaining investment to pay.
EXPENSE	The annual expenses assuming two percent growth rate due to inflation.
INT PAYMENT	The annual interest on the remaining debt.
CASH FLOW	The annual cash flow.
PROFIT	The annual profit or loss.
USAGE: HR	Equals the maximum number of hourly customers on the ramp during class days.
EMP	Equals the maximum number of employees on the ramp during class days.
TOT	Equals the maximum total ramp load during classdays.

Table heading		Comments
REV PER HOUR:	HR	Equals the mean revenue per hour from Table 56.
	MONTH-CALC	Equals the calculated revenue per hour from monthly customers.
REV PER MONTH:	MONTHLY(PROP)	Equals the suggested rate for montly customers.
	EMP(PROP)	Equals the suggested rate for employees.
REV PER YEAR:	MONTH	Equals the revenue per year from monthly customers using the suggested rate structure.
	EMPLOY	Equals the revenue per year from employees using the suggested rate structure.
	TOTAL	Equals the total revenue per year using the suggested rate structure.

```
C       THE POST INVESTMENT ANALYSIS PROGRAM PROJECTS THE
C       REVENUE AND UTILIZATION FOR THE RAMP OVER THE LIFE
C       REV1=ANNUAL REVENUE FROM HOURLY CUSTOMERS-CLASS DAYS
C       FALL ,WINTER AND SPRING QUARTERS
C       REV2=ANNUAL REVENUE FROM MONTHLY CUSTOMERS
C       REV3=ANNUAL REVENUE FROM WEEKENDS
C       REV4=ANNUAL REVENUE FROM CLASS DAYS SUMMER QUARTER
C       REV5=ANNUAL REVENUE QUARTER BREAKS AND VACATIONS
C       REV6=ANNUAL REVENUE EMPLOYEES
C       PRINC=AMOUNT OWING ON INVESTMENT
C       COST =EXPENSES IN YEAR 1
C       FLATION= GROWTH RATE FOR EXPENSES
C       INT= RATE OF RETURN REQUIRED
C       ROR=INTEREST RATE ON LOAN
C       PAY= INTEREST ON INVESTMENT
C       PROFIT=PROFIT OR LOSS
C       IMPLOY= MAXIMUM NO.OF EMPLOYEES PARKED AT ONE TIME
C       MAXHR = MAXIMUM NO. OF HOURLY CARS PARKED AT ONE TIME
C       MONTH =         NO. OF MONTHLY CARS PARKED EACH HOUR
C       RMONTH= MONTHLY RATE
C       DAYS = NO.OF CLASS DAYS IN F,W,SP,QUARTERS (168)
C       BASE = DAILY INCOME MONTHLY PARKERS
C       RATIO= WEEKENDS + CLASS DAYS/CLASS DAYS=226/168
C       LIFE = REMAINING RAMP LIFE
C       PAYMO= TOTAL NO. OF MONTHLY CUSTOMERS
C       IHR= HOURLY CUSTOMERS BY HOUR ON THE RAMP
C       MO = MONTHLY CUSTOMERS BY HOUR ON THE RAMP
C       IEMP= EMPLOYEES BY HOUR ON THE RAMP
C       ITOT= TOTAL RAMP LOAD BY HOUR
C       EXPAND=GROWTH RATE FOR EMPLOYEES,WEEKENDS,QB;VACATIONS
C       GROWTH=GROWTH RATE FOR CLASS DAYS
C       LOAD = REPRESENTS CARS BY HOUR TURNED AWAY FROM RAMP
C       JUMP = DUMMY ARRAY=CARS  TURNED AWAY EACH YEAR
C       REVV = REVENUE/YEAR
C       CF = CASH FLOW EACH YEAR
C       LOADD= MAXIMUM RAMP LOAD EACH YEAR
C       LODE = OVER OR UNDER CAPACITY AT MAXIMUM LOAD
C       R1 = REVENUE/HOUR FROM HOURLY CUSTOMERS
C       R4 = PROPOSED REVENUE/HOUR FROM MONTHLY CUSTOMERS
C       R5 = PRESENT REVENUE/DAY FROM EMPLOYEES
C       R6 = PROPOSED REVENUE/DAY FROM EMPLOYEES
C       RMONTH= REVENUE/MONTH-MONTHLY CUSTOMERS
C       REVMO = PROPOSED REVENUE/MONTH-MONTHLY CUSTOMERS
C       REVM  = PROPOSED REVENUE/YEAR -MONTHLY CUSTOMERS
C       REVT  = PROPOSED TOTAL REVENUE/YEAR
C       EMMP = NO.OF CREDIT CARDS OUT
        DIMENSION IHR(24),MO(24),IEMP(24),ITOT(24)
        DIMENSION LOAD(24),JUMP(24)
        DIMENSION EXPAND(50),GROWTH(50),REVV(50),CF(50)
        DIMENSION REVA(8),REVB(8),REVC(8),REVD(8),REVE(8),
```

```
     4REVF(8),RRMO(8)
      DIMENSION RATE1(10),RATE2(10),RATE3(10),RATE4(10),
     6RATE5(10),RATE6(10),RATE7(10),RATE8(10)
      DIMENSION REVT(50)
      DIMENSION RPHR(10)
      DIMENSION IIHR(24),MOO(24),IIEMP(24),IITOT(24)
      DO 2 I=1,50
      EXPAND(I)=0
      REVT(I)=0.
      GROWTH(I)=0
      CF(I)=0
2     REVV(I)=0
      DO 5 I=1,24
      IIHR(I)=0
      MOO(I)=0
      IIEMP(I)=0
      IITOT(I)=0
      IHR(I)=0
      MO(I)=0
      IEMP(I)=0
      JUMP(I)=0
      LOAD(I)=0
5     ITOT(I)=0
      IRUNS=4
      JRUNS=8
      ROR=0.0375
      LIFE=50
      REX=0.
      R6=5.15
      R1=0.133
      R2=0.011
      R3=0
      R4=0.011
      R5=0
      REVZ=0.
      BASE=0.
      REV1=0
      REV2=0
      REV3=0
      REV4=0
      REV5=0
      REV6=0
      RMONTH=8.24
      REVMO=8.24
      REVM=16083.
      RATIO=1.35
      EMMP  =250
      PAYMO=250
      DAYS=168.
      NERCNT=0
```

```
      Y=0.
      S=100000.
      READ(1,10)(IIHR(I),I=1,24)
10    FORMAT(24I3)
      READ(1,20)(MOO(I),I=1,24)
20    FORMAT(24I3)
      READ(1,30)(IIEMP(I),I=1,24)
30    FORMAT(24I3)
      READ(1,40)(IITOT(I),I=1,24)
40    FORMAT(24I3)
60    FORMAT(15F5.3)
      READ(1,60)(GROWTH(I),I=1,15)
50    FORMAT(15F5.3)
      READ(1,50)(EXPAND(I),I=1,15)
      READ(1,61)(REVA(I),I=1,8)
      READ(1,80)(REVC(I),I=1,8)
      READ(1,90)(REVD(I),I=1,8)
      READ(1,91)(REVE(I),I=1,8)
      READ(1,92)(REVF(I),I=1,8)
      READ(1,93)(RRMO(I),I=1,8)
      READ(1,94)(RPHR(I),I=1,8)
61    FORMAT(8F10.2)
70    FORMAT(8F10.2)
80    FORMAT(8F10.2)
90    FORMAT(8F10.2)
91    FORMAT(8F10.2)
92    FORMAT(8F10.2)
93    FORMAT(8F6.2)
94    FORMAT(8F10.3)
      DO 105 M=2,IRUNS
      RMONTH=RRMO(M)
      BASE=RMONTH*12./365.
      REVZ=RRMO(M)/RRMO(1)*16083.
      R2=BASE/24.
      DO 105 N=1,JRUNS
      R4=R2
      DO 135 L=1,24
      IHR(L)=IIHR(L)
      MO(L)=MOO(L)
      IEMP(L)=IIEMP(L)
135   ITOT(L)=IITOT(L)
      REV1=REVA(N)
      REV2=REVZ
      REV3=REVC(N)
      REV4=REVD(N)
      REV5=REVE(N)
      REV6=REVF(N)
      R1=RPHR(N)
      PWD=1265366.
      REVT(1)=42313.01
```

```
      XROR1=0.
      IYEAR=1968
      REVV(1)=42313.01
      DEPN=23307.
      PRINC=1242059.
      XPENS=0.
      PAY=0.
      FLATON=0.02
      CF(1)=21685.44
      COST=19358.
      PROFIT=0.
      MAXHR=123
      MONTH=250
      IMPLOY=83
      LOADD=0
      XROR=0
      WRITE(3,120)
120   FORMAT('1',T3,'YEAR',T8, 'RAMP',T13,'REVENUE',
     4T21,'DEPN',T27,'INVEST',T35,'EXPENSE',T43,'INT',
     5T52,'CASH',T58,'PROFIT',T66,'USAGE',T77,'REV PER HOUR'
     6,T90,'REV PER MONTH',T110,'REVENUE PER YEAR')
      WRITE(3,130)
130   FORMAT(T8,'USAG',T28,'TO PAY',T43,'PAYMENT',T52,
     7'FLOW',T65,'HR',T69,'EMP',T73,'TOT',T79,
     8'HR',T84,'MONTH',T90,'MONTHLY',T100,'EMP',T112,
     9'PROPOSED')
      WRITE(3,140)
140   FORMAT(T85,'CALC',T92,'PROP',T100,
     2'PROP',T108,'MONTH',T114,'EMPLOY',
     3T121,'TOTAL'/)
      DO 100 K=2,LIFE
      UTIL=0
      DO 3 I=8,23
3     UTIL=UTIL+ITOT(I)
      NERCNT=UTIL/(620*16)*100.
      IYEAR=IYEAR+1
      IF(IYEAR-1975)101,102,101
102   REV1=REV1-REV1*0.0636
      REV4=REV4-REV4*0.0636
101   CONTINUE
      REVV(K)=REV1+ REV2 + REV3 +REV4 +REV5
      REVT(K)=REV1+REVM+REV3+REV4+REV5+REV6
      REVV(2)=62748.57
      REVT(2)=62748.57
      DEPN=DEPN
      PRINC=PRINC-DEPN
      COST=COST+COST*FLATON
      XPENS=COST+REVV(K)*0.03
      PAY=PRINC*ROR
      CF(K)=REVV(K)-XPENS
```

```
      INCOME=REVV(K)-(DEPN+XPENS+PAY)
      MAXHR=IHR(11)
      MONTH=MO(11)
      IMPLOY=IEMP(11)
      LOADD= MAXHR+MONTH+IMPLOY
110   FORMAT(T2,I4,T8,I2,T12,F7.0,T20,F6.0,T27,F8.0,T36,
     3F6.0,T43,F7.0,T51,F7.0,T58,I6,T65,I3,T69,I3,T73,I3,T77,
     5F5.3,          T85,          F5.3,T91,F5.2,T100,F4.2,
     5T108,F6.0,T115,F6.0,T122,F7.0)
      WRITE(3,110)IYEAR,NERCNT,REVV(K),DEPN,PRINC,XPENS,PAY,
     6CF(K),INCOME,MAXHR,IMPLOY,LOADD,R1,R4,
     7REVMO,R6,REVM,REV6,REVT(K)
C INCREASES RAMP LOAD DUE TO GROWTH
      DO 25 I=1,24
      JUMP(I) =IHR(I)
      IHR(I)=IHR(I)+IHR(I)*GROWTH(K)
      IEMP(I)= IEMP(I)+IEMP(I)* EXPAND(K)
      ITOT(I)=IHR(I)+MO(I)+IEMP(I)
      IF(ITOT(I)-620)6,7,7
6     GO TO 25
7     LEFT=ITOT(I)-620
      LOAD(I)=LOAD(I)+LEFT
      IHR(I)=IHR(I)-LEFT
      ITOT(I)=IHR(I)+MO(I)+IEMP(I)
25    JUMP(I)=IHR (I)-JUMP(I)
C     CALCULATES REVENUE,MAX=0
      MAX=0
      DO 35 I=1,24
      IF(ITOT(I)-620)11,12,12
12    MAX=MAX+1
      GO TO 35
11    MAX=MAX
35    CONTINUE
      IF(MAX-0)13,13,14
13    REV1=REV1+REV1*GROWTH(K)
      REV3=REV3+REV3*EXPAND(K)
      REV4=REV4+REV4*GROWTH(K)
      REV5=REV5+REV5*EXPAND(K)
      REVMO=RMONTH
      REVM=REV2
      GO TO 100
C     CALCULATES REVENUE,MAX DOES NOT EQUAL 0
14    REVH=0
      R22=0
      DO 55 I=1,24
      REVH=REVH+JUMP(I)*R1
      IF(ITOT(I)-620)55,55,56
56    Y=(PAYMO-MO(I))/PAYMO
      RENT=Y/PAYMO*R1
      R22=R22+(BASE/MAX)*RATIO+RENT
```

```
55      CONTINUE
        R23=R22/MAX
        IF(R23-R1)8,9,9
8       R4=R1
        REX=R4*MAX
        IF(REX-BASE)107,108,108
107     REVM=REV2
        REVMO=RMONTH
        GO TO 18
108     REVM=(R4*MAX)/BASE*REV2
        REVMO=R4*30.41*MAX
        GO TO 18
9       R4=R2
        REVM=REV2
        REVMO=RMONTH
18      REV1=REV1+REVH*DAYS
        REV3=REV3+REV3*EXPAND(K)
        REV4=REV4 + REV4*GROWTH(K)
        REV5=REV5 + REV5*EXPAND(K)
        REV6=REV6
100     CONTINUE
        CALL EASY (LIFE,ROR,PWD,CF,XR)
        XROR=XR*100.
        DO 115 I=1,50
115     CF(I)=REVT(I)
        CALL EASY (LIFE,ROR,PWD,CF,XR)
        XROR1=XR*100.
98      FORMAT(T2,'MARR EQUALS',T15,F5.2,T22,'PERCENT',T95,
       4'MARR EQUALS',T108,F5.2,T115,'PERCENT')
        WRITE(3,98)XROR,XROR1
105     CONTINUE
        STOP
        END
```

```
      SUBROUTINE EASY(N,ROR,XI,A,XR)
      DIMENSION A(50)
C     RATE OF RETURN
      IGC=3
      PI=ROR
    9 F=PI+1.
      FACT=1.
      PW=-XI
      DO 50 I=1,N
      FACT=FACT*F
   50 PW=PW+A(I)/FACT
      GO TO (20,20,10),IGC
   10 IF(PW)11,12,12
   11 IGC=1
   13 PI=PI-.02
      GO TO 14
   12 IGC=2
   15 PI=PI+.02
   14 XPW=PW
      GO TO 9
   20 IF(PW)21,22,22
   21 GO TO(13,23),IGO
   23 XR=.02*XPW/(XPW-PW)+PI-.02
      RETURN
   22 GO TO(25,15),IGO
   25 XR=.02*PW/(PW-XPW)+PI
      RETURN
      END
```

Hourly Customer Analysis Program

The input data to this program is as follows:

Card no.	Variable name	Format	Comments
1	RATE(I)	F4.2	18 values for 1/2 hour rates. 9 values for hourly rates.
2	DATE	F5.0	Place the day of the month in columns 4 and 5.
3	DA,TE	2A4	Place the date in the first 8 columns e.g. 07-10-69.
4	DAYIN	5X,F2.0	Place day in, in columns 6 and 7.
	HRIN	F2.0	Place hour in, in columns 8 and 9.
	MININ	I2	Place minute in, in columns 10 and 11.
	DAYOUT	F2.0	Place day out, in columns 12 and 13.
	HROUT	F2.0	Place hour out, in columns 14 and 15.
	MINOUT	I2	Place minute out, in columns 16 and 17.
	CHARGE	F3.0	Place charges in columns 18, 19, and 20.

The output data from this program is as follows:

Table heading	Comments
TIME	Equals the hour of the day.
TIME IN	Equals the number of vehicles that enter during a given hour.
TIME OUT	Equals the number of vehicles that leave during a given hour.
RAMP LOAD	Equals the number of vehicles on the ramp at a given hour.

Table heading	Comments
TIME PARKED	Equals the number of vehicles that park one hour, two hours, etc.
PERCENT PARKED	Equals the percentage of vehicles that park one hour, two hours, etc.
HOURS PARKED	Equals the total number of hours parked by vehicles that enter during the hour stated.
REV	Equals the total revenue from the vehicles that enter during the hour stated.
AVG REV	Equals the average revenue per vehicle that enters during the hour stated.

```
C      HOURLY CUSTOMER ANALYSIS PROGRAM
C      PROGRAM ANALYZES HOURLY CUSTOMER TICKETS
C      TO RUN THIS PROGRAM MAKE THE FOLLOWING CHECKS
C      DATA CARD ONE CONTAINS THE RATE STRUCTURE ARRAY
C      DATA CARD 2  THE DATE E.G. 20 FOR THE TWENTIETH
C      DATA CARD 3 SHOWS THE DATE E.G. 09-20-69
C      THE CUSTOMER TICKET DATA NOW FOLLOWS .EACH DAYS
C      TICKET DATA IS FOLLOWED WITH A DUMMY CARD WHICH HAS
C      A 60 IN COLUMNS 6 AND 7  WHICH PASSES CONTROL TO THE
C      THE NEXT DAYS TICKET DATA
C      TO EVALUATE ONE HOUR RATES THE VALUE OF 'HRRR' MUST BE
C      ONE OR GREATER. TO EVALUATE HALF HOUR RATES THE VALUE
C      OF'HRRR' MUST BE LESS THAN ONE
C      THE VALUE OF'RUNS'EQUALS THE NO. OF DAYS TICKETS
C      BEING RUN
C      CARHR=HOURS EACH HOURLY CUSTOMER PARKS ON RAMP
C      HOURS=TOTAL CAR-HOURS FOR THE DAY
C      PARKER=THE TOTAL NUMBER OF HOURLY PARKERS
C             DURING THE DAY
C      LONG=THE NUMBER OF HOURLY PARKERS THAT PARKED
C           MORE THAN ONE DAY
C      CHARGE=CHARGE PER CUSTOMER
C      CHARGS =TOTAL INCOME FOR THE DAY FROM HOURLY
C              PARKERS
C      INCOME=AVERAGE INCOME PER CUSTOMER PER DAY
C      LOC =NUMBER OF CARS ON THE RAMP AT EACH HOUR
C           SPECIFIED
C      TIMIN=TIME A CAR ENTERS THE RAMP
C      TIMOUT = TIME A CAR LEAVES THE RAMP
C      DAYPAY = CALCULATED INCOME/DAY FROM TICKETS
C      DAYIN = DAY CAR ENTERS RAMP
C      HRIN = HOUR CAR ENTERS RAMP
C      MININ = MINUTE CAR ENTERS RAMP
C      DAYOUT = DAY CAR LEAVES RAMP
C      HROUT = HOUR CAR LEAVES RAMP
C      MINOUT = MINUTE CAR LEAVES RAMP
C      PAY = CHARGE ON TICKET BASED ON TIMES RECORDED
C             ON TICKET
C      IN     = NUMBER OF CARS ENTERING RAMP EACH HOUR
C      LEAVE  = NUMBER OF CARS LEAVING RAMP EACH HOUR
C      RUNS = NUMBER OF DAYS TICKETS BEING RUN
C      OF- HOUR-PARKERS
C      CALCULATES-PAY-CHARGES ON TICKET BASED ON
C      TIME RECORDED ON TICKET
C      CALCULATES-DAYPAY-INCOME/DAY ON ABOVE BASIS
C      CALCULATES-DIFF-DIFFERENCE BETWEEN DAYPAY
C      AND ACTUAL INCOME
C      CALCULATES- HOUR-THE LENGTH OF TIME EACH CAR
C      PARKS
C      CALCULATES-REV-THE INCOME FROM EACH GROUP OF
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C       REVENU = AVERAGE INCOME/CUSTOMER/DAY
C       HOUR = THE NUMBER OF CUSTOMERS THAT PARK FOR
C              ONE HOUR,TWO HOURS,ETC
        DIMENSION NHR(25)
        DIMENSION LOC(25),IN(25),LEAVE(25),HOUR(25),REV(25)
        DIMENSION IHR(25),TIME(25),RATE(25)
        READ(1,190)(RATE(I),I=1,18)
190     FORMAT(18F4.2)
        DECKS=0
110     DECKS=DECKS
        DO 38 K=1,25
        NHR(K)=0
        LOC(K)=0
        IN(K)=0
        LEAVE(K)=0
        REV(K)=0
        IHR(K)=0.
        TIME(K)=0
38      HOUR(K)=0
        DO 235 I=1,25
235     NHR(I)=I
10      FORMAT(5X,2F2.0,I2,2F2.0,I2,F3.0)
15      FORMAT(F5.0)
70      FORMAT(T3,I3,T8,I3,T12,I3,T17,I3,T22,F4.0,T31,F5.2,
       6T38,F6.2,T45,F5.2,T51,F4.2)
143     FORMAT(T5,'TIME PARKED=NO.OF CARS THAT PARK-X-HRS')
144     FORMAT(T5,'% PARKED=% OF CARS THAT PARK X-HRS')
146     FORMAT('1',T15,'HOURLY CUSTOMER ANALYSIS'/)
148     FORMAT(2A4)
149     FORMAT(T5,'DAY ANALYZED',T42,2A4)
150     FORMAT(4F10.3)
20      FORMAT('0',7F10.3)
105     FORMAT(2F10.0)
126     FORMAT(T5,'CUMULATIVE CAR HOURS',T40,F10.2)
127     FORMAT(T5,'TOTAL HOURLY PARKERS',T40,F10.2)
128     FORMAT(T5,'INCOME-FOR DAY-HOURLY TICKETS',T40,
       6F10.2)
129     FORMAT(T5,'INCOME FOR DAY-CALCULATED',T40,F10.2)
130     FORMAT(T5,'ACTUAL INCOME-CALCULATED INCOME',
       7T40,F10.2)
131     FORMAT(T5,'AVERAGE INCOME PER CUSTOMER',T40,
       8F10.2)
132     FORMAT(T5,'AVERAGE PARKING TIME/CUSTOMER',T40,
       9F10.2)
133     FORMAT(T5,'NO.OF HRLY CARS ON RAMP-9 HRS+',T40,
       4F10.2)
134     FORMAT(T5,'INCOME FROM 9-HOUR PLUS CARS',T40,
       5F10.2)
135     FORMAT(T5,'AVG INCOME FROM MOST HR PARKERS',T40,
       4F10.2)
```

```
136   FORMAT(T5,'AVG RAMP TIME FOR MOST HR PARKERS',
     5T40,F10.2)
137   FORMAT(T5,'TOTAL TIME FOR CARS PARKED 9 HRS+',
     3T40,F10.2)
138   FORMAT(T3,'TIME',T8,'TIME',T13,'TIME',T18,'RAMP',T23
     4,'TIME',T30,'PERCENT',T38,'HOURS',T45,'REV',T51,'AVG')
139   FORMAT(T9,'IN',T13,'OUT',T18,'LOAD',T23,'PARKED',T30
     5,'PARKED',T38,'PARKED',T51,'REV'/)
106   FORMAT(50X,2F10.3)
      HRRR=2.0
      DAY=1.00
      HRAVG=0
      BASE=0.10
      RUNS=3.
      HOURS=0
      REVNU=0
      CHARGE=0
      AMOUNT=0
      P=0.
      TTIME=0.
      RREV=0.
      ROOMER=0
      CLOCK=0
      AVGE2=0
      AVGE=0
      CHARGS=0
      DAYPAY=0
      N=10000
      HOURS=0
      LONG=0
      PARKER=0
      I=1
      READ(1,15)DATE
      READ(1,148)DA,TE
      DO 100 I=1,N
      READ(1,10)DAYIN,HRIN,MININ,DAYOUT,HROUT,MINOUT,
     6CHARGE
      IF(HRIN-1.)216,217,217
216   HRIN=HRIN+1.
      HROUT=HROUT+1.
      GO TO 228
217   CONTINUE
228   CHARGE=CHARGE/100
      IF(DAYIN-60)102,101,101
102   TIMIN =HRIN+MININ/60.
      TIMOUT=HROUT+MINOUT/60.
      PAY=0
      K=DAYOUT-DAYIN
      IF(K-0)6,6,4
4     IF(TIMOUT-TIMIN)5,5,6
```

```
5       CARHR=24*K-(TIMIN- TIMOUT)
35      GO TO 9
6       CARHR=24*K+(TIMOUT-TIMIN)
9       IF(CARHR-9.)116,117,117
117     AMOUNT=AMOUNT+CHARGE
        RCOMER=RCOMER+1.
        CLOCK=CLOCK+CARHR
116     IF(CARHR-1.)2,2,3
3       IF(CARHR-24.)7,7,8
8       J=25
        GO TO 19
2       J=1
        GO TO 19
7       IF(MININ-MINOUT)61,62,61
61      HR=CARHR
        HR=HR+1.
        J=HR
        GO TO 19
62      J=CARHR
19      HOUR(J)=HOUR(J)+1
        L=HRIN
        TIME(L)=TIME(L)+CARHR
        DAYS=CARHR/24.
        PAY=0
        HOURS=HOURS+CARHR
        K=1
        DO 60 K=1,500
        DAYS=DAYS-1.
        IF(DAYS-0)31,31,52
31      IF(CARHR-9.)51,51,56
51      IF(HRRR-1.)66,67,67
67      IF(CARHR-1.)53,53,54
53      PAY=PAY+RATE(1)
        GO TO 80
54      IF(MININ-MINOUT)57,58,57
58      CARHR=CARHR-0.7
57      L=CARHR+1
12      DO 95 J=1,L
95      PAY=PAY+RATE(J)
        GO TO 80
66      L=CARHR
        X=CARHR-L
        IF(X-0.5)68,68,69
68      L=L*2+1
        GO TO 71
69      L=L*2+2
71      DO 96 J=1,L
96      PAY=PAY+RATE(J)
        GO TO 80
56      PAY=PAY+DAY
```

```
      GO TO 80
52    PAY=PAY+DAY
      CARHR=CARHR-24.
60    CONTINUE
80    DAYPAY=DAYPAY+PAY
C     THIS PART OF THE PROGRAM DETERMINES
C     THE NUMBER OF CARS ON THE RAMP AT EACH HOUR
C     THE NUMBER OF CARS ENTERING EACH HOUR
C     THE NUMBER OF CARS LEAVING  EACH HOUR
      L=HRIN
      J=HROUT
      REV(L)=REV(L)+PAY
      IF(DAYOUT-DAYIN)114,17,26
26    IF(DAYOUT-DATE)114,13,24
13    IF(DAYIN-DATE)16,17,112
16    LEAVE(J)=LEAVE(J)+1
      DO 21 M=1,J
21    LOC(M)=LOC(M)+1
      GO TO 28
17    IF(HROUT-HRIN)111,32,18
18    IN(L)=IN(L)+1
      LEAVE(J)=LEAVE(J)+1
      L=L+1
      DO 22 M=L,J
22    LOC(M)=LOC(M)+1
      GO TO 28
24    IF(DAYIN-DATE)14,25,112
14    DO 27 M=1,24
27    LOC(M)=LOC(M)+1
      GO TO 26
25    IN(L)=IN(L)+1
      L=L+1
      DO 23 M=L,24
23    LOC(M)=LOC(M)+1
      GO TO 28
32    IN(L)=IN(L)+1
      LEAVE(J)=LEAVE(J)+1
28    CHARGS=CHARGS+CHARGE
      DIFF=CHARGS-DAYPAY
      PARKER=PARKER+1
      REVENU=CHARGS/PARKER
      AVGE=HOURS/PARKER
      PARKRS=PARKER-ROOMER
      HOURRS=HOURS-CLOCK
      CHARGG=CHARGS-AMOUNT
100   CONTINUE
101   REVNU=CHARGG/PARKRS
      AVGE2=HOURRS/PARKRS
      WRITE(3,146)
      WRITE(3,149)DA,TE
```

```
      WRITE(3,126)HOURS
      WRITE(3,127)PARKER
      WRITE(3,128)CHARGS
      WRITE(3,129)DAYPAY
      WRITE(3,130)DIFF
      WRITE(3,131)REVENU
      WRITE(3,132)AVGE
      WRITE(3,133)ROOMER
      WRITE(3,134)AMOUNT
      WRITE(3,135)REVNU
      WRITE(3,136)AVGE2
      WRITE(3,137)CLOCK
      WRITE(3,143)
      WRITE(3,144)
220   FORMAT(T3,'1/2 HOUR RATES',T20,8F4.2)
      WRITE(3,220)(RATE(I),I=1,8)
      WRITE(3,138)
      WRITE(3,139)
      DO 90 I=1,25
      PERCNT=(HOUR(I)/PARKER)*100.0
      IF(TIME(I)-0)207,207,208
207   HRAVG=0
      GO TO 210
208   HRAVG=REV(I)/TIME(I)
210   WRITE(3,70)NHR(I),IN(I),LEAVE(I),LOC(I),HOUR(I),
     4PERCNT,TIME(I),REV(I),HRAVG
      P=P+PERCNT
      TTIME=TTIME+TIME(I)
      RREV=RREV+REV(I)
90    CONTINUE
      WRITE(3,230)P,TTIME,RREV
230   FORMAT(T30,F6.2,T37,F7.2,T44,F6.2)
      DECKS=DECKS+1
      IF(DECKS-RUNS)110,115,115
112   WRITE(3,105)DAYIN,DATE
      GO TO 115
111   WRITE(3,106)HRIN,HROUT
      GO TO 115
114   WRITE(3,105)DAYOUT,DAYIN
115   STOP
      END
```

HOURLY CUSTOMER ANALYSIS

DAY ANALYZED	01-29-69
CUMULATIVE CAR HOURS	1234.19
TOTAL HOURLY PARKERS	412.00
INCOME-FOR DAY-HOURLY TICKETS	161.85
INCOME FOR DAY-CALCULATED	159.25
ACTUAL INCOME-CALCULATED INCOME	2.60
AVERAGE INCOME PER CUSTOMER	0.39
AVERAGE PARKING TIME/CUSTOMER	3.00
NO.OF HRLY CARS ON RAMP-9 HRS+	12.00
INCOME FROM 9-HOUR PLUS CARS	13.25
AVG INCOME FROM MOST HR PARKERS	0.37
AVG RAMP TIME FOR MOST HR PARKERS	2.60
TOTAL TIME FOR CARS PARKED 9 HRS+	194.77

TIME PARKED=NO.OF CARS THAT PARK-X-HRS

% PARKED=% OF CARS THAT PARK X-HRS

HOUR RATES 0.150.100.100.100.100.100.100.10

TIME	TIME IN	TIME OUT	RAMP LOAD	TIME PARKED	PERCENT PARKED	HOURS PARKED	REV	AVG REV
1	1	0	6	41.	9.95	16.38	1.00	0.06
2	0	0	7	133.	32.28	0.0	0.0	0.0
3	0	0	7	94.	22.82	0.0	0.0	0.0
4	0	0	7	63.	15.29	0.0	0.0	0.0
5	0	0	7	29.	7.04	0.0	0.0	0.0
6	0	0	7	22.	5.34	0.0	0.0	0.0
7	28	0	7	8.	1.94	107.93	13.75	0.13
8	29	9	35	4.	0.97	111.45	14.35	0.13
9	49	11	55	6.	1.46	167.72	22.15	0.13
10	27	22	93	5.	1.21	80.13	10.65	0.13
11	17	18	98	0.	0.0	103.47	9.40	0.09
12	39	27	97	0.	0.0	94.68	13.45	0.14
13	26	23	109	0.	0.0	64.07	9.40	0.15
14	22	38	112	1.	0.24	53.13	7.50	0.14
15	20	38	96	1.	0.24	35.03	5.60	0.16
16	12	36	78	0.	0.0	20.37	3.20	0.16
17	33	41	54	1.	0.24	96.33	13.05	0.14
18	26	13	46	2.	0.49	70.35	8.80	0.13
19	50	14	59	1.	0.24	131.93	17.20	0.13
20	22	42	95	0.	0.0	77.18	8.80	0.11
21	4	46	75	0.	0.0	3.62	0.80	0.22
22	1	27	33	0.	0.0	0.45	0.15	0.33
23	0	7	7	0.	0.0	0.0	0.0	0.0
24	0	0	0	0.	0.0	0.0	0.0	0.0
25	0	0	0	1.	0.24	0.0	0.0	0.0
					100.00	1234.23	159.25	

HOURLY CUSTOMER ANALYSIS

DAY ANALYZED	04-14-69
CUMULATIVE CAR HOURS	1381.89
TOTAL HOURLY PARKERS	433.00
INCOME-FOR DAY-HOURLY TICKETS	175.90
INCOME FOR DAY-CALCULATED	173.75
ACTUAL INCOME-CALCULATED INCOME	2.15
AVERAGE INCOME PER CUSTOMER	0.41
AVERAGE PARKING TIME/CUSTOMER	3.19
NO.OF HRLY CARS ON RAMP-9 HRS+	22.00
INCOME FROM 9-HOUR PLUS CARS	22.00
AVG INCOME FROM MOST HR PARKERS	0.37
AVG RAMP TIME FOR MOST HR PARKERS	2.68
TOTAL TIME FOR CARS PARKED 9 HRS+	280.40

TIME PARKED=NO.OF CARS THAT PARK-X-HRS
% PARKED=% OF CARS THAT PARK X-HRS

HOUR RATES 0.150.100.100.100.100.100.100.10

TIME	TIME IN	TIME OUT	RAMP LOAD	TIME PARKED	PERCENT PARKED	HOURS PARKED	REV	AVG REV
1	2	0	12	47.	10.85	27.45	2.00	0.07
2	0	0	14	151.	34.87	0.0	0.0	0.0
3	0	0	14	97.	22.40	0.0	0.0	0.0
4	0	0	14	40.	9.24	0.0	0.0	0.0
5	0	0	14	22.	5.08	0.0	0.0	0.0
6	1	0	14	11.	2.54	8.62	0.95	0.11
7	35	0	15	19.	4.39	135.52	17.50	0.13
8	38	9	50	13.	3.00	164.02	19.75	0.12
9	63	11	79	11.	2.54	277.91	33.25	0.12
10	35	20	131	6.	1.39	105.53	14.35	0.14
11	18	50	146	2.	0.46	51.03	7.10	0.14
12	27	31	114	5.	1.15	63.10	8.95	0.14
13	36	19	110	2.	0.46	83.80	11.70	0.14
14	31	28	127	0.	0.0	60.82	9.35	0.15
15	15	44	130	1.	0.23	19.92	3.75	0.19
16	10	60	101	2.	0.46	7.87	1.70	0.22
17	2	34	51	1.	0.23	20.43	1.70	0.08
18	15	10	19	1.	0.23	81.98	7.45	0.09
19	79	8	24	0.	0.0	187.50	24.35	0.13
20	12	18	95	0.	0.0	33.37	4.40	0.13
21	2	72	89	1.	0.23	13.97	1.50	0.11
22	0	16	19	1.	0.23	19.58	2.00	0.10
23	0	3	3	0.	0.0	19.52	2.00	0.10
24	0	0	0	0.	0.0	0.0	0.0	0.0
25	0	0	0	0.	0.0	0.0	0.0	0.0
					100.00	1381.93	173.75	

HOURLY CUSTOMER ANALYSIS

DAY ANALYZED	09-27-68
CUMULATIVE CAR HOURS	2000.90
TOTAL HOURLY PARKERS	393.00
INCOME-FOR DAY-HOURLY TICKETS	185.35
INCOME FOR DAY-CALCULATED	194.35
ACTUAL INCOME-CALCULATED INCOME	-9.00
AVERAGE INCOME PER CUSTOMER	0.47
AVERAGE PARKING TIME/CUSTOMER	5.09
NO.OF HRLY CARS ON RAMP-9 HRS+	34.00
INCOME FROM 9-HOUR PLUS CARS	53.50
AVG INCOME FROM MOST HR PARKERS	0.37
AVG RAMP TIME FOR MOST HR PARKERS	2.65
TOTAL TIME FOR CARS PARKED 9 HRS+	1050.43

TIME PARKED=NO.OF CARS THAT PARK-X-HRS

% PARKED=% OF CARS THAT PARK X-HRS

1/2 HOUR RATES 0.10C.10C.C5C.C5C.C5C.C5C.C5C.C5

TIME	TIME IN	TIME OUT	RAMP LOAD	TIME PARKED	PERCENT PARKED	HOURS PARKED	REV	AVG REV
1	1	0	22	57.	14.50	120.47	6.00	0.05
2	0	0	23	104.	26.46	0.0	0.0	0.0
3	0	0	23	76.	19.34	0.0	0.0	0.0
4	0	0	23	48.	12.21	0.0	0.0	0.0
5	0	0	23	26.	6.62	0.0	0.0	0.0
6	0	0	23	31.	7.89	0.0	0.0	0.0
7	38	2	23	5.	1.27	257.83	26.35	0.10
8	35	3	59	6.	1.53	209.33	21.25	0.10
9	33	10	91	6.	1.53	108.02	14.85	0.14
10	30	11	114	3.	0.76	90.33	12.45	0.14
11	42	31	133	3.	0.76	119.67	17.25	0.14
12	49	31	144	1.	0.25	171.55	18.80	0.11
13	38	54	162	1.	0.25	75.77	12.20	0.16
14	26	71	146	2.	0.51	48.05	7.65	0.16
15	25	49	101	1.	0.25	75.92	8.35	0.11
16	15	46	77	4.	1.02	39.13	4.10	0.10
17	4	38	46	2.	0.51	157.32	8.00	0.05
18	16	5	12	3.	0.76	55.93	7.05	0.13
19	3	3	23	0.	0.0	25.30	1.90	0.08
20	5	4	23	0.	0.0	136.53	7.20	0.05
21	5	18	24	1.	0.25	201.88	12.80	0.06
22	2	4	11	0.	0.0	44.33	3.20	0.07
23	4	3	9	1.	0.25	63.57	4.95	0.08
24	0	0	10	0.	0.0	0.0	0.0	0.0
25	0	0	0	12.	3.05	0.0	0.0	0.0
					100.00	2000.93	194.35	

HOURLY CUSTOMER ANALYSIS

DAY ANALYZED	01-29-69
CUMULATIVE CAR HOURS	1234.19
TOTAL HOURLY PARKERS	412.00
INCOME-FOR DAY-HOURLY TICKETS	161.85
INCOME FOR DAY-CALCULATED	166.50
ACTUAL INCOME-CALCULATED INCOME	-4.65
AVERAGE INCOME PER CUSTOMER	0.39
AVERAGE PARKING TIME/CUSTOMER	3.00
NO.OF HRLY CARS ON RAMP-9 HRS+	12.00
INCOME FROM 9-HOUR PLUS CARS	13.25
AVG INCOME FROM MOST HR PARKERS	0.37
AVG RAMP TIME FOR MOST HR PARKERS	2.60
TOTAL TIME FOR CARS PARKED 9 HRS+	194.77

TIME PARKED=NO.OF CARS THAT PARK-X-HRS
% PARKED=% OF CARS THAT PARK X-HRS

1/2 HOUR RATES 0.100.100.050.050.050.050.050.05

TIME	TIME IN	TIME OUT	RAMP LOAD	TIME PARKED	PERCENT PARKED	HOURS PARKED	REV	AVG REV
1	1	0	6	41.	9.95	16.38	1.00	0.06
2	0	0	7	133.	32.28	0.0	0.0	0.0
3	0	0	7	94.	22.82	0.0	0.0	0.0
4	0	0	7	63.	15.29	0.0	0.0	0.0
5	0	0	7	29.	7.04	0.0	0.0	0.0
6	0	0	7	22.	5.34	0.0	0.0	0.0
7	28	0	7	8.	1.94	107.93	14.15	0.13
8	29	9	35	4.	0.97	111.45	14.65	0.13
9	49	11	55	6.	1.46	167.72	22.90	0.14
10	27	22	93	5.	1.21	80.13	11.05	0.14
11	17	18	98	0.	0.0	103.47	9.80	0.09
12	39	27	97	0.	0.0	94.68	14.35	0.15
13	26	23	109	0.	0.0	64.07	9.75	0.15
14	22	38	112	1.	0.24	53.13	8.00	0.15
15	20	38	96	1.	0.24	35.03	6.00	0.17
16	12	36	78	0.	0.0	20.37	3.30	0.16
17	33	41	54	1.	0.24	96.33	13.80	0.14
18	26	13	46	2.	0.49	70.35	9.25	0.13
19	50	14	59	1.	0.24	131.93	18.25	0.14
20	22	42	95	0.	0.0	77.18	9.30	0.12
21	4	46	75	0.	0.0	3.62	0.85	0.24
22	1	27	33	0.	0.0	0.45	0.10	0.22
23	0	7	7	0.	0.0	0.0	0.0	0.0
24	0	0	0	0.	0.0	0.0	0.0	0.0
25	0	0	0	1.	0.24	0.0	0.0	0.0
					100.00	1234.23	166.50	

HOURLY CUSTOMER ANALYSIS

DAY ANALYZED	04-14-69
CUMULATIVE CAR HOURS	1381.89
TOTAL HOURLY PARKERS	433.00
INCOME-FOR DAY-HOURLY TICKETS	175.90
INCOME FOR DAY-CALCULATED	182.80
ACTUAL INCOME-CALCULATED INCOME	-6.90
AVERAGE INCOME PER CUSTOMER	0.41
AVERAGE PARKING TIME/CUSTOMER	3.19
NO.OF HRLY CARS ON RAMP-9 HRS+	22.00
INCOME FROM 9-HOUR PLUS CARS	22.00
AVG INCOME FROM MOST HR PARKERS	0.37
AVG RAMP TIME FOR MOST HR PARKERS	2.68
TOTAL TIME FOR CARS PARKED 9 HRS+	280.40

TIME PARKED=NO.OF CARS THAT PARK-X-HRS
% PARKED=% OF CARS THAT PARK X-HRS

1/2 HOUR RATES 0.10 0.10 0.05 0.05 0.05 0.05 0.05 0.05

TIME	TIME IN	TIME OUT	RAMP LOAD	TIME PARKED	PERCENT PARKED	HOURS PARKED	REV	AVG REV
1	2	0	12	47.	10.85	27.45	2.00	0.07
2	0	0	14	151.	34.87	0.0	0.0	0.0
3	0	0	14	97.	22.40	0.0	0.0	0.0
4	0	0	14	40.	9.24	0.0	0.0	0.0
5	0	0	14	22.	5.08	0.0	0.0	0.0
6	1	0	14	11.	2.54	8.62	1.00	0.12
7	35	0	15	19.	4.39	135.52	17.80	0.13
8	38	9	50	13.	3.00	164.02	20.45	0.12
9	63	11	79	11.	2.54	277.91	34.60	0.12
10	35	20	131	6.	1.39	105.53	15.05	0.14
11	18	50	146	2.	0.46	51.03	7.30	0.14
12	27	31	114	5.	1.15	63.10	9.65	0.15
13	36	19	110	2.	0.46	83.80	12.80	0.15
14	31	28	127	0.	0.0	60.82	9.80	0.16
15	15	44	130	1.	0.23	19.92	3.75	0.19
16	10	60	101	2.	0.46	7.87	1.90	0.24
17	2	34	51	1.	0.23	20.43	1.75	0.09
18	15	10	19	1.	0.23	81.98	7.95	0.10
19	79	8	24	0.	0.0	187.50	26.75	0.14
20	12	18	95	0.	0.0	33.37	4.70	0.14
21	2	72	89	1.	0.23	13.97	1.55	0.11
22	0	16	19	1.	0.23	19.58	2.00	0.10
23	0	3	3	0.	0.0	19.52	2.00	0.10
24	0	0	0	0.	0.0	0.0	0.0	0.0
25	0	0	0	0.	0.0	0.0	0.0	0.0
					100.00	1381.93	182.80	

Additional Programs Used in This Study

1. The analysis of variance testing undertaken in this study was accomplished by the "AARDVARK" computer program. This program was produced by the Statistical Laboratory, Iowa State University at Ames, Iowa and is referred to as Numerical Analysis - Programming Series No. 1.

   The program derived its name from the first letter of each statement indicating what the program is designed to do.

   A - Analysis of variance system

   A - Algebraic model options

   R - Residual and mean options

   D - Data format options

   V - Variate or covariate analysis

   A - Analysis on means options

   R - Requested pooled terms

   K - Key statistical transformations

   This program is available through the Statistical Laboratory.

2. The Chi-square testing undertaken in this study was accomplished by a Chi-square goodness of fit program available through the Statistical Laboratory.