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A TRANSIT ASSISTANCE PROGRAM FOR STATE EMPLOYEES

Department of Civil Engineering
and the Engineering Research Institute
Iowa State University
Ames, Iowa 50011

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FINAL REPORT

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16. Abstract

A transit subsidy program was initiated in the State of Iowa to encourage greater transit usage and thereby reduce the pressure on the state-owned parking facilities. Employees throughout the state were provided an opportunity to purchase monthly passes during the first year at a 50 percent subsidy level and during a second year at a 25 percent subsidy level. This research evaluates the transportation, socioeconomic, and attitudinal characteristics of the participants and nonparticipants in the subsidy program. The effectiveness of the program in changing travel habits and the cost of program are assessed.

The most significant and consistent variable for discriminating between users and non-users was the attitudinal factor. Travel cost, the policy variable addressed by the subsidy, was not a dominant variable in any of the models. Discriminant analysis probability models were able to correctly classify approximately 80 percent of the employees. Transferability of the models between cities was checked by classifying employees in the cities other than the one in which the model was calibrated. Employee classifications were most comparable with models based on the attitudinal components.

Approximately 45 percent of the users were auto drivers before the program. The savings from the potential reductions in parking demand could exceed the cost of the program, however, the demand is not uniformly reduced throughout the year. Recommendations are made to offer alternative pass or ticket forms in order to attract more employees to the program.

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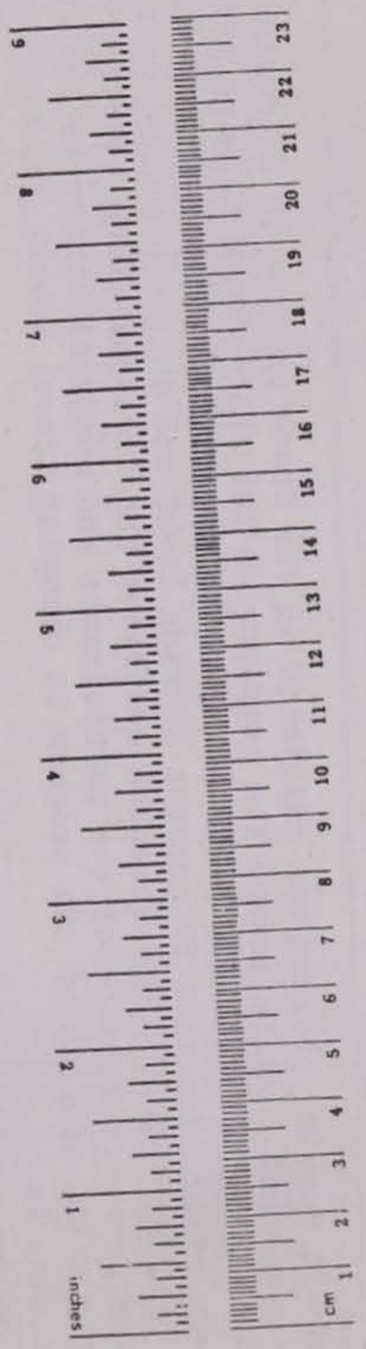
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

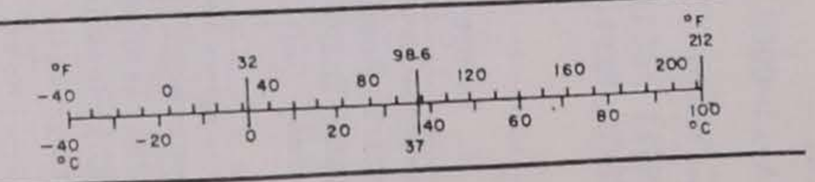
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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CHAPTER 1. BACKGROUND FOR THE STUDY

The pressure to reduce automobile travel has developed from many different directions during the past decade. Reasons related to traffic congestion, air pollution, noise pollution, energy conservation, land use order, social equity, safety and others have all been cited to encourage the public to consider alternative transportation modes. The research presented in this report evaluates a transit assistance program undertaken with congestion and land use issues as a foundation. More specifically, the program sought to relieve pressure on over-crowded parking lots without building additional parking spaces.

In 1978 the Iowa Legislature passed a bill to establish a transit subsidy program whereby any state employee who would agree not to bring a car to a state-owned lot could purchase a monthly pass on the local transit system for one-half the regular price. The state paid the other half of the fare. The focal point for the legislation was the State Capitol Complex area in Des Moines. Approximately 3,500 state employees work in the area of the capitol. The 2,600 parking spaces provided by the state for employees and visitors received heavy use, particularly during the legislative sessions, and were viewed as inadequate. The subsidy program was not, however, restricted to the capitol complex employees. Employees throughout the state were encouraged to use urban or approved commuter services with a 50 percent reduction in bus cost.

Although the legislature set aside funds to initiate the program there was no specific charge to evaluate it. The research presented in this report was undertaken through the support of the Urban Mass Transportation Administration's University Research and Training Program to perform that evaluation role. The subsidy program is comparable to a service demonstration program except that only a limited pre-implementation study was completed. This research began seven months after program initiation.

Research Objectives

The objectives of the research were much broader than the determination of how well the subsidy program met the legislative objective of reducing parking

demand. The emphasis was to provide transit management and planners with information about the characteristics of program subscribers and non-subscribers and to assess the service characteristics which impact the travel decisions of these groups. Specific objectives were to:

1. Develop socioeconomic profiles of program subscribers and non-subscribers which would assist in identifying market segments.
2. Identify transportation characteristics of employees. The research examines mode use prior to the program, the degree to which single-occupant travel is reduced, and the intensity of use of the pass for non-work purposes.
3. Examine the transit service characteristics of the cities, which may affect mode choice. Particular transit characteristics evaluated include the intensity of service, the transit and auto cost differences, and transfer requirements.
4. Establish the validity of a pre-implementation questionnaire as a forecasting tool. A survey had been conducted to determine the employees' willingness to participate in a transit program. The research provides an opportunity to determine the consistency between the stated intention and the actual behavior.
5. Analyze attitudinal variations of user and non-user groups. The research develops a composite index of individuals' perceptions of travel modes to assist in the stratification of users and non-users. The purpose is to develop a better prediction base than what is obtained from a stated intention response.
6. Develop recommendations for the implementation of an employee group assistance program. The study evaluates the effectiveness and the cost of the monthly pass program and assesses the desirability of alternative pass types.

Research Scope

Eighteen communities in Iowa provide urban transit services which were eligible for state employee use. Commuter services from six other communities

around Des Moines were also considered as eligible carriers. Since many of these cities have only limited service or a limited number of state employees, the research focuses on just Des Moines, Iowa City, and Ames. These three cities represent over 90 percent of the subsidy program subscribers. Further, since the capitol complex buildings were the target area of the legislation and the pre-implementation surveys were conducted only in Des Moines, the Des Moines area receives the greatest attention.

The subsidy program was originally funded for one year and this research was to evaluate the travel choices made for that stage of the program. However, during the course of the research the legislature increased the funds from $65,000 to $75,000 for a second year of operation while changing the state's contribution from 50 percent to 25 percent. This adjustment provided a valuable opportunity to determine the relationship between stated intentions and actual behavior in light of a fare change. The report assesses aggregate changes in usage as well as individual case evaluations of program users after the fare change. Statistical models of the relationships between user (subscriber) and non-user (non-subscriber) characteristics and the travel decision are developed. The models are not developed as forecasting or predictive models as much as for identifying employee characteristics which describe a market segment or suggest a marketing approach. The variable groupings evaluated include transportation system variables, socioeconomic variables, and attitudinal variables.

The sample used in the study represents a cross-section of employee types but it is confined to include only employees who were found to have transit access. Transit access is defined as being within three blocks of the bus route. Several analyses further limit the sample to those respondents who have transit access and auto access.

Research Methodology

Five separate surveys provide the data base for this study. Only one of these was under direct control of the researchers. The Iowa Department of Transportation was charged with the responsibility for implementing the transit assistance program and had gathered the data in the first four surveys.

The survey instruments and the analysis approaches are reviewed in this section. The details of the questionnaires, sampling procedures, and analysis techniques are given in later chapters. The questionnaires evaluated as part of this research included:

1. a pre-implementation survey distributed to state employees working in the capitol complex area,
2. a small sample survey of bus users in the capitol area,
3. an evaluation survey distributed to all program subscribers after the first six months of the program,
4. an interest survey of all persons who were on a waiting list at the end of six months because the program was over-subscribed in relation to program funding,
5. the project survey instrument distributed to a sample of program subscribers and non-subscribers in Des Moines, Iowa City, and Ames.

Questionnaires 1 through 4 were generally limited to providing information about previous mode of travel and the age and sex of the respondents. The Department provided data summaries from Questionnaire 1 and a listing of those respondents who indicated they would be willing to try a bus service if it was within three blocks of home and cost less than $1.00 per day. These names were manually matched with those persons who actually subscribed to the subsidy program. Detailed profiles of users and non-users were obtained only in the project questionnaire. Transportation characteristics considered were total and excess travel times for bus and auto, travel costs, walking distances to bus stops, and the need for a transfer. Reported travel times and costs were used rather than engineering estimates from network analysis. The socioeconomic and demographic data included age, sex, household size, employed persons, licensed drivers, autos owned, auto availability, and income. Attitudinal or modal bias data were obtained from psychological scaling techniques.

Cross classification analysis and tests of independence were used to identify differences in the profiles of users and non-users. These analyses are useful because they do not require any assumptions about the form of the statistical distributions. However, they are limited in value for selecting primary variables to identify behavioral groups when there are a large number of

variables which are interrelated. Therefore, discriminant analysis techniques were also used to identify significant variables. The discriminant analysis efforts focused on respondents who had access to both bus and auto.

The fare changes created by the 50 percent subsidy in 1978-1979 and the 25 percent subsidy in 1979-1980 would have conceptually provided an opportunity to assess the fare elasticity. This was not directly possible, however, because the pass sales were artifically constrained due to a lack of funds to support all applicants in 1978-1979. The research addresses the fare impacts by examining the effect of the cost and time variables in discriminant models, but also by carefully scrutinizing the data for those users who dropped the program after the subsidy rate decreased. The survey instruments were coded to allow case by case comparisons with the user lists.

Literature Review

Several incentive programs have been undertaken to reduce travel in the single-occupant automobile. Likewise, alternative analysis techniques and variable sets have emerged from research undertaken to evaluate behavior patterns of individuals. Some of these studies are reviewed here to show the pattern of results which have emerged.

Demonstration Programs

A number of studies have been undertaken to evaluate the impact of fare and service changes on transit ridership [1, 2, 3, 4, 5, 6]. In these studies the transit service levels generally have been found to be more important factors in mode choice than cost factors, although Mullen [5] and Schmenner [6] concluded the opposite. Because these fare changes are often small in magnitude or are made jointly with service changes, the transit usage changes have not been as dramatic as desired for evaluation. Therefore, special projects have been undertaken through the Service Methods and Demonstration programs of the Urban Mass Transportation Administration to provide controlled evaluations of ridership patterns.

Studenmund [7] and others have discussed travel behavioral changes due to free off-peak services in Trenton, New Jersey, and Denver, Colorado. They found that the elimination of fares in the off-peak hours increased ridership, but the changes were not generally different from those that would have been experienced for any other absolute fare change of the same amount.

An employer-based monthly pass program similar in concept to the Iowa program was evaluated by Parody and Brand [8]. They found that the acceptance of the program was a function of the type of pass offered. The change in ridership due to a change in the price was found to be in the same range expected for regular cash fare changes. An unrelated study also noted that the ability to avoid paying daily, an inherent feature in a prepaid pass program, was of very little importance in the mode choice decision [9].

Other programs have evaluated the effect of parking discounts and parking restrictions [10, 11, 12]. Pickerell and Shoup discussed a Canadian experience in which free parking was eliminated as an employee benefit [10]. Prices were established at 70 percent of the commercial rate and mode shifts were analyzed. The price change caused approximately 15 percent of those previously driving to work alone to switch to other modes.

A study of parking restrictions and cost changes as well as transit changes was conducted in a university environment [11]. The parking restrictions took the form of converting free, unrestricted time-limit spaces to one-hour and two-hour metered spaces. The research found the changes in parking behavior to be small. The persons riding with others showed the largest tendency to change modes. Of those driving alone before the parking restrictions were implemented, 85 percent continued to drive alone. The researchers evaluated several actual and hypothetical situations and concluded that shifts to transit were possible with severe restrictions on parking time; however many respondents would tolerate the inconvenience of the restrictions rather than shift to transit.

A carpooling program in Seattle has also been reported [12]. Free or discounted parking was provided to carpools with three or more occupants. Approximately 22 percent of the program participants had previously driven alone to work. The researchers found that the program actually diverted more people from the transit service than from single-occupant autos. Forty percent of the new carpoolers had been transit users.

Attitudinal Factors in Mode Choice

Socioeconomic, transportation, and attitudinal factors have been considered in several studies but the relative importance of each of these factors has been judged to be different in these studies. Part of the differences may be attributed to differences in trip purpose, trip destination or sample selection. Part may be due to survey methodology or the analytical models. The projects reviewed here display many of these variations. They focus on studies related to transit choice for the work trip and are especially pointed to studies that have included attitudinal measures.

One of the earliest efforts to incorporate attitudinal factors into a forecasting framework was by Hartgen [13]. A random sample of travelers was evaluated for each of the variable categories. He noted that 80 to 90 percent of the explained variation in mode choice behavior was due to special group situational data which combined trip purpose, auto availability, and income factors. The attitudinal factors which measured the importance of modal attributes explained only 10 to 20 percent of the variation. The study also noted that there was very little difference between the weighted or unweighted attitudes or between the results of logit, probit or discriminant analysis techniques if the grouped variable data were being evaluated. Howe and Cohen also found situational variables to be more important than the attitudinal components in a general population sample [14]. However, several other studies have found attitudes or perceptions to be more important [15, 16, 17, 18, 19]. Dobson and Tischer reported that for CBD employees the correlations between beliefs and modal choice were substantially larger than between sociodemographic data and mode choice [19]. The sociodemographic variables had secondary impact in the analyses, and transportation variables were least important in describing behavioral differences. Dumas and Dobson also noted that behavior is related to the perceptions of sub-attributes of comfort and convenience [20]. However, a stronger intervening variable was an overall measure referred to as modal affect. The modal affect is a measure of the overall image of a mode by the respondent.

An example of a mixed response within the same research is provided by Spear [9]. He developed a generalized variable to incorporate attitudinal factors related to convenience. The generalized attitudinal variable

significantly increased the goodness-of-fit for the model. It was noted, however, that the predictive ability of the model including the attitudinal measure was no better than models with just time and cost factors.

Several studies have been undertaken with the intent of identifying market segments rather than predictive models [20, 21, 22]. Nicolaidis and others identified six market segments [21]. In their study the dependent variable was frequency of use during a time period rather than mode choice for a particular trip. In this study the demographic and transportation accessibility variables were more highly correlated with frequency than the attitudinal factors.

After noting the possibility that the mode used by a person may affect the responses to attitudinal questions, Gensch and Torres removed that potential bias by assessing attitudes toward transit of only those persons who were auto users [22]. Three clusters were established, using the attitudinal responses, according to the potential to shift the groups to a transit mode. The clusters were based on stated intentions to use mass transportation if several different transportation improvements were made. Unfortunately no meaningful data were available to check the extent to which different cluster members actually switched to transit with a change in the transportation system. The research presented in this report provides the unique opportunity to follow through and determine if employees actually undertake a stated action when the opportunity is available.

Organization of the Report

Details about the assistance program, the study cities, the program participants, and the research results are presented in the following chapters. Chapters 2 and 3 discuss the general results of the surveys conducted by the Iowa Department of Transportation and the general community and transit characteristics of the cities included in this research. Chapters 4 and 5 present the analysis of employee characteristics and the variables which distinguish user and non-user groups. The results from these analyses are used to identify promotional areas. The final three chapters evaluate the impacts of the program regarding actual travel adjustments, program management, and costs.

CHAPTER 2. CHARACTERISTICS OF THE STUDY CITIES AND THE SUBSIDY PROGRAM

The state employee transit assistance program is only one of a number of efforts undertaken within Iowa to reduce vehicular travel and fuel consumption. Two other efforts which received special notice were the initiation of "flex-time" and the "I-Pool" program. Both of these affected the employee's ability to make arrangements for carpooling. "Flex-time" simply allowed the employee to select the most desirable starting and quitting time so that carpool arrangements, as well as other benefits, would be enhanced. The "I-Pool" program provided interested employees with the home and work location of other employees with whom carpooling arrangements may have been possible. In each case the intention was to provide these opportunities to all employees, but as would be expected the greatest opportunities for coordination could occur only where a significant mass of employees was concentrated.

The bus subsidy program entitled I AM READY 4 A CHANGE was also directed toward all state employees, but the actual participation was very concentrated. At the time the program began, a total of 18 communities served by urban transit systems and six communities served by commuter buses were included in the program. The highest concentrations of employees (employee estimates given in parentheses) are at the capitol complex in Des Moines (3,500), the Department of Transportation in Ames (1,200), and the three major state universities including Ames (3,500), Iowa City (10,000), and Cedar Falls-Waterloo (1,500). The Iowa City total includes the regular University faculty-staff as well as the Medical Center physicians and staff.

Table 2.1 presents a summary of all monthly passes sold during the first fiscal year. Employee participation is clearly concentrated in a small number of locations. The Iowa City area includes both Iowa City and Coralville. Although each city has its own bus system, the state employees are all employed in Iowa City. In further references these cities will generally be cited simply as Iowa City. Based on the March data, Iowa City and Des Moines represented over 90 percent of all program subscribers. Ames accounted for less than three percent of the total sales. Due to the low participation rates in the other cities,

Table 2.1. Monthly passes purchased during Fiscal Year 1978-79*

City	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Ames	12	30	30	31	32	30	31	17	13
Bettendorf	0	0	0	0	0	0	0	0	0
Burlington	2	0	2	2	1	1	2	1	0
Cedar Rapids	8	6	9	9	9	10	10	8	9
Clinton	1	1	1	1	1	1	1	1	1
Coralville	120	148	189	172	190	187	187	161	139
Council Bluffs	0	2	2	2	1	1	2	1	1
Davenport	2	2	2	1	1	1	1	1	1
Des Moines	298	298	309	302	308	300	310	264	255
Dubuque	3	1	3	2	2	2	2	1	1
Fort Dodge	0	0	0	0	0	0	0	0	0
Iowa City	469	516	593	561	600	581	590	445	391
Marshalltown	0	2	1	1	1	0	1	1	1
Mason City	0	0	0	0	0	0	0	0	0
Muscatine	0	0	0	0	0	1	0	0	0
Ottumwa	2	2	2	1	1	1	1	1	1
Sioux City	10	11	12	12	12	13	12	12	11
Waterloo	2	11	3	3	3	3	3	1	1
Commuter:									
Indianola	20	21	27	26	26	26	26	22	22
Martensdale	2	3	4	4	3	2	4	2	2
Norwalk	2	1	1	1	1	1	1	1	1
Carlisle	0	0	6	7	7	6	7	2	2
TOTAL	953	1,055	1,196	1,138	1,198	1,167	1,191	941	853

*Program only available for nine months (fiscal year commenced July 1, 1978).

only these areas were studied further. Ames was retained because it was a large employee center and it afforded an opportunity to view a wider range of transit services. The special characteristics of each of these localities are reviewed in the following sections.

Des Moines

General Characteristics

The Des Moines metropolitan area consists of six incorporated suburban communities and the central city of Des Moines. The population of the area approaches 250,000, with an estimated 200,000 in Des Moines. These seven cities comprise approximately 130 square miles.

As the capitol of the State of Iowa, Des Moines has two major work trip generators: the State Capitol Complex and a downtown financial district approximately one mile away. The area also has several manufacturing firms of various sizes and four regional shopping centers. Drake University, the College of Osteopathic Medicine and Surgery, Grandview College, and numerous business and vocational schools are located in Des Moines.

Transit Service

Public transportation service has been provided to Des Moines residents since the 1880s, and thus has become a vital element in the city's total transportation system. The strong central core of the metropolitan area makes it essential that a good public transit system continue to operate.

Public transit service in the City of Des Moines and the surrounding communities of Urbandale, Clive, Windsor Heights, and West Des Moines is provided by the public Metropolitan Transit Authority (MTA), which is headquartered in Des Moines. The MTA contracts separately with each city to provide specific fixed-route services. In addition, special services for the elderly and the handicapped are available.

During this study the transit authority operated a total of eight regular routes and five peak-period routes. Each participating community was served by at least one regular route and one express route. All routes traverse the Central Business District. Five of the eight regular routes serve the capitol area directly and all express runs serve the capitol area.

The normal operating hours are from 6:00 a.m. to 7:00 p.m., Monday through Saturday. Weekday buses run on a 15 minute headway from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:30 p.m. for most routes. During the other hours and on Saturdays one-half hour headways are maintained.

Several fare schedules and payment methods are available in the Des Moines system. The base fare is 50¢ for persons over 12 years of age but variations exist for students, elderly, handicapped, and loop shoppers. The unlimited monthly pass is $20. Under the initial Iowa program the state employee could purchase this for $10. Unlimited-ride weekly passes are also available for $4.50. Although the state program does not work with the passes of shorter duration, private employers have assisted employees with the weekly passes. The private program, which is referred to as the Employer Support Program (ESP), is not part of this research, but it may have served as the guiding force for the initial legislative action. To date 35 private companies, employing over 23,000 people, participate in that program. The employers participate at whatever level of subsidy they choose. The subsidy level range among current participants varies from 10 percent to 100 percent.

The commuter operations providing service at the beginning of the program all served Des Moines. The fares on these routes ranged from $35 to $46 per month. The state also paid 50 percent of those costs.

Parking System

Approximately 2,600 parking spaces are provided in the immediate area of the capitol complex. This total includes the visitor parking and the reserved lots as well as the general employee lots. Walking distances to the nearest lots are generally under two blocks and the parking is provided free.

Iowa City

General Characteristics

The cities of Iowa City and Coralville have populations of approximately 47,000 and 6,000, respectively. The area encompassed by the two cities totals nearly 37 square miles.

Iowa City is dominated by the main campus of the University of Iowa, with an estimated enrollment of 22,500, and the University of Iowa Hospitals. A Veterans Administration Medical Center adjoins the university hospital complex. Although several smaller businesses are located in Iowa City, most industrial workers who live in Iowa City work in the large industrial factories in metropolitan Cedar Rapids 20 miles to the north.

Coralville is considered a suburb of Iowa City, with the main employment consisting of service-oriented businesses. The majority of employed residents of Coralville, however, work in Iowa City or Cedar Rapids.

The focal point for state employees in the Iowa City area is clearly the University of Iowa and its associated Medical Center. Transit service to the university, however, is complicated because of the dispersion of the campus area. Major classroom and administration buildings are separated from the hospital, the recreation centers, dormitories, and other classrooms by a four-lane arterial and the Iowa River. The Oakdale Campus is located seven miles from the main campus and further complicates the transit operations. The University is located between Iowa City and Coralville. The central areas of the cities are approximately two miles apart. The Iowa City central district is immediately adjacent to the campus.

Transit Service

Transit in the Iowa City area is actually provided by three distinct operators: Iowa City, Coralville, and CAMBUS, the university's campus system. Twelve regular routes and four supplementary peak-hour routes operate in Iowa City. Thirty-minute headways are provided from 6:30 a.m. to 6:30 p.m., Monday through Saturday on 11 of the 12 regular routes [1]. One-hour headways are provided on the other route. All routes continue one-hour headways from 6:30 p.m. to 10:00 p.m. The peak period shuttle routes operate from 7:00 a.m. to 9:00 a.m.

and 4:00 p.m. to 6:00 p.m. on weekdays. Two routes provide 30-minute headways and two provide 60-minute headways. The Iowa City buses do not circulate through the campus.

The base fare in Iowa City is 25 cents. Monthly passes which had been in use for two years prior to the state program are sold for $8.00.

Coralville transit operates a total of three routes. Headways are 15 minutes on the main route from 6:00 a.m. to 10:00 a.m. and from 3:00 p.m. to 6:00 p.m., 30 minutes from 10:00 a.m. to 3:00 p.m., and 60 minutes from 6:00 p.m. to 12:30 a.m. This route operates with one-hour headways on Saturdays. The other two routes operate on weekdays with one-hour headways in the peak hours and two-hour headways between 10:00 a.m. and 3:00 p.m. Evening and Saturday services are not provided on those routes. Transfers to the Iowa City and campus systems are possible.

The base fare on the Coralville system is 35 cents. Monthly passes cost $12.00. Still other fare alternatives are available to both Iowa City and Coralville users but only the monthly passes are applicable to the state employees.

CAMBUS is the university sponsored service to provide circulation within the main campus and to the Oakdale campus. A mixture of headways is provided but on the main routes the headways are 7 1/2 minutes from 7:30 a.m. to 6:15 p.m. Other routes operate with headways of 10 to 30 minutes during the class hours. During the peak service periods 12 buses are in operation. Evening service is provided to as late as 12:30 a.m.

The university system is paid through student fees, parking system funds, donations and other university sources. Trip fares are not charged and any person in the community can ride the system without paying a fare.

Parking System

The total number of state provided parking spaces in Iowa City was estimated to be 7,600 [2]. Major parking areas are located away from the central campus areas. The CAMBUS service is relied on to provide access from the outlying lots to the central areas. Annual parking permits at the central lots are $96 per year.

Ames

General Characteristics

Ames is the smallest of the communities with a population of 43,000 and an area of 16 square miles. The community has a variety of private and federally based employees, but it is considered to be dominated by the two state employers, the Department of Transportation and Iowa State University. Both employers are located on the same arterial street, but they are about two miles apart and both are somewhat separated from the central business district.

Transit Service

Transit service in Ames has been in a nearly continuous transition. During the past five years the operation has changed from a private, fixed-route operation, to a publicly owned dial-a-ride operation and back to a fixed-route operation. During the initial subsidy program period a mixture of fixed-route and dial-a-ride services was provided. The service was adjusted in the second year of operation to be nearly complete by fixed-route service.

The service during the basic study period included three fixed routes operating from 6:30 a.m. to 8:30 a.m. and 4:00 p.m. to 6:00 p.m., Monday through Friday. The headways on all routes were 30 minutes. All three routes served both employers. Only one route continued as a fixed route between 8:30 a.m. and 4:00 p.m. The other vehicles transferred to dial-a-ride service.

During the second fiscal year the route structure was adjusted so that only two routes directly served the Department of Transportation. All routes went to fixed route service throughout the day. Dial-a-ride was available only to elderly and handicapped, and to those outside the service area. The transit operator estimates that 80 percent of the population is served by the fixed route.

The base fare is 50 cents. Monthly passes cost $20. In fiscal year (FY) 1979 trip tickets containing 20 rides were $7.00. In FY 1980 the rate rose to $8.50. The state program subsidized only the monthly pass but the increased cost for the trip ticket could affect the decision to purchase the pass.

Parking System

Parking is available at both employee sites generally within one to two blocks of the offices, if not immediately adjacent to the office. Parking at

the Department of Transportation is free. An annual $20 fee is charged for most spaces at the university although some reserved spots are priced at $60. Metered spaces are available for visitors.

Ridership Trends on the Transit Systems

An objective of the subsidy program was to increase transit usage. One can examine the ridership trends given in Table 2.2 and see that ridership had indeed increased in FY 1979. However, the increase certainly is not solely attributable to the assistance program. Transit ridership has been experiencing increases throughout the years shown. Several factors have contributed to this trend, including improved service, upgraded rolling stock, and higher fuel prices. The latter aspect is shown in Figure 2.1. During the 1970s the price of gasoline increased approximately 66 cents per gallon. Considering just the change from the 1978 end-of-year price of 65 cents to the 1979 price of $1.03, one finds a 58 percent increase. Even in constant dollar prices, based on the value of the dollar at the end of 1979, fuel prices increased 36 percent from 78 cents to $1.03. The effect of the fuel price increases on ridership, relative to the effect of reducing the transit fares, cannot be directly determined from Figure 2.1 or the ridership data. The data are presented to point out that the factors causing changes in total ridership are much broader than the subsidy program, even though it was hoped that all other factors would be held constant. Other data obtained from the surveys will be needed to sort out the subsidy program effects.

The ridership data are more valuable as a means of showing variations in transit use between the study cities. Although the Des Moines area is five times more populous than Iowa City and Coralville, total ridership is only 110 percent higher. If the university system is included one finds the total annual ridership in Iowa City in 1979 to be six percent higher than Des Moines. Clearly, Iowa City has been a transit-oriented area. It is not easy to sort out whether service level or price is the predominant reason for this because Iowa City provides both more service per capita and lower prices than the Des Moines system.

The differences in use are even more dramatic when comparing Iowa City with Ames. The universities in the communities are of nearly equal size. On a per capita basis Iowa City provides twice as many vehicle-miles of service but

Table 2.2. Selected transit ridership characteristics: FY 76-79

	Fiscal Year	Riders	Revenue mi	Pass/Rev-mi	Rides/Capita	Rides/Veh-hr	Veh-mi/Capita
DES MOINES	76	3,214,959	2,205,844	1.46	12.90	N/A	8.13
	77	3,177,806	2,250,574	1.39	12.51	N/A	9.03
	78	3,978,126	2,178,950	1.82	15.97	21.42	8.75
	79	4,372,239	2,375,404	1.84	17.55	22.88	9.53
IOWA CITY	76	1,422,930	517,691	2.75	29.79	N/A	10.84
	77	1,402,783	556,099	2.52	29.37	N/A	11.64
	78	1,521,192	609,350	2.50	31.85	27.02	12.76
	79	1,743,433	649,083	2.69	36.49	30.96	13.59
CORALVILLE	76	193,271	180,330	1.07	29.27	N/A	27.31
	77	212,001	180,330	1.18	32.10	N/A	27.31
	78	283,428	186,313	1.52	42.92	18.10	28.21
	79	334,998	201,633	1.66	50.72	20.07	30.53
CAMBUS	76	2,339,576	399,845	5.85	N/A	N/A	N/A
	77	1,993,562	335,000	5.95	N/A	N/A	N/A
	78	2,543,647	389,997	6.52	N/A	N/A	N/A
	79	N/A	N/A	N/A	N/A	N/A	N/A
AMES	76	N/A	N/A	N/A	N/A	N/A	N/A
	77*	86,368	204,534	0.42	1.94	N/A	4.58
	78	121,960	222,492	0.55	2.73	6.85	4.98
	79	160,800	270,755	0.59	3.60	7.64	6.06

*Nine months of operation

Sources: "A Report of Urban, Regional, Intercity, and Taxicab Operations for 1976-1979", Iowa Department of Transportation, Public Transit Division, Des Moines 1980; "Summary of Transit System Information", Johnson County Regional Planning Commission, Iowa City, 1978.

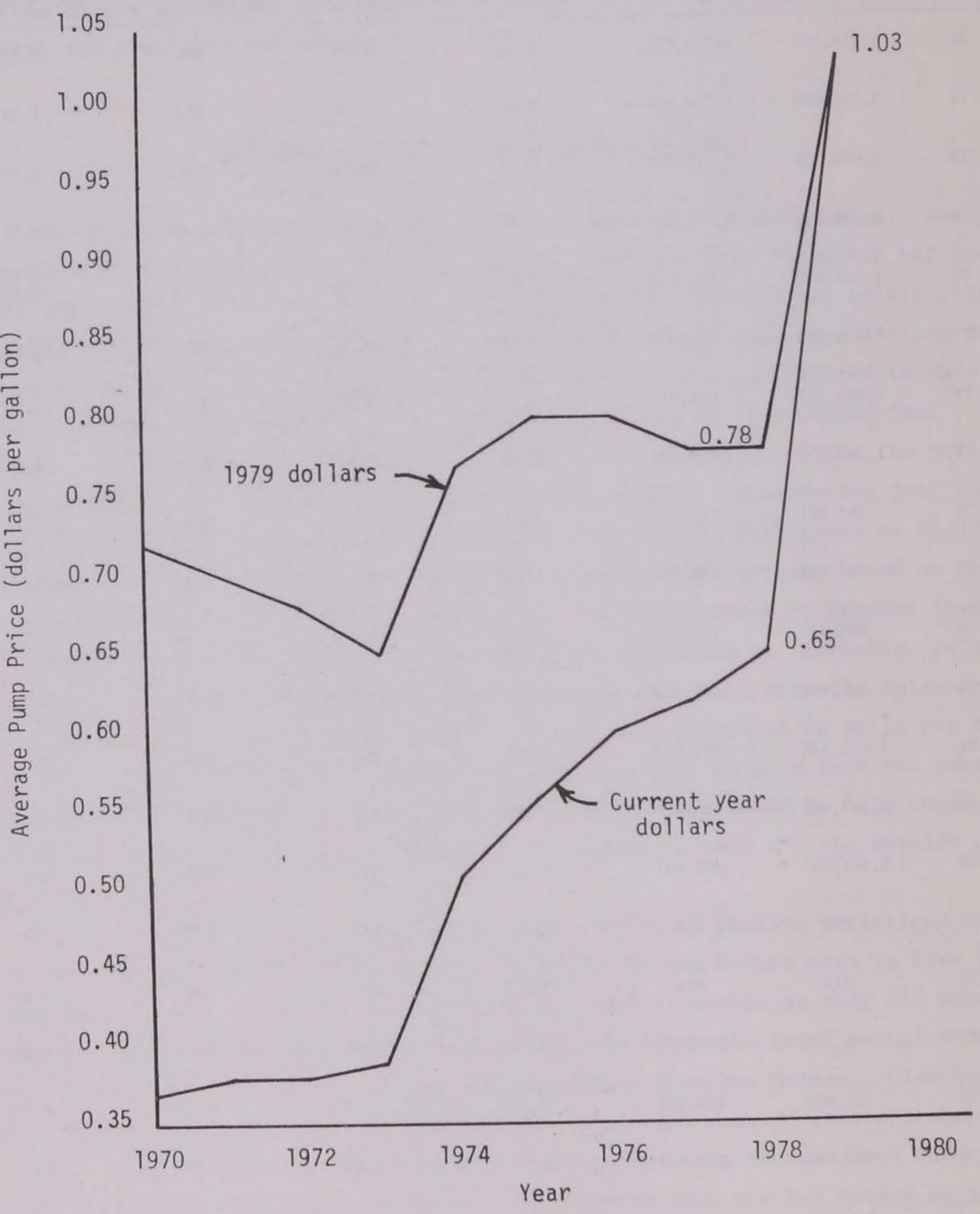

Figure 2.1 Gasoline price trends in Iowa, 1970-1980

Source: Iowa Department of Transportation, Motor Fuel Tax Analysis sheet, January, 1980.

experiences per capita ridership an order of magnitude higher than Ames. The peak hour headways in both cities are 30 minutes. Differences in ridership in the cities may be due to service hours, service frequency, or costs. Alternatively, it may be that because people in Iowa City have experienced a relatively stable system while Ames residents have experienced many operating changes the Iowa City residents have a better image of the available service. In the following chapters the cost, travel time and perceptual images of the transit systems will be discussed in relation to the differences observed between subsidy program subscribers and non-subscribers. These analyses should help define characteristics important to the explanation of ridership differences.

CHAPTER 3. PROGRAM DEVELOPMENT AND PRELIMINARY SURVEY RESULTS

The initial state assistance program was established to operate only during Fiscal Year (FY) 1979 and the $65,000 allocated to the program was supposed to allow any state employee to purchase a pass through a central office of the transit division. However, the program did not start until October and after three months the demand exceeded expectations. During the last half year the passes were distributed on a priority basis. Those who had purchased passes in earlier months received first priority, then permanent full-time employees, then permanent part-time employees, and so forth. Employees not receiving a pass were placed on a waiting list; if a subscriber dropped the program a person on the waiting list could purchase that pass.

The program was continued in FY 1980 but the subsidy rate was dropped from 50 percent to 25 percent and the total allotment was increased to $75,000. Every employee wishing to participate was allowed to do so until the funds ran out. A waiting list was not maintained.

The various phases of review from the program implementation stage to the research reported here involved five surveys of employees. These included the pre-implementation surveys of Des Moines employees and the capital employee bus users' survey, the six-month evaluation surveys of users and waiting-list employees, and the research questionnaires. In this chapter the general nature and results of the first group of questionnaires are reviewed and the development of the survey instrument and sampling for this research are discussed. Since the Des Moines employees were common to all surveys they receive the most attention throughout the study.

Pre-Implementation Questionnaires

Survey Distribution

The first survey instrument was distributed to over 3,800 employees on the State Comptroller's list of capital employees. The objectives of the survey were to obtain an overview of the current mode to work and the preferences for alternative bus and car-pool programs. The survey instrument

appears in Appendix A-1. These surveys were returned through the work supervisors with a return rate of 69 percent [1]. Each returned questionnaire contained a pre-printed label with the employee's name.

A second small-scale survey was conducted at transit disembarking points around the capitol building to determine the general characteristics of current employee transit users. This survey instrument appears in Appendix A-2. Previous mode, age, sex, and auto availability were the principal variables examined. Eighty-two of the 160 surveys distributed were returned, a rate of 55 percent [1].

Summary of Results

The modal distribution for work trips to the capital complex is shown in Figure 3.1. Nearly 57 percent drove alone to work and another 32 percent reported to be carpoolers. Bus trips accounted for five percent of the trips while all other modes accounted for six percent.

The preferences of the employees were assessed by obtaining yes-no responses to the five questions below. The percent stating yes is shown in parentheses.

1. If transit service was available for your work trip for less than $1.00 per working day (cost may be higher for those living outside urban area) and ran within three (3) blocks of your house, would you be willing to try it? (57 percent yes)
2. If transit service for your work trip took on passengers only at select boarding points, such as shopping centers and certain street corners, would you be willing to try it? (34 percent yes)
3. If park-and-ride service (commuter drives partway and rides transit partway) were available for your work trip, would you be willing to try it? (23 percent yes)
4. If you could join a carpool that would be convenient for you, would you be willing to try it? (32 percent yes)
5. If you are not in a carpool, would you be willing to join a carpool convenient to you, if a priority (close-in) parking system were established for carpooling in the capitol area? (40 percent yes)

Although transit access is the only mode addressed by the legislative program, it is informative to note the responses for all modes. Fifty-seven percent, or 1,513 persons, stated they would try the bus if it were available

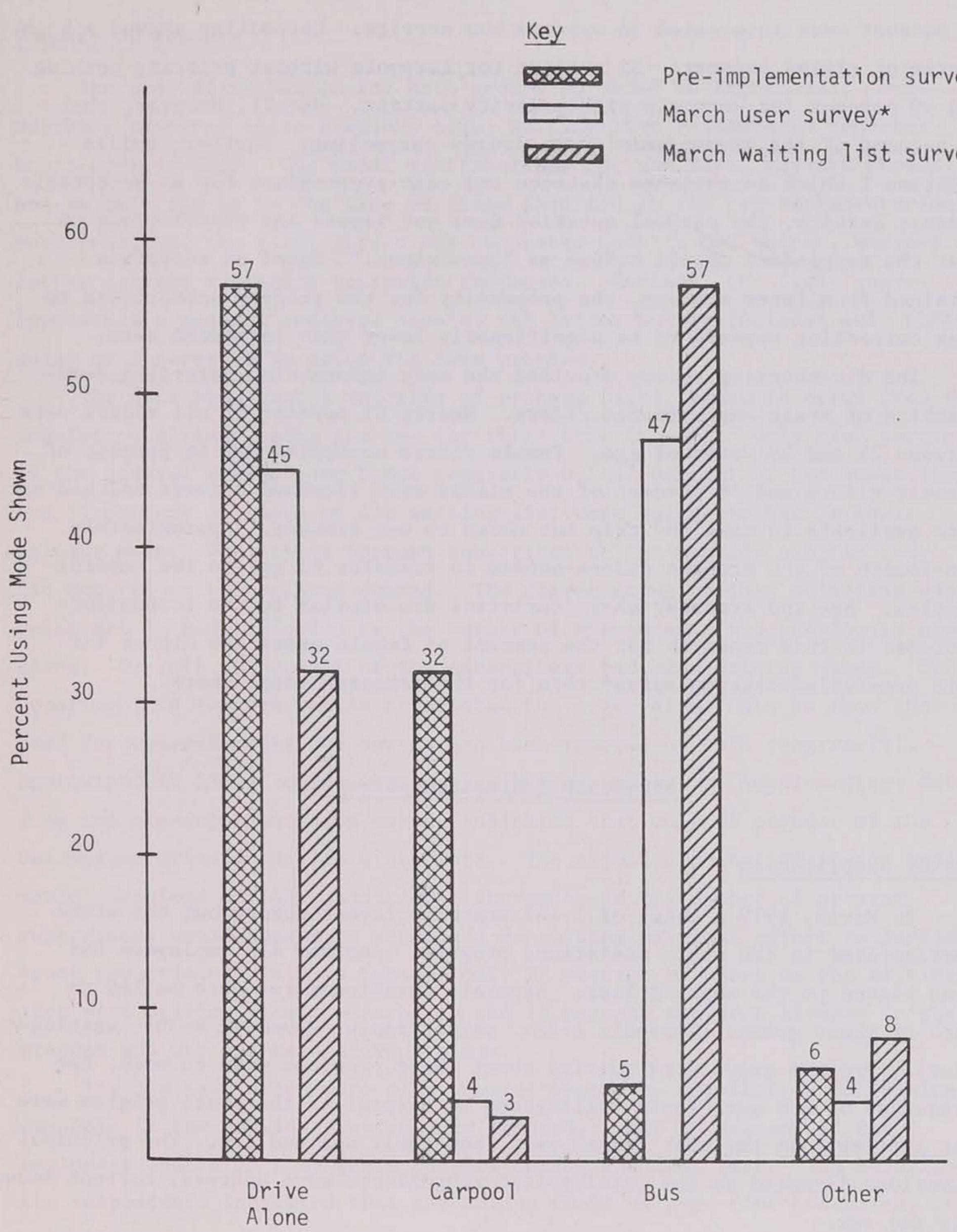

Figure 3.1 Mode usage for employee work trips

*Data represents mode used before participation in the program.

for less than $1.00 per day and if it ran within three blocks of home. Only 34 percent were interested in express bus service. Carpooling showed a high degree of stated support: 32 percent for carpools without priority parking and 40 percent for carpools with priority parking. Recall, however, that 32 percent of the respondents were already carpooling. Further, unlike Question 1 which establishes distance and cost constraints for an acceptable transit service, the carpool question does not impose any restrictions on what the respondent should define as "convenient." Based on responses obtained from later surveys, the propensity for the program subscribers to seek carpooling appears to be significantly lower than indicated here.

The disembarking survey provided the only information regarding demographics of state employee bus riders. Nearly 51 percent of all riders were between 21 and 39 years of age. Female riders accounted for 66 percent of transit riders and 58 percent of the riders were licensed drivers and had an auto available to make the trip but chose to use transit. Approximately one-fourth of the transit riders needed to transfer to get to the capitol complex. Age and transfer characteristics are similar to the respondents included in this research but the percent of female users was higher for this pre-implementation survey than for the research respondents.

Six-Month Evaluation Survey

Survey Distribution

In March, 1979 a total of 1,167 state employees throughout the state participated in the state assistance program. Another 436 employees had been placed on the waiting list. Separate questionnaires were mailed to each of these groups (Appendix A-3A: participants; Appendix A-3B: waiting-list). Program users were queried about their previous mode to work, the frequency of bus use, their willingness to carpool if the state program were not available in the next fiscal year, and their age and sex. The principal questions directed to the waiting-list respondents were address, current mode, age and sex.

Questionnaires were returned by mail and names were optional. The return rates were 71 percent and 47 percent for the users and waiting-list employees, respectively.

Socioeconomic Data

The socioeconomic data collected were standard elements including age, sex, family size, employed persons, auto ownership and availability, and income. Only the age and sex variables were common to the earlier surveys completed by the Iowa Department of Transportation.

Marketing Elements

Knowledge of the program, willingness to participate at a lower subsidy rate, and preferences for alternative pass schemes were the principal marketing issues addressed. Specific points of interest included the monthly demand pattern and the types of passes. The pass alternatives involved monthly and quarterly unlimited ride options and trip ticket options.

Survey Samples

The employees selected to receive surveys worked in either Des Moines, Iowa City or Ames. The complete breakdown of the survey distribution is shown in Table 3.1. Since Des Moines was the focal city, a 100 percent sample of all Des Moines users as of March, 1979 was selected. An equal number of non-users, living within three blocks of a bus route, was also chosen. A 100 percent sample was also obtained in Ames. Since the response rate was expected to be lower for non-users, twice as many non-users were surveyed there in order to have a meaningful base to compare with the users. The research budget was not large enough to sample all Iowa City users and a comparable non-user group. Instead, a user sample nearly equivalent in absolute numbers to Des Moines and a non-user sample adequate to give a comparative base were selected. The final surveys were also distributed to two special groups in the Des Moines area. These were the commuters from outlying communities (68 total) and a list of Des Moines users (81) who had used the pass for only two months before dropping the program. The latter group was of interest to determine if their characteristics were more comparable to the continuing user or to the non-user employees.

The program users were selected from the listing of participants maintained by the Public Transit Division. The non-users were randomly drawn from the payroll records of the State Comptroller's Office for Des Moines employees, from telephone directories at the universities in Ames and in Iowa City, and from the telephone directory of the Department of Transportation

Table 3.1. Survey distribution and response rates.

City	User			Non-User		
	Sent	Returned	Return Rate (%)	Sent	Returned	Return Rate (%)
Des Moines	301	197	66.4	302	101	34.1
Iowa City-Coralville	331	213	64.4	203	62	30.5
Ames	33	23	69.7	60	28	46.7
Indianola	26	21	80.8	25	7	28.0
Carlisle, Norwalk, Martensdale	7	5	71.4	10	2	20.0
Des Moines (pre-December)[a]	81	31	38.3	---	---	----
Total	779	490	63.3	600	200	33.7

Overall return rate = $\frac{690}{1379}$ = 50.4%

[a]The pre-December file represents employees who participated for the first one or two months of the program, then dropped out of the program.

in Ames. All surveys were sent via First Class mail and were returned by First Class Business Reply. The response rates of 63 percent and 34 percent for users and non-users, respectively, were considered good. For some individuals this questionnaire represented at least the third time in nine months that they had been asked to return a survey for this program.

All surveys were coded with an identifying number so the respondents could be matched with the names in the user file. It was possible, through manual cross-referencing efforts, to compare actual choice behavior to stated intentions. This was especially important in evaluating the effect of the subsidy rate change for FY 1980.

CHAPTER 4. PROFILES OF SUBSIDY PROGRAM USERS AND NON-USERS

Introduction

Travel, socioeconomic, and attitudinal characteristics were analyzed for program users and non-users. The purpose was to identify the characteristics that could be used to estimate the potential for respondents to participate in the bus pass program. The sampling process selected only employees who were within three blocks of the bus route, therefore, everyone had access to transit. However, accessibility by auto was determined only after the surveys were returned. In the user group 27 percent of the respondents indicated they did not have an automobile available for work. The primary modeling efforts were, therefore, based on data from employees who could reasonably be expected to know the auto travel times and auto excess times. Only program subscribers who indicated they arrived by auto before starting the subsidy program were included in the discriminant models discussed in Chapter 5. In this section, however, selected summary statistics are given for the entire sample and for the choice sample. The choice sample is the group of respondents able to report travel time and cost characteristics for auto and bus modes. The sample sizes for each city are shown in Table 4.1. The figures in the choice group (Group B) reflect removal of the captive riders and others who provided only partial data on key questions in the survey.

Table 4.1. Sample sizes for the statistical summaries

	Des Moines		Iowa City		Ames	
	Group A [a]	Group B	Group A	Group B	Group A	Group B
User	197	99	213	98	23	12
Non-User	101	75	62	26	28	20

[a] Group A represents the total respondents; group B represents the respondents who were able to report travel time and cost characteristics for auto and bus modes.

Additional surveys were received from the Des Moines area employees who had dropped the program after the first two months and from the commuters around Des Moines. These employees were surveyed to give an indication of the variability of user characteristics in these unique groups, even though the sample sizes were small. The data from the pre-December users were expected to exhibit characteristics more closely correlated with non-user groups than with other users. The travel characteristics of the commuters were certain to be different from those of the urban users but no hypotheses were stated regarding the distribution of socioeconomic and attitudinal factors. The data from these respondents were not included in the basic profiles or in the model development phase. The user profiles are presented in Appendix B and brief comparisons are discussed there.

Transportation Characteristics

Transit Accessibility

The non-users sampled for this research were all estimated to be within three blocks of a transit route. The transit access data are presented in Table 4.2. The data indicate discrepancies between the reported distance and the researchers' estimates. The largest discrepancy occurred in Des Moines where 19 percent of the non-users reportedly lived greater than three blocks from the bus route. The differences between the reported distances and the researchers' estimates may have been caused by the respondents moving from the original address, the researchers miscoding the address location, or the respondent overestimating the actual distance. The first two reasons were checked by comparing the original addresses against addresses in updated telephone directories and by double-checking the bus route and address locations. Only two cases were identified in which the employee was clearly inappropriately selected, and no cases were found in which the respondent had moved. For nine of the 17 remaining cases the researchers had estimated a walking distance of three blocks. These cases could be considered to be marginally close to the four or more blocks reported by the respondent and therefore subject to judgment differences of the researchers and the respondents. The final eight cases, 40 percent of the original cases, serve to point out the tendency of respondents

Table 4.2. Transit accessibility

Element	Des Moines		Iowa City		Ames	
	User	Non-user	User	Non-user	User	Non-user
Blocks[a] (Home to Stop)	≤ 1	≤ 2	≤ 1	≤ 1	≤ 2	≤ 2
Blocks[a] (Stop to Destination)	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1
Blocks > 3 (Home to Stop)	15%	19%	2%	10%	13%	7%
Blocks > 3 (Stop to Destination)	7%	6%	4%	10%	0%	7%
Transfer Required (Yes)	10%	29%	22%	27%	9%	7%

[a]These numbers are median values

to overestimate the difficulty in using a mode which they were not presently using. These employees were actually within three blocks.

Table 4.2 also shows the effect of transit routing policies on the need to transfer. The percentage of transit users required to transfer in Iowa City is approximately double the rate of the other cities. This can be readily explained because of the three transit entities in the Iowa City area. Because Coralville and the University each have their own systems, the Iowa City routes do not circulate through the major employee areas of the University. Bus riders must transfer to other systems to complete a trip to or from Iowa City. In Des Moines, five of the eight regular routes and all five express routes serve the capitol directly. In Ames, all three routes serve the Department of Transportation and the campus directly.

The percent of reported transfers in Des Moines was three times higher for non-users than for users. Even with this difference in the percentages, the hypothesis of no differences in the need to transfer for the user and non-user groups could not be rejected at the five percent significance level.

Travel Time and Cost

The reported travel characteristics are given in Table 4.3. The time and cost patterns exhibited in these data fit general expectations. Bus and auto travel times decrease with decreasing city size. Also, the users tend to experience lower bus times than the times noted by non-users, and non-users report lower auto times and costs than indicated by the program participants.

Des Moines non-users estimated a bus trip would take 40 minutes compared to the 30 minutes estimated by users. However, both groups reported an auto travel time of 17 minutes, an auto pick-up and walking time of 4 minutes and a bus waiting and walk time of 9 minutes. Engineering estimates of actual highway travel times were not developed to compare with any of the reported times, but since all excess times and perceived auto driving times were comparable, the researchers could find no clear reason why non-user bus times should be greater than user time, even though the reported differences were statistically significant.

The difference in round trip auto costs also reflect apparent biases in estimating costs. Although auto trip times are perceived to be equal, the bus users estimate a median cost of $1.40 per day while the non-users estimate a cost of only $1.00 per day. These reported values were statistically different.

Table 4.3. Reported travel time and cost characteristics for all respondents

Element	Des Moines		Iowa City		Ames	
	User	Non-user	User	Non-user	User	Non-user
Bus Total Time (min)[a]	30 (2)[b]	40 (4)	23 (0)	22 (6)	18 (0)	19 (4)
Auto Total Time (min)	17 (36)	17 (9)	14 (45)	11 (35)	12 (43)	10 (18)
Bus Waiting Time (min)	9 (2)	9 (5)	5 (0)	9 (2)	7 (0)	8 (4)
Auto Pick-up Time (min)	4 (38)	4 (11)	4 (46)	3 (37)	2 (43)	3 (18)
Bus Cost ($)[c]	0.50	0.50	0.23	0.21	0.50	0.50
Auto Cost ($)	1.40 (38)	1.00 (11)	1.20 (45)	0.70 (40)	0.70 (43)	0.60 (14)

[a] All times are measured in minutes for one-way trip.

[b] Numbers in parentheses represent the percent of "no response."

[c] Bus and auto costs are daily operating costs. The number of Iowa City fares is a weighted average of 20¢ in Iowa City and 30¢ in Coralville for the subsidized pass.

Similar patterns were generally observed in Iowa City and Ames. That is, program subscribers generally indicated lower bus times than those noted by the non-users, while the auto costs and times were reported to be higher for the subscriber group than for non-subscribers. One noted exception was that Iowa City non-subscribers actually estimated a lower bus time than did the users.

Socioeconomic Profiles

This research involves a unique segment of the population when compared to the stereotyped transit user. The stereotypical user is thought of as the poor, the young, the aged, or, in general, the transit captive who is using the bus because no other alternative is available. This study examines a population which is generally between 18 and 65 years of age, is employed, and has a reasonable level of mobility. Within that population certain individuals can be encouraged to participate in a transit program when offered an incentive while others cannot. Other modeling efforts have identified several variables that are useful in explaining mode choice patterns of the general population. Our objective has been to develop profiles within a more select population which may aid in explaining choice patterns and in developing programs that would be attractive to this population segment.

The socioeconomic data are given in Table 4.4 for all survey respondents. Consistent patterns were noted for several variables across the cities evaluated. A general overview indicates that the employees who have subscribed to the pass program are younger, are more likely to be female and are from smaller families with a lesser number of employed persons. They are also less likely to be licensed drivers or have a car available for the work trip. Auto ownership rates and income levels are lower for the user groups. Many of these differences, however, are neither significant in the full sample nor in the sample which excludes the captive rider.

Since many of the variables are not continucus in nature, the first stage statistical analyses to evaluate differences in the distributions used the non-parametric chi-square test of independence [1]. The five percent signficance level was used for all comparisons and the results are given in Table 4.5. The variables labeled as independent are variables in which the actual distribution pattern is the same for the user and non-user groups. The table shows

Table 4.4. Socioeconomic profiles for all respondents

Element	Des Moines		Iowa City		Ames	
	User	Non-user	User	Non-user	User	Non-user
AGE (Median - yrs)	38	42	32	38	35	44
AGE (Mode)	25-34	25-34	25-34	25-34	25-34	25-34
SEX (Female)	62%	61%	60%	45%	52%	22%
SEX (Male)	38%	39%	40%	55%	48%	78%
FS* (Median)	≤2	≤2	≤2	≤2	≤2	≤2
FS (Average)	2.2	2.5	2.6	2.7	2.2	2.5
EMP (Median)	<1	<1	<1	<1	<1	<1
EMP (Average)	0.8	1.0	0.8	0.9	0.7	1.0
LIC (Yes)	84%	96%	93%	90%	86%	93%
CAR (0)	16%	3%	8%	3%	17%	0%
CAR (1)	51%	39%	65%	63%	52%	46%
CAR (2)	24%	40%	23%	29%	30%	46%
CAR (3+)	8%	19%	3%	5%	0%	4%
CAR (Average)	1.2	1.8	1.3	1.4	1.1	1.5
AVA (Yes)	71%	92%	75%	85%	74%	93%
INC (<$10,000)	13%	13%	17%	3%	13%	4%
INC ($10,000-20,000)	45%	22%	47%	32%	39%	35%
INC ($20,000-30,000)	27%	32%	21%	29%	22%	11%
INC ($30,000-40,000)	9%	18%	10%	16%	9%	28%
INC ($40,000+)	4%	10%	3%	15%	13%	11%
INC (Average Dollars)	19,500	23,900	18,900	25,900	21,900	25,800
INC (No Response)	2%	5%	2%	5%	4%	11%

*FS = Total persons in household
EMP = Number of others employed in household
LIC = Licensed driver
CAR = Cars in household
AVA = Car availability
INC = Total income in household

Table 4.5. Tests of independence for the socioeconomic variables

Element	Des Moines		Iowa City		Ames	
	Group A[a]	Group B[b]	Group A	Group B	Group A	Group B
AGE	I[c]	I	D	D	I	I
SEX	I	I	D	D	D	I
FS[d]	D	D	I	I	I	I
EMP	I	I	I	I	I	I
LIC	D	I	I	I	I	I
CAR	D	D	I	I	I	I
AVA	D	I	I	I	D	I
INC	D	D	D	D	I	I

[a] All respondents

[b] Only respondents providing full information for travel time and travel cost.

[c] I indicates that the distribution of the variables is independent of the user or non-user classification. D indicates statistical dependence (tested with chi-square test of independence at the 5 percent significance level).

[d] FS = Total persons in household
EMP = Number of others employed in household
LIC = Licensed driver
CAR = Cars in household
AVA = Car availability
INC = Income

the results for the full sample and the choice rider sample. It is reasonable to expect that a larger number of the variables would be independent of the group classification for the choice sample than for the overall sample. One would expect, for example, that auto availability and licensed driver status are virtually identical when comparing the choice transit user with the non-user. This is demonstrated by the Des Moines data.

Age, sex, and the number of others in the household employed were not significantly different for the total sample in Des Moines. Only family size, auto ownership, and income differences were significant characteristics which could be used to identify the two groups.

The researchers had hypothesized that a similar set of significant socioeconomic factors would be identified across all study cities. The data, however, did not support that conclusion. In Iowa City only age, sex, and income distributions were statistically significant for both groups. The socioeconomic indicators were even less useful in Ames for differentiating between users and non-users. Only sex and auto availability were different for the total sample. Neither of these were significant indicators when only the choice riders were considered.

The chi-square test of independence is somewhat limited for testing all variations in category data because a minimum of five responses for each cell of the classification table is recommended [1]. When that is not available it is necessary to aggregate the data into a smaller number of categories. As an example, because of the small samples in Ames, the Ames income data had to be grouped into two classes instead of the original five classes. Thus the full variation of the income range was not measured. To a lesser extent aggregation was also required for Des Moines and Iowa City.

The aggregation problems were addressed by using the parametric t-test for the differences of sample means. Even though there was a limited number of categories, the distributions for age, family size, auto ownership, employees, and income were distributed approximately normally. The differences of means tests did show some limited differences in the statistical conclusions. Distributions of age and number of employees for the users and non-users were found to be different for the choice rider sample in Des Moines. In the total sample these factors were not statistically different. All Iowa City conclusions were

exactly the same as for the chi-square analysis. In Ames, auto ownership levels were significantly different for users and non-users in the total sample but not for the choice rider sample.

Overall, the data show that the stereotypical user is identifiable even in the special population of this study but that the differences in characteristics are often not strong. Only income differences were common across the two cities with the larger sample sizes. Generally, the socioeconomic characteristics do not readily explain the differences between program subscribers and non-subscribers although they do suggest market segments that are more likely to use the bus pass.

Atttitudinal Characteristics

Background for Developing Attitude Scores

Questionnaires that simply ask if a person would participate in a program under specified conditions have generally failed miserably in measuring actual behavior. One such study estimated an order of magnitude difference between stated intention and actual behavior [2]. The pre-implementation questionnaire in Des Moines used a "stated intention" concept. Approximately 1,510 persons indicated they would try a bus service if it was within three blocks of home and cost less than $1.00 per day. Only 730 of these people actually lived in the Des Moines service area. The researchers cross checked the employees' addresses and the bus route and found that 444 of them, or 61 percent, did have access and could have used the subsidized fare of $0.50 per day. Only 112 employees, or 25 percent of those meeting the criteria, actually subscribed to the program during the first year. Certainly the one-question survey used here was less than adequate for a prediction base.

Research efforts in the 1970s explored the psychological image travelers have of particular objects, services, or policies and tried to convert that image into an attitudinal measure that might help explain each individual's behavior. A few of those efforts were discussed in Chapter 1. The research presented in this report was not undertaken to develop alternative psychological constructs or unique factor loadings which may develop from the unique sample. Instead, this study selected major factors from other research and constructed

statements that could be analyzed using a five point successive category analysis. The questions were used to assess the degree to which individuals in different groups have positive reactions to bus characteristics or negative reaction to automobile travel. The attitudinal statements were discussed in Chapter 3 and are included in Question 13 of the project survey form in Appendix A-4.

Theoretically, the mathematical operations that can be performed on the responses from the attitudinal questions are limited because the measurements are not necessarily based on an equal interval scale; that is, the differences between scores of one and two may not be the same as between three and four for all statements. Procedures have been developed and computer codes have been written which can if necessary, correct the survey scale to an adjusted interval scale which can be subjected to more rigorous mathematical manipulations [3, 4, 5]. Previous research efforts by Hartgen [5] and by Kannel [6] have found that analysis with either the adjusted scales or the original scales produced the same results. Therefore, in this study there was no major effort to weight the coded values. Instead, the reasonableness of assuming that the original codes could be added or multiplied without distorting the statistical interpretations was tested by applying two separate common tests. The attitudinal responses were analyzed by a nonparametric test and a parametric test. The first test, the chi-square test, does not require any assumptions about the scale intervals or the functional form. The second test, the t-test of differences of means, assumes the data are uniformly continuous and normally distributed. Each attitude statement was evaluated by both techniques to test for differences in the response patterns of users and non-users. If the chi-square test and the t-test resulted in conflicting conclusions, the hypothesis that the use of the original codes would not distort the analysis would have been rejected.

Both tests were completed for Des Moines and Iowa City. The Ames sample was too small for the chi-square analysis. The statistical conclusions were the same for all statements using both tests so all further analyses used the original scales.

The ATTSUM Variable

Shortened versions of the statements used in the survey instrument are shown in Table 4.6 along with the average scores for all respondents. The full statements are repeated here for reference:

1. The bus can usually be depended on to get me to work on time.
2. The bus doesn't give enough choice of times to leave.
3. The bus trip takes too much time.
4. It is too far to walk to the bus.
5. Buses are usually on schedule.
6. The gas situation is making it difficult to get to work.
7. It is really a hassle to drive.
8. The bus is a good way to save fuel.
9. It costs too much to go by bus.
10. It costs too much to go by car.
11. Parking is a problem where I work.
12. I am willing to pay whatever it costs to be able to take my car.

A composite score, ATTSUM, was developed for each individual by adding the scores for each of the 12 items. The higher this score, the more positive is the reaction to public transit. For example, an individual who strongly agreed that the buses could be depended upon to get to work on time would score a five. He or she would be thought of as having a favorable perception of the bus service.

To help assure that respondents would not establish a pattern in the first few statements and then continue to mark all remaining questions at the same end of the scale without carefully thinking about them, several questions were reverse-coded. For example, a person who was generally satisfied with the number of times a bus departs would have to disagree with statement number 2. This response would then be recoded to the other end of the scale during processing. Statement numbers 2, 3, 4, 9, and 12 were reverse-coded.

The composite score was developed with the intent of averaging out the peaks and valleys that might occur for any particular individual considering all 12 factors. A person may have an overall positive attitude toward the bus but could score low on one or more items. By developing the composite score the overall image is retained. It was also hypothesized that the composite ATTSUM score would be fairly uniform across the cities and, therefore, of greater value in classifying users and non-users.

Table 4.6. Average attitudinal scores for all respondents

Characteristic	Average Scores					
	Des Moines		Iowa City		Ames	
	Users	Non-Users	Users	Non-Users	Users	Non-Users
1. Arrive on time	4.52	3.60	4.38	3.82	4.65	3.15
2. Departure choice	3.26	2.69	3.49*	3.19*	3.35	2.23
3. Bus time too long	3.67	2.51	3.97	3.24	4.17	2.96
4. Walking distance	4.22	3.61	4.60	4.24	4.56	3.54
5. On schedule	4.02	3.50	3.94	3.54	3.78*	3.31*
6. Gasoline shortage	3.07	2.61	2.88	2.48	2.38*	2.26*
7. Hassle to drive	3.69	2.44	3.87	3.12	3.00	1.85
8. Bus saves fuel	4.55	3.99	4.62	4.22	4.35*	4.37*
9. Bus too costly	3.84	3.28	4.37	3.90	4.00	3.00
10. Auto too costly	3.95	2.99	4.17	3.41	3.96	2.58
11. Parking is a problem	3.28	2.48	4.08	2.92	2.70	1.92
12. Pay to use car	4.38	3.55	4.49	4.19	4.43	3.81
ATTSUM	46.48	37.25	48.86	42.32	45.31	34.92
Sample Size	193	100	210	62	23	26

*The differences in scores for the users and non-users are statistically significant at the 0.05 level for all variables except those marked with an asterisk.

The ATTSUM scores could range from 12 to 60. Occasionally, a respondent would not have sufficient information to judge the characteristics being considered. Rather than throwing out the sample completely, the code for these cases was recoded at the neutral position, 3. The sample was thrown out if recoding was necessary on more than three of the 12 statements.

Attitudinal Profiles

The attitudinal responses exhibited consistent patterns across user and non-user groups for all cities. As expected, the program users scored higher on each factor and on the composite ATTSUM score. The differences between group scores were statistically significant for all sub-factors in Des Moines. Only the reactions to the adequacy of departure choices were not different in Iowa City; both groups tended toward a positive feeling regarding the departure frequency. In Ames both groups generally expressed positive reactions to schedule reliability and both expressed positive feelings that bus use was a good way to save fuel. On the other hand, neither Ames group felt that gasoline supply had caused them difficulty in getting to work.

The highest ratings were obtained in Iowa City where transit usage has traditionally been more successful on a per capita basis than in any other Iowa community. Even the non-users have a more positive reaction to the bus service. At the other end of the scale is Ames, which had gone from a fixed route service to a Dial-A-Ride service and back to more fixed route service during a five-year period. Although the fixed route service was generally stable during the research and was providing acceptable on-time performance, it was felt that earlier difficulties in the system were still affecting the judgments of the present service. The ATTSUM scores for the Ames employees were lower than their counterpart groups in the other cities.

The Ames area is the most compact of the study cities and the employees perceived less difficulty with auto travel. The issues of gasoline supply, driving hassles, and parking problems were all viewed as less onerous there than in the other communities.

Two issues in which both groups in all cities indicated positive reactions were "walking distance" and "the buses' ability to save fuel." The mean responses for these items were statistically different for the groups, but overall the employees felt walking distances were not a problem and buses would save fuel.

The parking issue also provides interesting results. The initial intent of the legislation was to initiate the program to relieve parking presure in the capitol complex area. The non-user scores of 2.48 and 1.92 for Des Moines and Ames, respectively, indicate that these employees disagree with the statement that parking is a problem. Even the program subscribers were in the neutral scoring range with scores of 3.28 and 2.70. Only 25 percent of the Des Moines non-users agreed or strongly agreed that parking was a problem; 50 percent of the users scored the parking issue in those two categories.

Iowa City employees expressed the greatest concern for parking. Parking lots in Des Moines and Ames are near the employee offices. The parking is free in Des Moines and at the Ames DOT, and only $20 per year for most faculty-staff spaces in Ames. Iowa City places greater reliance on the campus shuttle system to move drivers from the outlying lots. In addition the parking fees are $96 per year. As a result, the parking issue is emphasized more strongly. Over 75 percent of the program subscribers agreed or strongly agreed that parking was a problem.

Correlation analysis and several cross-classification analyses were completed to test for relationships between the ATTSUM score and the socioeconomic and transportation variables. There were no strong relationships which would allow one to estimate the attitudinal response levels based on socioeconomic variables; all correlations with ATTSUM were less than 0.10. The reported auto and bus times were marginally significant variables. Using linear regression, these variables explained 29 percent of the variation in the ATTSUM scores for the Des Moines groups.

Summary of Results

The transportation, socioeconomic, and attitudinal characteristics were examined and found to produce consistent patterns across user groups and between cities. The reported auto times for users and non-users were never statistically different. Reported bus travel times and cost differences were found to be significant for choice riders in Iowa City and Des Moines, but not in Ames.

The socioeconomic profiles produced consistent trends in all cities relative to differences in the employee groups. The differences in group characteristics are interesting and suggest potential market segments, but were generally not statistically significant, particularly when only the choice rider employees were analyzed. For the choice riders in Des Moines, family size, auto ownership, and income were significant; in Iowa City, age, sex, and income were significant. Thus, income was the only variable common to both the cities with the larger sample sizes. None of the socioeconomic variables was identified as being significantly different for the choice rider groups in Ames.

The attitudinal scores appear to provide an excellent base for distinguishing the subscriber and non-subscriber groups. The difference in the composite ATTSUM variable for these groups was significant in all three cities. Even the subscores for the individual factors were nearly all significantly different for the user and non-user groups. The perceptions people have of the transit-auto tradeoffs are strongly associated with the mode choice decision. The fact that the attitudinal components are relatively consistent from city to city, when viewed by themselves, suggests that they would be useful in models developed in one city and applied in other cities. This assumption is tested with the discriminant models.

CHAPTER 5. DISCRIMINANT ANALYSIS OF CHOICE BEHAVIOR

The decision to participate in the transit subsidy program is strongly associated with the attitudes individuals have about transportation modes. The previous analyses have also shown that the individual's travel characteristics and socioeconomic characteristics may be significant predictors. The statistical evaluations to this point have been univariate in nature, i.e., each variable is scrutinized individually without examining the intercorrelations among the many variables. This chapter examines these interactions and further identifies the capabilities to transfer data patterns from one city to another.

Models of transportation choice have focused on various probability analysis procedures. Probability models have been given considerable attention because they can be applied to discrete choices and can be calibrated with small data sets. The principal techniques used have been discriminant analysis, logit or multinomial logits, and probit models. Although the logit formulations have been used most extensively for forecasting models, each of the techniques has been used successfully within particular contexts.

The modeling objective for this research was to focus on employee characteristics that could be used to identify those employees who would be most likely to participate in the transit assistance program. The actual coefficients of a particular model were not the major concern because the employee sample being analyzed did not represent a sample of the entire employee population. Therefore, the model was not expected to be generally applicable to other general populations. The discriminant model, which addresses the principal objective of group classification, was used in this study.

Discriminant Analysis Concept

Discriminant analysis is formulated on the basis that individuals making discrete decisions possess characteristics that can be measured along a continuum and that a collection of discriminatory variables exists which could identify the points along that continuum at which persons making the same decision would be grouped. The mathematical objective is to select and weigh those

characteristics that would force the groups to be as distinct as possible. The success of the model is measured by the degree to which non-overlapping groups can be identified.

The maximum number of discriminating functions that can be developed is either one less than the number of groups, or the number of discriminating variables, whichever is smaller. In this research only two groups are identified, so only a single discriminating function can be derived. The key statistical problem is how to select the variables to be used.

Similar to the more commonly used linear regression analysis, it is possible to select variables in a stepwise procedure. The stepwise procedure first selects the single most discriminating variable and continues by adding the variables that can best improve the discriminating criterion when used in combination with the variables already in the function. The order of entry into the model is not necessarily the same as the order of relative importance when viewed alone; instead the additional variables contribute the most to the discrimination function in combination with previously selected variables. Selection of variables is based on the ability of each variable to reduce the unexplained variance between the two groups.

Once a set of significant discriminating variables has been selected a second phase, classification analysis, can be used to check the adequacy of the model. The classification phase places each member of the original data set into the group to which it has the highest probability of membership. These assignments can be checked against the actual group membership to evaluate the model. In addition, individuals whose group membership is not known can be classified. This feature was used in this study to see if models based on data for one city could correctly classify the employees in the other cities.

The Statistical Package for the Social Sciences (SPSS) computer program DISCRIMINANT was used to develop the models and the statistical measures [1]. The overall models were evaluated by the chi-square (X^2) statistic. Since it is possible to have an overall model that is highly significant but contains variables which are not making a significant contribution to the discriminating power of the model, individual F-statistics are computed for each variable. Any variable that is not important at a specified significance level may be eliminated. During the exploratory phases the researchers allowed liberal

inclusion levels in order to determine the general order of importance of the explanatory variables. The variables that were significant at the five percent level or better are marked in the tables.

Model Development and Testing

The employee responses used in most discriminant analyses were those from users who reported they had sometimes arrived by auto, and, therefore, provided auto travel time and cost, and from non-users who provided complete information. The resulting sample sizes were 99 users and 75 non-users in Des Moines, 98 users and 26 non-users in Iowa City, and 12 users and 20 non-users in Ames. Table 5.1 provides a description of each of the variable acronyms and the units of measurement. Table 5.2 gives the averages for the variables.

Des Moines

Although several models were developed in each of the cities, the greatest emphasis was devoted to Des Moines. Table 5.3 presents the variables and summary statistics for four models developed in Des Moines as well as the results for selected models from Iowa City and Ames. Model I allowed consideration only of the travel time and attitudinal characteristics. The composite attitudinal score, ATTSUM, was the most important variable in the discriminant function. The addition of TIMDF only reduced the residual variance from 62 percent to 60 percent. No other transportation variable was significant at the 0.05 level once the first two variables were included. The model was successful in correctly classifying 81 of 99 users (82%) and 61 of 75 non-users (81%).

Since the cost differences had earlier been identified as a significant variable if viewed alone, Model II was developed to force COSDF into the model. The coefficients and the relative effect of the original variables changed very little. The percent of users correctly classified remained the same and the accuracy of the non-user group actually dropped slightly. The principal reason for examining the equation with time and costs was to estimate the value placed on time savings. For a model of the form $Y = a + b_1 T + b_2 C$ where T equals time and C equals costs, an estimate of the value of time (VOT) is the ratio of the coefficients b_1 and b_2. Therefore, $VOT = b_1/b_2$. The coefficients in the Des

Table 5.1. Variables considered in the discriminant models

Code	Variables
BTT	Total bus travel time[a]
BWA	Bus walking and waiting time (excess time)
AUTT	Total auto travel time
AUPUT	Auto pick-up and walking time (excess time)
TIMDF	Time difference; BTT minus AUTT
COSDF	Cost difference in cents; daily bus costs minus auto costs
LHDF	Line-haul time difference[b] (bus time minus auto time)
ATTSUM	Composite attitude score
AGE	Age (five categories-converted to years in the tables)
SEX	Sex
FS	Family size
EMP	Number of other household members who are employed
LIC	Licensed driver (yes, no)
CAR	Number of cars, pickups, and vans in the household
AVA	Auto availability for the work trip (yes, no)
INC	Income (five categories-converted to dollars in the tables)
BLK1	Number of blocks from home to bus stop
BLK2	Number of blocks from bus stop to office
TRF	Transfer required (yes, no)

[a] All times are in minutes for a one-way trip

[b] Line-haul time = total time minus excess time

Table 5.2. Average statistics of independent variables considered in discriminant models

Variables	Group Means: Des Moines User	Des Moines Non-User	Des Moines Signif.[a] Level	Iowa City User	Iowa City Non-User	Iowa City Signif. Level	Ames User	Ames Non-User	Ames Signif. Level
BTT	33.4	42.5	.00	24.1	27.9	.05	23.7	25.1	.66
BWA	9.1	10.9	.10	6.7	10.5	.00	8.5	10.0	.57
AUTT	19.2	17.9	.21	15.4	13.2	.09	13.7	10.6	.07
AUPUT	5.0	4.2	.15	5.2	3.6	.05	3.8	3.1	.48
TIMDF	14.2	24.6	.00	8.6	14.7	.00	10.0	14.4	.19
COSDF	-90.9	-57.3	.00	-103.5	-71.4	.01	-25.0	-24.4	.97
LHDF	10.1	17.8	.00	7.2	7.8	.66	5.3	7.6	.32
ATTSUM	46.1	37.2	.00	48.5	41.3	.00	43.5	34.8	.00
BLK 1	1.5	2.0	.03	0.9	1.5	.04	1.5	1.8	.45
BLK 2	1.2	1.1	.56	1.1	1.4	.28	0.7	1.6	.03
AGE	38	42	.04	33	40	.01	42	43	.77
SEX	50% Male	50% Male	.35	42% Male	65% Male	.03	67% Male	80% Male	.42
FS	2.2	2.6	.02	2.6	2.5	.88	2.3	2.4	.87
EMP	0.7	1.0	.03	0.7	0.7	.80	0.8	0.9	.84
LIC	100% Yes	100% Yes	b	99% Yes	96% Yes	.31	100% Yes	95% Yes	.45
CAR	1.5	1.8	.00	1.4	1.5	.24	1.5	1.6	.81
AVA	90% Yes	100% Yes	.19	89% Yes	96% Yes	.26	90% Yes	100% Yes	.20
INC	$21,900	$25,100	.04	$18,700	$27,300	.00	$25,800	$26,000	.97

[a] Based on Univariate F-ratio test of discriminant program

[b] All respondents were licensed drivers

Table 5.3. Discriminant analysis summary

Variables	Variables considered for specified models									
	Des Moines				Iowa City			Ames		
	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model I	Model II	Model III
BTT	X[a]		X		X		X	X(2)[b]		X(2)[b]
BWA	X		X		X(2)[b]		X(3)[b]	X(3)		X
AUTT	X		X		X		X	X		X
AUPUT	X		X		X(4)		X(7)	X		X
TIMDF	X(2)[b]	X(2)[c]	X(4)	X(1)[c]	X	X(2)[c]	X	X	X(2)[c]	X
COSDF	X	X(3)[c]	X(6)	X(2)[c]	X(3)	X(3)[c]	X(6)	X	X(3)[c]	X
LHDF	X		X		X		X	X		X
ATTSUM	X(1)[b]	X(1)[c]	X(1)[b]		X(1)[b]	X(1)[c]	X(1)[b]	X(1)[b]	X(1)[c]	X(1)[b]
BLK 1			X				X			X
BLK 2			X				X			X(3)[b]
AGE			X(3)[b]				X(5)			X
SEX			X				X(9)			X
FS			X				X(8)			X
EMP			X				X			X
LIC			X				X(4)			X(4)
CAR			X(2)[b]				X			X
AVA			X(5)				X(10)			X(5)
INC			X				X(2)[b]			X
TRF				X(3)[c]						
Residual Variance (%)[d]	60	e	54	e	68	e	62	50	e	44
Percent correctly classified:										
User	82	82	80	72	81	77	81	92	92	100
Non-User	81	79	84	73	77	77	77	90	85	80

[a] Each X identifies a variable allowed to enter the model

[b] The variable was significant at the 0.05 level

[c] Numbers in parentheses represent the order of entry into the model. Significance tests were not performed by the sub-routine used because the variables were forced into the model.

[d] Based on the variables which are significant at the 0.05 level.

[e] This model forced variables into solution so values are not computed.

Moines model were Y = -6.11 + 0.149 ATTSUM - 0.0104 TIMDF - 0.00260 COSDF,

$$VOT = \frac{-0.0104}{-0.00260} \text{ cents/minute} \times \frac{60 \text{ minutes/hour}}{100 \text{ cents/dollar}} = \$2.40/\text{hour}$$

This estimate is not independent of all other factors because the ATTSUM variable also affects the magnitude of the coefficients. It is interesting to note, however, that for the average non-user in the model the round trip bus time is perceived to be 48 minutes longer than the auto trip. To make the bus equally attractive, all other factors being constant, the bus would need to be $1.90 cheaper than the car. Presently, non-users estimate the bus is $0.60 cheaper than the car. Even if the bus trip were free, the average non-user would still judge the bus as unsatisfactory.

Model III allowed the socioeconomic characteristics to be brought into the function. The attitudinal variable was again the predominant classification variable, but autos owned and age were now entered before the time difference. TIMDF was significant only at the 0.10 level. Use of the first three variables reduced the unexplained variance to 54 percent, compared to the 60 percent of Model I, but there was very little change in the percent of correct classification.

The ATTSUM variable always dominated the models but it is a variable over which there is no direct control. Therefore, a fixed model forced the entry of three variables which can be directly controlled by transportation policy. Model IV contained only TIMDF, COSDF and a variable indicating the need to transfer, TRF. The model was statistically valid but the contribution of TRF was marginal. An independence test indicated that transfer requirements of users and non-users were significant only at the 0.10 level when examined alone. Without the ATTSUM variable the percent correctly classified dropped to approximately 72 percent.

Iowa City

Models I through III were also developed with the Iowa City data. The attitudinal score was again the dominating variable. The only significant discriminating variables were ATTSUM and the reported bus waiting time. As noted in Table 5.3 both time and cost differences were significant discriminating variables if examined alone. However, these variables were correlated with

ATTSUM and once the first two variables were entered, time and cost effects were not significant. This model classified approximately 80 percent of the employees into the correct group. The model underpredicted the total number of subscribers.

When time and cost differences were forced into the model with ATTSUM, the percentage of correct classifications dropped to 77 percent. The estimated value of time based on the coefficients was $2.30 per hour. This is only slightly different from the $2.40 per hour figure in Des Moines. The additional 29 minutes of round trip time required for the non-user's bus trip would be valued at $1.10. This value considerably exceeds the daily 20 and 30 cent fares which the subscribers pay in Iowa City and Coralville, respectively.

The final model considered the socioeconomic variables. The income effect was the only such variable to enter the model. This model reduced the unexplained variance but it did not improve the classification capability.

The discriminant model provides very little additional assistance in identifying the market segments or marketing strategy. The one transportation policy variable of interest is bus waiting and walking time. In Des Moines, where peak period headways are 15 minutes, the bus excess time was not a significant factor, but in Iowa City, with headways of 30 minutes, this time element was viewed as more significant by the non-users. However, decreasing the headways in Iowa City is not likely to have a large direct effect in the probability estimates. The greater impact would likely be on the perceptual image of the service as measured by ATTSUM.

Ames

The total sample in Ames was small, but for comparison purposes the first three models were developed. The attitude score, bus total time, and walking distance at the destination were significant when all variables were considered. Those three variables reduced the unexplained variance to 44 percent and the model correctly classified all program users and 80 percent of the non-users. A statistical anomaly does occur with this model because the BTT variable was judged to be insignificant by itself, but once ATTSUM was in a model the BTT relationship was able to increase the discriminating power of the model. The actual contribution of BTT would appear to be spurious, i.e., not real in nature.

The model forcing time and cost differences was also of dubious value because neither variable was a significant discriminating variable. The relative ratios of the coefficients did, however, produce a value of time estimate of $2.50 per hour which was close to the values estimated for Des Moines and Iowa City.

Discriminant Models with Attitudinal Subscores

The relative importance of the attitudinal score was established in the previous sections. The composite ATTSUM score is necessarily related to perceptions of the transportation service. Since nearly all employees provided perceptual data and only those subscribers who sometimes use an auto provided full time and cost data, the researchers examined the capability of a discriminant model to classify all employees using only the responses on the attitudinal question. These models were based on 193 users and 100 non-users in Des Moines, 210 users and 52 non-users in Iowa City, and 23 users and 26 non-users in Ames.

The perceptual images of the employees regarding their trip choices may be of value in developing the marketing strategy for the pass program. If, for example, there is an identifiable difference between the views of the users and non-users about the ability to consistently arrive at work on time, the marketing program should direct attention to that issue. Certainly the potential to arrive on time is identical for both persons since they would be riding the same bus. The campaign to convince the non-user should present information about schedule reliability (assuming that reliability is good) and perhaps even provide schedule times near major centers.

On the other hand could be the issue of fuel conservation by buses. For this variable both users and non-users may have positive reactions that the bus can save fuel. In this case an advertising campaign to solicit ridership on the basis of fuel savings would have little impact. The non-user may already have that image, but for other reasons is not using the bus.

Table 5.4 presents the order of entry into the discriminant models for each of the cities and for the choice rider group as well as the total sample. The order of entry was different for the choice group than for the total group, but the differences were small. The primary discriminating variables for both groups were on-time reliability, driving hassle, total bus trip time, and the stated willingness to pay whatever it costs to take the car. For the reliability measure over 90 percent of the users agreed or strongly agreed that the buses

Table 5.4. Relative importance of attitudinal subscores

Variables	Statement	Relative Importance[a]							
		Des Moines		Iowa City		Ames		All	
		Group A[b]	Group B	Group A	Group B	Group A	Group B	Group A	Group B
X1	The bus can usually be depended on to get me to work on time	1[c]	1[c]	4[c]	4[c]	1[c]	1[c]	1[c]	1[c]
X2	The bus doesn't give enough choices of times to leave	8	5[c]	-	-	-	-	-	8
X3	The bus trip takes too much time	3[c]	3[c]	2[c]	2[c]	4	-	4[c]	3[c]
X4	It is too far to walk to the bus	-	-	6	-	-	-	5[c]	7[c]
X5	The bus is usually on schedule	6[c]	7	-	-	-	-	9	10
X6	The gas situation is making it difficult to get to work	-	-	5	-	-	-	8	-
X7	It is really a hassle to drive	2[c]	2[c]	-	3[c]	5	-	2[c]	2[c]
X8	The bus is a good way to save fuel	7	-	-	5	-	2	-	11
X9	It costs too much to go by bus	-	8	7	-	-	-	7[c]	5[c]
X10	It costs too much to go by car	5[c]	6[c]	3[c]	-	2[c]	-	3[c]	4[c]
X11	Parking is a problem where I work	-	-	1[c]	1[c]	-	-	6[c]	6[c]
X12	I am willing to pay whatever it costs to be able to take my car	4[c]	4[c]	8	-	3	-	-	9
Residual variance (%)		50	55	72	69	45	61	60	60
Percent correctly classified:									
	Users	85	83	74	74	96	75	81	83
	Non-users	80	76	76	77	88	90	77	86

[a] The relative importance of the factors was determined by the order in which the factor entered the discriminant model. The numbers indicate the entry order. A blank indicates the variable was not entered.

[b] Group A contained all respondents; Group B contained only respondents who provided full information on travel time and cost.

[c] These variables were significant at the 0.05 level.

were reliable while only 60 percent of the non-users felt that way. The bus cost and parking issues were found to be of little value in discriminating between groups.

Parking issues and total bus time perceptions were the primary factors identified in common for the Iowa City groups. The third step variables were auto costs for the total group and driving hassle for the choice group. The common element is that both issues relate to difficulties with auto use. For those employees who actually have a choice, the perceived variable of interest is not auto cost; it is the driving hassle that the groups are differentially sensitized to. Although these models could explain only 30 percent of the variation, the percent of employees correctly classified was 75 percent.

Two additional subscores were useful in defining groups in Ames. These were perceived differences in on-time reliability for the work trip and the auto cost. The latter variable was significant only for the total group. Interestingly, even though the number of variables was small, the models correctly classified nearly 90 percent of all cases.

The discriminant models in this section reconfirmed what has been presented earlier in this study as well as in other research. The most dominant factor appears to be the perceptual differences about the buses' ability to get people to work on time. Note that the issue was not overall transit system schedule reliability but the ability to get to work on time. The program users generally were less confident about the system reliability than they were about their own personal ability to get to work on time by bus.

Model Consistency between Cities

The researchers had hypothesized that information obtained from the employees in one city would be applicable for estimating behavioral patterns in other cities. The only common factor in the discriminant model was the attitudinal composite score and this was the dominating variable in all cases. The hypothesis was tested by applying the discriminant model for each city in the other two cities. This is equivalent to a hold-out sample used to verify an original model, but it is even more demanding because the samples were not selected from the same

populations. The degree to which a model correctly classifies users and non-users in the other cities was taken as a measure of the transferability of the models.

The results are presented in Table 5.5 for those models which allowed free selection from all variables (Model III) and the models using just the subscores from the ATTSUM variable. Considering only the Model III results one finds generally favorable, but not overwhelming, capability in classifying employees in cities other than the one from which the model was developed. Five of the 12 cells are either no better than or significantly poorer than a random choice,

Table 5.5. Transferability of model results between cities

City and group classified	Percent of correct classifications for models based on data for city shown					
	Des Moines		Iowa City		Ames	
	Model III	Att. Model	Model III	Att. Model	Model III	Att. Model
Des Moines						
User	80	81	57	74	94	a
Non-user	84	83	91	79	23	a
Iowa City						
User	92	85	81	72	95	a
Non-user	46	62	77	77	30	a
Ames						
User	75	92	25	67	100	83
Non-user	85	75	90	90	80	86

[a]These estimates were not developed for the Ames model

50-50 assignment. However, two of those five cells are from predictions using the Ames model. It was noted earlier that the sample size here was small and that an internal inconsistency was evident in the model. These discrepancies were therefore not considered further. The greater concern was that the

Des Moines model underpredicted Iowa City non-users and the Iowa City model underpredicted Des Moines and Ames users. To try to identify why this was happening, a case-by-case review of every non-user in Iowa City whom the Des Moines model had predicted to be a user was completed. This amounted to 14 of the 26 non-users.

Of the 14 employees who were not subscribing to the program but had time, cost, and attitudinal factors that placed them in the user category, eight persons provided a clear indication of why they were not using the pass. Four of the eight were not aware of the program, two needed the car to pick up children from day care centers after work, one person's work shift rotated so that the bus was not always available, and one person was already using the campus bus system. Since the campus system does not charge a fare there was no need for the latter person to subscribe to the state program. One additional person was currently carpooling or riding a bicycle.

The overall conclusion was that a number of these respondents did not really have the choices that they were assumed to have. We can't say that the four persons who didn't know about the system would have subscribed if they had known; nor can we say that the other employees would use the bus if they didn't have to pick up their children. But if all these cases were removed from the sample, the predictive capability of the models would certainly have been enhanced.

The attitudinal models demonstrated higher degrees of transferability than did the general models. Even within the cities for which they were developed the classification capability of the attitudinal models is not greatly different from that of the models that incorporated travel and socioeconomic variables. Overall the percentage of correct classification was 78 percent. The weighted average is the same as the value obtained for the models applied only in the city in which they were calibrated.

Summary of Models

The discriminant models were valuable for sorting through the many eligible explanatory variables regarding behavioral patterns. The attitudinal factors were always found to be more useful in determining the choice than the socioeconomic or travel variables. Since both the users and non-users were selected within the same service areas and within comparable walking distances, the lack

of discriminating importance of these variables should perhaps not be surprising. Indeed the inclusion of the variables may be a sign that the differences in times or costs are more imagined than real.

The socioeconomic indicators were also overshadowed by the attitudinal factor. Only auto ownership and age were significant in Des Moines and only income in Iowa City.

The models were able to classify approximately 80 percent of the cases into the correct user group. When the general models for one city were applied in the other cities the classification capability fell off only slightly. The models developed using only attitudinal subscores were actually able to classify correctly at almost the same 80 percent level as the basic models. These points suggest that if we can learn about the general attitudes and transportation characteristics of employees in an area it is possible to estimate the potential for similar choice behavior in other areas, if the cases are drawn from similar environments.

CHAPTER 6. EVALUATION OF SUBSIDY PROGRAM CHANGES

The subsidy program was extended and changed during the second year of operation. The subsidy level was reduced from 50 percent to 25 percent; the dollar allocation was increased from $65,000 to $75,000, and every eligible employee who applied for a pass was provided one. An evaluation of this extension was not an original component of the research, but the program extension occurred during the development phase and an opportunity was available to determine the impacts on users. The reduced subsidy level was equivalent to a 50 percent increase in fare for the first-year subscribers. The change in demand would normally be expected to decrease in light of the price increase except that the pass sales had been constrained in the previous year because of the limited funds. The 436 names on the March, 1979 waiting list is indicative of that constraint, but even that list is not a full measure of the potential demand. Other employees may have recognized that passes were not immediately available and simply did not apply.

Changes also occurred in the type and number of transit services eligible for participation in the second year. The service changes and the constrained sales created a situation in which it was not possible to determine a true price-elasticity evaluation of demand, however, the results presented in this chapter discuss the aggregate participation trends and examine specific cases of individuals who dropped the program in the second year.

Service and Use Trends

Service Adjustments

During the initial year 18 urban systems were eligible to participate. This number did not change, but minor service adjustments occurred in two study cities. Des Moines added one regular route and Ames adjusted the route structure and the service type. Whereas all three Ames routes had provided direct access to both major employers, the restructured routes created one which required a transfer in order to obtain access to the Department of Transportation. The routes were also changed from fixed-routes only in the peak period to fixed-routes throughout the day. The Dial-A-Ride service option was available only to persons outside the regular route areas and to the elderly and handicapped.

The more significant changes occurred in the commuter carriers. When the program began, six cities around the Des Moines area received service employees could use with subsidized passes. By December, 1979 the number of cities served had increased to 19. These cities were around the Des Moines and Ames employment centers.

Ridership Trends

The monthly ridership patterns for FY 1979 were given in Table 2.1. During that period an average of 1,077 monthly passes were issued, the peak number being 1,198 passes. Table 6.1 provides a condensed summary for the first six months of FY 1980. The average sales had increased to 1,250 passes, a 16 percent gain. Nearly all of this gain was in the commuter market. Using the month of December for comparisons, the commuter sales increased from 38 in 1978 to 182 in 1979. This increase of 144 passes represents 87 percent of the total sales increase. The increase in the more expensive commuter passes has had a dramatic effect on the total allocation of dollars. Only 10 percent of the expenditures were for the commuter services in 1978; by December, 1979, 33 percent of the funds went to employees using the commuter services.

Changes in the December sales in the three study cities were relatively small. Overall, three percent more passes were sold in those cities. Des Moines and Ames had experienced a total loss of 10 sales; Iowa City increased by 40.

Stated Intentions for Participation

Question 14 of the survey instrument (Appendix A-4) solicited responses from users and non-users regarding their willingness to purchase a pass if the subsidy rate was dropped to 25 percent. The continued interest in the program was high. The percentages of subscribers not willing to participate were six, three, and nine percent in Des Moines, Iowa City, and Ames, respectively. In the non-user groups the percentages stating they would not use the program were 48, 50, and 39 percent for the cities as listed above.

To evaluate the full impact of the stated willingness to use the bus one must also account for the time variability of that demand. The distributions of intended use by month of the year are given in Figures 6.1 and 6.2 for Des Moines and Ames, respectively. The Iowa City distribution is comparable

Table 6.1. Monthly subsidized pass sales in FY 1979-80

	FY 79 Average[a]	Monthly Passes FY 80 July	August	September	October	November	December	FY 80 Average
Des Moines	294	361	325	312	317	306	307	321
Iowa City	693	806	625	659	747	853	822	752
Ames	25	10	6	11	13	17	22	13
Commuter	32	111	119	131	128	136	182	135
Other	33	26	28	27	34	29	29	29
Total	1077	1314	1103	1140	1239	1341	1362	1250

[a] FY 79 statistics were for a 9-month period, October, 1978 through June, 1979.

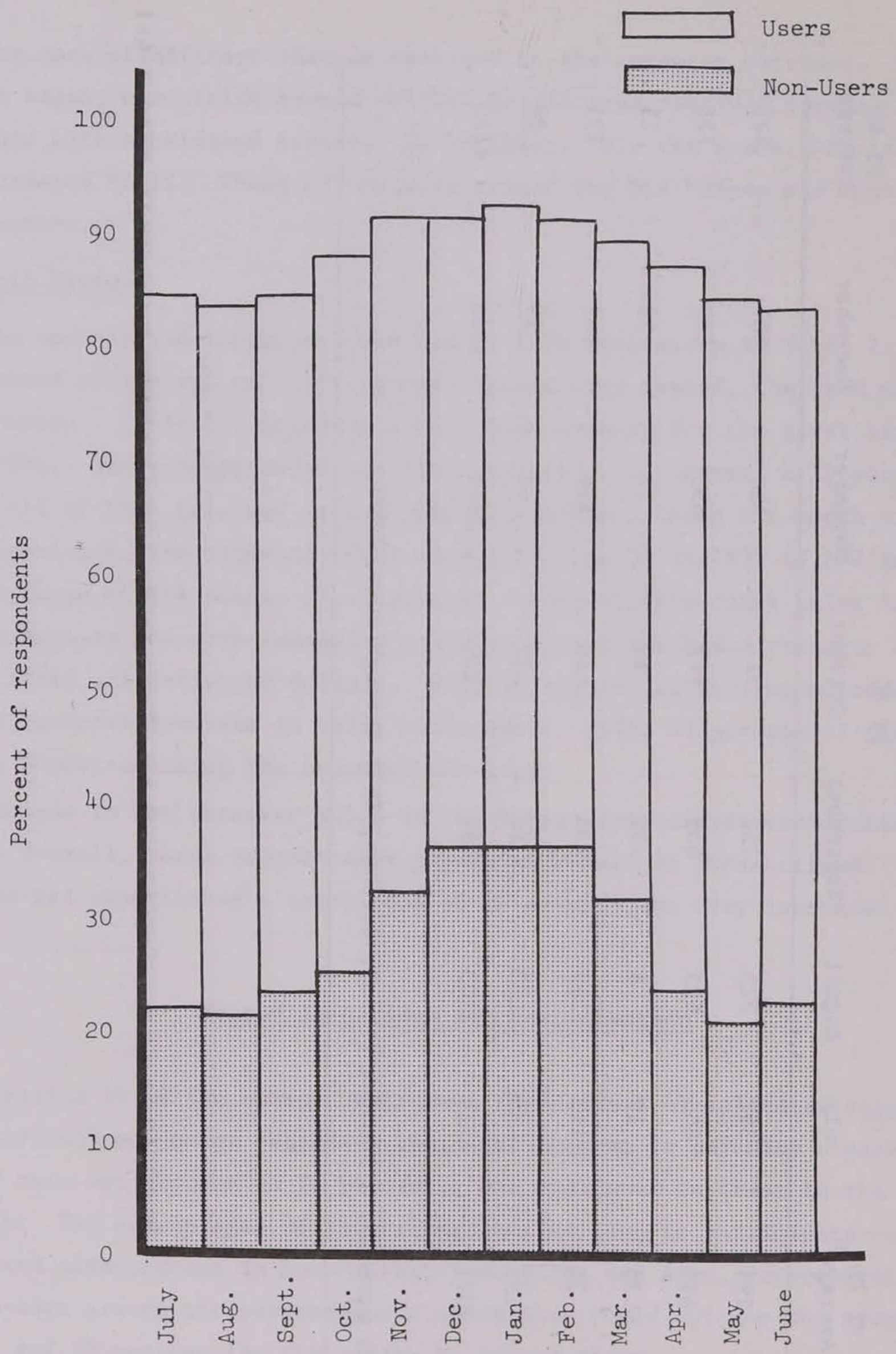

Figure 6.1 Monthly pattern of stated willingness for program participation in Des Moines

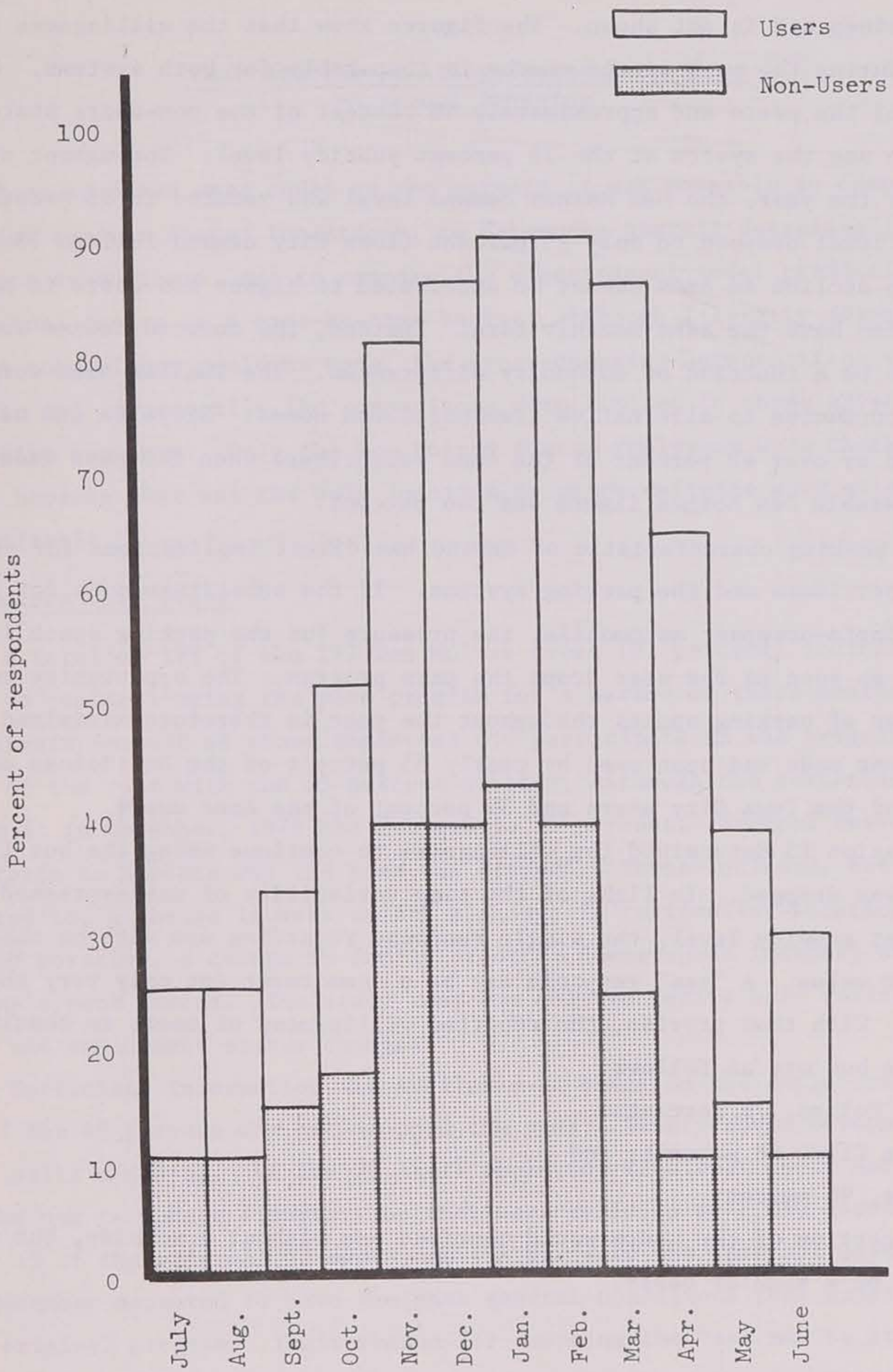

Figure 6.2 Monthly pattern of stated willingness for program participation in Ames

to Des Moines and is not shown. The figures show that the willingness to use the bus during the peak winter months is comparable for both systems. Over 90 percent of the users and approximately 40 percent of the non-users stated a desire to use the system at the 25 percent subsidy level. Throughout other months of the year, the Des Moines demand level was reduced to 85 percent but the Ames level dropped to only 25 percent (Iowa City demand fell to 75 percent). The sharp decline in Ames cannot be attributed to higher bus costs in Ames; both cities have the same monthly fare. Instead, the reduced demand would appear to be a function of community differences. The smaller Ames community is more conducive to alternative transportation modes. Bicycles and walking were used by over 40 percent of the Ames subscribers when the pass wasn't used. The comparable Des Moines figure was two percent.

The peaking characteristic of demand has direct implications for the transit providers and the parking systems. If the substitute mode for the bus is the single-occupant automobile, the pressure for the parking space is again realized as soon as the user drops the pass program. The opportunity to reduce the number of parking spaces throughout the year is therefore minimized. The drive-alone mode had been used by nearly 55 percent of the Des Moines users, 45 percent of the Iowa City users and 35 percent of the Ames users.

Question 15 determined the willingness to continue using the bus if all subsidy was dropped. In light of the time variability of use expressed at the 25 percent subsidy level, the single response regarding use with no subsidy is of lesser value. A "yes" response may be a commitment for only very short time periods. With that proviso, the reported willingness of users to continue using the bus was as follows:

Des Moines, 78 percent;

Iowa City, 88 percent; and

Ames, 96 percent.

A large portion of the users would continue use without a subsidy, but not necessarily on a regular basis.

Case Studies Relating Stated Intentions to Actual Behavior

Because names were coded on the surveys it was possible to compare actual behavior against stated intentions, to determine overall decreases in use by previous subscribers, and to compare the discriminant model predictions against the actual choice on a case-by-case basis. Although literally dozens of different comparisons could be made, the cross-checking between files was a manual process and so generally the comparisons were limited to those given in the following sections. Only the Des Moines system employees were checked in most cases because that was the only location in which definite work sites were identifiable.

Des Moines User Files

A total of 179 of the 197 Des Moines users (91 percent) indicated an intention to continue using the pass program for a period of three months or more. Eighty-six percent of those employees did participate in the program at least part of the year with the 25 percent subsidy, although the percentage still using it in December, 1979 had dropped to 73 percent. Several reasons could be set forth to explain why the pass was dropped. These included, but were not limited to, a change in work shift, a change in residential location, a change in job position, a change in family or other demographic factors, or a change in employment status. The study team was able to verify only residential location and employment status changes.

Sufficient information was available to check on the employment status of 39 of the 48 persons who had dropped the pass. Twenty-seven persons (69 percent) were still employed. Of the 27 still employed, 12 either could not be located in the new telephone directory or they were residing at a new address. Thus only 15 of the original 48 employees (31 percent) who were not using the pass in December appeared to have the same general conditions that existed under the original program. Their reason for dropping the pass may be attributable to the increased fare or to other non-identifiable personal reasons.

The survey forms of these 15 individuals were examined in detail to compare their general characteristics with the user and non-user group characteristics. The reported values for selected factors are shown in Table 6.2.

Table 6.2. Selected statistics for Des Moines employees dropping the pass program

Group	Average values for identified groups						
	BTT[a]	AUTT	COSDF	EMP	AGE	INC	ATTSUM
15 Users	31	18.4	-$0.82[b]	1.0	43	$27,700	47
Users	33	19.0	-0.91	0.7	38	21,900	46
Non-Users	43	17.9	-0.57	1.0	42	25,100	37

[a]See Table 3.1 for descriptions of terms and units

[b]Cost differences were calculated on the basis of a 50 percent subsidy level

A dichotomy appeared in that the 15 employees who dropped the program most resembled the travel and attitudinal characteristic of the user groups and the socioeconomic characteristics of the non-user groups. The only element known to have changed was the cost of the bus. When the new bus fare was introduced the 15 users' cost differences dropped to -$0.57. This value ironically is exactly equal to the average difference perceived by the non-user group. Overall these 15 employees, even though they were users in 1978, were very closely associated with the non-users.

The discriminant model classifications were also checked. Sufficient data were available to classify 11 persons. The model correctly classified 8 of 11 (73 percent) as users in FY 1979. The model with time and cost differences changed the classification of only three of these respondents when the subsidy change was introduced. The relative insensitivity of the cost variable had been noted previously and is verified here.

The discriminant models were also used to classify the 18 persons who stated they would not use the pass at the 25 percent level. Complete data were available for 12 of the 18 persons. The classification results suggested that these persons were nearer the boundary of the non-user category. In the general sample the Des Moines model was able to classify over 80 percent of the users correctly, but for this select group only 50 percent were classified as

users. The cost factor was not necessarily the reason that these persons dropped the program. The models, at least, did not predict that any of these employees would change because of the increased fare.

The persons indicating they would drop the pass if the subsidy level dropped to 25 percent were not running a bluff. None of them used the pass in 1980!

The file of all Des Moines users as of June, 1979, was also examined to determine the number of users who had dropped in FY 1980. Of the 106 persons who dropped the program, employment records could be checked for only 101. Approximately 64 percent were still employed. Only 35 percent of the total were still state employees and could be identified as being at the same address. Additional checks were not possible because many employees had not returned the survey. However, the 64 percent and 35 percent values are generally consistent with the 69 percent and 31 percent figures noted for the survey respondents.

Non-user Files

A single check was completed in all three communities to determine the degree to which the non-users who had indicated a willingness to participate actually purchased a pass. In Des Moines 22 persons indicated they would use the pass six months or more but only five (23 percent) had purchased a pass by December. Thirteen Iowa City non-users said they would participate but only one person (8 percent) actually did. Finally, in Ames none of the four persons carried through with their stated intention. These data clearly reemphasize that the positive responses received from employees in a simple "would you use" question are insufficient to estimate the usage of a mode to which the respondents are not already committed.

Summary

Changes in the number of employees participating in the subsidy program were more strongly associated with the increased service than the price changes. In the face of the reduced subsidy rate the monthly ridership actually increased. A majority of the increased ridership can be attributed to the additional commuter services.

The case studies indicated that over 70 percent of the Des Moines users who stated a willingness to continue the program at the lower subsidy level followed through with that action. By contrast the percentage of non-users following through was only 23 percent in Des Moines and 15 percent averaged over all cities. The travel cost and socioeconomic characteristics of the users who were still residing at the same address and were still employed but who dropped the program when the subsidy level changed were most closely related to the characteristics of the non-user employees. The discriminant models did not, however, generally predict that the price increase was sufficient to cause a shift from the pass program.

CHAPTER 7. EVALUATION OF THE STATE ASSISTANCE PROGRAM

Discriminant models, statistical tests and case studies are all helpful in describing the characteristics of the state assistance program subscribers and non-subscribers. However, these studies do not directly define how well the program has met its objective of changing travel habits and reducing parking demand. Nor do they evaluate the costs to achieve the objective or the strategies used to attain those objectives. Portions of the survey instrument solicited information about changes in travel behavior for work trips and other trips. In addition, factors related to management were considered. The Public Transit Division has also undertaken efforts to evaluate program management [1, 2]. The Transit Division's and the research team's efforts are discussed in this chapter.

Transportation and Trip-Making Adjustments

The state assistance program was intended to encourage greater use of public transit so the demand for parking could be reduced. Of course additional benefits related to fuel savings, reduced congestion and other features would accrue if large numbers of auto users switched to public transit. The numbers for 1979 indicate that 14,000 passes were distributed. Approximately 280,000 round trips were taken by using the passes for the work trip alone. The full measure of the program impact must assess the extent to which the program is replacing auto travel for the work trip as well as for other trips.

Mode to Work

Table 7.1 shows the distribution of modes used by the subscribers before they used the pass and the modes currently used by the non-subscribers. Just over 50 percent of the Des Moines urban and commuter area subscribers had driven a car alone but the percentages in Iowa City and Ames were only 39 and 35 respectively. The Des Moines value falls in the range of 45 to 57 percent found in earlier surveys (Figure 2.1). The Transit Division has estimated that as many as 165 parking spaces are no longer needed in Des Moines because the previous drive-alone operators are using the bus pass. Further consideration of this reduction is addressed in the section on parking.

Table 7.1. Mode usage for survey respondents

		Percent of respondents using the mode[a]			
		Drive Alone	Car Pool	Bus	Other[b]
Des Moines	User (197)[c]	53	6	35	12
	Non-User (101)	58	22	15	18
Iowa City	User (213)	39	6	30	38
	Non-User (62)	34	6	23	51
Ames	User (23)	35	0	13	56
	Non-User (28)	54	21	0	42
Commuter Area	User (26)	58	27	8	8
	Non-User (8)	25	75	0	0

[a] Percentages do not add to 100 because some employees used more than one mode.

[b] Other includes bicycle, walk, moped, motorcycle, etc.

[c] Numbers in parentheses are sample sizes

The degree to which non-subscribers could have used the bus may be established by several factors. The researchers determined the extent to which the auto was needed for job-related activities and found that only 8 to 11 percent of these employees needed their cars on either a daily or almost daily basis. The employees may have other personal constraints keeping them from using the bus, but these cannot be directly addressed by the employer.

Non-Work Trip Adjustments by the Bus Mode

The bus pass was frequently used for travel activities other than the work trip. Only the Des Moines pattern of trip making is discussed but the activities in the other cities were similar. Fifty-eight percent of the subscribers used the bus one or more times each week for non-work trips; five percent used the bus six or more times. Overall, an average of 1.6 non-work trips were completed by the user. We cannot say whether these were new trips or trips which were pre-

viously made by auto. We can say, however, that the longer people are associated with the program, the greater the likelihood that they will use the bus for other trip purposes. The project survey was able to identify 32 persons who had also responded to the March evaluation survey. During the five months between surveys 45 percent of these subscribers had increased their non-work trip bus travel beyond the level they experienced in the first three to six months of use. The increase, averaged over the 32 persons, was 1.3 trips per week.

The purposes of the non-work trips were as follows:

- 13 percent to eat or shop during lunch break
- 31 percent to shop in the evenings or on weekends
- 3 percent for recreation
- 19 percent for doctor visits
- 12 percent for all other purposes

The number of non-work trips is not large but one can see that the pass may serve as a catalyst to cause employees to think about the bus for trips other than the work trip. It was noted that approximately one-half of these trips were made by employees who had previously driven to work.

Other Adjustments to Reduce Travel

As part of the study the employees were queried about their personal efforts to reduce gasoline consumption. The responses are summarized in Table 7.2 for the Des Moines area. The response patterns in the other cities were similar.

Both the users and non-users indicated that their efforts were primarily in the low capital investment actions, e.g., greater use of the bus and lesser amounts of vehicle travel. The non-users are obviously more oriented to the auto as their transportation mode and are more likely to invest in a more efficient car. One in five indicated that such an action had been undertaken. Still, they also indicated that bus use was considered as often as the other auto oriented use, i.e., carpooling arrangements.

Table 7.2. Travel behavior changes to reduce energy consumption

Action	Percent of employees taking action shown[a]	
	Users	Non-Users
Buy more efficient car	11	20
Move to reduce driving distance	2	1
Make arrangements to carpool	2	15
Use bus more often	30	15
Reduce out-of-town trips	33	36
Reduce in-town trips	39	52
Other	7	25

[a]Percentages do not add to 100 percent because employees may have cited more than one action.

Parking System Impacts

The average percentage of all program users who previously drove alone to work in FY 79 was 45 percent. Applying this figure to the 1,167 subscribers in March, and assuming that all drivers parked in state lots, it was estimated that the need for 525 parking spaces had been removed [1]. Conceptually one should be able to calculate the annual capital costs and the operating and maintenance costs associated with these spaces and compare these potential savings to the costs of the program itself. Large variations in land and construction costs and limited data on operating and maintenance costs made it difficult to define a single average cost but a range of prices was determined from experience in Ames and Des Moines.

The initial investment per space ranged from $500 to $1000, exclusive of land costs. The annual operating and maintenance costs ranged from $30 to $60. Table 7.3 combines these four estimates to develop a range of the annual costs, which could be saved if the 525 spaces were in fact not developed.

Table 7.3. Annual cost estimates for parking spaces

Initial Construction ($/Space)	Annual Construction[a] ($/Space)	Annual Maintenance and Operation ($/Space)	Total Annual Cost ($/Space)	Total Cost[b] ($)
$ 500	$ 58	$ 30	$ 88	$46,200
500	58	60	118	62,000
1,000	117	30	147	77,200
1,000	117	60	177	92,900

[a]Based on a 20-year life and 10 percent interest.

[b]Total cost exclusive of land cost.

On the basis of these assumptions it is apparent that the savings in parking expenses can exceed the basic program costs of $65,000 if the true expenses are in the higher range. The program costs should also include administrative costs, and the parking lot costs should also consider the land costs. A private employer in Des Moines has determined the total monthly cost per space including land and interest expenses, to be $33. This is an annual cost of approximately $400 which is substantially greater than the values used in Table 7.3. The administrative costs for the subsidy program were approximately $12,000 in 1979. Therefore, the program cost including administration was $77,000. For this program, the savings from the reduction of 525 spaces would exceed the program cost, if the cost per space, including land cost, is greater than $147.

The detracting factor is that it is not apparent that the program has, in fact, changed the demand by the 525 spaces suggested here. On the surface it appeared that all subscribers would relinquish a parking space. The application form, which is shown in Appendix B, required the users to sign a statement agreeing not to bring a private vehicle to the state lot except in emergency situations. However, no actual effort was made in Des Moines or Ames to assure that a pass holder did not also have a parking permit. Further, since an employee was committed to the program for only a month at a time, the parking

space may not be truly released. During the adverse winter driving months the subscription rate was high, but it dropped as the weather improved and employees returned to their previous mode of travel. That mode was frequently the single-occupant auto.

One indication that the pressure for parking has not been reduced is provided in Des Moines. According to the pre-implementation surveys in Des Moines, approximately 85 percent of the auto drivers park in state-owned lots. Therefore, the program which attracted 165 single-occupant auto drivers during the sample month of March, 1979 can conceptually claim to have reduced the parking demand by 140 spaces in Des Moines. However, since the program was started, a 130-space crushed-stone parking lot has been added and an additional 25 spaces are planned. Although positive gains are being achieved regarding transit use, it is hard to argue that the state is convinced that the program is reducing parking space needs.

A second indication of parking pressure and aggregate adjustments in travel behavior was provided by the results from a one-day survey in November, 1979. At that time, major lots in the capitol complex were surveyed to determine lot occupancy rates and vehicle occupancy rates. The legislature was not in session and the parking supply was ample. Only one lot was filled to over 85 percent capacity. The average lot occupancy was 66 percent after the employees had reported to work. The lots surveyed did not include lots held solely for visitors. The most disappointing aspect was that the vehicle occupancy rate was 1.11 persons per auto. It is apparent that the subsidized pass has been very beneficial to those that use the program, but it is difficult to see that any major change in aggregate travel behavior of all employees has occurred.

Program Marketing and Administration

The assistance program was coordinated through a central office of the Transit Division in Des Moines. Program marketing materials originated from that office, applications were received there and passes for all systems were distributed from that office. The employee entered the program by submitting an application similar to that in Appendix C. The employee mailed a check and

a self-addressed, stamped envelope to the central office by the 15th of the month preceding the month of issuance. That office verified the employee status and mailed back the pass. In this section the general awareness of the program and the desirability of alternative administrative schemes are addressed.

Program Awareness

The program information and application materials were generally distributed through "stuffers" enclosed with the employee's paycheck. The single outstanding exception was Iowa State University in Ames, which elected to provide this information through a news release in the student paper and a one page notice in the Faculty Newsletter rather than through the pay envelopes.

Question 1 of the survey determined the non-users awareness of the subsidy program. The percentages of respondents who indicated that they were aware of the program were as follows:

Des Moines - 87 percent
Iowa City - 84 percent
Ames - 61 percent

The low level of awareness in Ames was particularly striking, albeit not unexpected, considering the indirect means of advertising. The Transit Division was concerned about the university's dissemination program but it did not push the issue because the program was quickly oversubscribed so that no additional passes could be sold. Future programs should certainly recognize the differences in the effectiveness of these advertising strategies.

Payment Methods

Monthly mailings and monthly billings were noted to be of concern to the program user. In the initial surveys a number of employees expressed the desire to change the purchasing arrangements so the passes could be obtained locally rather than through a central office. Question 17 of the survey instrument obtained further input on that issue. Considerable variation existed among the cities. Only 15 percent of the Des Moines employees preferred to have the opportunity to purchase the pass through the Des Moines Metropolitan Transit Authority. In the other communities over 40 percent of the respondents preferred the local purchase option. The principal concern expressed by those desiring a change was that the passes were often not received until the very end of the month. The patrons were fearful that the pass would not be available on time.

Processing by the local transit operator is not a recommended strategy, however, because of the opportunity for unauthorized purchases. Unless a control mechanism is established an employee could purchase multiple reduced fare tickets. It would be possible to provide each state employee with an identification card to verify employment status. However, the transit operator should not be expected to monitor the number of passes purchased each month using the card unless a computer matching system was provided.

The local control would be possible at the major employee sites if the employer established its own distribution center to handle applications. This would, however, create some duplication of effort and cost in training the local personnel.

The monthly pass was selected by the state as the desired mechanism for offering the reduced fare incentive. Use of a single type of pass minimizes the administrative expenses. The month-long commitment to the pass also increases the potential for the employee to abandon the automobile as the regular travel mode. This pass, however, may not be viewed as the most desirable system for all employees. Employees who are willing to make a longer term commitment to the pass may prefer a longer duration for the pass. Employees who rotate shifts may prefer to have a weekly system so a pass can be purchased only during the weeks in which the work-shift hours and the transit service hours coincide.

Table 7.4 presents a summary of the most preferred pass alternatives as determined in Question 16. The employees were asked to rank only the alternatives that were of interest to them. The percentage of persons selecting each alternative as either their first or second choice is shown. The existing monthly pass program was rated as the first choice of the users and non-users more frequently than any other alternatives. Approximately 60 percent of the users in the three cities preferred this arrangement. The non-users preferences were much less pronounced; the percentage selecting the monthly pass as the first choice dropped to the range of 25 to 40 percent. The non-users preferred a subsidized ticket which did not have a time constraint. Nearly 20 percent of the non-users preferred this approach. The quarterly pass and the limited ride - limited time alternatives were of low interest in all cities. Only the Iowa City users viewed the quarterly unlimited ride pass favorably. The cash outlay for a 3-month pass in Iowa City would still be only $12.00. Apparently that is not viewed as an excessive one-time payment. By comparison, Ames and Des Moines employees paid $10 for a single month.

Table 7.4. Preferred types of pass or ticket

Type of Pass[a]		Percent of respondents choosing pass type					
		Des Moines		Iowa City		Ames	
		User	Non-User	User	Non-User	User	Non-User
A	1st Choice	59	31	56	39	57	25
	2nd Choice	18	12	34	11	30	7
	N.I.[b]	11	45	4	35	0	29
B	1st Choice	14	7	36	13	17	11
	2nd Choice	34	15	39	21	30	18
	N.I.	33	57	13	44	17	43
C	1st Choice	8	11	1	3	4	14
	2nd Choice	14	12	7	19	0	14
	N.I.	46	51	51	42	39	43
D	1st Choice	5	2	1	5	4	7
	2nd Choice	5	9	3	6	9	7
	N.I.	54	59	52	45	35	50
E	1st Choice	9	23	3	19	17	21
	2nd Choice	6	8	7	6	22	21
	N.I.	48	44	52	37	22	39

[a]Type A: A monthly pass which provides unlimited rides during the months that I want to purchase it.

Type B: A quarterly pass which provides unlimited rides for a three month period (January to March, April to June, July to September, October to December) during the quarter that I want to purchase it.

Type C: A monthly ticket which would allow me a limited number of rides, for example 20 rides, during the month.

Type D: A quarterly ticket which would allow me a limited number of rides, for example 75 rides, during the quarter.

Type E: A reduced fare ticket which would allow a limited number of rides, for example 20 rides, with no time limit on the ticket. The cost per ride would be expected to be higher than in (C) above.

[b]N.I. = No Information

Management Expenses

The cost of administering the program through the centralized office was borne within the administrative budget of the Transit Division. The Division estimated the expenditures for the present manual system to be $11,900 per year [1]. During 1979 a total of 13,990 passes were distributed; the resulting cost per pass was $0.85. Evaluated differently, the administrative costs represent 17 percent of the amount expended for the passes in 1979. Analysis for part of the second year indicated that the administrative costs may be reduced to approximately 12 percent of sales.

Two changes in program management were considered to reduce these costs. The first alternative was an introduction of a computerized management program through the central office. The second alternative proposed a computer system interconnecting with the existing data systems of the three main employee systems, i.e., the state Comptroller's Office, the Board of Regents, and the Department of Transportation. This system would allow automatic payroll deduction plans. The costs for the systems are summarized as follows:

	Existing	Alternate 1	Alternate 2
First year cost	$11,900	$37,400	$34,000
Subsequent year cost	11,900	11,600	21,700

The high annual cost of Alternate 2 was due to the additional effort to coordinate five different computer systems of the three major groups. On the basis of these estimates the existing centralized, manual administration was found to be the most economical [1].

The administrative costs for a smaller private sector employer were obtained to provide a base with which to compare the state program. The private employer distributes approximately 120 passes per month. The administrative costs were approximately $1.00 per pass. Even though the state's checking process is necessarily more complex because of the number of agencies involved, it has been able to hold the costs in line with and lower than the private sector.

CHAPTER 8. SUMMARY AND RECOMMENDATIONS

The analyses completed in this research focused on the characteristics of public employees who had an opportunity to participate in a statewide transit assistance program. The factors considered to affect the traveler's decision were transportation, socioeconomic and attitudinal characteristics. Profiles of program subscribers and non-subscribers were developed and discriminant analysis techniques were used to classify the employees.

The study also evaluated the subsidy program elements and determined the degree to which travel habits were changed during the program. Travel for non-work purposes and parking demand adjustments were considered. Marketing and administrative costs were addressed to develop recommendations for other assistance programs.

Summary of Findings

Profiles of Employee Characteristics

Socioeconomic factors

Program subscribers were generally younger and from smaller families with lesser number of employed persons, had lower auto ownership and availability rates, and earned less income. The differences between users and non-users, however, were not always statistically significant. Within a city the socio-economic factors that were significant for the total sample were also significant for the sample that included only the choice riders. However, between cities the significant variables were not the same. Income distribution was the only economic variable that was a significant discriminating variable common to the larger cities, Des Moines and Iowa City. The relationships between the socio-economic factors and the choice of mode were weak.

Transportation factors

Total and excess travel times on the bus mode were reported to be higher for the non-users than the users. On the other hand, the users reported the highest auto total and excess travel times and auto costs. The perceived time and cost differences for users and non-users were statistically significant in

Des Moines and Iowa City, but the researchers could not discern that there were any actual differences in these characteristics. By design, the samples were selected to include only employees along bus routes available to all employees who had a common destination. Therefore, the actual travel times should be nearly equal. The auto costs could be somewhat lower for the non-users because they have a slightly larger number of employed persons per household and therefore more opportunities to share the auto costs.

Attitudinal factors

The attitudinal scores measured the degree of positive reaction toward transit and auto travel. The composite variable was the most consistent factor for identifying group membership in all cities. The differences in the perceptions about work-trip arrival time reliability, total bus times and driving hassles were the strongest attitudinal components separating users and non-users. Parking problems, the issue toward which the program was directed, was perceived to be important only by the Iowa City subscribers.

Models of choice

Discriminant analysis probability models were used to select the dominant variables that distinguished users and non-users. The modeling focused on those persons who had auto and transit access. The principal areas of concern with the discriminant models included the variables selected, the model accuracy and the transferability between study cities.

Significant variables for group identification

The composite attitudinal score was the most important variable to distinguish between users and non-users in all cities. Socioeconomic factors were next in importance in Des Moines and Iowa City, but perceived bus travel times were more important in Ames.

Although transit cost was the policy variable addressed by the program, the difference between transit and auto costs was not found to be an important discriminating variable once the attitudinal factor was considered. The time and cost variables were not included in the same model unless they were forced into the discriminating function. Models in which these variables were forced to enter suggested that the value of time ranged from $2.30 to $2.50 per hour

in the three cities. The probability model also indicated that the average program user was not likely to drop the program on a strictly economic basis when the subsidy level decreased from 50 percent to 25 percent.

The high degree of significance of the attitudinal variables for explaining the choice behavior agrees with other research, but one must recognize that the respondents selected for this study were intended to be homogeneous with respect to both auto and transit accessibility. The more homogeneous the travel time conditions, the less likely it is the variable will be useful for distinguishing the groups. The fact that the perceived times are different at all is suggestive of the biases of individuals.

Model accuracy

The best discriminant functions explained only 40 to 50 percent of the variance in the choice set. However, these models were able to correctly classify approximately 80 percent of all users and non-users. When only perceived time and cost differences were used, the percentage correctly classified dropped to under 70 percent.

A set of models using only the attitudinal responses correctly classified approximately 80 percent of the employees. This figure can be compared with the results from the first stage surveys in which employees responded to simple questions, "Would you ride if....?" Only 25 percent of those who would have been classified as users actually participated in the program. When the program changed to the 25 percent subsidy level, the actual participation rate of non-users who had stated a willingness to participate averaged approximately 15 percent. For those already using the pass, the correlation between stated intention and actual action was higher; approximately 70 percent followed through on their stated intentions.

Transferability between cities

The models based on data from one city and used to classify employees in the other cities were generally successful. A weighted average of the percentage of correct classifications was 81 percent for the two larger cities, 85 percent and 71 percent for the classifications in Des Moines and Iowa City, respectively. Case studies indicated a number of misclassifications could be attributed to constrained choices which were not evident from the factors

included in the variable list. Models using only attitudinal subscores correctly classified 75 percent of the employees even when used in cities other than the one in which they were calibrated.

Impact of Subsidy Level Change

Total pass sales increased by 16 percent after the program changed from a 50 percent subsidy to a 25 percent subsidy. The growth was attributed largely to new services in the commuter market. Sales within the study cities increased by three percent from December, 1978, to December, 1979. A total of 66 persons, or 34 percent of the first phase users, did not participate after the bus fare was effectively increased by 50 percent due to the subsidy change. These data would appear to suggest a shrinkage ratio of -0.68, but at least 33 of the persons who dropped the program did so either because they were no longer state employees or because they had changed residential location. Results from the discriminant models indicated that the cost change when evaluated along with auto costs and travel times would have affected only four percent of the Des Moines area classifications.

Attainment of Program Objectives

Conceptually the program reduced the need for over 500 parking spaces. Using a range of costs for construction and maintenance, exclusive of land costs, the potential savings of parking spaces exceeds the costs of the program for values at the high end of the range. However, because the commitment to the bus is not consistent throughout the year, a portion of the spaces have seasonal demand variations. When weather is inclement bus pass usage is high, but usage declines during more favorable weather conditions, thus placing the demand back on the parking system. Indeed, in Des Moines where the need for 140 spaces had been reportedly removed, the state has added or plans to add another 155 spaces.

The increased utilization of transit for non-work activity was assessed as a benefit of the pass program. The average subscriber in Des Moines used the bus for 1.6 non-work trips each week. The longer a person subscribes to the pass, the greater the likelihood that the bus will be accepted as an alternative for even more non-work trips. After a four-month period the employees who could be identified in two surveys reported their non-work trips to be 1.3 trips per week higher than in the earlier survey.

Program Evaluation

Marketing and selection of pass type

Dissemination of information about the program was non-uniform throughout the state. The lowest rate of participation was in Ames which also experienced the poorest promotion at the university. The low ridership in Ames could not be solely attributed to poor advertising, however, because although the Department of Transportation employees in Ames received direct mailings the participation rate was also low from that agency. Lower ridership was attributed to the more unstable service and the lower total service capacity.

The monthly pass was preferred by most employees; however, many employees cannot benefit from the monthly system because work schedule rotations or other personal reasons preclude bus travel on some days. Weekly passes and limited time passes would attract a higher number of users, but not on a daily basis.

Program administration

Administration of the program through a single central office was acceptable to most employees although many users outside the Des Moines area preferred to purchase the pass locally. They feared the pass would not be received on time. The costs for manually checking the applications and distributing the passes averaged $0.85 per pass. Computerized systems which would integrate the data files from all major program groups would be more expensive than the present manual system. The processing costs compare favorably with a private employer system in which passes are purchased directly from the employer.

Conclusions and Recommendations

The evaluation of employees' attitudes and the subsidy program elements provide the basis for several conclusions and recommendations for developing employer-based subsidy programs. A number of these have been suggested in the report; others are discussed here.

1. Types of subsidized passes.

   The program objectives should be defined before selecting the type of pass to use. A general goal of increasing the number of persons using transit can best be accomplished by providing a variety of pass alternatives.

Commitments for periods longer than one month are unattractive unless the patron's cash outlay is within the general limit of a monthly unsubsidized pass. Shorter time period commitments or unlimited time, fixed ride passes are especially essential for employers who have rotating work shifts.

If the objective is more restrictive, such as with the parking demand reductions of this study, the single monthly pass may be more appropriate, but in the long run the peaking characteristics indicate that the parking reductions are not maintained completely throughout the year.

2. Subsidy level.

The researchers found that the cost factors were not predominant in the choice models. We speculate that the initial decision for auto drivers to try the subsidized program may be associated as much with the employers' expression of interest as with the dollars saved. Nevertheless, the employee will compare the subsidized fare against other regular fare alternatives under the assumption that the bus could not be used every working day of a month. It is recommended that the subsidy level should reduce the employees' cost at least as low as the total daily fare for 16 working days per month.

3. Supplemental constraints.

A fully effective program addressing parking reductions must place special constraints on parking access. Employers could assure that the program participants are not receiving both the benefits of the use of a subsidized pass and a subsidized parking facility by controlling access to the parking lots. Gate controlled entrances or parking sticker systems should be implemented to monitor the lot usage. A large employer with several lots could consider the need for parking on an occassional "emergency" basis and designate a more remote lot or metered lot for these needs.

4. Employee surveys.

The potential for attracting employees to the program is a function of accessibility to the system as well as the socioeconomic and attitudinal characteristics of the individual. If an employer is interested in knowing the potential participation before start-up, a survey containing attitudinal and other personal data similar to that of this research should be completed. Since sophisticated statistical modeling capabilities may not be

generally available, simple averages and a histogram analysis may be completed. The employees whose response patterns are closest to the current bus users could serve as the base for estimating participation of all employees. Attitude scores, income and reported bus travel time differences are three key factors to identify potential subscribers. Since less than six percent of the subscribers in this study walked more than 3 blocks to the bus, only employees within 3 blocks need to be considered as being potentially attracted to transit.

5. Promotional activities.

Advertising or promotion of transit use should center on those attitudinal factors which exhibit the greatest differences for users and non-users. On-time arrival to work and bus travel times are transit factors which non-users viewed as significantly more onerous than the users. Actual reliability would be the same for users and non-users, therefore, this aspect is strictly an image problem. On the other hand, the research suggests that promotions focusing on bus energy savings or nearness of routes to home or work site will have less impact because the non-users already generally agree that buses are energy efficient and that walking distance is not a problem.

6. Alternative incentive programs

This research did not examine alternative programs or the (in)equities associated with the current program, but the results indicate that a combination of (dis)incentives is necessary to accomplish the full program objectives. The researchers recommended that the offer of an employee transit subsidy should be accompanied by a measure to initiate or to increase the parking fees to a level comparable with parking system cost. Without a change in the parking conditions the auto drivers may not perceive any actual changes in the transporation alternatives.

7. Additional research.

The discriminant models were used to classify the employees after the choice had already been made. A continuation of the study is recommended in which the employee characteristics are evaluated before a subsidy program is begun. This study would be of value to determine if attitudes are the basis for the choice or if expressed attitudes are just a function of the mode used. The direction of causality is assumed, but not proven by the data obtained in this report.

ACKNOWLEDGMENTS

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APPENDIX A-1

STATE EMPLOYEE
TRANSPORTATION
SURVEY

Name _____

Employee Number _ _ _ _ _ _ _ _ _ _
(6 — 10)

Home Address _____

_____

(Please correct if information is in error.)

After completing this survey, please return it to your supervisor for transmittal to the Iowa Department of Transportation, DOT Motor Vehicle Information Center, Motor Vehicle Division, Ground Floor, Lucas Building by October 2, 1978

CAPITOL COMPLEX FORM

This survey is being conducted by the Iowa Department of Transportation in cooperation with the Department of General Services and the State Comptroller's Office to obtain certain information on the transportation patterns and preferences of state employees. Interest in alternative and improved transportation programs will also be evaluated. The data collected from this survey will provide useful information in planning improvements of transportation options open to state employees including such things as public transportation, park-and-ride services, carpooling, and vanpooling.

INSTRUCTIONS

Please fill out this questionnaire by putting an "X" in the box in front of the appropriate answer to each question. Mark only one answer to each question unless otherwise indicated.

1. IF TRANSIT SERVICE WERE AVAILABLE FOR YOUR WORK TRIP FOR LESS THAN $1.00 PER WORKING DAY (cost may be higher for those who live outside urban area) AND RAN WITHIN THREE (3) BLOCKS OF YOUR HOUSE, WOULD YOU BE WILLING TO TRY IT?

   a. ☐ Yes

   b. ☐ No 27

2. IF TRANSIT SERVICE FOR YOUR WORK TRIP TOOK ON PASSENGERS ONLY AT SELECT BOARDING POINTS, SUCH AS SHOPPING CENTERS AND CERTAIN STREET CORNERS, WOULD YOU BE WILLING TO TRY IT?

   a. ☐ Yes

   b. ☐ No 28

3. IF PARK-AND-RIDE SERVICE (commuter drives partway and rides transit partway) WERE AVAILABLE FOR YOUR WORK TRIP, WOULD YOU BE WILLING TO TRY IT?

   a. ☐ Yes

   b. ☐ No 29

4. IF YOU COULD JOIN A CARPOOL THAT WOULD BE CONVENIENT FOR YOU, WOULD YOU BE WILLING TO TRY IT? (check one)

   a. ☐ Yes

   b. ☐ No 30

   c. ☐ Already in carpool (How many in your carpool? _____) 31

5. IF YOU ARE NOT IN A CARPOOL, WOULD YOU BE WILLING TO JOIN A CARPOOL CONVENIENT TO YOU, IF A PRIORITY (CLOSE-IN) PARKING SYSTEM WERE ESTABLISHED FOR CARPOOLERS IN THE CAPITOL AREA?

   a. ☐ Yes

   b. ☐ No 32

PLEASE CONTINUE ON NEXT PAGE . . . .

6. WHO IS YOUR EMPLOYER? (Write in the name of the Department, Commission or other major component of state government; then write in the name of the Division (if any); and finally write in the name of the Bureau or Office (if any).)

a. Department, Commission, etc. of _____

b. Division of _____

c. Bureau or Office of _____

7. WHERE IS YOUR PLACE OF WORK? 33

a. ☐ Capitol Building (001)
b. ☐ Lucas Building (E. 12th Street) (010)
c. ☐ Hoover Building (1305 E. Walnut) (012)
d. ☐ Executive Hills (1209-1223 E. Court) (013)
e. ☐ Central Energy Plant (047)
f. ☐ Grimes Building (E. 14 & Grand) (001)
g. ☐ Shell Station (E. 14th & Grand) (009)
h. ☐ Citizens Aid (515 E. 12th Street) (008)
i. ☐ Capitol Hill Annex (523 E. 12th) (007)
j. ☐ Historical Building (E. 12th & Grand) (006)
k. ☐ Vocational Rehabilitation (1029 Des Moines St.) (005)
l. ☐ Buildings and Grounds Shop (North of Grand) (004)
m. ☐ Job Service Building (1000 E. Grand) (002)
n. ☐ Wallace Building (900 E. Grand) (033)
o. ☐ 707 E. Locust (032)
p. ☐ Vehicle Dispatcher Building (301 E. 7th Street) (016)
q. ☐ Records and Property Center (E. 7th and Court) (014)
r. ☐ 215 E. 7th Street (015)
s. ☐ Dania Savings (E. 7th Street) (027)
t. ☐ 1018 Des Moines Street (048)
u. ☐ 800 Des Moines Street (049)
v. ☐ Other (specify) _____ (999)

8. PLEASE INDICATE (with an "X" in the appropriate box) YOUR SCHEDULED WORK STARTING TIME: 36

a. ☐ 7:00 a.m. (0700)
b. ☐ 7:15 a.m. (0715)
c. ☐ 7:30 a.m. (0730)
d. ☐ 7:45 a.m. (0745)
e. ☐ 8:00 a.m. (0800)
f. ☐ 8:15 a.m. (0815)
g. ☐ 8:30 a.m. (0830)
h. ☐ 8:45 a.m. (0845)
i. ☐ 9:00 a.m. (0900)
j. ☐ Other (specify) _____

9. PLEASE INDICATE (with an "X" in the appropriate box) YOUR SCHEDULED WORK QUITTING TIME: 40

a. ☐ 3:30 p.m. (1530)
b. ☐ 3:45 p.m. (1545)
c. ☐ 4:00 p.m. (1600)
d. ☐ 4:15 p.m. (1615)
e. ☐ 4:30 p.m. (1630)
f. ☐ 4:45 p.m. (1645)
g. ☐ 5:00 p.m. (1700)
h. ☐ 5:15 p.m. (1715)
i. ☐ 5:30 p.m. (1730)
j. ☐ Other (specify) _____

10. HOW DO YOU GET TO WORK MOST OF THE TIME? 44

a. ☐ Drive alone (auto, pick-up, van)
b. ☐ Driver with passengers (auto, pick-up van)
c. ☐ Passenger (auto, pick-up, van)
d. ☐ MTA Bus Passenger
e. ☐ Brothers Bus Passenger
f. ☐ Bicycle
g. ☐ Walk
h. ☐ Motorcycle
i. ☐ Other (specify) _____

11. IF YOU DRIVE (an auto, pick-up, van, or motorcycle), WHERE DO YOU PARK MOST OF THE TIME? (check one) 45

a. ☐ State parking reserved space
b. ☐ State parking lot - assigned lot
c. ☐ State parking lot - unreserved, unassigned
d. ☐ Other off street lot - reserved
e. ☐ Other off street lot - unreserved
f. ☐ On street - metered
g. ☐ On street - unmetered
h. ☐ Other (specify) _____

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Survey # 1 0013

Bus Stop # 5 —

TRANSIT DISEMBARKING QUESTIONNAIRE

1. ARE YOU A STATE EMPLOYEE? 7

   a. ☐ YES

   b. ☐ NO

2. WHERE IS YOUR PLACE OF WORK? 8 — —

   a. ☐ Capitol Building (001)
   b. ☐ Lucas Building (E. 12th Street) (010)
   c. ☐ Hoover Building (1305 E. Walnut) (012)
   d. ☐ Executive Hills (1209-1223 E. Court) (013)
   e. ☐ Central Energy Plant (047)
   f. ☐ Grimes Building (E. 14th & Grand) (011)
   g. ☐ Shell Station (E. 14th & Grand) (009)
   h. ☐ Citizens Aid (515 E. 12th Street) (008)
   i. ☐ Capitol Hill Annex (523 E. 12th) (007)
   j. ☐ Historical Building (E. 12th & Grand) (006)
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   l. ☐ Buildings and Grounds Shop (North of Grand) (004)
   m. ☐ Job Service Building (1000 E. Grand) (002)
   n. ☐ Wallace Building (900 E. Grand) (033)
   o. ☐ 707 E. Locust (032)
   p. ☐ Vehicle Dispatcher Building (301 E. 7th St.) (016)
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   s. ☐ Dania Savings (E. 7th Street) (027)
   t. ☐ 1018 Des Moines Street (048)
   u. ☐ 800 Des Moines Street (049)
   v. ☐ Other (specify) _____ (999)

3. HOW FAR WILL YOU WALK FROM THE BUS STOP? 11

   a. ☐ Less than one block
   b. ☐ One Block
   c. ☐ Two Blocks
   d. ☐ Three blocks
   e. ☐ Four to five blocks
   f. ☐ More than five blocks

4. HOW OFTEN DO YOU RIDE THE BUS? _____ times per week. 12 —

5. DO YOU HAVE A DRIVERS LICENCE? 14

   a. ☐ YES

   b. ☐ NO

6. DID YOU HAVE AN AUTO, VAN, PICK-UP OR MOTORCYCLE AVAILABLE FOR THIS TRIP? 15

   a. ☐ YES

   b. ☐ NO

7. SEX: 16

   a. ☐ FEMALE

   b. ☐ MALE

8. AGE: _____ YEARS 17 —

PLEASE CONTINUE ON NEXT PAGE . . . .

9. WHAT TIME DID YOU GET OFF THE BUS AT THE CAPITOL COMPLEX?_____ ☐ AM ☐ PM

19 — — — —

10. WHICH BUS BROUGHT YOU TO THE CAPITOL AREA? (Check one)

23

MTA:

a. ☐ Route 1 - Fairgrounds
West Des Moines

b. ☐ Route 2 - Crocker
Scott

c. ☐ Route 3 - Highland-Oak Park
University

d. ☐ Route 4 - Urbandale
East 14th

e. ☐ Route 5 - East 6th & 9th
Clark

f. ☐ Route 6 - West 9th-Douglas
Indianola-Lacona

g. ☐ Route 7 - Fort Des Moines
Walker

h. ☐ Route 8 - S.W. 14th-Havens
S. Union

i. ☐ Valley Express

j. ☐ Clive Express

k. ☐ Urbandale Express

l. ☐ West Des Moines Express

m. ☐ Windsor Heights Express

BROTHERS BUS:

n. ☐ Martensdale-Norwalk

o. ☐ Indianola

p. ☐ Carlisle-Hartford

q. ☐ Other route; or transit, paratransit, or taxicab service (specify) _____

11. DID YOU TRANSFER FROM ANOTHER BUS ROUTE?

24

a. ☐ Yes, if so, which route? _____

b. ☐ No

STATE LOCAL MAIL
SYSTEM ONLY

RETURN TO: DOT MOTOR VEHICLE INFORMATION CENTER
MOTOR VEHICLE DIVISION
GROUND FLOOR
LUCAS BUILDING, DES MOINES

APPENDIX A-3A

This survey is being conducted by the Iowa Department of Transportation to obtain information to help the Iowa Department of Transportation and the State Legislature determine if the bus pass program (I AM READY 4 A CHANGE) has been successful and if it should be continued.

I N S T R U C T I O N S

Please fill out this questionnaire by putting an "X" in the box in front of the appropriate answer to each question or inserting your own answer in the space provided.

1. Which system do you presently ride? _____

2. How long have you been a participant in this program? _____ months

3. How often do you ride the bus? _____ times per week
(Home to work and work to home = 2 times)

4. Before using this program, what type of transportation did you use to get to work?

☐ drive alone ☐ carpool ☐ bus ☐ bicycle ☐ walk

☐ motorcycle ☐ other

5. Do you think this program should be continued?

☐ no
☐ yes

Why?

6. Would you sign up to participate for a full year?

☐ no
☐ yes

7. Would you agree to payroll deduction for paying for your monthly pass?

☐ no
☐ yes

8. Would you carpool if this program was not available next fiscal year (July 1, 1979, through June 30, 1980).

☐ no
☐ yes

If no, why?

9. How do you think the program could be improved?

10. Sex: ☐ female ☐ male

11. My age is: ☐ under 20 ☐ 20 - 30 ☐ 30 - 40 ☐ over 40

Name: (Optional) _____

Address: (Optional) _____

_____

_____

PLEASE FOLD THIS FORM SO THAT THE RETURN ADDRESS ON THE REVERSE SIDE IS VISIBLE, STAPLE OR TAPE IT CLOSED AND MAIL BY MARCH 15, 1979.

APPENDIX A-3B

This survey is being conducted by the Iowa Department of Transportation to obtain information to help the Iowa Department of Transportation and the State Legislature determine if the bus pass program (I AM READY 4 A CHANGE) has been successful and if it should be continued.

I N S T R U C T I O N S

Please fill out this questionnaire by putting an "X" in the box in front of the appropriate answer to each question or inserting your own answer in the space provided.

1. Which system are you interested in riding? _____

2. If the bus pass program (I AM READY 4 A CHANGE) is continued and expanded would you sign up for a full year?

   ☐ no
   ☐ yes

   If no, why?

3. Would you agree to payroll deduction for paying for your monthly pass?

   ☐ no
   ☐ yes

4. What type of transportation do you have available to you at the present time?

   ☐ car ☐ bus ☐ carpool ☐ bicycle ☐ walk

   ☐ motorcycle ☐ other

5. How do you currently get to work?

   ☐ drive alone ☐ bus ☐ carpool ☐ bicycle ☐ walk

   ☐ motorcycle ☐ other

6. If you currently drive alone would you be willing to give up your parking place for a monthly bus pass?

   ☐ no
   ☐ yes

   If no, why?

7. Sex: ☐ female ☐ male

8. My age is: ☐ under 20 ☐ 20 - 30 ☐ 30 - 40 ☐ over 40

Name: (Optional) _____

Address: (Optional) _____

_____

_____

PLEASE FOLD THIS FORM SO THAT THE RETURN ADDRESS ON THE REVERSE SIDE IS VISIBLE, STAPLE OR TAPE IT CLOSED AND MAIL BY MARCH 15, 1979.

APPENDIX A-4A. RESEARCH PROJECT USER SURVEY FORM

Iowa State University of Science and Technology Ames, Iowa 50010

Engineering Research Institute
College of Engineering
104 Marston Hall
Telephone: 515-294-2336

Dear State Employee: July 17, 1979

During part of the past year you have participated in the state employee subsidy program entitled I AM READY FOR A CHANGE. As a participant you have been asked to return one or more questionnaires which were designed to provide the state legislature with information about the use of the program. Because of the importance of developing other innovative transit programs throughout the country, the U.S. Department of Transportation is now interested in a more detailed evaluation of bus user and bus service characteristics. The Engineering Research Institute is conducting this study.

The attached questionnaire will provide valuable data for the evaluation of this program. Although some of the questions may appear similar to earlier surveys, this questionnaire seeks more detailed data. Your cooperation in filling out this form and returning it in the enclosed self-addressed, postage-paid envelope is needed and will be greatly appreciated. Note that the information is confidential and will be used only for statistical evaluation purposes.

Yours truly,

Edward J. Kannel
Associate Professor of Transportation Engineering

The questions in this survey are divided into several groups. Most questions can be answered by either filling in the blanks or by checking a box which best describes your situation. Please try to answer all questions.

Your Trip to Work

1. Approximately how many minutes does it usually take you to get from home into your place of work when you go by bus? _____ minutes

2. How much of this total time is for walking to and from the bus stop and for waiting for the bus? _____ minutes

3. How many blocks do you have to walk when going:
   a. from home to the bus stop? ☐ less than 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4+
   b. from the bus stop to work? ☐ less than 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4+

4. Is it necessary for you to transfer between buses to make this trip?
   ☐ yes ☐ no

PLEASE CONTINUE WITH QUESTIONS ON THE NEXT PAGE (Backside of this page)

5. How do you usually get to work when you don't use the monthly pass?
   ☐ drive alone ☐ carpool ☐ bus ☐ bicycle ☐ walk ☐ other_____

   If you never drive alone or ride in a carpool you may skip to Question 10.

6. If you sometimes drive alone or share in a carpool, which of these means do you use most frequently? ☐ drive alone ☐ carpool

7. When you drive or carpool, as you checked above, how much time does it take to get from home into your place of work? _____ minutes

8. How much of this total time is spent picking up others, finding a parking space, and walking to the work place? _____minutes

9. Approximately how much do you think it costs you to go to and from work each day by this means if you considered the vehicle costs and the parking costs?

   ☐ Less than 25 cents ☐ 25 to 49 cents ☐ 50 to 74 cents
   ☐ 75 to 99 cents ☐ $1.00 to $1.24 ☐ $1.25 to $1.49
   ☐ $1.50 or more. My best estimate is that it costs $ _____per day.
   ☐ I really couldn't estimate this cost.

Other Trips by Bus

10. How many bus trips, besides those between home and work, did you make during an average week when you used the pass?(Consider each time you get on the bus as a new trip)

    ☐ None ☐ 1 or 2 ☐ 3 or 4 ☐ 5 or 6 ☐ more than 6 trips a week

11. If you used the bus for other trips, check the one or two most frequent types of trips that you made.

    ☐ to eat or shop downtown during my lunch break
    ☐ to go shopping in the evenings or the weekends
    ☐ to visit friends or go to other recreational activities
    ☐ to go to the doctor
    ☐ other (Please specify) _____

12. Had you been using the bus for any trips before you first purchased the subsidized pass? ☐ Yes ☐ No

PLEASE CONTINUE WITH QUESTIONS ON THE NEXT PAGE

Transportation Service Evaluation

13. It is necessary to know how people view the transit and auto services which are available to them in order to evaluate potential changes in the service. The following set of statements is intended to get an idea of how you feel about travel for the daily work trip. Particular emphasis is given to bus service. If you strongly agree with a statement, circle the number 5. If you strongly disagree with a statement, circle the number 1. If you don't have strong feelings one way or the other, you should circle the number between 1 and 5 which best describes how you feel. Do this for each of the statements below.

Statements	STRONGLY DISAGREE	DISAGREE	SOMEWHAT NEUTRAL	AGREE	STRONGLY AGREE	I Can't Judge
The bus can usually be depended on to get me to work on time	1	2	3	4	5	___
The bus doesn't give enough choice of times to leave	1	2	3	4	5	___
The bus trip takes too much time	1	2	3	4	5	___
It is too far to walk to the bus	1	2	3	4	5	___
Buses are usually on schedule	1	2	3	4	5	___
The gas situation is making it difficult to get to work	1	2	3	4	5	___
It is really a hassle to drive	1	2	3	4	5	___
The bus is a good way to save fuel	1	2	3	4	5	___
It costs too much to go by bus	1	2	3	4	5	___
It costs too much to go by car	1	2	3	4	5	___
Parking is a problem where I work	1	2	3	4	5	___
I am willing to pay whatever it costs to be able to take my car	1	2	3	4	5	___

Future Programs

During the 1979-1980 Fiscal Year, state employees will be able to purchase monthly bus passes with a 25% reduction in cost. That is, if a monthly pass costs $20 in your town, the subsidy program will pay $5 and you would pay only $15.

14. Which months of the year would you like to participate in this program? (Check all appropriate boxes.)

☐ None ☐ Every month ☐ July ☐ August ☐ September

☐ October ☐ November ☐ December ☐ January ☐ February

☐ March ☐ April ☐ May ☐ June

15. Would you prefer to have the state invest in a different transportation assistance program to reduce the costs and difficulties of getting to work? ☐ Yes ☐ No
If Yes, what assistance would be most helpful?_____

_____.

PLEASE CONTINUE WITH QUESTIONS ON THE NEXT PAGE

16. Several other methods could be considered for operating a subsidy program to pay for your bus rides. Some possibilities are listed below. Consider these alternatives and indicate which methods would seem best to you by ranking these methods. The type of pass or ticket and the method of payment which would be best for you should be rated best by giving it the number 1. Your second most preferred method should be ranked as 2, and so forth. If a method doesn't appeal to you at all you may leave it blank. Your cost per ride for all methods would be lower than the single trip cost in your city.

____ a. A monthly pass which provides unlimited rides during the months that I want to purchase it.

____ b. A quarterly pass which provides unlimited rides for a three month period (January to March, April to June, July to September, October to December) during the quarters that I want to purchase it.

____ c. A monthly ticket which would allow me a limited number of rides, for example 20 rides, during the month.

____ d. A quarterly ticket which would allow me a limited number of rides, for example 75 rides, during the quarter.

____ e. A reduced fare ticket which would allow a limited number of rides, for example 20 rides, with no time limit on the ticket. The cost per ride would be expected to be higher than in (c) above.

17. The subsidy system would be better for me if I could buy my pass directly from the transit system rather than sending in to the state office. (Check One)

☐ I agree ☐ I disagree ☐ Either way is OK

18. Many individuals are looking at ways to reduce their needs for gasoline. Have you made, or do you expect to make, any changes in your travel habits to adjust to the energy situation? ☐ Yes ☐ No
If Yes, place a check by all of the following actions that apply to you.

☐ buying a more efficient car
☐ moving to reduce driving distance
☐ making arrangements for carpool
☐ taking the bus more often
☐ reducing out-of-town trips
☐ reducing in-town trips
☐ Other_____

Personal Information

Please answer the following questions about yourself so we can check the representativeness of the sample and compare the results with other surveys.

19. Your age: ☐ under 25 ☐ 25 to 34 ☐ 35 to 44 ☐ 45 to 54 ☐ 55 or more
20. Your sex: ☐ Female ☐ Male
21. What is the total number of persons in your household? _____
22. How many other members of your household are employed? _____
23. Are you a licensed driver? ☐ Yes ☐ No
24. How many cars, vans, or pickups are available to your household? _____
25. Are any of these vehicles usually available to you to go to work? _____
26. What is the approximate combined total income, before taxes and other deductions, for all members of your household?

☐ less than $10,000 ☐ $10,000 to $20,000 ☐ $20,000 to $30,000
☐ $30,000 to $40,000 ☐ Over $40,000

THANK YOU FOR YOUR ASSISTANCE. PLEASE ADD ANY FURTHER SUGGESTIONS ON ANOTHER SHEET AND RETURN THEM WITH THIS FORM

Iowa State University of Science and Technology Ames, Iowa 50010

Engineering Research Institute
College of Engineering
104 Marston Hall
Telephone: 515-294-2336

Dear State Employee: July 17, 1979

In 1978 the Iowa Legislature appropriated money to establish a transit subsidy program for state employees. Employees were provided the opportunity to purchase a monthly pass which allowed them to ride the bus as often as he or she wished during each month that a pass was purchased. The cost of the monthly pass was divided equally between the employee and the state. The employee benefited by having a lower bus trip cost. The state has benefited by having a reduced demand for parking spaces around state buildings.

Because of the importance of such innovative transit programs, the Engineering Research Institute is doing a study, sponsored by the U.S. Department of Transportation, to evaluate this program. The attached questionnaire is intended to learn more about the travel characteristics and needs of a sample of state employees. To assure that a representative cross-section of responses is obtained for this study, your responses are needed. Your cooperation in filling out this form and returning it in the enclosed self-addressed, postage-paid envelope will be greatly appreciated. Note that the information is confidential and will be used only for statistical evaluation purposes.

Yours truly,

Edward J. Kannel
Associate Professor of Transportation Engineering

The questions in this survey are divided into several groups. Most questions can be answered by either filling in the blanks or by checking a box which best describes your situation. Please try to answer all questions.

Your Trip to Work

1. Were you aware of this transit subsidy program? ☐ Yes ☐ No

2. How do you usually get to work?
   ☐ drive alone ☐ carpool ☐ bus ☐ bicycle ☐ walk ☐ other_____

   If you never drive alone or never ride in a carpool you may skip to Question 8.

3. When you go to work by car, how many minutes does it generally take to get from your home into your place of work? _____ minutes

4. Approximately how much of this total time is spent picking up others, looking for a parking space, and walking to your building? _____minutes

PLEASE CONTINUE WITH QUESTIONS ON THE NEXT PAGE(Backside of this page)

5. How often do you need your vehicle to complete your normal job assignments?

   ☐ never ☐ very seldom ☐ almost daily ☐ daily

6. Do you now have to pay for parking at or near your building? ☐ Yes ☐ No

7. Approximately how much do you think it costs you to go to and from work each day when you go by car, if you consider the vehicle and parking costs?

   ☐ Less than 25 cents ☐ 25 to 49 cents ☐ 50 to 74 cents
   ☐ 75 to 99 cents ☐ $1.00 to $1.24 ☐ $1.25 to $1.49
   ☐ $1.50 or more. My best estimate is that it costs me $_____per day.
   ☐ I really couldn't estimate this cost.

Bus Service

The following questions try to determine more about your situation regarding the possible use of a bus to get to work.

8. How many blocks would you have to walk when going :

   a. from home to the bus stop? ☐ less than 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4+
   b. from the bus stop to work? ☐ less than 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4+

9. Would it be necessary to transfer between buses to make this trip?

   ☐ Yes ☐ No ☐ I don't know

10. Approximately how many minutes do you think it would take you to get from home to work if you took the bus? _____minutes

11. How much of this total time would be for walking to and from the bus stops and for waiting for the bus? _____minutes

12. Have you used the bus service to get to work or any other place in the past year? ☐ Yes ☐ No

    If yes, approximately how many times a month have you used it?

    ☐ once or twice a month ☐ 3 or4 ☐ 5 to 10 ☐ 11 to 15 ☐ almost daily

PLEASE CONTINUE WITH QUESTIONS ON THE NEXT PAGE

Transportation Service Evaluation

13. It is necessary to know how people view the transit and auto services which are available to them in order to evaluate potential changes in the service. The following set of statements is intended to get an idea of how you feel about travel for the daily work trip. Particular emphasis is given to bus service. If you strongly agree with a statement, circle the number 5. If you strongly disagree with a statement, circle the number 1. If you don't have strong feelings one way or the other, you should circle the number between 1 and 5 which best describes how you feel. Do this for each of the statements below.

Statements	STRONGLY DISAGREE	DISAGREE	SOMEWHAT NEUTRAL	AGREE	STRONGLY AGREE	I Can't Judge
The bus can usually be depended on to get me to work on time	1	2	3	4	5	___
The bus doesn't give enough choice of times to leave	1	2	3	4	5	___
The bus trip takes too much time	1	2	3	4	5	___
It is too far to walk to the bus	1	2	3	4	5	___
Buses are usually on schedule	1	2	3	4	5	___
The gas situation is making it difficult to get to work	1	2	3	4	5	___
It is really a hassle to drive	1	2	3	4	5	___
The bus is a good way to save fuel	1	2	3	4	5	___
It costs too much to go by bus	1	2	3	4	5	___
It costs too much to go by car	1	2	3	4	5	___
Parking is a problem where I work	1	2	3	4	5	___
I am willing to pay whatever it costs to be able to take my car	1	2	3	4	5	___

Future Programs

During the 1979-1980 Fiscal Year, state employees will be able to purchase monthly bus passes with a 25% reduction in cost. That is, if a monthly pass costs $20 in your town, the subsidy program will pay $5 and you would pay only $15.

14. Which months of the year would you like to participate in this program? (Check all appropriate boxes.)

☐ None ☐ Every month ☐ July ☐ August ☐ September

☐ October ☐ November ☐ December ☐ January ☐ February

☐ March ☐ April ☐ May ☐ June

15. Would you continue to use the bus service if the state stopped the subsidy program completely? ☐ Yes ☐ No

PLEASE CONTINUE WITH QUESTIONS ON THE NEXT PAGE

16. Several other methods could be considered for operating a subsidy program to pay for your bus rides. Some possibilities are listed below. Consider these alternatives and indicate which methods would seem best to you by ranking these methods. The type of pass or ticket and the method of payment which would be best for you should be rated best by giving it the number 1. Your second most preferred method should be ranked as 2, and so forth. If a method doesn't appeal to you at all you may leave it blank. Your cost per ride for all methods would be lower than the single trip cost in your city.

____ a. A monthly pass which provides unlimited rides during the months that I want to purchase it.

____ b. A quarterly pass which provides unlimited rides for a three month period (January to March, April to June, July to September, October to December) during the quarters that I want to purchase it.

____ c. A monthly ticket which would allow me a limited number of rides, for example 20 rides, during the month.

____ d. A quarterly ticket which would allow me a limited number of rides, for example 75 rides, during the quarter.

____ e. A reduced fare ticket which would allow a limited number of rides, for example 20 rides, with no time limit on the ticket. The cost per ride would be expected to be higher than in (c) above.

17. The subsidy system would be better for me if I could buy my pass directly from the transit system rather than sending in to the state office. (Check One)

☐ I agree ☐ I disagree ☐ Either way is OK

18. Many individuals are looking at ways to reduce their needs for gasoline. Have you made, or do you expect to make, any changes in your travel habits to adjust to the energy situation? ☐ Yes ☐ No
If Yes, place a check by all of the following actions that apply to you.

☐ buying a more efficient car ☐ moving to reduce driving distance
☐ making arrangements for carpool ☐ taking the bus more often
☐ reducing out-of-town trips ☐ reducing in-town trips
☐ Other_____

Personal Information

Please answer the following questions about yourself so we can check the representativeness of the sample and compare the results with other surveys.

19. Your age: ☐ under 25 ☐ 25 to 34 ☐ 35 to 44 ☐ 45 to 54 ☐ 55 or more
20. Your sex: ☐ Female ☐ Male
21. What is the total number of persons in your household? _____
22. How many other members of your household are employed? _____
23. Are you a licensed driver? ☐ Yes ☐ No
24. How many cars, vans, or pickups are available to your household? _____
25. Are any of these vehicles usually available to you to go to work? _____
26. What is the approximate combined total income, before taxes and other deductions, for all members of your household?

☐ less than $10,000 ☐ $10,000 to $20,000 ☐ $20,000 to $30,000
☐ $30,000 to $40,000 ☐ Over $40,000

THANK YOU FOR YOUR ASSISTANCE. PLEASE ADD ANY FURTHER SUGGESTIONS ON ANOTHER SHEET AND RETURN THEM WITH THIS FORM

APPENDIX B. PROFILES OF SPECIAL USER GROUPS

Two special groups were included in the initial survey sample. These were the participants from Des Moines who started the program but dropped after two months (pre-December group) and the commuters from Indianola, Carlisle, Norwalk, and Martensdale. Since the pre-December users dropped the program so quickly it was expected that they had special problems with bus use or characteristics more comparable to non-users than the users. None of the respondents from either of these groups was included in the main summaries. The travel and socioeconomic characteristics of these users are discussed here.

Tables B-1, B-2, and B-3 are structured similarly to Tables 4.2, 4.3, and 4.4, respectively. The sample sizes were 26 and 31 for the commuter and pre-December groups, respectively.

Commuter Characteristics

The commuters are picked up at designated points within the communities and delivered to the capitol complex area. The transit accessibility at the destination end was nearly the same as for the regular Des Moines bus riders but a greater effort was needed at the home end. As seen in Table B-1, 54 percent of the commuters live farther than three blocks from the bus stop points. As expected, the average travel time was longer than for Des Moines users but the travel time increments were nearly a constant element for the bus and auto modes. Average bus total time was 15 minutes greater and average auto time was 13 minutes greater than for the Des Moines users. Average excess travel times were the same for both groups. The auto costs were higher in the commuter market, but considering the greater distances, the additional 20 cents is rather nominal.

The most significant differences between the commuters and the Des Moines users were associated with the socioeconomic variables. The commuters are older and from larger families than the Des Moines patrons. Auto ownership and persons employed were even higher than the non-user group. The percentage of the riders who are female was also notably higher: 81 percent compared to 62 percent in Des Moines.

Table B-1. Transit accessibility for special group users

Element	Indianola, Carlisle, Norwalk, Martensdale	Des Moines (pre-December)
Blocks[a] (Home to Stop)	> 3	≤ 1
Blocks[a] (Stop to Destination)	≤ 1	≤ 1
Blocks > 3 (Home to Stop)	54%	13%
Blocks > 3 (Stop to Destination)	12%	3%
Transfer Required (Yes)	0%	6%

[a]These numbers are median values

Table B-2. Reported travel time and cost characteristics for special group users

Element	Indianola, Carlisle, Norwalk, Martensdale		Des Moines (pre-December)	
Bus Total Time (min)[a]	45	(0)[b]	28	(0)
Auto Total Time (min)	30	(15)	19	(26)
Bus Waiting Time (min)	9	(0)	6	(0)
Auto Pick-Up Time (min)	4	(15)	4	(32)
Bus Cost ($)	1.06[c]		0.50	
Auto Cost ($)	1.60	(19)	1.30	(29)

[a]All times are measured in minutes for one-way trip.

[b]The numbers in parentheses represent the percent of "no responses."

[c]Bus and auto costs are daily operating costs. The fare is a weighted average of 108¢ in Indianola, 88¢ in Carlisle, 88¢ in Norwalk, and 115¢ in Martensdale for the subsidized pass.

Table B-3. Socioeconomic profiles for special group users

Element	Indianola, Carlisle, Norwalk, Martensdale	Des Moines (pre-December)
AGE (Median-yrs)	43	44
AGE (Mode)	45 ~ 54	45 ~ 54
SEX (Female)	81%	50%
SEX (Male)	19%	50%
FS* (Median)	2.5	$\leq$ 2
FS (Average)	3.0	2.6
EMP (Median)	< 1	< 1
EMP (Average)	1.3	0.9
LIC (Yes)	100%	87%
CAR (0)	0%	13%
CAR (1)	19%	35%
CAR (2)	50%	32%
CAR (3+)	31%	13%
CAR (Average)	2.3	1.4
AVA (Yes)	96%	71%
INC ($10,000)	8%	10%
INC ($10,000-20,000)	31%	42%
INC ($20,000-30,000)	42%	19%
INC ($30,000-40,000)	0%	19%
INC ($40,000+)	8%	7%
INC (Average Dollars)	21,500	21,000
INC (No Responses)	11%	3%

*FS = Total Persons in Household

EMP = Number of Others Employed in Household

LIC = Licensed Driver

CAR = Cars in Household

AVA = Car Availability

INC = Total Income in Household

The attitudinal scores for the commuters was 39 which corresponds most closely with the levels expressed by other non-users. However, a direct comparison perhaps should not be made because the transit services are not really comparable.

Des Moines Pre-December User Characteristics

Transit accessibility, both to and from work, was better for this contingent than for the Des Moines users. Also, the percentage of pre-December patrons requiring a transfer to complete their work trip was less than that of continual Des Moines subscribers. The average travel times and excess travel times were nearly the same as Des Moines users. The auto costs were higher in the pre-December group than in the Des Moines non-user group. The pre-December users were expected to have characteristics more closely correlated with non-user groups, but the data show that their travel characteristics were more similar to the Des Moines user's group.

The pre-December group was normally older and from larger families than the Des Moines user and non-user groups. However, there were more male riders in this category than in the other groups in Des Moines, resulting in a 50%-50% male-female sex ratio. Auto ownership and the number of persons per household were nearly the same as the other groups in Des Moines. Average income was greater than the Des Moines users and less than the non-users.

The attitudinal score for the pre-December participants was 41, which compared to 46 for Des Moines users and 37 for non-users. Note that 41 is the approximate midpoint of the other two values, which could be expected considering that these individuals were subscribers but then became non-subscribers.

The travel, socioeconomic and attitudinal characteristics did not suggest any clear, distinct reasons why these employees dropped the program. When the basic discriminant model was applied to this group, 13 of the 20 persons, 65 percent, who provided full information were classified as users. Since the model correctly classified 80 percent of the regular Des Moines users, the borderline nature of the pre-December employees was again apparent. These employees have not, however, completely rejected the transit mode. Eighteen of the 31 respondents indicated a desire to participate in the program at the 25 percent subsidy level. Eight of those 18 persons, 44 percent, did return to

the program. It is possible that the reason the employees dropped the program was that they anticipated longer vacations during December and would, therefore not have received full value from the monthly pass. Then, because the program was oversubscribed, they could not purchase a pass again until the second year of the program.

$AVE 50% OR MORE

State Government has made it possible for STATE EMPLOYEES to RIDE THE BUS to and from work for HALF PRICE beginning Oct. 1, 1978. Why? Because it costs less to ride the bus than it does for the state to build parking lots, and you save the wear and tear on the family wheels (and your nerves).

EMPLOYEE NAME_____

SOCIAL SECURITY NO. _____

HERE'S HOW IT WORKS

1. Check the box (one only) on the reverse side showing what bus system you will use to ride to and from work. (You'll love the change from driving your car!)
2. Write a check (no cash, please) for the amount shown for that bus system. Make the check payable to the Iowa Department of Transportation.
3. Address an envelope to yourself (No stamp--we'll pay the postage). We will use that envelope to mail your October pass to you.
4. Mail your check, self-addressed envelope and this piece of paper (after you completed the reverse side) to: **I.M. READY 4 A CHANGE, Public Transit Division, Iowa DOT, Municipal Airport Office, Des Moines, Iowa 50319 (MAIL BEFORE MIDNIGHT, SEPT. 26, 1978).**
5. Then, with your pass in hand, board the bus and show the pass to the driver. You don't need to worry about having the exact fare--in fact you don't need any fare!
6. There is a limited supply of passes available--they are sold on a first come, first served basis, so ORDER EARLY!
7. This program is open to permanent, part-time, intermittent, emergency and temporary state employees. The passes are good for unlimited use during the month for which they are issued.
8. Information concerning passes for future months will be distributed later.

If you have any questions or need additional information, contact the DOT's Public Transit Division, (515) 281-4265.

I WILL RIDE: (Check one only)	YOUR SPECIAL PRICE PER MONTH
☐ Ames Cy-Ride	$10.00
☐ Bettendorf Transit	$ 4.00
☐ Burlington Urban Service	$ 5.00
☐ Cedar Rapids Transit	$ 6.00
☐ Clinton Transit	$ 6.00
☐ Coralville Transit	$ 6.00
☐ Council Bluffs MAT	$ 8.00
☐ Davenport Transit	$ 5.00
☐ Des Moines MTA	$10.00
☐ Dubuque Keyline	$ 8.00
☐ Fort Dodge Transit	$10.00
☐ Iowa City Transit	$ 4.00
☐ Marshalltown Transit	$ 5.00
☐ Mason City Transit	$10.00
☐ Muscatine Transit	$ 5.00
☐ Ottumwa Transit	$ 5.00
☐ Sioux City Transit	$ 7.00
☐ Waterloo MET	$ 8.00
BROTHERS BUS COMPANY (Round trip between Des Moines and...)	
☐ Indianola	$21.50
☐ Martinsdale	$23.00
☐ Norwalk	$17.50
☐ Lakewood	$17.50
☐ Prole	$21.50
☐ Echo Valley	$17.50
OTHER	
☐ _____	