

PARKING CONTROL AS A PLANNING TOOL TO MANAGE DOWNTOWN CONGESTION – USERS PERSPECTIVE

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ABSTRACT

Major city downtowns experience parking and congestion problems. Both problems can be improved by reducing single-occupancy vehicle use. Several factors affect transportation users' mode choice. This study investigated parking users' profile in Miami-Dade County, Florida, USA. The study investigated users' attitude towards alternative modes of transportation and the most common reasons for driving single-occupancy vehicles.

Parking data were obtained using a parking user survey distributed at representative locations throughout the county to cover all available types of parking facilities.

Survey results showed that parking was available and accessible. Most automobile users drove because driving was quicker and nearby transit services were not convenient. There was no formalized incentive structure for carpooling or vanpooling. A high percentage of respondents had an employer-paid parking subsidy.

Majority of automobile users were either willing to switch to an alternative transportation modes for the least suggested parking price increase or not willing to switch at all. Most automobile users who drove for business purposes were not willing to switch mode and ride transit, no matter how much parking prices increase.

The study recommends adopting pricing and accessibility policies to manage parking, encourage the use of high-occupancy vehicles, and thus improve traffic congestion in downtown areas.

KEYWORDS: Parking Survey, Mode Choice, Parking Management, Parking Policies

1. BACKGROUND AND INTRODUCTION

This study is part of a comprehensive study for Miami-Dade County, Florida, USA [1]. The general objectives of the county-wide study were to provide a countywide parking inventory (supply); evaluate existing parking conditions; develop parking strategies to address congestion/mobility needs; and evaluate feasibility of forming parking entity. The study conducted a countywide parking user's survey, a local agency survey, and a nationwide survey. This article addresses one part of the study, which deals with users' perspectives. The survey was completed in 1998.

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Various organizations directly or indirectly affect parking policy in Miami-Dade County. The Florida Department of Transportation (FDOT) and the Metro-Dade Metropolitan Planning Organization (MPO) are involved in transportation improvements and long-range and short-range planning. The Miami-Dade Transit Agency (MDTA) is responsible for providing transit services in the county. The City of Miami published the *Miami Comprehensive Neighborhood Plan (1989-2000)* [2], which contains transportation planning and legislation that influence mass transit and parking. The policy directly addresses parking supply stating the minimum and maximum to be used for on-site parking to promote economic growth, facilitate local traffic circulation, and encourage the use of public transportation. The zoning ordinances in the City of Miami Code contain the city's parking policies and regulations. The Department of Off-Street Parking or the Miami Parking System (MPS) is responsible for meeting public parking needs within city limits.

The Center for Urban Transit Research report [3] identified the need for a unified and well-coordinated planning and management effort related to Miami-Dade countywide parking. Specifically, there has been no unified parking authority or other entity responsible for parking management in the county. Parking issues were largely addressed indirectly by the planning and regulatory activities of a number of independent organizations with varying levels of coordination.

The CUTR report [3] concluded that transit agencies in Florida cities typically did not have a significant voice in the development of central business district (CBD) land use and access policies, including parking policies. Miami was especially noted as one of the cities in which transit officials had little influence in parking issues other than those involving park-and-ride services. The report further postulated that the low mode share of transit was a strong factor influencing the relatively weak negotiating position of transit officials in Florida's cities. This low transit usage was seen as the result of several major factors, which created an environment that strongly favored single occupant vehicle usage. These factors are the fiscal constraint of transit agencies, Florida's prevailing development patterns, the influence of employer-paid parking on mode choice, and an over supply of parking in downtown areas.

CUTR [3] and Urban Transportation Monitor [4] indicated that several parking strategies could discourage single occupant vehicle (SOV) trips. Some of these strategies were providing differential parking prices and treatments to provide incentives for non SOV users, modifying the parking policy requirements of minimum and maximum, modifying tax-exemptions for parking subsidies and travel allowance, limiting the total supply of parking in the area, and providing peripheral parking and shuttle services.

Strathman and Dueker [5] and Wilson [6] established a strong relationship between parking prices and transit use, and concluded that employer-paid parking was one of the most important factors influencing solo driving.

2. PURPOSE OF STUDY

The purpose of this study was to investigate Miami-Dade County parking users' opinions regarding their reactions to methods of reducing traffic congestion by different actions such as increasing parking prices and improving transit services, among others. These attitudes were investigated mainly based on parking-related incentives and disincentives.

A survey was also designed to present possible recommendations to alleviate traffic congestion by implementing limited parking management plans. The study investigated user perceptions of several factors such as parking availability, parking accessibility, and parking prices.

3. METHODOLOGY

Parking data were gathered through a survey that was developed and distributed at selected locations representative of the parking population in Miami-Dade County. The parking user survey, which was closely coordinated with the MPO and the Steering Committee established for this study, was designed to obtain parking users response to parking-related issues.

The survey forms, which had a return-address and paid postage, were posted on vehicles' windshields. The forms were written in English and Spanish because of the high percentage of Spanish-speakers in South Florida.

Sample Size

To achieve acceptable results, the sample size should be sufficient, representative of various groups, and illustrative of the population. Nunnally [7] recommended that the sample size be a percentage of the population. For a population of 10,000, which is approximately the total number of parking spaces in Miami-Dade County, the minimum sample size should be 5 percent.

A total of 5,360 forms were distributed and 508 were returned, which formed the actual sample size. The number of forms received was less than anticipated; however, the sample size was acceptable (5% of population). The reason for this low return rate of survey forms was partially due to the prevailing inclement weather conditions during the survey distribution period.

Based on Bernoulli Theorem [8], a certain number of observations (n_0) will give a certain confidence level ($1-\eta$) that a certain degree of error (ϵ) will not be exceeded. Bernoulli's Theorem is given by the following equation:

$$n > n_0 = (1+\epsilon) / \epsilon^2 * \text{Log}_e 1/\eta + 1/\epsilon$$

The sample size of 508 yields 98 percent confidence and 10 percent maximum error.

Survey Methodology

The Miami-Dade County was divided into 36 Traffic Analysis Super-districts (TASs). An inventory of total number of parking spaces available in each TAS was collected. The inventory of the existing on-street and off-street parking facilities was limited to major parking generators such as the CBD, hospital complexes, office and industrial parks, shopping centers, and government centers. Forms were distributed for various parking types (regular, metered, and reserved) and wherever possible, locations of high utilization rates were selected. Surveyed locations included free and paid parking, with a focus on paid parking facilities such as park-and-ride at Metrorail Stations.

The total 5,360 survey forms were allocated to various TASs proportional to the number of available parking spaces. Within each TAS, sample-parking locations were chosen to represent typical parking usage in that area. The number of forms distributed at each parking facility was set proportionally to the number of parking spaces at that location.

5. SURVEY RESULTS AND ANALYSIS

Survey responses were received over two-weeks after distribution was complete. Data was coded and analyzed using *Raosoft SURVEY*, a database information software system with capabilities for statistical analyses [9]. Forms were numbered sequentially so that quality control could be performed easily. A random quality control of data entry and coding was performed to ensure an acceptable level of accuracy.

General Summary

Approximately 88 percent of the total respondents were Miami-Dade County residents, 11 percent were Broward County (immediately north of Miami-Dade County) residents, and 1 percent came from other areas. A total of 137 respondents were transit users, of which 93.4 percent were Miami-Dade County residents and 73 percent were regular (daily) transit riders.

There were only 32 respondents who used vanpools or carpools to arrive at their parking locations. Approximately 44 percent of those drove from distant locations and it took them more than 30 minutes to arrive at their parking destinations. Formal parking incentives for carpool and vanpool users seemed to be almost nonexistent.

Countywide Statistics

Availability of parking was measured using two variables: time taken to park and availability of preferential (reserved) parking spaces. Parking time was slightly lower for transit users (at park-and-ride facilities) than auto users. On the average, countywide parkers (auto and transit users) enjoyed a reasonable level of parking availability with about 85 percent finding a parking space in less than 5 minutes. Automobile users had a higher access to reserved parking spaces than transit users. This did not result into a decrease in the average time to park for automobile users as evidenced by Table 1.

Table 1: Countywide Parking Time and Access to Reserved Parking Summaries

Group	Time Spent to Park (minutes)				Reserved Parking	
	< 1	1 to 5	5 to 10	> 10	YES	NO
All Users	46%	38%	11%	5%	8%	92%
Transit Users	50%	35%	11%	5%	4%	96%
Auto Users	45%	39%	12%	5%	10%	90%

Parking Accessibility was measured using two variables. For automobile users, this measure was estimated as a function of walking time from parking location to the final destination. For transit users, it was measured in terms of walking time from a parking location (taking off an automobile) to a transit vehicle (riding transit) and from transit station (taking off transit) to the final destination.

Parking was more accessible for auto users than transit users. Transit users experienced a considerable walking time in the last component of the combined auto-transit trip (from a transit station to a final destination) compared to the first component (from a parking location at a transit station to a transit vehicle), as shown in Table 2.

Table 2: Parking Accessibility

Group	Parking Accessibility (Minutes)		
	Avg. Time From Car to Transit	Avg. Time from Transit to Final Destination	Overall Average Time
Transit Users	6.6	7.3	13.9
Auto Users	-	-	5.9

The relatively high average walk time of 6.6 minutes for the first stage of the journey for transit users might be explained by the fact that multi level park-and-ride facilities, such as Dadeland South Station, can easily encounter a car-to-transit walk time of more than 6 minutes. Accessibility at this station, for example, required traversing an adjacent office building. Transit vehicles (buses and trains) stop at fixed stations, which might relatively be far from the final destination. Therefore, the average walking time for this segment of the trip took an average of 7.3 minutes.

Parking cost was measured based on the average amount paid for parking. Transit users enjoyed reduced parking cost (\$2.47/day) over automobile users (\$4.87/day).

Data Summaries per Region

Data was also aggregated into Traffic Analysis Super-district (TAS) zones based on locations where the survey forms were distributed. For statistical and geographical reasons, some TASs were grouped into regions and, thus, created larger sample sizes. The regions (and the associated sample sizes) were: Brickell/Coral Gables (173), Downtown (125), Miami Beach (69), Central (59), Northeast (41), South (23), Northwest (17), and Others (1).

1. Parking Cost: Downtown area was the most expensive followed by Miami Beach, Central, Northeast, and Coral Gables regions. The least expensive parking areas were the South and the Northwest regions.

2. Parking Availability: Table 3 shows that people in the South, Central, Northwest, Coral Gables, and Downtown regions enjoyed the convenience of parking. Approximately 90 percent of respondents found a parking space in 5 minutes or less. However, availability of parking in Miami Beach and the Northeast regions was less convenient. Approximately 30 percent of Coral Gables and 60 percent of Miami Beach respondents used curb metered-parking. Therefore, searching for a vacant parking space in Miami Beach took longer; therefore, was less available. However, parking in Coral Gables was abundant and parkers did not experience a long time searching for a parking space at curb metered-parking.

Table 3: Summary of Time Taken to Park by Region

Region	< 1 Minute	1 - 5 Minutes	5 – 10 Minutes	> 10 Minutes
South	71.4%	16.3%	8.2%	7.1%
Central	62.1%	31.0%	3.4%	3.4%
Northwest	71.4%	16.3%	0.2%	4.1%
Northeast	54.6%	9.1%	11.4%	25.0%
Brickell/Coral Gables	34.0%	56.0%	6.0%	4.0%
Downtown	43.4%	48.5%	5.6%	2.6%
Miami Beach	34.8%	32.2%	22.6%	10.4%
Countywide	46.5%	38.3%	11.1%	4.0%

3. Reasons for Driving: The most consistent two reasons for driving were "*driving was convenient*" and "*quicker*", as shown in Table 4. Contrary to common belief, safety at transit parking facilities was not an issue except in the downtown region. A considerable number of users in South and Northwest regions indicated that free/subsidized parking, which was mostly paid by their employers was a reason for driving. A considerable percentage of parkers in the Central and Brickell/Coral Gables

regions (45.5% and 31.2%, respectively) drove to transfer to transit, carpool, or vanpool. This showed that people in these two regions used park-and-ride facilities more than other regions. However, a considerable number of respondents from the same regions expressed that they drove because "*there was no convenient transit facility nearby*". This might be true for people living far from Metrorail/Metrobus lines, or those who simply believed that transit service was not convenient. This implies that transit could play a role in attracting non-transit users by providing better and convenient parking facilities.

6. CROSS RELATIONSHIPS

Analysis of various groups who were of special interest to the scope of this study was conducted. The following is a summary of some of the studied cross-relationships.

Parking Subsidy and Parking Cost: Approximately 92 percent of respondents paid their parking fares, 35 percent of which had employer-paid parking. Self-paid parking had higher daily parking rates than employer-paid parking while the reverse was true for monthly parking, as shown in Table 5. This might reflect employer indifference to parking rates owing to the federal tax-exempt status of employer-paid parking for parking subsidies up to \$155 per month per employee (based on 1996 regulations).

Table 4: Summary of Reasons for Driving by Region

Region	Transfer to HOV	No Convenient Transit	Parking is not Safe	Driving is Convenient	Driving is quicker	Subsidized Parking	Require for Work	Other
South	4.1%	36.4%	0.0%	68.2%	59.1%	31.8%	13.6%	9.1%
Central	45.5%	23.6%	0.0%	41.8%	40.0%	21.8%	10.9%	3.6%
Northwest	5.9%	47.1%	5.9%	64.7%	64.7%	35.3%	35.3%	0.0%
Northeast	10.0%	40.0%	3.3%	43.3%	46.7%	10.0%	3.3%	10.0%
Brickell / Coral Gables	31.2%	33.8%	5.2%	42.2%	35.6%	7.8%	14.3%	4.5%
Downtown	0%	36.4%	12.1%	61.6%	57.9%	19.6%	24.3%	5.6%
Miami Beach	0%	34.4%	3.3%	60.7%	49.2%	4.9%	32.8%	3.3%
Countywide	13.1%	35.8%	6.1%	53.7%	47.9%	14.3%	19.6%	5.3%

Table 5: Parking Cost and Subsidy

Parker Type	% Total Sample	% Paid-Parking	Average Daily Cost	Average Monthly Cost
Self-Paid	60%	65%	\$4.15	\$36.31
Employer- Paid	32%	35%	\$3.96	\$39.77

Accessibility to Reserved Parking by Employment Type: A considerable portion of employer-paid parkers (59%) were from the private sector, 38 percent from the government sector, and 3 percent were self-employed. These percentages were consistent with the overall employment sectors ratios. Figure 1 shows a summary of the willingness to switch to transit mode based on parking price increases for both employer-paid and self-paid parking users. Most of these parkers did not have reserved parking spaces. Those who had reserved parking spaces in the private sector were slightly higher than the government sector. However, the difference was negligible. The number of self-employed parkers was small and; therefore, no conclusion could be drawn for this group.

Parking Subsidy and Reasons for Driving: The major reasons given by self-paid parkers were “*driving is convenient,*” “*driving is quicker,*” and “*there is no convenient transit facility nearby,*” as shown in Figure 2. Employer-paid parkers also claimed convenience and quickness as reasons for driving. However, a smaller percentage of this group did not have any transit-related reason for driving. Furthermore, approximately 36 percent of the employer-paid parkers disclosed free or subsidized parking as a reason for driving a vehicle.



Figure 1: Willingness to Use Alternative Modes Based on Parking Price Increases and Employer Subsidy

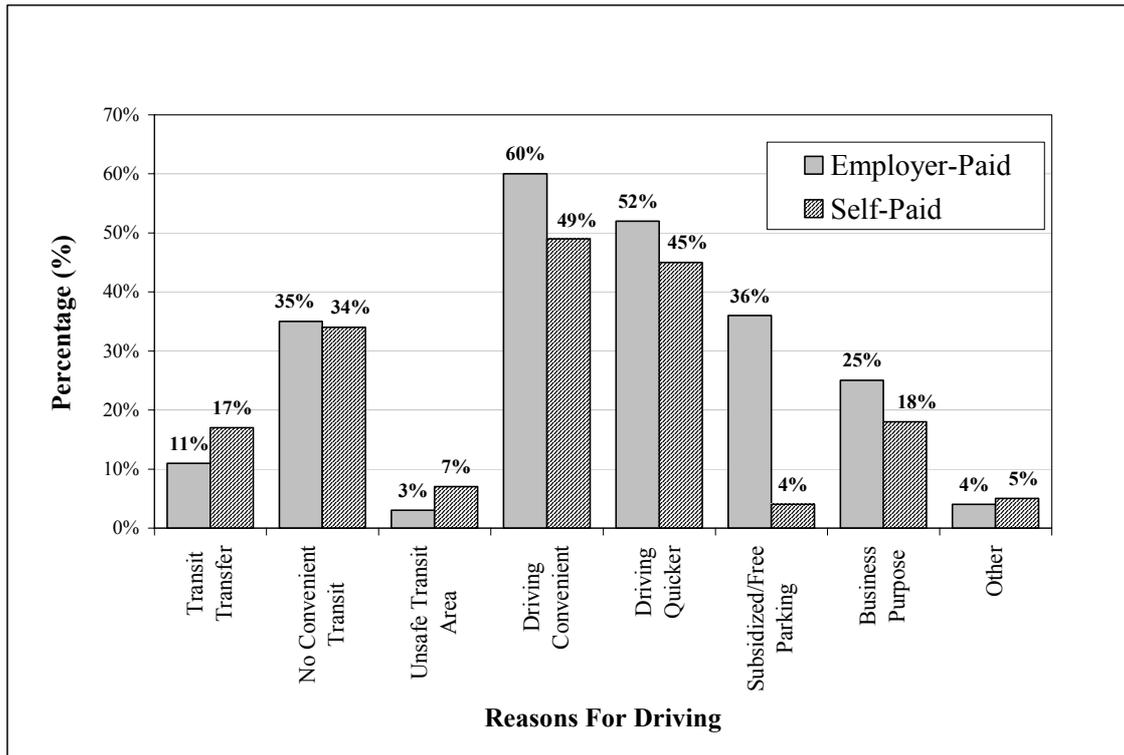


Figure 2: Reasons for Driving and Parking Payment Subsidy

Employment Sector and Inclination to Switch: Approximately 32 percent of private sector employees and 27 percent of government sector employees were not willing to switch, as shown in Figure 3. Approximately 24 percent of the government employees expressed their inclination to switch to transit modes for the slightest suggested parking price increase (50%), slightly higher than the overall average (21%). This could be explained by the fact that the majority of government employees work in the downtown area where transit services are available and relatively more accessible than other locations. However, the majority (65%) of the government sector employees would not switch for any parking price increase.

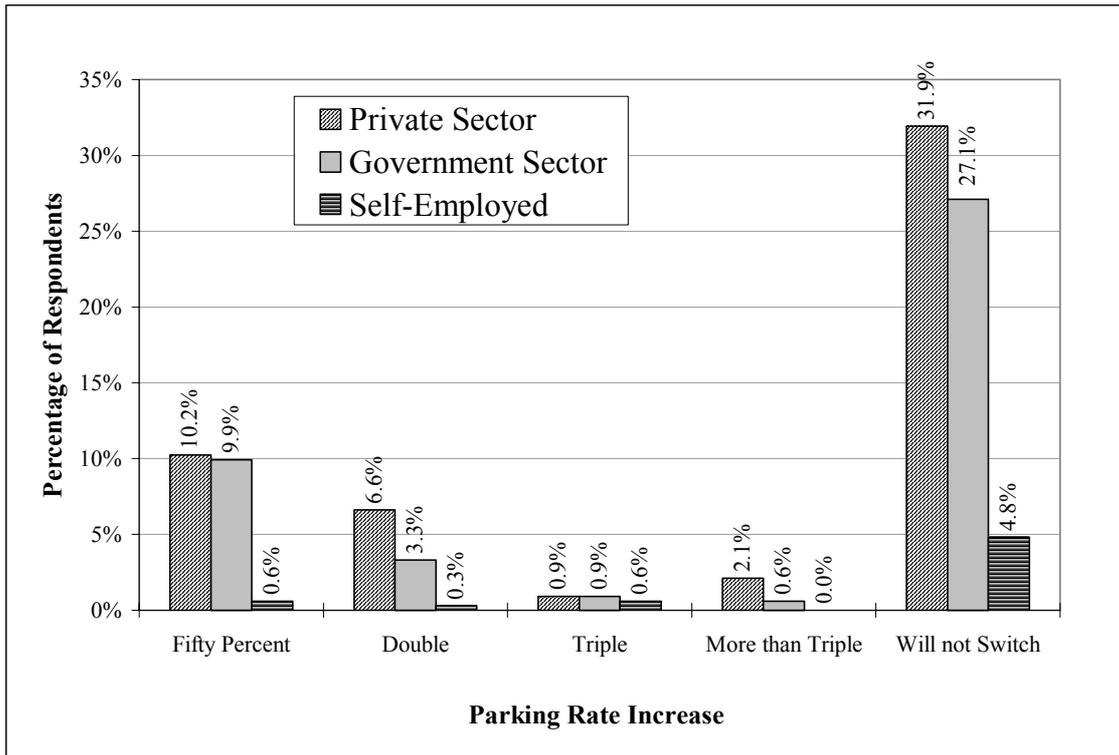


Figure 3: Willingness to Switch to Transit Based on Parking Price Increase per Employment Sector

Reasons for Driving and Willingness to Switch Mode: The inclination to switch to a different mode for people who drove because driving was convenient ranged from 23 percent who would switch for 50 percent increase to 32 percent who would switch if parking prices were tripled (as shown in Table 6). The majority of people who required driving for business purposes expressed that they were not willing to switch to a different mode for any increase in parking prices. The analysis showed that depending on the reason for driving, a considerable percentage of drivers were willing to switch for the least suggested parking price increase, and others were not willing to switch at all. The first type of drivers represents the target group that could potentially be attracted to switch to using transit services.

Table 6: Willingness to Switch to Transit Modes Based on Increases in Parking Prices and Reasons for Driving

PARKING RATE INCREASE	Reason for Driving							
	Transfer to transit/ carpool/vanpool	No convenient transit facility nearby	Transit facility parking area not safe	Driving is convenient	Driving is quicker	Subsidized/ free parking	Require it for business	Others
Fifty Percent	10%	22%	6%	23%	26%	5%	5%	2%
Double	10%	18%	0%	31%	31%	3%	5%	3%
Triple	21%	11%	0%	32%	16%	11%	5%	5%
> Triple	11%	21%	0%	26%	32%	0%	5%	5%
Will not Switch	4%	16%	3%	29%	24%	9%	14%	3%

7. SUMMARY AND CONCLUSIONS

Majority of automobile drivers in Miami-Dade County drove because it was quicker and access to transit services was not convenient. There was also no formalized incentive structure for carpooling/vanpooling - no formal parking fare/parking availability reward structure.

The majority of respondents (62%) did not intend to switch to alternative modes of transportation (transit) if parking prices were to increase, especially those who drove for business purposes. One of the reasons for not switching was the fact that 30 percent of the sample population enjoyed employer-paid parking. Therefore, any attempt to influence mode choice through changes in the parking price structures may be ineffective under the existing federal tax subsidy. The current regulation allows employers to write off a certain expense as a tax benefit. On the other hand, about 25 percent of the sample would switch for a 50 percent increase in parking rates.

Most transit users enjoyed a relatively short walking distance (less than 5 minutes) from the transit station to the final destination; and 90 percent of automobile users had less than 5 minutes to walk from their parking location to their final destination. Parking was generally available with 84 percent finding a parking space in less than 5 minutes. The South, Central, Northwest, Coral Gables, and the Downtown regions enjoyed the highest parking availability. Available parking spaces were accessible as 87 percent of the sample enjoyed less than a 5-minute walk to their destination.

It is recommended that parking-fare policies should be fully examined and implemented to divert some automobile drivers to using transit or other high occupancy vehicles such as carpools.

The preferential treatment for multi-occupancy vehicle participants such as reduced parking fares or access to preferential parking spaces would be an incentive for some people to switch to carpool/vanpool and, thus, reduce single occupancy automobile use. Therefore, it is recommended that mechanisms for implementing parking preferential treatments for such vehicles (such as reduced parking fares or reserved parking, among others) should be created in cooperation with parking facility operators and owners to encourage the use of multi-occupancy vehicles.

Parking facility operators might have difficulty implementing and accepting carpool preferential treatments. However, implementing such policies in public parking facilities would be more feasible.

It is imperative that improving transit services, cleanliness, scheduling, and accessibility will make transit more convenient, thus attract more riders, and reduce solo driving.

Transportation planners should examine limiting the abundance of parking in certain regions to discourage solo driving and to encourage the use of high occupancy vehicles.

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