Kirkland Parking Choice Study
City of Kirkland
Parking Advisory Board
December 2008

Introduction and Research Approach

The Parking Advisory Board (PAB) has an interest understanding and anticipating the demand for different types of new parking facilities, and its effect on-street, existing parking surface parking lots and parking in adjacent neighborhoods, subject to spillover parking. The PAB was faced with assessing parking options not currently in place, and for which there is little, if any, historic data on demand and usage. The PAB wanted to consider a new public parking garage and vary location by means of time spent searching for a parking place and walking distance, while at the same time varying price of parking and overtime parking fines for the new garage and other parking options.

When there is no past information on how demand responds to variations in these variables, one typically must a) "guess", b) use data from other places or locations and argue "by analogy", or c) design and implement what is known as a "stated preference" survey to obtain demand data. Stated preference surveys show samples of relevant people (in this case, people who park in Kirkland) a number of (parking) scenarios and ask them to "state" what (parking) option they would be likely to choose in each scenario.

In the parking choice study, each scenario offers the survey respondents different parking options that they can choose. Because a person can only park in one place at any one point in time, we say that these are "discrete choices", meaning that the options that can be chosen are mutually exclusive. Thus, a person can only choose one of them just as in a real parking situation. Each scenario offers survey respondents a choice of on-street parking, parking in a surface lot, parking in a new parking structure, free parking in a more distant location, such as an adjacent neighborhood, or not making the trip for which parking is required. Each person is asked to think about their last trip to downtown Kirkland involving a parking choice, and each scenario is referenced to that trip. That is, each survey respondent is asked to state what they most likely would have done on that previous trip if the parking options noted above were available at that time and as described in the scenario.

"As described" refers to a particular combination of parking fees, time required to search for and find a parking place, distance of the parking location from downtown Kirkland and overtime parking fines, if applicable. In a stated preference survey one assigns values to each of the variables (parking fees, search time, etc, to represent likely future variation in these variables. In the present case, we assigned the variables four discrete levels to represent variation in the options. The assigned levels to each variable are combined to create different parking options. For example, on-street parking has 4 values of parking fees, 4 values of search time, 4 values of distance from downtown Kirkland and 4 values of overtime parking fines. This means that there are 4 x 4 x 4 x4 (256) distinct

combinations of the variables representing different on-street parking options. Similarly, combinations of variable levels represent possible parking structures, and possible surface parking lots. Technically, each option has a certain number of possible combinations; all possible combinations of the option combinations represent all possible parking options represented by the set of variables and levels. The latter is a very large number representing many thousands (perhaps millions) of possibilities. Because there are so many possibilities, one cannot study all of them in any one survey (or even in many surveys), so one needs to sample from all the possibilities. The sampling method used in stated preference surveys is called an "experimental design", which is the method used to select particular combinations of parking options. Each of the combinations in the sample is called a "scenario". The sampling method constructs the scenarios in such a way to measure the impacts of all the variables on the choices of the people who participate in the survey. As earlier noted, a person can only choose one parking option at a time, so the choices that people make in each scenario measure demand.

The sampling approach that we used in this project is based on a paper by J. Louviere and G. Woodworth in the *Journal of Marketing Research* (1983); a more recent review of stated preference surveys is *Stated Choice Methods: Analysis and Applications* by J. Louviere, D. Hensher and J. Swait (Cambridge U Press, 2000). We sampled 256 scenarios from the thousands possible in such as way that we could measure the impacts of all the variables representing all the parking options on choices. Naturally, 256 scenarios are more than any one person can consider, so we randomly divided the sample of 256 scenarios into 32 versions of 8 scenarios each. Each person who participated in the survey was randomly assigned to one of the 32 versions. We also added questions to the survey to ask why people parked in downtown Kirkland, the length of time that they parked and several demographic details (age, gender, work status and household income).

The survey was programmed in survey software to allow it to be administered on the internet. Dr. Jordan Louviere, Executive Director, and Edward Wei, Research Manager, Centre for the Study of Choice (CenSoC), University of Technology, Sydney, provided technical guidance. A sample of Kirkland residents was recruited with the assistance of Ken Dueker. Each recruit was randomly assigned to one survey version, which resulted in a sample of 89 relevant individuals, or about three people per scenario (2.78). The choices of the survey respondents were analyzed using choice modeling software, and a choice model was developed to allow one to make "what if" predictions of choices. That is, the software allows analysts to change any variable of any of the parking options and predict the proportion of people who will choose each option.

Parking Choice Survey

Nearly 100 Kirkland residents participated in the parking choice survey. Each resident responded to eight parking scenarios that asked them to choose among the following options: a) On-Street, b) Surface Parking Lot, c) New Downtown Parking Garage, d) Free, but more distant, on-street space, or e) Choice of None of the options/would not make the trip. Each scenario systematically varied levels of Price, Walk Distance, Search

Time, Time Limit, and Overtime Parking Fine for each choice option in order to separately determine their impacts of choices. Table 1 shows the levels for each of the attributes of parking options.

The intent was to administer the survey to owners of vehicles observed parking in the downtown. City staff collected license plate numbers of vehicles parking on street and in City owned lots, during representative week days, evenings and weekends. Names and addresses of owners were obtained from the State DMV and they were sent a letter asking them to visit a website to take the stated preference survey. Unfortunately, the task of going to a computer and keying in the URL resulted in a low response rate. As a fall back, neighborhood association members were sent a message asking them to take the parking survey. Using e-mail, we were able to provide a link that they could click to transfer to the website and take the survey. This improved response, but included persons who may not regularly, visit and park downtown. This may result in a larger proportion of response to the choice option that they will not make the trip and /or go elsewhere. Thus, the diversion of persons from downtown to other locations may be overstated, when the price, walk distance, or search time is greater than what they are used to.

Table 1
The levels of Price/Fees, Walk Distance, Search Time, Time Limit, and Overtime Parking Fine

Choice	On-Street	Surface Lot	New Garage	Free on-street (farther)	None/no trip
Price	Free $0.50 per hr $1 per hour $2 per hour	Free $0.50 per hr $1 per hour $2 per hour	Free $0.50 per hr $1 per hour $2 per hour	Free	
Walk Distance	0-400 feet (<1 blk) 400-800 ft (1-2 blks) 800-1200 ft (2-3 blks) >1200 ft (>3 blks)	0-400 feet (<1 blk) 400-800 ft (1-2 blks) 800-1200 ft (2-3 blks) >1200 ft (> 3 blks)	0-400 feet (<1 blk) 400-800 ft (1-2 blks) 800-1200 ft (2-3 blks) >1200 ft (> 3 blks)	>1200 ft (>3 blks)	
Search Time	0-1 minutes 1-2 min. 2-4 min. 4-6 min.	0-1 minutes 1-2 min. 2-4 min. 4-6 min.	0-1 minutes 1-2 min. 2-4 min. 4-6 min.	0-1 mins 1-2 min. 2-4 min. 4-6 min.	
Time Limit	2 hr 3 hr 4 hr unlimited	2 hr 3 hr 4 hr unlimited	2 hr 3 hr 4 hr unlimited	2 hr 3 hr 4 hr unlimited	
Overtime Parking Fine	$20 $30 $40 $50	$20 $30 $40 $50	$20 $30 $40 $50	$20 $30 $40 $50	

Findings from the analysis of respondent choices

The data are analyzed by isolating the effect of levels of attributes, such as parking price, search time, and walk distance, and seeing how choice of parking location varies when controlling for the level of an attribute.

On-Street Parking Results

Summary results for on-street parking are shown in Chart 1. Results of systematically varying attribute levels of On-Street Parking influence the proportion of choice for other parking options. For example, an increase of parking charges from free to $2 per hour reduces the proportion choosing on-street parking while increasing the choice of other options. A small increase in parking fees from free to $0.50 per hour has a large impact on choices.

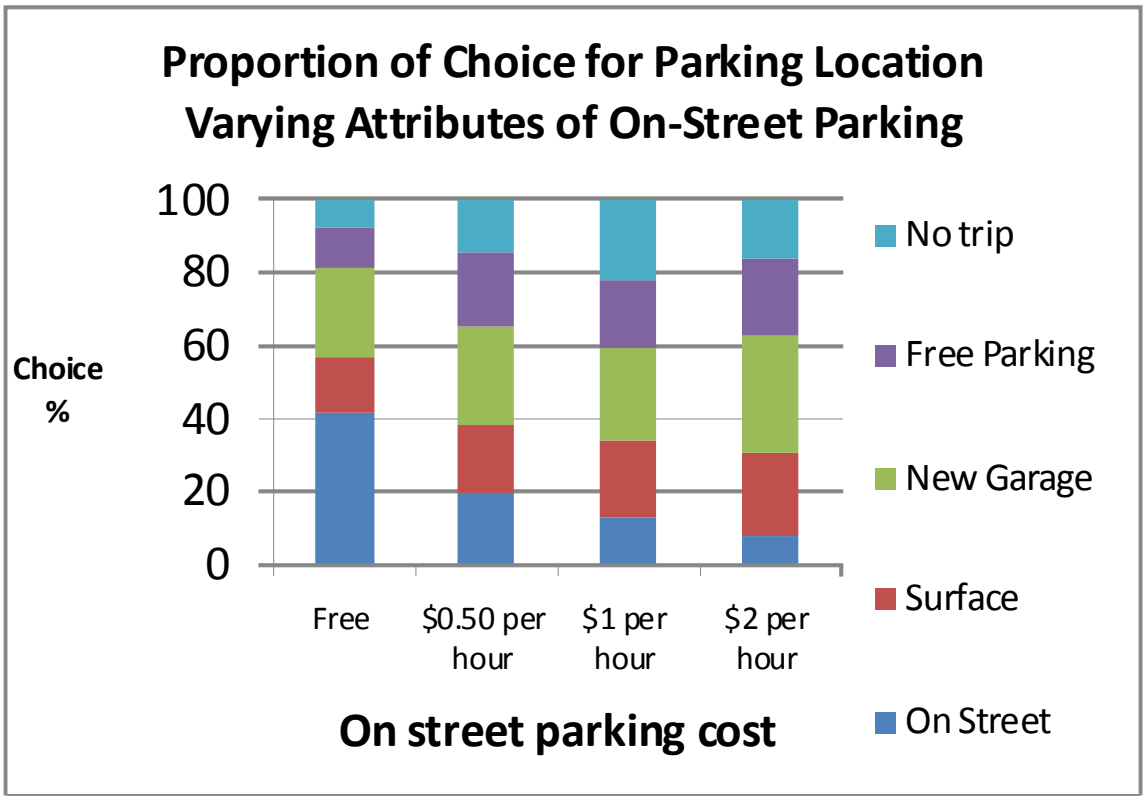

Chart 1. Choice of parking location while controlling for cost of on-street parking

Chart 2 shows that a 1-2 block increase in walking distance for on-street parking also has a large impact, but the impact is much less than for the change in fees.

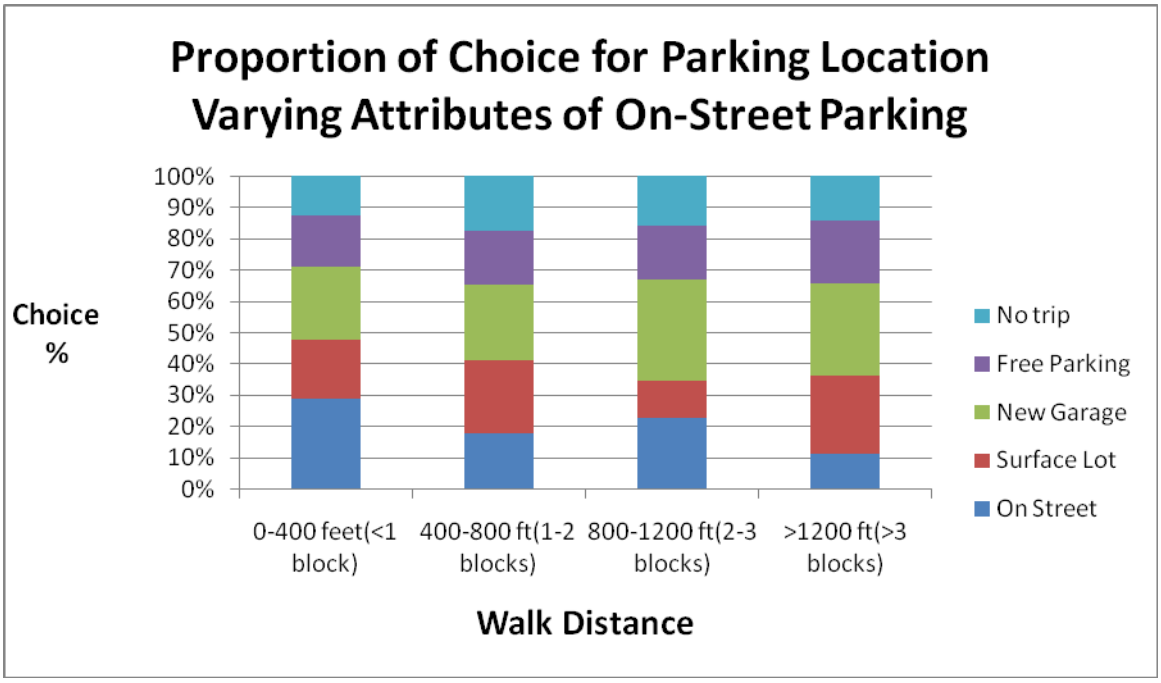

Chart 2. Choice of parking location while controlling for on-street walk distance

Chart 3 shows that an increase of search time from 0-1 minutes to 1-2 minutes for on-street parking has little impact; but search times above 2 minutes have an impact almost as large as increases in walking distance.

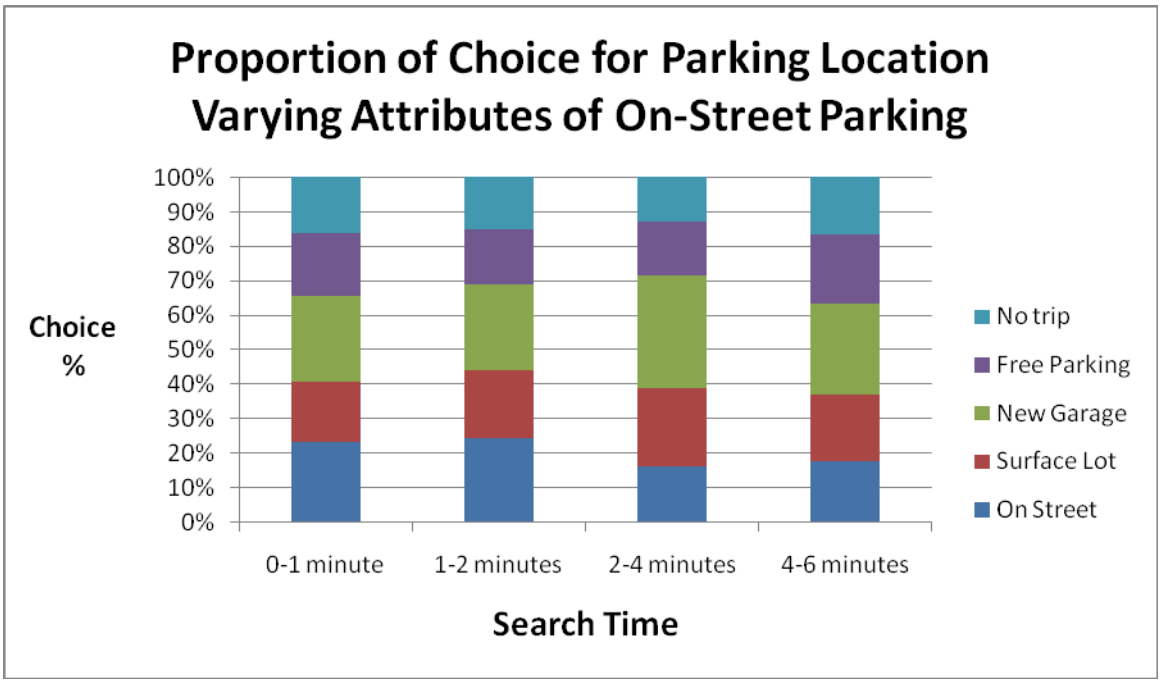

Chart 3. Choice of parking location while controlling for on-street search time

Chart 4 shows that a time limit of two hours discourages choice of on-street parking, much more than longer time limits.

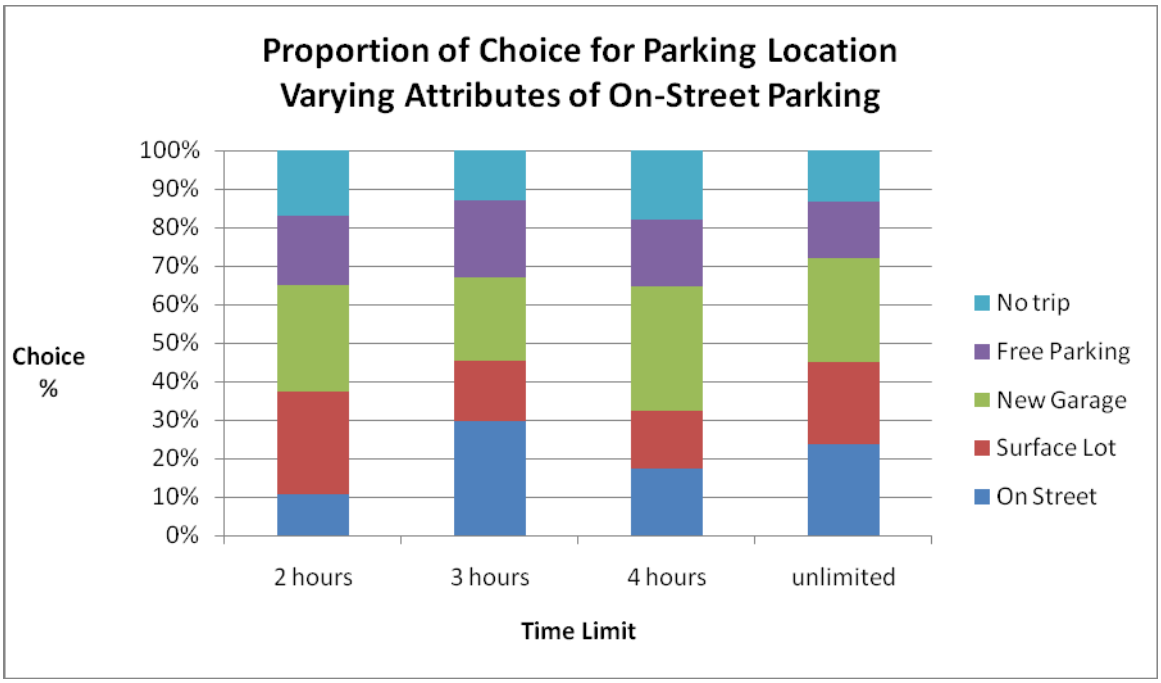

Chart 4. Choice of parking location while controlling for on-street time li

Because of the small sample, the only reliable demographic differences in choices are gender differences. Chart 5 shows gender results for price for parking on street. Significant differences in choices are associated with level of parking fees. Similarly, Charts 6 and 7 show the effect of time limits and walking distances. Females were less likely to choose on-street parking, new garages or free parking than males, and were more likely to choose surface lots or not travel than males. Females were less sensitive to fees, search times, walking distances and overtime fines, but more sensitive to time limits.

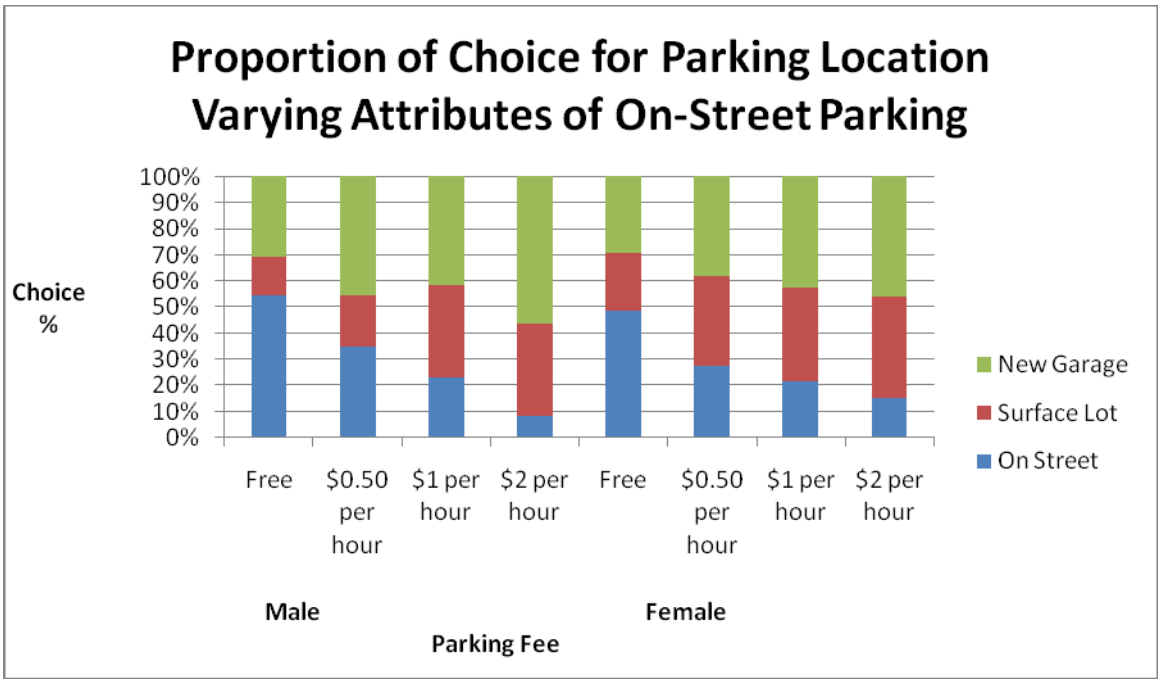

Chart 5 Gender differences in choice of parking location while controlling for the cost of on-street parking

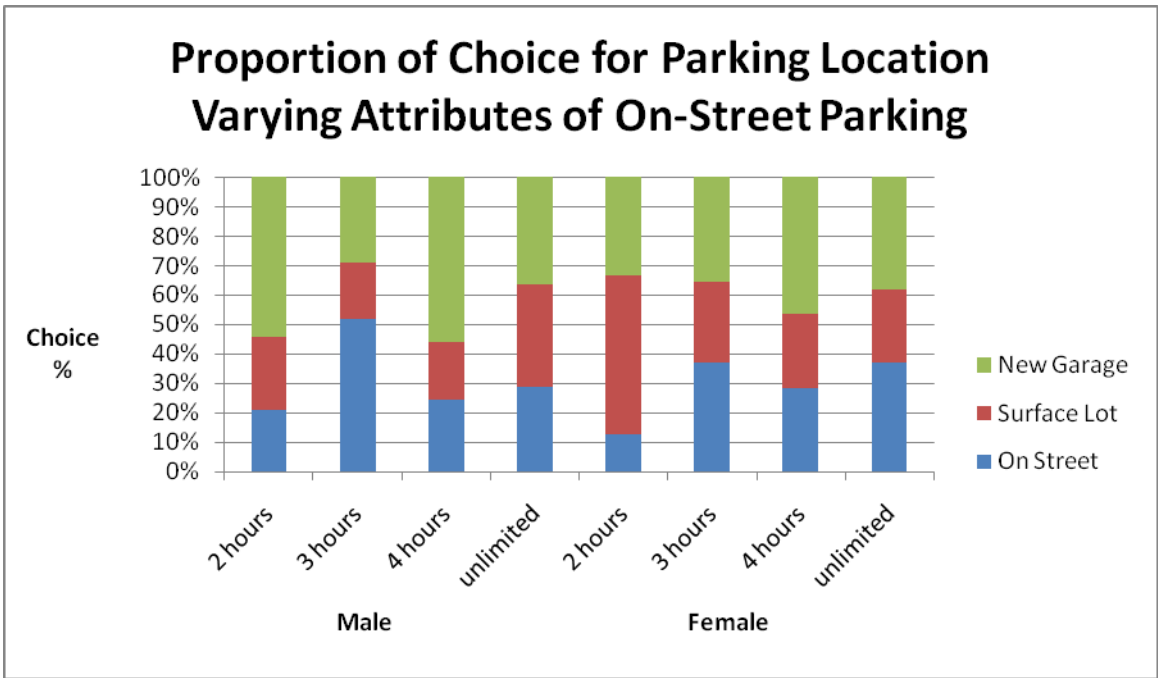

Chart 6. Gender differences in choice of parking location while controlling for the on-street time limit

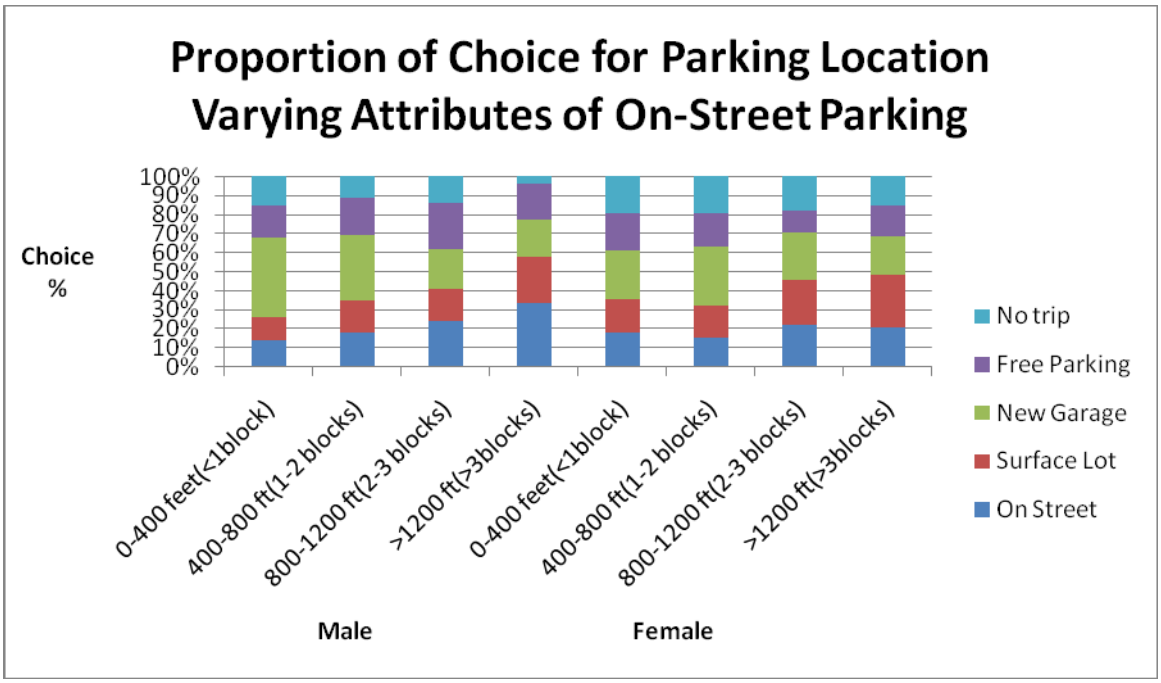

Chart 7. Gender differences in choice of parking location while controlling for the on-street walking distance

New Parking Garage

This section reports the results of systematically varying the level of attributes for a new parking garage upon the choice of other parking options. Chart 8 shows there is high sensitivity to parking fees, and Charts 9 and 10 show a somewhat less but still significant sensitivity to time limits and walking distances over 800 feet. There is much less sensitivity to search times and overtime fines (not shown).

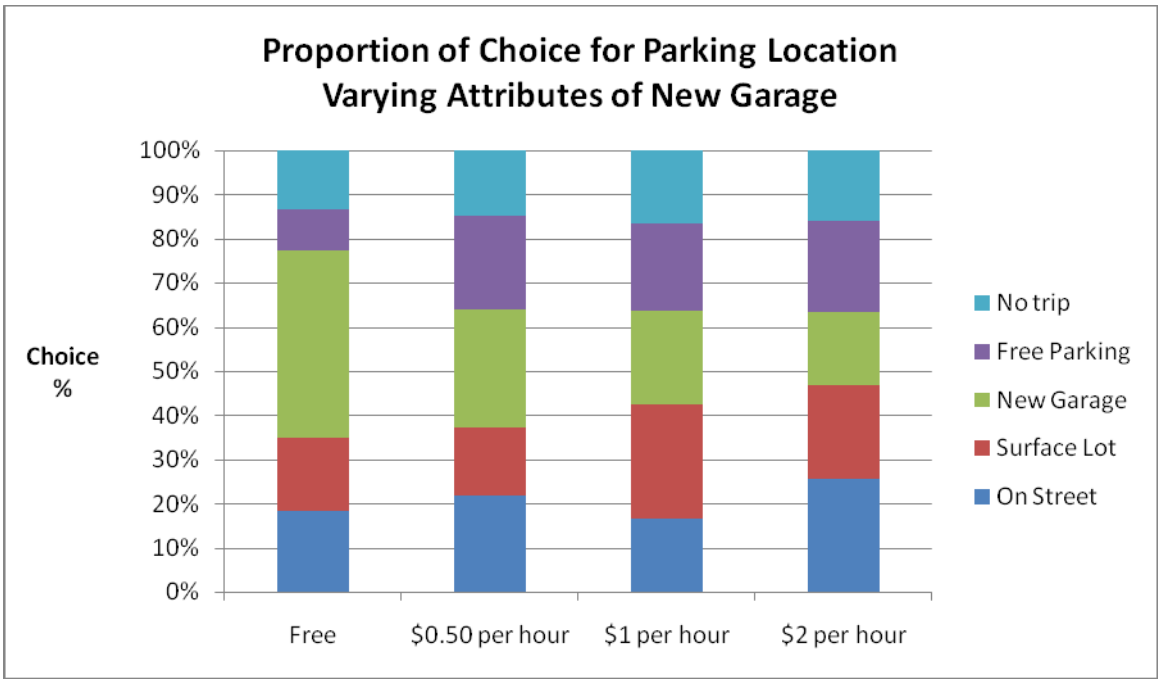

Chart 8. Choice of parking location while controlling for the cost of parking in a new garage

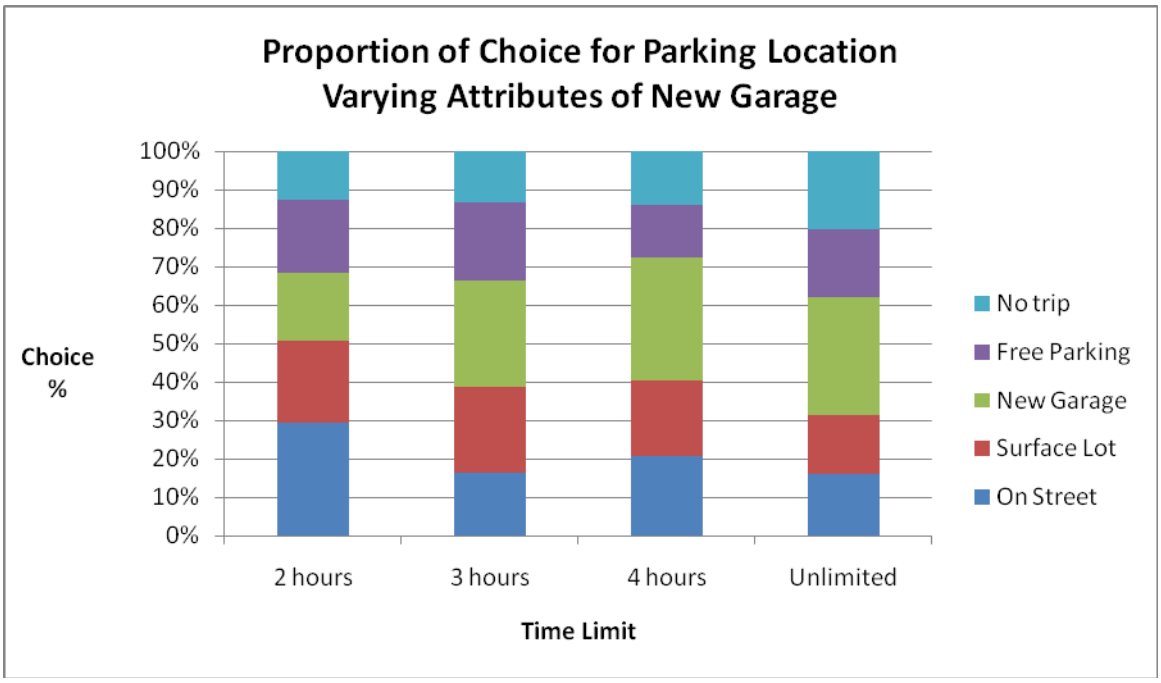

Chart 9. Choice of parking location while controlling for time limit in garage

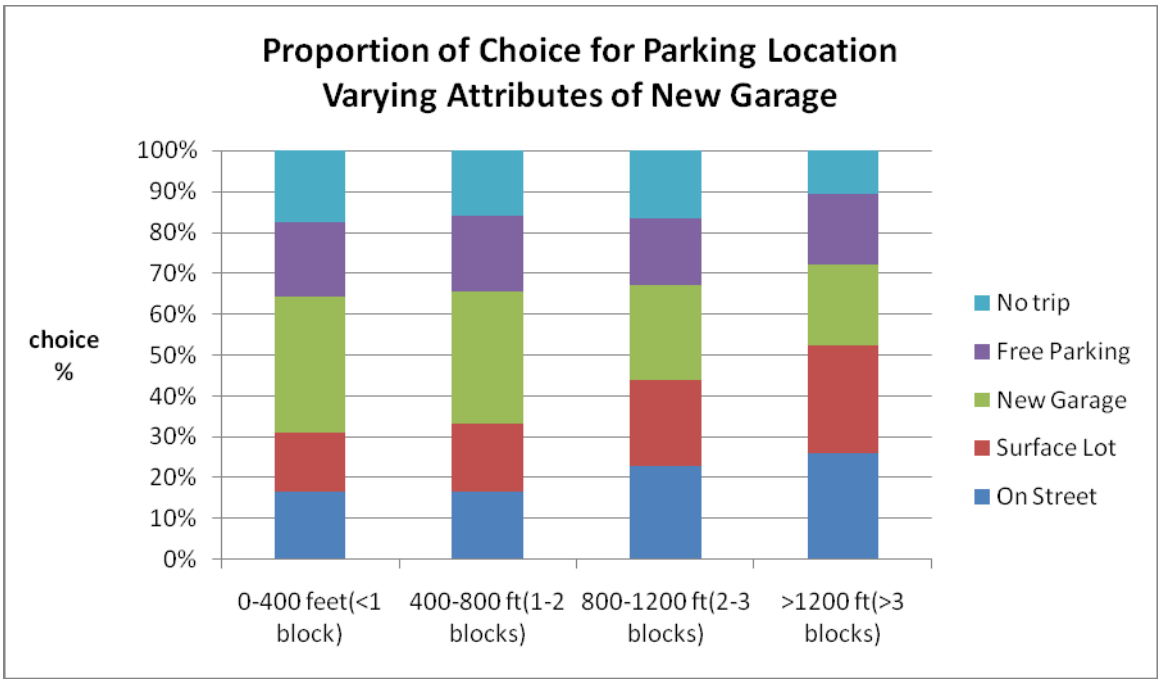

Chart 10. Choice of parking location while controlling for walk distance to new garage

There are gender differences for a new parking garage. Males are much more sensitive to parking fees and walking distances than females. Males are more likely to choose a parking garage than are females.

Groups with Similar Preferences

Nearly half of the respondents have similar preferences toward the parking attributes, and they are or behave like retired persons of high income, while the other half of the respondents have different preferences. This second group is predominantly employed persons with lower income. Since respondents were drawn from participants in neighborhood associations they are not representative of Kirkland's population. They tend to be older than the general population.

Members of Group 2 have a much stronger preference for free on-street parking than do members of group 1. Group 2 has a stronger negative preference for time limits for on-street parking than do members of group 1. Although both groups prefer a short walk distance to on-street parking, older members of group 1 have a stronger preference for a short walk. Group 2 has a stronger preference for a short search time for on-street parking, than do members of Group 1.

Both groups have a strong preference for free off-street parking in a new parking garage, though group 1 is more willing to pay to park than are members of group 2. Both groups dislike time limits to park in a new parking garage. Both groups prefer a short walk distance to park in a new parking garage. Group 2 is more willing to spend time searching for space in a new parking garage than are members of group 1. Fines,

particularly high fine levels are strongly disliked by members of group 2 when choosing a new parking garage. Group 1 members are largely indifferent to fines and their level when parking in a new parking garage.

Generally, members of group1 are more interested in convenience than price, while members of group 2 are quite price sensitive and are more willing to walk than to pay to park.

Simulation Results

The purpose of this section is to estimate the preferences and choices of groups of respondents, and to estimate the choices for parking pricing options and for location of the new parking garage.

The overall preference for parking location in the choice experiment is shown in Table 2.

Table 2
Parking Preference for All Respondents

Parking Choice	**Preference**
On-Street Parking	17%
Surface Lot	29%
New Downtown Parking Garage	38%
Free, but distant parking	15%

Table 3 shows the parking preference for one of the larger subsets of respondents, those who are male, 60 years of age or older, income between $45,000 to $100,000 per year, and whose usual downtown trip purpose is eat drink. Table 3 also shows the preference for younger males (less than 35 years of age)

Table 3
Parking Preference for Older and Younger Males

Parking Choice	**Preference of Older Males**	**Preference of Younger Males**
On-Street Parking	7%	26%
Surface Lot	36%	18%
New Downtown Parking Garage	50%	30%
Free, but distant parking	7%	16%

The older group has a greater preference for off-street parking and less preference for on-street parking or free but distant parking than do younger males or all respondents.

Table 4 compares two parking pricing policies. One policy is to price off-street parking and not on-street parking. The other policy is to price both on- and off-street parking.

Table 4
Most Preferred Parking Option

Parking Option	**Free On-Street, Pay-to-Park Off-Street**	**Pay-to-Park On-Street, Pay-to-Park Off-Street**
On-Street	56%	16%
Surface Parking Lot	9%	22%
New Parking Garage	20%	23%
Free, but Distant Parking	15%	38%

The most preferred option is on-street parking if it is free on-street, while pricing parking in off-street locations. However, if parking were to be priced both on- and off-street there will likely be a substantial spillover to nearby neighborhoods.

Table 5 compares a downtown core parking garage location (like Lake & Central, or Marina Park) to a peripheral one (like under Lee Johnson Field).

Table 5
Most Preferred Parking Option

Parking Option	**Short Walk Distance to New Parking Garage**	**Long Walk Distance to New Parking Garage**
On-Street Parking with a moderate or long search time	11%	28%
Surface Parking Lot with a moderate or long search time	22%	24%
New Parking Garage	36%	29%
Free, but Distant Parking	31%	19%

This comparison shows that a more distant location for a new parking garage will reduce demand for it while increasing the preference for on-street parking even when it involves a moderate to long search time.

Table 6 also compares a downtown core parking garage location (like Lake & Central, or Marina Park) to a peripheral one (like under Lee Johnson Field), but with a short search time for on-street parking and for surface parking lots.

Table 6
Most Preferred Parking Option

Parking Option	Short Walk Distance to New Parking Garage	Long Walk Distance to New Parking Garage
On-Street Parking with a short search time	28%	27%
Surface Parking Lot with a short search time	17%	32%
New Parking Garage	31%	19%
Free, but Distant Parking	24%	22%

Shorter search times for existing downtown core on- and off-street parking dampens the demand for a new parking garage in either location, but particularly at a peripheral location. Shorter search times are likely early in the day while longer search times are likely in the evening peak period or on nice weather days when the general demand for parking downtown is at its highest.

Willingness to Pay

Appendix A shows how willingness to pay to save walk distance and search time for parking is estimating from the study results. The analysis estimates that a 1200-foot walk is equal to a parking cost of $.095 while a search time of five minutes is equal to a parking cost of $0.45. Since walking 1200 feet takes nearly five minutes the two-fold difference in parking cost suggests that people find walking 1200 feet twice as onerous as a search time of 5 minutes.

Conclusions

The stated preference survey method provided a rich set of data on parking preferences that provides insights on pricing, regulatory measures, and the prospect of a new parking garage. Unfortunately, the small sample size and questions about its representativeness limit the analysis of demographic groups. Nevertheless, insights were gained about consequences of charging for parking, time limits, and levels of overtime parking fines.

Some principal findings are that charging for on-street parking will cause spillover into neighborhoods and cause some persons to go to destinations other than downtown. However, women and older persons are less sensitive to parking charges and seem more willing to pay for convenience and for parking availability, while younger persons are more sensitive to parking charges and are more willing to walk and avoid parking charges.

Similarly, free parking in a new parking garage is highly desired. Women are less likely to park in a parking garage than are men. The location of a new parking garage is quite important. A long walk distance will detract from its desirability.

Appendix A
Willingness to Pay Utilities

Chart A-1 displays a cross tabulation of the most and least preferred option against price for on-street parking. Table A-1 displays the utilities of these options. The estimate of utilities are constructed from the Ln(sqrt(most/least)).
Similarly, utilities were calculated for most and least preferred option against price of surface lot and new garage parking locations. The utilities were regressed and the slope of the linear regression is 0.66, which is interpreted as the willingness to pay for the difference of 2 hours.

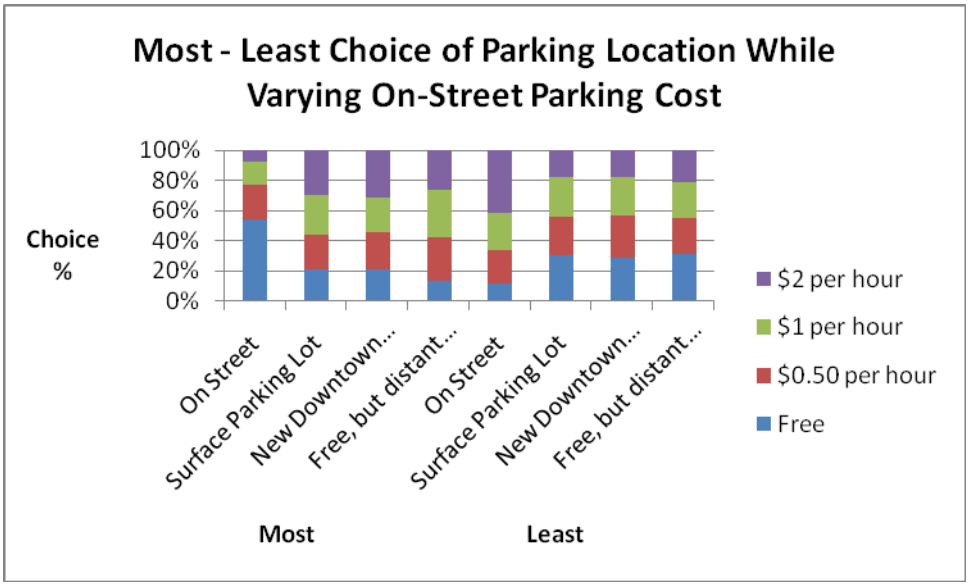

Chart A-1. Most – Least choice of parking location while controlling for on-street parking cost

Table A-1
Utilities for Most – Least Choice of Parking Location
While Controlling for On-Street Parking Cost

On Street	Surface Parking Lot	New Downtown Parking Garage	Free, but distant Parking
0.59	-0.24	-0.17	-0.17
-0.17	-0.12	-0.09	0.35
-0.43	-0.07	-0.05	0.41
-1.03	0.18	0.27	0.37

Chart A-2 displays the cross tabulation of the most and least preferred option while controlling for on-street walk distance, and the Chart A-3 display controls for on-street search time. Utilities were calculated from the most and least proportions and the difference in utilities for walk distance and search time minimum and maximum levels are divided by the willingness to pay estimate of 0.66 to produce a willingness to pay for

a 1200 foot walk of $.095 for on-street parkers. The willingness to pay for 5 minutes of search time is $0.45 for on-street. Since walking 1200 feet take nearly five minutes the two-fold difference in willingness to pay says people find walking 1200 feet twice as onerous as a search time of 5 minutes.

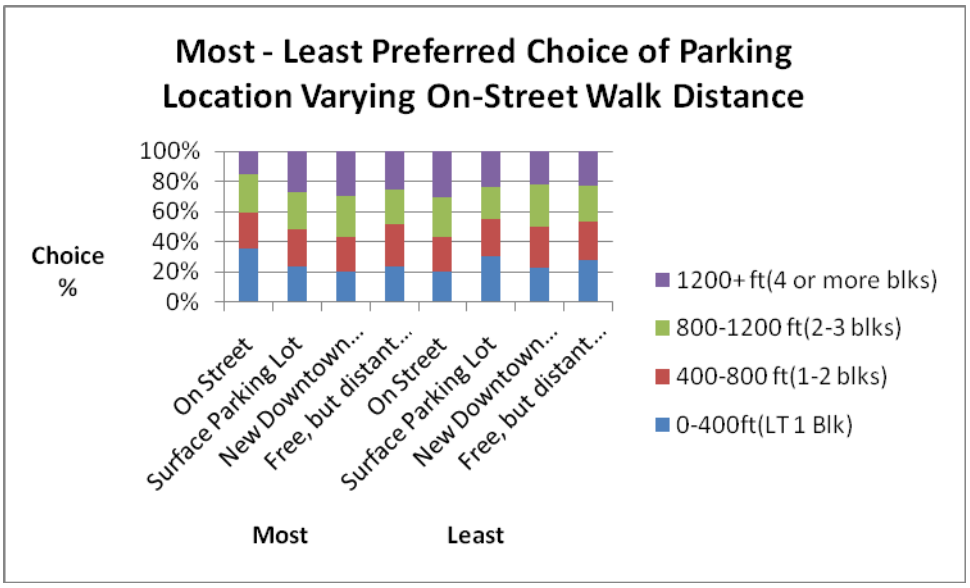

Chart A-2 Most – Least preferred choice of parking location while controlling for on-street walk distance
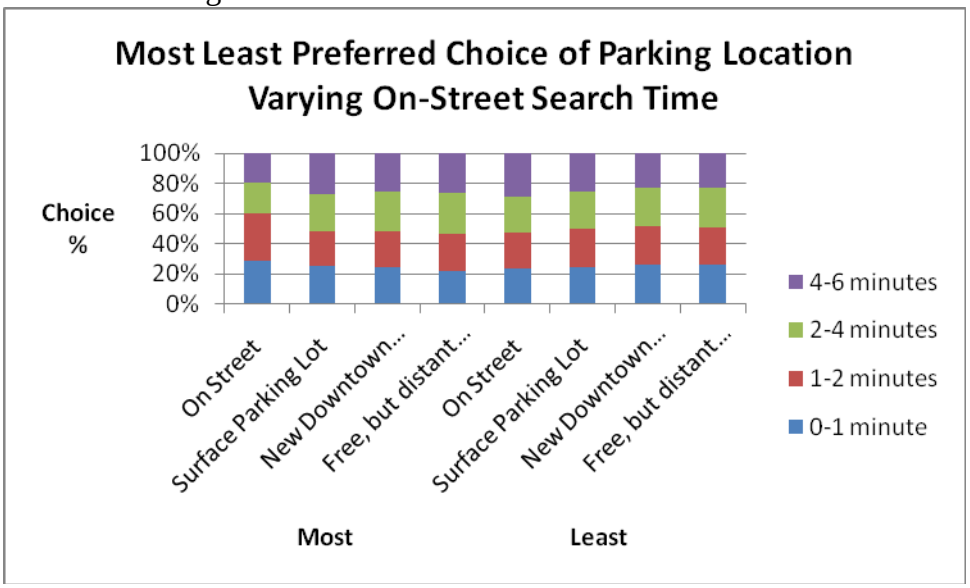
Chart A-3 Most – Least preferred choice of parking location while controlling for on-street search time