ACCESSORY DWELLING UNITS

AND

THE PERCEPTION OF DENSITY

IN

NORTH BERKELEY

SONIA-LYNN ABENOJAR | ALBERTO BENEJAM | TAMAR NATIV

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PROFESSOR PETER BOSSELMAN | GSI PATRICK HAESLOOP

TABLE OF CONTENTS

I. INTRODUCTION

BACKGROUND

Accessory Dwelling Units generally describe secondary units with their own kitchens, living areas, and entrances that share a property with a larger, primary house. The definitional specifics vary by jurisdiction, but the essence remains the same. Accessory Dwelling Units (ADUs) are intended to provide additional housing units in existing residential areas without significant disruptions to the character or streetscape of the neighborhood.

Our interest in studying ADUs arose from the ongoing debates in the City of Berkeley regarding ADUs and their permitting process. As the semester began, the City Council was presented with a series of policy recommendations by the Planning Department to facilitate the permitting and construction of ADUs. The most notable recommendation was the grant ADU permits by-right, if certain conditions are met, instead of the current process which requires lengthy and costly individual variances.

While ADUs are relatively common in Berkeley, the proposed policy changes--if enacted--are expected to substantially increase their numbers. Debates surrounding housing, density, and construction within the city can be quite contentious, with many citizens impassioned to defend the character of the neighborhoods they live in and contribute to from over-development. ADU proponents cite their ability to camouflage into the backyards of the primary units as evidence that they are unlikely to invoke the analogous negative reactions.

The Planning Department identified several conditions that must be satisfied if an ADU is to be permitted automatically, rather than through a hearing process. The criteria helped us tailor our study to the areas that have the greatest potential to be impacted by changes to the permitting process. The criteria include limitations on lot sizes, distance to transit, parking availability, and zoning lot coverages. Their specificity and implications to our project and methodology will be discussed in greater detail throughout the report.

The City Council opted to delay its vote on the proposed recommendations, citing the need for additional discussion of the issue. Our project provides a timely investigation into the perceptions of density associated with Accessory Dwelling Units, in hopes to answer the essential question at hand: Can ADUs provide an uncontroversial solution for more housing within Berkeley?

II. PROJECT DESCRIPTION

Location of Study

Berkeley, California

Objective

The intent of this study is to investigate residents' perceptions of density of their North Berkeley neighborhood. The study is directed towards residents with varying numbers of ADUs located within their neighborhood block. The sample size includes those living on blocks with a low, medium, and high count of ADUs. Using a survey-questionnaire as the primary research method, residents of the selected blocks will engage in a number of questions that ask them to assess to the quality characteristics of their neighborhood.

Research Question

Does the presence of Accessory Dwelling Units (ADUs) on a given neighborhood block change a resident's perception of density in North Berkeley?

Hypothesis

Regardless of the number of ADUs on a given block, residents will rate the number of people living within their neighborhood uniformly.

Definitions

- **Accessory Dwelling Unit (ADU)** — Self-contained and detached smaller living units on the lot of a larger, primary structure, such as a detached garage converted into an independent cottage.
- **Density** — Density: Units per acre & land coverage
  Human Density: Number of residents per acre
- **Blocks** — A segment of a street bounded by consecutive cross streets; including its buildings and inhabitants
- **Perception** — The relationship between sensations, which is a response to stimuli; cognition, a process of understanding and learning; and evaluation, a qualitative assessment of the perceived experience (Amos Rapoport, Human Aspects of Urban Form 1977).

Sample Size

Total of 6 North Berkeley Neighborhood Blocks:

# of Blocks	ADU Density	ADUs per Block
2	High	8-11
2	Medium	5-7
2	Low	0-4

III. SITE SELECTION

Methodology

The research group identified preliminarily Berkeley neighborhoods with the presence of constructed ADUs. The south Berkeley neighborhoods were eliminated from the site selection process due to the high concentration of multifamily buildings located within each block and the transient student population. The northern side of Berkeley presented the researchers with ideal neighborhood characteristics: majority residential and a consistent count of single family homes within each block. The neighborhoods bounded by Rose Street, Shattuck Avenue, University Avenue, and Sacramento Street were chosen as a prime location to continue field work analysis.

City of Berkeley ADU Guidelines

The Berkeley Planning Department's proposed by-right ADU criteria served as a baseline to further identify ideal neighborhood blocks and lots, as these areas are likely to see the greatest impact from eased regulations. The proposed criteria for facilitated permitting require the following:

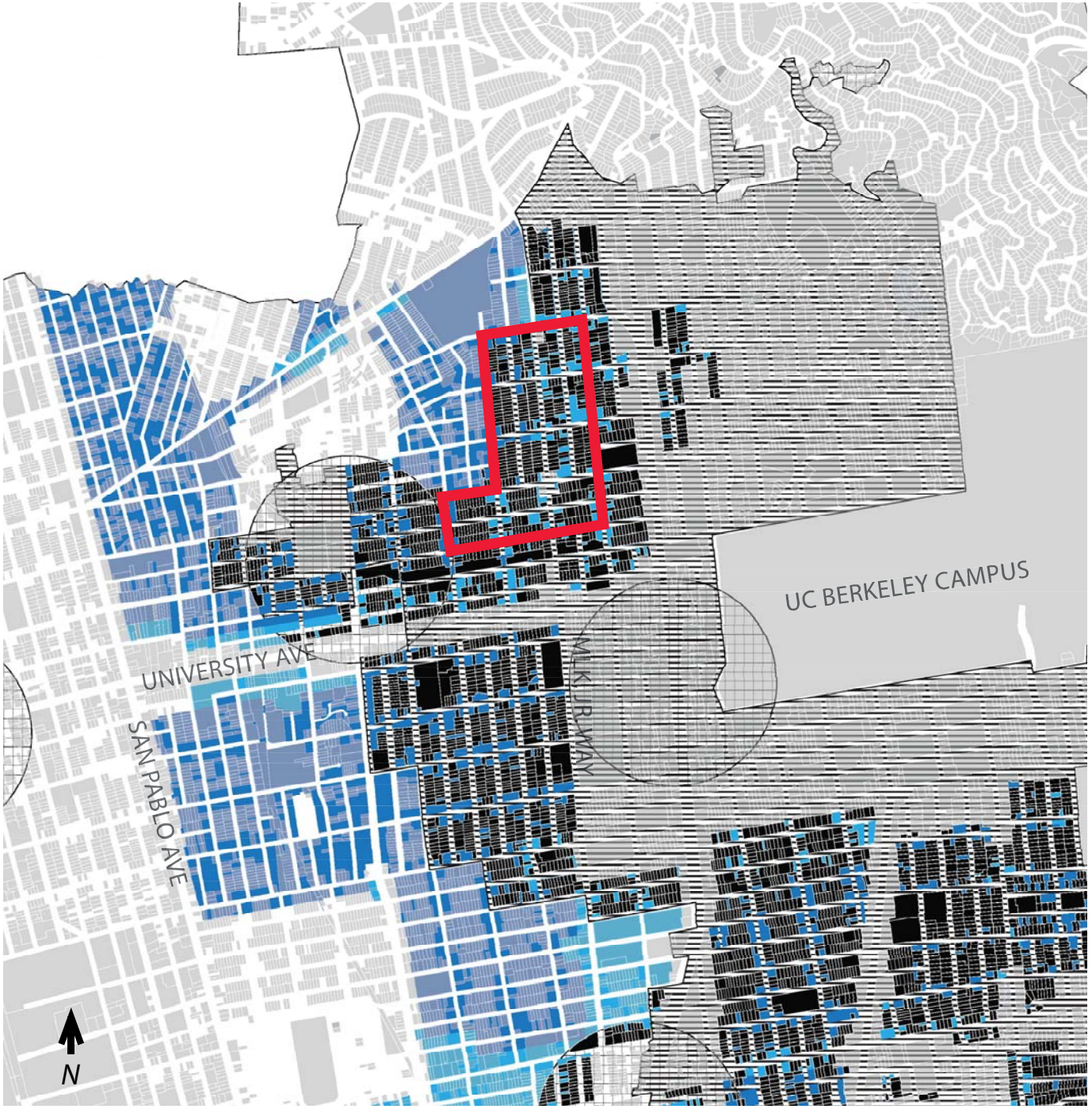
- Minimum lot size of 4,200 square feet
- ADU can be no larger than 25 % of the size of the main dwelling unit
- Minimum unit size: 300 square feet; Maximum unit size: 750 Square Feet
- Parking requirements are waived when ADU is located within 1/4 mile of transit or within Residential Parking Permit area
- ADU is to be located in the rear of the parcel; ADU is not allowed within the front yard setback unless Administrative Use Permit is approved

Operating Variables

- **Zoning**
  R2 - Restricted Two Family: >5,000 sq ft lot, max 50% coverage, max 28 ft height
  R2A - Restricted Multifamily: >5,000 sq ft lot, max 66% coverage, max 28 ft height
- **Parking**
  Residential Permit Parking Zone
- **Block Characteristics**
  Parcel count range from 28 -35 parcels per block
  Average block size: 270ft X 600ft
- **Minimize**
  Number of multifamily buildings within block
  Number of parcels with commercial use
  Public buildings or parks

ADU Site Survey

Map denotes the optimal locations for the siting of ADUs within North Berkeley using variables from the City of Berkeley ADU Guidelines. The area outlined in red indicated the most promising locations to find varying numbers of ADUs per block while controlling for other density variables.



OPTIMAL ADU LOCATION

R-2 ZONING

R-2A ZONING

RESIDENTIAL PERMIT PARKING ZONE

TRANSIT RADIUS

>4200 SQ FT LOT

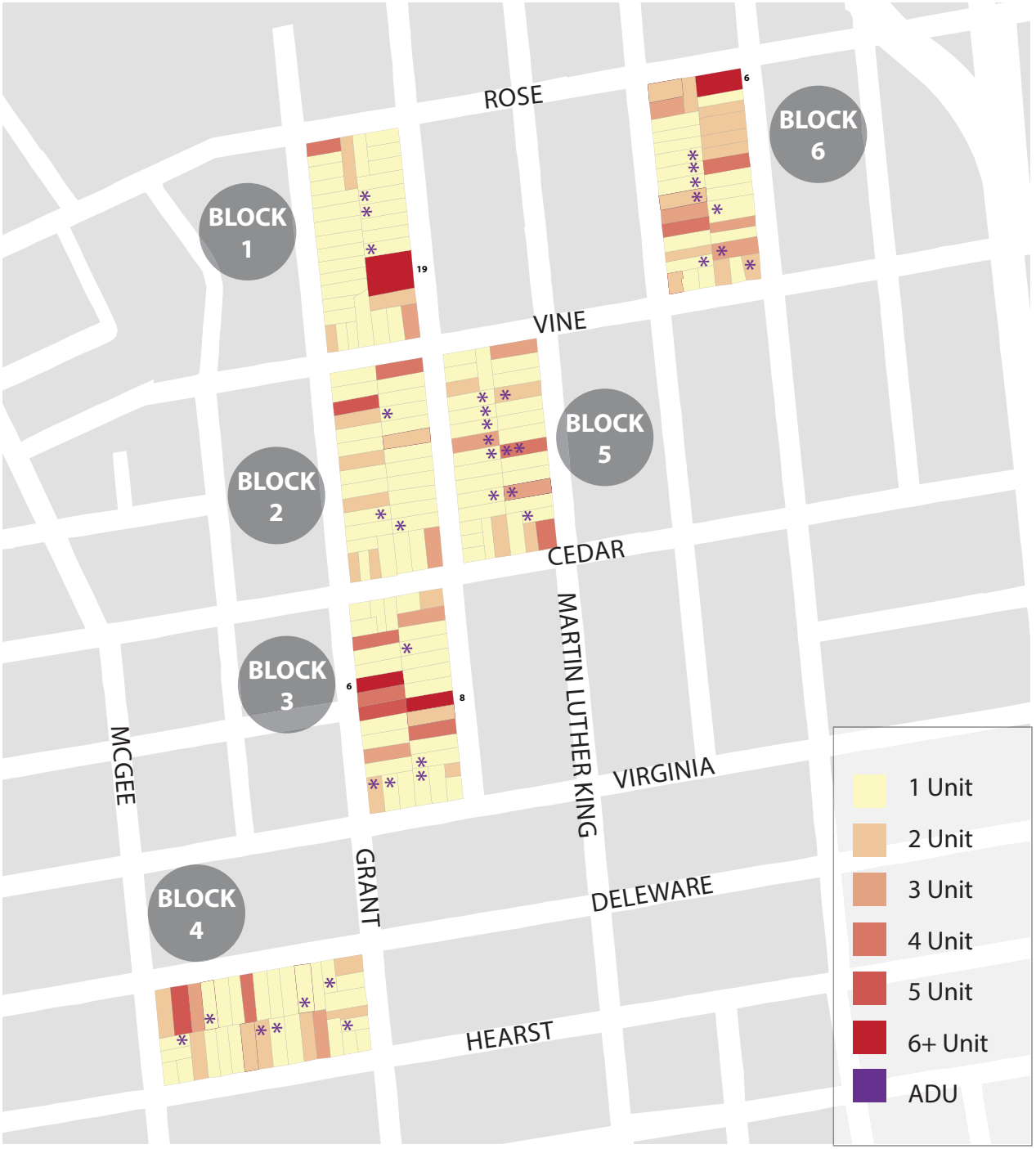
SITE BOUNDARIES

Final Block Selection

After identifying a promising area for Accessory Dwelling Units within Berkeley, site visits were conducted to select the final blocks for the project study area. The design of the project required the selection of blocks that were as similar as possible, except in the number of ADUs they contained. The limitation of other factors affecting the perception of density would maximize the probability that any discovered variations in density perception could be attributed to ADUs and not to other factors.

The control factors selected for in the earliest site visits include the following: entirely residential blocks with no commercial or public park properties (the Ohlone Greenway runs through the larger study area); relative consistency in the ratio of single family to multi-family units; and no major variation in the streetscape, vegetation, or upkeep of the blocks.

The six blocks depicted in this graphic represent the most similar blocks according to these criteria.



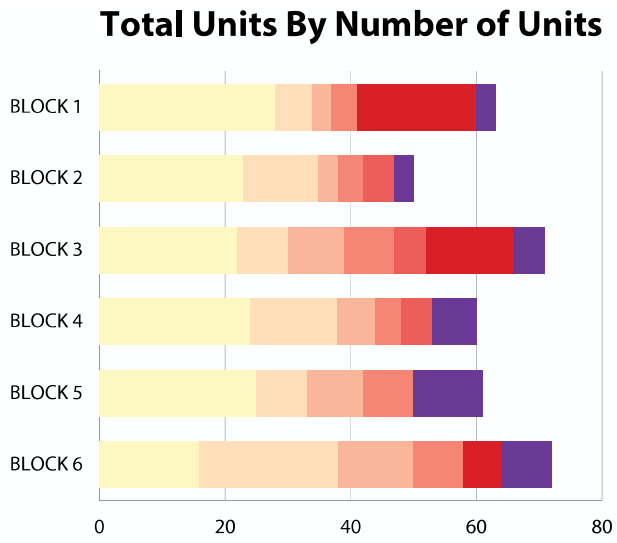
IV. FIELD WORK

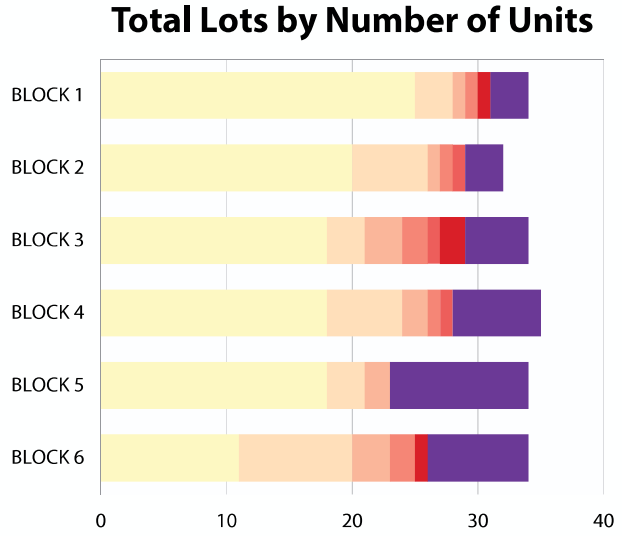
Methodology

After the initial fieldwork narrowed down the six blocks based on observation, additional investigation was done to quantify the control variables. Through additional site work, as well as the use of satellite imagery, census data, and traffic counts, our initial observation was double-checked and confirmed as accurate. The final list of variables analyzed include the following: housing stock composition, land coverage, vegetation coverage, elevation characteristics, sectional characteristics, parking availability, traffic counts, and demographic data.

Housing Stock Composition

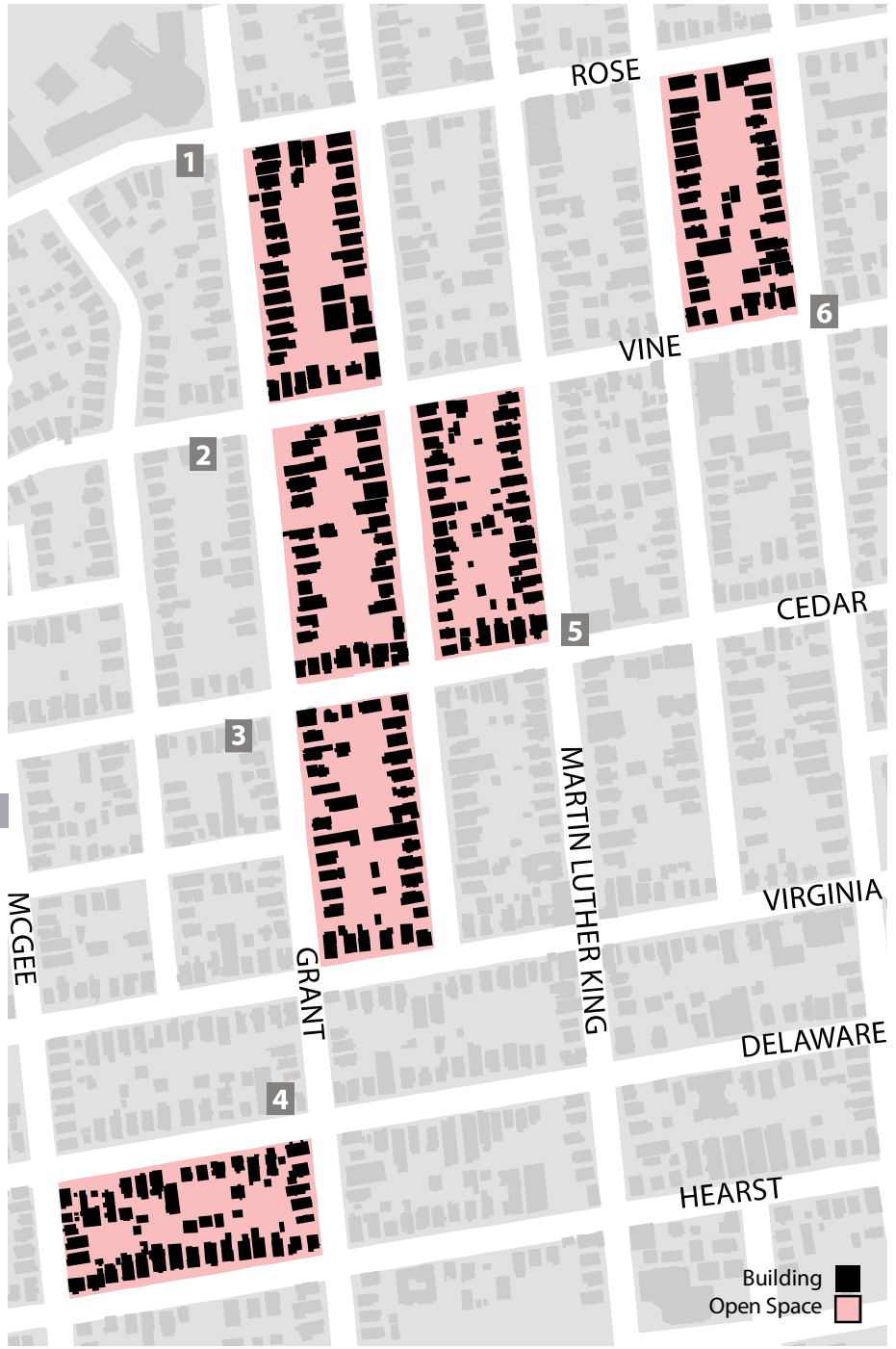
Although our initial observations accounted for the presence of multi-family unit density generally, we felt it important to quantify the total number of units per property and per block to ensure consistency across the blocks. The two graphics below summarize the information from the map on page 7.
We learned two things from this detailed investigation. The first is that Block 6 contains a smaller proportion of single-family homes compared to the other five blocks, however, given the difficulty in finding another block in the same area with a high number of ADUs, we included this block in our study. The second takeaway was that while ADUs will not add nearly enough units to solve the housing problems of the Bay Area, their effect on the blocks is by no means insignificant. Represented in the graphs below in purple, we were surprised by the noticeable impact it had in the total sum of units.



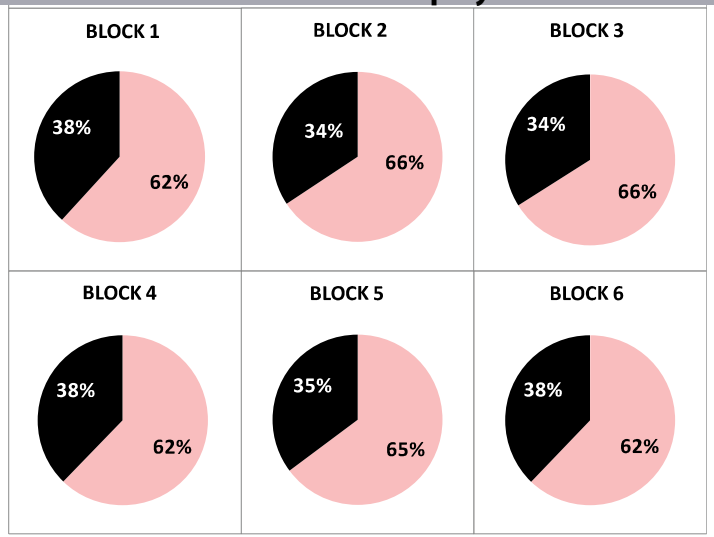


Land Coverage | Figure ground of Built Area

In this research we evaluate measures of density compared to resident's perception of density. Land coverage is a measure of density that calculates the relationship between percent built-up land, to percent free land. The following map, which is based on the city of Berkeley aerial map, was used to calculate land coverage. It is found that among the 6 blocks of the survey, land coverage is rather similar, between 34% - 38%.

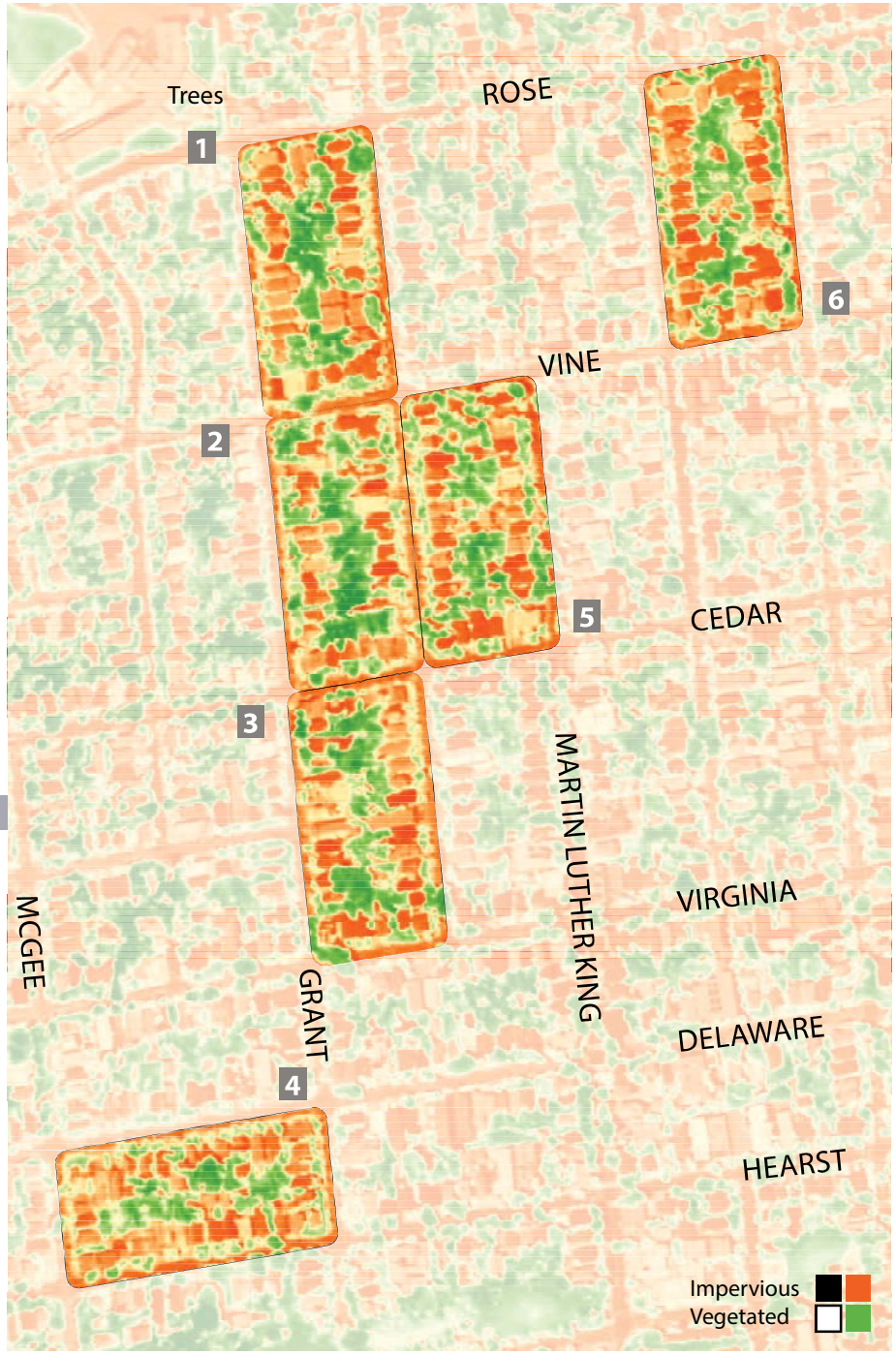


Percent Area Built-Up by Block

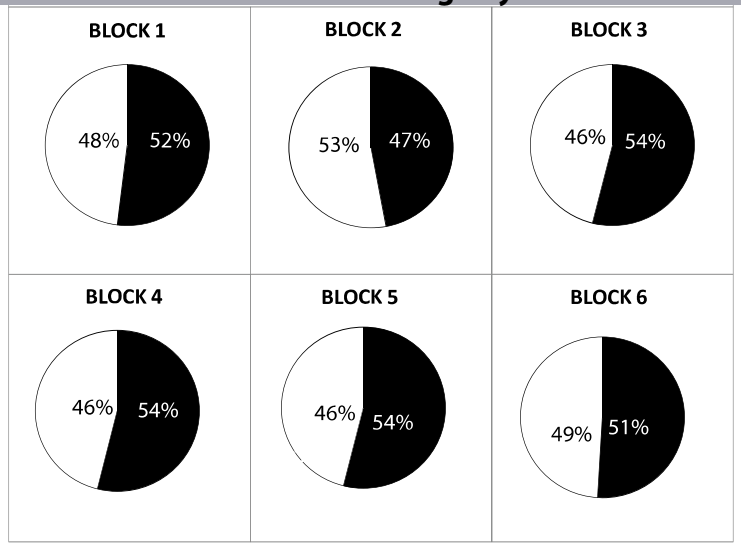


Block Green Space | NDVI

The following map is based on 'Normalized Difference Vegetation Index' (NDVI), a sensing measurement of green vegetation. Since the existence of vegetation or the lack of may affect residents' perception of density, we use this map to measure green space in each block and see whether the amount of vegetation is varied upon block. It is found that green space levels are much alike and rages between 47% – 54%.



Percent Tree Coverage by Block



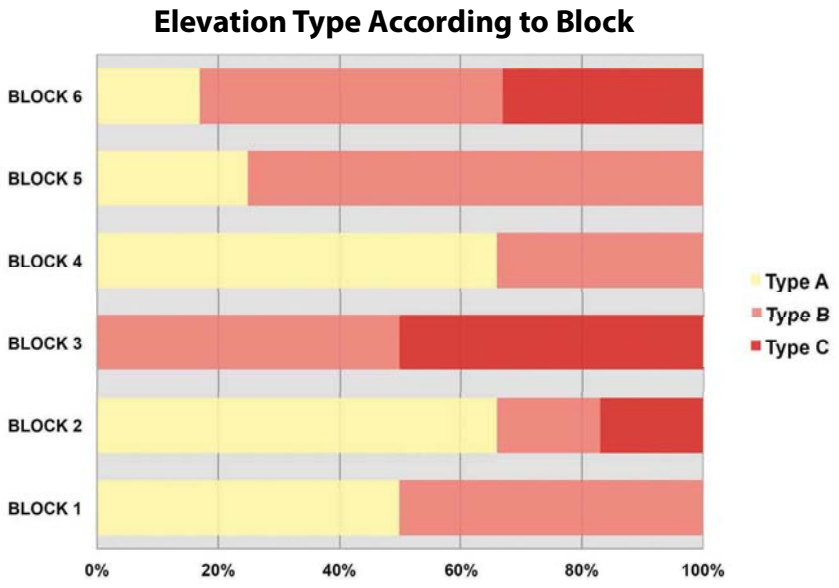
Elevation Characteristics | Levels of Porosity

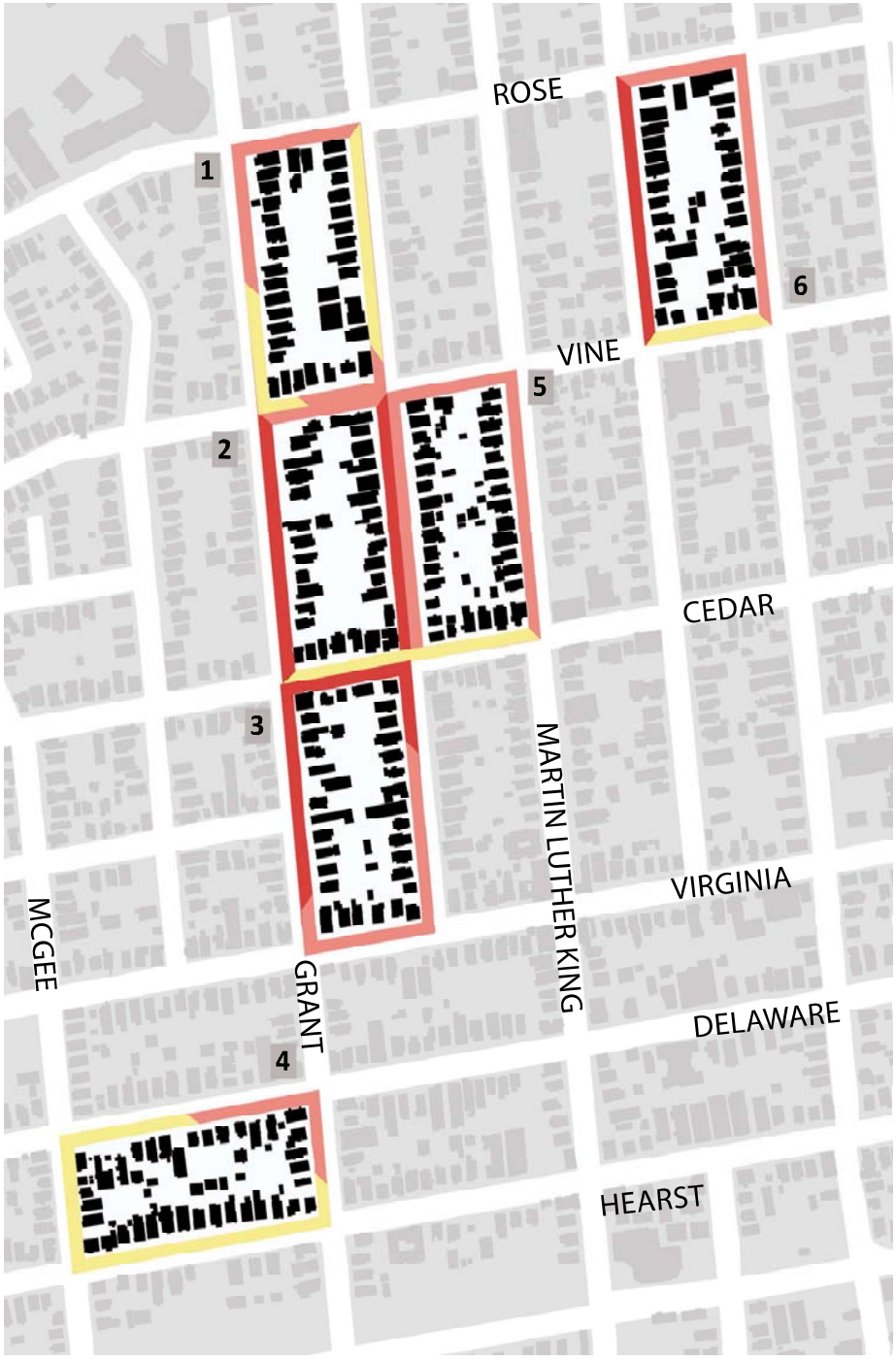
Elements in the character of street elevations may affect how residents perceive density. Specifically, the extent of openness between the street and the parcels, and the ability to "see through" into the backyard can shift perceptions of density.

In order to examine whether elements in the street elevation influence residents' perception of density, we measure the character of the street elevation according to levels of porosity. Porosity refers to the extent of openness of view from the street into the backyard. The existence of elements such as vegetation, fences or elevated street obstruct the view and therefor reduce porosity levels. According to this definition we characterized three types of elevations: High porosity (least obstructions), Medium porosity, and Low porosity (a lot of obstructions). The perimeter elevations of all 6 blocks were defined according to these three types of elevations.

Elevation Characteristics | Levels of Porosity

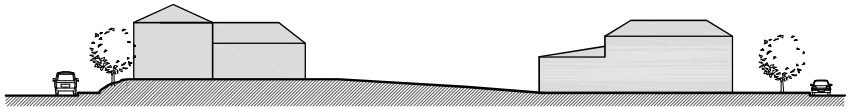
The following map displays the character of the elevations of the 6 perimeter blocks, according to the 3 elevation types that were defined above. The graph below displays the representation of elevation type in each of the 6 blocks. It is found that overall, the six blocks are relatively close in porosity levels; however, blocks 3 and 6 are characterized by slightly lower porosity than the rest of the blocks.



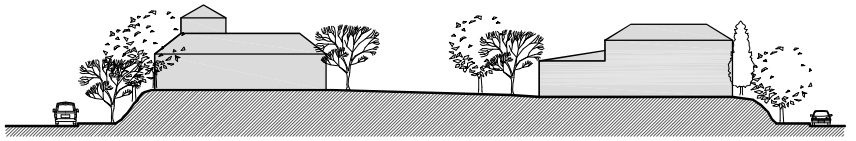


Block Characteristics | Sectional Characteristics

The blocks sections provide an illustration of the relationship between different types of housing units to the street and to the back yard, while taking under account elevation characteristics as analyzed above. The sections are typical for each block, as they were taken in the point that most represents the entire block. Overall, characteristics such as fencing, elevated streets, existence or absence of ADUs, and vegetation are in mixed levels in each of the 6 blocks. Since the sections are graphical interpretations of the block as a whole, few direct conclusions can be drawn except for the understanding that the sectional differences inside of each block is just as great as the section differences across blocks.

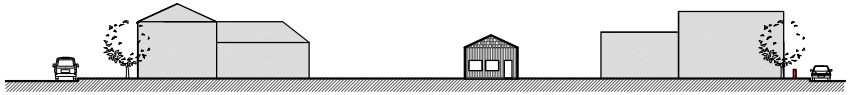


Block 1



Block 2

Block 3



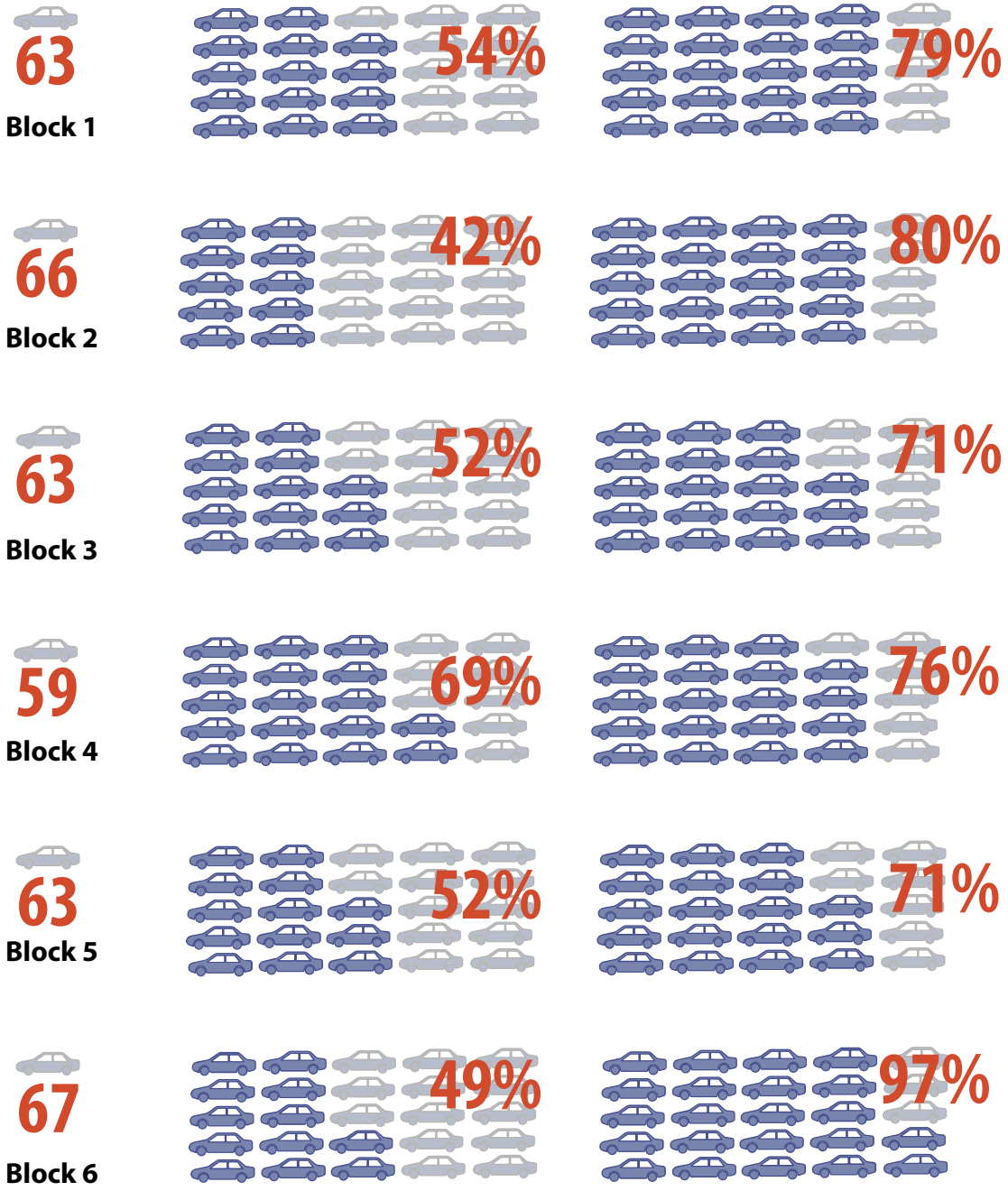
Block 4

Block 5

Block 6

Parking Availability

The availability of parking in North Berkeley is important since it is related with the discussion of whether ADUs will create parking shortage. While none of the six blocks are within the quarter mile radius to a transit station, they are all inside a residential parking permit zone. Thus the policy recommendations pending before the City Council would allow new ADUs to be exempted from the off street parking requirement. We measured parking availability in Berkeley for each of the 6 block at 5pm and also at 10pm. We find that while in mid-day parking is rather available, late in the day parking availability is limited, and filled capacity is between 79% - 97%.



Traffic Counts

The following map is based on traffic volume counts map from the city of Berkeley. Counts were taken between 2000 – 2006, and represent daily average total. Arrows illustrate directions and relativity of traffic counts. The 6 blocks of the survey are mostly surrounded by low traffic roads, while block number 4 has an elevation to MLK Street which has medium-high traffic.

Neighborhood Profile

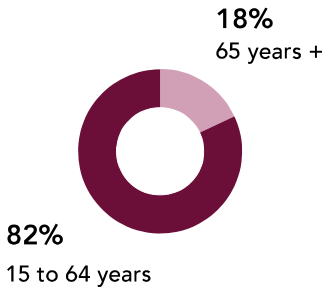
The site lies within Census Tracts 5217, 4218, and 4223. Using 2010 U.S. Census data, general characteristics about neighborhood tenure, household age, transportation means, and vehicle reliance were assembled.

At 58%, more than half of the households within the North Berkeley neighborhoods are Renter-Occupied compared to 42% of Owner-Occupied households.

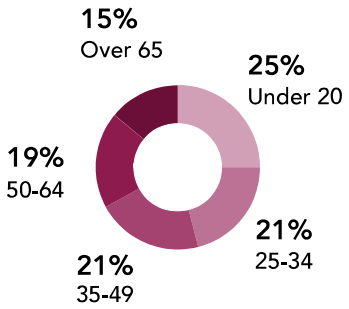
The age of residents of this North Berkeley neighborhood are generally evenly distributed within each age category.

Data shows that slightly over half of the neighborhood use cars as a primary means of transportation to get to work. 89% of houses have access to one vehicle, while 55% have access to 2 or more vehicles. We assumed that data regarding the significance of vehicles in this neighborhood may correlate to residents' perception of density and crowdedness of their block.

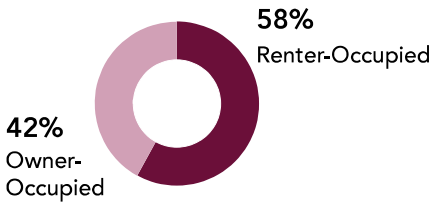
Household Age



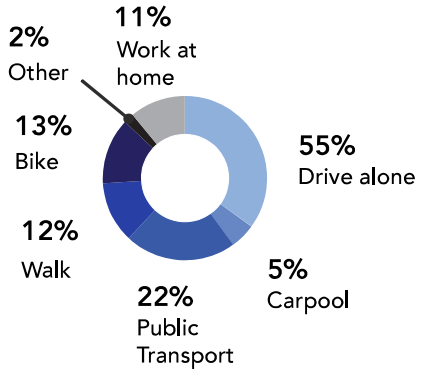
Household Age Distribution



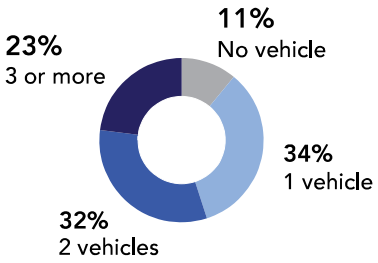
Rent v. Own



Transportation Mode



Vehicles Available



	BLOCK 1	BLOCK 2	BLOCK 3	BLOCK 4	BLOCK 5	BLOCK 6
POPULATION	119	119	104	108	115	123
TOTAL UNITS	57	67	41	53	60	66
POP. PER UNIT	2.09	1.78	2.21	2.04	1.92	1.86

V. SURVEY

Design

The survey questions were designed to answer our research question, whether perception of density differ among different type of blocks, high, medium or low ADU. The survey starts with general questions regarding tenure in the neighborhood and familiarity with term Accessory Dwelling Unit, and continues with more elaborate questions regarding measures of density and experience of density. We distinguish between objective estimates of population and number of units, as measures of density, to the experience of density, defined by the word "crowded". We also ask direct questions about respondents' opinion about housing in the bay area. Parking is an additional topic in the survey, since parking availability and residents concern about the topic, greatly affects the debate about ADUs in Berkeley.

Distribution Methodology

We distributed a total of 180 surveys among the 6 blocks, from which we received a total of 49 responses. 30 surveys were delivered in each block: 20 to single-family houses, 5 to apartments, and another 5 to ADUs. However, part of the ADU's surveys could not be delivered since a mail box was not available. Most of the survey was directed to residents of single family houses and ADUs, since this is the population that will be affected by potential change in ADU policy. We yet surveyed apartment residents as well, as they too have a stake in the neighborhood's future.

Survey Questions

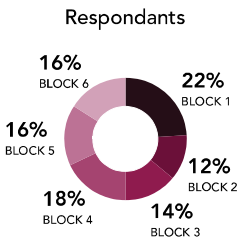
The survey questions were designed to elicit nuanced responses from area residents. Several categories of questions were used including: multiple choice, word associations, and Likert scales. The questions were worded carefully, particularly in the Likert scale questions, so that a person holding consistent views would have to agree to some questions and disagree to others. This was done as an attempt to avoid any leading questions or implications of bias in the survey (i.e., pressuring respondents to view ADUs as positive). Sometimes, pairs of similar questions were asked to ascertain slightly different types of information, including asking both whether their block was crowded, and whether it has gotten more crowded in the time they have lived there. Similarly, questions about parking asked whether it was easy to find parking on their block, as well as asking whether there is sufficient parking on their block.

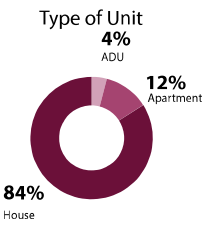
The survey in its entirety may be found in the appendix.

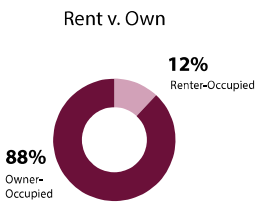
Survey Results | Multiple Choice

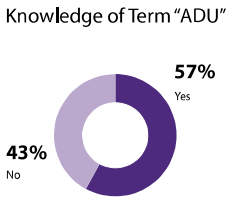
Each block had between 7 and 13 residents mail back surveys. The following pie charts summarize the first set of multiple-choice questions on the survey. These questions serve as background information on the residents and helped us gauge the different levels of familiarity with ADUs. Their main characteristics are as follows:

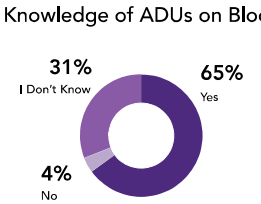
- 84% of respondents live in single family homes instead of in ADUs or multi-family units.
- The majority of residents in this neighborhood are familiar with the term ADU and are aware of their presence in the neighborhood. Very few respondents had an ADU on their property.
- 88% of the respondents are homeowners, which is a significant overrepresenation from what the Census data indicates.
- 59% have lived in the neighborhood for over 20 years, however, respondents estimated that most of their neighbors have been there for 11-20 years.
- Streetscape character was slightly more common as an important factor in selecting the residence than backyard character.
- 54% of respondents rely exclusively on street parking, while only 30% exclusively rely on a private driveway. Only 1 respondent (3%) did not own a car.
- Over 50% believe that pedestrian and bicyclist activity on their street are at the optimal levels.

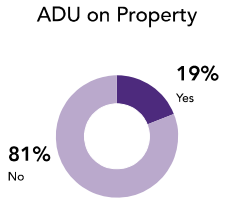


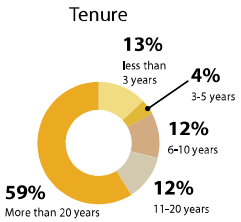


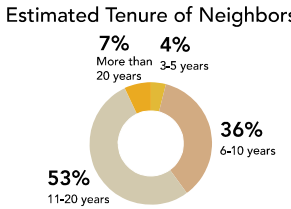


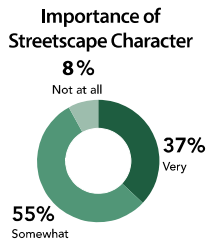


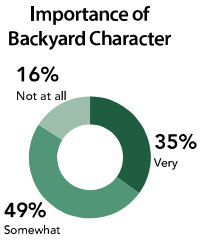


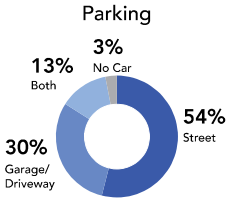


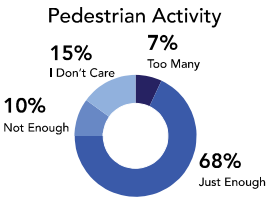












Likert Scale Questions

The survey asked residents to respond to various statements and indicate their opinion on a scale ranging from strongly disagreeing to strongly agreeing. While quantifying responses, these answers were translated a numerical value between -4 to +4 .

Perception of ADU: Unobtrusive/ disruptive

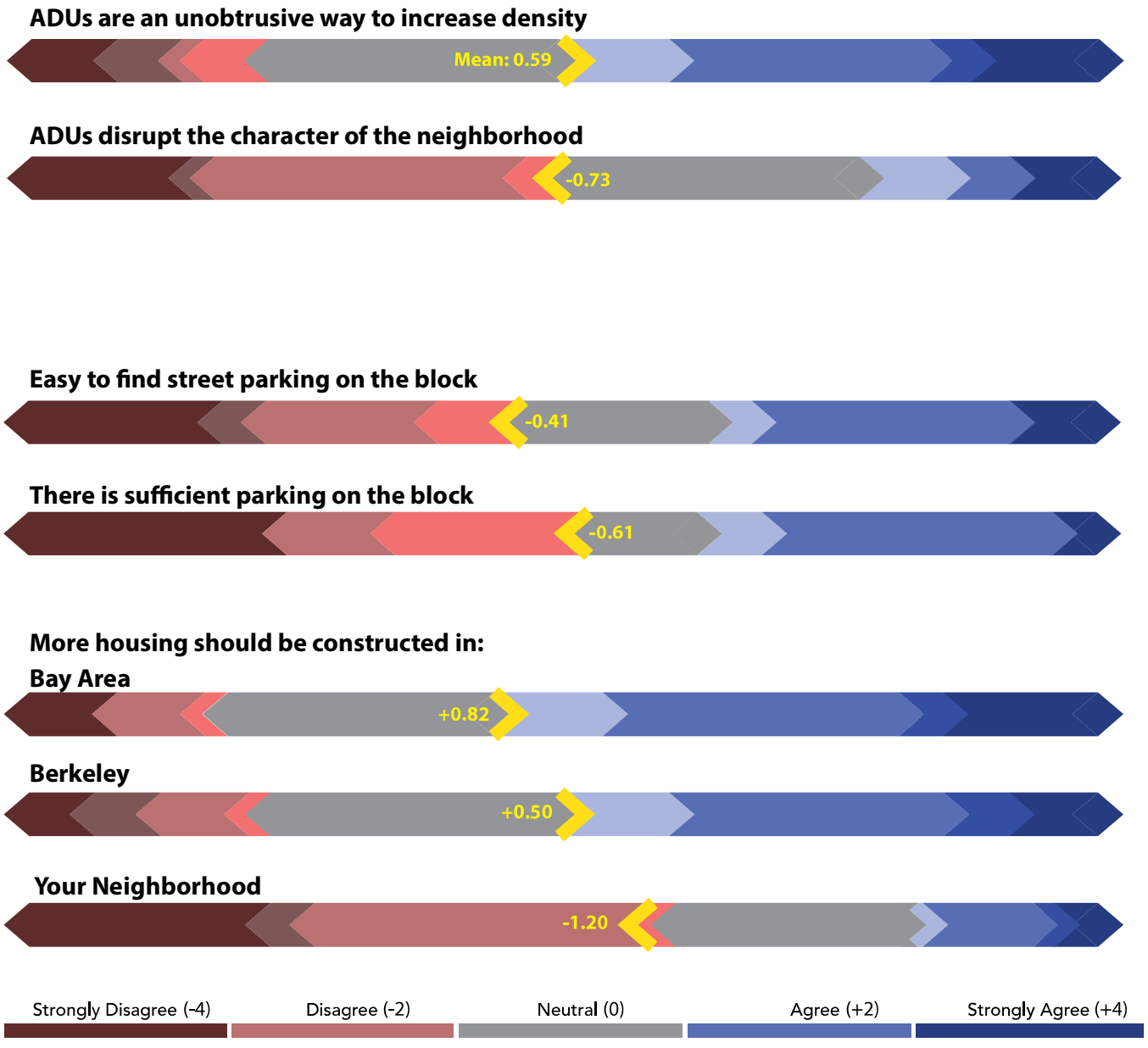
While the means for each answer are close to zero, the responses themselves were highly polarized. However, the value of 0.59 and -0.73 reveals slight inclination to perceiving ADUs as unobtrusive and as not disrupting the neighborhood character.

Parking Availability:

Respondents were concerned about parking and many of them disagreed with the statement regarding sufficient street parking. However, responses were mixed so the average is slightly lower than 0.

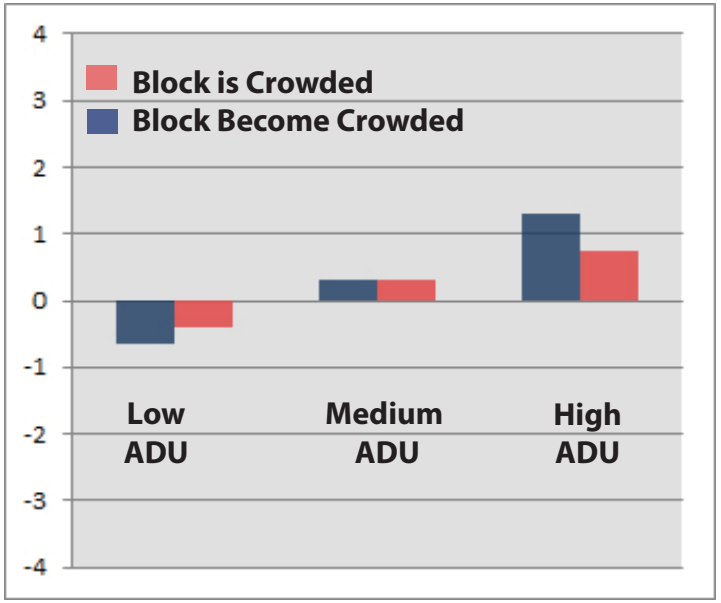
New Housing

Respondents answered with extreme agreement or disagreement to questions regarding new housing around the Bay Area. Still, responses were rather positive about new housing in the bay area and even in Berkeley. However, when asked about new housing in their neighborhood, more respondents were against it.



Experience of Crowdedness

Overall, respondents slightly agree with statements regarding their block being crowded or becoming crowded recently, with average responses below 0.5. However, we filtered the responses to this question by the ADU density groups (Low, Med, High) and found that there is somewhat of a difference in how respondents rank these two questions, according to blocks. The two High ADU blocks were more likely to agree with the statements. Given the implications this would have on our hypothesis, we dug a little deeper and found that most of the negative (more crowded) responses were coming specifically from Block 6. Earlier in the report, we discussed how Block 6 contains a larger proportion of multi-family units than any of the other blocks. The responses from Block 5 (highest total number of ADUs) were much more in line with the other 4 blocks, therefore we believe that the variation in this answer is due to the composition of the units rather than the number of ADUs.



You would describe your block as crowded

Your block/ Neighborhood have become more crowded since you've lived there

MEASURES OF DENSITY

Two definitions for density measurement were used in this project: the first is by number of people, and the second is by number of units. The surveyed residents were asked to estimate the number of people and units that are on their own block.

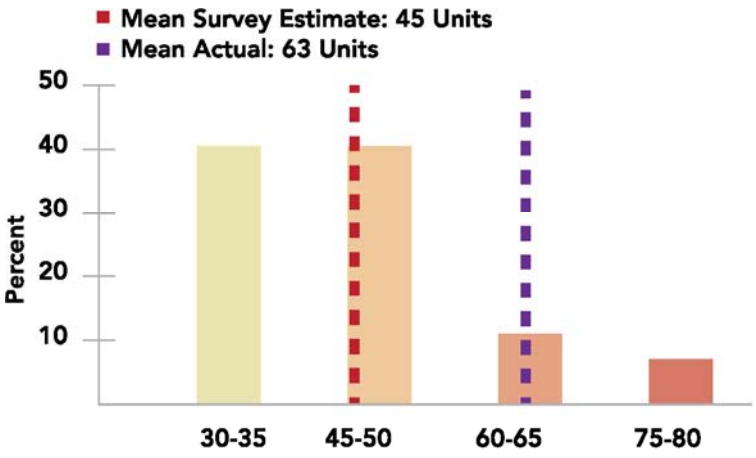
The average estimate of number of people in the block is rather close to the real average: respondents estimated 111 residents compared to an average of 115 residents. The table shows that responses error for each block is similarly small, and shows no apparent correlation with ADU density.

The average estimate of number of units underestimated the real number: 45 compared to an average of 63 units per block. However, the values are just shy of statistical significance, so it can only imply the possibility that even with the presence of ADUs residents will undercount the number of units present on their block.

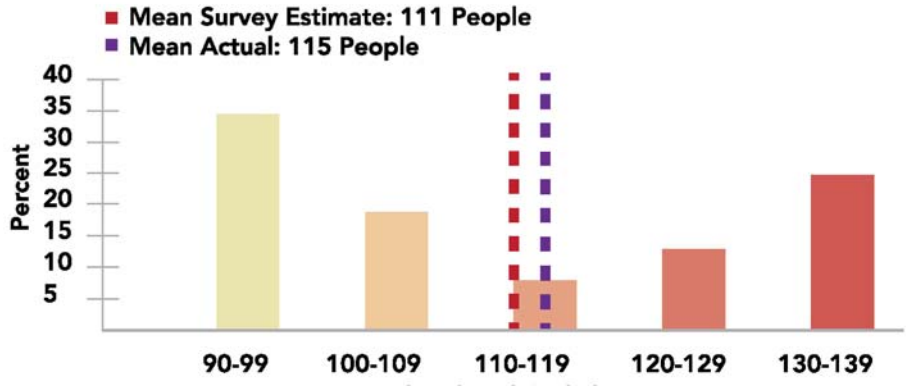
Population Counts versus Estimates

	BLOCK 1	BLOCK 2	BLOCK 3	BLOCK 4	BLOCK 5	BLOCK 6	TOTAL AVERAGE
Actual Population	115	104	119	119	108	123	**115**
Estimated Population	111	109	103	113	112	115	**111**
Estimation Error	-3%	5%	-13%	-5%	4%	-7%	**-3%**
Total Units	63	50	71	60	61	72	**63**
Zoned Units	60	47	67	57	53	66	**58**
Estimated Units	50	41	39	51	39	44	**45**
Estimation Error	-21%	-18%	-45%	-15%	-36%	-39%	**-29%**
Population Per Unit	1.83	2.08	1.68	1.98	1.77	1.71	**1.84**

Estimated Number of Units in Block



Estimated Number of People in Block



Word Clouds

Backyard Character

Respondents were asked to pick words from a list of adjectives which they find as descriptive of the streetscape and of the backyard. With these two questions we wanted to examine respondents' intuitive perception of their living environment.

We find that in all 6 blocks respondents describe both their backyard and the streetscape in positive words, such as: good, pleasant, vegetated, living, quite, comfortable, green, etc. Words such as dense or secluded were in very low use, or no use at all.

Low ADU

Medium ADU

High ADU

Streetscape Character

Again, despite choosing from a long list of adjectives containing positive, neutral, and negative descriptions, survey respondents were very likely to choose positive descriptions for the character of their streetscape.

This abundant positivity is in contrast to the answers that asked how important the character of these spaces were in the selection of their unit. Many residents responded by saying streetscape and backyard character were not at all important, or only slightly important, in the selection of their unit.

Low ADU

Medium ADU

High ADU

VI. FINDINGS

Methodology

Our project relied on two ways of looking at the survey response data. The first was with relatively straightforward summaries, analyzed in the previous chapter. It was through this process that we found overall trends: ADUs have a slightly positive perception in this area; residents are more likely to describe their neighborhood as crowded than not; residents are extremely likely to undercount the total number of units on their block.

While these results were helpful and informative, they do not provide enough information to compare against our hypothesis. In order to gauge whether ADUs have an impact on the perception of density, as well as to unearth any other hidden stories in our data, we used a second method: correlation. We created an extensive correlation table that calculates how likely the answer to any individual question will predict the responses for the other questions in the survey. This allows us to discuss effects and connections rather than just summaries, and in doing so, we discovered 6 important and interesting trends. While the six trends will be discussed below, the correlation table in its entirety may be found in the appendix.

ADUs + Density | Trend 1

Overall, the actual (not perceived) number of ADUs on a given block is a very poor indicator of how a respondent was likely to answer the rest of the questions on the survey. While respondents were not aware or informed of this number anywhere on the survey (or whether they live on a Low, Medium, or High ADU block), we coded the envelopes so that we could identify which of the six blocks the responses came from. This information was not included in the survey information so as not to influence the response to any question, and therefore lends a certain validity and honesty to this widespread lack of correlation. Therefore we can say with a reasonable degree of certainty that, in our study, the presence of ADUs has a negligible effect on whether they are perceived positively or negatively, where and whether a respondent is likely to support the construction of additional housing, or how they are likely to estimate the number of people or units on their block.

There is of course one exception to this trend, which was discussed in the previous section of this report: crowdedness. Respondents in the High ADU blocks where much more likely to describe their block as crowded, with a correlation of about 40%. As was discussed, however, we believe this to be an example of correlation without causation. That is to say, it is not the presence of the ADUs that is causing residents to perceive their block as crowded, but the presence of a third variable that happens to overlap with the High-Medium-Low division. The difference in the housing stock composition of

Block 6 is more likely to be responsible for the increased perception of crowdedness, in our opinion. This is because Block 5, which has a greater number of ADUs than Block 6 (11 versus 8), was much more similar to the other four blocks than it was to Block 6 in both housing stock composition and in perception of crowdedness.

While it is admittedly outside the threshold of statistical significance, the overall poor correlation between the presence of ADUs and the majority of the survey, indicates that our hypothesis may be correct. While the issue of crowdedness was an unexpected result, our research question and hypothesis place much greater emphasis on the fact that there was no correlation between the number of ADUs and the estimates of density (both in people and in units).

Although this is the question we initially set out to investigate, our survey results indicate five other important trends that contribute to the overall discussion about ADUs and density.

Renting vs. Owning |
Trend 2

While the presence of ADUs was a very weak indicator of how residents answered the survey, a resident's tenure status was by far the strongest indicator of the answers to other questions. In fact, we found correlations over 25% with tenure in over half of the survey questions. Not only does renting vs. owning predict how long a resident has lived in the area, or whether they live in an apartment building or a single family home, and parking habits, but it also correlates very strongly to issues of density.

Renters were 26% more likely to find ADUs as an unobtrusive way to provide more housing, and 38% less likely to believe that ADUs significantly disrupt the character of a neighborhood. Renters were 6%, 21%, and 40% more likely to support the construction of additional housing in the San Francisco Bay Area, in Berkeley, and in their neighborhood (respectively). In fact, while the overall mean of whether more housing should be built in their neighborhood was the most extreme at -1.2, renters alone had a net positive support for additional housing locally.

This trend actually becomes very important in our research when the demographics of survey respondents is compared with the Census data for the neighborhood as a whole. The Census indicates that about 58% of the area is comprised of renters, but only 12% of our survey respondents indicated that they were renters. Given the correlation between renting and positive views of ADUs as well as more housing in general, this vast underrepresentation of renters within our responses is likely to have skewed our survey results. However, since we've shown that even with an overrepresenation of home owners ADUs are still perceived positively, we think that an inclusion of more renters would only further strengthen the argument that ADUs are generally supported in this area and that they have very little effect on how density is perceived.

Parking is King | Trend 3

Another surprise within our survey results was a very strong correlation between parking habits and perceptions of crowdedness. Even including the outlier of Block 6 discussed earlier, whether a resident parks on the street or a private driveway / garage was the single largest indicator of how they perceive changes in crowdedness. People who rely exclusively on street parking were 41% less likely to describe parking as easy or sufficient, and were 44% more likely to believe that their block has gotten more crowded during their tenure.

While the survey again under-counted people who use alternate modes of transportation (walking, biking, public transit), parking is clearly a sensitive subject. This sensitivity comes even with the parking restrictions that are already in place with Berkeley's Residential Permit Parking program. Our research question and hypothesis didn't really address parking, this is clearly one the largest issues to overcome if the City is going to make changes to off-street parking requirements as part of the permitting process.

Minor Trends | Trends 4-6

While the above three trends describe the most significant findings of our research process, we found a few minor story lines that are still interesting and worth mentioning. The first of these (Trend 4), is that all of the Likert scale questions (Strongly Disagree, Disagree, Neither Disagree nor Agree...) have a strong correlation to each other. An earlier part of the report discussed how the answers to questions were inverted in order to convey neutrality, so that a supporter of ADUs would agree to some questions and disagree with others. The fact that these questions have a strong correlation with each other indicates that people were consistent in their answers and paid close attention to the inversions. This lends credibility to our findings as it shows we weren't misleading people into answering in a particular way.

Trend 5 appears as a correlation between the importance of streetscape character and backyard character in the selection of the unit. While this may be intuitive, it is interesting to note that in spite of their correlation to each other, their correlations to the rest of the survey are inverted, which is unusual. Another peculiarity is that people who indicated streetscape character was very important were more likely to find ADUs obtrusive and disruptive to the character of the neighborhood. This is in spite of the minor effect ADUs have on streetscape as most are completely eclipsed by the primary unit on the lot.

Lastly, Trend 6 in the correlation table shows that people who overestimated the population of their block where more likely to support additional housing regionally. Again, this is intuitive as they may perceive a greater need for housing for their larger perceived populations. However, this support for more housing regionally, still did not translate to an increased or net positive support for more local housing.

VII. CONCLUSION

Acknowledgments

Before concluding, we wanted to share some thoughts about our process. We would be remiss if we didn't mention, for example, some of the difficulties in researching Accessory Dwelling Units. Their potential benefit to provide additional housing without perceptible changes to the streetscape and neighborhood character was the greatest source of challenges in this study. A comprehensive list of ADUs has never been compiled by the City of Berkeley, so identifying their presence on our block was difficult and must be acknowledged as a potential source of error. However, by relying on and crosschecking between a combination of first-hand observations, satellite imagery and processing, and survey responses we are confident that we arrived that best possible estimates for where these units might be. However, even more certainty in identifying the location of ADUs would only add more credibility and significance to similar studies in the future.

A special thanks to Professor Peter Bosselman and GSI Patrick Haesloop for their continued support and guidance of our project, as well as to the City of Berkeley Planning Department for their assistance with our many questions and providing us with the most up-to-date GIS files (accessed at http://www.ci.Berkeley.ca.us/datacatalog/). Additional GIS files are courtesy of Professor John Radke (accessed at http://ced.Berkeley.edu/courses/sp13/cyplan204c/), with our satellite imagery downloaded from the USGS National Map Viewer (http://viewer.nationalmap.gov/viewer/).

Design Recommendations

Since the inspiration for undertaking this study originated with the conversations happening at the City level, we wanted to conclude by analyzing the effects of our results on the proposed recommendations. Overall, the net positive support for more Accessory Dwelling Units as well as the lack of correlation with changes in the perception of density would lead us to support policies that facilitate the permitting and approval process. We would urge the city to make significant efforts to reach out to renters in the community and bring their opinions into the conversation. We believe that a more accurate representation of the community within our survey responses would have shifted the perception of ADUs from slightly positive, to solidly beneficial.

We also wholeheartedly recommend policies that retroactively approve existing but undocumented Accessory Dwelling Units. In our study, we had no way of identifying which structures were built according to the proper procedures and which weren't, but this proves irrelevant in how they are perceived in regard to density. The real benefit to retroactive approvals would be the creation of a comprehensive database of the location of every ADU within the City. This would not only allow future studies to be more certain of their accuracy, but would also measure if any areas are approaching

saturation. While our study found no significant impact on the perception of density by ADUs, our highest block count was only 11. There may exist a threshold where ADUs do begin to affect perceptions of density, but this would be very difficult to figure out without keeping a good record.

The results of our study also lead to us to support most of the criteria identified in the proposed policies that would need to be met for expedited approval to occur. While we did not directly study parcel size, we found ADUs successfully nestled onto properties that range in size and shape. Our building roof-print and vegetation index research found that the blocks as a whole are well within the maximum coverages allowed by the R-2 and R-2A zoning. We would therefore also support the slight increase in flexibility for lot coverages that could be applied only towards ADUs and not towards enlarging the primary unit.

The only criteria recommendation we believe may need further review and community input is the easing of parking requirements for ADUs to be located within 0.25 miles of a transit stop or within a Residential Parking Permit (RPP) area. Despite our entire study are being located within a RPP zone, parking evoked the strongest responses and emotions. Many residents view their parking availability as completely saturated and we would expect them to be displeased by the idea of more residents but not more parking. While the use of automobiles is a larger societal issue increasingly questioned in the long run, having the facilitated permitting process for ADUs derailed by vocal opposition to the parking issue alone would be very unfortunate.

We look forward to hearing the City Council's dialogue on Accessory Dwelling Units as the policy proposals move forward. We hope that our Council members and planning officials are able to gather the community support needed, and that the near-invisibility of ADUs from the street can help convince skeptics.

APPENDIX

Complete Survey

Cover image courtesy of Green Journey Blog:
"October | 2010 | Green Journey." 2014. Accessed December 12.
https://greenpiece1.wordpress.com/2010/10/.

North Berkeley Neighborhood Street Study

Thank you for participating in this brief survey. This information will be used in a study of the quality of the quality of street life in your neighborhood that we are conducting through the University of California at Berkeley. Your identity will remain confidential.

Please answer each question listed below. It should take about 10 minutes to complete the whole questionnaire. Please mail this survey in the envelope provided.

If you have any questions, please do not hesitate to contact us at *NorthBerkeleySurvey@gmail.com*

Again, thanks for your help!

For the following questions, please check one answer that best describes your experience:

- Do you own or rent your current residence?
  - ☐ Own
  - ☐ Rent

- How long have you lived at your current address?
  - ☐ Less than 3 years
  - ☐ 3-5 years
  - ☐ 5-10 years
  - ☐ 10-20 years
  - ☐ More than 20 years

- How long do you think most people on your block have lived at their current address?
  - ☐ Less than 3 years
  - ☐ 3-5 years
  - ☐ 5-10 years
  - ☐ 10-20 years
  - ☐ More than 20 years

- How important was the character of **streetscape** in the selection of your residence? **Streetscape** is defined as the visual elements of a street (road, adjoining buildings, street furniture, trees and open spaces) that combine to form the street's character.
  - ☐ Not at all important
  - ☐ Somewhat important
  - ☐ Very important

- How important was the character of the unit's **backyard** in the selection of your residence?
  - ☐ Not at all important
  - ☐ Somewhat important
  - ☐ Very important

For the following questions, please quickly scan the list of adjectives provided and circle the words that best describe the qualities of the space. Do not worry about duplications or contradictions. Work quickly and select however many adjectives apply.

- Of the following list, which adjectives best describe the character of your block's **streetscape?**

active awesome bare barren beautiful big bleak boring bright brown bushy calm changing clean clear colorful colorless comfortable content dangerous dark dead dense depressing deserted desolate destroyed dirty drab dry dull empty eroded exciting expansive flat flowery forested fresh gloomy good gray green happy inspiring invigorating inviting isolated large lifeless living lonely lovely lush massive meadowy natural noisy old open peaceful plain pleasant pretty pure quiet refreshing relaxing remote rough rugged sad secluded secure serene shadowy shady sloping spacious tranquil tree-studded ugly unfriendly uninspiring uninteresting uninviting vast vegetated warm wooded

- Of the following list, which adjectives best describe the character of your unit's **backyard?**

active awesome bare barren beautiful big bleak boring bright brown bushy calm changing clean clear colorful colorless comfortable content dangerous dark dead dense depressing deserted desolate destroyed dirty drab dry dull empty eroded exciting expansive flat flowery forested fresh gloomy good gray green happy inspiring invigorating inviting isolated large lifeless living lonely lovely lush massive meadowy natural noisy old open peaceful plain pleasant pretty pure quiet refreshing relaxing remote rough rugged sad secluded secure serene shadowy shady sloping spacious tranquil tree-studded ugly unfriendly uninspiring uninteresting uninviting vast vegetated warm wooded

For the following questions, please check one answer that best describes your experience:

- Are you familiar with the term "**Accessory Dwelling Unit**" (ADU)**?** The term describes a secondary unit on a property that is **detached** from the primary residence.
  - ☐ Yes
  - ☐ No

- Is there an **ADU** on your lot of your current residence?
  - ☐ Yes, but I live in the primary unit
  - ☐ Yes, and I live in ADU
  - ☐ No
  - ☐ I do not wish to disclose this information

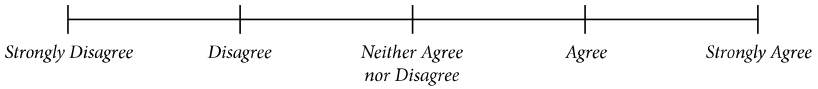
- Do any lots in your current neighborhood block contain ADUs?
  - ☐ Yes
  - ☐ No
  - ☐ I'm not sure

- How many **people** do you estimate live on your block? The numbers below represent approximate quantities.
  - ☐ 80
  - ☐ 120
  - ☐ 160
  - ☐ 200

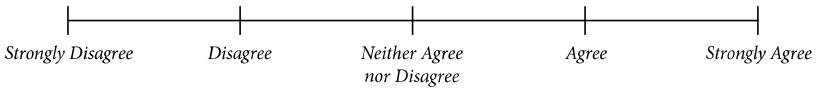
- How many **housing units** do you estimate exist on your block? The numbers below represent approximate quantities.
  - ☐ 15
  - ☐ 30
  - ☐ 45
  - ☐ 60

For the following questions, mark on the line your level of agreement or disagreement to the statements. The markings are indicated for reference only; you may mark your opinion anywhere on the provided line, either on, or in-between the markings.

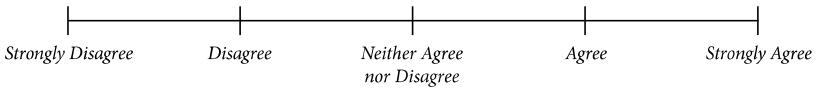
- Accessory Dwelling Units are an unobtrusive way to provide more housing in Berkeley.



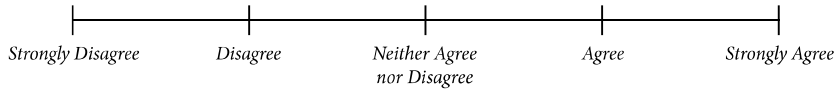
- Accessory Dwelling Units significantly disrupt the character of the neighborhood.



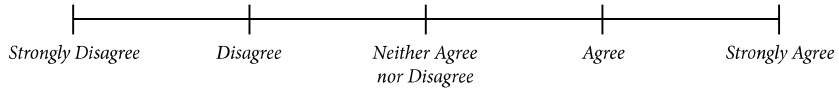
- More housing should be constructed in the greater San Francisco Bay Area.



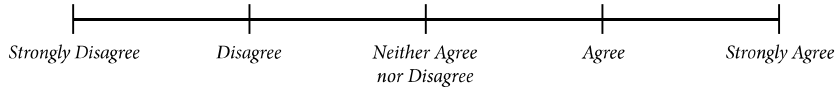
- More housing should be constructed within the City of Berkeley.



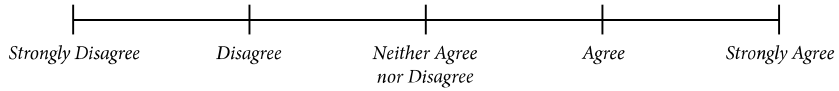
- More housing should be constructed in your neighborhood.



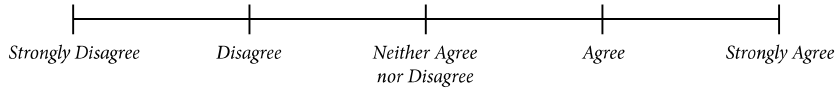
- You would describe your current block or neighborhood as **crowded**.



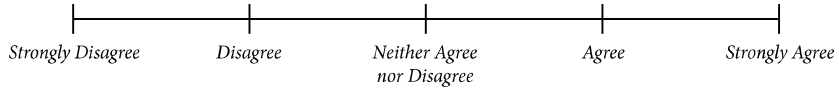
- Your block or neighborhood has become **more crowded** in the time you have lived there.



- It is easy to find street parking on your block.



- There is sufficient street parking on your block.



For the following questions, please check one answer that best describes your experience:

- Where do you usually park your vehicle(s)?
  - ☐ Primarily on the street
  - ☐ Primarily on a private driveway or garage
  - ☐ Both; one vehicle on the street and one vehicle on a private driveway or garage
  - ☐ I do not own a vehicle

- Reflecting on the pedestrian activity on your street, which answer best describes your opinion:
  - ☐ There are **far too many** pedestrians on my block
  - ☐ There are a **few too many** pedestrians on my block
  - ☐ There are **just the right amount** of pedestrians on my block
  - ☐ There are **not quite enough** pedestrians on my block
  - ☐ There are **not nearly enough** pedestrians on my block
  - ☐ I don't know or don't care

- Reflecting on the bicycle activity on your street, which answer best describes your opinion:
  - ☐ There are **far too many** bicyclists on my block
  - ☐ There are a **few too many** bicyclists on my block
  - ☐ There are **just the right amount** of bicyclists on my block
  - ☐ There are **not quite enough** bicyclists on my block
  - ☐ There are **not nearly enough** bicyclists on my block
  - ☐ I don't know or don't care

Thank you for completing this anonymous survey!

This information will be used in a study of the quality of the quality of street life in your neighborhood that we are conducting through the University of California at Berkeley. If you would like to see the results of this survey, please provide an email address below, or send us an email at *NorthBerkeleySurvey@gmail.com.* Please also contact us if you have any questions about the survey.

Again, thanks for your help!

If you wish to provide your email to receive the survey results, please provide it on the line below:

_____

(We will not share this email address or any of your answers with any third party)

Complete Correlation Table

	BLOCK NUMBER	LOW / MED / HI	BUILDING TYPE (#)	RENT /OWN	LENGTH OF RESIDENCE	NEIGHBOR LENGTH OF RESIDENCE	IMPORTANCE: STREETSCAPE	IMPORTANCE: BACKYARD	FAMILIAR WITH "ADU"?	ADU ON LOT (MULTIPLE ANSWER)	ADU ON LOT (YES/NO)	ADUs in NEIGHBORHOOD?	PEOPLE PER BLOCK (#)	UNITS PER BLOCK (#)
BLOCK NUMBER	100%	96%	-5%	9%	-30%	-5%	-2%	4%	0%	29%	27%	-21%	10%	-14%
LOW / MED / HI		100%	-4%	1%	-25%	-1%	-7%	-3%	0%	22%	22%	-18%	8%	-19%
BUILDING TYPE (#)			100%	**48%**	-18%	-20%	-13%	-23%	3%	-19%	-21%	18%	-31%	-16%
RENT/OWN				**100%**	**-32%**	**-35%**	**-28%**	**-37%**	-5%	**27%**	1%	17%	-14%	15%
LENGTH OF RESIDENCE					100%	19%	4%	-15%	10%	1%	-7%	-9%	-11%	-16%
NEIGHBOR LENGTH OF RESIDENCE						100%	26%	11%	1%	3%	19%	-8%	28%	-14%
IMPORTANCE: STREETSCAPE							100%	46%	8%	-12%	20%	-11%	**-7%**	**-26%**
IMPORTANCE: BACKYARD								100%	3%	-12%	17%	-13%	**23%**	**9%**
FAMILIAR WITH "ADU" ?									100%	12%	1%	-6%	8%	9%
ADU ON LOT (MULTIPLE ANSWER)										100%	95%	-23%	8%	6%
ADU ON LOT (YES/NO)											100%	-25%	22%	-4%
ADUs in NEIGHBORHOOD?												100%	22%	24%
PEOPLE PER BLOCK (#)													100%	52%
UNITS PER BLOCK (#)														100%
ADU = UNOBTRUSIVE?														
ADU DISRUPT CHARACTER														
MORE HOUSING SF														
MORE HOUSING BERK														
MORE HOUSING NEIGHB														
CROWDED?														
MORE CROWDED?														
EASY PARKING														
SUFFICIENT PARKING														
WHERE DO YOU PARK?														
PARK ON STREET? (Yes/No)														
PEDESTRIAN ACTIVITY														
BICYCLE ACTIVITY														

PEOPLE PER BLOCK (#)	UNITS PER BLOCK (#)	ADU = UNOBTRUSIVE	ADU DISRUPT CHARACTER	MORE HOUSING SF	MORE HOUSING BERK	MORE HOUSING NEIGHB	CROWDED	MORE CROWDED	EASY PARKING	SUFFICIENT PARKING	WHERE DO YOU PARK?	PARK ON STREET?	PEDESTRIAN ACTIVITY	BICYCLE ACTIVITY	
10%	-14%	**4%**	**-4%**	**-10%**	**-10%**	**-4%**	**40%**	**22%**	-6%	3%	-12%	-10%	-1%	-12%	BLOCK NUMBER
8%	-19%	**1%**	**4%**	**-16%**	**-16%**	**-10%**	**41%**	**21%**	0%	4%	-8%	-18%	6%	-10%	LOW / MED / HI
-31%	-16%	11%	-13%	11%	6%	7%	-13%	-7%	15%	17%	-9%	-9%	-4%	3%	BUILDING TYPE (#)
-14%	15%	**26%**	**-38%**	6%	**21%**	**40%**	-9%	**-31%**	11%	**27%**	18%	**-27%**	-13%	13%	RENT/OWN
-11%	-16%	-20%	24%	-8%	5%	-8%	14%	22%	-6%	-23%	-40%	22%	6%	9%	LENGTH OF RESIDENCE
28%	-14%	-12%	13%	4%	-3%	-32%	-19%	27%	2%	-10%	6%	3%	31%	-7%	NEIGHBOR LENGTH OF RESIDENCE
-7%	**-26%**	**-21%**	**24%**	-8%	-19%	-27%	-23%	18%	-3%	-20%	-16%	27%	-2%	-24%	IMPORTANCE: STREETSCAPE
23%	**9%**	**-4%**	**6%**	2%	-10%	-15%	-22%	8%	6%	8%	-21%	28%	2%	-15%	IMPORTANCE: BACKYARD
8%	9%	9%	-4%	-1%	8%	5%	-10%	-12%	4%	1%	3%	-10%	-19%	4%	FAMILIAR WITH "ADU" ?
8%	6%	8%	-18%	-9%	10%	9%	16%	-5%	-18%	-4%	15%	-16%	-4%	13%	ADU ON LOT (MULTIPLE ANSWER)
22%	-4%	2%	-7%	14%	-1%	-21%	11%	7%	1%	4%	16%	-12%	23%	-7%	ADU ON LOT (YES/NO)
22%	24%	6%	1%	13%	14%	10%	-28%	-28%	8%	6%	20%	-14%	1%	-6%	ADUs in NEIGHBORHOOD?
100%	52%	17%	-6%	**41%**	**33%**	**-6%**	-12%	7%	-29%	-15%	21%	11%	1%	0%	PEOPLE PER BLOCK (#)
	100%	21%	-30%	13%	16%	17%	-1%	-8%	-27%	-12%	21%	9%	0%	8%	UNITS PER BLOCK (#)
		100%	**-65%**	**48%**	**54%**	**66%**	**-29%**	**-30%**	0%	23%	10%	-29%	-30%	-12%	ADU = UNOBTRUSIVE?
			100%	**-33%**	**-49%**	**-56%**	**8%**	**34%**	-8%	-27%	0%	13%	38%	-1%	ADU DISRUPT CHARACTER
				100%	**85%**	**46%**	**-31%**	**-21%**	-1%	18%	2%	-5%	-14%	-20%	MORE HOUSING SF
					100%	**64%**	**-27%**	**-31%**	-4%	18%	-1%	-16%	-32%	-17%	MORE HOUSING BERK
						100%	**-11%**	**-39%**	-6%	13%	3%	-16%	-42%	-13%	MORE HOUSING NEIGHB
							100%	**36%**	**-25%**	**-35%**	**-11%**	**13%**	12%	9%	CROWDED?
								100%	**-38%**	**-36%**	**-18%**	**44%**	25%	-22%	MORE CROWDED?
									100%	**69%**	**-8%**	**-41%**	14%	-3%	EASY PARKING
										100%	**6%**	**-41%**	4%	13%	SUFFICIENT PARKING
											100%	**-45%**	16%	2%	WHERE DO YOU PARK?
												100%	-18%	-14%	PARK ON STREET? (Yes/No)
													100%	31%	PEDESTRIAN ACTIVITY
	match line													100%	BICYCLE ACTIVITY