



Cambridge Property Analysis

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Introduction

Background

Whether to buy a house is always a difficult decision to make. According to Ruffini (2022), Massachusetts, the home buying trends in 2022 remain consistent with the trends in 2011 and 2022. The total sales of the whole country have increased 8.5% because of the low mortgage rates. The Housing Statistics from National Association of Realtors (2019) shows that in Boston-Cambridge-Newton Metropolitan Area, the main home buyers are the people with the age from 25 to 44 (59.1%), three-people family (59.1%), whose income is between \$50K to \$150K (43%) and whose educational level is bachelor's degree or above.

Home price is one of the key factors when people considering buying a home. Bloomberg reported that the median price of previously owned, single-family homes reached new highs in 2020 (Tanzi, 2021). There are many factors which might influence the property's price, like the location, supply and demand, interests' rates, property market performance, population and demographics, size and facilities, renovation potential, investment potential etc. (Aoki, 2021). These factors are those buyers would consider when buying a home.

Purpose of this report

The purpose of this project is to provide information on the properties in Cambridge, Massachusetts U.S. mainly focusing on the single-family residence property class with a budget range of 700k to 1 million dollars. The analysis and data visualizations of this report are based on the Cambridge property data set provided by [City of Cambridge](#).

The original data set contains the 43 variables with 174,504 records of the properties in Cambridge. In this paper, we analyzed data and aim to answer below the questions:

1. *What kinds of properties are popular in the Cambridge area?*
2. *What is the sale trend of single-family residence property from the 1900s to 2010s?*
3. *Having a budget between 700k to 1 million dollars, what are the options for a Single-Family Residence property in Cambridge?*
4. *What are the overall conditions of the Single-Family Residence property in Cambridge by age?*
5. *Is there any difference regarding the parking availability of the single-family residence property by age?*
6. *Can single-family residence property defeat the cold, freezing weather in the Cambridge area?*

For the data cleaning part, we correct the variable types, remove the missing records for in the variables we selected and set the visualization range to exclude some obvious outliers that are recorded mistakenly, like the sale price equals zero, the coordinate values are (0,0) which is not in Cambridge, and etc.

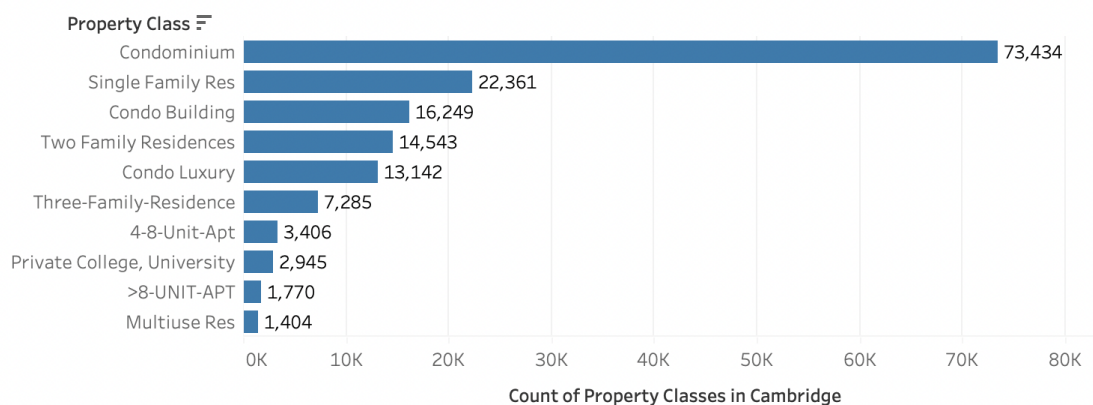
The variables we used to build the visualizations are as followed: <Property Class>, <Sales Date>, <Sales Price>, <Condition Year Built>, <Address>, <Interior Bedrooms>, <Interior Total Rooms>, <Interior Living Area>, and <Interior Full Baths>.

The visualization methods we chose to answer the questions are bar chart, time series chart, scatter map and text table.

Visualisations & Interpretations

1. What kinds of properties are popular in the Cambridge area?

Top 10 Property Classes



The above graph shows the top 10 property classes in Cambridge. The Condominium being the largest shareholder, following by single family residency and the least out of 10 is Multiuse residency. All the properties here are residential in nature except the university property which is not a surprise that the Cambridge area is indeed famous for living.

2. What are the sale and frequency trends of single-family homes from the 1900s to 2010s?

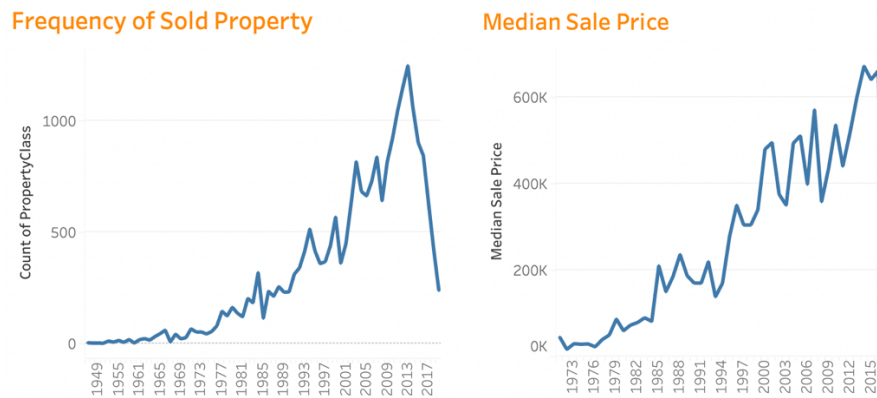


Figure 2: Single-family residence trends

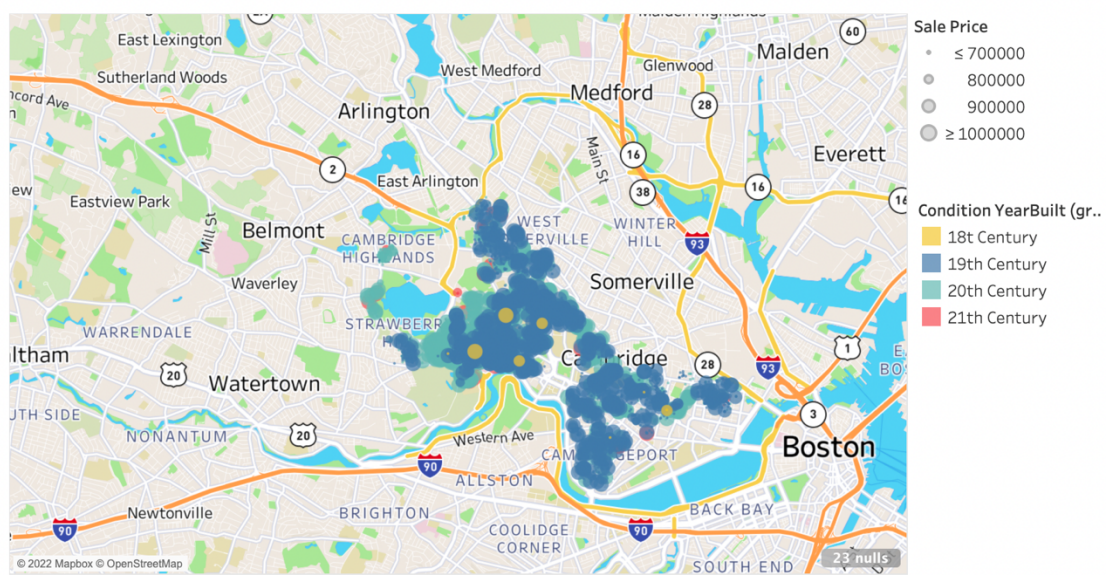
The single-family residences class is the top 2nd with 22,361 properties in Cambridge. To see the trend of this property class, we can click on the corresponding bar graph. For the general trend from the 1900s to the 2010s, the number of properties sold increased. Especially, it decreased in 2008 and sharply increased almost twice. Along with that, the general trend of the median sale price also increased but was very volatile and decreased in 2008. As the dataset consists of the information until 2013 only, thus the line fell to zero after that.

The line graph is the best choice to illustrate the changes during the given period. Line graph is also best used when the data is continuous or discrete across the period. The color combinations are very important as per the research done on the visualization aspect. Hence, we have chosen pastel blue lines, and grey labels which have softer look and easier for perception. While the color of the title is orange, making an accent to the graphs naming, and is paired with pastel colors.

3. Having a budget between 700k to 1 million dollars, what are the options for a Single-Family Residence property in Cambridge?

Looking at the dashboard the customer can look at the property class of interest information. In our case, the customer can choose the single-family residences class and see the map that will show the property with the sale price between 700k to 1 million dollars available in Cambridge. The tooltip of the map shows additional information regarding the property chosen, such as the sale price, year built, and the exact address.

Map of property price by centuries and classes



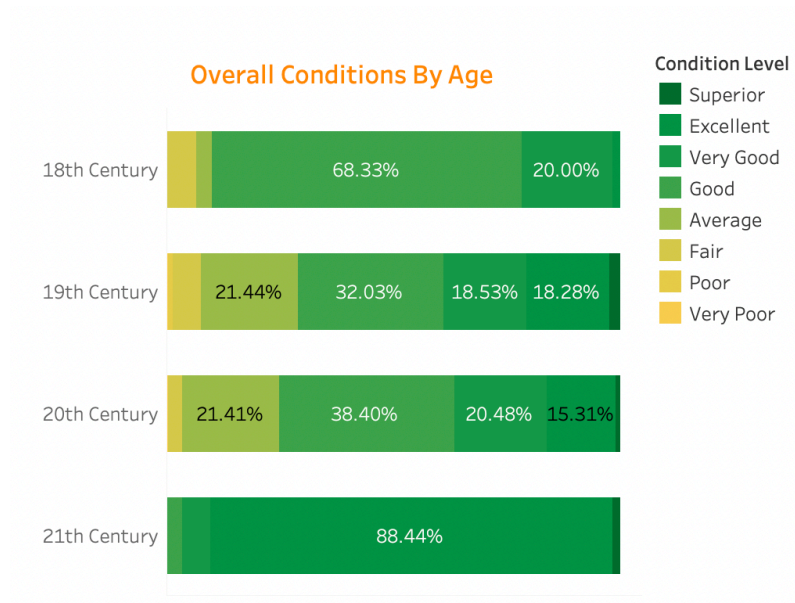
Property Details

PropertyClass	Avg. Interior Bedrooms	Avg. Interior TotalRooms	Avg. Interior FullBaths	Avg. Exterior NumStories	Avg. Interior LivingArea
SNGL-FAM-RES	4	8	2	2	2,159

The viewer can focus on the parameters they want. The table below shows the property details such as the average number of interior bedrooms, total rooms, full bathrooms, stories, and living area. Most of the properties are from the 19th and 20th centuries and are in the southwest part of Cambridge. The map background is chosen as a street which will help us to illustrate the property location on a map its neighborhood. The legend of a graph represents metrics of the Sale Price by the circle sizes, and Years built by colors. This is a presentation which includes 5 parameters in it and is a good source of information.

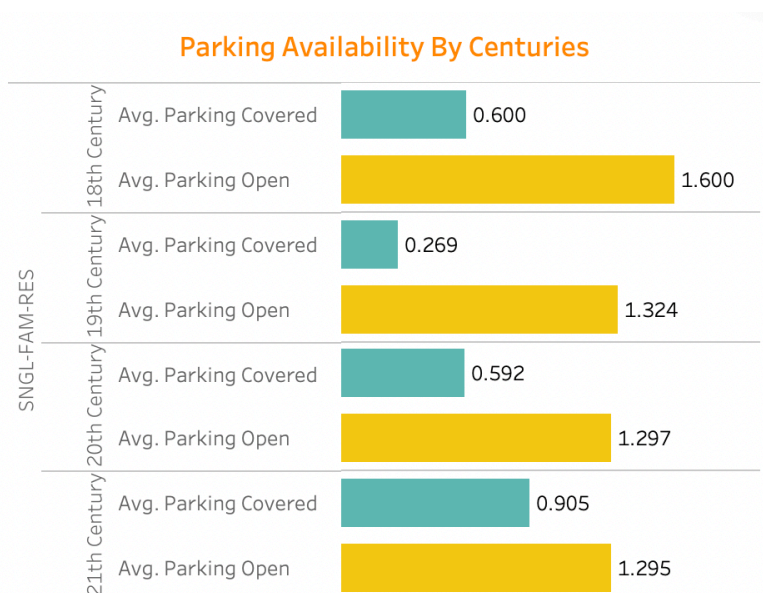
4. What are the overall conditions of the Single-Family Residence property in Cambridge by age?

From the figure below: The stacked bar charts are always summing to 100% with various divisions as per the conditions and their percentages can be displayed, therefore we have chosen to display the overall condition of single-family-residence properties by the year they built with proportion of “very poor” to “Superior”. In 19th and 20th century building, we see that more than 70% are in good condition, have relatively more proportion of “poor” to “fair” conditions. Whereas in 18th and 21st century we see that more than 88% condition of buildings are above good.



When considering buying a single-family-residence home in Cambridge, better choose the property built in 18th or 21st century with most of which are with good conditions or above.

5. Is there any difference regarding the parking availability of the single-family residence property by age?

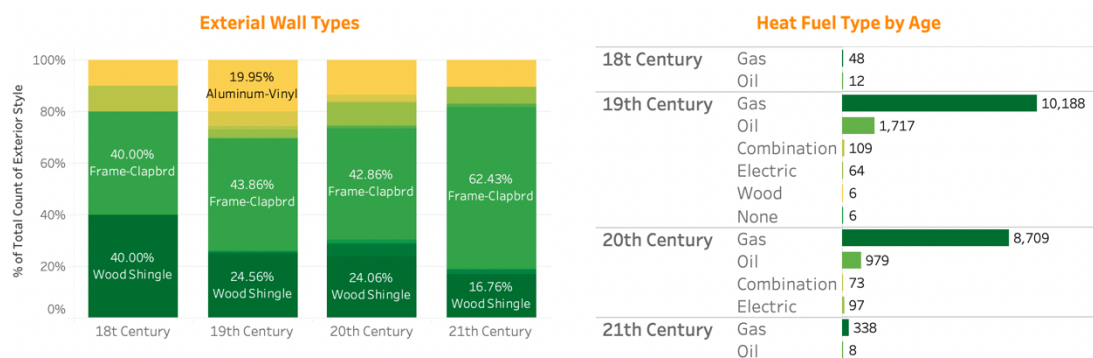


Average open parking space seems to be higher than the average covered parking space for single family residents across the centuries. Open parking space is reducing from 18th century and to 21st century and in the contrary, we see that covered parking space has got a rising trend except the 19th century. While the newest properties usually have covered building, as the average number of covered parking in the homes built in 21st century is nearly 1.

If you want to find a single-family-residence home with greater average parking choose those built in 21st century, or 18th century. If there aren't any preferences, we are good to choose any property as all have minimum 1 parking on an average.

Here we have different parking options across the centuries and to display the comparison between both options we felt horizontal bar chart can give the better picture than the other charts and display the information correctly. This would be easy for audience of the report to interpret and read.

6. Can the properties of single-family residence defeat the cold weather in Cambridge area?



First, we have made a cumulative bar / stacked chart of different kinds of external wall type based on proportion. There are majorly 6 types of external wall and among them the highest are wood shingle and frame clapboard. Furthermore, we may observe that proportion of wood shingle is in decreasing trend and proportion of frame clapboard is in the rising trend which indicates property building are using frame clapboard as external wall material.

Second, from the perspective of heating method, we used <count> function by group of centuries and made a bar chart of 5 types of heating methods. For single family type of property built in 18th and 21st centuries, the choice of heating is relatively limited: only gas and oil, where gas takes up the most proportion. For the properties built in the 19th and 20th, the heating method is more various: have additional electric and combination as heating fuel, but still, the gas heating also takes up the most proportion. Interesting thing is, in 19th century, there were 6 single-family properties built with wood as heating method, and they are the only properties with this heating method. On the other hand, there are 6 single-family properties without any heating method.

As a result, from both the graphs we can conclude that, the most single-family property in Cambridge area have heating methods indoor (only 6 out of 22362 are without any heating method), and the external walls of the most properties are capable to keep warm in the freezing weather of Cambridge area.

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What is data visualization? definition, examples, and learning resources. Tableau. (n.d.). Retrieved March 10, 2022, from <https://www.tableau.com/learn/articles/data-visualization>

Appendix

The Tableau Dashboard for the graphs above is uploaded in the assignment submission