

Toronto Apartment Building Conditions Can be Improved*

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04 Feb 2022

Abstract

Examining apartment building conditions are critical to ensuring the living conditions of residents. The city of Toronto evaluate each building based on the information collected in the dataset Apartment Building Registration. The paper examines the condition of Toronto apartment buildings through two aspects: safety and convenience. The results found that some areas can be improved.

1 Introduction

The conditions of apartment buildings directly relate to residents' well-being. Whether building owners did the maintenance can be examined through the overall condition of the buildings. Thus, it is important to check the buildings on a regular basis to ensure the safety and convenience of residents. All apartment buildings of Toronto are examined upon registration. The information will get updated each year when they renew their registration. All criteria and results of the study are documented in the dataset Apartment Building Registration.

This paper explores the dataset Apartment Building Registration to seek overall conditions of apartment buildings in Toronto. There are 3486 buildings recorded. Various aspects of the conditions are examined. The dataset contains 70 variables, including numerical, categorical and descriptive variables on buildings' facilities and the systems. The numeric and category variables are easy to analyze. However, the descriptive variables contains unique description of each building, which takes more time and effort to be summarized by data analytic tools.

The paper talks about the source of the data 2.1, the methodology 2.2, and data characteristics 2.3. To see the overall situation of Toronto apartment buildings, the paper explores the dataset through two aspects, safety and convenience. The safety aspect looks at the implementation of the sprinkler system, an approved fire safety plan and emergency power system. A third of buildings still do not have sprinklers and half of buildings do not have emergency power system. On the convenience side, half of the buildings do not have locker rooms or a storage space for residents. The average available parking spots for each building is less than 7. Eventhough the conditions are overall good, there is still space for improvement.

2 Data

2.1 Source

The name of the dataset is called the Apartment Building Registration. The data set was retrieved on The Toronto Open Data Portal through the R package opendatatoronto (Sharla Gelfand 2020). It is a free data portal accessible to the general public. The research was conducted under a by-law residential inspection program called RentSafeTO (RentSafeTO 2020). All information collected in the dataset was based on a formal criteria of how well building owners served operated. The criteria are defined by the sub-program called Apartment Building Standard program under the RentSafeTO. More information can be found on their website. The program aims to establish a new property standard in replacement of the old one, which was

*Code and data supporting this analysis is available at: <https://github.com/zzzhiyiliu/Paper1.git>

based on residents' complaints (Municipal Licensing and Standards 2016). The city of Toronto can monitor all buildings in a standardized format. All residential apartments with 3 or more storeys and 10 or more units in the system are required to be inspected. Thus, the samples in the dataset are all registered apartment buildings in Toronto. If the building owner refuse to participate in the inspection, their registration status in the system will not be renewed.

2.2 Methodology

Information was collected on the date of initial registration and updated when the building owners renew their registrations each year. The dataset is refreshed on a monthly basis. The time of update for each building is indicated in the dataset. The full dataset contains 3486 buildings (Apartment Building Registration, 2022). Each building is represented by an observation. Since the research provides building conditions from a wide range of aspects, the dataset contains 70 variables. Some variables are number of storeys, number of units, approved fire safety plan, annual fire alarm test records, bike parking, heating type, number of elevators, etc.

The software used to analyze the dataset is R studio, an open source statistical analyzing program (R Core Team 2020). In addition to the package Open data toronto, packages used are tidyverse (Wickham et al. 2019) and patchwork (Thomas Lin Pedersen 2020).

2.3 Data Characteristics

The variables in the dataset includes numbers, categories and descriptions. Number variables are in character form. Most categories are binary, in the form of 'YES' and 'NO'. Sometimes values within the same variable are not formatted in the same manner. Descriptive variables depict the space available in the building, which varies across different observations. Not to mention that the descriptive variables have the vast majority of values missing, which is hard to analyze.

The first few variables of the data set looks is shown below.

```
## # A tibble: 3,488 x 70
##   `id` AIR_CONDITIONING~ AMENITIES_AVAILAB~ ANNUAL_FIRE_ALA~ ANNUAL_FIRE_PUMP~
##   <int> <chr>           <chr>           <chr>           <chr>
## 1 93601 NONE            <NA>            YES            YES
## 2 93602 NONE            Indoor exercise r~ YES            YES
## 3 93603 NONE            <NA>            YES            NO
## 4 93604 NONE            Indoor recreation~ YES            YES
## 5 93605 NONE            Indoor pool , Ind~ YES            YES
## 6 93606 NONE            <NA>            YES            YES
## 7 93607 CENTRAL AIR      Indoor recreation~ YES            YES
## 8 93608 NONE            <NA>            YES            YES
## 9 93609 NONE            <NA>            YES            NO
## 10 93610 NONE           <NA>            YES            YES
## # ... with 3,478 more rows, and 65 more variables:
## #   APPROVED_FIRE_SAFETY_PLAN <chr>, BALCONIES <chr>,
## #   BARRIER_FREE_ACCESSIBILTY_ENTR <chr>, BIKE_PARKING <chr>,
## #   CONFIRMED_STOREYS <int>, CONFIRMED_UNITS <int>,
## #   DATE_OF_LAST_INSPECTION_BY_TSSA <chr>,
## #   DESCRIPTION_OF_CHILD_PLAY_AREA <chr>,
## #   DESCRIPTION_OF_INDOOR_EXERCISE_ROOM <chr>, ...
```

The data has several strength. Since the information was collected by a mandatory program by the government, all registered buildings are required to do the assessment. The sample used by the dataset is a close representation, if not all, of the population. The information is also up-to-date due to the yearly renewal policy. The Open Data Toronto portal provides free-access dataset, as mentioned before. It makes replicating this paper more feasible. It contribute to the reproducible factor. More specifically about the dataset itself, the source has a wide range of aspects. It gives a holistic view of the building conditions in Toronto.

Upon closer inspection, the source has a few weaknesses. Given that the dataset is collected by the government, the primary source is very hard to replicate. In other words, we cannot easily conduct the research again to verify the conditions of every building. Moreover, some numeric variables are in character form. There are few variables with empty values for all observations. For instance, the variable NO_OF_UNITS is empty. Another variable CONFIRMED_UNITS has values in it. Assuming the two are indicating the same thing, NO_OF_UNITS would be extra in the dataset.

In this project, two dimensions of the conditions will be examined, safety and convenience. For the safety of the building, we will look at the sprinkler, fire safety and emergency power system. The locker storage room, laundry rooms and number of parking spaces will determine the convenience aspect of the building.

3486 buildings have both right-skewed distribution in number of storeys and units. There are more buildings that have less storeys and units that are below the average. The average numbers are presented with the blue line in the appendix. On average, apartment buildings have 7.79 floors and 90.48 units in total (Appendix 1 & 2). In other words, there are less taller buildings and densely packed buildings.

2.4 Safety Conditions

First, we look at the safety conditions of those observations. Since the dataset has 70 variables, it would be impossible to examine all 70 given limited time and resources. For this reason, three variables from the safety criteria will be chosen based on intuition. The purpose of the section is to see the implement rate of those safety systems.

Sprinkler system, a categorical variable contains information on whether the building has installed sprinklers in case of fire emergency. The results is shown below in figure 1.

Figure 1: Frequency of Sprinkler System in Toronto Buildings

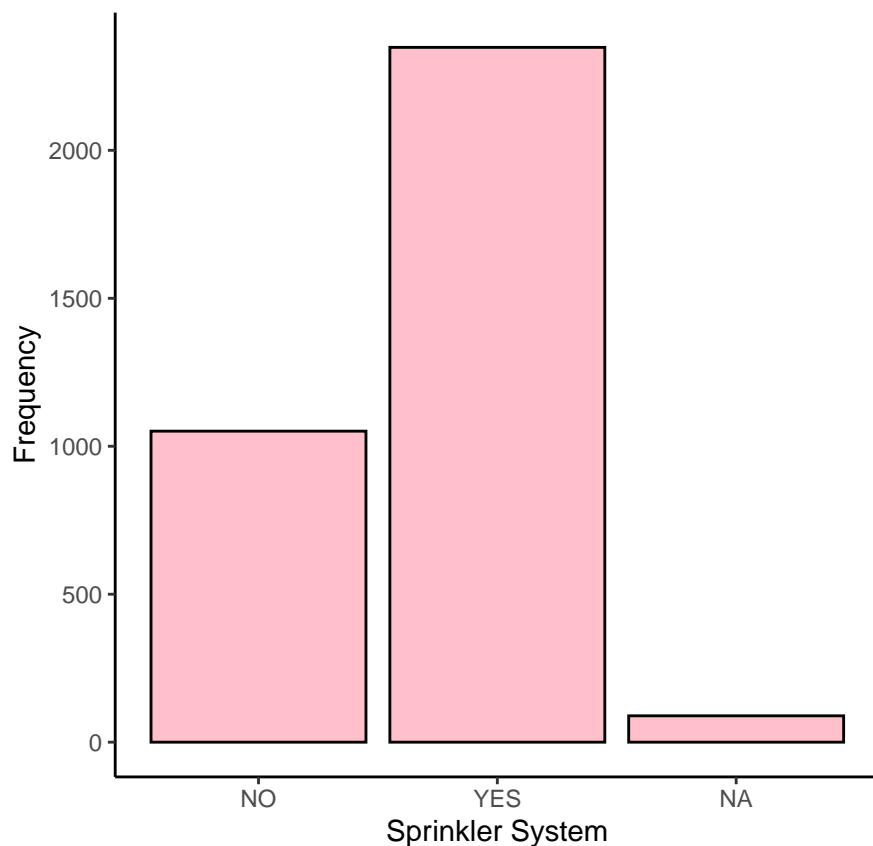


Figure 2: Frequency of Spaces in Toronto Buildings

	Sprinkler System	Approved Fire Safety Plan	Emergency Power
YES	2347	3311	1451
NO	1052	89	1951
N/A	87	86	84

We see that almost buildings have approved fire safety plan by the program (Figure 2). Only 89 buildings need improvement on implementing a safer plan in case of fire emergency. With that being said, 86 buildings have not reported the conditions. On the other hand, a third of buildings does not have a sprinkler system that can detect smoke. Surprisingly, more than half of the buildings does not have emergency back up power system.

According to the three variables studies, buildings are in good conditions but still have spaces for improvement. The 89 buildings that did not pass the fire safety plan should implement alternative plans to ensure the safety of residents.

Assuming safety standards of buildings becomes higher as time progresses, we can examine the year which the building was built. We can see whether if older buildings are equipped with less safety systems. The data suggest the interquartile range of the year built is between 1955 and 1970.

Figure 3: Histogram of Year of Apartment Buildings Built

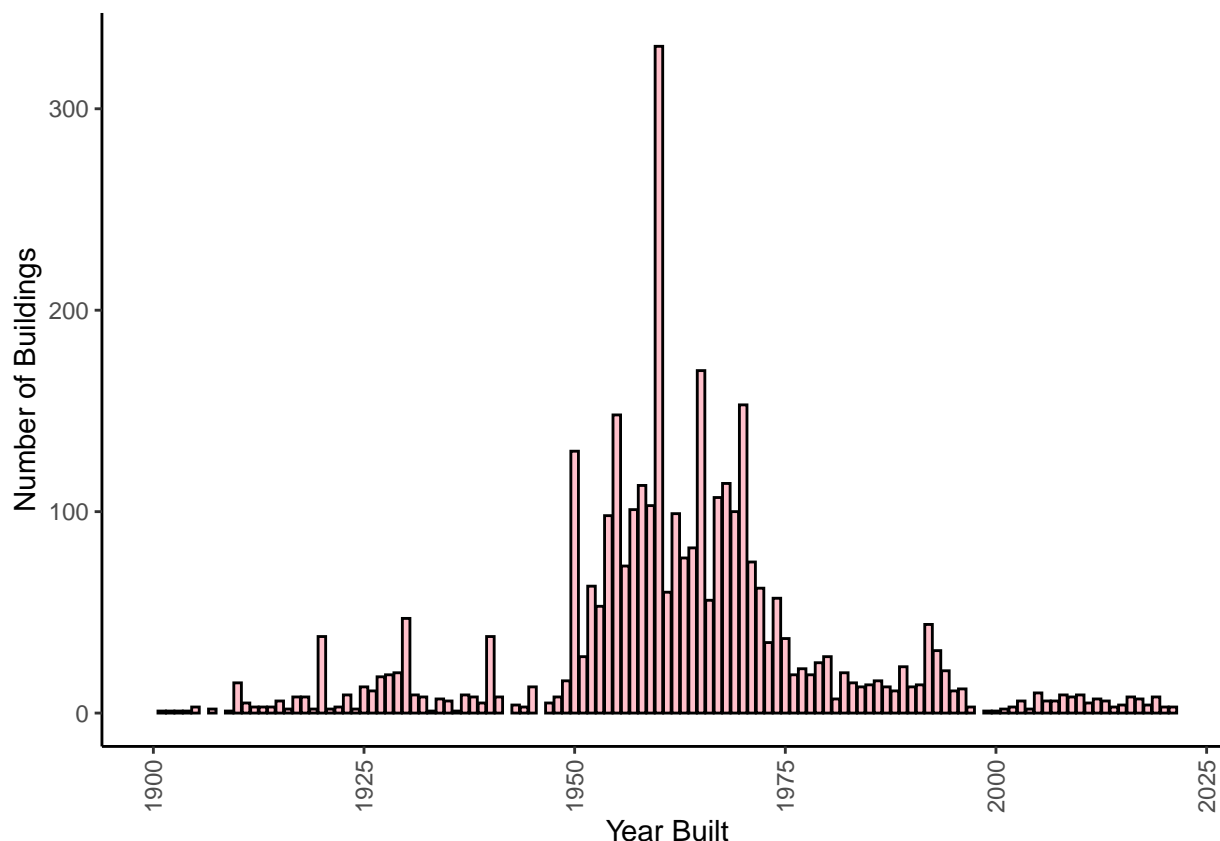


Figure 4: Summary of Years of Apartment Buildings Built

Min	Q1	Median	Mean	Q3	Max
1805	1995	1962	1962	1970	2021

Figure 5: Relationship of Age of Buildings and Sprinkler System



The relationship between sprinkler system installation and the age of the building is shown in figure 5. As we can see, most recently built apartments have the sprinklers. It is very rare to see buildings without sprinklers built in recent years. However, it does not suggest that older buildings tend to have less sprinklers installation rate.

2.5 Convenience

The second dimension measured is the convenience of the buildings. The original intention was to analyze the amenities available in the buildings. The amenities are recorded by lists of amenities in the building. My ability of organizing the answers are limited. Perhaps more skillful statistician can further examine that category. Thus, for this project, we will look at other available functional areas in the building.

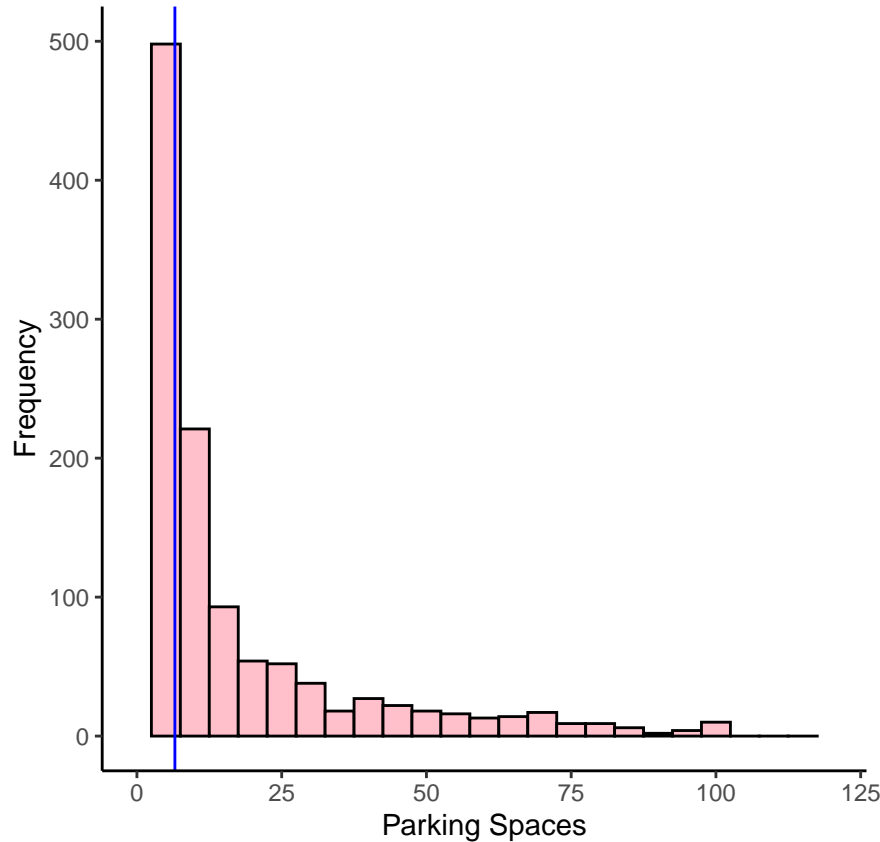
Figure 6: Frequency of Common Spaces in Toronto Buildings

	Storage Rooms	Laundry Rooms
YES	1930	3289
NO	1468	112
N/A	88	85

Most Buildings have laundry rooms, only 112 buildings does not, with 85 not available observations. This does not include the case that each unit is equipped with a laundry machine. In this case, it should be more convenient for the residents to use their own machine. Overall speaking, most buildings have laundry rooms. Moreover, half of the buildings does not have storage or locker rooms in the building. Depending on the space available around the neighborhood, residents might not have that much free space for residents to store belongings (Figure 6).

Furthermore, we examine the available parking spaces of the buildings. We see that half of the buildings have less than 6.559 parking spots available in each building.

Figure 7: Frequency of Number of Parking Spaces



The Pearson's correlation test was used to determine whether the number of parking spaces is related with the total number of units in the building. The result shows that the correlation coefficient is 0.0029. They are almost not correlated (Figure 8).

Figure 8: Pearson's Correlation Coefficient Analysis Table

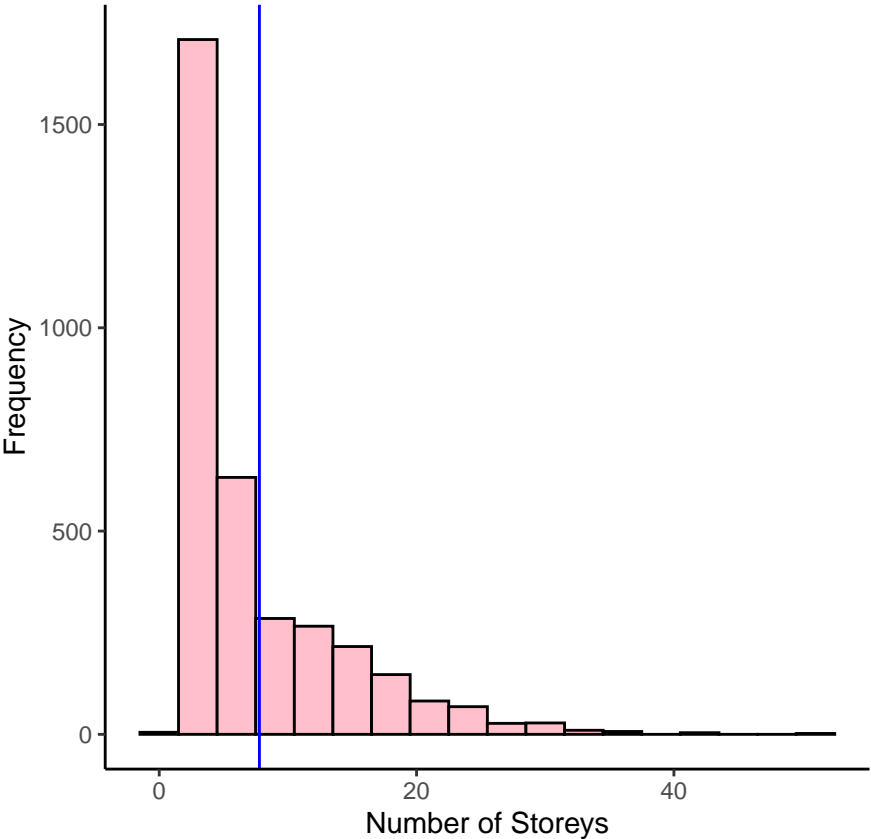
	r	Test-statistics t	Degree of Freedom df
Result	0.229	0.16808	3360

Given that the average units of each building is 90 and the parking spaces available is 6.559, there is insufficient parking spots in the buildings of Toronto.

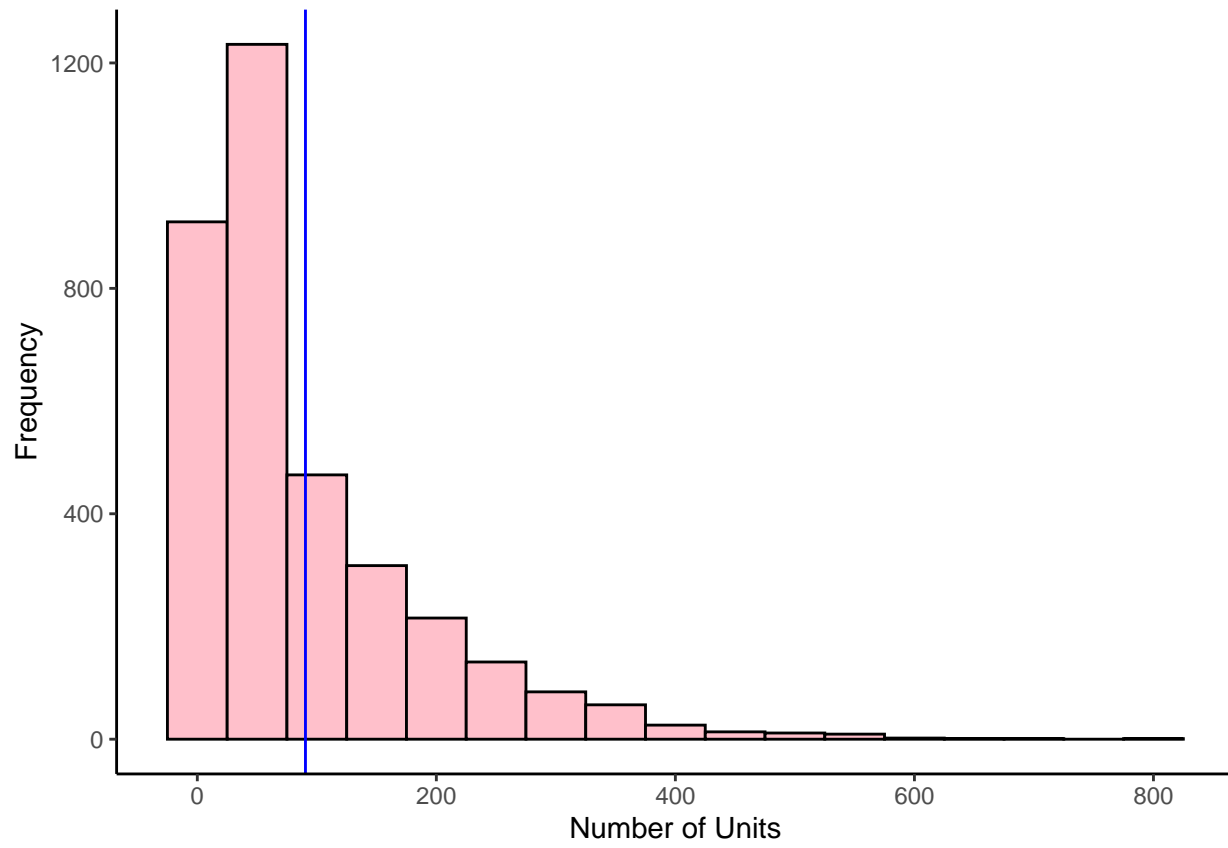
The dataset contains more information on the safety and convenience aspects of the buildings. The paper only discuss a few due to limitations. The overall condition through the examined variables show that toronto buildings need some minor improvements on areas such as sprinkler systems, emergency power, more storage rooms and more parking spaces.

Appendix

Appendix 1: Toronto Building Number of Confirmed Storeys



Appendix 2: Toronto Building Number of Confirmed Units



A References

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