VISUALIZAITON AND ANALYSIS
OF FIRE ACCIDNETS
IN TORONTO

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CONTENT

Introduction

Fire accidents lead to property damage and even worse, cause loss of lives. However, by investigating causes of fire accidents and detecting current deficiency of the fire control system, prevention actions could be taken. Thus, lives could be saved, and property damage could be decreased.

This report focuses on fire accident defined by the Ontario Fire Marshal in Toronto. The dataset originates from Open Data Toronto , which could be accessed via this link: https://open.toronto.ca/dataset/fire-incidents/.This dataset provides detailed information about the building status, the condition of fire-safety facilities, the impact of the accidents and etc.

The main questions to investigate in this report are as following:

- The frequency and severity of loss caused by fire accidents in each district in Toronto.
- The causes of fire
- The situation of fire alarm system in buildings that have fire accidents
- The situation of sprinkler system in buildings that have fire accidents
- The methods of control of the fire accidents

Data Preparation

The dataset provides information of fire accidents by ward of Toronto. The ward code complies with the 44-Ward Model that was implemented during 2014 to 2018.

In order to depict the boundaries of the 44 ward of Toronto, ward profiles dataset that states geographic information was also used. Detailed information could be accessed via this link: https://www.toronto.ca/city-government/data-research-maps/neighbourhoods-communities/ward-profiles/44-ward-model/.

Due to the need the of same values for joining two tables, the ward code and district name were extracted respectively from ward profiles dataset. The column Incident Code from the Fire Accident dataset the column Ward Code from the 44 Ward dataset were joined to get one table.

The dataset has 19 dimensions of possible causes of fire accidents. For clarity purpose, possible causes were categorized into 10 groups, ranging from unintentional causes to fire caused by certain factors.

Visualizations

The visualization contains two dashboards. The first dashboard *Accidents Overview by District of Toronto* provides information about the frequency and severity of loss of fire accidents in each district in Toronto. The second dashboard *Factors Lead to Fire Accident in Toronto* explains the condition of fire alarm system and sprinkler system, the causes of fire and the method of control.

Dashboard 1: Accidents Overview by District of Toronto
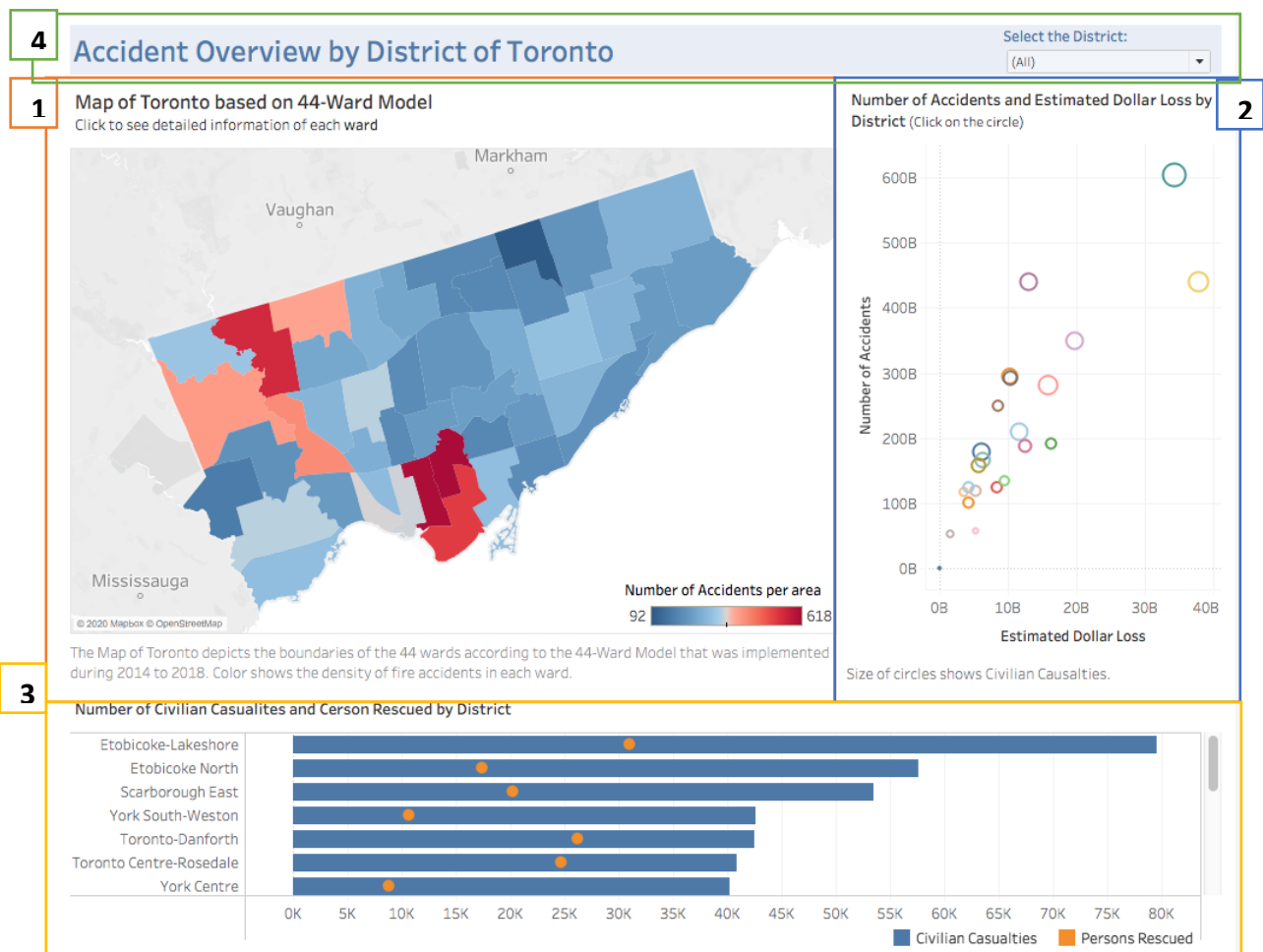
Components of Dashboard 1

The first dashboard consists mainly four parts: title, map of Toronto by ward, a circle plot and a bar plot.

1. The map of Toronto depict the boundaries of the 44 wards according to the 44-Ward Model that was implemented during 2014 to 2018. Color shows the

number of fire accidents in each ward per area. Information of ward could be accessed by hovering on the ward.

2. The X axis and Y axis for the circle plot are estimated dollar loss and number of fire accidents respectively. Size shows number of civilian casualties. Each circle represents a district.

3. The bar plot dedicated to give personnel information. The blue bar in bar plot shows number of civilian casualties and the orange circle gives number of persons rescued in selected District.

4. The name of the dashboard is Accident Overview by District as shown on the title. On the right corner of the dashboard, there is a filter, which allows to choose one or multiple district. Once the districts are selected, the whole dashboard will only show the information about those districts.

Insights from Dashboard 1

As the map of Toronto shows, the top three districts with highest density of fire accidents are: Toronto Centre-Rosedale, Trinity-Spadina, and York West. Etobicoke-Lakeshore is the most severe district, since it has the highest frequency and the highest number of civilian casualties. Etobicoke North is another district that requires more, as it had the highest estimated loss from the fire accidents.

Dashboard 2: Factors Lead to Fire Accidents in Toronto
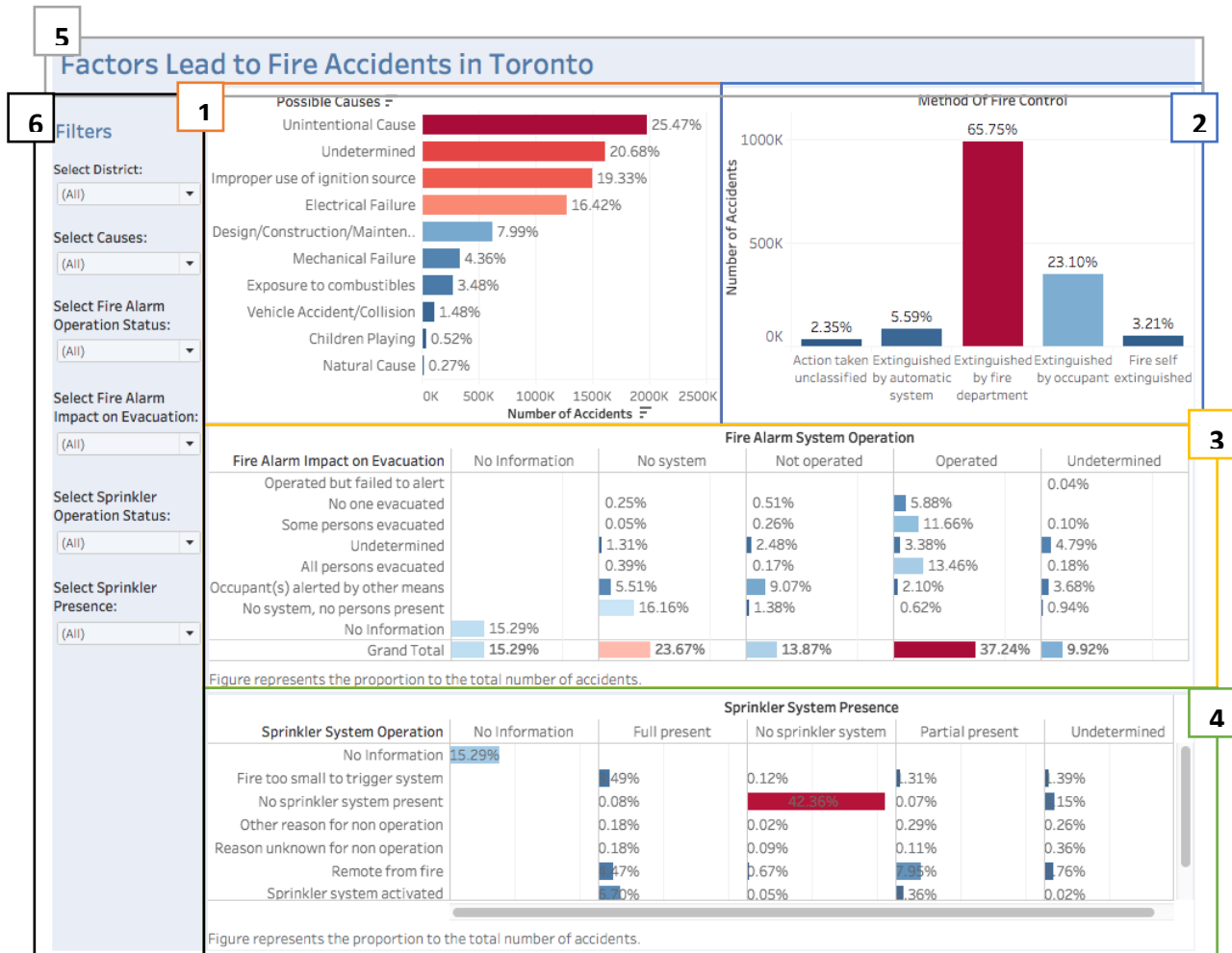
Components of Dashboard 2

The second dashboard consists four bar charts, the navigation part, and the title part.

1. The bar chart in the top left corner stands for the proportion of fire accidents causing by different reasons. The x axis is the number of accidents and the label is the percent in total. There are in total 10 different possible causes.

2. This part gives information about the distribution of how fires have been controlled. Each bar represents the number of accidents that were controlled by certain method.

3. The column is the situation of the fire alarm system operation. The row is the situation of the fire alarm system impact on evacuation. The figure and color represent the proportion of number of accidents of the total accidents. The purpose of this plot is to exam the relationship between the situation of fire alarm system and the number of accidents happened.

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4. The column is the situation of the sprinkler system presence. The row is the situation of the sprinkler system operation. The figure and color represent the proportion of number of accidents of the total accidents. The purpose of this plot is to exam the relationship between the situation of sprinkler system and the number of accidents happened.

5. The name of the dashboard is Reasons of Fire Accidents as shown on the title.

6. On the left of the dashboard, there is a navigation bar for the audience to interact with the data. The audience could select on the districts they would like to see and investigate the factors that may lead to fire accidents, including the possible causes, the fire alarm system and the sprinkler system. The audience could also choice the methods of how fires were controlled.

Insights from Dashboard 2

Among the 10 possible causes, the top three causes: Unintentional Cause, Undetermined Causes, and Improper Use of Ignition Source account for nearly 2/3 of the total accidents. An astonishing finding is that about 40% of the buildings do not have operated fire alarm systems and only 15% of the buildings have sprinkler system.

Findings Across Dashboards

The top three districts that require most attention are *Etobicoke-Lakeshore, Etobicoke North and Toronto Centre-Rosedale*, as they have the highest frequency of fire accidents and the highest severity of loss in terms of boss economical and personnel. When investigated further on the factors that may lead to the fire in these three districts (select Etobicoke-Lakeshore, Etobicoke North and Toronto Centre-Rosedale in Filters on the second dashboard), it not hard to find out that approximately 45% of the fire accidents are caused by unintentional causes and improper use of ignition source. Among all the fire accidents happened in the three districts, only 7% of them are extinguished by automatic system.

Of all the fire accidents in all district, only 84,112 (5.59%) are extinguished by automatic system. However, when there is a fire alarm system operating (select *Operated* in Filters of Fire Alarm System Operation Status on the second dashboard), the rate of fire accidents extinguished by automatic system more than doubled. When there is a Sprinkler System Presence (select *Full present* in Filters of *Sprinkler System Presence* on the second dashboard), that rate increased significantly to 34.14%.