**Sales potential estimation**

The map below shows the northern part of the City of Toronto. This area is served by 4 regional shopping centers. (Figure 1.2.1) In this section, the sales potential in Census Tract 535,266 for Yorkdale Shopping Centre was calculated using the Huff model.

Diagram, engineering drawing

Description automatically generated

Figure 1.2.2 Location of four shopping centers in the northern part of Toronto

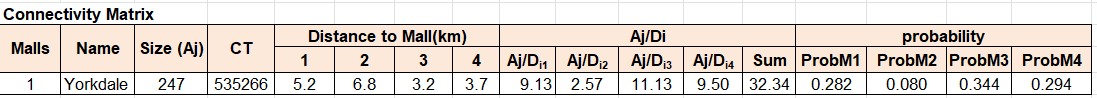
Probability can be calculated using the original Huff formula,

Text, letter

Description automatically generated

Initially, the probability was calculated for all the four malls (Table 1.2.1)

**Table 1.2.1 Calculation of probabilities for the four Malls**



Using Table 1.2.1 the Probability of the Yorkdale Mall = 9.13/32.34 =0.282

Now the sales potential can be calculated as,

Sales Potential = No. of HH \* average HH income\* % of income spent on consumer goods\*Probability

For the census tract 535,266

No. of households= 945

Average household income =$188,855

Percentage of income spent on household goods = 15% (based on a customer survey.

The exponent to the distance, λ is assumed as 2.

So, the Sales potential = 945 \* 188855\* 0.15\* 0.282

= $7,562,108

= **7.56 $ million**

**Study on the impact of trade area of the malls due to the addition of Vaughan Mills Mall**

This section examines how the introduction of another mall affects the retail environment in the Toronto Census Metropolitan Area. The study assesses how the inclusion of Vaughan Mills Mall influences the trading regions of established shopping centers such as Promenade, Yorkdale, and Square One. The Huff model was used to define the trading area**.**

Map

Description automatically generated



**Figure 1.3.1 location of Thirteen regional shopping centers in the Toronto CMA**

The trade area of the said malls was delineated using the Huff model. For this purpose, an already created Huff model geoprocessing toolset was used in the ArcGIS environment.

A list of regional shopping centers with center attributes (Table 1.3.1) and the CT-level census data for the Toronto CMA was used to run the model. The tool calculated the distance between the centroid of each CT and each shopping center.

**Table 1.3.1 Thirteen regional shopping centers in the Toronto CMA**



Initially, a composite "attractiveness" variable was generated by considering the floor space, number of stores, number of fashion stores, and number of department stores.

Each variable was standardized using the Min score method, and the new composite variable was calculated in the automated tool.

**Attractiveness = (floor space \* weight) + (number of stores \*weight) + (number of fashion stores \*weight) + (Number of department stores \*weight)**

The specified weights are used to input the variables to compute the composite attractiveness index.

Floor space -2 (medium value, as it decides the number of stores)

Number of stores - 3 (higher value, as this attracts more shoppers)

Number of fashion stores -2.5 (Fashion retailers occupy most of the Malls, and it is one of the main reasons people visit Malls to shop at these stores)

Department stores -1 (Low value, as people may tend to shop at their nearby mainstream supermarkets rather than visiting a mall. Only people who plan a multipurpose visit shop in the Mall Department stores)

Subsequently, the Huff model was employed using the automated tool and the probabilities for all three malls before and after the addition of the Vaughan Mills mall were recorded. The trade areas were classified into primary and secondary based on their probabilities, with census tracts having a probability greater than 0.6 considered primary trade areas and those with a probability between 0.4 and 0.6 classified as secondary trade areas (Figure 1.3.2, 1.3.3 and 1.3.4)

Chart

Description automatically generated

**Figure 1.3.2 Primary and Secondary Trade Area of Yorkdale Shopping Centre**

**Chart

Description automatically generated**

**Figure 1.3.3 Primary and Secondary Trade Area of Promenade Mall**

**Chart, radar chart

Description automatically generated**

**Figure 1.3.4 Primary and Secondary Trade Area of Square One Shopping Centre**

The sales potential in each trade area is calculated (Table 1.3.1) using the following formula:

Sales Potential = (number of census families \* average family income \* percent of family income spent on goods-services purchased in the mall \* probability)

The percentage of family income spent on goods-services purchased in the mall is assumed as 20%.

**Table 1.3.1 Impact of Vaughan Mills Mall on Yorkdale, Promenade and Square One shopping malls.**



The sales potential of the Promenade Mall has experienced the most significant impact compared to the other two malls. This decrease may be due to its proximity to the Vaughan Mills Mall.

In this scenario, the "Attractiveness” of a mall was determined by evaluating its floor area, number of stores, number of fashion outlets, and number of department stores. To enhance the model, additional factors such as the number of available parking spots and the mall's transit score could be considered. More parking spaces may attract shoppers from further away, and if the mall is accessible by public transportation, it may also draw in customers who don't have a vehicle.

**Site Selection and Trade Area Analysis Using Location-Allocation Modeling**

The presented study is a hypothetical case wherein a retail company plans to establish five (5) supermarkets within the city of Brampton. The Location-Allocation method is employed to aid in selecting suitable sites, to maximize service to the local populace or minimize the total weighted travel distance. To achieve this objective, two models, namely Max Cover and Min Distance, are utilized. The Max Cover model is designed to identify sites that can serve the maximum demand with a pre-defined number of potential sites, while the Min Distance model is used to determine locations that minimize the total weighted distance travelled from the demand points to the proposed supermarket sites.

The ArcGIS Network Analyst extension was employed to create and evaluate the two models using the data provided.

1. 2016 census: centroids of 2006 census tract (points of demand)

2. land use information: centroids of commercial land use (points of supply), and size of the land use candidates (site screening)

3. Brampton Road network

4. 2016 Census tract boundaries with census data.

The first step involved creating a network environment using the Brampton Road network shapefile, followed by configuring the parameters and allocating the demand points.

First, a maximum coverage model was created with commercial land parcels greater than 100,000 sq. ft as the facilities and the centroid of the Census tracts in Brampton as demand points. (*It is assumed that demand or population in the census tract is concentrated at that one location***)** with the number of households in each census tract as weight. Subsequently, a minimum impedance model was run to select five locations with a maximum distance a customer to travel in 10 minutes. The Max Cover and Min Distance models selected the same five sites with the same trade area, as depicted in Figure 8.

Diagram

Description automatically generated Diagram

Description automatically generated

**Figure 2.8 Chosen five facilities and the location of demand.**

A new layer called "lines" was created to connect the chosen facilities to the demand points, which created a spider-web pattern.  The locations were derived from the facilities output table, and the allocation of Census tracts to each site was determined using the attribute table of the demand points layer. Using this data, the trade area for each of the five chosen sites was delineated (Figure 2.9), and site statistics were tabulated (Table 2.1).

Chart, map

Description automatically generated

**Figure 2. 9 Trade area delineation of the selected five sites**

The Survey of Household Spending discovered that households in the Toronto Census Metropolitan Area (CMA) spend an average of 9 percent of their gross income on groceries and convenience items that are typically sold in a supermarket[2.3]. In location-allocation models, the probability is 1, since they take a deterministic or monopolistic approach to trade area delineation, which does not impact the calculation of sales potential. (Wang and Du, 2020). Therefore, the formula for estimating sales potential is,

**Sales potential = Sales potential = Number of households x Average household income x percentage of expenditure on groceries and household goods.**

Out of the 98 census tracts that encompass 95% of Brampton's population and households, only four tracts were excluded from the trade area of the five sites. Based on the table calculations, sites number 8 and 50 show a high sales potential of over 400 million dollars, while sites number 252, 137, and 22 have the next highest sales potentials of 236, 193, and 153 million dollars respectively.



**Table 2.2 Trade area characteristics of the five selected sites**

**Evaluating the five sites by considering competition, accessibility, and visibility**

**Competition analysis**

In order to accurately predict the sales potential of the five selected trade areas, it is necessary to conduct a competition analysis that takes into account the possibility of competitors diverting customers. This analysis involves identifying competitors operating in the same trade area. The locations of existing supermarkets in Brampton are gathered using OpenStreetMap and the Overpass Turbo application, and the competitor locations are plotted on a map. Competitors situated within 1, 2.5, and 5 kilometers from the five optimal sites are identified and examined, including full-line supermarkets run by major retail chains such as Metro and Sobeys, independent supermarkets, and ethnic grocery stores. (Figure 2.10 and Table 2.2).

Map

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**Figure 2.10 Existing supermarkets in Brampton**

**Table2.2 Trade area characteristics of the five selected sites**



The two mainstream supermarkets within a 2.5 km radius of high sales potential sites 8 and 50 indicate that major retailers carefully selected these sites for their maximum potential. Sobey’s store is located in the same location as of 8. Although several ethnic stores are present within a 5 km radius, a detailed site investigation is necessary to assess their impact as competitors. Site number 252 has only one mainstream store, No Frills, within a 2.5 km radius, but there are ten mainstream supermarkets within a 5 km radius.

**Accessibility**

If the store is more accessible, **more people can potentially buy from it**. Hence it is worth studying if these locations are easily accessible and at major road intersections. The site conditions of the five sites are evaluated (Table 2.3)

**Table 2.3 Major intersection of the chosen sites**



To evaluate the site conditions, OpenStreetMap was utilized. Screenshots displaying the selected locations and their surrounding areas are provided (Figure 2.11, 2.12, 2.13, 2.14 and 2.15)

Engineering drawing, map

Description automatically generated



**8**

**Figure 2.11 Site 8**

Map

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**Figure 2.12 Site 22**

Map

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**Figure 2.13 Site 50**

Map

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**137**



**Figure 2.14 Site 137**

Map

Description automatically generated with medium confidence



**Figure 2.15 Site 252**

As such, the city appears to be oversaturated with supermarkets. Sites 252 and 157 appear to be promising as there are no immediate mainstream competitors, and they are easily accessible at major intersections. If the retail company intends to open a store, a thorough site investigation involving the ethnic composition and real estate rates is required. However, if the store is a major retailer and has its patrons, the five sites are worth considering despite the high competition.