

Analysis of Computer Accessibility for Vulnerable Populations in Ottawa

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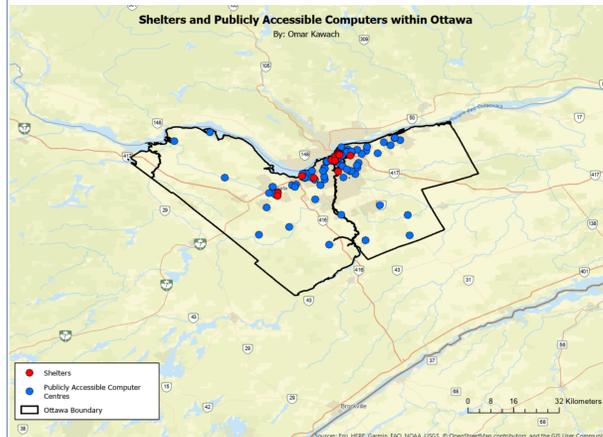


Background:

Ottawa has several shelters to support vulnerable populations such as disadvantaged low-income families, troubled youth, women facing abuse, the disabled, the homeless, etc. Vulnerable populations are more in risk of becoming homeless but are not always exclusively homeless, as evident in the different shelters in Ottawa. However, homelessness is a potential socio-economic consequence that vulnerable populations face as a part of their struggle. Technology allows the vulnerable population to utilize social services, stay connected, and search for jobs and housing (Eyrich-Garg, 2011). One way to tackle the digital divide that impacts vulnerable populations is better access to technology. Given that supporting vulnerable populations is a socio-economic issue, unequal access to technologies may limit the feasibility of conducting a social service such as technology-based intervention (Rhoades, et al., 2017). Therefore, services that provide access to technologies should be conveniently accessible to vulnerable populations (Orrick, 2011).

Research Question:

How accessible are publicly accessible computers for Ottawa's vulnerable population?



Methodology:

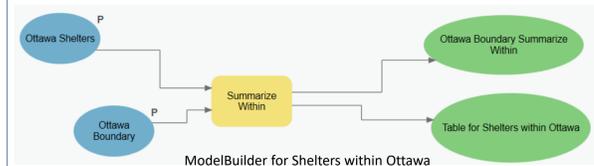
Data Collection

Data was collected and manually pre-processed from various sources. Each source was utilized to collect specific data:

- Google Maps: Shelters
- Open Ottawa: Publicly accessible computer (PAC) centres and City Boundary
- Statistics Canada: Road Network (shapefile)
- Carleton University: OC Transpo Bus Network (shapefiles)

Geoprocessing Workflows:

In ArcGIS Pro, ModelBuilder was used to run a series of geoprocessing operations to answer questions regarding the point and polygon datasets collected.



Proximity-based Analyses:

As part of proximity-based analyses, a Python script was developed to solve for the closest PAC centre to a shelter using Euclidian distance. However, moving in a straight line may not provide all the information required. As the second part of proximity-based analyses, a transportation network-based measure of distance was calculated using ArcGIS Pro's Network Analyst Extension. The first step was to build the gathered line shapefiles in ArcMap. The outcome was two network datasets: the OC Transpo Bus Network and the Ottawa Road Network. Then each network dataset was added in ArcGIS Pro. Once a network dataset was added as a source, Closest Facility analysis was conducted. The Facilities were the PAC centres, and the Incidences were the shelters.

Results:

ModelBuilder:

From the ModelBuilder outputs using Summarize Within, Ottawa has 87 PAC centres and 15 shelters. 44 of the 87 PAC centres have Wi-Fi. The outputs using Frequency and Summary Statistics found that there was 1 PAC centre with 82 computers (the maximum number of computers at a centre), and 11 PAC centres with 1 computer (the minimum number of computers at a centre). The highest occurrence of computers was 2 at 13 PAC centres, and finally the mean number of computers was 9.37.

Euclidian-based Analysis

The outcome of this operation was that each shelter was assigned the closest PAC centre based on Euclidian distance.

Location	Lat	Lon	geometry	Closest_site	Closest_km
0 Matthew House Ottawa	45.350385694079728	-75.7662662678389	POINT (-75.76627 45.35039)	Blair Franklin Place Client Service Centre	1.03
1 Western Ottawa Community Resource Centre	45.30118577389354	-75.87966632559025	POINT (-75.87967 45.30119)	Community Employment Resource Centre	0.35
2 Shepherds of Good Hope - King Edward Ave	45.431598435514905	-75.6889370120741	POINT (-75.68894 45.43160)	Bibliothèque Ottawa Library - Rideau	0.66
3 Shepherds of Good Hope - Castlereak Rd	45.2917334822926984	-75.88038506070554	POINT (-75.88039 45.29173)	Bibliothèque Ottawa Library - Hazeldean	0.88
4 Carling Family Shelter	45.35704549758195	-75.80354111513182	POINT (-75.80354 45.35705)	Michalee Heights Community House	0.8

Top Five Rows of the Euclidian-based Analysis Outcome

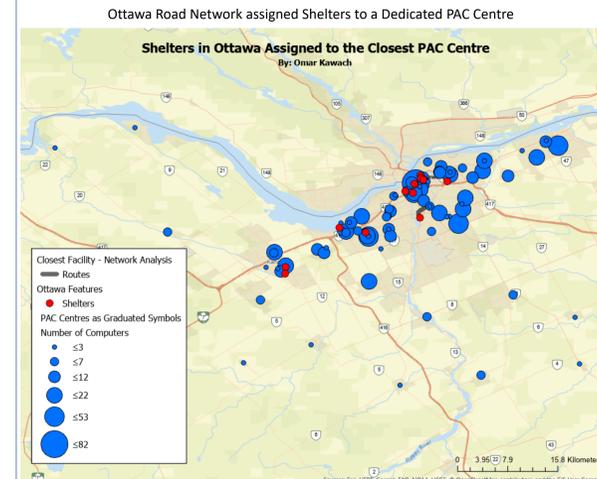
Transportation Network-based Analysis

The transportation network-based analysis via the Ottawa Road Network had assigned shelters to a dedicated PAC centre and the same was done via the OC Transpo Bus Network, but with less than favourable results.



ID	SHAPE	OBJECTID	SUBTYPE	SUBCLASS	OWNERSHIP	FLOW	COLLECTION	GRADUATED	ROAD_LAND	OWNER_1_CO	OWNER_2_CO	OWNER_3_CO	MODIFIED_D	CREATED_D	NE
1	Polyline	1	5	LOCAL	PUBLIC	VECTOR	NO	CU	CU	CU	CU	CU	2019-09-12	2019-09-12	...
2	Polyline	2	5	LOCAL	PUBLIC	VECTOR	NO	CU	CU	CU	CU	CU	2019-09-12	2019-09-12	...
3	Polyline	3	5	LOCAL	PUBLIC	VECTOR	NO	CU	CU	CU	CU	CU	2019-09-12	2019-09-12	...
4	Polyline	4	5	LOCAL	PUBLIC	VECTOR	NO	CU	CU	CU	CU	CU	2019-09-12	2019-09-12	...
5	Polyline	5	5	LOCAL	PUBLIC	VECTOR	NO	CU	CU	CU	CU	CU	2019-09-12	2019-09-12	...
6	Polyline	6	4	COLLECTOR	PUBLIC	VECTOR	NO	ZZ	SL	SL	SL	UNK	2020-05-05	2012-11-21	...
7	Polyline	7	5	LOCAL	PUBLIC	VECTOR	NO	NE	NE	NE	NE	UNK	2020-06-19	2020-06-19	...
8	Polyline	8	5	LOCAL	PUBLIC	VECTOR	NO	NE	NE	NE	NE	UNK	2020-06-19	2020-06-19	...
9	Polyline	9	4	COLLECTOR	PUBLIC	VECTOR	NO	ZZ	OO	OO	OO	UNK	2020-06-19	2012-11-21	...
10	Polyline	10	5	LOCAL	PUBLIC	VECTOR	NO	CU	CU	CU	CU	UNK	2020-06-19	2020-06-19	...
11	Polyline	11	5	LOCAL	PUBLIC	VECTOR	NO	NE	NE	NE	NE	UNK	2020-06-19	2020-06-19	...
12	Polyline	12	9	HIGHWAY	PROVINCIAL	FT	VECTOR	WIC	WIC	WIC	WIC	UNK	2020-02-14	2012-11-21	...

OC Transpo Bus Network Analysis found to be Insufficient for Accessibility of PAC Centres to Shelters



Limitations:

- Euclidian distance only measures the distance between two points using a straight line.
- The OC Transpo Bus Network was time consuming to develop since each route had its own shapefile which needed to be merged into one shapefile. This may be a recurring issue for other cities if the research methodology is replicated
- Each route in the OC Transpo Bus Network was considered one line so accessing nearby PAC centres from a shelter required an unnecessary trip around the city, i.e., the dataset didn't have stops
- The results from the network-based analysis do not consider that one PAC centre can be close to shelters and not provide enough computers for those shelters
- Use of the Ottawa Road Network for the network-based analysis means walking distance and bussing is not considered

Future Work:

- Gather shelter capacity data to support Location-Allocation analysis
- Generate a more effective bus network dataset than the one currently available by manually adding bus stops to each route
- Utilize the results to produce a web viewer that would be useful for vulnerable populations
- Consider hours of operation for PAC centres and shelters as a measure for accessibility

Conclusion:

- Measuring accessibility with Euclidian distance was unrealistic since people travel along networks and not in a straight line.
- The OC Transpo Bus Network for network-based analysis was insufficient for the accessibility of PAC centres to shelters.
- The Ottawa Road Network for network-based analysis was best able to answer the question of how accessible PAC centres are to Ottawa's vulnerable population
- As expected, downtown shelters had the best accessibility to PAC centres
- There are PAC centres located outside of downtown but are inaccessible and thus inconvenient for the shelters outside of the downtown core
- Given the abundance of PAC centres near shelters, one may conclude that PAC centres are accessible to Ottawa's vulnerable population to an extent
- Thus, Ottawa's accessibility centered in downtown means it fails to tackle the digital divide that impacts the homeless in the rest of the city, outside of downtown.

Sources:

Eyrich-Garg, K. M. (2011). Sheltered in cyberspace? Computer use among the unsheltered 'street' homeless. *Computers in Human Behavior*, 27(1), 296-303. <https://doi.org/10.1016/j.chb.2010.08.007>

Orrick, R. (2011). Envisioning an internet center for homeless individuals: One group's quest to reduce the digital divide. *University of Minnesota Digital Conservancy*. <https://core.ac.uk/reader/211356988>

Rhoades, H., Wenzel, S. L., Rice, E., Winetrobe, H., & Henwood, B. (2017). No digital divide? Technology use among homeless adults. *Journal of Social Distress and the Homeless*, 26(1), 73-77. <http://dx.doi.org/10.1080/10530789.2017.1305140>

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