Analysis of Security Incidents in 2014

York University Keele Campus

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Introduction

York University's Keele Campus is an educational facility of over 50 000 students, not including the faculty members, staff, temporary workers, visitors and the Toronto civilians living within the student residential area called 'The Village'. Each of these groups is exposed to the threat of crime from minor harassment to theft and more major crimes like assault whether they are studying in the Scott Library, parents attending a tour with their children or walking to their home in 'The Village'. In 2014, thefts totalled 255 and between 2013 and 2014 there were 38 incidents of assault (York University Security

Services, 2014). These numbers are appalling for an educational facility and public space where students have the right to practice education in a safe environment without the fear of physical or emotional harm. Students should not have to constantly feel physically guarded around the community in which they hope to learn and develop in, nor should they feel mistrust. To help community members feel safe on campus, this project aims to provide a spatial analysis of the security incidents that occurred in 2014 at the Keele Campus, in order to identify areas of high risk for each type of incident so these can be improved on to create a long-lasting solution for future generations that set foot on the campus.

Study Area

York University is situated in Toronto, Ontario in the York University Heights neighbourhood. The campus area is approximately 114 hectares, consisting of the Academic Core, the surrounding areas under York University ownership and 'The Village' which is owned by the City of Toronto but is predominantly used for student housing (Figure 1). 'The Village' is a constant area of crime involving students, so the University should play a part in preventing and stopping these crimes from occurring.

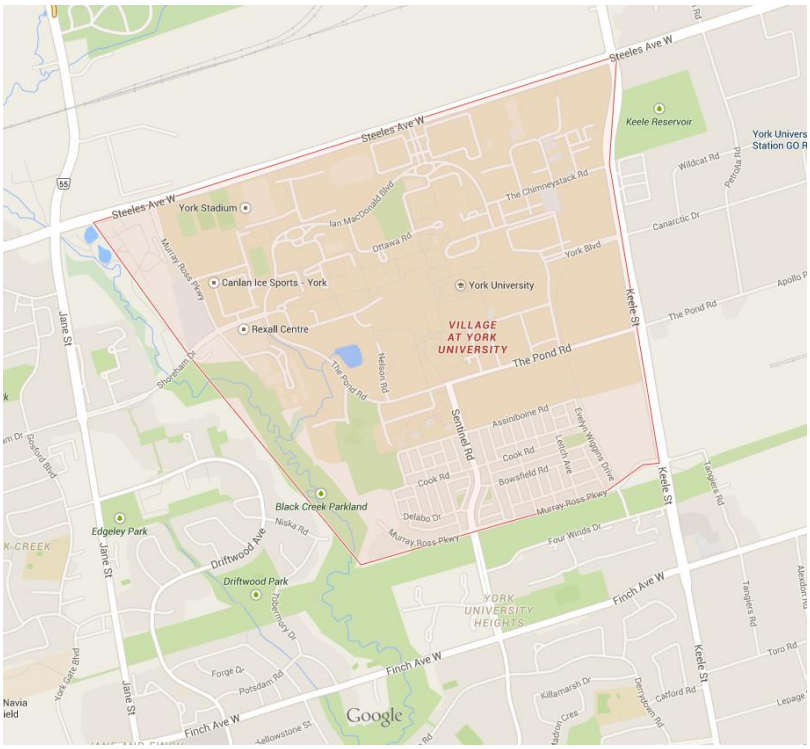


Figure 1 - Reference area for the study site of York University Keele Campus and The Village. Adapted from https://www.google.ca/maps/place/Village+at+York+University,+Toronto,+ON/@43.7725815,79.506002,15z/data=!3m1!4b1!4m2!3m1!1s0x882b2e2fa4eeb1fd:0xce6bc503b50ad2e8

Hypothesis

Our hypothesis is that more incidents occur in areas with a lack of lighting, security phones, close to vegetation and away from main roads and pathways, indicating that there is a need for improvements to these features in order to reduce security incidents. We will test our hypothesis by adding layers for each of these features existing on the campus grounds to a GIS environment to provide the spatial context for our analysis. The security incidents will be added to visualize and interpret the incidents relation to these feature layers. The results of our analysis will provide the platform officials need to make changes to the current setting of security on campus for more sustainable planning and risk reduction. Beyond just security features, our project will provide the information for researchers in future work with security in mind and providing analysis to help unravel and uproot the core problems causing these security incidents to persist.

Acquired Data & Metadata

Data Layers

- Base map
    - Polygons & Lines:

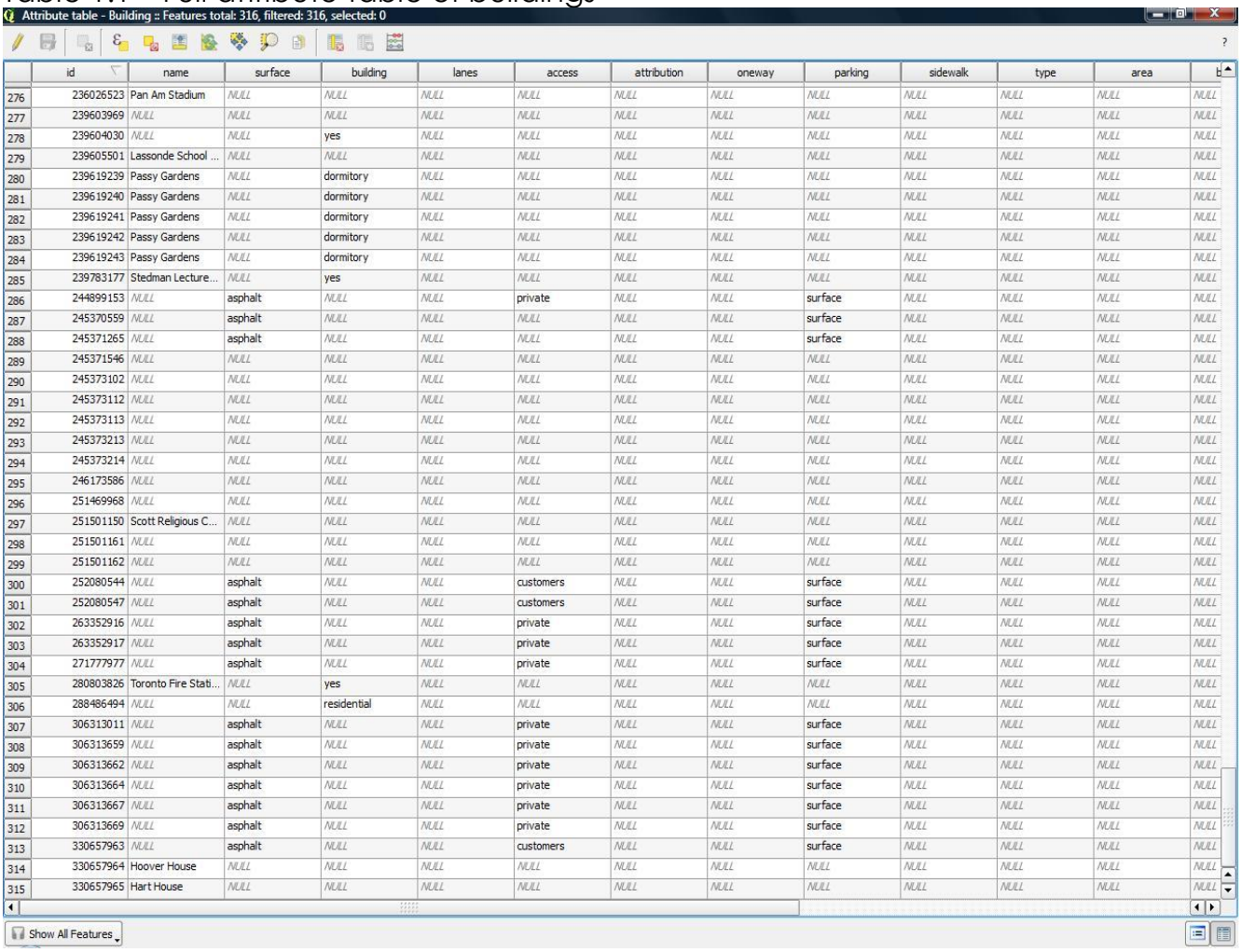
Buildings, woodlots, parking lots and water are the land class types used as polygons. Roads were the only line vector used. These vectors were acquired from OpenStreetMap. OpenStreetMap is an open data, community powered database that is added to by contributors from a variety of backgrounds and fields. The data is kept accurate by the contributors through aerial imagery, GPS devices and field maps. The data may be bias and inaccurate because it is community driven, but with support from many members, this bias and inaccuracy can be detected and removed. The local and community origin of the data mean there is no central underlying objective with the data, so the user can be ensured that it comes from contributors who want to uphold open data principles. The diverse field of actors contributing to this data also means that it may be more accurate than commercial and private organizations because it incorporates local knowledge that may otherwise be excluded. OpenStreetMap is a widely used and credited dautabase that even provides OpenLayer base maps for QGIS.

Table 1 – Attribute table of buildings (fields shortened to see building names)

Attribute table - Building :: Features total: 316, filtered: 316, selected: 0

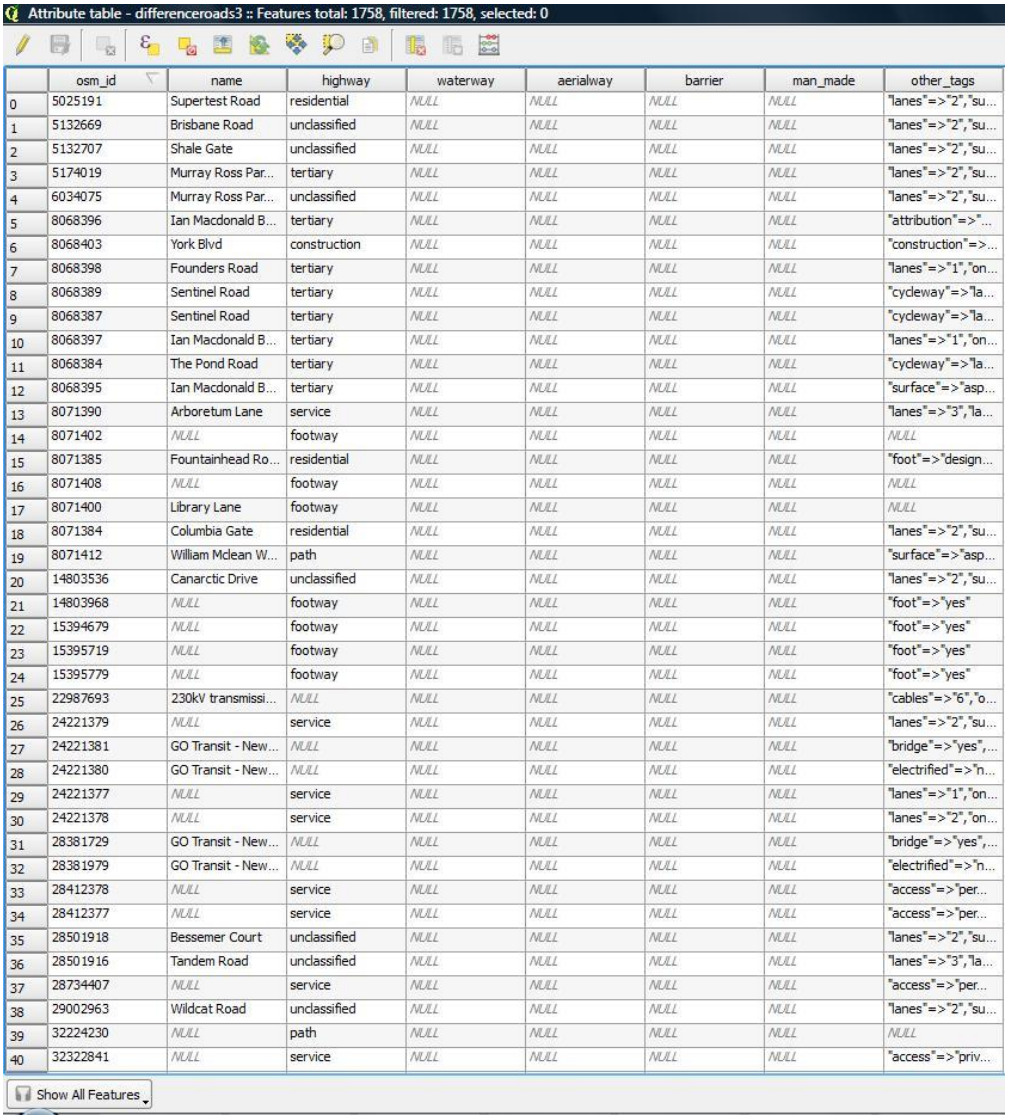
	id	name	surface	building
0	3	Sherman Health ...	NULL	NULL
1	4	Tait McKenzie	NULL	NULL
2	5	Seymour Schulich...	NULL	NULL
3	6	Bennet Centre fo...	NULL	NULL
4	7	Burton Auditorium	NULL	NULL
5	8	Kaneff Tower	NULL	NULL
6	9	Behavioural Scie...	NULL	NULL
7	10	Student Centre	NULL	NULL
8	11	York Lanes Retail	NULL	NULL
9	12	Scott Library	NULL	NULL
10	13	Vari Hall	NULL	NULL
11	14	Technology Enha...	NULL	NULL
12	15	Central Square	NULL	NULL
13	16	Ross Building	NULL	NULL
14	20	Petrie Science & ...	NULL	NULL
15	21	Staecie Science ...	NULL	NULL
16	23	Lassonde Building	NULL	NULL
17	24	Farquharson Life ...	NULL	NULL
18	25	Chemistry Building	NULL	NULL
19	26	Centre for Film a...	NULL	NULL
20	27	Goldfarb Centre ...	NULL	NULL
21	28	Atkinson Residence	NULL	NULL
22	31	Vanier Residence	NULL	NULL
23	32	Health, Nursing a...	NULL	NULL
24	33	Osgoode Hall La...	NULL	NULL
25	34	Atkinson	NULL	NULL
26	35	Quinlan Building	NULL	NULL
27	40	Curtis Lecture Halls	NULL	NULL
28	45	Observatory	NULL	NULL
29	46	Toronto Track & ...	NULL	NULL
30	50	The Village	NULL	residential
31	51	The Village	NULL	residential
32	52	The Village	NULL	residential
33	53	The Village	NULL	residential
34	54	The Village	NULL	residential
35	55	The Village	NULL	residential

Table 1.1 – Full attribute table of buildings



	id	name	surface	building	lanes	access	attribution	oneway	parking	sidewalk	type	area	b
276	236026523	Pan Am Stadium	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
277	239603969	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
278	239604030	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
279	239605501	Lassonde School ...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
280	239619239	Passy Gardens	NULL	dormitory	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
281	239619240	Passy Gardens	NULL	dormitory	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
282	239619241	Passy Gardens	NULL	dormitory	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
283	239619242	Passy Gardens	NULL	dormitory	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
284	239619243	Passy Gardens	NULL	dormitory	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
285	239783177	Stedman Lecture...	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
286	244899153	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
287	245370559	NULL	asphalt	NULL	NULL	NULL	NULL	NULL	surface	NULL	NULL	NULL	NULL
288	245371265	NULL	asphalt	NULL	NULL	NULL	NULL	NULL	surface	NULL	NULL	NULL	NULL
289	245371546	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
290	245373102	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
291	245373112	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
292	245373113	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
293	245373213	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
294	245373214	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
295	246173586	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
296	251469968	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
297	251501150	Scott Religious C...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
298	251501161	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
299	251501162	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
300	252080544	NULL	asphalt	NULL	NULL	customers	NULL	NULL	surface	NULL	NULL	NULL	NULL
301	252080547	NULL	asphalt	NULL	NULL	customers	NULL	NULL	surface	NULL	NULL	NULL	NULL
302	263352916	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
303	263352917	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
304	271777977	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
305	280803826	Toronto Fire Stati...	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
306	288486494	NULL	NULL	residential	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
307	306313011	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
308	306313659	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
309	306313662	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
310	306313664	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
311	306313667	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
312	306313669	NULL	asphalt	NULL	NULL	private	NULL	NULL	surface	NULL	NULL	NULL	NULL
313	330657963	NULL	asphalt	NULL	NULL	customers	NULL	NULL	surface	NULL	NULL	NULL	NULL
314	330657964	Hoover House	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
315	330657965	Hart House	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Table 1.2 – Attribute table of roads


Attribute table - differenceroads3 :: Features total: 1758, filtered: 1758, selected: 0

	osm_id	name	highway	waterway	aerialway	barrier	man_made	other_tags
0	5025191	Supertest Road	residential	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
1	5132669	Brisbane Road	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
2	5132707	Shale Gate	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
3	5174019	Murray Ross Par...	tertiary	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
4	6034075	Murray Ross Par...	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
5	8068396	Ian Macdonald B...	tertiary	NULL	NULL	NULL	NULL	"attribution"=>"...
6	8068403	York Blvd	construction	NULL	NULL	NULL	NULL	"construction"=>...
7	8068398	Founders Road	tertiary	NULL	NULL	NULL	NULL	"lanes"=>"1","on...
8	8068389	Sentinel Road	tertiary	NULL	NULL	NULL	NULL	"cycleway"=>"la...
9	8068387	Sentinel Road	tertiary	NULL	NULL	NULL	NULL	"cycleway"=>"la...
10	8068397	Ian Macdonald B...	tertiary	NULL	NULL	NULL	NULL	"lanes"=>"1","on...
11	8068384	The Pond Road	tertiary	NULL	NULL	NULL	NULL	"cycleway"=>"la...
12	8068395	Ian Macdonald B...	tertiary	NULL	NULL	NULL	NULL	"surface"=>"asp...
13	8071390	Arboretum Lane	service	NULL	NULL	NULL	NULL	"lanes"=>"3","la...
14	8071402	NULL	footway	NULL	NULL	NULL	NULL	NULL
15	8071385	Fountainhead Ro...	residential	NULL	NULL	NULL	NULL	"foot"=>"design...
16	8071408	NULL	footway	NULL	NULL	NULL	NULL	NULL
17	8071400	Library Lane	footway	NULL	NULL	NULL	NULL	NULL
18	8071384	Columbia Gate	residential	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
19	8071412	William Mclean W...	path	NULL	NULL	NULL	NULL	"surface"=>"asp...
20	14803536	Canarctic Drive	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
21	14803968	NULL	footway	NULL	NULL	NULL	NULL	"foot"=>"yes"
22	15394679	NULL	footway	NULL	NULL	NULL	NULL	"foot"=>"yes"
23	15395719	NULL	footway	NULL	NULL	NULL	NULL	"foot"=>"yes"
24	15395779	NULL	footway	NULL	NULL	NULL	NULL	"foot"=>"yes"
25	22987693	230kV transmissi...	NULL	NULL	NULL	NULL	NULL	"cables"=>"6","o...
26	24221379	NULL	service	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
27	24221381	GO Transit - New...	NULL	NULL	NULL	NULL	NULL	"bridge"=>"yes",...
28	24221380	GO Transit - New...	NULL	NULL	NULL	NULL	NULL	"electrified"=>"n...
29	24221377	NULL	service	NULL	NULL	NULL	NULL	"lanes"=>"1","on...
30	24221378	NULL	service	NULL	NULL	NULL	NULL	"lanes"=>"2","on...
31	28381729	GO Transit - New...	NULL	NULL	NULL	NULL	NULL	"bridge"=>"yes",...
32	28381979	GO Transit - New...	NULL	NULL	NULL	NULL	NULL	"electrified"=>"n...
33	28412378	NULL	service	NULL	NULL	NULL	NULL	"access"=>"per...
34	28412377	NULL	service	NULL	NULL	NULL	NULL	"access"=>"per...
35	28501918	Bessemer Court	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
36	28501916	Tandem Road	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"3","la...
37	28734407	NULL	service	NULL	NULL	NULL	NULL	"access"=>"per...
38	29002963	Wildcat Road	unclassified	NULL	NULL	NULL	NULL	"lanes"=>"2","su...
39	32224230	NULL	path	NULL	NULL	NULL	NULL	NULL
40	32322841	NULL	service	NULL	NULL	NULL	NULL	"access"=>"priv...

Show All Features

- Emergency Campus Features

    - Points:

The emergency phones and streetlamps were gathered from York University maps. The attribute tables for the emergency phones and street lights show exactly how many of them there are and their exact location. York University offers map resources for students and the public that are especially helpful for this study because of its focus on the University. These maps provide information about on-campus spatial features that may not be accessible anywhere else

and the accuracy is better because the University installed these features and documented their locations themselves.

The following maps show York University Keele Campus' security features; blue light emergency phones map, streetlights map, and a combined map of both blue light emergency phones and street light to show the relationship between these campus features. As shown on the maps, the blue light emergency phones are scattered around campus making a total of 52 phones. Most of these phones are located beside the campus buildings, with very few in the parking lots, and none are located in the Village (student residential area). The streetlight map shows that York University has lots of light around the roads, paths, buildings, but lacks in places where there is vegetation (forests, grass etc.) The combined map of the two campus security features shows that the blue light emergency phones are surrounded by streetlights making them visible at night. When looking at the map with the security features and incidents combined, it can be seen that the incidents happen close to the security features. Especially the distance between the emergency phones and the incidents, which happen in very close proximity to them.

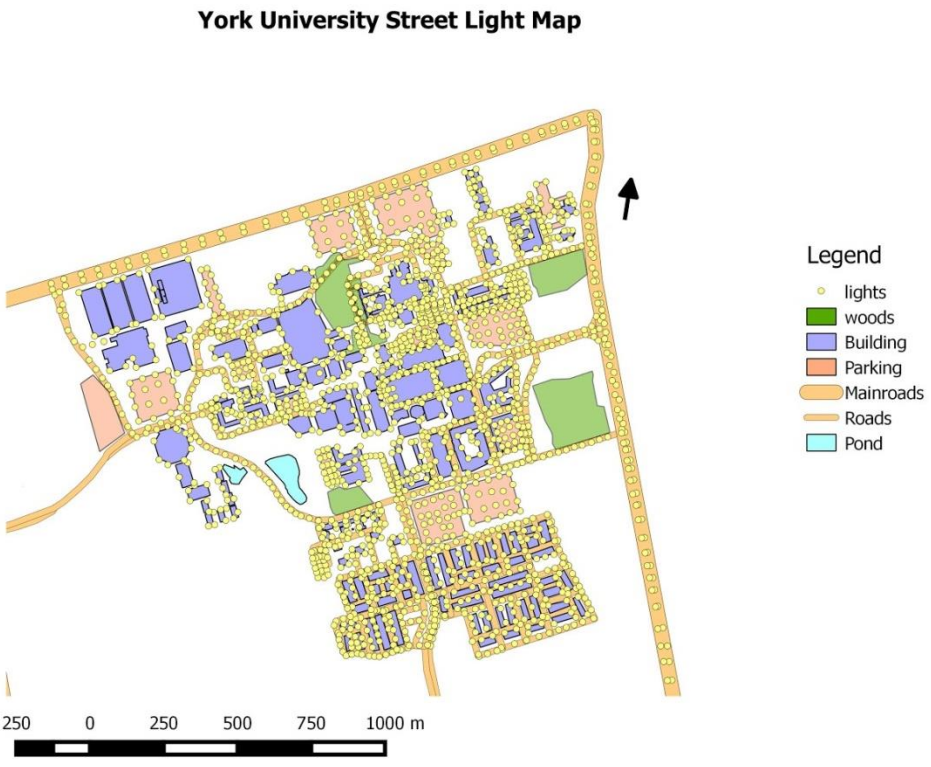


Figure 2 – Map of lighting

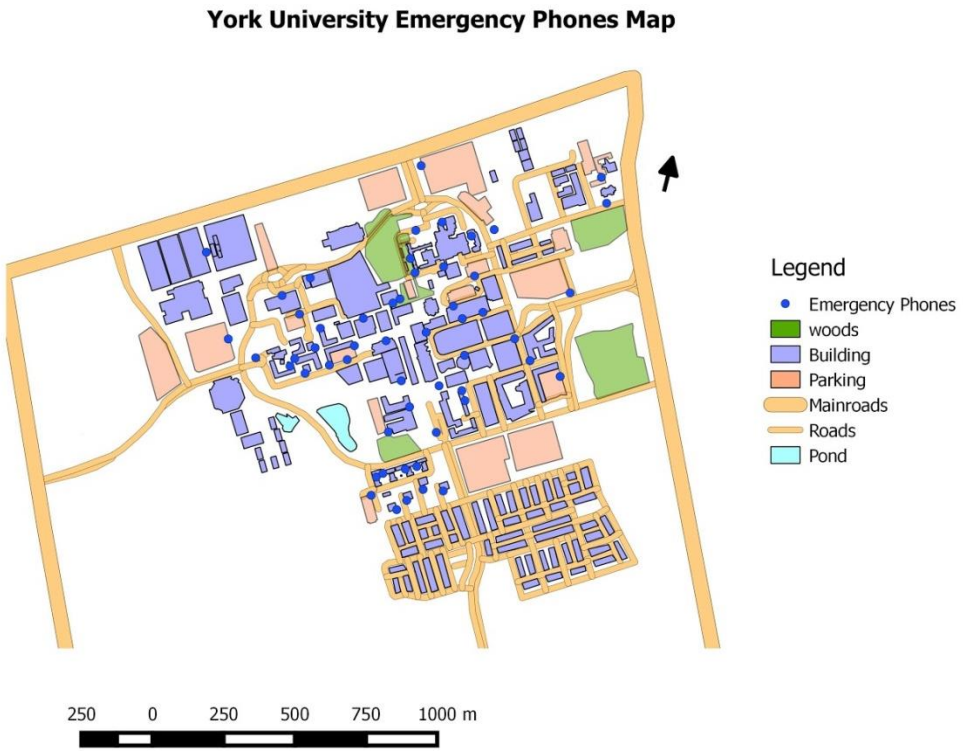


Figure 2.1 – Map of emergency phones

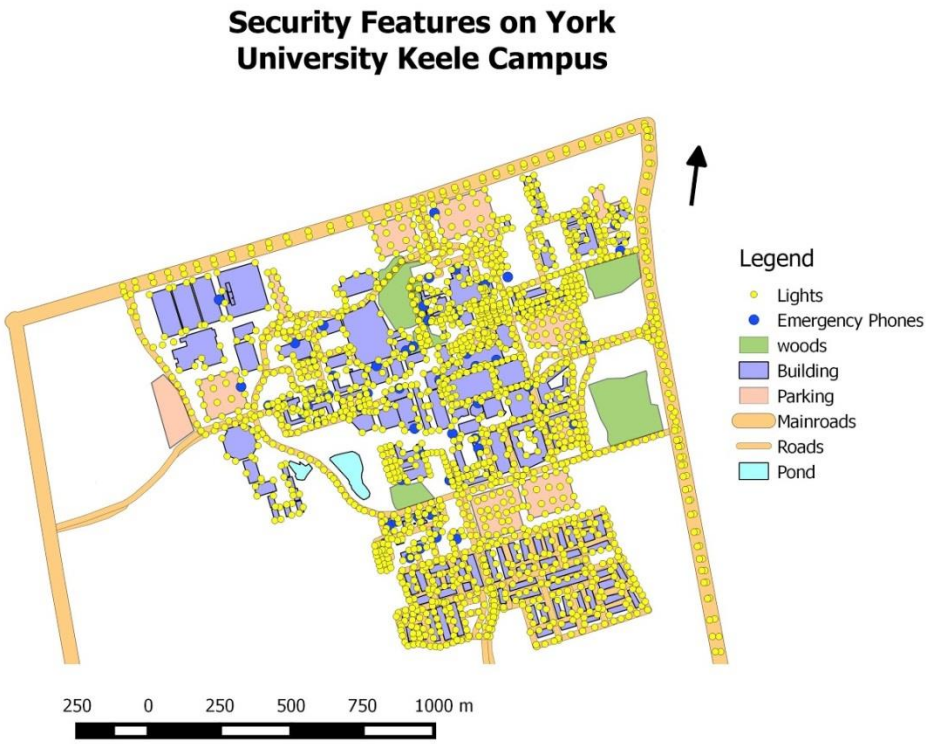


Figure 2.2 – Combined map of emergency phones and lights

- Security Incidents

The security incidents were acquired from the Weekly Security Incident Log by the Security Services of York University (Weekly Security Incident Log, 2015). Each week Security Services adds a new incident log of security incidents for that week. The log categorizes incidents by reported date and time, building name, category, subcategory and a summary of the incident. The category is a general grouping for the incident and the subcategory provides more information on what was involved with the incident type. For example, the category Fire Alarm has subcategories: unintentional activation, malfunction or malicious activation, while Robbery has the subcategories: with a weapon or no weapon. The summaries provide detail of the event such as if Toronto Police were contacted, what action was taken and the results; however, sometimes they are very inexplicit. When there are certain incidents that are categorized generally, like harassment, general (subcategory), there should be some clarity on what is meant by "general".

In the summary for a particular incident on March 20, 2014, a general harassment occurred where, "a community member reported unwanted attention by an unknown male classmate", when a day before another general harassment occurred where, "a community member reported unwanted attention from another community member". Both of these leave little detail about the people involved such as gender, how the situation occurred, if anything has been done to prevent these incidents from occurring again and other information that could be helpful in research studies like this. The first incidents' summary states the harassing party was a male, but the second incidents' summary does not. The large variety of details provided for summaries shows that there are no requirements on what must be included in these reports, discrediting their complete accuracy. In one harassment incident the subcategory was labelled as sexual because a male verbally sexually harassed another male. This is interesting because there are many more harassment cases such as the ones above that are only labelled as general. If more information was given about these cases it might be determined that they too should be classified as sexual verbal harassment. The more critical incidents are posted in a security bulletin that is sent out to all York University community members and posted on the Security Bulletin website. Considering the source is an education institution that practices safety with the Toronto Police, the credibility of these incidents is sound, but there should be more transparency and easier access to more detailed information. There could also be errors because incidents are not reported and without knowing whether incidents go unreported, the effectiveness of York Security remains uncertain.

Not all security incidents reported in the weekly security incident log were used in the dataset because, in our opinion, they are not relevant to crime mapping and do not pose a serious threat to community members. The security incidents that were excluded are: fire alarm, disorderly behavior (pertaining most often to intoxicated individuals), mischief under $5000 (pertaining to vandalism), emergency medical, disturbance causing (pertaining to loitering, disputes), information (pertaining to individuals communicating information to security), motor vehicle incident, suspicious persons, smoking complaint, domestic dispute, false pretences (pertaining to fraud) and damage. The decisions to exclude of these variables are subjective and may skew the data, but it was important to reduce the size of our dataset and to improve the relevance of it so that these variables did not take away value from more relevant variables like robberies, assaults or sexual assaults in data interpretation. All of the fields from the original data were used, but time incident was reported and date reported are separate. Additional columns were also included. The month that each incident was reported was added separate from date reported so that trends over the year and by season can be plotted. A column

called 'Type' was added that often copied the category provided by the original data but was sometimes changed for organizational and analytical purposes. One example is that all sexual assault are categorized as assaults and subcategorized as sexual, so for easier access to sexual assault data when doing analyses, they were categorized as sexual assault under 'Type'. The official category and subcategory were provided in adjacent columns. The incidents will be separated in maps by thefts because it covers nearly half of the incidents and by all other incidents except those excluded above. The incidents included are:

1) Trespassing: Non-Community Member
2) Assault: Causing Bodily Harm, Common
3) Sexual Assault: Indecent Exposure, Sexual, General
4) Harassment: Community Member, General, Unknown, Criminal/Stalking
5) Break & Enter: Private Property, University Property
6) Robbery: Weapon, No Weapon
7) Robbery Attempt: Weapon, No Weapon

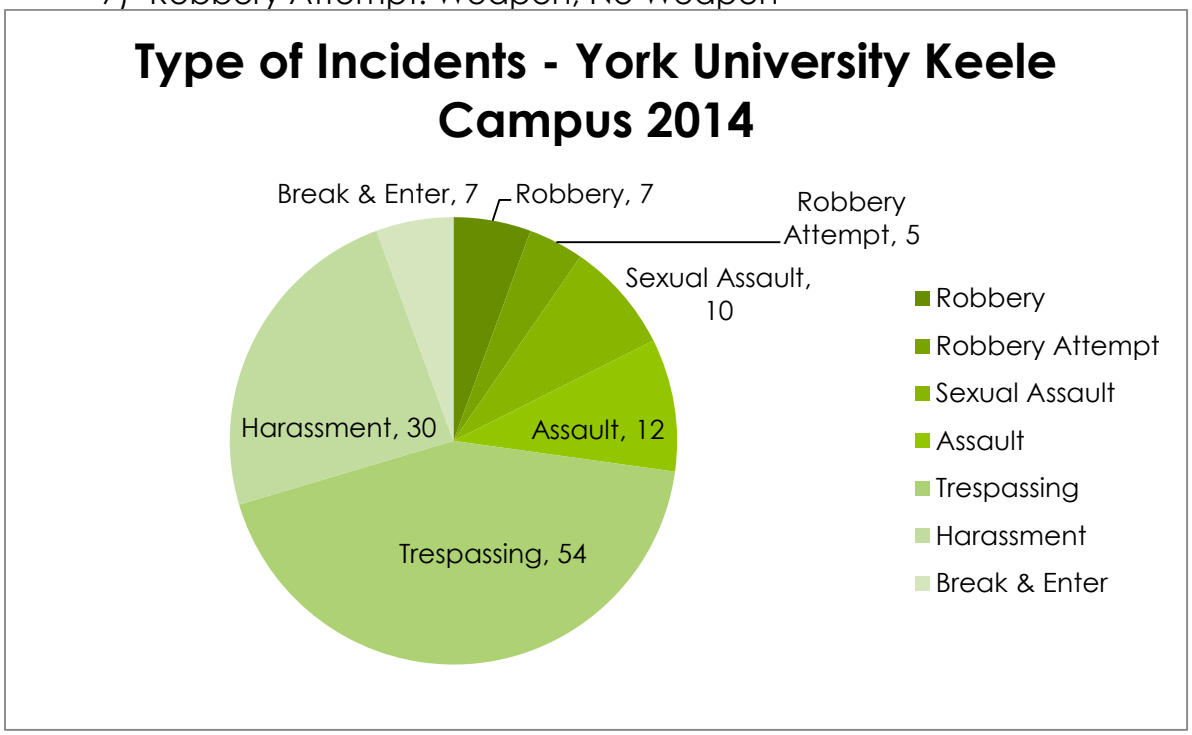


Figure 2.3 - Chart of Incident Types used for second map by weight

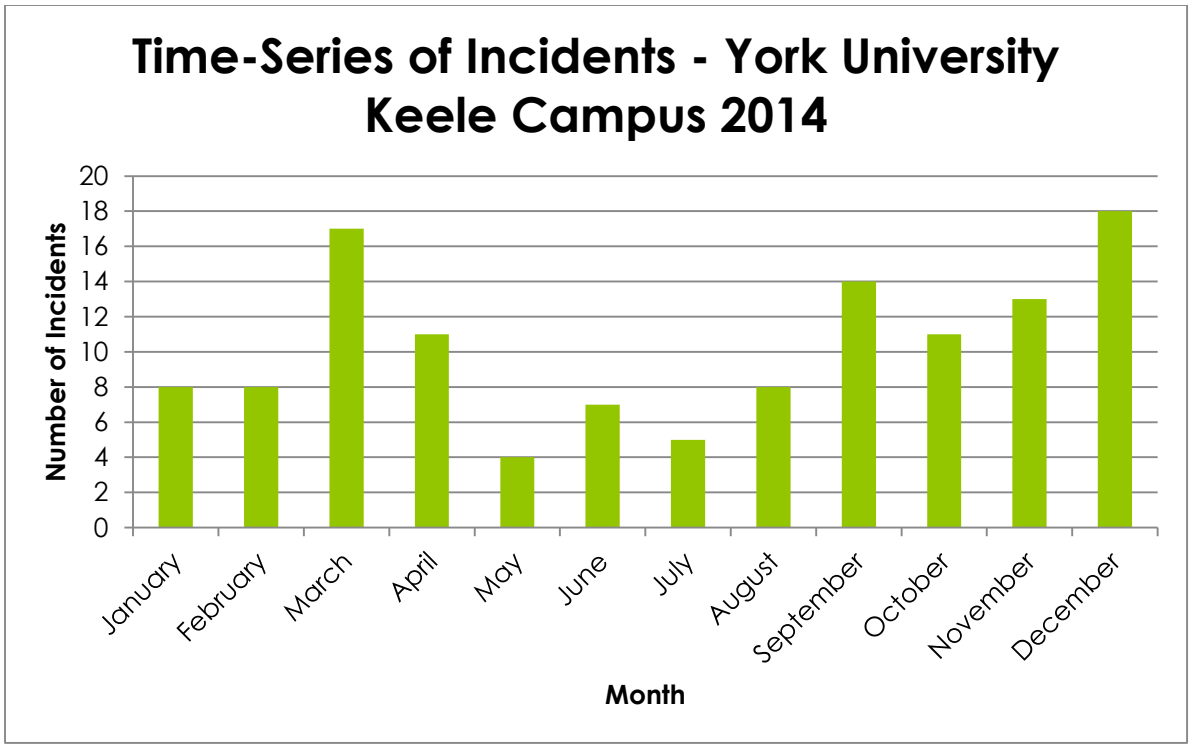


Figure 2.4 - Chart of Incidents by month for the year of 2014

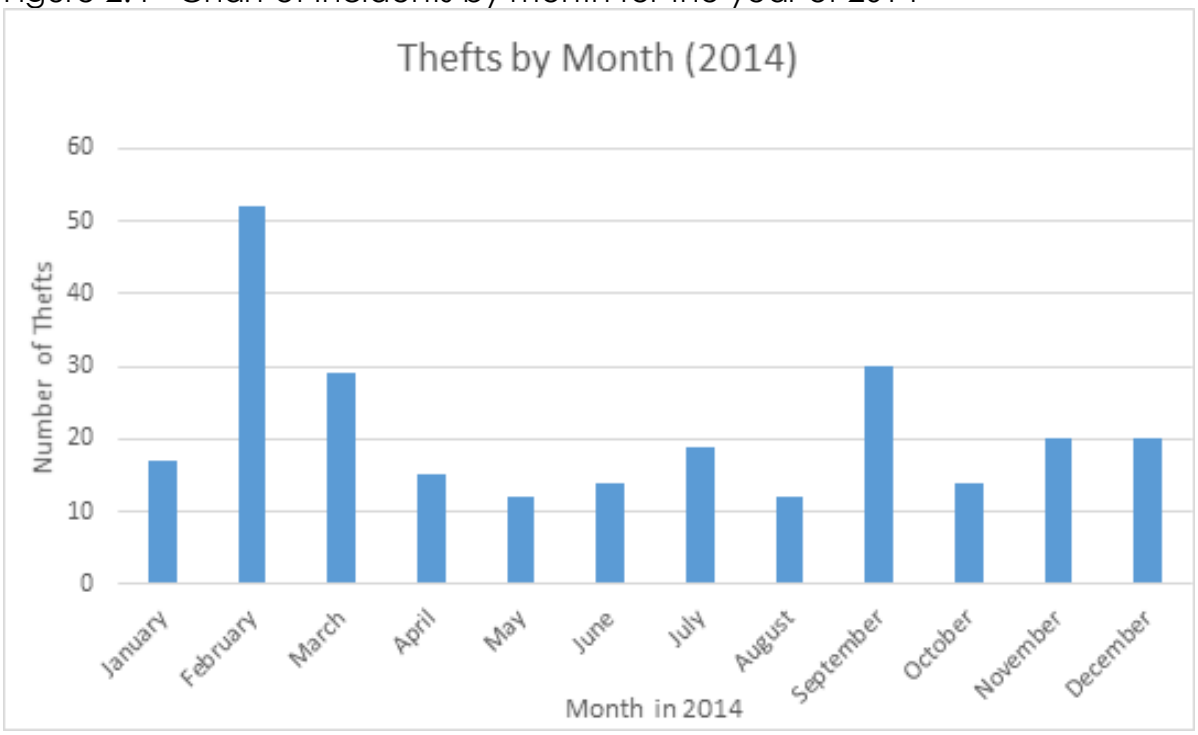


Figure 2.5 Chart of thefts according to month in 2014

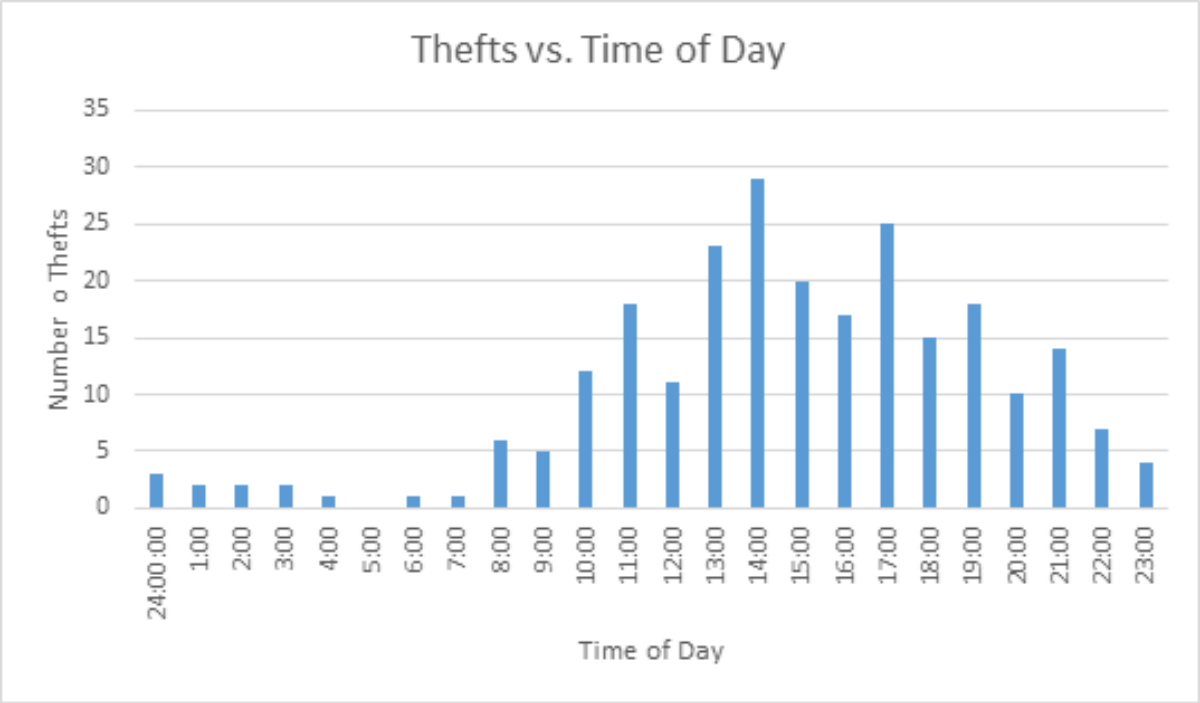
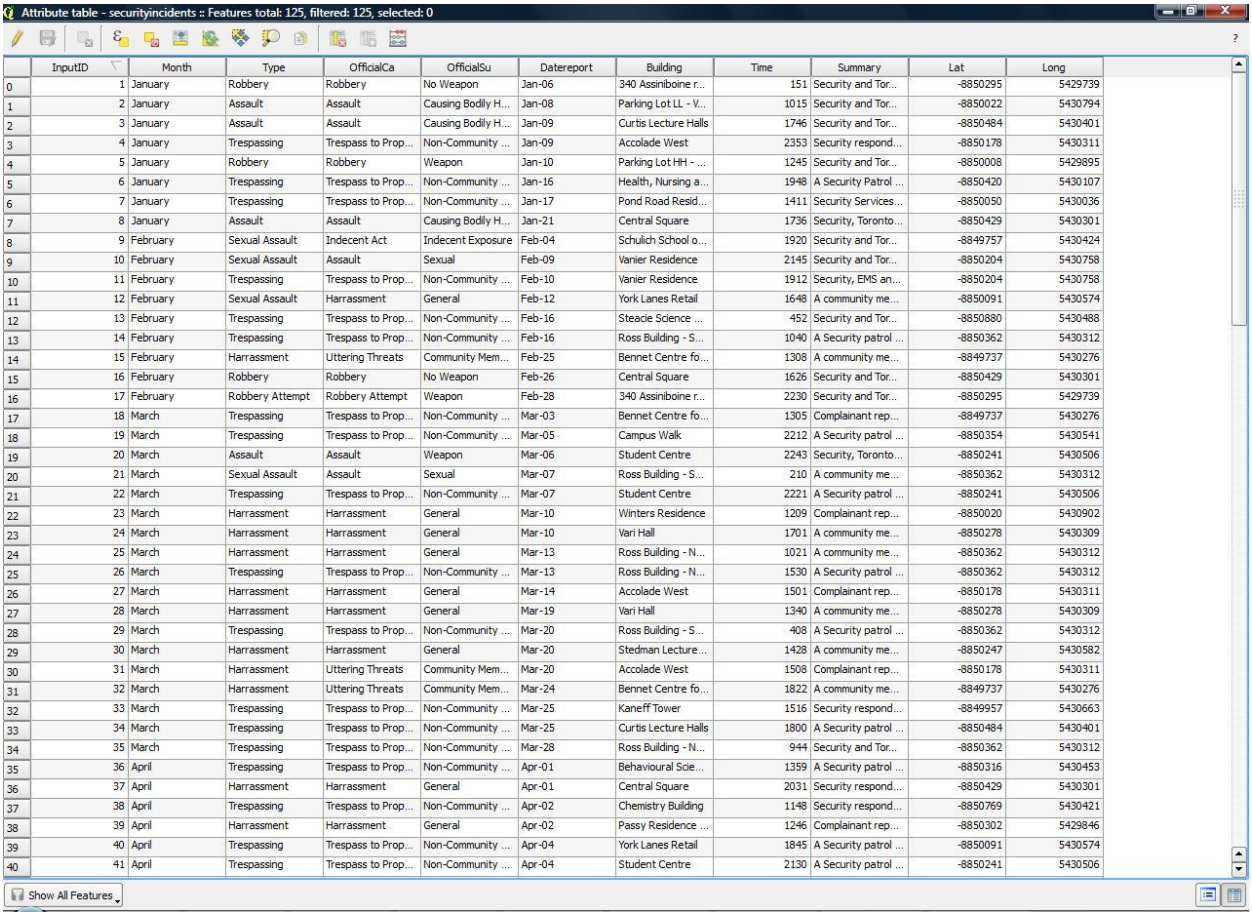


Figure 2.6 Chart of thefts according to time of day in 2014

Table 1.3 – Attribute table of thefts

InputID	Month	Type	OfficialCa	OfficialSu	Datereport	Building	Time	Summary
1	January	Theft	Theft, Unc	Private Pr	Jan-06	Tait McKe	1722	Complainant reported the theft of a wallet left unattended in the Fitness Centre
2	January	Theft	Theft, Unc	Private Pr	Jan-10	Tait McKe	2049	Complainant reported the theft of a winter jacket left unattended in the field house.
3	January	Theft	Theft, Unc	Private Pr	Jan-12	Tait McKe	1535	Complainant reported the theft of a jacket and cellular phone left unattended in the field house
4	January	Theft	Theft, Unc	Private Pr	Jan-13	Central Sq	1413	Complainant reported the theft of a cellular phone left unattended in an office area.
5	January	Theft	Theft, Unc	Private Pr	Jan-13	Scott Libra	1613	Complainant reported the theft of a laptop computer left unattended on the fifth floor.
6	January	Theft	Theft, Unc	Private Pr	Jan-13	Scott Libra	1637	Complainant reported the theft of a cellular phone left unattended on the fourth floor. A description of a suspect was obtain
7	January	Theft	Theft, Unc	Private Pr	Jan-15	Scott Libra	1156	Complainant reported the theft of a laptop computer left unattended on the fifth floor.
8	January	Theft	Theft, Unc	Private Pr	Jan-17	Schulich S	1326	Complainant reported the theft of a laptop computer, back pack and text book from a secure locker. There was no evidence o
9	January	Theft	Theft, Unc	Private Pr	Jan-17	York Hall-	2443	Complainant reported the theft of a purse left unattended in a washroom
10	January	Theft	Theft, Unc	Private Pr	Jan-20	Calumet C	1634	Complainant reported the theft of a cellular phone left unattended in the college.
11	January	Theft	Theft, Unc	Private Pr	Jan-21	Vari Hall	1146	Complainant reported the theft of a banner from Vari Hall.
12	January	Theft	Theft, Unc	Private Pr	Jan-21	Tait McKe	2112	Complainant reported the theft of a winter coat, wallet and cellular phone. The coat was left insecure and unattended in a lo
13	January	Theft	Theft, Unc	Private Pr	Jan-22	Scott Libra	1832	Complainant reported the theft of a backpack which contained a laptop computer and text book that had been left unattende
14	January	Theft	Theft, Unc	Private Pr	Jan-23	Scott Libra	1419	Complainant reported the theft of a laptop computer left unattended on the third floor
15	January	Theft	Theft, Unc	Private Pr	Jan-24	Scott Libra	1928	Complainant reported the theft of a laptop computer left unattended on the third floor
16	January	Theft	Theft, Unc	Private Pr	Jan-28	Petrie Sci	1005	Complainant reported the theft of a Metro pass that has been secured in an envelope and left unattended in the second floo
17	January	Theft	Theft, Unc	Private Pr	Jan-29	Scott Libra	1307	Complainant reported the theft of a laptop computer left unattended on the fifth floor.
18	February	Theft	Theft, Unc	Private Pr	Feb-01	Leslie Fros	1021	Complainant reported the theft of a laptop computer left unattended in the library.
19	February	Theft	Theft, Unc	Private Pr	Feb-03	Scott Libra	1141	Complainant reported the theft of a purse left unattended on the second floor
20	February	Theft	Theft, Unc	Private Pr	Feb-03	Tait McKe	2342	Complainant reported the theft of a jacket and backpack left unattended in the gymnasium.
21	February	Theft	Theft, Unc	Private Pr	Feb-04	Scott Libra	1536	Complainant reported the theft of a computer tablet left unattended on the fifth floor.
22	February	Theft	Theft, Unc	Private Pr	Feb-04	McLaughli	2113	Complainant reported the theft of a laptop computer and charger that were left unattended in a basement level classroom.
23	February	Theft	Theft, Unc	Private Pr	Feb-05	York Hall-	1515	Complainant reported the theft of a hip pouch that was left unattended in a first floor male washroom.
24	February	Theft	Theft, Unc	Private Pr	Feb-05	York Lane:	1539	Complainant reported the theft of a backpack from a York Lanes restaurant. A description of the suspect was obtained via CCT
25	February	Theft	Theft, Unc	Private Pr	Feb-06	Scott Libra	1705	Complainant reported the theft of a laptop computer left unattended on the fourth floor.
26	February	Theft	Theft, Unc	Private Pr	Feb-06	Student C	1803	Complainant reported the theft of a wallet left on the counter at a Student Centre restaurant. The complainant advised the w

Table 1.4 – Attribute table of all other incidents used


Attribute table - securityincidents :: Features total: 125, filtered: 125, selected: 0

	InputID	Month	Type	OfficialCa	OfficialSu	Datereport	Building	Time	Summary	Lat	Long
0	1	January	Robbery	Robbery	No Weapon	Jan-06	340 Assiniboine r...	151	Security and Tor...	-8850295	5429739
1	2	January	Assault	Assault	Causing Bodily H...	Jan-08	Parking Lot LL - V...	1015	Security and Tor...	-8850022	5430794
2	3	January	Assault	Assault	Causing Bodily H...	Jan-09	Curtis Lecture Halls	1746	Security and Tor...	-8850484	5430401
3	4	January	Trespassing	Trespass to Prop...	Non-Community ...	Jan-09	Accolade West	2353	Security respond...	-8850178	5430311
4	5	January	Robbery	Robbery	Weapon	Jan-10	Parking Lot HH - ...	1245	Security and Tor...	-8850008	5429895
5	6	January	Trespassing	Trespass to Prop...	Non-Community ...	Jan-16	Health, Nursing a...	1948	A Security Patrol ...	-8850420	5430107
6	7	January	Trespassing	Trespass to Prop...	Non-Community ...	Jan-17	Pond Road Resid...	1411	Security Services...	-8850050	5430036
7	8	January	Assault	Assault	Causing Bodily H...	Jan-21	Central Square	1736	Security, Toronto...	-8850429	5430301
8	9	February	Sexual Assault	Indecent Act	Indecent Exposure	Feb-04	Schulich School o...	1920	Security and Tor...	-8849757	5430424
9	10	February	Sexual Assault	Assault	Sexual	Feb-09	Vanier Residence	2145	Security and Tor...	-8850204	5430758
10	11	February	Trespassing	Trespass to Prop...	Non-Community ...	Feb-10	Vanier Residence	1912	Security, EMS an...	-8850204	5430758
11	12	February	Sexual Assault	Harrassment	General	Feb-12	York Lanes Retail	1648	A community me...	-8850091	5430574
12	13	February	Trespassing	Trespass to Prop...	Non-Community ...	Feb-16	Steacie Science ...	452	Security and Tor...	-8850880	5430488
13	14	February	Trespassing	Trespass to Prop...	Non-Community ...	Feb-16	Ross Building - S...	1040	A Security patrol ...	-8850362	5430312
14	15	February	Harrassment	Uttering Threats	Community Mem...	Feb-25	Bennet Centre fo...	1308	A community me...	-8849737	5430276
15	16	February	Robbery	Robbery	No Weapon	Feb-26	Central Square	1626	Security and Tor...	-8850429	5430301
16	17	February	Robbery Attempt	Robbery Attempt	Weapon	Feb-28	340 Assiniboine r...	2230	Security and Tor...	-8850295	5429739
17	18	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-03	Bennet Centre fo...	1305	Complainant rep...	-8849737	5430276
18	19	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-05	Campus Walk	2212	A Security patrol ...	-8850354	5430541
19	20	March	Assault	Assault	Weapon	Mar-06	Student Centre	2243	Security, Toronto...	-8850241	5430506
20	21	March	Sexual Assault	Assault	Sexual	Mar-07	Ross Building - S...	210	A community me...	-8850362	5430312
21	22	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-07	Student Centre	2221	A Security patrol ...	-8850241	5430506
22	23	March	Harrassment	Harrassment	General	Mar-10	Winters Residence	1209	Complainant rep...	-8850020	5430902
23	24	March	Harrassment	Harrassment	General	Mar-10	Vari Hall	1701	A community me...	-8850278	5430309
24	25	March	Harrassment	Harrassment	General	Mar-13	Ross Building - N...	1021	A community me...	-8850362	5430312
25	26	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-13	Ross Building - N...	1530	A Security patrol ...	-8850362	5430312
26	27	March	Harrassment	Harrassment	General	Mar-14	Accolade West	1501	Complainant rep...	-8850178	5430311
27	28	March	Harrassment	Harrassment	General	Mar-19	Vari Hall	1340	A community me...	-8850278	5430309
28	29	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-20	Ross Building - S...	408	A Security patrol ...	-8850362	5430312
29	30	March	Harrassment	Harrassment	General	Mar-20	Stedman Lecture...	1428	A community me...	-8850247	5430582
30	31	March	Harrassment	Uttering Threats	Community Mem...	Mar-20	Accolade West	1508	Complainant rep...	-8850178	5430311
31	32	March	Harrassment	Uttering Threats	Community Mem...	Mar-24	Bennet Centre fo...	1822	A community me...	-8849737	5430276
32	33	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-25	Kaneff Tower	1516	Security respond...	-8849957	5430663
33	34	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-25	Curtis Lecture Halls	1800	A Security patrol ...	-8850484	5430401
34	35	March	Trespassing	Trespass to Prop...	Non-Community ...	Mar-28	Ross Building - N...	944	Security and Tor...	-8850362	5430312
35	36	April	Trespassing	Trespass to Prop...	Non-Community ...	Apr-01	Behavioural Scie...	1359	A Security patrol ...	-8850316	5430453
36	37	April	Harrassment	Harrassment	General	Apr-01	Central Square	2031	Security respond...	-8850429	5430301
37	38	April	Trespassing	Trespass to Prop...	Non-Community ...	Apr-02	Chemistry Building	1148	Security respond...	-8850769	5430421
38	39	April	Harrassment	Harrassment	General	Apr-02	Passy Residence ...	1246	Complainant rep...	-8850302	5429846
39	40	April	Trespassing	Trespass to Prop...	Non-Community ...	Apr-04	York Lanes Retail	1845	A Security patrol ...	-8850091	5430574
40	41	April	Trespassing	Trespass to Prop...	Non-Community ...	Apr-04	Student Centre	2130	A Security patrol ...	-8850241	5430506

Show All Features

Metadata

Table 2 – Metadata of security incidents

Metadata - Security Incidents	
Source	York University Security Services
Date Acquired	March 3, 2015
Location of data	York University, Keele Campus, 4700 Keele St, Toronto, ON, CA
Dates of data	January 1 – December 31, 2014
Coordinates of study area	43.773056, -79.503611
Size of study area	114 hectares

Table 2.1 – Metadata of line and polygon data

Metadata - Lines and Polygons (Roads, buildings, woodlots, parking lots, ponds)	
Source	OpenStreetMap
Date Acquired	February 29, 2015
Location of data	York University, Keele Campus, 4700 Keele St, Toronto, ON, CA
Coordinates of study area	43.773056, -79.503611
Size of study area	114 hectares
Open data license	Open Data Commons Open Database License
Creative Commons license	Creative Commons Attribution-ShareAlike 2.0
Projection	WGS84

Table 2.2 – Metadata of emergency campus features

Metadata - Points (lights, emergency phones)	
Source	York University Libraries - Map Library
Date Acquired	February 29, 2015
Location of data	York University, Keele Campus, 4700 Keele St, Toronto, ON, CA
Coordinates of study area	43.773056, -79.503611
Size of study area	114 hectares

Methods

Pre-Analysis (Building the database)

1. Using the OpenLayers plugin, OpenStreetMap data was opened as a basemap and the location of York University, Keele Campus was found on the basemap. From the OpenStreetMap website, the York University data was exported as a .osm extension.
2. The OpenStreetMap dataset was imported into QGIS by clicking the vector tab -> openstreetmap -> download data. A window will open where the .osm file is added. Once the download was successful, the dataset was added to QGIS using vector->openstreetmap -> import topology from XML using the .osm file. The output created an osm.db file and connection was made.
3. The last step in creating the database is vector->openstreetmap-> import topology to spatialite. The osm.db file is added and polygons are selected to be added to QGIS. You will need to click on load from DB and click on layers that you need such as "building".
4. This will import the building polygon layer and all attribute values into QGIS. We needed to create polygons for the missing buildings and points for the emergency phones and lights through digitization. We also digitized parking lots and woodlots, as separate layers, using the OpenStreetMap basemap as a reference.
5. To digitize we created new SpatiaLite polygon layers. We then clicked 'Toggle Editing' and then added polygons around the boundaries from the openstreetmap basemap. The same was done for the phones and lights, but a point layer was created instead.
6. The roads were added from the .osm file using the same process but selecting lines instead of polygons as the layer type. There were many additional roads that went through buildings that needed to be removed. The difference vector tool was used to create a layer of only these lines. The original road layer could then be removed and the external roads retained. All missing attribute information that was relevant for the security incidents
7. The security incidents were added to the database by transferring all of the data from the Weekly Security Incident Log to an excel spreadsheet. Each incident was given a unique identifier (ID). Any additional fields were added. Next, incidents were spatially referenced to appear on the map by adding latitude and longitude coordinates to each incident. The excel file was saved as a .csv and added to QGIS as a delimited text file and a new layer was created for incidents. The locations with multiple points

were overlying each other, so a density analysis was done using the heatmap plugin.

8. Due to the large number of thefts, these were grouped by building into an excel document. The first field is the building name, the second field is the total number of thefts that occurred for that building and the third and fourth fields were dedicated to latitude and longitude and the excel file was added to QGIS as a .csv file. This way, graduated symbology could be used for the thefts. To compare thefts and the rest of the incidents, the same process was done for the other incidents.

Analysis

- **Density map**

The first analysis taken was a heat map and was needed to properly visualize the large volume of incidents, excluding thefts, especially concentrated in the center of the map. All of the points within a single location overlapped each other so the absolute number of incidents was hidden. The heatmap plugin was used to characterize this volume by creating an interpolated surface with a radius based on the volume of incidents. The output is a new raster layer with a different level of density for each raster cell, showing greater density near the center and less as we move away from the center point feature. The gradient scale can be classified for different interval types and the radius can be changed to provide different interpretations. Equal area was used for this heatmap along with all of the following heat maps. Graduated symbols were also used for both the theft incidents and the rest of the incidents so that the two could be compared.

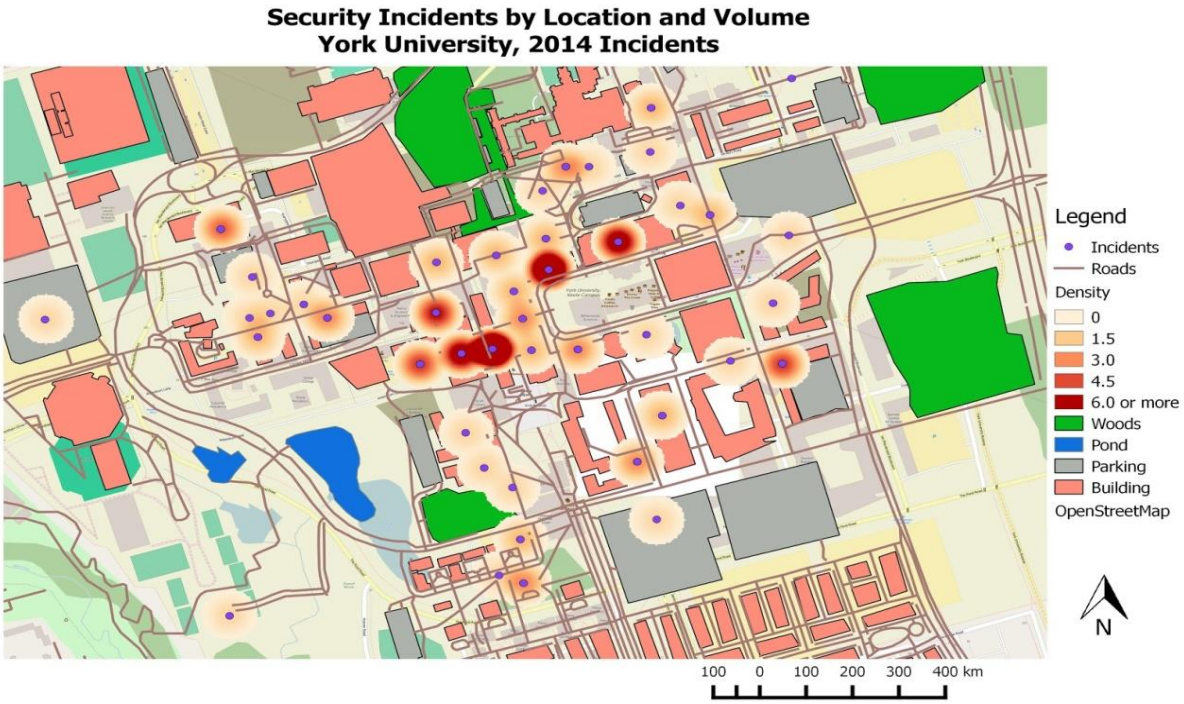


Figure 3 – Density analysis (heatmap) of security incidents

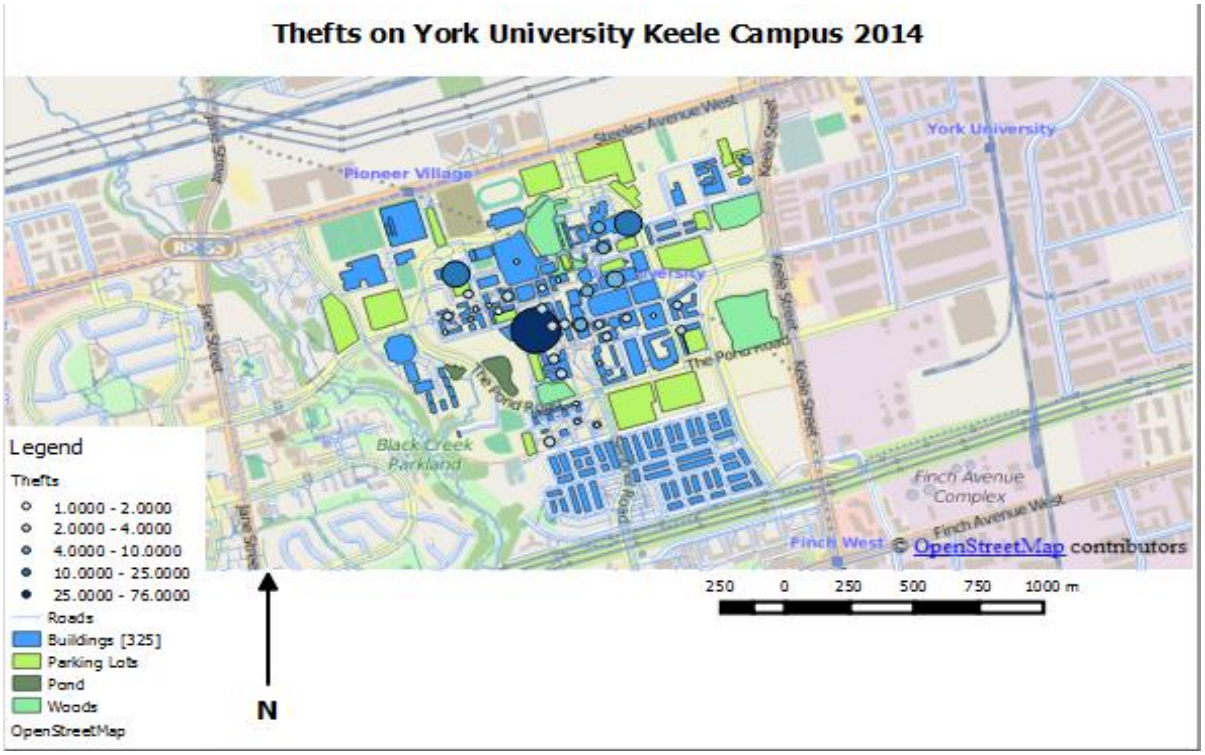


Figure 3.1 Density analysis (graduated symbols) of reported thefts

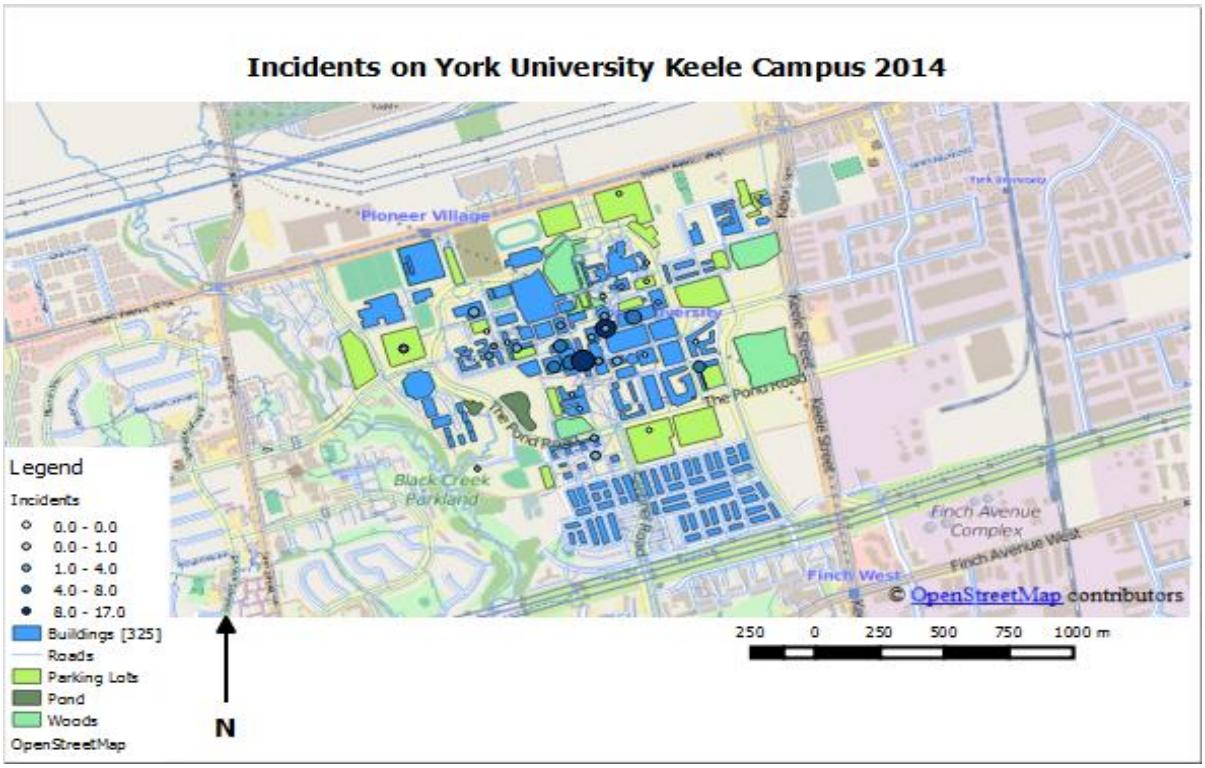


Figure 3.2 Density analysis (graduated symbols) of all incidents, excluding thefts, on campus

- **Categorized by Type**

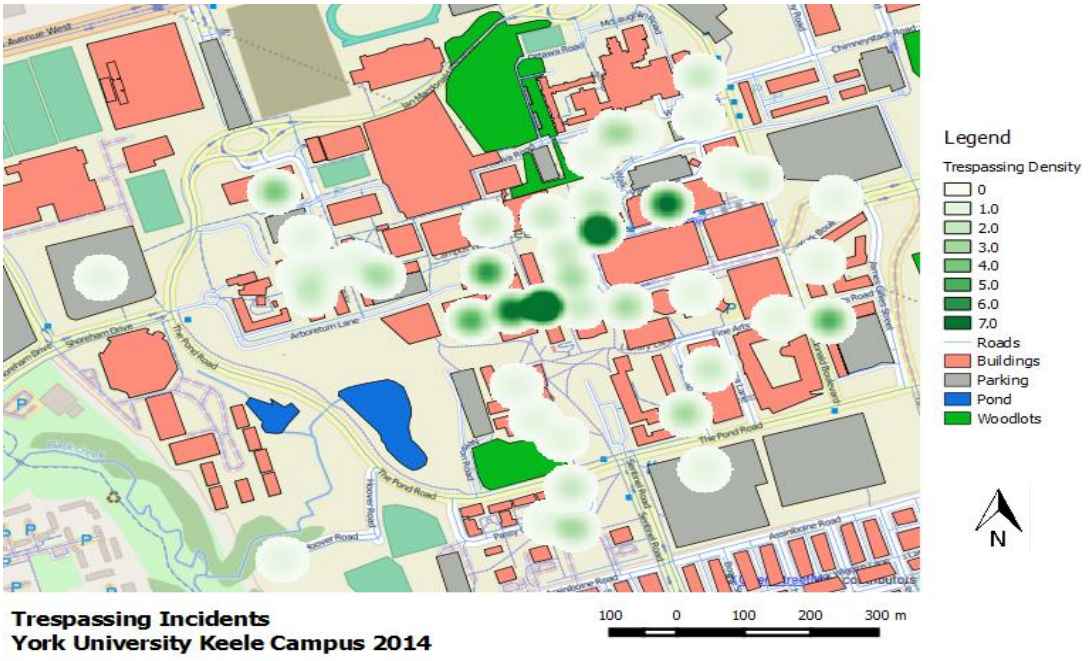


Figure 4 – Density analysis (heatmap) of trespassing security incidents

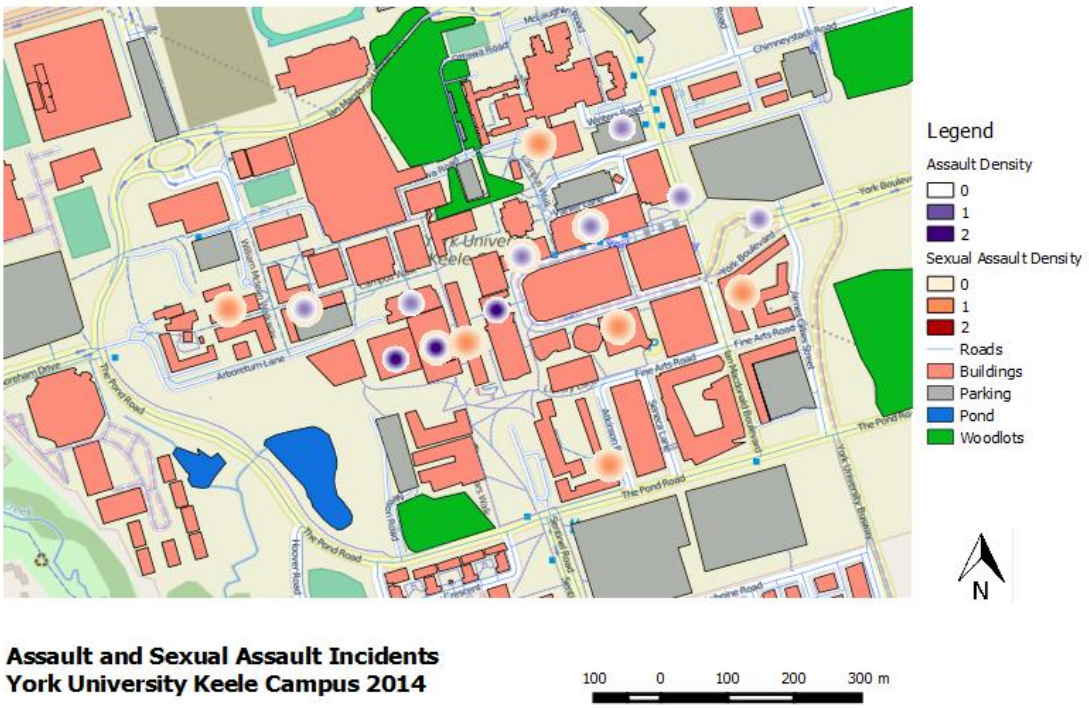


Figure 4.1 – Density analysis (heatmap) of assault and sexual assault incidents

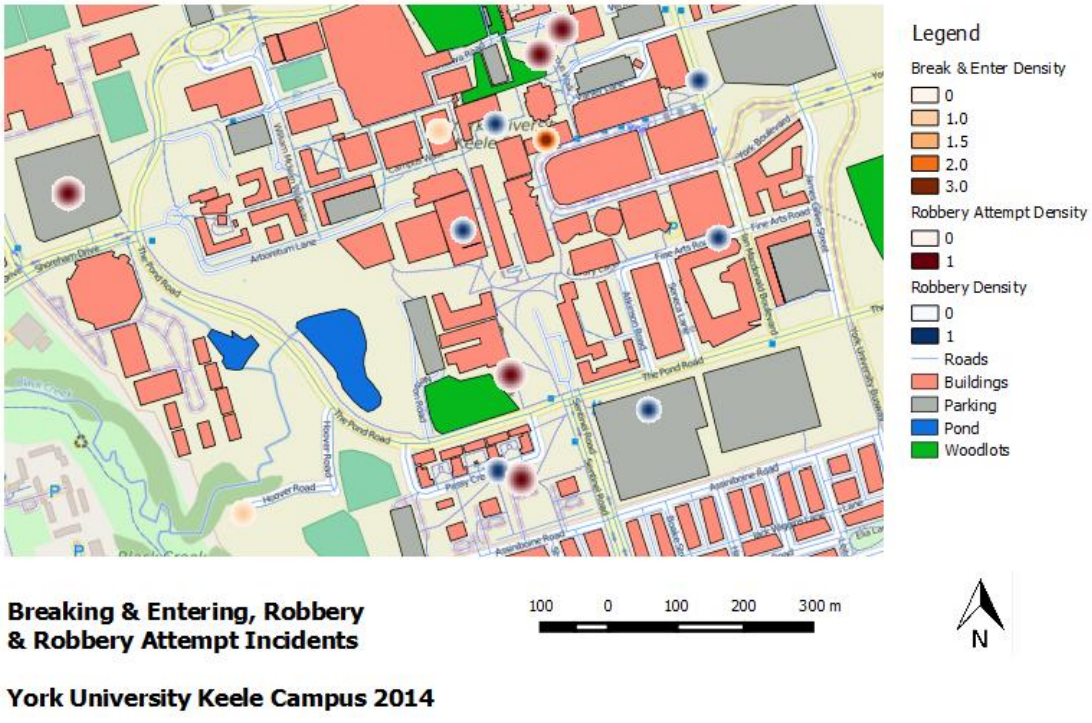


Figure 4.2 – Density analysis (heatmap) of break & enter, robbery & attempt

Figure 4.3 – Density analysis (heatmap) of harassment security incidents

- **Categorized by Season**

Security incidents, excluding thefts, were divided into seasons to better understand the temporal changes in security incidents and whether certain times of the year had higher incident rates than others. The incidents were divided into seasons as opposed to months because of the difference between twelve and four maps to interpret. The seasons were based on the seasonal periods in the Northern Hemisphere for 2014. Spring included incidents from April to June, summer from July to September, autumn from October to December and winter from January to March.

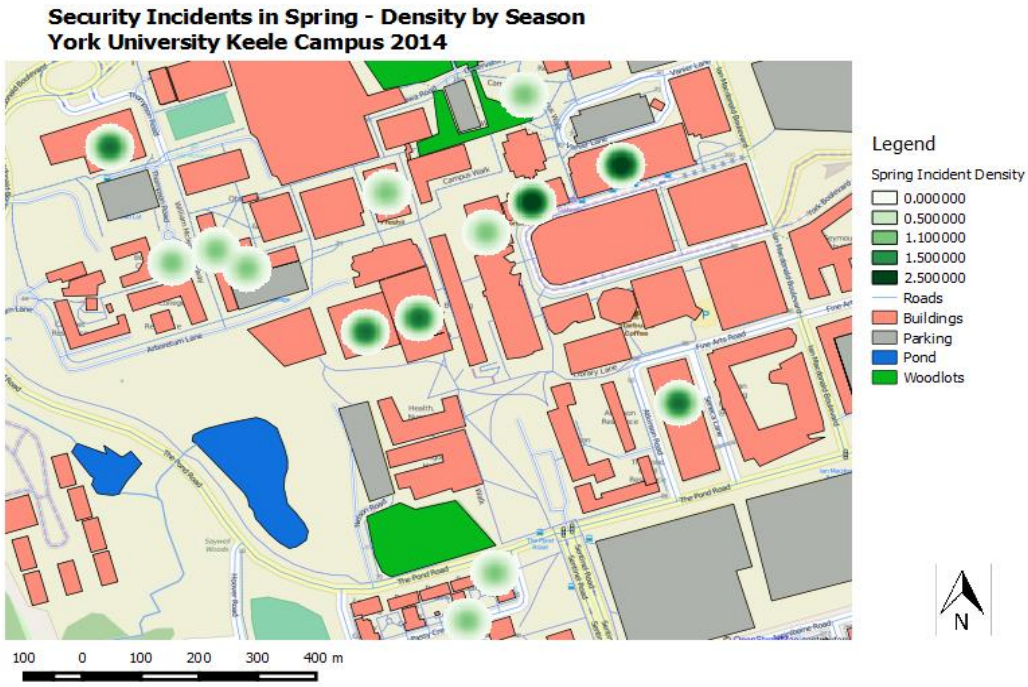


Figure 5 – Density analysis (heatmap) of security incidents reported in Spring

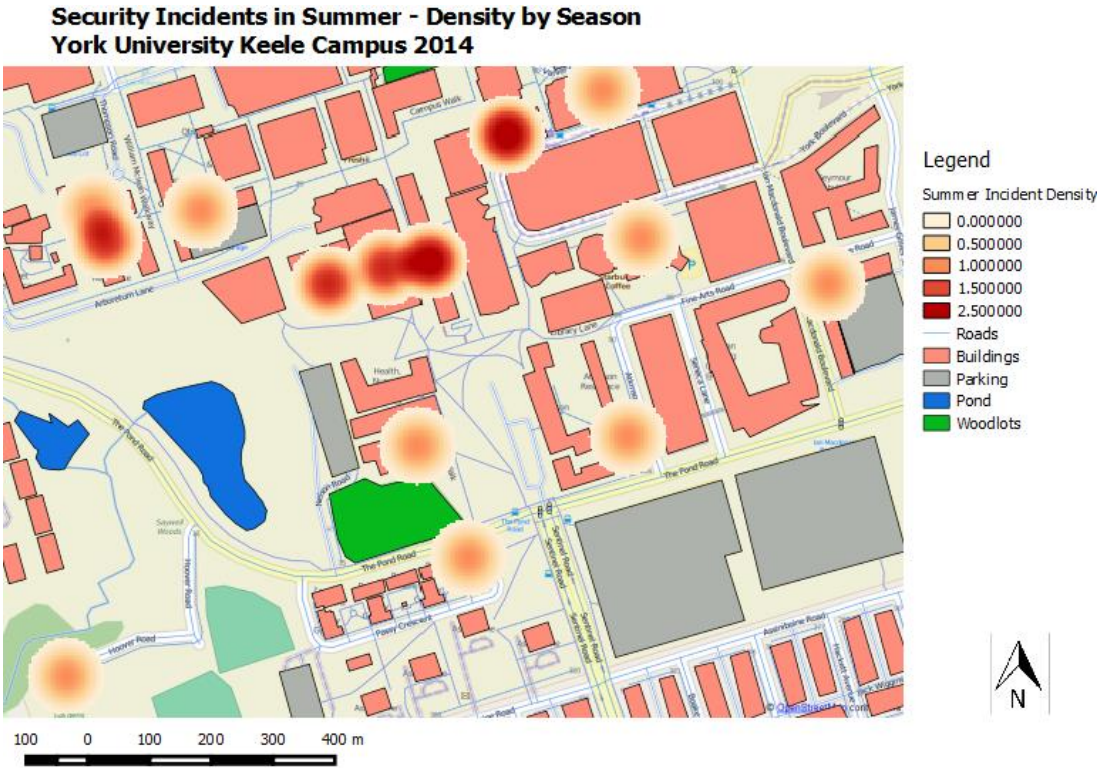


Figure 5.1 – Density analysis (heatmap) of security incidents reported in Summer

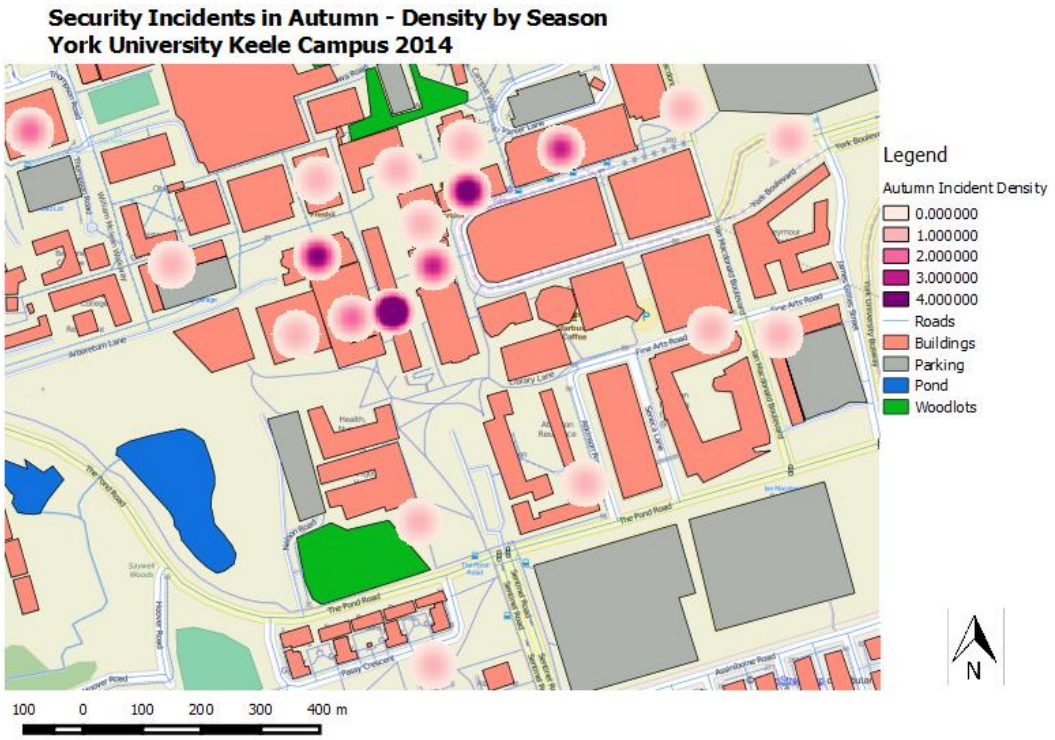


Figure 5.2 – Density analysis (heatmap) of security incidents reported in Autumn

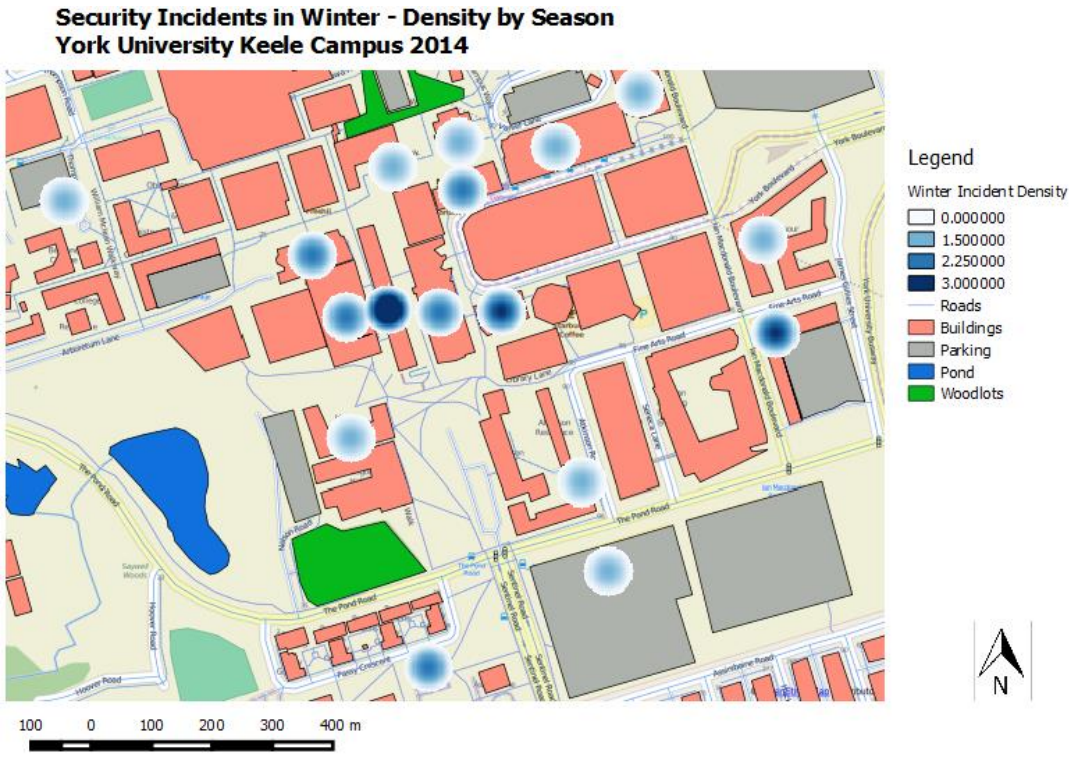


Figure 5.3 – Density analysis (heatmap) of security incidents reported in Winter

- **Time Density Map**

Security incidents, excluding thefts, were further divided by the hour of the day, but using a different method than the heatmap. The number format of the time fields made it possible to use graduated symbols by changing the symbology of the security incidents layer. These symbols can be scaled to represent density of incidents to show how many incidents at a certain location occurred at a certain hour of the day. The feature blending mode was changed to 'Lighten' in order to see overlap of the clusters. Although not the best visualization method because the clusters are overlapping and it is hard to discern them, the capability to visualize a field like time is much easier than trying to create new layers to be used in the heatmap, if even possible. The large concentration in the center can be better seen in Figure 6.1.

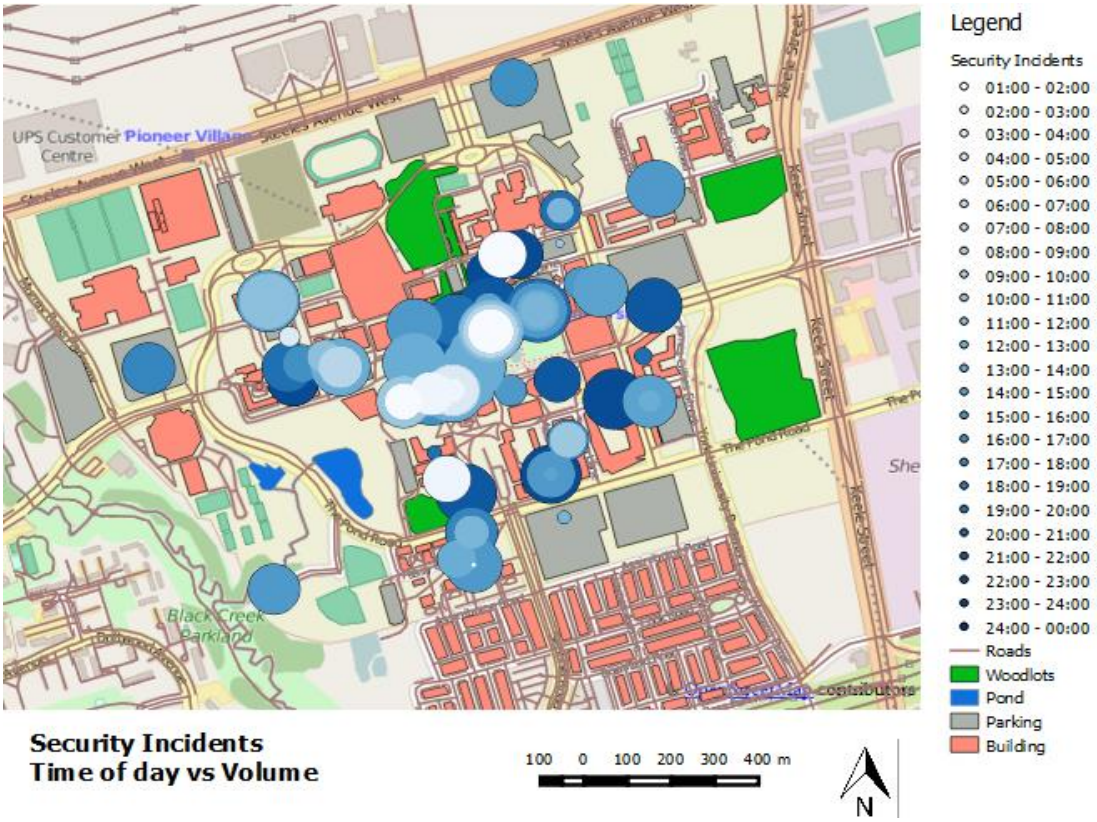


Figure 6 – Graduated density map of security incidents for each hour of the day

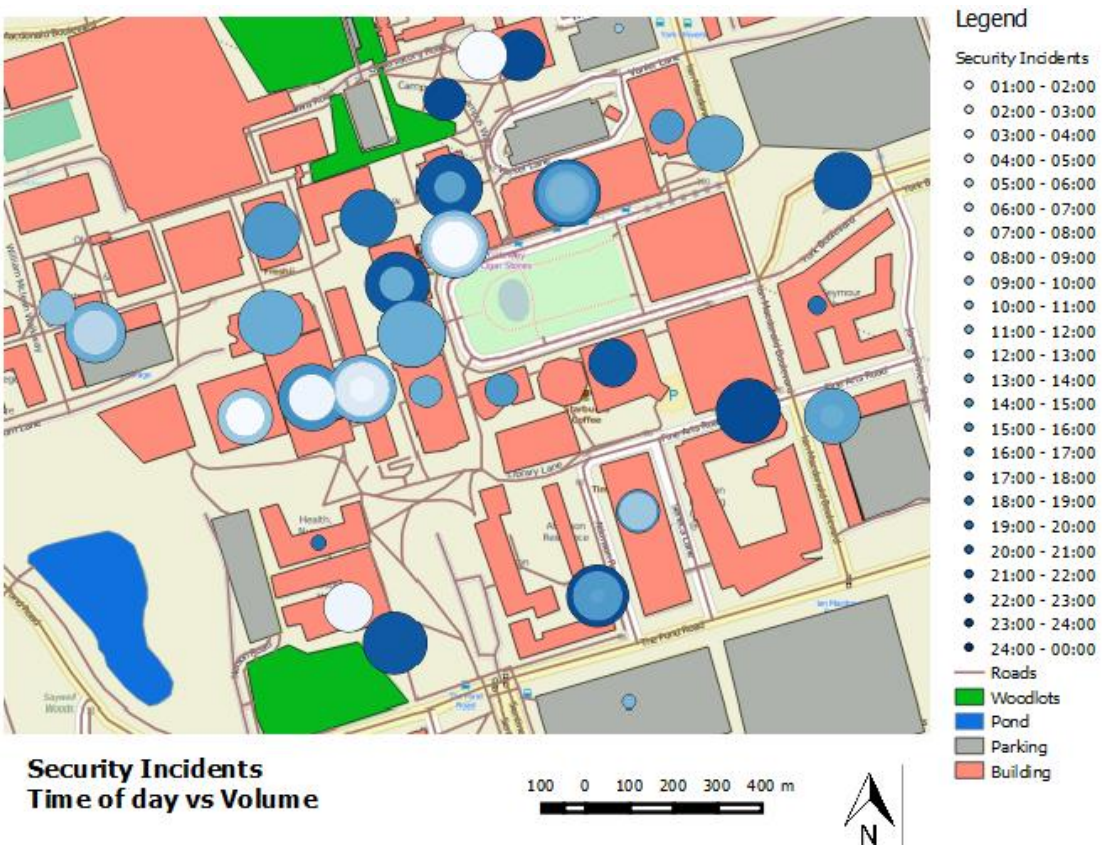


Figure 6.1 - Graduated density map of security incidents for each hour of the day

- **Combined maps of all layers**

The following maps are combinations of the data that was gathered throughout the stages of the project put into two maps and one final map featuring all the gathered data from 2014 of the security and theft incidents and security features from York University Keele Campus. The final map shows (figure 5.4) the locations of the security features and the security and theft incidents that happened on the campus in 2014. It shows an overlap of security incidents and theft incidents, and all the areas that have been reported for these incidents.

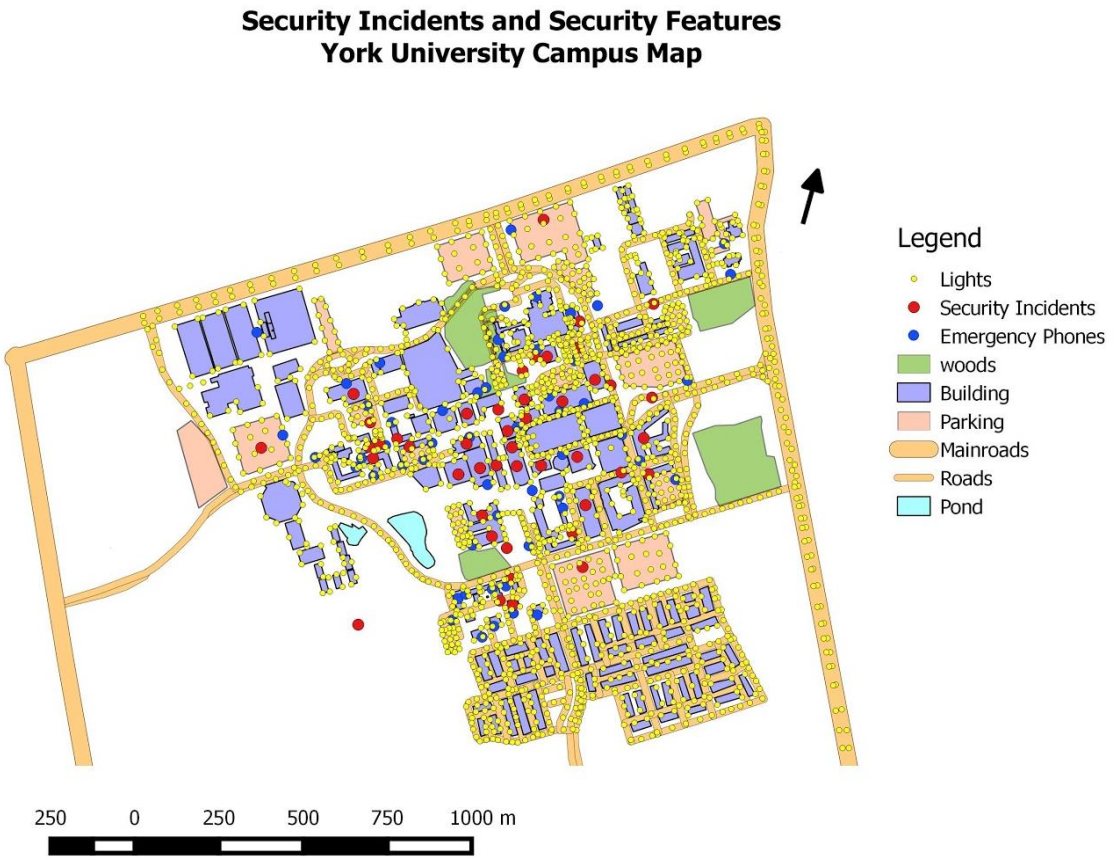


Figure 7 – Combined map of security incidents, blue light emergency phones, and streetlights

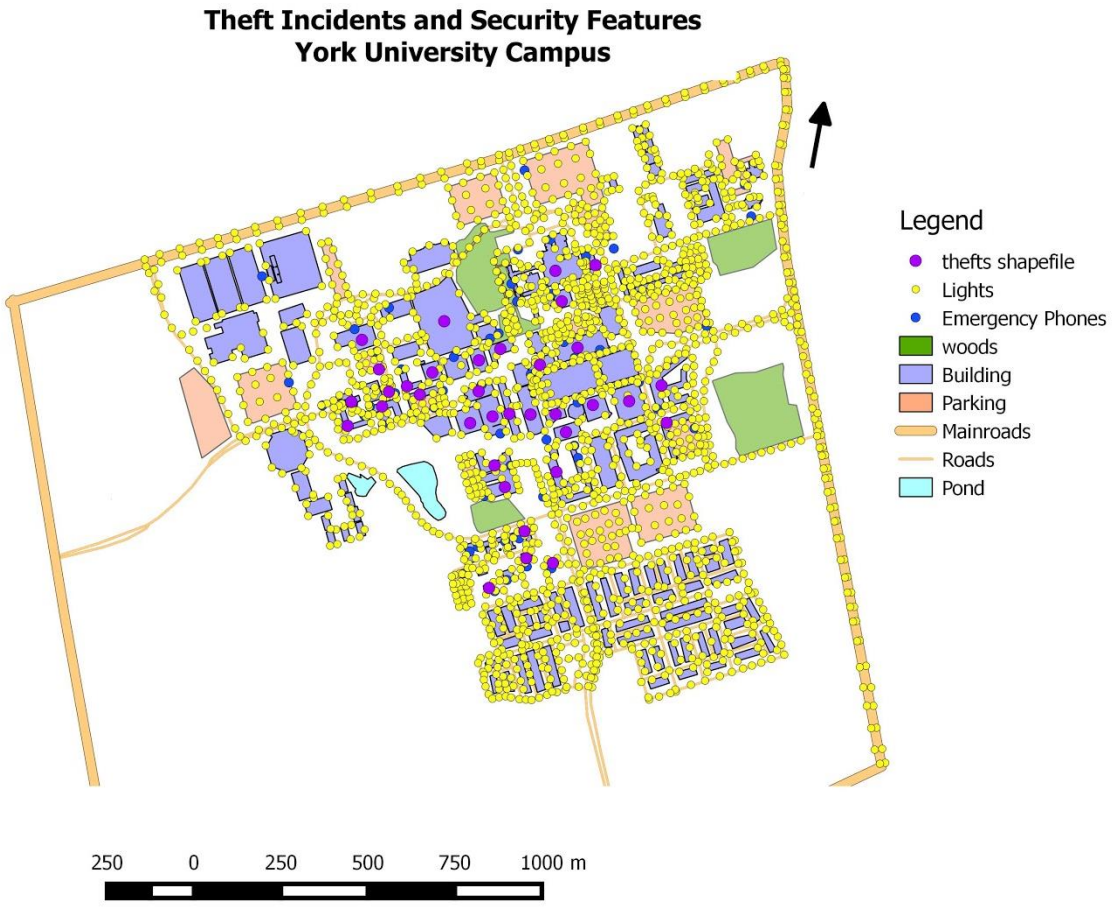


Figure 7.1 – Combined map of theft incidents, blue light emergency phones, and streetlights

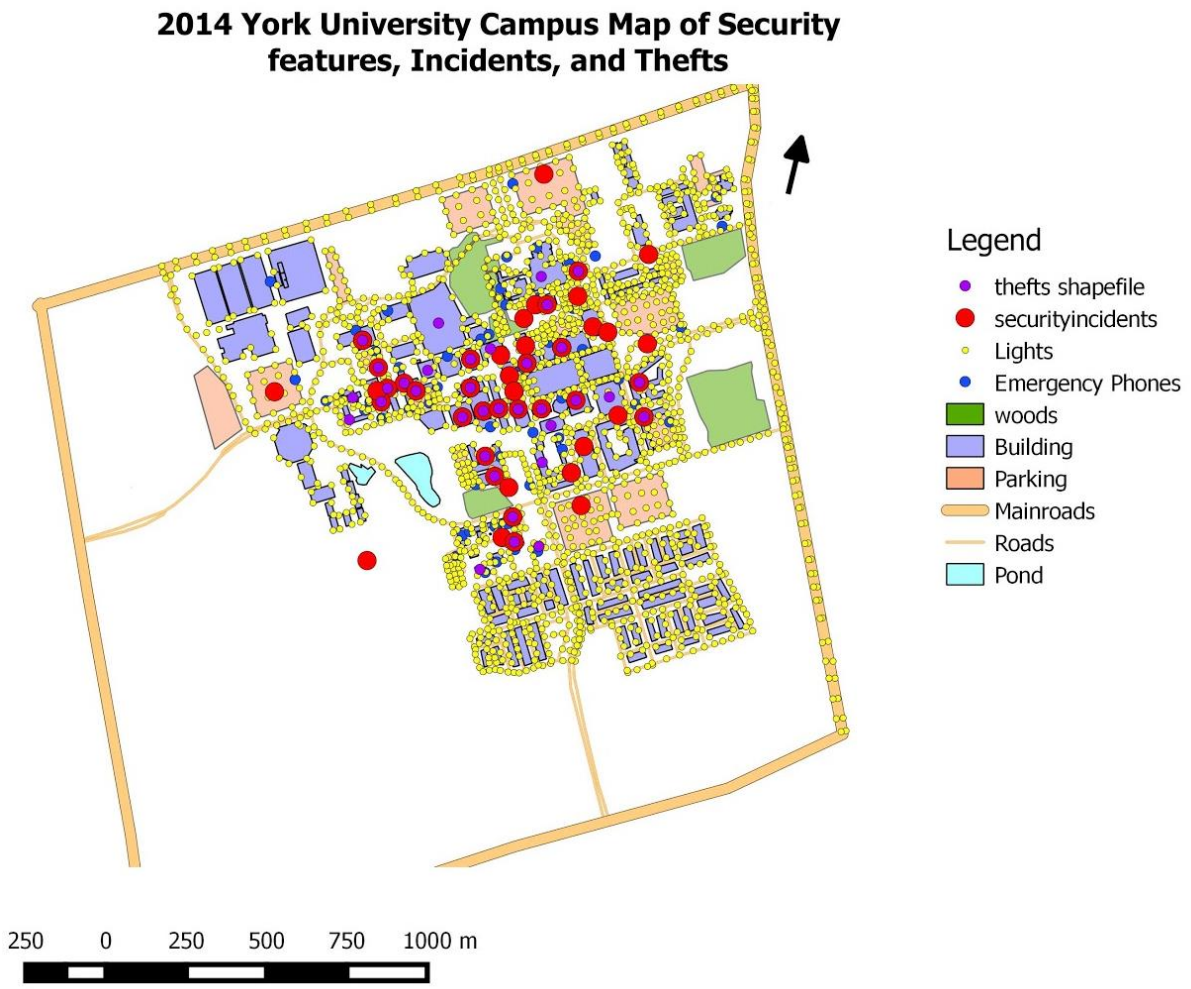


Figure 7.2 – Final map of theft incidents, security incidents, blue light emergency phones, and streetlights

Results & Discussion

Spatial analysis using a GIS environment like QGIS is an important direction for reducing and preventing security incidents in any context. As a University somewhat secluded at the edge of the city, York is a target for security threats because of the large property area of the campus grounds with many isolated spots, especially around the periphery. Students often need to traverse these isolated areas by foot and sometimes for classes that run late at night. Parking lots and bus stations are typically a source of crime because there are many that are located on the periphery of campus and require community members to walk long distances to leave campus. Woodlots can also be dangerous areas because of their seclusion and dense vegetation to provide camouflage.

There are a number of factors that increase the risk of security threats and the analysis done in this report regarding the correlation between incidents and these factors can assist in an investigation of what is causing incident occurrence and how measures can be taken to alleviate them. The data taken from the Weekly Security Incident Log from the Security Services website provided information on the date and time each incident was reported and the type of incident, which could each be manipulated to provide new insights into the spatial relationships of the data. Our hypothesis is that more incidents occur far from lighting and emergency phones and close to woodlots and parking lots. The assumption is that more of these incidents are likely to occur around the edges of the campus where parking lots and woodlots exist. This assumption is augmented by the lighting and emergency phone maps that show a greater number of these security features around the center of the campus. Although lighting is dispersed evenly across the image, it can only be found along main walkways, even though there are many more smaller pathways and students may take short-cuts across ground that is not a designated pathway. Emergency phones are much less prevalent and mostly exist in the center of the campus. Shockingly these phones are not often present in parking lots and woodlots.

If more security features are found in the center of the campus, then it should be assumed that a lower number of incidents also occur in this area. To test this, the volume-location relationship of security incidents was mapped to visualize the magnitude and distribution of incidents across the campus. A heatmap was used to show this distribution (Figure 3). The center of the campus in this project includes the buildings clustered together in the center of the map, including Ross, Vari Hall, Curtis Lecture Hall, Central Square and Scott Library. The Student Center and York Lanes can also be considered a part of this core and are areas where a large number of students gather, so they are similar to those buildings in the center of the campus. Each of the incidents have at least a single value associated with them, but certain locations have more. This is especially true in the center of the campus. The buildings with the highest number of incidents include Ross, Student Centre, York Lanes and Curtis Lecture Hall. Buildings with medium incident rates include Scott Library, Central Square, Bennett Center and Tait McKenzie. There are a number of buildings that include more than a single incident, but these are quite numerous and too much to analysis individually. However, the important trend from these lower incident rates is that they occur around the center of campus as well. In fact, there

seems to be a strong inverse correlation between incident occurrence and distance from the center of campus. Another important feature of these locations with low incident numbers is that certain locations in the center and nearby those locations with very high incident numbers still have these low numbers. An example of this is Vari Hall, which is typically a very populated area where students engage in social activities, yet only had a low number of incident occurrences in 2014. It is also immediately adjacent to Ross which has the highest incident occurrence. The Student Centre and Central Square are also areas that are primarily used for social activities over food, yet they have high incident occurrences. Scott Library is predominately used for studying purposes, so it seems counterintuitive to have high incidents occurrences here, but there may be other factors that may be revealed by analysis of the type of incident and the temporal distribution of incidents.

By using the heatmap application and creating separate layers for each type of incident, their distribution and the relationship between incident types can be visualized. Due to the low number of occurrences for certain incident types, some categories were grouped together when mapped. Trespassing by far has the most number of occurrences by incident type, at 54 in the pie chart (Figure 2.3). Harassment, the second largest category has 30 incident occurrences and assault has 12, while the rest have from 5 to 7 occurrences. These numbers may be low when distributed over an entire year, but they are still important, especially depending on the severity of the incident. While trespassing is of minor importance if it does not include robberies or breaking and entering, it is shocking how high the number is. It leads to questions of how trespassing is determined by security personnel, the issue of homelessness around the Keele campus and how the University may be wrongfully stifling these issues. Harassment is one of the most general and vague incident types and only by analysis of each incident summary can there be any true interpretation of these incidents and their importance. Earlier it was mentioned that harassment was used as the category type by the York University Security Services despite the summary indicating it was a sexual assault incident, crediting the broad number of incidents this category contains.

Figure 4 shows the density and distribution of trespassing incidents by location. The pattern and densities are strikingly similar to the heatmap of all incidents, which makes sense considering trespassing has the greatest number of incidents and makes up a large portion of the data. The only notable aspect

of this map is that trespassing incidents occur over the entire area of the campus and even occur in parking lots and walkways. This is interesting because the most trespassing incidents involve non-community members entering the campus, but there are many non-community members visiting the campus every day. Some of the incidents are understandably warranted as trespassing, such as one incident where a non-community member was in possession of marijuana and "engaging in prohibited activity" in the Ross building. Others, however, are less explanatory, such as "Security responded to a report of two unknown males acting in a suspicious manner in the vicinity of an orientation party. The males were identified as non-community members and directed to leave the property." Another inconspicuous incident occurred in the Student Centre where, "A security patrol encountered a known trespasser asleep on the fourth floor. The individual was trespassed from the property and escorted off campus by Police." How are the people escorted off the campus because they are non-community members different than those visiting the campus that are not considered trespassing? Why is a University that should prize inclusion escorting people off campus who are not even in a building, but just outside?

Assaults and sexual assaults are the incidents of most concern because they can leave the victim with heavy physical and emotional harm. Most of the assaults and sexual assaults were reported with no injuries sustained, however, some did involve weapons and injuries, even in busy areas like the Student Centre. Most sexual assaults were targeted at women, however, there were some where a male was sexually assaulted by another male, while others do not relay any information on the targets gender, but do for the perpetrator. Some assaults involve minor disputes among colleagues, for example, a person is shoved after an argument, while others are much more violent. Some sexual assaults involve contact while others involve indecent behaviour such as exposure to women or inappropriate comments are made towards another individual. One example of a sexual assault incident that involved contact was, "A community member reported that an unknown male approached her and asked her for a kiss while a second male appeared to be video recording the encounter". Figure 4.1 shows the density and distribution sexual assault and assault incidents. Some incidents do overlap, but these are noticeable because sexual assault incidents have a larger radius than assaults. Interestingly, many assault incidents occur in Scott Library, Central Square and Vari Hall where sexual assault incidents are not present. Similarly, sexual assault incidents occur

in Ross while there are no assault incidents. The lack of overlap can be found in most areas where there is low overall incident occurrence. Low density assault incidents, other than in the William Small Centre, York Lanes and the Student Centre occur in a parking lot and on walkways, while all of the sexual assault incidents occur in buildings. Also, the sexual assault incidents seem to have a random pattern to them and more edge oriented than assaults.

Robbery, robbery attempt and breaking & entering have the lowest number of incidents of all incident types and they are similar in that they typically involve theft with the victim involved. Breaking & entering does not always have to directly involve interaction between perpetrator and victim, but it was included because it involves theft to a community member. Figure 4.2 shows the relationship between these incidents and their individual distributions. None of the different incident types overlap and there seems to be no multiple occurrences in the same location with the exception of breaking & entering in the Student Center (underground). Interestingly, the only incidents that occur in the center of the campus are robberies in Curtis Lecture Halls. There are a number of breaking & entering incidents that occur in the Student Centre (underground), but the remainder of robbery, robbery attempt and breaking & entering incidents occur in residence buildings, parking lots or on walkways, with the exception of a breaking & entering incident in the Lassonde Building. This discovery can be further analyzed with a proximity analysis to security features since these incidents primarily occur away from the core of the campus.

The second largest number of incidents is allocated to the category, 'harassment'. Figure 4.3 shows the spatial distribution of these incidents. The greatest density is at the Bennett Centre with a moderate number of incidents in Ross, Vari Hall, Tait McKenzie, York Lanes, the Technology and Enhanced Learning building, Accolade West and the 340 Assiniboine Road Residence, however, there are an equal number of single incident occurrences in other locations, including Scott Library and Curtis Lecture Halls where there are a large number of incidents for the overall incidents. Despite having 30 of the 125 incidents allocated to harassment, they are much more widely distributed than trespassing incidents. This means trespassing accounts for more of the incidents in the center of the campus rather than harassment. None of the harassment incidents occur on walkways and parking lots, just buildings.

The incidents were analysed temporally to determine if there are seasonal or daily patterns to incidents. Seasons were used because the theory is that

certain weather patterns or even occasions associated with certain seasons may have certain crime patterns. For example, over the Christmas break there are a greater number of incidents like robbery because criminals know that new and expensive items will be purchased or given as gifts or those same criminals may need presents of their own and cannot afford them. However, in winter there may be less incidents because the weather is not favourable for travelling outside, either alone or to engage in criminal activity.

Figure 2.4 shows the distribution of incidents by month to provide a more quantitative view of the distribution. With the exception of January and February, the graph has a bi-modal pattern with left and right skews and low values in the middle. This indicates that the end of spring and the beginning of summer have lower incident rates in 2014. Autumn months (October – December) have the most overall number of incidents compared to other seasons. December has the highest number of incident occurrences, indicating that the holidays may be a significant factor in this. The second largest number of incidents occur in March, which is also a time when students are bustling to get done work for the semester and anxiety and stress are high, which could lead to an increased number of incidents. The first map (Figure 5) shows all incidents in the spring season. The highest density of incidents occurred in York Lanes and the Student Centre. Moderate densities occurred in Curtis Lecture Halls, Scott Library, TEL and Tait McKenzie. The second map (Figure 5.1) shows all incidents in the summer season. Ross and the Student Centre have the highest densities and Curtis Lecture Halls, Scott Library and Stong College have moderate densities. Autumn incidents are shown in Figure 5.2. The largest density is in the Ross building, while more moderate densities are in the Student Centre, Central Square and York Lanes. Winter incidents are shown in Figure 5.3. Again, the highest number of incidents occur in the Ross building and more moderate incidents in the Bennett Centre and Accolade West.

There seems to be no singular spatial or density pattern across all seasons, rather similarities between seasons. summer, autumn and winter have the greatest concentration of incidents in the Ross Building, whereas spring has no incidents at all in Ross. Instead, spring has the highest concentration of incidents in both the Student Centre and York Lanes, whereas York Lanes has a fairly low number of incidents for all other seasons. However, one common feature is that the Student Centre has one of the highest density amounts in each season. The central area (Ross, Curtis Lecture Halls, Vari Hall, Central Square and Scott

Library) of the campus do not have equal densities by location per month. For example, in winter, no incidents occur in Scott Library, but in spring no incidents occur in Ross or in Central Square.

Hour of the day of incidence occurrence was also examined spatially. The gradient scale begins at 1 A.M. in a 24-hour clock as white and to midnight as a dark blue colour. As the hour increases the colour becomes darker and the lightest colours are early in the morning (1 A.M.), so incidents that occur around 11 P.M. or 1 A.M., only two hours difference, will be drastically different colours, even though temporally they are not significantly different. The map is also scaled to measure the density of incidents, which is a similar approach to the heatmap but provides a different representation and a different form of analysis. This graduated map also represents all of the incidents in a different style than the heatmap. In Figure 8.1, the incidents in the center of campus are much more evident. The largest density is found at the Ross Building and incidents occur early-midday. This trend occurs in Curtis Lecture Halls, Scott Library and the Student Centre, but in Vari Hall and Central Square, incidents occurred more in the day. In York Lanes incidents seem to be evened out throughout midday to night, however, there are fewer incidents at night. It's interesting that most incidents late at night occur on pathways. However, a lot of incidents that occur in the early hours of the day (1 – 3 A.M.) are found in buildings. One of the different pieces of information that can be picked up better from this type of representation as opposed to the heatmap for density analysis is that the differences in the size of the circle, although not completely easy to see, makes use of a range of scale better than the class system used to change scale for the heatmap plugin. In the map (Figure 6.1) it is obvious that there are few incidents that occur in the Health, Nursing and Environmental Studies building and the Seymour Schulich building, but in the heatmap (Figure 3) all of the locations that have had only a few incident occurrences are the same label and all look to be the same.

Figure 2.5, depicting the number of thefts in each month of 2014 shows some patterns but there are some inexplicable outliers. In the months when classes are held (September-November and January-March), the number of thefts is generally higher than the amount in the months when limited summer semester classes are held (May-August). The school year began in the second week of September with a total of 30 reported thefts which puts it at the third highest month for thefts reported in 2014. Students are returning for the

beginning of a new academic year and class attendance tends to be much higher at the beginning of the fall semester, and so increased campus traffic logically brings more thefts. There is a relatively high volume of students studying in libraries as well as other buildings, and classes are full which creates more opportunity for thefts. In October, the number of thefts was less than half at 14 reports. This may be due to the fact that Reading Week takes place partly in October, and therefore there is less campus traffic. However, this dramatic decrease in the number of reported thefts from the previous month is otherwise difficult to explain. November of 2014 brought 20 reported thefts which is a slight increase from the last month, and may be explicable due to the fact that many final assignments come due at the end of November and the semester is drawing to a close which brings more students back to class. Having said that, part of reading week usually runs into the first week of November which should drive campus traffic and therefore thefts down. Finally, in December when there are classes only for the first week and exams for the next two weeks, the number of reported thefts is the same as November. This does not seem to follow logic as in December there are considerably less students on campus due to no scheduled classes for two weeks, and holidays for the last week when the campus has an extremely limited number of students. However, one may consider that during the two weeks of the exam period, all students enrolled in classes will have to come to campus at some point to write their exams, even if they have not been attending classes during previous months; this means that a high number of students are on campus, even if only for a few hours at a time, which translates into more opportunities for theft.

After the holiday break students return to campus for the last three weeks of January. In January of 2014, there were 17 total reported thefts which is relatively low compared to the first month of the previous semester which had a little less than double that number. January marks the beginning of the second semester which one would imagine means many students are likely to attend classes but the number of thefts suggests the opposite. Moving in February which is the second month of the second semester of the academic year and includes part of the Winter semester reading week, there is an unusually high number of thefts. At a count of 52, February of 2014 is a largely outlying month in terms of reported thefts. This phenomenon is somewhat inexplicable as February is the 'middle' month of the semester and it includes some of reading week- these two fact suggest that class attendance should be relatively low, though the extremely high number of thefts says otherwise. Moving into March, the

number of reported thefts goes back down and comes in at 29. March is the last full month of classes which suggests that more students may be travelling to campus to work on final assignments and catch up as final exams draw nearer. In April of 2014, the number of reported thefts was 15, which is quite low. There are classes held as usual in the first week of April, then the exam period spans the next two weeks, and finally the last week marks the end of the academic year. The fact that final exams are held in the middle two weeks of April suggests that there would be a very high volume of students on campus studying and writing exams, which may be interpreted as increased opportunities for thefts to occur. However, the low number of reports proves the opposite.

Finally, in the months of May, June, July, and August when a limited number of Summer semester classes are held, the number of reported thefts is relatively low. In May, June, and August, the number of thefts reported was 12, 14, and 12 respectively. These numbers are overall lower than those over the rest of the academic year (with the exception of October with 14 reports and April with 15 reports). This is easily understandable as campus traffic is much lower than during the rest of the year, which means there are much fewer opportunities for theft. The outlier for this group is the month of July which has 19 reported thefts; this is higher than the months of October, January, and April, all of which are in the 'regular' school year. This occurrence is difficult to explain because, as previously mentioned, classes in July are very limited and nowhere near as high volume as during the Fall and Winter semesters.

When it comes to the time of day when thefts are reported, the patterns seen are very logical. The peak time for thefts in 2014 seemed to be from 1pm-5pm which is the middle of the school day. Students who have early classes may stay on campus for several hours after to study or complete assignments in the library, computer labs, or other places, and students who have late classes may travel to campus a few hours early to do the same. By 8pm the number of thefts generally decreases, as there are fewer night classes and students have generally left campus by that time. Between the hours of 11 pm and 9 am, the number of reported thefts is under 5 (with the exception of the hour of 8 am when there were 6 reports). This is very logical as those are nighttime/early morning hours when there are no classes and campus traffic is very low. However, there are still some reports as some students may remain on campus studying or working, or using facilities such as the Tait McKenzie gym.

Finally, some patterns can be seen in the location of reported thefts. The locations on campus with the highest number of thefts in 2014 were Scott Library (76), and Tait McKenzie Gym (25). The security reports show that the majority of thefts reported from Scott Library took place on the fifth floor and were most commonly of laptops, wallets, and winter jackets left unattended. It is very logical that this location has by far the most thefts as it is a very large building with many different areas and obstructions. There is a total of five floors, and countless quiet places where a thief might take someone else's personal property and quietly leave with it unnoticed. Many large bookshelves and 'wings' on each floor mean that a thief may go to an area, steal something, and disappear from sight very easily. Additionally, a very high volume of students frequent the library and tend to stay for several hours at a time to study and work on assignments. Tait McKenzie Gym has the next highest amount of reported thefts, though it is still only approximately a third of those reported in Scott Library. In this location, many thefts of wallets, winter jackets, and purses all left unattended were reported. Again, many students frequent this large and complex building where they are required to leave their possessions in an area separate from where they use the gym's facilities, and often for an hour or more at a time. In this environment, a thief is able to steal someone else's personal property, say from a locker room, and may conceal it in the private areas of the locker room before leaving the building altogether.

Previous Findings Comparison

The hypothesis from our current project and the previous project were very similar. Both the hypothesis stated that more incidents would occur in areas farther away from security features and in isolated areas. However both the map of security incidents that we created and the map the previous group created showed a clustering of incidents around the campus centroid. The two maps show a similarity in the location of the incidents. As shown in the maps, most security incidents occur near or in buildings. The previous group analyzed the location of the incidents from 2007 to 2010, and their graph showed that 86% of the incidents occurred in buildings. It can be seen that the trend is still continuing in recent years. The two maps also show that the incidents happen in almost the same locations, which would mean those areas would need to have the increased security features, and be monitored more. The previous group also put emphasis on the lights on the campus, and have seen the lack of lighting in some areas as an issue. The findings done by our group found that most incidents occurred during the day and in well-lit areas. Therefore the

connection between increased incidents and lack of lights was hard to make. Our findings showed that people are more likely to commit petty crime like theft when the most people are around because it is easier to get away with. Like the previous group, we also are trying to find the causes of the incidents, and what future analysis needs to be done to make the campus safer. What makes the security on campus hard to address is the lack of access to certain information. Patrol routes and camera locations are not available to the public and the information is deemed confidential. Therefore it is hard to create solutions for the incidents happening inside the buildings, as the previous group also pointed out.

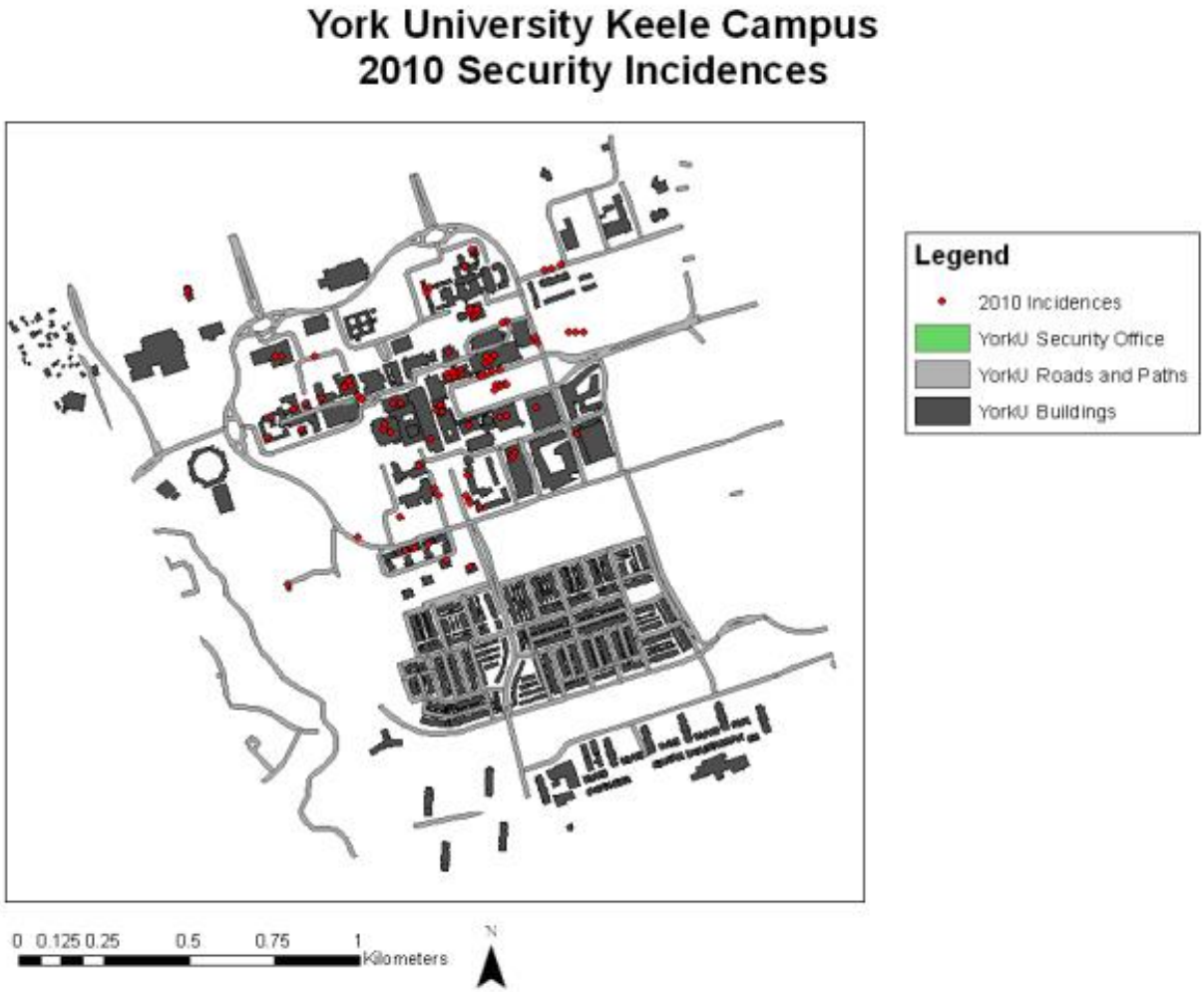


Image courtesy of Tano De Luca, James Marzotto, Andrew Moretti, Ian Sachs and Tami Shum, 2012.

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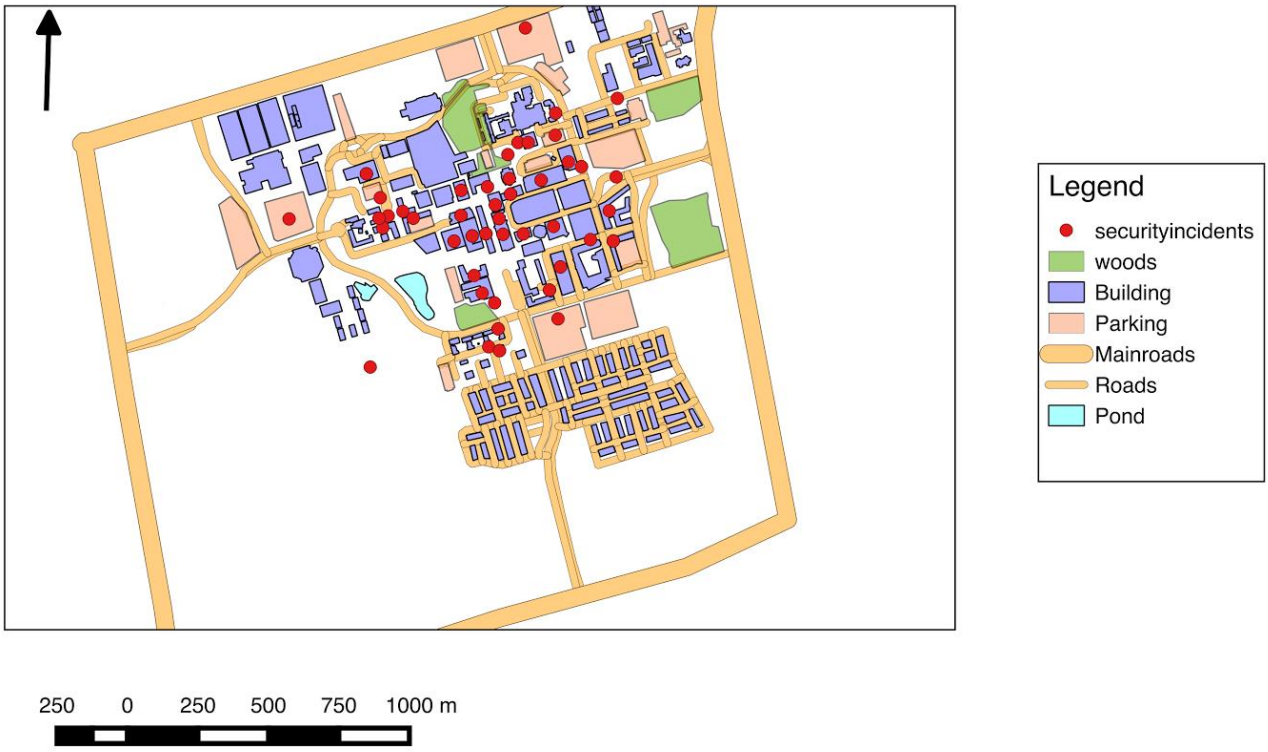

Conclusion

York University Keele campus has been experiencing many security incidents throughout the years. For our project we looked at the security incidents that have occurred in 2014 and examined the relationships between the security incidents and the security features located on campus as well as the density of incidents per location and these trends over the entire campus. Trends over time and by incident were also analysed and compared. According to our findings, our initial hypothesis was incorrect. What we had found was that the relationship between security incidents and security features has no correlation; many of the incidents happened right beside the security features such as the blue light emergency phones and the street lights as well as further from vegetation, closer to buildings and pathways and further from main roads. Due to the lack of indication that incidents and distance from high risk security features are correlated, there must be underlying issues that cause the persistence of security incidents. The incidents happen despite the available

security features on campus, but their benefits may not be understood just through spatial analysis. If the security features were not available on campus, there could have been a greater amount of incidents because these features are located at high traffic areas which are surrounded by light and emergency features. Not all the security features' locations are available to the public such as cameras and those incidents that occur within the buildings cannot be managed with just emergency phones and lights. Another problem with our surface analysis is that it does not tell us about the distribution of incidents on a vertical scale. All incidents that occur within a building will be considered equal, even though isolated incidents on the top floor of the Ross towers have more risk of occurring than those in the busy corridor below. One of the main reasons for creating this map is that it can provide community members with knowledge about security risks which are pervasive to their daily lives. We hope that our findings can in turn be used to create a solution for future generations.

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