

Business Opportunities for the Edinburgh Tram Extension

1 Background & Opportunity Statement

1.1 Background

The City of Edinburgh in Scotland has a population of around 500,000 and has grown by 12.5% over the last ten years¹. After London, it is the second most popular visitor destination for incoming international tourists² in the UK, with over two million visitors per annum.

It has a tram line which opened in May 2014, connecting the airport in the East to the city centre, which carries 7.3 million passengers per annum³. In March 2019, the City of Edinburgh Council voted to extend the tram line from the city centre to the west of the city⁴. The line is expected to be operational in the first quarter of 2023.

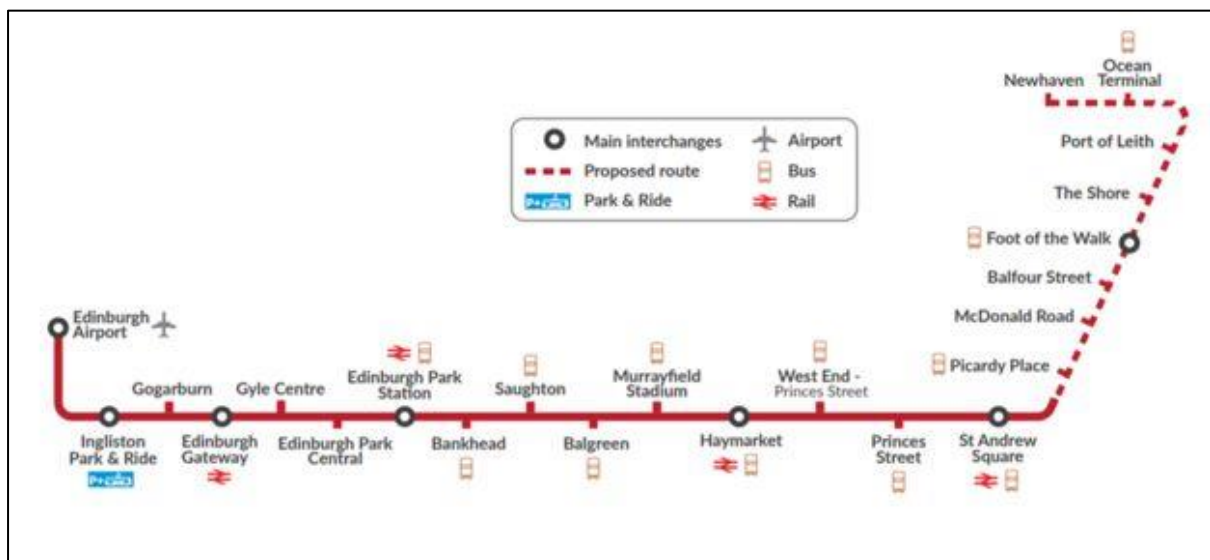


Figure 1: Edinburgh Tram Line: Current & Future

The extension of the tram line provides a great opportunity for local businesses, whether established businesses wishing to expand or startups.

The purpose of my Capstone project is to identify the types of local businesses and amenities which are close to the tramline, to compare those to the rest of the city, and to recommend which types of businesses have the best opportunity to set up along the route of the extended tramline.

¹ http://www.edinburgh.gov.uk/downloads/file/9904/edinburgh_by_numbers_2018

² <https://www.visitbritain.org/town-data>

³ <https://stv.tv/news/east-central/1434343-number-of-people-using-trams-in-edinburgh-increases-by-10/>

⁴ <https://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-47555231>

2 Data Sources

2.1 Postcode Data

Postcode data is available from the National Records of Scotland website⁵.

The format of a UK postcode is postcode area / postcode district / postcode sector. For example, the postcode for the headquarters of Standard Life Assurance Limited⁶ is EH1 2DH. The postcode area is EH; the postcode district is EH1, and the postcode sector is EH1 2.

There are 56 postcode districts in the EH postcode area⁷, illustrated in Figure 2. We will use a subset of these covering the centre of Edinburgh and the area covered by the tram extension.

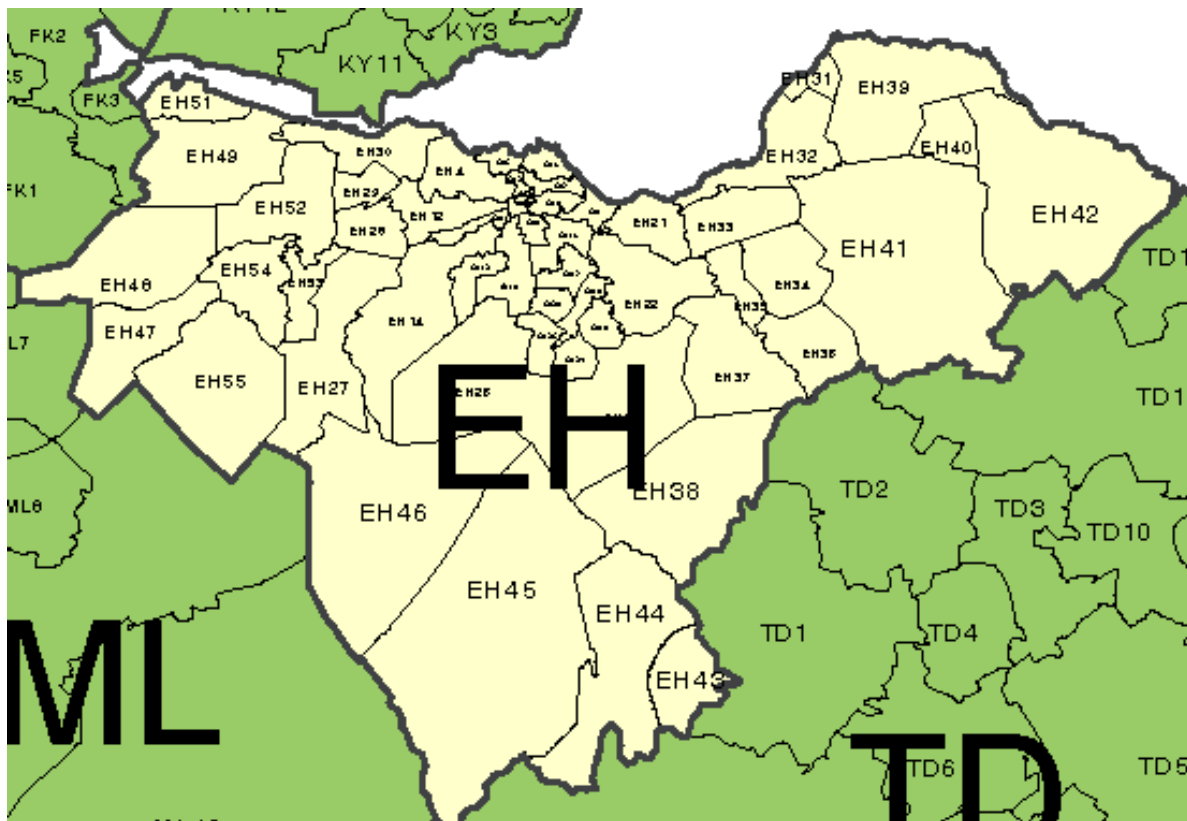


Figure 2: EH Postcode Districts

2.2 Foursquare Data

We will use the Foursquare API to collect data relating to venues near the postcode districts of interest.

⁵ <https://www.nrscotland.gov.uk/statistics-and-data/geography/our-products/scottish-postcode-directory/2019-1-scottish-postcode-directory-files>

⁶ <https://www.standardlife.com/sl/about-us/our-locations.page>

⁷ <https://www.gbmaps.com/4-digit-postcode-maps/eh-edinburgh-postcode-map.html>

2.3 Open Source Data

There is a comprehensive range of 233 open source data sources provided by the City of Edinburgh Council and freely available at the website <https://edinburghopendata.info/>. This includes around 70 csv files which we will investigate in more detail at the next stage of the project.

For example, Figure 3 shows a dataset relating to libraries⁸ and Figure 4 a dataset relating to sports facilities⁹.

Picture	Name	News	Blog	Details	Address	Postcode	Telephone	Email	Twitter	Opening...
http://www...	Art Library	Catch">...		Enjoy life...	7-9 Geor...	EH1 1EG	0131 24...	central.fi...	http://twit...	Mon, Tu...
http://www...	Balerno ...	">https://...			1 Main S...	EH14 7EQ	0131 52...	balerno.li...		Mon & ...
http://www...	Balgreen...	http://ww...			173 Balg...	EH11 3AT	0131 52...	balgreen...		Mon & ...
http://www...	Blackhall...	http://ww...			56 Hillho...	EH4 5EG	0131 52...	blackhall...		Mon, Tu...
http://www...	Central ...	Catch">...		Explore ...	7-9 Geor...	EH1 1EG	0131 24...	childrens...	http://twit...	Mon & ...
http://www...	Central L...	Catch">...		High inte...	7-9 Geor...	EH1 1EG	0131 24...	centrallib...	http://twit...	Mon, Tu...

Figure 3: Sample Open Data - Libraries

Name	Address	Postcode	Telephone	Email	Opening...	Facilities	Activities	Prices	Timetab...	More inf...
Ainslie P...	92 Pilton...	EH5 2HF	0131 55...	mail@ed...	Monday ...	25m swi...	Adult an...	http://ww...	http://ww...	http://ww...
Balgreen...	Balgreen...	EH12 5TY	0131 31...		Mid-April...					
Bingham...	35 Bingham...	EH15 3HZ	0131 52...	sportspit...		Football				
Braid Hill...	Braid Hill...	EH10 6JY	0131 44...			Braid Hill...	Golf	Weekda...		
Braidbur...	168 Com...	EH10 5TE	0131 52...			Orienteer...	Cycling ...			
Bruntsfie...	Melville ...	EH9 9EX	0131 52...	sfc.south...		Short hol...		Free to p...		http://ww...

Figure 4: Sample Open Data – Sports Facilities

As the project progresses, we will examine all the available datasets and determine the extent to which they can add value to the foursquare data.

2.4 Neighbourhoods Data

The City of Edinburgh, like all UK cities, does not have formal “neighbourhoods” that would apply in, for example, the USA and Canada. However, the citizens of Edinburgh do refer to their locales in an informal manner, and some examples of these are provided on various websites¹⁰. We will investigate the extent to which we can apply these informal locales to the postcode districts in an attempt to bring some more descriptive analysis of the locales in the city.

⁸ <https://data.edinburghopendata.info/dataset/libraries/resource/6e9777d2-41a4-44d7-83de-20b1feab5328>

⁹ <https://data.edinburghopendata.info/dataset/sports-and-recreational-facilities/resource/b31e2bd8-b933-4adb-9b53-0d6b0a3b6832>

¹⁰ <https://theculturetrip.com/europe/united-kingdom/scotland/articles/the-coolest-neighbourhoods-in-edinburgh/>

3 Methodology

3.1 Data Collection

3.1.1 Postcodes of Current & Future Tram Stops

The postcodes of each tram stop can be found in various places including a local website¹¹. We are interested in the nine tram stops which towards the centre of the city, listed in Figure 5. The other seven stops (Edinburgh Park Station, Edinburgh Park Central, Gyle Centre, Edinburgh Gateway, Gogarburn, Ingliston Park & Ride, Edinburgh Airport) have not been used as they are further out of the city and not representative of what we want to understand about businesses close to the existing and planned tram lines. I manually created this first dataframe with the data in Figure 5.

Tram Stop	Postcode	Status
Saughton	EH11 3NE	Current
Balgreen	EH12 5XQ	Current
Murrayfield Stadium	EH12 5PL	Current
Haymarket	EH12 5JZ	Current
West End	EH3 8ET	Current
Princes Street	EH2 2ER	Current
St Andrew's Square	EH2 2AD	Current
York Place	EH1 3JD	Current

Figure 5: Postcodes of Existing Tram Stops

The postcodes of future tram stops are partly found in places including a local website¹². I did some manual checking of these based on local knowledge and made some changes. I created a second dataframe with this data in Figure 6. The purpose for creating these as separate dataframes is so that if in the future the raw data is published to a website, the I could use other automated methods to update the data.

Tram Stop	Postcode	Status
Picardy Place	EH1 3JT	Future
McDonald Road	EH7 4LX	Future
Balfour Street	EH6 5EP	Future
Foot of the Walk	EH6 7AB	Future
The Shore	EH6 6QN	Future
Port of Leith	EH6 6JD	Future
Ocean Terminal	EH6 6JJ	Future
Newhaven	EH6 4JJ	Future

Figure 6: Postcodes of Future Tram Stops

¹¹ <https://www.scotsman.com/regions/edinburgh-fife-lothians/the-cost-of-renting-near-every-stop-on-edinburgh-s-tram-line-1-4022451>

¹² <https://www.edinburghlive.co.uk/news/edinburgh-news/what-you-need-know-edinburghs-15109962>

I concatenated the two data frames to create a single dataframe, shown in Figure 7.

	TramStop	Postcode	Status
0	Saughton	EH11 3NE	Current
1	Balgreen	EH12 5XQ	Current
2	Murrayfield Stadium	EH12 5PL	Current
3	Haymarket	EH12 5JZ	Current
4	West End	EH3 8ET	Current
5	Princes Street	EH2 2ER	Current
6	St Andrews Square	EH2 2AD	Current
7	York Place	EH1 3JD	Current
8	Picardy Place	EH1 3JT	Future
9	McDonald Road	EH7 4LX	Future
10	Balfour Street	EH6 5EP	Future
11	Foot of the Walk	EH6 7AB	Future
12	The Shore	EH6 6QN	Future
13	Port of Leith	EH6 6JD	Future
14	Ocean Terminal	EH6 6JJ	Future
15	Newhaven	EH6 4JJ	Future

Figure 7: Concatenated Dataframe of Current & Future Tram Stops

3.1.2 Addition of Deprivation Index to Tram Stops

The website <https://www2.gov.scot/Topics/Statistics/SIMD/PostcodeLookupEdinburghCi> provides a list of postcodes in Scotland with additional statistics such as Deprivation Index.

The Deprivation Index is an indicator of the wealth of the locale, with a number which increases as the wealth increases.

The actual data is available via a URI which automatically downloads the file in Excel format at <https://www2.gov.scot/Resource/0041/00412531.xls>

The file has 12,489 rows by 25 columns, which I imported using the pandas.read_excel function.

I dropped most of the columns, keeping the Deprivation Index and Intermediate Zone Name, which I renamed. The first five lines of this dataframe is shown in Figure 6.

Postcode	Deprivation	intZoneName
EH1 1AD	3880	Old Town and Leith Street
EH1 1BB	2964	Old Town and Leith Street
EH1 1BD	2964	Old Town and Leith Street
EH1 1BE	2964	Old Town and Leith Street
EH1 1BJ	2964	Old Town and Leith Street

Figure 8: First five lines of local stats Dataframe created from imported postcode File

I then merged the tram stops dataframe (Figure 7) and local Stats dataframe (Figure 8).

3.1.3 Addition of Council Tax Band to Tram Stops

The deprivation index is from 2012, and although interesting is likely to be out of date. Another indication of the wealth of the locale is the level of Council Tax.

The website <https://data.edinburghopendata.info> is the open data portal for the City of Edinburgh and contains data about the level of Council Tax at the postcode level (typically 20-100 households) at <https://data.edinburghopendata.info/dataset/council-tax-bands-by-postcode>.

The actual data is available via a URI which automatically downloads the file in csv format at <https://data.edinburghopendata.info/dataset/3794ec1e-672d-40eb-8af6-59c7b0e431e3/resource/5cf39178-5297-4a9d-beed-91db092d96a6/download/counciltaxbandsbypostcode.csv>

The file has 27,036 rows by 2 columns, postcode and “Current Chargeable Band”, which I imported this file using the `pandas.read_csv` function. The Council Tax band ranges from A to G, with G being the highest value properties.

The first five lines of this dataframe is shown in Figure 9.

	Postcode	Council Tax Band
0	EH10 4AA	B
1	EH10 4AD	D
2	EH10 4AD	E
3	EH10 4AE	D
4	EH10 4AF	D

Figure 9: First five lines of Council Tax Band Dataframe

Some postcodes did not have Council Tax Bands and on inspection it seemed as though these were in retail-only areas - I changed these NaN entries to X. I merged the dataframe in Figure 9 with the dataframe consisting of tram stops dataframe (Figure 7) and local Stats dataframe (Figure 8).

There is not a 1:1 relationship between Postcode and Council Tax Band, for example the postcode EH10 4AD includes both bands D and E. I therefore sought out the actual levels of Council Tax, so that I could apply an average.

3.1.4 Addition of Council Tax Level to Tram Stops

The website <https://littlejohns.ltd.uk/council-tax-information> is a website which contains the level of Council Tax against the band.

I scraped this table using the read_html function, and added a row for any postcodes without a Council Tax Band, for example because they are retail-only to create the following dataframe:

	Council Tax Band	Council Tax
0	A	1147.76
1	B	1339.05
2	C	1530.35
3	D	1721.64
4	E	2221.32
5	F	2717.46
6	G	3241.98
7	H	4018.11
8	X	0.00

Figure 10: Council Tax Levels Dataframe

I merged the dataframe in Figure 10 with the dataframe consisting of tram stops dataframe (Figure 7) and local Stats dataframe (Figure 8), and Council Tax bands (Figure 9).

In order to create an average Annual Council Tax per postcode, I used the groupby method to create the following dataframe:

TramStop	Deprivation	Council Tax
Balfour Street	3261	1434.70
Balgreen	4962	2221.32
Foot of the Walk	786	1339.05
Haymarket	5897	1824.44
McDonald Road	5499	1703.09
Murrayfield Stadium	5956	2669.63
Newhaven	2218	1530.35
Ocean Terminal	2772	2726.92
Picardy Place	3197	1569.38
Port of Leith	241	1530.35
Princes Street	5689	3325.85
Saughton	973	1147.76
St Andrews Square	2964	0.00
The Shore	4086	1824.44
West End	4593	2286.55
York Place	3197	3049.72

Figure 11: Dataframe with Average Levels of Council Tax in Postcode of Tram Stop

I merged the dataframe in Figure 11 with the original dataframe consisting of tram stops (Figure 7) and local Stats dataframe (Figure 8), dropped the Council Tax bands and added another column for postcode lookup.

3.2 Geo-Positioning

3.2.1 Lat Long Lookup

I used Nominatim to find the latitude and longitude of the postcodes and created the dataframe as shown in Figure 12.

TramStop	Postcode	Status	intZoneName	Deprivation	Council Tax	PostcodeUK	Latitude	Longitude
0 Saughton	EH11 3NE	Current	Stenhouse	973	1147.76	EH11 3NE, UK	55.954953	-3.193626
1 Balgreen	EH12 5XQ	Current	Balgreen and Roseburn	4962	2221.32	EH12 5XQ, UK	55.938746	-3.252139
2 Murrayfield Stadium	EH12 7AB	Current	Corstorphine	5956	1721.64	EH12 7AB, UK	55.942157	-3.279596
3 Haymarket	EH12 5JZ	Current	Dean, West End and West Coates	5897	1824.44	EH12 5JZ, UK	55.946088	-3.219854
4 West End	EH3 8ET	Current	Tollcross	4593	2286.55	EH3 8ET, UK	55.947872	-3.211167
5 Princes Street	EH2 1GF	Current	New Town West	5689	0.00	EH2 1GF, UK	55.953478	-3.201140
6 St Andrews Square	EH2 2BD	Current	Old Town and Leith Street	2964	0.00	EH2 2BD, UK	55.953542	-3.192686
7 York Place	EH1 3JD	Current	Old Town and Leith Street	3197	3049.72	EH1 3JD, UK	55.956369	-3.188400
8 Picardy Place	EH1 3JT	Future	Old Town and Leith Street	3197	1569.38	EH1 3JT, UK	55.957080	-3.187381
9 McDonald Road	EH7 4LX	Future	Broughton	5499	1703.09	EH7 4LX, UK	55.935023	-3.332908
10 Balfour Street	EH6 5EP	Future	Bonnington and Pilrig	3261	1434.70	EH6 5EP, UK	55.966748	-3.177103
11 Foot of the Walk	EH6 7AB	Future	Great Junction Street	786	1339.05	EH6 7AB, UK	55.971126	-3.170299
12 The Shore	EH6 6QN	Future	Leith Docks	4086	1824.44	EH6 6QN, UK	55.976969	-3.169065
13 Port of Leith	EH6 6JD	Future	North Leith and Newhaven	241	1530.35	EH6 6JD, UK	55.977093	-3.174966
14 Ocean Terminal	EH6 6JJ	Future	Leith Docks	2772	2726.92	EH6 6JJ, UK	55.980920	-3.177839
15 Newhaven	EH6 4JJ	Future	North Leith and Newhaven	2218	1530.35	EH6 4JJ, UK	55.979565	-3.189817

Figure 12: Dataframe with Tram Stops, Deprivation Index, Annual Council Tax and Lat Long

3.2.2 Folium Map

I created a map of the TramStopsFinal dataframe using folium, shown in Figure 13.

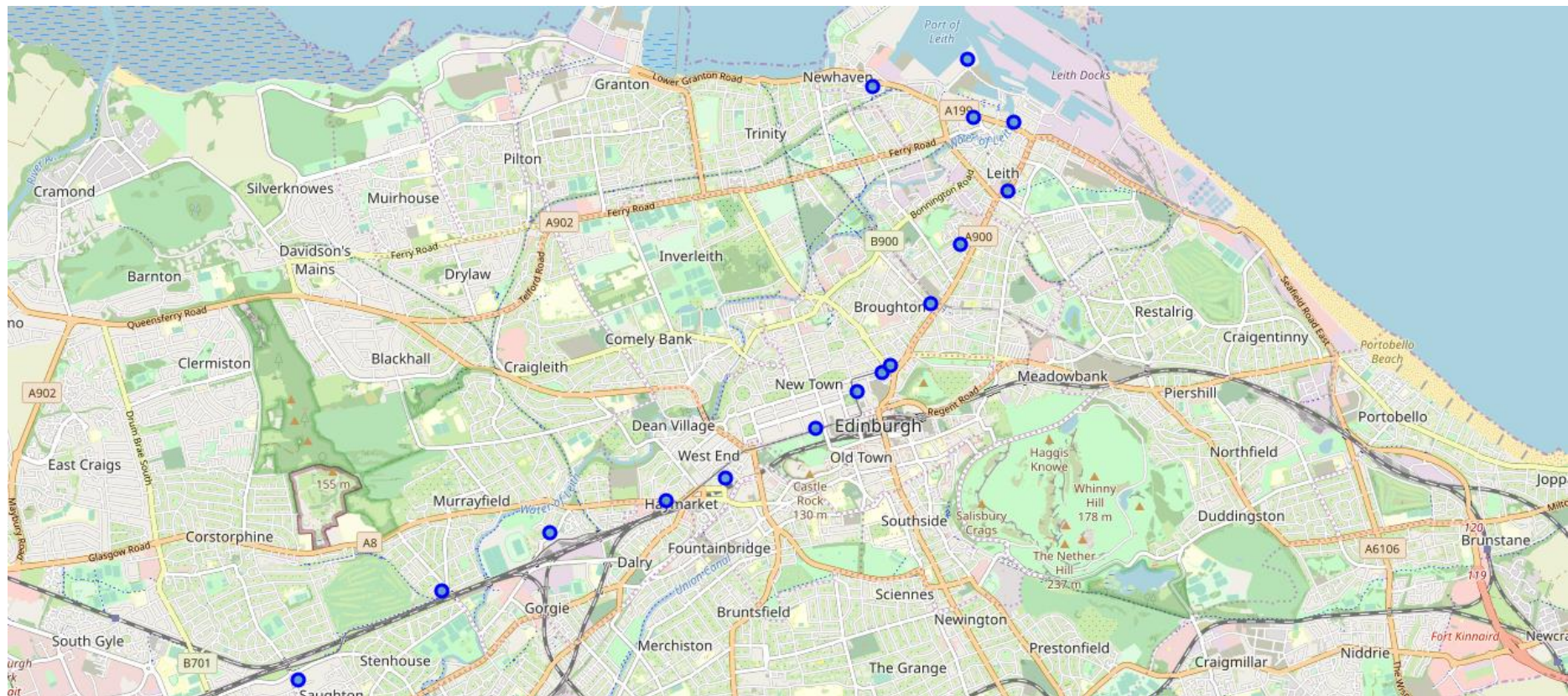


Figure 13: Folium Map of Current and Future Tram Stops

3.3 Local Venues

Using the foursquare API, I found the venues within 500 metres of the tram stop, totalled in Figure 14.

TramStop	Postcode	Status	intZoneName	Deprivation	Council Tax	PostcodeUK	Latitude	Longitude	Venues
0 Saughton	EH11 3NE	Current	Stenhouse	973	1147.76	EH11 3NE, UK	55.954953	-3.193626	4
1 Balgreen	EH12 5XQ	Current	Balgreen and Roseburn	4962	2221.32	EH12 5XQ, UK	55.938746	-3.252139	5
2 Murrayfield Stadium	EH12 7AB	Current	Corstorphine	5956	1721.64	EH12 7AB, UK	55.942157	-3.279596	13
3 Haymarket	EH12 5JZ	Current	Dean, West End and West Coates	5897	1824.44	EH12 5JZ, UK	55.946088	-3.219854	34
4 West End	EH3 8ET	Current	Tollcross	4593	2286.55	EH3 8ET, UK	55.947872	-3.211167	97
5 Princes Street	EH2 1GF	Current	New Town West	5689	0.00	EH2 1GF, UK	55.953478	-3.201140	100
6 St Andrews Square	EH2 2BD	Current	Old Town and Leith Street	2964	0.00	EH2 2BD, UK	55.953542	-3.192686	100
7 York Place	EH1 3JD	Current	Old Town and Leith Street	3197	3049.72	EH1 3JD, UK	55.956369	-3.188400	74
8 Picardy Place	EH1 3JT	Future	Old Town and Leith Street	3197	1569.38	EH1 3JT, UK	55.957080	-3.187381	68
9 McDonald Road	EH7 4LX	Future	Broughton	5499	1703.09	EH7 4LX, UK	55.935023	-3.332908	40
10 Balfour Street	EH6 5EP	Future	Bonnington and Pilrig	3261	1434.70	EH6 5EP, UK	55.966748	-3.177103	25
11 Foot of the Walk	EH6 7AB	Future	Great Junction Street	786	1339.05	EH6 7AB, UK	55.971126	-3.170299	31
12 The Shore	EH6 6QN	Future	Leith Docks	4086	1824.44	EH6 6QN, UK	55.976969	-3.169065	35
13 Port of Leith	EH6 6JD	Future	North Leith and Newhaven	241	1530.35	EH6 6JD, UK	55.977093	-3.174966	42
14 Ocean Terminal	EH6 6JJ	Future	Leith Docks	2772	2726.92	EH6 6JJ, UK	55.980920	-3.177839	16
15 Newhaven	EH6 4JJ	Future	North Leith and Newhaven	2218	1530.35	EH6 4JJ, UK	55.979565	-3.189817	6

Figure 14: Number of Foursquare Venues near Tram Stops

The number of venues within 500m of each tram stop is shown in Figure 15.

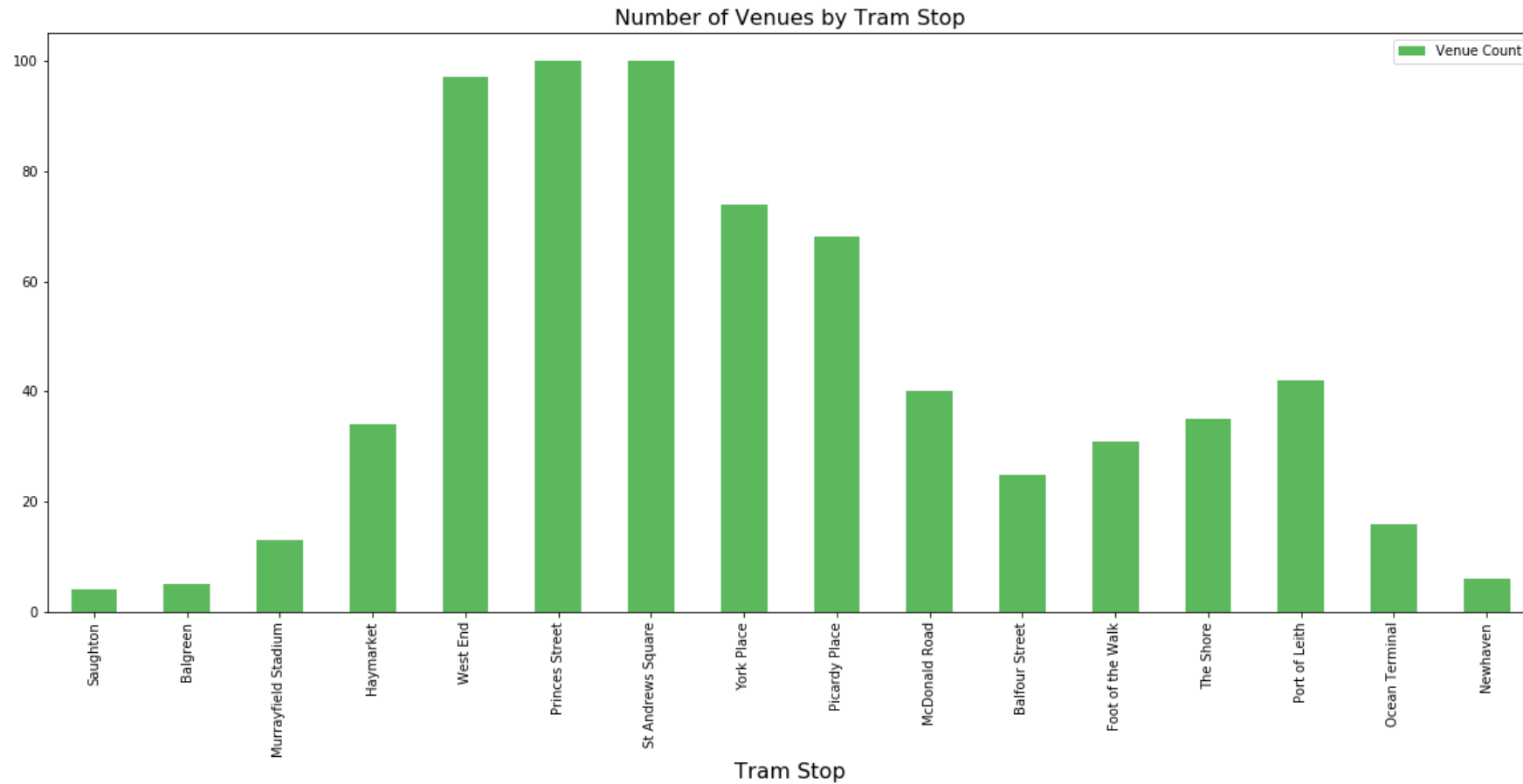


Figure 15: Number of Foursquare Venues near Tram Stops

As a next step, I looked at venues in more detail, to find the most common types of venues at each tram stop, summarised in Figure 16.

[280]:

	TramStop	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Balfour Street	Bar	Coffee Shop	Bakery	Italian Restaurant	Park
1	Balgreen	Grocery Store	Scenic Lookout	Playground	Tram Station	Park
2	Foot of the Walk	Bar	Coffee Shop	Hotel	Pub	Supermarket
3	Haymarket	Hotel	Café	Bar	Restaurant	Pizza Place
4	McDonald Road	Italian Restaurant	Grocery Store	Pub	Bakery	Bar
5	Murrayfield Stadium	Hotel	Clothing Store	Deli / Bodega	Soccer Field	Skating Rink
6	Newhaven	Café	Harbor / Marina	Climbing Gym	Supermarket	Food & Drink Shop
7	Ocean Terminal	Greek Restaurant	Spa	Movie Theater	Italian Restaurant	Bookstore
8	Picardy Place	Hotel	Bar	Café	Restaurant	Pub
9	Port of Leith	Café	Seafood Restaurant	Bar	Italian Restaurant	Hotel
10	Princes Street	Café	Bar	Pub	Coffee Shop	Sandwich Place
11	Saughton	Track	Golf Course	Tram Station	Fish & Chips Shop	
12	St Andrews Square	Hotel	Bar	Café	Coffee Shop	Pub
13	The Shore	Bar	Café	Pub	Seafood Restaurant	Coffee Shop
14	West End	Bar	Sandwich Place	Italian Restaurant	Pub	Hotel
15	York Place	Hotel	Bar	Pub	Café	Italian Restaurant

Figure 16: Most Common Foursquare Venues near Tram Stops

Finally, I applied a kmeans clustering function to each of the sixteen tram stops. I tried clustering in clusters of 3,4 and 5, and in all cases, a main cluster occurred covering the twelve tram stations in the centre of Edinburgh, a city well known for its food and drink economy.

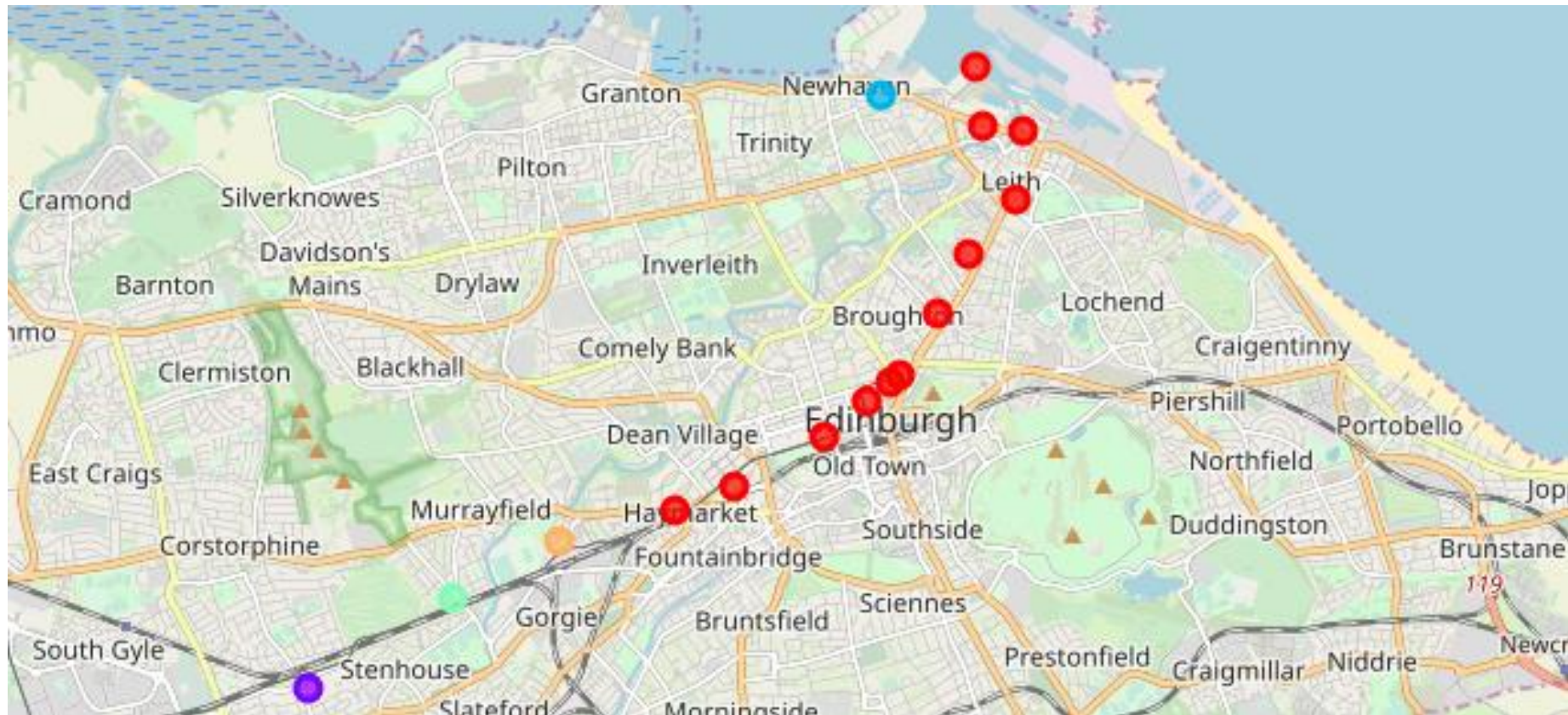


Figure 17: Clusters of Locales

4 Results

To recall, the Edinburgh Tram line currently extends from the airport to the West to the City Centre. This study examined the tram stops within the built-up part of the city, which starts at Saughton. We therefore examined eight current and eight future tram stops, as illustrated in the Figure 18.

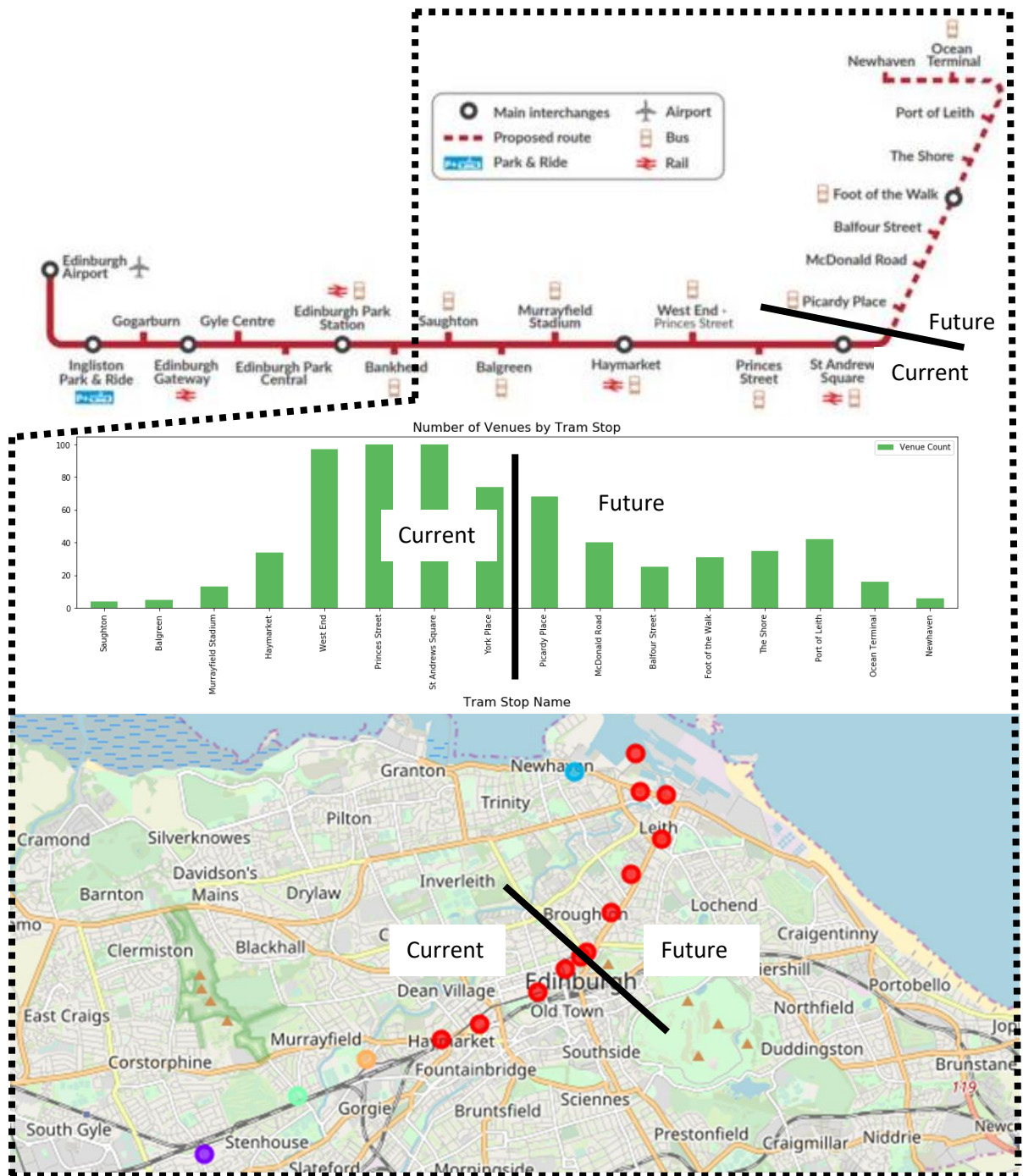


Figure 18: Summary of Study Area

Currently the Edinburgh Tram line run from the airport to the west and enter the built up area of the city at Saughton. It then passes three stops which are largely residential and do not have venues and amenities which at all resemble the centre of Edinburgh. These three stops (Saughton, Balgreen and Murrayfield) have a small number of venues (between 4 and 13) as found in Foursquare. Saughton is relatively a poorer area.

The number of venues and amenities rises between Haymarket and the centre of Edinburgh.

Beyond the existing tram line to the east, the profile of locales is more similar to the centre of Edinburgh than that of other areas. The number of venues does not drop off significantly, and rises again towards Port of Leith.

One outlier is Newhaven, at the end of the line. It currently has few venues and amenities.

It has relatively low Council Tax, which is based on lower property values. It will have a terminal tram stop, making it a more attractive location to commute into the centre of Edinburgh. That is likely to drive property demand and the opportunity for new businesses to set up in the locale.

Of course, the development of locales is more than just data. but all the data in this study points to a great opportunity for local businesses particularly food and drink outlets.

5 Discussion

The quality of the Foursquare data is unknown but may be limited. Although the three locales to the west are heavily residential, my feeling is that there are more venues to the east. With a limit of 100 venues per location, it is unknown how many venues are really in the city centre areas. We would need to establish whether Foursquare is the best source of data in the UK.

Much of the Open Data provided by the City of Edinburgh is out of date. This may be a feature of municipal run open data platforms. In an age of austerity, public sector bodies perhaps do not have the time or resource to invest in the maintenance of such data. This is a mistake. The economic benefits of enabling citizen data science will far outweigh the costs of employing a handful of open data officers.

6 Conclusion

Based on an analysis of data on Council Tax levels, existing venues and the likely benefits of a tram line infrastructure investment, it is likely that Newhaven at the end of the tram line extension will experience an economic boost which will make it attractive for local businesses, particularly those in the food and drink sector.