# A Report

# On

# Accessibility to Electric Vehicle Charging Power Stations

SUBMITTED TO: -

**Dr Harish Puppala**


**Submitted By**

| **Name of the Student** | **Enrolment Number** |
|---|---|
| Gunda Venkata Sai Jai Harsha | 190C2050003 |
| Thatikonda Vamshidar Reddy | 190C2050013 |
| Tummala Vishal Reddy | 190C2050014 |


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Remote Sensing and Geographical Information Systems



SCHOOL OF ENGINEERING AND TECHNOLOGY

BML MUNJAL UNIVERSITY GURGAON.

# TABLE OF CONTENTS

# ACKNOWLEDGEMENT:

We would like to express our gratitude towards Dr. Harish Puppala for giving us an opportunity to do the project work on Accessibility to Electric Vehicle Charging Power Stations assessment in Remote sensing and geographical information systems and allowing us to complete our project on time. We take this moment to acknowledge his contribution gratefully and deepest thanks to our mentor for taking part in constructive discussions.

# ABSTRACT

The usage of the Electric Vehicles has been increasing very rapidly and so as the need of the charging stations, as well as the awareness of the availability of charging stations.

This report is a result of a GIS Based examined application on the availability of the Charging Stations around the citizens by sampling a small city called Bristol in UK.

Previously there have been few experiments made on the similar application by using various methods like 2SFCA, 3SFCA, E2SFCA, etc. We have fetched the EV stations and population Data from Open Bristol Source and Road networks and buildings data from BB Bikes source. Here we have used 2SFCA to find the spatial accessibility of the Charging Stations in the city of Bristol with respect to the supply and demand of the services.

# LITERATURE REVIEW

- https://repository.usfca.edu/cgi/viewcontent.cgi?article=1587&context=capstone
- Full article: Suitable location selection for the electric vehicle fast charging station with AHP and fuzzy AHP methods using GIS
- Optimal siting of electric vehicle charging stations: A GIS-based fuzzy Multi-Criteria Decision Analysis – ScienceDirect
- Sustainability | Free Full-Text | Electric Charging Demand Location Model—A User- and Destination-Based Locating Approach for Electric Vehicle Charging Stations
- Solving Location Problem for Electric Vehicle Charging Stations—A Sharing Charging Model | IEEE Journals & Magazine | IEEE Xplore
- An enhanced two-step floating catchment area (E2SFCA) method for measuring spatial accessibility to primary care physicians

These are the different papers we are referring for the project.

# INTRODUCTION

As EVs continue to grow, additional electric vehicle charging stations (EVCSs) will be needed for EV customers to utilize. However, before implementing EVCSs in the public, there are various criteria that need to be considered. One of these criteria is public EVCSs' accessibility to amenities and different things. When people are charging their EVs that require a significant amount of waiting time, having amenities nearby will provide them with the option to spend their time efficiently on worthwhile activities etc.. We are making the suitable areas and nearest to the people accessible areas which they charge their vehicles.In world every country initiated to converting into EVs for next 10 years the automobile market completely shifts into electric vehicles. So, the requirement of electric charging stations is more currently there are 98 charging stations in Bristol city. Our view is to work on the EV charging stations in Bristol by using ARCGIS Pro software and implementing the no of houses and population in the various area so will create a Data.

After completing this project, with the help of the obtained data, hopefully we would be able to analyze the areas where the charging point is located with utmost accessibility to the people around it and plan for the new stations where people aren't having the accessibility. We can also achieve the new skillset of working with ArcGIS and QGIS with which we could develop or work on many more analysis like this and few more findings will be beneficial.

## STUDY AREA - Bristol City

- We will download Bristol map and from Bristol open source we will download electric charging stations and the road map of the city and the buildings in the city we will be doing in ArcGIS.
- The two-step floating catchment area method has emerged in the last decade as a key measure of spatial accessibility, particularly in its application to charging stations access. Many recent 'improvements' to the original 2SFCA method have been developed, which generally either account for distance-decay within a catchment or enable the usage of variable catchment sizes.
- We will be using network analysis for the finding the near Ev charging station.

## Data availability and status of data collection.

- No of vehicles In Bristol city EV 59,740 vehicles
- No of present charging stations in Bristol = 98
- Population in Bristol = 700,630.

## Sites: -

- https://opendata.bristol.gov.uk/pages/homepage/
- https://extract.bbbike.org/

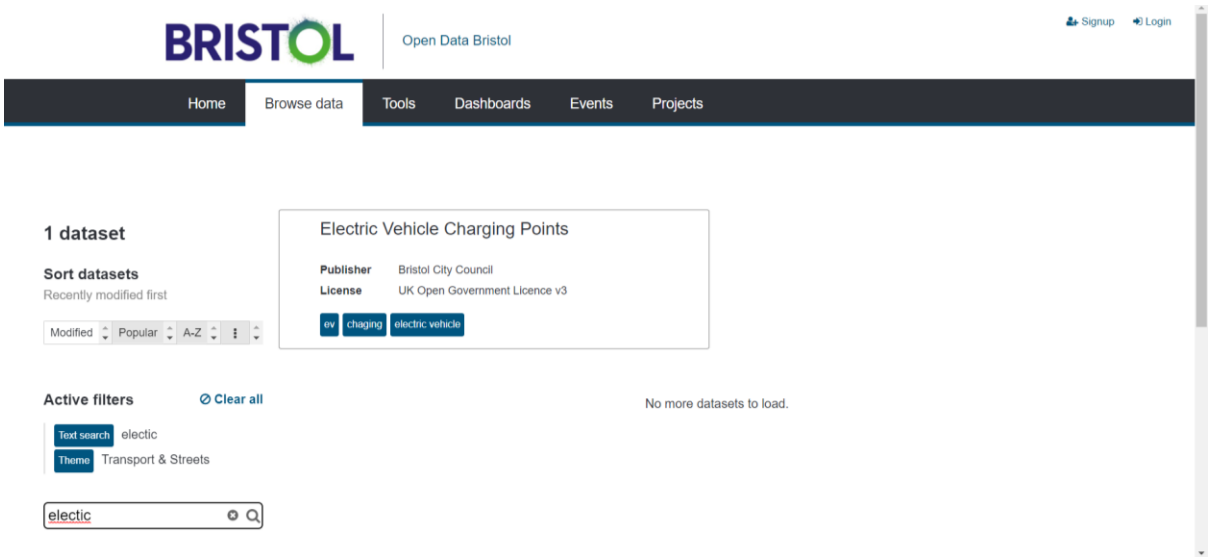
# METHODOLOGY

- First, we will download Bristol map and from Bristol open source and then after we will download electric charging stations and the road map of the city and the buildings in the city and the population of the city.
- we will start doing in ArcGIS with all the steps and measures and we will be applying the two-step floating catchment area method has emerged in the last decade as a key measure of spatial accessibility, particularly in its application to charging stations access.
- Many recent 'improvements' to the original 2SFCA method have been developed, which generally either account for distance-decay within a catchment or enable the usage of variable catchment sizes.
- We will be using network analysis for the finding the nearest Ev charging station.

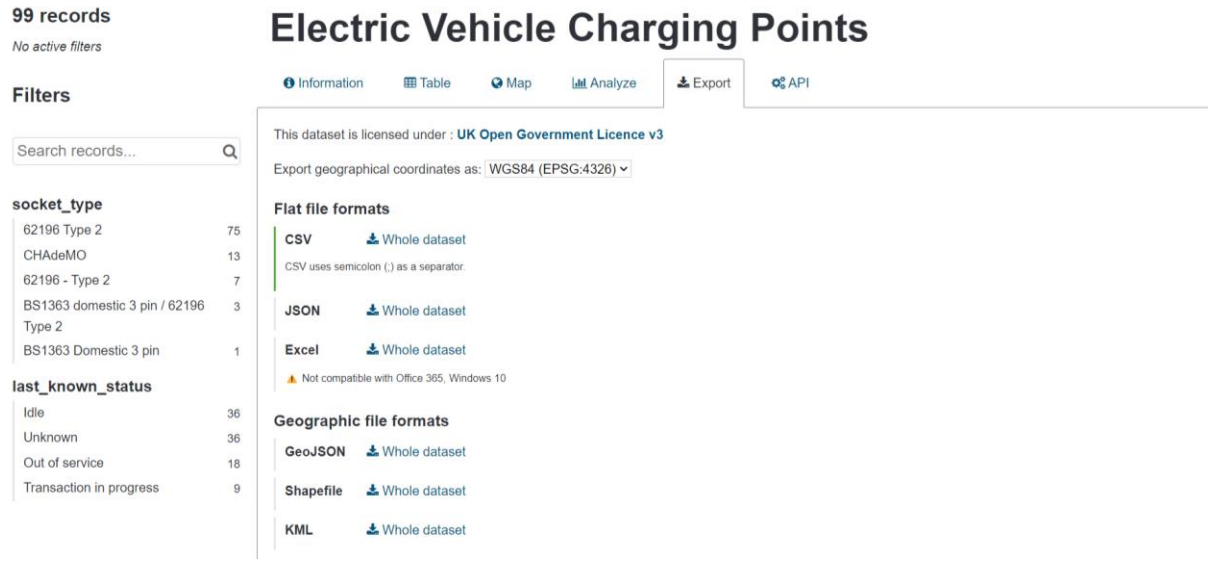
We will start with the download and adding all the data in ARGIS pro.

For Electric charging stations and population data set we downloaded from open Bristol Source.

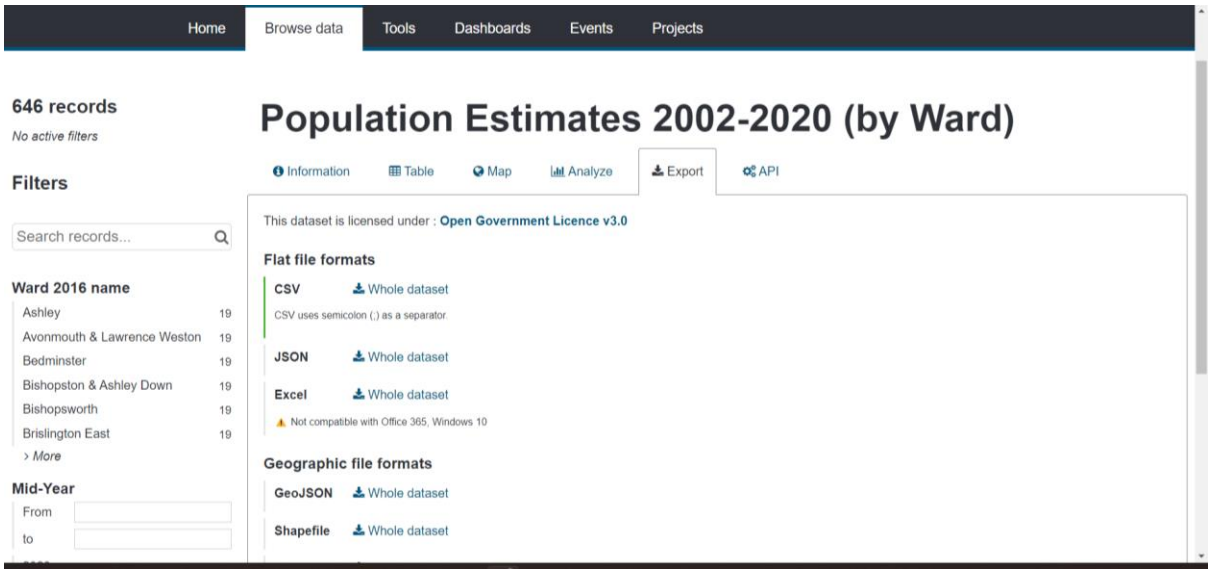
Electric Vehicle stations data.



## Data Set Download.

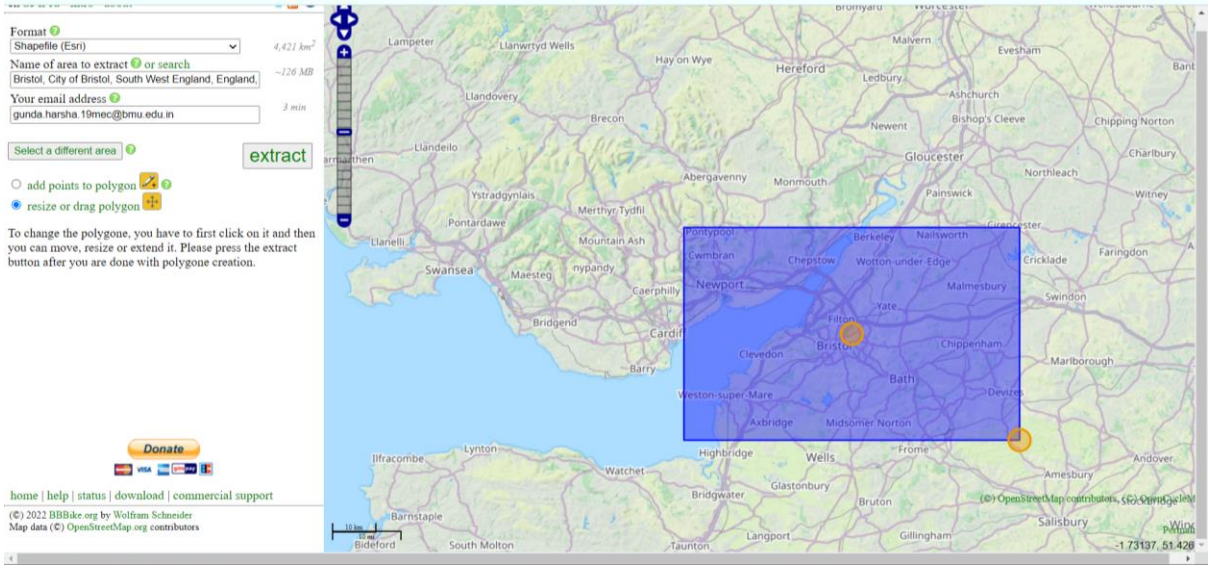



**Population data set.**




Next, we download buildings and roads data set from BB Bikes.

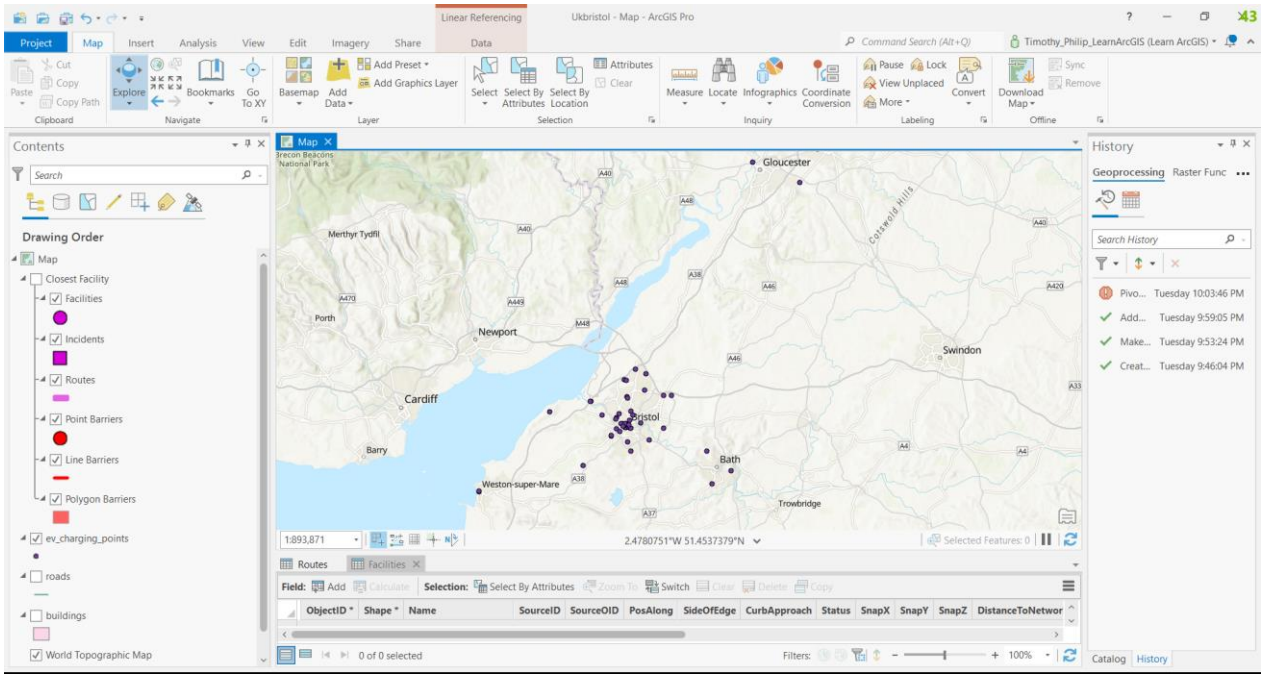
**Data set of Bristol City.**




# Next step is Processing in ArcGIS pro.

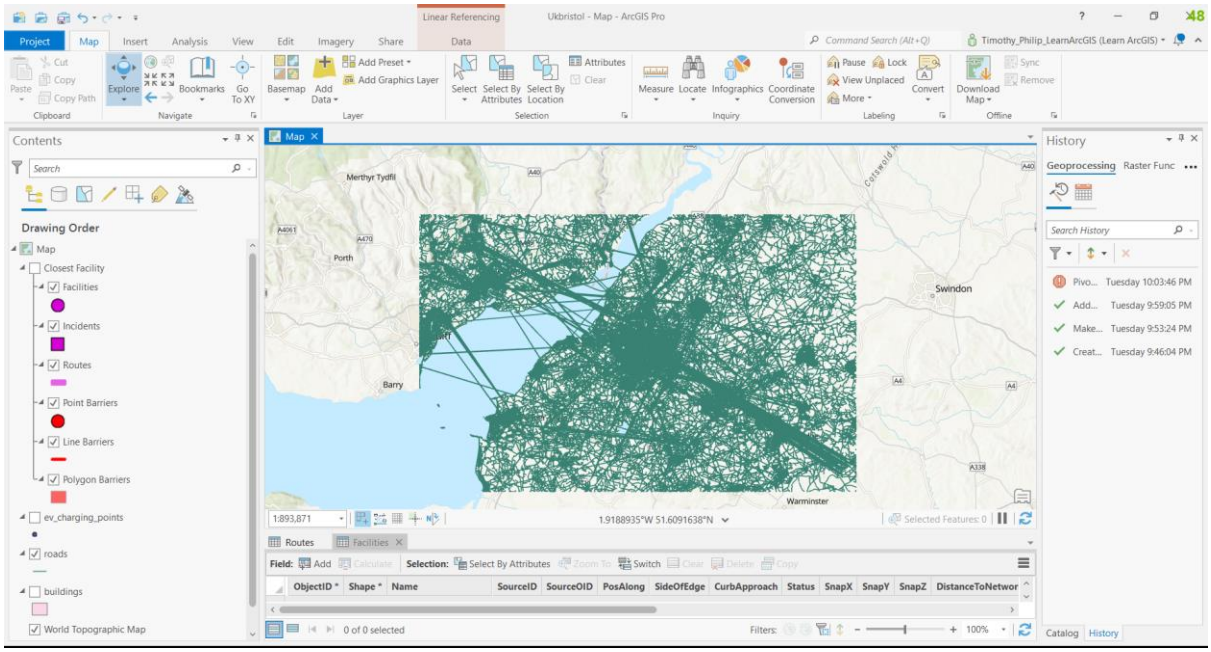
## Step 1

- Add data option to add the Electric stations points in Bristol city.



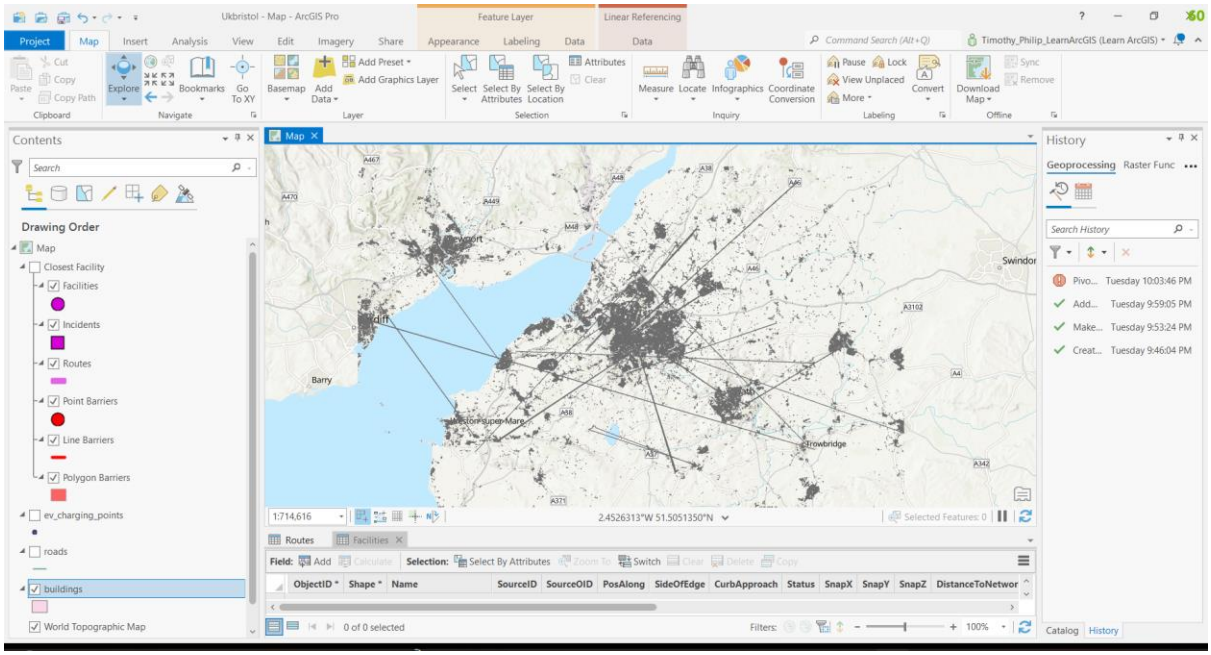
## Step 2

Add data option to add the road map of Bristol City.



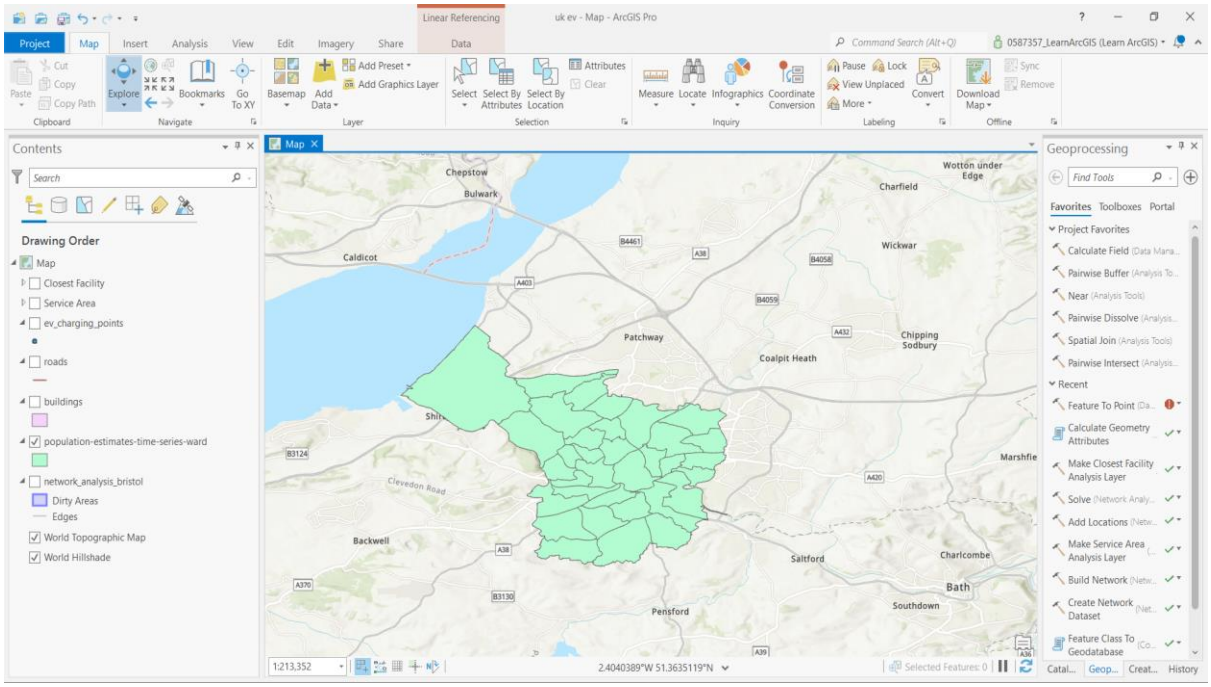

## Step 3

Add data option to add the buildings of Bristol City.



## Step 4

Add data option to add the population.

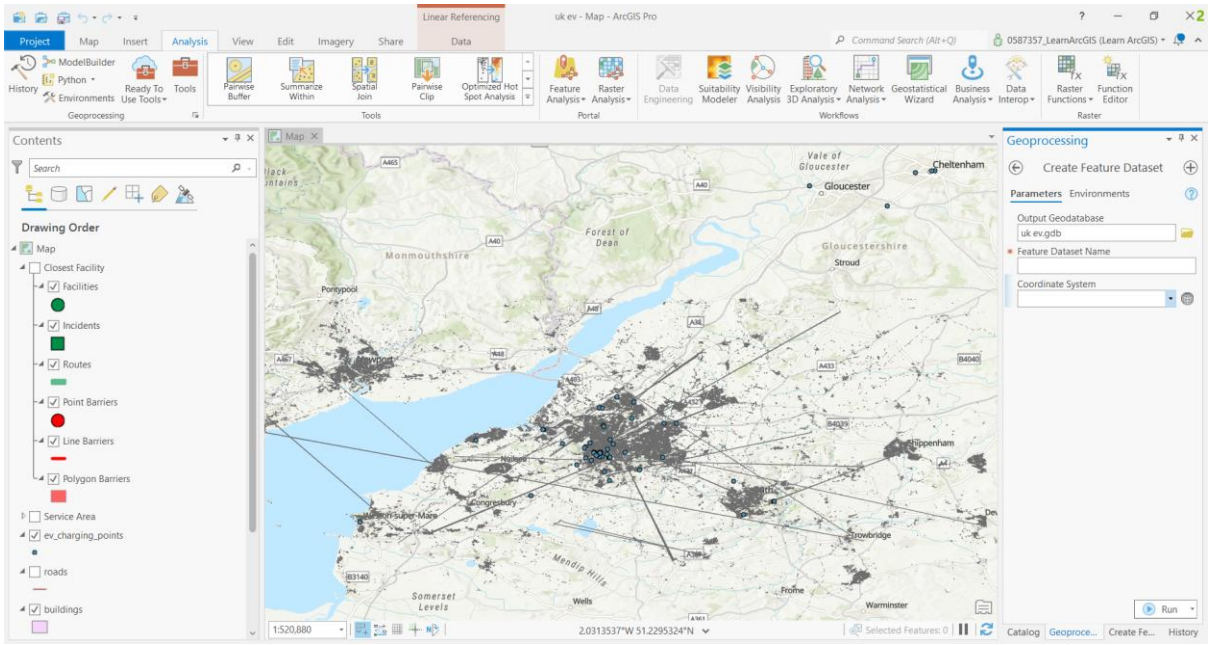



## Now we will start the Network Analysis

We will be doing location allocation of the data set.

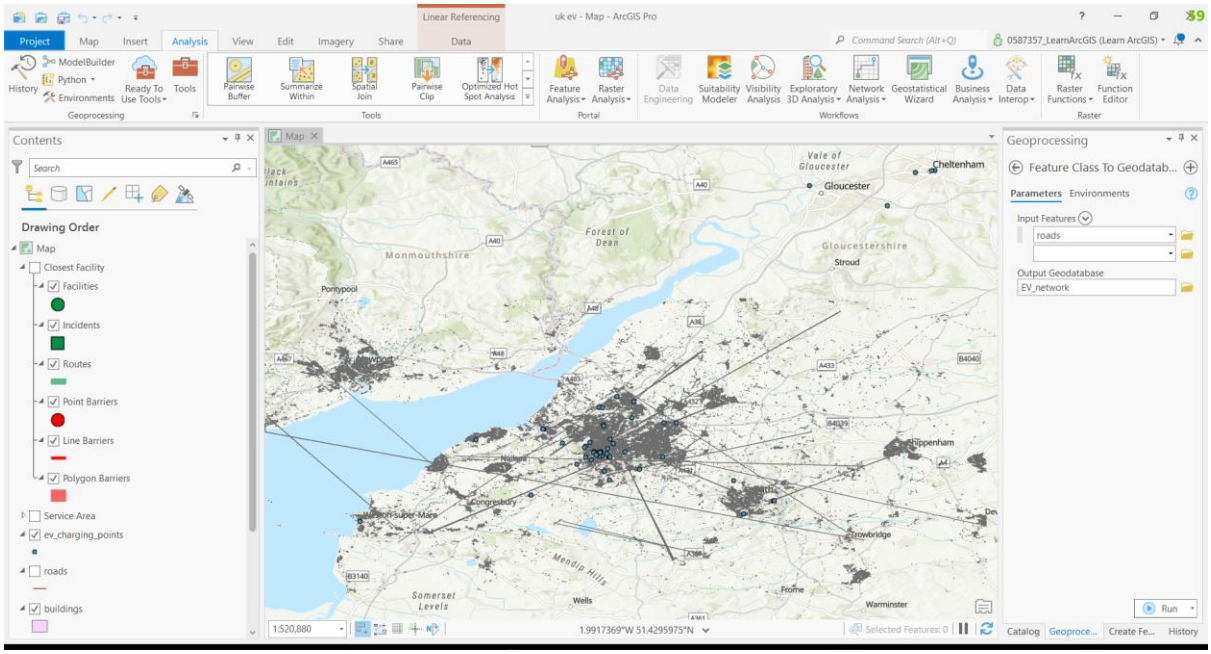
1 First, we must create feature dataset. A feature dataset is a collection of related feature classes that share a common coordinate system.

- We add Feature Dataset name as EV network



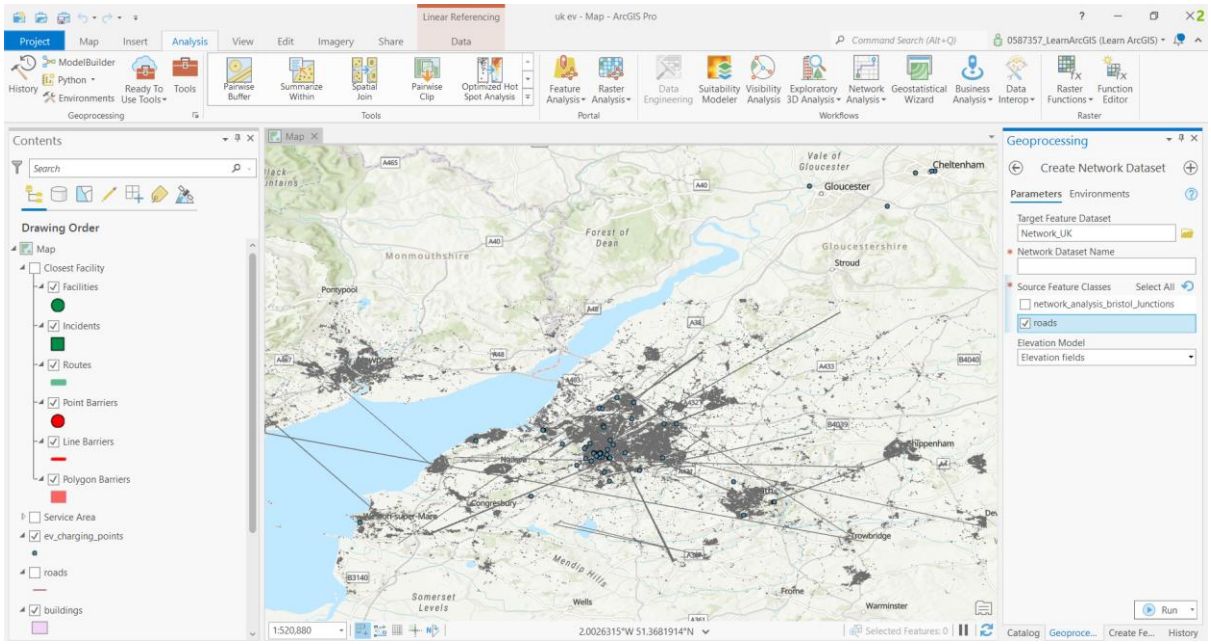
## 2 Feature class to Geodatabase

The geodatabase is the native data structure for ArcGIS and is the primary data format used for editing and data management.



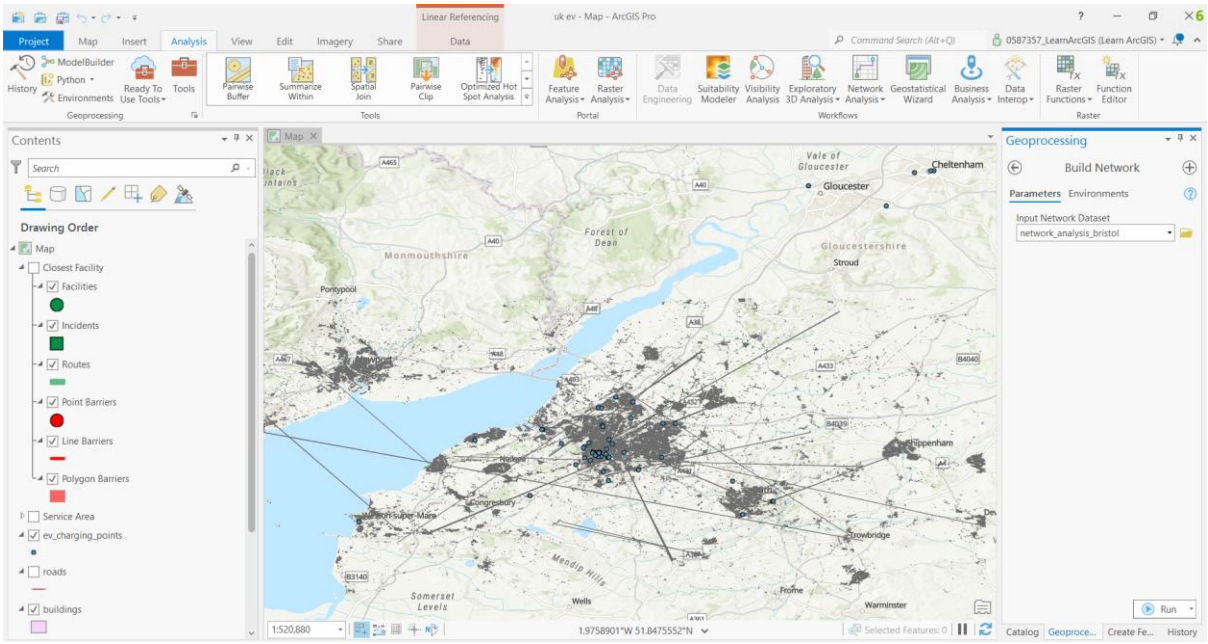

## 3 Create network Dataset

Network datasets are well suited to model transportation networks. They are created from source features, which can include simple features (lines and points) and turns, and they store the connectivity of the source features.



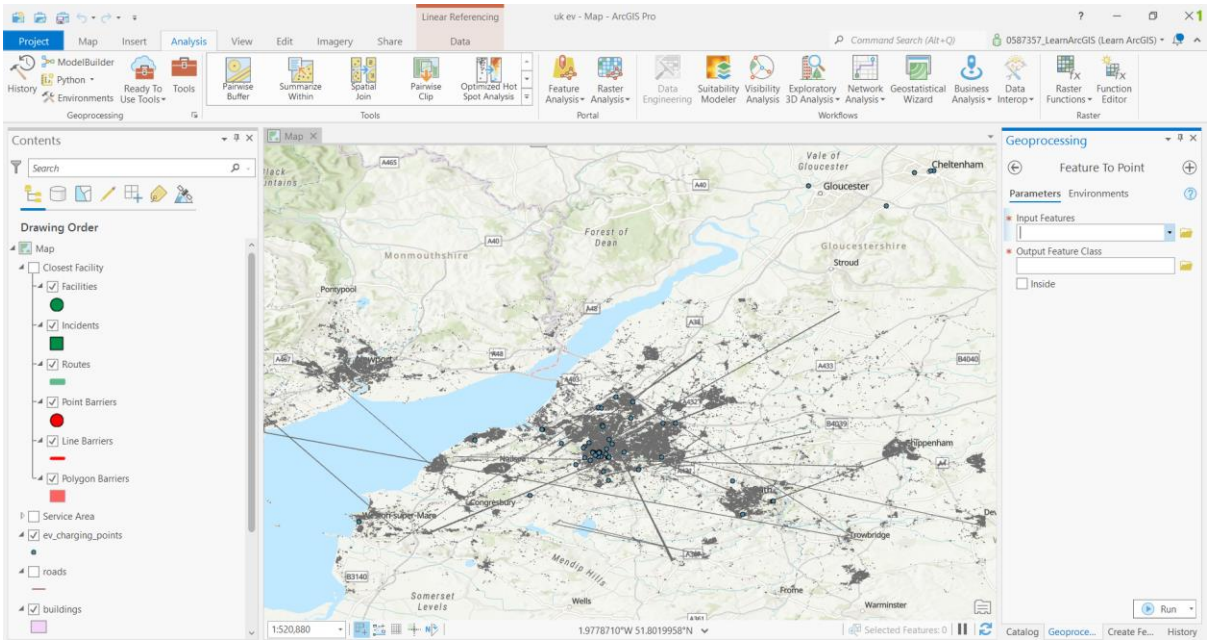
## 4 Build network.

The first build process on a new network dataset creates network elements, establishes connectivity, and assigns values to the network attributes based on the properties you defined in the New Network Dataset wizard. Also, a point feature class containing all the system junctions is created in the workspace that contains the network dataset.




## Shapefile coverting

- We must change the shapefile of buildings polygon to points we will be using the feature to the point option

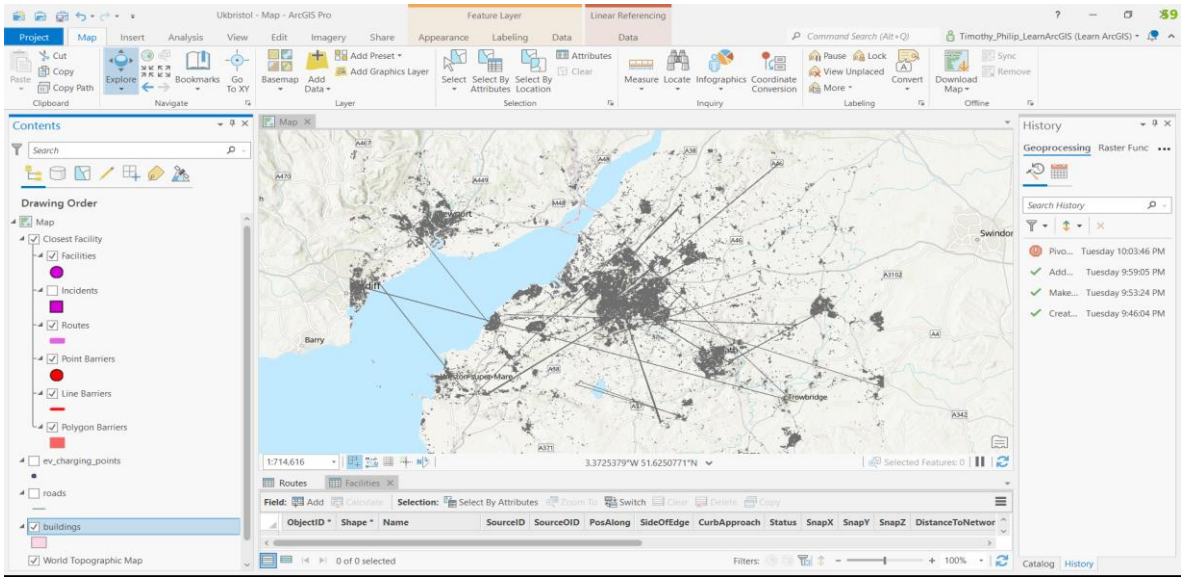


# Closest facility.

The closest facility solver finds one or more facilities that are closest to an incident based on travel time or travel distance and outputs the best routes as driving directions between the incidents and the chosen facilities.

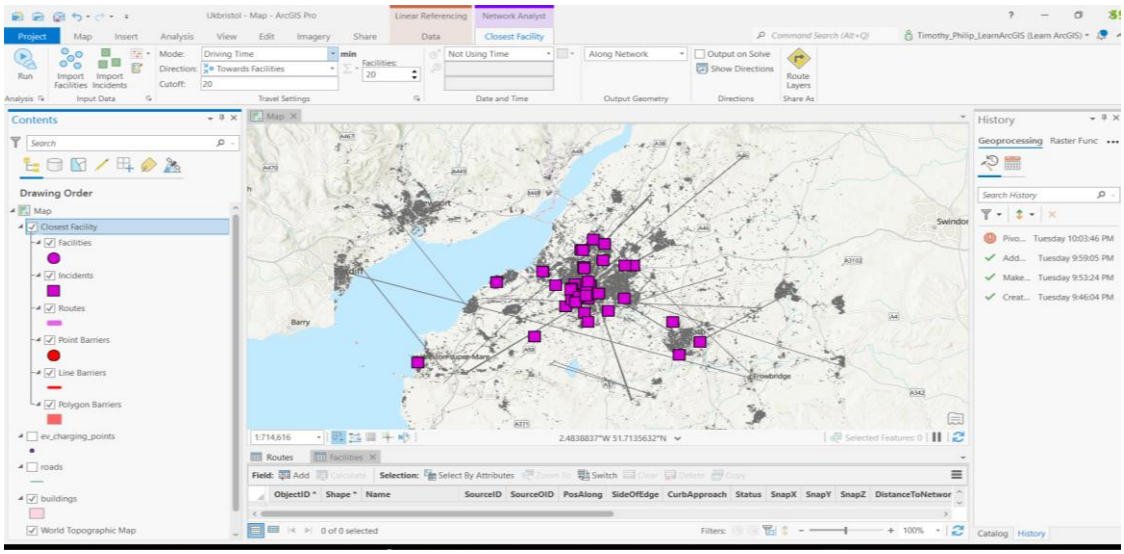
We will be adding data and the all the import points and line which are needed to find the nearest Ev charging station.

## 1 Add Closet Facility.



# 2 By closest Facility option.

- First, we will import the import incidents  electric charging stations. Then buildings and roads.
- Then we will get the closest data set of each station.



# Service Analysis.

With the ArcGIS Network Analyst extension, you can find service areas around any location on a network. A network service area is a region that encompasses all accessible streets (that is, streets that are within a specified impedance). For instance, the 5-minute service area for a point on a network includes all the streets that can be reached within five minutes from that point.

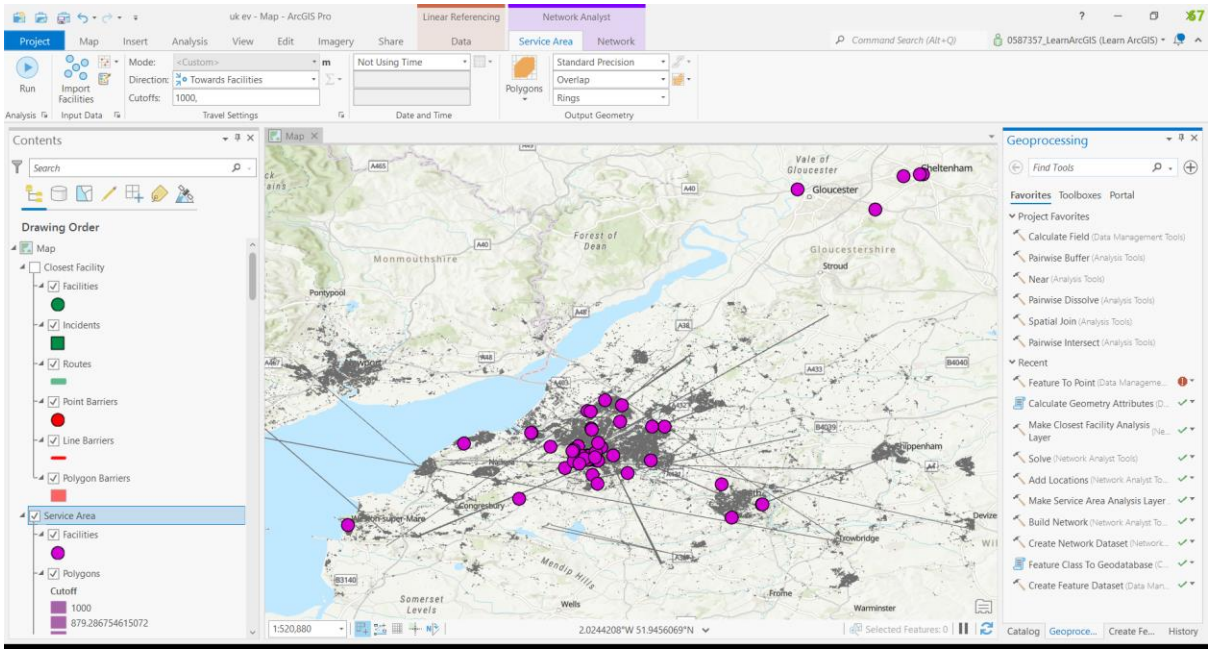
Service areas created by Network Analyst also help evaluate accessibility. Concentric service areas show how accessibility varies with impedance. Once service areas are created, you can use them to identify how much land, how many people, or how much of anything else is within the neighbourhood or region.

A network service area is a region that encompasses all streets that can be accessed within a given distance or travel time from one or more facilities. For instance, the 10-minute service area for a facility includes all the streets that can be reached within 10 minutes from that facility.

We will be adding data and all the import points and line which are needed to find the nearest Ev charging station.

By service analysis option

- First, we will import the import incidents electric charging stations. Then buildings and roads.
- Then we will get the service data set. In polygon shape.




- We will Direction as Towards the facilities and the cutoff as 1000 and not using time then we have run the process. We will be getting the results in polygon nearer to the Ev charging Stations.

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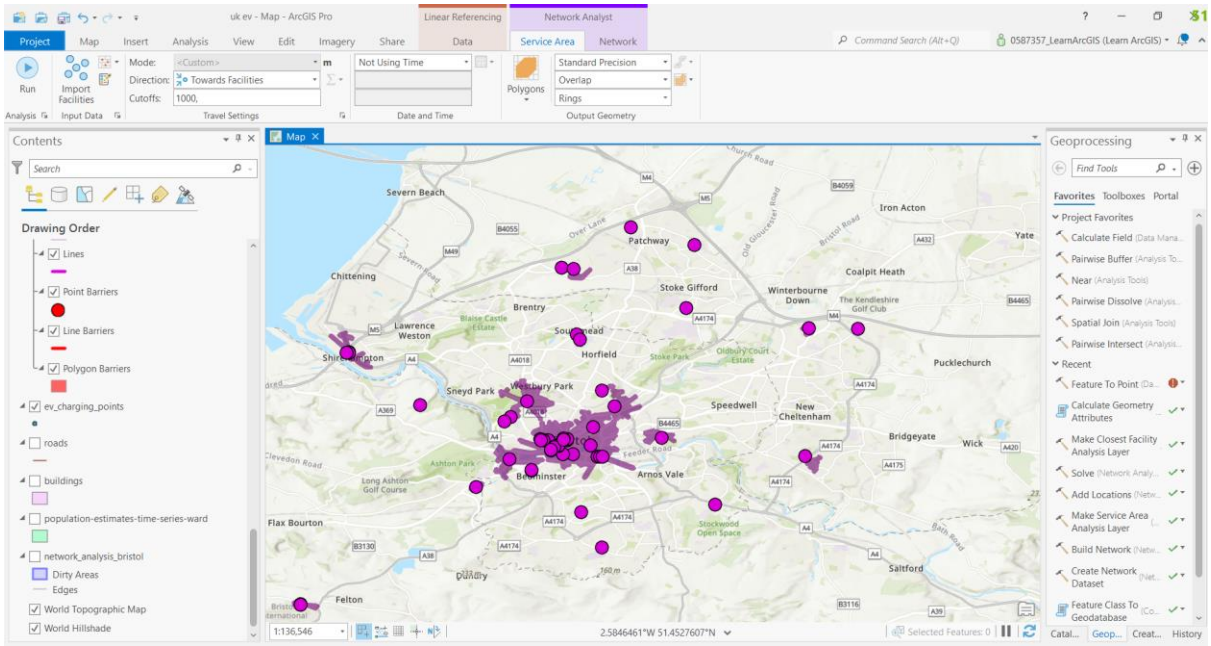
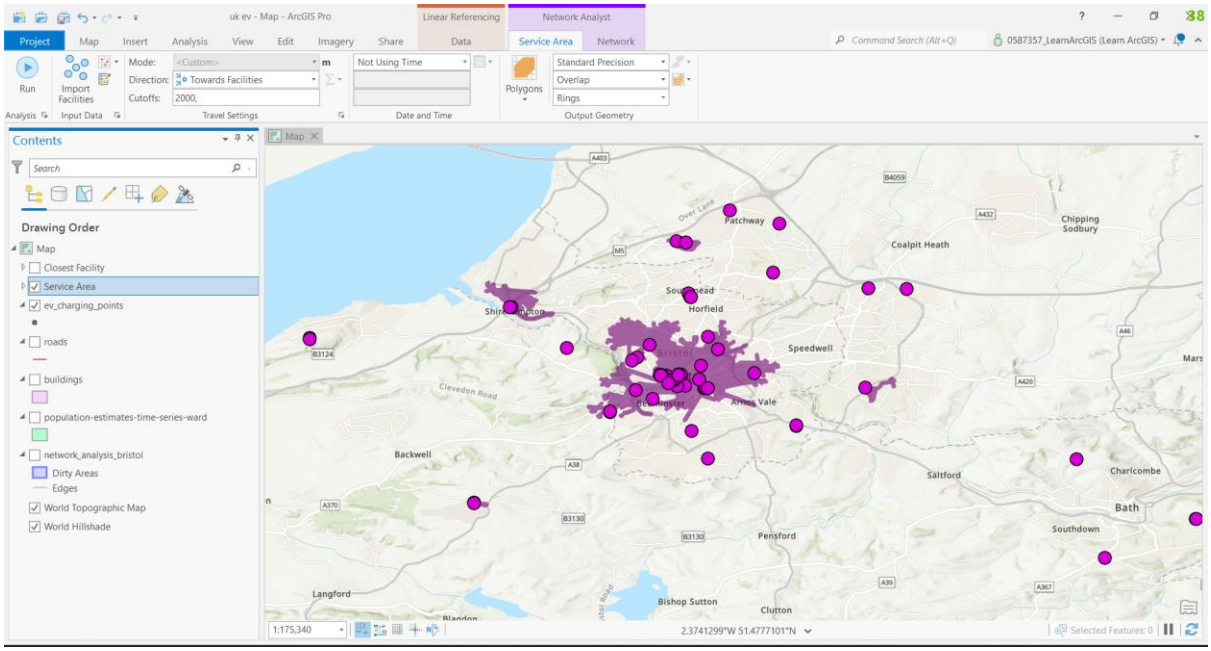


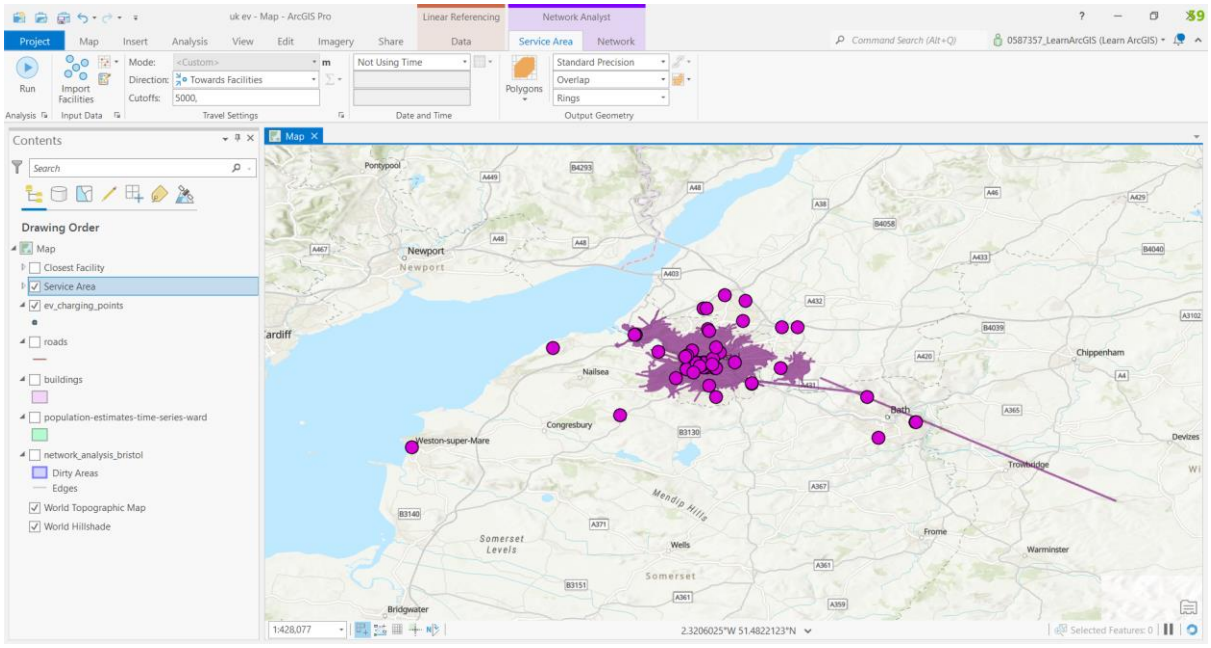

- We will be getting the polygon shape of 1000m nearer to the EV charging station.

Those shape Represent nearer to the station.




- . We will Direction as Towards the facilities and the cutoff as 2000 and not using time then we have run the process. We will be getting the results in polygon nearer to the Ev charging Stations.
- We will be getting the polygon shape of 2000m nearer to the EV charging station.

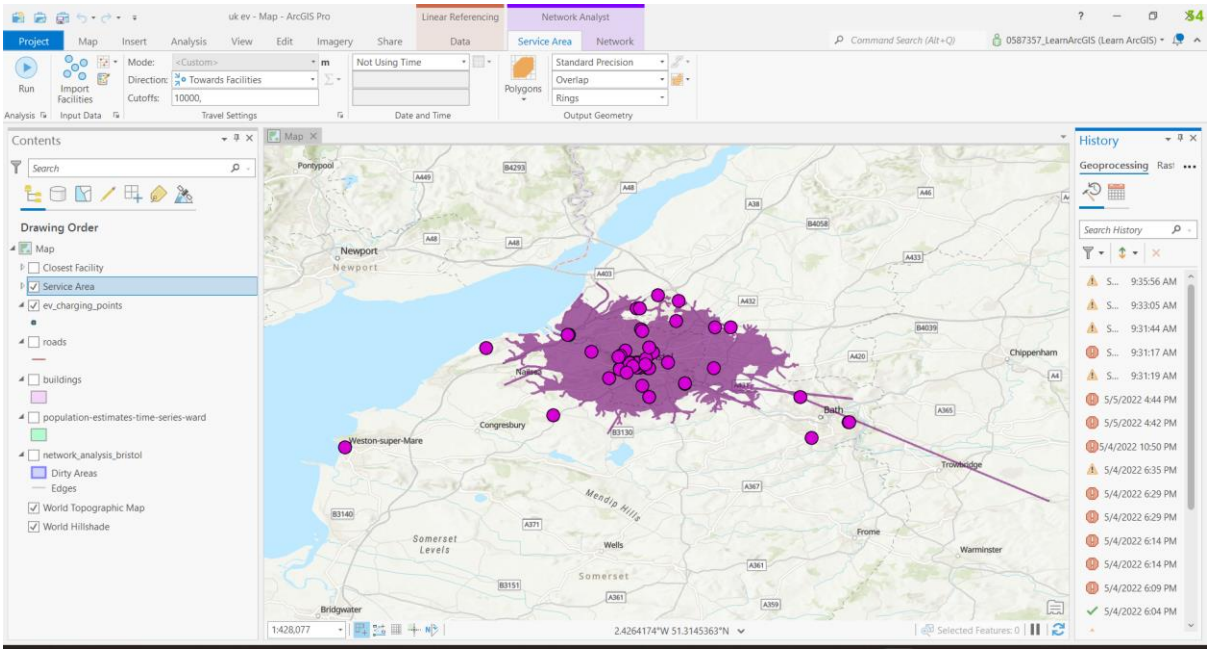
Those shape Represent nearer to the station.




- We will Direction as Towards the facilities and the cutoff as 5000 and not using time then we have run the process. We will be getting the results in polygon nearer to the Ev charging Stations.

- We will be getting the polygon shape of 5000m nearer to the EV charging station.

Those shape Represent nearer to the station.

- 


  We will Direction as Towards the facilities and the cutoff as 10000 and not using time then we have run the process. We will be getting the results in polygon nearer to the Ev charging Stations.

- We will be getting the polygon shape of 10000m nearer to the EV charging station.

Those shape Represent nearer to the station.

# CONCLUSION

In this we obtain the results by using the criteria of service analysis method together with the spatial analysis features of ARCGIS. A map layer was created for each cut-off criterion applied in the study of 1000,5000, 10,000 meters distance and make shape of polygon and the covered area will be the near to the electric stations. We have also learnt many more other aspects of this software which made us work more confidently and efficiently. Now after this task, we can say that we have found out the area which has covered the Electric Vehicle charging stations with utmost accessibility with all the people staying around it. Through the help of this obtained data, we can analyse the locations of EVCS's and plan for new positions accordingly.

# THANK YOU