



University Transportation Research Center - Region 2

Final Report

Business Location Data Analysis and Editing Interface Tool Development

Performing Organization: The City College of New York/CUNY

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of Transportation



DISCLAIMER

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16. Abstract One of the most important aspects of transportation planning is understanding employment information of businesses and organizations. Information such as location of employment, size of organization or business in terms of employees, sales, can provide valuable input to understanding travel patterns and human activities. Visualizing this information along with several administrative, transportation and infrastructure facilities provides key contextual information to transportation planning agencies. The objective of this project is to develop an open source software to visualize business location and employment information in the state of New York. The application is also interfaced with transportation road network, public transit network, various administrative boundaries such as MPOs, counties, municipalities so that the business data can be queried accordingly. Furthermore, the application also provides the ability to edit and update the information per the understanding of experts in agencies statewide.			
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Executive Summary

This project aims to provide a web-based tool to transportation agencies to help understand and analyze the economic activities and transportation movements across different scale and geographic regions. This tool seeks to help transportation agencies by simplifying the process of locating businesses of various types, comparing economic and employment metrics in different locations, which in turn, helps the agencies in understanding transportation infrastructure needs and impacts without the need of specialized GIS software. The tool also provides the agencies the ability to export the data for presentation purposes.

The business location data used in this project is the InfoUSA Marketing, Inc. – (“InfoGroup”) business records dataset which contains detailed information of business establishments. The business establishment data and other open data for New York State are combined and housed within open sourced development framework to allow NYSDOT and related transportation stakeholders to easily analyze planning metrics such as number of businesses, business volumes, number of employees in several different ways.

In the development of the tool, popular Javascript frameworks and libraries were chosen to work on this project such as: NodeJS, LeafletJS (mapping), ExpressJS (server) and PostgreSQL (RDBMS) for open sourced support and integration. The primary purpose of using open source environments is to keep the application development process transparent and the tools to be available to other agencies in the state.

Some of the visualization tools include features such as: layers-based query (zip code, county, MPO, etc.), query using drawing tools and query around selected road sections. After each query, the interface provides information such as infoGroup IDs, street addresses, sales volume, employee size, NAICS and SIC classification codes, and other attributes, as well as, descriptive statistics (average, summation, etc).

User authentication and access incorporates the different user levels to manage and edit business information on the platform and to fix errors in the business establishments dataset. Changes to the dataset are recorded with auditing capabilities for administrators with the required access.

A user manual is provided to get new users started. It serves as a tutorial and a listing of almost all the features available in the web-application. It is advisable to refer to this manual if users are not sure how to handle certain tools.

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1. Introduction and Problem Statement

One of the main tasks of transportation agencies is to study and analyze the economic activities and transportation movements across different geographic regions. Depending on the scale of the analysis, it is necessary to have information about the diverse categories of business establishments to understand transportation infrastructure needs and the impacts of various transportation planning initiatives such as transit-oriented development, roadway maintenance and understanding multimodal user base, to name a few.

One of the sources of business location data that NYSDOT utilizes for business locations is from InfoUSA Marketing, LLC (“InfoGroup”). This establishment location dataset contains granular information of businesses such as, street address, sales volume, employee size, NAICS and SIC classification codes, and other crucial attributes. The transportation agency planners and modelers need to contextualize these data to be able to provide analyses on infrastructure needs, evaluate and propose policy initiatives. A tool that can help extract, visualize and summarize the business establishment data from the perspective of type of business, number of employees, sales volume, etc. would be very useful in this regard. Furthermore, as the business establishment data comes from a diversity of sources, it is prone to contain uncertainty, redundancy and error. Hence, additional functionality to edit erroneous or inaccurate data can help improve data quality. This tool must also be able to integrate with existing analytical tools available to NYSDOT for seamless access to users.

Therefore, the goal of this project is to provide the NYSDOT and relevant transportation stakeholders with a web-based GIS application where users could utilize this dataset for different operations:

- Data dissemination
- Query, analysis and visualization
- Data maintenance
- Data quality check

In the next section, the Research Objectives of this project are explained in detail. The third section, Methods, details the choice of tools for this project. Fourth and fifth sections elaborate each of the functionalities and design aspects of the tool.

2. Research Objectives

As mentioned earlier, key functionalities of the tool are to extract, visualize and summarize business establishment data, ability to ensure data quality and integrate with an existing NYSDOT open-sourced analytics framework.

To elaborate on each of the objectives for this project, we divide them into four different groups:

1. **Visualization Capability:** Ability to visualize businesses points on a map, display statistical analysis and information and easily view key data fields

2. Querying:
 - a. Have predefined GIS layers to query, such as:
 - i. MPO's, NYS Counties, DOT regions, Municipalities, etc...
 - b. Querying by Street Names (OSM)
 - c. Graphically using Geometries
 - i. Euclidean Distance
 - ii. Manhattan Distance
 - d. Non-spatial data
 - i. Company Name
 - ii. Employee Size
 - iii. NAICS, SIC and Match Code
3. Editing: the original business location data collection was performed by people. As a result, inaccuracy or duplication of data is inevitable. Therefore, there is a need to provide an interface with:
 - a. Multi User Editing and Archiving: to be able to correct spotted errors in the dataset.
 - b. Continuous Versioning and Preserving Editing History: in case we want to refer to the original or past data.
4. User Authentication: to allow data dissemination and management, it is necessary for users to have an account to mitigate unauthorized access and also, to differentiate different user privileges:
 - a. Normal users
 - b. Editors: allow for submission of changes to the dataset.
 - c. Administrator: review and approvals

3. Methods

In order to achieve the stated objectives appropriate software tools and datasets have to be chosen. This section explains various tools chosen to integrate data and visualization capabilities. Furthermore, datasets that are relevant and useful for users of this tool in extracting and visualizing data are also explained.

Integration of the existing analytics platform is also an important consideration in the development process of the tool. This would help in seamless transition of existing users and authorization schema. Thus, all of the tools developed for this application are open sourced. Choice of open source software also helps in advancing development of the tool in future.

3.1 Software tools

For the development of this project, popular open source software tools were chosen. As most of them are widely used by developers, it is fully maintained by the community and also, it is also convenient to receive support for future capabilities. Moreover, this tool will be able to integrate with the existing analytical tools as it is also an open source program.

By using open source libraries, we could also easily modify some parts of the code to fit our needs. For instance, when we modified the chosen pie chart library, *d3pie.js*, to produce a desired outcome when we select different sections of the chart at the same time (discussed more in detail later.)

- Basic Javascript stack
 - Node.js v12.18.3 LTS. **End-of-Life: 2022-04-30**
 - ExpressJS v4.16.3
 - EJS templating language
 - PostgreSQL v12.0. **End-of-Life: 2024-11-14**

3.1.1 Front-end Libraries

Bootstrap v4.5.3 as the general theme of the application and JQuery v3.3.1 to control the flow/actions. JQuery UI v1.12.1 for the autocomplete/dropdown functionality.

3.1.2 Mapping

[LeafletJS](#) v1.7.1 is used as the base library to display the map and the different OSM base layers providers, along with the basic required tools in GIS applications. (i.e., zoom, select, pan, etc.)

There are couple of plugins added to LeafletJS that provides the functionality to draw figures and facilitate displaying drawing information:

Plugin Name	Description/Purpose	Version
Marker Cluster	Create clusters of markers to display businesses points.	v1.4.1
Leaflet Measure Path	Displays measurements of drawn objects.	v1.5.0
Leaflet FeatureGroup SubGroup	Allows subgroups for the Marker Cluster plugin. This helps grouping correctly when the map is filtered by NAICS or Match code.	v1.0.2
Leaflet Editable	Provides tools to draw objects on the map.	v1.2.0

3.1.3 Table

All the tables in the application are made using the library: [DataTables](#) which is a plugin to jQuery for tables.

DataTable extensions used:

1. Buttons
2. Responsive
3. Select

3.1.4 Graphs

Pie chart made with a library called [d3pie](#). It is a library built on [d3.js](#) to make pie charts easier to make. The library did not provide functionality for multiple section selections. Therefore, it was slightly modified to fit for that need.

[Modifications](#) to the d3pie library includes:

1. Added “getOpenSegments()” function to get opened segments.
2. Added “closeSegments()” function to close all the opened segments.
3. “closeSegment()” method is made synchronous.
4. “maybeCloseOpenSegment()” method is modified to allow multiple segment selections.

Histogram and Legend graphs are made using plain d3.js.

3.1.5 Other Front-end library used

Library Name	Description/Purpose	Version
Momentjs	Date formatting for display purposes.	v2.24
DOM to Image	Main library to convert the DOM to images for the export functionality.	v2.6.0
Html2canvas	Secondary library to convert the DOM to images for the export functionality in case the first option fails.	v1.0.0
jsPDF	Library to build a PDF document for the export functionality.	v1.5.3
jsPDF - AutoTable	Helper library to create tables for the export functionality.	v3.5.6
FileSaver.js	Solution to saving files on the client-side.	v1.3.3
JSZip	A library for creating, reading and editing .zip files with JavaScript.	v3.1.5
FontAwesome	Free solution to provide icons.	
PopperJS	Required library for bootstrap to display modals.	v1.12.9
Turf	Solution to process geoJSON geometries in the front end.	v5.1.6

3.1.6 Back-end Libraries

Back-end server is set up using NodeJS v12.18.3 LTS with [ExpressJS](#) v4.16.3.

List of back-end libraries and middlewares

Library Name	Description/Purpose	Version
body-parser	Middleware to parse JSON bodies.	v1.18.2
compression	Compress JSON files sent to the client.	^1.7.4

ejs	Simple templating language to generate HTML markup with plain JavaScript.	^2.7.1
ExpressJS	Server framework for Node.js	^4.16.3
express-session	Solution to create a user session in express.	^1.17.0
node-env-file	Library to facilitate adding an environmental file.	^0.1.8
node-fetch	Request library used to make requests to Geocoding API such as Nominatim, Mapquest, etc...	^2.6.1
passport	Authentication middleware.	^0.4.0
passport-local	Local strategy to authenticate users.	^1.0.0
pg	Non-blocking PostgreSQL client for Node.js.	^7.12.1
pg-hstore	Helper library to create Hstore data type objects. Used mainly in audit tables.	^2.3.3
session-file-store	Solution to store session data in the session file.	^1.3.1
uuid	Creates RFC4122 UUIDs for the session ID.	^3.3.3

3.2 Datasets Chosen

Various datasets chosen to help is overlaying and extracting appropriate business location data are elaborated in this subsection. Some of the key fields used in the data visualization and analysis are also described.

3.2.1 Database Overview

Description

PostgreSQL 12.0 is used as the Enterprise RDBMS. PostGIS (3.0.0rc2 r17909), HStore and PgRouting (3.0.0-alpha) need to be installed and enabled.

Database export can be downloaded by requesting access to AVAIL.

Tables Overview and Description

Table Name	Description	Source
public Schema		
amtrak	Contains the information and geometry of AMTRAK stations. Geometry type: POINT, SRID: 4326.	MTA

at_2po_4pgr	Table containing routing information for NY state. Geometry type: LINESTRING, SRID: 26918.	OSM
business_edit	Contains the status and information of edits submitted by users of the application.	Generated
businesses	Table containing all the information collected. It is constructed by unifying the businesses location database for neighboring counties including Canada and NY State. Geometry type: POINT, SRID: 26918.	Generated
businesses_o	Copy of table “businesses” before any made changes. Geometry type: POINT, SRID: 26918.	Generated
businesses_2019	2019 dataset of businesses in NY state. Geometry type: POINT, SRID: 26918.	InfoGroup
businesses_can	2019 dataset of businesses in Canada. Geometry type: POINT, SRID: 4269.	InfoGroup
businesses_ct_ma_ny_pa_vt	2019 dataset of businesses neighbouring NY state. Geometry type: POINT, SRID: 4269.	InfoGroup
cities_towns	Table containing the information and geometry of cities and towns in NY state. Geometry type: MULTIPOLYGON, SRID: 26918.	Open Data
counties_neighbor	Table containing the information and geometry of counties neighboring NY state including Canada districts. Geometry type: GEOMETRY, SRID: 26918.	Open Data
counties_shoreline	Table containing the information and geometry of counties in NY state. Geometry type: MULTIPOLYGON, SRID: 26918.	Open Data
mpo	Table containing the information and geometry of MPO’s in NY state. Geometry type: MULTIPOLYGON, SRID: 26918.	Open Data
mta_li	Contains the information and geometry of the Long Island Railroad stations. Geometry type: POINT, SRID: 4326.	MTA
mta_mn	Contains the information and geometry of the Metro-North Railroad stations. Geometry type: POINT, SRID: 4326.	MTA
mta_nyc	Contains the information and geometry of NYC subway stations. Geometry type: POINT, SRID: 4326.	MTA

prmsic	Contains information for the primary Standard Industrial Classification (SIC) extracted from the “businesses” table.	InfoGroup
roadway	Contains road information of NY state. Used by the “search nearby roads” query. Geometry type: MULTILINESTRING, SRID: 26918.	OSM
villages	Table containing the information and geometry of villages in NY state. Geometry type: MULTIPOLYGON, SRID: 26918.	Open Data
zip	Table containing the information and geometry of ZIP codes in NY state. Geometry type: MULTIPOLYGON, SRID: 4269.	Open Data
audit Schema		
business_audit_log	Table contains the changes made to the table “business_edit”. It is filled by the trigger function: “log_business_edit()” on Insert and Update.	Generated
logged_actions	Contains all the changes made to “businesses” table.	Generated

Tables Key Fields

In this project, we are using a wide range of data provided by the **businesses** table. Some of the columns mostly utilized/important in this application are the following:

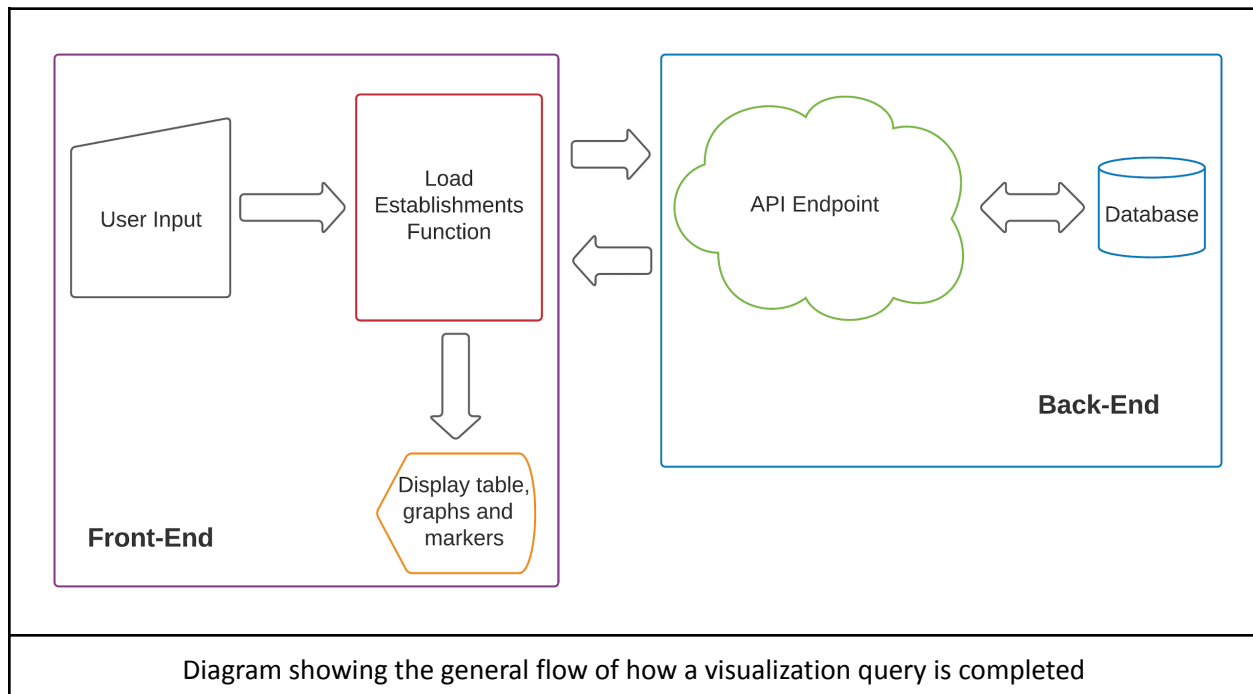
- **NAICS code:** Standard used to classify business establishments for the analysis of statistical data describing the U.S. economy.
This table provides all 6 digits NAICS code classification for each business point. However, due to the extensive amount of categories, we process the displayed data into 2 or 4 digits NAICS code. This allows us to search businesses type in certain areas with less granularity.
- **Primary SIC code:** Classification system that uses a four-digit code for classifying a company's primary industry which is based upon the company’s highest revenue category.
- **Match Level code:** Indicates the accuracy of the business establishment location collected. They are matched the following level accuracy:
 - **X:** matched based on the 5 digits zip code centroid.
 - **4:** matched based on the 4 digits zip code centroid.
 - **2:** matched based on the 2 digits zip code centroid.
 - **P:** matched using the Parcel centroid.
 - **0:** Site level exact location.

- Employee Size: the dataset used provides two columns indicating the employee size of establishments:
 - Location Employee Size
 - Corporate Employee Size

Both columns are categorized with letters from A to K or none according to their size:

- **A:** 1 - 4
- **B:** 5 - 9
- **C:** 10 - 19
- **D:** 20 - 49
- **E:** 50 - 99
- **F:** 100 - 249
- **G:** 250 - 499
- **H:** 500 - 999
- **I:** 1,000 - 4,999
- **J:** 5,000 - 9,999
- **K:** 10,000+

3.3 Visualization And Querying



The Leaflet library contains the ability to pan, zoom, select, identify geometry objects contained in a leaflet map. To facilitate making queries by sight/drawing, [Leaflet Editable](#) plugin is added to Leaflet. This library allows users to easily create drawing objects such as circles, rectangles and linestring to query businesses around the desired section viewed on the map. Take in account that these drawings are calculated using the Euclidean distance.

A Manhattan Distance functionality is added to the mapping interface in the form of driving distance, where users create a marker in the desired area and a route is created according to the specified driving distance. PgRouting is the solution used to implement this calculation, along with road information provided by OSM.

Searching inside layers in NYS (eg: DOT regions, MPOs, counties, transit lines, etc...), a back-end API is created to provide this information to the user interface. A request to the desired API is made in the front-end and then, the returned JSON object is processed to create markers to the map for the businesses with a specific color and size scheme. Depending on the query, another request is made later to the server to add an overlay layer to illustrate the search area.

Search areas/layers are not limited to only NYS, as there is data of businesses in counties neighboring NYS. This includes some of the districts located in lower Canada that were selected because of its closeness to NYS.

The user interface also contains a data table, which provides detailed information in categories:

- PRIMARY_SIC_DESC
- MATCH_LEVEL_CODE
- NAICS_DESC
- HQ_BRANCH_DESC

and also in quantiles:

- ACTUAL_LOCATION_EMPLOYMENT_SIZE
- ACTUAL_CORPORATE_EMPLOYMENT_SIZE
- ACTUAL_LOCATION_SALES_VOLUME
- ACTUAL_CORPORATE_SALES_VOLUME
- SQUARE_FOOTAGE_CODE/+
- LATITUDE
- LONGITUDE

Previously mentioned information could be used to filter down the desired businesses by making use of the advanced tab section of the user interface or making a request to the “*bysearch*” API endpoint. Furthermore, it has the ability to search in the currently displayed overlay layer to facilitate the filtering of businesses in search areas that users have created manually using the drawing functionality.

A Multi-search functionality is also incorporated into the mapping interface. This provides the capability for users to create complex search areas by combining different location layers simultaneously that could also be merged with user defined drawings objects. Furthermore, pre-defined layers provided by the database (MPO, county, etc...) are allowed to be modified in this tab, granting users some degree of freedom designing the query. Note that this custom query could also be filtered using the advanced tab with the search in current selection feature.

Additionally, the user interface includes a statistics tab consisting of cards and bar charts that displays descriptive statistics from the record selections. For example, cards containing the count, sum, mean of company sales and, bar charts illustrating company and employee size distribution in the selected area.

List of the different layers available to query in the application:

- Zip code
- County
- Metropolitan planning organization (MPO)
- NYSDOT Region
- Municipality (Town, City)
- Address (geocoding)
- Train/subway station
- InfoGroup ID
- Road name and signing
- Drawing (bounding box, circle buffer, linestring)
- Driving distance

The screenshot displays the application's interface. On the left is a map of New York City with a red circle highlighting a specific area in ZIP 10001. On the right, a pie chart shows the distribution of industries in that area. Below the pie chart is a table of establishments.

ZIP 10001 Industry Distribution (from pie chart):

- MINING, QUARRYING, AND OIL AND GAS EXPLORATION
- AGRICULTURE, FORESTRY, FISHERIES, AND HUNTING
- TRANSPORTATION AND WAREHOUSING
- PUBLIC ADMINISTRATION
- MANUFACTURING
- MANAGEMENT OF COMPANIES AND ENTERPRISES
- TRANSPORTATION AND WAREHOUSING
- UNCLASSIFIED ESTABLISHMENTS
- ARTS, ENTERTAINMENT, AND RECREATION
- EDUCATIONAL SERVICES
- RETAIL TRADE
- INDUSTRIAL TRADE
- FINANCE AND INSURANCE
- ADMINISTRATIVE AND SUPPORT AND WASTE REMEDIATION AND REPAIR
- HEALTH CARE AND SOCIAL ASSISTANCE
- CONSTRUCTION
- OTHER SERVICES (EXCEPT PUBLIC ADMINISTRATION)
- REAL ESTATE AND RENTAL AND LEASING
- ACCOMMODATION AND FOOD SERVICES
- PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES
- UTILITIES

Legend

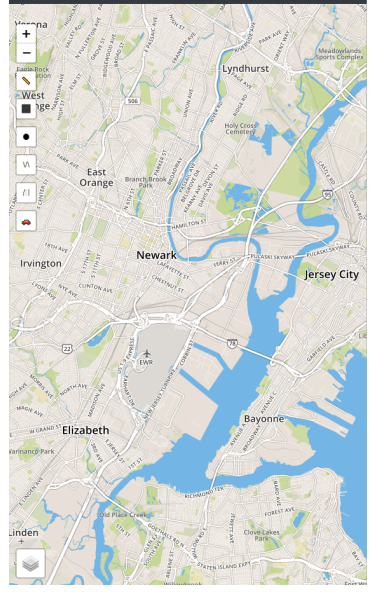
Expand Table **Export** **MatchCD** **More statistics...**

Name	EmpSZ	NAICS	Primary SIC	
BANCLAB	7	UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
GIS INDUSTRIES INC	8	NEW SINGLE-FAMILY HOUSING CONSTR. EXC. FOR-SALE BLDGS)	GENERAL CONTRACTORS	Edit
EXPONENTS LEADERS AND TRANSFORMED	15	OTHER SOCIAL ADVOCACY ORGANIZATIONS	DRUG ABUSE & ADDICTION INFO & TREATMENT	Edit
INTRICITY LLC	7	UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
TITAN OUTDOOR HOLDINGS INC	5	OUTDOOR ADVERTISING	ADVERTISING-OUTDOOR	Edit
UTILISAVE LLC	30	OTHER ACCOUNTING SERVICES	AUDITORS	Edit
RMT TRACKING CORP	7	UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
WINBROOK MANAGEMENT LLC	6	OFFICES OF REAL ESTATE AGENTS & BROKERS	REAL ESTATE	Edit
TALL GRASS PUBLIC	10	PUBLIC REL. ATIONAL POLYMER ORG.		Edit

Showing 1 to 10 of 6,288 entries

Basic interface of the application

Home Proposals
BANCLAB - ID: 26
417



244 5TH AVE # 2024, NEW YORK, NY 10001 - View

ALIAS: BANCLAB Company name: BANCLAB

EMP SIZE CODE: B EMP SIZE DESC: 5-9

Actual Employment Size: 7

NAICS CODE: 99999005 NAICS DESC: UNCLASSIFIED ESTABLISHMENTS

PRIMARY SIC CODE: 999966 PRIMARY SIC DESC: FEDERAL GOVERNMENT CONTRACTORS

SQF CODE: 6 SQF DESC: 20,000 - 39,999

LSALVOLCD: LSAIVOLDS:

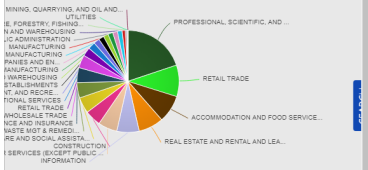
Sales Volume: Actual Sales Volume (in Millions):

CSALVOLCD: CSALVOLDS:

Corporate Sales Volume: Actual Corporate Sales Volume (in Millions):

Comments:

[Submit Edit](#) [Close](#)

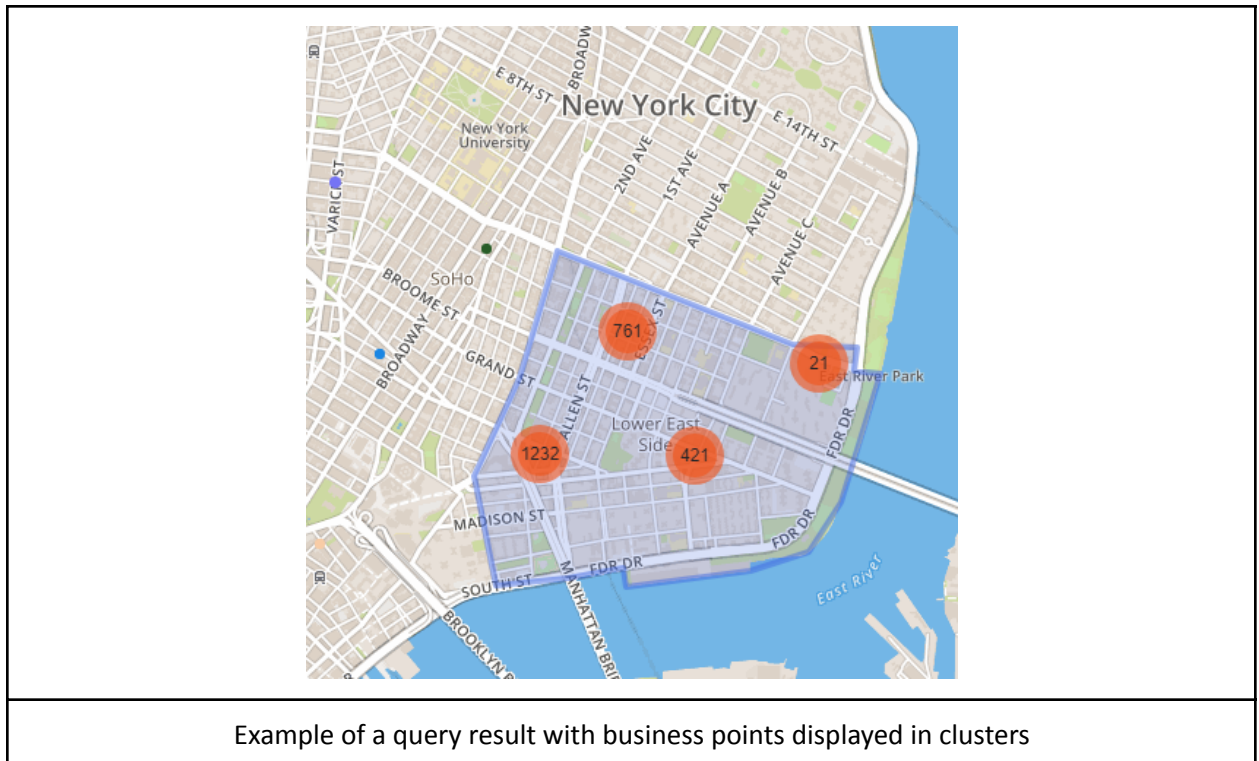


MatchCD [More statistics...](#)

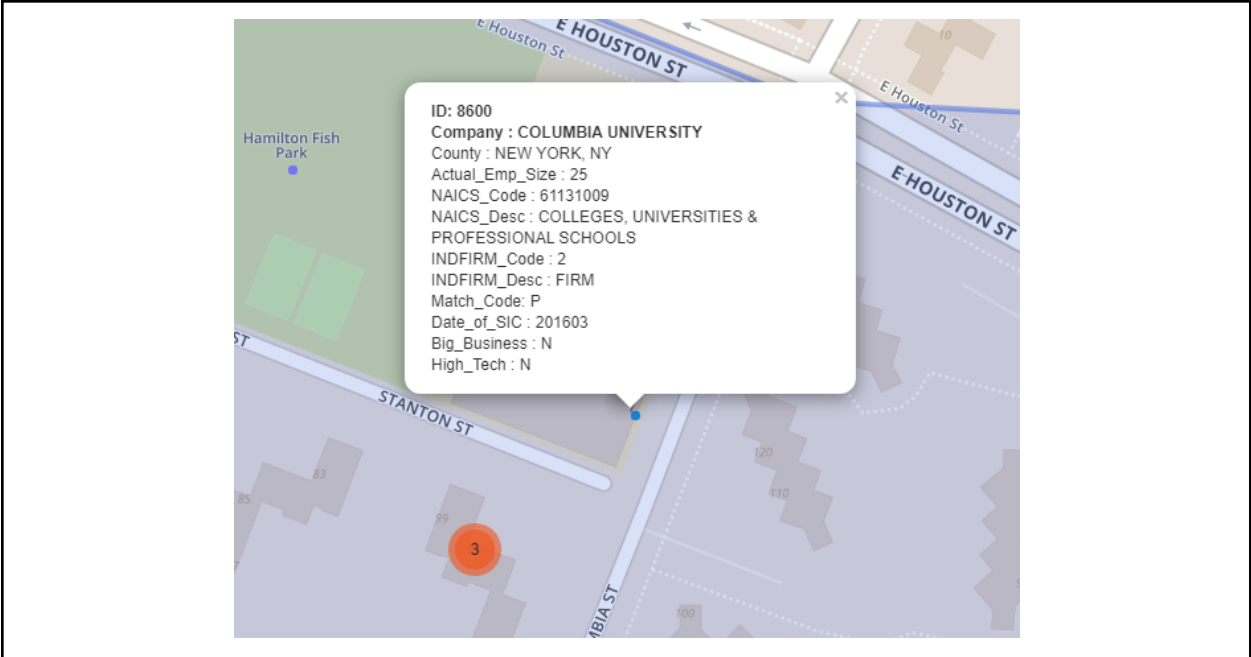
NAICS	Primary SIC	
UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
NEW SINGLE-FAMILY HOUSING CONSTR. EXC. FOR-SALE BLDGS	GENERAL CONTRACTORS	Edit
OTHER SOCIAL ADVOCACY ORGANIZATIONS	DRUG ABUSE & ADDICTION INFO & TREATMENT	Edit
UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
OUTDOOR ADVERTISING	ADVERTISING-OUTDOOR	Edit
OTHER ACCOUNTING SERVICES	AUDITORS	Edit
UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
OFFICES OF REAL ESTATE AGENTS & BROKERS	REAL ESTATE	Edit

Previous 1 2 3 4 5 ... 629 Next

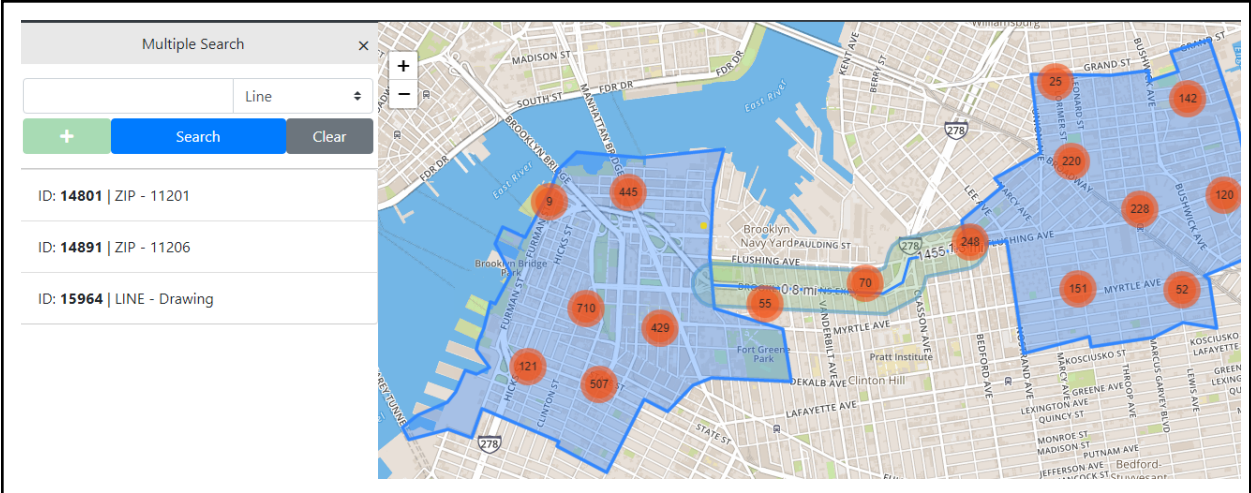
Detailed information view of a business point



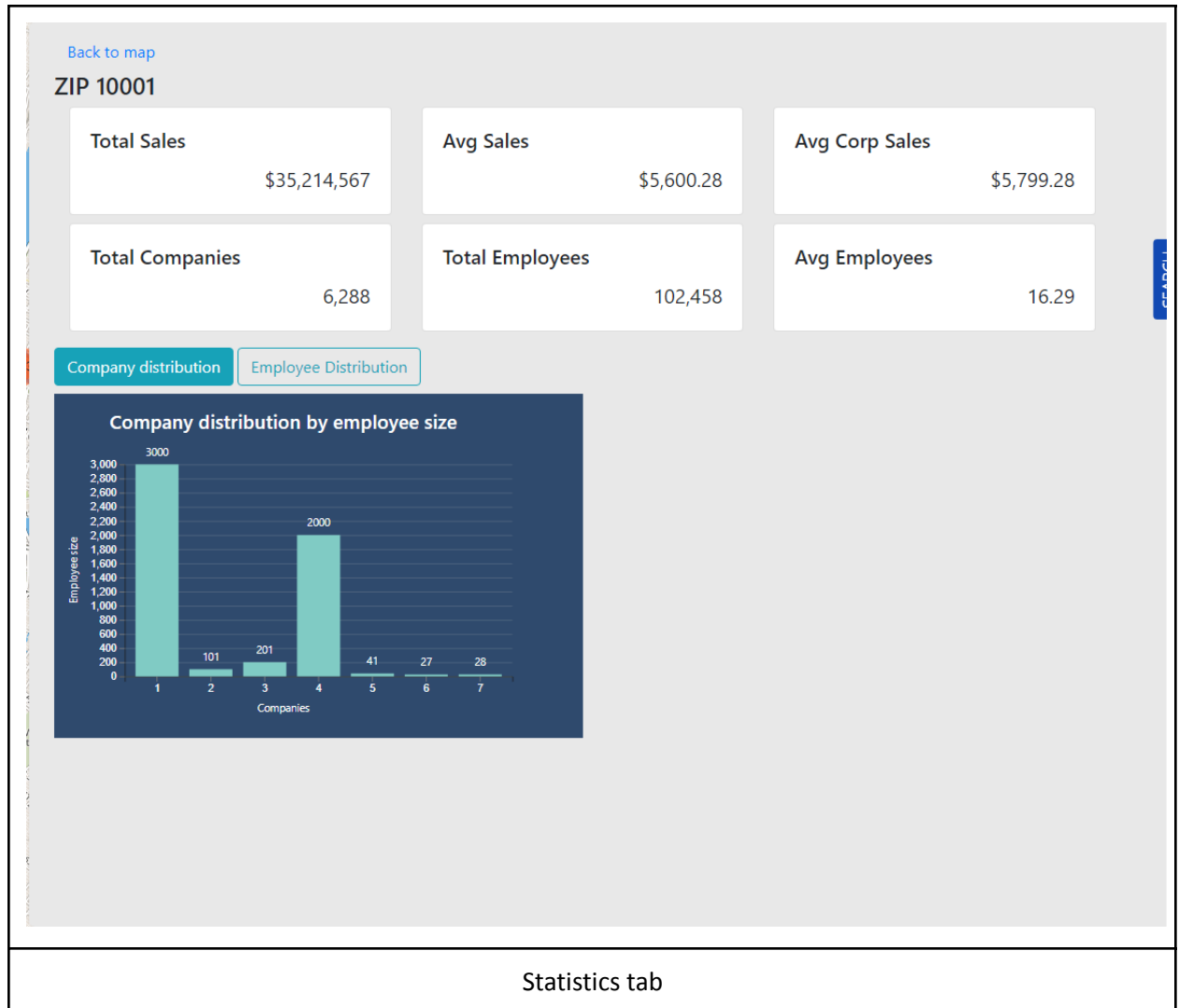
Example of a query result with business points displayed in clusters



Zooming into a business marker to reveal quick information about an establishment



Example of a Multi-query feature result using zip codes and linestring drawing



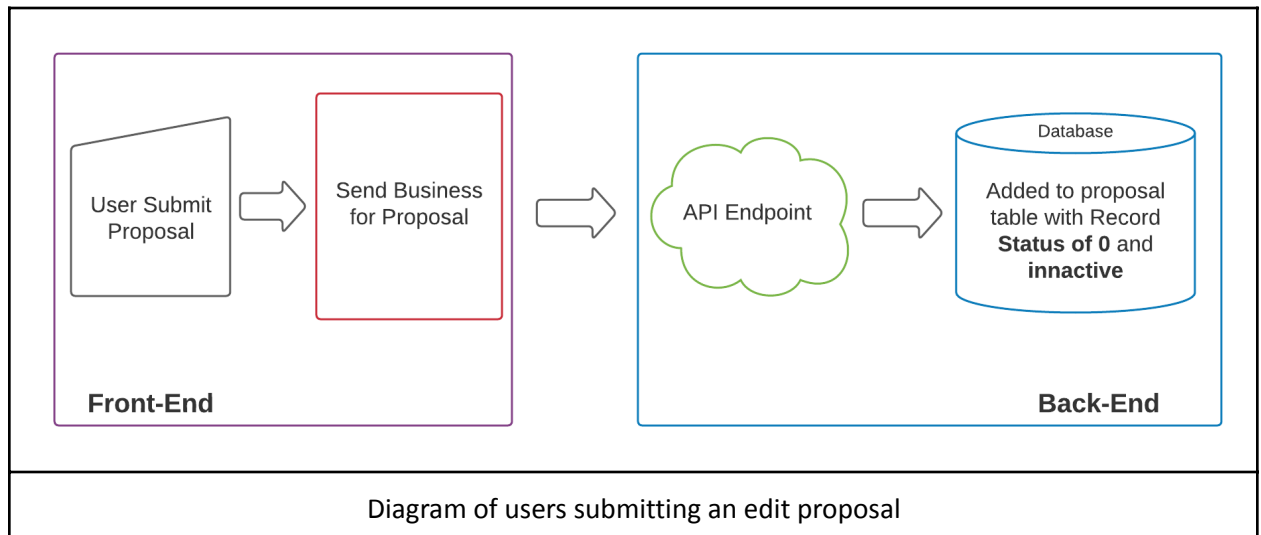
3.4 Editing

This project provides a web-based interface for editing and archiving any corrections identified by the NYSDOT staff to the data.

There are two phases to this procedure:

1. Editing users submit a proposal for the information change.
2. Administrator users are to audit this submission before accepting the change.

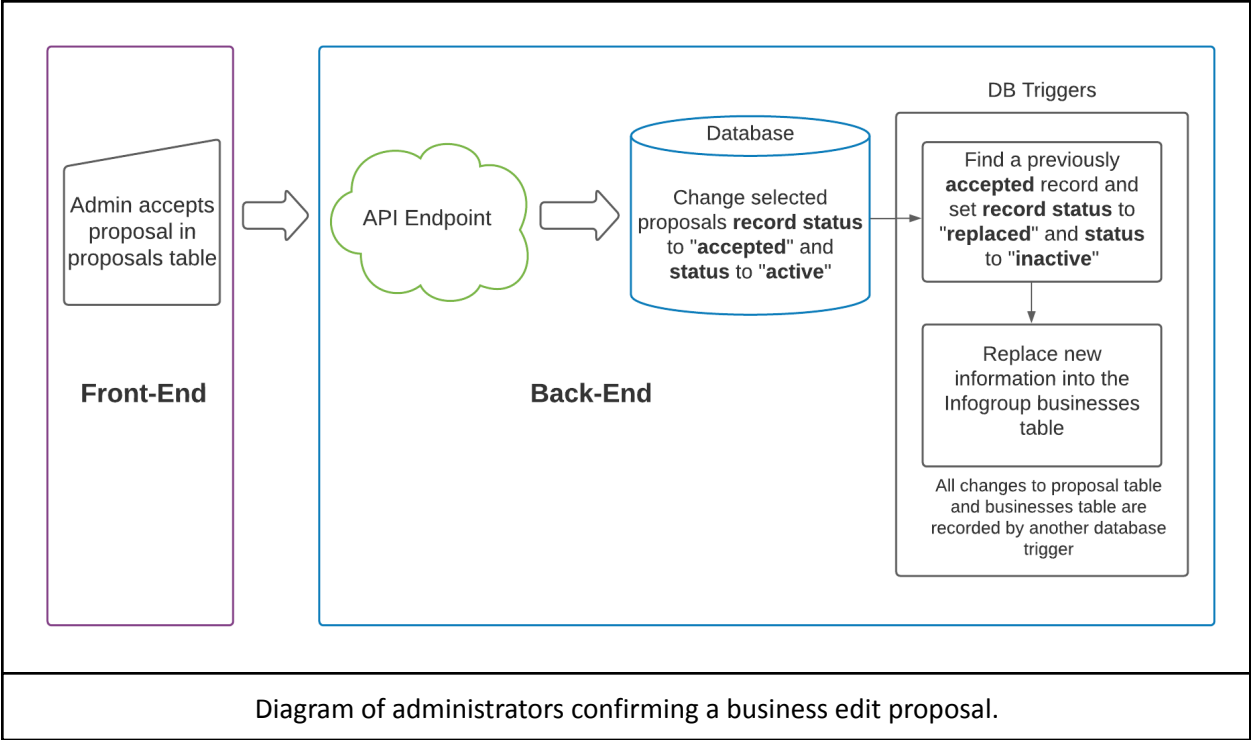
Only administrators are allowed to approve changes and users with edit privileges to propose changes. Accepted changes are to modify the *“businesses”* table directly and currently irreversible using the web interface. If users wish to reverse a change, a resubmission with the desired information could be made to nullify the change. These changes are tracked in the table *“logged_actions”* in the audit schema. It logs information of both previous/original data and the changes made along with the timestamp. This table could be potentially used as a migration table in case the *“businesses”* table is reset or a new table is generated.



To keep track of proposals submitted by users and changes by administrators, the table “*business_edit*” is provided. Records are tracked using two different fields:

1. Record status code:
 - **0** - PROPOSED
 - **1** - WITHDRAWN
 - **2** - REJECTED
 - **3** - REPLACED
 - **4** - ACCEPTED
2. Status code:
 - **0** - INACTIVE / RETIRED
 - **1** - ACTIVE

The field “record status” determines the current phase of the submitted record and the “status” field determines if the record is published and if it is shown to users when it is queried. Notice that some combinations are illegal. For example, a record cannot be “rejected” and “active” or “accepted” and “inactive/retired” at the same time. Records that are accepted and later taken over by another proposal are to be considered “replaced” instead of “accepted” and “inactive/retired”



Any changes made by the administrators, either single or batch, are made in database transactions and if an error were to occur in the process, failed transaction records are rolled back. This provides a fail save record change allowing developers to debug the error in case it occurs.

The database also provides a table called "businesses_o" to users that want to access the original data unchanged. This query is easily made in the web interface by changing the version dropdown in the navigation bar. Also, could be made to the API endpoint (if session token is provided) by using the "v" parameter available.

The screenshot shows a web application interface for managing business edit proposals. At the top, there are navigation links for 'Home' and 'Proposals', and a user ID '4417'. The main area is divided into a map on the left and a table on the right. The map shows a city grid with a red location pin. The table, titled 'Edit', has columns for 'ID', 'Name', 'By', 'created_at', 'comment', and 'changed_fields'. The second row is highlighted in blue. Below the table, there are navigation controls like 'First', 'Previous', 'Next', and 'Last'.

ID	Name	By	created_at	comment	changed_fields
27	BANCLAB	davidng9891	10/20/2020, 12:28pm		"LOCATION_EMPLOYMENT_SIZE_CODE"=>"A"; "LOCATION_EMPLOYMENT_SIZE_DESC"=>"1-4"; "ACTUAL_LOCATION_EMPLOYMENT_SIZE"=>"1"
27	BANCLAB	davidng9891	10/20/2020, 12:17pm		"LATITUDE_1"=>"40.740892335768336"; "LONGITUDE_1"=>"-73.9879792286958"
27	BANCLAB	davidng9891	10/20/2020, 11:40am		"LATITUDE_1"=>"40.74013634343157"; "LONGITUDE_1"=>"-73.98626604351808"
	ALBANY CITY WATER DEPT	davidng9891	09/11/2020, 1:39am		"ACTUAL_LOCATION_EMPLOYMENT_SIZE"=>"2"
	ALBANY CITY WATER DEPT	davidng9891	05/07/2020, 2:28pm		"LATITUDE_1"=>"42.468436735968524"; "LONGITUDE_1"=>"-73.9234694838524"; "PRIMARY_CITY"=>"COEYMAN'S HOLLOW"; "PRIMARY_ADDRESS"=>"20 ALCOVE RD"; "MATCH_LEVEL_CODE"=>"0"; "PRIMARY_ZIP_CODE"=>"12046"
	ALBANY CITY WATER DEPT	davidng9891	05/07/2020, 2:28pm		"LATITUDE_1"=>"42.47830098850463"; "LONGITUDE_1"=>"-73.81919860839845"; "PRIMARY_CITY"=>"RAVENA"; "PRIMARY_ADDRESS"=>"2326 US ROUTE 9W"; "MATCH_LEVEL_CODE"=>"0"; "PRIMARY_ZIP_CODE"=>"12143"
26	BANCLAB	davidng9891	01/30/2020, 2:28pm	change location	"LATITUDE_1"=>"40.745131423940634"; "LONGITUDE_1"=>"-73.98643702268602"; "MATCH_LEVEL_CODE"=>"0"
26	BANCLAB	davidng9891	01/30/2020, 2:27pm		"CORPORATE_SALES_VOLUME_CODE"=>"1"; "CORPORATE_SALES_VOLUME_DESC"=>"\$100-500 MILLION"
26	BANCLAB	davidng9891	01/23/2020, 9:15am	BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT BIG COMMENT	"CORPORATE_SALES_VOLUME_CODE"=>"A"; "CORPORATE_SALES_VOLUME_DESC"=>"LESS THAN \$500,000"
26	BANCLAB	davidng9891	01/23/2020, 9:11am		"CORPORATE_SALES_VOLUME_CODE"=>"C"; "CORPORATE_SALES_VOLUME_DESC"=>"\$1-2.5 MILLION"

Interface for administrators to manage business edit proposals

3.5 User Authentication

Users authentication is managed by AVAIL group in Albany. Whenever a user logs in, the application server makes a request to the AVAIL API endpoint with the provided credentials and awaits for the response. If the user credentials are valid, [Express-session](#) and [PassportJS](#) will create a session and provide a token to the user. Session contains the information of the user provided by AVAIL, which is processed by a middleware in expressJS to determine the user authentication level.

Different users level code are the following:

- **0 - utrc_general:** View users
- **3 - utrc_edit:** Edit users with ability to submit changes for approval
- **5 - utrc_admin:** Administrators with ability to submit changes and approve/reject proposals
- **10 - utrc_dev:** Developers

User levels are assigned by AVAIL group administrators or "utrc_dev" when users are created in AVAIL. To request an user account please visit: <https://availauth.availabs.org/> and register for an account. Users that are accepted will receive a confirmation email and a link to change the password. By default, with the current status of the provided AVAIL endpoint, users are not assigned to any "utrc" group, and a developer level user will be needed to manually assign the desired level to the new user.

Disclaimer: User privileges could be subject to be changed by AVAIL. This application has no control over those changes. This also applies to user privilege codes, which are used to determine the user level in the web interface and API endpoints.

4. Setting up

1. Install PostgreSQL v12.0 or higher. Allow PostGIS and PgRouting to be installed.
2. Download a database dump of this project database.
3. Create the database from the SQL export file.
4. Clone the project [repository](https://github.com/ng9891/infoGroup) in Github.
<https://github.com/ng9891/infoGroup>
5. Create a “.env” environmental file “postgres.env” at repository_name/utis.
6. “.env” file should contain the following:
 - a. `POSTGRES_DB=database_name`
`POSTGRES_USER=database_user`
`POSTGRES_PASSWORD=database_password`
`POSTGRES_NETLOC=PostgreSQL_ip`
`POSTGRES_PORT=PostgreSQL_port`
`SECRET=secret_for_the_session`
`QUERY_DIST=1609`
`MAPQUEST_KEY=map_quest_api_key_for_reverse_geocoding`
7. Run “npm i” in the console to install dependencies.
8. To start the server run: “npm start”.
9. The application should be running at port 3000.

5. Conclusion

Information on local and regional travel patterns is a key component for transportation planners in their analyses. Studies such as analysis on infrastructure needs, evaluate and propose policy initiatives, etc. require detailed information on travel demand patterns. Commuting, shopping and recreation are all significant components of trips in everyday travel. Hence, transportation planners require detailed information on location of points of interest (offices, businesses, etc.) and volume of trips, more specifically, the destination of trips and number of trips.

Accurate location of business establishments, size of workforce and sales volume at each location can provide valuable information for planners. An easy-to-use tool that can query information from the business establishment data in various methods layering with several other useful data and visualize key aspects can be very helpful for planners. In this project, we developed a novel software application that helps query, visualize and also edit any missing or less accurate data of business establishments. Furthermore, this application is web-based and does not require any software to be installed locally by NYSDOT planning staff.

One of the sources of business location data that NYSDOT utilizes is obtained from InfoUSA Marketing, LLC (“InfoGroup”). This establishment location dataset contains granular information of businesses such as, street address, sales volume, employee size, NAICS and SIC classification codes, and other crucial attributes. In order for planners to contextualize these data, the software tool has the ability to layer the business establishment data with several other administrative and infrastructure data such as county, municipality, MPO boundaries, transit lines & station and highways, etc. A tool that can help extract, visualize and summarize the business establishment data from the perspective of type of business, number of employees, sales volume, etc. would be very useful in this regard.

In addition, the tool provides several ways to query business location data such as manually drawn circles (within a certain distance of a point of interest) or polygon of any shape, using user-selected distance along roadways, and several combinations of these methods. These querying features are also designed to mirror those available in a standard GIS tool so that the planners can easily transfer their experience with standard GIS tools.

Furthermore, as the business establishment data comes from a diversity of sources, it is prone to contain uncertainty, redundancy and error. Hence, additional functionality to edit erroneous or inaccurate data can help improve data quality.

Lastly, this tool seamlessly integrates with existing analytical framework available to NYSDOT for easy access to existing user base. The choice of software tools is made in using similar open source tools used in the analytical framework. Also, this choice gives the flexibility to advance the features of the tools and add new features.

6. Appendix

6.1 API End-points

Currently the application API service is not open to service as it does not provide a token for users to make requests. Furthermore, users need to be authenticated to be able to access the API.

To make it easier to distinguish the endpoints, the API is divided into two groups:

1. “/by” requests: Queries the businesses points in the project database.
2. “/get” requests: Mainly provides information and geometry of metadata such as: county names, zip codes, nearby roads from a point, etc...

/by requests

By InfoGroup ID	/api/byinfoid/{infousa_id}
By NYSDOT Region	/api/byregion/{dotRegion}

By Driving Distance	/api/bydrivingdist
By Railroad	/api/byrailroad
By Polyline String Geometry	/api/bypolyline
By Geocode	/api/bygeocode/{address}
By Search	/api/search
By County	/api/bycounty/{countyName}
By Radius	/api/bydistance
By Business ID	/api/byid/{businessID}
By MPO	/api/bympo/{mpoName}
By Municipality	/api/bymun/{municipalityName}
By Bounding Box	/api/byrectangle
By Zip Code	/api/byzip/{zipCode}

/get requests

Get Zip Code	/api/getzip/{autocompleteZipCode}
Get NYSDOT Region	/api/getregion/{regionName}
Get Driving Distance Geometry	/api/getdrivingdist
Get Railroad	/api/getrailroad

Get Nearby Roads	/api/getnearbyroad
Get Business Name	/api/getconame/{autocompleteBusinessName}
Get County	/api/getcounty/{autocompleteCountyName}
Get Employment Size	/api/getempsize
NAICS Code	/api/getindustries/
Get MPO	/api/getmpo/{autocompleteMPOName}
Get Municipality	/api/getmun/{autocompleteMunicipalityName}
Get Road names	/api/getroad
Get Sales Volume categories	/api/getsalesvolume
Get Primary SIC Code	/api/getsic
Get Location Size - Square Foot Description	/api/getsqfoot
Get Reverse Geocode	/api/get/geocode/reverse

6.2 More Info

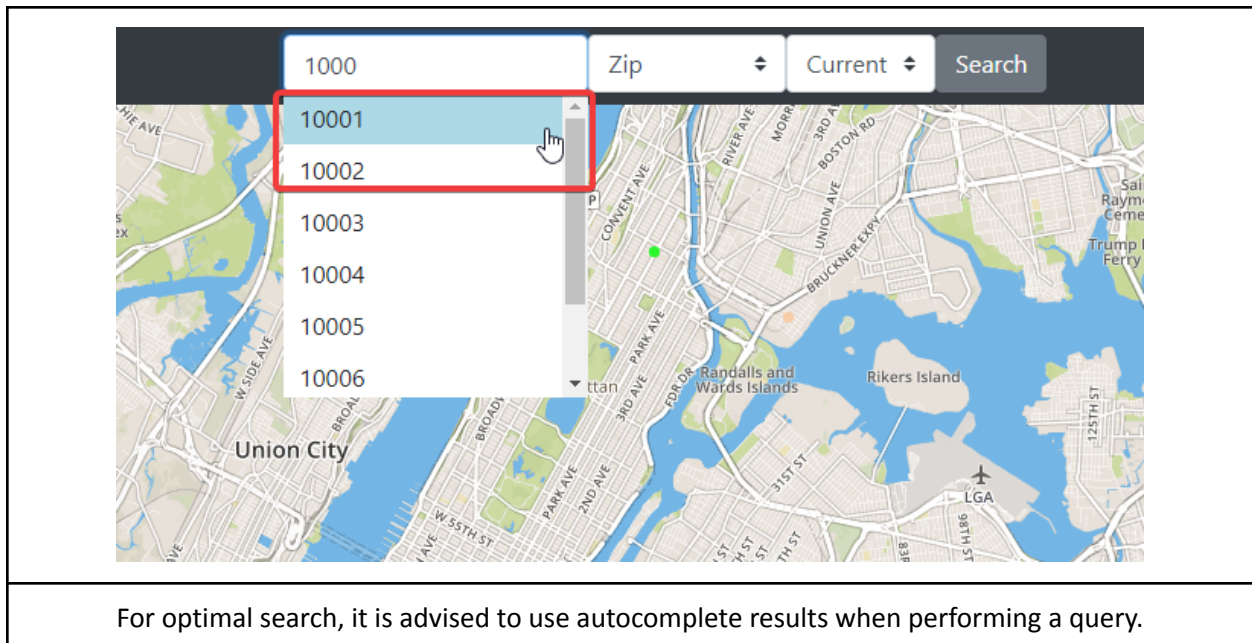
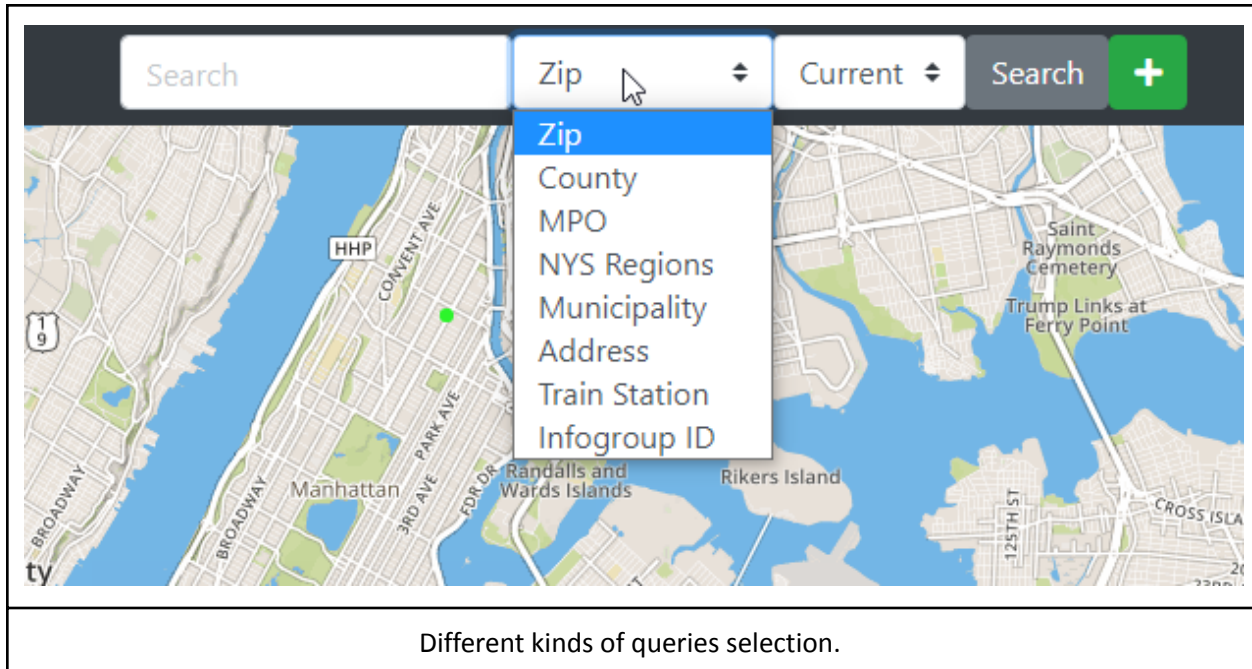
For more information about the endpoints, please refer to the [documentation](#).

6.3 User Manual

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6.1 Basic Queries



10002 Zip Current Search

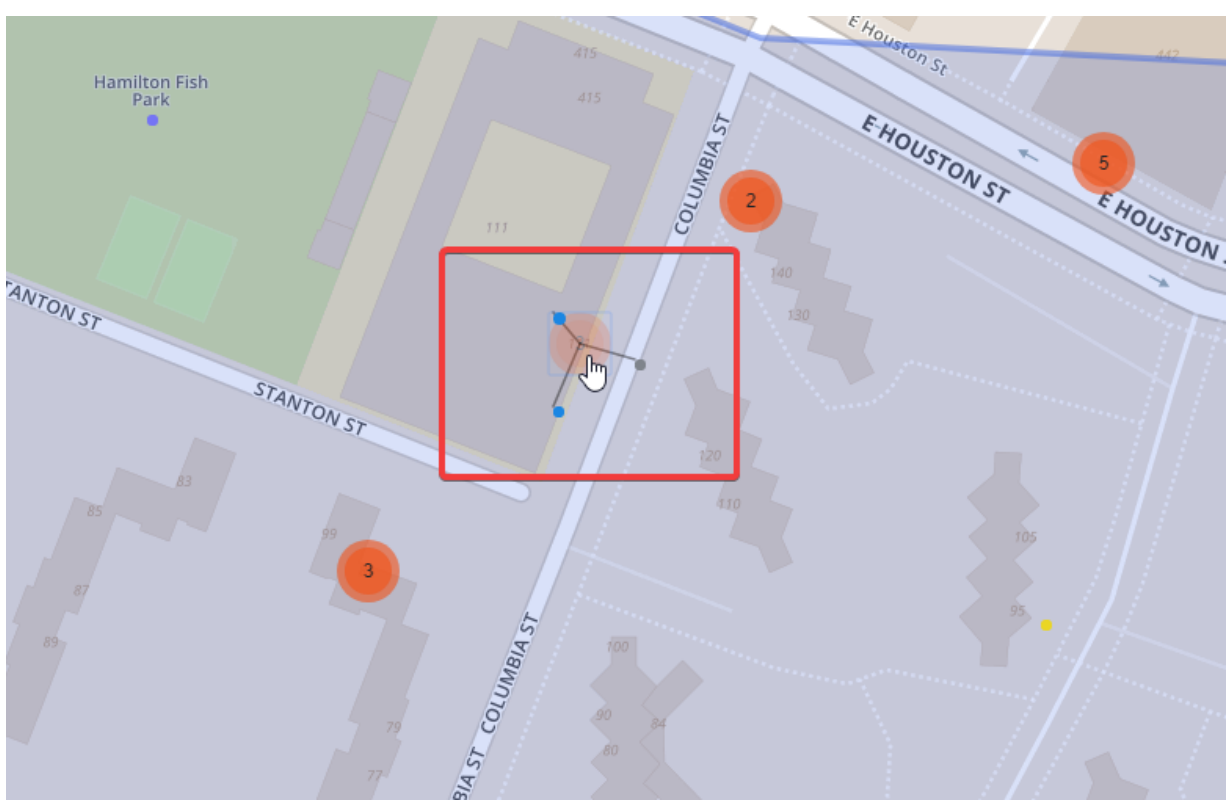
Current
Current
Original

Database version

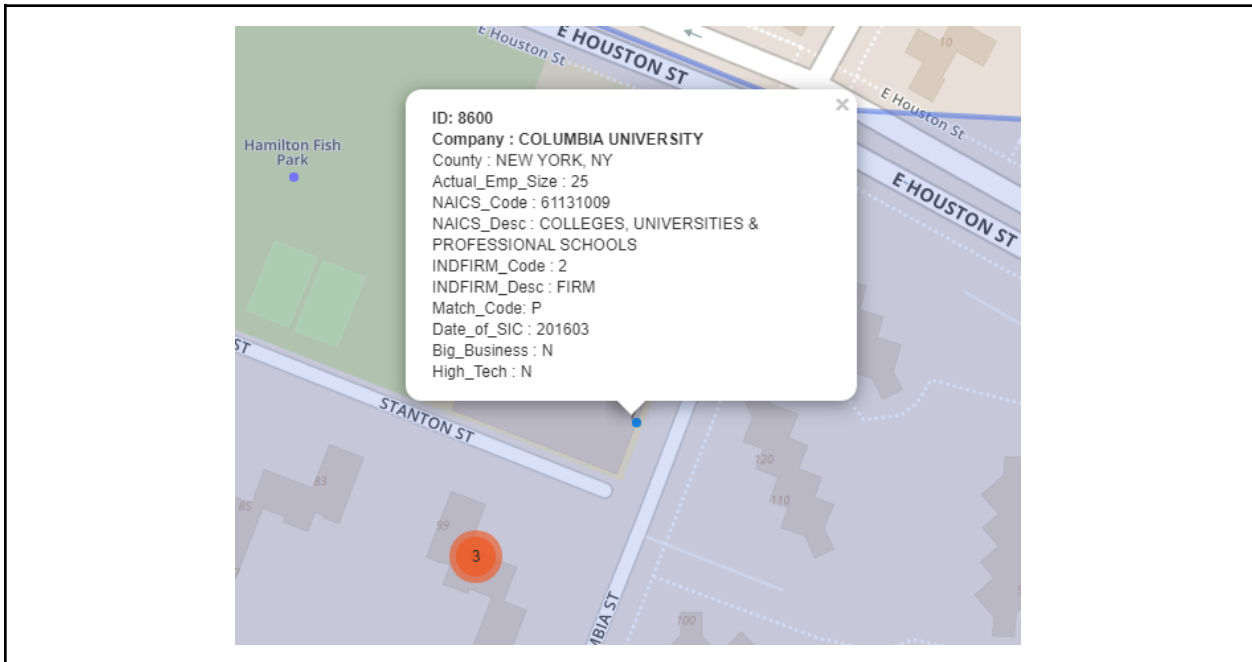
New York City

761
21
1232
421

Example Query result



Businesses spiderfied clusters.



Clicking on a business marker will reveal quick information about the establishment

6.1.1 Main Tab

ZIP 10002

AGRICULTURE, FORESTRY, FISHING AND HUNTING
UTILITIES
MINING, QUARRYING, AND OIL AND GAS EXTRACTION
TRANSPORTATION AND WAREHOUSING
PUBLIC ADMINISTRATION
MANUFACTURING
UNCLASSIFIED ESTABLISHMENTS
MANAGEMENT OF COMPANIES AND ENTERPRISES
MANUFACTURING
TRANSPORTATION AND WAREHOUSING
RETAIL TRADE
WHOLESALE TRADE
MANUFACTURING
ARTS, ENTERTAINMENT, AND RECREATION
INFORMATION
FINANCE AND INSURANCE
EDUCATIONAL SERVICES
ADM & SUP & WASTE MGT & REMEDIATION SERVICES
CONSTRUCTION
OTHER SERVICES (EXCEPT PUBLIC ADMINISTRATION)
HEALTH CARE AND SOCIAL ASSISTANCE

ACCOMMODATION AND FOOD SERVICES
REAL ESTATE AND RENTAL AND LEASING
RETAIL TRADE
PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES

Legend [More statistics...](#)

Export Search:

Name	EmpSZ	NAICS	Primary SIC	PRM	
SUBWAY	8	LIMITED-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
LOS FELIZ	15	FULL-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
TIENLEY CO INC	10	OTHER MISCELLANEOUS DURABLE GOODS MERCHANT WHLSRS	IMPORTERS (WHLS)	<input checked="" type="checkbox"/>	Edit
MERCHANTS PROPERTIES INC	8	OFFICES OF REAL ESTATE AGENTS & BROKERS	REAL ESTATE	<input checked="" type="checkbox"/>	Edit
B'S BEAUTY SALON	7	BEAUTY SALONS	BEAUTY SALONS	<input checked="" type="checkbox"/>	Edit

Showing 1 to 17 of 2,443 entries Previous 1 2 3 4 5 ... 144 Next

Main tab title contains information about the current query.

6.1.2 Main Tab - Pie section

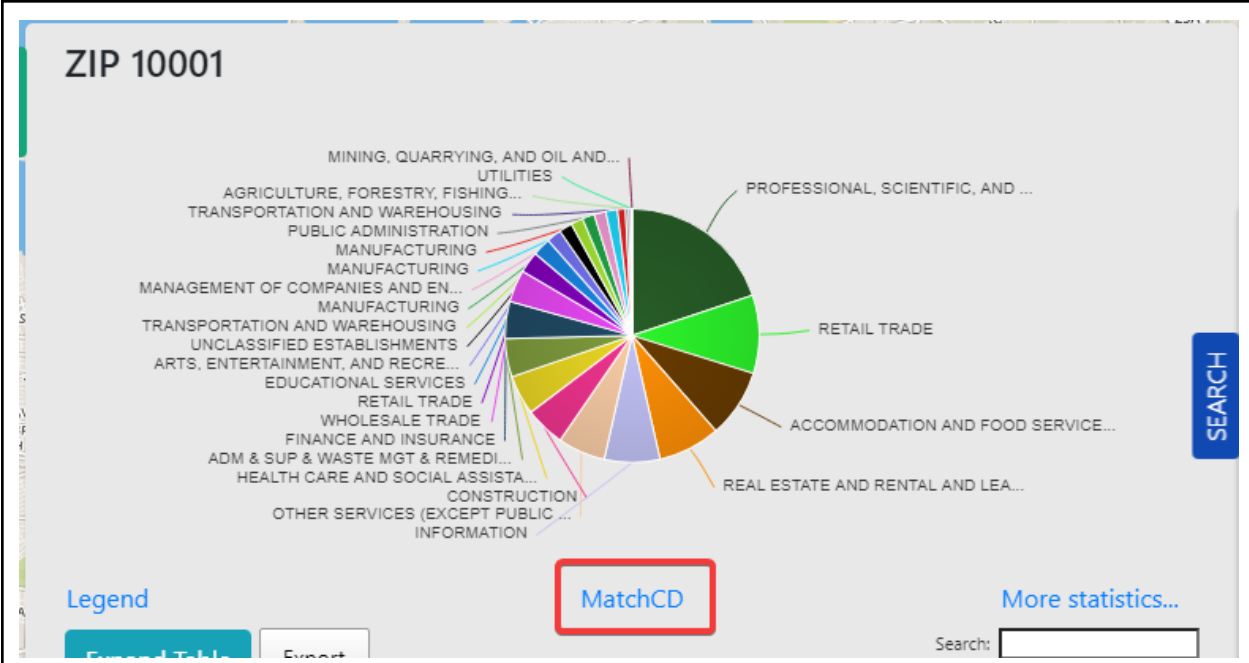
ZIP 10002

AGRICULTURE, FORESTRY, FISHING AND HUNTING
UTILITIES
MINING, QUARRYING, AND OIL AND GAS EXTRACTION
TRANSPORTATION AND WAREHOUSING
PUBLIC ADMINISTRATION
MANUFACTURING
UNCLASSIFIED ESTABLISHMENTS
MANAGEMENT OF COMPANIES AND ENTERPRISES
MANUFACTURING
TRANSPORTATION AND WAREHOUSING
RETAIL TRADE
WHOLESALE TRADE
MANUFACTURING
ARTS, ENTERTAINMENT, AND RECREATION
INFORMATION
FINANCE AND INSURANCE
EDUCATIONAL SERVICES
ADM & SUP & WASTE MGT & REMEDIATION SERVICES
CONSTRUCTION
OTHER SERVICES (EXCEPT PUBLIC ADMINISTRATION)
HEALTH CARE AND SOCIAL ASSISTANCE

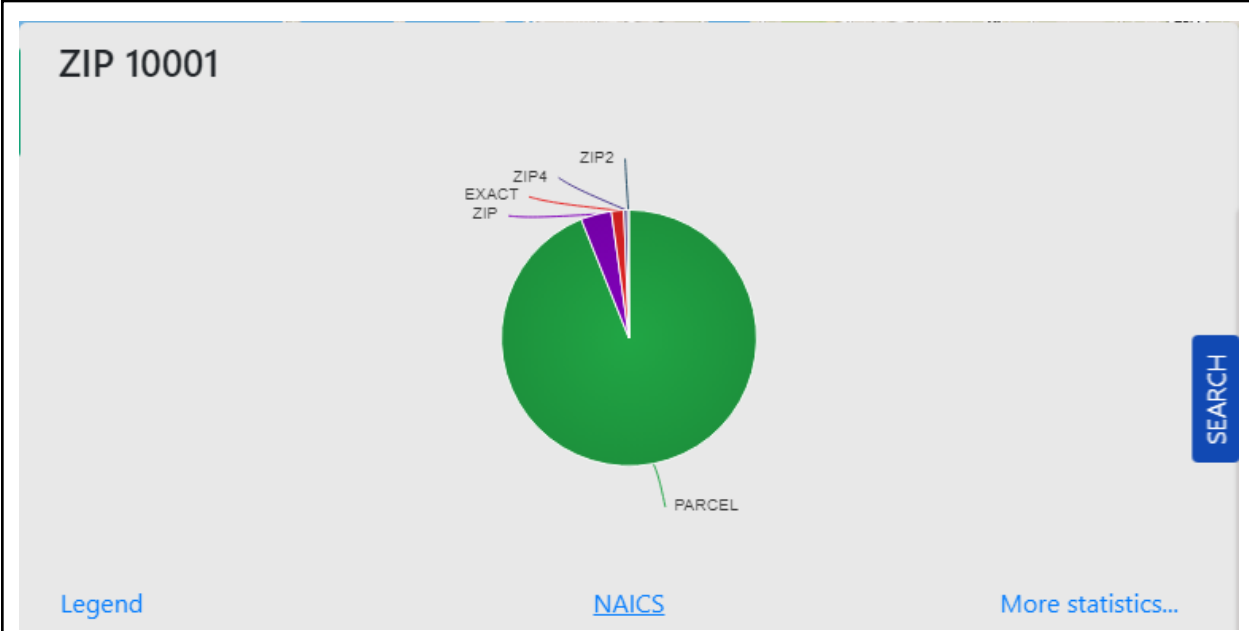
ACCOMMODATION AND FOOD SERVICES
REAL ESTATE AND RENTAL AND LEASING
RETAIL TRADE
PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES

Legend [More statistics...](#)

NAICS pie chart.

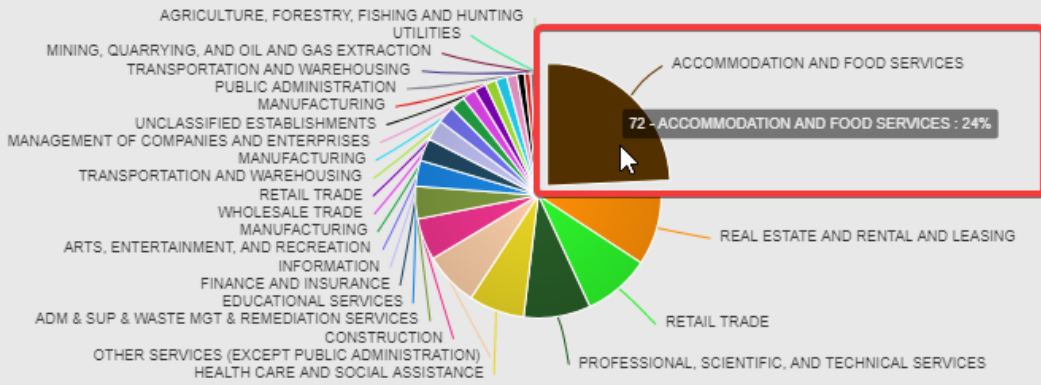


Change the pie chart type to Match Code by clicking the MatchCD button.



Match Code pie chart.

ZIP 10002



SEARCH

Legend

[More statistics...](#)

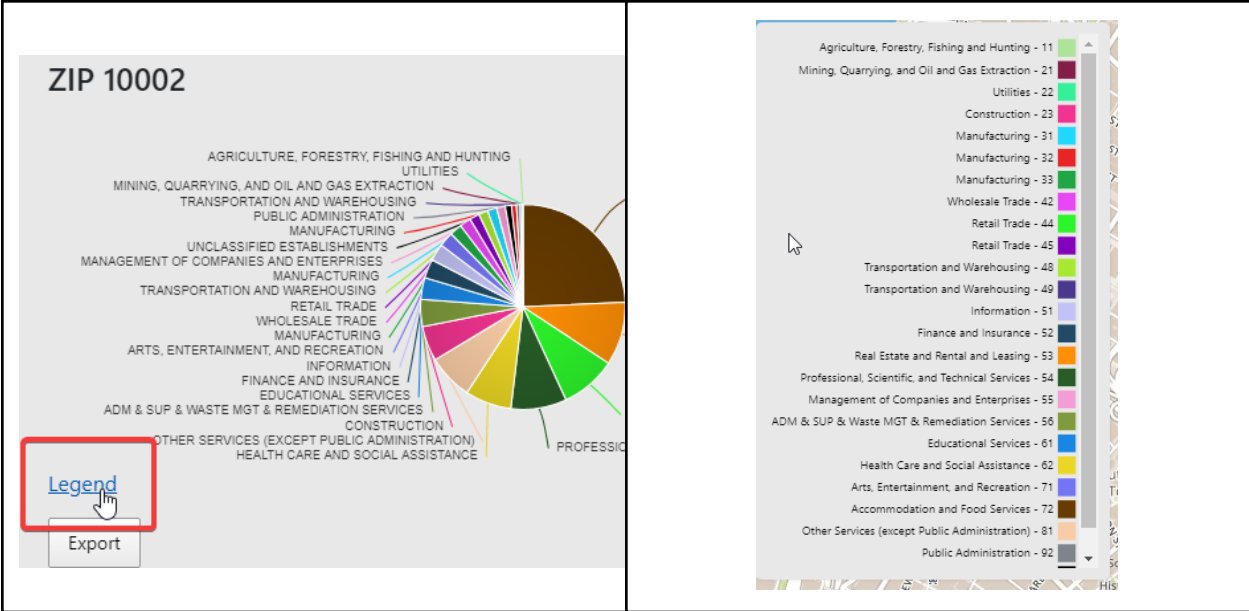
Export

Search:

Name	EmpSZ	NAICS	Primary SIC	PRM	
SUBWAY	8	LIMITED-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
LOS FELIZ	15	FULL-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
YAYA TEA	10	FULL-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
BACK ROOM	8	DRINKING PLACES ALCOHOLIC BEVERAGES	BARS	<input checked="" type="checkbox"/>	Edit
FREEMANS	6	FULL-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
BLUE MOON HOTEL	8	HOTELS (EXCEPT CASINO HOTELS) & MOTELS	HOTELS & MOTELS	<input checked="" type="checkbox"/>	Edit

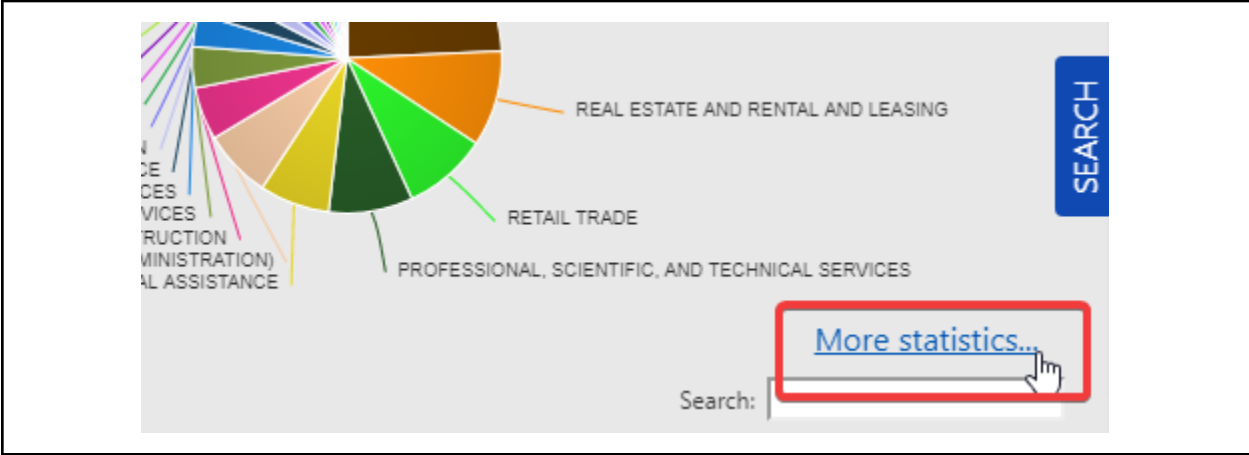
Showing 1 to 17 of 593 entries (filtered from 2,443 total entries) Previous 1 2 3 4 5 ... 35 Next

Clicking on a section will filter the datatable.

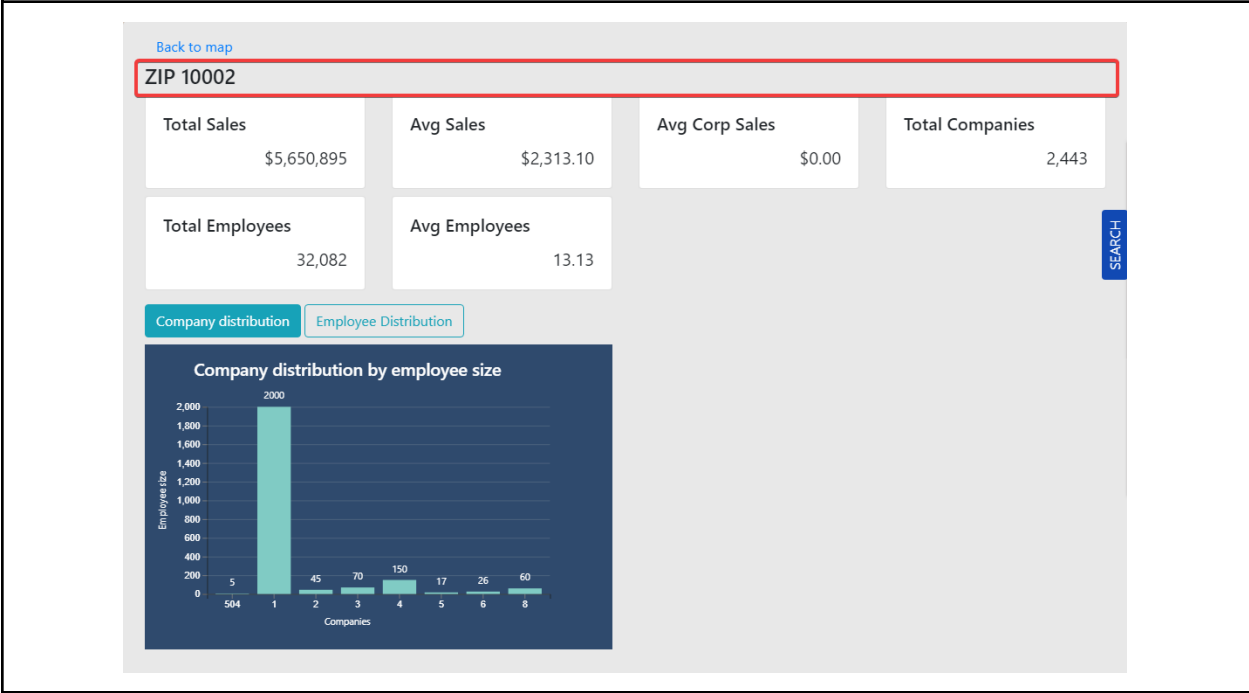


Legend tab can be opened by clicking the “Legend” button below the pie chart.

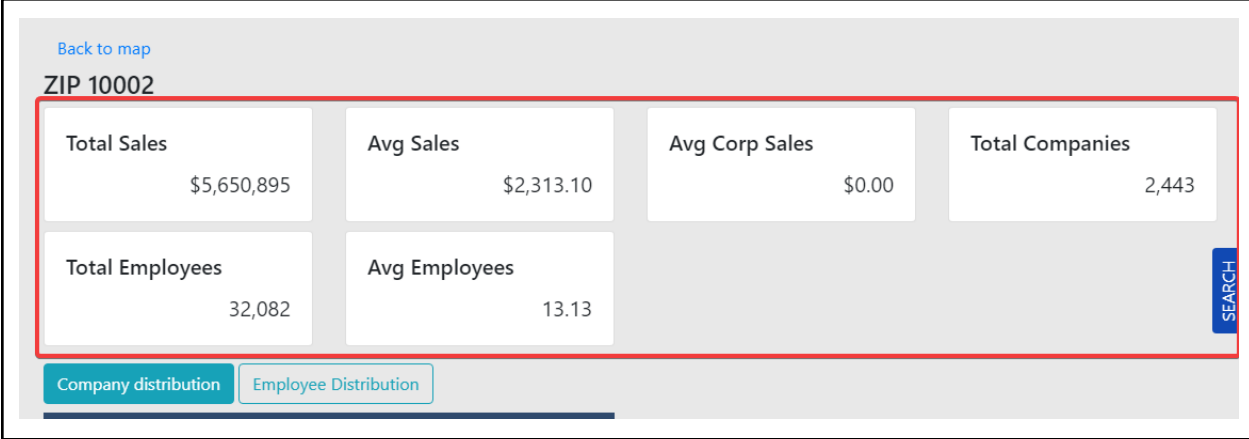
6.1.3 Statistic Tab



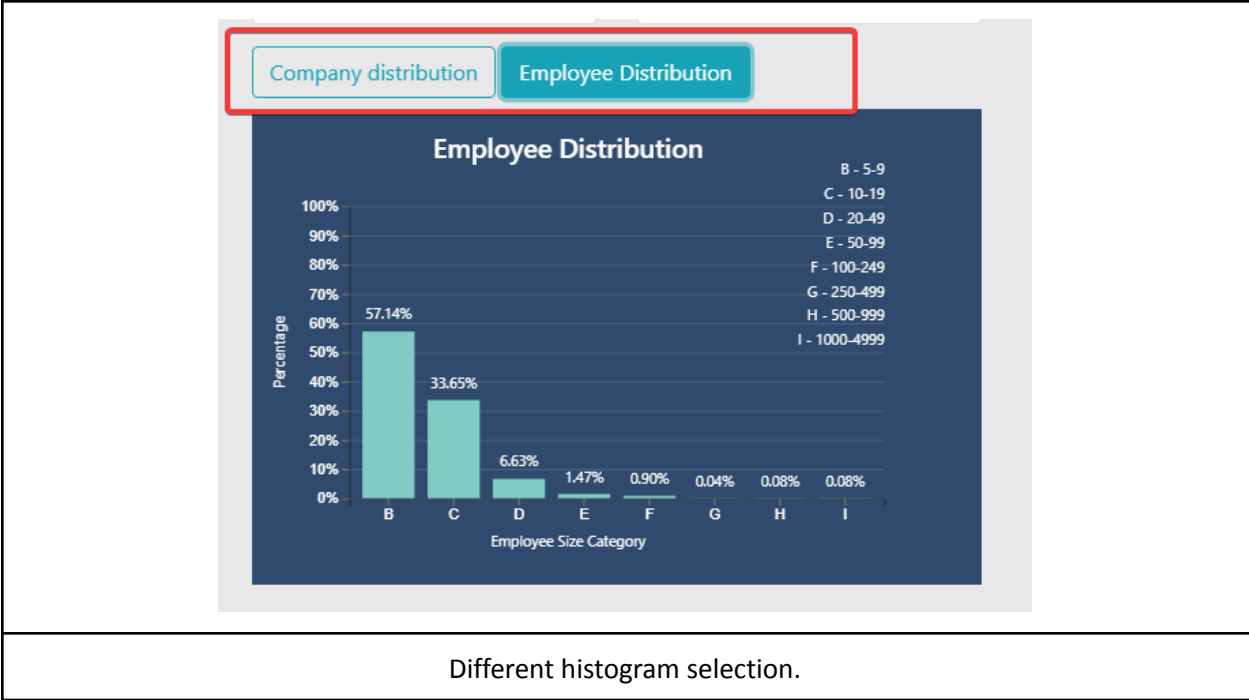
To open statistics tab



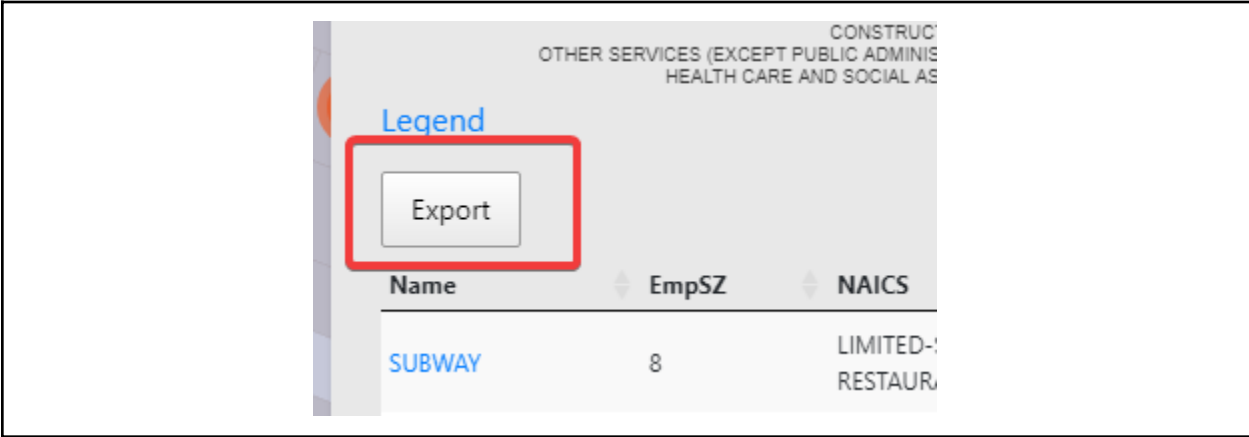
Statistics tab title contains information about the current query.



Brief summary cards of the queried region.



6.1.4 Main Tab - Exporting data



The export button will export the current table into a CSV file. Also, take screenshots of the map, pie charts and the histograms into a PDF.

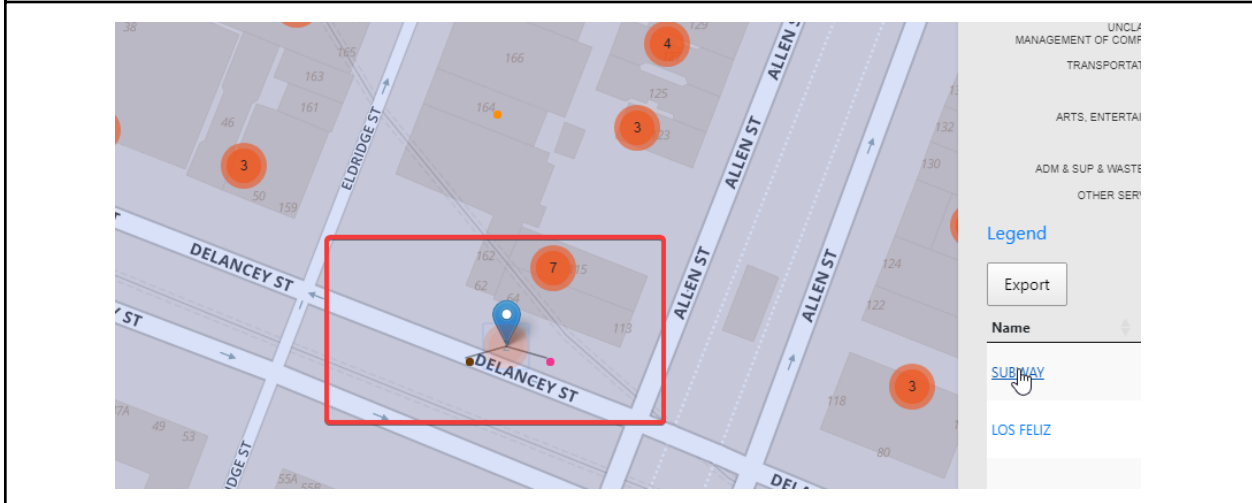
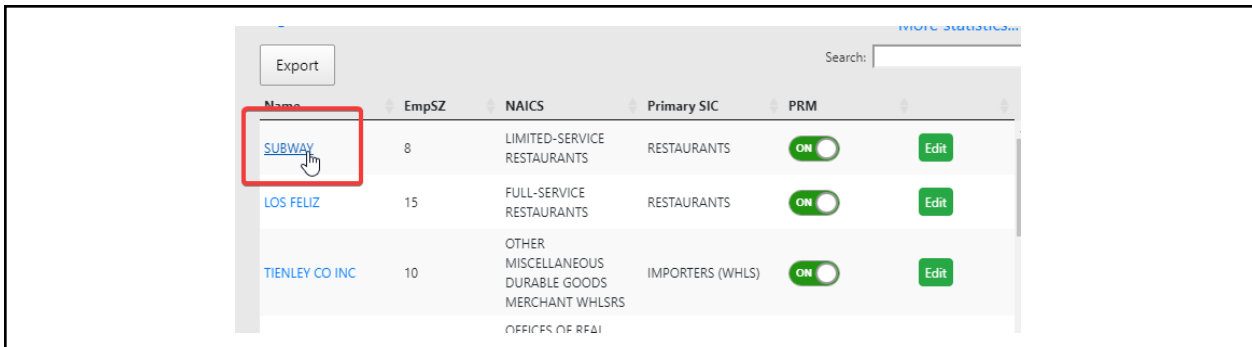
6.1.5 Main Tab - Table section

Name	EmpSZ	NAICS	Primary SIC	PRM	
SUBWAY	8	LIMITED-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
LOS FELIZ	15	FULL-SERVICE RESTAURANTS	RESTAURANTS	<input checked="" type="checkbox"/>	Edit
TIENLEY CO INC	10	OTHER MISCELLANEOUS DURABLE GOODS MERCHANT WHLSRS	IMPORTERS (WHLS)	<input checked="" type="checkbox"/>	Edit
MERCHANTS PROPERTIES INC	8	OFFICES OF REAL ESTATE AGENTS & BROKERS	REAL ESTATE	<input checked="" type="checkbox"/>	Edit
B'S BEAUTY SALON	7	BEAUTY SALONS	BEAUTY SALONS	<input checked="" type="checkbox"/>	Edit

Showing 1 to 17 of 2,443 entries

Previous 1 2 3 4 5 ... 144 Next

Table header listing company name, employee size, NAICS description and Primary SIC



Clicking the name of a business on the table will bring the user to the location on the map.

Name	EmpSZ	NAICS	Primary SIC	PRM	
SUBWAY	8	LIMITED-SERVICE RESTAURANTS	RESTAURANTS	ON	Edit
LOS FELIZ	15	FULL-SERVICE RESTAURANTS	RESTAURANTS	ON	Edit

SUBWAY - ID: 6345 ×

64 DELANCEY ST, NEW YORK, NY 10002 - [View](#)

ALIAS Company name

SUBWAY SUBWAY

EMP SIZE CODE EMP SIZE DESC

B ▾ 5-9

Actual Employment Size 8

NAICS CODE NAICS DESC

72251301 LIMITED-SERVICE RESTAURANTS

PRIMARY SIC CODE PRIMARY SIC DESC

581208 RESTAURANTS

SQF CODE SQF DESC

1 ▾ 1 - 1,499

LSALVOLCD LSALVOLDS

B ▾ \$500,000-\$1 MILLION

Actual Sales Volume (in Millions) 0.661

CSALVOLCD CSALVOLDS

Corporate Sales Volume ▾

Actual Corporate Sales Volume (in Millions)

Clicking the edit/view button will reveal a new tab with more information

6.1.6 Location editing in the edit tab

449 NEW SALEM RD, VOORHEESVILLE, NY 12186 - [View](#)

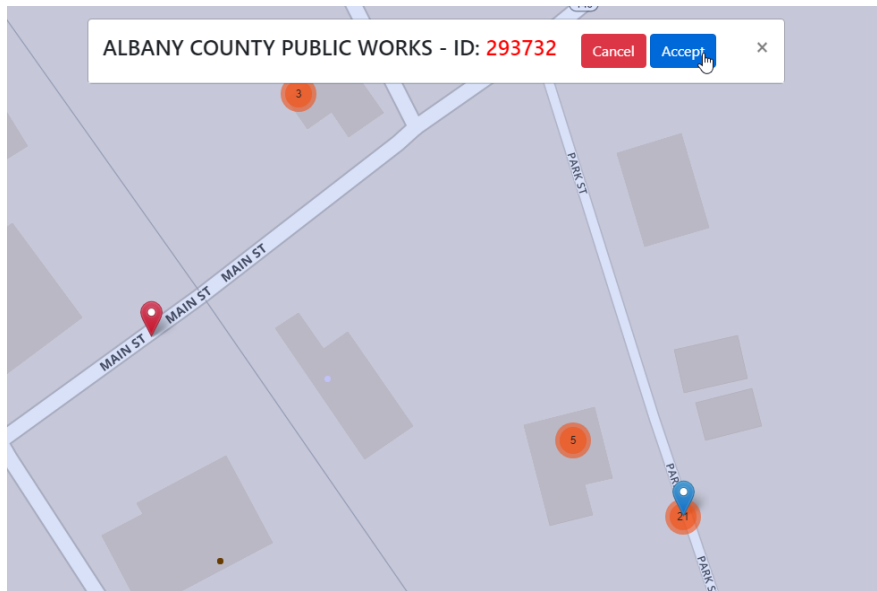
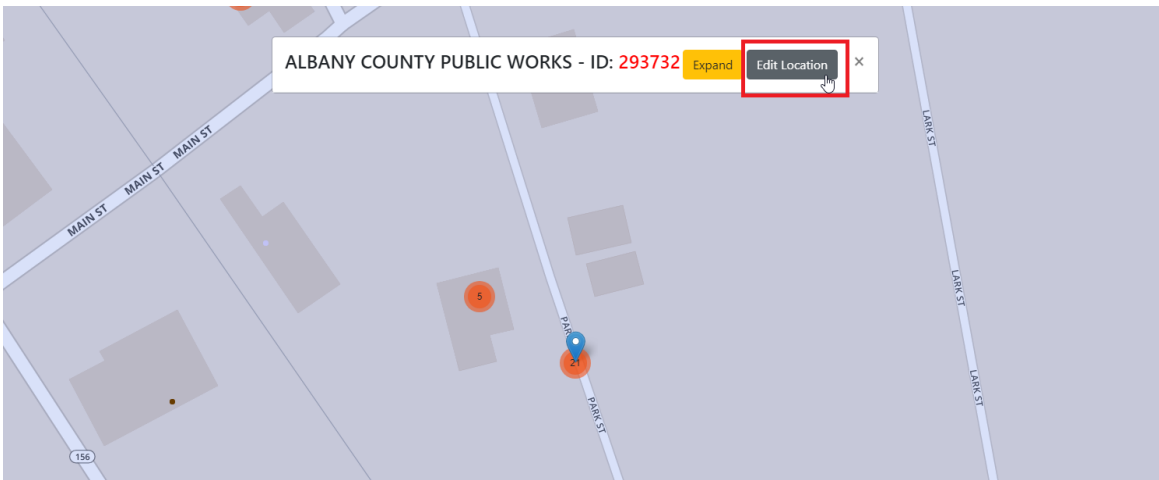
PRM ADDR PRM CITY

449 NEW SALEM RD VOORHEESVILLE

STATE ZIP LAT LON MATCH LEVEL CODE

NY 12186 42.700599 -74.031845 ZIP ▾

[Locate on Map](#) | [Geocode Address](#)



Drag the red marker to the new location. (Original location represented in blue) and click accept.

After changing the latitude and longitude of a business point, if users wish to change the address also, a button will appear to use the reverse geocode feature.



BANCLAB - ID: 26 ×

228 W 26TH ST, NEW YORK, NY 10001 - [View](#)

ADDRESS CITY

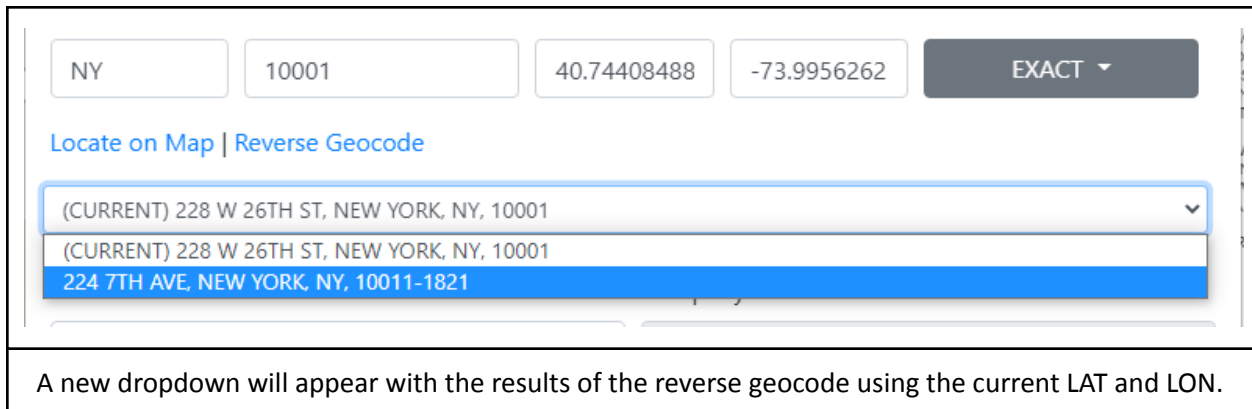
228 W 26TH ST NEW YORK

STATE ZIP LAT LON MATCH LEVEL CODE

NY 10001 40.74408488 -73.9956262 EXACT ▾

[Locate on Map](#) | **Reverse Geocode**

Reverse Geocode Button appears after changing the latitude and longitude.



NY 10001 40.74408488 -73.9956262 EXACT ▾

[Locate on Map](#) | [Reverse Geocode](#)

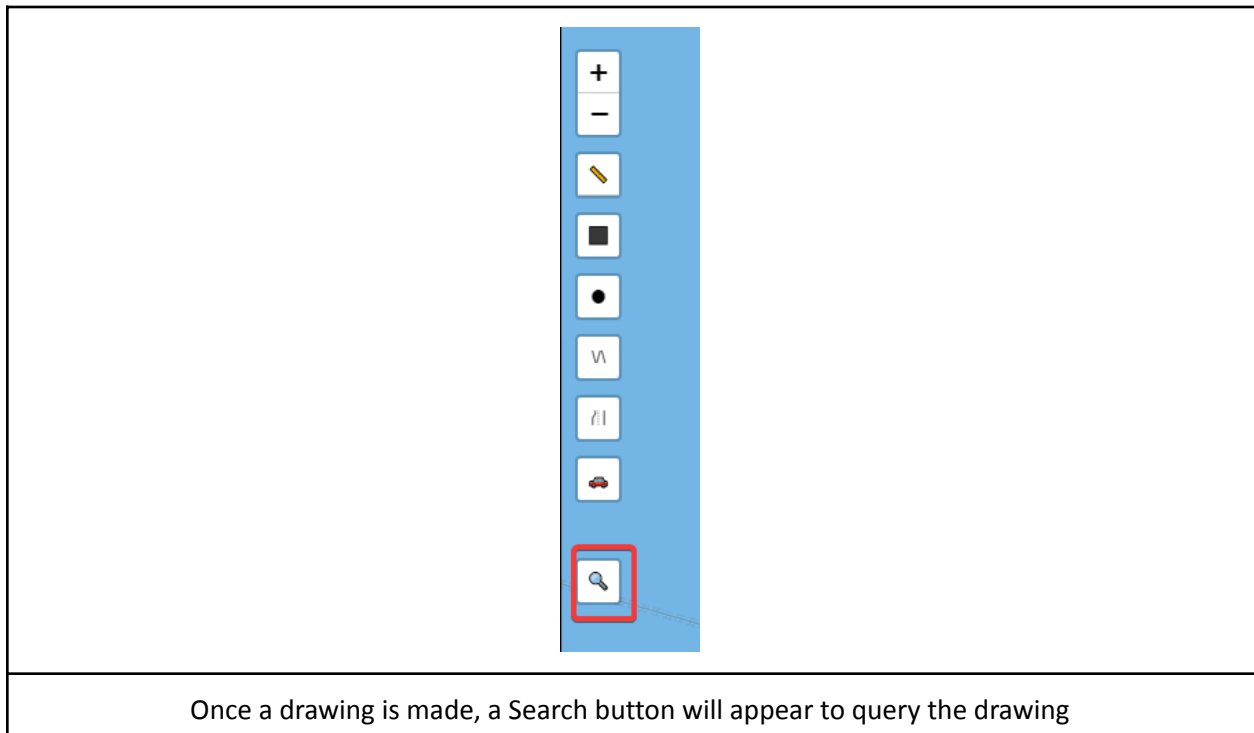
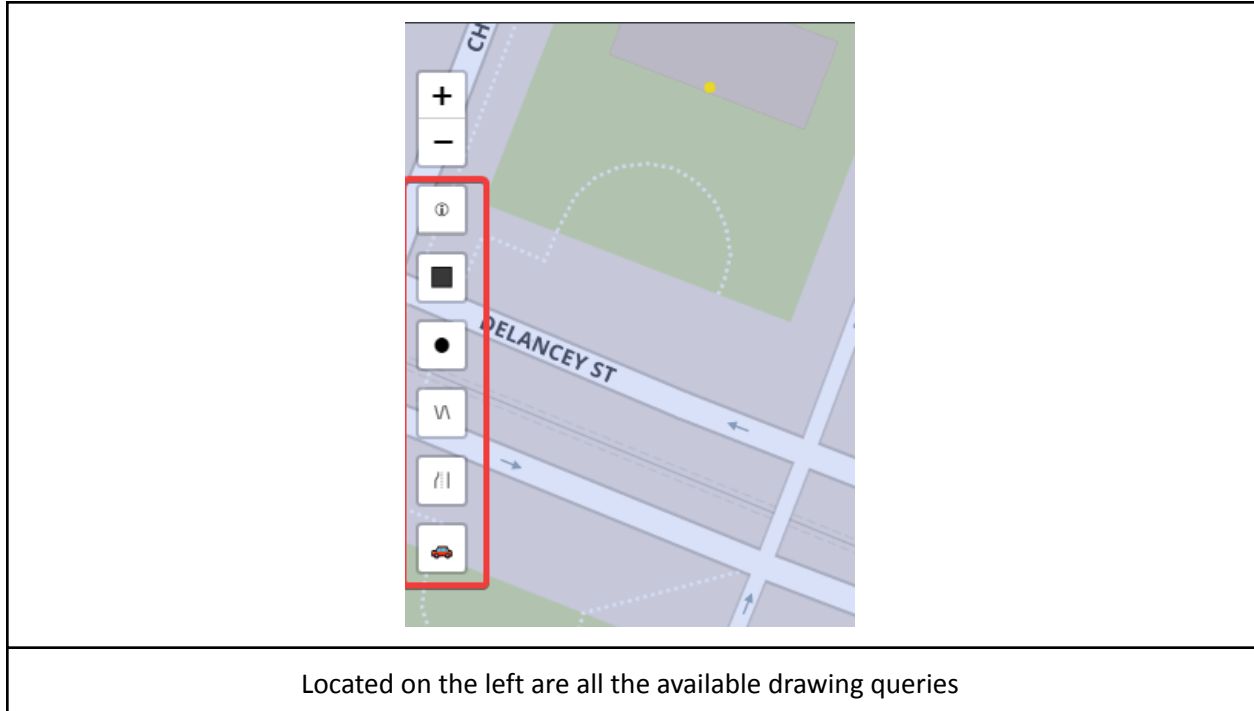
(CURRENT) 228 W 26TH ST, NEW YORK, NY, 10001 ▾

(CURRENT) 228 W 26TH ST, NEW YORK, NY, 10001

224 7TH AVE, NEW YORK, NY, 10011-1821

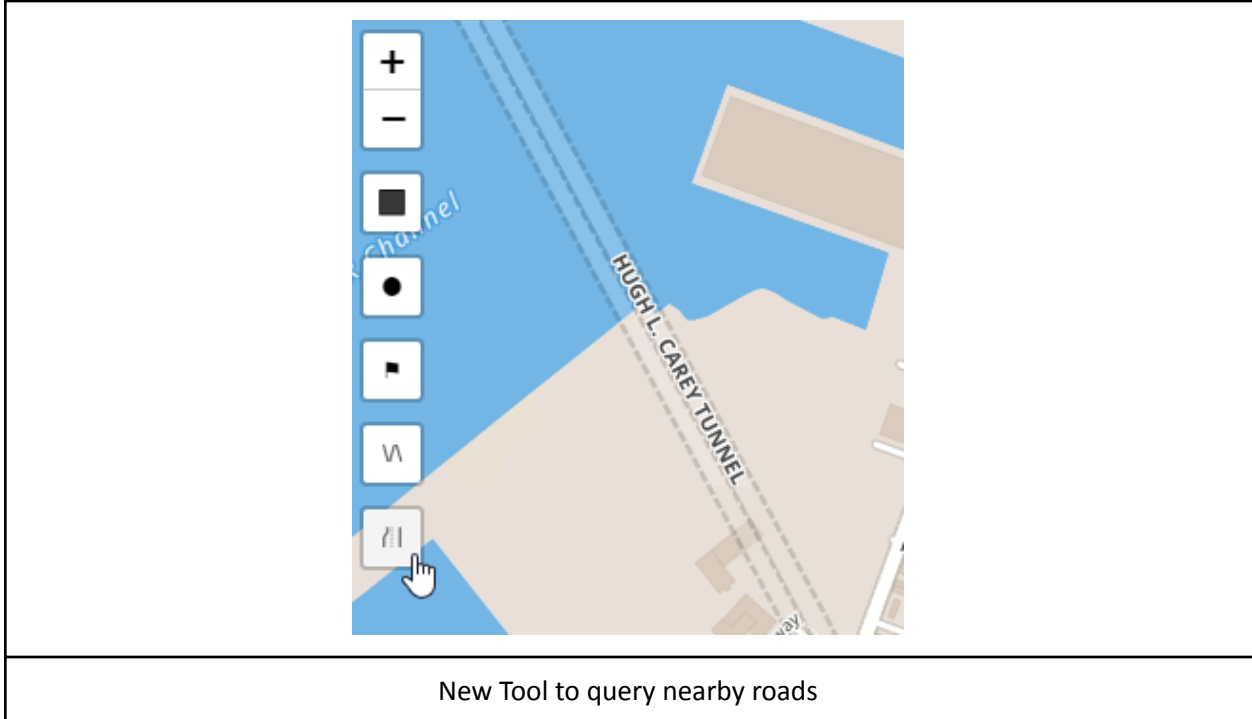
A new dropdown will appear with the results of the reverse geocode using the current LAT and LON.

6.2 Drawing Queries

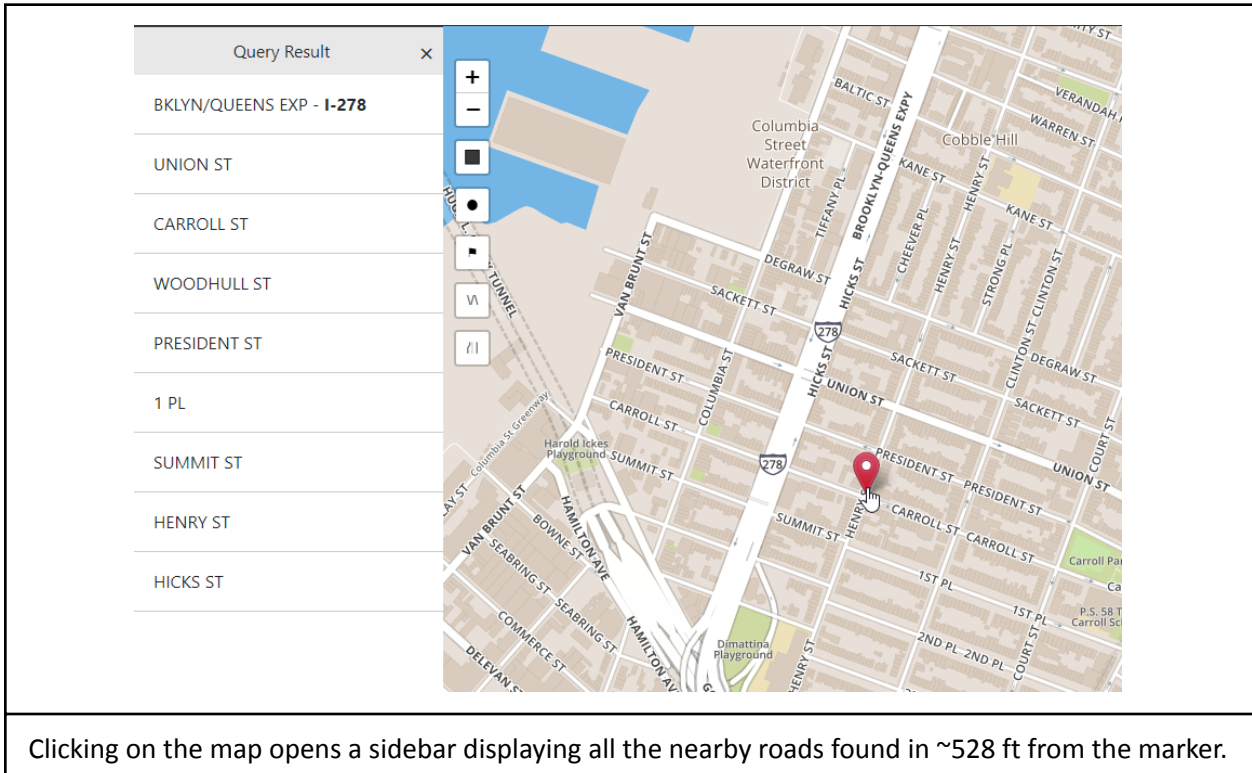


6.2.1 Road Query

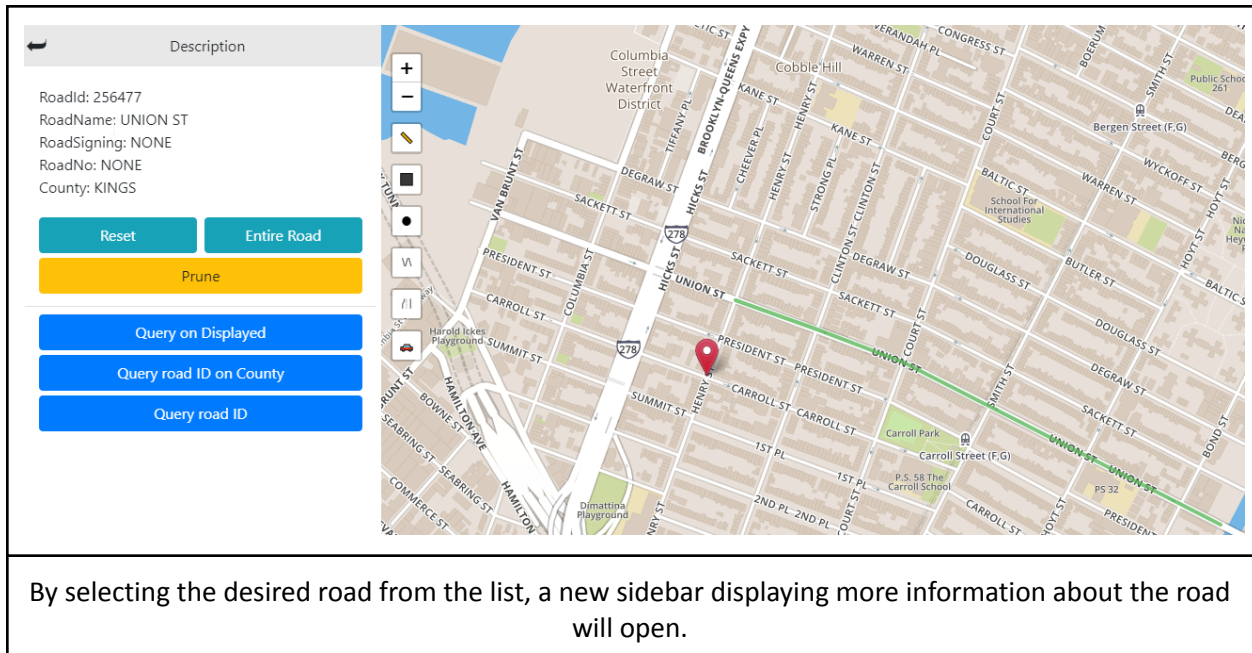
A tool to select nearby roads by dropping a marker in a specific location on the map.



New Tool to query nearby roads

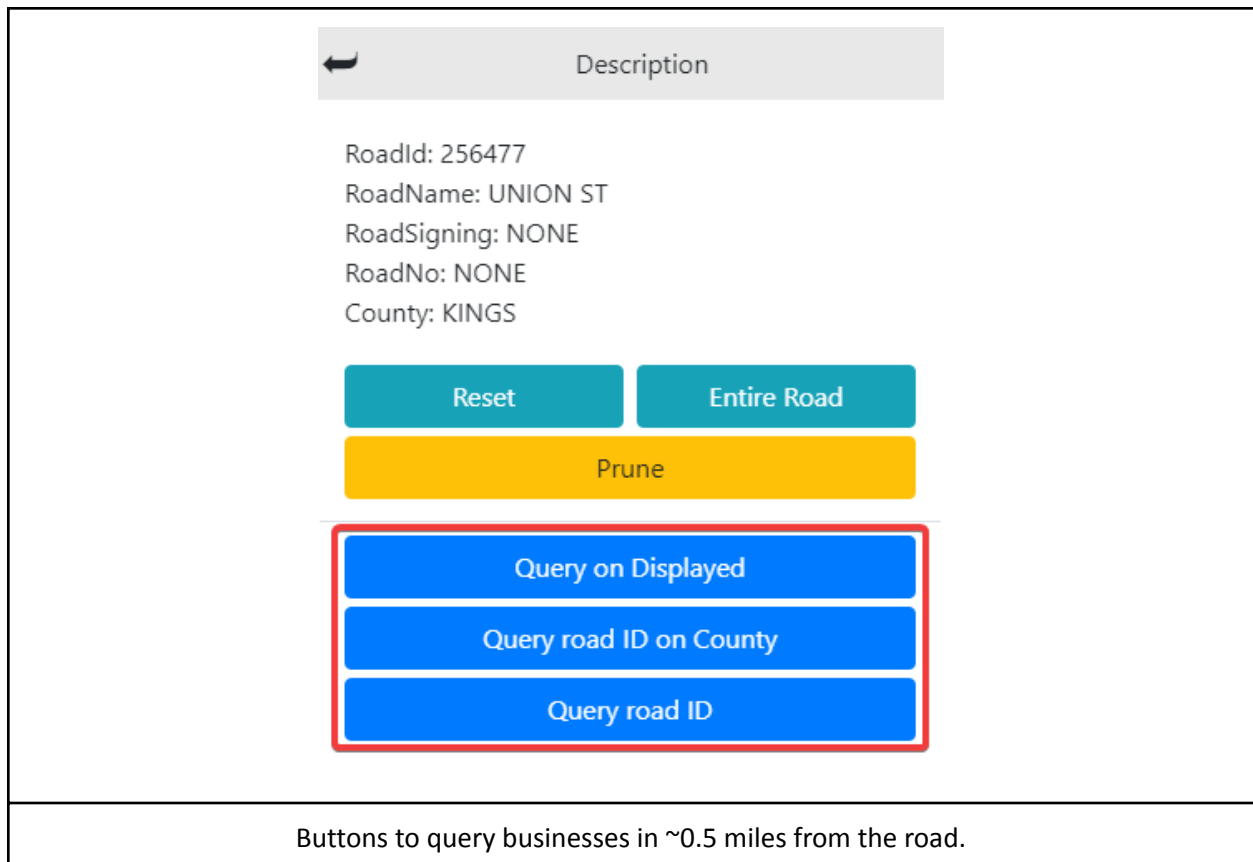


Clicking on the map opens a sidebar displaying all the nearby roads found in ~528 ft from the marker.



Once a road is selected, there are buttons to query businesses around the selected road:

1. Query on Displayed: allows to query around the road from the currently displayed road section.
2. Query road ID on County: it will query the road ID bounded by the county specified in the description.
3. Query road ID: it will query the entire road ID. Be aware when querying Interstate roads, it will take a considerable amount of time to load.



There are options to change the displayed road section when using the Query on Displayed feature:

1. Reset Button: resets the displayed road to the originally displayed section.
2. Entire Road: queries the server to load the entire road section.
3. Prune: allows users to draw a rectangle to specify the desired road length of the road section.

←
Description

RoadId: 256477
 RoadName: UNION ST
 RoadSigning: NONE
 RoadNo: NONE
 County: KINGS

Reset

Entire Road

Prune

Query on Displayed

Query road ID on County

Query road ID

Options to change the displayed road sections.

Reset

Entire Road

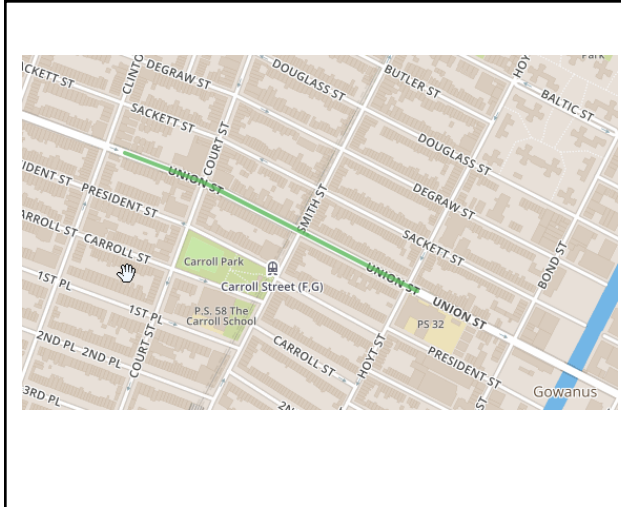
Prune

Confirm

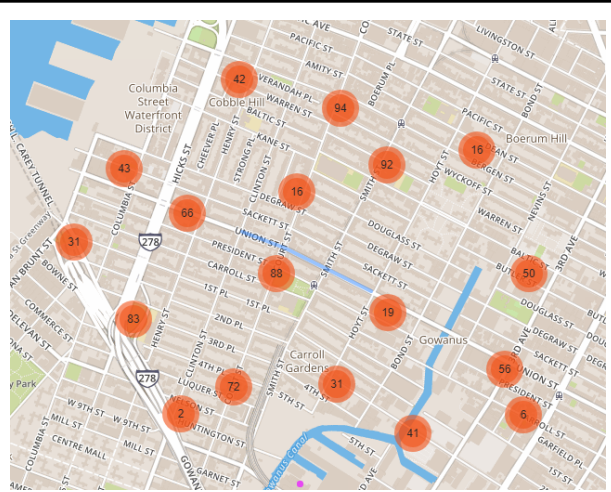
Cancel

Clicking the *Prune button* allows users to draw a rectangle to shorten the displayed road section.

Once a desired length is drawn, confirm by clicking the *Confirm button*.



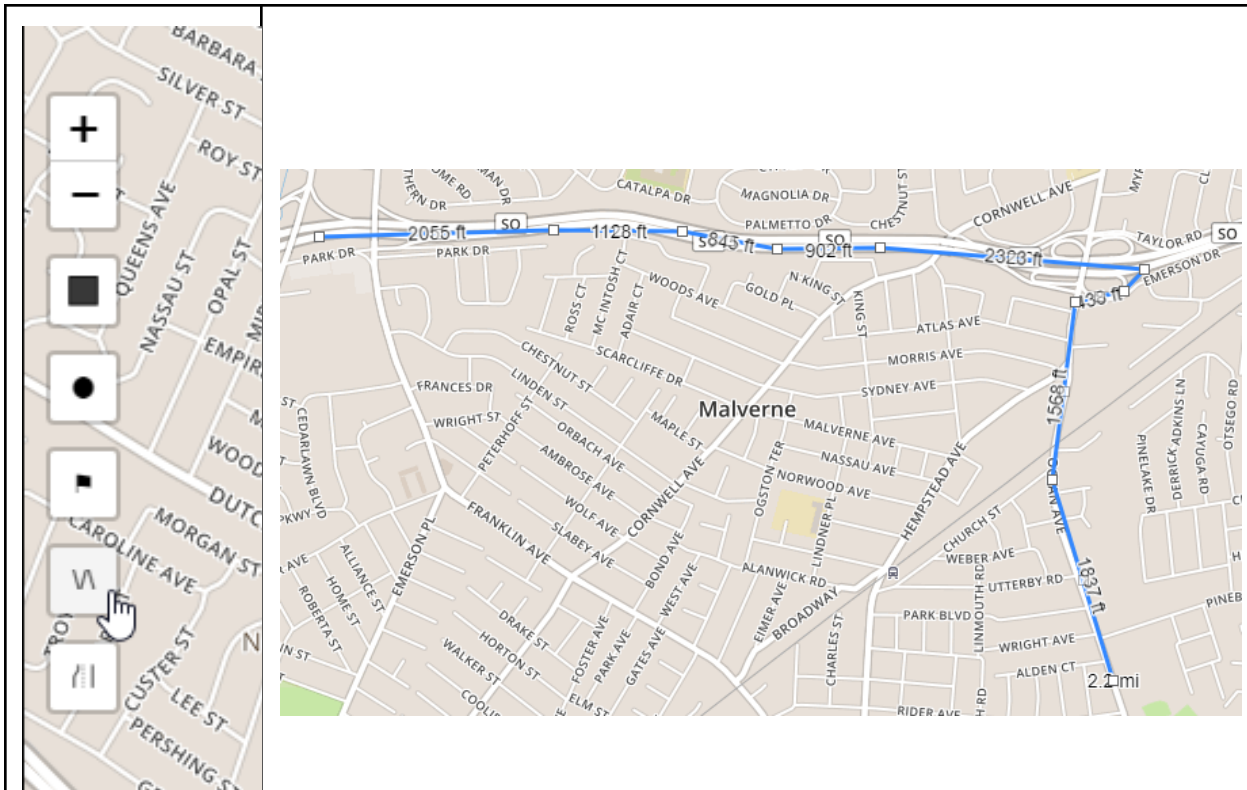
Shortened road using Prune.



Result from Query on Displayed.

6.2.2 Road Drawing

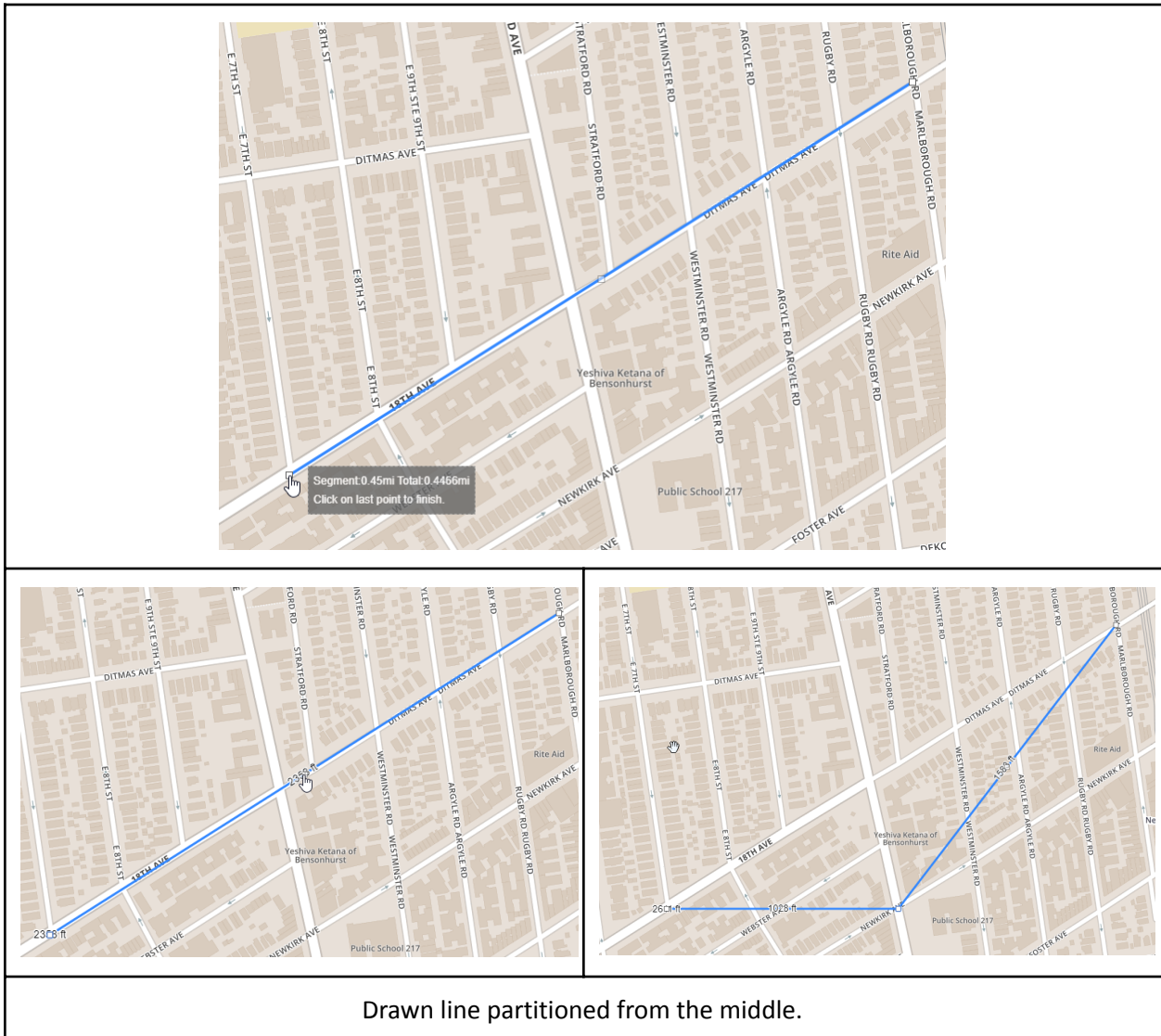
This feature to query a specific section of a road or a specific route. Default buffer size is 0.5 miles.



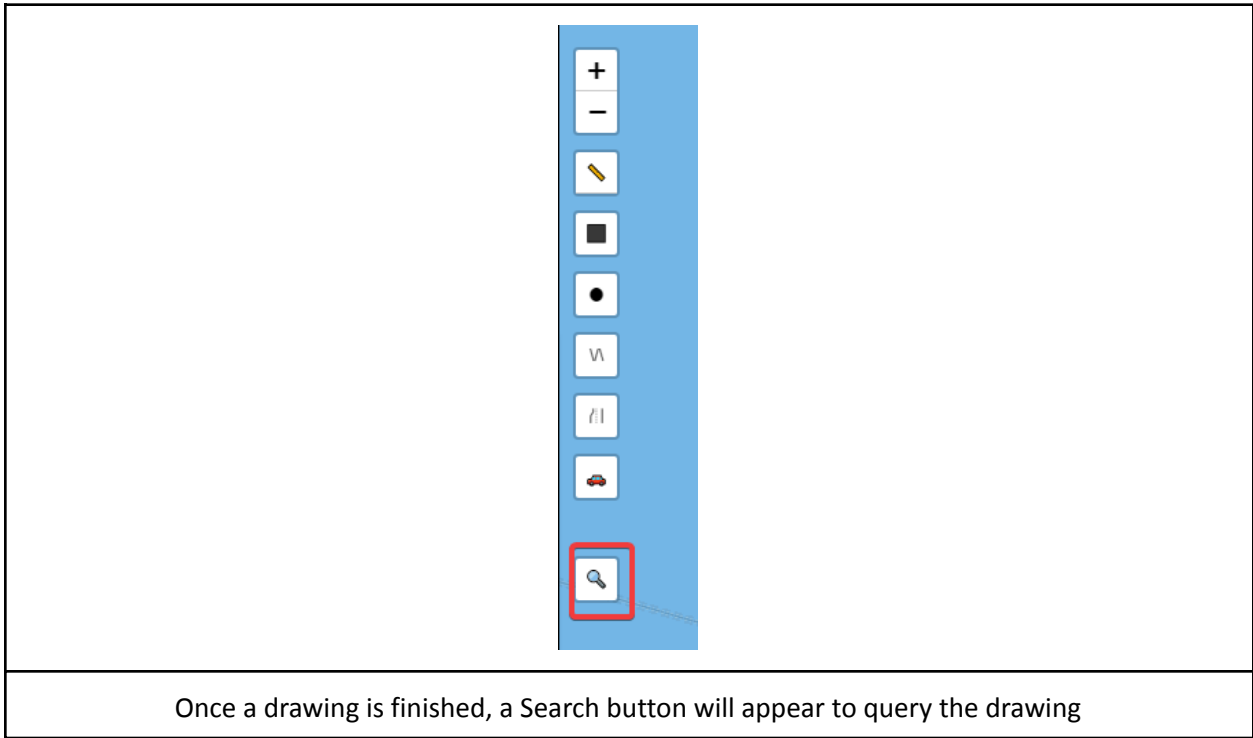
Line drawing tool.

Drawn specific route on the map.

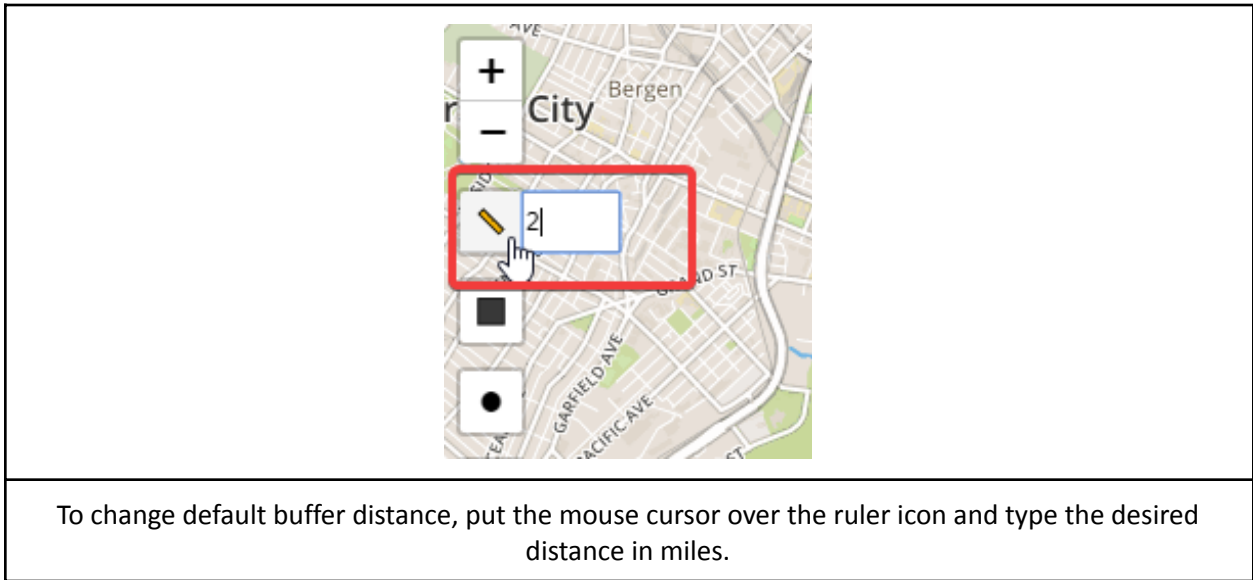
To finish a line drawing, just click the last point of the line once again. Also, keep in mind that a drawn line can be extended and also partitioned from the middle.

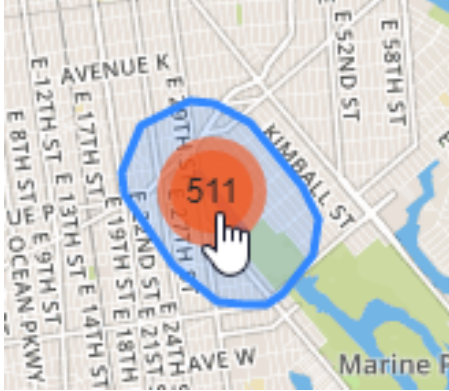
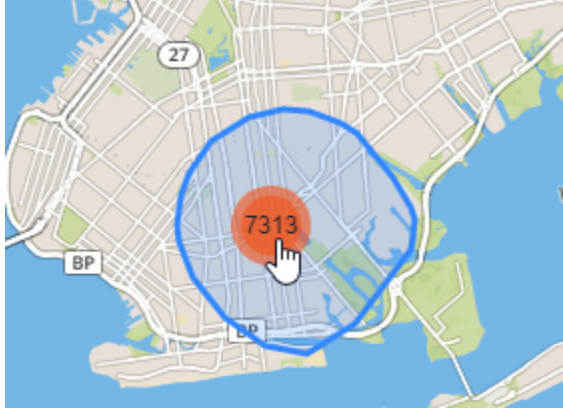


Drawn line partitioned from the middle.

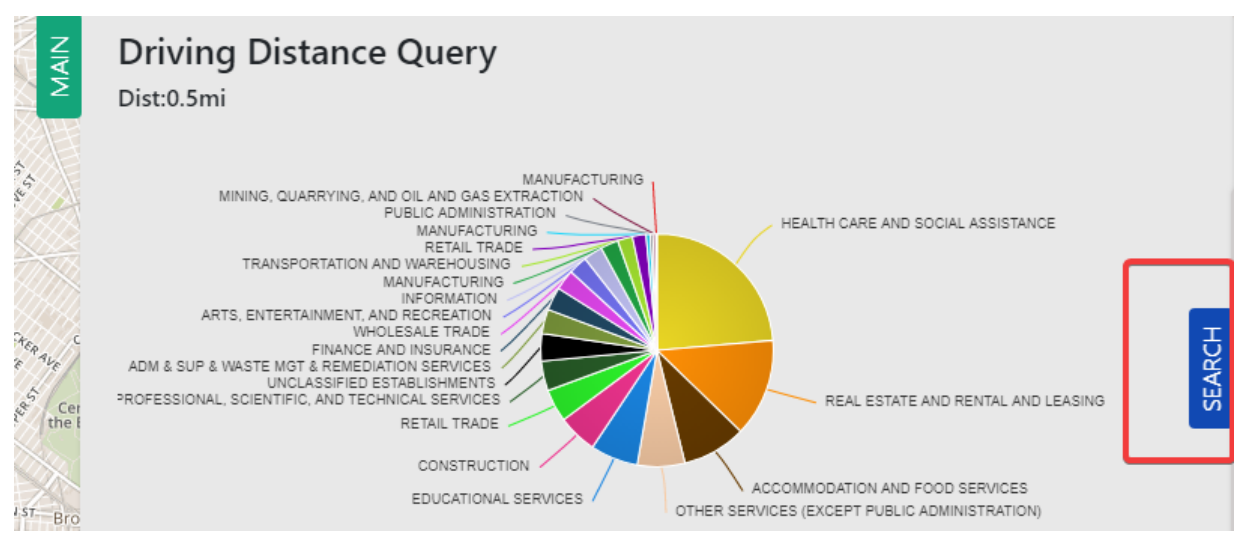


6.2.3 Changing the default query buffer size on drawing queries



	
<p>Road query results with a default buffer size of 0.5 miles</p>	<p>Road query results with a buffer size of 2 miles.</p>

6.3 Advanced Queries



Driving Distance Query
Dist: 0.5mi

MAIN

SEARCH

- MANUFACTURING
- HEALTH CARE AND SOCIAL ASSISTANCE
- MINING, QUARRYING, AND OIL AND GAS EXTRACTION
- PUBLIC ADMINISTRATION
- MANUFACTURING
- RETAIL TRADE
- TRANSPORTATION AND WAREHOUSING
- MANUFACTURING
- INFORMATION
- ARTS, ENTERTAINMENT, AND RECREATION
- WHOLESALE TRADE
- FINANCE AND INSURANCE
- ADM & SUP & WASTE MGT & REMEDIATION SERVICES
- UNCLASSIFIED ESTABLISHMENTS
- PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES
- RETAIL TRADE
- CONSTRUCTION
- EDUCATIONAL SERVICES
- OTHER SERVICES (EXCEPT PUBLIC ADMINISTRATION)
- REAL ESTATE AND RENTAL AND LEASING
- ACCOMMODATION AND FOOD SERVICES

Advanced query tab located at the right side of the main tab.

SEARCH

Company Name e.g. CUNY

NAICS e.g. Manufacturing SIC e.g. Warehouses

Road No. e.g. 87 Signing e.g. I Dist Miles(opt)

Employees Min Max

County e.g. Albany - NY MPO e.g. CDTC

Municipality e.g. Hudson Sales Volume ▾

MATCH LEVEL CODE ▾

Search Search On Current Selection Reset

Clicking on the button opens up the advanced search tab.

Company Name CUNY

Industry e.g. Financial Code OPTIONAL

Road No. e.g. 87 Signing e.g. I Dist Miles(opt)

Employees Min Max

County New York - NY MPO e.g. CDTC

Municipality e.g. Hudson Sales Volume ▾

New York City

Example advanced search query result.

Industry	<input type="text" value="FULL-SERVICE RESTAURANTS"/>
Road No.	<input type="text" value="87"/> Signing <input type="text" value="I"/>
Employees	Min <input type="text"/> Max <input type="text"/>
County	<input type="text" value="Albany - NY"/> MPO <input type="text" value="e.g. C"/>

Road query is also available in advanced query.

6.3.1 Search on current selected layer

It is also possible to make further queries after a basic query has been made. Using the “Search on current layer button”, it will use the displayed Overlay Layer to query desired businesses.

Basic Query result. Zip 11204

Company Name e.g. CUNY

NAICS ACCOMMODATION AND FOOD SEI SIC e.g. Wareh

Road No. e.g. 87 Signing e.g. I

Employees Min Max

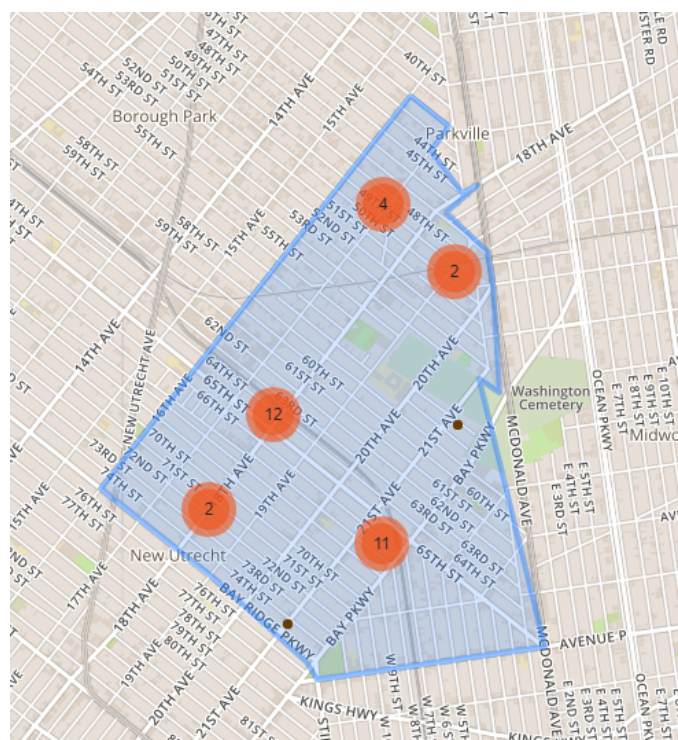
County e.g. Albany - NY MPO e.g. CDT

Municipality e.g. Hudson

MATCH LEVEL CODE ▾

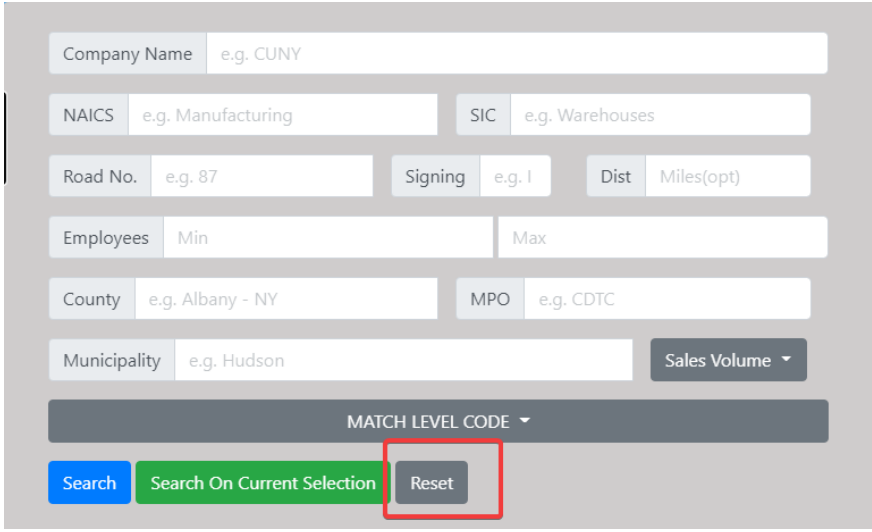
Search Search On Current Selection Reset

Search businesses on the current layer using NAICS code 72. (Accommodation and food)



Result from the search on *Current Selection* query.

6.3.2 Reset fields

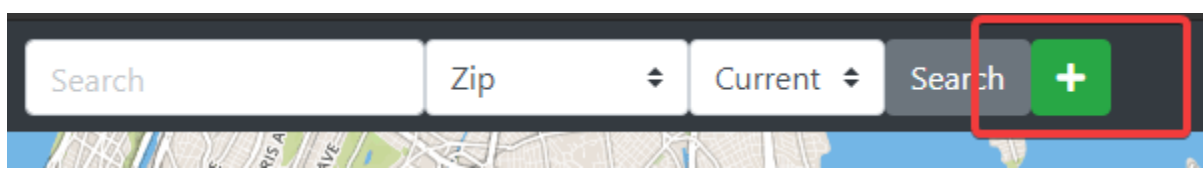


The screenshot shows a form with several input fields: Company Name (e.g. CUNY), NAICS (e.g. Manufacturing), SIC (e.g. Warehouses), Road No. (e.g. 87), Signing (e.g. I), Dist (Miles(opt)), Employees (Min and Max), County (e.g. Albany - NY), MPO (e.g. CDTC), Municipality (e.g. Hudson), and Sales Volume (dropdown). Below these fields is a 'MATCH LEVEL CODE' dropdown menu. At the bottom of the form are three buttons: 'Search' (blue), 'Search On Current Selection' (green), and 'Reset' (grey). The 'Reset' button is highlighted with a red rectangular box.

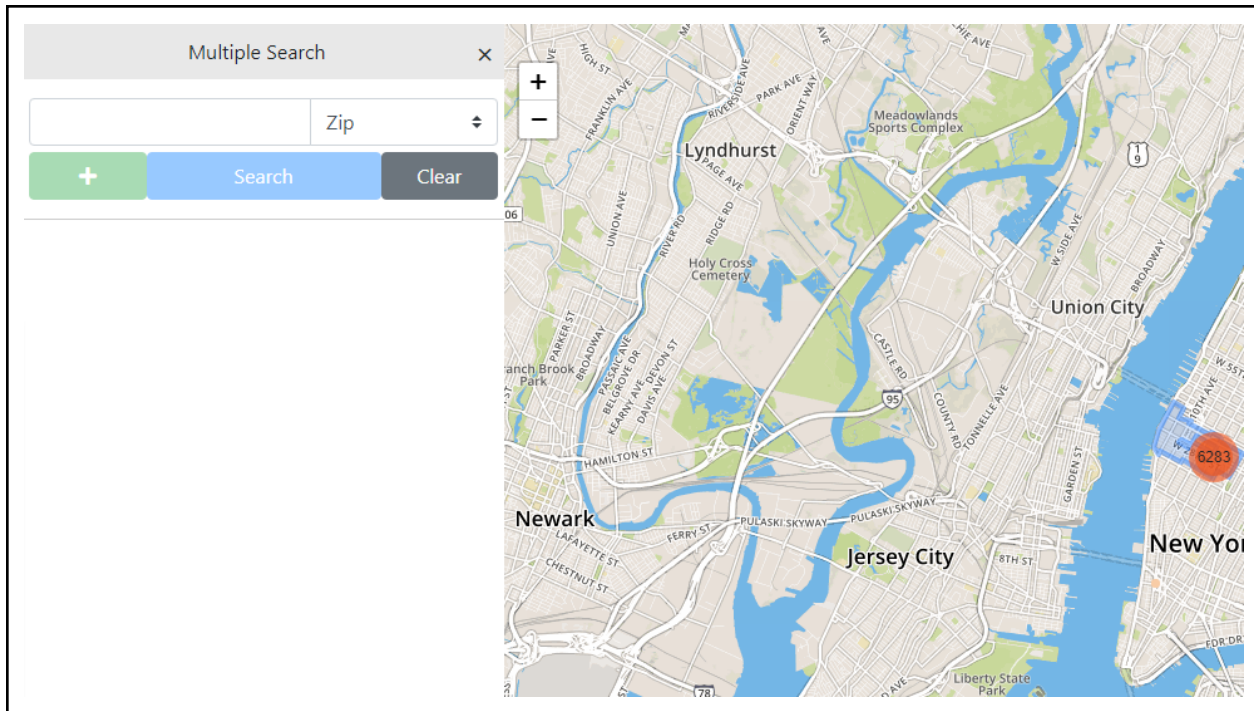
Reset the advanced query fields by clicking the reset button.

6.4 Multi-Queries

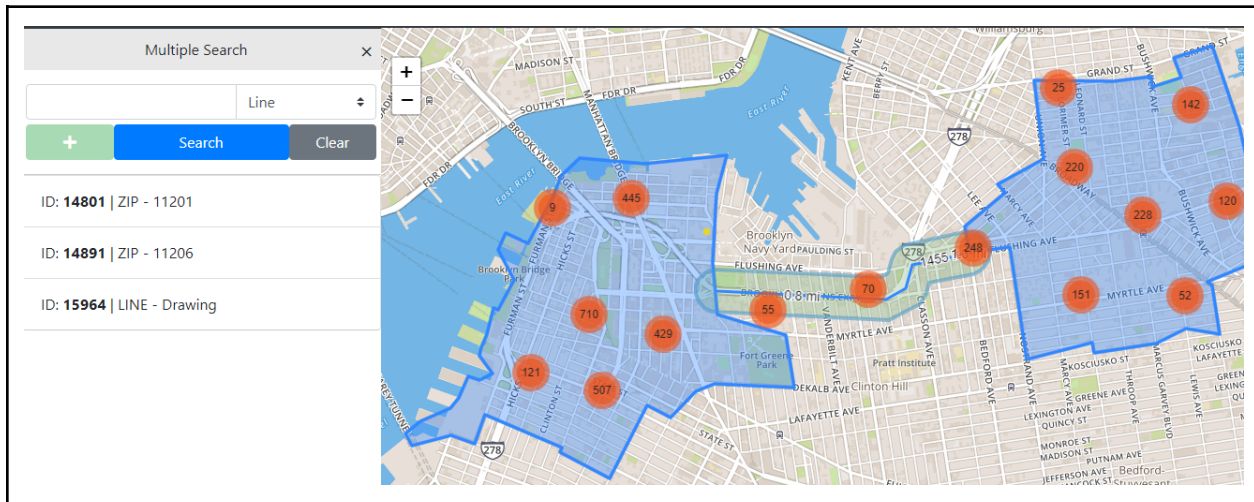
The Multi-queries feature allows users to create different Overlay layers to query businesses from. Users will have the ability to combine different base layers such as: Zip code layer, counties, road sections and user drawings together.



The screenshot shows a multi-query interface with a dark background. It features a search bar on the left, followed by a 'Zip' dropdown menu, a 'Current' dropdown menu, and another search bar. To the right of the second search bar is a green square button with a white plus sign (+). This button is highlighted with a red rectangular box.

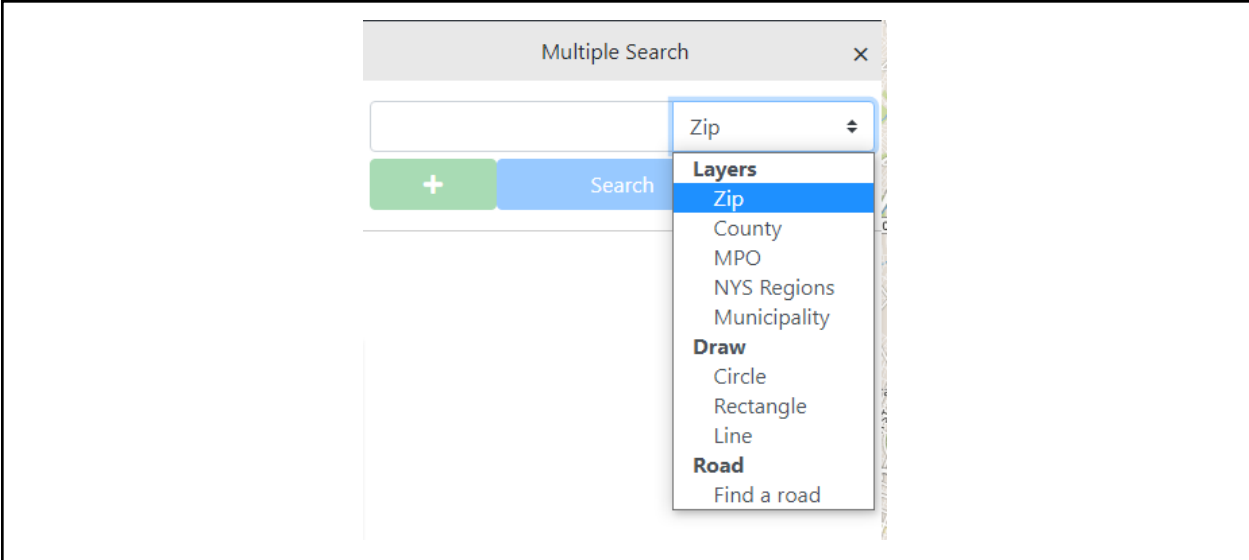


Clicking the “+” button on the navigation bar will bring out the multiple search section.

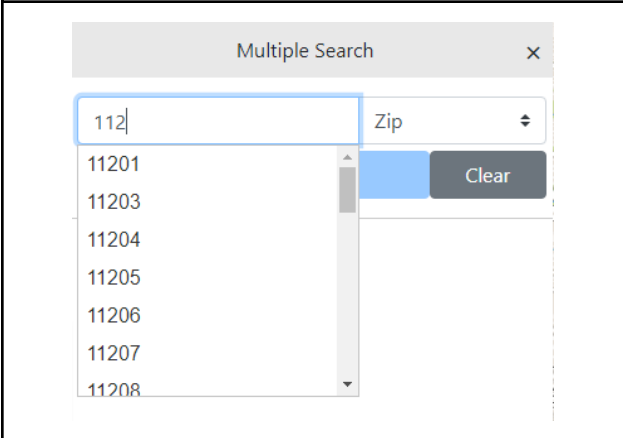


Example of a Multi-Search.

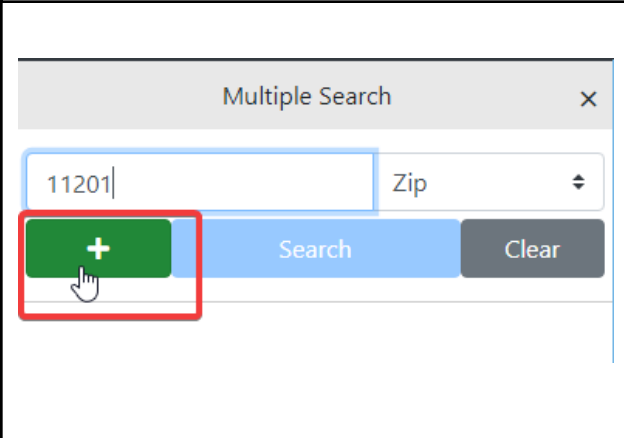
The search section of the Multi-search is similar to the basic query but with more options to add different layers.



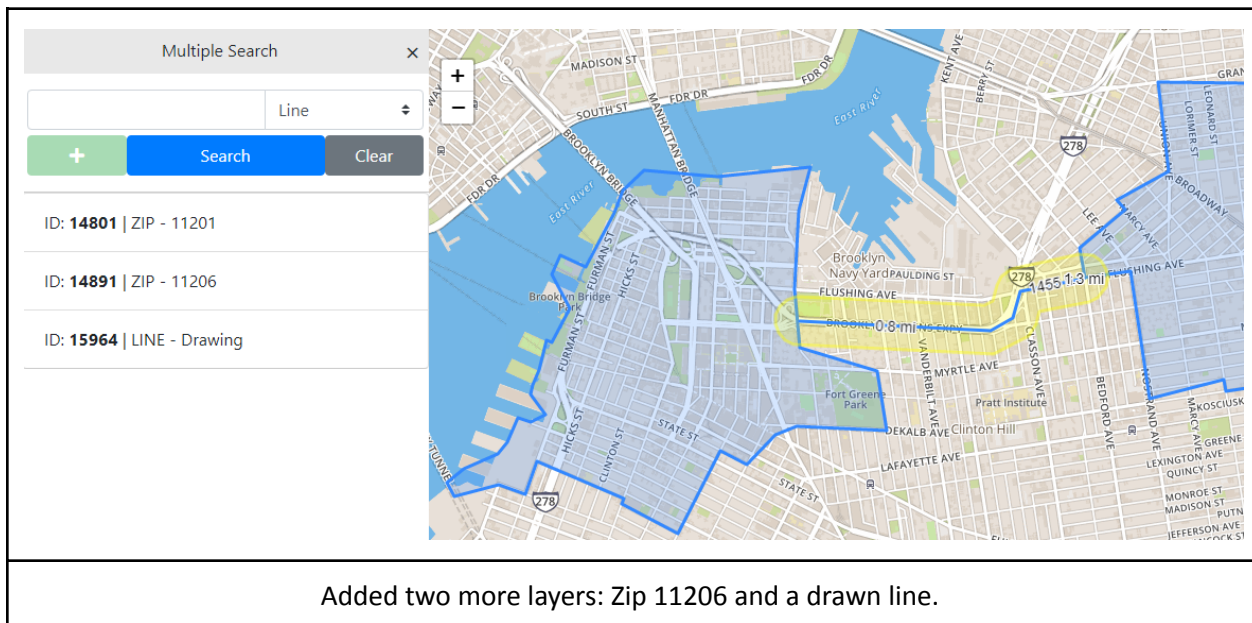
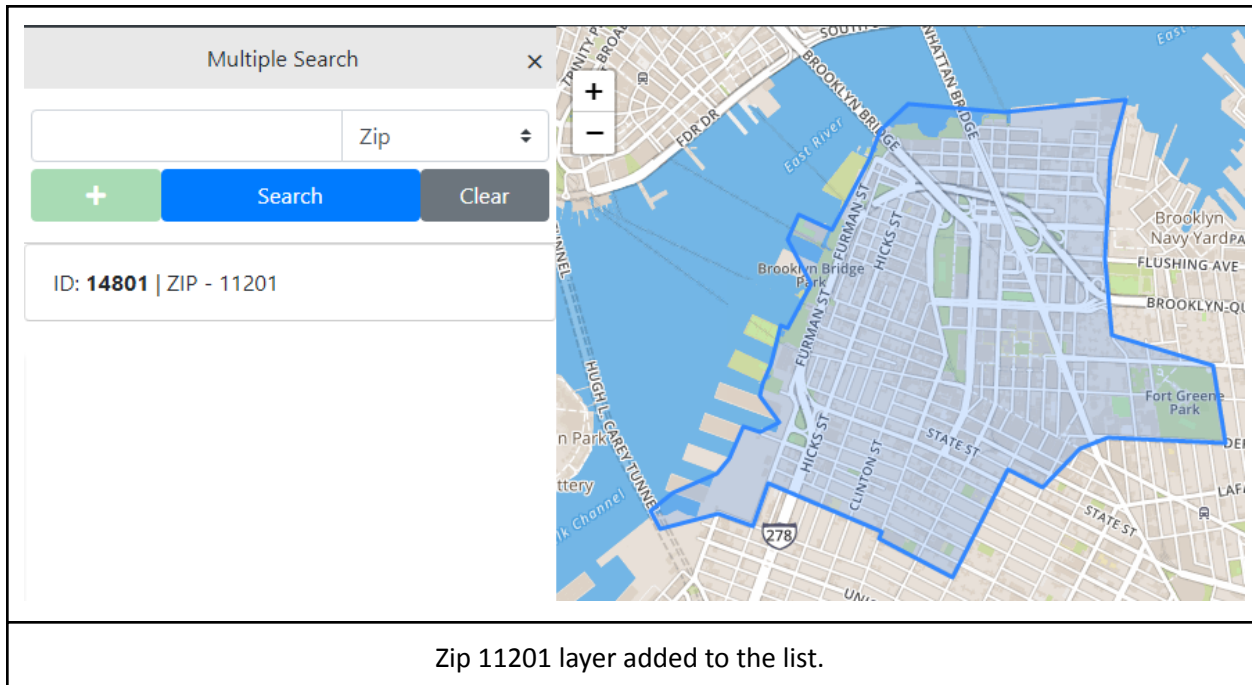
Multi-search dropdown menu.



Similar to basic query, it has an autocomplete feature.



Once an option is selected, by pressing the “+” button, it will add the layer to the list.



6.4.1 Editing layers

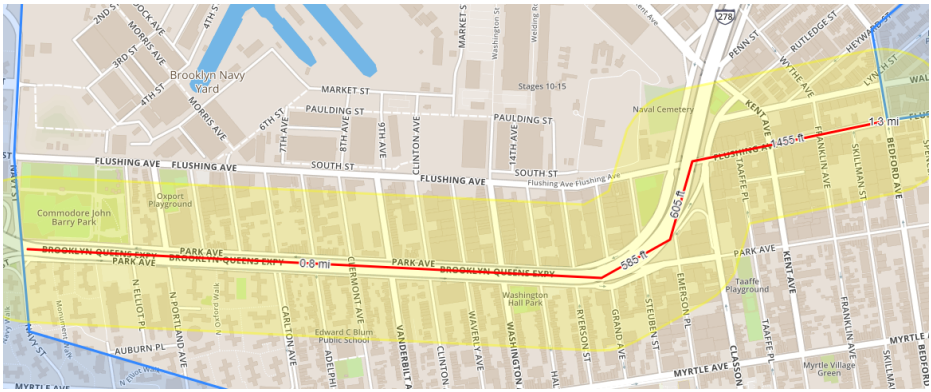
Unlike basic queries, the multi-queries feature allows users to modify specific overlay layers and its buffer.

ID: 14801 | ZIP - 11201

ID: 14891 | ZIP - 11206

ID: 15964 | LINE - Drawing

[Edit](#)



Clicking on a desired layer, will highlight the layer in red color. The yellow buffer is the distance around the line that will be queried.

ID: 14801 | ZIP - 11201

ID: 14891 | ZIP - 11206

ID: 15964 | LINE - Drawing

[Edit](#)

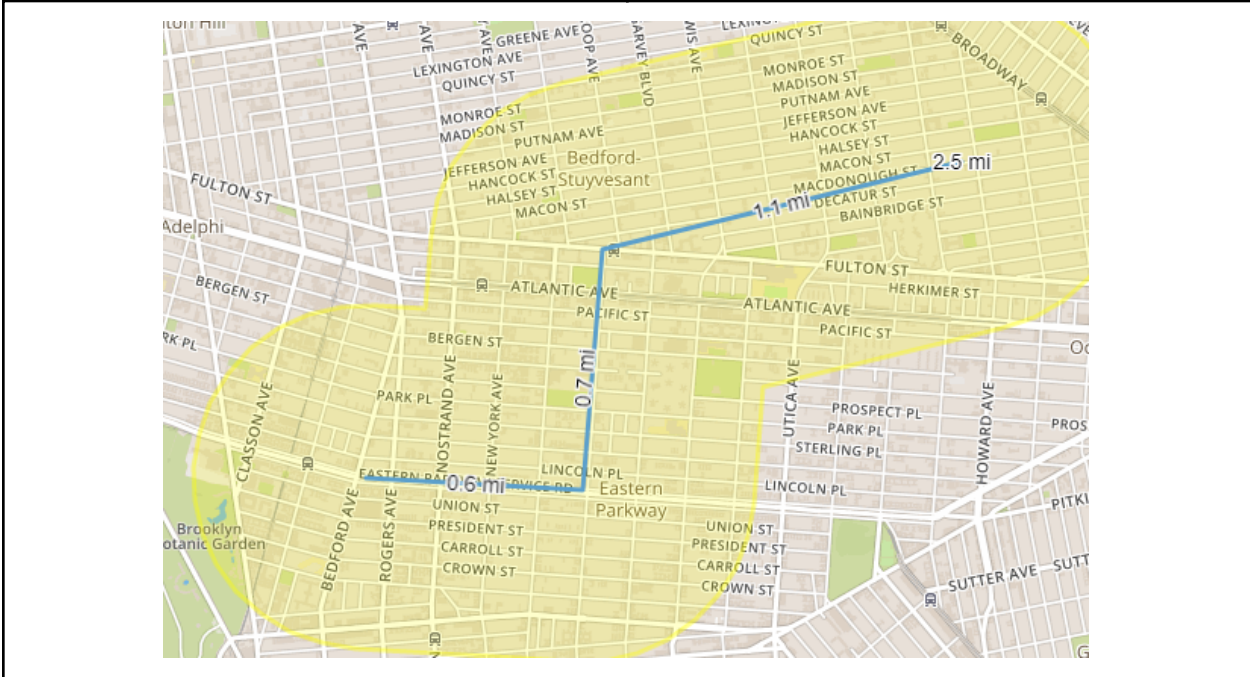
Button to edit layer.

Clicking the edit button, will trigger the functionality to change the current layer layout and also, depending on the layer type, to change the buffer distance desired.

<p>ID: 14801 ZIP - 11201</p>	
<p>ID: 14891 ZIP - 11206</p>	
<p>ID: 15964 LINE - Drawing</p> <p>Buffer <input type="text" value="0.1"/></p> <p>Edit Save Cancel</p>	

A new input box to change the buffer around the drawn line.

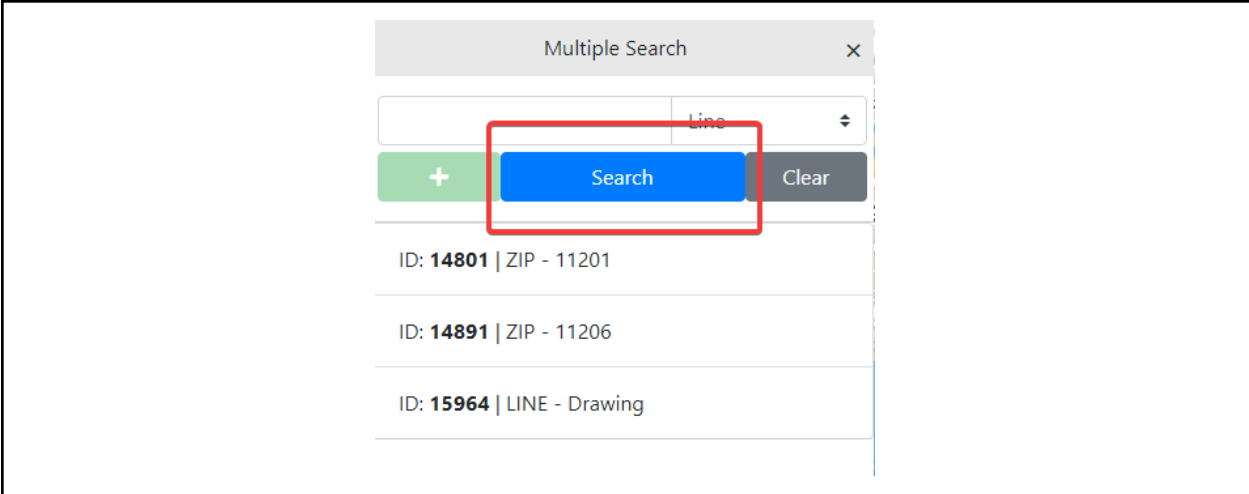
Highlighted layer. Allowing users to change the shape of the overlay layer.



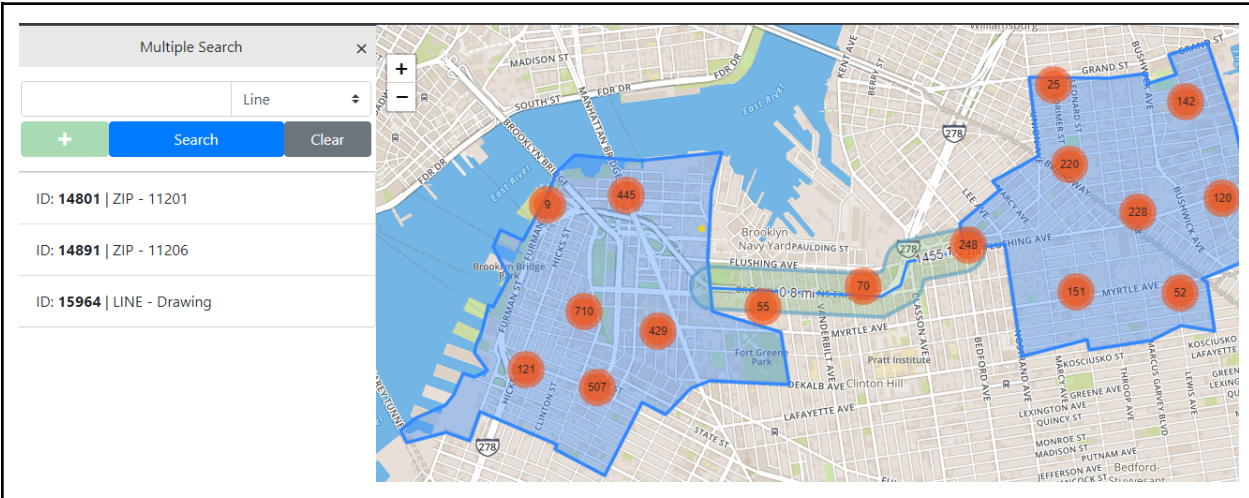
Buffers are represented around a line with a yellow background.

6.4.2 Search

Once all the desired layers are in the multi-query list, press the *Search* button to find businesses inside or around the overlay layer.



Search button.



Multi-query result.

If users wish to filter their search on their multi-search overlay, the *Advanced queries* tab allows that option with the *Search On Current Selection* feature.

Company Name e.g. CUNY

NAICS MANUFACTURING SIC e.g. Warehouses

Road No. e.g. 87 Signing e.g. I Dist Miles(opt)

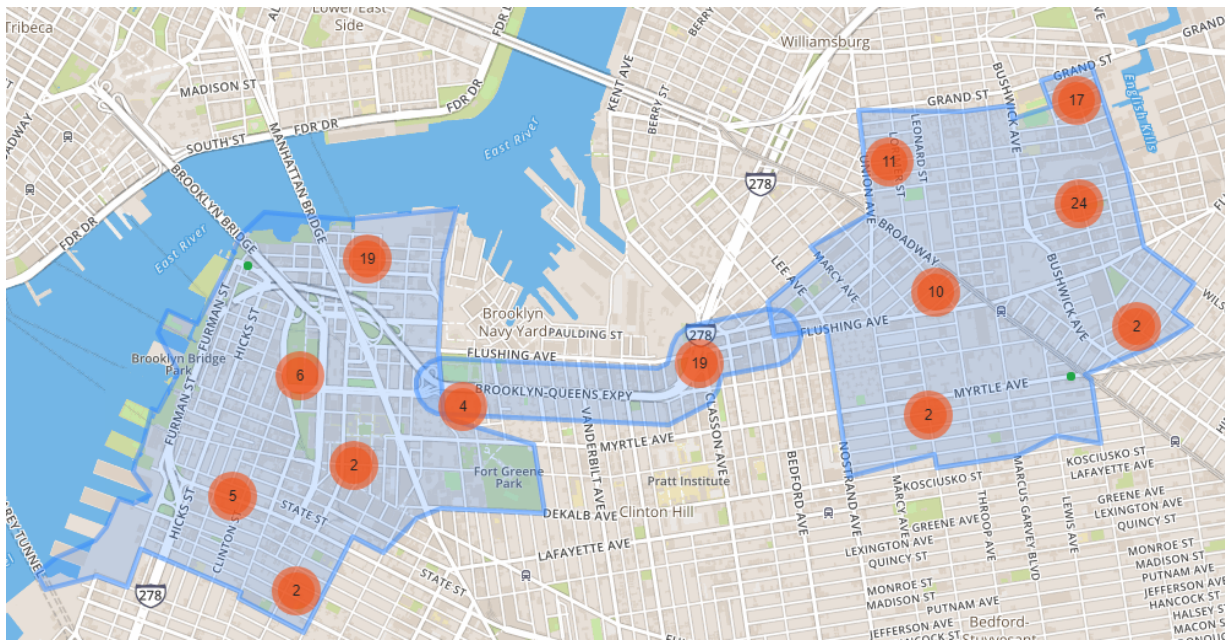
Employees Min Max

County e.g. Albany - NY MPO e.g. CDTC

Municipality e.g. Hudson Sales Volume ▾

MATCH LEVEL CODE ▾

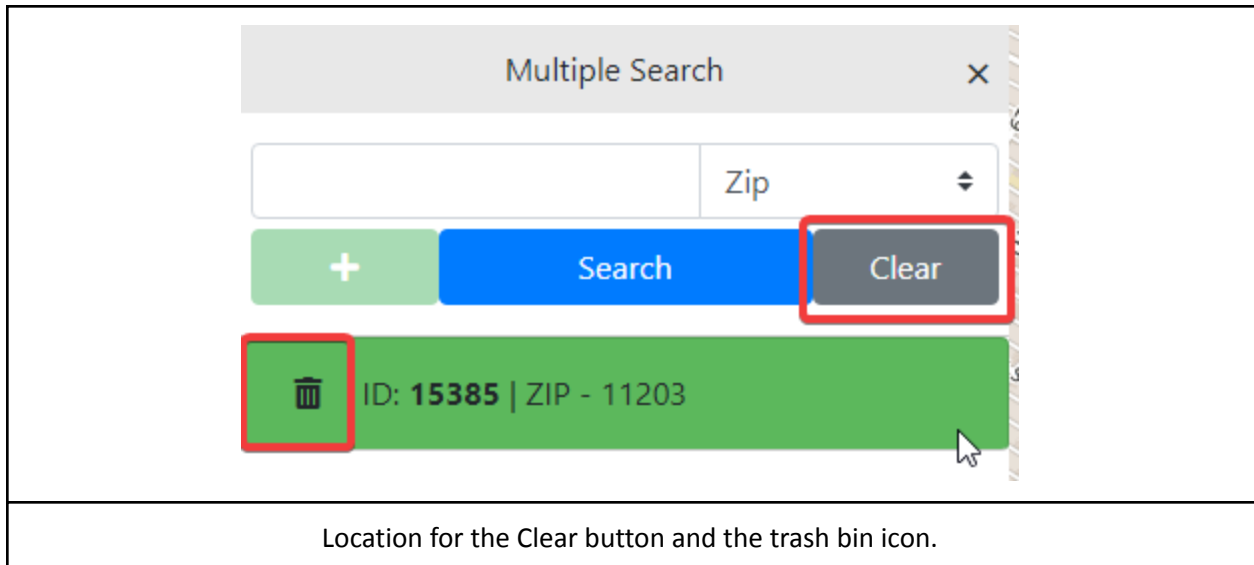
Search Search On Current Selection Reset



Result from the multi-search filtered with MANUFACTURING only businesses.

6.4.3 Clear layers

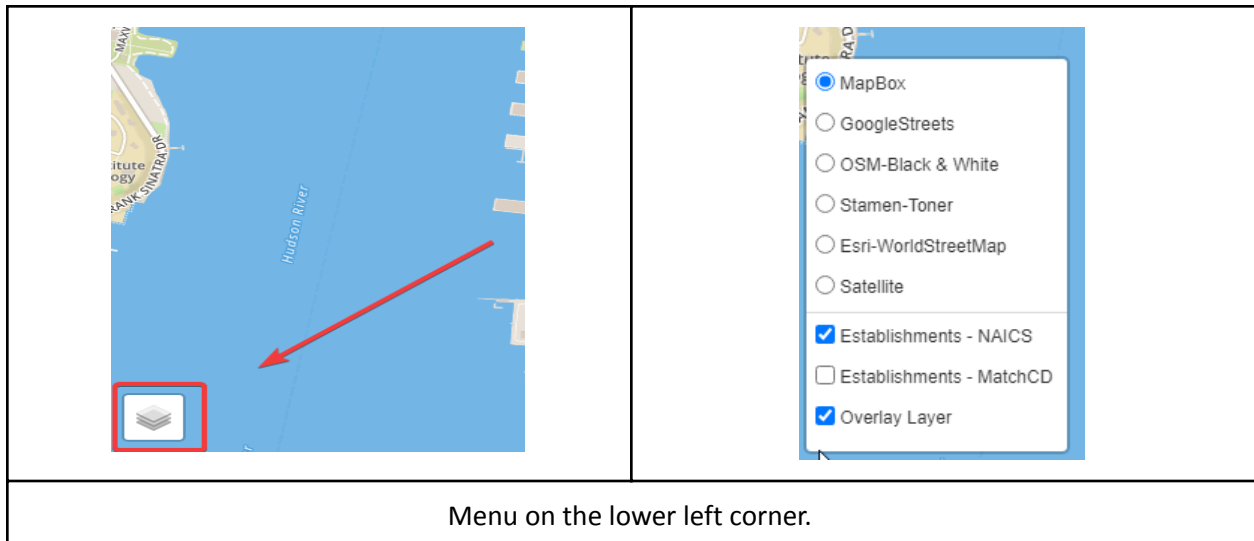
To clear undesired added layers, there is an icon in the form of a trash bin that users have access to when the mouse pointer is hovered on the layer name. There is also a clean button in the search bar to clear up every layer.



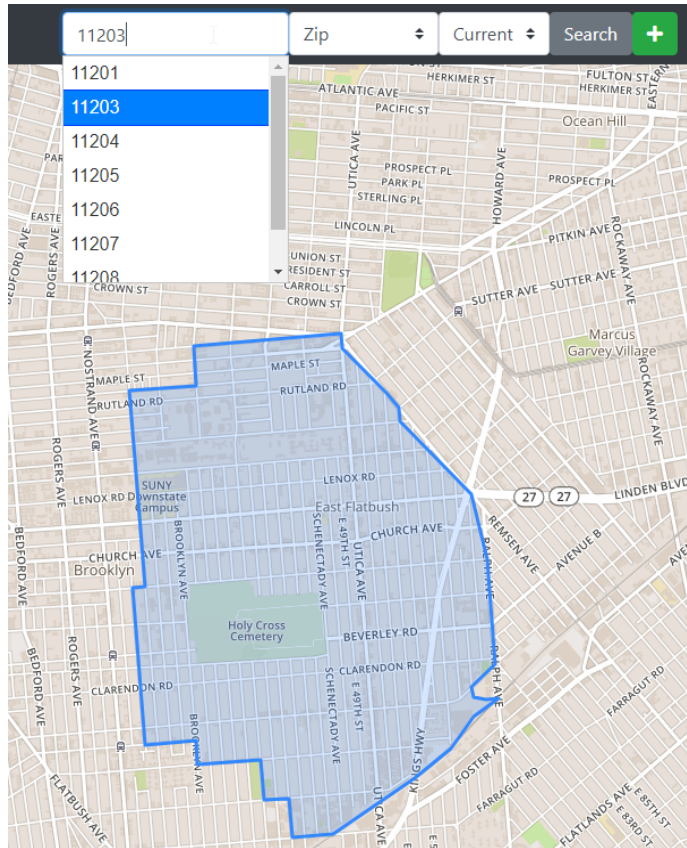
6.5 Tips

This section will mention a couple of things to keep in mind while using the application:

In the lower left section of the application, there is a menu to change to different map types and also, to turn off the different layers displayed on the map.

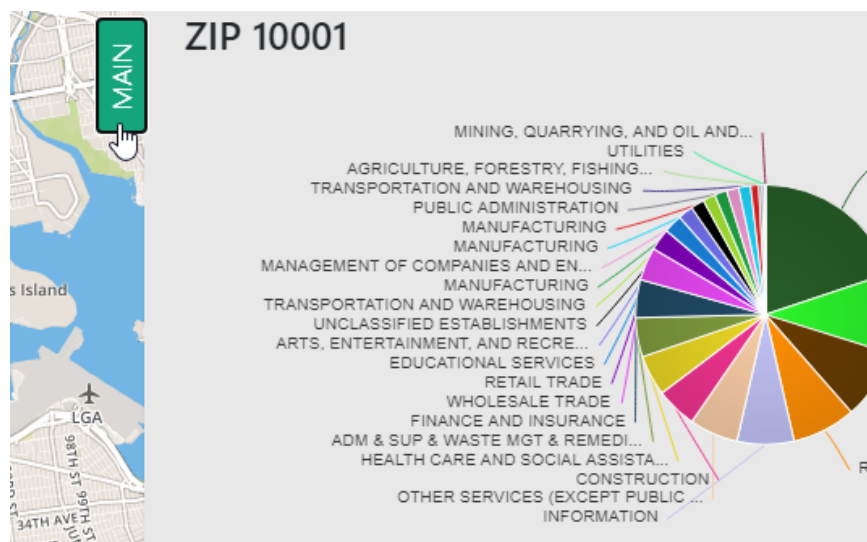


While using the basic search or multi-search autocomplete, you are able to use the down/up arrow on your keyboard to preview the layers before selecting it.



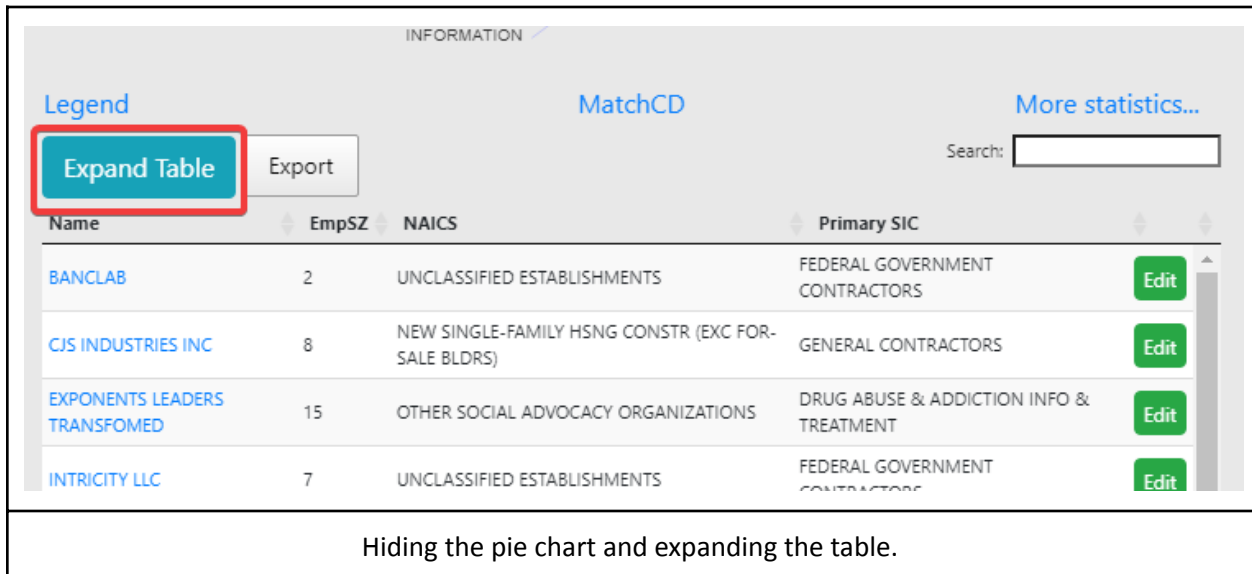
Preview of Zip code 11203 before selecting it using the down arrow on the keyboard.

The main tab can be closed to have a better look at the map.



Main tab button to close the main tab.

The Expand table button is useful if you wish to hide the pie chart.



The screenshot shows a data table interface. At the top, there is a header with 'INFORMATION' and a checkmark. Below the header, there are navigation options: 'Legend', 'MatchCD', and 'More statistics...'. A search bar is located on the right side. The main table has columns for 'Name', 'EmpSZ', 'NAICS', and 'Primary SIC'. The 'Expand Table' button is highlighted with a red box. Below the table, there is a caption: 'Hiding the pie chart and expanding the table.'

Name	EmpSZ	NAICS	Primary SIC	
BANCLAB	2	UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit
CJS INDUSTRIES INC	8	NEW SINGLE-FAMILY HSNG CONSTR (EXC FOR-SALE BLDRS)	GENERAL CONTRACTORS	Edit
EXONENTS LEADERS TRANSFOMED	15	OTHER SOCIAL ADVOCACY ORGANIZATIONS	DRUG ABUSE & ADDICTION INFO & TREATMENT	Edit
INTRICITY LLC	7	UNCLASSIFIED ESTABLISHMENTS	FEDERAL GOVERNMENT CONTRACTORS	Edit