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Introduction

Geography 328 Laboratory 2

Based on the description on the City of Victoria webpage, Victoria is known as the "cycling capital of Canada," where 11% of the city population bikes to work and 4% within this population complete all transportation within the city by bikes (City of Victoria,2012). Due to this rapid growing mode of transportation in developing sustainable cities, it is essential to understand the range of available bike facilities to residents, this can dramatically influence the biking population in the city (Abraham and Hunt,2007). With that being said, a map that presents the biking routes throughout the city and the locations of the bike racks in the city of Victoria could have a positive influence on promoting riderships. In this lab, the main goal of this project is to collect the primary and secondary data for the purpose of creating a cycling route map for the Greater Victoria Cycling Coalition. The map has to include bike routes, bike racks, and other useful features to the bikers. Also, the positional accuracy and the appropriateness of the collected data has to be analyzed and using only the most suitable data for the final product.

Data and Study Area

The study area for this lab assignment is the City of Victoria. It is located on the south end tip of the Vancouver Island and it is the capital city of the British Columbia province. The City of Victoria is part of the Capital Regional District municipal that is made up of fourteen smaller neighborhoods: Burnside, Downtown, Fairfield, Fernwood, Gonzales, Harris Green, Hillside Quadra, James Bay, North Park, Oaklands, Rockland, South Jubilee, and Victoria West (City of Victoria,2012). These fourteen neighborhoods have a total population of 83,000. However, the city is the urban core for the 360,000 citizens that lives in the surrounding municipalities at the south end tip of the Vancouver Island.

The primary and secondary data that are required for this project were both collected by the students. Primary data refers to the collected UTM coordinates of the additional features with the help of GPS. It includes the files such as "mall," "hotels," "public washrooms," and etc. As for the secondary data collection, it can be completed with the help of multiple online webpages that provides secondary data for the City of Victoria. The City of Victoria has an open data catalogue webpage, which provides the following data files: "BikeRoutesSHP," "StreetCentrelinesSHP,"

“NeighbourhoodSHP,” and “BikeRacksSHP” (City of Victoria,2012). The Statistics Canada webpage provided the other type of road network file, “Irnf000r15a_e” (Statistics Canada,2015). All of these files mentioned above are from September 2015 and are updated daily, except “NeighbourhoodSHP” that is from June 2015 and “Irnf000r15a_e” from 2015. The base map was received from ArcGIS Data Online World Imagery. It's used as a map with a higher accuracy for analyzing the positional accuracy of the road network data. The data layers are all set to the same projection “NAD1983_UTM_10N” and therefore it is appropriate to be used together for analyzing and creating the final city bike route map. The data all consist of vector files of points, lines, and polygons.

Methods

The collection of secondary data was the primary step for the creation of a bike route map for the Greater Victoria City Coalition. This process can be done by downloading the SHP files from the two webpages mentioned above, “City of Victoria” and “Statistics Canada”. The “City of Victoria” provides “BikeRoutesSHP,” “StreetCentrelinesSHP,” “NeighbourhoodSHP,” and “BikeRacksSHP” on the open data catalogue page (City of Victoria,2012). The “Statistics Canada” can download the road network file, “Irnf000r15a_e”, from the Geography section (Statistics Canada,2015). However, the road network file from Statistics Canada provided the entire road network data for all of Canada. The amount of data in this file is too large', which makes it slow to process and load for the ArcGIS program. To fix this issue, clip tool was required. The “Irnf000r15a_e” file was placed as the input layer and was clipped using the “NeighbourhoodSHP” file as the clipping layer. The new output layer was labeled as “Irnf000r15a_e_clip” and only displayed the road network data located within the municipality of Victoria.

The “BikeRoutesSHP” file downloaded from “The City of Victoria” contains attributes that classifies the bike routes into five different categories: “Bicycle network to be completed,” “Conventional bike lane,” “Signed bike route,” “Multi-use trail,” and “Buffer bike lane.” The differentiation of the different types of bike routes from the “BikeRoutesSHP” file can be done by using the “select by attributes” tool to select the target type. Once that is completed, export the data into a new bike route layer.

The Greater Victoria City Coalition required the data to be projected with the NAD 1983 Zone 10N projection. This could be done once all the data layers mentioned above were added to the map using Catalog. Separately enter each of these data layers to their properties to see its active projection and can change its projection to the required NAD 1983 Zone 10N projection. By making each data layer into the same projection, it can ensure that each layer is positioned in the

correct location with the same coordinate system. This step is essential before performing other tasks and producing the final product.

The primary data collection was completed by the student with the help of a GPS. Students were required to physically travel to sites, such as bike shops, that are beneficial and appropriate to the final map production. Once the student arrived at the sites, they can turn on the GPS to collect the UTM coordinates of these beneficial features. After gathering ten to twelve additional features' UTM coordinates, they are required to be entered into Excel files, each with the layout of: waypoint, X, Y, and attribute. The X, Y data from each of the Excel files were added to ArcGIS as shape files, which shows the location of these additional features that would be appropriate to the map.

Due to the laboratory instructions it is required to have two sets of road networks data from different sources, the “Irnf000r15a_e_clip” and the “StreetCentrelinesSHP.” However, two road networks are unnecessary for the projection of one map. It is essential to determine which road network data layer was the most appropriate and accurate to the real world projection. The base map data layer downloaded from the ArcGIS Data Online World Imagery was used as a map of higher accuracy to determine which of the two road network data has a higher positional accuracy in relation to the base map. This can be done through the process of visual analysis. Once the most ideal and suitable set of data layers were determined, the touch up process of the colors and symbols were adjusted to present the most helpful bike route map for the Greater Victoria City Coalition.

Results

Table 1. Excel file for bike pumps

waypoint	x	y	attributes
1	472866.86	5365030.4	Petro- Canada
2	472734.23	5365163.98	Co- Op
3	473482.19	5364418.02	Quadra Mohak

Table 2. Excel file for bike shops

waypoint	x	y	attributes
1	473480.05	5364136.24	North Park Bicycle
2	472947.26	5363914.12	Broad Street Cycles
3	473673.6	5363425.05	Fort Street Cycle
4	472823.49	5363929.72	MEC

Table 3. Excel file for bus stations

waypoint	x	y	Bus number
1	473079.43	5363830.12	1,2,24,25,27,28

2	473020.28	5363790.27	11,14,21,22
3	473023.05	5363828.61	15,24,25
4	472832.27	5363846.53	15,24,25
5	472823.48	5363834.57	4,30,31,32,47,48,50...

Table 4. Excel file for coffee shops

waypoint	x	y	attributes
1	473249.78	5363731.94	Habit Coffee
2	472976.72	5363484.13	Blenz Coffee
3	472993.46	5363486.83	La Fiesta Cafe
4	473400.2	5363656.87	Starbucks
5	472835.92	5363789.71	Starbucks 2
6	473228.69	5363870.87	Tim Hortons

Table 5. Excel file for mall

waypoint	x	y	attribute
1	472897.25	5363589.89	The Bay Center

Table 6. Excel file for hospital

waypoint	x	y	attribute
1	475691.73	5364249.15	Royal Jubilee Hospital

Table 7. Excel file for food

waypoint	x	y	attribute	type
1	472989.35	5363587.78	Cactus Club Cafe	Mexican
2	472652.95	5363618.63	The Keg	Steak house
3	472619.64	5363783.75	The Joint Pizza	Pizza
4	472814.64	5363655.76	Earls Kitchen+ Bar	Menu
5	472909.91	5363081.07	Old Spaghetti Factory	Italian
6	473059.8	5363467.07	The Japanese Village	Japanese

Table 8. Excel file for hotels

waypoint	x	y	attribute
1	472438.6	5363125.91	Hotel Grand Pacific
2	472325.29	5363165.26	Best Wester Plus Inner Harbour
3	472239.73	5363205.25	Huntingdon Manor
4	472855.91	5363238.61	Fairmont Empress
5	473020.99	5363224.37	Victoria Marriott Inner Harbour
6	473208.25	5363881.98	Ocean Island Blackpackers Suites

Table 9. Excel file for public washroom

waypoint	x	y	attribute
1	472753.83	5363720.19	Lanley street loo
2	473012.36	5362251.02	Beacon Hill Park

Table 10. Excel file for sites of interests

waypoint	x	y	attribute
1	472617.49	5363016.67	British Columbia Legislature
2	472823.1	5363015.68	Royal BC Museum
3	473053.76	5363442.64	Greater Victoria Public Library

Figure 1. City of Victoria Bicycle Route Map (the following page)

Discussion

The base map provided by the ArcGIS Data Online World Imagery as a "map of higher accuracy" to compare which of the road network data, "StreetCentrelinesSHP" and "Irnf000r15a_e_clip", would be the best representation for this project. One of the largest weaknesses for the base map imagery is that it did not provide any metadata or attribute information. Therefore, the date of the base map imagery was unavailable, this is a crucial weakness because this map was used as a higher accuracy to compare the road datas. Without the date, it is unknown about how up to date and accurate the base map imagery is.

The "StreetCentrelinesSHP" and "Irnf000r15a_e_clip" data files were both projected on the base map to determine which file presented a more accurate road network by visual examination. From a visual point of view, the "Irnf000r15a_e_clip" appears to be off the true positions on the base map imagery by a few degrees. Many of the roads presented from the "Irnf000r15a_e_clip" are overlapping cross walks or buildings in the base map. On the other hand, the "StreetCentrelinesSHP" presented a more positional accurate road network data because from a visual examination, it appeared that the roads were correctly in place on the base map. The "StreetCentrelinesSHP" also had a more completed city road networks data, due to the fact that it presented more roads than the "Irnf000r15a_e_clip". With that being said, "StreetCentrelinesSHP" also has a better currency flow and connectivity. In conclusion, the "StreetCentrelineSHP" file was the best for this project.

Students were required to choose ten additional features that would be beneficial to bikers and the following are my choices: bike pumps, bike shops, bus stations, coffee shops, mall, hospital, food, hotels, public washrooms, and sites of interest. The locations of bike pumps and bike shops are two essential informations for the bikers due to repairing and refueling. If bikers decided to travel far distances or are tired, buses at bus stations would be an ideal backup plan and these bus station legends provided the available bus number in its attribute. The locations of coffee shops and food would be helpful to hungry bikers that are looking for quick bike or a decent meal. Additional features of mall and sites of interest provided entertainment location around the Downtown area. Public washrooms could also be an adequate information to the bikers, when you got to go you have to go. The location of the hotels could be helpful to travel bikers, but also could be inadequate

information to the Victoria citizens' bikers. Lastly, the Royal Jubilee Hospital is located on the east side of the city and along the bike routes, it is important feature because of the potential of injury from biking.

All of these additional features are located in the Downtown and James Bay areas along the biking routes, except the Beacon Hill Park Washroom. This additional feature is located far away from bike routes and is inadequate to the rest of the maps. The additional features that are located close to the bike routes are the most adequate and helpful informations to the bikers.

Conclusion

By comparing the two road networks data to the base map using visual examination and other analysis methods, a conclusion that “StreetCentrelinesSHP” provided a better presentation for the purpose of this laboratory can be drawn. Using the Primary data of additional features collected by GPS and the Secondary data collected from the websites, a final product of the City of Victoria Bicycle Route Map for the Greater Victoria City Coalition is made. 'It is essential that the information included in this map is beneficial to the bikers/cyclists. One of the limitations to the study is the lack of metadata provided by the Secondary data and base map. The lack of information can affect the accuracy of the provided data.

References

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