Using GIS to analyze the transit service in Fredericton

Hung Cao

Introduction

Fredericton Transit did a survey* about their service. Summary of key points and findings:

- 2,312 completed surveys; approximately 50% non-riders

- 57% of users are satisfied or extremely satisfied with Fredericton Transit service quality

- 60% of users are in favor of Sunday service

- 76% of non-users are either likely or very likely to use transit services if there were more transit routes or greater bus frequency.

The aim of this project is to use GIS to analyze the data and producing some insights for the purpose of improving the public transit services in Fredericton

* http://www.fredericton.ca/en/news/city-hall/transit-strategic-plan-update-and-survey-results-released

Datasets

- Fredericton's Building footprints [data] [Metadata]
- Street Centerline Segments represent each street in the City of Fredericton [data] [Metadata]
- Fredericton Demographics [data] [Metadata]
- All bus routes of Fredericton City [data] [Metadata]:
    - Route 10 [data]
    - Route 11 [data]
    - Route 12 [data]
    - Route 13 [data]
    - Route 14 [data]
    - Route 15 [data]
    - Route 16 [data]
    - Route 17 [data]
    - Route 18 [data]
    - Route 20 [data]
    - Route 116 [data]
    - Route 216 [data]
- All bus stops in the Fredericton Transit network [data] [Metadata]
- Fredericton Traffic Signals [data] [Metadata]
- Fredericton Traffic Accidents [data] [Metadata]

Challenges

- A huge amount of workload
- Solve the problem independently when I faced a technical issue
- Finish this project in a short time (5 weeks)
- Process data from many different sources
- My background is Computer Science
- Apply GIS knowledge and technology into a practical and highly applicable project
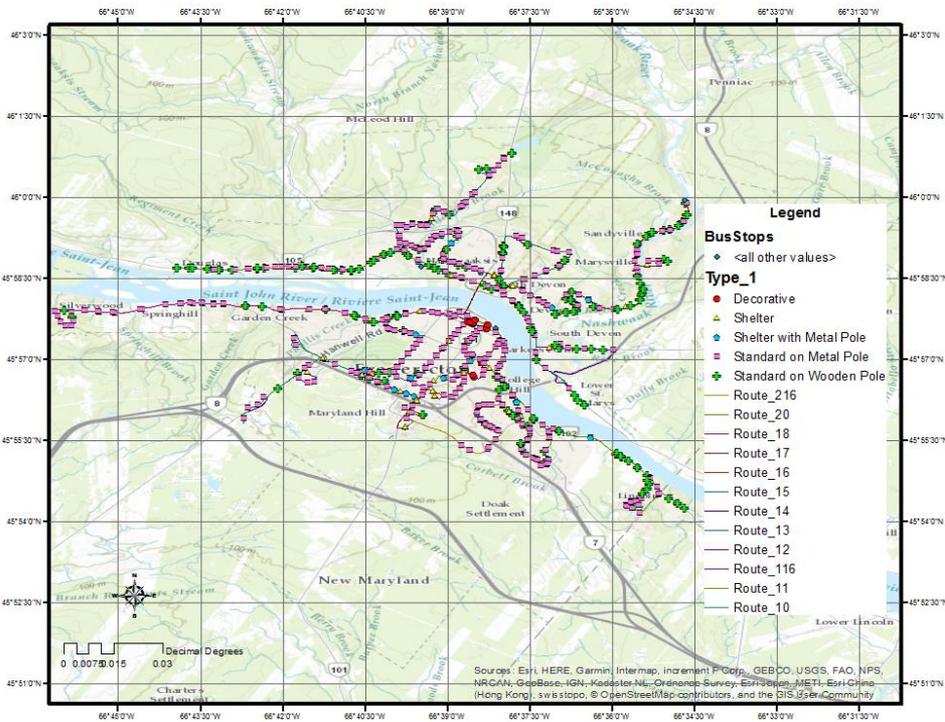
Analysis performed
Data Processing

- Task 1: Prepare and processing the bus stop data provided by the City of Fredericton.
- Task 2: Prepare and processing the bus route, street centre line data as well as and building footprint data collected from Fredericton Transit and the City of Fredericton
- Task 3: Dealing with the demographics data of the City of Fredericton
- Task 4: Prepare the data of traffic signal of the City of Fredericton
- Task 5: Prepare and processing the traffic accident in Fredericton from 2007 - 2018
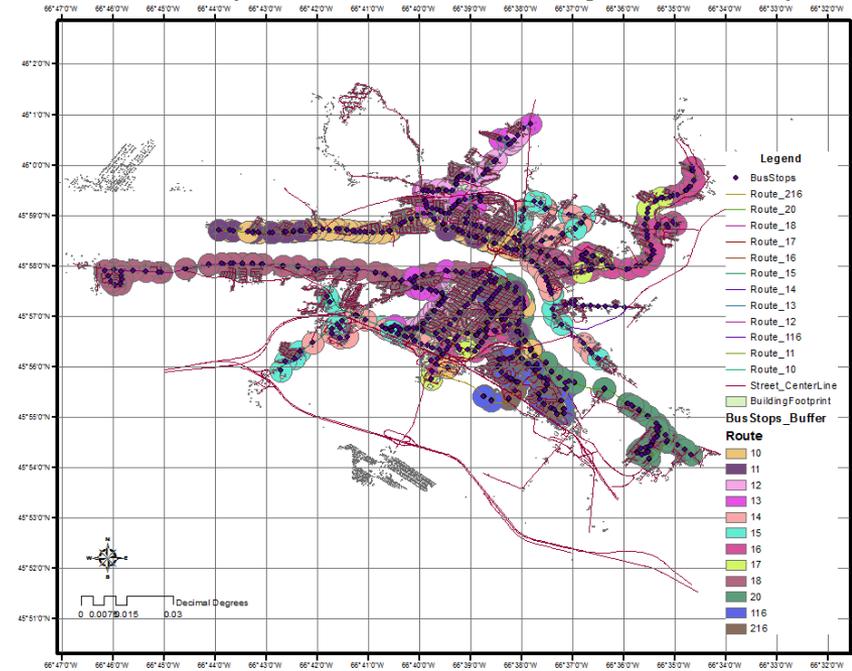
Analysis performed
Data Processing

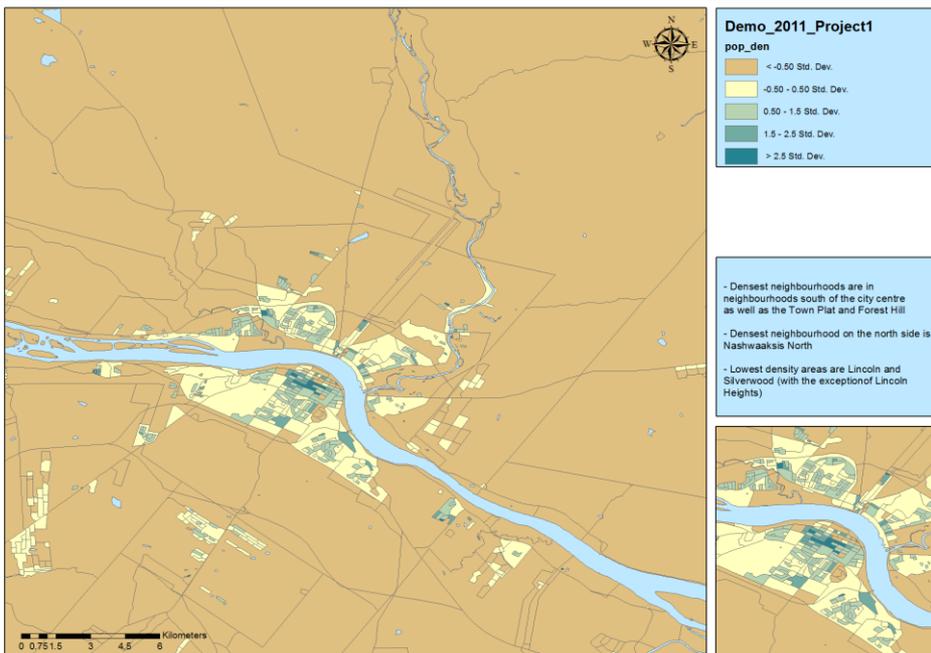Bus stops in Fredericton classfied by different types

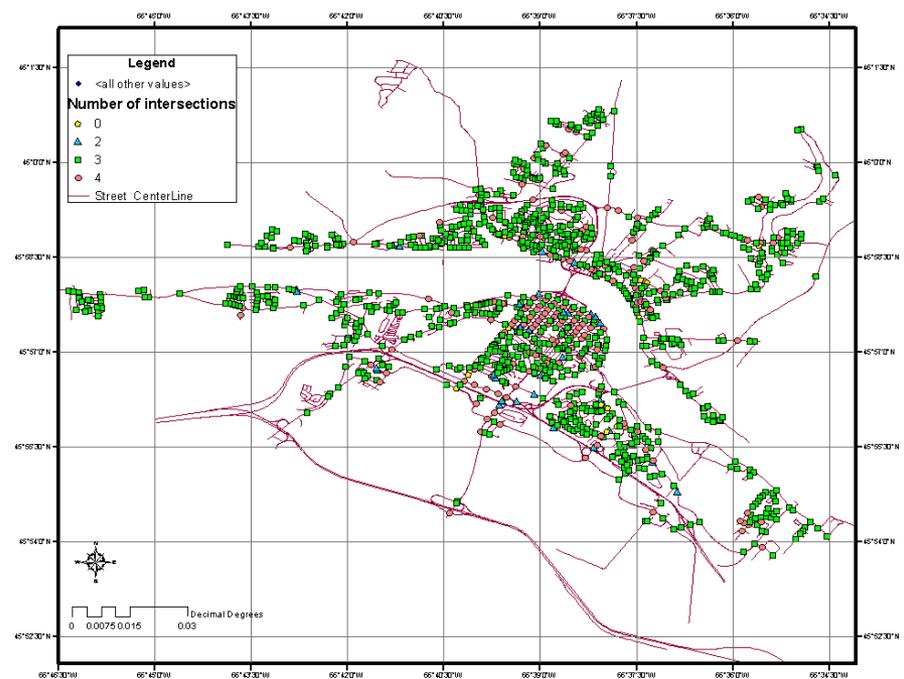Bus Stops 400 meters coverage buffer map

Analysis performed
Data Processing

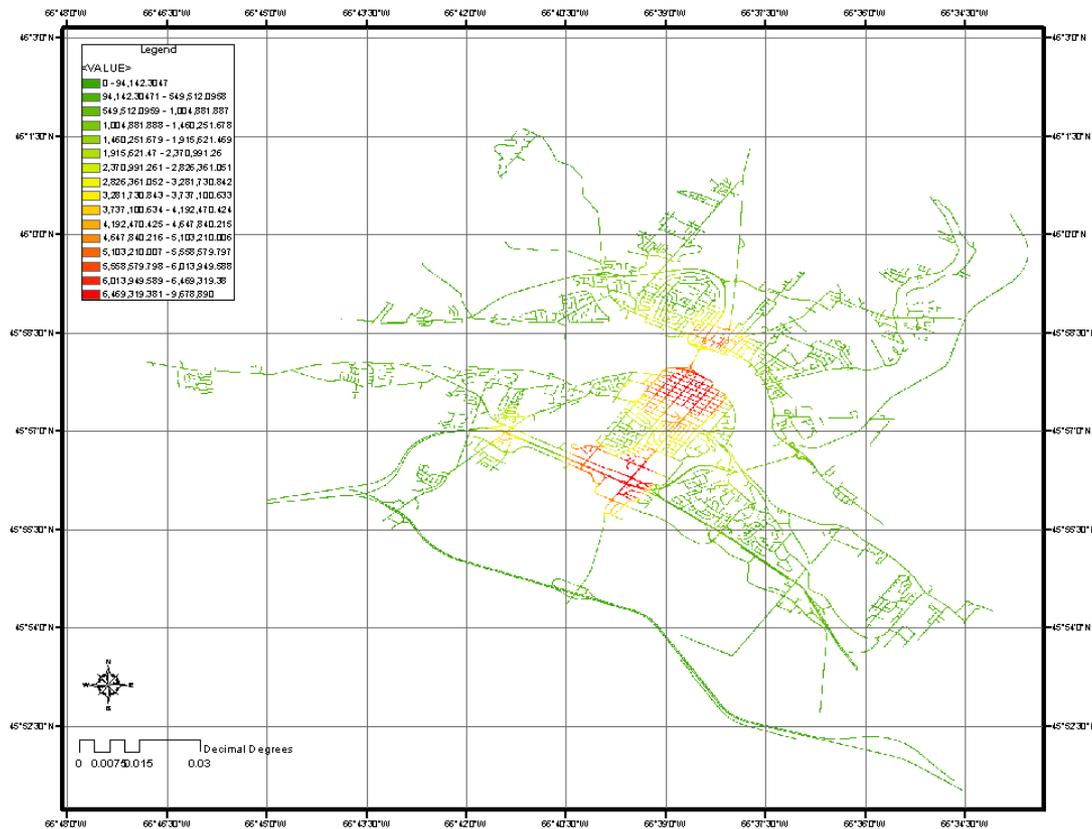Population Density of Fredericton

Fredericton's traffic signal classified by the number of intersections

Analysis performed
Data Processing

Fredericton's traffic accident heatmap

Analysis performed
Data Analysis

- Analytical task 1: Exploring the bus service provided by Fredericton Transit.

- Analytical task 2: How accessibility can the bus service provide to passengers?

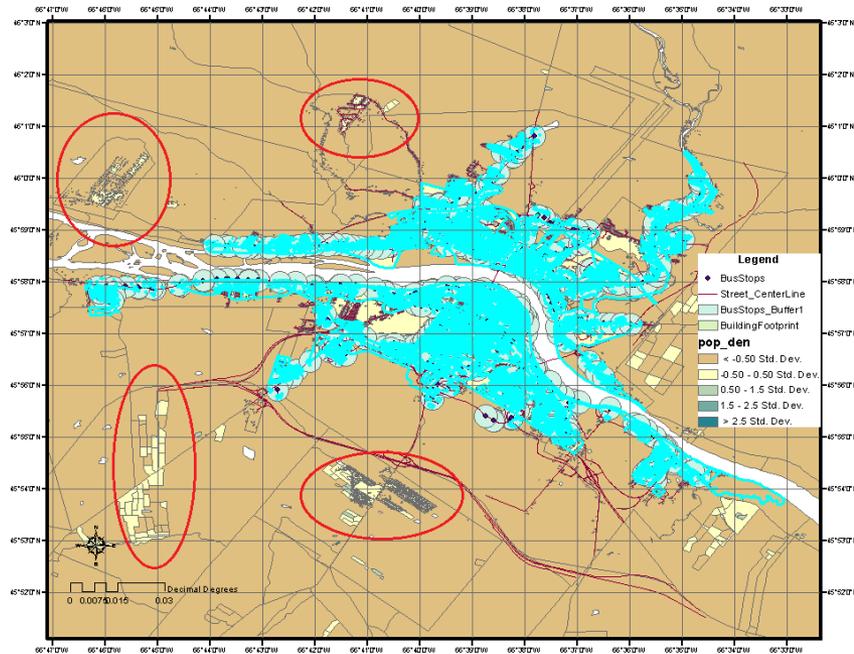- Analytical task 3: Can we manipulate the data to provide the safety for the Fredericton Transit service?

Analysis performed

- Analytical task 1: Exploring the bus service provided by Fredericton Transit.
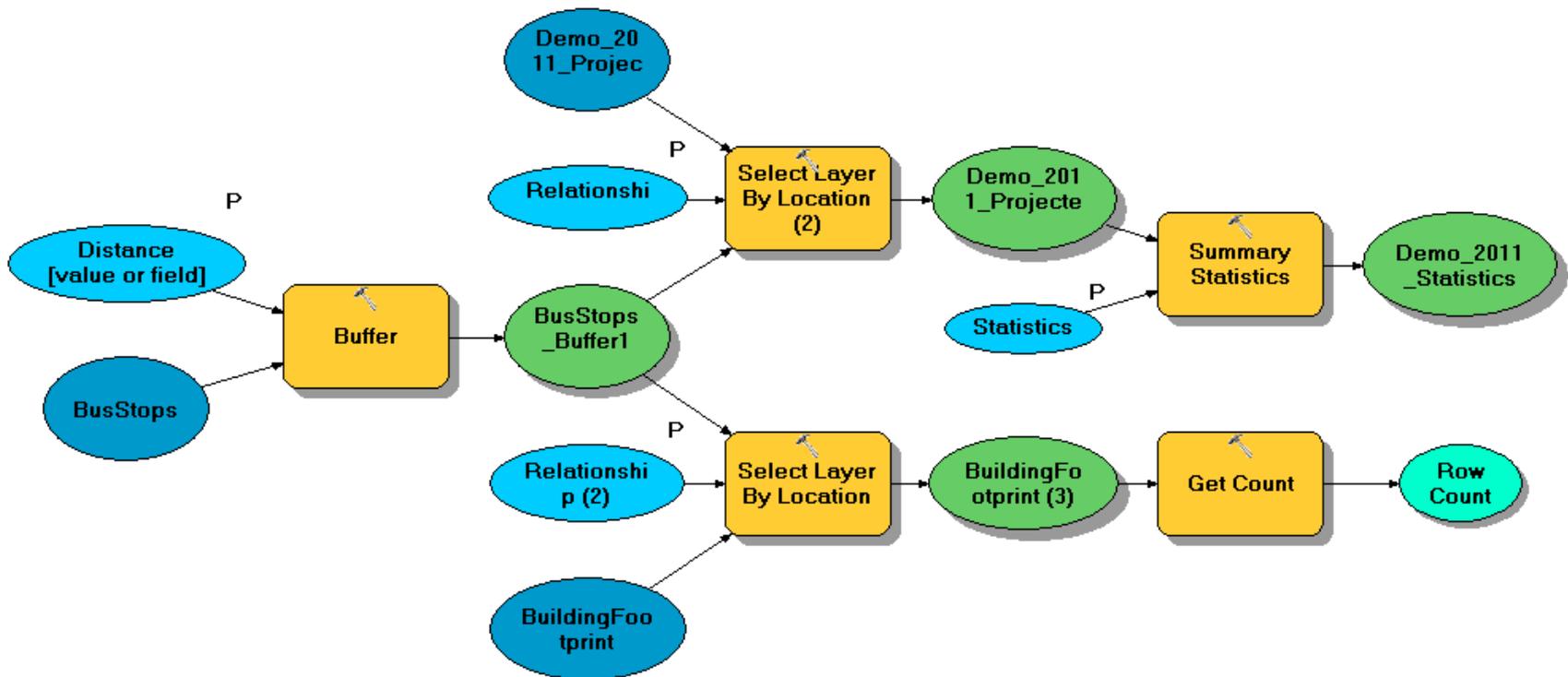
Analysis performed

The coverage map of bus service provided by Fredericton Transit

|	Total Population	Male	Female	Male less than 16	Male from 16 to 65	Male over 65	Female less than 16	Female from 16 to 65	Female over 65	School Enrollment
Fredericton's Population	96592	47131	49491	8318	33883	4930	8168	35007	6316	15515
Transit service beneficiaries	43938	20956	23029	3374	15063	2519	3311	16204	3514	6332
The ratio	45.49%	44.46%	46.53%	40.56%	44.46%	51.10%	40.54%	46.29%	55.64%	40.81%

Analysis performed

- Analytical task 2: How accessibility can the bus service provide to passengers?

All bus stops with in 50 meter distance from the (3 and 4-way) traffic signals
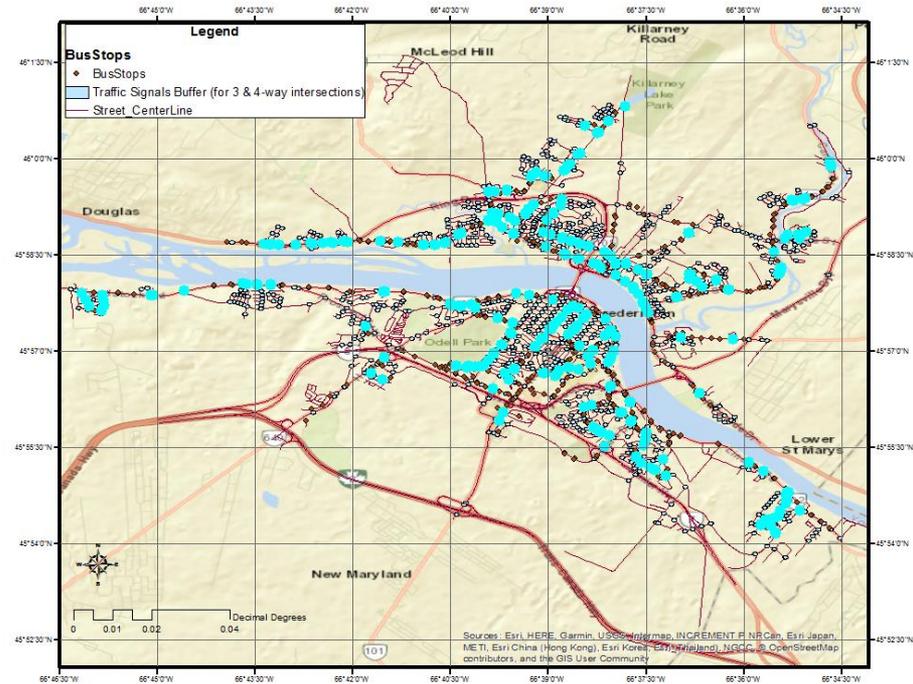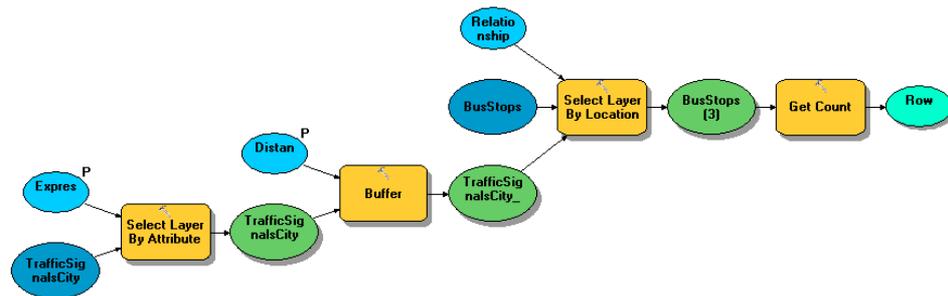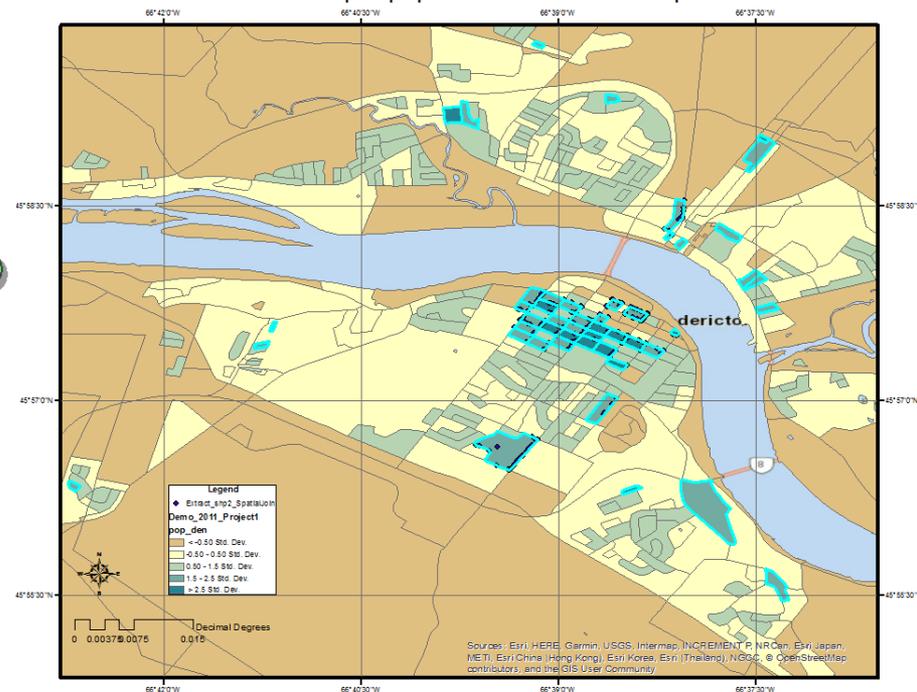
Analysis performed

- Analytical task 3: Can we manipulate the data to provide the safety for the Fredericton Transit service?
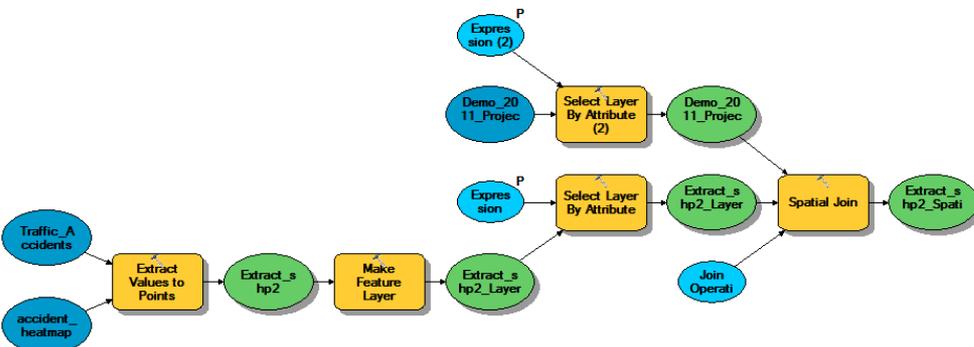
Dangerous warning area extracted by the accident heat map & population distribution map

ESRI technology used

- ArcGIS Desktop
- ArsGIS Online
- ArcGIS Apps
- Model Builder
- Spatial Analyst Tool
- Geostatistical Tool
- Geoprocessing Tool
- Conversion Tool
- ArcGIS geodatabase

Conclusion

- Improving facility at bus stations since only a few stations equipped by Shelter and Decorative while most of the bus stations are Standard on Wooden Pole and distributing in suburb areas.

- Providing service to the remote area, since the analysis results show that the remote area in the north-west and south-west area of the Fredericton City is not covered by any transit service.

- Bus services provided by Fredericton Transit only covered nearly a half of the population. Therefore, some necessary actions need to be taken to improve this ratio.

- According to our analysis, the accessibility rate of the transit services is about 40%. Therefore, increasing the accessibility rate is needed.

- To provide the safety for the Fredericton Transit service, driver should be warned about the areas with high probability of accidents, especially Downtown area and Uptown along the Prospect St area.

Demo

- We build a web application to illustrate all analytical tasks, results, findings and maps of this project. The link of the web can be found here:

http://gaia.gge.unb.ca/gge3423/online/14/

- Besides that, we also disseminate some of our results to the ArcGIS Online. Some of our example can be seen below:

https://arcg.is/S5KWj

- ArcGIS online map showing the population of Fredericton:

https://arcg.is/1Oi9r5