



Using Google[®] Applications to Develop Traffic Data Visualization Tools

Giuseppe Grande, B.Sc., EIT.

Auja Ominski, B.Sc., EIT.

Jonathan Regehr, Ph.D., P.Eng.

Outline

- Introduction
 - Google Earth Data Visualization Tool
 - Purpose
 - Development
 - Functions
 - Advantages & Disadvantages
 - Google Maps JavaScript API Visualization Tool
 - Purpose
 - Development
 - Functions
 - Advantages & Disadvantages
 - Summary and concluding remarks
-



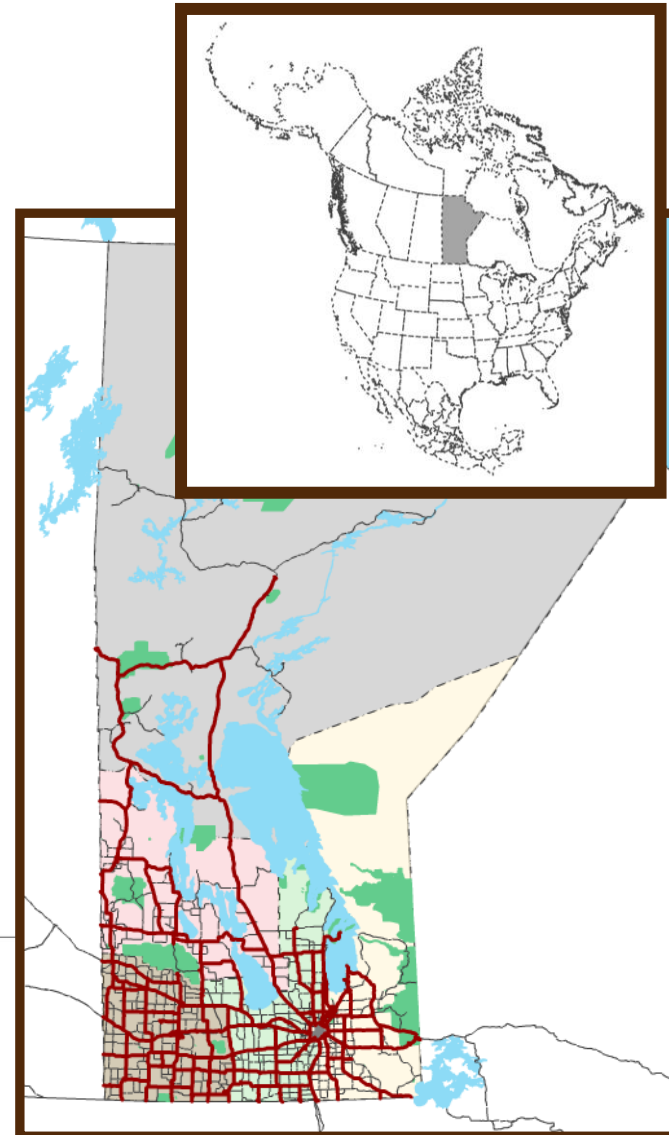
Introduction

- How people want to view and interact with data is changing
- Customers have new priorities:
 - Ease of use
 - Mobility
 - Customization capabilities
 - Real-time or near real-time access
- New tools can help us satisfy these needs



Introduction: MHTIS

- Traffic Flow Map
 - Annually produced tool
 - Describes traffic flow on Manitoba highways
 - Web-based access
 - Some user-interface capabilities including
 - Pre-defined queries
 - Data download
 - Layer visibility control



ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER
VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY
TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER

Google Earth Data Visualization Tool



UNIVERSITY
OF MANITOBA

Purpose



Manitoba
Infrastructure and Transportation

TRANSPORTATION SUPPLY

National Highway System Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

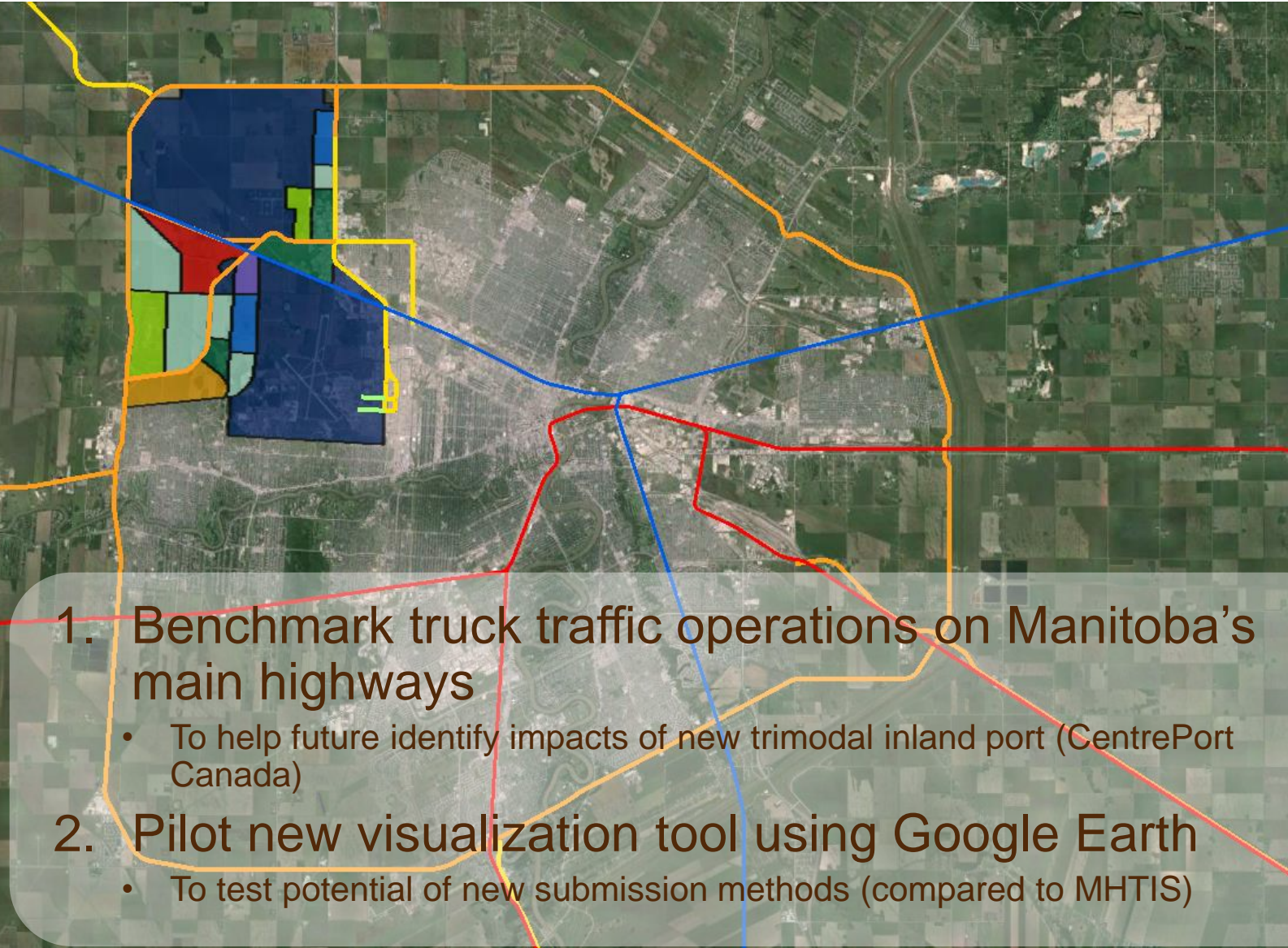
FLOW SYSTEM

Counting Stations

- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

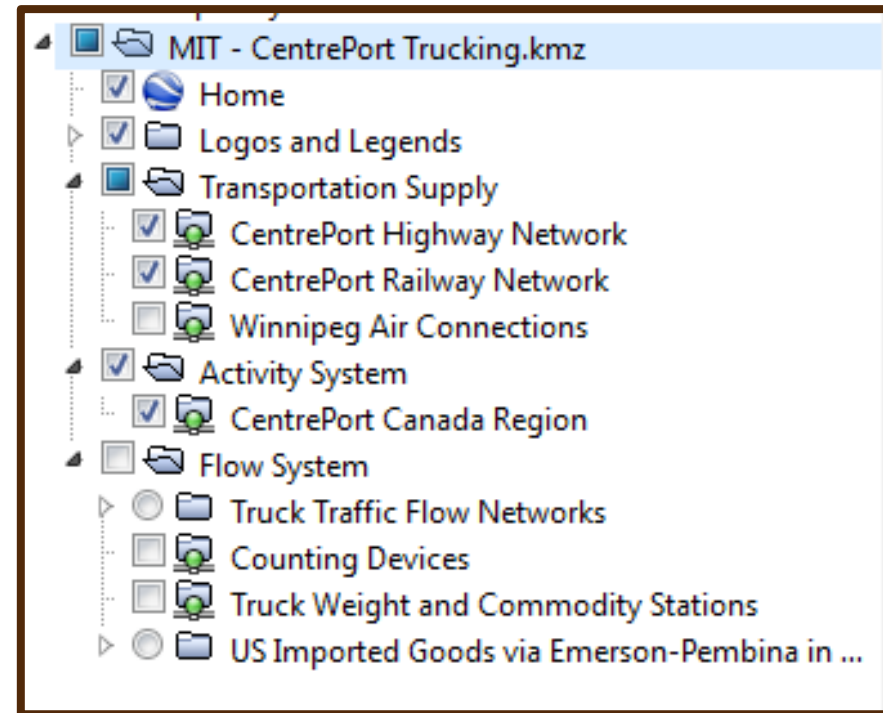
- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data



1. Benchmark truck traffic operations on Manitoba's main highways
 - To help future identify impacts of new trimodal inland port (CentrePort Canada)
2. Pilot new visualization tool using Google Earth
 - To test potential of new submission methods (compared to MHTIS)

Development

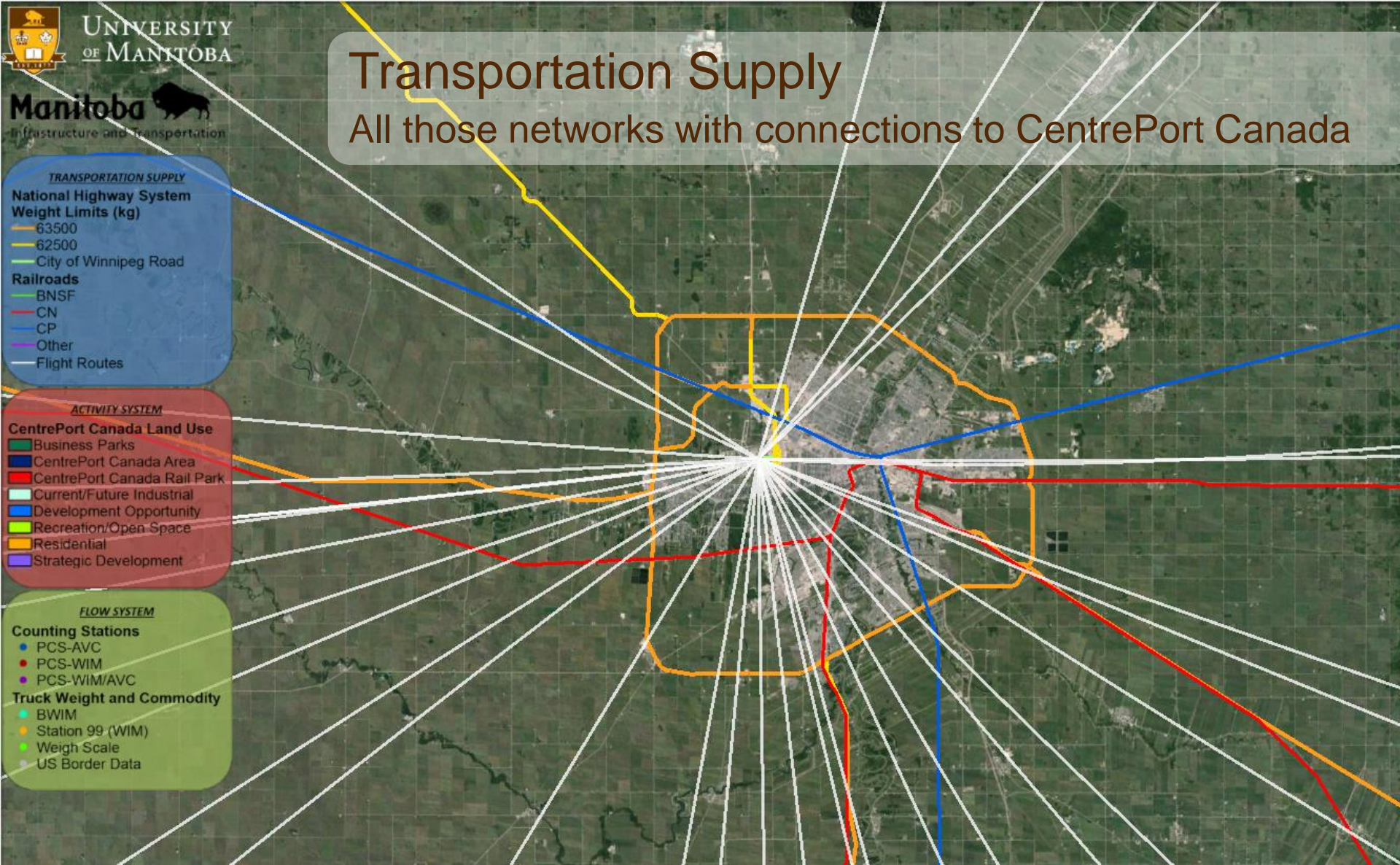
- Map layers created from varied data sources in three categories:
 - Transportation supply (road network, rail network, air connections)
 - Industry activity at inland port
 - Truck traffic flow (including volume, vehicle classification, weight, commodities)



Development

Transportation Supply

All those networks with connections to CentrePort Canada



Development

Activity System

CentrePort Canada Region, classified by land use



TRANSPORTATION SUPPLY

National Highway System Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

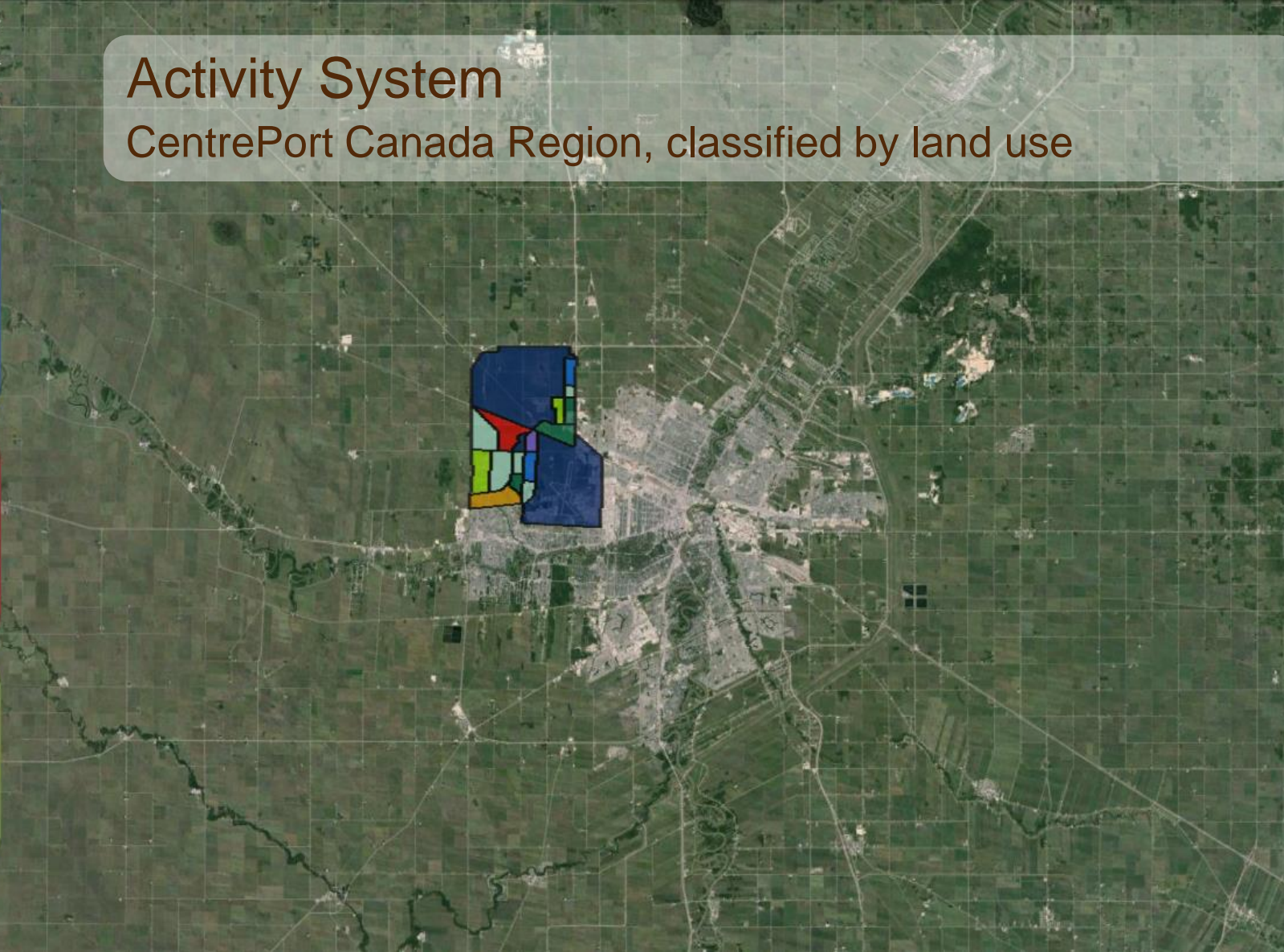
FLOW SYSTEM

Counting Stations

- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data



Development



Flow System

Truck Traffic Flow Map (Colours represent data quality)
Counting Devices
Commodity Flow to/from USA

TRANSPORTATION SUPPLY

National Highway System Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

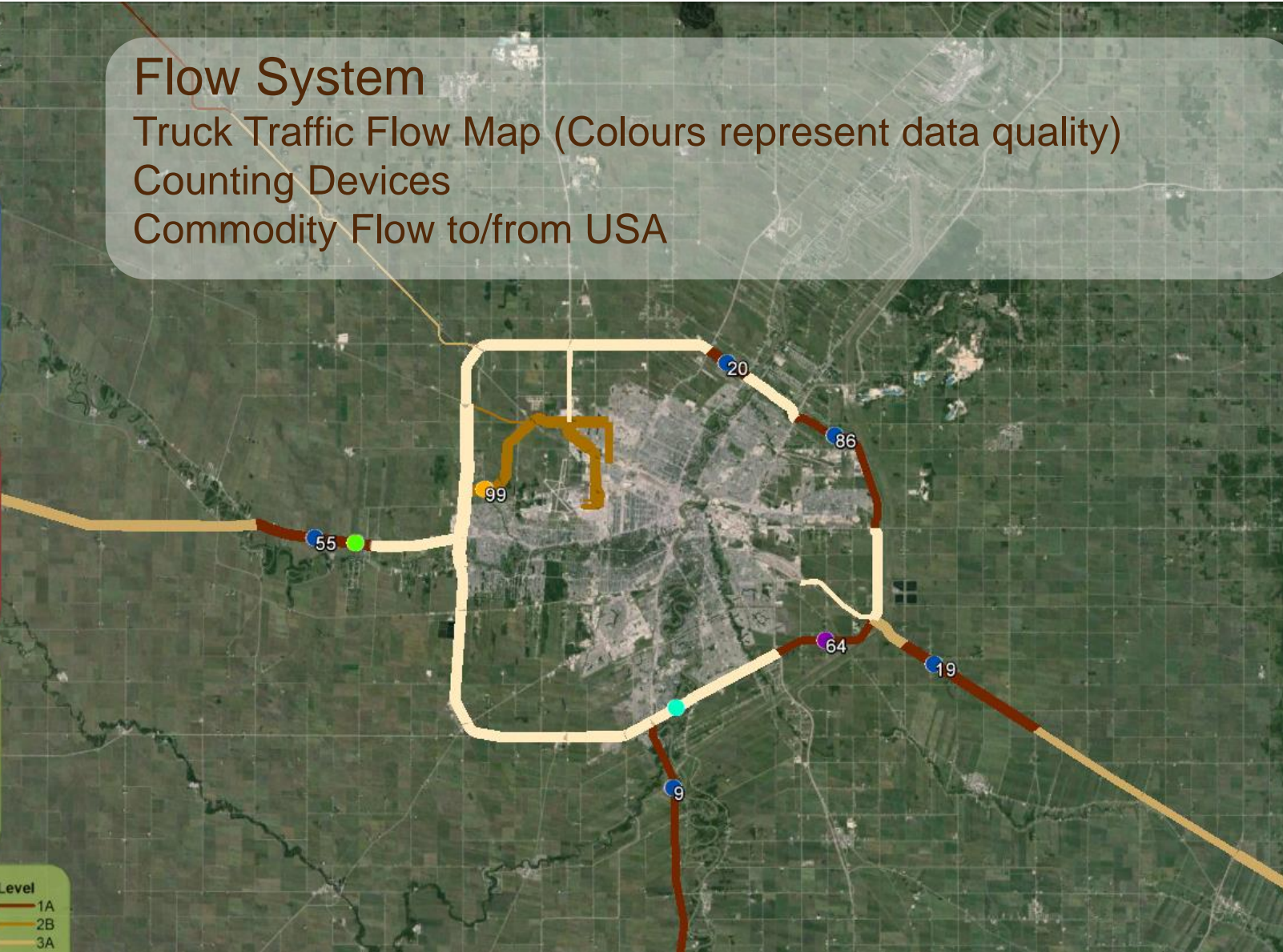
FLOW SYSTEM

Counting Stations

- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data



Functions



TRANSPORTATION SUPPLY

National Highway System
Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

FLOW SYSTEM

Counting Stations

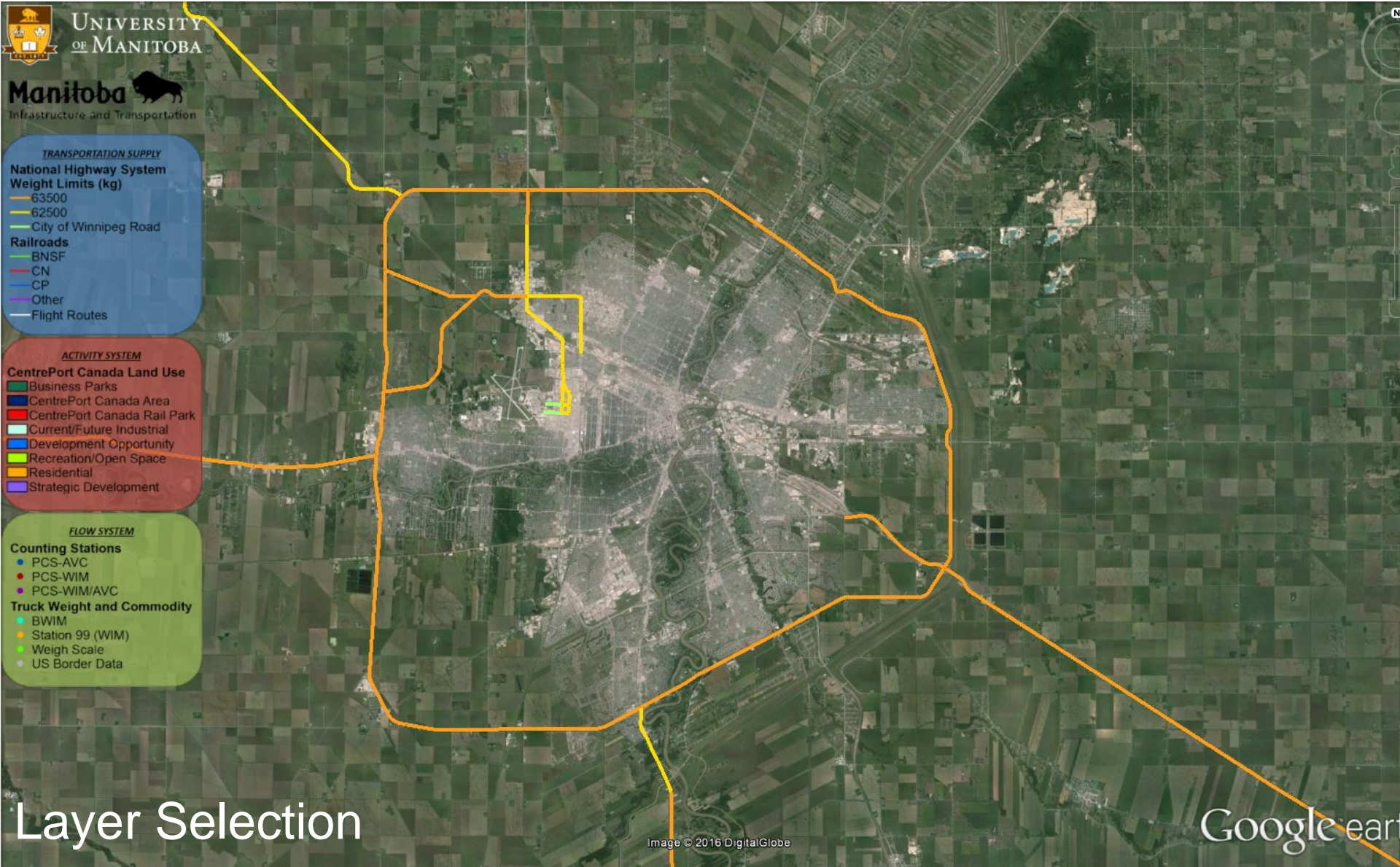
- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

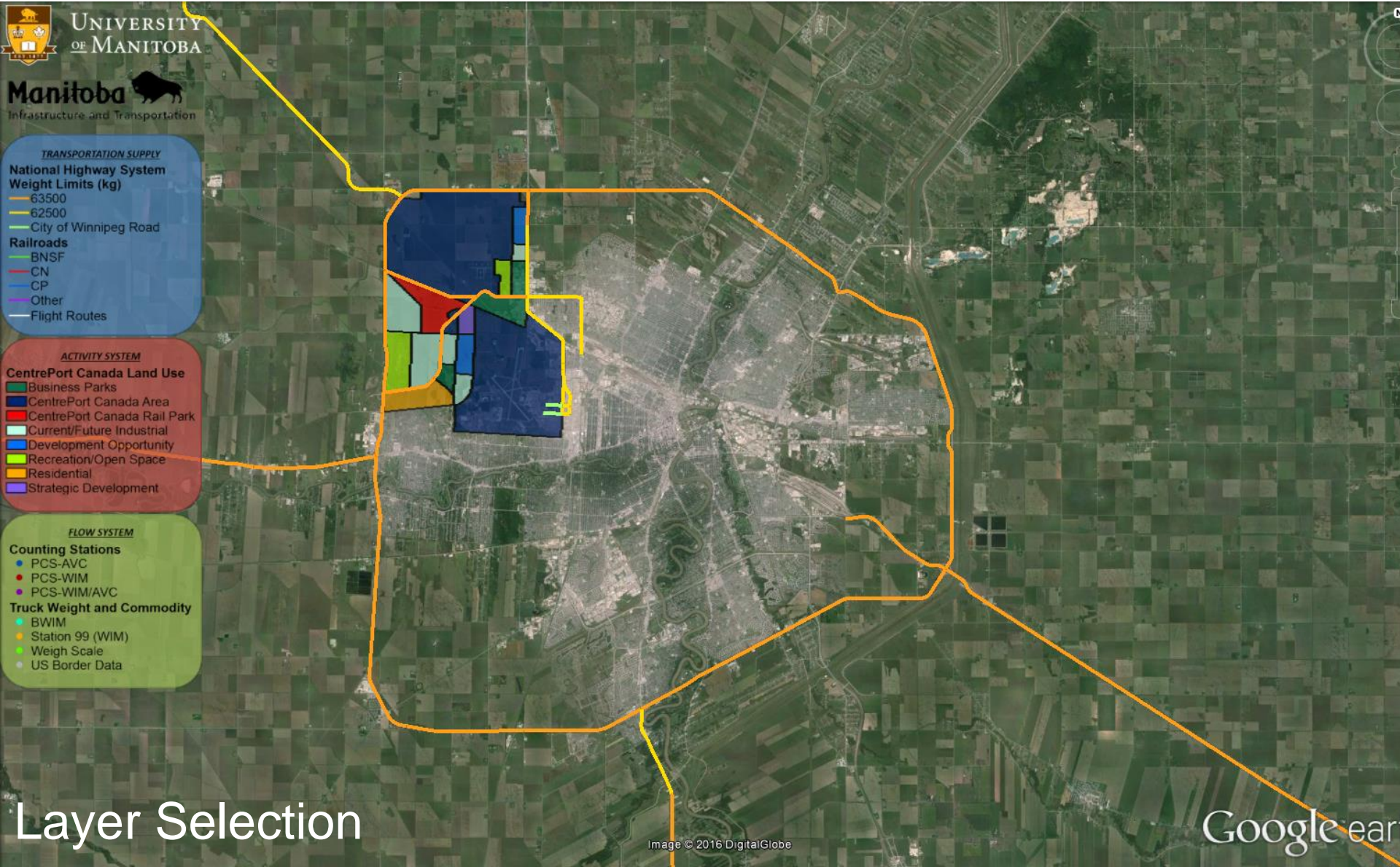
- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data

Layer Selection

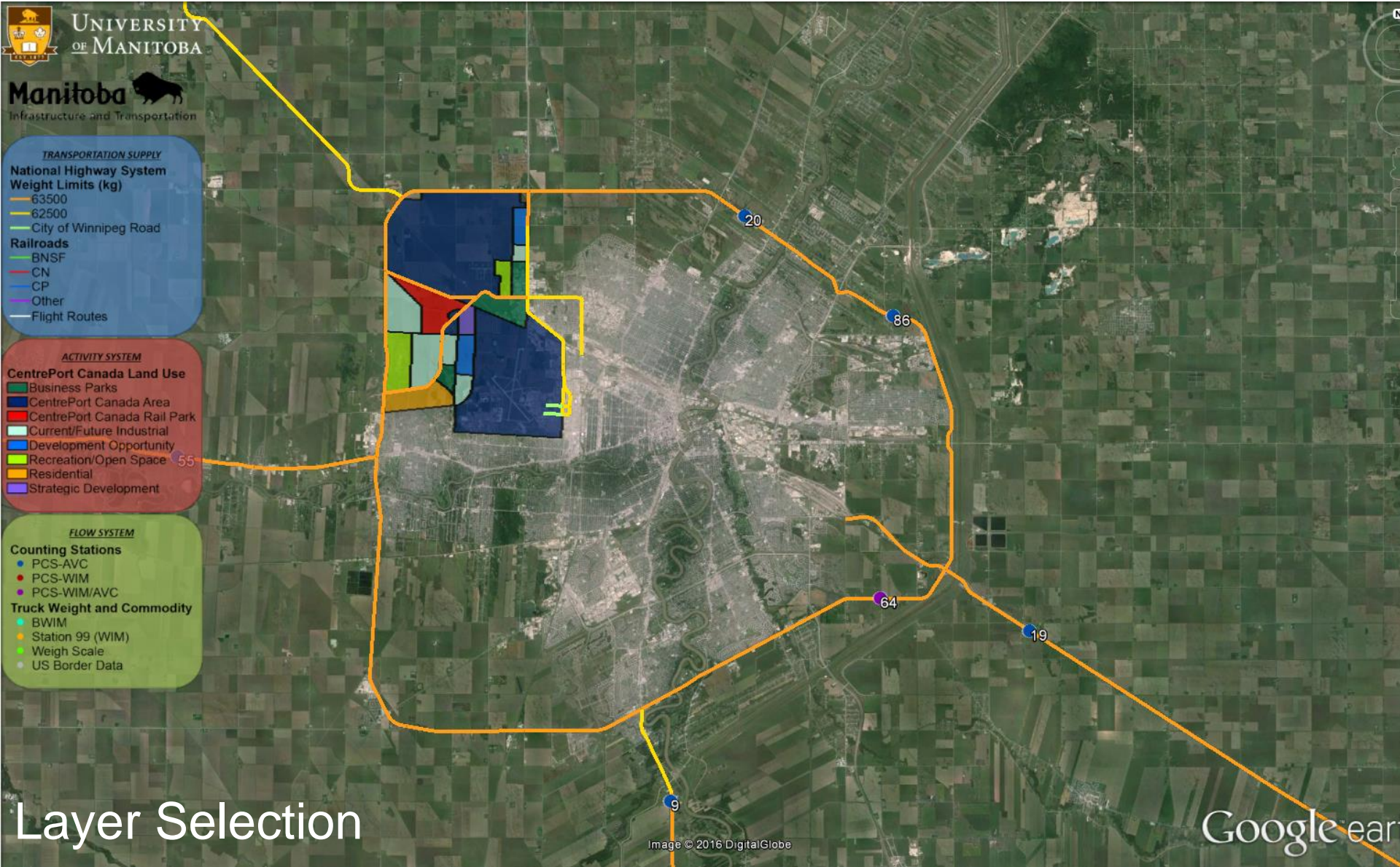
Functions



Functions



Functions



Functions



TRANSPORTATION SUPPLY

National Highway System Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

FLOW SYSTEM

Counting Stations

- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data

2013 AADTT

Level

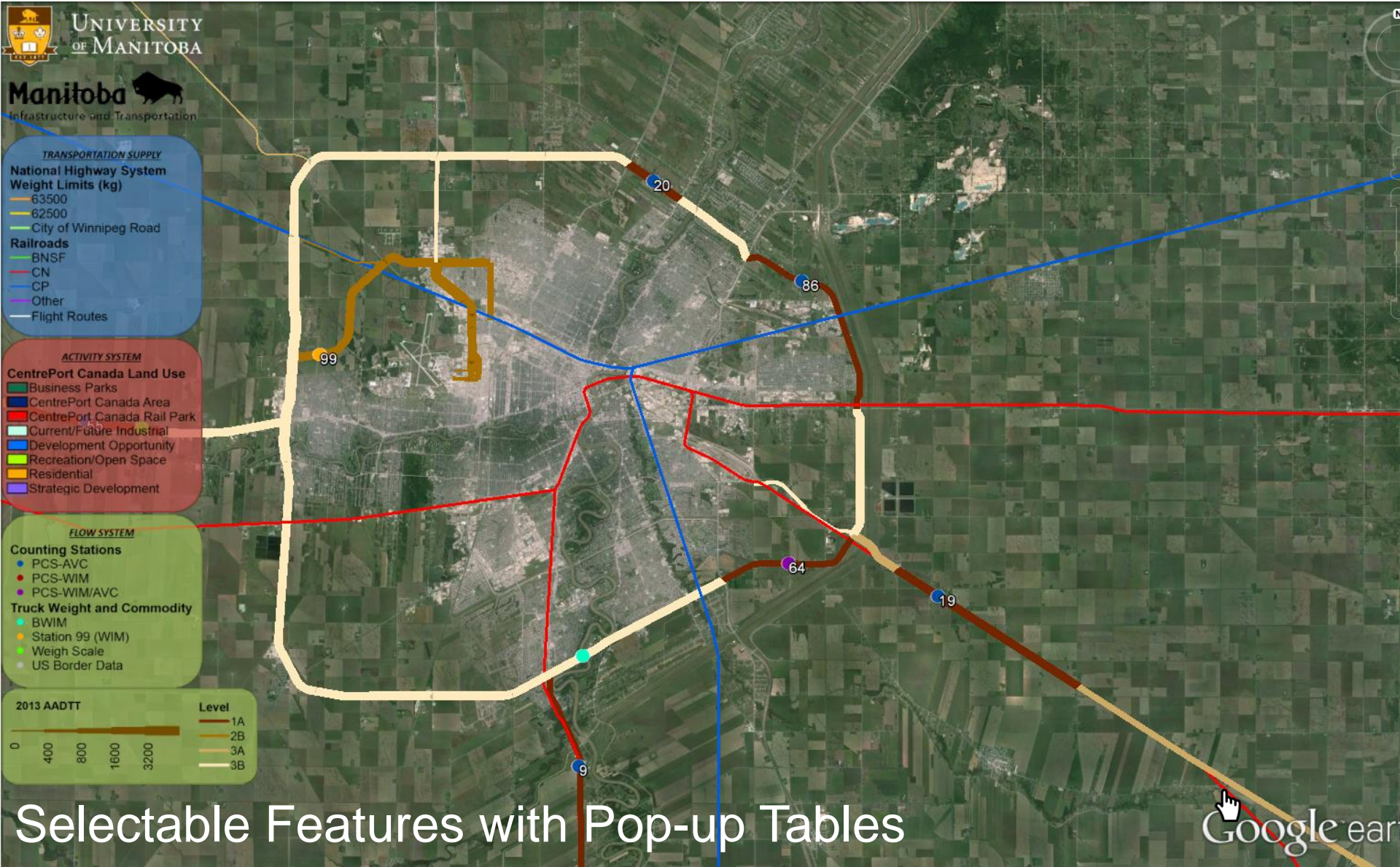
- 1A
- 2B
- 3A
- 3B



Adjustable Legend Overlay

Google earth

Functions



Selectable Features with Pop-up Tables

Functions



TRANSPORTATION SUPPLY

National Highway System Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

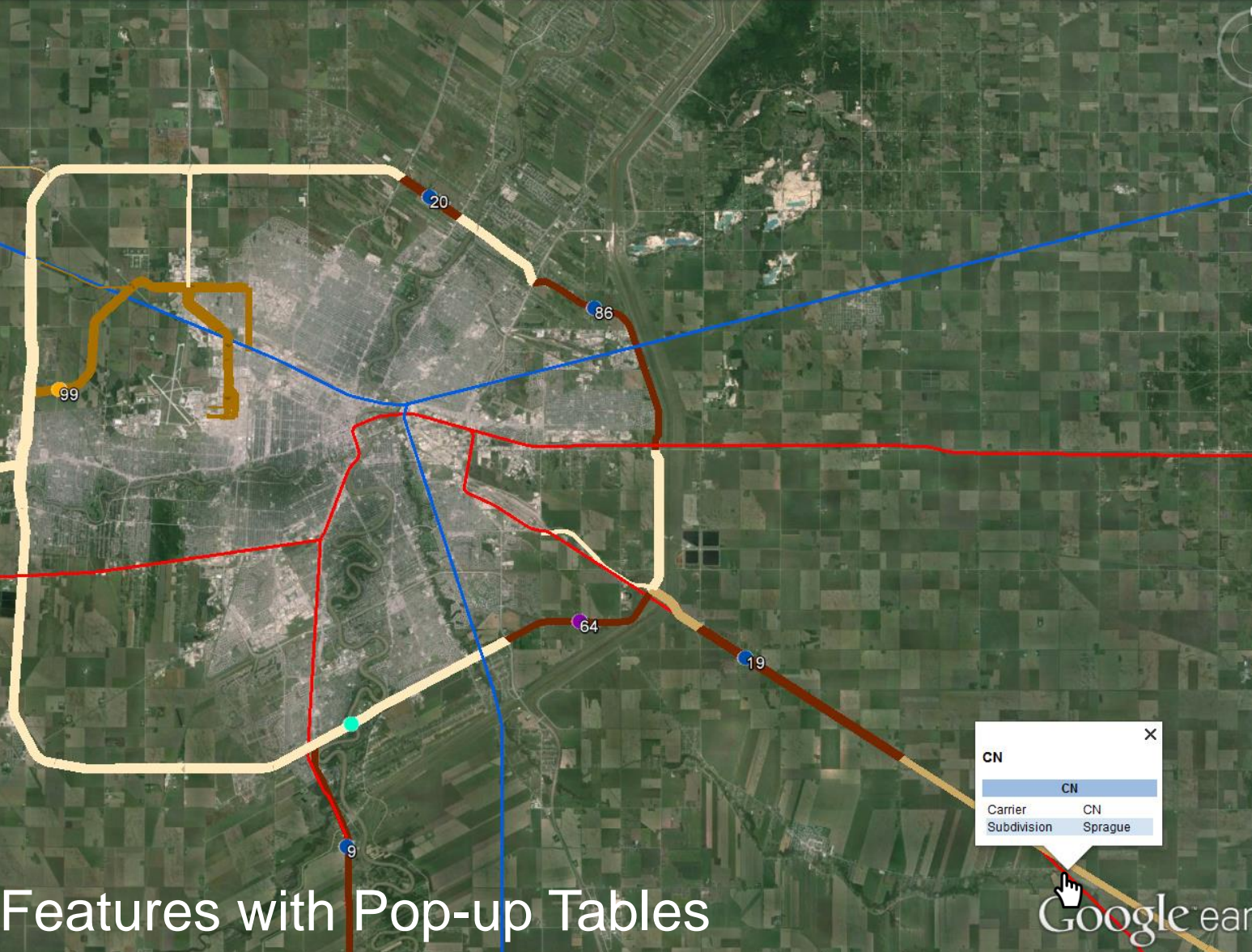
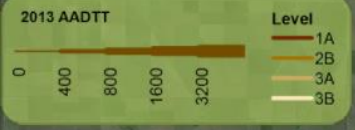
FLOW SYSTEM

Counting Stations

- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data



CN

Carrier	CN
Subdivision	Sprague

Selectable Features with Pop-up Tables



Functions



Manitoba
Infrastructure and Transportation

TRANSPORTATION SUPPLY

National Highway System Weight Limits (kg)

- 63500
- 62500
- City of Winnipeg Road

Railroads

- BNSF
- CN
- CP
- Other
- Flight Routes

ACTIVITY SYSTEM

CentrePort Canada Land Use

- Business Parks
- CentrePort Canada Area
- CentrePort Canada Rail Park
- Current/Future Industrial
- Development Opportunity
- Recreation/Open Space
- Residential
- Strategic Development

FLOW SYSTEM

Counting Stations

- PCS-AVC
- PCS-WIM
- PCS-WIM/AVC

Truck Weight and Commodity

- BWIM
- Station 99 (WIM)
- Weigh Scale
- US Border Data



Highway 101

Highway 101	
Modified CS Key	0110108010
Highway Type	PTH
Control Section	01101080HU
Sequence	10
Highway Class	URTAC
Max GVW	63500
Level	3B
2013 AADT	9380
2013 Total AADTT	2200
2013 Class 4 AADTT	10
2013 Class 5 AADTT	90
2013 Class 6 AADTT	110
2013 Class 7 AADTT	10
2013 Class 8 AADTT	70
2013 Class 9 AADTT	1000
2013 Class 10 AADTT	450
2013 Class 11 AADTT	10
2013 Class 12 AADTT	10
2013 Class 13 AADTT	450
Percent Trucks	24
2013 AADTT Classes 4-7	220
2013 AADTT Classes 8-10	1520
2013 AADTT Classes 11-13	470

Selectable Features with Pop-up Tables

Google earth

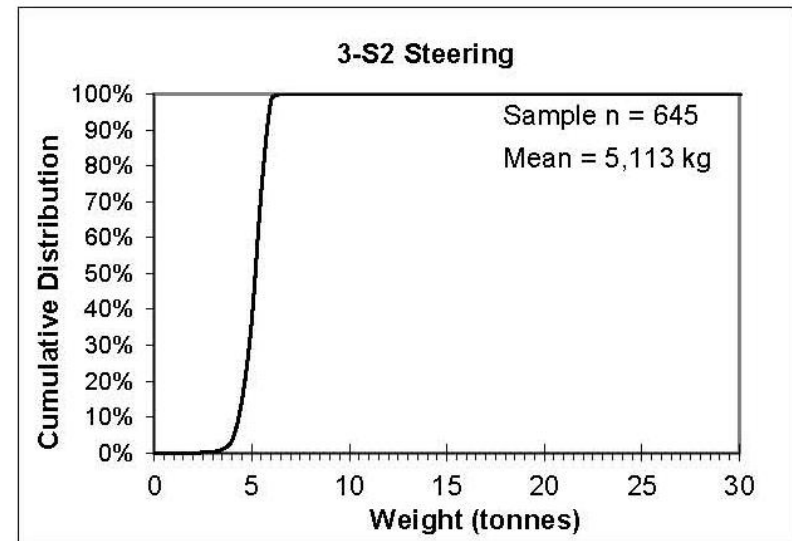
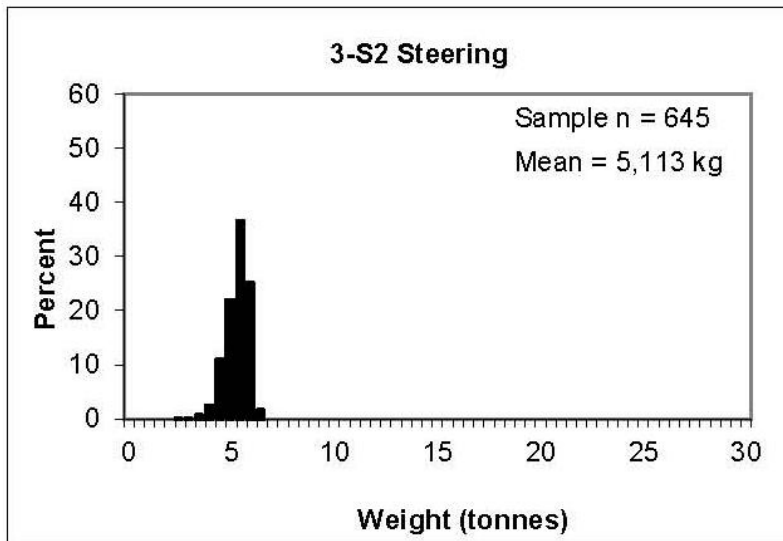
Functions

Benchmarking Truck Traffic Operations on the Highway Network Serving Centrepport Canada

Station 99

Location: MB 190, 1.3 km East of PTH 101

Direction: WB



Selectable Features with Pop-up Tables

Advantages & Disadvantages

Advantages:

- Data can be updated any time
- Layers can be inserted by request
- Easy data transfer
- Google Earth interface is customer-friendly
- Link to (theoretically) limitless amount of information

Disadvantages:

- Requires .KMZ file to be downloaded
- Security concerns of online data storage
- Web server requirements can be cumbersome
- Computer programming experience required



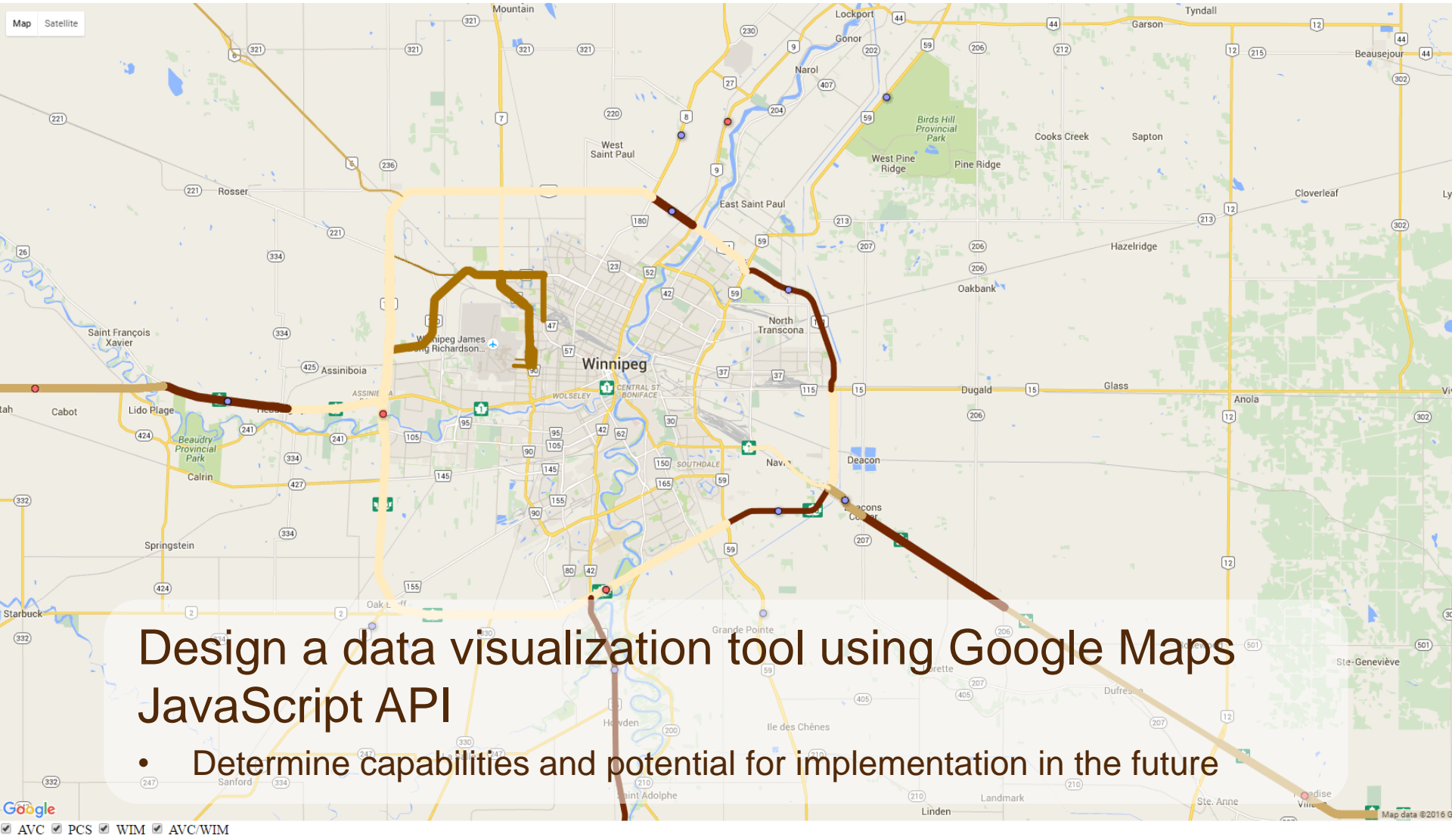
ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER
VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY
TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER

Google Maps JavaScript API Data Visualization Tool



UNIVERSITY
OF MANITOBA

Purpose



Development

What is an API?

- Application Programming Interface
- Toolbox and rulebook for creating applications



Google Maps JavaScript API

- Code with JavaScript (&HTML)
- Allows for integration of data and maps



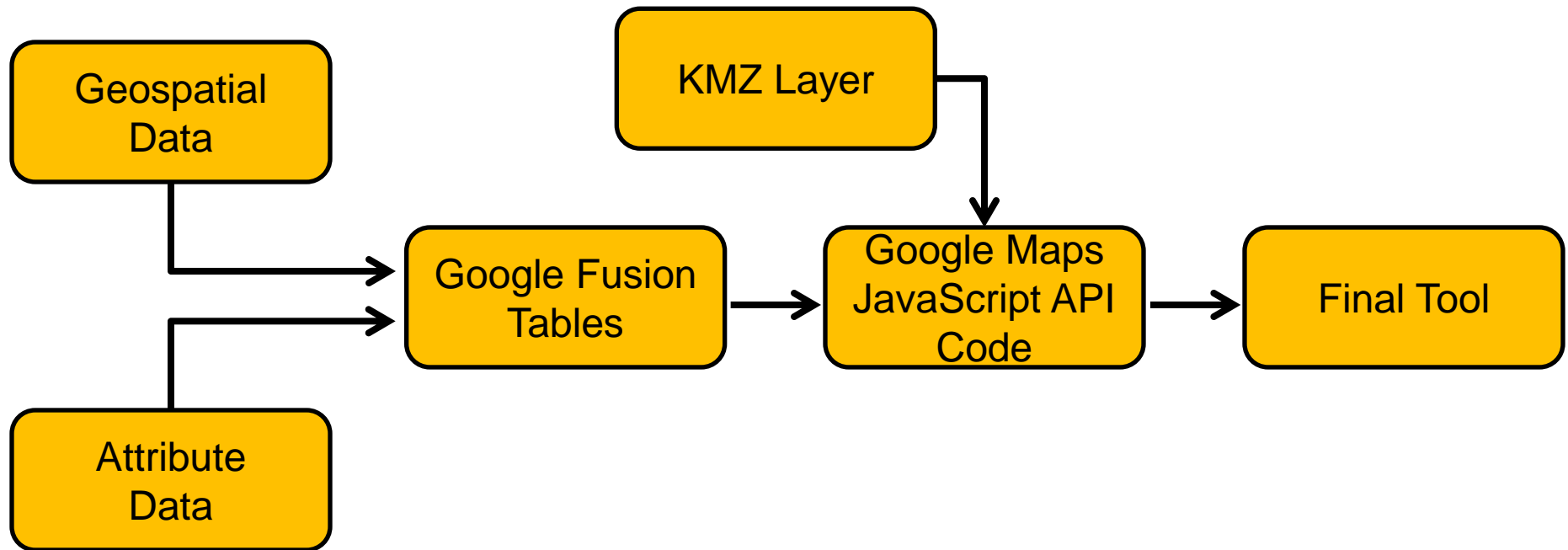
Development

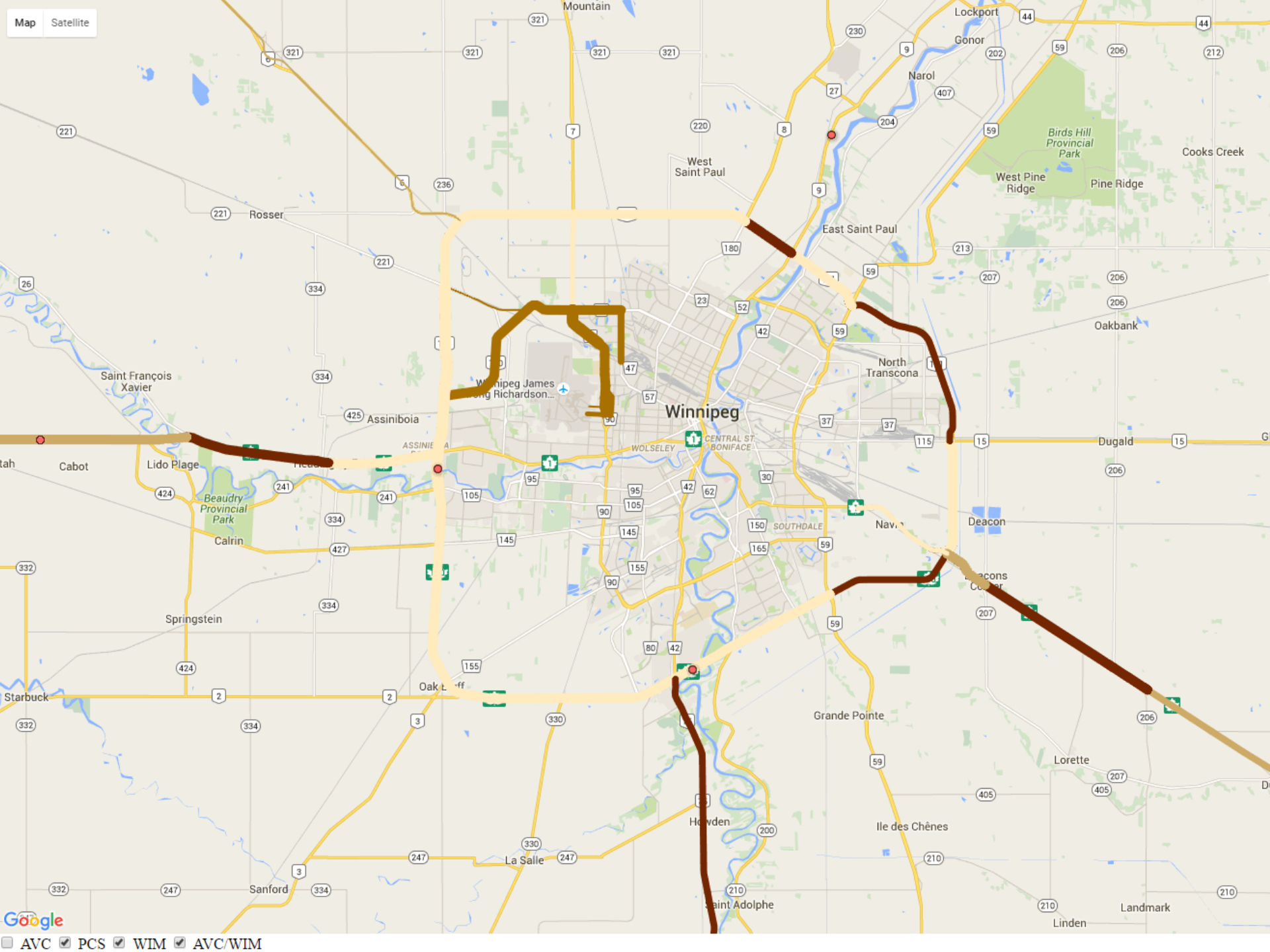
Source Data

- Manitoba Highway Traffic Information System (MHTIS)
 - Geospatial data of all continuous count stations
 - Binned (hourly) count data a single continuous count station (Station 20)
 - Truck traffic flow map (.kmz)



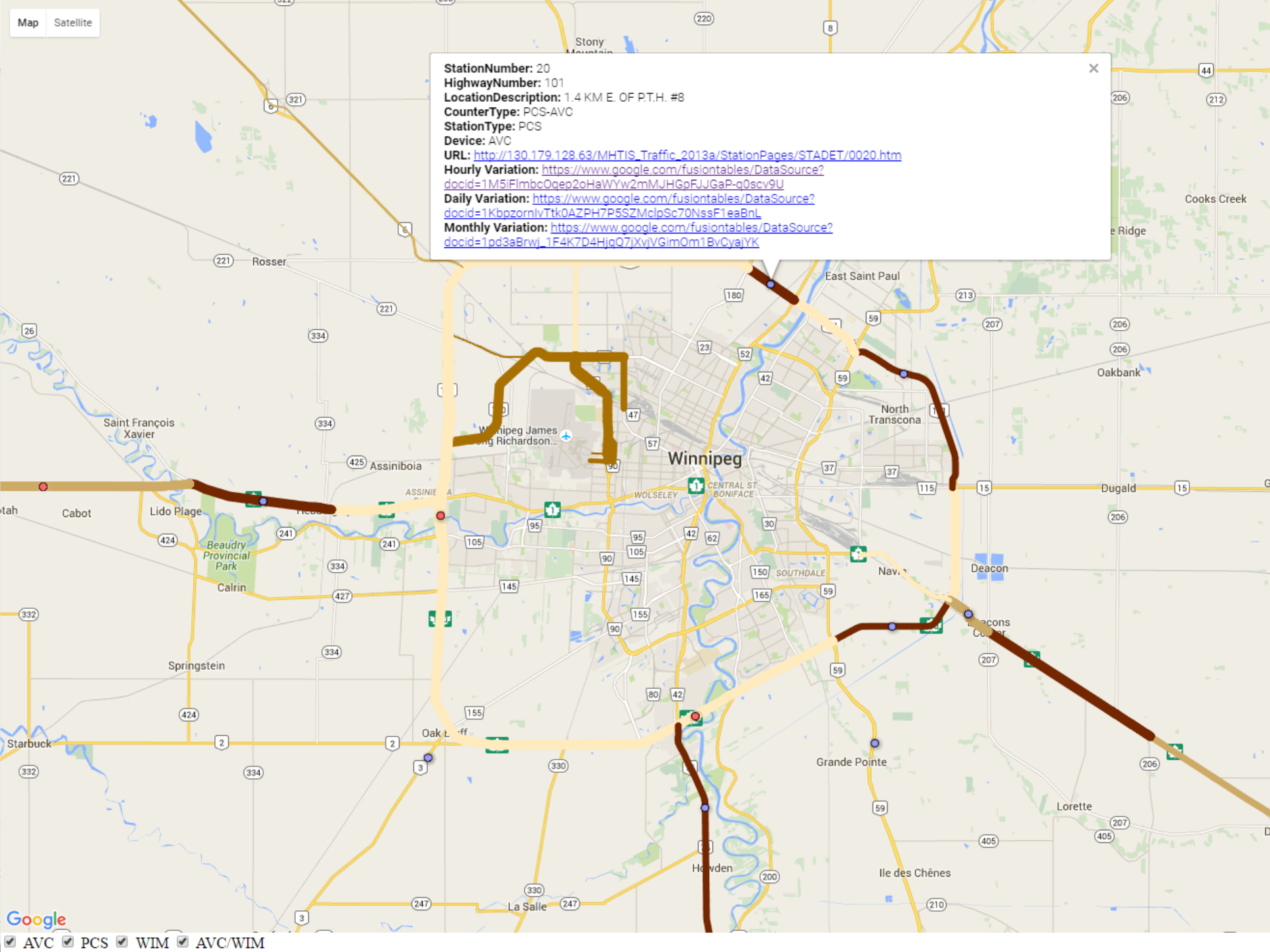
Development





Map Satellite

StationNumber: 20
HighwayNumber: 101
LocationDescription: 1.4 KM E. OF P.T.H. #8
CounterType: PCS-AVC
StationType: PCS
Device: AVC
URL: http://130.179.128.63/MHTIS_Traffic_2013a/StationPages/STADET/0020.htm
Hourly Variation: <https://www.google.com/fusiontables/DataSource?docid=1M5iFImbcOqep2oHaWYw2mMJHGpFJJGaP-q0scv9U>
Daily Variation: <https://www.google.com/fusiontables/DataSource?docid=1KbpzornlvTtk0AZPH7P5SZMclpSc70NssF1eaBnl>
Monthly Variation: https://www.google.com/fusiontables/DataSource?docid=1pd3a8rwl_1F4K7D4HjqO7jXvjVimOm1BvCyajYK



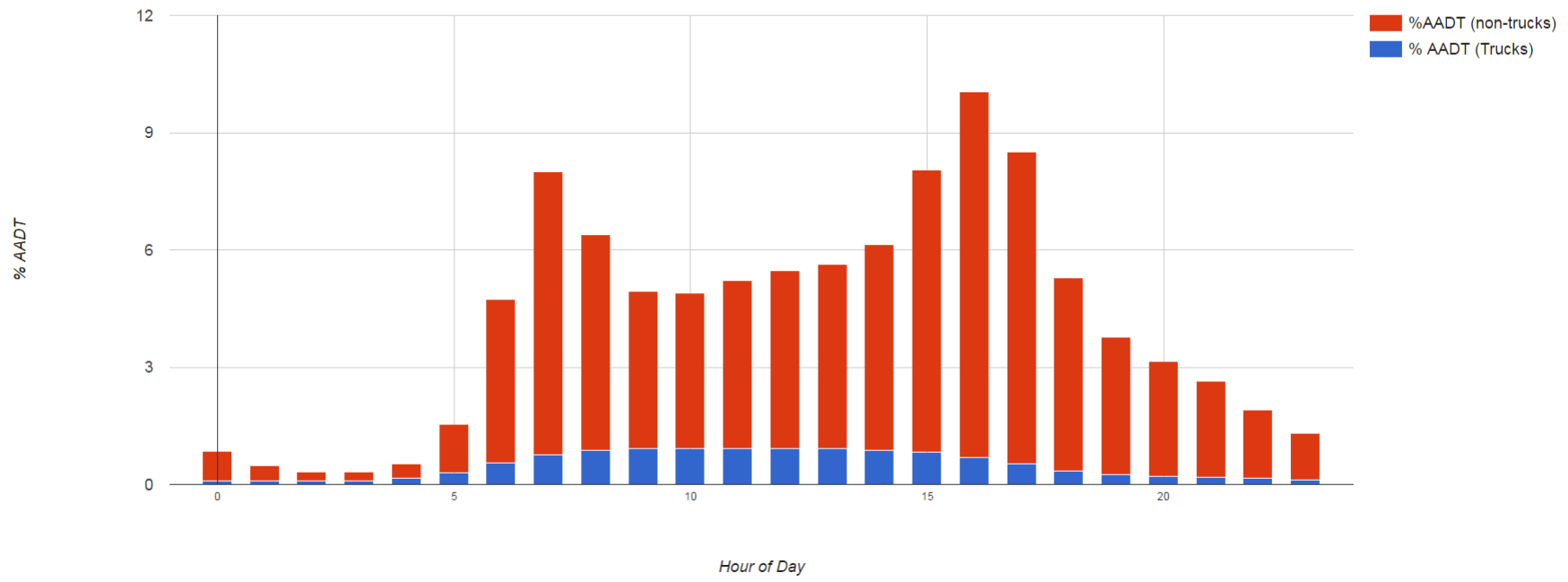
Station 20 Hourly Data

Hourly %AADT (non-truck & truck) and %AADTT
Attribution unknown - Edited on 2015 March 30

File Edit Tools Help [Data] [Cards 1] [Hourly Total Traffic Variation] [Hourly Truck Traffic Variation]

Filter No filters applied. Sorted by Hour Not saving 24 rows

Total Traffic Variation by Hour of Day



Station 20 Hourly Data
 Hourly %AADT (non-truck & truck) and %AADTT
 Attribution unknown - Edited on 2015 March 30

File Edit Tools Help

Data Cards 1

Hourly Total Traffic Variation

Hourly Truck Traffic Variation

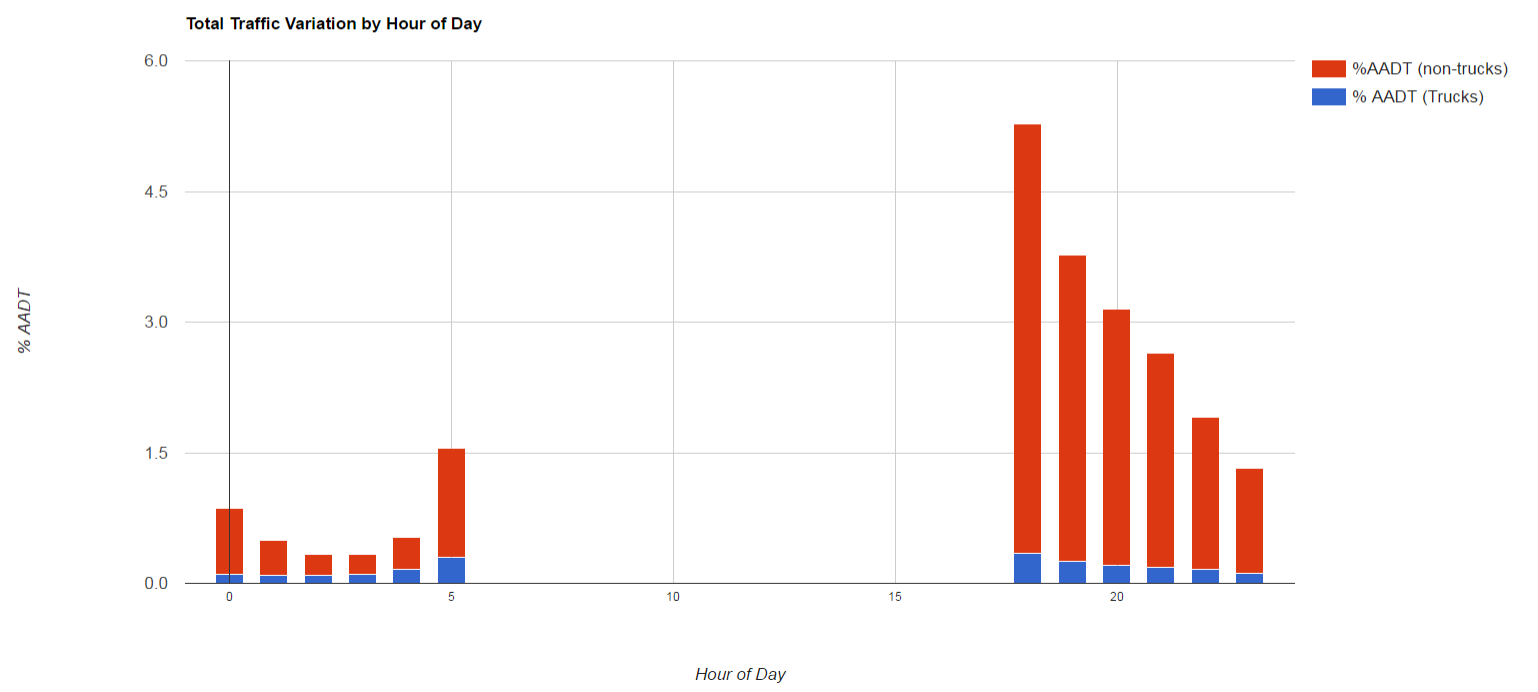
Filter % AADT (Trucks) >= 0 AND % AADT (Trucks) <= 0.5. Sorted by Hour

% AADT (Trucks)

0 - 0.5 Find

24 values from 0.09 through 0.93

Not saving 12 rows



Station 20 Hourly Data

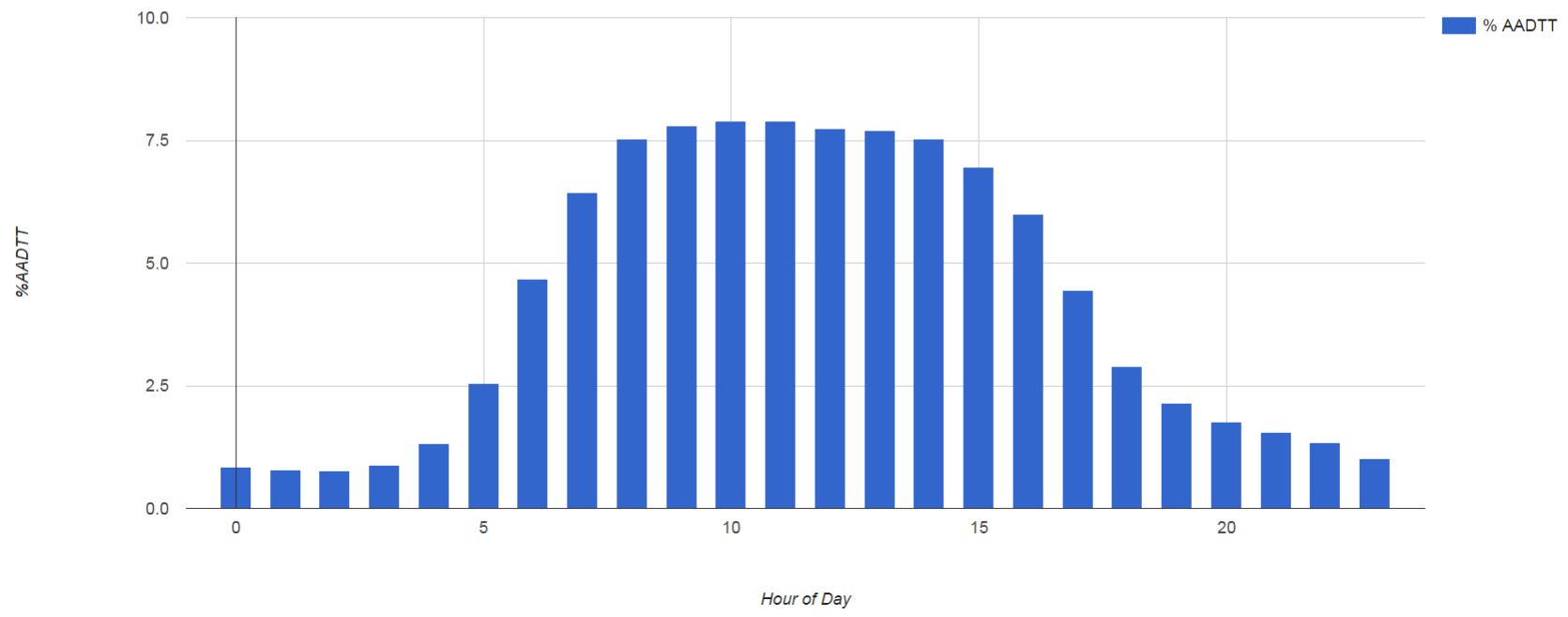
Hourly %AADT (non-truck & truck) and %AADTT
Attribution unknown - Edited on 2015 March 30

Share

File Edit Tools Help | Data | Cards 1 | Hourly Total Traffic Variation | **Hourly Truck Traffic Variation** +

Filter No filters applied. Sorted by Hour Not saving 24 rows

Truck Traffic Variation by Hour



Advantages & Disadvantages

Advantages:

- Data can be easily updated by the developer
- Can be customized based on user preference
- Easily accessible via the Internet
- Easy to use: well known Google Maps interface

Disadvantages:

- Complex (not user intuitive) coding required
- Application limitations



Summary and concluding remarks

Criteria	Google Earth	Google Maps JavaScript API
Ease of Development	-	X
Updateability	✓	✓
Customizability	✓	✓
Accessibility	✓	✓
Cost	✓	✓
Ease of Use	✓	✓
Interactivity	✓	✓
Security	-	✓
Reliability	-	✓

X Low
 - Medium
 ✓ High



Summary and concluding remarks

- Google applications for traffic data visualization:
 - Convenient methods of displaying location-based traffic information
 - Require experience to develop
 - Can improve customer experience and understanding
- Future work
 - Improved interactivity (e.g., customer querying, chart-building tools)
 - Real-time data validation, processing, and dissemination



TRAILBLAZER CHALLENGER

CHALLENGER DEFENDER VISIONARY

DEFENDER VISIONARY ADVENTURER TRAILBLAZER

VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY

ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER

TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY ADVENTURER TRAILBLAZER

DEFENDER VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER

ADVENTURER TRAILBLAZER CHALLENGER



UNIVERSITY
OF MANITOBA