

Urban Mobility Modeling Using Volunteered Geographic Information and High-Resolution Population Data (P15-6367)

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Summary

- Mobility is an important measure to evaluate the efficiency and livability in urban areas.
- Volunteered geographic information and high-resolution population data, together with National Household Travel Survey (NHTS) data, can help modeling urban mobility scenarios on a unified platform.
- We developed the Toolbox for Urban Mobility Simulation (TUMS) system to simulate urban transportation systems with microscopic approach at global level.
- The major features of the TUMS are:
 - ✓ Open-source and independent platform
 - ✓ Open data and unified data structure
 - ✓ Large-scale microscopic traffic simulation
 - ✓ Two levels of visualization

The TUMS System

The TUMS system consists of three major modules, as shown in Figure 1. It runs on different operation systems.

Data Processing

- ✓ Volunteered geographic information, OpenStreetMap, provides road network data. Figure 2 shows an example in Alexandria city.
- ✓ High-resolution population data, LandScan, estimate mobility dynamics and trip numbers. Figure 3 shows both data time and night time population distributions.
- ✓ Open data, such as NHTS, helps the validation and calibration process for trip generation.

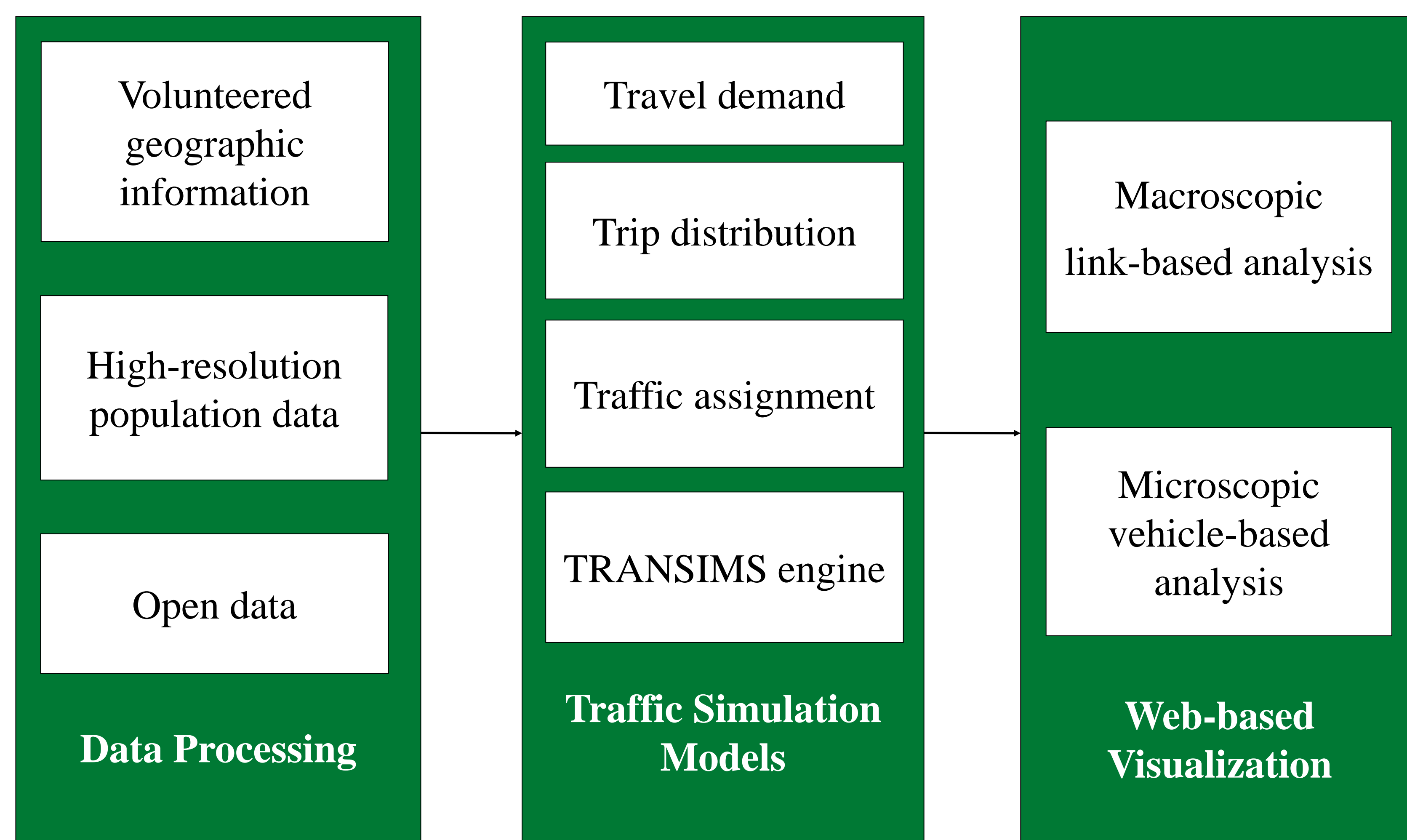


Figure 1 The TUMS System Architecture

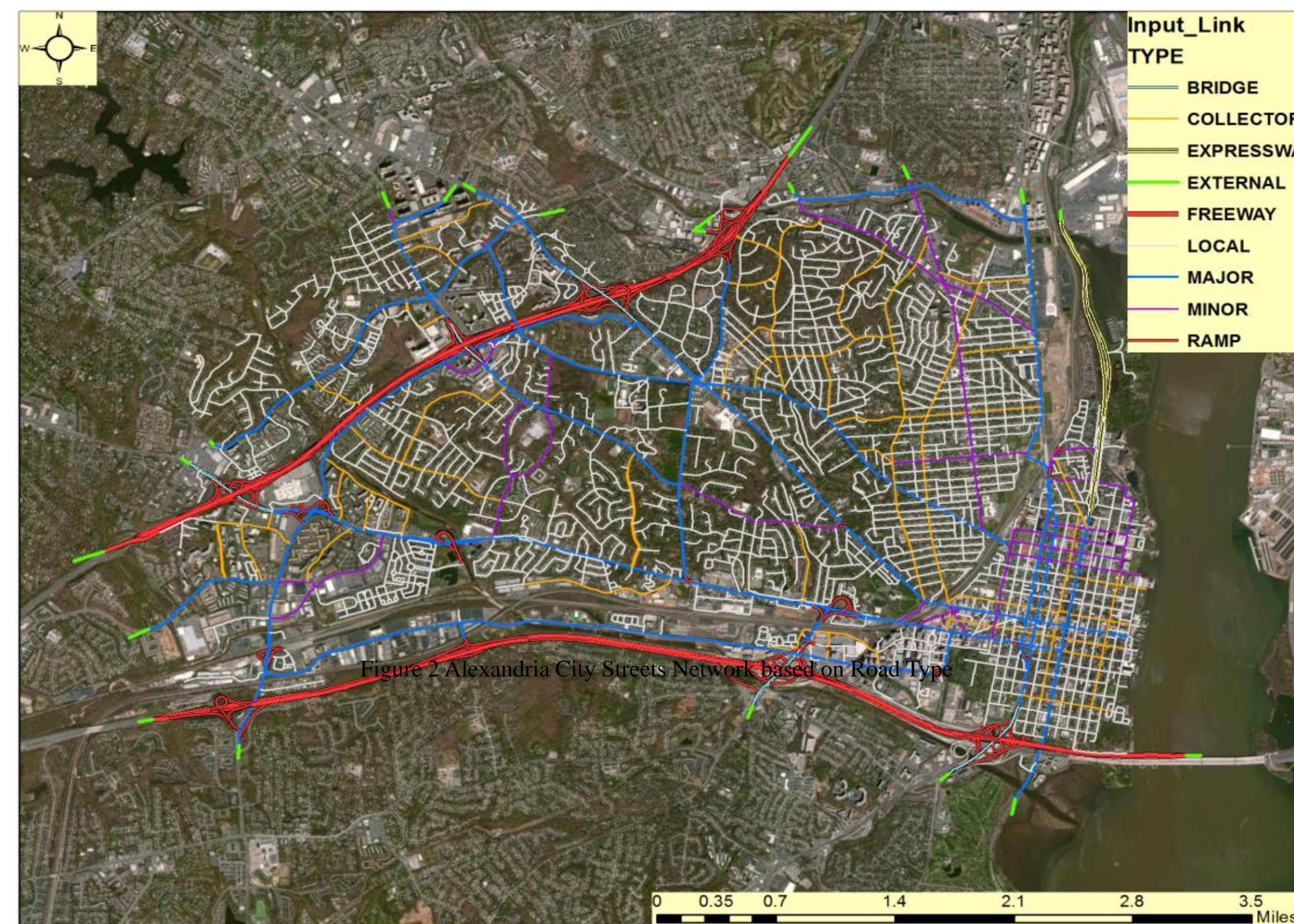


Figure 2 Alexandria City Streets Network based on Road Type

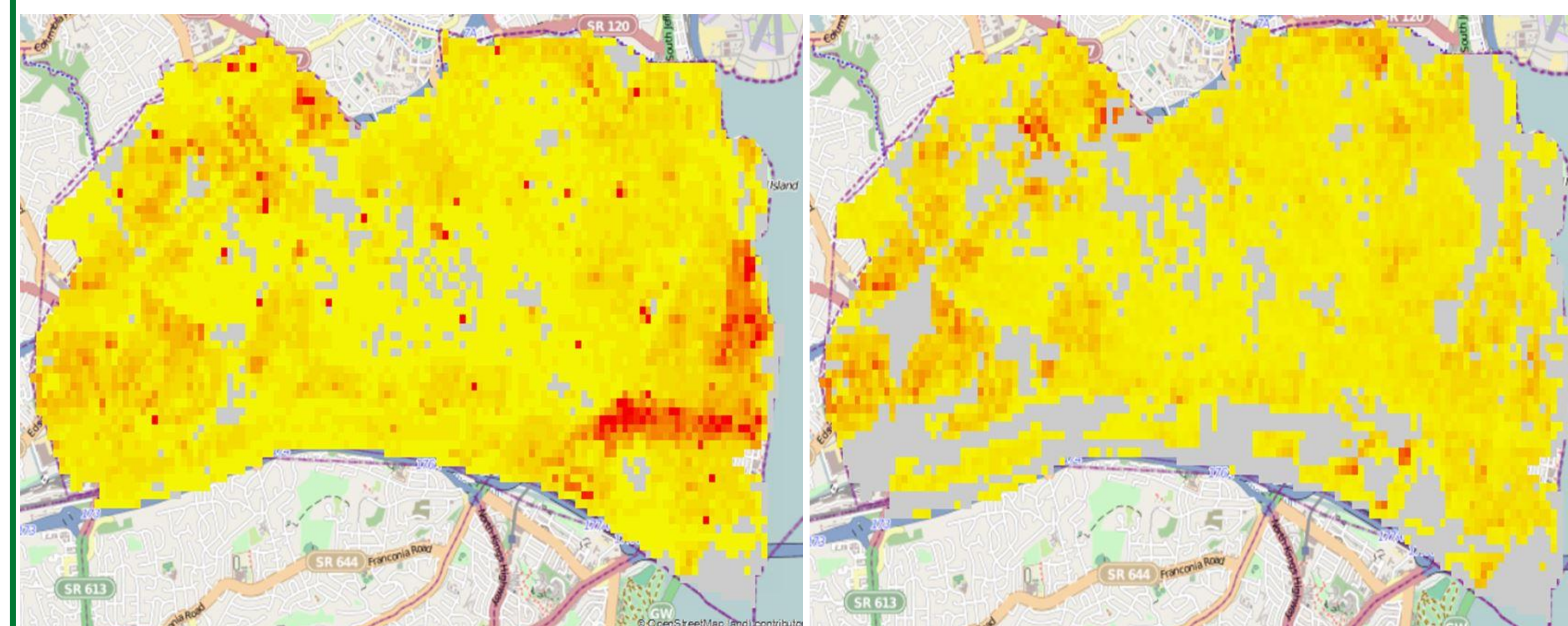


Figure 3 Alexandria city LandScan population data cells: Daytime (left) and Nighttime (right); red: higher population; yellow: lower population; grey: zero

Traffic Simulation Models

- ✓ Travel demand modeling: the number of trips and travelers departure time choices
- ✓ Trip distribution modeling: origin-destination matrix for both normal scenarios and emergency scenarios.
- ✓ Traffic Assignment modeling: road network access and routing issues. High resolution population data need a revised activity-based assignment algorithm, as Figure 4.
- ✓ Use TRANSIMS as traffic engine for large-scale macroscopic and microscopic simulations.

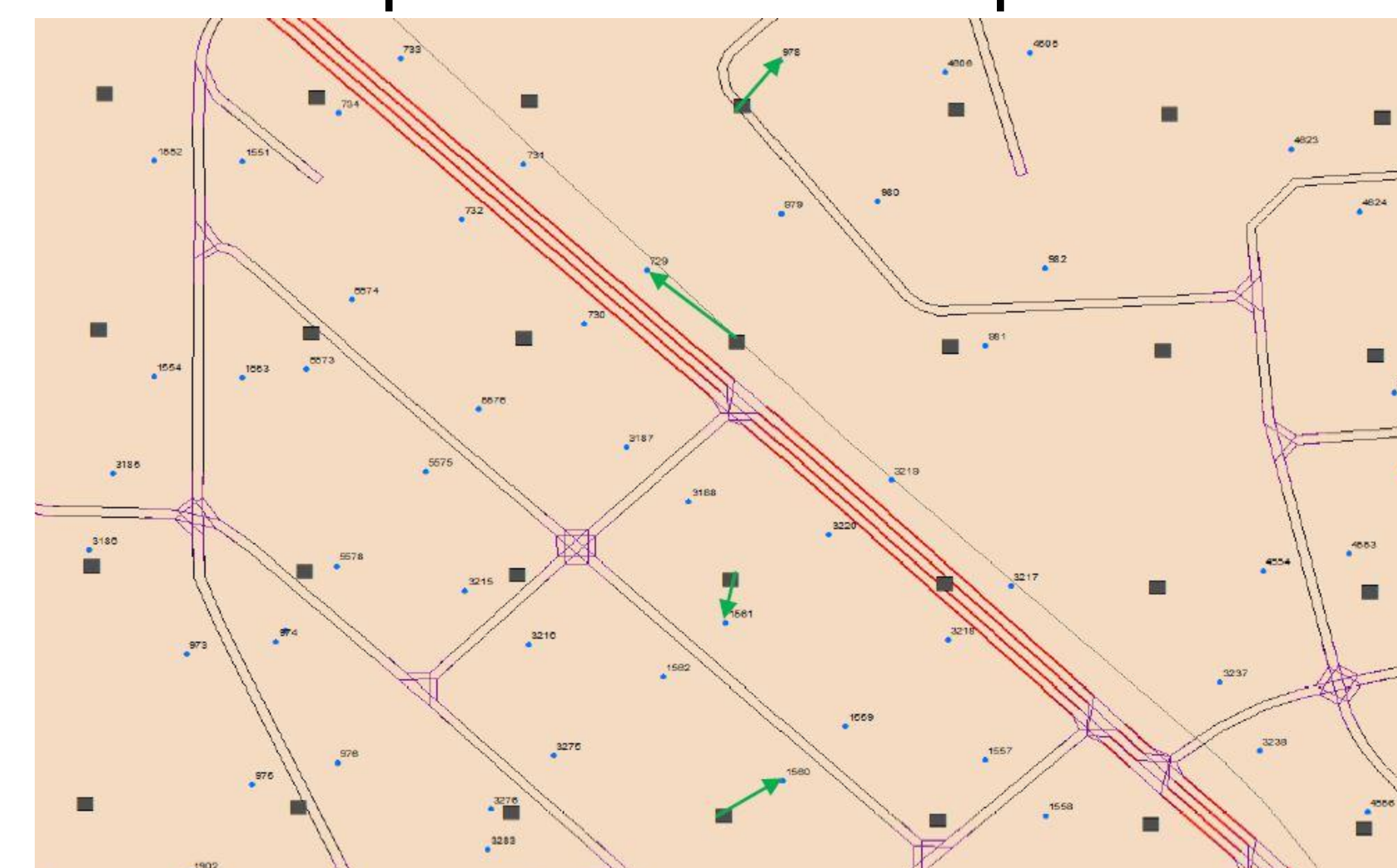


Figure 4 Using High Resolution LandScan Population Data for Activity-based Traffic Assignment

Web-based Visualization

- ✓ Global accessibility for large-scale geospatial area study.
- ✓ Link-based macroscopic visualization for network performance analysis, as Figure 5.
- ✓ Vehicle-based microscopic visualization for driving behavior monitoring, as Figure 6.

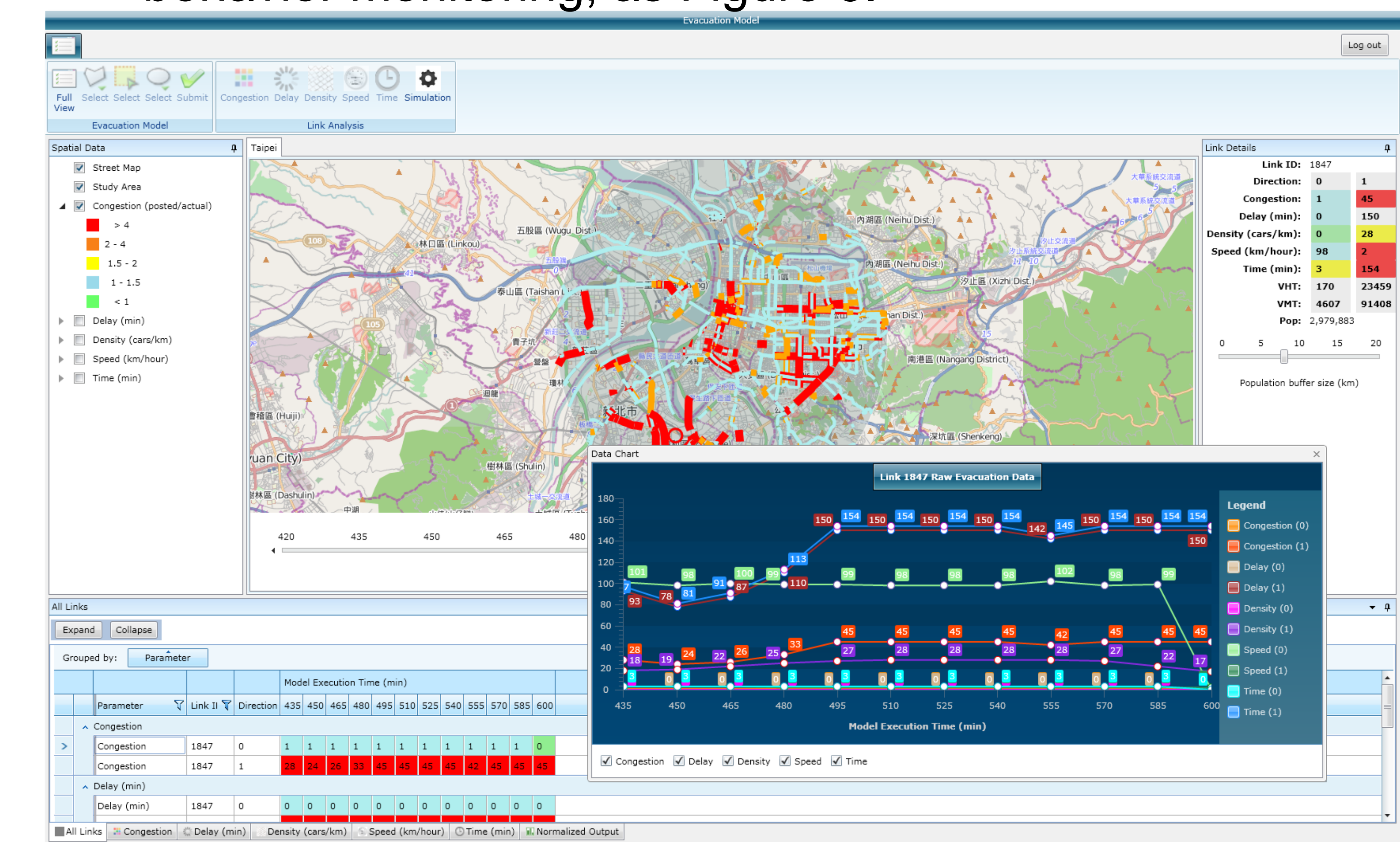


Figure 5 Link-based Macroscopic Visualization tool

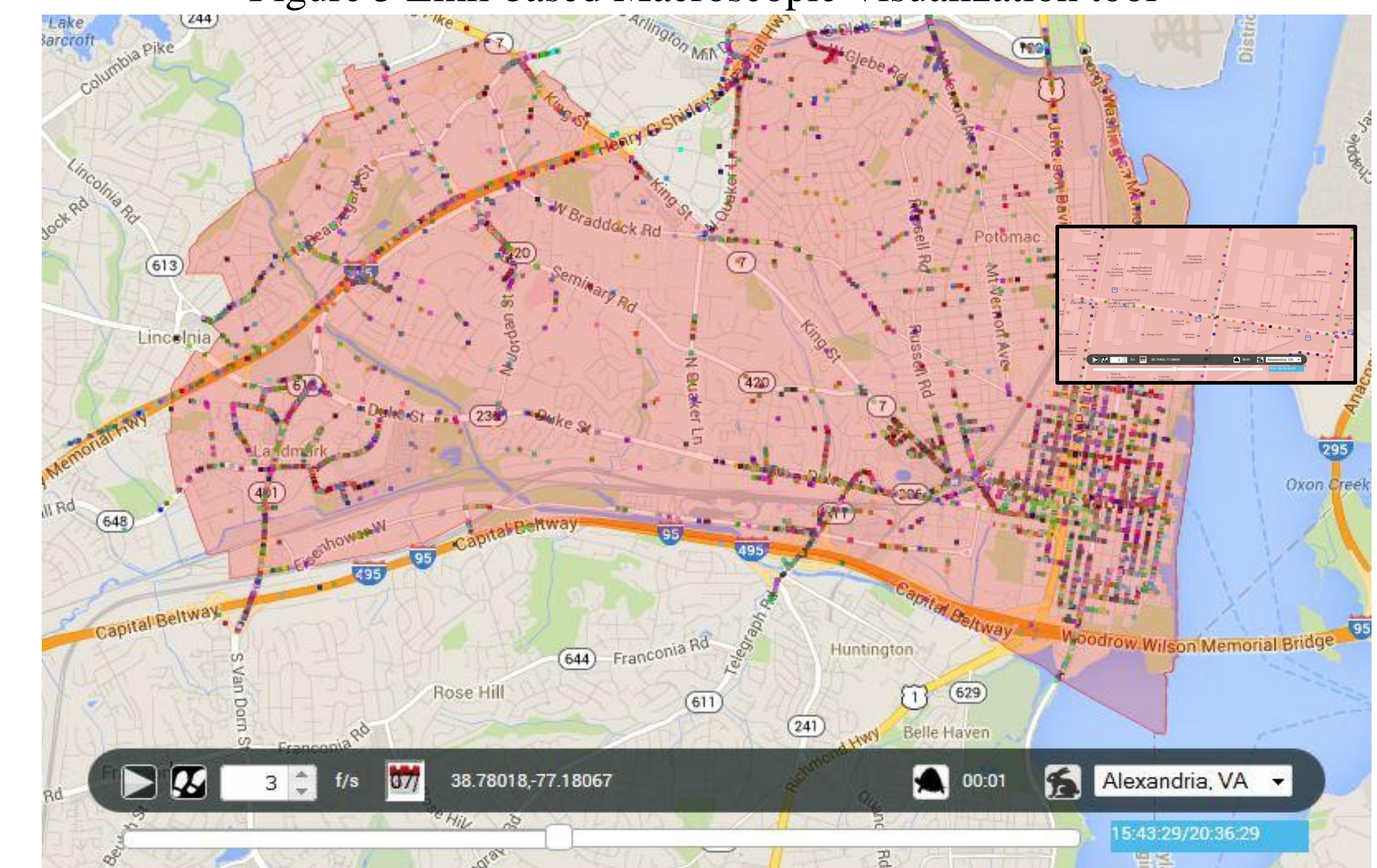


Figure 6 Vehicle-based Microscopic Visualization in Alexandria

Discussion

- The TUMS can simulate world-wide transportation and mobility scenarios with open data, unified data preparation, and two levels of visualization.
- NHTS can improve the accuracy of microscopic traffic simulation with more available geo-location information.

Acknowledgments

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