East West Gateway
Council of Governments

Emergency Evacuation Demand Analysis

EAST-WEST GATEWAY
Council of Governments
Creating Solutions Across Jurisdictional Boundaries

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INTRODUCTION

This memorandum describes the development and assumptions used in traffic flow estimation for evacuation of the Wood River Levee District, and the demand it would place on the transportation infrastructure owned and operated by the Illinois Department of Transportation (IDOT).

To prepare for an advance notice flood evacuation event and minimize its impact, IDOT needs to understand the traffic pressures and demand during such an event. The flood evacuation event occurs when a levee over topping occurs. With a flood evacuation event, for the travel pattern, there is an initial mobilization period and then an evacuation period that occur. This produces a specific travel pattern, which will be discussed later in the document as well as the mobilization and evacuation steps. To this end, East West Gateway Council of Governments (EWGCOG) employed the regional travel demand model to forecast traffic flows and provided an origin destination (O-D) matrix of the mobilization and evacuation within the study area. These trips will then be assigned to a roadway network to identify likely travel patterns under such a scenario. The following document describes approach that was taken by EWGCOG to provide the traffic flow information.

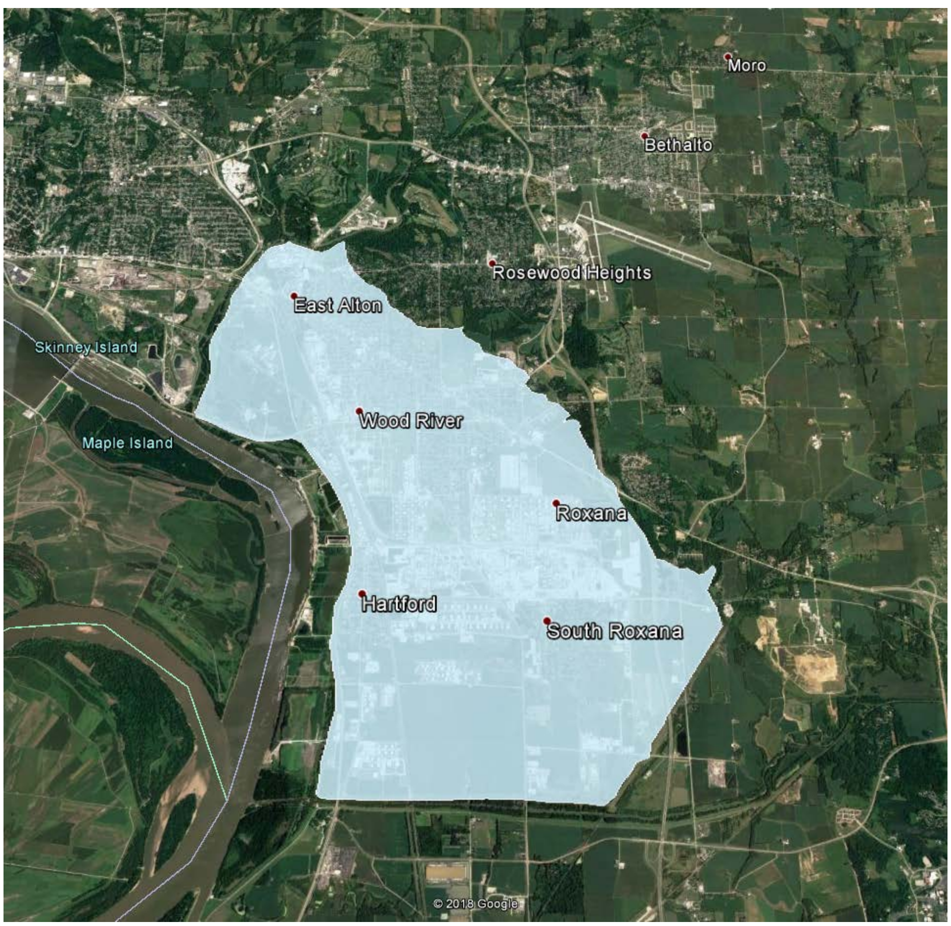

Figure 1: Study Area

ANALYSIS

Study Parameters

Based on the discussions with SIUE, the geographical extent or the study area was defined as well as the levee breach scenario. The study area included; the general area from which the population would evacuate under the levee topping scenario, and the worst case scenario would be modeled.
The study area is bounded by Illinois route 3 (IL 3) and the Wood River Levee on the West, The Wood River Levee to the South, Illinois 255 to the East, and E Edwardsville Rd (Il 143) to the North.
The network was further limited to a focus subarea network agreed upon by SIUE. For the purpose of developing the emergency evacuation plans and evacuee trip tables, the focus within the study area was on the roadway network that surrounds I-255. This area of focus includes Expressway IL-255, principal arterial IL-143 and minor arterial IL-111. Further, subarea matrices were created to accompany the subarea network.

Scenario

After discussing with the stakeholders, it was agreed that the modeled scenario would be compromised of the 2018 Full Build Network and a mid-day, mid-week run. The scenario mimicked the travel patterns for a levee breach evacuation that required a mobilization and an evacuation sequence. Mobilization and Evacuation sequence are defined in the next section of this report.

Methodology

A full travel demand model run was conducted for year 2018, to reflect normal daily traffic throughout the region. The travel demand volumes were forecasted by using only the trips that would occur during a mobilization and evacuation phase. From Reuben Goldblatt and KLD Associates, "Evacuation Planning Human Factors and Traffic Engineering Perspectives", the first sequence, mobilization, is performed when the public receives notification. For the population at work, it is observed that they first travel home, pack or load some belongings and then head on out. If the public is already at home, then the sequence for mobilization would only require them to receive notification information and be at home. The second sequence, evacuation, is performed when the public prepares their home to leave for an evacuation trip. The trips were then assigned to the subarea network.

1. TransEval Regular Model Run Results

As mentioned before, the analysis year for this effort is 2018. Corresponding land use, socioeconomic data, along with the appropriate transit and highway networks were used in this study. These data are the same as used for the latest Transportation Improvement Program (TIP 18-21). For a typical weekday, model estimated 2018 daily loaded volumes are shown in Figure 3.

The model has been calibrated using the 2015 model outputs and the 2015 AADTs, provided by IDOT. The model is performing satisfactorily in the forecast mode.

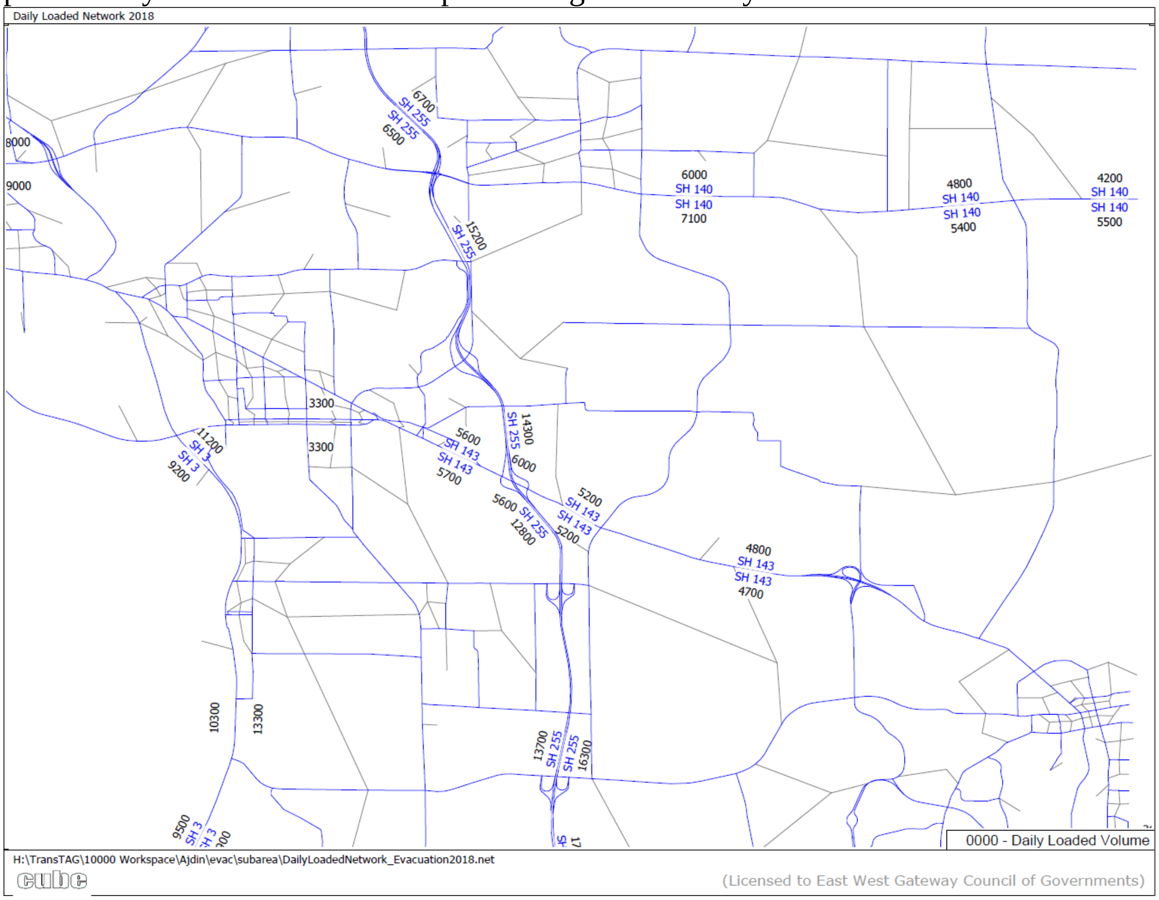

Figure 2: Daily Loaded Volume in Study Area

2. Midday Evacuation Traffic Estimation Method

Demand

Based on a study by Reuben Goldblatt and KLD Associates, "Evacuation Planning Human Factors and Traffic Engineering Perspectives", the scenario for this evacuation model was modeled by assigning trips in two steps. This document describes the process of evacuating as mobilization and evacuation. The first sequence, mobilization, is performed when the public receives notification for work, prepares to leave work and then travels home. If the public is already at home, then the sequence for mobilization would only require them to receive notification information and be at home. The second sequence, evacuation, is performed when the public prepares their home to leave for an evacuation trip. Figure two demonstrates this process graphically. Steps, 1, 2, 3 and 4 are part of the mobilization sequence. These steps can follow a basic order of 1, 2, 3, and 4. Or, if the public is already at home, then the only steps are 1 and 2. Finally, going from step 2 or 4 to 5 is the sequence for evacuation.

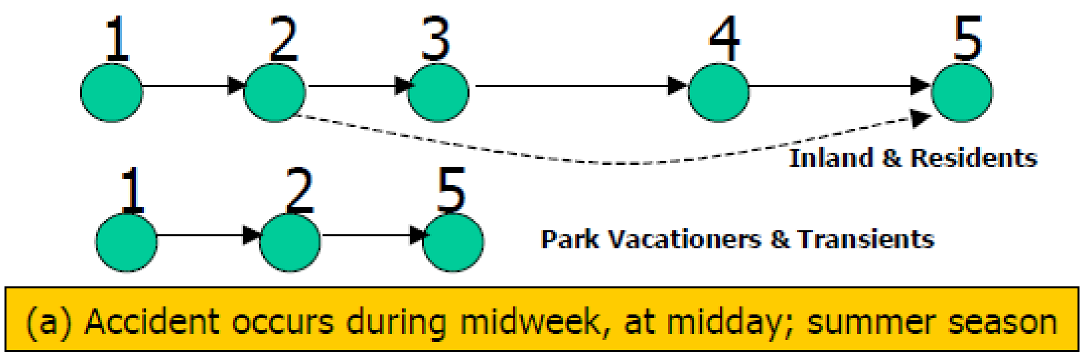

Figure 3: Graphical representation of Mobilization and Evacuation Sequence

Initially, the trip tables were manipulated to reflect the travel patterns seen during an evacuation scenario. In the mobilization sequence, the travel will be internal as well as internal-external (some people are leaving) and external-internal responders and emergency staff mobilized. As for the evacuation sequence, the travel will only be internal-external. For this study, the trips by purpose were examined and a determination was made as far as the amount and type of trips that will be executed during an evacuation sequence. To mimic this effect, the total daily trips by occupancy were manipulated based on the Goldblatt and KLD study. To recreate this in the travel demand model we used the hourly trips by occupancy type and split them into mobilization and evacuation sequence trips. For the mobilization sequence, we configured the input matrices to reflect the traffic information for its three hour duration. Similarly, the evacuation matrix is split into six hours, with the spread shown below in table one.

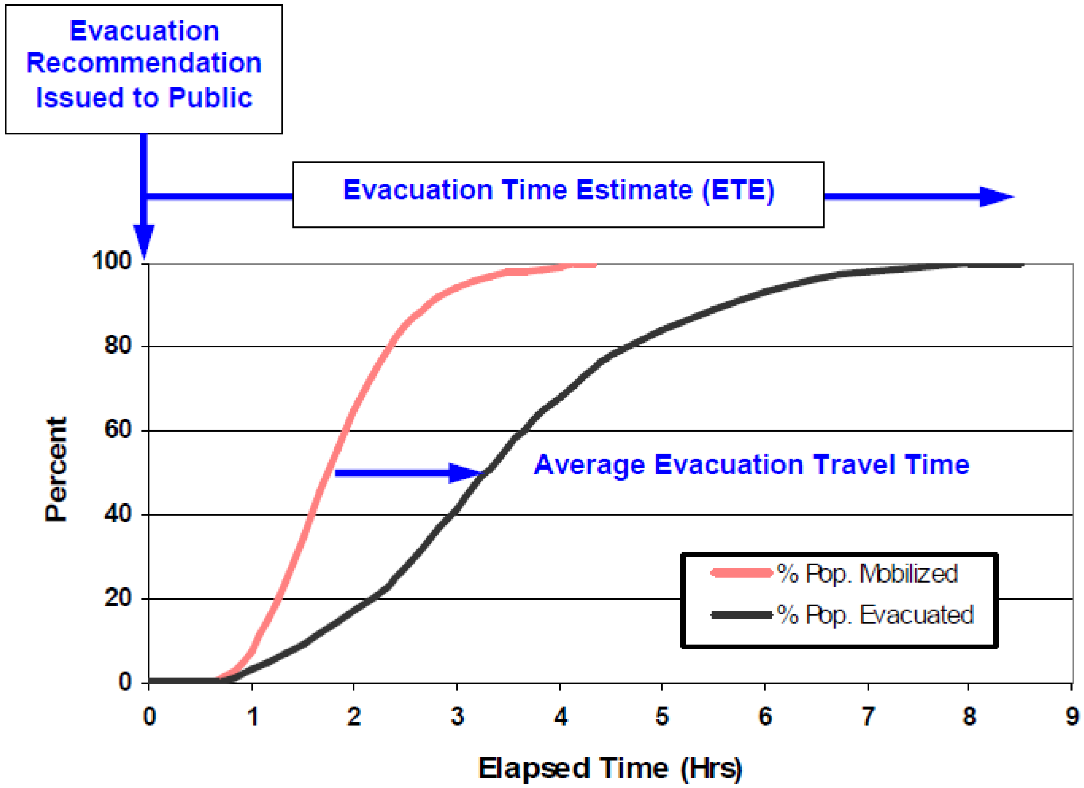

Figure 4: Evacuation Time Estimate vs. Average Evacuation Travel Time

Elapsed time after notice→	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6
Mobilization traffic→	20%	50%	30%			
Evacuation traffic→	3%	15%	20%	27%	18%	17%

Table 1: Spread of Mobilization and Evacuation Trips.

Vulnerable Population

Although this was not part of the travel demand modeling, an assessment of the population is a foresight into good evacuation planning. Considering that time is of the essence in emergency situations, having a good understanding of the vulnerable population is key to maintaining a high survival rate. The vulnerable population would include people have disabilities or medical conditions that would require extra time or special modes of transportation, those who are in a low income bracket or do not have means of transportation and people that are above the age of 65. Figure five shows the vulnerable populations in grey against the backdrop of the study area and roadway network. These are the five largest vulnerable populations within this study area.

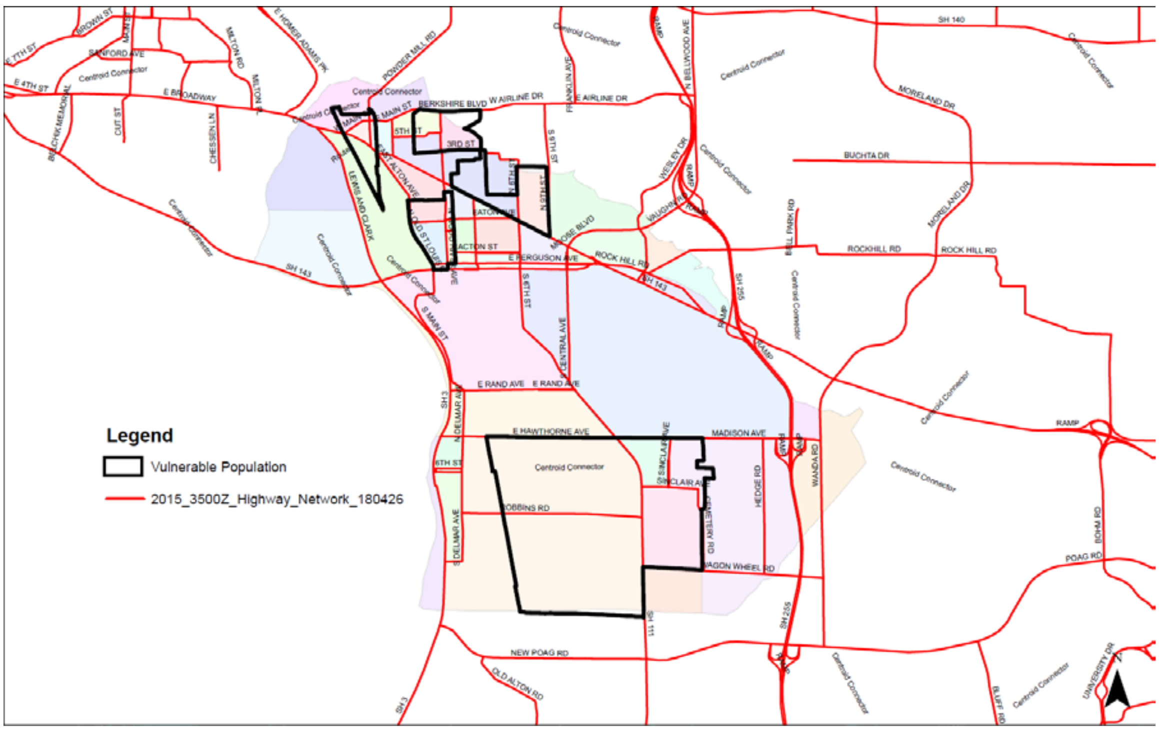

Figure 5: Vulnerable Population against Study Area and Network

3. Demand Matrices and VISSIM

For the scenario above, the demand matrix is extracted from the regional demand model and used in VISSIM for microsimulation. It is important to note that the traffic zones delivered are small, and coincide with the VISSIM network developed and the sinks or zones used. When the sub area is extracted from the full network, each link that is 'cut' becomes an external station. This way we get the demand from the specific roadway network that SIUE wanted. The following figures show the sub-area network, sub-area network over the full network, SIUE's requested sub-area network and corresponding demand matrices extraction.

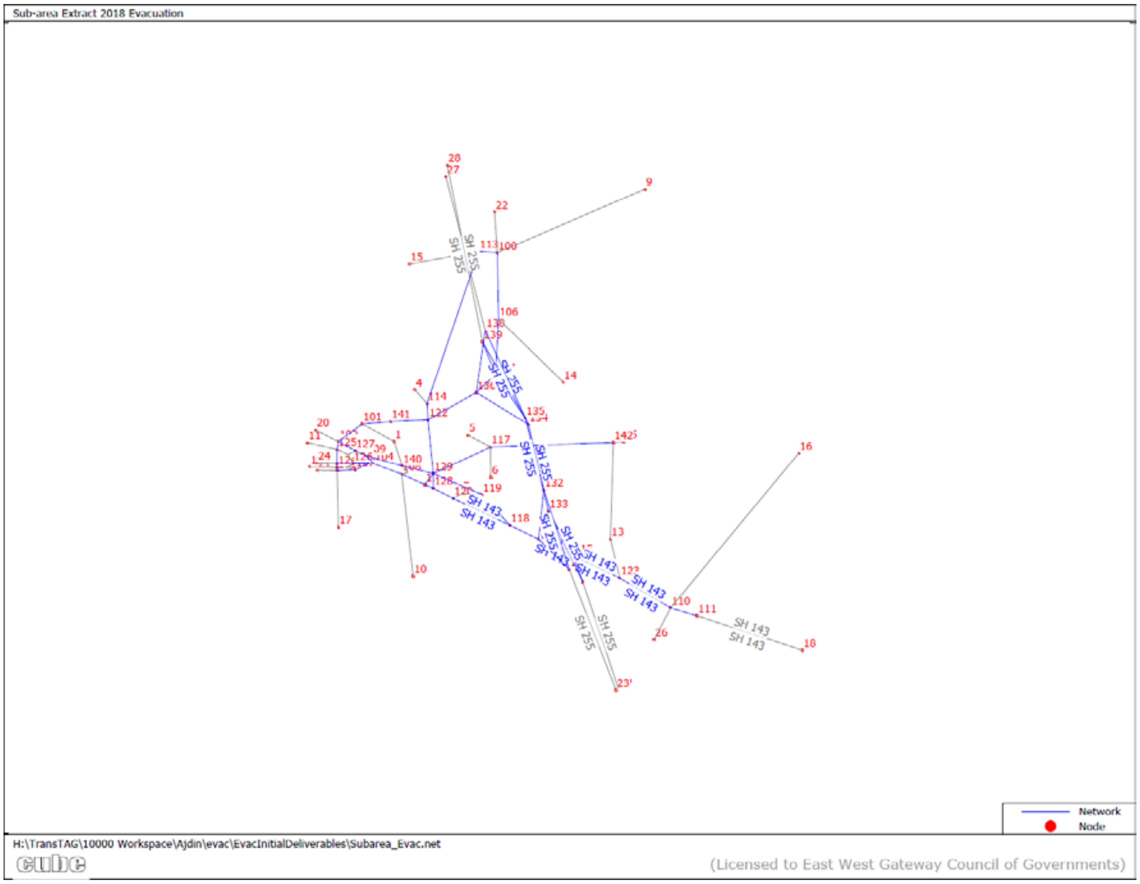

Figure 6: Sub-Area Network Extraction

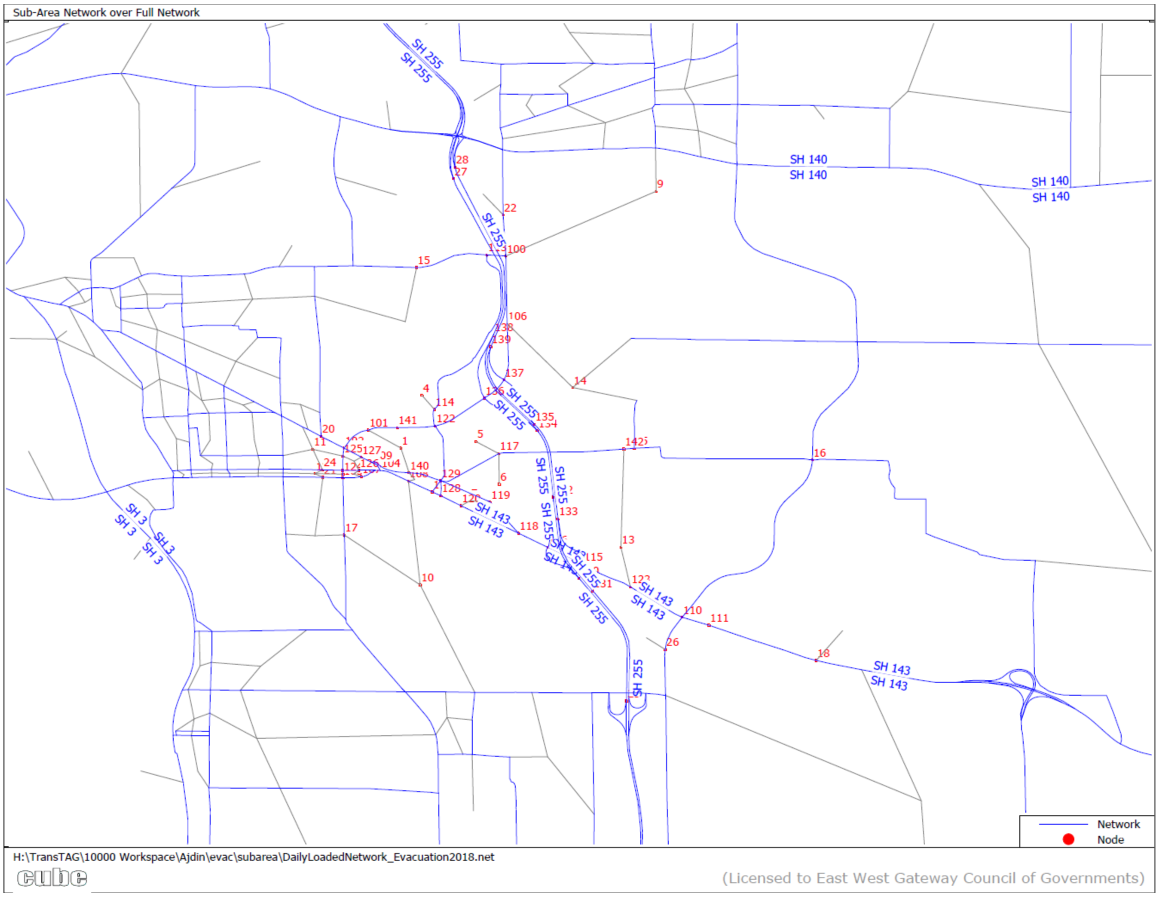

Figure 7: Sub-Area Network over complete network

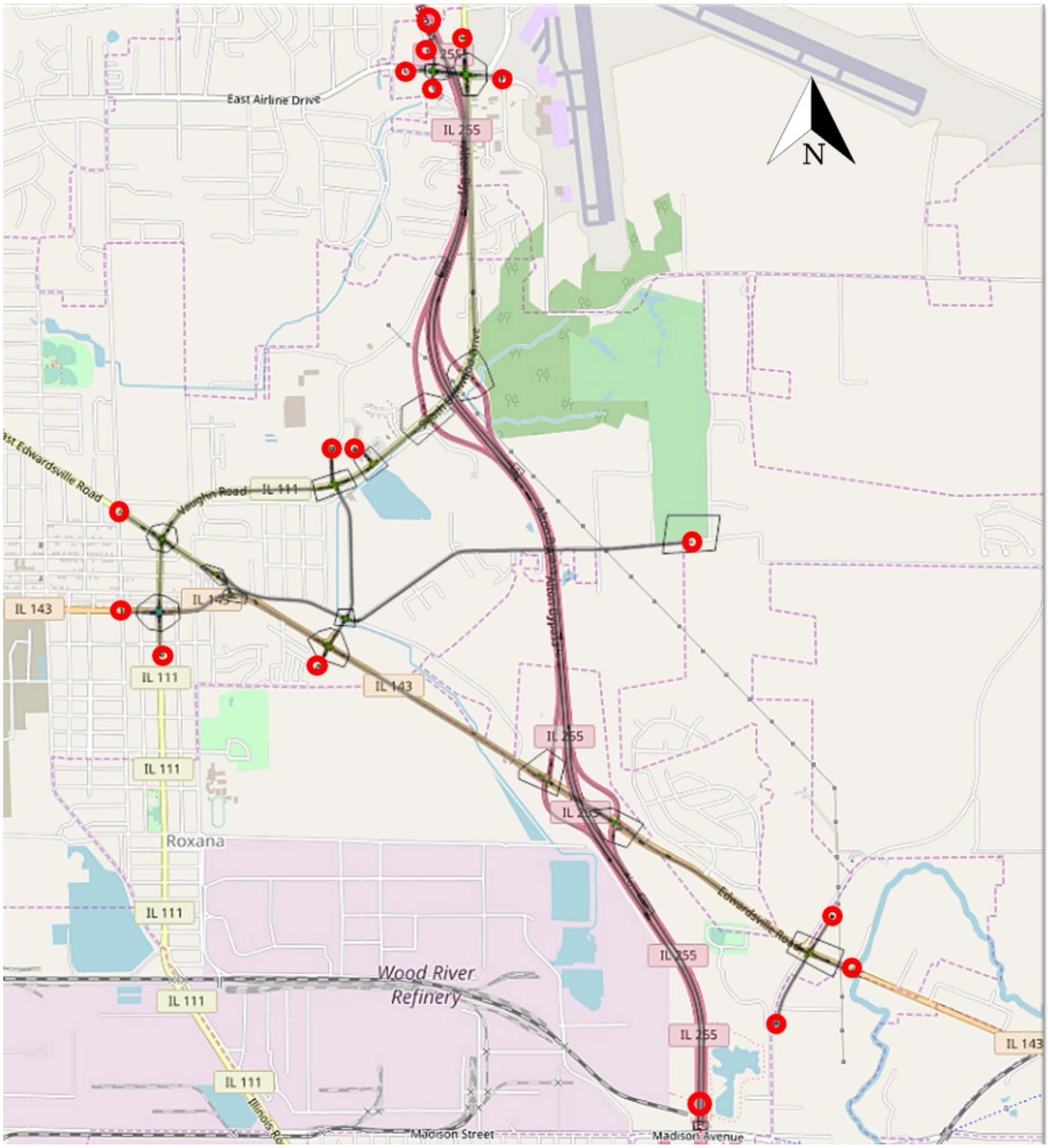

Figure 8: SIUE sub-area network

Data was reviewed in conjunction with the VISSIM network and the sub-area was finalized. All VISSIM modeling was conducted by SIUE team, under Dr. Ryan's supervision.

APPENDIX A

Works Cited

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