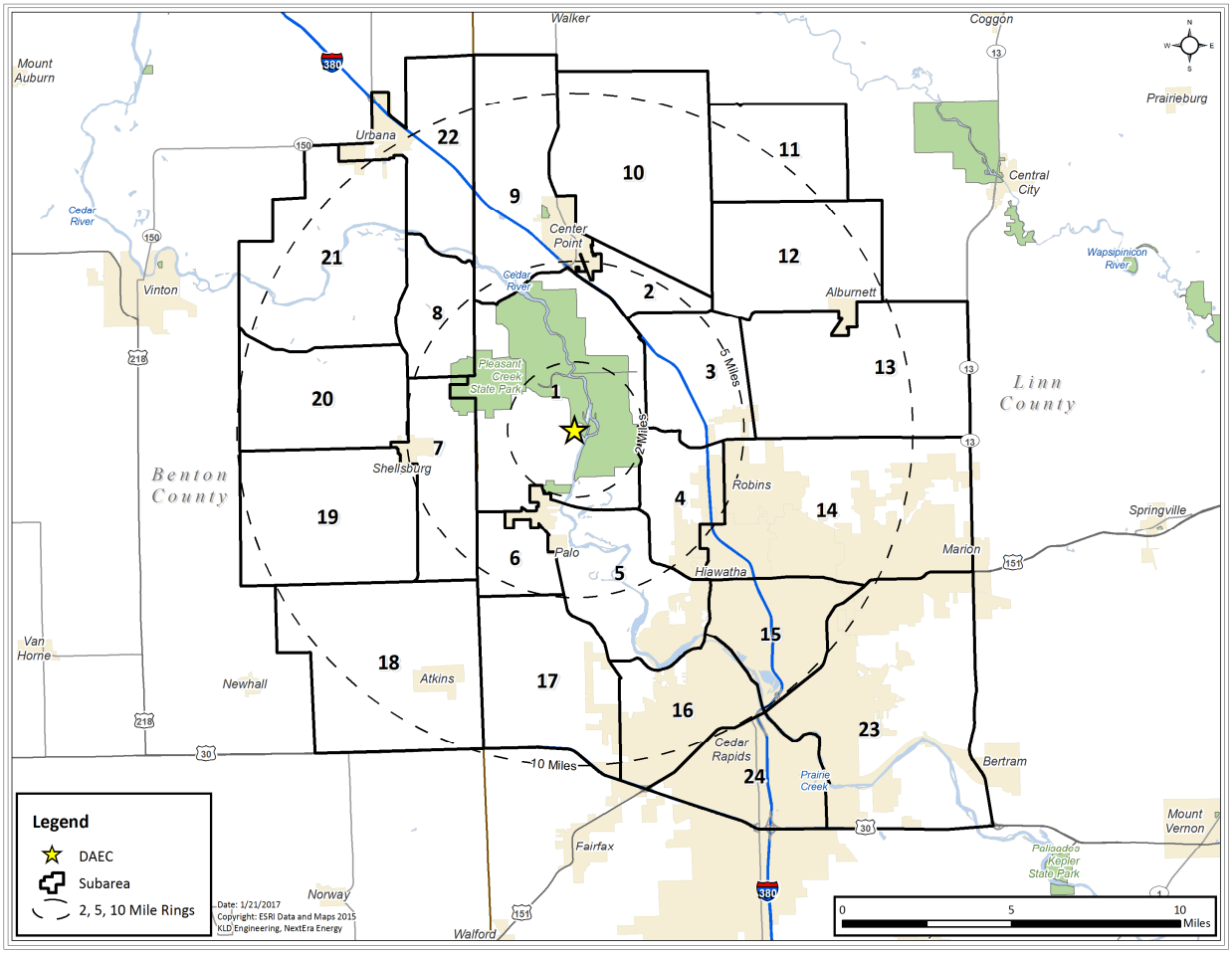
KLD ENGINEERING, P.C.

Duane Arnold Energy Center

Development of Evacuation Time Estimates

for Revised EPZ Boundary



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ABSTRACT

Federal regulations (10CFR50, Appendix E, Section IV, Items 3 and 4) require nuclear power plant licensees to:

- Conduct an Evacuation Time Estimate (ETE, the time needed to evacuate the plume exposure pathway Emergency Planning Zone – EPZ – around a nuclear power plant) study using the most recent decennial census data and submit the study to the Nuclear Regulatory Commission (NRC) for review
- After NRC review, use the approved ETE study to formulate protective action recommendations (PAR)
- Provide the ETE to State and local governmental authorities for use in developing offsite protective action strategies

NextEra Energy (NextEra) conducted an ETE study in 2012 for the Duane Arnold Energy Center (DAEC) using the data from the 2010 Census, and submitted to the NRC for review. Following NRC review, the ETE study was used by NextEra and the State and county agencies within the EPZ to formulate PAR and develop offsite protective action strategies.

This document serves as an update to the 2012 ETE study based on the following:

- A reduction in the size of the EPZ boundary requested by the Linn County Emergency Management Commission. Specifically, the area south of U.S. Highway 30 in Subarea 24 will be removed, thereby resulting in less people and vehicles evacuating from the Subarea
- Consideration of bottlenecks beyond the original study area (out to 15-miles radially from the plant as per NRC guidance), especially along U.S. Highway 30 eastbound leaving the City of Cedar Rapids towards Mount Vernon. These bottlenecks result in queuing outside the EPZ which significantly reduces the available roadway capacity to evacuees within the EPZ.

Comparing the 2012 study and this study, the impact on ETE of these changes is as follows:

- The 2-mile region, 5-mile region, and keyholes comprised of the 2-mile region and downwind sectors to 5-miles were not significantly impacted (changes of 5 minutes or less) as both changes identified above were well beyond the 5-mile radius from DAEC.
- The reduction in EPZ size reduced the ETE for the full EPZ by up to 35 minutes at the 90th percentile and up to 1 hour and 10 minutes at the 100th percentile as approximately 9,000 less vehicles are evacuating from Subarea 24.
- The ETE for the full EPZ and for keyholes comprised of the 2-mile region and downwind sectors to the EPZ boundary were significantly increased (up to 55 minutes at the 90th percentile and 1 hour and 55 minutes at the 100th percentile) for wind directions which blow over the City of Cedar Rapids. The increase in ETE was the direct result of consideration of bottlenecks beyond the original study area.

Despite the changes in ETE, the PAR do not change based on the criteria documented in the federal guidance – NUREG-0654/FEMA-REP-1, Rev. 1, Supplement 3:

- The 90th percentile ETE for the 2-mile region are less than 2 hours (criterion for immediate evacuation of the 2-mile region) in the 2012 study, and in this study.
- The 90th percentile ETE for the keyholes comprised of the 2-mile region and downwind sectors to 5-miles are less than 3 hours (criterion for immediate evacuation of the downwind sectors to 5 miles) in the 2012 study, and in this study.
- The 90th percentile ETE for the full EPZ is greater than 3 hours (criterion for immediate evacuation of the downwind sectors to the EPZ boundary) in the 2012 study, and in this study.
- Staged evacuation showed no benefit in the 2012 study, and in this study.

Table of Contents

1 INTRODUCTION 1-1

1.1 Overview of the ETE Process 1-4
1.2 The Duane Arnold Energy Center Location 1-6
1.3 Preliminary Activities 1-8
1.4 Comparison with Prior ETE Study 1-12

2 STUDY ESTIMATES AND ASSUMPTIONS 2-1

2.1 Data Estimates 2-1
2.2 Study Methodological Assumptions 2-2
2.3 Study Assumptions 2-3

3 DEMAND ESTIMATION 3-1

3.1 Permanent Residents 3-3
3.1.1 College Students 3-5

3.2 Shadow Population 3-12
3.3 Transient Population 3-15
3.4 Employees 3-19
3.5 Special Facilities 3-23
3.6 External Traffic 3-23
3.7 Background Traffic 3-23
3.8 Special Event 3-24
3.9 Summary of Demand 3-24

4 ESTIMATION OF HIGHWAY CAPACITY 4-1

4.1 Capacity Estimations on Approaches to Intersections 4-2
4.2 Capacity Estimation along Sections of Highway 4-4
4.3 Application to the Duane Arnold Energy Center Study Area 4-6
4.3.1 Two-Lane Roads 4-6
4.3.2 Multi-Lane Highway 4-6
4.3.3 Freeways 4-7
4.3.4 Intersections 4-8

4.4 Simulation and Capacity Estimation 4-8
4.5 Boundary Conditions 4-9

5 ESTIMATION OF TRIP GENERATION TIME 5-1

5.1 Background 5-1
5.2 Fundamental Considerations 5-3
5.3 Estimated Time Distributions of Activities Preceding Event 5 5-6
5.4 Calculation of Trip Generation Time Distribution 5-12
5.4.1 Statistical Outliers 5-13
5.4.2 Staged Evacuation Trip Generation 5-16

6 DEMAND ESTIMATION FOR EVACUATION SCENARIOS 6-1

7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE) 7-1

7.1 Voluntary Evacuation and Shadow Evacuation 7-1

7.2 Staged Evacuation 7-1
7.3 Patterns of Traffic Congestion during Evacuation 7-2
7.4 Evacuation Rates 7-4
7.5 Evacuation Time Estimate (ETE) Results 7-4
7.6 Staged Evacuation Results 7-6
7.7 Protective Action Recommendation Logic 7-7
7.8 Guidance on Using ETE Tables 7-7
8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES 8-1
8.1 Transit Dependent People Demand Estimate 8-2
8.2 School, College, Preschool and Day Care Center Population – Transit Demand 8-4
8.3 Medical Facilities and Group Homes 8-4
8.4 Evacuation Time Estimates for Transit Dependent People 8-5
8.5 Special Needs Population 8-12
8.6 Correctional Facilities 8-14
9 TRAFFIC MANAGEMENT STRATEGY 9-1
10 EVACUATION ROUTES 10-1
11 SURVEILLANCE OF EVACUATION OPERATIONS 11-1
12 CONFIRMATION TIME 12-1

List of Appendices

A. GLOSSARY OF TRAFFIC ENGINEERING TERMS A-1
B. DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL B-1
C. DYNEV TRAFFIC SIMULATION MODEL C-1
C.1 Methodology C-5
C.1.1 The Fundamental Diagram C-5
C.1.2 The Simulation Model C-5
C.1.3 Lane Assignment C-12
C.2 Implementation C-12
C.2.1 Computational Procedure C-12
C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD) C-15
D. DETAILED DESCRIPTION OF STUDY PROCEDURE D-1
E. SPECIAL FACILITY DATA E-1
F. TELEPHONE SURVEY F-1
F.1 Introduction F-1
F.2 Survey Instrument and Sampling Plan F-2
F.3 Survey Results F-4
F.3.1 Household Demographic Results F-5
F.3.2 Evacuation Response F-10
F.3.3 Time Distribution Results F-14

F.4 Conclusions F-17
G. TRAFFIC MANAGEMENT PLAN G-1
G.1 Traffic Control Points G-1
G.2 Access Control Points G-2
H EVACUATION REGIONS H-1
J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM J-1
K. EVACUATION ROADWAY NETWORK K-1
L. SUBAREA BOUNDARIES L-1
M. EVACUATION SENSITIVITY STUDIES M-1
M.1 Effect of Changes in Trip Generation Times M-1
M.2 Effect of Changes in the Number of People in the Shadow Region Who Relocate M-2
M.3 Effect of Changes in EPZ Resident Population M-3
M.4 Effect of Changes to EPZ Boundary M-5
M.4.1 Introduction M-5
M.4.2 Methodology M-5
M.4.3 Assumptions M-6
M.4.4 Results M-7
N. ETE CRITERIA CHECKLIST N-1

Note: Appendix I intentionally skipped

List of Figures

Figure 1-1. Proposed EPZ Change 1-2
Figure 1-2. DAEC Location 1-7
Figure 1-3. DAEC Link-Node Analysis Network 1-10
Figure 2-1. Voluntary Evacuation Methodology 2-9
Figure 3-1. Subareas Comprising the DAEC EPZ 3-2
Figure 3-2. Census Boundaries within the DAEC Study Area 3-7
Figure 3-3. Permanent Resident Population by Sector 3-10
Figure 3-4. Permanent Resident Vehicles by Sector 3-11
Figure 3-5. Shadow Population by Sector 3-13
Figure 3-6. Shadow Vehicles by Sector 3-14
Figure 3-7. Transient Population by Sector 3-17
Figure 3-8. Transient Vehicles by Sector 3-18
Figure 3-9. Employee Population by Sector 3-21
Figure 3-10. Employee Vehicles by Sector 3-22
Figure 4-1. Fundamental Diagrams 4-9
Figure 5-1. Events and Activities Preceding the Evacuation Trip 5-5
Figure 5-2. Time Distributions for Evacuation Mobilization Activities 5-11
Figure 5-3. Comparison of Data Distribution and Normal Distribution 5-14
Figure 5-4. Comparison of Trip Generation Distributions 5-19
Figure 5-5. Comparison of Staged and Un-staged Trip Generation Distributions in the 2 to 5 Mile Region 5-21
Figure 6-1. Subareas Comprising the DAEC EPZ 6-5
Figure 7-1. Voluntary Evacuation Methodology 7-18
Figure 7-2. DAEC Shadow Region 7-19
Figure 7-3. Congestion Patterns at 30 Minutes after the Advisory to Evacuate 7-20
Figure 7-4. Congestion Patterns at 1 Hour after the Advisory to Evacuate 7-21
Figure 7-5. Congestion Patterns at 2 Hours and 45 Minutes after the Advisory to Evacuate 7-22
Figure 7-6. Congestion Patterns at 3 Hours and 30 Minutes after the Advisory to Evacuate 7-23
Figure 7-7. Congestion Patterns at 5 Hours after the Advisory to Evacuate 7-24
Figure 7-8. Congestion Patterns at 6 Hours after the Advisory to Evacuate 7-25
Figure 7-9. Congestion Patterns at 6 Hours and 50 Minutes after the Advisory to Evacuate 7-26
Figure 7-10. Congestion Patterns at 7 Hours and 35 Minutes after the Advisory to Evacuate 7-27
Figure 7-11. Evacuation Time Estimates - Scenario 1 for Region R03 7-28
Figure 7-12. Evacuation Time Estimates - Scenario 2 for Region R03 7-28
Figure 7-13. Evacuation Time Estimates - Scenario 3 for Region R03 7-29
Figure 7-14. Evacuation Time Estimates - Scenario 4 for Region R03 7-29
Figure 7-15. Evacuation Time Estimates - Scenario 5 for Region R03 7-30
Figure 7-16. Evacuation Time Estimates - Scenario 6 for Region R03 7-30
Figure 7-17. Evacuation Time Estimates - Scenario 7 for Region R03 7-31
Figure 7-18. Evacuation Time Estimates - Scenario 8 for Region R03 7-31
Figure 7-19. Evacuation Time Estimates - Scenario 9 for Region R03 7-32
Figure 7-20. Evacuation Time Estimates - Scenario 10 for Region R03 7-32
Figure 7-21. Evacuation Time Estimates - Scenario 11 for Region R03 7-33
Figure 7-22. Evacuation Time Estimates - Scenario 12 for Region R03 7-33
Figure 7-23. Evacuation Time Estimates - Scenario 13 for Region R03 7-34

Figure 7-24. Evacuation Time Estimates - Scenario 14 for Region R03 7-34
Figure 8-1. Chronology of Transit Evacuation Operations 8-15
Figure 8-2. Transit-Dependent Bus Routes 8-16
Figure 8-3. Transit Dependent Bus Routes – Cedar Rapids 8-17
Figure 10-1. General Population and Temporary Relocation Centers 10-2
Figure 10-2. Evacuation Route Map 10-3
Figure B-1. Flow Diagram of Simulation-DTRAD Interface B-5
Figure C-1. Representative Analysis Network C-4
Figure C-2. Fundamental Diagrams C-6
Figure C-3. A UNIT Problem Configuration with $t_1 > 0$ C-6
Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3) C-14
Figure D-1. Flow Diagram of Activities D-5
Figure E-1. Overview of Schools, Pre-Schools and Daycares within the EPZ E-15
Figure E-2. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with A-G) E-16
Figure E-3. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with H-K) E-17
Figure E-4. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with L-R) E-18
Figure E-5. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with S-Z) E-19
Figure E-6. Medical Facilities within the EPZ E-20
Figure E-7. Employment Locations within the EPZ which Attract Employees from Outside the EPZ E-21
Figure E-8. Recreational Areas within the EPZ E-22
Figure E-9. Lodging Facilities within the EPZ (1 of 2) E-23
Figure E-10. Lodging Facilities within the EPZ (2 of 2) E-24
Figure E-11. Correctional Facilities within the EPZ E-25
Figure F-1. Household Size in the EPZ F-5
Figure F-2. Household Vehicle Availability F-6
Figure F-3. Vehicle Availability - 1 to 5 Person Households F-7
Figure F-4. Vehicle Availability - 6 to 9+ Person Households F-7
Figure F-5. Household Ridesharing Preference F-8
Figure F-6. Commuters in Households in the EPZ F-9
Figure F-7. Modes of Travel in the EPZ F-10
Figure F-8. Number of Vehicles Used for Evacuation F-11
Figure F-9. Households Evacuating with Pets F-12
Figure F-10. Households with Pets that would Evacuate if Evacuation Centers do not Accept Pets F-12
Figure F-11. Evacuation Destinations F-13
Figure F-12. Time Required to Prepare to Leave Work/College F-14
Figure F-13. Time to Travel Home from Work/College F-15
Figure F-14. Time to Prepare Home for Evacuation F-16
Figure F-15. Time to Clear Driveway of 6"-8" of Snow F-17
Figure G-1. Traffic and Access Control Points for the Duane Arnold Energy Center G-3
Figure G-2. New TCP Schematic – Iowa 1 and Martelle Rd G-4
Figure G-3. New TCP Schematic – US-151 and Springville Rd G-5
Figure G-4. New TCP Schematic – Iowa 1 and Cedar River Rd G-6
Figure G-5. New TCP Schematic – Iowa 1 and Iowa 382 NE G-7

Figure G-6. New TCP Schematic – 21st Ave and 77th St G-8
Figure G-7. New ACP Schematic – US-30 and Iowa 1 ..... G-9
Figure H-1. Region R01 ..... H-4
Figure H-2. Region R02 ..... H-5
Figure H-3. Region R03 ..... H-6
Figure H-4. Region R04 ..... H-7
Figure H-5. Region R05 ..... H-8
Figure H-6. Region R06 ..... H-9
Figure H-7. Region R07 ..... H-10
Figure H-8. Region R08 ..... H-11
Figure H-9. Region R09 ..... H-12
Figure H-10. Region R10 ..... H-13
Figure H-11 Region R11 ..... H-14
Figure H-12 Region R12 ..... H-15
Figure H-13 Region R13 ..... H-16
Figure H-14 Region R14 ..... H-17
Figure H-15 Region R15 ..... H-18
Figure H-16 Region R16 ..... H-19
Figure H-17 Region R17 ..... H-20
Figure H-18 Region R18 ..... H-21
Figure H-19 Region R19 ..... H-22
Figure H-20 Region R20 ..... H-23
Figure H-21 Region R21 ..... H-24
Figure H-22 Region R22 ..... H-25
Figure H-23 Region R23 ..... H-26
Figure H-24 Region R24 ..... H-27
Figure H-25 Region R25 ..... H-28
Figure H-26 Region R26 ..... H-29
Figure H-27 Region R27 ..... H-30
Figure H-28 Region R28 ..... H-31
Figure H-29 Region R29 ..... H-32
Figure H-30 Region R30 ..... H-33
Figure H-31 Region R31 ..... H-34
Figure H-32 Region R32 ..... H-35
Figure H-33 Region R33 ..... H-36
Figure H-34 Region R34 ..... H-37
Figure H-35 Region R35 ..... H-38
Figure H-36 Region R36 ..... H-39
Figure H-37 Region R37 ..... H-40
Figure H-38 Region R38 ..... H-41
Figure J-1. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1) J-9
Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2) J-9
Figure J-3. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3) J-10
Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4) J-10
Figure J-5. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5) J-11
Figure J-6. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6) J-11

Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7) J-12
Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Snow (Scenario 8) J-12
Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9) J-13
Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 10) J-13
Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Snow (Scenario 11) J-14
Figure J-12. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12) J-14
Figure J-13. ETE and Trip Generation: Summer, Evening, Good Weather, Special Event (Scenario 13) J-15
Figure J-14. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14) J-15
Figure K-1. Duane Arnold Energy Center Link-Node Analysis Network K-2
Figure K-2. Link-Node Analysis Network – Grid 1 ..... K-3
Figure K-3. Link-Node Analysis Network – Grid 2 ..... K-4
Figure K-4. Link-Node Analysis Network – Grid 3 ..... K-5
Figure K-5. Link-Node Analysis Network – Grid 4 ..... K-6
Figure K-6. Link-Node Analysis Network – Grid 5 ..... K-7
Figure K-7. Link-Node Analysis Network – Grid 6 ..... K-8
Figure K-8. Link-Node Analysis Network – Grid 7 ..... K-9
Figure K-9. Link-Node Analysis Network – Grid 8 ..... K-10
Figure K-10. Link-Node Analysis Network – Grid 9 ..... K-11
Figure K-11. Link-Node Analysis Network – Grid 10 ..... K-12
Figure K-12. Link-Node Analysis Network – Grid 11 ..... K-13
Figure K-13. Link-Node Analysis Network – Grid 12 ..... K-14
Figure K-14. Link-Node Analysis Network – Grid 13 ..... K-15
Figure K-15. Link-Node Analysis Network – Grid 14 ..... K-16
Figure K-16. Link-Node Analysis Network – Grid 15 ..... K-17
Figure K-17. Link-Node Analysis Network – Grid 16 ..... K-18
Figure K-18. Link-Node Analysis Network – Grid 17 ..... K-19
Figure K-19. Link-Node Analysis Network – Grid 18 ..... K-20
Figure K-20. Link-Node Analysis Network – Grid 19 ..... K-21
Figure K-21. Link-Node Analysis Network – Grid 20 ..... K-22
Figure K-22. Link-Node Analysis Network – Grid 21 ..... K-23
Figure K-23. Link-Node Analysis Network – Grid 22 ..... K-24
Figure K-24. Link-Node Analysis Network – Grid 23 ..... K-25
Figure K-25. Link-Node Analysis Network – Grid 24 ..... K-26
Figure K-26. Link-Node Analysis Network – Grid 25 ..... K-27
Figure K-27. Link-Node Analysis Network – Grid 26 ..... K-28
Figure K-28. Link-Node Analysis Network – Grid 27 ..... K-29
Figure K-29. Link-Node Analysis Network – Grid 28 ..... K-30
Figure K-30. Link-Node Analysis Network – Grid 29 ..... K-31
Figure K-31. Link-Node Analysis Network – Grid 30 ..... K-32
Figure K-32. Link-Node Analysis Network – Grid 31 ..... K-33
Figure M-1. Proposed Modification to EPZ 8
Figure M-2. 2012 Link-Node Analysis Network 9
Figure M-3. 2016 Link-Node Analysis Network 10
Figure M-4. ETE and EPZ Boundary Change – Scenario 1 ..... M-13

Figure M-5. ETE and EPZ Boundary Change – Scenario 6 ..... M-14

List of Tables

Table 1-1. Stakeholder Interaction 1-4
Table 1-2. Highway Characteristics 1-8
Table 1-3. ETE Study Comparisons 1-14
Table 2-1. Evacuation Scenario Definitions 2-6
Table 2-2. Model Adjustment for Adverse Weather 2-8
Table 3-1. County Population Change and Annual Growth Rate from April 1, 2010 to July 1, 2015 3-6
Table 3-2. Municipality Population Change and Annual Growth Rate from April 1, 2010 to July 1, 2015 3-6
Table 3-3. EPZ Permanent Resident Population 3-8
Table 3-4. Permanent Resident Population and Vehicles by Subarea 3-9
Table 3-5. Shadow Population and Vehicles by Sector 3-12
Table 3-6. Summary of Transients and Transient Vehicles 3-16
Table 3-7. Summary of Employees and Employee Vehicles Commuting into the EPZ 3-20
Table 3-8. External Traffic Traversing the DAEC Study Area 3-25
Table 3-9. Summary of Population Demand 3-26
Table 3-10. Summary of Vehicle Demand 3-27
Table 5-1. Event Sequence for Evacuation Activities 5-3
Table 5-2. Time Distribution for Notifying the Public 5-6
Table 5-3. Time Distribution for Employees to Prepare to Leave Work 5-7
Table 5-4. Time Distribution for Commuters to Travel Home 5-8
Table 5-5. Time Distribution for Population to Prepare to Leave Home 5-9
Table 5-6. Time Distribution for Population to Clear 6"-8" of Snow 5-10
Table 5-7. Mapping Distributions to Events 5-12
Table 5-8. Description of the Distributions 5-12
Table 5-9. Trip Generation Histograms for the EPZ Population for Un-staged Evacuation 5-18
Table 5-10. Trip Generation Histograms for the EPZ Population for Staged Evacuation 5-20
Table 6-1. Description of Evacuation Regions 6-3
Table 6-2. Evacuation Scenario Definitions 6-6
Table 6-3. Percent of Population Groups Evacuating for Various Scenarios 6-7
Table 6-4. Vehicle Estimates by Scenario 6-8
Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population 7-10
Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population 7-12
Table 7-3. Time to Clear *90* Percent of the 2-Mile Region when Evacuating Additional Subareas Downwind to 5 Miles 7-14
Table 7-4. Time to Clear *100* Percent of the 2-Mile Region when Evacuating Additional Subareas Downwind to 5 Miles 7-15
Table 7-5. Description of Evacuation Regions 7-16
Table 8-1. Transit-Dependent Population Estimates 8-18
Table 8-2. School, College, Preschool and Daycare Population Demand Estimates 8-19
Table 8-3. Temporary Relocation Centers for Schools, Preschools and Daycares 8-23
Table 8-4. Transit Demand for Medical Facilities and Group Homes 8-27
Table 8-5. Summary of Transportation Resource Capacities 8-30

Table 8-6. Bus Route Descriptions 8-32
Table 8-7. Evacuation Time Estimates for Schools, Preschools and Daycares - Good Weather 8-39
Table 8-8. Evacuation Time Estimates for Schools, Preschools and Daycares – Rain 8-45
Table 8-9. Evacuation Time Estimates for Schools, Preschools and Daycares – Snow 8-51
Table 8-10. Summary of Transit-Dependent Bus Routes 8-57
Table 8-11. Transit-Dependent Evacuation Time Estimates - Good Weather 8-58
Table 8-12. Transit-Dependent Evacuation Time Estimates – Rain 8-62
Table 8-13. Transit Dependent Evacuation Time Estimates – Snow 8-66
Table 8-14. Medical Facility and Group Home Evacuation Time Estimates - Good Weather 8-70
Table 8-15. Medical Facility and Group Home Facility Evacuation Time Estimates – Rain 8-73
Table 8-16. Medical Facility and Group Home Evacuation Time Estimates – Snow 8-76
Table 8-17. Homebound Special Needs Population Evacuation Time Estimates 8-79
Table 8-18. Homebound Special Needs Persons Evacuation Time Estimates - Second Wave for Ambulatory/Wheelchair Bound 8-80
Table 8-19. Correctional Facility Evacuation Time Estimates 8-81
Table 12-1. Estimated Number of Telephone Calls Required for Confirmation of Evacuation 12-2
Table A-1. Glossary of Traffic Engineering Terms A-1
Table C-1. Selected Measures of Effectiveness Output by DYNEV II C-2
Table C-2. Input Requirements for the DYNEV II Model C-3
Table C-3. Glossary C-7
Table E-1. Schools, Pre-Schools and Daycares within the EPZ E-2
Table E-2. Medical Facilities within the EPZ E-8
Table E-3. Major Employers within the EPZ E-10
Table E-4. Recreational Areas within the EPZ E-11
Table E-5. Lodging Facilities within the EPZ E-12
Table E-6. Correctional Facilities within the EPZ E-14
Table F-1. DAEC Telephone Survey Sampling Plan F-3
Table H-1. Percent of Subarea Population Evacuating for Each Region H-2
Table J-1. Characteristics of the Ten Highest Volume Signalized Intersections J-2
Table J-2. Sample Simulation Model Input J-4
Table J-3. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03) J-5
Table J-4. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1) J-6
Table J-5. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1 ..... J-7
Table K-1. Evacuation Roadway Network Characteristics K-34
Table K-2. Nodes in the Link-Node Analysis Network which are Controlled K-131
Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study M-1
Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study M-2
Table M-3. ETE Variation with Population Change M-4
Table M-4. 2016 Population and Vehicles within the Removed Portion of Subarea 24 11
Table M-5. Comparison of Vehicle Demand 11
Table M-6. ETE Variation with EPZ Boundary & Population Change M-12
Table N-1. ETE Review Criteria Checklist N-1

EXECUTIVE SUMMARY

ES.1. Introduction

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Duane Arnold Energy Center (DAEC) located in Linn County, Iowa. ETE are part of the required planning basis and provide NextEra Energy and State and local governments with site-specific information needed for Protective Action decision-making.

The last ETE study done for the DAEC was dated December 2012. It incorporated 2010 Census data and adhered to new federal regulations and guidance that were published in November 2011. In 2013, the Linn County Emergency Management Commission requested to reduce the size of the DAEC Emergency Planning Zone (EPZ). The area proposed to be removed is located in Subarea 24 south of U.S. Highway 30 (US-30) bounded on the west by Edgewood Road, the south by 76th Ave SW, and on the east by C Street Road SW. The area removed from the EPZ includes the entire College Community School District main campus,

Part IV, Section K of the January 2016 FEMA Radiological Emergency Preparedness (REP) Program Manual outlines the process for making changes to the EPZ boundary:

> If an ORO wants to change the boundary of an existing EPZ, the proposal must be submitted to the FEMA Regional Administrator or his/her designee, usually the RAC [Regional Assistance Committee] Chair. The proposal shall include, but not be limited to:
>
> - Action by appropriate ORO [Offsite Response Organization] officials desiring the change to the boundary (i.e., resolution by elected official, etc.);
> - Description of the change to the boundary;
> - Discussion of the population affected by the change;
> - Effect that the change has on evacuation routes or evacuation time estimates; and
> - Maps showing the existing EPZ boundary and proposed new boundary.
>
> FEMA and the RAC will review the request on its merits. After the regional review, the request and RAC recommendation will be forwarded to FEMA Headquarters for final action.
>
> If the EPZ boundary change is approved, the approval is contingent on the ORO submitting for review the appropriate changes to their plans/procedures, maps of the EPZ, public information material, and impact that the addition or subtraction of population from the EPZ has on the evacuation time estimates. The required information would include changes to the geographical boundary descriptions and the ANS [Alert and Notification System], including additional sirens or other means for public notification. Any modifications to an ANS must be consistent with Section V, Part A of this Manual [the FEMA REP Program Manual], Alert and Notification Systems.

According to NRC's Title 10 of the Code of Federal Regulations Part 50.54(q),

> The licensee may make changes to its emergency plan without NRC approval only if the licensee performs and retains an analysis demonstrating that the changes do not reduce the effectiveness of the plan and the plan, as changed, continues to meet the requirements in appendix E to this part and, for nuclear power reactor licensees, the planning standards of § 50.47(b).
>
> The changes to a licensee's emergency plan that reduce the effectiveness of the plan as defined in paragraph (q)(1)(iv) of this section may not be implemented without prior approval by the NRC. A licensee desiring to make such a change after February 21, 2012 shall submit an application for an amendment to its license. In addition to the filing requirements of §§ 50.90 and 50.91, the request must include all emergency plan pages affected by that change and must be accompanied by a forwarding letter identifying the change, the reason for the change, and the basis for concluding that the licensee's emergency plan, as revised, will continue to meet the requirements in appendix E to this part and, for nuclear power reactor licensees, the planning standards of § 50.47(b).

In accordance with the aforementioned federal regulations, this report describes the analyses undertaken and the results obtained by a study to develop ETE for the DAEC utilizing the proposed new EPZ.

In the performance of this effort, guidance is provided by documents published by Federal Governmental agencies. Most important of these are:

- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011.
- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, November 2011.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG-0654/FEMA-REP-1, Rev. 1, November 1980.
- Development of Evacuation Time Estimates for Nuclear Power Plants, NUREG/CR-6863, January 2005.

ES.2. Project Activities

This project began in April 2016 and extended over a period of approximately one year. The major activities performed are briefly described in chronological sequence:

- Phase 1 – the identification of whether or not the change in the EPZ boundary impacted the ETE, was performed. Phase 1 was an "apples to apples" comparison wherein the roadway system and the population from the 2012 ETE study were maintained, except for the removal of the portion of Subarea 24 south of US-30. The objective of the "apples to apples" comparison was to ensure that any change in ETE was the result of

the change in EPZ boundary. Phase 1 found that the 17,301 people and 9,116 vehicles removed from Subarea 24 resulted in a decrease in 90th percentile ETE of up to 20 minutes, and a decrease in 100th percentile ETE of up to 40 minutes. The results of Phase 1 are documented in KLD Technical Report (TR) – 827, dated May 11, 2016.

- Phase 2 – update the complete ETE study (by completing the activities listed below) to incorporate the change in the EPZ boundary.
- Projected 2010 Census permanent resident population to 2016 using annual growth rates computed by comparing 2010 data with 2015[1] population estimates published by the Census Bureau.
- Updated the link-node analysis network representing the highway system topology and capacities within the EPZ, plus a Shadow Region covering the region between the EPZ boundary and approximately 15 miles radially. The analysis network was expanded to as far as 25 miles south and east of the DAEC site to incorporate roadway changes since the 2012 ETE study (e.g., Highway 100 Extension in Cedar Rapids, traffic circles in the Cities of Marion and Mt. Vernon).
- Utilized the results of the 2012 telephone survey of residents within the EPZ to gather focused data needed for this ETE study that were not contained within the census database. The U.S. Census Bureau's American Community Survey (ACS)[2] household income and household size data for the counties within the EPZ for 2012, 2014[3], and 2015 were analyzed to validate that EPZ demographics are similar in 2016 to what they were in 2012, thereby justifying the use of the 2012 telephone survey results in this ETE study.
- Transient data from the 2012 ETE study were maintained based on discussion with NextEra and the OROs.
- Special facility (schools, preschools, day care centers, medical facilities, group homes, and correctional facilities) were updated based on the latest county radiological emergency plans.
- Estimated the number of employees commuting into the EPZ using data obtained from the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool[4].
- The traffic demand and trip-generation rates of evacuating vehicles were estimated from the gathered data. The trip generation rates reflect the estimated mobilization time (i.e., the time required by evacuees to prepare for the evacuation trip) computed using the results of the telephone survey of EPZ residents.

[1] The annual population estimates prepared by the Census Bureau for the entire U.S. involve an extensive data gathering process. As such, population estimates are a year behind – 2015 data are released in 2016. The schedule for release of Census data is provided on the Census website: http://www.census.gov/popest/schedule.html

[2] http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

[3] Information for 2013 and 2016 was not available.

[4] http://onthemap.ces.census.gov/

- Following federal guidelines, the existing 24 Subareas within the EPZ were grouped within circular areas or "keyhole" configurations (circles plus radial sectors) that define a total of 38 Evacuation Regions.
- The time-varying external circumstances were represented as Evacuation Scenarios, each described in terms of the following factors: (1) Season (Summer, Winter); (2) Day of Week (Midweek, Weekend); (3) Time of Day (Midday, Evening); and (4) Weather (Good, Rain, Snow). One special event scenario, the Cedar Rapids Freedom Festival, was considered. One roadway impact scenario was considered wherein a single lane was closed on Interstate-380 southbound from County Home Road (Exit 28) to the interchange with Wright Brothers Blvd (Exit 13), for the duration of the evacuation.
- Staged evacuation was considered for those regions wherein the 2-mile Region and sectors downwind to 5 miles are evacuated.
- As per NUREG/CR-7002, the Planning Basis for the calculation of ETE is:
    - A rapidly escalating accident at the DAEC that quickly assumes the status of a general emergency wherein evacuation is ordered promptly and no early protective actions have been implemented such that the Advisory to Evacuate (ATE) is virtually coincident with the siren alert.
    - While an unlikely accident scenario, this planning basis will yield ETE, measured as the elapsed time from the ATE until the stated percentage of the population exits the impacted Region that represent "upper bound" estimates. This conservative Planning Basis is applicable for all initiating events.
- The ETE for schoolchildren are calculated separately. Two separate computations of ETE were considered for school children if an accident occurs at the DAEC while schools are in session:
    - For a slowly progressing accident, children will be evacuated by bus directly to a temporary relocation center (TRC) located outside the EPZ where they will subsequently be picked up by parents.
    - For a rapidly progressing accident, children will be evacuated by bus directly to a general population reception center where they can unite with parents or guardians.
- Evacuees who do not have access to a private vehicle will either ride-share with relatives, friends or neighbors, or be evacuated by buses provided by the counties. The homebound special needs population and residents of medical facilities, group homes, and correctional facilities will likewise be evacuated with public transit, as needed: bus, van, wheelchair transport or ambulance, as required. Separate ETE are calculated for the transit-dependent evacuees, homebound special needs population, and residents of medical facilities, group homes, and correctional facilities.

ES.3. Computation of ETE

A total of 532 ETE were computed for the evacuation of the general public. Each ETE quantifies the aggregate evacuation time estimated for the population within one of the 38 Evacuation Regions to evacuate from that Region, under the circumstances defined for one of the 14 Evacuation Scenarios (38 x 14 = 532). Separate ETE are calculated for transit-dependent evacuees, including schoolchildren for applicable scenarios.

Except for Region R03, which is the evacuation of the entire EPZ, only a portion of the people within the EPZ would be advised to evacuate. That is, the Advisory to Evacuate applies only to those people occupying the specified impacted region. It is assumed that 100 percent of the people within the impacted region will evacuate in response to this Advisory. The people occupying the remainder of the EPZ outside the impacted region may be advised to take shelter.

The computation of ETE assumes that 20% of the population within the EPZ but outside the impacted region will elect to "voluntarily" evacuate. In addition, 20% of the population in the Shadow Region will also elect to evacuate. These voluntary evacuees could impede those who are evacuating from within the impacted region. The impedance that could be caused by voluntary evacuees is considered in the computation of ETE for the impacted region.

Staged evacuation is considered wherein those people within the 2-mile Region evacuate immediately, while those beyond 2 miles, but within the EPZ, shelter-in-place. Once 90 percent of the 2-mile Region is evacuated, those people beyond 2 miles begin to evacuate. As per federal guidance, 20% of people beyond 2 miles will evacuate (non-compliance) even though they are advised to shelter-in-place.

The computational procedure is outlined as follows:

- A link-node representation of the highway network is coded. Each link represents a unidirectional length of highway; each node usually represents an intersection or merge point. The capacity of each link is estimated based on the field survey observations and on established traffic engineering procedures.
- The evacuation trips are generated at locations called "zonal centroids" located within the EPZ and Shadow Region. The trip generation rates vary over time reflecting the mobilization process, and from one location (centroid) to another depending on population density and on whether a centroid is within, or outside, the impacted area.
- The evacuation model computes the routing patterns for evacuating vehicles that are compliant with federal guidelines (outbound relative to the plant) and then simulates the traffic flow movements over space and time. This simulation process estimates the rate that traffic flow exits the impacted region.

The ETE statistics provide the elapsed times for 90 percent and 100 percent, respectively, of the population within the impacted region, to evacuate from within the impacted region. These statistics are presented in tabular and graphical formats. The 90th percentile ETE have been identified as the values that should be considered when making protective action decisions

because the 100th percentile ETE are prolonged by those relatively few people who take longer to mobilize. This is referred to as the "evacuation tail" in Section 4.0 of NUREG/CR-7002.

ES.4. Traffic Management

This study modeled the comprehensive "DAEC Emergency Planning Zone Traffic Management Plan" dated October 2014. Based on congestion patterns predicted by the evacuation simulations, five additional Traffic Control Point (TCPs) and one additional Access Control Point (ACP) were identified to expedite the evacuation. Refer to Section 9 and Appendix G for additional details.

ES.5. Selected Results

A compilation of selected information is presented on the following pages in the form of figures and tables extracted from the body of the report; these are described below.

- Figure 6-1 displays a map of the DAEC EPZ showing the layout of the 24 Subareas that comprise, in aggregate, the EPZ.
- Table 3-1 presents the estimates of permanent resident population in each Subarea based on the 2010 Census data extrapolated to 2016.
- Table 6-1 defines each of the 38 Evacuation Regions in terms of their respective groups of Subareas.
- Table 6-2 defines the 14 Evacuation Scenarios.
- Tables 7-1 and 7-2 are compilations of ETE. These data are the times needed to clear the indicated regions of 90 and 100 percent of the population occupying these regions, respectively. These computed ETE include consideration of mobilization time and of estimated voluntary evacuations from other regions within the EPZ and from the Shadow Region.
- Tables 7-3 and 7-4 present ETE for the 2-mile region when evacuating additional Subareas downwind to 5 miles for un-staged and staged evacuations for the 90th and 100th percentiles, respectively.
- Table 8-7 presents ETE for the schoolchildren in good weather.
- Table 8-11 presents ETE for the transit-dependent population in good weather.
- Figure H-8 presents an example of an Evacuation Region (Region R08) to be evacuated under the circumstances defined in Table 6-1. Maps of all Regions are provided in Appendix H.

ES.6. Conclusions

- General population ETE were computed for 532 unique cases. Table 7-1 and Table 7-2 document these ETE for the 90th and 100th percentiles. These ETE range from 1:30 (hr:min) to 7:40 at the 90th percentile and 3:30 to 10:05 at the 100th percentile.
- Inspection of Table 7-1 and Table 7-2 indicates that the ETE for the 100th percentile are

significantly longer than those for the 90th percentile. This is the result of the congestion within the EPZ. When the system becomes congested, traffic exits the EPZ at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuation routes service the remaining demand. See Figures 7-11 through 7-24.

- Inspection of Table 7-3 and Table 7-4 indicates that a staged evacuation provides no benefits to evacuees from within the 2-Mile Region, and adversely impacts (ETE increases of up to 25 minutes at the 90th percentile) some evacuees located beyond 2 miles from the plant (compare Regions R02 and R04 through R12 with Regions R29 through R38, respectively, in Table 7-1). See Section 7.6 for additional discussion.
- Comparison of Scenarios 5 (summer, midweek/weekend, evening) and 13 (summer, weekend, evening) in Table 7-1 and Table 7-2 indicates that the special event, Cedar Rapids Freedom Festival, has a significant impact on the ETE (90th percentile increases of up to 20 minutes and 100th percentile increases of up to 35 minutes) for regions including a portion of Cedar Rapids (R03, R13, R25 – R28). See Section 7.5 for additional discussion.
- Comparison of Scenarios 1 and 14 in Table 7-1 and Table 7-2 indicates that the roadway closure – one lane southbound on I-380 –does have a significant impact on ETE (up to 30 minute increases at the 90th percentile, and 1 hour and 10 minutes at the 100th percentile) for regions including Cedar Rapids (R03, R13, R14, R24–R28). See Section 7.5 for additional discussion.
- Cedar Rapids, Marion, and Hiawatha are the most congested areas during an evacuation. The last location in the EPZ to exhibit traffic congestion is US-30 westbound leaving Cedar Rapids. All congestion within the EPZ clears by 8 hours and 10 minutes after the Advisory to Evacuate during summer, midweek, midday conditions (Scenario 1). See Section 7.3 and Figures 7-3 through 7-10.
- Separate ETE were computed for schools, preschools, day care centers, medical facilities, group homes correctional facilities, transit-dependent persons and homebound special needs persons. The average single-wave ETE for all facilities, transit-dependent persons, and homebound special needs persons is comparable or less than the 90th percentile ETE for the general population for an evacuation of the entire EPZ (Region R03) under Scenario 6 conditions.al. See Section 8.
- Table 8-5 indicates that there is sufficient transportation resource capacity available to evacuate wheelchair bound and bedridden population in a single wave. The bus capacity is not sufficient to evacuate all requiring a bus in a single wave. Second wave ETE are computed for all facilities/people. See Sections 8.4 and 8.5.
- The general population ETE at the 90th and 100th percentiles are reduced by 10 minutes and 30 minutes, respectively, when the mobilization time is reduced by 1 hour. An increase in mobilization time by 1 hour does not impact the 90th or 100th percentile ETE due to the traffic congestion within the EPZ. See Table M-1.
- The general population ETE is reduced when the voluntary evacuation of vehicles in the Shadow Region is reduced and increased when the voluntary evacuation of vehicles in the Shadow Region is increased (60% and 100% shadow evacuation increases the 90th

percentile ETE by 20 minutes and increases the 100th percentile ETE by 20 minutes and 55 minutes, respectively). See Table M-2.

- An increase in permanent resident population (EPZ plus Shadow Region) of 10% or greater results in an increase in the 90th percentile ETE of 30 minutes, which meets the federal criterion for performing a fully updated ETE study between decennial Censuses. See Section M.3.
- **The reduction in EPZ size reduces ETE by up to 35 minutes and 1 hour and 10 minutes for the 90th and 100th percentiles, respectively, as there are 9,231 less vehicles evacuating from within the EPZ. See Section M.4.**
- The ETE in this study increased significantly relative to those ETE computed in the 2012 ETE study, predominately as a result of the consideration of bottlenecks outside of the study area, and to a lesser extent the increase in population and evacuating vehicles in the study area. Consideration of bottlenecks outside of the study area: the federal guidance (NUREG-0654 and NUREG/CR-7002) recommends an EPZ with an approximate radius of 10 miles centered at the plant, and a Shadow Region which extends to 15 miles radially. The EPZ for the DAEC is unique in that the EPZ extends beyond 15 miles to the southeast in Subarea 23 (see Figure 7-2). In 2012, the link-node analysis network was stopped just beyond the boundary of Subarea 23 as it was approximately 16 miles from the plant. The last node in the network along US-30 eastbound was just east of the interchange with Iowa State Highway 13 (IA-13). At that point, US-30 eastbound is acting as a freeway with 2 lanes eastbound (each with a capacity of 2,250 vehicles per hour) for a total capacity of 4,500 vehicles per hour. Approximately 3.5 miles east of that, US-30 eastbound narrows to a single lane with a capacity of 1,700 vehicles per hour. An additional 2 miles east of the drop to a single lane, US-30 eastbound enters a single lane traffic circle in Mount Vernon with a posted speed limit of 20 mph and an estimated capacity of 900 vehicles per hour. This study models US-30 eastbound through Mount Vernon (see Figure 1-3) versus the 2012 study which stopped just east of the interchange with IA-13. Thus, the capacity of the network exit along US-30 eastbound in 2012 was 4,500 vehicles per hour, versus 900 vehicles per hour in this study – a reduction in capacity of 80%. This causes significant congestion and queuing along US-30 eastbound leaving Cedar Rapids, which results in thousands of vehicles seeking alternate routes (US-30 westbound, I-380 southbound, US-151B southbound, IA-965 southbound, and Ely Rd southbound), prolonging congestion and significantly increasing ETE. See Section 1.3.
- Federal guidance (NUREG-0654/FEMA-REP-1, Rev. 1, Supplement 3) advised licensees how to use ETE results to inform Protective Action Recommendations (PAR). The changes in ETE in this study relative to the 2012 study do not impact PAR as the ETE values relative to the NRC criteria have not changed. See Section 7.7.

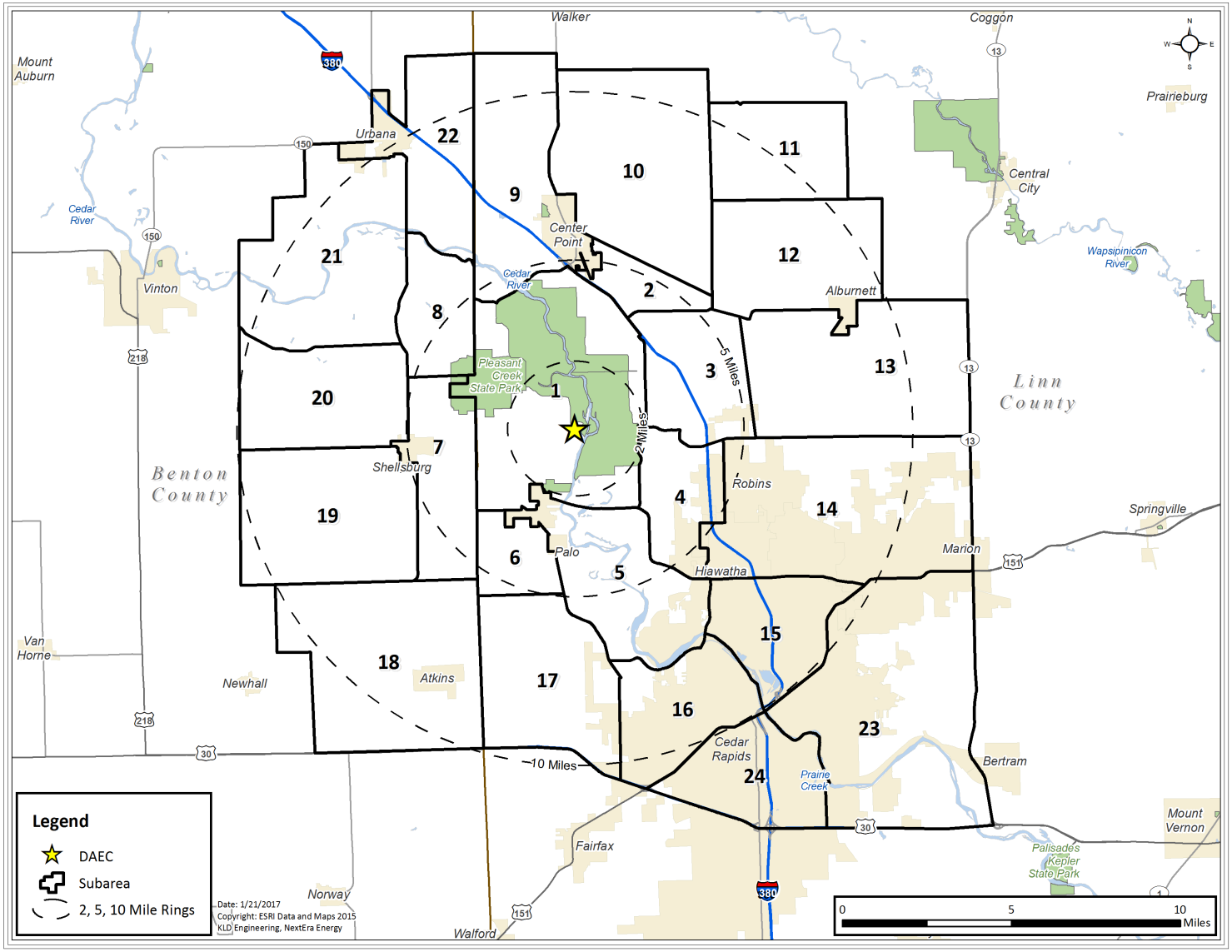

Figure 6-1. Subareas Comprising the DAEC EPZ

Table 3-1. EPZ Permanent Resident Population

Subarea	2010 Population	2016 Extrapolated Population
1	1,307	1,373
2	271	283
3	889	935
4	3,442	3,588
5	5,205	5,520
6	68	72
7	1,416	1,372
8	248	244
9	2,782	2,924
10	445	463
11	146	153
12	976	1,018
13	487	511
14	45,159	48,424
15	28,472	29,676
16	30,626	31,872
17	2,668	2,781
18	2,141	2,298
19	239	238
20	494	488
21	871	857
22	1,729	1,724
23	35,485	37,453
24	18,652	19,407
TOTAL	**184,218**	**193,674**
EPZ Population Growth (2010-2016):		**5.1%**

Note: The revised EPZ (removal of the portion of Subarea 24 south of US-30) decreases the 2010 EPZ permanent resident population in this study by 5,218 people (approximately 2.8%) relative to the population in the previous ETE study (KLD TR-529, dated December 2012).

Table 6-1. Description of Evacuation Regions

Region	Description	Subarea																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R01	2-Mile Ring	X																							
R02	5-Mile Ring	X	X	X	X	X	X	X	X																
R03	Full EPZ	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Evacuate 2-Mile Region and Downwind to 5 Miles																									
Region	Wind Direction From:	Subarea																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R04	NNW, N 326.26° - 11.25°	X			X	X	X																		
R05	NNE, NE, ENE 11.26° - 78.75°	X				X	X	X																	
R06	E, ESE, SE 78.76° - 146.25°	X						X	X																
R07	SSE 146.26° - 168.75°	X	X						X																
R08	S 168.76° - 191.25°	X	X	X					X																
R09	SSW, SW 191.26° - 236.25°	X	X	X																					
R10	WSW 236.26° - 258.75°	X	X	X	X																				
R11	W 258.76° - 281.25°	X		X	X																				
R12	WNW, NW 281.26° - 326.25°	X		X	X	X																			
Evacuate 2-Mile Region and Downwind to the EPZ Boundary																									
Region	Wind Direction From:	Subarea																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R13	N 348.76° - 11.25°	X			X	X	X									X	X	X	X					X	X
R14	NNE 11.26° - 33.75°	X				X	X	X									X	X	X	X					X
R15	NE 33.76° - 56.25°	X				X	X	X										X	X	X	X				
R16	ENE 56.26° - 78.75°	X				X	X	X											X	X	X	X			
R17	E 78.76° - 101.25°	X						X	X										X	X	X	X			
R18	ESE 101.26° - 123.75°	X						X	X											X	X	X	X		
R19	SE 123.76° - 146.25°	X						X	X	X											X	X	X		
R20	SSE 146.26° - 168.75°	X	X						X	X	X											X	X		
R21	S 168.76° - 191.25°	X	X	X					X	X	X	X	X									X	X		
R22	SSW 191.26° - 213.75°	X	X	X						X	X	X	X	X									X		
R23	SW 213.76° - 236.25°	X	X	X							X	X	X	X											
R24	WSW 236.26° - 258.75°	X	X	X	X						X	X	X	X	X										
R25	W 258.76° - 281.25°	X		X	X								X	X	X	X								X	
R26	WNW 281.26° - 303.75°	X		X	X	X							X	X	X	X	X							X	X
R27	NW 303.76° - 326.25°	X		X	X	X								X	X	X	X	X						X	X
R28	NNW 326.26° - 348.75°	X			X	X	X								X	X	X	X	X					X	X

Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles																									
			Subarea																						
Region	**Wind Direction From:**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
R29	5-Mile Radius	N/A	X	X	X	X	X	X	X	X																
R30	NNW, N	326.26° - 11.25°	X			X	X	X																		
R31	NNE, NE, ENE	11.26° - 78.75°	X				X	X	X																	
R32	E, ESE, SE	78.76° - 146. 25°	X						X	X																
R33	SSE	146.26° - 168.75°	X	X						X																
R34	S	168.76° - 191.25°	X	X	X					X																
R35	SSW, SW	191.26° - 236.25°	X	X	X																					
R36	WSW	236.26° - 258.75°	X	X	X	X																				
R37	W	258.76° - 281.25°	X		X	X																				
R38	WNW, NW	281.26° - 326.25°	X		X	X	X																			
Subarea(s) Shelter-in-Place until 90% ETE for R01, then Evacuate						Subarea(s) Shelter-in-Place											Subarea(s) Evacuate								

Table 6-2. Evacuation Scenario Definitions

Scenario	Season[5]	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain	None
8	Winter	Midweek	Midday	Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Weekend	Midday	Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Weekend	Evening	Good	Cedar Rapids Freedom Festival
14	Summer	Midweek	Midday	Good	Roadway Impact – Lane Closure on I-380 Southbound

[5] Winter means school is in session, with normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ														
R01	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R02	2:00	2:00	2:00	2:00	1:50	2:00	2:00	2:15	2:00	2:00	2:15	1:50	1:55	2:00
R03	6:10	6:50	5:05	5:35	5:00	6:25	6:55	7:40	5:00	5:35	6:00	4:50	5:05	6:40
2-Mile Region and Keyhole to 5 Miles														
R04	2:00	2:00	2:00	2:00	1:50	2:00	2:00	2:10	2:00	2:00	2:10	1:50	1:55	2:00
R05	1:35	1:40	1:35	1:35	1:35	1:35	1:40	2:10	1:35	1:35	2:10	1:35	1:35	1:35
R06	1:40	1:40	1:35	1:35	1:35	1:40	1:40	2:15	1:35	1:35	2:10	1:35	1:35	1:40
R07	1:40	1:40	1:30	1:35	1:30	1:40	1:40	2:10	1:35	1:35	2:05	1:35	1:30	1:40
R08	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:15	2:05	2:10	2:10	2:05	2:05	2:05
R09	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:15	2:05	2:10	2:10	2:05	2:05	2:05
R10	2:05	2:05	2:05	2:05	2:00	2:05	2:05	2:15	2:05	2:05	2:15	2:00	2:00	2:05
R11	2:05	2:05	2:05	2:05	2:00	2:05	2:05	2:15	2:05	2:05	2:15	2:00	2:00	2:05
R12	2:00	2:00	1:55	1:55	1:45	2:00	2:00	2:10	1:55	1:55	2:10	1:45	1:50	2:00
2-Mile Region and Keyhole to EPZ Boundary														
R13	5:30	6:05	4:30	4:55	4:20	5:45	6:15	6:50	4:25	4:55	5:20	4:15	4:40	5:45
R14	3:35	3:50	3:05	3:20	2:55	3:35	3:55	4:20	3:00	3:15	3:30	2:50	2:55	3:50
R15	2:10	2:25	1:55	2:10	1:55	2:15	2:25	2:50	2:00	2:10	2:30	1:50	2:00	2:20
R16	2:05	2:25	2:00	2:10	1:55	2:05	2:25	2:45	2:00	2:05	2:20	1:50	1:55	2:10
R17	2:10	2:25	2:00	2:10	1:55	2:10	2:20	2:40	1:55	2:10	2:20	1:50	1:55	2:10
R18	1:45	1:45	1:35	1:35	1:35	1:45	1:45	2:20	1:35	1:35	2:10	1:35	1:35	1:45
R19	2:05	2:05	2:05	2:05	1:55	2:05	2:05	2:15	2:05	2:05	2:15	1:55	1:55	2:05
R20	2:05	2:10	2:05	2:05	2:00	2:05	2:05	2:15	2:05	2:05	2:15	2:00	2:00	2:05
R21	2:05	2:10	2:05	2:05	1:55	2:05	2:10	2:20	2:05	2:05	2:15	2:00	1:55	2:05
R22	2:05	2:05	2:05	2:05	1:55	2:05	2:05	2:20	2:05	2:05	2:15	1:55	1:55	2:05
R23	2:05	2:05	2:00	2:05	1:55	2:05	2:05	2:15	2:05	2:05	2:15	1:55	1:55	2:05

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
R24	3:05	3:20	2:50	3:05	2:55	3:15	3:20	3:35	2:50	3:00	3:30	3:00	2:55	3:15
R25	4:45	5:05	4:00	4:20	4:00	4:50	5:25	6:00	3:55	4:25	4:45	4:00	4:05	5:05
R26	6:00	6:30	5:05	5:20	4:50	6:00	6:40	7:15	4:55	5:20	5:30	4:45	5:00	6:05
R27	6:00	6:40	5:00	5:35	4:50	6:15	6:50	7:25	4:55	5:25	5:55	4:50	5:05	6:20
R28	6:10	6:50	5:10	5:40	5:00	6:20	7:05	7:40	5:00	5:35	6:05	4:55	5:20	6:20
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	2:15	2:20	2:15	2:20	2:15	2:15	2:15	2:45	2:15	2:20	2:45	2:15	2:20	2:15
R30	2:15	2:15	2:15	2:20	2:20	2:15	2:15	2:45	2:15	2:20	2:45	2:20	2:20	2:15
R31	2:20	2:20	2:20	2:25	2:25	2:20	2:20	2:55	2:25	2:25	3:00	2:25	2:25	2:20
R32	2:05	2:05	2:05	2:05	2:05	2:05	2:05	2:35	2:05	2:05	2:35	2:05	2:05	2:05
R33	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00
R34	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:25	2:05	2:10	2:25	2:05	2:05	2:05
R35	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:20	2:05	2:10	2:20	2:05	2:05	2:05
R36	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:10	2:10	2:30	2:10	2:10	2:10
R37	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:10	2:10	2:30	2:10	2:10	2:10
R38	2:15	2:20	2:20	2:20	2:20	2:15	2:20	2:50	2:20	2:20	2:50	2:20	2:20	2:20

Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ														
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R02	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R03	8:20	9:30	6:50	7:50	6:25	9:00	10:05	10:05	7:00	7:05	7:45	6:30	7:00	9:05
2-Mile Region and Keyhole to 5 Miles														
R04	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R05	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R06	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R07	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R08	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R09	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R10	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R11	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R12	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
2-Mile Region and Keyhole to EPZ Boundary														
R13	7:30	7:55	6:00	6:55	6:00	7:50	7:55	9:40	6:05	6:45	7:25	5:50	6:10	7:45
R14	5:20	5:25	4:35	4:55	4:30	5:10	5:40	6:25	4:20	4:50	5:25	4:10	4:30	5:20
R15	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R16	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R17	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R18	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R19	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R20	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R21	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R22	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R23	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
R24	5:00	5:20	4:45	4:55	4:40	5:10	5:25	5:30	4:45	4:55	5:20	4:50	4:40	5:10
R25	6:45	7:10	5:55	6:15	5:35	6:50	7:25	8:15	5:40	6:10	6:40	5:40	5:50	6:45
R26	8:05	8:35	6:35	7:10	6:20	8:00	8:55	9:55	6:25	6:55	7:15	6:15	6:30	8:35
R27	7:40	8:55	6:25	7:05	6:25	7:55	8:40	9:45	6:20	7:05	7:40	6:15	6:40	8:50
R28	8:20	9:30	6:50	7:50	6:25	9:00	10:05	10:05	7:00	7:05	7:45	6:30	7:00	9:05
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R30	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R31	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R32	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R33	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R34	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R35	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R36	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R37	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R38	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35

Table 7-3. Time to Clear *90* Percent of the 2-Mile Region when Evacuating Additional Subareas Downwind to 5 Miles

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
2-Mile Region														
R01	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
5-Mile Region, 2-Mile Region and Keyhole to 5 Miles														
R02	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R04	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R05	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R06	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R07	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R08	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R09	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R10	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R11	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R12	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R30	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R31	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R32	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R33	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R34	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R35	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R36	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R37	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R38	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40

Table 7-4. Time to Clear *100* Percent of the 2-Mile Region when Evacuating Additional Subareas Downwind to 5 Miles

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
2-Mile Region														
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
5-Mile Region, 2-Mile Region and Keyhole to 5 Miles														
R02	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R04	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R05	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R06	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R07	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R08	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R09	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R10	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R11	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R12	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R31	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R32	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R33	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R34	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R35	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R36	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R37	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R38	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30

Table 8-7. School Evacuation Time Estimates – Good Weather

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
BENTON COUNTY SCHOOLS												
Atkins Elementary School	60	15	3.5	3.8	56	**2:15**	9.5	23	**2:35**	52.7	80	**3:35**
Center Point Intermediate School (Urbana)	60	15	2.5	44.4	4	**1:20**	16.3	40	**2:00**	16.9	26	**1:45**
Early Beginnings Preschool/Daycare	60	15	3.5	3.8	56	**2:15**	9.5	23	**2:35**	52.7	80	**3:35**
Kid Zone Daycare (Urbana)	60	15	2.5	44.4	4	**1:20**	16.3	40	**2:00**	16.9	26	**1:45**
Shellsburg Elementary School	60	15	5.0	46.0	7	**1:25**	8.0	20	**1:45**	16.9	26	**1:50**
LINN COUNTY SCHOOLS												
Alburnett Schools	60	15	3.6	54.9	4	**1:20**	15.3	37	**2:00**	52.7	80	**2:40**
All Saints Catholic School	60	15	8.9	3.7	144	**3:40**	23.0	56	**4:35**	68.0	102	**5:25**
All Saints Daycare	60	15	8.9	3.7	144	**3:40**	23.0	56	**4:35**	68.0	102	**5:25**
All Saints Preschool	60	15	8.9	3.7	144	**3:40**	23.0	56	**4:35**	68.0	102	**5:25**
Apple Kids Marion School District	60	15	10.3	4.4	142	**3:40**	7.9	19	**4:00**	23.7	36	**4:15**
Apple Kids - Noelridge	60	15	9.9	2.4	249	**5:25**	18.7	45	**6:10**	22.3	34	**6:00**
Arthur Elementary School & Preschool	60	15	9.0	2.2	245	**5:20**	18.7	45	**6:05**	22.3	34	**5:55**
ASAC - Heart of Iowa Child Care	60	15	11.4	13.3	52	**2:10**	18.7	45	**2:55**	22.3	34	**2:45**
Ascension Lutheran Preschool	60	15	10.0	6.2	98	**2:55**	18.7	45	**3:40**	22.3	34	**3:30**
Bethany Lutheran Preschool	60	15	9.2	2.4	234	**5:10**	18.7	45	**5:55**	22.3	34	**5:45**
Bowman Woods Elementary	60	15	9.5	4.4	130	**3:25**	18.7	45	**4:10**	22.3	34	**4:00**
Busy Bee Day Care Inc.	60	15	8.2	5.5	90	**2:45**	18.7	45	**3:30**	22.3	34	**3:20**
Calvery Christian Preschool	60	15	8.2	2.4	208	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Caring Corner Christian Daycare	60	15	12.8	2.7	285	**6:00**	18.7	45	**6:45**	22.3	34	**6:35**
Cedar Valley Christian High School	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Christian Preschool	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Christian School (7-8)	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Christian School (K-6)	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Montessori School	60	15	5.0	1.9	156	**3:55**	18.7	45	**4:40**	22.3	34	**4:25**
Center Point Elementary School (CP)	60	15	2.5	55.0	3	**1:20**	18.7	45	**2:05**	22.3	34	**1:55**

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Center Point Urbana High School (CP)	60	15	2.6	55.0	3	**1:20**	18.7	45	**2:05**	22.3	34	**1:55**
Center Point Urbana Middle School (CP)	60	15	7.6	55.0	9	**1:25**	18.7	45	**2:10**	22.3	34	**2:00**
Children Prevail	60	15	9.3	55.0	11	**1:30**	18.7	45	**2:15**	22.3	34	**2:00**
Children's Corner	60	15	11.7	2.6	275	**5:50**	18.7	45	**6:35**	22.3	34	**6:25**
Children's Weekday Ministry-Lovely Lane	60	15	7.5	2.2	207	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Child's Discovery Montessori Preschool	60	15	7.9	2.2	214	**4:50**	18.7	45	**5:35**	22.3	34	**5:25**
Cleveland Elementary School	60	15	3.1	4.6	41	**2:00**	18.7	45	**2:45**	22.3	34	**2:30**
Coolidge Elementary School	60	15	13.3	3.5	228	**5:05**	15.3	37	**5:40**	52.7	80	**6:25**
Echo Hill Elementary	60	15	10.7	5.6	115	**3:10**	18.7	45	**3:55**	22.3	34	**3:45**
Emerson Elementary	60	15	10.3	4.4	142	**3:40**	18.7	45	**4:25**	22.3	34	**4:15**
Erskine Elementary School	60	15	7.2	3.9	110	**3:05**	18.7	45	**3:50**	22.3	34	**3:40**
Essential Montessori School of Hiawatha	60	15	10.5	2.5	257	**5:35**	18.7	45	**6:20**	22.3	34	**6:10**
Excelsior Middle School	60	15	8.2	5.5	90	**2:45**	18.7	45	**3:30**	22.3	34	**3:20**
Five Season Learning Center - Wright (Age 3-5)	60	15	9.9	2.4	249	**5:25**	18.7	45	**6:10**	22.3	34	**6:00**
Five Seasons LC - Viola Gibson	60	15	12.2	2.6	281	**6:00**	18.7	45	**6:45**	22.3	34	**6:30**
Five Seasons Learning Center - Arthur	60	15	9.0	2.2	245	**5:20**	18.7	45	**6:05**	22.3	34	**5:55**
Five Seasons Learning Center - Coolidge (age 3-5)	60	15	13.3	3.5	228	**5:05**	15.3	37	**5:40**	52.7	80	**6:25**
Five Seasons Learning Center - Nixon	60	15	12.1	2.6	278	**5:55**	15.3	37	**6:30**	52.7	80	**7:15**
Four Oaks Day Program	60	15	3.6	3.3	66	**2:25**	15.3	37	**3:00**	52.7	80	**3:45**
Francis Marion Intermediate	60	15	8.8	6.1	86	**2:45**	15.3	37	**3:20**	52.7	80	**4:05**
Franklin Middle School	60	15	8.3	2.2	227	**5:05**	15.3	37	**5:40**	52.7	80	**6:25**
Garfield Elementary School	60	15	8.2	2.5	201	**4:40**	15.3	37	**5:15**	52.7	80	**6:00**
Good Shepard Lutheran School (Pre-K - 8th)	60	15	9.9	2.4	249	**5:25**	15.3	37	**6:05**	52.7	80	**6:45**

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Grant Elementary School/Preschool	60	15	6.7	3.4	120	**3:15**	15.3	37	**3:55**	52.7	80	**4:35**
Grant Wood Elementary	60	15	7.8	3.9	120	**3:15**	15.3	37	**3:55**	52.7	80	**4:35**
HACAP Head Start - Jane Boyd	60	15	5.5	5.3	63	**2:20**	15.3	37	**2:55**	52.7	80	**3:40**
HACAP Head Start - Hayes Center	60	15	3.6	5.2	42	**2:00**	15.3	37	**2:35**	52.7	80	**3:20**
HACAP Head Start - Marion	60	15	10.3	4.4	142	**3:40**	15.3	37	**4:15**	52.7	80	**5:00**
HACAP Head Start - Olivet	60	15	6.4	3.4	112	**3:10**	15.3	37	**3:45**	52.7	80	**4:30**
HACAP Head Start - Urban Family	60	15	7.5	2.2	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
HACAP Horizons	60	15	5.0	5.2	58	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
Hand in Hand - 35th Avenue	60	15	13.8	5.9	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
Hand in Hand - Hiawatha	60	15	8.7	2.4	222	**5:00**	15.3	37	**5:35**	52.7	80	**6:20**
Hand in Hand - Linn Grove Elementary	60	15	12.1	5.8	125	**3:20**	15.3	37	**4:00**	52.7	80	**4:40**
Hand in Hand - Tower Lane	60	15	9.7	2.4	241	**5:20**	15.3	37	**5:55**	52.7	80	**6:40**
Harding Middle School	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**
Harrison Elementary School	60	15	4.4	2.9	92	**2:50**	15.3	37	**3:25**	52.7	80	**4:10**
Harvest Christian DC & Learning Center	60	15	5.9	3.3	108	**3:05**	15.3	37	**3:40**	52.7	80	**4:25**
Hiawatha Elementary School	60	15	10.4	2.4	255	**5:30**	15.3	37	**6:10**	52.7	80	**6:50**
Holloway House Learning Center	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**
Hoover Elementary School	60	15	2.3	4.5	31	**1:50**	15.3	37	**2:25**	52.7	80	**3:10**
Indian Creek Elementary School	60	15	7.2	5.5	79	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
Isaac Newton Christian Academy & Preschool	60	15	7.8	2.2	211	**4:50**	15.3	37	**5:25**	52.7	80	**6:10**
Jackson Elementary School	60	15	3.6	3.0	72	**2:30**	15.3	37	**3:05**	52.7	80	**3:50**
Jefferson Senior High School	60	15	6.1	4.9	75	**2:30**	15.3	37	**3:10**	52.7	80	**3:50**
Johnson Elementary School	60	15	7.8	3.9	120	**3:15**	15.3	37	**3:55**	52.7	80	**4:35**
Josiah's Playground	60	15	6.4	3.4	112	**3:10**	15.3	37	**3:45**	52.7	80	**4:30**
Jungle Friends	60	15	11.2	2.6	264	**5:40**	15.3	37	**6:20**	52.7	80	**7:00**
Kennedy Senior High School	60	15	9.8	2.4	247	**5:25**	15.3	37	**6:00**	52.7	80	**6:45**
Kenwood Elementary School	60	15	10.2	2.5	249	**5:25**	15.3	37	**6:05**	52.7	80	**6:45**
Kid Zone Daycare & Learning Center	60	15	9.4	55.0	11	**1:30**	15.3	37	**2:05**	52.7	80	**2:50**
Kids Inc. - Alburnett	60	15	3.6	54.9	4	**1:20**	15.3	37	**2:00**	52.7	80	**2:40**
Kid's Inc. - Marion LC	60	15	11.2	4.4	154	**3:50**	15.3	37	**4:30**	52.7	80	**5:10**

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Kid's Kampus Learning Center	60	15	8.2	9.9	50	**2:05**	15.3	37	**2:45**	52.7	80	**3:25**
KidsPoint Downtown Learning Center & Preschool	60	15	5.0	1.9	156	**3:55**	15.3	37	**4:30**	52.7	80	**5:15**
KidsPoint North Learning Center & Preschool	60	15	11.7	2.6	275	**5:50**	15.3	37	**6:30**	52.7	80	**7:10**
Kinder Kollege	60	15	3.5	3.0	70	**2:25**	15.3	37	**3:05**	52.7	80	**3:45**
Kindercare Learning Center - West	60	15	12.8	12.8	60	**2:15**	15.3	37	**2:55**	52.7	80	**3:35**
Kindercare Learning Center #292	60	15	12.8	2.7	285	**6:00**	15.3	37	**6:40**	52.7	80	**7:20**
La Petite Academy	60	15	11.8	4.6	154	**3:50**	15.3	37	**4:30**	52.7	80	**5:10**
Lasalle Intermediate School	60	15	6.6	4.9	81	**2:40**	15.3	37	**3:15**	52.7	80	**4:00**
Lily Pad Daycare & Preschool	60	15	12.1	2.6	278	**5:55**	15.3	37	**6:30**	52.7	80	**7:15**
Linn County Child Development Center	60	15	4.2	2.8	89	**2:45**	15.3	37	**3:25**	52.7	80	**4:05**
Linn Grove Elementary	60	15	5.2	5.7	56	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
Linn-Mar Compass Program	60	15	7.8	5.5	85	**2:40**	15.3	37	**3:20**	52.7	80	**4:00**
Linn-Mar High School	60	15	7.8	5.5	85	**2:40**	15.3	37	**3:20**	52.7	80	**4:00**
Linn-Mar High School Success Program	60	15	7.8	4.4	108	**3:05**	15.3	37	**3:40**	52.7	80	**4:25**
Little Cupcakes Child Care	60	15	1.9	4.6	25	**1:40**	15.3	37	**2:20**	52.7	80	**3:00**
Little Lambs Christian Preschool	60	15	10.4	4.6	137	**3:35**	15.3	37	**4:10**	52.7	80	**4:55**
Little Learners Inc.	60	15	10.5	2.5	257	**5:35**	15.3	37	**6:10**	52.7	80	**6:55**
Little People Daycare & Learning Center	60	15	2.5	55.0	3	**1:20**	15.3	37	**1:55**	52.7	80	**2:40**
Madison Elementary School	60	15	5.5	4.8	69	**2:25**	15.3	37	**3:05**	52.7	80	**3:45**
Marion High School	60	15	10.0	7.1	85	**2:40**	15.3	37	**3:20**	52.7	80	**4:00**
McKinley Middle School	60	15	5.0	5.2	58	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
Metro High School	60	15	4.1	5.2	48	**2:05**	15.3	37	**2:40**	52.7	80	**3:25**
Metro Parent - Child Center	60	15	4.1	5.2	48	**2:05**	15.3	37	**2:40**	52.7	80	**3:25**
Mother Goose Daycare	60	15	2.3	4.5	31	**1:50**	15.3	37	**2:25**	52.7	80	**3:10**
Mother Goose Learning Center	60	15	10.5	4.5	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
My Iman Montessori Preschool	60	15	3.1	4.6	41	**2:00**	15.3	37	**2:35**	52.7	80	**3:20**
Nixon Elementary School	60	15	12.1	2.6	278	**5:55**	15.3	37	**6:30**	52.7	80	**7:15**
Noah's Ark Preschool	60	15	2.9	12.2	15	**1:30**	15.3	37	**2:10**	52.7	80	**2:50**

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Novak Elementary School	60	15	8.2	5.5	90	**2:45**	15.3	37	**3:25**	52.7	80	**4:05**
Oak Ridge Middle School	60	15	10.1	5.6	109	**3:05**	15.3	37	**3:45**	52.7	80	**4:25**
Our Little Haven	60	15	5.8	4.4	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
Pierce Elementary School	60	15	9.5	2.4	240	**5:15**	15.3	37	**5:55**	52.7	80	**6:35**
Pointer Pup Preschool (Center Point)	60	15	2.6	55.0	3	**1:20**	15.3	37	**1:55**	52.7	80	**2:40**
Polk Alternative School	60	15	7.5	3.1	147	**3:45**	15.3	37	**4:20**	52.7	80	**5:05**
Regis Middle School	60	15	8.6	2.5	208	**4:45**	15.3	37	**5:20**	52.7	80	**6:05**
Rockwell Collins Child Development Center D	60	15	12.8	2.7	285	**6:00**	15.3	37	**6:40**	52.7	80	**7:20**
Roosevelt Middle School	60	15	6.4	3.4	112	**3:10**	15.3	37	**3:45**	52.7	80	**4:30**
Share & Care Christian Preschool	60	15	2.3	4.5	31	**1:50**	15.3	37	**2:25**	52.7	80	**3:10**
St. James Kids Club Daycare	60	15	4.4	2.9	92	**2:50**	15.3	37	**3:25**	52.7	80	**4:10**
St. Joseph Catholic School	60	15	12.7	4.5	168	**4:05**	15.3	37	**4:40**	52.7	80	**5:25**
St. Joseph Early Childhood Daycare	60	15	12.7	4.5	168	**4:05**	15.3	37	**4:40**	52.7	80	**5:25**
St. Joseph Preschool	60	15	12.7	4.5	168	**4:05**	15.3	37	**4:40**	52.7	80	**5:25**
St. Jude's Daycare	60	15	6.5	4.9	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
St. Jude's Elementary School	60	15	6.5	4.9	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
St. Jude's Preschool	60	15	6.5	4.9	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
St. Ludmila Catholic Center	60	15	4.5	5.2	52	**2:10**	15.3	37	**2:45**	52.7	80	**3:30**
St. Ludmila Daycare	60	15	4.5	5.2	52	**2:10**	15.3	37	**2:45**	52.7	80	**3:30**
St. Ludmila Preschool	60	15	4.5	5.2	52	**2:10**	15.3	37	**2:45**	52.7	80	**3:30**
St. Matthew Preschool	60	15	8.7	2.2	237	**5:15**	15.3	37	**5:50**	52.7	80	**6:35**
St. Matthew School	60	15	8.7	2.2	237	**5:15**	15.3	37	**5:50**	52.7	80	**6:35**
St. Matthew's Child Care Program	60	15	8.7	2.2	237	**5:15**	15.3	37	**5:50**	52.7	80	**6:35**
St. Paul's Parents Day Out	60	15	7.5	2.2	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
St. Paul's Preschool FOCUS	60	15	7.5	2.2	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
St. Pius X Child Care Program	60	15	7.5	2.3	193	**4:30**	15.3	37	**5:05**	52.7	80	**5:50**
St. Pius X Preschool	60	15	10.1	2.5	246	**5:25**	15.3	37	**6:00**	52.7	80	**6:45**
St. Pius X School	60	15	10.1	2.5	246	**5:25**	15.3	37	**6:00**	52.7	80	**6:45**
Starry Elementary	60	15	10.1	6.2	99	**2:55**	15.3	37	**3:35**	52.7	80	**4:15**
Summit Preschool	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**
Summit School (Pre-K - 6th)	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**

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Taft Middle and Alternative School	60	15	8.2	13.2	38	**1:55**	15.3	37	**2:30**	52.7	80	**3:15**
Taylor Elementary School/Preschool	60	15	9.3	2.8	198	**4:35**	15.3	37	**5:10**	52.7	80	**5:55**
Teddy Bear Childcare Center	60	15	6.7	5.3	77	**2:35**	15.3	37	**3:10**	52.7	80	**3:55**
The Arc of East Central Iowa	60	15	5.0	5.2	58	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
The Cedar Rapids Day School	60	15	9.7	2.4	239	**5:15**	15.3	37	**5:55**	52.7	80	**6:35**
The Hiawatha Day School	60	15	10.4	2.4	255	**5:30**	15.3	37	**6:10**	52.7	80	**6:50**
The Robyn's Nest	60	15	8.4	2.4	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
Trinity Lane Preschool	60	15	9.3	2.8	198	**4:35**	15.3	37	**5:10**	52.7	80	**5:55**
Trinity Lutheran Childcare	60	15	6.0	2.6	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
Trinity Lutheran School District	60	15	6.0	2.6	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
Truman Elementary School	60	15	2.9	12.2	15	**1:30**	15.3	37	**2:10**	52.7	80	**2:50**
Van Buren Elementary School	60	15	11.9	3.2	224	**5:00**	18.7	45	**5:45**	22.3	34	**5:35**
Vernon Middle School	60	15	10.5	6.2	103	**3:00**	18.7	45	**3:45**	22.3	34	**3:35**
Viola Gibson Elementary School	60	15	12.2	2.6	281	**6:00**	18.7	45	**6:45**	22.3	34	**6:30**
Washington High School	60	15	9.2	2.3	245	**5:20**	18.7	45	**6:05**	22.3	34	**5:55**
We Teach 2	60	15	5.9	4.8	74	**2:30**	18.7	45	**3:15**	22.3	34	**3:05**
Wee Wisdom (Marion)	60	15	5.8	5.6	63	**2:20**	18.7	45	**3:05**	22.3	34	**2:55**
Westfield Elementary	60	15	10.5	5.6	113	**3:10**	18.7	45	**3:55**	22.3	34	**3:45**
Wilkins Elementary	60	15	5.8	4.4	80	**2:35**	18.7	45	**3:20**	22.3	34	**3:10**
Wilson Middle School	60	15	7.0	5.3	80	**2:35**	18.7	45	**3:20**	22.3	34	**3:10**
Wright Elementary School	60	15	9.9	2.5	240	**5:15**	18.7	45	**6:00**	22.3	34	**5:50**
Xavier High School	60	15	12.0	2.6	277	**5:55**	18.7	45	**6:40**	22.3	34	**6:30**
YMCA-Stoney Point	60	15	1.4	1.8	48	**2:05**	11.9	29	**2:35**	77.2	116	**4:00**
					Maximum for EPZ:	**6:00**		**Maximum:**	**6:45**		**Maximum:**	**7:20**
					Average for EPZ:	**3:40**		**Average:**	**4:20**		**Average:**	**4:45**

Table 8-11. Transit-Dependent Evacuation Time Estimates – Good Weather

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
1	1	90	30.1	51.2	35	30	**2:35**	20.2	48	5	10	97	30	**5:50**
1	2	120	30.1	52.9	34	30	**3:05**	20.2	48	5	10	97	30	**6:20**
2	1	90	18.8	4.4	255	30	**6:15**	21.8	52	5	10	89	30	**9:25**
2	2 & 3	120	18.8	4.6	243	30	**6:35**	21.8	52	5	10	89	30	**9:45**
3	1	90	15.5	7.5	124	30	**4:05**	22.0	53	5	10	92	30	**7:15**
3	2	105	15.5	7.5	125	30	**4:20**	22.0	53	5	10	93	30	**7:35**
3	3 & 4	120	15.5	7.7	120	30	**4:30**	22.0	53	5	10	91	30	**7:40**
4	1	90	17.8	47.5	22	30	**2:25**	15.4	37	5	10	71	30	**5:00**
4	2	120	17.8	51.0	21	30	**2:55**	15.4	37	5	10	71	30	**5:30**
5	1	90	9.2	41.1	13	30	**2:15**	2.8	7	5	10	35	30	**3:45**
5	2 & 3	120	9.2	37.8	15	30	**2:45**	9.2	22	5	10	49	30	**4:45**
6	1	90	25.8	55.0	28	30	**2:30**	20.2	48	5	10	92	30	**5:40**
6	2	120	25.8	55.0	28	30	**3:00**	20.2	48	5	10	93	30	**6:10**
7	1 & 2	90	32.8	8.6	229	30	**5:50**	21.8	52	5	10	114	30	**9:25**
7	3 & 4	95	32.8	8.7	225	30	**5:50**	21.8	52	5	10	114	30	**9:25**
7	5 & 6	100	32.8	8.8	224	30	**5:55**	21.8	52	5	10	111	30	**9:25**
7	7 & 8	105	32.8	8.9	221	30	**6:00**	21.8	52	5	10	109	30	**9:30**
7	9 & 10	110	32.8	9.0	219	30	**6:00**	21.8	52	5	10	109	30	**9:30**
7	11 & 12	120	32.8	9.3	212	30	**6:05**	21.8	52	5	10	108	30	**9:35**
8	1 & 2	90	23.9	6.2	232	30	**5:55**	21.8	52	5	10	100	30	**9:15**
8	3 & 4	95	23.9	6.2	230	30	**5:55**	21.8	52	5	10	100	30	**9:15**
8	5 & 6	100	23.9	6.4	225	30	**5:55**	21.8	52	5	10	100	30	**9:15**
8	7 & 8	105	23.9	6.4	223	30	**6:00**	21.8	52	5	10	97	30	**9:15**
8	9 & 10	110	23.9	6.5	220	30	**6:00**	21.8	52	5	10	97	30	**9:15**
8	11 & 12	120	23.9	6.8	211	30	**6:05**	21.8	52	5	10	96	30	**9:20**
9	1 & 2	90	18.9	3.6	313	30	**7:15**	21.8	52	5	10	90	30	**10:25**
9	3 & 4	95	18.9	3.8	297	30	**7:05**	21.8	52	5	10	90	30	**10:15**
9	5 & 6	100	18.9	3.9	295	30	**7:05**	21.8	52	5	10	90	30	**10:15**
9	7 & 8	105	18.9	3.9	292	30	**7:10**	21.8	52	5	10	90	30	**10:20**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
9	9 & 10	110	18.9	3.9	289	30	**7:10**	21.8	52	5	10	90	30	**10:20**
9	11	120	18.9	4.0	284	30	**7:15**	21.8	52	5	10	90	30	**10:25**
10	1 & 2	90	11.5	2.9	240	30	**6:00**	21.8	52	5	10	81	30	**9:00**
10	3 & 4	95	11.5	2.9	239	30	**6:05**	21.8	52	5	10	81	30	**9:05**
10	5 & 6	100	11.5	3.0	230	30	**6:00**	21.8	52	5	10	81	30	**9:00**
10	7 & 8	105	11.5	3.0	229	30	**6:05**	21.8	52	5	10	81	30	**9:05**
10	9	110	11.5	3.0	227	30	**6:10**	21.8	52	5	10	81	30	**9:10**
10	10 & 11	120	11.5	3.2	214	30	**6:05**	21.8	52	5	10	81	30	**9:05**
11	1 & 2	90	17.3	3.4	301	30	**7:05**	21.8	52	5	10	87	30	**10:10**
11	3 & 4	95	17.3	3.6	291	30	**7:00**	21.8	52	5	10	87	30	**10:05**
11	5 & 6	100	17.3	3.6	289	30	**7:00**	21.8	52	5	10	87	30	**10:05**
11	7 & 8	105	17.3	3.6	287	30	**7:05**	21.8	52	5	10	87	30	**10:10**
11	9 & 10	110	17.3	3.6	285	30	**7:05**	21.8	52	5	10	87	30	**10:10**
11	11	120	17.3	4.0	260	30	**6:50**	21.8	52	5	10	87	30	**9:55**
12	1 & 2	90	16.5	8.9	111	30	**3:55**	54.9	132	5	10	170	30	**9:45**
12	3 & 4	95	16.5	9.1	109	30	**3:55**	54.9	132	5	10	170	30	**9:45**
12	5 & 6	100	16.5	9.0	110	30	**4:00**	54.9	132	5	10	167	30	**9:45**
12	7 & 8	105	16.5	9.2	108	30	**4:05**	54.9	132	5	10	166	30	**9:50**
12	9 & 10	110	16.5	9.2	108	30	**4:10**	54.9	132	5	10	165	30	**9:55**
12	11 & 12	120	16.5	9.3	107	30	**4:20**	54.9	132	5	10	165	30	**10:05**
13	1 & 2	90	15.1	5.8	155	30	**4:35**	54.9	132	5	10	163	30	**10:15**
13	3 & 4	95	15.1	5.9	154	30	**4:40**	54.9	132	5	10	163	30	**10:20**
13	5 & 6	100	15.1	5.9	153	30	**4:45**	54.9	132	5	10	163	30	**10:25**
13	7 & 8	105	15.1	6.0	151	30	**4:50**	54.9	132	5	10	163	30	**10:30**
13	9 & 10	110	15.1	6.1	149	30	**4:50**	54.9	132	5	10	163	30	**10:30**
13	11	120	15.1	6.2	147	30	**5:00**	54.9	132	5	10	163	30	**10:40**
14	1	90	12.7	32.2	24	30	**2:25**	54.9	132	5	10	215	30	**9:00**
14	2	105	12.7	34.6	22	30	**2:40**	54.9	132	5	10	211	30	**9:10**
14	3 & 4	120	12.7	36.0	21	30	**2:55**	54.9	132	5	10	204	30	**9:20**
15	1	90	15.9	48.0	20	30	**2:20**	15.4	37	5	10	69	30	**4:55**
15	2 & 3	120	15.9	50.2	19	30	**2:50**	15.4	37	5	10	69	30	**5:25**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
16	1 & 2	90	17.9	3.2	337	30	**7:40**	64.5	155	5	10	193	30	**14:15**
16	3 & 4	95	17.9	3.5	308	30	**7:15**	64.5	155	5	10	193	30	**13:50**
16	5 & 6	100	17.9	3.5	306	30	**7:20**	64.5	155	5	10	193	30	**13:55**
16	7 & 8	110	17.9	3.6	302	30	**7:25**	64.5	155	5	10	193	30	**14:00**
16	9	120	17.9	3.6	297	30	**7:30**	64.5	155	5	10	193	30	**14:05**
17	1	90	18.8	3.4	330	30	**7:30**	64.5	155	5	10	194	30	**14:05**
17	2	95	18.8	3.4	329	30	**7:35**	64.5	155	5	10	194	30	**14:10**
17	3	100	18.8	3.4	328	30	**7:40**	64.5	155	5	10	194	30	**14:15**
17	4	105	18.8	3.5	327	30	**7:45**	64.5	155	5	10	194	30	**14:20**
17	5	110	18.8	3.5	325	30	**7:45**	64.5	155	5	10	194	30	**14:20**
17	6 & 7	115	18.8	3.7	303	30	**7:30**	64.5	155	5	10	194	30	**14:05**
17	8 & 9	120	18.8	3.7	301	30	**7:35**	64.5	155	5	10	194	30	**14:10**
18	1	90	18.1	3.4	320	30	**7:20**	64.6	155	5	10	194	30	**13:55**
18	2	95	18.1	3.4	319	30	**7:25**	64.6	155	5	10	194	30	**14:00**
18	3	100	18.1	3.5	314	30	**7:25**	64.6	155	5	10	194	30	**14:00**
18	4	105	18.1	3.5	312	30	**7:30**	64.6	155	5	10	194	30	**14:05**
18	5	110	18.1	3.5	309	30	**7:30**	64.6	155	5	10	194	30	**14:05**
18	6 & 7	115	18.1	3.5	308	30	**7:35**	64.6	155	5	10	194	30	**14:10**
18	8 & 9	120	18.1	3.5	306	30	**7:40**	64.6	155	5	10	194	30	**14:15**
19	1	90	9.9	3.1	192	30	**5:15**	76.9	185	5	10	212	30	**12:40**
19	2	95	9.9	3.1	190	30	**5:15**	76.9	185	5	10	212	30	**12:40**
19	3	100	9.9	3.2	188	30	**5:20**	76.9	185	5	10	212	30	**12:45**
19	4	110	9.9	3.4	174	30	**5:15**	76.9	185	5	10	212	30	**12:40**
20	1	90	13.9	3.8	218	30	**5:40**	76.9	185	5	10	219	30	**13:10**
20	2	95	13.9	3.9	216	30	**5:45**	76.9	185	5	10	219	30	**13:15**
20	3	100	13.9	3.9	213	30	**5:45**	76.9	185	5	10	219	30	**13:15**
20	4	110	13.9	4.2	200	30	**5:40**	76.9	185	5	10	219	30	**13:10**
20	5	120	13.9	4.3	195	30	**5:45**	76.9	185	5	10	219	30	**13:15**
21	1	90	12.6	4.0	189	30	**5:10**	64.6	155	5	10	185	30	**11:35**
21	2	95	12.6	4.0	188	30	**5:15**	64.6	155	5	10	185	30	**11:40**
21	3	100	12.6	4.1	184	30	**5:15**	64.6	155	5	10	185	30	**11:40**

Route Number	Bus Number	One-Wave						Distance to R.C. (miles)	Two-Wave					
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
21	4	110	12.6	4.3	174	30	**5:15**	64.6	155	5	10	185	30	**11:40**
21	5	120	12.6	4.3	175	30	**5:25**	64.6	155	5	10	185	30	**11:50**
						Maximum ETE:	**7:45**						**Maximum ETE:**	**14:20**
						Average ETE:	**5:40**						**Average ETE:**	**10:30**

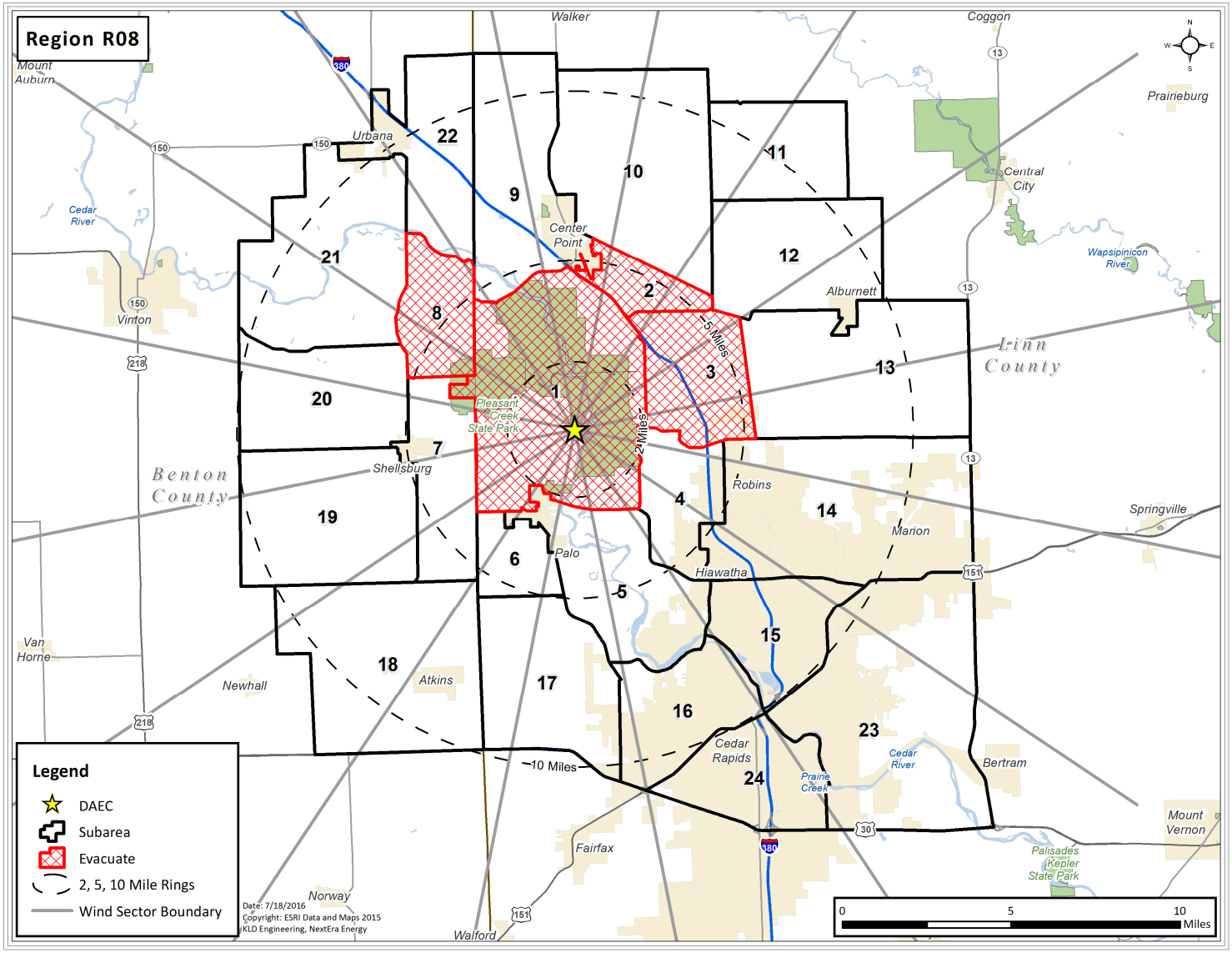

Figure H-8. Region R08

1 INTRODUCTION

In 2012, an Evacuation Time Estimate (ETE) study was conducted for the Duane Arnold Energy Center (DAEC) EPZ. In 2013, the Linn County Emergency Management Commission requested to reduce the size of the DAEC EPZ. The area proposed to be removed is located in Subarea 24 south of US Highway 30 (US-30) bounded on the west by Edgewood Road, the south by 76th Ave SW, and on the east by C. Street Road SW. The area includes the entire College Community School District main campus and can be seen with orange hatching in Figure 1-1.

Part IV, Section K of the January 2016 FEMA Radiological Emergency Preparedness (REP) Program Manual outlines the process for making changes to the EPZ boundary:

> If an ORO wants to change the boundary of an existing EPZ, the proposal must be submitted to the FEMA Regional Administrator or his/her designee, usually the RAC [Regional Assistance Committee] Chair. The proposal shall include, but not be limited to:
>
> - Action by appropriate ORO officials desiring the change to the boundary (i.e., resolution by elected official, etc.);
> - Description of the change to the boundary;
> - Discussion of the population affected by the change;
> - Effect that the change has on evacuation routes or evacuation time estimates; and
> - Maps showing the existing EPZ boundary and proposed new boundary.
>
> FEMA and the RAC will review the request on its merits. After the regional review, the request and RAC recommendation will be forwarded to FEMA Headquarters for final action.
>
> If the EPZ boundary change is approved, the approval is contingent on the ORO submitting for review the appropriate changes to their plans/procedures, maps of the EPZ, public information material, and impact that the addition or subtraction of population from the EPZ has on the evacuation time estimates. The required information would include changes to the geographical boundary descriptions and the ANS, including additional sirens or other means for public notification. Any modifications to an ANS must be consistent with Section V, Part A of this Manual, Alert and Notification Systems.

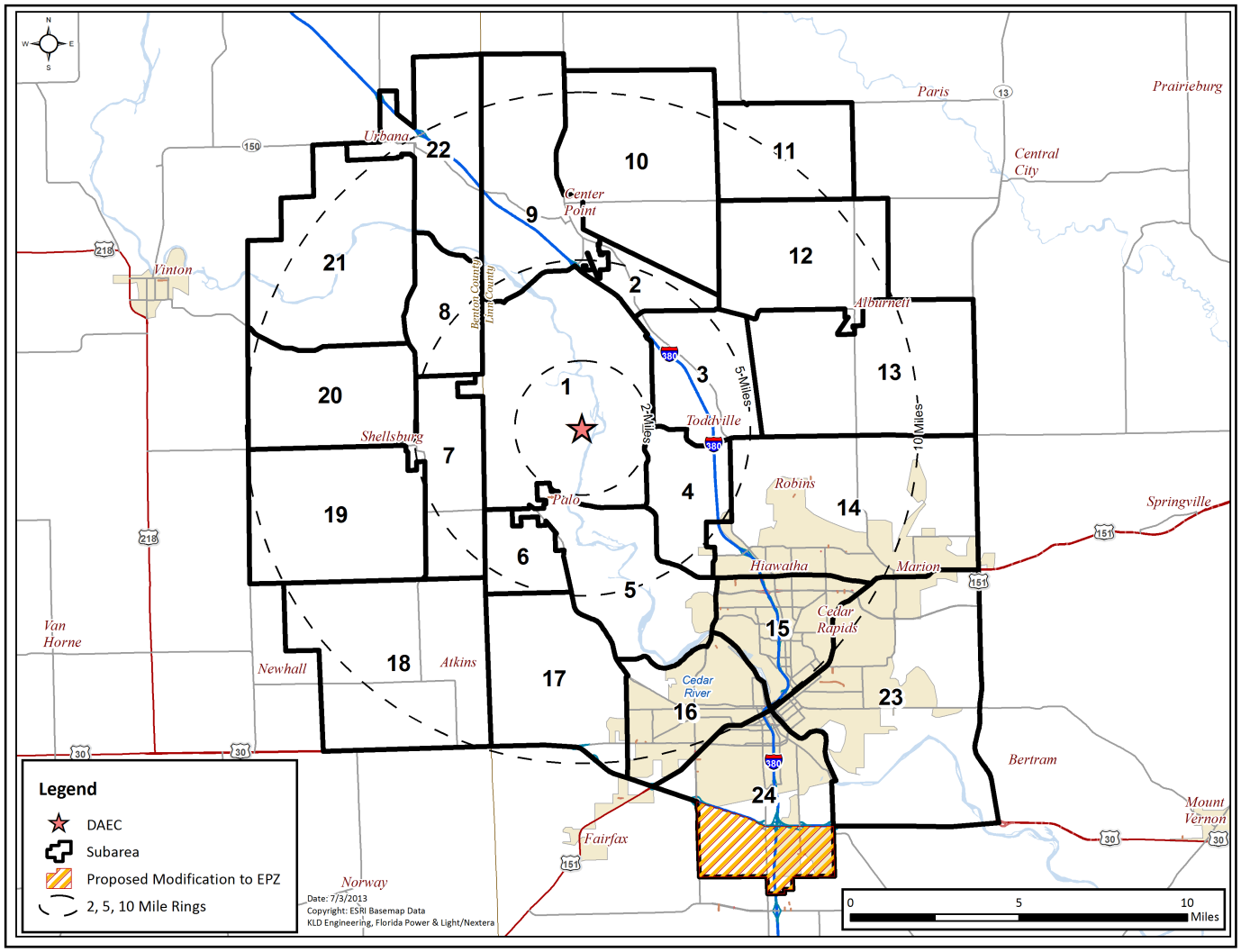

Figure 1-1. Proposed EPZ Change

According to NRC's Title 10 of the Code of Federal Regulations Part 50.54(q),

> The licensee may make changes to its emergency plan without NRC approval only if the licensee performs and retains an analysis demonstrating that the changes do not reduce the effectiveness of the plan and the plan, as changed, continues to meet the requirements in appendix E to this part and, for nuclear power reactor licensees, the planning standards of § 50.47(b).
>
> The changes to a licensee's emergency plan that reduce the effectiveness of the plan as defined in paragraph (q)(1)(iv) of this section may not be implemented without prior approval by the NRC. A licensee desiring to make such a change after February 21, 2012 shall submit an application for an amendment to its license. In addition to the filing requirements of §§ 50.90 and 50.91, the request must include all emergency plan pages affected by that change and must be accompanied by a forwarding letter identifying the change, the reason for the change, and the basis for concluding that the licensee's emergency plan, as revised, will continue to meet the requirements in appendix E to this part and, for nuclear power reactor licensees, the planning standards of § 50.47(b).

In accordance with the aforementioned federal regulations, this report describes the analyses undertaken and the results obtained by a study to develop ETE for the DAEC utilizing the proposed EPZ. In addition, this study includes updated population data and accounts for roadway changes since the 2012 ETE study. This ETE study provides NextEra Energy and state and local governments with site-specific information needed for Protective Action decision-making.

In the performance of this effort, guidance is provided by documents published by Federal Governmental agencies. Most important of these are:

- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011.
- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, November 2011.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG-0654/FEMA REP 1, Rev. 1, November 1980.
- Analysis of Techniques for Estimating Evacuation Times for Emergency Planning Zones, NUREG/CR-1745, November 1980.
- Development of Evacuation Time Estimates for Nuclear Power Plants, NUREG/CR-6863, January 2005.

The work effort reported herein was supported and guided by local stakeholders who contributed suggestions, critiques, and the local knowledge base required. Table 1-1 presents a summary of stakeholders and interactions.

Table 1-1. Stakeholder Interaction

Stakeholder	Nature of Stakeholder Interaction
NextEra Energy	Attended conference calls to define the EPZ boundary and any new data requirements. Reviewed and approved all project assumptions. Provided current county emergency plans, special facility, schools, and homebound special needs data, and traffic management plans through telephone calls and emails. Engaged in the ETE development and were informed of the study results.
Linn County Emergency Management	Attended conference calls to define the EPZ boundary and any new data requirements. Reviewed and approved all project assumptions. Engaged in the ETE development and were informed of the study results.
Benton County Emergency Management	Attended conference calls to define the EPZ boundary and any new data requirements. Reviewed and approved all project assumptions. Engaged in the ETE development and were informed of the study results.
Iowa State Department of Transportation	Obtained traffic management plans, roadway construction information and AADT data.
Local and State Police Agencies	Consulted for traffic management plans and emergency operation.

1.1 Overview of the ETE Process

The following outline presents a brief description of the work effort in chronological sequence:

1. Information Gathering:
    a. Defined the proposed EPZ and scope of work in discussions with representatives from NextEra Energy.
    b. Held conference calls with emergency planners from Benton County EMA, Linn County EMA, and DAEC to identify issues to be addressed and resources available.
    c. Updated the 2012 link-node analysis network based on aerial imagery within the Emergency Planning Zone (EPZ)[1], Shadow Region, and in some areas out to 25 miles radially from the DAEC. See Section M.4.2.

[1] All references to Emergency Planning Zone or EPZ refer to the plume exposure pathway EPZ.

d. Obtained demographic data from the 2010 census. Projected 2010 Census data to the year 2016. See Section 3.1.

e. Estimated the number of non-EPZ employees using data obtained from the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool[2].

f. Utilized data from the 2012 random sample telephone survey of EPZ residents.

g. Obtained data (to the extent available) to update the database of schools, colleges, preschools, day care centers, medical facilities, group homes, correctional facilities, transient attractions, major employers, homebound residents, transportation resources available and other important information gathered in support of the 2012 ETE study.

2. Reviewed the 2012 distributions of trip generation times representing the time required by various population groups (permanent residents, employees, and transients) to prepare (mobilize) for the evacuation trip and updated where necessary. These estimates are primarily based upon the 2012 random sample telephone survey.

3. Defined Evacuation Scenarios. These scenarios reflect the variation in demand, in trip generation distribution and in highway capacities, associated with different seasons, day of week, time of day and weather conditions.

4. Reviewed the existing traffic management plan to be implemented by local and state police in the event of an incident at the plant. Traffic control is applied at specified Traffic Control Points (TCP) and Access Control Points (ACPs) located within the study area.

5. Used the proposed Subareas to define evacuation regions. The EPZ is partitioned into 24 Subareas along jurisdictional and geographic boundaries. "Regions" are groups of contiguous subareas for which ETE are calculated. The configurations of these Regions reflect wind direction and the radial extent of the impacted area. Each Region, other than those that approximate circular areas, approximates a "key-hole section" within the EPZ as recommended by NUREG/CR-7002.

6. Estimated demand for transit services for persons at special facilities and for transit-dependent persons at home.

7. Prepared the input streams for the DYNEV II.

   a. Estimated the evacuation traffic demand, based on the available information derived from Census data, and from data provided by NextEra Energy, and from the 2012 telephone survey.

[2] http://onthemap.ces.census.gov/ ; the latest data available on using the OnTheMap census tool is for the year 2014.

b. Updated and extended the 2012 link-node representation of the evacuation network, which is used as the basis for the computer analysis that calculates the ETE.

c. Applied the procedures specified in the 2010 Highway Capacity Manual (HCM[3]) to the link-node analysis network to estimate the capacity of all highway segments comprising the evacuation routes.

d. Calculated the evacuating traffic demand for each Region and for each Scenario.

e. Specified selected candidate destinations for each "origin" (location of each "source" where evacuation trips are generated over the mobilization time) to support evacuation travel consistent with outbound movement relative to the location of the DAEC.

8. Executed the DYNEV II model to determine optimal evacuation routing and compute ETE for all residents, transients and employees ("general population") with access to private vehicles. Generated a complete set of ETE for all specified Regions and Scenarios.
9. Documented ETE in formats in accordance with NUREG/CR-7002.
10. Calculated the ETE for all transit activities including those for special facilities (schools, colleges, preschools, day care centers, medical facilities, group homes (overnight capacity of 10 or more) and correctional facilities), for the transit-dependent population and for homebound special needs population.

1.2 The Duane Arnold Energy Center Location

The DAEC is located near the town of Palo on the western side of Cedar River in Linn County, Iowa. It is approximately 8 miles northwest of Cedar Rapids, 35 miles southeast of Waterloo, and 30 miles northwest of Iowa City. The EPZ consists of parts of Linn and Benton Counties. Figure 1-2 displays the area surrounding the DAEC. This map identifies the communities in the area and the major roads.

[3] Highway Capacity Manual (HCM 2010), Transportation Research Board, National Research Council, 2010.

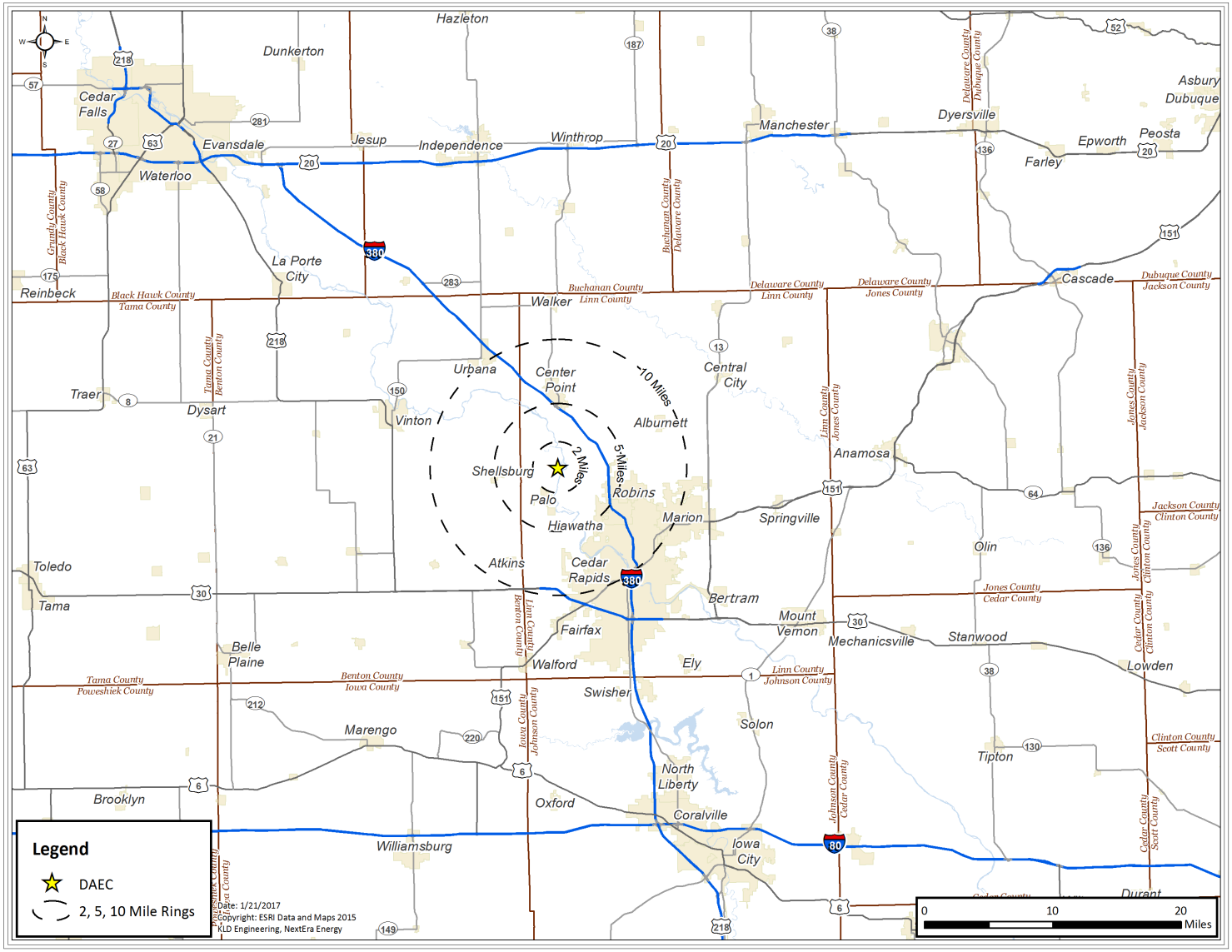

Figure 1-2. DAEC Location

1.3 Preliminary Activities

These activities are described below.

Field Surveys of the Highway Network

In 2012, KLD personnel drove the entire highway system within the EPZ and the Shadow Region which consists of the area between the EPZ boundary and approximately 15 miles radially from the plant. The characteristics of each section of highway were recorded. These characteristics are shown in Table 1-2:

Table 1-2. Highway Characteristics

- Number of lanes
- Lane width
- Shoulder type & width
- Interchange geometries
- Lane channelization & queuing capacity (including turn bays/lanes)
- Geometrics: curves, grades (>4%)
- Posted speed
- Actual free speed
- Abutting land use
- Control devices
- Intersection configuration (including roundabouts/traffic circles where applicable)
- Traffic signal type
- Unusual characteristics: Narrow bridges, sharp curves, poor pavement, flood warning signs, inadequate delineations, toll booths, etc.

Video and audio recording equipment were used to capture a permanent record of the highway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of highway sections. For example, Exhibit 15-7 in the HCM 2010 indicates that a reduction in lane width from 12 feet (the "base" value) to 10 feet can reduce free flow speed (FFS) by 1.1 mph – not a material difference – for two-lane highways. Exhibit 15-30 in the HCM 2010 shows little sensitivity for the estimates of Service Volumes at Level of Service (LOS) E (near capacity), with respect to FFS, for two-lane highways.

The data from the audio and video recordings were used to create detailed geographic information systems (GIS) shapefiles and databases of the roadway characteristics and of the traffic control devices observed during the road survey; this information was referenced while preparing the input stream for the DYNEV II System.

As documented on page 15-5 of the HCM 2010, the capacity of a two-lane highway is 1,700 passenger cars per hour in one direction. For freeway sections, a value of 2,250 vehicles per hour per lane is assigned, as per Exhibit 11-17 of the HCM 2010. The road survey has identified several segments which are characterized by adverse geometrics on two-lane highways which are reflected in reduced values for both capacity and speed. These estimates are consistent

with the service volumes for LOS E presented in HCM Exhibit 15-30. These links may be identified by reviewing Appendix K. Link capacity is an input to DYNEV II which computes the ETE. Further discussion of roadway capacity is provided in Section 4 of this report.

Traffic signals are either pre-timed (signal timings are fixed over time and do not change with the traffic volume on competing approaches), or are actuated (signal timings vary over time based on the changing traffic volumes on competing approaches). Actuated signals require detectors to provide the traffic data used by the signal controller to adjust the signal timings. These detectors are typically magnetic loops in the roadway, or video cameras mounted on the signal masts and pointed toward the intersection approaches. If detectors were observed on the approaches to a signalized intersection during the road survey, detailed signal timings were not collected as the timings vary with traffic volume. TCPs at locations which have control devices are represented as actuated signals in the DYNEV II system.

If no detectors were observed, the signal control at the intersection was considered pre-timed, and detailed signal timings were gathered for several signal cycles. These signal timings were input to the DYNEV II system used to compute ETE, as per NUREG/CR-7002 guidance.

Figure 1-3 presents the link-node analysis network that was constructed to model the evacuation roadway network in the EPZ and Shadow Region. The directional arrows on the links and the node numbers have been removed from Figure 1-3 to clarify the figure. The detailed figures provided in Appendix K depict the analysis network with directional arrows shown and node numbers provided. The observations made during the field survey and aerial imagery was used to calibrate the analysis network.

In 2016, the link-node analysis network was updated to include newly constructed roadway improvements. There have been several major roadway changes within the study area, including the construction of multiple traffic circles in City of Marion and Mt. Vernon and the Highway 100 Extension Project, which was newly constructed. Aerial imagery and roadway design plans (to the extent available) were used to update the network. Additionally, the network was expanded out to 25 miles radially from the plant to the east and south.

Telephone Survey

A telephone survey was performed in 2012 to gather information needed for the study. Appendix F presents the survey instrument, the procedures used and tabulations of data compiled from the survey returns. Given there were no significant changes in demographics (see Appendix F), the behavioral responses to the survey questions are not likely to change significantly and the results of the 2012 survey are applicable to this study.

These data were utilized to develop estimates of vehicle occupancy to estimate the number of evacuating vehicles during an evacuation and to estimate elements of the mobilization process. This database was also referenced to estimate the number of transit-dependent residents.

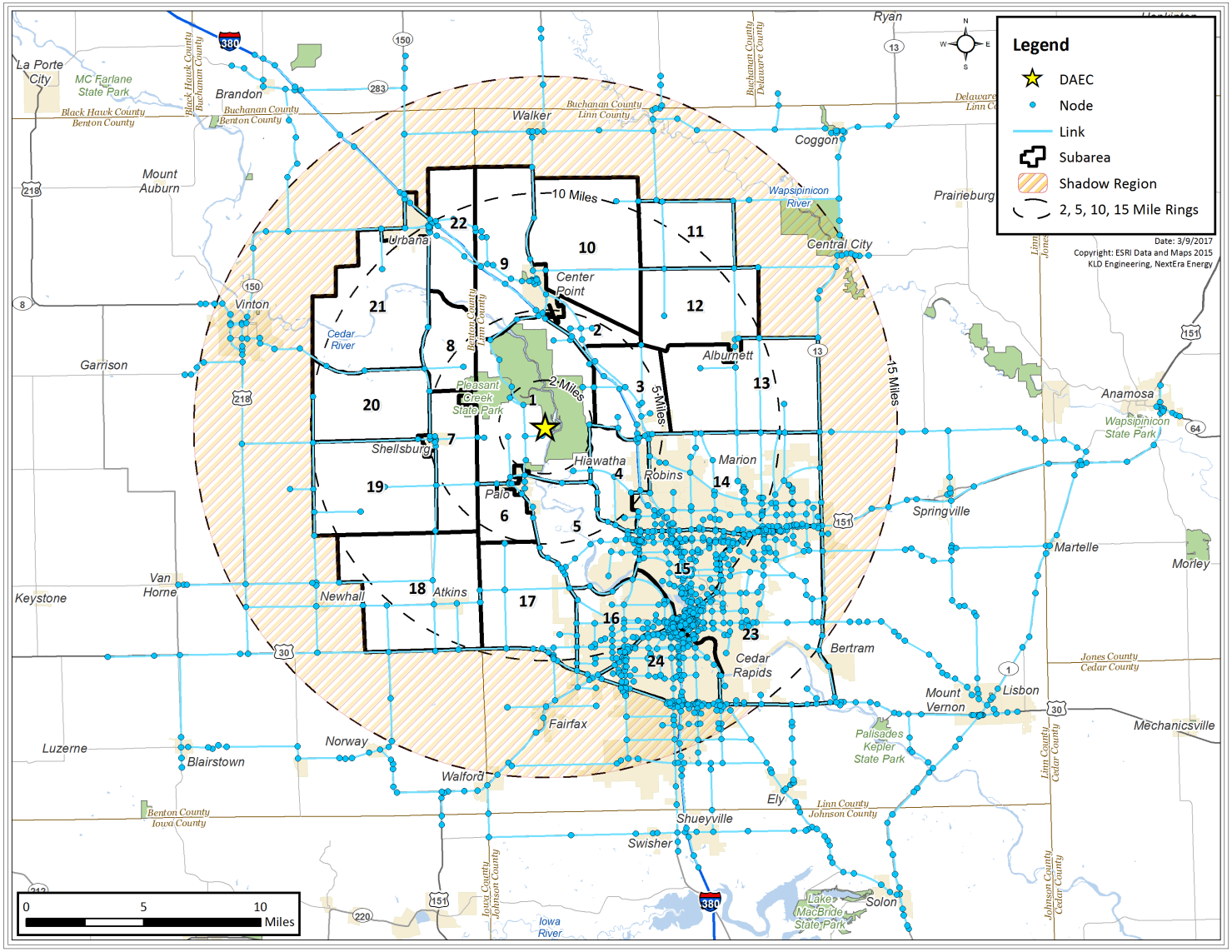

Figure 1-3. DAEC Link-Node Analysis Network

Computing the Evacuation Time Estimates

The overall study procedure is outlined in Appendix D. Demographic data were obtained from several sources, as detailed later in this report. These data were analyzed and converted into vehicle demand data. The vehicle demand was loaded onto appropriate "source" links of the analysis network using GIS mapping software. The DYNEV II system was then used to compute ETE for all Regions and Scenarios.

Analytical Tools

The DYNEV II System that was employed for this study is comprised of several integrated computer models. One of these is the DYNEV (DYnamic Network EVacuation) macroscopic simulation model, a new version of the IDYNEV model that was developed by KLD under contract with the Federal Emergency Management Agency (FEMA).

DYNEV II consists of four sub-models:

- A macroscopic traffic simulation model (for details, see Appendix C).
- A Trip Distribution (TD), model that assigns a set of candidate destination (D) nodes for each "origin" (O) located within the analysis network, where evacuation trips are "generated" over time. This establishes a set of O-D tables.
- A Dynamic Traffic Assignment (DTA), model which assigns trips to paths of travel (routes) which satisfy the O-D tables, over time. The TD and DTA models are integrated to form the DTRAD (Dynamic Traffic Assignment and Distribution) model, as described in Appendix B.
- A Myopic Traffic Diversion model which diverts traffic to avoid intense, local congestion, if possible.

Another software product developed by KLD, named UNITES (UNIfied Transportation Engineering System) was used to expedite data entry and to automate the production of output tables.

The dynamics of traffic flow over the network are graphically animated using the software product, EVAN (EVacuation ANimator), developed by KLD. EVAN is GIS based, and displays statistics such as LOS, vehicles discharged, average speed, and percent of vehicles evacuated, output by the DYNEV II System. The use of a GIS framework enables the user to zoom in on areas of congestion and query road name, town name and other geographical information.

The procedure for applying the DYNEV II System within the framework of developing ETE is outlined in Appendix D. Appendix A is a glossary of terms.

For the reader interested in an evaluation of the original model, I-DYNEV, the following references are suggested:

- NUREG/CR-4873 – Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code
- NUREG/CR-4874 – The Sensitivity of Evacuation Time Estimates to Changes in Input Parameters for the I-DYNEV Computer Code

The evacuation analysis procedures are based upon the need to:

- Route traffic along paths of travel that will expedite their travel from their respective points of origin to points outside the EPZ.
- Restrict movement toward the plant to the extent practicable, and disperse traffic demand so as to avoid focusing demand on a limited number of highways.
- Move traffic in directions that are generally outbound, relative to the location of the plant.

DYNEV II provides a detailed description of traffic operations on the evacuation network. This description enables the analyst to identify bottlenecks and to develop countermeasures that are designed to represent the behavioral responses of evacuees. The effects of these countermeasures may then be tested with the model.

1.4 Comparison with Prior ETE Study

Table 1-3 presents a comparison of the present ETE study with the 2012 ETE study. The major factors contributing to the differences between the ETE values obtained in this study and those of the previous study are:

- The boundary of Subarea 24 was modified – the portion south of US-30 was removed from the EPZ. There were 5,218 permanent residents living in this portion of Subarea 24 according to the 2010 Census, and 5,427 permanent residents when extrapolated to 2016.
- The permanent resident population was projected to 2016, which resulted in an increase in permanent resident population (2.2%) within the EPZ. The growth in population would have been 5.1% if the area of Subarea 24 were still in the EPZ. Nonetheless, the population increase results in additional evacuating vehicles within the EPZ which could increase ETE.
- The permanent resident population in the Shadow Region was also projected to 2016 and increased by 6,165 people (32.0% increase). However, 5,427 of those people are from the portion of Subarea 24 that was removed from the EPZ. Thus, the permanent resident population in the Shadow Region increased by 738 people, or about 3.8%. This population increase results in additional evacuating vehicles in the Shadow Region, which reduces the available roadway capacity for EPZ evacuees and could increase ETE.
- Several significant roadway improvements were completed within the study area after 2012, including the construction of 2 traffic circles in the City of Marion to replace all-way stop intersections, the Iowa Highway 100 (IA-100) Extension Project in Cedar Rapids (from Covington Rd to Edgewood Rd NE) and two traffic circles, in Mt. Vernon. This is to be expected – as population increases, infrastructure improves, albeit slowly at times. The extension of IA-100, as well as other roadway improvements, provides additional capacity to evacuees in the area and thereby can reduce ETE.
- The roadway network was extended south and east of the plant to 25 miles radially (rather than 15 miles as was done in 2012 – see Figures M-2 and M-3 in Appendix M). These additional roadways provide alternate evacuation routes and additional storage

and capacity, thereby potentially reducing the ETE.

- Consideration of bottlenecks outside of the study area; the federal guidance (NUREG-0654 and NUREG/CR-7002) recommends an EPZ with an approximate radius of 10 miles centered at the plant, and a Shadow Region which extends to 15 miles radially. The EPZ for the DAEC is unique in that the EPZ extends beyond 15 miles to the southeast in Subarea 23 (see Figure 7-2). In 2012, the link-node analysis network was stopped just beyond the boundary of Subarea 23 as it was approximately 16 miles from the plant. The last node in the network along US-30 eastbound was just east of the interchange with IA-13. At that point, US-30 eastbound is acting as a freeway with 2 lanes eastbound (each with a capacity of 2,250 vehicles per hour) for a total capacity of 4,500 vehicles per hour. Approximately 3.5 miles east of that, US-30 eastbound narrows to a single lane with a capacity of 1,700 vehicles per hour. An additional 2 miles east of the drop to a single lane, US-30 eastbound enters a single lane traffic circle in Mount Vernon with a posted speed limit of 20 mph and an estimated capacity of 900 vehicles per hour. This study models US-30 eastbound through Mount Vernon (see Figure 1-3) versus the 2012 study which stopped just east of the interchange with IA-13. Thus, the capacity of the network exit along US-30 eastbound in 2012 was 4,500 vehicles per hour, versus 900 vehicles per hour in this study – a reduction in capacity of 80%. This could significantly increase ETE.
- Five additional TCPs and one ACP were identified based on the latest simulations and resulting congestion patterns due to the significant reduction in capacity of US-30 eastbound leaving Cedar Rapids. The TCPs are at stop controlled intersections along alternate routes leaving Cedar Rapids, while the ACP is at one of the traffic circles in Mount Vernon to stop the flow of traffic along US-30 westbound towards Cedar Rapids. Staffing the TCPs with a traffic control officer could increase their throughput and thereby reduce ETE. Staffing the ACP with a traffic control officer could reduce the amount of traffic on US-30 westbound towards Cedar Rapids thereby causing less impedance to traffic leaving Cedar Rapids, which could decrease ETE.

The ETE in this study increased significantly relative to those ETE computed in the 2012 ETE study, predominately as a result of the consideration of bottlenecks outside of the study area, and to a lesser extent the increase in population and evacuating vehicles in the study area. The significant reduction in capacity (note the capacity of the road itself was not reduced, rather the way the road was modeled in the analysis reflected a reduction in capacity) along US-30 eastbound in this study relative to the 2012 study results in significant congestion and queuing along US-30 eastbound leaving Cedar Rapids. This results in thousands of vehicles seeking alternate routes (US-30 westbound, I-380 southbound, US-151B southbound, IA-965 southbound, and Ely Rd southbound) and prolonged congestion throughout Cedar Rapids, thereby increasing ETE.

The change in the EPZ boundary, however, decreases ETE. Appendix M (Section M.4) illustrates that when the robust (extending out to 25 miles in some areas) analysis network used in this study is held constant, and the EPZ boundary (Subarea 24) is reduced, the 90th and 100th percentile ETE decrease significantly (greater than 30 minutes).

Table 1-3. ETE Study Comparisons

Topic	Previous ETE Study	Current ETE Study
Resident Population	ArcGIS Software using 2010 US Census blocks; area ratio method used. Population = 189,436	ArcGIS software using 2010 US Census blocks and projecting out to 2016 using 2015 population changes published by the US Census; area ratio method used. Population = 193,674
Resident Population Vehicle Occupancy	2.25 persons/household, 1.26 evacuating vehicles/household yielding: 1.79 persons/vehicle.	2.25 persons/household, 1.26 evacuating vehicles/household yielding: 1.79 persons/vehicle.
Employee Population	Employee estimates based on census work area profile and GIS inflow/outflow analysis. 1.10 employees per vehicle based on telephone survey results. Employees = 31,316	Employee estimates based on census work area profile and GIS inflow/outflow analysis. 1.10 employees per vehicle based on telephone survey results. Employees = 32,250
Transit-Dependent Population	Estimates based upon U.S. Census data and the results of the telephone survey. A total of 6,754 people who do not have access to a vehicle, requiring 136 buses to evacuate. An additional 1,289 homebound special needs persons needed special transportation to evacuate (949 required a bus, 219 required a wheelchair-accessible vehicle, and 43 required an ambulance).	Estimates based upon U.S. Census data and the results of the 2012 telephone survey. A total of 6,905 people who do not have access to a vehicle, requiring 144 buses to evacuate. An additional 1,172 homebound special needs persons need special transportation to evacuate (906 require a bus or van, 251 require a wheelchair-accessible vehicle, and 15 require an ambulance).
Transient Population	Transient estimates based upon telephone calls placed to facilities and estimations made based on parking capacity. Transients = 11,056	Transient estimates based upon telephone calls placed to facilities and estimations made based on parking capacity. Transients = 10,907
Special Facility Population	Special facility (medical, group home, correctional facility) population based on information provided by each county within the EPZ. Bus capacity required = 5,237 Ambulance capacity required = 483	Special facility population based on information provided by each county within the EPZ. Bus capacity required = 4,143 Ambulance capacity required = 476

Topic	Previous ETE Study	Current ETE Study
School/Preschool/Day Care Centers Population	School population based on information provided by each county within the EPZ. Preschools and Day Care Centers are included in these estimates. Total enrollment = 44,268 Buses required = 811	School population based on information provided by each county within the EPZ. Colleges, preschools and day care centers are included in these estimates. Total enrollment = 42,467 Buses required = 805
Shadow Population	ArcGIS Software using 2010 US Census blocks; area ratio method used. Population = 19,285	ArcGIS software using 2010 US Census blocks and projecting out to 2016 using 2015 population changes published by the US Census; area ratio method used. Population = 25,450
Voluntary evacuation from within EPZ in areas outside region to be evacuated	20% of the population within the EPZ, but not within the Evacuation Region	20% of the population within the EPZ, but not within the Evacuation Region (see Figure 2-1)
Shadow Evacuation	20% of people outside of the EPZ within the Shadow Region	20% of people outside of the EPZ within the Shadow Region (see Figure 7-2)
Network Size	1,700 links; 1,028 nodes	2,099 links; 1,290 nodes
Roadway Geometric Data	Field surveys conducted in February 2012. Roads and intersections were video archived. Road capacities based on 2010 HCM.	Field surveys conducted in February 2012. Roads and intersections were video archived. Updated with use of aerial imagery. Road capacities based on 2010 HCM.
Colleges/ School/Preschools/Day Care Centers Evacuation	Direct evacuation to designated Reception Center/Temporary Relocation Centers.	Direct evacuation to designated Reception Center/Temporary Relocation Centers.
Ridesharing	50 percent of transit dependent persons will evacuate with a neighbor or friend.	50 percent of transit dependent persons will evacuate with a neighbor or friend.

Topic	Previous ETE Study	Current ETE Study
Trip Generation for Evacuation	Based on residential telephone survey of specific pre-trip mobilization activities: Residents with commuters returning leave between 15 and 210 minutes. Residents without commuters returning leave between 10 and 165 minutes. Employees and transients leave between 5 and 90 minutes. All times measured from the Advisory to Evacuate.	Based on residential telephone survey of specific pre-trip mobilization activities: Residents with commuters returning leave between 15 and 210 minutes. Residents without commuters returning leave between 10 and 165 minutes. Employees and transients leave between 5 and 90 minutes. All times measured from the Advisory to Evacuate.
Weather	Normal, Rain, or Snow. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain and 20% for snow.	Normal, Rain, or Snow. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain and 20% for snow.
Modeling	DYNEV II System – Version 4.0.10.0	DYNEV II System – Version 4.0.19.2
Special Events	Cedar Rapids Freedom Festival Special Event Population = 26,250 additional transients	Cedar Rapids Freedom Festival Special Event Population = 26,250 additional transients
Evacuation Cases	38 Regions (central sector wind direction and each adjacent sector technique used) and 14 Scenarios producing 532 unique cases.	38 Regions (central sector wind direction and each adjacent sector technique used) and 14 Scenarios producing 532 unique cases.
Evacuation Time Estimates Reporting	ETE reported for 90th and 100th percentile population. Results presented by Region and Scenario.	ETE reported for 90th and 100th percentile population. Results presented by Region and Scenario.
Evacuation Time Estimates for the entire EPZ, 90th percentile	Winter Midweek Midday, Good Weather: 5:40 Summer Weekend, Midday, Good Weather: 4:45	Winter Midweek Midday, Good Weather: 6:25 Summer Weekend, Midday, Good Weather: 5:05
Evacuation Time Estimates for the entire EPZ, 100th percentile	Winter Midweek, Midday, Good Weather: 7:40 Summer Weekend, Midday, Good Weather: 6:30	Winter Midweek, Midday, Good Weather: 9:00 Summer Weekend, Midday, Good Weather: 6:50

2 STUDY ESTIMATES AND ASSUMPTIONS

This section presents the estimates and assumptions utilized in the development of the evacuation time estimates.

2.1 Data Estimates

1. Permanent resident population estimates are based upon 2010 Census data projected to 2016 using annual growth rates computed by comparing 2010 data with 2015[1] population estimates published by the US Census (see Section 3.1).
2. Estimates of employees who reside outside the EPZ and commute to work within the EPZ are based upon data obtained from the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool[2]. The number of employees commuting into the EPZ to work was calculated by Census block using the work area profile and GIS inflow/outflow analysis (see Section 3.4).
3. Population estimates at special facilities are based upon data included in the county radiological emergency response plans.
4. Evacuee mobilization times are based on a statistical analysis of data acquired from a random sample telephone survey of EPZ residents conducted in 2012 (see Section 5 and Appendix F).
5. The relationship between resident population and evacuating vehicles is developed from the U.S. Census and the telephone survey (See Appendix F). Average values of 2.25 persons per household and 1.26 evacuating vehicles per household are used. The relationship between persons and vehicles for employees, transients and the special event is as follows:
    a. Employees: 1.10 employees per vehicle (2012 telephone survey results) for all major employers. See Figure F-7.
    b. Parks and historic sites: Vehicle occupancy was assumed to be the same as average household size: 2.25 evacuees per vehicle.
    c. Lodging facilities: Vehicle occupancy varies by facility, but is 2.54 persons per vehicle, on average, for all lodging facilities. See Section 3.3 and Appendix E.
    d. Special Event: Cedar Rapids Freedom Festival – 4.50 persons per vehicle based on information provided by the festival organizer. See Section 3.8.
6. Roadway capacity estimates are based on 2012 field surveys, 2016 aerial imagery) and application of the Highway Capacity Manual 2010.

[1] The annual population estimates prepared by the Census Bureau for the entire U.S. involve an extensive data gathering process. As such, population estimates are a year behind – 2015 data are released in 2016. The schedule for release of Census data is provided on the Census website: http://www.census.gov/popest/schedule.html
[2] http://onthemap.ces.census.gov/

2.2 Study Methodological Assumptions

1. The center-point of the plant is located at the center of the containment building, (42° 6' 2.2" N, 91° 46' 38.75" W).
2. As indicated in Figure 2-2 of NUREG/CR-7002, 100% of people within the impacted "keyhole" evacuate. Twenty percent (20%) of those people within the EPZ, not within the impacted keyhole, will voluntarily evacuate. Also, 20% of those people within the Shadow Region beyond the EPZ will voluntarily evacuate. See Figure 2-1 for a graphical representation of these evacuation percentages. Sensitivity studies explore the effect on ETE of increasing the percentage of voluntary evacuees in the Shadow Region (see Appendix M).
3. The ETE are computed and presented in tabular format and graphically, in a format compliant with NUREG/CR-7002.
4. ETE are presented for the evacuation of the 90th and 100th percentiles of population for each Region and for each Scenario. The percentile ETE is defined as the elapsed time from the Advisory to Evacuate (ATE) issued to a specific Region of the EPZ, to the time that Region is clear of the indicated percentile of evacuees. A Region is defined as a group of subareas that is issued an ATE. A Scenario is a combination of circumstances, including time of day, day of week, season, and weather conditions.
5. Staged evacuation is considered as defined in NUREG/CR-7002 – those people beyond 2 miles will shelter-in-place until 90 percent of the 2-mile Region has evacuated, then they will evacuate.
6. The models of the I-DYNEV System were recognized as state of the art by the Atomic Safety & Licensing Board (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik[3]). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The new DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment. The DYNEV II System is used to compute ETE in this study.
7. Evacuation movements (paths of travel) are generally outbound relative to the plant to the extent permitted by the highway network. All major evacuation routes are used in the analysis.
8. Regions are defined by the underlying "keyhole" or circular configurations as specified in Section 1.4 of NUREG/CR-7002. These Regions, as defined, display irregular boundaries reflecting the geography of the subareas included within these underlying configurations. All 16 cardinal and intercardinal wind direction keyhole configurations are considered.
9. The Shadow Region extends to 15 miles radially from the plant, or approximately 5 miles radially beyond the EPZ boundary (except in Cedar Rapids southeast of the plant where the EPZ boundary extends beyond 15 miles), as per NRC guidance.

[3] Urbanik, T., et. al. Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code, NUREG/CR-4873, Nuclear Regulatory Commission, June, 1988.

10. A total of 14 “Scenarios” representing different temporal variations (season, time of day, day of week) and weather conditions are considered. These Scenarios are outlined in Table 2-1.
11. Scenario 14 considers the closure of one lane southbound on Interstate-380 from the interchange with County Home Road (Exit 28) to the interchange with Wright Brothers Blvd (Exit 13).

2.3 Study Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating event at the plant wherein evacuation is ordered promptly, no early protective actions have been implemented, and includes the following[4]:
    a. The ATE is announced coincident with the siren notification.
    b. Mobilization of the general population will commence within 15 minutes after siren notification.
    c. ETE are measured relative to the ATE.
2. It is assumed that 100 percent of the EPZ population can be notified within 45 minutes, in accordance with the 2016 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness Program Manual.
3. It is assumed that everyone within the group of Subareas forming a Region that is issued an ATE will, in fact, respond and evacuate in general accord with the planned routes.
4. In calculating ETE, it is assumed that evacuees will drive safely, travel in directions identified in the plan, and obey all control devices and traffic guides.
5. Buses, vans, wheelchair transport vehicles, and ambulances will be used to transport those without access to private vehicles:
    a. The county plans outline two types of evacuation – “Selective Evacuation” for slowly developing accidents wherein there is time to take early protective actions and “General Evacuation” where everyone in the area at risk (keyhole typically) is evacuated with no time for early protective actions. For a Selective Evacuation, if schools, preschools and day care centers are in session, buses will evacuate students directly to the designated Temporary Relocation Centers (TRC). For a General Evacuation, schools, preschool and day care centers would be evacuated directly to Reception Centers.
    b. Buses, wheelchair vans and ambulances will evacuate patients at medical facilities, at group homes, or homebound special needs within the EPZ, as needed.
    c. Transit-dependent general population will be evacuated to reception centers.

[4] It is emphasized that the adoption of this planning basis is <u>not</u> a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

See Section 5.1 for more detail.

d. Children in schools, preschools and day care centers, if in session, are given priority in assigning transit vehicles.
e. Bus mobilization time is considered in ETE calculations.
f. Inmates at correctional facilities will shelter until adequate bus resources and law enforcement personnel are available.
g. Analysis of the number of required round-trips ("waves") of evacuating transit vehicles is presented.
h. Transport of transit-dependent evacuees from reception centers to congregate care centers is not considered in this study.

6. Transit vehicles mobilization times:
   a. Transit dependent buses are mobilized within 90 minutes, the time it takes approximately 90 percent of residents with no commuters to complete their mobilization.
   b. School buses will arrive at schools to be evacuated within 60 minutes of the ATE.
   c. Vehicles will arrive at medical facilities to be evacuated within 90 minutes of the ATE.
7. Vehicle loading times:
   a. School buses will be loaded in 15 minutes.
   b. Transit Dependent buses will require 1 minute of loading time per bus stop.
   c. Ambulances will require 15 minutes of loading time per bedridden passenger.
   d. Buses for medical facilities will require 1 minute of loading time per ambulatory passenger
   e. Wheelchair transport vehicles will require 5 minutes of loading time per wheelchair bound passenger.
8. Transit vehicle capacities:
   a. School buses = 70 students per bus for primary schools/preschools/day care centers, 50 students per bus for middle/high schools, and 30 students per bus for colleges
   b. Transit-dependent persons = 50 persons per bus
   c. Ambulatory, medical facility patients and group homes = 30 persons per bus
   d. Ambulances = 2 persons per vehicle
   e. Wheelchair transport = county emergency plans indicate that nearly all buses in the county have the ability to transport wheelchairs with the capacity ranging from 1 to 3 wheelchairs per bus
   f. Correctional Facility Buses = 66 persons per vehicle
9. It is assumed that drivers for all transit vehicles identified in Table 8-5 are available.
10. Provisions are made for evacuating the transit-dependent portion of the general population to reception centers by bus, based on the assumption that some of these people will ride-share with family, neighbors, and friends, thus reducing the demand for buses. We assume that the percentage of people who rideshare is 50%. This assumption is based upon reported experience for other emergencies[5], and on guidance

[5] Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The report indicates that 6,600 people of a transit-dependent population of 8,600 people shared rides with

in Section 2.2 of NUREG/CR-7002.

11. The ETE will also include consideration of "through" (External-External) trips during the time that such traffic is permitted to enter the evacuated Region. Background traffic is assumed to be present within the study area at the start of the emergency. See Sections 3.6 and 3.7.
12. The "DAEC Emergency Planning Zone Traffic Management Plan (TMP)," dated October 2014, defines Access Control Points (ACP) as intersections that will be manned after the evacuation has been completed to prevent people from entering the evacuated area (both for security and for safety reasons). NUREG/CR-7002 (Section 2.5.3) defines access control somewhat differently, wherein ACPs are established during the evacuation to stop the flow of through (external) traffic through the EPZ. Doing so reserves the capacity on major through routes for evacuees, rather than traffic that is passing through the area. As defined in Section 3.6, the major through routes in the EPZ are US-30 and I-380. This study assumes (in accordance with federal guidance) that the following four ACP intersections will be manned within 120 minutes after the ATE to stop the flow of through traffic in the EPZ:
    a. The interchange of I-380 & Wright Brothers Blvd (ACP #24N in the existing TMP) – divert the flow of northbound traffic on I-380
    b. The interchange of I-380 & 31st Avenue/Iowa 150 (ACP #22B in the existing TMP) – divert the flow of southbound traffic on I-380
    c. Intersection of US-30/218/73rd St & 30th Ave (ACP #18H in the existing TMP) – divert the flow of eastbound traffic on US-30
    d. Intersection of US-30 & Iowa 1 (new ACP – See Figure G-7) – divert the flow of westbound traffic on US-30

    Earlier activation of ACP locations could delay returning commuters. It is assumed that no external through traffic will enter the EPZ after this 120-minute time-period (See Section 3.6 and Appendix G). The additional ACPs as defined in the TMP will be manned by traffic guides once the evacuation of the EPZ has been completed.
13. Traffic Control Points (TCP) within the EPZ will be staffed over time, beginning at the ATE. Their number and location will depend on the Region to be evacuated and resources available. The objectives of these TCP are:
    a. Facilitate the movements of all (mostly evacuating) vehicles at the location.
    b. Discourage inadvertent vehicle movements towards the plant.
    c. Provide assurance and guidance to any traveler who is unsure of the appropriate actions or routing.
    d. Act as local surveillance and a communications center.
    e. Provide information to the emergency operations center (EOC) as needed, based on direct observation or on information provided by evacuees.
14. Two types of adverse weather scenarios are considered. Rain may occur for either winter or summer scenarios; snow occurs in winter scenarios only. It is assumed that the rain or snow begins earlier or at about the same time the evacuation advisory is issued.

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other residents; a ride share rate of 76% (Page 5-10).

No weather-related reduction in the number of transients who may be present in the EPZ is assumed. It is assumed that roads are passable and that the appropriate agencies are plowing the roads as they would normally when snowing.

Adverse weather scenarios affect roadway capacity and the free flow highway speeds. The factors applied for the ETE study are based on research on the effects of weather on roadway operations[6]; the factors are shown in

15. Table 2-2.
16. Trip generation time (time to prepare for and begin evacuation) will be based upon the results of the 2012 telephone survey, as per NRC guidance.
17. The telephone survey indicated that 58% of the households in the EPZ have at least 1 commuter (see Figure F-6 in Appendix F); 42% of those households with commuters will await the return of a commuter before (see Section F.3.2 in Appendix F) beginning their evacuation trip. Therefore 24 percent (58% x 42% = 24%) of EPZ households will await the return of a commuter, prior to beginning their evacuation trip.

[6] Agarwal, M. et. al. Impacts of Weather on Urban Freeway Traffic Flow Characteristics and Facility Capacity, Proceedings of the 2005 Mid-Continent Transportation Research Symposium, August, 2005. The results of this paper are included as Exhibit 10-15 in the HCM 2010.

Table 2-1. Evacuation Scenario Definitions

Scenario	Season[7]	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain	None
8	Winter	Midweek	Midday	Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Weekend	Midday	Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Weekend	Evening	Good	Cedar Rapids Freedom Festival
14	Summer	Midweek	Midday	Good	Roadway Impact – Lane Closure on I-380 Southbound

[7] Winter means that school is in session, at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

Table 2-2. Model Adjustment for Adverse Weather

Scenario	Highway Capacity*	Free Flow Speed*	Mobilization Time for General Population	Mobilization Time for Transit Vehicles
Rain	90%	90%	No Effect	10-minute increase
Snow	80%	80%	Clear driveway before leaving home (See Figure F-15)	20-minute increase
*Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable.				

Figure 2-1. Voluntary Evacuation Methodology

3 DEMAND ESTIMATION

The estimates of demand, expressed in terms of people and vehicles, constitute a critical element in developing an evacuation plan. These estimates consist of three components:

1. An estimate of population within the EPZ, stratified into groups (resident, employee, transient).
2. An estimate, for each population group, of mean occupancy per evacuating vehicle. This estimate is used to determine the number of evacuating vehicles.
3. An estimate of potential double-counting of vehicles.

Appendix E presents much of the source material for the population estimates. Our primary source of population data, the 2010 Census, however, is not adequate for directly estimating some transient groups.

Throughout the year, vacationers and tourists enter the EPZ. These non-residents may dwell within the EPZ for a short period (e.g., a few days or one or two weeks), or may enter and leave within one day. Estimates of the size of these population components must be obtained, so that the associated number of evacuating vehicles can be ascertained.

The potential for double-counting people and vehicles must be addressed. For example:

- A resident who works and shops within the EPZ could be counted as a resident, again as an employee and once again as a shopper.
- A visitor who stays at a hotel and spends time at a park, then goes shopping could be counted three times.

Furthermore, the number of vehicles at a location depends on time of day. For example, motel parking lots may be full at dawn and empty at noon. Similarly, parking lots at area parks, which are full at noon, may be almost empty at dawn. Estimating counts of vehicles by simply adding up the capacities of different types of parking facilities will tend to overestimate the number of transients and can lead to ETE that are too conservative.

Analysis of the population characteristics of the DAEC EPZ indicates the need to identify three distinct groups:

- Permanent residents – people who are year round residents of the EPZ.
- Transients – people who reside outside of the EPZ who enter the area for a specific purpose (shopping, recreation) and then leave the area.
- Employees – people who reside outside of the EPZ and commute to businesses within the EPZ on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups are presented for each Subarea and by polar coordinate representation (population rose). The DAEC EPZ is subdivided into 24 Subareas as shown in Figure 3-1.

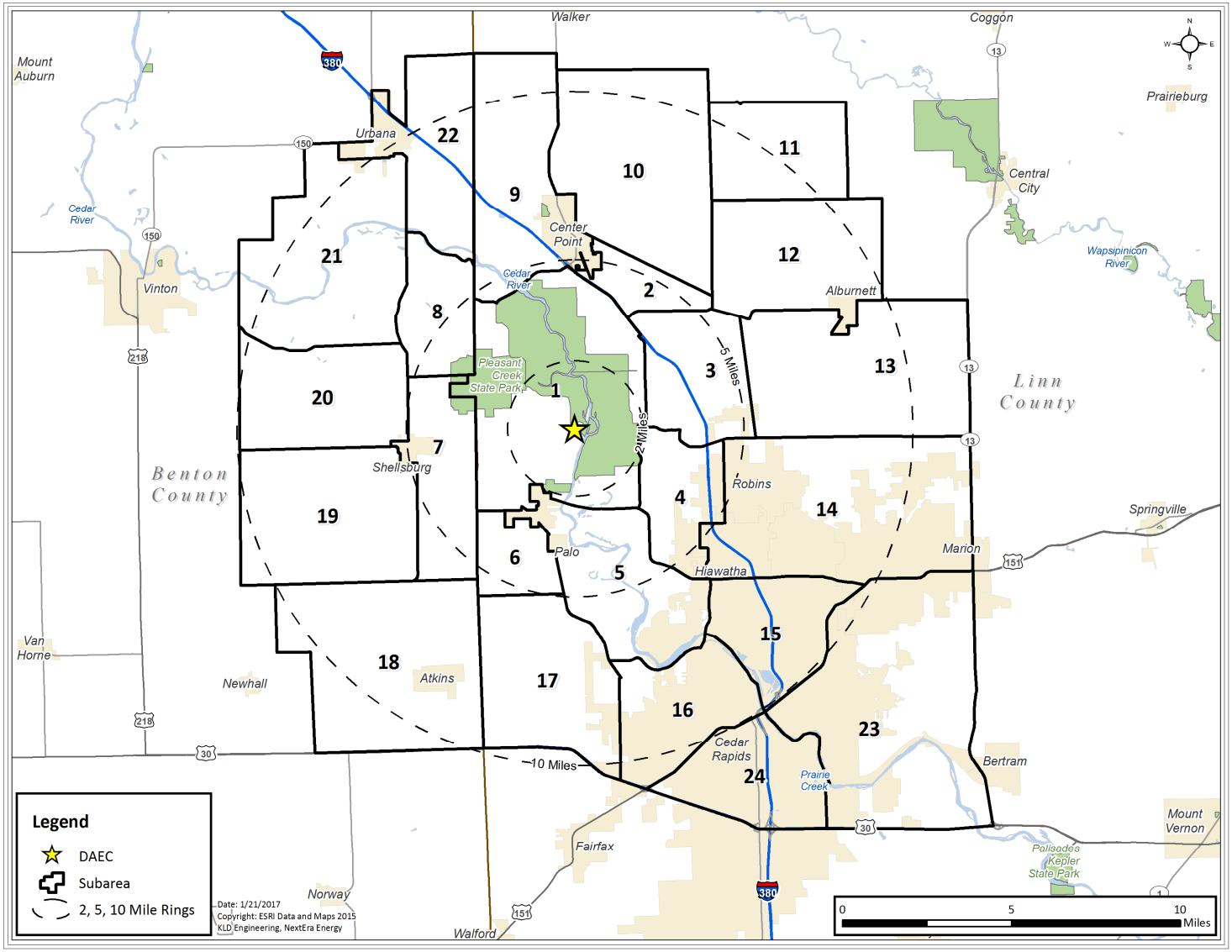


Figure 3-1. Subareas Comprising the DAEC EPZ

3.1 Permanent Residents

The primary source for estimating permanent population is the latest U.S. Census data. The U.S. Census Bureau conducts a physical census of the permanent resident population in the U.S. every ten years. The last census began on April 1, 2010 with data from the census being published on April 1, 2011. In the years between the decennial censuses, the Census Bureau works with state and local agencies to provide annual population estimates at the state and local levels. These estimates are done using data on deaths, births and migration. This annual data gathering process and analysis is extensive. As such, population estimates are a year behind – 2015 data are released in 2016.

This study is based on 2010 Census population data from the Census Bureau website[1] extrapolated to 2016 using annual growth rates computed from the 2015 Census population estimates as outlined in the methodology below.

The Census Bureau QuickFacts[2] website provides annual population estimates for each state, county, and municipality[3] in the United States. As discussed above, Census population estimates are a year behind. Thus, the most recent population estimates available for the counties and municipalities are for the time period from April 1, 2010 to July 1, 2015[4]. The population change and annual growth rate for each county and municipality in the study area (EPZ plus Shadow Region) are provided in Table 3-1 and Table 3-2, respectively. Figure 3-2 shows the county and municipality boundaries identified by the Census Bureau.

The permanent resident population, as per the 2010 Census, for the EPZ and the Shadow Region was projected to 2016 using the compound growth formula (Equation 1). In the compound growth formula, g is the annual growth rate and X is the number of years projected forward from Year 2010. The compound growth formula can be solved for g as shown in Equation 2.

Equation 1

$$(Compound\ Growth\ for\ X\ years): Population\ 201X\ =\ Population\ 2010\ (1\ +\ g)^{\ x}$$

Equation 2

$$(Solving\ for\ the\ annual\ growth\ rate): g\ =\ (Population\ 201X\ \div\ Population\ 2010)^{1/x} - 1$$

The 2010 and 2015 population data provided in Table 3-1 and Table 3-2 were used in Equation 2 to compute the annual growth rate for each county and municipality in the study area using X = 5.25 (5 years and 3 months from April 1, 2010 to July 1, 2015). The computed annual growth rate for each county and municipality is summarized in the final column of Table 3-1 and Table

[1] www.census.gov
[2] https://www.census.gov/quickfacts/
[3] http://www.census.gov/data/tables/2015/demo/popest/total-cities-and-towns.html
[4] The schedule for release of Census data is provided on the Census website: http://www.census.gov/programs-surveys/popest/about/schedule.html

3-2, respectively.

The most detailed data should always be used when forecasting population. In terms of detailed data, municipal data is the finest level of detail, then county data, and state data. The municipality growth rate was used first and if that was not available or applicable within the study area, then the county growth rate was used. County growth rates are available for the entire study area and were used (in the absence of municipal data) as they are the finest level of detail available for the entire study area. Thus, state data was not used.

The Census Bureau does not provide population data specific to the boundaries of the study area. As such, the entire county or municipality population was used to compute the annual growth rate. Then, the appropriate municipality or county growth rate was applied only to those Census blocks located within the study area. All other blocks outside of the study area were not considered as part of the EPZ or Shadow Region population, even if they are located within one of the municipalities or counties that intersect the study area.

The appropriate annual growth rate was applied to each Census block in the study area depending on which county or municipality the block is located within. The population was extrapolated, using Equation 1, to November 1, 2016 as the base year for this ETE study.

The permanent resident population is estimated by cutting the census block polygons by the Subarea and EPZ boundaries. A ratio of the original area of each census block and the updated area (after cutting) is multiplied by the total block population to estimate what the population is within the EPZ. This methodology (referred to as the "area ratio method") assumes that the population is evenly distributed across a census block.

Table 3-3 provides the permanent resident population within the EPZ, by Subarea, for 2010 (based on the most recent U.S. Census) and for 2016 (based on the methodology above). As indicated, the permanent resident population within the EPZ has increased by 5.1% since the 2010 Census.

The average household size (2.25 persons/household – was estimated using U.S. Census data - see Appendix F, sub-section F.3.1). The number of evacuating vehicles per household (1.26 vehicles/household – See Appendix F, sub-section F.3.2) were adapted from the telephone survey results.

The year 2016 permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household in order to estimate number of vehicles. Permanent resident population and vehicle estimates are presented in Table 3-4. Figure 3-3 and Figure 3-4 present the permanent resident population and permanent resident vehicle estimates by sector and distance from the DAEC. This population "rose" was constructed using GIS software.

It can be argued that this estimate of permanent residents overstates, somewhat, the number of evacuating vehicles, especially during the summer. It is certainly reasonable to assert that some portion of the population would be on vacation during the summer and would travel elsewhere. A rough estimate of this reduction can be obtained as follows:

- Assume 50 percent of all households vacation for a period over the summer.
- Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e. 10 percent of the population is on vacation during each two-week interval.
- Assume half of these vacationers leave the area.

On this basis, the permanent resident population would be reduced by 5 percent in the summer and by a lesser amount in the off-season. Given the uncertainty in this estimate, we elected to apply no reductions in permanent resident population for the summer scenarios to account for residents who may be out of the area.

3.1.1 College Students

There are three colleges in the EPZ considered in this study: Coe College, Kaplan University, and Mount Mercy University. Some students will evacuate in private vehicles which are accounted for in the "College Students" columns in Table 3-9 and Table 3-10 (discussed below in Section 3.9). Other students either rideshare with a fellow classmate or are already accounted for in the permanent resident population from the census.

Coe College is located in Subarea 15, 9.9 miles southeast of the DAEC. It has a total full-time enrollment of 1,357 students according to the *Iowa College and University Enrollment Report, Fall 2015*[5] and U.S. News[6] reported that 75% of students in this college have a vehicle on campus. Therefore, 1,018 (1,357 x 75%) students have vehicles on campus, and the remaining 339 students will be evacuated via ridesharing or buses. A vehicle occupancy rate of 1.10 students per vehicle (commuter vehicle occupancy rate from the telephone survey, see Appendix F, Figure F-7) was assumed for these students, resulting in 926 (1,018 ÷ 1.10) evacuating vehicles total. It was conservatively assumed that additional ridesharing amongst students would occur in the event of an emergency evacuation. Based upon NUREG/CR-7002 guidance, it is acceptable to assume that up to 50 percent of residents would offer a ride to individuals waiting for transportation. Thus, of the aforementioned 339 transit-dependent students, half of them, or 170 students, will evacuate with the aforementioned 1,018 students with private vehicles, for a total of 1,188 students in the 926 student vehicles evacuating from campus. The remaining 169 transit-dependent students require buses for evacuation. Using a capacity of 30 people per bus, the total number of transit dependent buses needed for Coe College is 6 buses (12 vehicles; 1 bus is equivalent to 2 passenger vehicles – see Section 8).

Kaplan University is located in Subarea 24, 10.9 miles south-southeast of the DAEC. It is a commuter school and has a total full-time enrollment of 303 according to the *Iowa College and University Enrollment Report, Fall 2015*[5]. The vehicle occupancy rate of 1.10 students per vehicle was assumed for these students, resulting in 276 evacuating vehicles total.

Mount Mercy University is located in Subarea 15, 9.4 miles southeast of the DAEC. According to the *Iowa College and University Enrollment Report, Fall 2015*[5], this university has an enrollment of 1,104 full-time students – 90% of whom have a vehicle on campus according to U.S. News.[7]

[5] https://www.iowacollegeaid.gov/sites/default/files/ICCHPSE2015EnrollmentReport.pdf
[6] http://colleges.usnews.rankingsandreviews.com/best-colleges/coe-college-1854
[7] http://colleges.usnews.rankingsandreviews.com/best-colleges/mount-mercy-university-1880

Therefore, 994 (1,104 x 90%) students have vehicles on campus, which results in 110 students who will either be evacuated via ridesharing or bus. Using the vehicle occupancy rate of 1.10 students, there are 904 privately owned vehicles evacuating from this college. Applying the same ridesharing percentage and bus capacity as above for Coe College, the total number of students who drive/rideshare is 1,049, which results in 2 buses (4 vehicles) for the 55 transit-dependent students.

Table 3-1. County Population Change and Annual Growth Rate from April 1, 2010 to July 1, 2015

County	2010 Population	2015 Population	Percent Change	Annual Growth Rate
EPZ				
Benton	26,076	25,658	-1.60%	-0.31%
Linn	211,226	219,916	4.11%	0.77%
Shadow Region				
Buchanan	20,958	21,062	0.50%	0.09%

Table 3-2. Municipality Population Change and Annual Growth Rate from April 1, 2010 to July 1, 2015

Municipality	2010 Population	2015 Population	Percent Change	Annual Growth Rate
Benton County, IA				
EPZ				
Atkins	1,670	1,795	7.49%	1.38%
Shellsburg	983	951	-3.26%	-0.63%
Urbana	1,458	1,459	0.07%	0.01%
Shadow Region				
Newhall	875	850	-2.86%	-0.55%
Vinton	5,257	5,148	-2.07%	-0.40%
Linn County, IA				
EPZ[8]				
Alburnett	673	695	3.27%	0.61%
Cedar Rapids	126,326	130,405	3.23%	0.61%
Center Point	2,421	2,521	4.13%	0.77%
Hiawatha	7,024	7,199	2.49%	0.47%
Marion	34,768	37,330	7.37%	1.36%
Palo	953	1,053	10.49%	1.92%
Robins	3,142	3,454	9.93%	1.82%
Shadow Region				
Central City	1,257	1,269	0.95%	0.18%
Fairfax	2,123	2,497	17.62%	3.14%
Walford[9]	382	394	3.14%	0.59%
Walker	791	792	0.13%	0.02%

[8] A small area of Bertram, Iowa is within the EPZ; however, there is no population residing within this small area. As a result, Bertram is not included in the analysis.
[9] The City of Walford, Iowa is located across two counties – Benton and Linn. Only the portion of the population within Linn County is reported in Table 3-2, as the Benton County portion is outside the study area.

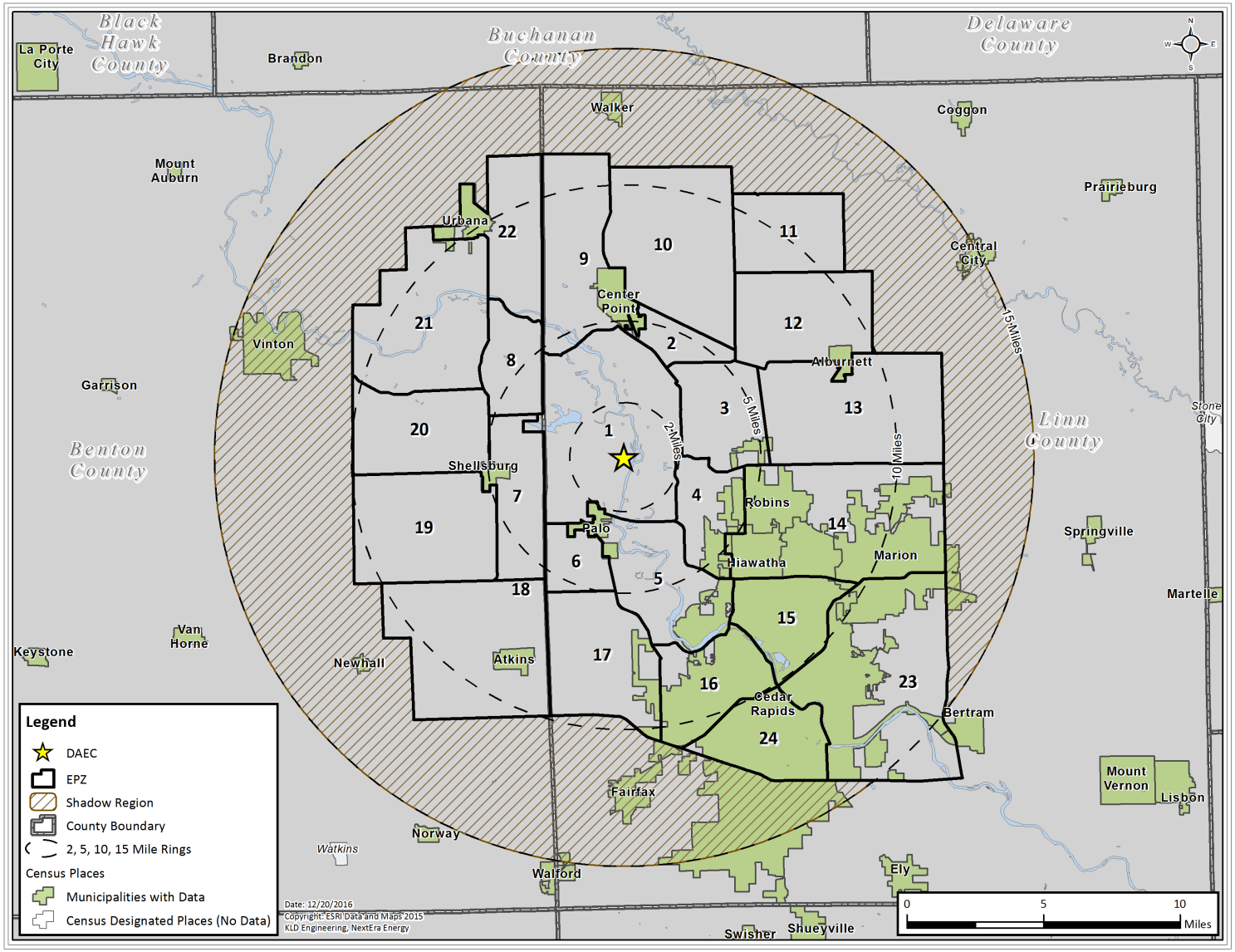


Figure 3-2. Census Boundaries within the DAEC Study Area

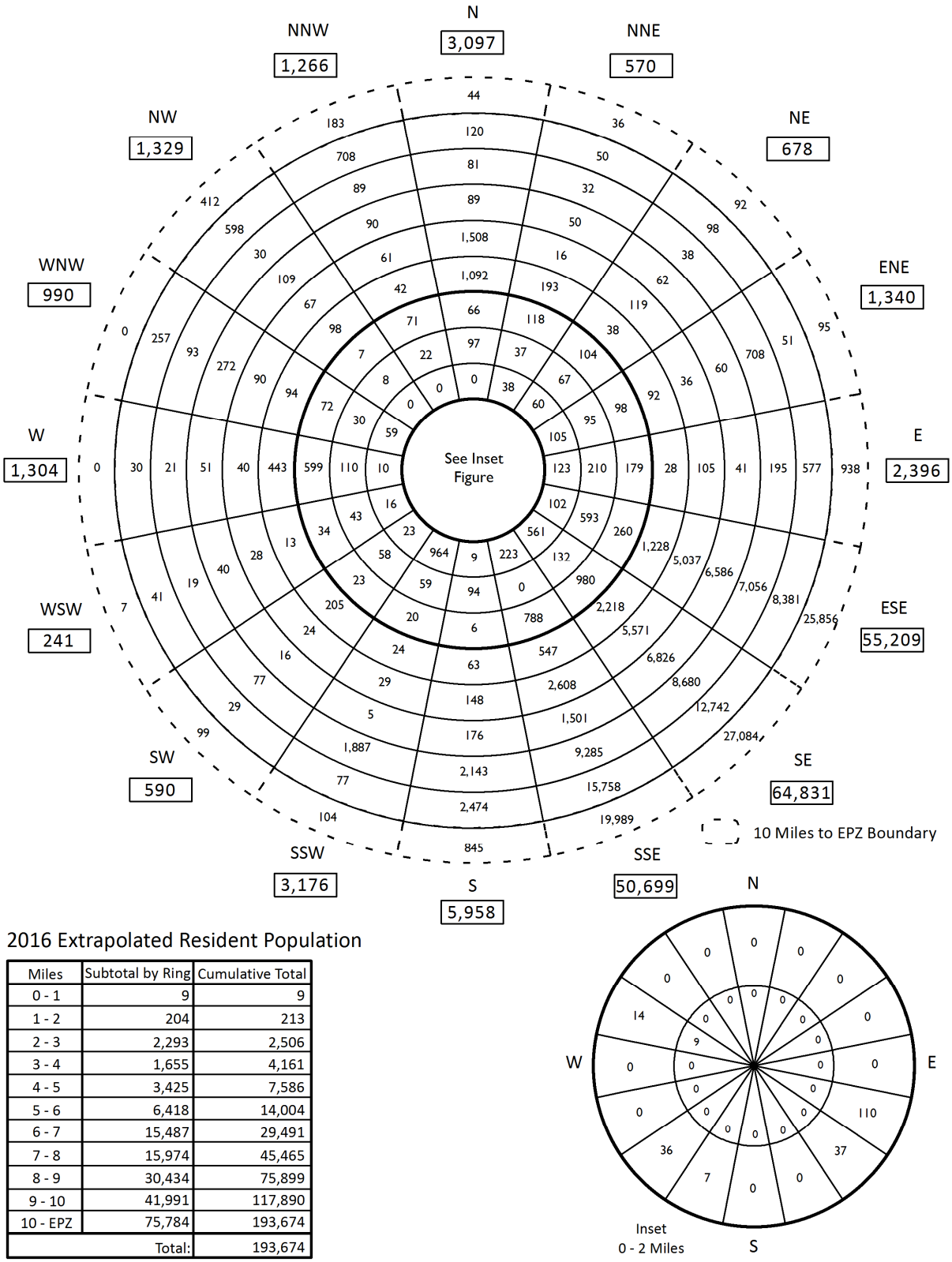
Table 3-3. EPZ Permanent Resident Population

Subarea	2010 Population	2016 Extrapolated Population
1	1,307	1,373
2	271	283
3	889	935
4	3,442	3,588
5	5,205	5,520
6	68	72
7	1,416	1,372
8	248	244
9	2,782	2,924
10	445	463
11	146	153
12	976	1,018
13	487	511
14	45,159	48,424
15	28,472	29,676
16	30,626	31,872
17	2,668	2,781
18	2,141	2,298
19	239	238
20	494	488
21	871	857
22	1,729	1,724
23	35,485	37,453
24	18,652	19,407
TOTAL	**184,218**	**193,674**
EPZ Population Growth (2010-2016):		**5.1%**

Note: The revised EPZ (removal of the portion of Subarea 24 south of US-30) decreases the 2010 EPZ permanent resident population in this study by 5,218 people (approximately 2.8%) relative to the population in the previous ETE study (KLD TR-529, dated December 2012).

Table 3-4. Permanent Resident Population and Vehicles by Subarea

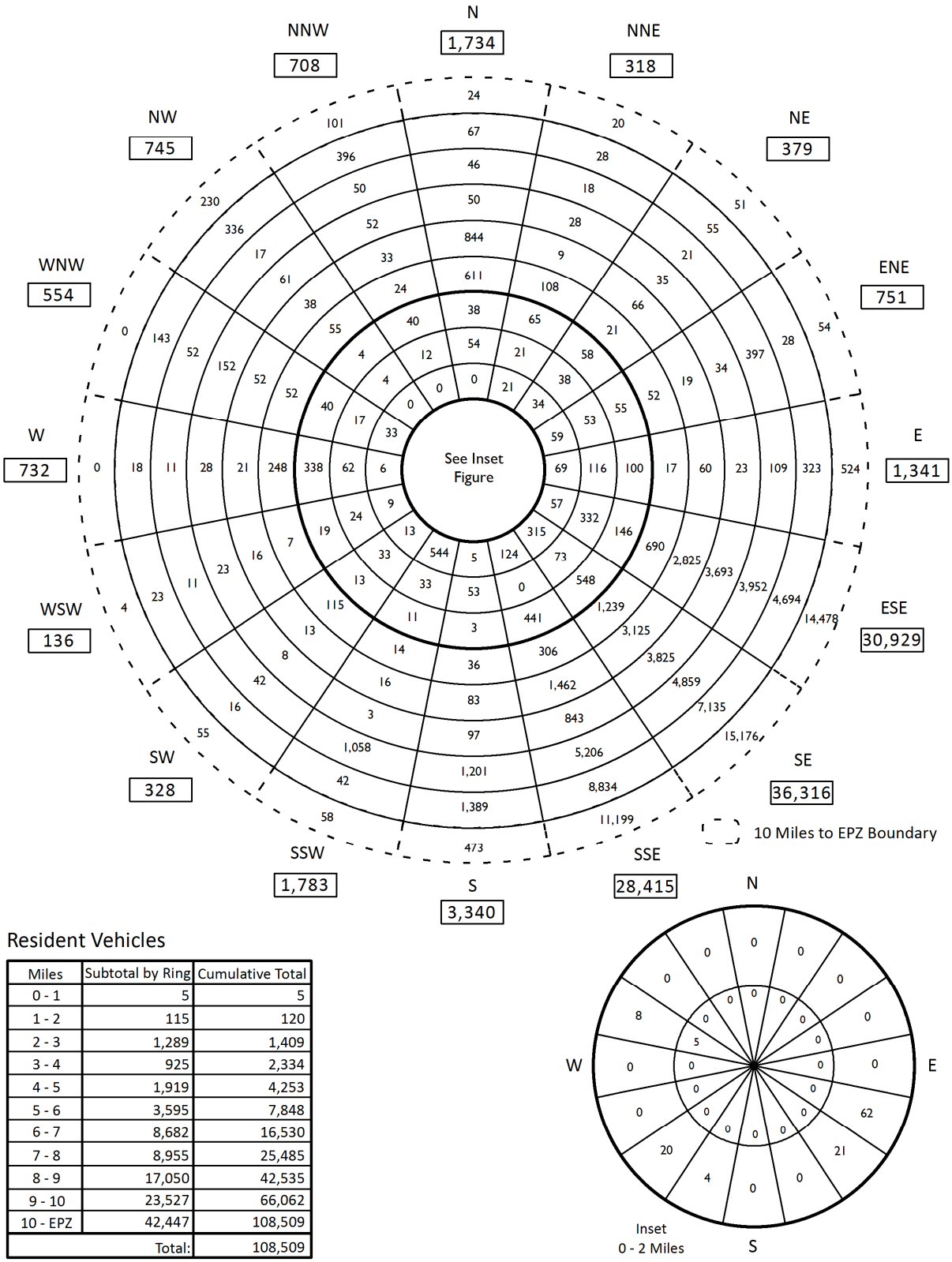
Subarea	2016 Extrapolated Population	2016 Resident Vehicles
1	1,373	771
2	283	159
3	935	523
4	3,588	2,005
5	5,520	3,099
6	72	40
7	1,372	770
8	244	138
9	2,924	1,637
10	463	258
11	153	86
12	1,018	570
13	511	286
14	48,424	27,129
15	29,676	16,618
16	31,872	17,866
17	2,781	1,558
18	2,298	1,285
19	238	134
20	488	272
21	857	480
22	1,724	965
23	37,453	20,982
24	19,407	10,878
TOTAL	**193,674**	**108,509**



2016 Extrapolated Resident Population

Miles	Subtotal by Ring	Cumulative Total
0 - 1	9	9
1 - 2	204	213
2 - 3	2,293	2,506
3 - 4	1,655	4,161
4 - 5	3,425	7,586
5 - 6	6,418	14,004
6 - 7	15,487	29,491
7 - 8	15,974	45,465
8 - 9	30,434	75,899
9 - 10	41,991	117,890
10 - EPZ	75,784	193,674
Total:		193,674

Figure 3-3. Permanent Resident Population by Sector



Resident Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	5	5
1 - 2	115	120
2 - 3	1,289	1,409
3 - 4	925	2,334
4 - 5	1,919	4,253
5 - 6	3,595	7,848
6 - 7	8,682	16,530
7 - 8	8,955	25,485
8 - 9	17,050	42,535
9 - 10	23,527	66,062
10 - EPZ	42,447	108,509
	Total:	108,509

Figure 3-4. Permanent Resident Vehicles by Sector

3.2 Shadow Population

A portion of the population living outside the evacuation area extending to 15 miles radially from the DAEC (in the Shadow Region) may elect to evacuate without having been instructed to do so. Based upon NUREG/CR-7002 guidance, it is assumed that 20 percent of the permanent resident population, based on U.S. Census Bureau data, in the Shadow Region will elect to evacuate.

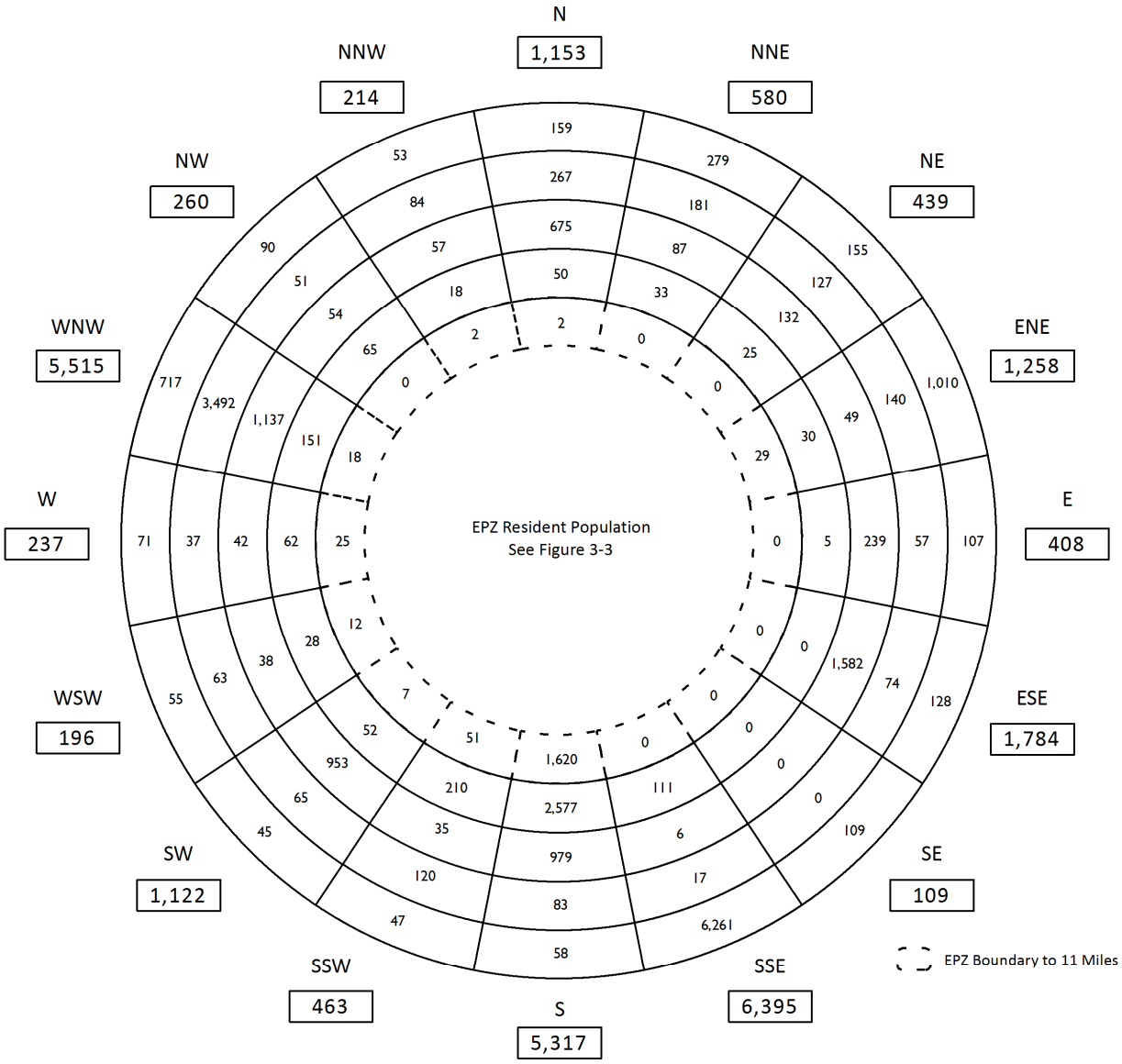
Shadow population characteristics (household size, evacuating vehicles per household, mobilization time) are assumed to be the same as those for the EPZ permanent resident population. Table 3-5, Figure 3-5, and Figure 3-6 present estimates of the shadow population and vehicles, by sector.

The 2010 Census permanent resident population within the Shadow Region was also extrapolated to November 1, 2016 using the methodology discussed in Section 3.1 for the permanent resident population within the EPZ.

Note the shadow population in the SSE sector has increased significantly since the 2012 study, as a result of the change in the boundary of Subarea 24. Those people (more than 5,000) living in Subarea 24 south of US-30 are now considered part of the Shadow Region.

Table 3-5. Shadow Population and Vehicles by Sector

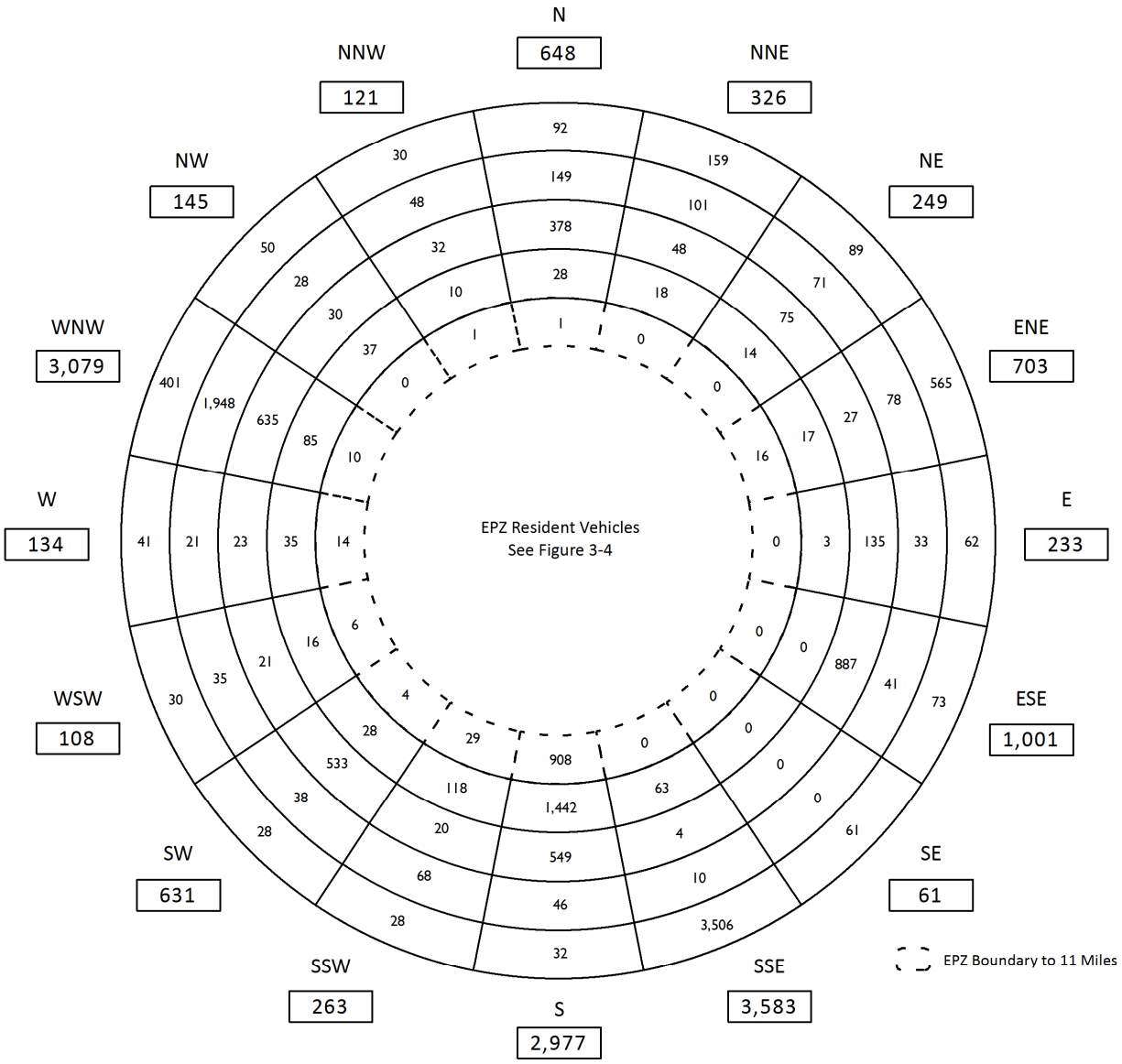
Sector	2016 Extrapolated Population	Evacuating Vehicles
N	1,153	648
NNE	580	326
NE	439	249
ENE	1,258	703
E	408	233
ESE	1,784	1,001
SE	109	61
SSE	6,395	3,583
S	5,317	2,977
SSW	463	263
SW	1,122	631
WSW	196	108
W	237	134
WNW	5,515	3,079
NW	260	145
NNW	214	121
TOTAL	**25,450**	**14,262**



2016 Extrapolated Shadow Population

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	1,766	1,766
11 - 12	3,417	5,183
12 - 13	6,065	11,248
13 - 14	4,858	16,106
14 - 15	9,344	25,450
	Total:	25,450

Figure 3-5. Shadow Population by Sector



Shadow Vehicles

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	989	989
11 - 12	1,914	2,903
12 - 13	3,397	6,300
13 - 14	2,715	9,015
14 - 15	5,247	14,262
	Total:	14,262

Figure 3-6. Shadow Vehicles by Sector

3.3 Transient Population

Transient population groups are defined as those people (who are not permanent residents, nor commuting employees or college students) who enter the EPZ for a specific purpose (shopping, recreation).

Transients may spend less than one day at a recreational area or stay overnight at camping facilities, hotels and motels. The DAEC EPZ has a number of areas and facilities that attract transients, including:

- Lodging Facilities – 5,454 transients in 2,159 vehicles; 2.53 people per vehicle
- Historic Sites –1,625 transients in 722 vehicles; 2.25 people per vehicle
- Recreational Areas – 3,828 transients in 1,729 vehicles; 2.21 people per vehicle

Surveys of transient facilities within the EPZ were conducted in 2012 to determine the number of transients and vehicles present at peak times. Estimations were made based on parking lot capacity if data was not provided by the facility. The average household size of 2.25 persons (telephone survey) was used if vehicle occupancy was not provided by the facility, based on the assumption that transients would travel to a facility as a family/household. Data provided by lodging facilities in the area indicated a range of vehicle occupancy from 1 to 5 people.

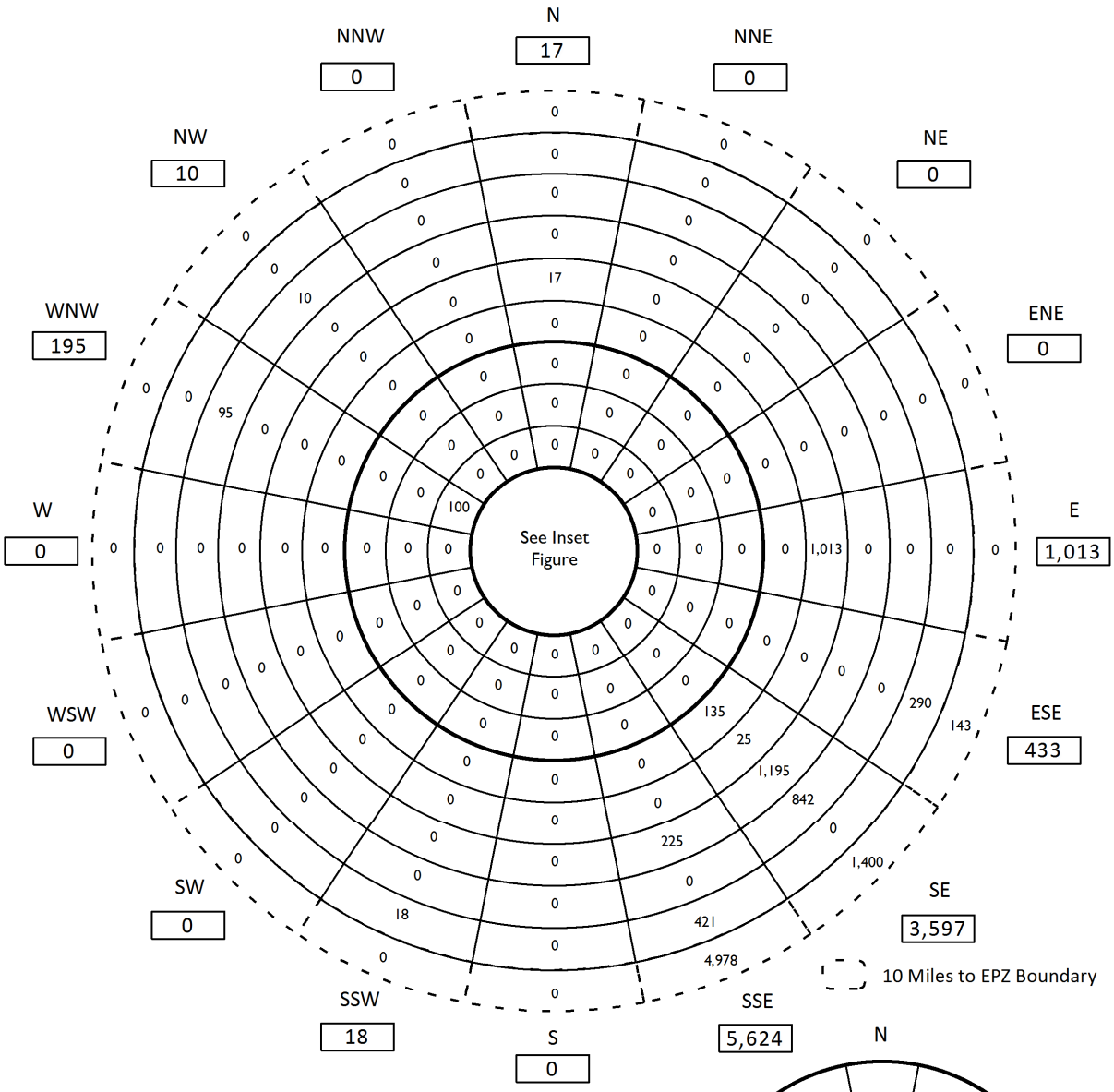
Appendix E summarizes the transient data that was gathered for the EPZ. Table E-4 presents the number of transients visiting historic sites and recreational areas, while Table E-5 presents the number of transients at lodging facilities within the EPZ.

Table 3-6 presents the transient population and transient vehicle estimates by Subarea. Figure 3-7 and Figure 3-8 present these data by sector and distance from the plant. There are a total of 10,907 transients in 4,610 vehicles (an average of 2.37 transients per vehicle) assigned to transient facilities in the EPZ.

Based on discussions with NextEra, the transient estimates for 2012 are still valid for 2016 as there have not been any major changes to transient attractions in the EPZ. Those transient facilities in the portion of Subarea 24 south of US-30 (i.e., the Kirkwood Hotel) have been removed based on the change in the EPZ boundary.

Table 3-6. Summary of Transients and Transient Vehicles

Subarea	Transients	Transient Vehicles
1	100	44
2	0	0
3	0	0
4	0	0
5	225	100
6	0	0
7	0	0
8	0	0
9	17	7
10	0	0
11	0	0
12	0	0
13	1,013	450
14	303	141
15	2,192	951
16	421	173
17	18	18
18	0	0
19	0	0
20	0	0
21	105	66
22	0	0
23	1,535	675
24	4,978	1,985
TOTAL	**10,907**	**4,610**



Transients

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	100	100
3 - 4	0	100
4 - 5	0	100
5 - 6	135	235
6 - 7	1,055	1,290
7 - 8	1,420	2,710
8 - 9	947	3,657
9 - 10	729	4,386
10 - EPZ	6,521	10,907
	Total:	10,907

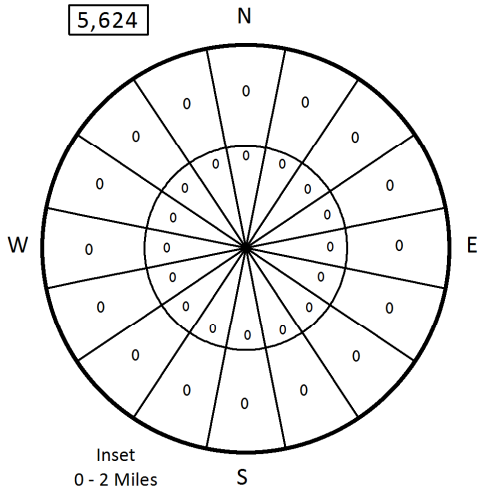
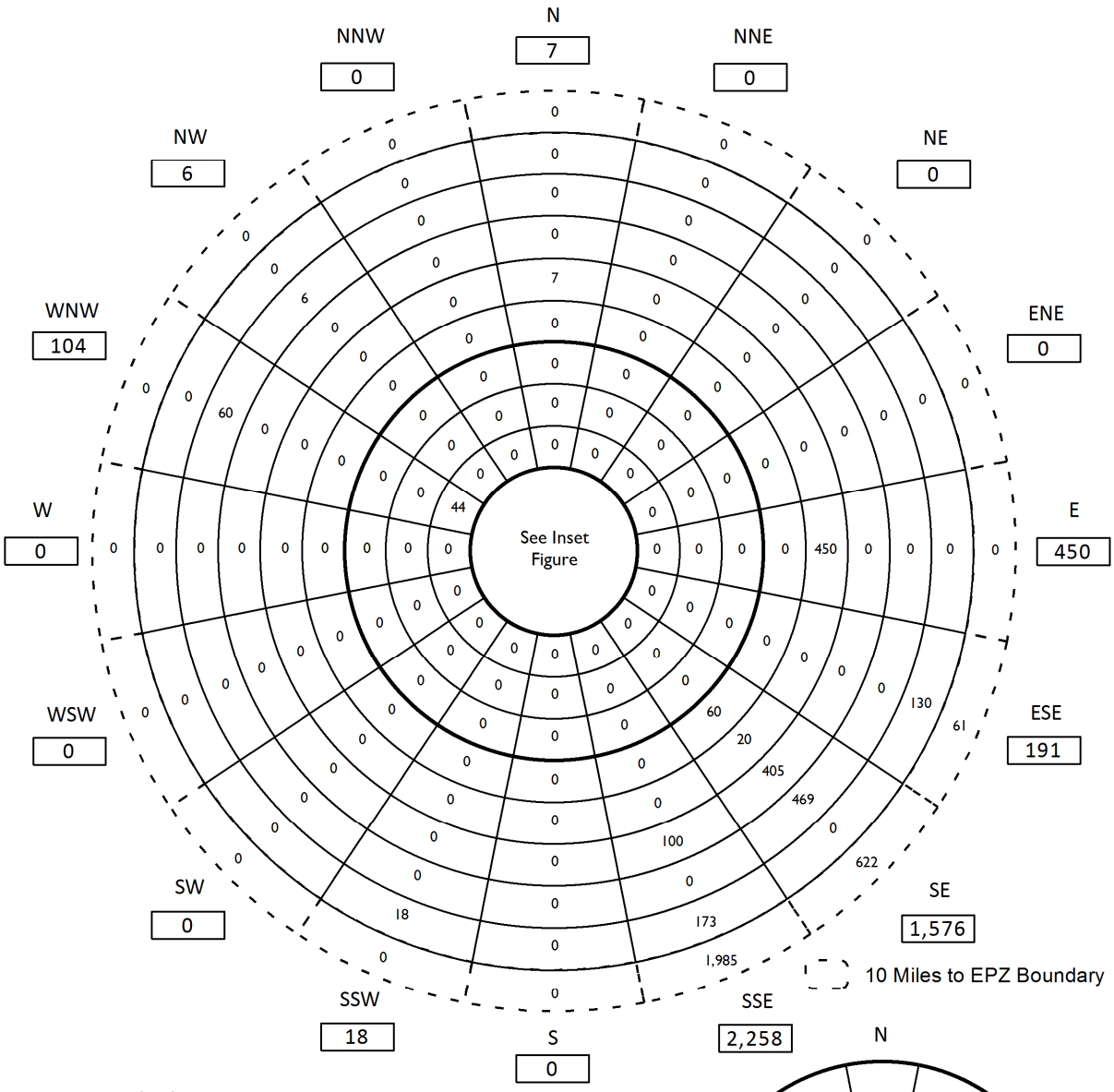


Figure 3-7. Transient Population by Sector



Transient Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	44	44
3 - 4	0	44
4 - 5	0	44
5 - 6	60	104
6 - 7	477	581
7 - 8	505	1,086
8 - 9	535	1,621
9 - 10	321	1,942
10 - EPZ	2,668	4,610
	Total:	4,610

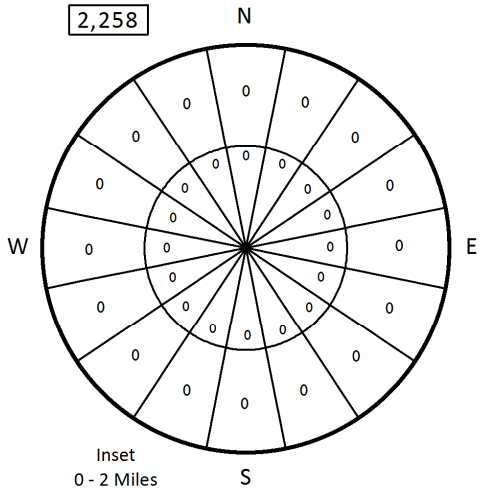


Figure 3-8. Transient Vehicles by Sector

3.4 Employees

Employees who work within the EPZ fall into two categories:

- Those who live and work in the EPZ
- Those who live outside of the EPZ and commute to jobs within the EPZ.

Those of the first category are already counted as part of the permanent resident population. To avoid double counting, we focus only on those employees commuting from outside the EPZ who will evacuate along with the permanent resident population.

Data obtained from the U.S. Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool[10] were used to estimate the number of employees commuting into the EPZ. The 2014 Workplace Area Characteristic data was also obtained from this website and was used to determine the number of employees by Census Block within the DAEC EPZ.

Since not all employees are working at facilities within the EPZ at one time, a maximum shift reduction was applied. The Work Area Profile Report, also output by the OnTheMap tool, breaks down jobs within the EPZ by industry sector. Assuming maximum shift employment occurs Monday through Friday between 9 AM and 5 PM, the following jobs take place outside the typical 9-5 work day:

- Manufacturing – 16.0% of jobs; takes place in shifts over 24 hours
- Arts, Entertainment, and Recreation – 1.1% of jobs; takes place in evenings and on weekends
- Accommodations and Food Services – 6.6% of jobs; peaks in the evenings

The maximum shift in the EPZ is about 76.3% (100% - 16.0% - 1.1% - 6.6% = 76.3%). This value was applied to the total employment for 2014 (latest data available) to represent the maximum number of employees present in the EPZ at any one time.

The Inflow/Outflow Report for the DAEC EPZ was then used to calculate the percent of employees that work within the EPZ but live outside. This value, 43.4%, was applied to the maximum shift employee values to compute the number of people commuting into the EPZ to work at peak times.

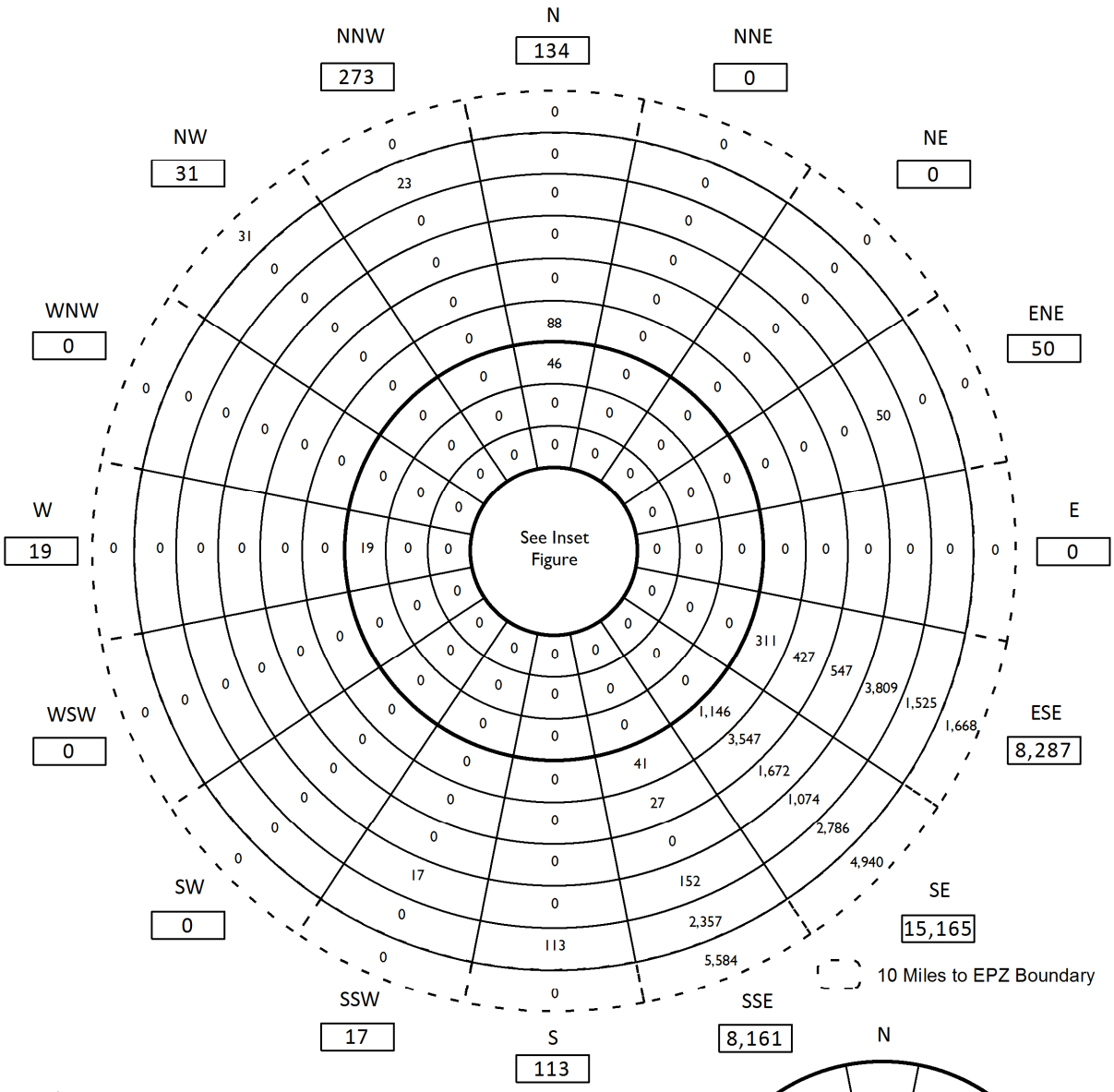
In Table E-3, the Employees (Max Shift) column is multiplied by the percent non-EPZ factor to determine the number of employees who are not residents of the EPZ. A vehicle occupancy of 1.10 employees per vehicle obtained from the telephone survey (See Appendix F, Figure F-7) was used to determine the number of evacuating employee vehicles for all major employers.

Table 3-7 summarizes the estimates of employees and vehicles commuting into the EPZ, by Subarea. Figure 3-9 and Figure 3-10 present these data by sector.

[10] http://onthemap.ces.census.gov/

Table 3-7. Summary of Employees and Employee Vehicles Commuting into the EPZ

Subarea	Employees	Employee Vehicles
1	250	228
2	22	20
3	0	0
4	97	89
5	1,889	1,718
6	0	0
7	19	17
8	0	0
9	112	102
10	0	0
11	0	0
12	50	45
13	0	0
14	4,367	3,971
15	10,723	9,749
16	3,042	2,766
17	19	17
18	17	15
19	0	0
20	0	0
21	0	0
22	54	49
23	6,379	5,798
24	5,210	4,736
TOTAL	**32,250**	**29,320**



Employees

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	250	250
2 - 3	0	250
3 - 4	0	250
4 - 5	65	315
5 - 6	1,586	1,901
6 - 7	4,001	5,902
7 - 8	2,219	8,121
8 - 9	5,102	13,223
9 - 10	6,804	20,027
10 - EPZ	12,223	32,250
	Total:	32,250

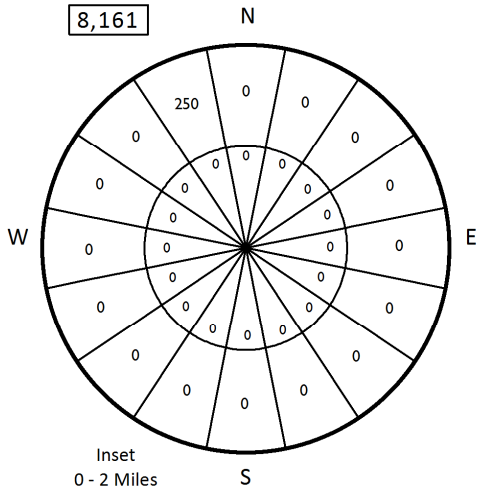
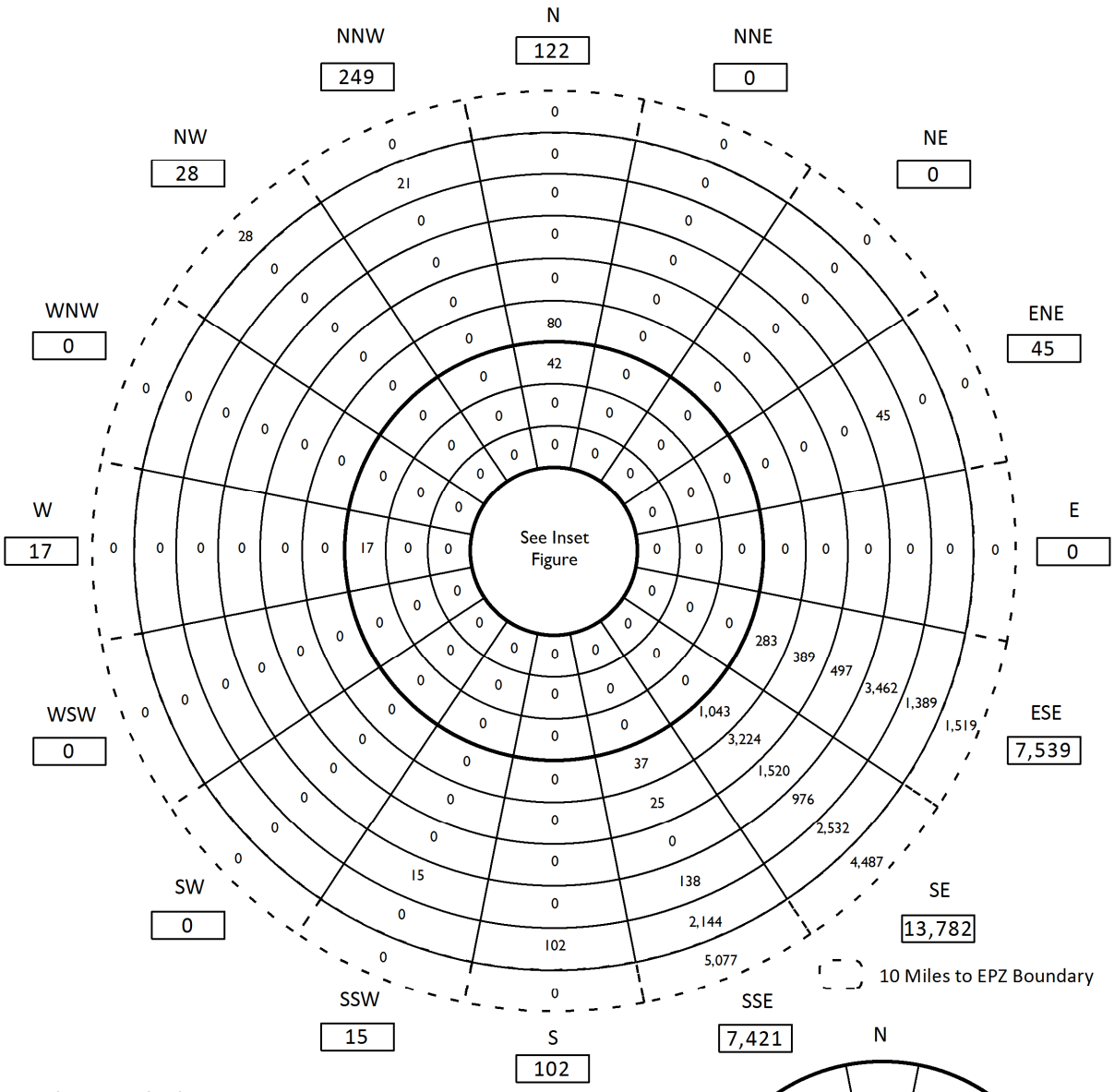


Figure 3-9. Employee Population by Sector



Employee Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	228	228
2 - 3	0	228
3 - 4	0	228
4 - 5	59	287
5 - 6	1,443	1,730
6 - 7	3,638	5,368
7 - 8	2,017	7,385
8 - 9	4,636	12,021
9 - 10	6,188	18,209
10 - EPZ	11,111	29,320
	Total:	29,320

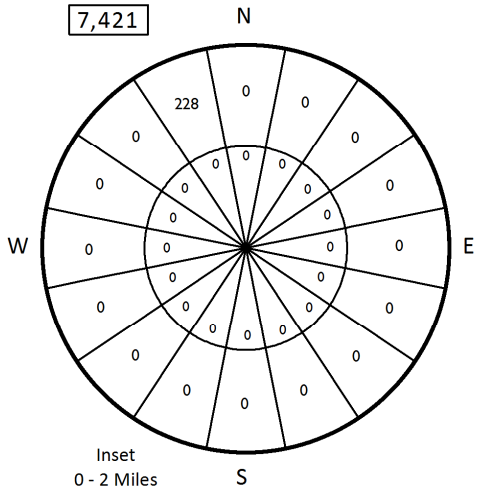


Figure 3-10. Employee Vehicles by Sector

3.5 Special Facilities

Data were gathered from the most recent county emergency plans for the special facilities (schools, pre-schools, daycares, medical facilities, and correctional facilities) within the EPZ; these data are summarized in Tables E-1, E-2 and E-6 in Appendix E. Section 8 details the evacuation of special facilities and their residents. School buses can evacuate up to 70 students per bus for primary schools, pre-schools, and day care centers, and up to 50 students for middle and high schools. The number and type of evacuating vehicles that need to be provided for medical facilities depend on the patients' state of health. It is estimated that buses can transport up 30 patients; wheelchair buses, up to 15 patients; wheelchair vans, up to 4 patients; and ambulances, up to 2 patients. Inmates at correctional facilities will be evacuated using buses, when resources are available. It is estimated that buses can transport up to 66 inmates.

3.6 External Traffic

Vehicles will be traveling through the EPZ (external-external trips) at the time of an emergency event. After the Advisory to Evacuate is announced, these through-travelers will also evacuate. These through vehicles are assumed to travel on the major routes traversing the study area – I-380 and US-30. It is assumed that this traffic will continue to enter the study area during the first two hours following the Advisory to Evacuate.

Average Annual Daily Traffic (AADT) data was obtained from the Iowa Department of Transportation to estimate the number of vehicles per hour on the aforementioned routes. The AADT was multiplied by the K-Factor, which is the proportion of the AADT on a roadway segment or link during the design hour, resulting in the design hour volume (DHV). The design hour is usually the 30th highest hourly traffic volume of the year, measured in vehicles per hour (vph). The DHV is then multiplied by the D-Factor, which is the proportion of the DHV occurring in the peak direction of travel (also known as the directional split). The resulting values are the directional design hourly volumes (DDHV), and are presented in Table 3-8, for each of the routes considered. The DDHV is then multiplied by two hours (Access Control Points (ACP) – are assumed to be activated at 120 minutes after the advisory to evacuate as per federal guidance) to estimate the total number of external vehicles loaded on the analysis network. As indicated, there are 7,058 vehicles entering the study area as external-external trips prior to the activation of the ACP and the diversion of this traffic. This number is reduced by 60% for evening scenarios (Scenarios 5, 12 and 13) as discussed in Section 6.

3.7 Background Traffic

Section 5 discusses the time needed for the people in the EPZ to mobilize and begin their evacuation trips. As shown in Table 5-9, there are 14 time periods during which traffic is loaded on to roadways in the study area to model the mobilization time of people in the EPZ. Note there is no traffic generated during the 15th time period, as this time period is intended to allow traffic that has already begun evacuating to clear the study area boundaries.

This study does not assume that roadways are empty at the start of Time Period 1. Rather, there is a one-hour initialization time period (often referred to as "fill time" in traffic simulation) wherein the traffic volumes from Time Period 1 are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of Time Period 1 depends on the scenario and the region being evacuated (see Section 6). There are 7,793 vehicles on the roadways in the study area at the end of fill time for an evacuation of the entire EPZ (Region R03) under Scenario 1 (summer, midweek, midday, good weather) conditions.

3.8 Special Event

The Cedar Rapids Freedom Festival is considered a special event (Scenario 13) for this ETE study, in accordance with NUREG/CR-7002, because it attracts the largest transient population of any event in the EPZ. The Cedar Rapids Freedom Festival takes place on the 4th of July each year, on the Cedar River, located in the downtown area of Cedar Rapids, near Mays Island. In 2012, data was obtained from the festival organizer, who indicated that the maximum attendance at the festival is 105,000 people during the fireworks show in the evening, where 75% are local residents that are already present during an average summer evening. Thus, 25% of attendees – 26,250 people – are transients present in the EPZ for the special event. The festival organizer also indicated that those attending the festival arrive in vehicles with an average occupancy of 4.5 persons, resulting in 5,833 evacuating vehicles for the transients attending the festival.

The special event vehicle trips were generated utilizing the same mobilization distributions as transients. Public transportation is not provided for this event and was not considered in the special event analysis.

Discussions with NextEra and the county emergency management agencies indicated that the data for the festival gathered in 2012 is still valid in 2016.

3.9 Summary of Demand

A summary of population and vehicle demand is provided in Table 3-9 and Table 3-10, respectively. This summary includes all population groups described in this section. Additional population groups – transit-dependent, special facility and school population – are described in greater detail in Section 8. A total of 295,912 people and 156,903 vehicles are considered in this study.

Table 3-8. External Traffic Traversing the DAEC Study Area

Upstream Node	Downstream Node	Road Name	Direction	IOWADOT[1] AADT	K-Factor[2]	D-Factor[2]	Hourly Volume	External Traffic
8003	3	I-380	SB	26,100	0.107	0.5	1,396	2,792
8618	618	I-380	NB	26,100	0.107	0.5	1,396	2,792
8621	621	US-30	EB	4,500[3]	0.136	0.5	306	612
8616	1142	US-30	WB	7,300[4]	0.118	0.5	431	862
							TOTAL:	**7,058**

[1] IOWADOT AADT Traffic Book 2014

[2] HCM 2010

[3] AADT information taken at Tama/Benton County Lines

[4] AADT information taken at Cedar/Linn County Lines

Table 3-9. Summary of Population Demand

Subarea	Residents	Transit-Dependent	Transients	Employees	Special Facilities[1]	Schools	College Students[2]	Shadow Region[3]	External Traffic	Total
1	1,373	49	100	250	0	0	0	0	0	1,772
2	283	10	0	22	0	0	0	0	0	315
3	935	33	0	0	0	0	0	0	0	968
4	3,588	128	0	97	20	652	0	0	0	4,485
5	5,520	197	225	1,889	0	978	0	0	0	8,809
6	72	3	0	0	0	0	0	0	0	75
7	1,372	49	0	19	35	278	0	0	0	1,753
8	244	9	0	0	0	0	0	0	0	253
9	2,924	104	17	112	0	1,441	0	0	0	4,598
10	463	17	0	0	0	0	0	0	0	480
11	153	6	0	0	0	0	0	0	0	159
12	1,018	36	0	50	0	661	0	0	0	1,765
13	511	18	1,013	0	0	0	0	0	0	1,542
14	48,424	1,727	303	4,367	874	10,583	0	0	0	66,278
15	29,676	1,058	2,192	10,723	558	8,528	2,237	0	0	54,972
16	31,872	1,136	421	3,042	1,231	5,326	0	0	0	43,028
17	2,781	99	18	19	0	117	0	0	0	3,034
18	2,298	82	0	17	0	373	0	0	0	2,770
19	238	8	0	0	0	0	0	0	0	246
20	488	17	0	0	0	0	0	0	0	505
21	857	31	105	0	0	0	0	0	0	993
22	1,724	61	0	54	0	358	0	0	0	2,197
23	37,453	1,335	1,535	6,379	1,629	6,995	0	0	0	55,326
24	19,407	692	4,978	5,210	272	3,637	303	0	0	34,499
Shadow	0	0	0	0	0	0	0	5,090	0	5,090
Total	**193,674**	**6,905**	**10,907**	**32,250**	**4,619**	**39,927**	**2,540**	**5,090**	**0**	**295,912**

[1] Special Facilities include medical facilities, correctional facilities and group homes that have 10 people or more that stay overnight. Staff numbers are included in total.
[2] College Students only includes students evacuating in private vehicles, not including those who are EPZ permanent residents.
[3] Shadow Region has been reduced to 20%. Refer to Figure 2-1 for additional information.

Table 3-10. Summary of Vehicle Demand

Subarea	Residents	Transit-Dependent[1]	Transients	Employees	Special Facilities[1]	School Buses[1]	College Students[2]	Shadow Region[3]	External Traffic	Total
1	771	2	44	228	0	0	0	0	0	1,045
2	159	0	0	20	0	0	0	0	0	179
3	523	2	0	0	0	0	0	0	0	525
4	2,005	6	0	89	2	22	0	0	0	2,124
5	3,099	8	100	1,718	0	42	0	0	0	4,967
6	40	0	0	0	0	0	0	0	0	40
7	770	2	0	17	4	10	0	0	0	803
8	138	2	0	0	0	0	0	0	0	140
9	1,637	4	7	102	0	60	0	0	0	1,810
10	258	2	0	0	0	0	0	0	0	260
11	86	0	0	0	0	0	0	0	0	86
12	570	2	0	45	0	30	0	0	0	647
13	286	2	450	0	0	0	0	0	0	738
14	27,129	70	141	3,971	79	408	0	0	0	31,798
15	16,618	44	951	9,749	87	350	1,830	0	0	29,629
16	17,866	46	173	2,766	129	206	0	0	0	21,186
17	1,558	4	18	17	0	4	0	0	0	1,601
18	1,285	4	0	15	0	14	0	0	0	1,318
19	134	0	0	0	0	0	0	0	0	134
20	272	2	0	0	0	0	0	0	0	274
21	480	2	66	0	0	0	0	0	0	548
22	965	2	0	49	0	18	0	0	0	1,034
23	20,982	54	675	5,798	233	294	0	0	0	28,036
24	10,878	28	1,985	4,736	16	152	276	0	0	18,071
Shadow	0	0	0	0	0	0	0	2,852	7,058	9,910
Total	**108,509**	**288**	**4,610**	**29,320**	**550**	**1,610**	**2,106**	**2,852**	**7,058**	**156,903**

[1] Buses represented as two passenger vehicles. Refer to Section 8 for additional information.
[2] College Students only includes private vehicles.
[3] Shadow Region has been reduced to 20%. Refer to Figure 2-1 for additional information.

4 ESTIMATION OF HIGHWAY CAPACITY

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of a road is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane of roadway during a given time period under prevailing roadway, traffic and control conditions, as stated in the 2010 Highway Capacity Manual (HCM 2010).

In discussing capacity, different operating conditions have been assigned alphabetical designations, A through F, to reflect the range of traffic operational characteristics. These designations have been termed "Levels of Service" (LOS). For example, LOS A connotes free-flow and high-speed operating conditions; LOS F represents a forced flow condition. LOS E describes traffic operating at or near capacity.

Another concept, closely associated with capacity, is “Service Volume” (SV). Service volume is defined as “The maximum hourly rate at which vehicles, bicycles or persons reasonably can be expected to traverse a point or uniform section of a roadway during an hour under specific assumed conditions while maintaining a designated level of service.” This definition is similar to that for capacity. The major distinction is that values of SV vary from one LOS to another, while capacity is the service volume at the upper bound of LOS E, only.

This distinction is illustrated in Exhibit 11-17 of the HCM 2010. As indicated there, the SV varies with Free Flow Speed (FFS), and LOS. The SV is calculated by the DYNEV II simulation model, based on the specified link attributes, FFS, capacity, control device and traffic demand.

Other factors also influence capacity. These include, but are not limited to:

- Lane width
- Shoulder width
- Pavement condition
- Horizontal and vertical alignment (curvature and grade)
- Percent truck traffic
- Control device (and timing, if it is a signal)
- Weather conditions (rain, snow, fog, wind speed, ice)

These factors are considered during the road survey and in the capacity estimation process; some factors have greater influence on capacity than others. For example, lane and shoulder width have only a limited influence on Base Free Flow Speed (BFFS[1]) according to Exhibit 15-7 of the HCM. Consequently, lane and shoulder widths at the narrowest points were observed during the road survey and these observations were recorded, but no detailed measurements of lane or shoulder width were taken. Horizontal and vertical alignment can influence both FFS and capacity. The estimated FFS were measured using the survey vehicle’s speedometer and observing local traffic, under free flow conditions. Capacity is estimated from the procedures of

[1] A very rough estimate of BFFS might be taken as the posted speed limit plus 10 mph (HCM 2010 Page 15-15)

the 2010 HCM. For example, HCM Exhibit 7-1(b) shows the sensitivity of Service Volume at the upper bound of LOS D to grade (capacity is the Service Volume at the upper bound of LOS E).

As discussed in Section 2.3, it is necessary to adjust capacity figures to represent the prevailing conditions during inclement weather. Based on limited empirical data, weather conditions such as rain reduce the values of free speed and of highway capacity by approximately 10 percent. Over the last decade new studies have been made on the effects of rain on traffic capacity. These studies indicate a range of effects between 5 and 20 percent depending on wind speed and precipitation rates. As indicated in Section 2.3, we employ a reduction in free speed and in highway capacity of 10 percent and 20 percent for rain and snow, respectively.

Since congestion arising from evacuation may be significant, estimates of roadway capacity must be determined with great care. Because of its importance, a brief discussion of the major factors that influence highway capacity is presented in this section.

Rural highways generally consist of: (1) one or more uniform sections with limited access (driveways, parking areas) characterized by "uninterrupted" flow; and (2) approaches to at-grade intersections where flow can be "interrupted" by a control device or by turning or crossing traffic at the intersection. Due to these differences, separate estimates of capacity must be made for each section. Often, the approach to the intersection is widened by the addition of one or more lanes (turn pockets or turn bays), to compensate for the lower capacity of the approach due to the factors there that can interrupt the flow of traffic. These additional lanes are recorded during the field survey and later entered as input to the DYNEV II system.

4.1 Capacity Estimations on Approaches to Intersections

At-grade intersections are apt to become the first bottleneck locations under local heavy traffic volume conditions. This characteristic reflects the need to allocate access time to the respective competing traffic streams by exerting some form of control. During evacuation, control at critical intersections will often be provided by traffic control personnel assigned for that purpose, whose directions may supersede traffic control devices. The existing traffic management plans documented in the county emergency plans are extensive and were modeled accordingly.

The per-lane capacity of an approach to a signalized intersection can be expressed (simplistically) in the following form:

$$Q_{cap,m} = \left(\frac{3600}{h_m}\right) \times \left(\frac{G-L}{C}\right)_m = \left(\frac{3600}{h_m}\right) \times P_m$$

where:

$Q_{cap,m}$ = Capacity of a single lane of traffic on an approach, which executes

movement, *m*, upon entering the intersection; vehicles per hour (vph)

h_m = Mean queue discharge headway of vehicles on this lane that are executing movement, *m*; seconds per vehicle

G = Mean duration of GREEN time servicing vehicles that are executing movement, *m*, for each signal cycle; seconds

L = Mean "lost time" for each signal phase servicing movement, *m*; seconds

C = Duration of each signal cycle; seconds

P_m = Proportion of GREEN time allocated for vehicles executing movement, *m*, from this lane. This value is specified as part of the control treatment.

m = The movement executed by vehicles after they enter the intersection: through, left-turn, right-turn, and diagonal.

The turn-movement-specific mean discharge headway h_m, depends in a complex way upon many factors: roadway geometrics, turn percentages, the extent of conflicting traffic streams, the control treatment, and others. A primary factor is the value of "saturation queue discharge headway", h_{sat}, which applies to through vehicles that are not impeded by other conflicting traffic streams. This value, itself, depends upon many factors including motorist behavior. Formally, we can write,

$$h_m = f_m(h_{sat}, F_1, F_2, \ldots)$$

where:

h_{sat} = Saturation discharge headway for through vehicles; seconds per vehicle

F_1,F_2 = The various known factors influencing h_m

$f_m( )$ = Complex function relating h_m to the known (or estimated) values of h_{sat}, F_1, F_2, …

The estimation of h_m for specified values of h_{sat}, F_1, F_2, ... is undertaken within the DYNEV II simulation model by a mathematical model[2]. The resulting values for h_m always satisfy the condition:

$$h_m \geq h_{sat}$$

[2]Lieberman, E., "Determining Lateral Deployment of Traffic on an Approach to an Intersection", McShane, W. & Lieberman, E., "Service Rates of Mixed Traffic on the far Left Lane of an Approach". Both papers appear in Transportation Research Record 772, 1980. Lieberman, E., Xin, W., "Macroscopic Traffic Modeling For Large-Scale Evacuation Planning", presented at the TRB 2012 Annual Meeting, January 22-26, 2012

That is, the turn-movement-specific discharge headways are always greater than, or equal to the saturation discharge headway for through vehicles. These headways (or its inverse equivalent, "saturation flow rate"), may be determined by observation or using the procedures of the HCM 2010.

The above discussion is necessarily brief given the scope of this ETE report and the complexity of the subject of intersection capacity. In fact, Chapters 18, 19 and 20 in the HCM 2010 address this topic. The factors, F_1, F_2,…, influencing saturation flow rate are identified in equation (18-5) of the HCM 2010.

The traffic signals within the EPZ and Shadow Region are modeled using representative phasing plans and phase durations obtained as part of the field data collection. Traffic responsive signal installations allow the proportion of green time allocated (P_m) for each approach to each intersection to be determined by the expected traffic volumes on each approach during evacuation circumstances. The amount of green time (G) allocated is subject to maximum and minimum phase duration constraints; 2 seconds of yellow time are indicated for each signal phase and 1 second of all-red time is assigned between signal phases, typically. If a signal is pre-timed, the yellow and all-red times observed during the road survey are used. A lost time (L) of 2.0 seconds is used for each signal phase in the analysis.

4.2 Capacity Estimation along Sections of Highway

The capacity of highway sections -- as distinct from approaches to intersections -- is a function of roadway geometrics, traffic composition (e.g. percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. There is a fundamental relationship which relates service volume (i.e. the number of vehicles serviced within a uniform highway section in a given time period) to traffic density. The top curve in Figure 4-1 illustrates this relationship.

As indicated, there are two flow regimes: (1) Free Flow (left side of curve); and (2) Forced Flow (right side). In the Free Flow regime, the traffic demand is fully serviced; the service volume increases as demand volume and density increase, until the service volume attains its maximum value, which is the capacity of the highway section. As traffic demand and the resulting highway density increase beyond this "critical" value, the rate at which traffic can be serviced (i.e. the service volume) can actually decline below capacity ("capacity drop"). Therefore, in order to realistically represent traffic performance during congested conditions (i.e. when demand exceeds capacity), it is necessary to estimate the service volume, V_F, under congested conditions.

The value of V_F can be expressed as:

$$V_F = R \times Capacity$$

where:

R = Reduction factor which is less than unity

We have employed a value of R=0.90. The advisability of such a capacity reduction factor is based upon empirical studies that identified a fall-off in the service flow rate when congestion occurs at "bottlenecks" or "choke points" on a freeway system. Zhang and Levinson[3] describe a research program that collected data from a computer-based surveillance system (loop detectors) installed on the Interstate Highway System, at 27 active bottlenecks in the twin cities metro area in Minnesota over a 7-week period. When flow breakdown occurs, queues are formed which discharge at lower flow rates than the maximum capacity prior to observed breakdown. These queue discharge flow (QDF) rates vary from one location to the next and also vary by day of week and time of day based upon local circumstances. The cited reference presents a mean QDF of 2,016 passenger cars per hour per lane (pcphpl). This figure compares with the nominal capacity estimate of 2,250 pcphpl estimated for the ETE and indicated in Appendix K for freeway links. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

Since the principal objective of evacuation time estimate analyses is to develop a "realistic" estimate of evacuation times, use of the representative value for this capacity reduction factor (R=0.90) is justified. This factor is applied only when flow breaks down, as determined by the simulation model.

Rural roads, like freeways, are classified as "uninterrupted flow" facilities. (This is in contrast with urban street systems which have closely spaced signalized intersections and are classified as "interrupted flow" facilities.) As such, traffic flow along rural roads is subject to the same effects as freeways in the event traffic demand exceeds the nominal capacity, resulting in queuing and lower QDF rates. As a practical matter, rural roads rarely break down at locations away from intersections. Any breakdowns on rural roads are generally experienced at intersections where other model logic applies, or at lane drops which reduce capacity there. Therefore, the application of a factor of 0.90 is appropriate on rural roads, but rarely, if ever, activated.

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity. Exhibit 15-30 in the Highway Capacity Manual was referenced to estimate saturation flow rates. The impact of narrow lanes and shoulders on free-flow speed and on capacity is not material, particularly when flow is predominantly in one direction as is the case during an evacuation.

The procedure used here was to estimate "section" capacity, V_E, based on observations made traveling over each section of the evacuation network, based on the posted speed limits and travel behavior of other motorists and by reference to the 2010 HCM. The DYNEV II simulation model determines for each highway section, represented as a network link, whether its capacity would be limited by the "section-specific" service volume, V_E, or by the intersection-specific capacity. For each link, the model selects the lower value of capacity.

[3]Lei Zhang and David Levinson, "Some Properties of Flows at Freeway Bottlenecks," Transportation Research Record 1883, 2004.

4.3 Application to the Duane Arnold Energy Center Study Area

As part of the development of the link-node analysis network for the study area, an estimate of roadway capacity is required. The source material for the capacity estimates presented herein is contained in:

2010 Highway Capacity Manual (HCM)
Transportation Research Board
National Research Council
Washington, D.C.

The highway system in the study area consists primarily of three categories of roads and, of course, intersections:

- Two-Lane roads: Local, State
- Multi-Lane Highways (at-grade)
- Freeways

Each of these classifications will be discussed.

4.3.1 Two-Lane Roads

Ref: HCM Chapter 15

Two lane roads comprise the majority of highways within the EPZ. The per-lane capacity of a two-lane highway is estimated at 1,700 passenger cars per hour (pc/h). This estimate is essentially independent of the directional distribution of traffic volume except that, for extended distances, the two-way capacity will not exceed 3,200 pc/h. The HCM procedures then estimate LOS and Average Travel Speed. The DYNEV II simulation model accepts the specified value of capacity as input and computes average speed based on the time-varying demand: capacity relations.

Based on the field survey and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the EPZ are classified as “Class I”, with "level terrain"; some are “rolling terrain”.
- “Class II” highways are mostly those within urban and suburban centers.

4.3.2 Multi-Lane Highway

Ref: HCM Chapter 14

Exhibit 14-2 of the HCM 2010 presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,200 pc/h, for free-speeds of 45 to 60 mph, respectively. Based on observation, the multi-lane highways outside of urban areas within the EPZ service traffic with free-speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand: capacity relationship and the impact of control at intersections. A

conservative estimate of per-lane capacity of 1,900 pc/h is adopted for this study for multi-lane highways outside of urban areas, as shown in Appendix K.

4.3.3 Freeways

Ref: HCM Chapters 10, 11, 12, 13

Chapter 10 of the HCM 2010 describes a procedure for integrating the results obtained in Chapters 11, 12 and 13, which compute capacity and LOS for freeway components. Chapter 10 also presents a discussion of simulation models. The DYNEV II simulation model automatically performs this integration process.

Chapter 11 of the HCM 2010 presents procedures for estimating capacity and LOS for “Basic Freeway Segments". Exhibit 11-17 of the HCM 2010 presents capacity vs. free speed estimates, which are provided below.

Free Speed (mph):	55	60	65	70+
Per-Lane Capacity (pc/h):	2,250	2,300	2,350	2,400

The inputs to the simulation model are highway geometrics, free-speeds and capacity based on field observations. The simulation logic calculates actual time-varying speeds based on demand: capacity relationships. A conservative estimate of per-lane capacity of 2,250 pc/h is adopted for this study for freeways, as shown in Appendix K.

Chapter 12 of the HCM 2010 presents procedures for estimating capacity, speed, density and LOS for freeway weaving sections. The simulation model contains logic that relates speed to demand volume: capacity ratio. The value of capacity obtained from the computational procedures detailed in Chapter 12 depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 13 of the HCM 2010 presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 13-8 of the HCM 2010, and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 13-10 and is a function of the ramp free flow speed. The DYNEV II simulation model logic simulates the merging operations of the ramp and freeway traffic in accord with the procedures in Chapter 13 of the HCM 2010. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions (The HCM does not address LOS F explicitly).

4.3.4 Intersections

Ref: HCM Chapters 18, 19, 20, 21

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 18 (signalized intersections), Chapters 19, 20 (un-signalized intersections) and Chapter 21 (roundabouts). The complexity of these computations is indicated by the aggregate length of these chapters. The DYNEV II simulation logic is likewise complex.

The simulation model explicitly models intersections: Stop/yield controlled intersections (both 2-way and all-way) and traffic signal controlled intersections. Where intersections are controlled by fixed time controllers, traffic signal timings are set to reflect average (non-evacuation) traffic conditions. Actuated traffic signal settings respond to the time-varying demands of evacuation traffic to adjust the relative capacities of the competing intersection approaches.

The model is also capable of modeling the presence of manned traffic control. At specific locations where it is advisable or where existing plans call for overriding existing traffic control to implement manned control, the model will use actuated signal timings that reflect the presence of traffic guides. At locations where a special traffic control strategy (continuous left-turns, contra-flow lanes) is used, the strategy is modeled explicitly. Where applicable, the location and type of traffic control for nodes in the evacuation network are noted in Appendix K. The characteristics of the ten highest volume signalized intersections are detailed in Appendix J.

4.4 Simulation and Capacity Estimation

Chapter 6 of the HCM is entitled, "HCM and Alternative Analysis Tools." The chapter discusses the use of alternative tools such as simulation modeling to evaluate the operational performance of highway networks. Among the reasons cited in Chapter 6 to consider using simulation as an alternative analysis tool is:

> *"The system under study involves a group of different facilities or travel modes with mutual interactions invoking several procedural chapters of the HCM. Alternative tools are able to analyze these facilities as a single system."*

This statement succinctly describes the analyses required to determine traffic operations across an area encompassing an EPZ operating under evacuation conditions. The model utilized for this study, DYNEV II, is further described in Appendix C. It is essential to recognize that simulation models do not replicate the methodology and procedures of the HCM – they *replace* these procedures by describing the complex interactions of traffic flow and computing Measures of Effectiveness (MOE) detailing the operational performance of traffic over time and by location. The DYNEV II simulation model includes some HCM 2010 procedures only for the purpose of estimating capacity.

All simulation models must be calibrated properly with field observations that quantify the performance parameters applicable to the analysis network. Two of the most important of

these are: (1) Free flow speed (FFS); and (2) saturation headway, h_{sat}. The first of these is estimated by direct observation during the road survey; the second is estimated using the concepts of the HCM 2010, as described earlier. These parameters are listed in Appendix K, for each network link.

4.5 Boundary Conditions

As illustrated in Figure 1-3 and in Appendix K, the link-node analysis network used for this study is finite. The analysis network does extend well beyond the 15-mile radial study area in some locations in order to model intersections with other major evacuation routes beyond the study area. However, the network does have an end at the destination (exit) nodes as discussed in Appendix C. Beyond these destination nodes, there may be signalized intersections or merge points that impact the capacity of the evacuation routes leaving the study area. Rather than neglect these "boundary conditions," this study assumes a 25% reduction in capacity on two-lane roads (Section 4.3.1 above) and multi-lane highways (Section 4.3.2 above) if there are stop signs or traffic signals located along the roadway within a mile downstream of the end of the analysis network. There is no reduction in capacity for freeways due to boundary conditions. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area (see Table K-2) and the fact that the evacuating traffic volume will be more significant than the competing traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

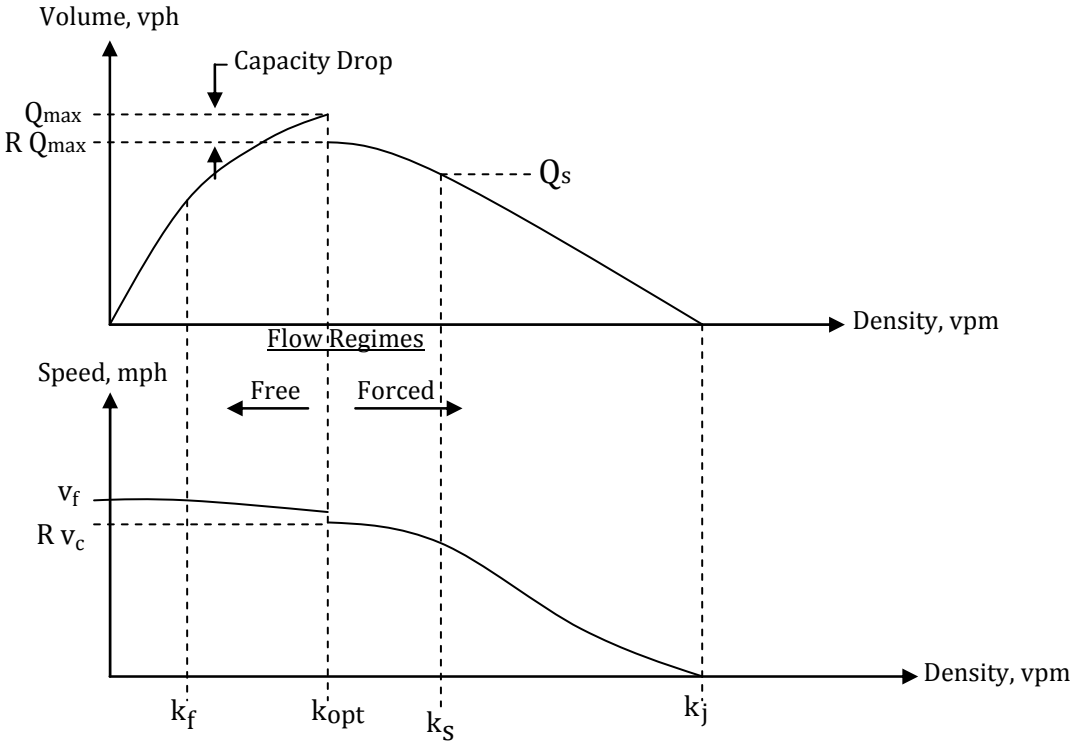


Figure 4-1. Fundamental Diagrams

5 ESTIMATION OF TRIP GENERATION TIME

Federal Government guidelines (see NUREG/CR-7002) specify that the planner estimate the distributions of elapsed times associated with mobilization activities undertaken by the public to prepare for the evacuation trip. The elapsed time associated with each activity is represented as a statistical distribution reflecting differences between members of the public. The quantification of these activity-based distributions relies largely on the results of the telephone survey. We define the sum of these distributions of elapsed times as the Trip Generation Time Distribution.

5.1 Background

In general, an accident at a nuclear power plant is characterized by the following Emergency Classification Levels (see Appendix 1 of NUREG 0654 for details):

1. Unusual Event
2. Alert
3. Site Area Emergency
4. General Emergency

At each level, the Federal guidelines specify a set of Actions to be undertaken by the Licensee, and by the State and Local offsite authorities. As a Planning Basis, we will adopt a conservative posture, in accordance with Section 1.2 of NUREG/CR-7002, that a rapidly escalating accident at the plant wherein evacuation is ordered promptly and no early protective actions have been implemented will be considered in calculating the Trip Generation Time. We will assume:

1. The Advisory to Evacuate will be announced coincident with the siren notification.
2. Mobilization of the general population will commence within 15 minutes after the siren notification.
3. ETE are measured relative to the Advisory to Evacuate.

We emphasize that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various classes of an emergency.

For example, suppose one hour elapses from the siren alert to the Advisory to Evacuate. In this case, it is reasonable to expect some degree of spontaneous evacuation by the public during this one-hour period. As a result, the population within the EPZ will be lower when the Advisory to Evacuate is announced, than at the time of the siren alert. In addition, many will engage in preparation activities to evacuate, in anticipation that an Advisory will be broadcast. Thus, the time needed to complete the mobilization activities and the number of people

remaining to evacuate the EPZ after the Advisory to Evacuate, will both be somewhat less than the estimates presented in this report. Consequently, the ETE presented in this report are higher than the actual evacuation time, if this hypothetical situation were to take place.

The notification process consists of two events:

1. Transmitting information using the alert and notification systems (ANS) available within the EPZ (e.g. sirens, tone alerts, EAS broadcasts, loud speakers).
2. Receiving and correctly interpreting the information that is transmitted.

The population within the EPZ is dispersed over an area of approximately 414 square miles and is engaged in a wide variety of activities. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an accident.

The amount of elapsed time will vary from one individual to the next depending on where that person is, what that person is doing, and related factors. Furthermore, some persons who will be directly involved with the evacuation process may be outside the EPZ at the time the emergency is declared. These people may be commuters, shoppers and other travelers who reside within the EPZ and who will return to join the other household members upon receiving notification of an emergency.

As indicated in Section 2.13 of NUREG/CR-6863, the estimated elapsed times for the receipt of notification can be expressed as a distribution reflecting the different notification times for different people within, and outside, the EPZ. By using time distributions, it is also possible to distinguish between different population groups and different day-of-week and time-of-day scenarios, so that accurate ETE may be computed.

For example, people at home or at work within the EPZ will be notified by siren, and/or tone alert and/or radio (if available). Those well outside the EPZ will be notified by telephone, radio, TV and word-of-mouth, with potentially longer time lags. Furthermore, the spatial distribution of the EPZ population will differ with time-of-day; families will be united in the evenings, but dispersed during the day. In this respect, weekends will differ from weekdays.

As indicated in Section 4.1 of NUREG/CR-7002, the information required to compute trip generation times is typically obtained from a telephone survey of EPZ residents. Such a survey was conducted in 2012 in support of a previous ETE study for this site. Appendix F discusses the survey sampling plan, documents the survey instrument utilized, and provides the survey results. The remaining discussion will focus on the application of the trip generation data obtained from the 2012 telephone survey to the development of the ETE documented in this report.

5.2 Fundamental Considerations

The environment leading up to the time that people begin their evacuation trips consists of a sequence of events and activities. Each event (other than the first) occurs at an instant in time and is the outcome of an activity.

Activities are undertaken over a period of time. Activities may be in "series" (i.e., to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time). Activities conducted in series are functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one another. The relevant events associated with the public's preparation for evacuation are:

Event Number	Event Description
1	Notification
2	Awareness of Situation
3	Depart Work
4	Arrive Home
5	Depart on Evacuation Trip

Associated with each sequence of events are one or more activities, as outlined below:

Table 5-1. Event Sequence for Evacuation Activities

Event Sequence	Activity	Distribution
1 → 2	Receive Notification	1
2 → 3	Prepare to Leave Work	2
2,3 → 4	Travel Home	3
2,4 → 5	Prepare to Leave to Evacuate	4
N/A	Snow Clearance	5

These relationships are shown graphically in Figure 5-1.

- An Event is a 'state' that exists at a point in time (e.g., depart work, arrive home)
- An Activity is a 'process' that takes place over some elapsed time (e.g., prepare to leave work, travel home)

As such, a completed Activity changes the 'state' of an individual (i.e., the activity, 'travel home' changes the state from 'depart work' to 'arrive home'). Therefore, an Activity can be described as an 'Event Sequence'; the elapsed times to perform an event sequence vary from one person to the next and are described as statistical distributions on the following pages.

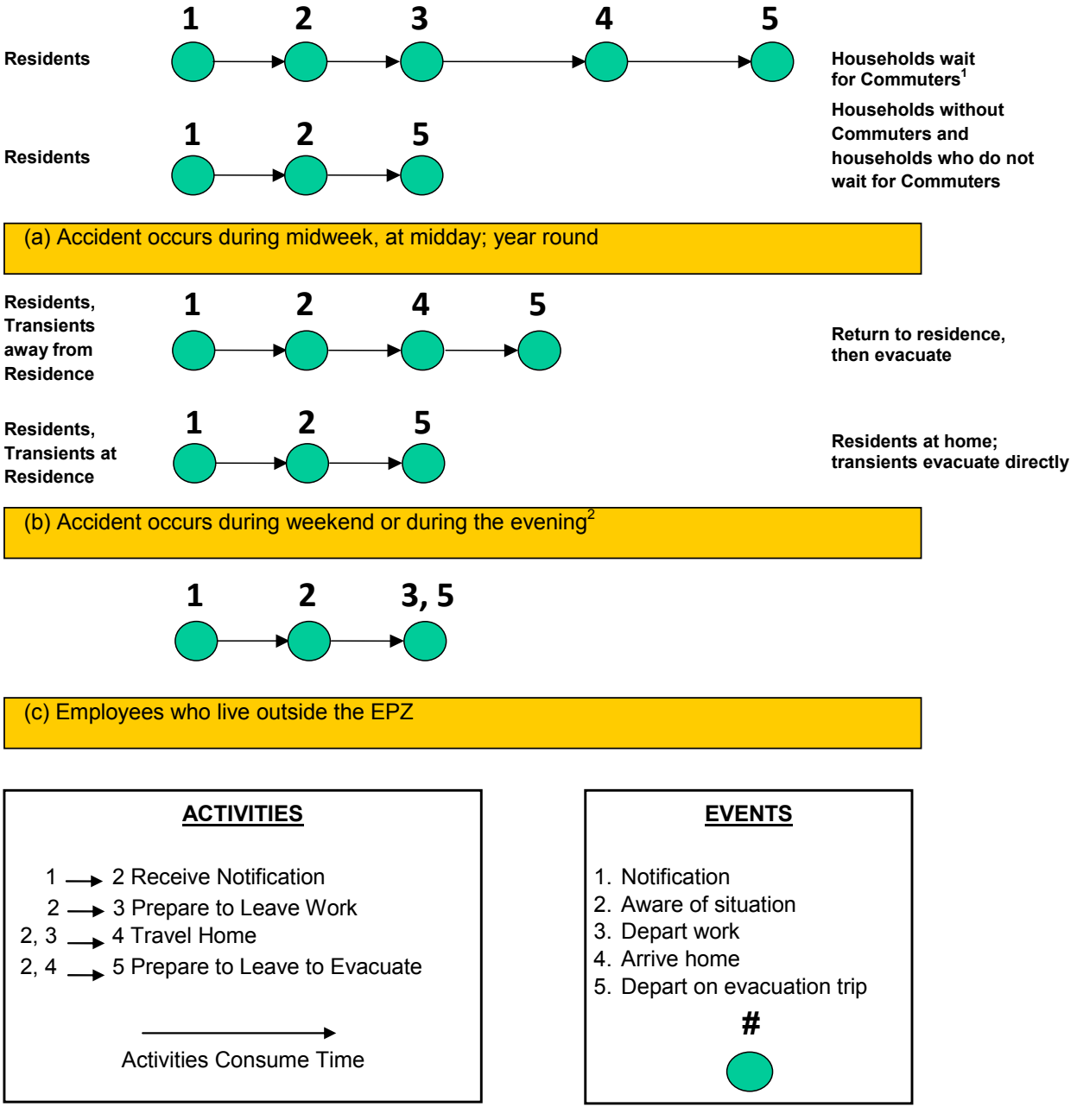
An employee who lives outside the EPZ will follow sequence (c) of Figure 5-1. A household

within the EPZ that has one or more commuters at work, and will await their return before beginning the evacuation trip will follow the first sequence of Figure 5-1(a). A household within the EPZ that has no commuters at work, or that will not await the return of any commuters, will follow the second sequence of Figure 5-1(a), regardless of day of week or time of day.

Households with no commuters on weekends or in the evening/night-time will follow the applicable sequence in Figure 5-1(b). Transients will always follow one of the sequences of Figure 5-1(b). Some transients away from their residence could elect to evacuate immediately without returning to the residence, as indicated in the second sequence.

It is seen, from Figure 5-1, that the Trip Generation time (the total elapsed time from Event 1 to Event 5) depends on the scenario and will vary from one household to the next. Furthermore, Event 5 depends, in a complicated way, on the time distributions of all activities preceding that event. That is, to estimate the time distribution of Event 5, we must obtain estimates of the time distributions of all preceding events. For this study, we adopt the conservative posture that all activities will occur in sequence.

In some cases, assuming certain events occur strictly sequential (for instance, commuter returning home before beginning preparation to leave, or removing snow only after the preparation to leave) can result in rather *conservative* (that is, longer) estimates of mobilization times. It is reasonable to expect that at least some parts of these events will overlap for many households, but that assumption is not made in this study.



[1] Applies for evening and weekends also if commuters are at work.
[2] Applies throughout the year for transients.

Figure 5-1. Events and Activities Preceding the Evacuation Trip

5.3 Estimated Time Distributions of Activities Preceding Event 5

The time distribution of an event is obtained by "summing" the time distributions of all prior contributing activities. (This "summing" process is quite different than an algebraic sum since it is performed on distributions – not scalar numbers).

Time Distribution No. 1, Notification Process: Activity 1 $\rightarrow$ 2

Federal regulations (10CFR50 Appendix E, Item IV.D.3) stipulate, "[t]he design objective of the prompt public alert and notification system shall be to have the capability to essentially complete the initial alerting and initiate notification of the public within the plume exposure pathway EPZ within about 15 minutes". Furthermore, Item 2 of Section B in Appendix 3 of NUREG-0654/FEMA-REP-1 states that "special arrangements will be made to assure 100 percent coverage within 45 minutes of the population who may not have received the initial notification within the entire plume exposure EPZ".

Given the federal regulations and guidance, and the presence of sirens within the EPZ, it is assumed that 100 percent of the population in the EPZ can be notified within 45 minutes. The assumed distribution for notifying the EPZ population is provided in Table 5-2.

Table 5-2. Time Distribution for Notifying the Public

Elapsed Time (Minutes)	Percent of Population Notified
0	0%
5	7%
10	13%
15	27%
20	47%
25	66%
30	87%
35	92%
40	97%
45	100%

Distribution No. 2, Prepare to Leave Work: Activity 2 $\rightarrow$ 3

It is reasonable to expect that the vast majority of business enterprises within the EPZ will elect to shut down following notification and most employees would leave work quickly. Commuters, who work outside the EPZ could, in all probability, also leave quickly since facilities outside the EPZ would remain open and other personnel would remain. Personnel or farmers responsible for equipment/livestock would require additional time to secure their facility. The distribution of Activity 2 $\rightarrow$ 3 shown in Table 5-3 reflects data obtained by the telephone survey. This distribution is also applicable for residents to leave stores, restaurants, parks and other locations within the EPZ. This distribution is plotted in Figure 5-2.

Table 5-3. Time Distribution for Employees to Prepare to Leave Work

Elapsed Time (Minutes)	Cumulative Percent Employees Leaving Work
0	0%
5	56%
10	70%
15	81%
20	86%
25	88%
30	95%
35	95%
40	96%
45	98%
50	98%
55	98%
60	100%

NOTE: The survey data was normalized to distribute the "Don't know" response. That is, the sample was reduced in size to include only those households who responded to this question. The underlying assumption is that the distribution of this activity for the “Don’t know” responders, if the event takes place, would be the same as those responders who provided estimates.

Distribution No. 3, Travel Home: Activity 3 $\rightarrow$ 4

These data are provided directly by those households which responded to the telephone survey. This distribution is plotted in Figure 5-2 and listed in Table 5-4.

Table 5-4. Time Distribution for Commuters to Travel Home

Elapsed Time (Minutes)	Cumulative Percent Returning Home
0	0%
5	14%
10	40%
15	64%
20	82%
25	87%
30	94%
35	95%
40	98%
45	100%

NOTE: The survey data was normalized to distribute the "Don't know" response

Distribution No. 4, Prepare to Leave Home: Activity 2, 4 $\rightarrow$ 5

These data are provided directly by those households which responded to the telephone survey. This distribution is plotted in Figure 5-2 and listed in Table 5-5.

Table 5-5. Time Distribution for Population to Prepare to Leave Home

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0%
15	20%
30	66%
45	73%
60	91%
75	93%
90	95%
105	95%
120	98%
135	100%

NOTE: The survey data was normalized to distribute the "Don't know" response

Distribution No. 5, Snow Clearance Time Distribution

Inclement weather scenarios involving snowfall must address the time lags associated with snow clearance. It is assumed that snow equipment is mobilized and deployed during the snowfall to maintain passable roads. The general consensus is that the snow-plowing efforts are generally successful for all but the most extreme blizzards when the rate of snow accumulation exceeds that of snow clearance over a period of many hours.

Consequently, it is reasonable to assume that the highway system will remain passable – albeit at a lower capacity – under the vast majority of snow conditions. Nevertheless, for the vehicles to gain access to the highway system, it may be necessary for driveways and employee parking lots to be cleared to the extent needed to permit vehicles to gain access to the roadways. These clearance activities take time; this time must be incorporated into the trip generation time distributions. These data are provided by those households which responded to the telephone survey. This distribution is plotted in Figure 5-2 and listed in Table 5-6.

Note that those respondents (46%) who answered that they would not take time to clear their driveway were assumed to be ready immediately at the start of this activity. Essentially they would drive through the snow on the driveway to access the roadway and begin their evacuation trip.

Table 5-6. Time Distribution for Population to Clear 6"-8" of Snow

Elapsed Time (Minutes)	Cumulative Percent Completing Snow Removal
0	46%
15	60%
30	82%
45	88%
60	96%
75	97%
90	98%
105	98%
120	100%

NOTE: The survey data was normalized to distribute the "Don't know" response

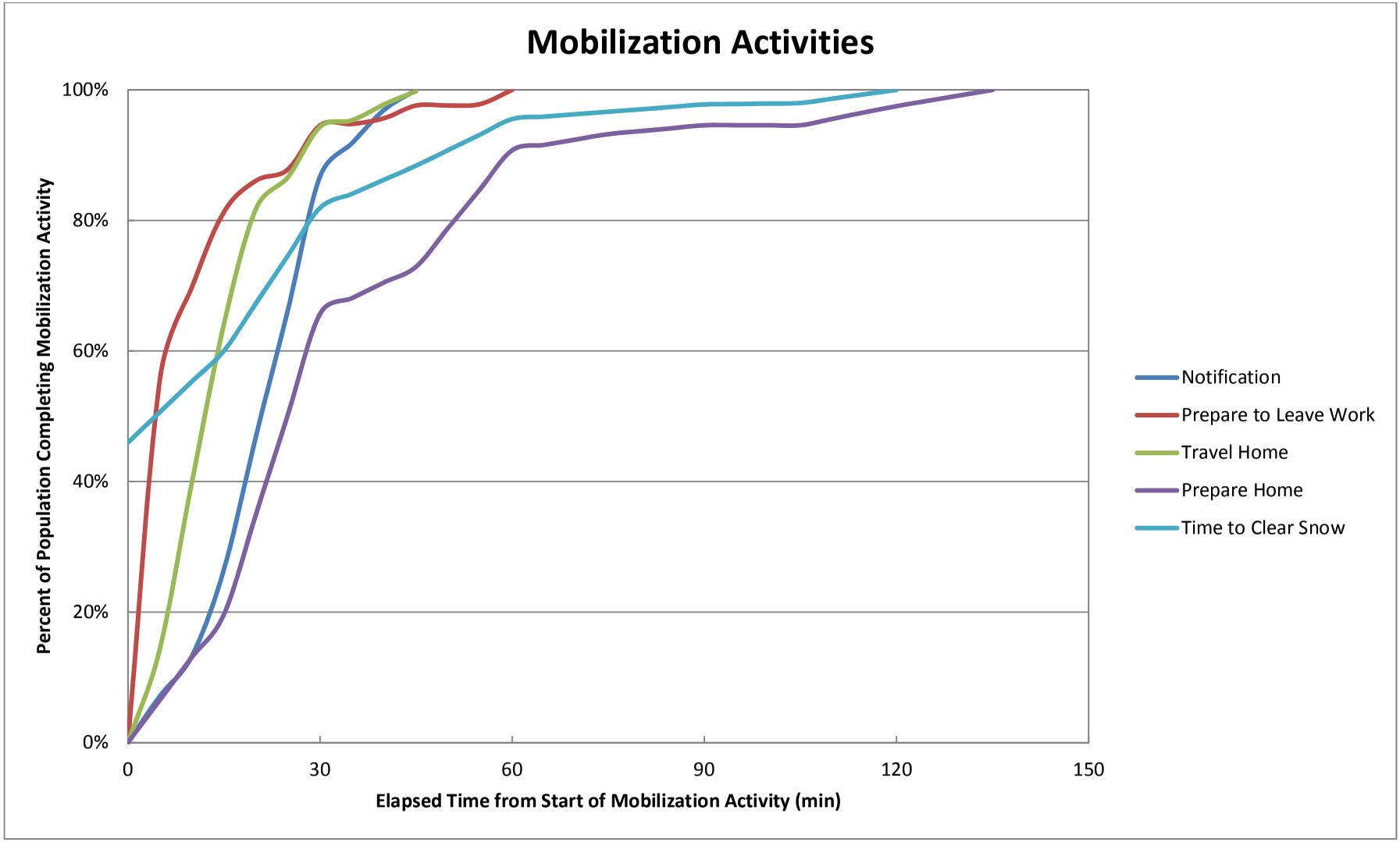


Figure 5-2. Time Distributions for Evacuation Mobilization Activities

5.4 Calculation of Trip Generation Time Distribution

The time distributions for each of the mobilization activities presented herein must be combined to form the appropriate Trip Generation Distributions. As discussed above, this study assumes that the stated events take place in sequence such that all preceding events must be completed before the current event can occur. For example, if a household awaits the return of a commuter, the work-to-home trip (Activity 3 $\rightarrow$ 4) must precede Activity 4 $\rightarrow$ 5.

To calculate the time distribution of an event that is dependent on two sequential activities, it is necessary to "sum" the distributions associated with these prior activities. The distribution summing algorithm is applied repeatedly to form the required distribution. As an outcome of this procedure, new time distributions are formed; we assign "letter" designations to these intermediate distributions to describe the procedure. Table 5-7 presents the summing procedure to arrive at each designated distribution.

Table 5-7. Mapping Distributions to Events

Apply "Summing" Algorithm To:	Distribution Obtained	Event Defined
Distributions 1 and 2	Distribution A	Event 3
Distributions A and 3	Distribution B	Event 4
Distributions B and 4	Distribution C	Event 5
Distributions 1 and 4	Distribution D	Event 5
Distributions C and 5	Distribution E	Event 5
Distributions D and 5	Distribution F	Event 5

Table 5-8 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

Table 5-8. Description of the Distributions

Distribution	Description
A	Time distribution of commuters departing place of work (Event 3). Also applies to employees who work within the EPZ who live outside, and to Transients within the EPZ.
B	Time distribution of commuters arriving home (Event 4).
C	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5).
D	Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5).
E	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip, after snow clearance activities (Event 5).
F	Time distribution of residents with no commuters returning home, leaving to begin the evacuation trip, after snow clearance activities (Event 5).

5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer "don't know" to some questions or choose to not respond to a question. The mobilization activity distributions are based upon actual responses. But, it is the nature of surveys that a few numeric responses are inconsistent with the overall pattern of results. An example would be a case in which for 500 responses, almost all of them estimate less than two hours for a given answer, but 3 say "four hours" and 4 say "six or more hours".

These "outliers" must be considered: are they valid responses, or so atypical that they should be dropped from the sample?

In assessing outliers, there are three alternatives to consider:

1) Some responses with very long times may be valid, but reflect the reality that the respondent really needs to be classified in a different population subgroup, based upon special needs;

2) Other responses may be unrealistic (6 hours to return home from commuting distance, or 2 days to prepare the home for departure);

3) Some high values are representative and plausible, and one must not cut them as part of the consideration of outliers.

The issue of course is how to make the decision that a given response or set of responses are to be considered "outliers" for the component mobilization activities, using a method that objectively quantifies the process.

There is considerable statistical literature on the identification and treatment of outliers singly or in groups, much of which assumes the data is normally distributed and some of which uses non-parametric methods to avoid that assumption. The literature cites that limited work has been done directly on outliers in sample survey responses.

In establishing the overall mobilization time/trip generation distributions, the following principles are used:

1) It is recognized that the overall trip generation distributions are conservative estimates, because they assume a household will do the mobilization activities sequentially, with no overlap of activities;

2) The individual mobilization activities (prepare to leave work, travel home, prepare home, clear snow) are reviewed for outliers, and then the overall trip generation distributions are created (see Figure 5-1, Table 5-7, Table 5-8);

3) Outliers can be eliminated either because the response reflects a special population (e.g. special needs, transit dependent) or lack of realism, because the purpose is to estimate trip generation patterns for personal vehicles;

4) To eliminate outliers,
    a) the mean and standard deviation of the specific activity are estimated from the responses,
    b) the median of the same data is estimated, with its position relative to the mean noted,
    c) the histogram of the data is inspected, and
    d) all values greater than 3.5 standard deviations are flagged for attention, taking special note of whether there are gaps (categories with zero entries) in the histogram display.

    In general, only flagged values more than 4 standard deviations from the mean are allowed to be considered outliers, with gaps in the histogram expected.

    When flagged values are classified as outliers and dropped, steps "a" to "d" are repeated.

5) As a practical matter, even with outliers eliminated by the above, the resultant histogram, viewed as a cumulative distribution, is not a normal distribution. A typical situation that results is shown below in Figure 5-3.

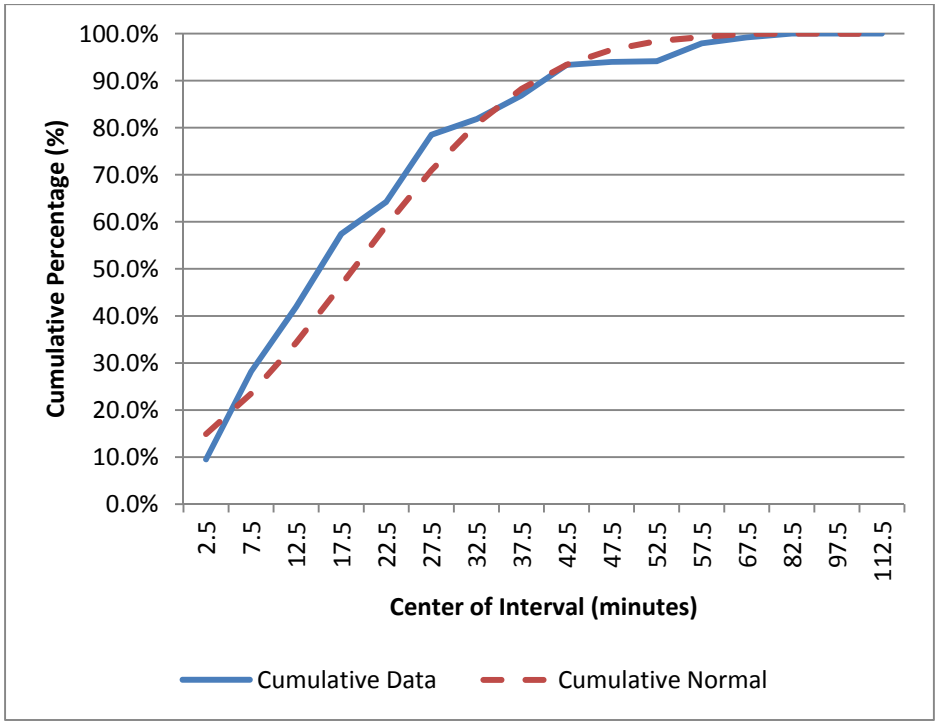


Figure 5-3. Comparison of Data Distribution and Normal Distribution

6) In particular, the cumulative distribution differs from the normal distribution in two key aspects, both very important in loading a network to estimate evacuation times:

- Most of the real data is to the left of the "normal" curve above, indicating that the network loads faster for the first 80-85 percent of the vehicles, potentially causing more (and earlier) congestion than otherwise modeled;
- The last 10-15 percent of the real data "tails off" slower than the comparable "normal" curve, indicating that there is significant traffic still loading at later times.

Because these two features are important to preserve, it is the histogram of the data that is used to describe the mobilization activities, not a "normal" curve fit to the data. One could consider other distributions, but using the shape of the *actual* data curve is unambiguous and preserves these important features;

7) With the mobilization activities each modeled according to Steps 1-6, including preserving the features cited in Step 6, the overall (or total) mobilization times are constructed.

This is done by using the data sets and distributions under different scenarios (e.g., commuter returning, no commuter returning, no snow or snow in each). In general, these are additive, using weighting based upon the probability distributions of each element; Figure 5-4 presents the combined trip generation distributions for each population group considered. These distributions are presented on the same time scale. (As discussed earlier, the use of strictly additive activities is a conservative approach, because it makes all activities sequential – preparation for departure follows the return of the commuter; snow clearance follows the preparation for departure, and so forth. In practice, it is reasonable that some of these activities are done in parallel, at least to some extent – for instance, preparation to depart begins by a household member at home while the commuter is still on the road.)

The mobilization distributions that result are used in their tabular/graphical form as direct inputs to later computations that lead to the ETE.

The DYNEV II simulation model is designed to accept varying rates of vehicle trip generation for each origin centroid, expressed in the form of histograms. These histograms, which represent Distributions A, C, D, E and F, properly displaced with respect to one another, are tabulated in Table 5-9 (Distribution B, Arrive Home, omitted for clarity).

The final time period (15) is 600 minutes long. This time period is added to allow the analysis network to clear, in the event congestion persists beyond the trip generation period. Note that there are no trips generated during this final time period.

5.4.2 Staged Evacuation Trip Generation

As defined in NUREG/CR-7002, staged evacuation consists of the following:

1. Subareas comprising the 2-Mile region are advised to evacuate immediately
2. Subareas comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the 2-Mile region is cleared
3. As vehicles evacuate the 2-Mile region, sheltered people from 2 to 5 miles downwind continue preparation for evacuation
4. The population sheltering in the 2 to 5-Mile region are advised to begin evacuating when approximately 90 percent of those originally within the 2-Mile region evacuate across the 2-Mile region boundary
5. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20 percent.

Assumptions

1. The EPZ population in subareas beyond 5 miles will react as does the population in the 2 to 5-Mile region; that is they will first shelter, then evacuate after the 90th percentile ETE for the 2-Mile region
2. The population in the Shadow Region beyond the EPZ boundary, extending to approximately 15 miles radially from the plant, will react as they do for all non-staged evacuation scenarios. That is 20 percent of these households will elect to evacuate with no shelter delay.
3. The transient population will not be expected to stage their evacuation because of the limited sheltering options available to people who may be at parks, on a beach, or at other venues. Also, notifying the transient population of a staged evacuation would prove difficult.
4. Employees will also be assumed to evacuate without first sheltering.

Procedure

1. Trip generation for population groups in the 2-Mile region will be as computed based upon the results of the telephone survey and analysis.
2. Trip generation for the population subject to staged evacuation will be formulated as follows:
    a. Identify the 90th percentile evacuation time for the subareas comprising the two mile region. This value, T_{Scen}^{*}, is obtained from simulation results. It will become the time at which the region being sheltered will be told to evacuate for each scenario.
    b. The resultant trip generation curves for staging are then formed as follows:

i. The non-shelter trip generation curve is followed until a maximum of 20 percent of the total trips are generated (to account for shelter non-compliance).
ii. No additional trips are generated until time T_{Scen}^*
iii. Following time T_{Scen}^*, the balance of trips are generated:
    1. by stepping up and then following the non-shelter trip generation curve (if T_{Scen}^* is $\leq$ max trip generation time) or
    2. by stepping up to 100 percent (if T_{Scen}^* is > max trip generation time)

c. Note: This procedure implies that there may be different staged trip generation distributions for different scenarios. NUREG/CR-7002 uses the statement "approximately 90th percentile" as the time to end staging and begin evacuating. The value of T_{Scen}^* is on average about 1:45 for non-snow scenarios and 2:15 for snow scenarios.

3. Staged trip generation distributions are created for the following population groups:
    a. Residents with returning commuters
    b. Residents without returning commuters
    c. Residents with returning commuters and snow conditions
    d. Residents without returning commuters and snow conditions

Figure 5-5 presents the staged trip generation distributions for both residents with and without returning commuters and employees/transients; the 90th percentile two-mile evacuation time is 105 minutes for non-snow scenarios and 135 minutes for snow scenarios. At T_{Scen}, 20 percent of the resident population (who normally would have completed their mobilization activities for an un-staged evacuation) advised to shelter has nevertheless departed the area. These people do not comply with the shelter advisory. Also included on the plot are the trip generation distributions for these groups as applied to the regions advised to evacuate immediately.

Since the 90th percentile evacuation time occurs before the end of the trip generation time, after the sheltered region is advised to evacuate, the shelter trip generation distribution rises to meet the balance of the non-staged trip generation distribution. Following time T_{Scen}^*, the balance of staged evacuation trips that are ready to depart are released within 15 minutes. After T_{Scen}^*+15, the remainder of evacuation trips are generated in accordance with the un-staged trip generation distribution.

Table 5-10 provides the trip generation histograms for staged evacuation.

Table 5-9. Trip Generation Histograms for the EPZ Population for Un-staged Evacuation

Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period					
		Employees (Distribution A)	Transients (Distribution A)	Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)	Residents With Commuters Snow (Distribution E)	Residents Without Commuters Snow (Distribution F)
1	15	8%	8%	0%	1%	0%	1%
2	15	39%	39%	1%	11%	0%	5%
3	15	36%	36%	5%	28%	3%	16%
4	15	11%	11%	16%	27%	9%	20%
5	15	4%	4%	23%	14%	15%	18%
6	15	2%	2%	20%	10%	17%	14%
7	15	0%	0%	14%	3%	16%	9%
8	15	0%	0%	9%	1%	13%	5%
9	15	0%	0%	4%	1%	9%	4%
10	15	0%	0%	2%	2%	5%	3%
11	15	0%	0%	3%	2%	4%	2%
12	15	0%	0%	1%	0%	4%	1%
13	30	0%	0%	2%	0%	3%	2%
14	30	0%	0%	0%	0%	2%	0%
15	600	0%	0%	0%	0%	0%	0%

NOTE:

- Shadow vehicles are loaded onto the analysis network (Figure 1-3) using Distributions C and E for good weather and snow, respectively.
- Special event vehicles are loaded using Distribution A.

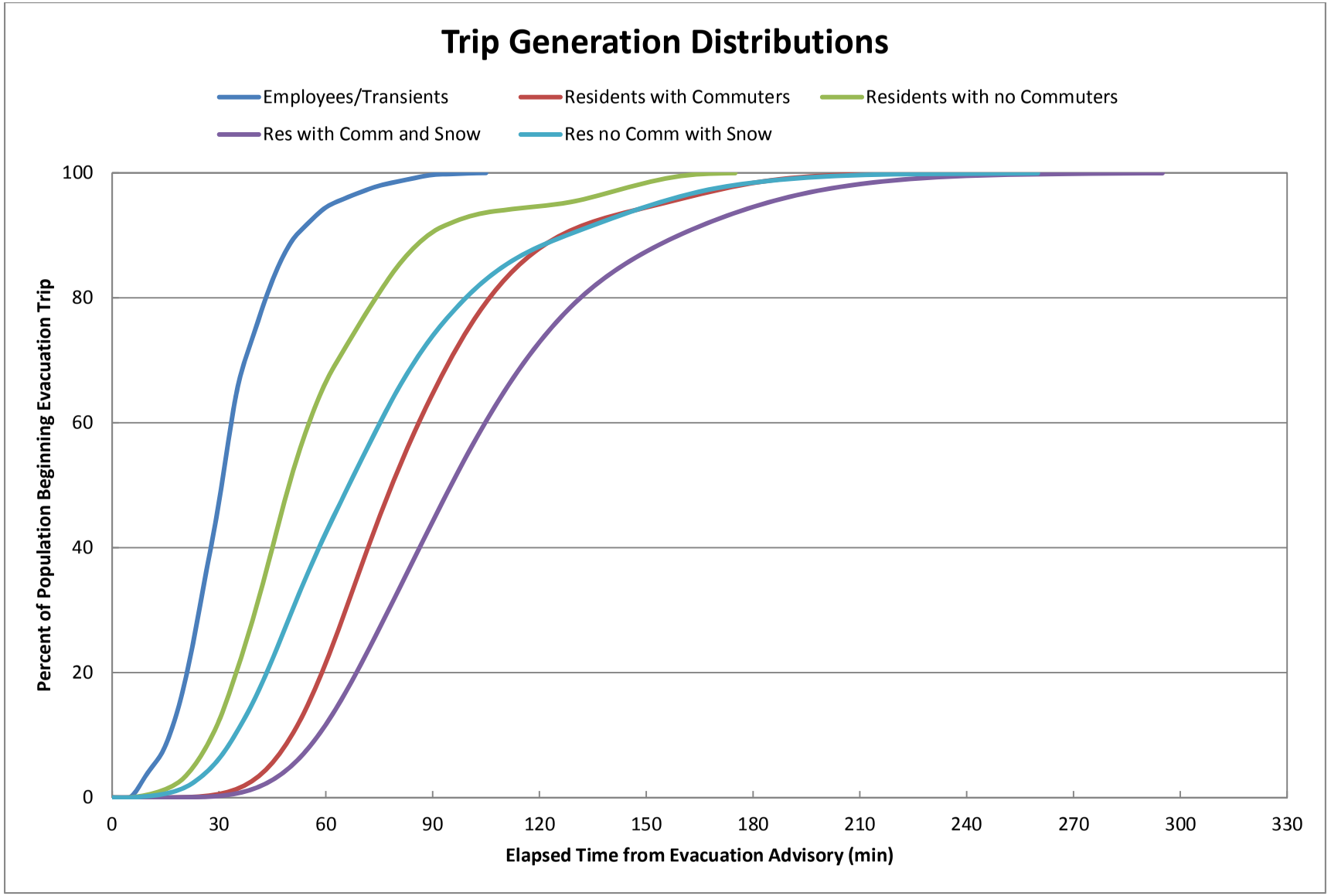


Figure 5-4. Comparison of Trip Generation Distributions

Table 5-10. Trip Generation Histograms for the EPZ Population for Staged Evacuation

Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period*			
		Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)	Residents With Commuters Snow (Distribution E)	Residents Without Commuters Snow (Distribution F)
1	15	0%	0%	0%	0%
2	15	0%	2%	0%	1%
3	15	1%	6%	1%	3%
4	15	3%	5%	1%	4%
5	15	5%	3%	3%	4%
6	15	4%	2%	4%	3%
7	15	3%	1%	3%	2%
8	15	72%	76%	3%	1%
9	15	4%	1%	1%	0%
10	15	2%	2%	71%	77%
11	15	3%	2%	4%	2%
12	15	1%	0%	4%	1%
13	30	2%	0%	3%	2%
14	30	0%	0%	2%	0%
15	600	0%	0%	0%	0%

*Trip Generation for Employees and Transients (see Table 5-9) is the same for Un-staged and Staged Evacuation.

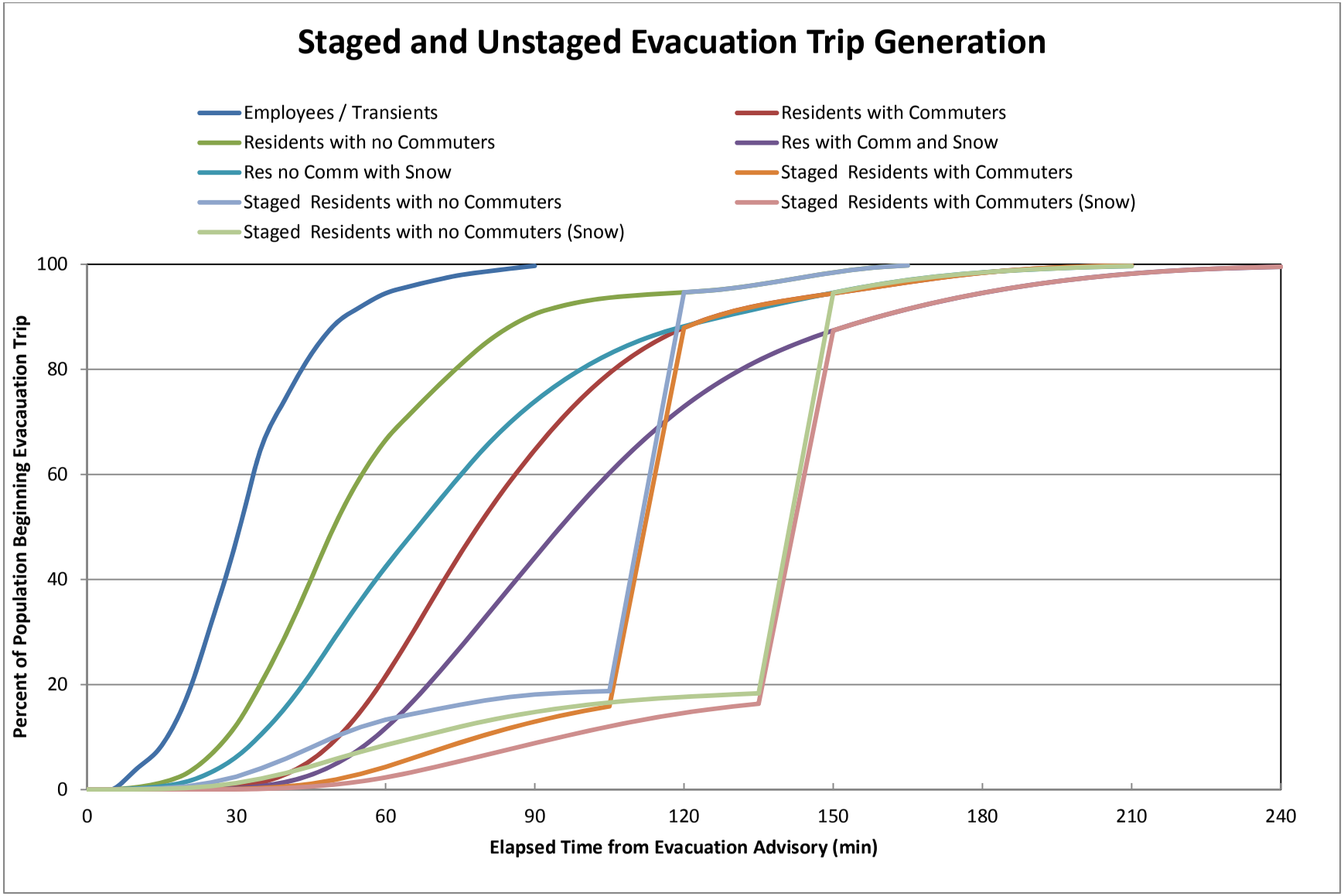


Figure 5-5. Comparison of Staged and Un-staged Trip Generation Distributions in the 2 to 5 Mile Region

6 DEMAND ESTIMATION FOR EVACUATION SCENARIOS

An evacuation "case" defines a combination of Evacuation Region and Evacuation Scenario. The definitions of "Region" and "Scenario" are as follows:

Region A grouping of contiguous evacuating Subareas that forms either a "keyhole" sector-based area, or a circular area within the EPZ, that must be evacuated in response to a radiological emergency.

Scenario A combination of circumstances, including time of day, day of week, season, and weather conditions. Scenarios define the number of people in each of the affected population groups and their respective mobilization time distributions.

A total of 38 Regions were identified which encompass all the groupings of Subareas considered. These Regions are defined in Table 6-1. The Subarea configurations are identified in Figure 6-1. Each keyhole sector-based area consists of a central circle centered at the power plant, and three or more adjoining sectors, each with a central angle of 22.5 degrees, as per NUREG/CR-7002 guidance. The central sector coincides with the wind direction. One or two sectors (if a Subarea is close to the adjoining sector boundary, the Subarea is included, such that multiple adjoining sectors are included) on either side of the central sector are also included to account for potential wind variation. These sectors extend to 5 miles from the plant (Regions R04 through R12) or to the EPZ boundary (Regions R13 through R28). Regions R01, R02 and R03 represent evacuations of circular areas with radii of 2, 5 and 10 miles, respectively. Regions R13 through R16, and R26 through R28, are based on the current Emergency Plan Implementing Procedure – EPIP 3.3 – for the DAEC. Regions R29 through R38 are identical to Regions R02 and R04 through R12, respectively; however, those Subareas between 2 miles and 5 miles are staged until 90% of the 2-mile region (Region R01) has evacuated.

A total of 14 Scenarios were evaluated for all Regions. Thus, there are a total of 38 x 14 = 532 evacuation cases. Table 6-2 is a description of all Scenarios.

Each combination of region and scenario implies a specific population to be evacuated. The population group and vehicle estimates presented in Section 3 and in Appendix E are peak values. These peak values are adjusted depending on the scenario and region being considered, using scenario and region specific percentages, such that the average population is considered for each evacuation case. The scenario percentages are presented in Table 6-3, while the regional percentages are provided in Table H-1. The percentages presented in Table 6-3 were determined as follows:

The number of residents with commuters during the week (when workforce is at its peak) is equal to 24%, which is the product of 58% (the number of households with at least one commuter) and 42% (the number of households with a commuter that would await the return of the commuter prior to evacuating). See assumption 17 in Section 2.3. It is estimated for weekend and evening scenarios that 10% of those households with returning commuters

during the week (24%) will have a commuter at work during those times, or 2% of households overall.

Employment is assumed to be at its peak (100%) during the winter, midweek, midday scenarios. Employment is reduced slightly (96%) for summer, midweek, midday scenarios. This is based on the estimation that 50% of the employees commuting into the EPZ will be on vacation for a week during the approximate 12 weeks of summer. It is further estimated that those taking vacation will be uniformly dispersed throughout the summer with approximately 4% of employees vacationing each week. It is assumed that only 10% of the employees are working in the evenings and during the weekends.

Transient activity is estimated to be at its peak (100%) during summer weekends and less (80%) during the week. As shown in Appendix E, there are many lodging facilities offering overnight accommodations in the EPZ, offset by other transient facilities in which evening use is minimal (parks, historical sites, and other recreational areas); thus, evening transient activity is estimated to be 60% for summer and 30% for winter. Transient activity on winter weekends is estimated to be 50% and less (40%) during the week.

As noted in the shadow footnote to Table 6-3, the shadow percentages are computed using a base of 20% (see assumption 2 in Section 2.2); to include the employees within the Shadow Region who may choose to evacuate, the voluntary evacuation is multiplied by a scenario-specific proportion of employees to permanent residents in the Shadow Region. For example, using the values provided in Table 6-4 for Scenario 1, the shadow percentage is computed as follows:

$$20\% \times \left(1 + \frac{28{,}147}{26{,}438 + 82{,}071}\right) = 25\%$$

One special event – the Cedar Rapids Freedom Festival – was considered as Scenario 13. Thus, the special event traffic is 100% evacuated for Scenario 13, and 0% for all other scenarios.

As discussed in Section 7, schools and college students are in session during the winter season, midweek, midday and 100% of buses will be needed under those circumstances. It is estimated that summer school and college enrollment is approximately 10% of enrollment during the regular school year for midweek, midday scenarios. School and college are not in session during weekends and evenings, thus no buses for school children or colleges are needed under those circumstances.

Transit buses for the transit-dependent population are equal to 100% for all scenarios as it is assumed that the transit-dependent population is present in the EPZ at all times.

External traffic is estimated to be 100% for all midday scenarios, while it is significantly less (40%) during evening scenarios.

Table 6-1. Description of Evacuation Regions

Region	Description		Subarea																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R01	2-Mile Ring		X																							
R02	5-Mile Ring		X	X	X	X	X	X	X	X																
R03	Full EPZ		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Evacuate 2-Mile Region and Downwind to 5 Miles																										
Region	Wind Direction From:		Subarea																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R04	NNW, N	326.26° - 11.25°	X			X	X	X																		
R05	NNE, NE, ENE	11.26° - 78.75°	X				X	X	X																	
R06	E, ESE, SE	78.76° - 146.25°	X						X	X																
R07	SSE	146.26° - 168.75°	X	X						X																
R08	S	168.76° - 191.25°	X	X	X					X																
R09	SSW, SW	191.26° - 236.25°	X	X	X																					
R10	WSW	236.26° - 258.75°	X	X	X	X																				
R11	W	258.76° - 281.25°	X		X	X																				
R12	WNW, NW	281.26° - 326.25°	X		X	X	X																			
Evacuate 2-Mile Region and Downwind to the EPZ Boundary																										
Region	Wind Direction From:		Subarea																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R13	N	348.76° - 11.25°	X			X	X	X									X	X	X	X					X	X
R14	NNE	11.26° - 33.75°	X				X	X	X									X	X	X	X					X
R15	NE	33.76° - 56.25°	X				X	X	X										X	X	X	X				
R16	ENE	56.26° - 78.75°	X				X	X	X											X	X	X	X			
R17	E	78.76° - 101.25°	X						X	X										X	X	X	X			
R18	ESE	101.26° - 123.75°	X						X	X											X	X	X	X		
R19	SE	123.76° - 146.25°	X						X	X	X											X	X	X		
R20	SSE	146.26° - 168.75°	X	X						X	X	X											X	X		
R21	S	168.76° - 191.25°	X	X	X					X	X	X	X	X									X	X		
R22	SSW	191.26° - 213.75°	X	X	X						X	X	X	X	X									X		
R23	SW	213.76° - 236.25°	X	X	X							X	X	X	X											
R24	WSW	236.26° - 258.75°	X	X	X	X						X	X	X	X	X										
R25	W	258.76° - 281.25°	X		X	X								X	X	X	X								X	
R26	WNW	281.26° - 303.75°	X		X	X	X							X	X	X	X	X							X	X
R27	NW	303.76° - 326.25°	X		X	X	X								X	X	X	X	X						X	X
R28	NNW	326.26° - 348.75°	X			X	X	X								X	X	X	X	X					X	X

Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles																									
			Subarea																						
Region	**Wind Direction From:**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
R29	5-Mile Radius	N/A	X	X	X	X	X	X	X	X																
R30	NNW, N	326.26° - 11.25°	X			X	X	X																		
R31	NNE, NE, ENE	11.26° - 78.75°	X				X	X	X																	
R32	E, ESE, SE	78.76° - 146.25°	X						X	X																
R33	SSE	146.26° - 168.75°	X	X						X																
R34	S	168.76° - 191.25°	X	X	X					X																
R35	SSW, SW	191.26° - 236.25°	X	X	X																					
R36	WSW	236.26° - 258.75°	X	X	X	X																				
R37	W	258.76° - 281.25°	X		X	X																				
R38	WNW, NW	281.26° - 326.25°	X		X	X	X																			
Subarea(s) Shelter-in-Place until 90% ETE for R01, then Evacuate						Subarea(s) Shelter-in-Place											Subarea(s) Evacuate								

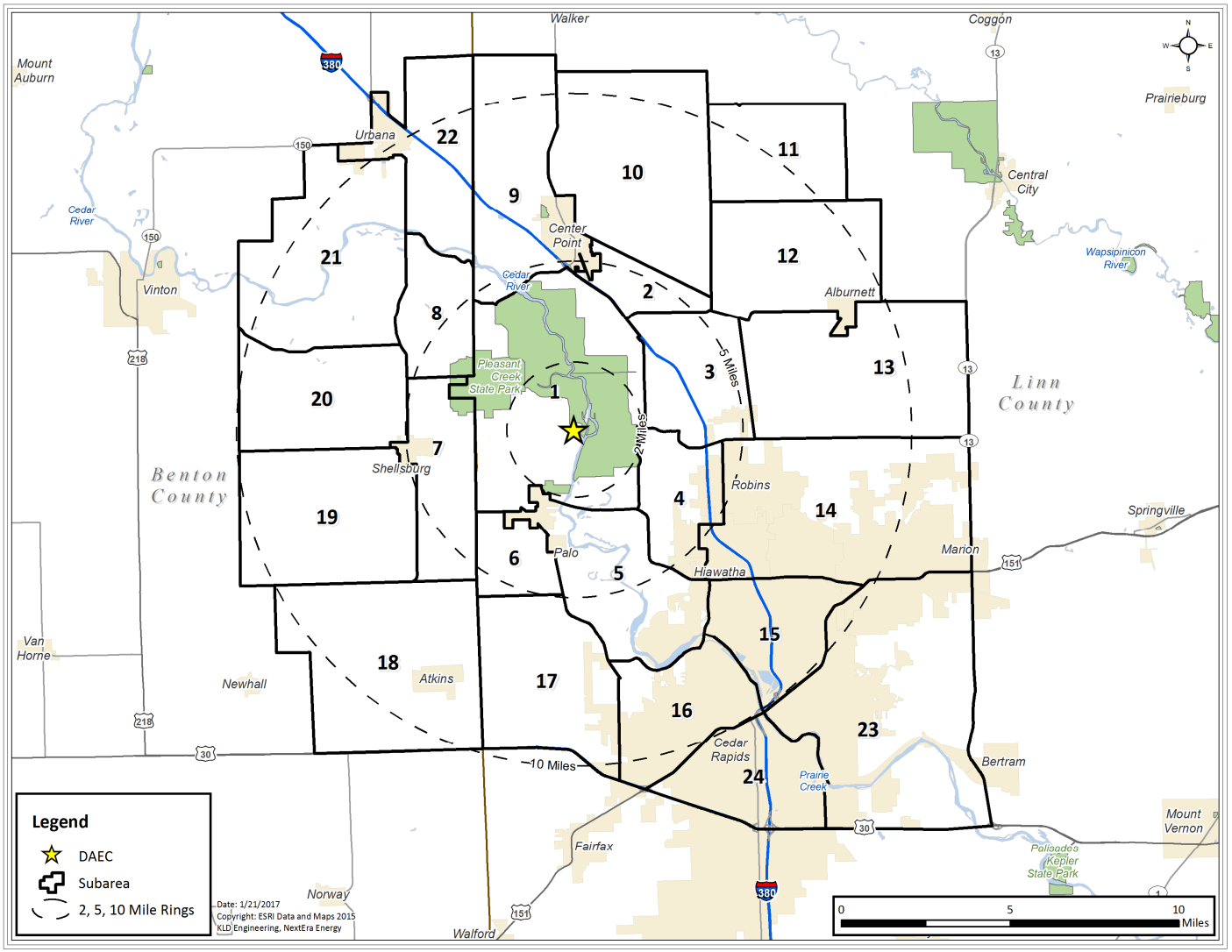


Figure 6-1. Subareas Comprising the DAEC EPZ

Table 6-2. Evacuation Scenario Definitions

Scenario	Season[1]	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain	None
8	Winter	Midweek	Midday	Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Weekend	Midday	Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Weekend	Evening	Good	Cedar Rapids Freedom Festival
14	Summer	Midweek	Midday	Good	Roadway Impact – Lane Closure on I-380 Southbound

[1] Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

Table 6-3. Percent of Population Groups Evacuating for Various Scenarios

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Shadow	Special Event	College Students	School Buses	Transit Buses	External Through Traffic
1	24%	76%	96%	80%	25%	0%	10%	10%	100%	100%
2	24%	76%	96%	80%	25%	0%	10%	10%	100%	100%
3	2%	98%	10%	100%	21%	0%	0%	0%	100%	100%
4	2%	98%	10%	100%	21%	0%	0%	0%	100%	100%
5	2%	98%	10%	60%	21%	0%	0%	0%	100%	40%
6	24%	76%	100%	40%	25%	0%	100%	100%	100%	100%
7	24%	76%	100%	40%	25%	0%	100%	100%	100%	100%
8	24%	76%	100%	40%	25%	0%	100%	100%	100%	100%
9	2%	98%	10%	50%	21%	0%	0%	0%	100%	100%
10	2%	98%	10%	50%	21%	0%	0%	0%	100%	100%
11	2%	98%	10%	50%	21%	0%	0%	0%	100%	100%
12	2%	98%	10%	30%	21%	0%	0%	0%	100%	40%
13	2%	98%	10%	60%	21%	100%	0%	0%	100%	40%
14	24%	76%	96%	80%	25%	0%	10%	10%	100%	100%

Resident Households with Commuters .....Households of EPZ residents who await the return of commuters prior to beginning the evacuation trip.
Resident Households with No Commuters ..Households of EPZ residents who do not have commuters or will not await the return of commuters prior to beginning the evacuation trip.
Employees.....EPZ employees who live outside the EPZ
Transients .....People who are in the EPZ at the time of an accident for recreational or other (non-employment) purposes.
Shadow.....Residents and employees in the Shadow Region (outside of the EPZ) who will spontaneously decide to relocate during the evacuation. The basis for the values shown is a 20% relocation of shadow residents along with a proportional percentage of shadow employees.
Special Event.....Additional vehicles in the EPZ due to the identified special event.
College Students..... Privately owned college student vehicles. College students evacuating by bus are included in the school buses column.
School and Transit Buses .....Vehicle-equivalents present on the road during evacuation servicing schools and transit-dependent people (1 bus is equivalent to 2 passenger vehicles).
External Through Traffic .....Traffic on interstates/freeways and major arterial roads at the start of the evacuation. This traffic is stopped by access control 2 hours after the evacuation begins.

Table 6-4. Vehicle Estimates by Scenario

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Shadow	Special Event	College Students	School Buses	Transit Buses	External Through Traffic	Total Scenario Vehicles
1	26,438	82,071	28,147	3,688	3,592	-	211	161	288	7,058	151,654
2	26,438	82,071	28,147	3,688	3,592	-	211	161	288	7,058	151,654
3	2,644	105,865	2,932	4,610	2,929	-	-	-	288	7,058	126,326
4	2,644	105,865	2,932	4,610	2,929	-	-	-	288	7,058	126,326
5	2,644	105,865	2,932	2,766	2,929	-	-	-	288	2,823	120,247
6	26,438	82,071	29,320	1,844	3,623	-	2,106	1,610	288	7,058	154,358
7	26,438	82,071	29,320	1,844	3,623	-	2,106	1,610	288	7,058	154,358
8	26,438	82,071	29,320	1,844	3,623	-	2,106	1,610	288	7,058	154,358
9	2,644	105,865	2,932	2,305	2,929	-	-	-	288	7,058	124,021
10	2,644	105,865	2,932	2,305	2,929	-	-	-	288	7,058	124,021
11	2,644	105,865	2,932	2,305	2,929	-	-	-	288	7,058	124,021
12	2,644	105,865	2,932	1,383	2,929	-	-	-	288	2,823	118,864
13	2,644	105,865	2,932	2,766	2,929	5,833	-	-	288	2,823	126,080
14	26,438	82,071	28,147	3,688	3,592	-	211	161	288	7,058	151,654

Note: Vehicle estimates are for an evacuation of the entire EPZ (Region R03)

7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II System described in Appendices B, C and D. These results cover 38 Regions within the DAEC EPZ and the 14 Evacuation Scenarios discussed in Section 6.

The ETE for all Evacuation Cases are presented in Table 7-1 and Table 7-2. These tables present the estimated times to clear the indicated population percentages from the Evacuation Regions for all Evacuation Scenarios. The ETE for the 2-Mile region in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 defines the Evacuation Regions considered. The tabulated values of ETE are obtained from the DYNEV II System outputs which are generated at 5-minute intervals.

7.1 Voluntary Evacuation and Shadow Evacuation

"Voluntary evacuees" are people within the EPZ in Subareas for which an Advisory to Evacuate (ATE) has not been issued, yet who elect to evacuate. "Shadow evacuation" is the voluntary outward movement of some people from the Shadow Region (outside the EPZ) for whom no protective action recommendation has been issued. Both voluntary and shadow evacuations are assumed to take place over the same time frame as the evacuation from within the impacted Evacuation Region.

The ETE for the DAEC EPZ addresses the issue of voluntary evacuees in the manner shown in Figure 7-1. Within the EPZ, 20 percent of located in subareas outside of the Evacuation Region who are not advised to evacuate, are assumed to elect to evacuate. Similarly, it is assumed that 20 percent of those permanent residents in the Shadow Region will choose to leave the area.

Figure 7-2 presents the area identified as the Shadow Region. This region extends radially from the plant to cover a region between the EPZ boundary and approximately 15 miles. The population and number of evacuating vehicles in the Shadow Region were estimated using the same methodology that was used for permanent residents within the EPZ (see Section 3.1). As discussed in Section 3.2, it is estimated that a total of 25,450 people reside in the Shadow Region; 20 percent of them would evacuate. See Table 6-4 for the number of evacuating vehicles from the Shadow Region.

Traffic generated within this Shadow Region, traveling away from the DAEC location, has the potential for impeding evacuating vehicles from within the Evacuation Region. All ETE calculations include this shadow traffic movement.

7.2 Staged Evacuation

As defined in NUREG/CR-7002, staged evacuation consists of the following:

1. Subareas comprising the 2-Mile Region are advised to evacuate immediately.
2. Subareas comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the 2-Mile Region is cleared.

3. As vehicles evacuate the 2-Mile Region, people from 2 to 5 miles downwind continue preparation for evacuation while they shelter.
4. The populations sheltering in the 2 to 5-Mile Region are advised to begin evacuating when approximately 90 percent of those originally within the 2-Mile Region evacuate across the 2-Mile Region boundary.
5. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20 percent.

See Section 5.4.2 for additional information on staged evacuation.

7.3 Patterns of Traffic Congestion during Evacuation

Figure 7-3 through Figure 7-10 illustrate the patterns of traffic congestion that arise for the case when the entire EPZ (Region R03) is advised to evacuate during the summer, midweek, midday period under good weather conditions (Scenario 1).

Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2010, page 5-5):

> The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have exceeded a specified service measure value, or combination of service measure values, that most users would consider unsatisfactory. However, particularly for planning applications where different alternatives may be compared, analysts may be interested in knowing just how bad the LOS F condition is. Several measures are available to describe individually, or in combination, the severity of a LOS F condition:
>
> • *Demand-to-capacity ratios* describe the extent to which capacity is exceeded during the analysis period (e.g., by 1%, 15%, etc.);
>
> • *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h); and
>
> • *Spatial extent measures* describe the areas affected by LOS F conditions. These include measures such as the back of queue, and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

All highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Throughout the entirety of the evacuation, congestion never develops within the 2-Mile Region. Congestion does, however, develop rapidly around concentrations of population and traffic bottlenecks, which are predominately beyond 5 miles from the plant.

Figure 7-3 displays congestion patterns within the study area at 30 minutes after the ATE. There is significant traffic volume within the population centers of Cedar Rapids, Hiawatha and Marion located southeast of the plant. These cities, located in Subareas 14, 15, 16, 23 and 24, contain about 86% of the EPZ population (254,328 people) and are congested throughout the duration

of the evacuation. In Cedar Rapids and Hiawatha, the majority of congestion develops from vehicles waiting to access I-380 southbound ramps. In Marion, vehicles must traverse numerous traffic signals and several traffic circles before accessing US-151 eastbound or Iowa State Highway 13 (IA-13) southbound.

At 1 hour after the ATE, Figure 7-4 indicates that traffic congestion within the study area has intensified. At this time, approximately 66 percent of evacuating vehicles have mobilized and approximately 17 percent of vehicles have evacuated the EPZ. It can be seen that evacuating vehicles are choosing alternate routes to avoid the congestion in the southeast. Only minor congestion exists in the north and northwest as vehicles evacuate on IA-13 northbound near Coggon, I-380 northbound, and County Route E24 (61st St) westbound near Vinton. In the southwest, US-30 westbound and US-151 southwest-bound towards Walford are being used more heavily as vehicles divert away from Cedar Rapids towards I-80 and destinations south and west of DAEC. In Cedar Rapids, the majority of roadways are gridlocked. Since I-380 southbound experiences significant congestion, vehicles are evacuating along other roadways including US-30 eastbound, IA-965, Edgewood Road, and Ely Road southbound to exit the city. In Marion, more vehicles are evacuating eastbound on County Home Road and on US-151 to avoid the congestion in the city center.

At 2 hours and 45 minutes after the ATE, as shown in Figure 7-5, pronounced congestion persists in the southeast but is slowly dissipating away from the plant. The north and northwest portions of the EPZ are completely clear of congestion. At this time, nearly all evacuees have mobilized, but only 47% of evacuees have successfully departed the EPZ. All external traffic has stopped due to access control points established along I-380 and US-30 at 2 hours into the evacuation. In the southwest, congestion worsens on US-30 westbound to LOS F where the road narrows from two lanes to one just west of US-218. Congestion persists along US-30 eastbound, as well, due to a lane drop just east of IA-13 and then further loses capacity at two low-speed traffic circles in Mount Vernon. Cedar Rapids remains gridlocked. IA-965, Edgewood Road, and Ely Road southbound remain significantly congested and exhibit LOS F conditions. In Marion, vehicles continue to evacuate eastbound along County Home Road and US-151 to avoid the traffic congestion to the south.

At 3 hours and 30 minutes after the ATE, as shown in Figure 7-6, all population groups have completed their mobilization activities and 59% of evacuees have exited the EPZ. Little congestion exists north of the plant – only some congestion along IA-13 northbound. No congestion remains within a 5-mile radius of the plant. Vehicles continue to exit the EPZ on the same routes, but are delayed due to insufficient roadway and intersection capacities.

At 5 hours after the ATE, as shown in Figure 7-7, congestion within Hiawatha has cleared and congestion within Marion and Cedar Rapids is slowly dissipating. US-30, IA-1, and I-380 southbound leaving Cedar Rapids and surrounding areas remain highly congested. At this time, 78% of vehicles have evacuated the EPZ.

At 6 hours after the ATE, as shown in Figure 7-7, congestion remains south of US-151/US-151 Business in Cedar rapids. Congestion continues to dissipate in Marion. LOS F conditions remain on all major evacuation routes leaving the southeast portion of the study area. US-30 westbound

continues to operate at LOS F east of US-218. IA-201 (30th Ave) southbound towards Norway is congested as well, as vehicles reroute southbound towards I-80, to avoid the congestion along US-30 westbound. At this time, 88% of vehicles have cleared the EPZ.

At 6 hours and 50 minutes after the ATE, shown in Figure 7-9, congestion has cleared within 10 miles of the plant and within the city centers of Marion and Cedar Rapids. Congestion still exists on major roadways leaving these cities to the east, south, and west due to the limited capacity of these roadways and the large volume of evacuating traffic. At this time, 96% of vehicles have successfully evacuated the EPZ.

At 7 hours and 35 minutes after the ATE, Figure 7-10 displays the last of the congestion in the EPZ as the remaining vehicles evacuate along US-30 westbound. Ninety-eight percent of vehicles have evacuated the EPZ. US-30 westbound and IA-201 southbound still exhibit LOS F conditions within the study area. Significant congestion remains outside of the Shadow Region to the southeast along US-30, IA-1, Mount Vernon Road and Springville Road near Mount Vernon, as well as along Ely Road, IA-965, County Route E70, and Jappa Road near Ely, Shueyville, and Swisher. The EPZ is completely clear of congestion at 8 hours and 10 minutes after the ATE and the last vehicle departs the EPZ 10 minutes later.

7.4 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-11 through Figure 7-24. These figures display the rate at which traffic flows out of the indicated areas for the case of an evacuation of the full EPZ (Region R03) under the indicated conditions. One figure is presented for each scenario considered.

As indicated in Figure 7-11, there is typically a long "tail" to these distributions. Vehicles begin to evacuate an area slowly at first, as people respond to the ATE at different rates. Then traffic demand builds rapidly (slopes of curves increase). When the system becomes congested, traffic exits the EPZ at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuation routes service the remaining demand.

This decline in aggregate flow rate, towards the end of the process, is characterized by these curves flattening and gradually becoming horizontal. Ideally, it would be desirable to fully saturate all evacuation routes equally so that all will service traffic near capacity levels and all will clear at the same time. For this ideal situation, all curves would retain the same slope until the end – thus minimizing evacuation time. In reality, this ideal is generally unattainable reflecting the spatial variation in population density, mobilization rates and in highway capacity over the EPZ.

7.5 Evacuation Time Estimate (ETE) Results

Table 7-1 and Table 7-2 present the ETE values for all 38 Evacuation Regions and all 14 Evacuation Scenarios. Table 7-3 and Table 7-4 present the ETE values for the 2-Mile region for both staged

and un-staged keyhole regions downwind to 5 miles. The tables are organized as follows:

Table	Contents
7-1	ETE represents the elapsed time required for 90 percent of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios.
7-2	ETE represents the elapsed time required for 100 percent of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios.
7-3	ETE represents the elapsed time required for 90 percent of the population within the 2-Mile Region, to evacuate from that the 2-Mile Region with both Concurrent and Staged Evacuations of additional Subareas downwind in the keyhole Region.
7-4	ETE represents the elapsed time required for 100 percent of the population within the 2-Mile Region, to evacuate from the 2-Mile Region with both Concurrent and Staged Evacuations of additional Zones downwind in the keyhole Region.

The animation snapshots described above reflect the ETE statistics for the concurrent (un-staged) evacuation scenarios and regions, which are displayed in Figure 7-3 through Figure 7-10. Most of the congestion is located in subareas 14, 15, 16, 23 and 24 which are beyond the 5-mile radius; this is reflected in the ETE statistics:

- The 90th percentile ETE for Regions R01 and R02 (2-Mile and 5-Mile Regions) are comparable and generally range between 1:30 (hr:min) and 2:00 (slightly higher for rain and snow).
- The 90th percentile ETE for Regions R03 (full EPZ), R13 and R25 – R28 (which extend to the EPZ boundary and include at least part of Cedar Rapids) are approximately 3 and half hours longer, on average.
- The 100th percentile ETE for all Regions that extend to 5 miles are comparable to mobilization time (3 hours and 30 minutes – see Table 5-9 and Figure 5-4) for all Scenarios. This fact implies that the congestion within the 5-mile Region dissipates prior to the end of mobilization, as is displayed in Figure 7-6. However, for those evacuation regions that extend beyond 5 miles, ETE is significantly longer than mobilization time, implying that traffic congestion does not clear prior to the completion of mobilization time, as seen in Figure 7-7 through Figure 7-10.

Comparison of Scenarios 5 and 13 in Table 7-1 indicates that the Special Event – Cedar Rapids Freedom Festival – has a significant impact on the ETE for regions including at least part of Cedar Rapids (R03, R13, and R25 – R28). The additional 5,833 vehicles present for the special event are located in downtown Cedar Rapids, where heavy congestion already exists. The special event

scenario increases 90th percentile ETE by as much as 20 minutes and the 100th percentile by as much as 35 minutes.

Comparison of Scenarios 1 and 14 in Table 7-1 indicates that the roadway closure – one lane southbound on I-380 from the interchange with County Home Road (Exit 28) to the interchange with US-30 (Exit 16) – does have a material impact on 90th percentile ETE regions including Cedar Rapids (R03, R13, R14, R24 – R28), with up to 30 minute increases in ETE. The 100th percentile ETE increase by up to 1 hour and 10 minutes. For an evacuation of the full EPZ, I-380 southbound is the most heavily used evacuation route. Reducing its capacity from three lanes to two forces vehicles to choose alternate paths and increases congestion throughout southern Cedar Rapids, thus prolonging ETE.

The results of the roadway impact scenario indicate that events such as adverse weather or traffic accidents which close a lane on I-380 could impact ETE. State and local police could consider traffic management tactics such as using the shoulder of the roadway as a travel lane or re-routing of traffic along other evacuation routes to avoid overwhelming I-380. All efforts should be made to remove the blockage on I-380 (or any major evacuation route) as soon as possible.

7.6 Staged Evacuation Results

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (un-staged) and staged evacuation studies. Note that Regions R29 through R38 are the same geographic areas as Regions R02 and R04 through R12, respectively. The times shown in Table 7-3 and Table 7-4 are when the 2-Mile Region is 90 percent clear and 100 percent clear, respectively.

The objective of staged evacuation is to show that the ETE for the 2-Mile Region can be reduced without significantly impacting the Region between 2 miles and 5 miles. In all cases, as shown in these tables, the ETE for the 2-Mile Region is unchanged when a staged evacuation is implemented. The reason for this is that the congestion within the 5-Mile Region does not extend upstream to the extent that it penetrates to within 2 miles of the plant. Consequently, the impedance, due to this congestion within the 5-Mile Region to evacuees from within the 2-Mile Region is not sufficient to materially influence the 90th percentile ETE for the 2-Mile Region. Therefore, staging the evacuation to reduce congestion within the 5-Mile Region provides no benefits to evacuees from within the 2-Mile Region.

While failing to provide assistance to evacuees from within 2 miles of the DAEC, staging produces a negative impact on the ETE for those evacuating from within the 5-Mile Region. A comparison of ETE between similar regions reveals that staging retards the 90th percentile ETE for those in the 2 to 5-Mile Region by up to 25 minutes (compare Regions R02 and R04 through R12 to Regions R29 through R38, respectively, in Table 7-1). This extending of ETE is due to the delay in beginning the evacuation trip, experienced by those who shelter, plus the effect of the trip-generation "spike" (significant volume of traffic beginning the evacuation trip at the same time – see Figure 5-5) that follows their eventual ATE, in creating congestion within the EPZ beyond 2 miles. The 100th percentile ETE for these regions remain the same (see Table 7-2) since the 100th percentile ETE for the 2-mile and 5-mile regions are dictated by trip generation time and the trip generation time is longer than the congestion generated by the aforementioned "spike".

In summary, the staged evacuation option provides no benefits to evacuees from within the 2-Mile Region, and adversely impacts some evacuees located beyond 2 miles from the plant.

7.7 Protective Action Recommendation Logic

Federal regulations (10CFR50, Appendix E, Section IV, Items 3 and 4) require nuclear power plant licensees to:

- Conduct an ETE study using the most recent decennial census data and submit the study to the Nuclear Regulatory Commission (NRC) for review
- After NRC review, use the approved ETE study to formulate protective action recommendations (PAR)
- Provide the ETE to State and local governmental authorities for use in developing offsite protective action strategies

Despite the changes in ETE in this study relative to the 2012 ETE study (see Section 1.4 and Table 1-3), the PAR do not change based on the criteria documented in the federal guidance – NUREG-0654/FEMA-REP-1, Rev. 1, Supplement 3:

- The 90th percentile ETE for the 2-mile region are less than 2 hours (criterion for immediate evacuation of the 2-mile region) in the 2012 study, and in this study.
- The 90th percentile ETE for the keyholes comprised of the 2-mile region and downwind sectors to 5-miles are less than 3 hours (criterion for immediate evacuation of the downwind sectors to 5 miles) in the 2012 study, and in this study.
- The 90th percentile ETE for the full EPZ is greater than 3 hours (criterion for immediate evacuation of the downwind sectors to the EPZ boundary) in the 2012 study, and in this study.
- Staged evacuation showed no benefit in the 2012 study, and in this study.

7.8 Guidance on Using ETE Tables

The user first determines the percentile of population for which the ETE is sought (The NRC guidance calls for the 90th percentile). The applicable value of ETE within the chosen table may then be identified using the following procedure:

1. Identify the applicable **Scenario**:
   - Season
     - Summer
     - Winter (also Autumn and Spring)
   - Day of Week
     - Midweek
     - Weekend
   - Time of Day
     - Midday
     - Evening
   - Weather Condition

        - Good Weather
        - Rain
        - Snow
    - Special Event
        - Cedar Rapids Freedom Festival
        - Roadway Impact (one lane on I-380 SB is closed)
    - Evacuation Staging
        - No, Staged Evacuation is not considered
        - Yes, Staged Evacuation is considered

While these Scenarios are designed, in aggregate, to represent conditions throughout the year, some further clarification is warranted:

- The conditions of a summer evening (either midweek or weekend) and rain are not explicitly identified in the tables. For these conditions, Scenarios (2) and (4) apply.
- The conditions of a winter evening (either midweek or weekend) and rain are not explicitly identified in the tables. For these conditions, Scenarios (7) and (10) for rain apply.
- The conditions of a winter evening (either midweek or weekend) and snow are not explicitly identified in the Tables. For these conditions, Scenarios (8) and (11) for snow apply.
- The seasons are defined as follows:
    - Summer assumes schools are in session at summer school enrollment levels (lower than normal enrollment).
    - Winter (includes Spring and Autumn) considers that schools are in session at normal enrollment levels.
- Time of Day: Midday implies the time over which most commuters are at work or are travelling to/from work.

2. With the desired percentile ETE and Scenario identified, now identify the **Evacuation Region**:
    - Determine the projected azimuth direction of the plume (coincident with the wind direction). This direction is expressed in terms of compass orientation: from N, NNE, NE – or in degrees (°).
    - Determine the distance that the Evacuation Region will extend from the nuclear power plant. The applicable distances and their associated candidate Regions are given below:
        - 2 Miles (Region R01)
        - To 5 Miles (Region R02, R04 through R12)
        - To EPZ Boundary (Regions R03, R13 through R28)
    - Enter Table 7-5 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the DAEC. Select the Evacuation Region identifier in that row, based on the azimuth direction (or degree measure) of the plume, from the first column of the Table.
3. Determine the **ETE Table** based on the **percentile** selected. Then, for the **Scenario** identified in Step 1 and the **Region** identified in Step 2, proceed as follows:

- The columns of Table 7-1 through Table 7-4 are labeled with the Scenario numbers. Identify the proper column in the selected Table using the Scenario number defined in Step 1.
- Identify the row in this table that provides ETE values for the Region identified in Step 2.
- The unique data cell defined by the column and row so determined contains the desired value of ETE expressed in Hours:Minutes.

Example

It is desired to identify the ETE for the following conditions:

- Sunday, August 10th at 4:00 AM.
- It is raining.
- Wind direction is from the northeast (NE).
- Wind speed is such that the distance to be evacuated is judged to be a 2-Mile radius and downwind to 10 miles (to EPZ boundary).
- The desired ETE is that value needed to evacuate 90 percent of the population from within the impacted Region.
- A staged evacuation is not desired.

Table 7-1 is applicable because the 90th percentile ETE is desired. Proceed as follows:

1. Identify the Scenario as summer, weekend, evening and raining. Entering Table 7-1, it is seen that there is no match for these descriptors. However, the clarification given above assigns this combination of circumstances to Scenario 4.
2. Enter Table 7-5 and locate the Region described as "Evacuate 2-Mile Region and Downwind to the EPZ Boundary" for wind direction from the NE and read Region R15 in the first column of that row.
3. Enter Table 7-1 to locate the data cell containing the value of ETE for Scenario 4 and Region R15. This data cell is in column (4) and in the row for Region R15; it contains the ETE value of **2:10**.

Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ														
R01	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R02	2:00	2:00	2:00	2:00	1:50	2:00	2:00	2:15	2:00	2:00	2:15	1:50	1:55	2:00
R03	6:10	6:50	5:05	5:35	5:00	6:25	6:55	7:40	5:00	5:35	6:00	4:50	5:05	6:40
2-Mile Region and Keyhole to 5 Miles														
R04	2:00	2:00	2:00	2:00	1:50	2:00	2:00	2:10	2:00	2:00	2:10	1:50	1:55	2:00
R05	1:35	1:40	1:35	1:35	1:35	1:35	1:40	2:10	1:35	1:35	2:10	1:35	1:35	1:35
R06	1:40	1:40	1:35	1:35	1:35	1:40	1:40	2:15	1:35	1:35	2:10	1:35	1:35	1:40
R07	1:40	1:40	1:30	1:35	1:30	1:40	1:40	2:10	1:35	1:35	2:05	1:35	1:30	1:40
R08	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:15	2:05	2:10	2:10	2:05	2:05	2:05
R09	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:15	2:05	2:10	2:10	2:05	2:05	2:05
R10	2:05	2:05	2:05	2:05	2:00	2:05	2:05	2:15	2:05	2:05	2:15	2:00	2:00	2:05
R11	2:05	2:05	2:05	2:05	2:00	2:05	2:05	2:15	2:05	2:05	2:15	2:00	2:00	2:05
R12	2:00	2:00	1:55	1:55	1:45	2:00	2:00	2:10	1:55	1:55	2:10	1:45	1:50	2:00
2-Mile Region and Keyhole to EPZ Boundary														
R13	5:30	6:05	4:30	4:55	4:20	5:45	6:15	6:50	4:25	4:55	5:20	4:15	4:40	5:45
R14	3:35	3:50	3:05	3:20	2:55	3:35	3:55	4:20	3:00	3:15	3:30	2:50	2:55	3:50
R15	2:10	2:25	1:55	2:10	1:55	2:15	2:25	2:50	2:00	2:10	2:30	1:50	2:00	2:20
R16	2:05	2:25	2:00	2:10	1:55	2:05	2:25	2:45	2:00	2:05	2:20	1:50	1:55	2:10
R17	2:10	2:25	2:00	2:10	1:55	2:10	2:20	2:40	1:55	2:10	2:20	1:50	1:55	2:10
R18	1:45	1:45	1:35	1:35	1:35	1:45	1:45	2:20	1:35	1:35	2:10	1:35	1:35	1:45
R19	2:05	2:05	2:05	2:05	1:55	2:05	2:05	2:15	2:05	2:05	2:15	1:55	1:55	2:05
R20	2:05	2:10	2:05	2:05	2:00	2:05	2:05	2:15	2:05	2:05	2:15	2:00	2:00	2:05
R21	2:05	2:10	2:05	2:05	1:55	2:05	2:10	2:20	2:05	2:05	2:15	2:00	1:55	2:05
R22	2:05	2:05	2:05	2:05	1:55	2:05	2:05	2:20	2:05	2:05	2:15	1:55	1:55	2:05
R23	2:05	2:05	2:00	2:05	1:55	2:05	2:05	2:15	2:05	2:05	2:15	1:55	1:55	2:05

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
R24	3:05	3:20	2:50	3:05	2:55	3:15	3:20	3:35	2:50	3:00	3:30	3:00	2:55	3:15
R25	4:45	5:05	4:00	4:20	4:00	4:50	5:25	6:00	3:55	4:25	4:45	4:00	4:05	5:05
R26	6:00	6:30	5:05	5:20	4:50	6:00	6:40	7:15	4:55	5:20	5:30	4:45	5:00	6:05
R27	6:00	6:40	5:00	5:35	4:50	6:15	6:50	7:25	4:55	5:25	5:55	4:50	5:05	6:20
R28	6:10	6:50	5:10	5:40	5:00	6:20	7:05	7:40	5:00	5:35	6:05	4:55	5:20	6:20
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	2:15	2:20	2:15	2:20	2:15	2:15	2:15	2:45	2:15	2:20	2:45	2:15	2:20	2:15
R30	2:15	2:15	2:15	2:20	2:20	2:15	2:15	2:45	2:15	2:20	2:45	2:20	2:20	2:15
R31	2:20	2:20	2:20	2:25	2:25	2:20	2:20	2:55	2:25	2:25	3:00	2:25	2:25	2:20
R32	2:05	2:05	2:05	2:05	2:05	2:05	2:05	2:35	2:05	2:05	2:35	2:05	2:05	2:05
R33	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00
R34	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:25	2:05	2:10	2:25	2:05	2:05	2:05
R35	2:05	2:10	2:05	2:10	2:05	2:05	2:10	2:20	2:05	2:10	2:20	2:05	2:05	2:05
R36	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:10	2:10	2:30	2:10	2:10	2:10
R37	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:10	2:10	2:30	2:10	2:10	2:10
R38	2:15	2:20	2:20	2:20	2:20	2:15	2:20	2:50	2:20	2:20	2:50	2:20	2:20	2:20

Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ														
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R02	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R03	8:20	9:30	6:50	7:50	6:25	9:00	10:05	10:05	7:00	7:05	7:45	6:30	7:00	9:05
2-Mile Region and Keyhole to 5 Miles														
R04	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R05	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R06	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R07	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R08	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R09	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R10	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R11	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R12	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
2-Mile Region and Keyhole to EPZ Boundary														
R13	7:30	7:55	6:00	6:55	6:00	7:50	7:55	9:40	6:05	6:45	7:25	5:50	6:10	7:45
R14	5:20	5:25	4:35	4:55	4:30	5:10	5:40	6:25	4:20	4:50	5:25	4:10	4:30	5:20
R15	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R16	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R17	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R18	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R19	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R20	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R21	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R22	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40
R23	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:10	3:40	3:40	4:10	3:40	3:40	3:40

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
R24	5:00	5:20	4:45	4:55	4:40	5:10	5:25	5:30	4:45	4:55	5:20	4:50	4:40	5:10
R25	6:45	7:10	5:55	6:15	5:35	6:50	7:25	8:15	5:40	6:10	6:40	5:40	5:50	6:45
R26	8:05	8:35	6:35	7:10	6:20	8:00	8:55	9:55	6:25	6:55	7:15	6:15	6:30	8:35
R27	7:40	8:55	6:25	7:05	6:25	7:55	8:40	9:45	6:20	7:05	7:40	6:15	6:40	8:50
R28	8:20	9:30	6:50	7:50	6:25	9:00	10:05	10:05	7:00	7:05	7:45	6:30	7:00	9:05
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R30	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R31	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R32	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R33	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R34	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R35	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R36	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R37	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35
R38	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:05	3:35	3:35	4:05	3:35	3:35	3:35

Table 7-3. Time to Clear *90* Percent of the 2-Mile Region when Evacuating Additional Subareas Downwind to 5 Miles

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
2-Mile Region														
R01	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
5-Mile Region, 2-Mile Region and Keyhole to 5 Miles														
R02	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R04	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R05	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R06	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R07	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R08	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R09	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R10	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R11	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R12	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R30	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R31	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R32	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R33	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R34	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R35	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R36	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R37	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40
R38	1:40	1:40	1:30	1:30	1:30	1:40	1:40	2:05	1:30	1:35	2:05	1:35	1:30	1:40

Table 7-4. Time to Clear *100* Percent of the 2-Mile Region when Evacuating Additional Subareas Downwind to 5 Miles

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
2-Mile Region														
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
5-Mile Region, 2-Mile Region and Keyhole to 5 Miles														
R02	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R04	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R05	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R06	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R07	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R08	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R09	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R10	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R11	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R12	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles														
R29	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R31	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R32	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R33	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R34	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R35	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R36	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R37	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30
R38	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:00	3:30	3:30	4:00	3:30	3:30	3:30

Table 7-5. Description of Evacuation Regions

Region	Description	Subarea																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R01	2-Mile Ring	X																								
R02	5-Mile Ring	X	X	X	X	X	X	X	X																	
R03	Full EPZ	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Evacuate 2-Mile Region and Downwind to 5 Miles																										
Region	Wind Direction From:	Subarea																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R04	NNW, N 326.26° - 11.25°	X			X	X	X																			
R05	NNE, NE, ENE 11.26° - 78.75°	X				X	X	X																		
R06	E, ESE, SE 78.76° - 146. 25°	X						X	X																	
R07	SSE 146.26° - 168.75°	X	X						X																	
R08	S 168.76° - 191.25°	X	X	X					X																	
R09	SSW, SW 191.26° - 236.25°	X	X	X																						
R10	WSW 236.26° - 258.75°	X	X	X	X																					
R11	W 258.76° - 281.25°	X		X	X																					
R12	WNW, NW 281.26° - 326.25°	X		X	X	X																				
Evacuate 2-Mile Region and Downwind to the EPZ Boundary																										
Region	Wind Direction From:	Subarea																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R13	N 348.76° - 11.25°	X			X	X	X									X	X	X	X					X	X
R14	NNE 11.26° - 33.75°	X				X	X	X									X	X	X	X					X
R15	NE 33.76° - 56.25°	X				X	X	X										X	X	X	X				
R16	ENE 56.26° - 78.75°	X				X	X	X											X	X	X	X			
R17	E 78.76° - 101. 25°	X						X	X										X	X	X	X			
R18	ESE 101.26° - 123.75°	X						X	X											X	X	X	X		
R19	SE 123.76° - 146. 25°	X						X	X	X											X	X	X		
R20	SSE 146.26° - 168.75°	X	X						X	X	X											X	X		
R21	S 168.76° - 191.25°	X	X	X					X	X	X	X	X									X	X		
R22	SSW 191.26° - 213.75°	X	X	X						X	X	X	X	X									X		
R23	SW 213.76° - 236.25°	X	X	X							X	X	X	X											
R24	WSW 236.26° - 258.75°	X	X	X	X						X	X	X	X	X										
R25	W 258.76° - 281.25°	X		X	X								X	X	X	X								X	
R26	WNW 281.26° - 303.75°	X		X	X	X							X	X	X	X	X							X	X
R27	NW 303.76° - 326.25°	X		X	X	X								X	X	X	X	X						X	X
R28	NNW 326.26° - 348.75°	X			X	X	X								X	X	X	X	X					X	X

Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles																								
Region	Wind Direction From:		Subarea																					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R29	5-Mile Radius	N/A	X	X	X	X	X	X	X	X																
R30	NNW, N	326.26° - 11.25°	X			X	X	X																		
R31	NNE, NE, ENE	11.26° - 78.75°	X				X	X	X																	
R32	E, ESE, SE	78.76° - 146. 25°	X						X	X																
R33	SSE	146.26° - 168.75°	X	X						X																
R34	S	168.76° - 191.25°	X	X	X					X																
R35	SSW, SW	191.26° - 236.25°	X	X	X																					
R36	WSW	236.26° - 258.75°	X	X	X	X																				
R37	W	258.76° - 281.25°	X		X	X																				
R38	WNW, NW	281.26° - 326.25°	X		X	X	X																			
Subarea(s) Shelter-in-Place until 90% ETE for R01, then Evacuate								Subarea(s) Shelter-in-Place							Subarea(s) Evacuate									

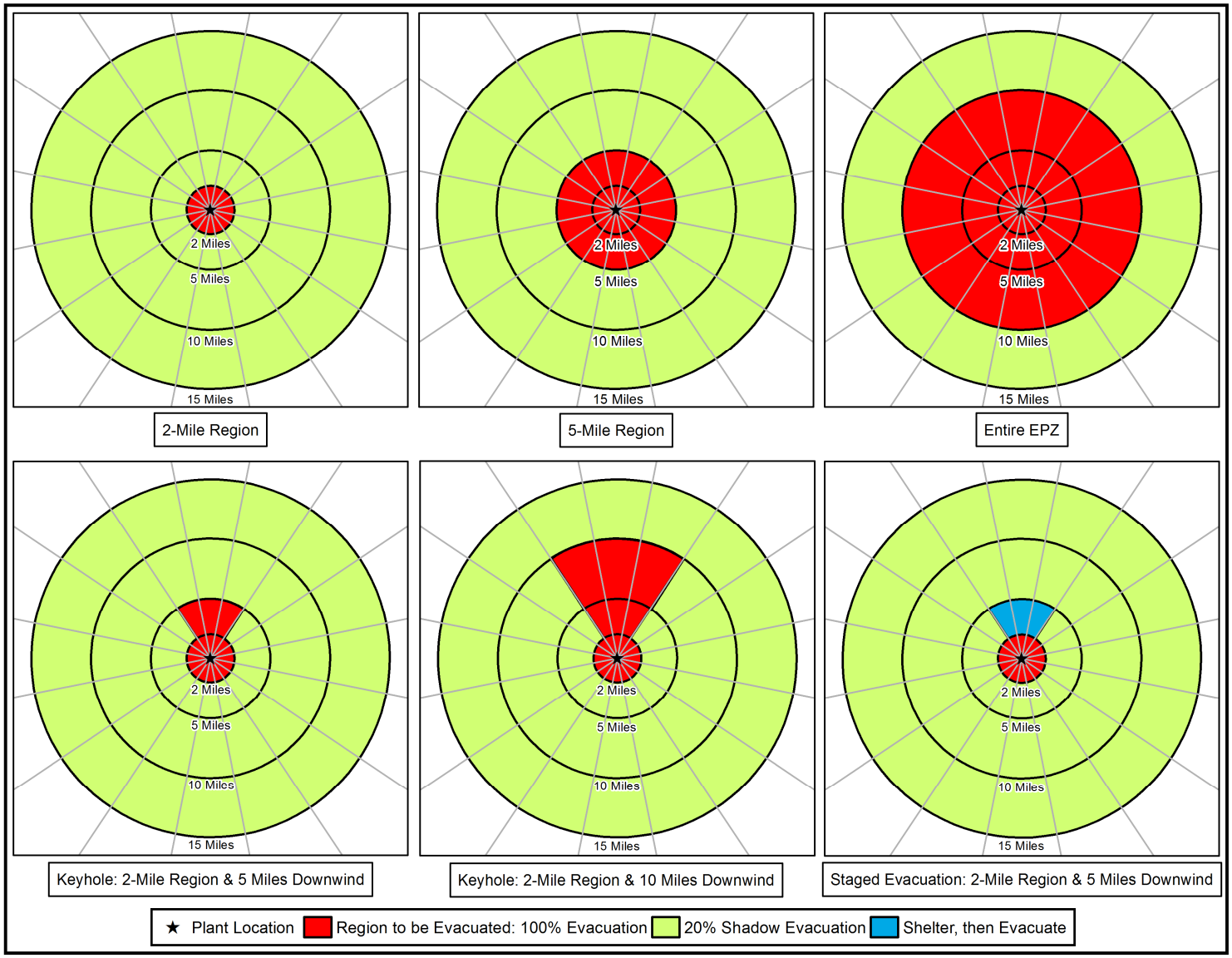


Figure 7-1. Voluntary Evacuation Methodology

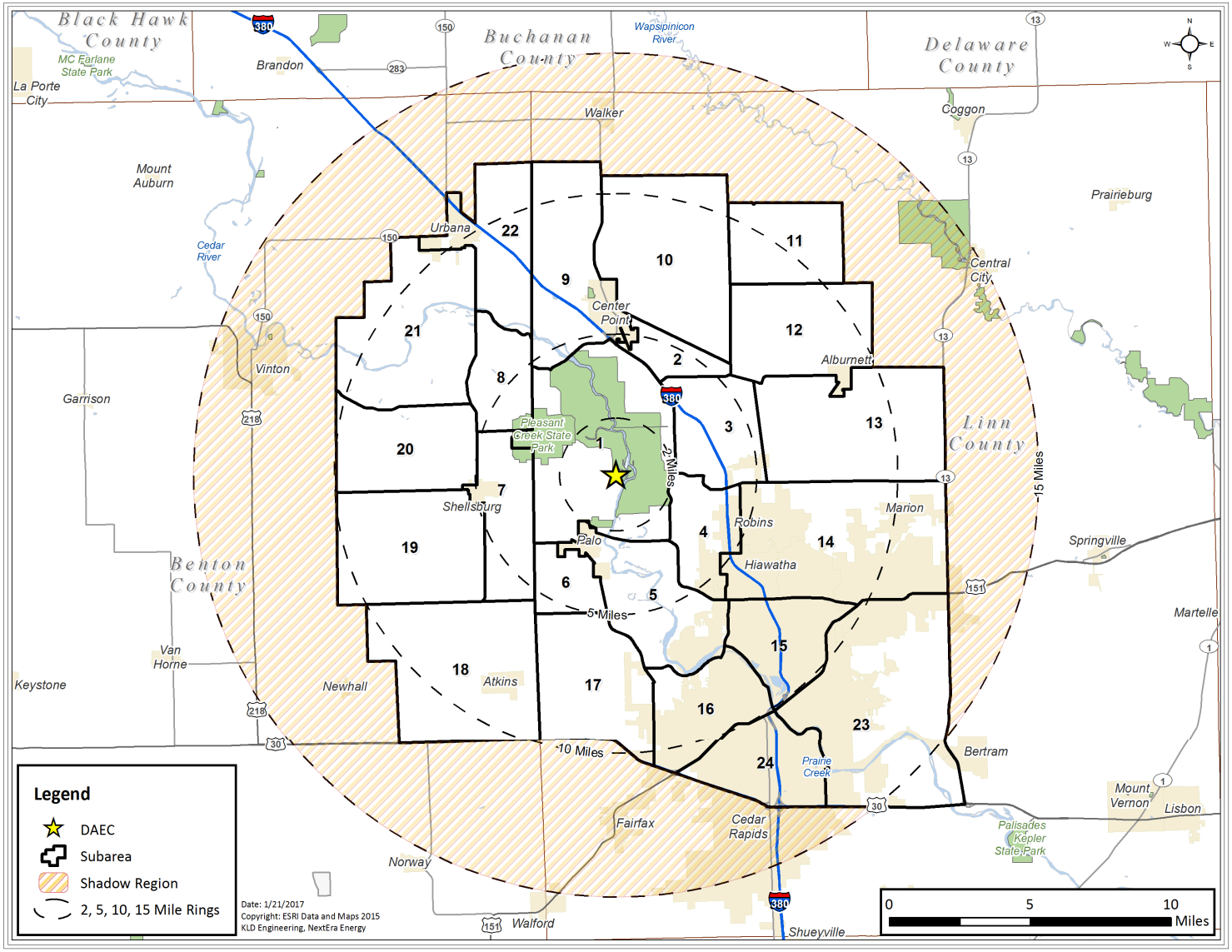


Figure 7-2. DAEC Shadow Region

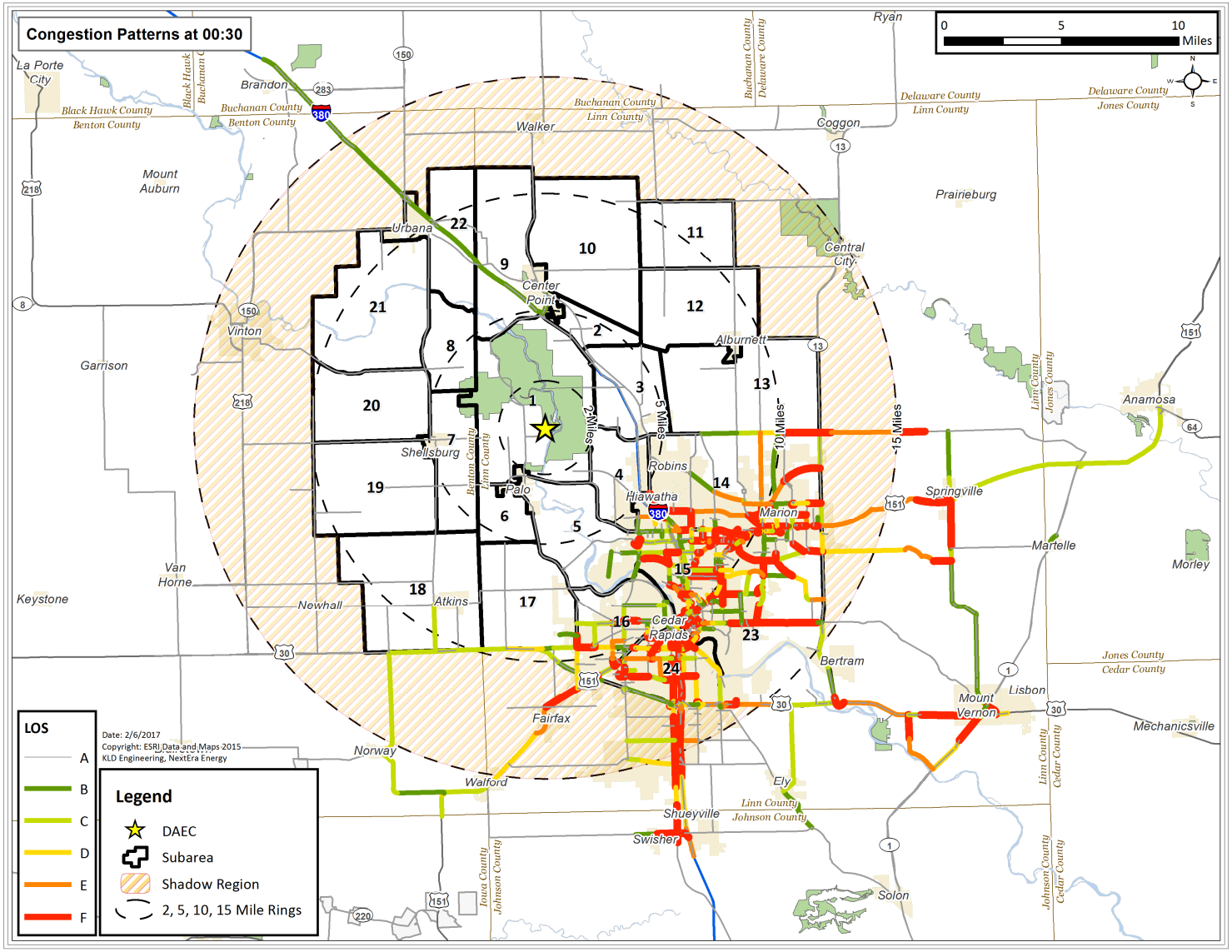


Figure 7-3. Congestion Patterns at 30 Minutes after the Advisory to Evacuate

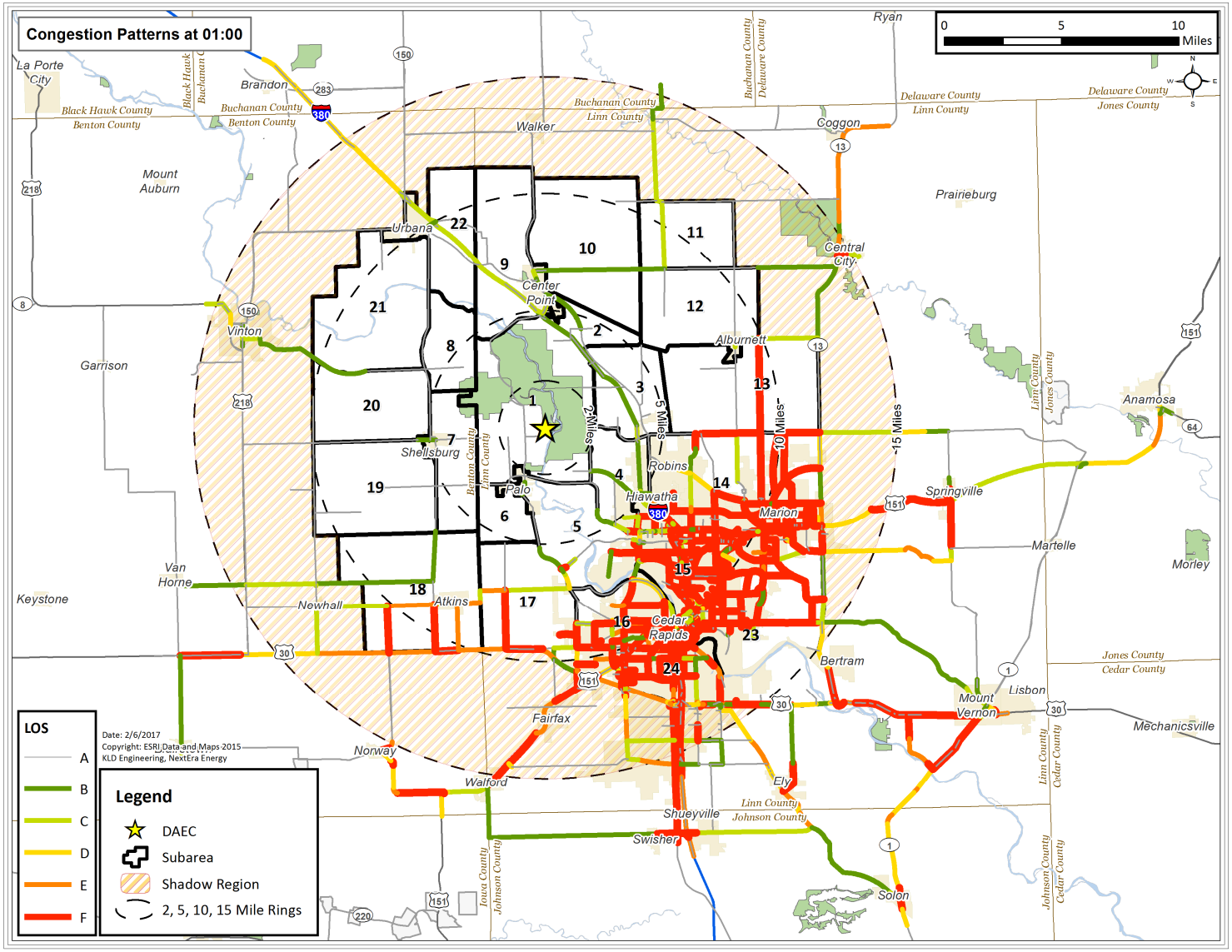


Figure 7-4. Congestion Patterns at 1 Hour after the Advisory to Evacuate

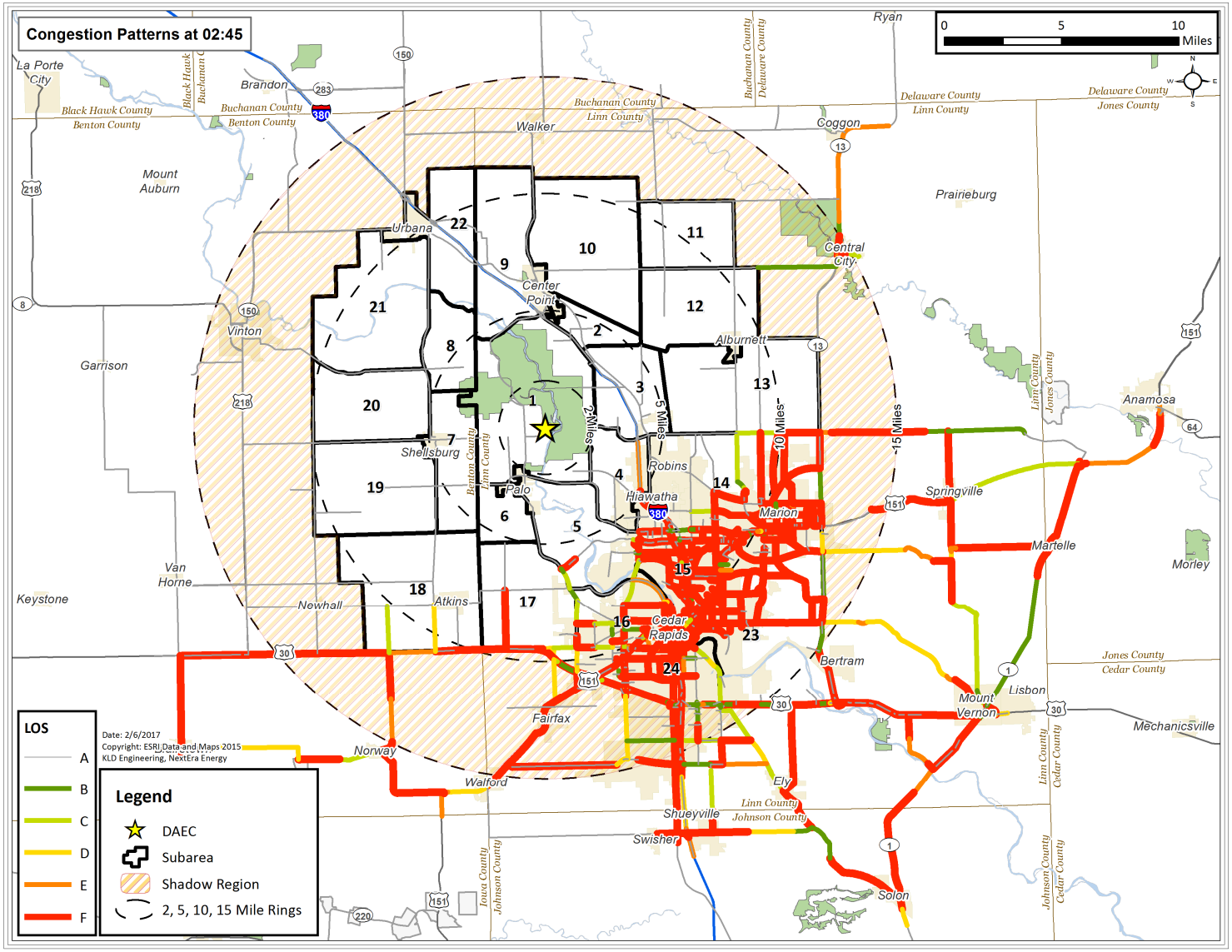


Figure 7-5. Congestion Patterns at 2 Hours and 45 Minutes after the Advisory to Evacuate

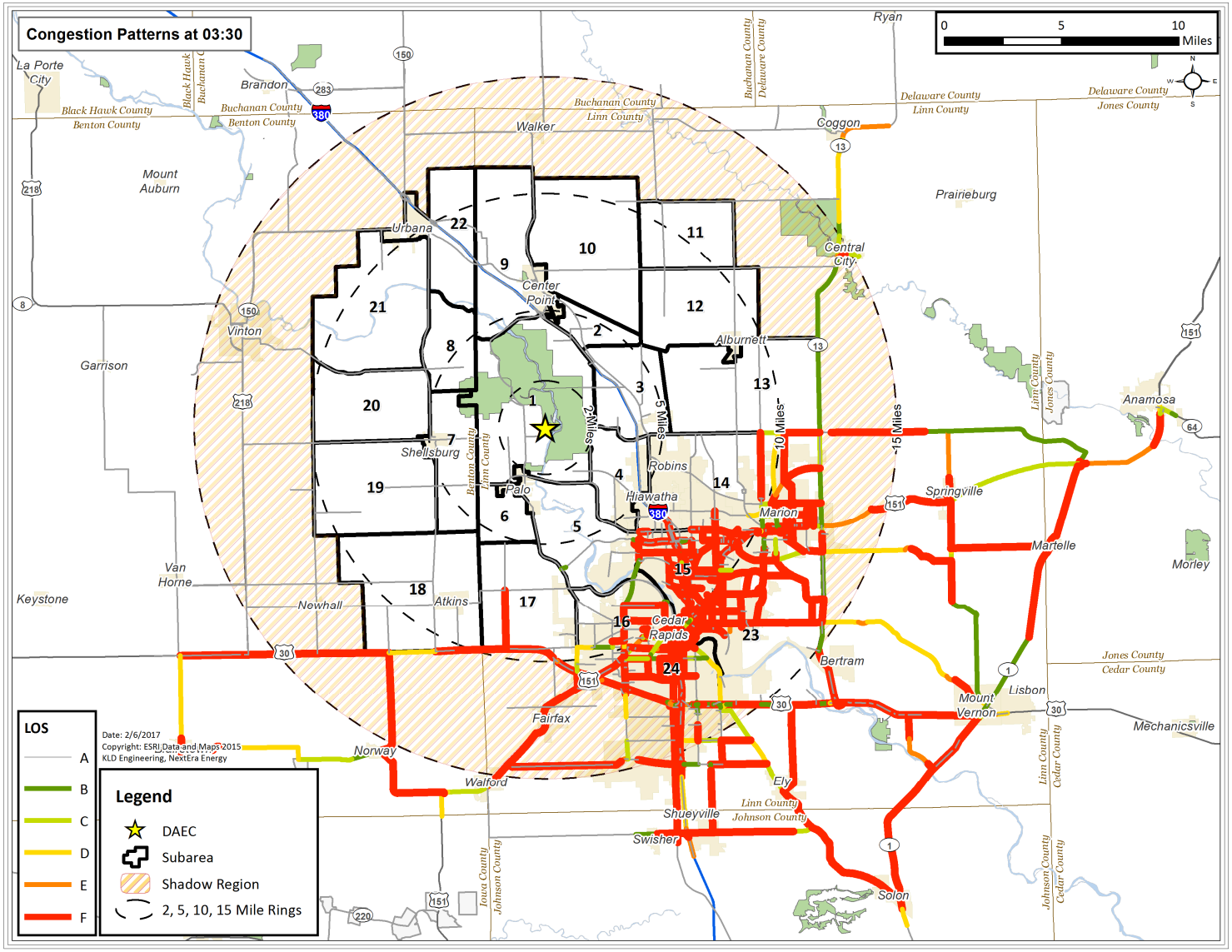


Figure 7-6. Congestion Patterns at 3 Hours and 30 Minutes after the Advisory to Evacuate

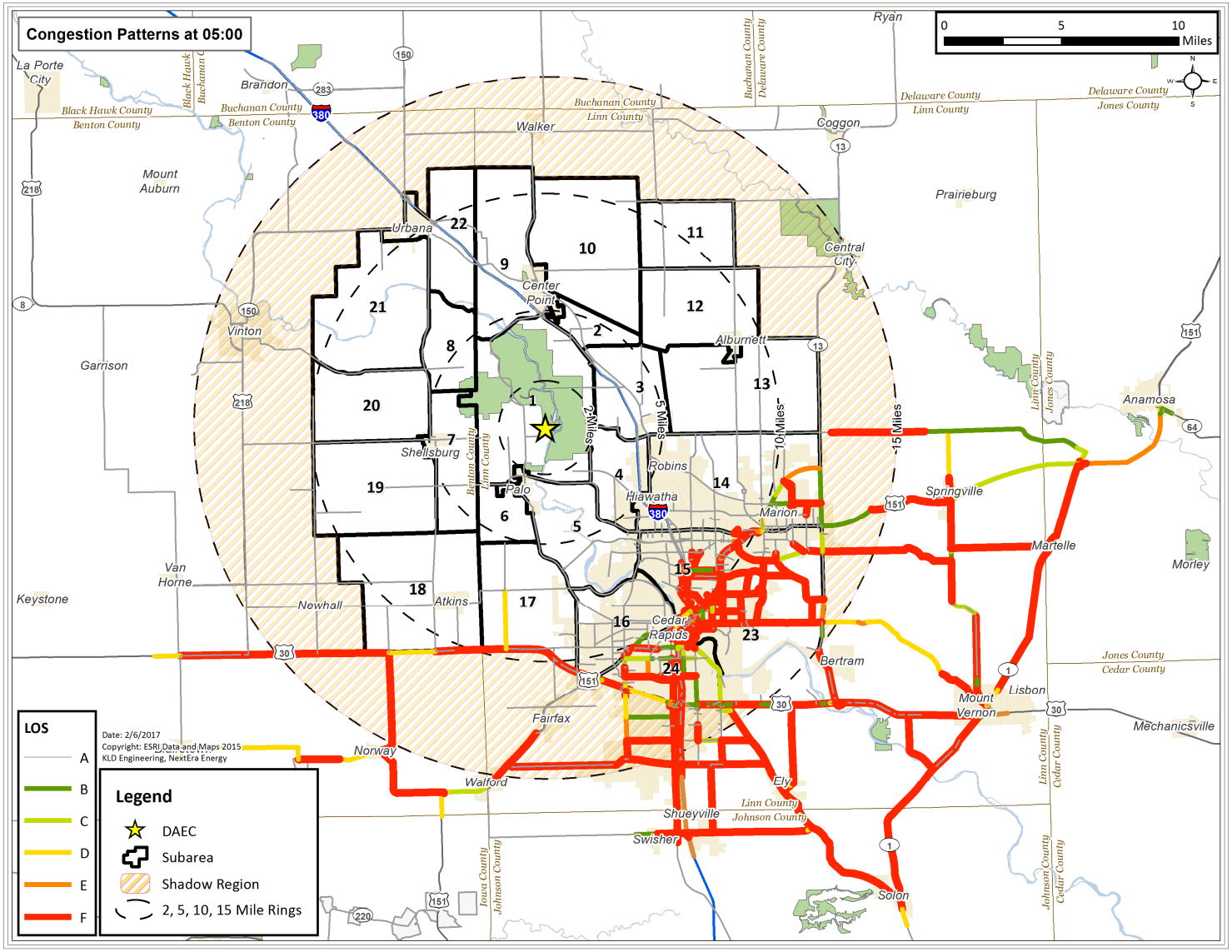


Figure 7-7. Congestion Patterns at 5 Hours after the Advisory to Evacuate

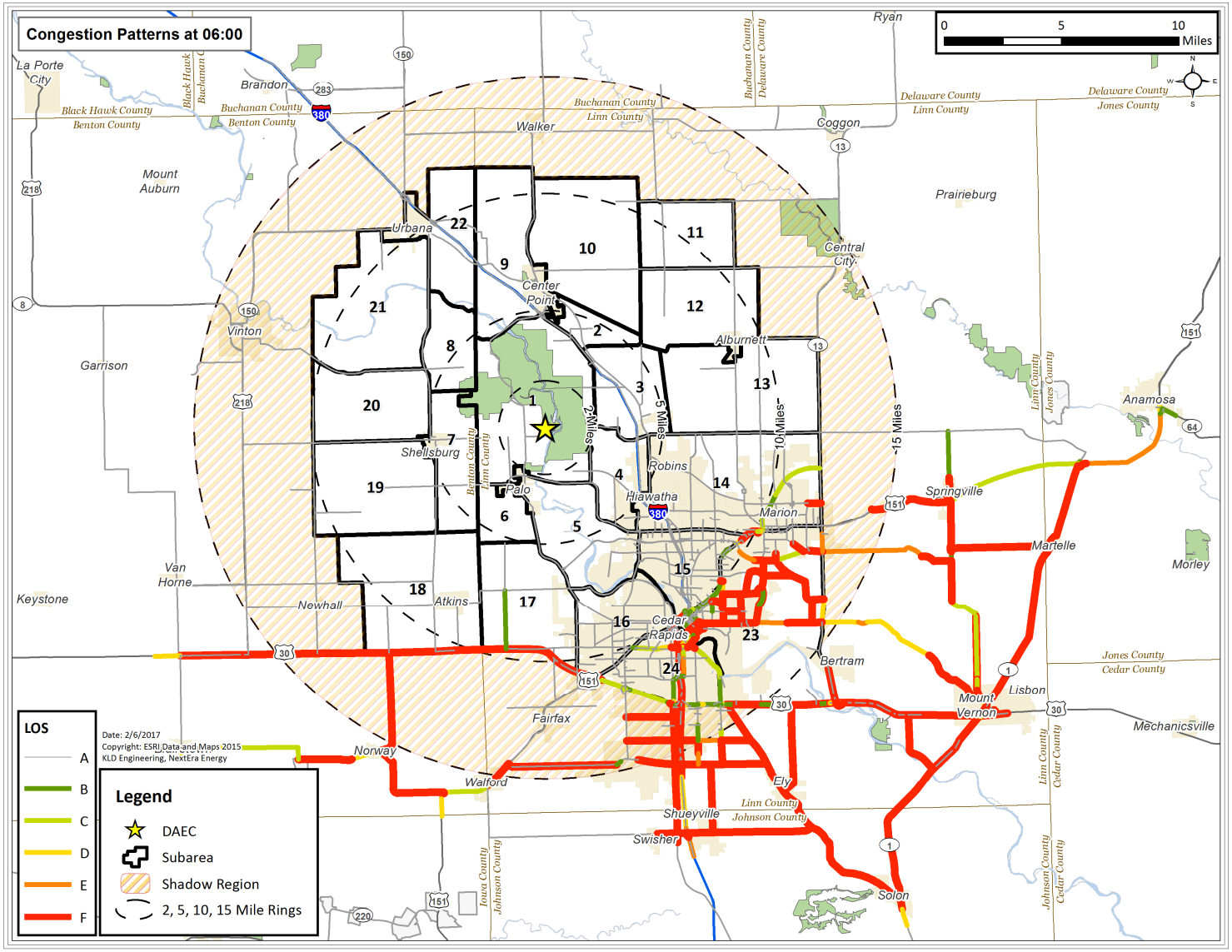


Figure 7-8. Congestion Patterns at 6 Hours after the Advisory to Evacuate

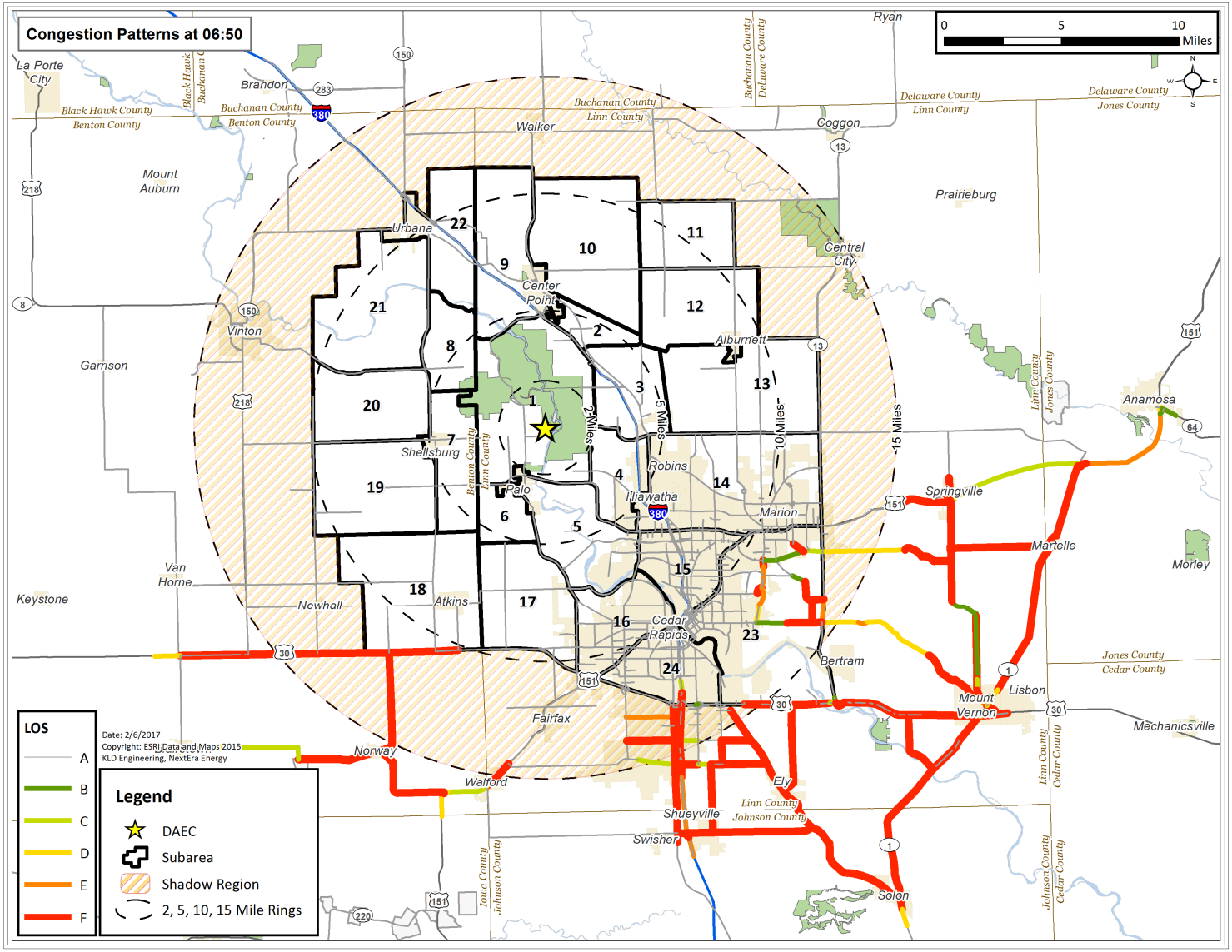


Figure 7-9. Congestion Patterns at 6 Hours and 50 Minutes after the Advisory to Evacuate

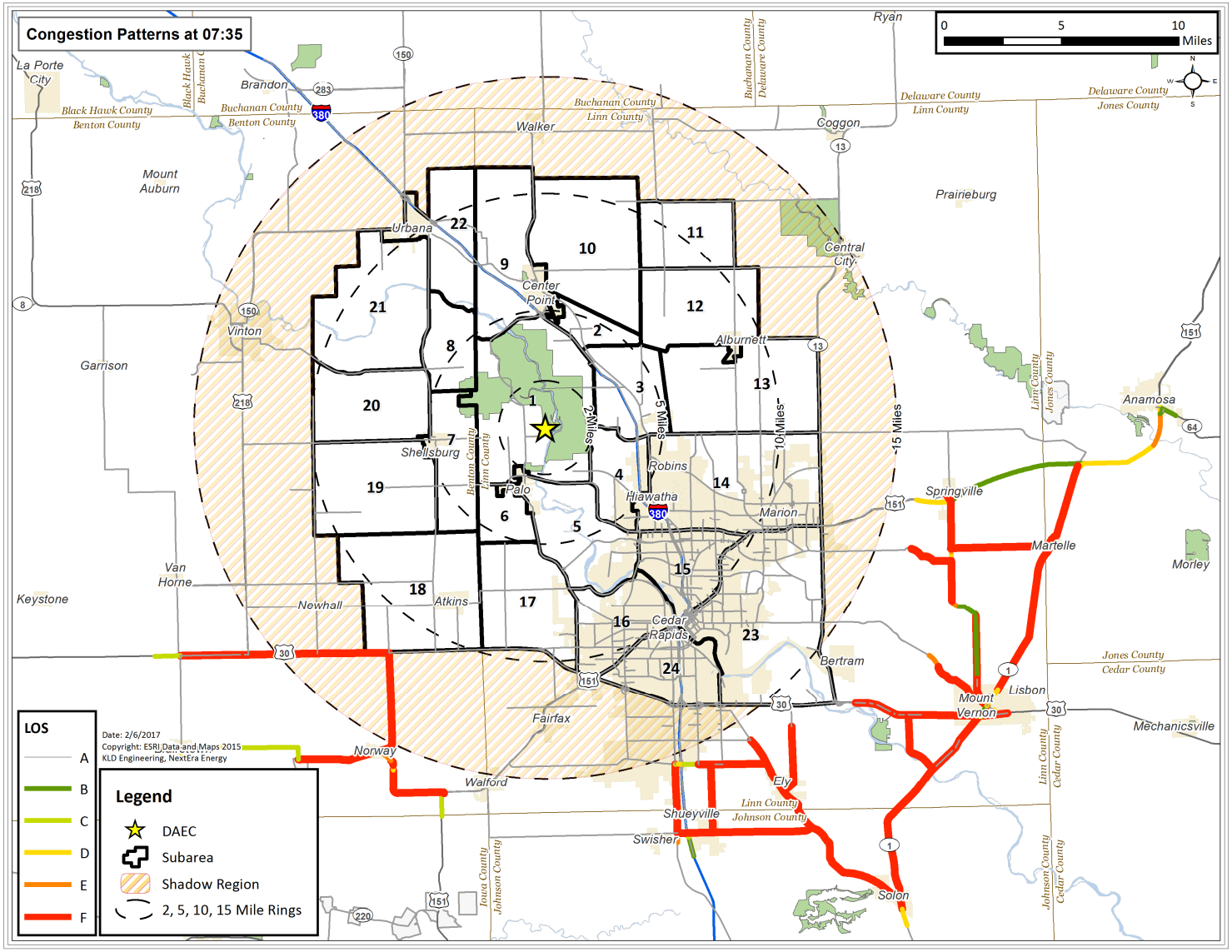


Figure 7-10. Congestion Patterns at 7 Hours and 35 Minutes after the Advisory to Evacuate

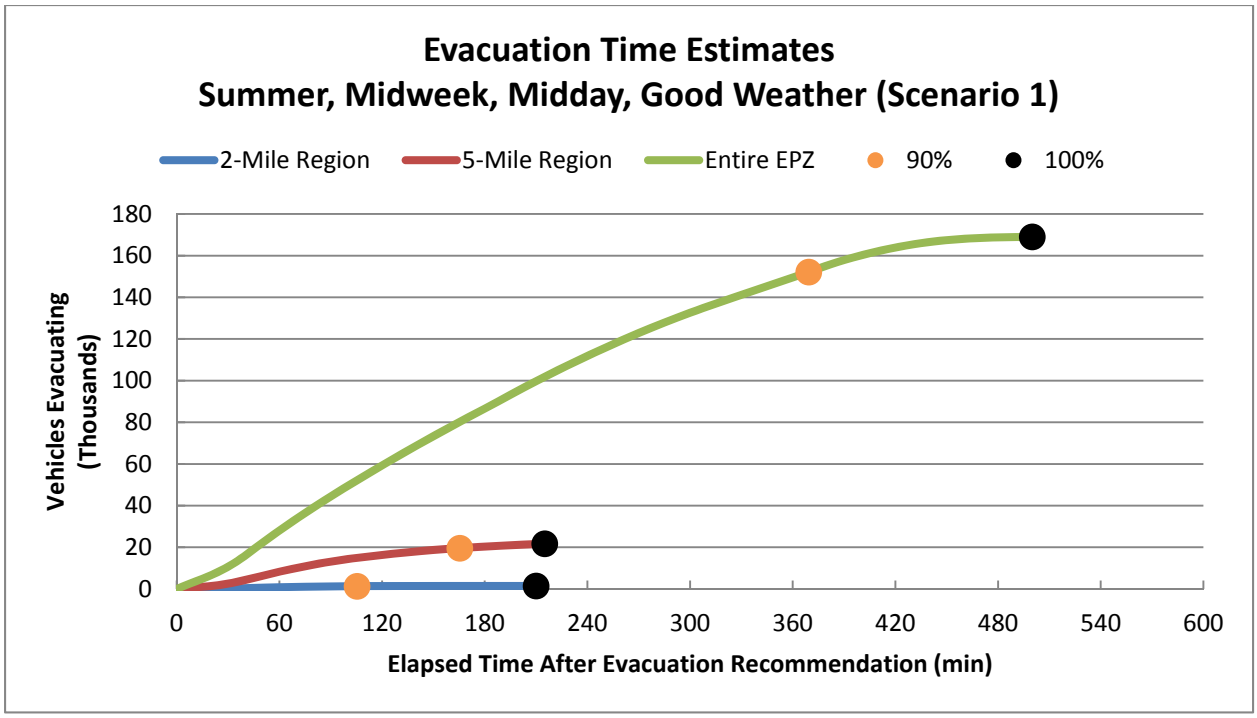


Figure 7-11. Evacuation Time Estimates - Scenario 1 for Region R03

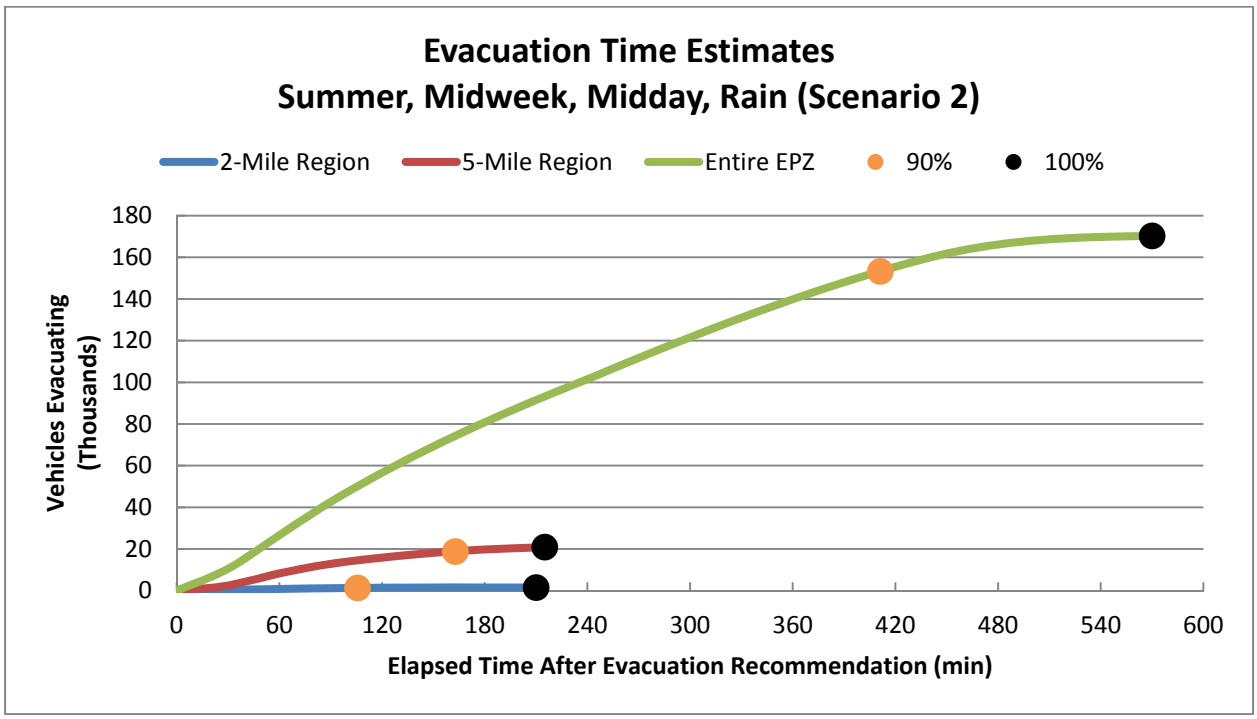


Figure 7-12. Evacuation Time Estimates - Scenario 2 for Region R03

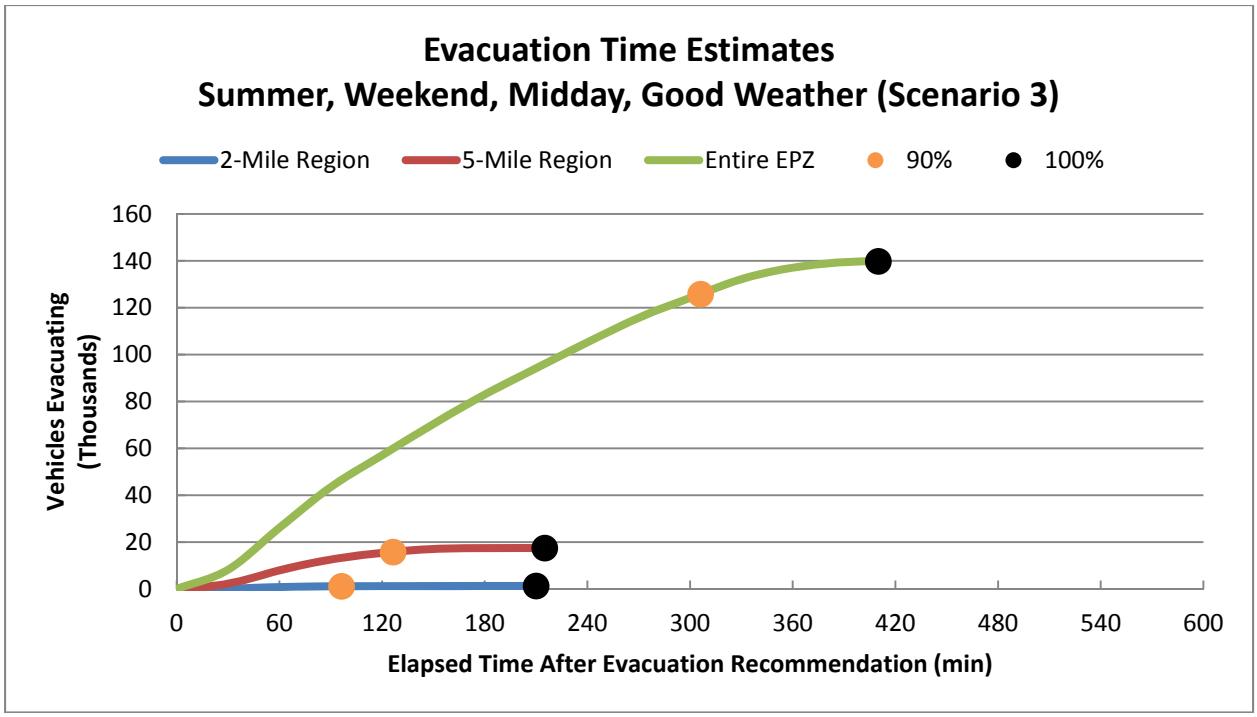


Figure 7-13. Evacuation Time Estimates - Scenario 3 for Region R03

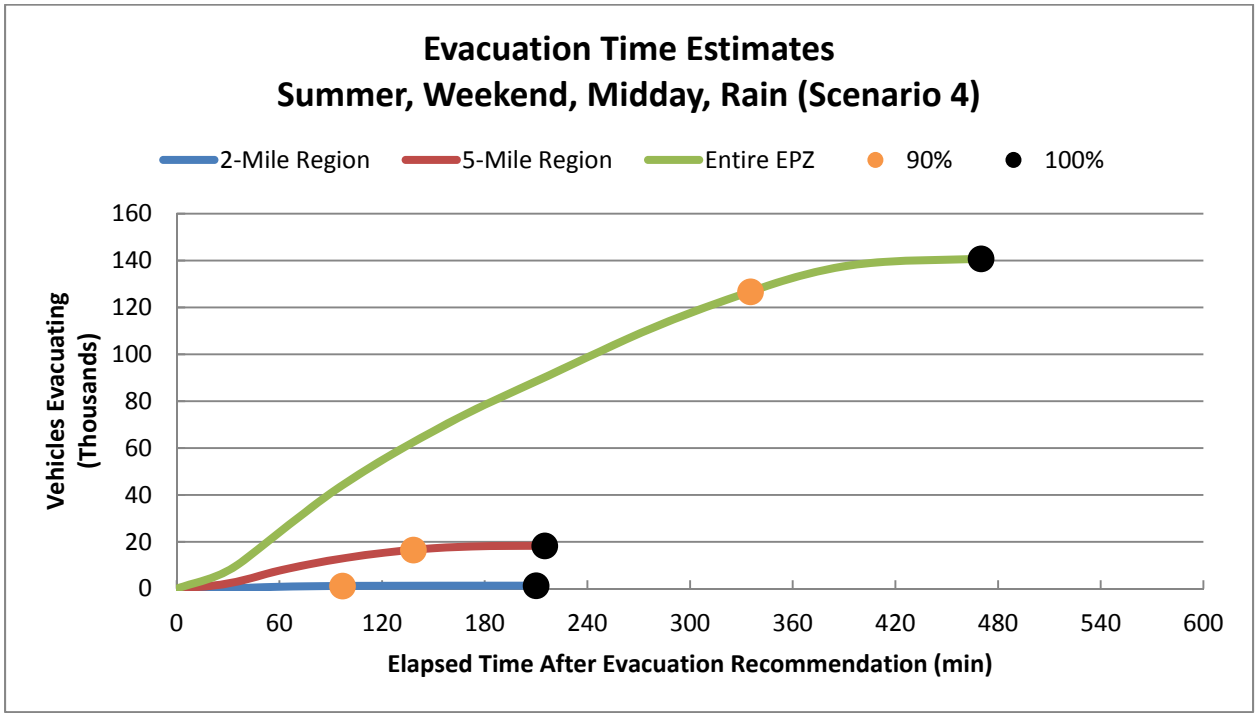


Figure 7-14. Evacuation Time Estimates - Scenario 4 for Region R03

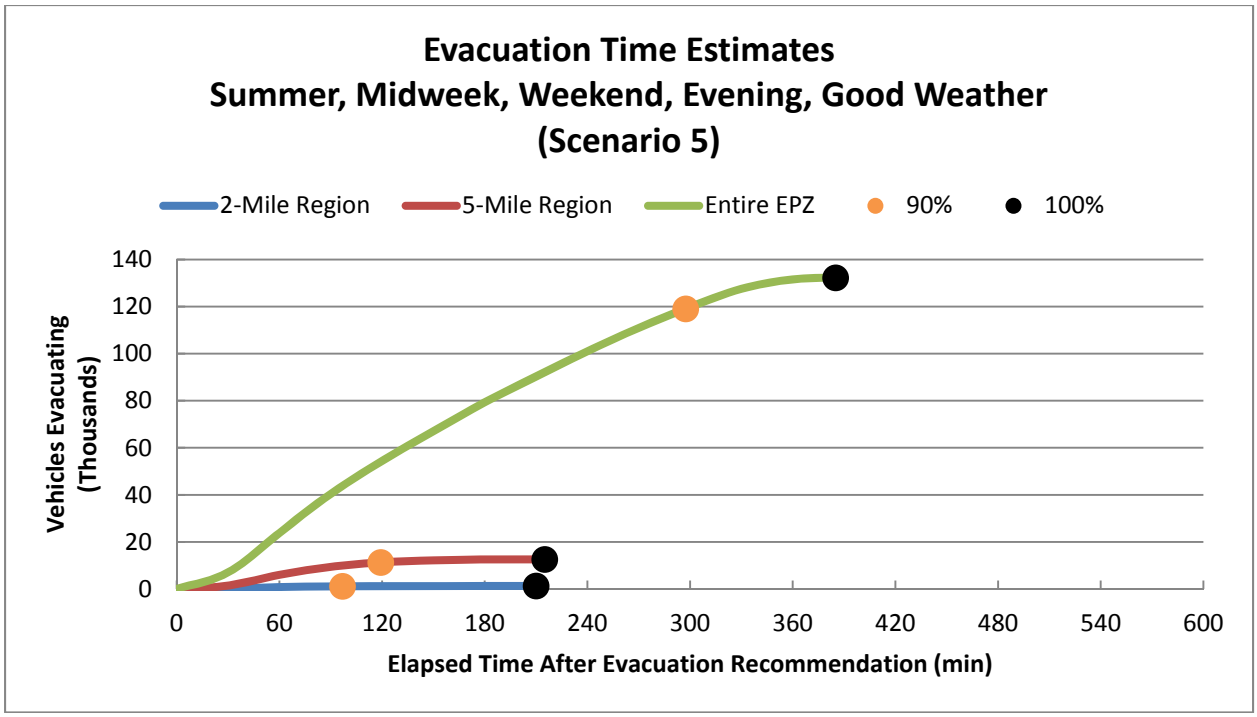


Figure 7-15. Evacuation Time Estimates - Scenario 5 for Region R03

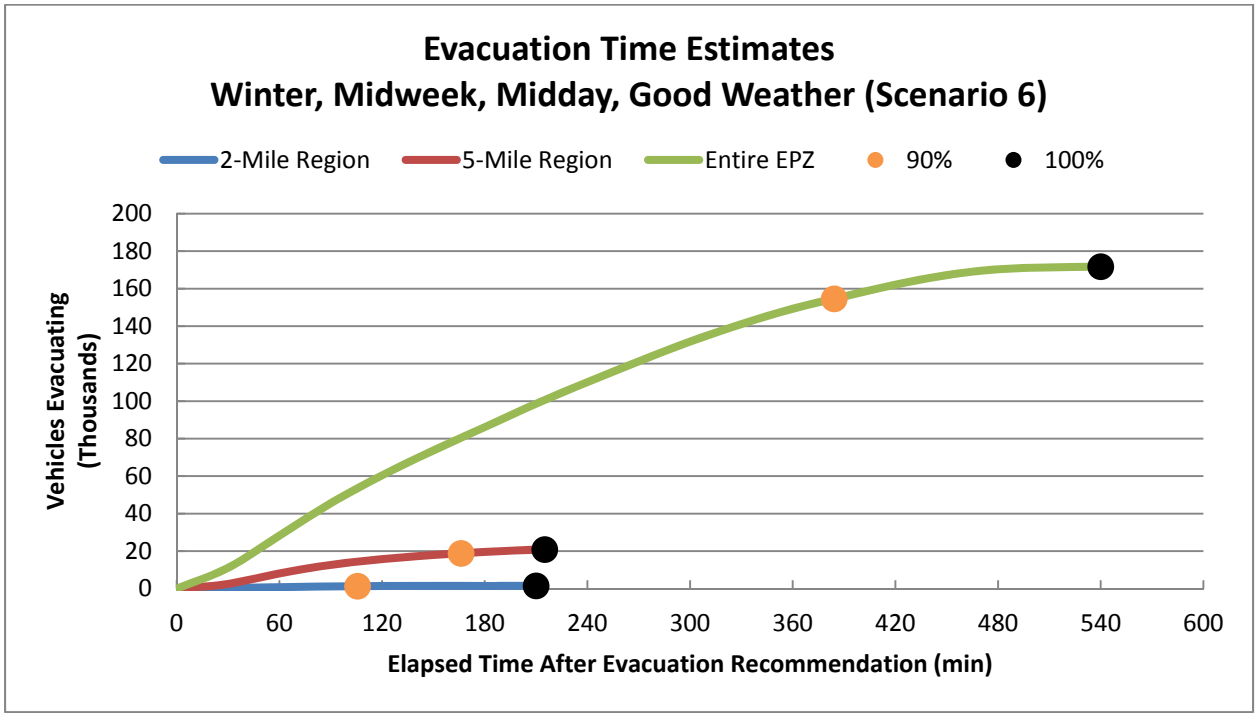


Figure 7-16. Evacuation Time Estimates - Scenario 6 for Region R03

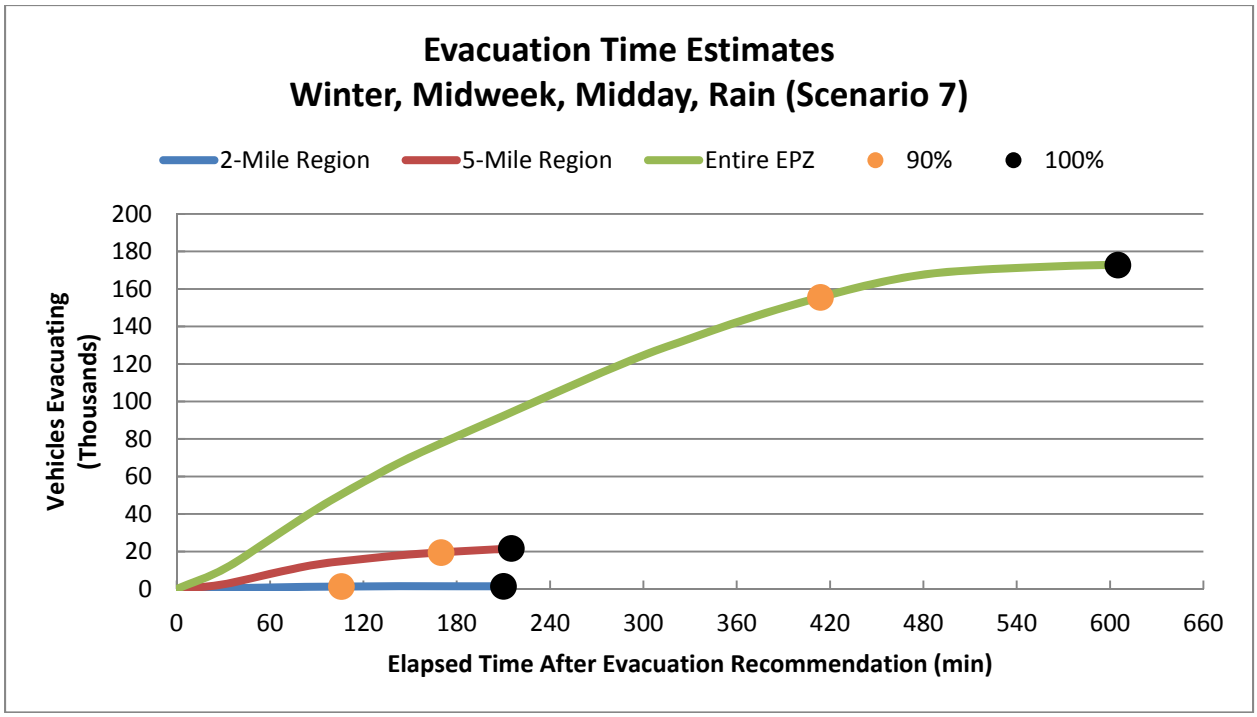


Figure 7-17. Evacuation Time Estimates - Scenario 7 for Region R03

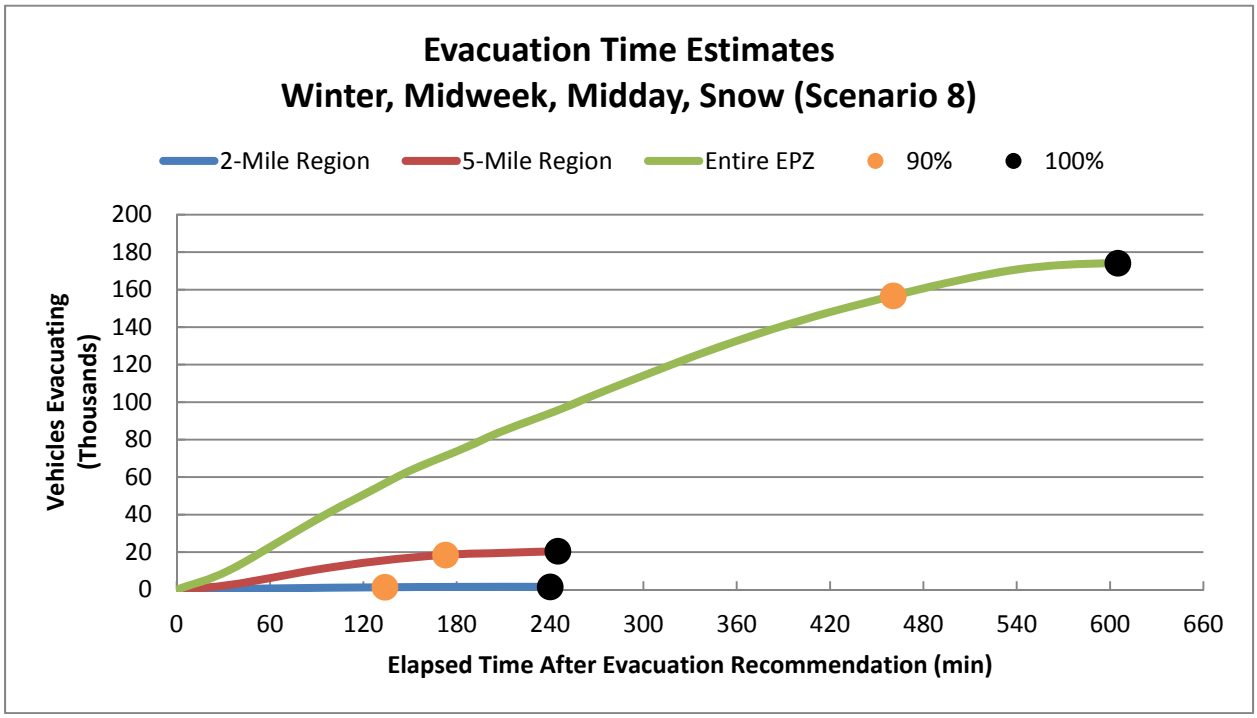


Figure 7-18. Evacuation Time Estimates - Scenario 8 for Region R03

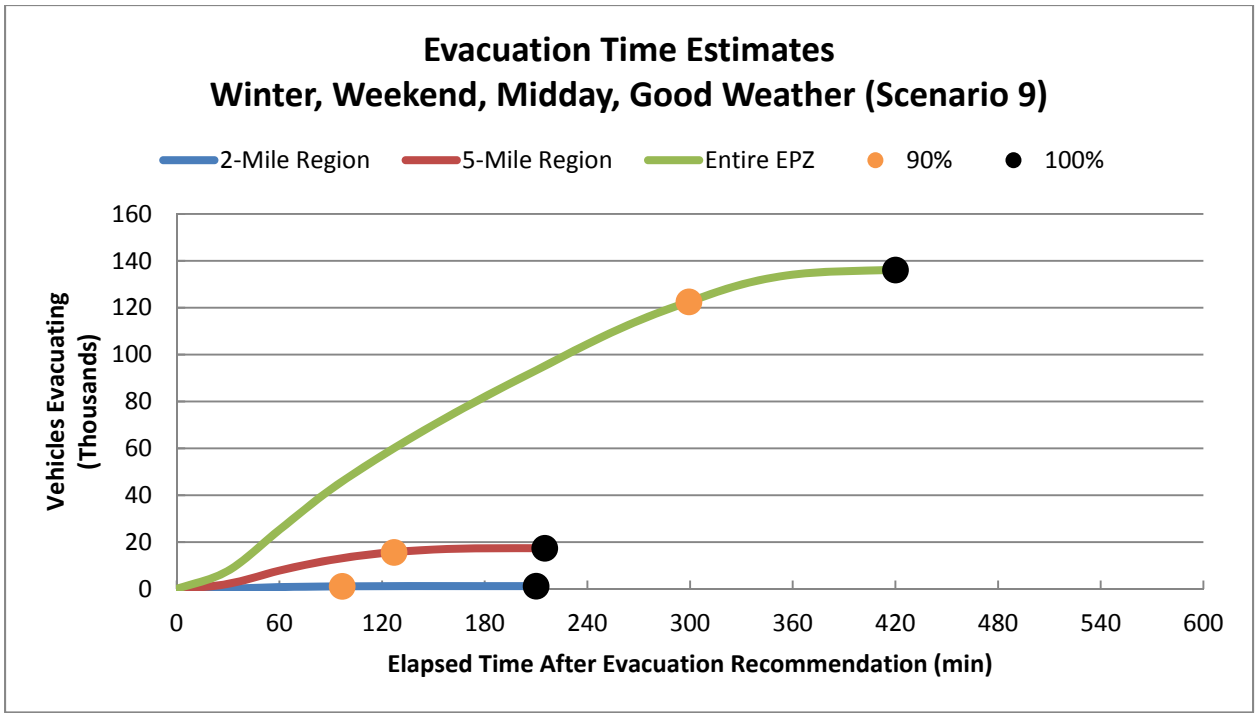


Figure 7-19. Evacuation Time Estimates - Scenario 9 for Region R03

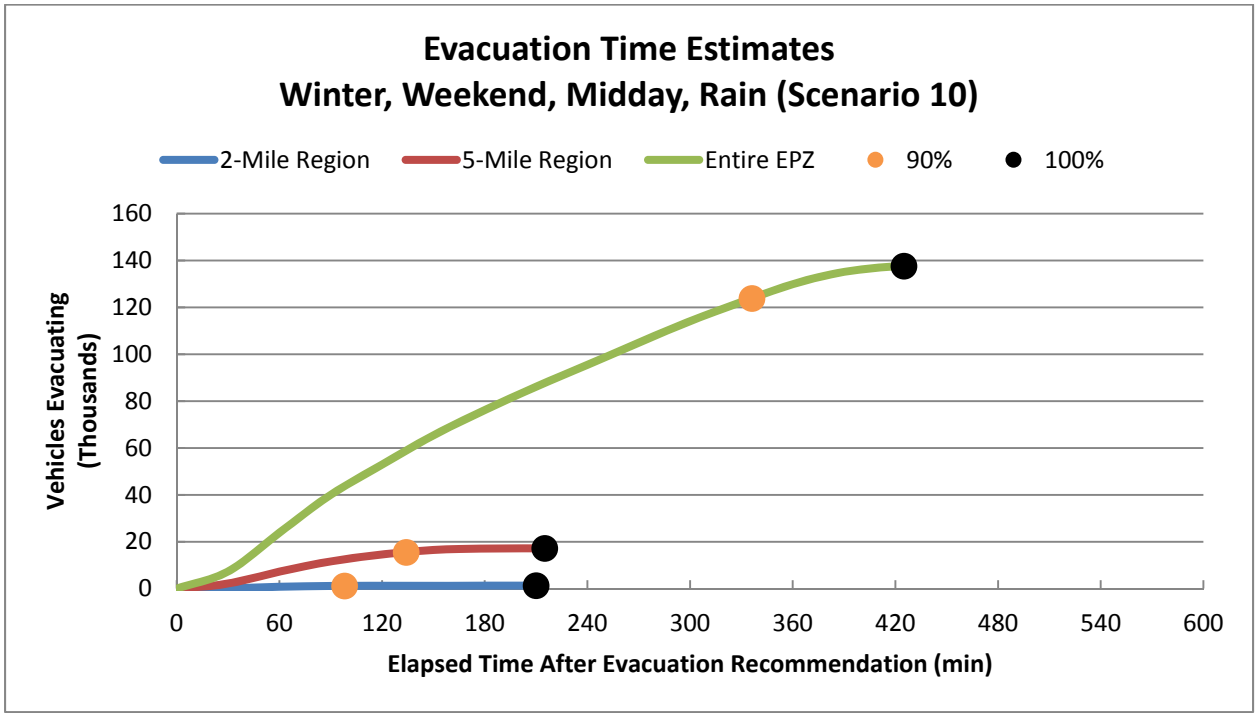


Figure 7-20. Evacuation Time Estimates - Scenario 10 for Region R03

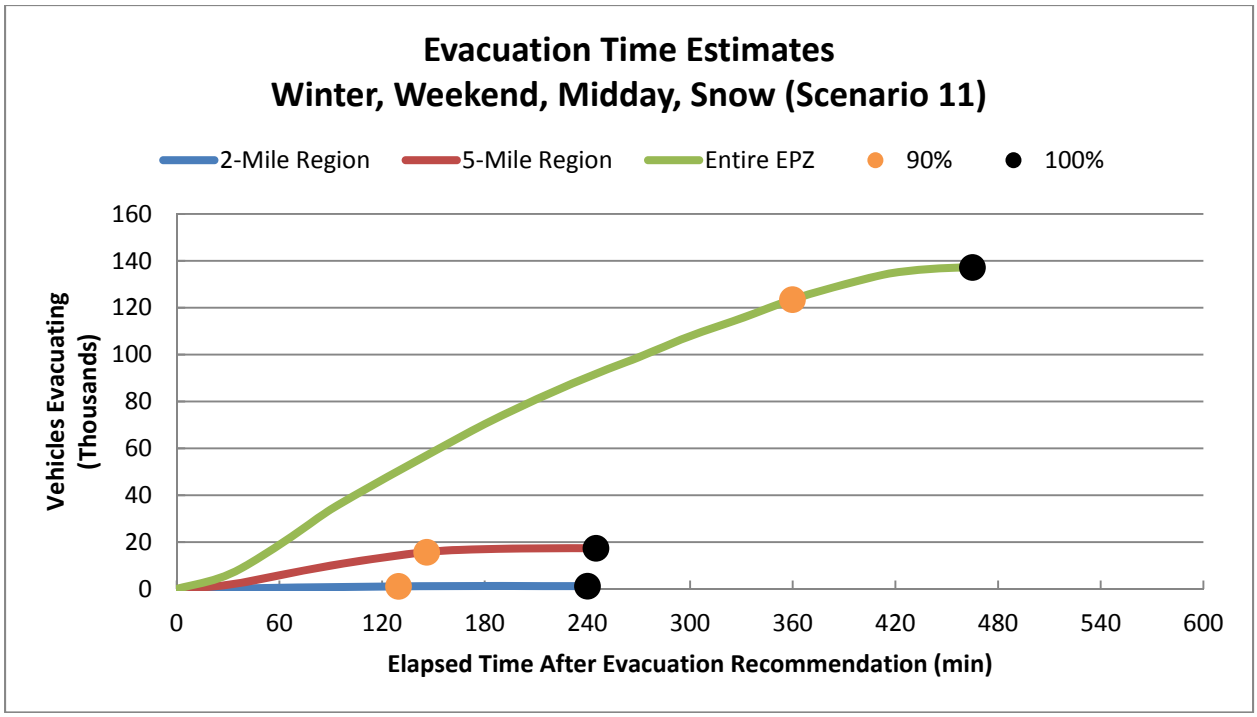


Figure 7-21. Evacuation Time Estimates - Scenario 11 for Region R03

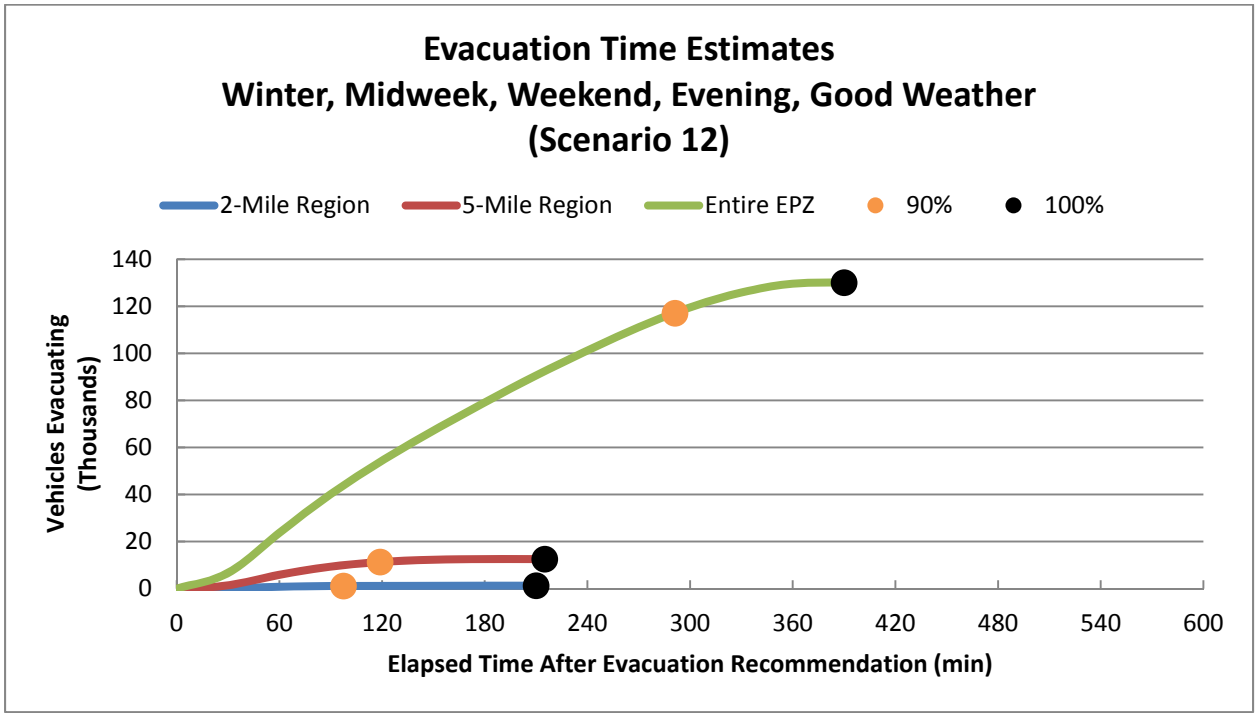


Figure 7-22. Evacuation Time Estimates - Scenario 12 for Region R03

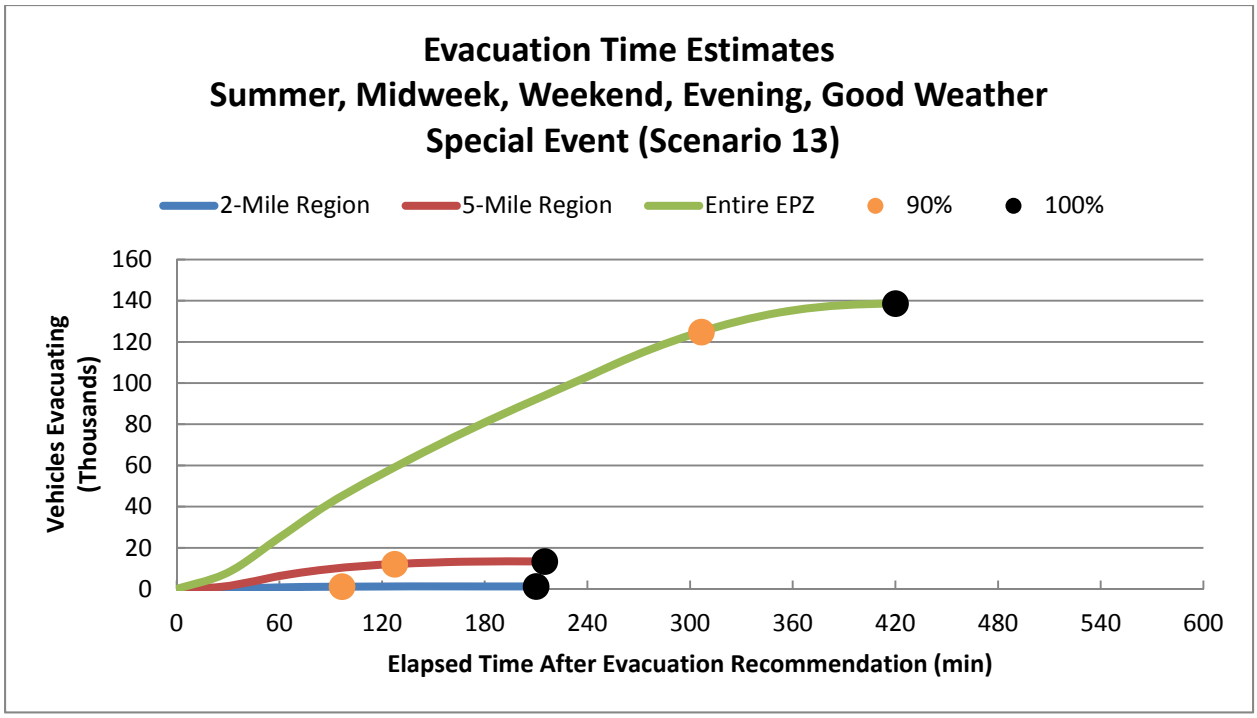


Figure 7-23. Evacuation Time Estimates - Scenario 13 for Region R03

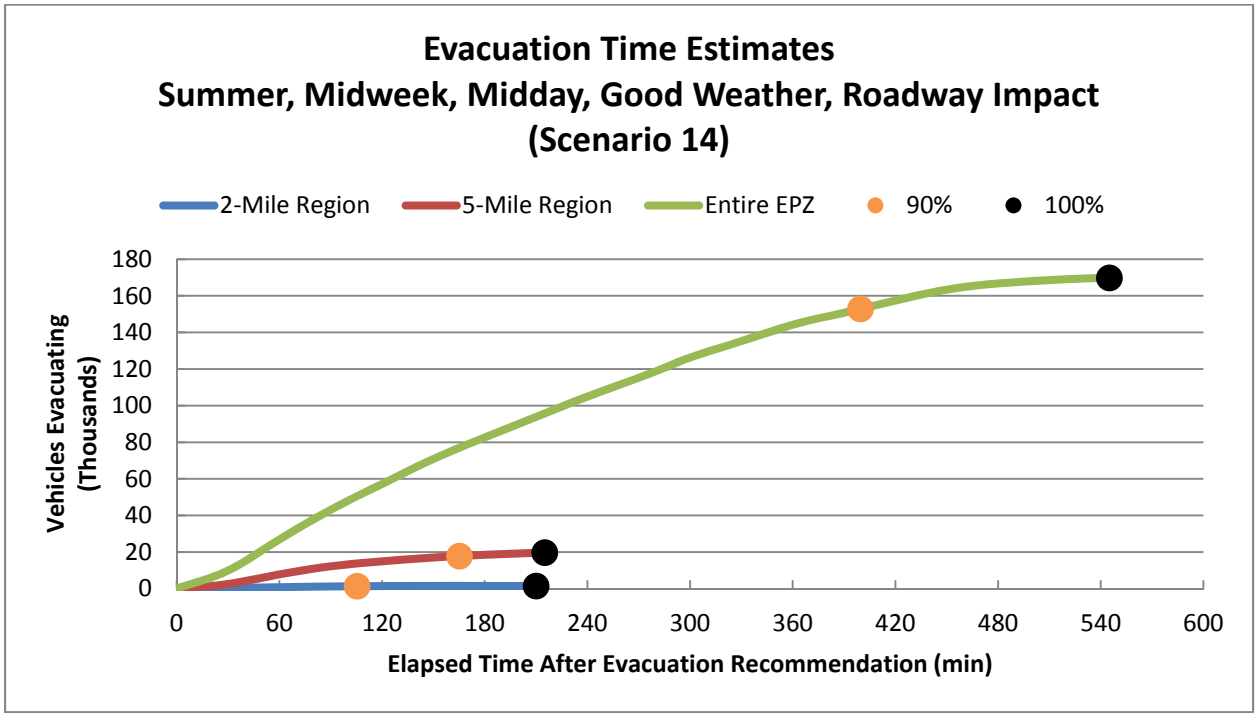


Figure 7-24. Evacuation Time Estimates - Scenario 14 for Region R03

8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES

This section details the analyses applied and the results obtained in the form of evacuation time estimates for transit vehicles (buses, vans, wheelchair accessible bus, and ambulances). The demand for transit service reflects the needs of three population groups: (1) residents with no vehicles available; (2) residents of special facilities such as schools, preschools, day care centers, colleges, medical facilities, and correctional facilities; and (3) homebound special needs population.

These transit vehicles mix with the general evacuation traffic that is comprised mostly of "passenger cars" (pc's). The presence of each transit vehicle in the evacuating traffic stream is represented within the modeling paradigm described in Appendix D as equivalent to two pc's. This equivalence factor represents the longer size and more sluggish operating characteristics of a transit vehicle, relative to those of a pc.

Transit vehicles must be mobilized in preparation for their respective evacuation missions. Specifically:

- Bus drivers must be alerted
- They must travel to the bus depot
- They must be briefed there and assigned to a route or facility

These activities consume time. Based on discussion with the offsite agencies, it is estimated that bus mobilization time will average approximately 60 minutes for schools and 90 minutes for transit dependent buses extending from the Advisory to Evacuate to the time when buses first arrive at the facility to be evacuated.

During this mobilization period, other mobilization activities are taking place. One of these is the action taken by parents, neighbors, relatives and friends to pick up children from schools, preschools or day care centers prior to the arrival of buses, so that they may join their families. Virtually all studies of evacuations have concluded that this "bonding" process of uniting families is universally prevalent during emergencies and should be anticipated in the planning process. The current public information disseminated to residents of the DAEC EPZ indicates that schoolchildren (includes private schools, preschools and day care centers) will be evacuated to Temporary Relocation Centers (TRC), where they can be picked up by their parents.

As discussed in Section 2, the county plans identify "Selective Evacuation" and "General Evacuation." Schools, preschools and day care centers would be evacuated to TRCs for a Selective Evacuation, or to reception centers for a General Evacuation. As such, this section computes ETE for schools to TRCs and for schools to reception centers.

This report provides estimates of buses under the assumption that no children will be picked up by their parents (in accordance with NUREG/CR-7002), to present an upper bound estimate of buses required. Parents picking up children at school, preschool or a day care center could add to traffic congestion at these facilities, delaying the departure of the buses evacuating children, which may have to return in a subsequent "wave" to the EPZ to evacuate the transit-dependent

population.

The procedure for computing transit-dependent ETE is to:

- Estimate demand for transit service
- Estimate time to perform all transit functions
- Estimate route travel times to the EPZ boundary and to the TRCs or reception centers

8.1 Transit Dependent People Demand Estimate

The 2012 telephone survey (see Appendix F) results were used to estimate the portion of the population requiring transit service:

- Those persons in households that do not have a vehicle available.
- Those persons in households that do have vehicle(s) that would not be available at the time the evacuation is advised.

In the latter group, the vehicle(s) may be used by a commuter(s) who does not return (or is not expected to return) home to evacuate the household.

Table 8-1 presents estimates of transit-dependent people. Note:

- Estimates of persons requiring transit vehicles include schoolchildren. For those evacuation scenarios where children are at school when an evacuation is ordered, separate transportation is provided for the schoolchildren. The actual need for transit vehicles by residents is thereby less than the given estimates. However, estimates of transit vehicles are not reduced when schools are in session.
- It is reasonable and appropriate to consider that many transit-dependent persons will evacuate by ride-sharing with neighbors, friends or family. For example, nearly 80 percent of those who evacuated from Mississauga, Ontario who did not use their own cars, shared a ride with neighbors or friends. Other documents report that approximately 70 percent of transit dependent persons were evacuated via ride sharing. **We will adopt a conservative estimate that 50 percent of transit dependent persons will ride share, in accordance with NUREG/CR-7002.**

The estimated number of bus trips needed to service transit-dependent persons is based on an estimate of average bus occupancy of 50 persons at the conclusion of the bus run. Transit vehicle seating capacities typically equal or exceed 70 children on average (roughly equivalent to 50 adults). If transit vehicle evacuees are two thirds adults and one third children, then the number of "adult seats" taken by 50 persons is 50 x 2/3 + [50/70 x (50 x 1/3)] = 45. On this basis, the average load factor anticipated is (45/50) x 100 = 88 percent. Thus, if the actual demand for service exceeds the estimates of Table 8-1 by 10.7 percent, the demand for service can still be accommodated by the available bus seating capacity.

$$\left[50 \times \frac{2}{3} + \left(\frac{50}{70} \times 50 \times \frac{1}{3}\right)\right] \div 50 \times 1.107 = 1.00$$

Table 8-1 indicates that transportation must be provided for 6,905 people. Therefore, a total of 139 bus runs are required to transport this population to reception centers. As discussed below in Section 8.4, in order to service all of the transit dependent population, and have a least one bus drive through each of the subareas picking up transit dependent people, **144 bus runs** are used in the ETE calculations (even though only 139 buses are needed from a capacity standpoint).

To illustrate this estimation procedure, we calculate the number of persons, P, requiring public transit or ride-share, and the number of buses, B, required for the DAEC EPZ:

$$P = No.\,of\ HH\ \times \sum_{i=0}^{n} \{(\%\ HH\ with\ i\ vehicles) \times [(Average\ HH\ Size) - i]\} \times A^i C^i$$

Where,

A = Percent of households with commuters

C = Percent of households who will not await the return of a commuter

$$P = 86{,}077 \times [0.054 \times 1.44 + 0.305 \times (1.57 - 1) \times 0.58 \times 0.58 + 0.396 \times (2.54 - 2) \times (0.58 \times 0.58)^2] = 13{,}810$$

$$B = (0.5 \times P) \div 50 = (0.5 * 13{,}810) \div 50 = 139$$

These calculations, based on the telephone survey results, are explained as follows:

- All members (1.44 avg.) of households (HH) with no vehicles (5.4%) will evacuate by public transit or ride-share. The term 86,077 (number of households) x 0.054 x 1.44, accounts for these people.
- The members of HH with 1 vehicle away (30.5%), who are at home, equal (1.57-1). The number of HH where the commuter will not return home is equal to (84,194 x 0.305 x 0.58 x 0.58), as 58% of EPZ households have a commuter, 58% of which would not return home in the event of an emergency. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms.
- The members of HH with 2 vehicles that are away (39.6%), who are at home, equal (2.54 – 2). The number of HH where neither commuter will return home is equal to 86,077 x 0.396 x $(0.58 \times 0.58)^2$. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms (the last term is squared to represent the probability that neither commuter will return).
- Households with 3 or more vehicles are assumed to have no need for transit vehicles.
- The total number of persons requiring public transit is the sum of such people in HH with no vehicles, or with 1 or 2 vehicles that are away from home.

The estimate of transit-dependent population in Table 8-1 far exceeds the number of registered transit-dependent persons in the EPZ as provided by the counties (discussed below in Section

8.5). This is consistent with the findings of NUREG/CR-6953, Volume 2, in that a large majority of the transit-dependent population within the EPZs of U.S. nuclear plants does not register with their local emergency response agency.

8.2 School, College, Preschool and Day Care Center Population – Transit Demand

Table 8-2 presents the school, college, preschool and day care center population and transportation requirements for the direct evacuation of all these facilities within the EPZ for the 2015 to 2016 school year. This information was included in the local county emergency plans provided by NextEra. The column in Table 8-2 entitled "Buses Required" specifies the number of buses required for each school, college, preschool or day care center under the following set of assumptions and estimates:

- No students will be picked up by their parents prior to the arrival of the buses.
- While many high school students commute to school using private automobiles (as discussed in Section 2.4 of NUREG/CR-7002), the estimate of buses required for school evacuation does not consider the use of these private vehicles.
- Bus capacity, expressed in students per bus, is set to 70 for primary schools, preschools and day care centers, 50 for middle and high schools, and 30 for colleges.
- Those staff members who do not accompany the students will evacuate in their private vehicles.
- No allowance is made for student absenteeism, typically 3 percent daily.
- Only college students who do not have a private vehicle on campus and who are not able to rideshare are considered transit-dependent. (See Section 3.1.1)

Implementation of a process to confirm individual school transportation needs prior to bus dispatch may improve bus utilization. In this way, the number of buses dispatched to the schools will reflect the actual number needed. The need for buses would be reduced by any high school students who have evacuated using private automobiles (if permitted by school authorities). Those buses originally allocated to evacuate schoolchildren that are not needed due to children being picked up by their parents, can be gainfully assigned to service other facilities or those persons who do not have access to private vehicles or to ride-sharing.

Table 8-3 presents a list of the TRCs for each evacuating school, preschool and day care center in the EPZ. Children will be transported to these TRCs for a Selective Evacuation, where they will be subsequently retrieved by their respective families. However, for a General Evacuation, children will be transported to the reception center assigned to the reception center assigned to the Subarea where their schools is located.

8.3 Medical Facilities and Group Homes

Table 8-4 presents the census of medical facilities and group homes[1] in the EPZ. A total of 4,013 people have been identified as living in, or being treated in, these facilities. The capacity, secured

[1] Group homes are only considered if they have capacity for 10 people or more, and they offer overnight residency. Capacity is calculated based on the number of beds within the facility.

unit capacity, number of ambulatory (bus capacity required) and bedridden (ambulance capacity required) people for each facility were included in the county emergency plans provided by NextEra.

The transportation requirements for the special facility population are provided in the county emergency plans and are summarized in Table 8-4. The number of bus runs is determined by assuming that 30 evacuees can be accommodated per trip for medical facilities and group homes; the number of ambulance runs assumes 2 patients per trip.

8.4 Evacuation Time Estimates for Transit Dependent People

EPZ bus resources are assigned to evacuating schoolchildren (if school is in session at the time of the ATE) as the first priority in the event of an emergency. In the event that the allocation of buses dispatched from the depots to the various facilities and to the bus routes is somewhat inefficient, or if there is a shortfall of available drivers, then there may be a need for some buses to return to the EPZ from the reception center or TRC after completing their first evacuation trip, to complete a "second wave" of providing transport service to evacuees. For this reason, the ETE for the transit-dependent population will be calculated for both a one wave transit evacuation and for two waves. Of course, if the impacted Evacuation Region is other than R03 (the entire EPZ), then there will likely be ample transit resources relative to demand in the impacted Region and this discussion of a second wave would likely not apply.

When school evacuation needs are satisfied, subsequent assignments of buses to service the transit-dependent should be sensitive to their mobilization time. Clearly, the buses should be dispatched after people have completed their mobilization activities and are in a position to board the buses when they arrive at the various routes described below.

Evacuation Time Estimates for transit trips were developed using both good weather and adverse weather conditions. Figure 8-1 presents the chronology of events relevant to transit operations. The elapsed time for each activity will now be discussed with reference to Figure 8-1.

Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the Advisory to Evacuate until the time the buses arrive at the facility to be evacuated. Based on discussions with NextEra and the county emergency management agencies, school bus drivers would require 60 minutes to be contacted, to travel to the depot, be briefed, and to travel to the transit-dependent facilities for a rapidly escalating radiological emergency with no observable indication before the fact. Mobilization time is slightly longer in adverse weather – 70 minutes when raining, 80 minutes when snowing.

Activity: Board Passengers (C→D)

Based on discussions with the offsite agencies, a loading time of 15 minutes for good weather (20 minutes for rain and 25 minutes for snow) for school buses is used.

For multiple stops along a pick-up route (transit-dependent bus routes) estimation of travel time must allow for the delay associated with stopping and starting at each pick-up point. The time, t, required for a bus to decelerate at a rate, "a", expressed in ft/sec/sec, from a speed, "v",

expressed in ft/sec, to a stop, is t = v/a. Assuming the same acceleration rate and final speed following the stop yields a total time, T, to service boarding passengers:

$$T = t + B + t = B + 2t = B + \frac{2v}{a},$$

Where B = Dwell time to service passengers. The total distance, "s" in feet, travelled during the deceleration and acceleration activities is: $s = v^2/a$. If the bus had not stopped to service passengers, but had continued to travel at speed, v, then its travel time over the distance, s, would be: s/v = v/a. Then the total delay (i.e. pickup time, P) to service passengers is:

$$P = T - \frac{v}{a} = B + \frac{v}{a}$$

Assigning reasonable estimates:

- B = 50 seconds: a generous value for two passengers, carrying personal items, to board per stop
- v = 25 mph = 37 ft/sec
- a = 4 ft/sec/sec, a moderate average rate

Then, P ≈ 1 minute per stop. Allowing a 30-minute pick-up time per bus run implies 30 stops per run, for good weather. Given the transit-dependent bus capacity of 50 passengers, most stops will have two passengers boarding, with some stops only picking up a single passenger. It is assumed that bus acceleration and speed will be less in rain; total loading time is 40 minutes per bus in rain, 50 minutes in snow.

Activity: Travel to EPZ Boundary (D→E)

School, College, Preschool, and Day Care Centers Evacuation

The transportation resources available were documented in the EPZ county emergency plans which were provided by NextEra; Table 8-5 summarizes the available capacity of transportation resources. Also included in the table transportation resource capacity needed to evacuate schools, colleges, preschools, day care centers, special facilities (medical facilities, group homes, and correction facilities (discussed below in Section 8.6)), transit-dependent population, and homebound special needs persons (discussed below in Section 8.5). These numbers indicate there is sufficient capacity available to evacuate wheelchair bound and bedridden EPZ residents in a single wave, however there is insufficient bus capacity to evacuate the transit-dependent and special facility residents. Schoolchildren will be given priority for buses if school is in session. If school is in session, a two wave evacuation will be needed for other facilities and transit-dependent population in the EPZ. It is assumed that there are enough drivers available to man all resources listed in Table 8-5.

The buses servicing the schools, preschools and day care centers are ready to begin their evacuation trips at 75 minutes after the advisory to evacuate – 60 minute mobilization time plus 15 minute loading time – in good weather. The UNITES software discussed in Section 1.3 was used to define bus routes along the most likely path from a school being evacuated to the EPZ boundary, traveling toward the appropriate TRC. This is done in UNITES by interactively selecting the series of nodes from the school to the EPZ boundary. Each bus route is given an identification

number and is written to the DYNEV II input stream. DYNEV computes the route length and outputs the average speed for each 5-minute interval, for each bus route. The specified bus routes are documented in Table 8-6 (refer to the maps of the link-node analysis network in Appendix K for node locations). Data provided by DYNEV during the appropriate timeframe depending on the mobilization and loading times (i.e., 70 to 75 minutes after the advisory to evacuate for good weather) were used to compute the average speed for each route, as follows:

$$Average\ Speed\ \left(\frac{mi.}{hr}\right) = \left[\frac{\sum_{i=1}^{n} length\ of\ link\ i\ (mi)}{\sum_{i=1}^{n} Delay\ on\ link\ i\ (min.) + \frac{length\ of\ link\ i\ (mi.)}{current\ speed\ on\ link\ i\ \left(\frac{mi.}{hr.}\right)} \times \frac{60\ min.}{1\ hr.}}\right] \times \frac{60\ min.}{1\ hr.}$$

The average speed computed (using this methodology) for the buses servicing each of the schools, preschools and day care centers in the EPZ is shown in Table 8-7 through Table 8-9, and in Table 8-11 through Table 8-13 for the transit vehicles evacuating transit-dependent persons, which are discussed later. The travel time to the EPZ boundary was computed for each bus using the computed average speed and the distance to the EPZ boundary along the most likely route out of the EPZ. The travel time from the EPZ boundary to the TRC or reception center was computed assuming an average speed of 25 mph, 20 mph, and 15 mph for good weather, rain and snow, respectively, given the prevalence of traffic congestion which persists in the outskirts of Cedar Rapids. Speeds were reduced in Table 8-7 through Table 8-9 and in Table 8-11 through Table 8-13 to 55 mph (50 mph for rain – 10% decrease – and 45 mph for snow – 20% decrease) for those calculated bus speeds which exceed 55 mph, as the school bus speed limit for state routes in Iowa is 55 mph.

Table 8-7 (good weather), Table 8-8 (rain) and Table 8-9 (snow) present the following evacuation time estimates (rounded up to the nearest 5 minutes) for schools, preschools and day care centers in the EPZ: (1) The elapsed time from the Advisory to Evacuate until the bus exits the EPZ; (2) The elapsed time until the bus reaches the TRC (in a Selective Evacuation); and (3) The elapsed time until the bus reaches the Reception Center (in a General Evacuation).

The evacuation time out of the EPZ can be computed as the sum of times associated with Activities A→B→C, C→D, and D→E (For example: 60 min. + 15 + 56 = 2:15 for Atkins Elementary School, in good weather, rounded up to the nearest 5 minutes). The average single wave ETE (3 hours and 40 minutes) for schools, preschools and day care centers is less than the 90th percentile ETE for Region R03 for the general population during Scenario 6 conditions.

The evacuation time to the TRC or Reception Center is determined by adding the time associated with Activity E→F (discussed below), to this EPZ evacuation time.

Evacuation of Transit-Dependent Population

The county emergency plans do not identify pre-defined bus routes or pick-up points to service the transit-dependent population in the EPZ. The 21 bus routes shown graphically in Figure 8-2 and Figure 8-3 and described in Table 8-10 were designed as part of this study to service the major routes through each population center in the EPZ. The buses servicing the transit-dependent evacuees will travel along their pick-up routes and then proceed out of the EPZ, to their respective Reception Center.

The buses dispatched from the depots to service the transit-dependent evacuees will be scheduled so that they arrive at their respective routes after their passengers have completed their mobilization. As shown in Figure 5-4 (Residents with no Commuters), approximately 90% of the evacuees will complete their mobilization by the time buses will begin their routes, approximately 90 minutes after the Advisory to Evacuate, for good weather. Mobilization time is longer in adverse weather – 100 minutes in rain and 110 minutes in snow – to account for slower travel speeds and reduced roadway capacity.

Subareas 14, 15, 16, 23 and 24 have high transit-dependent populations and require more buses than any other Subareas (Table 8-10). As such, two or three separate routes have been identified for each of these Subareas.

Although Section 8.1 indicates that only 139 buses are needed from a capacity standpoint to service the transit dependent population, Table 8-10 indicates a total of 144 buses based on round-off error with the computations, and the need to have at least one bus service each Subarea within the EPZ.

It is assumed that residents will walk to the nearest major roadway and flag down a passing bus, and that they can arrive at the roadway within the bus mobilization time. Those routes with multiple buses have been designated such that individual buses or groups of buses are dispatched using varying headways (5 to 30 minutes), as shown in Table 8-11 through Table 8-13. The use of bus headways ensures that those people who take longer to mobilize will be picked up.

As previously discussed, a pickup time of 30 minutes (good weather) is estimated for 30 individual stops to pick up passengers, with an average of one minute of delay associated with each stop. Longer pickup times of 40 minutes and 50 minutes are used for rain and snow, respectively.

The travel distance along the respective pick-up routes within the EPZ is estimated using the UNITES software. Bus travel times within the EPZ are computed using average speeds computed by DYNEV, using the aforementioned methodology that was used for school, preschool, and child care center evacuation.

Table 8-11 through Table 8-13 present the transit-dependent population evacuation time estimates for each bus route calculated using the above procedures for good weather, rain and snow, respectively.

For example, the ETE for the first bus servicing bus Route 1 (services Subareas 1, 2 and 3) is computed as 90 + 35 + 30 = 2:35 for good weather. Here, 35 minutes is the time to travel 30.1 miles at 51.2 mph, the average speed output by the model for this route starting at 90 minutes.

This is shorter than the general population 90th percentile ETE for the evacuation of the entire EPZ. The ETE for a second wave (discussed below) is presented in the event there is a shortfall of available buses or bus drivers, due to the limited transportation resources, as previously discussed and shown in Table 8-5.

Activity: Travel to TRCs and/or Reception Centers (E→F)

The distances from the EPZ boundary to the TRCs and reception centers are measured using GIS software along the most likely route from the EPZ exit point to the reception center or TRC. The reception centers and TRCs are mapped in Figure 10-1. For a one-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. For a two-wave evacuation, the ETE for buses must be considered separately, since it could exceed the ETE for the general public. Assumed bus speeds of 25 mph, 20 mph, and 15 mph for good weather, rain, and snow, respectively, will be applied for this activity for buses servicing the transit-dependent population.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C)

The buses assigned to return to the EPZ to perform a "second wave" evacuation of transit-dependent evacuees will be those that have already evacuated transit-dependent people who mobilized more quickly. The first wave of transit-dependent people departs the bus, and the bus then returns to the EPZ, travels to its route and proceeds to pick up more transit-dependent evacuees along the route. The travel time back to the EPZ is equal to the travel time to the reception center.

The second-wave ETE for the first bus servicing Route Number 1 is computed as follows for good weather:

- Bus arrives at reception center at 3:23 in good weather (2:35 to exit EPZ + 48-minute travel time to reception center).
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to EPZ and completes second wave of evacuation along the route: 48 minutes (equal to travel time to reception center) + 15 minutes (10 miles back to the start of the route at an assumed speed of mph) + 34 minutes (30.1 miles @ 53.8 mph – average speed along route output by DYNEV at 4 hours and 40 minutes when the bus begins second wave evacuation along the route) = 97 minutes
- Bus completes pick-ups along route: 30 minutes.
- Bus exits EPZ at time 2:35 + 0:48 + 0:15 + 0:97 + 0:30 = 5:45 (rounded to nearest 5 minutes) after the Advisory to Evacuate.

The ETE for the completion of the second wave for all transit-dependent bus routes are provided in Table 8-11 through Table 8-13. The average ETE for a two-wave evacuation of transit-dependent people exceeds the 90th percentile ETE for the general population for an evacuation of the entire EPZ.

The relocation of transit-dependent evacuees from the reception centers to congregate care

centers, if the counties decide to do so, is not considered in this study.

As shown in Table 8-5, there is a shortfall of school buses for evacuation of children in a single wave, if the entire EPZ is evacuated at once (a highly unlikely event). As such, a two wave evacuation may be needed for some schools. Due to the large number of schools in the EPZ, second-wave ETE were not computed for each school. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation of schools. The travel time from the TRC back to the EPZ boundary and then back to the school was computed assuming an average speed of 55 mph (good weather), 50 mph (rain), and 45 mph (snow) as buses will be traveling counter to evacuating traffic. Times and distances are based on averages for all schools in the EPZ for good weather:

- School buses arrive at the TRCs at 4:20 (see average value in Table 8-7)
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to facility: 26 minutes (average distance to TRC (16.1 miles) + average distance to EPZ boundary (7.9 miles) at 55 mph))
- Loading Time: 15 minutes.
- Bus completes second wave of service along route: 71 minutes (1:11) (average distance to EPZ boundary (7.9 miles) at network wide average speed at 5:15 (6.69 mph))
- Bus exits EPZ at time 4:20 + 0:15 + 0:26 + 1:11 + 0:15 = 6:30 (rounded up to nearest 5 minutes) after the Advisory to Evacuate.

Given the average single wave ETE for schools is 3:40 (see Table 8-7); a second wave evacuation would require an additional 2 hours and 50 minutes on average. The average two-wave ETE of schools is comparable to the 90th percentile ETE of the full EPZ during a winter, midweek, midday scenario (Scenario 6).

Evacuation of Medical Facilities and Group Homes

The evacuation of these facilities is similar to school evacuation except:

- Buses are assigned on the basis of 30 patients to allow for the accompaniment of medical staff.
- Ambulances can accommodate 2 patients.
- The passenger loading time will be longer at approximately one minute per ambulatory passenger to account for the time to move patients from inside the facility to the vehicles.
- A loading time of 15 minutes per bedridden patient is assumed for ambulances.

Using the data provided and the aforementioned assumptions and vehicles capacities, Table 8-4 indicates that 142 bus runs and 242 ambulance runs are needed to service all of the medical facilities and group homes in the EPZ. According to Table 8-5, the counties can collectively provide 760 buses, 25 vans and 86 ambulances. However, during a school day, all school buses will be needed to evacuate school children. Thus, there are insufficient transportation resources to evacuate the ambulatory and bedridden persons from the medical facilities and group homes in a single wave. Two waves of evacuation are needed for ambulatory persons and three waves are

needed for bedridden persons in medical facilities and group homes.

Similar to schools, it is estimated that mobilization time averages 90 minutes in good weather, 100 minutes in rain, and 110 minutes in snow. Specially trained medical support staff (working their regular shift) will be on site to assist in the evacuation of patients. Additional staff (if needed) could be mobilized over this same 90-minute timeframe.

Table 8-14 through Table 8-16 summarize the ETE for medical facilities and group homes within the EPZ for good weather, rain, and snow. The distances from the medical facilities to the EPZ boundary were estimated using GIS software. Average speeds output by the model for Scenario 6 (Scenario 7 for rain and Scenario 8 for snow) Region 3, capped at 55 mph (50 mph for rain and 45 mph for snow), are used to compute travel time to EPZ boundary. The travel time to the EPZ boundary is computed by dividing the distance to the EPZ boundary by the average travel speed. The ETE is the sum of the mobilization time, total passenger loading time, and travel time to the EPZ boundary. Concurrent loading on multiple buses and ambulances at capacity is assumed, such that the maximum loading times for buses (maximum capacity of 30 times 1 minute per passenger), and ambulances (2 times 15) are 30 minutes for all vehicles. All ETE are rounded to the nearest 5 minutes.

For example, the calculation of ETE for the Asbury House with 20 ambulatory residents during good weather is:

ETE: 90 + 20 x 1 + 50 = 160 min. or 2:40.

It is assumed that medical facility and group home residents are directly evacuated to appropriate host facilities, outside of the EPZ. Relocation of this population to permanent facilities and/or passing through the reception center before arriving at the host facility is not considered in this analysis.

Due to the large number of medical facilities and group homes in the EPZ, second-wave ETE were not computed for each facility. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation of ambulatory patients. The travel time from the EPZ boundary to the facility was computed assuming an average speed of 55 mph (good weather), 50 mph (rain), and 45 mph (snow), as buses will be traveling counter to evacuating traffic. It is assumed that the buses used to evacuate schoolchildren will return to the EPZ to evacuate ambulatory residents at medical facilities and group homes. As such, times and distances are based on averages for school buses (after children have been evacuated) in the EPZ for good weather:

- School buses arrive at the TRCs at 4:20 (see average value in Table 8-7)
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to EPZ and travels to the medical facilities and group homes to assist with evacuation: 26 minutes (average distance to TRC (16.1 miles) + average distance to EPZ boundary (7.9 miles) at 55 mph))
- Loading Time: 15 minutes.
- Bus travels to EPZ boundary: 117 minutes (1:57) (average distance from medical facilities to EPZ boundary (13 miles) at network wide average speed at 5:15 (6.69

mph))

- Bus exits EPZ at time 4:20 + 0:15 + 0:26 + 0:15 + 1:57 = 7:15 (rounded up to nearest 5 minutes) after the Advisory to Evacuate.

Given the average single wave ETE for medical facilities and group homes is 5:05 (see Table 8-14); a second wave evacuation of ambulatory patients at medical facilities would require an additional 2 hours and 10 minutes, on average. The average two-wave ETE of medical facilities and group homes is longer than the 90th percentile ETE of the full EPZ during a winter, midweek, midday scenario (Scenario 6).

In the event there is a shortfall of ambulances, a second-wave ETE is computed for the bed ridden population at medical facilities and group homes and is as follows for good weather:

- Ambulances arrive at Reception Centers at 6:48 on average (5:05 average ETE from Table 8-14 plus 103-minute average travel time to Reception Center calculated from Table 8-11)
- Ambulance discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Ambulance returns to EPZ and travels back to the facility to complete second route: 61 minutes (average distance to RC (42.8 miles) from Table 8-11 + average distance to EPZ boundary (13 miles) at 55 mph)
- Remaining bedridden patients loaded on ambulance (maximum): 30 minutes.
- Ambulance travels to EPZ boundary: 20 minutes (average distance from medical facilities to EPZ boundary (13 miles) at network wide average speed at 40 mph (congestion in the EPZ has cleared after 8 hours)
- Ambulance exits EPZ at time 6:48 + 0:15 + 1:01 + 0:30 + 0:20 = 8:55 (rounded up to nearest 5 minutes) after the Advisory to Evacuate.

8.5 Special Needs Population

Based on data provided by the Linn County Emergency Management Agency, there are an estimated 1,172 homebound special needs people within the EPZ:

- 906 requiring a bus
- 251 needing wheelchair assistance
- 15 requiring an ambulance.

ETE for Homebound Special Needs Persons

Table 8-17 summarizes the ETE for homebound special needs people. The table is categorized by type of vehicle required and then broken down by weather condition. The table takes into consideration the deployment of multiple vehicles (not filled to capacity) to reduce the number of stops per vehicle. Due to the limitations on driving for homebound special needs persons, it is assumed they will be picked up from their homes. Furthermore, it is conservatively assumed that ambulatory and wheelchair bound special needs households are spaced 3 miles apart and bedridden households are spaced 5 miles apart. Bus and ambulance speeds approximate 10 mph (pronounced congestion in the EPZ) between households in good weather (10% slower in rain,

20% slower in snow). Mobilization times of 90 minutes were used (100 minutes for rain, and 110 minutes for snow). Loading times of 5 minutes per person are assumed for ambulatory people, 5 minutes per person for wheelchair bound people and 15 minutes per person for bedridden people. The last HH is assumed to be 5 miles from the EPZ boundary, and the network-wide average speed, capped at 55 mph (50 mph for rain and 45 mph for snow), after the last pickup is used to compute travel time. ETE is computed by summing mobilization time, loading time at first household, travel to subsequent households, loading time at subsequent households, and travel time to the EPZ boundary. All ETE are rounded to the nearest 5 minutes.

For example, assuming no more than one special needs person per HH implies that 906 ambulatory and 251 wheelchair bound households need to be serviced. While 36 buses are needed from a capacity perspective, if 95 wheelchair capable buses are deployed to service these special needs HH, then each bus would require about 13 stops. The following outlines the ETE calculations for a bus:

1. Assume 95 buses are deployed, each with at most 13 stops, to service a total of 1,157 HH.
2. The ETE is calculated as follows:
    - Buses arrive at the first pickup location: 90 minutes
    - Load HH members at first pickup: 5 minutes
    - Travel to subsequent pickup locations: 12 @ 18 minutes = 216 minutes
    - Load HH members at subsequent pickup locations: 12 @ 5 minutes = 60 minutes
    - Travel to EPZ boundary: 37 minutes (5 miles @ 8.0 mph – blended network wide average speed at 5:10).

    ETE: 90 + 5 + 216 + 60 + 37 = 6:50 rounded to the nearest 5 minutes

The average single wave ETE for homebound special needs population is longer than the 90th percentile ETE for the general population evacuating for the entire EPZ (Region R03) under Scenario 6 conditions.

The following outlines the ETE calculations for a second wave for ambulatory and wheelchair bound homebound special needs in good weather using school buses after the schools have been evacuated (see Table 8-18):

- School buses arrive at TRC (average value from Table 8-7): 4:20
- Unload students at TRC: 5 minutes.
- Driver takes 10-minute rest: 10 minutes.
- Travel time back to EPZ: 39 minutes (average time of "Travel Time from EPZ Bdry to TRC" from Table 8-7)
- Bus travels to all stops: 13 stops @ 18 minutes = 234 minutes
- Loading time at all stops: 13 stops @ 5 minutes = 65 minutes
- Travel time to EPZ boundary: 8 minutes (5 miles @ 40 mph – assumed speed since EPZ is clear of congestion at this time)

ETE: 4:20 + 0:15 + 0:39 + 3:54 + 1:05 + 0:08 = 10:25 (rounded up to the nearest 5 minutes)

The following outlines the ETE calculations for a second-wave for bedridden patients in good weather:

- Ambulances arrive at Reception Centers at 3:44 on average (3:05 average ETE from Table 8-17 plus 64-minute travel time to Reception Center from Table 8-11)
- Ambulance discharges passengers and driver takes a rest: 15 minutes.
- Ambulance returns to EPZ: 64 minutes (equal to average travel time to Reception Center from Table 8-11)
- Ambulance travels to all stops: 2 stops @ 10 minutes = 20 minutes
- Loading time at all stops: 2 stops @ 15 minutes = 30 minutes
- Ambulance travels to EPZ boundary: 37 minutes (5 miles @ 8.16 mph – average speed output by DYNEV at 5:55)

Ambulance exits EPZ at time 3:44 + 0:15 + 1:04 + 0:20 + 0:30 + 0:37 = 6:30 after the Advisory to Evacuate.

8.6 Correctional Facilities

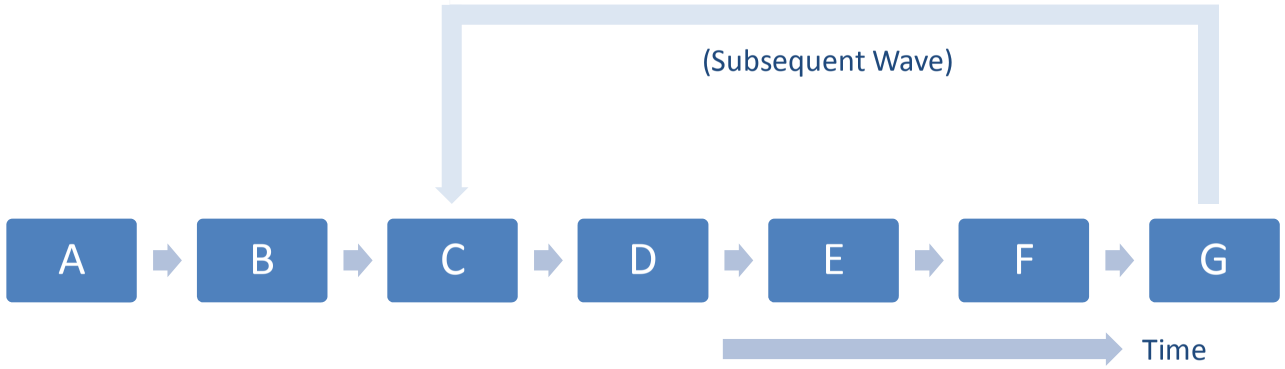
As detailed in Table E-6, there are four correctional facilities within the EPZ with a total population of 606 inmates:

- Anchor Center (26 inmates)
- Hinzman Center (86 inmates)
- Linn County Correctional Center (401 inmates)
- Lary Nelson Center (93 inmates)

As per the Linn County Emergency Plan, inmates will shelter in place, until transportation resources are available. An estimated bus capacity of 66 inmates per bus was provided by NextEra. A total of 12 buses are needed to evacuate these facilities. Mobilization time is assumed to be 90 minutes (100 minutes in rain and 110 minutes in snow). It is assumed that it takes 2 minutes per inmate to load the inmates onto a bus. It is further assumed that buses will be loaded in parallel such that the maximum loading time for any correctional facility is 132 minutes (bus capacity of 66 times 2 minutes per inmate).Using GIS software, the shortest route from the facilities to the EPZ boundary was determined.

The evacuation time out of the EPZ can be computed as the sum of mobilization time + loading time + travel time to EPZ Boundary. (For example: 90 min + 52 min (2 min loading time per 26 inmates) + 85 min (4.3 miles @ 3.0 mph) = 3:50 for Anchor Center, in good weather, rounded up to the nearest 5 minutes).

Table 8-19 summarizes the ETE for the correctional facilities (rounded up to the nearest 5 minutes) during good weather, rain and snow. On average, ETE for correctional facilities are less than for the general population for an evacuation of the entire EPZ under Scenario 6 conditions.



Event	
A	Advisory to Evacuate
B	Bus Dispatched from Depot
C	Bus Arrives at Facility/Pick-up Route
D	Bus Departs for TRC/Reception Center
E	Bus Exits Region
F	Bus Arrives at TRC/Reception Center
G	Bus Available for "Second Wave" Evacuation Service
Activity	
A→B	Driver Mobilization
B→C	Travel to Facility or to Pick-up Route
C→D	Passengers Board the Bus
D→E	Bus Travels Towards Region Boundary
E→F	Bus Travels Towards TRC/Reception Center
F→G	Passengers Leave Bus; Driver Takes a Break

Figure 8-1. Chronology of Transit Evacuation Operations

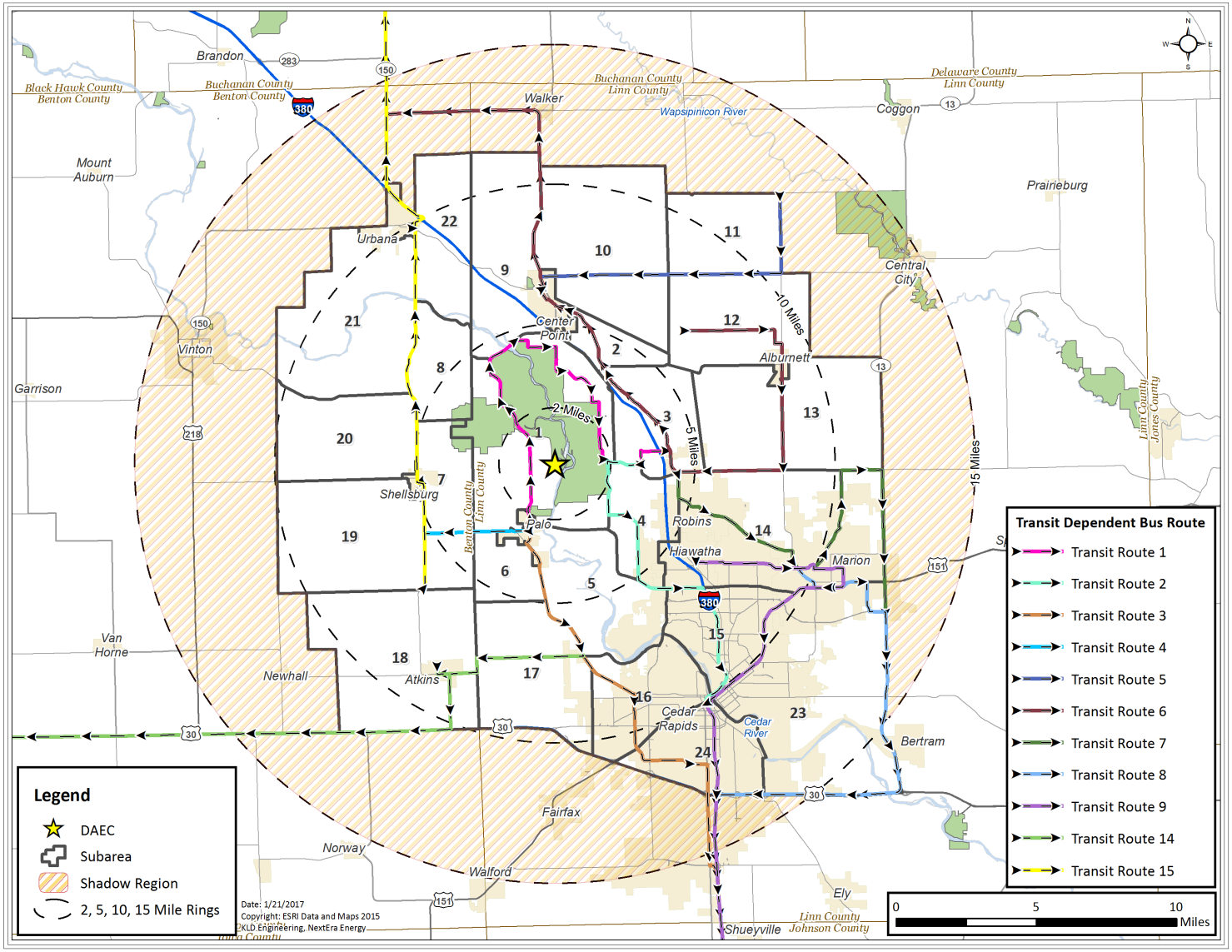


Figure 8-2. Transit-Dependent Bus Routes

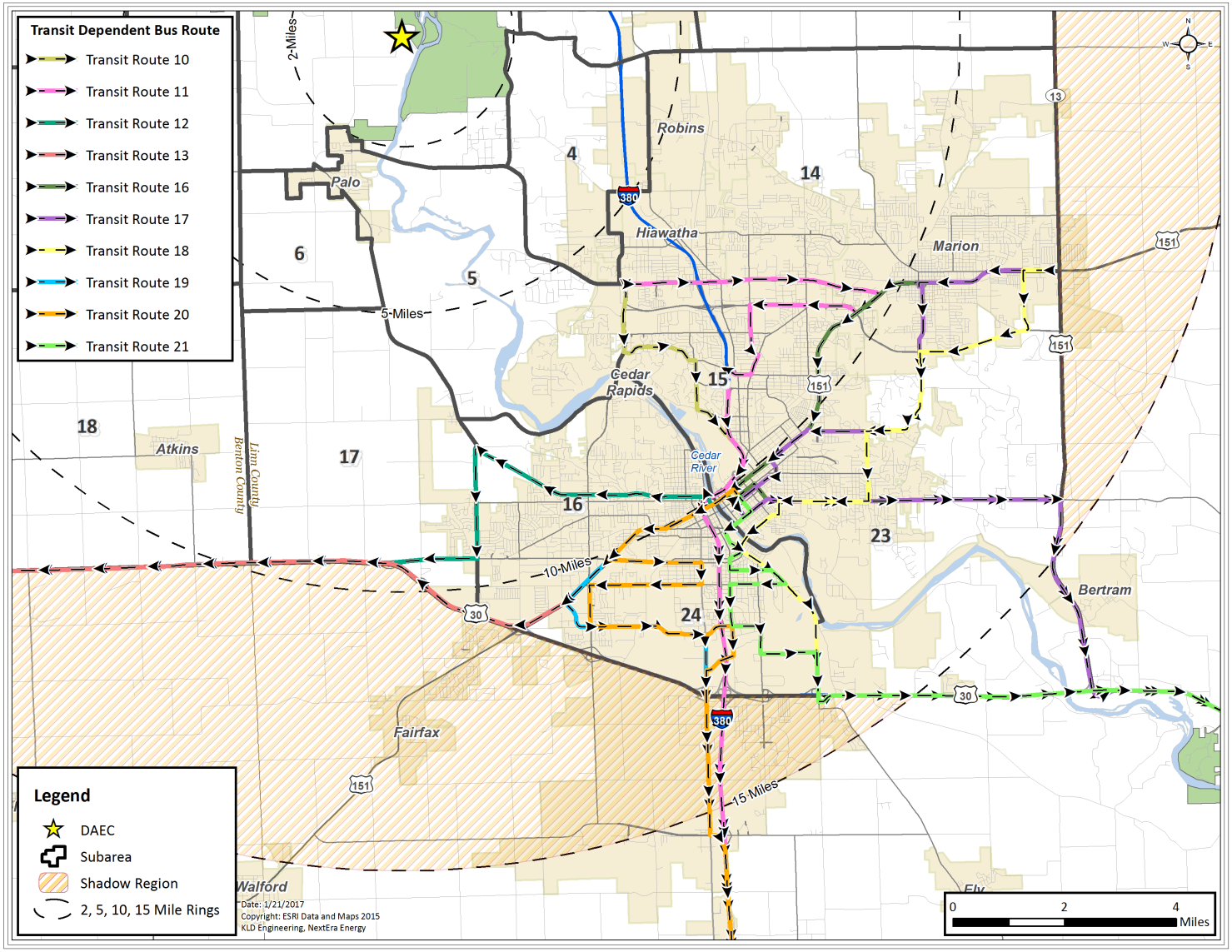


Figure 8-3. Transit Dependent Bus Routes – Cedar Rapids

Table 8-1. Transit-Dependent Population Estimates

2016 EPZ Population	Survey Average HH Size with Indicated No. of Vehicles			Estimated No. of Households	Survey Percent HH with Indicated No. of Vehicles			Survey Percent HH with Commuters	Survey Percent HH with Non-Returning Commuters	Total People Requiring Transport	Estimated Ridesharing Percentage	People Requiring Public Transit	Percent Population Requiring Public Transit
	0	1	2		0	1	2						
193,674	1.44	1.57	2.54	86,077	5.4%	30.5%	39.6%	58%	58%	13,810	50%	6,905	3.6%

Table 8-2. School, College, Preschool and Daycare Population Demand Estimates

Subarea	School Name	Enrollment	Buses Required
4	Five Seasons LC - Viola Gibson	152	3
4	Viola Gibson Elementary School	500	8
5	Children's Corner	95	2
5	KidsPoint North Learning Center & Preschool	162	3
5	Xavier High School	721	16
7	Shellsburg Elementary School & Preschool	278	5
9	Center Point Elementary School (CP)	340	6
9	Center Point Urbana High School (CP)	466	10
9	Center Point Urbana Middle School (CP)	350	8
9	Children Prevail	44	1
9	Kid Zone Daycare & Learning Center	47	1
9	Little People Daycare & Learning Center	47	1
9	Pointer Pup Preschool (Center Point)	147	3
12	Alburnett Schools (K-12)	644	14
12	Kids Inc. - Alburnett	17	1
14	Apple Kids Marion School District	144	3
14	Bowman Woods Elementary	485	8
14	Busy Bee Daycare Inc.	49	1
14	Echo Hill Elementary	604	10
14	Emerson Elementary	171	3
14	Essential Montessori School of Hiawatha	20	1
14	Excelsior Middle School	972	21
14	Five Seasons Learning Center - Nixon	100	2
14	HACAP Head Start - Marion	63	2
14	Hand in Hand - 35th Avenue	146	3
14	Hand in Hand - Hiawatha	109	2
14	Hand in Hand - Linn Grove Elementary	85	2
14	Hand in Hand - Tower Lane	96	2
14	Hiawatha Elementary School	450	7
14	Indian Creek Elementary School	528	9
14	Kids Inc. - Marion LC	173	3
14	La Petite Academy	125	2
14	Lily Pad Daycare & Preschool	84	2
14	Linn Grove Elementary	579	9
14	Linn-Mar Compass Program	72	2
14	Linn-Mar High School	2,113	45
14	Linn-Mar High School Success Program	8	1
14	Little Lambs Christian Preschool	44	1
14	Little Learners Inc.	75	2
14	Mother Goose Learning Center	90	2
14	Nixon Elementary School	365	6

Subarea	School Name	Enrollment	Buses Required
14	Novak Elementary	572	9
14	Oak Ridge Middle School	754	16
14	Our Little Haven	212	4
14	St. Joseph Catholic School	139	3
14	St. Joseph Early Childhood Daycare	60	1
14	St. Joseph Preschool	53	1
14	The Hiawatha Day School	135	3
14	The Robyn's Nest	24	1
14	Wee Wisdom (Marion)	18	1
14	Westfield Elementary	421	7
14	Wilkins Elementary	445	7
15	Apple Kids - Noelridge	43	1
15	Arthur Elementary School (K-5)	350	6
15	Calvery Christian Preschool	81	2
15	Caring Corner Christian Daycare & Preschool	156	3
15	Children's Weekday Ministry-Lovely Lane	131	3
15	Child's Discovery Montessori Preschool	40	1
15	Coe College[2]	1,357	6
15	Five Seasons Learning Center - Arthur	60	1
15	Five Seasons Learning Center - Wright (Age 3-5)	88	2
15	Franklin Middle School	650	14
15	Garfield Elementary School	250	4
15	Good Shepard Lutheran School (Pre-K - 8th)	9	1
15	Harding Middle School	820	18
15	Holloway House Learning Center	16	1
15	Isaac Newton Christian Academy & Preschool	238	4
15	Jungle Friends	70	2
15	Kennedy High School	1,900	40
15	Kenwood Elementary School	450	7
15	Kids Kampus Learning Center	131	3
15	Kindercare Learning Center #292	95	2
15	Mount Mercy University[3]	1,104	2
15	Pierce Elementary School	380	6
15	Polk Alternative School	75	2
15	Regis Middle School	335	8
15	Rockwell Collins Child Development Center D	448	8
15	St. Matthew Preschool	92	2
15	St. Matthew School	165	3
15	St. Matthew's Child Care Program	230	4
15	St. Pius X Child Care Program	82	2

[2] There are 169 students who need a bus to evacuate. Using a capacity of 30 students per bus, 6 buses are needed.
[3] There are 55 students who need a bus to evacuate. Using a capacity of 30 students per bus, 2 buses are needed.

Subarea	School Name	Enrollment	Buses Required
15	St. Pius X Preschool	89	2
15	St. Pius X School	338	6
15	Summit Preschool	16	1
15	Summit School (Pre-K - 6th)	116	2
15	Wright Elementary School	360	6
16	Cleveland Elementary School	400	7
16	Coolidge Elementary School	500	8
16	Five Seasons Learning Center - Coolidge (age 3-5)	108	2
16	HACAP Head Start - Olivet	32	1
16	Harrison Elementary School	400	7
16	Harvest Christian DC & Learning Center	208	4
16	Hoover Elementary School	390	6
16	Jackson Elementary School	380	6
16	Josiah's Playground	98	2
16	Kindercare Learning Center - West	96	2
16	Lasalle Intermediate School	188	4
16	Linn County Child Development Center	68	2
16	Little Cupcakes Child Care	59	1
16	Madison Elementary School	280	5
16	Mother Goose Daycare	93	2
16	My Iman Montessori Preschool	43	1
16	Noah's Ark Preschool	50	1
16	Roosevelt Middle School	575	13
16	Share & Care Christian Preschool	32	1
16	St. James Kids Club Daycare	134	3
16	St. Jude’s Daycare	69	2
16	St. Jude’s Elementary School	106	2
16	St. Jude’s Preschool	45	1
16	Taft Middle and Alternative School	600	13
16	Truman Elementary School	270	5
16	We Teach 2	102	2
17	YMCA-Stoney Point	117	2
18	Atkins Elementary School	241	4
18	Early Beginnings Preschool/Daycare	132	3
22	Center Point Intermediate School (Urbana)	347	8
22	Kid Zone Daycare (Urbana)	11	1
23	All Saints Catholic School	199	4
23	All Saints Daycare	56	1
23	All Saints Preschool	98	2
23	Ascension Lutheran Preschool	20	1
23	Bethany Lutheran Moms Morning Out	20	1
23	Cedar Valley Christian High School	60	2
23	Cedar Valley Christian Preschool	15	1

Subarea	School Name	Enrollment	Buses Required
23	Cedar Valley Christian School (7-8)	18	1
23	Cedar Valley Christian School (K-6)	77	2
23	Cedar Valley Montessori School	150	3
23	Erskine Elementary School	380	6
23	Francis Marion Intermediate	300	7
23	Grant Wood Elementary	420	7
23	HACAP Head Start - Jane Boyd	36	1
23	HACAP Head Start-Urban Family Resource	40	1
23	HACAP Horizons	42	1
23	Johnson Elementary School	400	7
23	KidsPoint Downtown Learning Center & Preschool	221	4
23	Marion High School	638	14
23	McKinley Middle School	510	11
23	Metro High School	425	9
23	Metro Parent - Child Center	34	1
23	St. Paul's Parents Day Out	108	2
23	St. Paul's Preschool FOCUS	40	1
23	Starry Elementary	378	7
23	The ARC of East Central Childcare Program	88	2
23	The Cedar Rapids Day School	200	4
23	Vernon Middle School	622	14
23	Washington High School	1,400	30
24	ASAC Heart of Iowa Child	85	2
24	Four Oaks Day Program	48	1
24	Grant Elementary School/Preschool	365	6
24	HACAP Head Start Hayes Center	40	1
24	Jefferson Senior High School	1,525	33
24	Kaplan University	303	0
24	Kinder Kollege	58	1
24	St. Ludmila Catholic Center	71	2
24	St. Ludmila Daycare	20	1
24	St. Ludmila Preschool	22	1
24	Taylor Elementary School/Preschool	315	5
24	Teddy Bear Childcare Center	88	2
24	Trinity Lane Preschool	42	1
24	Trinity Lutheran Childcare	10	1
24	Trinity Lutheran School District	178	4
24	Van Buren Elementary School	370	6
24	Wilson Middle School	400	9
	TOTAL:	**42,467**	**805**

Table 8-3. Temporary Relocation Centers for Schools, Preschools and Daycares

School	Temporary Relocation Center
Atkins Elementary School	Benton Community High School
Early Beginnings Preschool/Daycare	
Four Oaks Day Program	City High School
HACAP Head Start Hayes Center	
Jefferson Senior High School	Clear Creek-Amana Middle School
Roosevelt Middle School	
Taft Middle and Alternative School	
ASAC Heart of Iowa Child	Cornell College
Ascension Lutheran Preschool	
Bethany Lutheran Moms Morning Out	
Bowman Woods Elementary	
Cedar Valley Montessori School	
Echo Hill Elementary	
Excelsior Middle School	
HACAP Head Start - Jane Boyd	
HACAP Head Start-Urban Family Resource	
HACAP Horizons	
Indian Creek Elementary School	
Kids Inc. - Marion LC	
KidsPoint Downtown Learning Center & Preschool	
Kinder Kollege	
Linn Grove Elementary	
Linn-Mar Compass Program	
Linn-Mar High School	
Linn-Mar High School Success Program	
Mother Goose Learning Center	
Novak Elementary	
Oak Ridge Middle School	
St. Paul's Parents Day Out	
St. Paul's Preschool FOCUS	
Teddy Bear Childcare Center	
The ARC of East Central Childcare Program	
The Cedar Rapids Day School	
Westfield Elementary	
Wilkins Elementary	
Center Point Urbana High School (CP)	Independence Jr./Sr. High School
Center Point Urbana Middle School (CP)	
Erskine Elementary School	Lakeview Elementary
Grant Wood Elementary	
Johnson Elementary School	
Trinity Lane Preschool	
Trinity Lutheran Childcare	
Trinity Lutheran School District	

School	Temporary Relocation Center
Cleveland Elementary School	Middle Amana (Amana Elementary School)
Harrison Elementary School	
Hoover Elementary School	
Jackson Elementary School	
Madison Elementary School	
Truman Elementary School	
Apple Kids Marion School District	Mt. Vernon Middle School
Emerson Elementary	
Francis Marion Intermediate	
Marion High School	
Starry Elementary	
Vernon Middle School	
Alburnett Schools (K-12)	North Linn Schools
Kids Inc. - Alburnett	
McKinley Middle School	Solon High School
Metro High School	
Metro Parent - Child Center	
Washington High School	
Apple Kids - Noelridge	Southeast Junior High School
Busy Bee Daycare Inc.	
Calvery Christian Preschool	
Caring Corner Christian Daycare & Preschool	
Children's Corner	
Children's Weekday Ministry-Lovely Lane	
Child's Discovery Montessori Preschool	
Essential Montessori School of Hiawatha	
Five Seasons Learning Center - Arthur	
Good Shepard Lutheran School (Pre-K - 8th)	
HACAP Head Start - Marion	
HACAP Head Start - Olivet	
Hand in Hand - 35th Avenue	
Hand in Hand - Hiawatha	
Hand in Hand - Linn Grove Elementary	
Hand in Hand - Tower Lane	
Harvest Christian DC & Learning Center	
Holloway House Learning Center	
Isaac Newton Christian Academy & Preschool	
Josiah's Playground	
Jungle Friends	
Kids Kampus Learning Center	
KidsPoint North Learning Center & Preschool	
Kindercare Learning Center - West	
Kindercare Learning Center #292	

School	Temporary Relocation Center
La Petite Academy	Southeast Junior High School
Lily Pad Daycare & Preschool	
Linn County Child Development Center	
Little Cupcakes Child Care	
Little Lambs Christian Preschool	
Little Learners Inc.	
Mother Goose Daycare	
My Iman Montessori Preschool	
Noah's Ark Preschool	
Our Little Haven	
Rockwell Collins Child Development Center D	
Share & Care Christian Preschool	
St. James Kids Club Daycare	
Summit Preschool	
Summit School (Pre-K - 6th)	
The Hiawatha Day School	
The Robyn's Nest	
We Teach 2	
Wee Wisdom (Marion)	
YMCA-Stoney Point	
Coolidge Elementary School	Springville Elem/HS
Five Seasons Learning Center - Coolidge (age 3-5)	
Grant Elementary School/Preschool	
Taylor Elementary School/Preschool	
Van Buren Elementary School	
Wilson Middle School	
Center Point Elementary School (CP)	St. John's Elementary
Center Point Intermediate School (Urbana)	
Children Prevail	
Kid Zone Daycare & Learning Center	
Kid Zone Daycare (Urbana)	
Little People Daycare & Learning Center	
Pointer Pup Preschool (Center Point)	
Shellsburg Elementary School & Preschool	Tilford Elementary School
Cedar Valley Christian High School	Washington Elementary
Cedar Valley Christian Preschool	
Cedar Valley Christian School (7-8)	
Cedar Valley Christian School (K-6)	

School	Temporary Relocation Center
All Saints Catholic School	West High School
All Saints Daycare	
All Saints Preschool	
Arthur Elementary School (K-5)	
Five Seasons LC - Viola Gibson	
Five Seasons Learning Center - Nixon	
Five Seasons Learning Center - Wright (Age 3-5)	
Franklin Middle School	
Garfield Elementary School	
Harding Middle School	
Hiawatha Elementary School	
Kennedy High School	
Kenwood Elementary School	
Lasalle Intermediate School	
Nixon Elementary School	
Pierce Elementary School	
Polk Alternative School	
Regis Middle School	
St. Joseph Catholic School	
St. Joseph Early Childhood Daycare	
St. Joseph Preschool	
St. Jude’s Daycare	
St. Jude’s Elementary School	
St. Jude’s Preschool	
St. Ludmila Catholic Center	
St. Ludmila Daycare	
St. Ludmila Preschool	
St. Matthew Preschool	
St. Matthew School	
St. Matthew's Child Care Program	
St. Pius X Child Care Program	
St. Pius X Preschool	
St. Pius X School	
Viola Gibson Elementary School	
Wright Elementary School	
Xavier High School	

Table 8-4. Transit Demand for Medical Facilities and Group Homes

Subarea	Facility Name	Municipality	Capacity	Secured Unit Capacity	Bus Capacity Required	Ambulance Capacity Required	Bus Runs	Ambulance Runs
BENTON COUNTY								
7	Rock Ridge Residential Care Facility	Shellsburg	35	0	35	0	2	0
Linn County Subtotal:			***35***	***0***	***35***	***0***	***2***	***0***
LINN COUNTY								
4	Promise House	Hiawatha	20	20	20	0	1	0
14	Bickford Cottage	Marion	46	7	46	0	2	0
14	Emery Place	Robins	64	19	64	0	3	0
14	Hiawatha Care Center	Hiawatha	109	0	97	12	4	6
14	Keystone Cedars	Cedar Rapids	66	16	66	0	3	0
14	Milestones in Marion	Marion	55	0	55	0	2	0
14	Northbrook Manor Care Center	Cedar Rapids	130	0	130	0	5	0
14	REM Iowa Developmental Services (8)	Hiawatha	65	0	65	0	3	0
14	REM Iowa Developmental Services (9)	Hiawatha	75	0	75	0	3	0
14	Oldorf Hospice House of Mercy	Hiawatha	12	0	12	0	1	0
14	Summit Pointe Living Community	Marion	202	0	202	0	7	0
14	Winslow House Care Center	Marion	50	0	45	5	2	3
15	Manor Care Health Services	Cedar Rapids	105	0	85	20	3	10
15	Sacred Heart Convent	Cedar Rapids	33	0	33	0	2	0
15	St. Luke's Hospital	Cedar Rapids	420	74	330	90	11	45
16	Evergreen Estates I	Cedar Rapids	50	0	50	0	2	0
16	Evergreen Estates II	Cedar Rapids	25	0	25	0	1	0
16	Evergreen Estates III	Cedar Rapids	39	0	39	0	2	0
16	Foundation 2	Cedar Rapids	30	0	30	0	1	0
16	Heritage Nursing and Evergreen Estates	Cedar Rapids	130	24	95	35	4	18
16	Kingston Hill	Cedar Rapids	25	0	25	0	1	0

Subarea	Facility Name	Municipality	Capacity	Secured Unit Capacity	Bus Capacity Required	Ambulance Capacity Required	Bus Runs	Ambulance Runs
16	Meadow View Memory Care Village	Cedar Rapids	68	0	68	0	3	0
16	Meth-Wick Community - Arbor Place	Cedar Rapids	32	32	32	0	2	0
16	Meth-Wick Community - Brendelwood	Cedar Rapids	50	0	50	0	2	0
16	Meth-Wick Community - Custom Care	Cedar Rapids	32	0	32	0	2	0
16	Meth-Wick Community - Deer Ridge	Cedar Rapids	100	0	100	0	4	0
16	Meth-Wick Community - Greenwood Terrace	Cedar Rapids	106	0	106	0	4	0
16	Meth-Wick Community - The Manor	Cedar Rapids	175	0	172	3	6	2
16	Meth-Wick Community - The Woodlands	Cedar Rapids	65	65	55	10	2	5
16	Milestones Adult Day Health Center	Cedar Rapids	70	13	70	0	3	0
16	Prairie Hills Senior Living	Cedar Rapids	86	0	86	0	3	0
16	Ridge View Assisted Living	Cedar Rapids	88	0	88	0	3	0
16	West Ridge Care Center	Cedar Rapids	60	15	40	20	2	10
23	Cottage Grove Place	Cedar Rapids	100	35	99	1	4	1
23	Crestview Acres Care Center	Marion	100	21	80	20	3	10
23	Garnett Place	Cedar Rapids	49	5	49	0	2	0
23	Higley Mansion Care Center	Cedar Rapids	50	0	43	7	2	4
23	Irving Point	Cedar Rapids	110	0	110	0	4	0
23	Linn Manor Care Center	Marion	38	0	33	5	2	3
23	Living Center East	Cedar Rapids	93	0	90	3	3	2
23	Mercy Hallmar Residential Care	Cedar Rapids	55	0	53	2	2	1
23	Mercy Medical Center	Cedar Rapids	305	20	92	213	4	107
23	St. Luke's Living Center West	Cedar Rapids	85	0	75	10	3	5
23	Tanager Place	Cedar Rapids	68	0	68	0	3	0
23	Villages at Marion	Marion	84	20	84	0	3	0
23	Willow Gardens Care Center	Marion	91	0	71	20	3	10
24	Asbury House	Cedar Rapids	20	0	20	0	1	0

Subarea	Facility Name	Municipality	Capacity	Secured Unit Capacity	Bus Capacity Required	Ambulance Capacity Required	Bus Runs	Ambulance Runs
24	Emeritus at Silver Pines	Cedar Rapids	47	0	47	0	2	0
		Linn County Subtotal:	***3,978***	***386***	***3,502***	***476***	***140***	***242***
		EPZ TOTAL:	**4,013**	**386**	**3,537**	**476**	**142**	**242**

Table 8-5. Summary of Transportation Resource Capacities

Transportation Resource	Bus Capacity	Wheelchair Capacity	Ambulance Capacity
Resources Available			
Alburnett School District	841	0	0
Anamosa School District	1,330	50	0
Area Ambulance	0	0	20
Benton Community Schools Transportation	1,054	0	0
Benton County Transportation	80	22	0
Cedar Rapids Bus Department	330	184	0
Cedar Rapids School District	6,776	361	0
Cedar Valley Christian	235	0	0
Center Point Ambulance	0	0	3
Center Point Fire Department	0	0	4
Center Point-Urbana Schools	1,285	0	0
Central City School (North Linn)	549	0	0
College Community School	4,156	225	0
Covenant Ambulance	0	0	6
Hiawatha Ambulance	0	0	3
Hiawatha Fire Department	0	0	2
Independence School	1,198	14	0
Johnson Co. Ambulance	0	0	5
LIFTS	483	137	0
Linn County Care Facilities Total[4]	346		
Linn County Group Homes Total[4]	681		
Linn County Hospitals Total[4]	86		
Linn-Mar Schools	4,293	237	0
Lisbon Schools	537	17	0
Marion Independent Schools	798	71	0
Metro Office of Catholic Ed.	270	0	0
Mt. Vernon School	836	6	0
National Guard	0	0	160
North Benton Ambulance	0	0	4
North Linn Schools	911	16	0
Northeast Linn	0	0	2
Regional medical Ambulance	0	0	2
Sartori Hospital	0	0	5

[4] These values represent total capacities at all facilities, as provided by the county emergency management agencies. The data was not broken down by vehicle type.

Transportation Resource	Bus Capacity	Wheelchair Capacity	Ambulance Capacity
SE Iowa Medical Transport	0	0	26
Solon School District	1,123	61	0
Springville School	450	0	0
St. John's Elementary	65	0	0
St. Luke's Hospital	0	0	2
Tama Ambulance	0	0	6
Tanager Place	48	0	0
Trinity Lutheran School	130	0	0
U of I Hospitals and Clinics	0	0	4
Urbana Fire and Rescue	0	0	2
Vinton/Shellsburg Schools	830	0	0
Washington Co. Ambulance	0	0	242
Waterloo (1st Student) Community Schools	5,845	625	0
Western Dubuque Schools	4,276	126	0
TOTAL:	**39,842**	**2,152**	**498**
Capacity Needed			
Schools (Table 8-2):	42,467	0	0
Medical Facilities (Table 8-4):	3,537	0	476
Transit-Dependent Population (Table 8-10):	6,905	0	0
Homebound Special Needs (Section 8.5):	906	251	15
Correctional Facilities (Section 8.6):	606	0	0
TOTAL TRANSPORTATION CAPACITY NEEDS:	**54,421**	**251**	**491**

Table 8-6. Bus Route Descriptions

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
1	HACAP Head Start - Olivet Harrison Elementary School Harvest Christian DC & Learning Center Jackson Elementary School Josiah's Playground Kinder Kollege Linn County Child Development Center Roosevelt Middle School St. James Kids Club Daycare Kingston Hill Meth-Wick Community - Arbor Place Meth-Wick Community - Brendelwood Meth-Wick Community - Custom Care Meth-Wick Community - Deer Ridge Meth-Wick Community - Greenwood Terrace Meth-Wick Community - The Manor Meth-Wick Community - The Woodlands Milestones Adult Day Health Center	724, 731, 673, 664, 172, 625, 180, 405, 624, 410, 179, 178
2	Asbury House	40, 41, 42, 43, 722, 44, 443, 444, 45
4	Calvery Christian Preschool Caring Corner Christian Daycare Harding Middle School Holloway House Learning Center Jungle Friends Kenwood Elementary School Kindercare Learning Center #292 Rockwell Collins Child Development Center D St. Pius X Child Care Program St. Pius X Preschool St. Pius X School Summit Preschool Summit School (Pre-K - 6th) The Robyn's Nest Wright Elementary School	321, 986, 320, 297, 24, 25, 26, 324, 717, 27, 28, 33, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
5	Essential Montessori School of Hiawatha	290, 289, 288, 19, 20, 21, 23, 25, 26, 27, 28, 33, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
	Five Seasons LC - Viola Gibson	
	Five Seasons Learning Center - Nixon	
	Hand in Hand - Hiawatha	
	Hand in Hand - Tower Lane	
	Hiawatha Elementary School	
	Lily Pad Daycare & Preschool	
	Little Learners Inc.	
	Mother Goose Learning Center	
	Nixon Elementary School	
	The Hiawatha Day School	
	Viola Gibson Elementary School	
	Hiawatha Care Center	
	Oldorf Hospice House of Mercy	
	Promise House	
	REM Iowa Developmental Services (8)	
	REM Iowa Developmental Services (9)	
6	ASAC - Heart of Iowa Child Care	422, 430, 431, 427, 66, 65, 442, 441, 440, 443, 444, 45
	Emeritus at Silver Pines	
7	Busy Bee Day Care Inc.	389, 1249, 1250, 971, 159, 154, 559, 155, 394, 156, 367
	Echo Hill Elementary	
	Excelsior Middle School	
	Hand in Hand - 35th Avenue	
	Hand in Hand - Linn Grove Elementary	
	Indian Creek Elementary School	
	Linn Grove Elementary	
	Linn-Mar Compass Program	
	Linn-Mar High School	
	Novak Elementary School	
	Oak Ridge Middle School	
	Wee Wisdom (Marion)	
	Westfield Elementary	
	Emery Place	
	Keystone Cedars	
	Northbrook Manor Care Center	
	Summit Pointe Living Community	
	Winslow House Care Center	
8	Marion High School	317, 635, 318, 319, 155, 394, 156, 1025, 755, 157, 158, 1056, 454, 72
9	Cedar Valley Christian High School	391, 392, 393, 987, 394, 156, 1025, 755, 157, 158, 1056, 454, 72
	Cedar Valley Christian Preschool	
	Cedar Valley Christian School (7-8)	
	Cedar Valley Christian School (K-6)	
10	Center Point Elementary School (CP)	133, 203, 10, 959, 9, 8, 7, 6, 5
	Kid Zone Daycare & Learning Center	

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
11	Center Point Urbana High School (CP)	598, 274, 134, 133, 203, 10, 959, 9, 8, 7, 6, 5
	Center Point Urbana Middle School (CP)	
	Children Prevail	
	Little People Daycare & Learning Center	
	Pointer Pup Preschool (Center Point)	
12	Taylor Elementary School/Preschool	941, 257, 258, 850, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
	Trinity Lane Preschool	
	Trinity Lutheran Childcare	
	Trinity Lutheran School District	
13	All Saints Catholic School	365, 513, 511, 366, 1024, 759, 988, 156, 1025, 755, 157, 158, 1056, 454
	All Saints Daycare	
	All Saints Preschool	
	Erskine Elementary School	
	Grant Wood Elementary	
	Johnson Elementary School	
14	Bethany Lutheran Preschool	361, 835, 670, 344, 342, 340, 341, 368, 519, 369, 370, 871, 377, 378, 523, 379, 526, 528, 304, 547, 216, 505, 1243, 803, 1241, 1242, 1043, 217, 799, 501, 558, 556, 500, 554, 1246, 1244, 1245, 218, 219, 795, 796, 493, 492, 220, 969, 487, 154, 221
	Cedar Valley Montessori School	
	HACAP Head Start - Urban Family	
	KidsPoint Downtown Learning Center & Preschool	
	St. Paul's Parents Day Out	
	St. Paul's Preschool FOCUS	
	The Cedar Rapids Day School	
	YMCA-Stoney Point	
15	HACAP Head Start - Jane Boyd	844, 749, 994, 746, 855, 246, 991, 245, 244, 243, 242, 241, 1022, 239, 240, 223
	HACAP Head Start - Hayes Center	
	HACAP Horizons	
	McKinley Middle School	
	Metro High School	
	Metro Parent - Child Center	
	St. Ludmila Catholic Center	
	St. Ludmila Daycare	
	St. Ludmila Preschool	
	Teddy Bear Childcare Center	
	The Arc of East Central Iowa	
	Wilson Middle School	
	Tanager Place	
16	Washington High School	371, 372, 516, 365, 513, 511, 366, 1024, 759, 988, 156, 1025, 755, 157, 158, 1056, 454
17	Polk Alternative School	34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
18	Four Oaks Day Program	756, 264, 263, 43, 722, 44, 443, 444, 45
	Grant Elementary School/Preschool	
19	Garfield Elementary School	337, 336, 339, 333, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
	Regis Middle School	
	Sacred Heart Convent	

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
20	Cleveland Elementary School	885, 171, 1046, 180, 406, 881, 1052, 640, 411, 637, 231, 61, 232, 62, 63, 437, 432, 64, 45
	Hoover Elementary School	
	Jefferson Senior High School	
	La Petite Academy	
	Lasalle Intermediate School	
	Little Cupcakes Child Care	
	Little Lambs Christian Preschool	
	Madison Elementary School	
	Mother Goose Daycare	
	My Iman Montessori Preschool	
	Share & Care Christian Preschool	
	St. Jude's Daycare	
	St. Jude's Elementary School	
	St. Jude's Preschool	
	Van Buren Elementary School	
	We Teach 2	
	Evergreen Estates I	
	Evergreen Estates II	
	Evergreen Estates III	
	Foundation 2	
	Heritage Nursing and Evergreen Estates	
	Meadow View Memory Care Village	
	Prairie Hills Senior Living	
	Ridge View Assisted Living	
	West Ridge Care Center	
21	Ascension Lutheran Preschool	968, 779, 508, 317, 635, 318, 319, 155, 394, 156, 1025, 755, 157, 158, 1056, 454
	Francis Marion Intermediate	
	Starry Elementary	
	Vernon Middle School	
	Crestview Acres Care Center	
	Linn Manor Care Center	
22	Apple Kids Marion School District	557, 558, 556, 500, 554, 1246, 1244, 1245, 218, 219, 795, 796, 493, 492, 220, 969, 487, 154, 559, 155, 394, 156, 1025, 755, 157, 158, 1056, 454
	Bowman Woods Elementary	
	Emerson Elementary	
	HACAP Head Start - Marion	
	Kid's Inc. - Marion LC	
	Linn-Mar High School Success Program	
	Our Little Haven	
	St. Joseph Catholic School	
	St. Joseph Early Childhood Daycare	
	St. Joseph Preschool	
	Wilkins Elementary	
	Bickford Cottage	
	Milestones in Marion	
	Villages at Marion	
	Willow Gardens Care Center	

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
23	Arthur Elementary School & Preschool	871, 370, 369, 519, 368, 341, 340, 342, 344, 838, 348, 345, 346, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
	Five Seasons Learning Center - Arthur	
	Franklin Middle School	
	St. Matthew Preschool	
	St. Matthew School	
	St. Matthew's Child Care Program	
	Cottage Grove Place	
	Garnett Place	
	Manor Care Health Services	
24	Apple Kids - Noelridge	681, 680, 570, 226, 299, 985, 24, 25, 26, 27, 28, 33, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
	Children's Corner	
	Children's Weekday Ministry-Lovely Lane	
	Child's Discovery Montessori Preschool	
	Five Season Learning Center - Wright (Age 3-5)	
	Good Shepard Lutheran School (Pre-K - 8th)	
	Isaac Newton Christian Academy & Preschool	
	Kennedy Senior High School	
	Kid's Kampus Learning Center	
	KidsPoint North Learning Center & Preschool	
	Pierce Elementary School	
	Xavier High School	
25	Coolidge Elementary School	652, 654, 169, 733, 170, 414, 1048, 413, 410, 179, 178, 60, 61, 407, 62, 63, 437, 432, 64, 45
	Five Seasons Learning Center - Coolidge (age 3-5)	
	Kindercare Learning Center - West	
	Noah's Ark Preschool	
	Taft Middle and Alternative School	
	Truman Elementary School	
26	Atkins Elementary School	877, 878, 122, 55, 54
	Early Beginnings Preschool/Daycare	
27	Center Point Intermediate School (Urbana)	609, 78, 273, 272, 7, 6, 5
	Kid Zone Daycare (Urbana)	
28	Shellsburg Elementary School	689, 688, 958, 75, 128, 938, 129
	Rock Ridge Residential Care Facility	
30	Alburnett Schools	942, 1008, 162, 1057, 575
	Kids Inc. - Alburnett	
40	Linn County Correctional Center	1005, 822, 823, 824, 837, 674, 360, 747, 742, 853, 675, 739, 258, 850, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
41	Higley Mansion Care Center	665, 362, 750, 363, 816, 819, 364, 403, 365, 513, 511, 366, 1024, 759, 988, 156, 1025, 755, 157, 158, 1056, 454
	Irving Point	
	Mercy Hallmar Residential Care	
	Mercy Medical Center	
42	Living Center East	630, 362, 750, 363, 816, 819, 364, 403, 365, 513, 511, 366, 1024, 759, 988, 156, 1025, 755, 157, 158, 1056, 454
	St. Luke's Hospital	
	St. Luke's Living Center West	
43	Anchor Center	261, 262, 883, 263, 43, 722, 44, 443, 444, 45
	Hinzman Center	
	Lary Nelson Center	

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
51	Transit Route 1	196, 197, 198, 199, 200, 201, 202, 203, 133, 134, 599, 596, 135, 582, 136, 581
52	Transit Route 2	768, 765, 763, 762, 209, 287, 210, 1102, 917, 918, 463, 465, 211, 805, 21, 23, 25, 26, 27, 28, 33, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
53	Transit Route 3	189, 593, 592, 188, 1103, 190, 191, 1090, 1091, 1095, 1093, 1092, 192, 193, 760, 653, 729, 726, 728, 414, 1048, 413, 410, 412, 1049, 1050, 411, 1072, 642, 998, 884, 262, 265, 433, 266
54	Transit Route 4	184, 74, 688, 958, 75, 76, 77, 609, 78, 273, 272, 7, 6, 5
55	Transit Route 5	596, 135, 149, 2, 150, 152
56	Transit Route 6	282, 704, 281, 705, 277, 14, 771, 13, 12, 772, 11, 10, 959, 9, 8, 7, 6, 5
57	Transit Route 7	306, 707, 708, 307, 308, 309, 815, 314, 315, 482, 383, 387, 388, 160, 159, 154, 559, 155, 394, 156, 1025, 755, 157, 158, 1056, 454
58	Transit Route 8	290, 565, 291, 312, 313, 314, 316, 574, 217, 799, 501, 558, 556, 500, 554, 1246, 1244, 1245, 218, 219, 795, 796, 493, 492, 220, 969, 487, 154, 559, 155, 394, 156, 1025, 755, 157, 158, 1056, 454
59	Transit Route 9	216, 547, 304, 528, 526, 379, 523, 378, 377, 871, 370, 369, 519, 368, 341, 340, 342, 344, 670, 835, 361, 349, 671, 248, 354, 256, 741, 743, 851, 258, 850, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
60	Transit Route 10	210, 1100, 566, 224, 1077, 1078, 225, 899, 568, 226, 227, 898, 323, 1012, 326, 335, 334, 333, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
61	Transit Route 11	210, 1102, 917, 918, 463, 465, 211, 212, 1169, 213, 214, 1020, 295, 321, 467, 380, 328, 1017, 327, 1018, 325, 324, 717, 27, 28, 33, 32, 770, 34, 35, 347, 355, 353, 36, 37, 40, 41, 42, 43, 722, 44, 443, 444, 45
62	Transit Route 12	249, 395, 253, 649, 892, 194, 230, 653, 901, 652, 654, 169, 165, 737, 57, 926, 56, 122, 55, 54
63	Transit Route 13	248, 354, 256, 672, 255, 939, 173, 972, 673, 664, 172, 625, 180, 405, 624, 410, 179, 59, 168, 655, 58, 57, 926, 56, 122, 55, 54
64	Transit Route 14	191, 1090, 1091, 1095, 1093, 1092, 192, 927, 1027, 1028, 877, 56, 122, 55, 54
65	Transit Route 15	184, 74, 688, 958, 75, 76, 77, 609, 78, 273, 272, 7, 6, 5
66	Transit Route 16	216, 547, 304, 528, 526, 379, 523, 378, 377, 871, 370, 369, 519, 368, 341, 340, 342, 753, 632, 631, 630, 362, 750, 363, 816, 819, 364, 403, 365, 513, 511, 366, 1024, 759, 988, 156, 1025, 755, 157, 158, 1056, 454
67	Transit Route 17	370, 369, 519, 368, 341, 340, 342, 753, 632, 631, 668, 843, 856, 836, 837, 674, 360, 845, 820, 665, 362, 750, 363, 816, 819, 364, 403, 365, 513, 511, 366, 1024, 759, 988, 156, 1025, 755, 157, 158, 1056, 454

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
68	Transit Route 18	372, 516, 365, 403, 364, 819, 816, 363, 750, 362, 665, 820, 845, 360, 749, 994, 746, 855, 246, 991, 245, 244, 243, 242, 241, 1022, 239, 448, 69, 950, 869, 867, 1200, 636, 70, 71, 453
69	Transit Route 19	824, 833, 834, 835, 361, 349, 671, 248, 354, 256, 672, 255, 939, 173, 972, 673, 664, 172, 625, 180, 405, 624, 410, 412, 1049, 1050, 411, 1072, 642, 998, 884, 262, 265, 433, 266
70	Transit Route 20	822, 823, 831, 349, 671, 248, 354, 256, 672, 255, 939, 173, 972, 673, 664, 172, 890, 628, 404, 260, 261, 997, 645, 644, 999, 643, 406, 881, 1052, 640, 411, 1072, 642, 998, 884, 262, 265, 433, 266
71	Transit Route 21	360, 747, 742, 853, 247, 854, 246, 398, 399, 419, 756, 421, 422, 426, 423, 428, 67, 68, 445, 446, 69, 950, 869, 867, 1200, 636, 70, 71, 453

Table 8-7. Evacuation Time Estimates for Schools, Preschools and Daycares - Good Weather

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
BENTON COUNTY SCHOOLS												
Atkins Elementary School	60	15	3.5	3.8	56	**2:15**	9.5	23	**2:35**	52.7	80	**3:35**
Center Point Intermediate School (Urbana)	60	15	2.5	44.4	4	**1:20**	16.3	40	**2:00**	16.9	26	**1:45**
Early Beginnings Preschool/Daycare	60	15	3.5	3.8	56	**2:15**	9.5	23	**2:35**	52.7	80	**3:35**
Kid Zone Daycare (Urbana)	60	15	2.5	44.4	4	**1:20**	16.3	40	**2:00**	16.9	26	**1:45**
Shellsburg Elementary School	60	15	5.0	46.0	7	**1:25**	8.0	20	**1:45**	16.9	26	**1:50**
LINN COUNTY SCHOOLS												
Alburnett Schools	60	15	3.6	54.9	4	**1:20**	15.3	37	**2:00**	52.7	80	**2:40**
All Saints Catholic School	60	15	8.9	3.7	144	**3:40**	23.0	56	**4:35**	68.0	102	**5:25**
All Saints Daycare	60	15	8.9	3.7	144	**3:40**	23.0	56	**4:35**	68.0	102	**5:25**
All Saints Preschool	60	15	8.9	3.7	144	**3:40**	23.0	56	**4:35**	68.0	102	**5:25**
Apple Kids Marion School District	60	15	10.3	4.4	142	**3:40**	7.9	19	**4:00**	23.7	36	**4:15**
Apple Kids - Noelridge	60	15	9.9	2.4	249	**5:25**	18.7	45	**6:10**	22.3	34	**6:00**
Arthur Elementary School & Preschool	60	15	9.0	2.2	245	**5:20**	18.7	45	**6:05**	22.3	34	**5:55**
ASAC - Heart of Iowa Child Care	60	15	11.4	13.3	52	**2:10**	18.7	45	**2:55**	22.3	34	**2:45**
Ascension Lutheran Preschool	60	15	10.0	6.2	98	**2:55**	18.7	45	**3:40**	22.3	34	**3:30**
Bethany Lutheran Preschool	60	15	9.2	2.4	234	**5:10**	18.7	45	**5:55**	22.3	34	**5:45**
Bowman Woods Elementary	60	15	9.5	4.4	130	**3:25**	18.7	45	**4:10**	22.3	34	**4:00**
Busy Bee Day Care Inc.	60	15	8.2	5.5	90	**2:45**	18.7	45	**3:30**	22.3	34	**3:20**
Calvery Christian Prechool	60	15	8.2	2.4	208	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Caring Corner Christian Daycare	60	15	12.8	2.7	285	**6:00**	18.7	45	**6:45**	22.3	34	**6:35**
Cedar Valley Christian High School	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Christian Preschool	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Christian School (7-8)	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Christian School (K-6)	60	15	8.5	2.4	209	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Cedar Valley Montessori School	60	15	5.0	1.9	156	**3:55**	18.7	45	**4:40**	22.3	34	**4:25**
Center Point Elementary School (CP)	60	15	2.5	55.0	3	**1:20**	18.7	45	**2:05**	22.3	34	**1:55**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Center Point Urbana High School (CP)	60	15	2.6	55.0	3	**1:20**	18.7	45	**2:05**	22.3	34	**1:55**
Center Point Urbana Middle School (CP)	60	15	7.6	55.0	9	**1:25**	18.7	45	**2:10**	22.3	34	**2:00**
Children Prevail	60	15	9.3	55.0	11	**1:30**	18.7	45	**2:15**	22.3	34	**2:00**
Children's Corner	60	15	11.7	2.6	275	**5:50**	18.7	45	**6:35**	22.3	34	**6:25**
Children's Weekday Ministery-Lovely Lane	60	15	7.5	2.2	207	**4:45**	18.7	45	**5:30**	22.3	34	**5:20**
Child's Discovery Montessori Preschool	60	15	7.9	2.2	214	**4:50**	18.7	45	**5:35**	22.3	34	**5:25**
Cleveland Elementary School	60	15	3.1	4.6	41	**2:00**	18.7	45	**2:45**	22.3	34	**2:30**
Coolidge Elementary School	60	15	13.3	3.5	228	**5:05**	15.3	37	**5:40**	52.7	80	**6:25**
Echo Hill Elementary	60	15	10.7	5.6	115	**3:10**	18.7	45	**3:55**	22.3	34	**3:45**
Emerson Elementary	60	15	10.3	4.4	142	**3:40**	18.7	45	**4:25**	22.3	34	**4:15**
Erskine Elementary School	60	15	7.2	3.9	110	**3:05**	18.7	45	**3:50**	22.3	34	**3:40**
Essential Montessori School of Hiawatha	60	15	10.5	2.5	257	**5:35**	18.7	45	**6:20**	22.3	34	**6:10**
Excelsior Middle School	60	15	8.2	5.5	90	**2:45**	18.7	45	**3:30**	22.3	34	**3:20**
Five Season Learning Center - Wright (Age 3-5)	60	15	9.9	2.4	249	**5:25**	18.7	45	**6:10**	22.3	34	**6:00**
Five Seasons LC - Viola Gibson	60	15	12.2	2.6	281	**6:00**	18.7	45	**6:45**	22.3	34	**6:30**
Five Seasons Learning Center - Arthur	60	15	9.0	2.2	245	**5:20**	18.7	45	**6:05**	22.3	34	**5:55**
Five Seasons Learning Center - Coolidge (age 3-5)	60	15	13.3	3.5	228	**5:05**	15.3	37	**5:40**	52.7	80	**6:25**
Five Seasons Learning Center - Nixon	60	15	12.1	2.6	278	**5:55**	15.3	37	**6:30**	52.7	80	**7:15**
Four Oaks Day Program	60	15	3.6	3.3	66	**2:25**	15.3	37	**3:00**	52.7	80	**3:45**
Francis Marion Intermediate	60	15	8.8	6.1	86	**2:45**	15.3	37	**3:20**	52.7	80	**4:05**
Franklin Middle School	60	15	8.3	2.2	227	**5:05**	15.3	37	**5:40**	52.7	80	**6:25**
Garfield Elementary School	60	15	8.2	2.5	201	**4:40**	15.3	37	**5:15**	52.7	80	**6:00**
Good Shepard Lutheran School (prek - 8th)	60	15	9.9	2.4	249	**5:25**	15.3	37	**6:05**	52.7	80	**6:45**

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Grant Elementary School/Preschool	60	15	6.7	3.4	120	**3:15**	15.3	37	**3:55**	52.7	80	**4:35**
Grant Wood Elementary	60	15	7.8	3.9	120	**3:15**	15.3	37	**3:55**	52.7	80	**4:35**
HACAP Head Start - Jane Boyd	60	15	5.5	5.3	63	**2:20**	15.3	37	**2:55**	52.7	80	**3:40**
HACAP Head Start - Hayes Ctr	60	15	3.6	5.2	42	**2:00**	15.3	37	**2:35**	52.7	80	**3:20**
HACAP Head Start - Marion	60	15	10.3	4.4	142	**3:40**	15.3	37	**4:15**	52.7	80	**5:00**
HACAP Head Start - Olivet	60	15	6.4	3.4	112	**3:10**	15.3	37	**3:45**	52.7	80	**4:30**
HACAP Head Start - Urban Family	60	15	7.5	2.2	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
HACAP Horizons	60	15	5.0	5.2	58	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
Hand in Hand - 35th Avenue	60	15	13.8	5.9	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
Hand in Hand - Hiawatha	60	15	8.7	2.4	222	**5:00**	15.3	37	**5:35**	52.7	80	**6:20**
Hand in Hand - Linn Grove Elementary	60	15	12.1	5.8	125	**3:20**	15.3	37	**4:00**	52.7	80	**4:40**
Hand in Hand - Tower Lane	60	15	9.7	2.4	241	**5:20**	15.3	37	**5:55**	52.7	80	**6:40**
Harding Middle School	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**
Harrison Elementary School	60	15	4.4	2.9	92	**2:50**	15.3	37	**3:25**	52.7	80	**4:10**
Harvest Christian DC & Learning Center	60	15	5.9	3.3	108	**3:05**	15.3	37	**3:40**	52.7	80	**4:25**
Hiawatha Elementary School	60	15	10.4	2.4	255	**5:30**	15.3	37	**6:10**	52.7	80	**6:50**
Holloway House Learning Center	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**
Hoover Elementary School	60	15	2.3	4.5	31	**1:50**	15.3	37	**2:25**	52.7	80	**3:10**
Indian Creek Elementary School	60	15	7.2	5.5	79	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
Isaac Newton Christian Academy & Preschool	60	15	7.8	2.2	211	**4:50**	15.3	37	**5:25**	52.7	80	**6:10**
Jackson Elementary School	60	15	3.6	3.0	72	**2:30**	15.3	37	**3:05**	52.7	80	**3:50**
Jefferson Senior High School	60	15	6.1	4.9	75	**2:30**	15.3	37	**3:10**	52.7	80	**3:50**
Johnson Elementary School	60	15	7.8	3.9	120	**3:15**	15.3	37	**3:55**	52.7	80	**4:35**
Josiah's Playground	60	15	6.4	3.4	112	**3:10**	15.3	37	**3:45**	52.7	80	**4:30**
Jungle Friends	60	15	11.2	2.6	264	**5:40**	15.3	37	**6:20**	52.7	80	**7:00**
Kennedy Senior High School	60	15	9.8	2.4	247	**5:25**	15.3	37	**6:00**	52.7	80	**6:45**
Kenwood Elementary School	60	15	10.2	2.5	249	**5:25**	15.3	37	**6:05**	52.7	80	**6:45**
Kid Zone Daycare & Learning Center	60	15	9.4	55.0	11	**1:30**	15.3	37	**2:05**	52.7	80	**2:50**
Kids Inc - Alburnett	60	15	3.6	54.9	4	**1:20**	15.3	37	**2:00**	52.7	80	**2:40**

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Kid's Inc. - Marion LC	60	15	11.2	4.4	154	**3:50**	15.3	37	**4:30**	52.7	80	**5:10**
Kid's Kampus Learning Center	60	15	8.2	9.9	50	**2:05**	15.3	37	**2:45**	52.7	80	**3:25**
KidsPoint Downtown Learning Center & Preschool	60	15	5.0	1.9	156	**3:55**	15.3	37	**4:30**	52.7	80	**5:15**
KidsPoint North Learning Center & Preschool	60	15	11.7	2.6	275	**5:50**	15.3	37	**6:30**	52.7	80	**7:10**
Kinder Kollege	60	15	3.5	3.0	70	**2:25**	15.3	37	**3:05**	52.7	80	**3:45**
Kindercare Learning Center - West	60	15	12.8	12.8	60	**2:15**	15.3	37	**2:55**	52.7	80	**3:35**
Kindercare Learning Center #292	60	15	12.8	2.7	285	**6:00**	15.3	37	**6:40**	52.7	80	**7:20**
La Petite Academy	60	15	11.8	4.6	154	**3:50**	15.3	37	**4:30**	52.7	80	**5:10**
Lasalle Intermediate School	60	15	6.6	4.9	81	**2:40**	15.3	37	**3:15**	52.7	80	**4:00**
Lily Pad Daycare & Preschool	60	15	12.1	2.6	278	**5:55**	15.3	37	**6:30**	52.7	80	**7:15**
Linn County Child Development Center	60	15	4.2	2.8	89	**2:45**	15.3	37	**3:25**	52.7	80	**4:05**
Linn Grove Elementary	60	15	5.2	5.7	56	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
Linn-Mar Compass Program	60	15	7.8	5.5	85	**2:40**	15.3	37	**3:20**	52.7	80	**4:00**
Linn-Mar High School	60	15	7.8	5.5	85	**2:40**	15.3	37	**3:20**	52.7	80	**4:00**
Linn-Mar High School Success Program	60	15	7.8	4.4	108	**3:05**	15.3	37	**3:40**	52.7	80	**4:25**
Little Cupcakes Child Care	60	15	1.9	4.6	25	**1:40**	15.3	37	**2:20**	52.7	80	**3:00**
Little Lambs Christian Preschool	60	15	10.4	4.6	137	**3:35**	15.3	37	**4:10**	52.7	80	**4:55**
Little Learners Inc.	60	15	10.5	2.5	257	**5:35**	15.3	37	**6:10**	52.7	80	**6:55**
Little People Daycare & Learning Center	60	15	2.5	55.0	3	**1:20**	15.3	37	**1:55**	52.7	80	**2:40**
Madison Elementary School	60	15	5.5	4.8	69	**2:25**	15.3	37	**3:05**	52.7	80	**3:45**
Marion High School	60	15	10.0	7.1	85	**2:40**	15.3	37	**3:20**	52.7	80	**4:00**
McKinley Middle School	60	15	5.0	5.2	58	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
Metro High School	60	15	4.1	5.2	48	**2:05**	15.3	37	**2:40**	52.7	80	**3:25**
Metro Parent - Child Center	60	15	4.1	5.2	48	**2:05**	15.3	37	**2:40**	52.7	80	**3:25**
Mother Goose Daycare	60	15	2.3	4.5	31	**1:50**	15.3	37	**2:25**	52.7	80	**3:10**
Mother Goose Learning Center	60	15	10.5	4.5	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
My Iman Montessori Preschool	60	15	3.1	4.6	41	**2:00**	15.3	37	**2:35**	52.7	80	**3:20**
Nixon Elementary School	60	15	12.1	2.6	278	**5:55**	15.3	37	**6:30**	52.7	80	**7:15**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Noah's Ark Preschool	60	15	2.9	12.2	15	**1:30**	15.3	37	**2:10**	52.7	80	**2:50**
Novak Elementary School	60	15	8.2	5.5	90	**2:45**	15.3	37	**3:25**	52.7	80	**4:05**
Oak Ridge Middle School	60	15	10.1	5.6	109	**3:05**	15.3	37	**3:45**	52.7	80	**4:25**
Our Little Haven	60	15	5.8	4.4	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
Pierce Elementary School	60	15	9.5	2.4	240	**5:15**	15.3	37	**5:55**	52.7	80	**6:35**
Pointer Pup Preschool (Center Point)	60	15	2.6	55.0	3	**1:20**	15.3	37	**1:55**	52.7	80	**2:40**
Polk Alternative School	60	15	7.5	3.1	147	**3:45**	15.3	37	**4:20**	52.7	80	**5:05**
Regis Middle School	60	15	8.6	2.5	208	**4:45**	15.3	37	**5:20**	52.7	80	**6:05**
Rockwell Collins Child Development Center D	60	15	12.8	2.7	285	**6:00**	15.3	37	**6:40**	52.7	80	**7:20**
Roosevelt Middle School	60	15	6.4	3.4	112	**3:10**	15.3	37	**3:45**	52.7	80	**4:30**
Share & Care Christian Preschool	60	15	2.3	4.5	31	**1:50**	15.3	37	**2:25**	52.7	80	**3:10**
St. James Kids Club Daycare	60	15	4.4	2.9	92	**2:50**	15.3	37	**3:25**	52.7	80	**4:10**
St. Joseph Catholic School	60	15	12.7	4.5	168	**4:05**	15.3	37	**4:40**	52.7	80	**5:25**
St. Joseph Early Childhood Daycare	60	15	12.7	4.5	168	**4:05**	15.3	37	**4:40**	52.7	80	**5:25**
St. Joseph Preschool	60	15	12.7	4.5	168	**4:05**	15.3	37	**4:40**	52.7	80	**5:25**
St. Judes Daycare	60	15	6.5	4.9	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
St. Judes Elementary School	60	15	6.5	4.9	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
St. Judes Preschool	60	15	6.5	4.9	80	**2:35**	15.3	37	**3:15**	52.7	80	**3:55**
St. Ludmila Catholic Center	60	15	4.5	5.2	52	**2:10**	15.3	37	**2:45**	52.7	80	**3:30**
St. Ludmila Daycare	60	15	4.5	5.2	52	**2:10**	15.3	37	**2:45**	52.7	80	**3:30**
St. Ludmila Preschool	60	15	4.5	5.2	52	**2:10**	15.3	37	**2:45**	52.7	80	**3:30**
St. Matthew Preschool	60	15	8.7	2.2	237	**5:15**	15.3	37	**5:50**	52.7	80	**6:35**
St. Matthew School	60	15	8.7	2.2	237	**5:15**	15.3	37	**5:50**	52.7	80	**6:35**
St. Matthew's Child Care Program	60	15	8.7	2.2	237	**5:15**	15.3	37	**5:50**	52.7	80	**6:35**
St. Paul's Parents Day Out	60	15	7.5	2.2	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
St. Paul's Preschool FOCUS	60	15	7.5	2.2	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
St. Pius X Child Care Program	60	15	7.5	2.3	193	**4:30**	15.3	37	**5:05**	52.7	80	**5:50**
St. Pius X Preschool	60	15	10.1	2.5	246	**5:25**	15.3	37	**6:00**	52.7	80	**6:45**
St. Pius X School	60	15	10.1	2.5	246	**5:25**	15.3	37	**6:00**	52.7	80	**6:45**
Starry Elementary	60	15	10.1	6.2	99	**2:55**	15.3	37	**3:35**	52.7	80	**4:15**
Summit Preschool	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Summit School (PreK - 6th)	60	15	10.4	2.5	253	**5:30**	15.3	37	**6:05**	52.7	80	**6:50**
Taft Middle and Alternative School	60	15	8.2	13.2	38	**1:55**	15.3	37	**2:30**	52.7	80	**3:15**
Taylor Elementary School/Preschool	60	15	9.3	2.8	198	**4:35**	15.3	37	**5:10**	52.7	80	**5:55**
Teddy Bear Childcare Center	60	15	6.7	5.3	77	**2:35**	15.3	37	**3:10**	52.7	80	**3:55**
The Arc of East Central Iowa	60	15	5.0	5.2	58	**2:15**	15.3	37	**2:50**	52.7	80	**3:35**
The Cedar Rapids Day School	60	15	9.7	2.4	239	**5:15**	15.3	37	**5:55**	52.7	80	**6:35**
The Hiawatha Day School	60	15	10.4	2.4	255	**5:30**	15.3	37	**6:10**	52.7	80	**6:50**
The Robyn's Nest	60	15	8.4	2.4	210	**4:45**	15.3	37	**5:25**	52.7	80	**6:05**
Trinity Lane Preschool	60	15	9.3	2.8	198	**4:35**	15.3	37	**5:10**	52.7	80	**5:55**
Trinity Lutheran Childcare	60	15	6.0	2.6	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
Trinity Lutheran School District	60	15	6.0	2.6	140	**3:35**	15.3	37	**4:15**	52.7	80	**4:55**
Truman Elementary School	60	15	2.9	12.2	15	**1:30**	15.3	37	**2:10**	52.7	80	**2:50**
Van Buren Elementary School	60	15	11.9	3.2	224	**5:00**	18.7	45	**5:45**	22.3	34	**5:35**
Vernon Middle School	60	15	10.5	6.2	103	**3:00**	18.7	45	**3:45**	22.3	34	**3:35**
Viola Gibson Elementary School	60	15	12.2	2.6	281	**6:00**	18.7	45	**6:45**	22.3	34	**6:30**
Washington High School	60	15	9.2	2.3	245	**5:20**	18.7	45	**6:05**	22.3	34	**5:55**
We Teach 2	60	15	5.9	4.8	74	**2:30**	18.7	45	**3:15**	22.3	34	**3:05**
Wee Wisdom (Marion)	60	15	5.8	5.6	63	**2:20**	18.7	45	**3:05**	22.3	34	**2:55**
Westfield Elementary	60	15	10.5	5.6	113	**3:10**	18.7	45	**3:55**	22.3	34	**3:45**
Wilkins Elementary	60	15	5.8	4.4	80	**2:35**	18.7	45	**3:20**	22.3	34	**3:10**
Wilson Middle School	60	15	7.0	5.3	80	**2:35**	18.7	45	**3:20**	22.3	34	**3:10**
Wright Elementary School	60	15	9.9	2.5	240	**5:15**	18.7	45	**6:00**	22.3	34	**5:50**
Xavier High School	60	15	12.0	2.6	277	**5:55**	18.7	45	**6:40**	22.3	34	**6:30**
YMCA-Stoney Point	60	15	1.4	1.8	48	**2:05**	11.9	29	**2:35**	77.2	116	**4:00**
					Maximum for EPZ:	**6:00**		**Maximum:**	**6:45**		**Maximum:**	**7:20**
					Average for EPZ:	**3:40**		**Average:**	**4:20**		**Average:**	**4:45**

Table 8-8. Evacuation Time Estimates for Schools, Preschools and Daycares – Rain

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
BENTON COUNTY SCHOOLS												
Atkins Elementary School	70	20	3.5	3.9	55	**2:25**	9.5	29	**2:55**	52.7	80	**3:45**
Center Point Intermediate School (Urbana)	70	20	2.5	41.3	4	**1:35**	16.3	49	**2:25**	16.9	26	**2:00**
Early Beginnings Preschool/Daycare	70	20	3.5	3.9	55	**2:25**	9.5	29	**2:55**	52.7	80	**3:45**
Kid Zone Daycare (Urbana)	70	20	2.5	41.3	4	**1:35**	16.3	49	**2:25**	16.9	26	**2:00**
Shellsburg Elementary School	70	20	5.0	38.4	8	**1:40**	8.0	24	**2:05**	16.9	26	**2:05**
LINN COUNTY SCHOOLS												
Alburnett Schools	70	20	3.6	7.2	30	**2:00**	15.3	46	**2:50**	52.7	91	**3:35**
All Saints Catholic School	70	20	8.9	3.1	173	**4:25**	23.0	69	**5:35**	68.0	117	**6:20**
All Saints Daycare	70	20	8.9	3.1	173	**4:25**	23.0	69	**5:35**	68.0	117	**6:20**
All Saints Preschool	70	20	8.9	3.1	173	**4:25**	23.0	69	**5:35**	68.0	117	**6:20**
Apple Kids Marion School District	70	20	10.3	3.9	160	**4:10**	7.9	24	**4:35**	23.7	41	**4:55**
Apple Kids - Noelridge	70	20	9.9	2.3	256	**5:50**	18.7	57	**6:45**	22.3	39	**6:25**
Arthur Elementary School & Preschool	70	20	9.0	2.1	258	**5:50**	18.7	57	**6:45**	22.3	39	**6:30**
ASAC - Heart of Iowa Child Care	70	20	11.4	9.3	74	**2:45**	18.7	57	**3:45**	22.3	39	**3:25**
Ascension Lutheran Preschool	70	20	10.0	5.9	102	**3:15**	18.7	57	**4:10**	22.3	39	**3:55**
Bethany Lutheran Preschool	70	20	9.2	2.1	262	**5:55**	18.7	57	**6:50**	22.3	39	**6:35**
Bowman Woods Elementary	70	20	9.5	3.8	150	**4:00**	18.7	57	**5:00**	22.3	39	**4:40**
Busy Bee Day Care Inc.	70	20	8.2	5.2	94	**3:05**	18.7	57	**4:05**	22.3	39	**3:45**
Calvery Christian Prechool	70	20	8.2	2.3	212	**5:05**	18.7	57	**6:00**	22.3	39	**5:45**
Caring Corner Christian Daycare	70	20	12.8	4.1	188	**4:40**	18.7	57	**5:35**	22.3	39	**5:20**
Cedar Valley Christian High School	70	20	8.5	2.1	248	**5:40**	18.7	57	**6:35**	22.3	39	**6:20**
Cedar Valley Christian Preschool	70	20	8.5	2.1	248	**5:40**	18.7	57	**6:35**	22.3	39	**6:20**
Cedar Valley Christian School (7-8)	70	20	8.5	2.1	248	**5:40**	18.7	57	**6:35**	22.3	39	**6:20**
Cedar Valley Christian School (K-6)	70	20	8.5	2.1	248	**5:40**	18.7	57	**6:35**	22.3	39	**6:20**
Cedar Valley Montessori School	70	20	5.0	1.8	166	**4:20**	18.7	57	**5:15**	22.3	39	**4:55**
Center Point Elementary School (CP)	70	20	2.5	2.7	56	**2:30**	18.7	57	**3:25**	22.3	39	**3:05**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Center Point Urbana High School (CP)	70	20	2.6	4.6	34	**2:05**	18.7	57	**3:05**	22.3	39	**2:45**
Center Point Urbana Middle School (CP)	70	20	7.6	4.9	94	**3:05**	18.7	57	**4:05**	22.3	39	**3:45**
Children Prevail	70	20	9.3	3.6	155	**4:05**	18.7	57	**5:05**	22.3	39	**4:45**
Children's Corner	70	20	11.7	2.4	292	**6:25**	18.7	57	**7:20**	22.3	39	**7:05**
Children's Weekday Ministery-Lovely Lane	70	20	7.5	2.2	209	**5:00**	18.7	57	**6:00**	22.3	39	**5:40**
Child's Discovery Montessori Preschool	70	20	7.9	2.3	206	**5:00**	18.7	57	**5:55**	22.3	39	**5:35**
Cleveland Elementary School	70	20	3.1	4.2	45	**2:15**	18.7	57	**3:15**	22.3	39	**2:55**
Coolidge Elementary School	70	20	13.3	4.5	179	**4:30**	15.3	46	**5:15**	52.7	91	**6:00**
Echo Hill Elementary	70	20	10.7	4.5	144	**3:55**	18.7	57	**4:55**	22.3	39	**4:35**
Emerson Elementary	70	20	10.3	5.2	119	**3:30**	18.7	57	**4:30**	22.3	39	**4:10**
Erskine Elementary School	70	20	7.2	3.8	115	**3:25**	18.7	57	**4:25**	22.3	39	**4:05**
Essential Montessori School of Hiawatha	70	20	10.5	3.1	204	**4:55**	18.7	57	**5:55**	22.3	39	**5:35**
Excelsior Middle School	70	20	8.2	2.3	217	**5:10**	18.7	57	**6:05**	22.3	39	**5:50**
Five Season Learning Center - Wright (Age 3-5)	70	20	9.9	5.2	114	**3:25**	18.7	57	**4:25**	22.3	39	**4:05**
Five Seasons LC - Viola Gibson	70	20	12.2	2.3	320	**6:50**	18.7	57	**7:50**	22.3	39	**7:30**
Five Seasons Learning Center - Arthur	70	20	9.0	2.2	244	**5:35**	18.7	57	**6:35**	22.3	39	**6:15**
Five Seasons Learning Center - Coolidge (age 3-5)	70	20	13.3	3.0	264	**5:55**	15.3	46	**6:40**	52.7	91	**7:25**
Five Seasons Learning Center - Nixon	70	20	12.1	3.1	238	**5:30**	15.3	46	**6:15**	52.7	91	**7:00**
Four Oaks Day Program	70	20	3.6	5.4	40	**2:10**	15.3	46	**3:00**	52.7	91	**3:45**
Francis Marion Intermediate	70	20	8.8	3.5	149	**4:00**	15.3	46	**4:45**	52.7	91	**5:30**
Franklin Middle School	70	20	8.3	3.8	133	**3:45**	15.3	46	**4:30**	52.7	91	**5:15**
Garfield Elementary School	70	20	8.2	3.4	144	**3:55**	15.3	46	**4:40**	52.7	91	**5:25**
Good Shepard Lutheran School (prek - 8th)	70	20	9.9	2.3	255	**5:45**	15.3	46	**6:35**	52.7	91	**7:20**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Grant Elementary School/Preschool	70	20	6.7	2.2	185	**4:35**	15.3	46	**5:25**	52.7	91	**6:10**
Grant Wood Elementary	70	20	7.8	5.3	90	**3:00**	15.3	46	**3:50**	52.7	91	**4:35**
HACAP Head Start - Jane Boyd	70	20	5.5	2.0	163	**4:15**	15.3	46	**5:00**	52.7	91	**5:45**
HACAP Head Start - Hayes Ctr	70	20	3.6	5.3	42	**2:15**	15.3	46	**3:00**	52.7	91	**3:45**
HACAP Head Start - Marion	70	20	10.3	2.3	264	**5:55**	15.3	46	**6:40**	52.7	91	**7:25**
HACAP Head Start - Olivet	70	20	6.4	6.1	64	**2:35**	15.3	46	**3:20**	52.7	91	**4:05**
HACAP Head Start - Urban Family	70	20	7.5	3.8	118	**3:30**	15.3	46	**4:15**	52.7	91	**5:00**
HACAP Horizons	70	20	5.0	2.0	151	**4:05**	15.3	46	**4:50**	52.7	91	**5:35**
Hand in Hand - 35th Avenue	70	20	13.8	2.6	324	**6:55**	15.3	46	**7:40**	52.7	91	**8:25**
Hand in Hand - Hiawatha	70	20	8.7	4.2	126	**3:40**	15.3	46	**4:25**	52.7	91	**5:10**
Hand in Hand - Linn Grove Elementary	70	20	12.1	5.5	133	**3:45**	15.3	46	**4:30**	52.7	91	**5:15**
Hand in Hand - Tower Lane	70	20	9.7	2.3	252	**5:45**	15.3	46	**6:30**	52.7	91	**7:15**
Harding Middle School	70	20	10.4	5.9	107	**3:20**	15.3	46	**4:05**	52.7	91	**4:50**
Harrison Elementary School	70	20	4.4	2.9	92	**3:05**	15.3	46	**3:50**	52.7	91	**4:35**
Harvest Christian DC & Learning Center	70	20	5.9	2.3	151	**4:05**	15.3	46	**4:50**	52.7	91	**5:35**
Hiawatha Elementary School	70	20	10.4	3.9	162	**4:15**	15.3	46	**5:00**	52.7	91	**5:45**
Holloway House Learning Center	70	20	10.4	2.3	270	**6:00**	15.3	46	**6:50**	52.7	91	**7:35**
Hoover Elementary School	70	20	2.3	1.9	72	**2:45**	15.3	46	**3:30**	52.7	91	**4:15**
Indian Creek Elementary School	70	20	7.2	3.4	127	**3:40**	15.3	46	**4:25**	52.7	91	**5:10**
Isaac Newton Christian Academy & Preschool	70	20	7.8	41.8	12	**1:45**	15.3	46	**2:30**	52.7	91	**3:15**
Jackson Elementary School	70	20	3.6	7.2	30	**2:00**	15.3	46	**2:50**	52.7	91	**3:35**
Jefferson Senior High School	70	20	6.1	3.8	98	**3:10**	15.3	46	**3:55**	52.7	91	**4:40**
Johnson Elementary School	70	20	7.8	9.9	48	**2:20**	15.3	46	**3:05**	52.7	91	**3:50**
Josiah's Playground	70	20	6.4	2.0	195	**4:45**	15.3	46	**5:35**	52.7	91	**6:20**
Jungle Friends	70	20	11.2	2.4	283	**6:15**	15.3	46	**7:00**	52.7	91	**7:45**
Kennedy Senior High School	70	20	9.8	2.3	252	**5:45**	15.3	46	**6:30**	52.7	91	**7:15**
Kenwood Elementary School	70	20	10.2	9.5	65	**2:35**	15.3	46	**3:25**	52.7	91	**4:10**
Kid Zone Daycare & Learning Center	70	20	9.4	3.8	149	**4:00**	15.3	46	**4:45**	52.7	91	**5:30**
Kids Inc - Alburnett	70	20	3.6	2.0	110	**3:20**	15.3	46	**4:10**	52.7	91	**4:55**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Kid's Inc. - Marion LC	70	20	11.2	2.4	280	**6:10**	15.3	46	**7:00**	52.7	91	**7:45**
Kid's Kampus Learning Center	70	20	8.2	2.4	208	**5:00**	15.3	46	**5:45**	52.7	91	**6:30**
KidsPoint Downtown Learning Center & Preschool	70	20	5.0	1.9	161	**4:15**	15.3	46	**5:00**	52.7	91	**5:45**
KidsPoint North Learning Center & Preschool	70	20	11.7	2.4	290	**6:20**	15.3	46	**7:10**	52.7	91	**7:55**
Kinder Kollege	70	20	3.5	3.8	56	**2:30**	15.3	46	**3:15**	52.7	91	**4:00**
Kindercare Learning Center - West	70	20	12.8	5.5	140	**3:50**	15.3	46	**4:40**	52.7	91	**5:25**
Kindercare Learning Center #292	70	20	12.8	5.5	140	**3:50**	15.3	46	**4:40**	52.7	91	**5:25**
La Petite Academy	70	20	11.8	4.0	179	**4:30**	15.3	46	**5:15**	52.7	91	**6:00**
Lasalle Intermediate School	70	20	6.6	3.8	105	**3:15**	15.3	46	**4:05**	52.7	91	**4:50**
Lily Pad Daycare & Preschool	70	20	12.1	2.5	297	**6:30**	15.3	46	**7:15**	52.7	91	**8:00**
Linn County Child Development Center	70	20	4.2	5.2	49	**2:20**	15.3	46	**3:05**	52.7	91	**3:50**
Linn Grove Elementary	70	20	5.2	50.0	7	**1:40**	15.3	46	**2:25**	52.7	91	**3:10**
Linn-Mar Compass Program	70	20	7.8	5.9	80	**2:50**	15.3	46	**3:40**	52.7	91	**4:25**
Linn-Mar High School	70	20	7.8	5.9	80	**2:50**	15.3	46	**3:40**	52.7	91	**4:25**
Linn-Mar High School Success Program	70	20	7.8	5.6	84	**2:55**	15.3	46	**3:40**	52.7	91	**4:25**
Little Cupcakes Child Care	70	20	1.9	5.2	23	**1:55**	15.3	46	**2:40**	52.7	91	**3:25**
Little Lambs Christian Preschool	70	20	10.4	5.7	110	**3:20**	15.3	46	**4:10**	52.7	91	**4:55**
Little Learners Inc.	70	20	10.5	4.5	142	**3:55**	15.3	46	**4:40**	52.7	91	**5:25**
Little People Daycare & Learning Center	70	20	2.5	4.5	34	**2:05**	15.3	28	**2:35**	52.7	91	**3:35**
Madison Elementary School	70	20	5.5	3.8	88	**3:00**	15.3	46	**3:45**	52.7	91	**4:30**
Marion High School	70	20	10.0	2.3	260	**5:50**	15.3	46	**6:40**	52.7	91	**7:25**
McKinley Middle School	70	20	5.0	9.7	31	**2:05**	15.3	46	**2:50**	52.7	91	**3:35**
Metro High School	70	20	4.1	5.2	48	**2:20**	15.3	46	**3:05**	52.7	91	**3:50**
Metro Parent - Child Center	70	20	4.1	5.2	48	**2:20**	15.3	46	**3:05**	52.7	91	**3:50**
Mother Goose Daycare	70	20	2.3	4.9	29	**2:00**	15.3	46	**2:45**	52.7	91	**3:30**
Mother Goose Learning Center	70	20	10.5	2.3	271	**6:05**	15.3	46	**6:50**	52.7	91	**7:35**
My Iman Montessori Preschool	70	20	3.1	4.5	42	**2:15**	15.3	46	**3:00**	52.7	91	**3:45**
Nixon Elementary School	70	20	12.1	2.3	318	**6:50**	15.3	46	**7:35**	52.7	91	**8:20**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Noah's Ark Preschool	70	20	2.9	3.7	48	**2:20**	15.3	46	**3:05**	52.7	91	**3:50**
Novak Elementary School	70	20	8.2	2.0	241	**5:35**	15.3	46	**6:20**	52.7	91	**7:05**
Oak Ridge Middle School	70	20	10.1	3.8	159	**4:10**	15.3	46	**4:55**	52.7	91	**5:40**
Our Little Haven	70	20	5.8	2.9	119	**3:30**	15.3	46	**4:15**	52.7	91	**5:00**
Pierce Elementary School	70	20	9.5	2.6	220	**5:10**	15.3	46	**6:00**	52.7	91	**6:45**
Pointer Pup Preschool (Center Point)	70	20	2.6	4.2	38	**2:10**	15.3	46	**2:55**	52.7	91	**3:40**
Polk Alternative School	70	20	7.5	3.4	132	**3:45**	15.3	46	**4:30**	52.7	91	**5:15**
Regis Middle School	70	20	8.6	3.8	136	**3:50**	15.3	46	**4:35**	52.7	91	**5:20**
Rockwell Collins Child Development Center D	70	20	12.8	4.1	188	**4:40**	15.3	46	**5:25**	52.7	91	**6:10**
Roosevelt Middle School	70	20	6.4	3.8	102	**3:15**	15.3	46	**4:00**	52.7	91	**4:45**
Share & Care Christian Preschool	70	20	2.3	4.0	35	**2:05**	15.3	46	**2:55**	52.7	91	**3:40**
St. James Kids Club Daycare	70	20	4.4	4.1	65	**2:35**	15.3	46	**3:25**	52.7	91	**4:10**
St. Joseph Catholic School	70	20	12.7	4.4	172	**4:25**	15.3	46	**5:10**	52.7	91	**5:55**
St. Joseph Early Childhood Daycare	70	20	12.7	3.0	254	**5:45**	15.3	46	**6:30**	52.7	91	**7:15**
St. Joseph Preschool	70	20	12.7	3.0	254	**5:45**	15.3	46	**6:30**	52.7	91	**7:15**
St. Judes Daycare	70	20	6.5	3.0	132	**3:45**	15.3	46	**4:30**	52.7	91	**5:15**
St. Judes Elementary School	70	20	6.5	2.0	200	**4:50**	15.3	46	**5:40**	52.7	91	**6:25**
St. Judes Preschool	70	20	6.5	2.0	200	**4:50**	15.3	46	**5:40**	52.7	91	**6:25**
St. Ludmila Catholic Center	70	20	4.5	1.8	150	**4:00**	15.3	46	**4:50**	52.7	91	**5:35**
St. Ludmila Daycare	70	20	4.5	2.2	121	**3:35**	15.3	46	**4:20**	52.7	91	**5:05**
St. Ludmila Preschool	70	20	4.5	2.2	121	**3:35**	15.3	46	**4:20**	52.7	91	**5:05**
St. Matthew Preschool	70	20	8.7	2.3	225	**5:15**	15.3	46	**6:05**	52.7	91	**6:50**
St. Matthew School	70	20	8.7	2.3	225	**5:15**	15.3	46	**6:05**	52.7	91	**6:50**
St. Matthew's Child Care Program	70	20	8.7	2.3	225	**5:15**	15.3	46	**6:05**	52.7	91	**6:50**
St. Paul's Parents Day Out	70	20	7.5	5.9	77	**2:50**	15.3	46	**3:35**	52.7	91	**4:20**
St. Paul's Preschool FOCUS	70	20	7.5	2.3	200	**4:50**	15.3	46	**5:40**	52.7	91	**6:25**
St. Pius X Child Care Program	70	20	7.5	2.3	200	**4:50**	15.3	46	**5:40**	52.7	91	**6:25**
St. Pius X Preschool	70	20	10.1	9.5	64	**2:35**	15.3	46	**3:20**	52.7	91	**4:05**
St. Pius X School	70	20	10.1	2.4	251	**5:45**	15.3	46	**6:30**	52.7	91	**7:15**
Starry Elementary	70	20	10.1	3.6	171	**4:25**	15.3	46	**5:10**	52.7	91	**5:55**
Summit Preschool	70	20	10.4	2.4	258	**5:50**	15.3	46	**6:35**	52.7	91	**7:20**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Summit School (PreK - 6th)	70	20	10.4	2.4	258	**5:50**	15.3	46	**6:35**	52.7	91	**7:20**
Taft Middle and Alternative School	70	20	8.2	2.3	217	**5:10**	15.3	46	**5:55**	52.7	91	**6:40**
Taylor Elementary School/Preschool	70	20	9.3	2.3	242	**5:35**	15.3	46	**6:20**	52.7	91	**7:05**
Teddy Bear Childcare Center	70	20	6.7	2.0	204	**4:55**	15.3	46	**5:40**	52.7	91	**6:25**
The Arc of East Central Iowa	70	20	5.0	2.3	132	**3:45**	15.3	46	**4:30**	52.7	91	**5:15**
The Cedar Rapids Day School	70	20	9.7	2.6	225	**5:15**	15.3	46	**6:05**	52.7	91	**6:50**
The Hiawatha Day School	70	20	10.4	9.0	70	**2:40**	15.3	46	**3:30**	52.7	91	**4:15**
The Robyn's Nest	70	20	8.4	3.2	158	**4:10**	15.3	46	**4:55**	52.7	91	**5:40**
Trinity Lane Preschool	70	20	9.3	2.7	204	**4:55**	15.3	46	**5:40**	52.7	91	**6:25**
Trinity Lutheran Childcare	70	20	6.0	2.0	180	**4:30**	15.3	46	**5:20**	52.7	91	**6:05**
Trinity Lutheran School District	70	20	6.0	7.8	47	**2:20**	15.3	46	**3:05**	52.7	91	**3:50**
Truman Elementary School	70	20	2.9	7.4	24	**1:55**	15.3	46	**2:40**	52.7	91	**3:25**
Van Buren Elementary School	70	20	11.9	9.3	77	**2:50**	18.7	57	**3:45**	22.3	39	**3:30**
Vernon Middle School	70	20	10.5	2.3	271	**6:05**	18.7	57	**7:00**	22.3	39	**6:40**
Viola Gibson Elementary School	70	20	12.2	2.7	270	**6:00**	18.7	57	**7:00**	22.3	39	**6:40**
Washington High School	70	20	9.2	4.2	133	**3:45**	18.7	57	**4:40**	22.3	39	**4:25**
We Teach 2	70	20	5.9	5.1	70	**2:40**	18.7	57	**3:40**	22.3	39	**3:20**
Wee Wisdom (Marion)	70	20	5.8	5.1	68	**2:40**	18.7	57	**3:35**	22.3	39	**3:20**
Westfield Elementary	70	20	10.5	3.9	163	**4:15**	18.7	57	**5:10**	22.3	39	**4:55**
Wilkins Elementary	70	20	5.8	2.9	120	**3:30**	18.7	57	**4:30**	22.3	39	**4:10**
Wilson Middle School	70	20	7.0	2.9	143	**3:55**	18.7	57	**4:50**	22.3	39	**4:35**
Wright Elementary School	70	20	9.9	2.3	256	**5:50**	18.7	57	**6:45**	22.3	39	**6:25**
Xavier High School	70	20	12.0	2.4	296	**6:30**	18.7	57	**7:25**	22.3	39	**7:05**
YMCA-Stoney Point	70	20	1.4	1.7	51	**2:25**	11.9	36	**3:00**	77.2	133	**4:35**
					Maximum for EPZ:	**6:55**		**Maximum:**	**7:50**		**Maximum:**	**8:25**
					Average for EPZ:	**4:05**		**Average:**	**4:55**		**Average:**	**5:20**

Table 8-9. Evacuation Time Estimates for Schools, Preschools and Daycares – Snow

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
BENTON COUNTY SCHOOLS												
Atkins Elementary School	80	25	3.5	7.8	27	**2:15**	9.5	38	**2:50**	52.7	80	**3:35**
Center Point Intermediate School (Urbana)	80	25	2.5	36.5	5	**1:50**	16.3	66	**3:00**	16.9	26	**2:20**
Early Beginnings Preschool/Daycare	80	25	3.5	7.8	27	**2:15**	9.5	38	**2:50**	52.7	80	**3:35**
Kid Zone Daycare (Urbana)	80	25	2.5	36.5	5	**1:50**	16.3	66	**3:00**	16.9	26	**2:20**
Shellsburg Elementary School	80	25	5.0	35.7	9	**1:55**	8.0	32	**2:30**	16.9	26	**2:20**
LINN COUNTY SCHOOLS												
Alburnett Schools	80	25	3.6	12.1	18	**2:05**	15.3	62	**3:05**	52.7	106	**3:50**
All Saints Catholic School	80	25	8.9	3.1	175	**4:40**	23.0	92	**6:15**	68.0	136	**7:00**
All Saints Daycare	80	25	8.9	3.1	175	**4:40**	23.0	92	**6:15**	68.0	136	**7:00**
All Saints Preschool	80	25	8.9	3.1	175	**4:40**	23.0	92	**6:15**	68.0	136	**7:00**
Apple Kids Marion School District	80	25	10.3	3.5	179	**4:45**	7.9	32	**5:20**	23.7	48	**5:35**
Apple Kids - Noelridge	80	25	9.9	2.2	266	**6:15**	18.7	75	**7:30**	22.3	45	**7:00**
Arthur Elementary School & Preschool	80	25	9.0	2.0	265	**6:10**	18.7	75	**7:25**	22.3	45	**6:55**
ASAC - Heart of Iowa Child Care	80	25	11.4	12.7	54	**2:40**	18.7	75	**3:55**	22.3	45	**3:25**
Ascension Lutheran Preschool	80	25	10.0	6.8	89	**3:15**	18.7	75	**4:30**	22.3	45	**4:00**
Bethany Lutheran Preschool	80	25	9.2	2.1	270	**6:15**	18.7	75	**7:30**	22.3	45	**7:00**
Bowman Woods Elementary	80	25	9.5	3.5	164	**4:30**	18.7	75	**5:45**	22.3	45	**5:15**
Busy Bee Day Care Inc.	80	25	8.2	4.6	108	**3:35**	18.7	75	**4:50**	22.3	45	**4:20**
Calvery Christian Prechool	80	25	8.2	2.2	226	**5:35**	18.7	75	**6:50**	22.3	45	**6:20**
Caring Corner Christian Daycare	80	25	12.8	3.6	215	**5:20**	18.7	75	**6:35**	22.3	45	**6:05**
Cedar Valley Christian High School	80	25	8.5	2.0	255	**6:00**	18.7	75	**7:15**	22.3	45	**6:45**
Cedar Valley Christian Preschool	80	25	8.5	2.0	255	**6:00**	18.7	75	**7:15**	22.3	45	**6:45**
Cedar Valley Christian School (7-8)	80	25	8.5	2.0	255	**6:00**	18.7	75	**7:15**	22.3	45	**6:45**
Cedar Valley Christian School (K-6)	80	25	8.5	2.0	255	**6:00**	18.7	75	**7:15**	22.3	45	**6:45**
Cedar Valley Montessori School	80	25	5.0	1.6	183	**4:50**	18.7	75	**6:05**	22.3	45	**5:35**
Center Point Elementary School (CP)	80	25	2.5	2.5	60	**2:45**	18.7	75	**4:00**	22.3	45	**3:30**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Center Point Urbana High School (CP)	80	25	2.6	5.6	28	**2:15**	18.7	75	**3:30**	22.3	45	**3:00**
Center Point Urbana Middle School (CP)	80	25	7.6	5.5	84	**3:10**	18.7	75	**4:25**	22.3	45	**3:55**
Children Prevail	80	25	9.3	3.4	164	**4:30**	18.7	75	**5:45**	22.3	45	**5:15**
Children's Corner	80	25	11.7	2.3	301	**6:50**	18.7	75	**8:05**	22.3	45	**7:35**
Children's Weekday Ministery-Lovely Lane	80	25	7.5	2.0	224	**5:30**	18.7	75	**6:45**	22.3	45	**6:15**
Child's Discovery Montessori Preschool	80	25	7.9	2.2	218	**5:25**	18.7	75	**6:40**	22.3	45	**6:10**
Cleveland Elementary School	80	25	3.1	4.3	44	**2:30**	18.7	75	**3:45**	22.3	45	**3:15**
Coolidge Elementary School	80	25	13.3	3.8	209	**5:15**	15.3	62	**6:20**	52.7	106	**7:00**
Echo Hill Elementary	80	25	10.7	3.6	180	**4:45**	18.7	75	**6:00**	22.3	45	**5:30**
Emerson Elementary	80	25	10.3	4.6	136	**4:05**	18.7	75	**5:20**	22.3	45	**4:50**
Erskine Elementary School	80	25	7.2	3.6	121	**3:50**	18.7	75	**5:05**	22.3	45	**4:35**
Essential Montessori School of Hiawatha	80	25	10.5	3.1	205	**5:10**	18.7	75	**6:25**	22.3	45	**5:55**
Excelsior Middle School	80	25	8.2	2.2	228	**5:35**	18.7	75	**6:50**	22.3	45	**6:20**
Five Season Learning Center - Wright (Age 3-5)	80	25	9.9	4.6	131	**4:00**	18.7	75	**5:15**	22.3	45	**4:45**
Five Seasons LC - Viola Gibson	80	25	12.2	2.2	333	**7:20**	18.7	75	**8:35**	22.3	45	**8:05**
Five Seasons Learning Center - Arthur	80	25	9.0	2.1	254	**6:00**	18.7	75	**7:15**	22.3	45	**6:45**
Five Seasons Learning Center - Coolidge (age 3-5)	80	25	13.3	2.9	278	**6:25**	15.3	62	**7:25**	52.7	106	**8:10**
Five Seasons Learning Center - Nixon	80	25	12.1	3.2	230	**5:35**	15.3	62	**6:40**	52.7	106	**7:25**
Four Oaks Day Program	80	25	3.6	5.1	43	**2:30**	15.3	62	**3:30**	52.7	106	**4:15**
Francis Marion Intermediate	80	25	8.8	3.6	147	**4:15**	15.3	62	**5:15**	52.7	106	**6:00**
Franklin Middle School	80	25	8.3	3.6	140	**4:05**	15.3	62	**5:10**	52.7	106	**5:55**
Garfield Elementary School	80	25	8.2	3.3	148	**4:15**	15.3	62	**5:15**	52.7	106	**6:00**
Good Shepard Lutheran School (prek - 8th)	80	25	9.9	2.2	274	**6:20**	15.3	62	**7:25**	52.7	106	**8:05**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Grant Elementary School/Preschool	80	25	6.7	2.1	188	**4:55**	15.3	62	**5:55**	52.7	106	**6:40**
Grant Wood Elementary	80	25	7.8	4.6	103	**3:30**	15.3	62	**4:30**	52.7	106	**5:15**
HACAP Head Start - Jane Boyd	80	25	5.5	2.1	159	**4:25**	15.3	62	**5:30**	52.7	106	**6:10**
HACAP Head Start - Hayes Ctr	80	25	3.6	4.5	48	**2:35**	15.3	62	**3:35**	52.7	106	**4:20**
HACAP Head Start - Marion	80	25	10.3	2.2	276	**6:25**	15.3	62	**7:25**	52.7	106	**8:10**
HACAP Head Start - Olivet	80	25	6.4	7.1	55	**2:40**	15.3	62	**3:45**	52.7	106	**4:30**
HACAP Head Start - Urban Family	80	25	7.5	3.6	124	**3:50**	15.3	62	**4:55**	52.7	106	**5:35**
HACAP Horizons	80	25	5.0	2.1	146	**4:15**	15.3	62	**5:15**	52.7	106	**6:00**
Hand in Hand - 35th Avenue	80	25	13.8	2.5	337	**7:25**	15.3	62	**8:25**	52.7	106	**9:10**
Hand in Hand - Hiawatha	80	25	8.7	3.6	144	**4:10**	15.3	62	**5:15**	52.7	106	**5:55**
Hand in Hand - Linn Grove Elementary	80	25	12.1	4.5	160	**4:25**	15.3	62	**5:30**	52.7	106	**6:15**
Hand in Hand - Tower Lane	80	25	9.7	2.2	262	**6:10**	15.3	62	**7:10**	52.7	106	**7:55**
Harding Middle School	80	25	10.4	6.7	93	**3:20**	15.3	62	**4:20**	52.7	106	**5:05**
Harrison Elementary School	80	25	4.4	2.9	92	**3:20**	15.3	62	**4:20**	52.7	106	**5:05**
Harvest Christian DC & Learning Center	80	25	5.9	2.4	150	**4:15**	15.3	62	**5:20**	52.7	106	**6:05**
Hiawatha Elementary School	80	25	10.4	3.5	179	**4:45**	15.3	62	**5:50**	52.7	106	**6:30**
Holloway House Learning Center	80	25	10.4	2.2	281	**6:30**	15.3	62	**7:30**	52.7	106	**8:15**
Hoover Elementary School	80	25	2.3	2.1	68	**2:55**	15.3	62	**3:55**	52.7	106	**4:40**
Indian Creek Elementary School	80	25	7.2	3.2	138	**4:05**	15.3	62	**5:05**	52.7	106	**5:50**
Isaac Newton Christian Academy & Preschool	80	25	7.8	37.2	13	**2:00**	15.3	62	**3:00**	52.7	106	**3:45**
Jackson Elementary School	80	25	3.6	12.1	18	**2:05**	15.3	62	**3:05**	52.7	106	**3:50**
Jefferson Senior High School	80	25	6.1	3.7	100	**3:25**	15.3	62	**4:30**	52.7	106	**5:15**
Johnson Elementary School	80	25	7.8	9.9	48	**2:35**	15.3	62	**3:35**	52.7	106	**4:20**
Josiah's Playground	80	25	6.4	1.7	223	**5:30**	15.3	62	**6:30**	52.7	106	**7:15**
Jungle Friends	80	25	11.2	2.3	295	**6:40**	15.3	62	**7:45**	52.7	106	**8:30**
Kennedy Senior High School	80	25	9.8	2.1	283	**6:30**	15.3	62	**7:30**	52.7	106	**8:15**
Kenwood Elementary School	80	25	10.2	10.7	58	**2:45**	15.3	62	**3:45**	52.7	106	**4:30**
Kid Zone Daycare & Learning Center	80	25	9.4	3.5	163	**4:30**	15.3	62	**5:30**	52.7	106	**6:15**
Kids Inc - Alburnett	80	25	3.6	2.0	109	**3:35**	15.3	62	**4:40**	52.7	106	**5:20**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Kid's Inc. - Marion LC	80	25	11.2	2.3	288	**6:35**	15.3	62	**7:35**	52.7	106	**8:20**
Kid's Kampus Learning Center	80	25	8.2	2.3	212	**5:20**	15.3	62	**6:20**	52.7	106	**7:05**
KidsPoint Downtown Learning Center & Preschool	80	25	5.0	2.0	154	**4:20**	15.3	62	**5:25**	52.7	106	**6:05**
KidsPoint North Learning Center & Preschool	80	25	11.7	2.4	298	**6:45**	15.3	62	**7:45**	52.7	106	**8:30**
Kinder Kollege	80	25	3.5	3.7	57	**2:45**	15.3	62	**3:45**	52.7	106	**4:30**
Kindercare Learning Center - West	80	25	12.8	4.5	170	**4:35**	15.3	62	**5:40**	52.7	106	**6:25**
Kindercare Learning Center #292	80	25	12.8	4.5	170	**4:35**	15.3	62	**5:40**	52.7	106	**6:25**
La Petite Academy	80	25	11.8	3.5	200	**5:05**	15.3	62	**6:10**	52.7	106	**6:55**
Lasalle Intermediate School	80	25	6.6	3.8	104	**3:30**	15.3	62	**4:35**	52.7	106	**5:15**
Lily Pad Daycare & Preschool	80	25	12.1	2.4	303	**6:50**	15.3	62	**7:50**	52.7	106	**8:35**
Linn County Child Development Center	80	25	4.2	4.5	56	**2:45**	15.3	62	**3:45**	52.7	106	**4:30**
Linn Grove Elementary	80	25	5.2	45.0	7	**1:55**	15.3	62	**2:55**	52.7	106	**3:40**
Linn-Mar Compass Program	80	25	7.8	6.8	69	**2:55**	15.3	62	**4:00**	52.7	106	**4:40**
Linn-Mar High School	80	25	7.8	6.8	69	**2:55**	15.3	62	**4:00**	52.7	106	**4:40**
Linn-Mar High School Success Program	80	25	7.8	5.2	90	**3:15**	15.3	62	**4:20**	52.7	106	**5:05**
Little Cupcakes Child Care	80	25	1.9	5.1	23	**2:10**	15.3	62	**3:10**	52.7	106	**3:55**
Little Lambs Christian Preschool	80	25	10.4	5.5	113	**3:40**	15.3	62	**4:40**	52.7	106	**5:25**
Little Learners Inc.	80	25	10.5	3.6	175	**4:40**	15.3	62	**5:45**	52.7	106	**6:30**
Little People Daycare & Learning Center	80	25	2.5	4.5	34	**2:20**	15.3	28	**2:50**	52.7	106	**4:05**
Madison Elementary School	80	25	5.5	4.2	79	**3:05**	15.3	62	**4:10**	52.7	106	**4:50**
Marion High School	80	25	10.0	2.3	265	**6:10**	15.3	62	**7:15**	52.7	106	**8:00**
McKinley Middle School	80	25	5.0	13.8	22	**2:10**	15.3	62	**3:10**	52.7	106	**3:55**
Metro High School	80	25	4.1	4.5	55	**2:40**	15.3	62	**3:45**	52.7	106	**4:30**
Metro Parent - Child Center	80	25	4.1	4.5	55	**2:40**	15.3	62	**3:45**	52.7	106	**4:30**
Mother Goose Daycare	80	25	2.3	4.6	31	**2:20**	15.3	62	**3:20**	52.7	106	**4:05**
Mother Goose Learning Center	80	25	10.5	2.2	283	**6:30**	15.3	62	**7:30**	52.7	106	**8:15**
My Iman Montessori Preschool	80	25	3.1	5.8	33	**2:20**	15.3	62	**3:20**	52.7	106	**4:05**
Nixon Elementary School	80	25	12.1	2.2	330	**7:15**	15.3	62	**8:20**	52.7	106	**9:05**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Noah's Ark Preschool	80	25	2.9	3.8	47	**2:35**	15.3	62	**3:35**	52.7	106	**4:20**
Novak Elementary School	80	25	8.2	2.0	248	**5:55**	15.3	62	**6:55**	52.7	106	**7:40**
Oak Ridge Middle School	80	25	10.1	3.5	176	**4:45**	15.3	62	**5:45**	52.7	106	**6:30**
Our Little Haven	80	25	5.8	2.8	126	**3:55**	15.3	62	**4:55**	52.7	106	**5:40**
Pierce Elementary School	80	25	9.5	2.5	226	**5:35**	15.3	62	**6:35**	52.7	106	**7:20**
Pointer Pup Preschool (Center Point)	80	25	2.6	4.5	35	**2:20**	15.3	62	**3:25**	52.7	106	**4:10**
Polk Alternative School	80	25	7.5	3.2	143	**4:10**	15.3	62	**5:10**	52.7	106	**5:55**
Regis Middle School	80	25	8.6	3.5	148	**4:15**	15.3	62	**5:15**	52.7	106	**6:00**
Rockwell Collins Child Development Center D	80	25	12.8	3.6	215	**5:20**	15.3	62	**6:25**	52.7	106	**7:10**
Roosevelt Middle School	80	25	6.4	3.7	105	**3:30**	15.3	62	**4:35**	52.7	106	**5:20**
Share & Care Christian Preschool	80	25	2.3	4.5	31	**2:20**	15.3	62	**3:20**	52.7	106	**4:05**
St. James Kids Club Daycare	80	25	4.4	4.1	64	**2:50**	15.3	62	**3:55**	52.7	106	**4:35**
St. Joseph Catholic School	80	25	12.7	3.8	202	**5:10**	15.3	62	**6:10**	52.7	106	**6:55**
St. Joseph Early Childhood Daycare	80	25	12.7	2.9	266	**6:15**	15.3	62	**7:15**	52.7	106	**8:00**
St. Joseph Preschool	80	25	12.7	2.9	266	**6:15**	15.3	62	**7:15**	52.7	106	**8:00**
St. Judes Daycare	80	25	6.5	2.7	145	**4:10**	15.3	62	**5:15**	52.7	106	**6:00**
St. Judes Elementary School	80	25	6.5	1.9	204	**5:10**	15.3	62	**6:15**	52.7	106	**6:55**
St. Judes Preschool	80	25	6.5	1.9	204	**5:10**	15.3	62	**6:15**	52.7	106	**6:55**
St. Ludmila Catholic Center	80	25	4.5	1.9	145	**4:10**	15.3	62	**5:15**	52.7	106	**6:00**
St. Ludmila Daycare	80	25	4.5	2.2	121	**3:50**	15.3	62	**4:50**	52.7	106	**5:35**
St. Ludmila Preschool	80	25	4.5	2.2	121	**3:50**	15.3	62	**4:50**	52.7	106	**5:35**
St. Matthew Preschool	80	25	8.7	2.2	240	**5:45**	15.3	62	**6:50**	52.7	106	**7:35**
St. Matthew School	80	25	8.7	2.2	240	**5:45**	15.3	62	**6:50**	52.7	106	**7:35**
St. Matthew's Child Care Program	80	25	8.7	2.2	240	**5:45**	15.3	62	**6:50**	52.7	106	**7:35**
St. Paul's Parents Day Out	80	25	7.5	6.8	67	**2:55**	15.3	62	**3:55**	52.7	106	**4:40**
St. Paul's Preschool FOCUS	80	25	7.5	2.2	209	**5:15**	15.3	62	**6:20**	52.7	106	**7:00**
St. Pius X Child Care Program	80	25	7.5	2.2	209	**5:15**	15.3	62	**6:20**	52.7	106	**7:00**
St. Pius X Preschool	80	25	10.1	10.7	57	**2:45**	15.3	62	**3:45**	52.7	106	**4:30**
St. Pius X School	80	25	10.1	2.2	280	**6:25**	15.3	62	**7:30**	52.7	106	**8:15**
Starry Elementary	80	25	10.1	3.6	170	**4:35**	15.3	62	**5:40**	52.7	106	**6:25**
Summit Preschool	80	25	10.4	2.2	288	**6:35**	15.3	62	**7:35**	52.7	106	**8:20**

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to TRC (mi.)	Travel Time from EPZ Bdry to TRC (min)	ETE to TRC (hr:min)	Dist. EPZ Bdry to RC (mi.)	Travel Time from EPZ Bdry to RC (min)	ETE to RC (hr:min)
Summit School (PreK - 6th)	80	25	10.4	2.2	288	**6:35**	15.3	62	**7:35**	52.7	106	**8:20**
Taft Middle and Alternative School	80	25	8.2	2.2	228	**5:35**	15.3	62	**6:35**	52.7	106	**7:20**
Taylor Elementary School/Preschool	80	25	9.3	2.2	253	**6:00**	15.3	62	**7:00**	52.7	106	**7:45**
Teddy Bear Childcare Center	80	25	6.7	1.8	230	**5:35**	15.3	62	**6:40**	52.7	106	**7:25**
The Arc of East Central Iowa	80	25	5.0	2.3	130	**3:55**	15.3	62	**5:00**	52.7	106	**5:45**
The Cedar Rapids Day School	80	25	9.7	2.5	230	**5:35**	15.3	62	**6:40**	52.7	106	**7:25**
The Hiawatha Day School	80	25	10.4	10.7	59	**2:45**	15.3	62	**3:50**	52.7	106	**4:30**
The Robyn's Nest	80	25	8.4	3.2	158	**4:25**	15.3	62	**5:25**	52.7	106	**6:10**
Trinity Lane Preschool	80	25	9.3	2.7	206	**5:15**	15.3	62	**6:15**	52.7	106	**7:00**
Trinity Lutheran Childcare	80	25	6.0	2.0	180	**4:45**	15.3	62	**5:50**	52.7	106	**6:35**
Trinity Lutheran School District	80	25	6.0	12.6	29	**2:15**	15.3	62	**3:20**	52.7	106	**4:00**
Truman Elementary School	80	25	2.9	12.1	15	**2:00**	15.3	62	**3:05**	52.7	106	**3:50**
Van Buren Elementary School	80	25	11.9	12.5	58	**2:45**	18.7	75	**4:00**	22.3	45	**3:30**
Vernon Middle School	80	25	10.5	2.2	283	**6:30**	18.7	75	**7:45**	22.3	45	**7:15**
Viola Gibson Elementary School	80	25	12.2	2.5	298	**6:45**	18.7	75	**8:00**	22.3	45	**7:30**
Washington High School	80	25	9.2	3.7	148	**4:15**	18.7	75	**5:30**	22.3	45	**5:00**
We Teach 2	80	25	5.9	4.5	78	**3:05**	18.7	75	**4:20**	22.3	45	**3:50**
Wee Wisdom (Marion)	80	25	5.8	4.5	77	**3:05**	18.7	75	**4:20**	22.3	45	**3:50**
Westfield Elementary	80	25	10.5	3.5	181	**4:50**	18.7	75	**6:05**	22.3	45	**5:35**
Wilkins Elementary	80	25	5.8	2.7	131	**4:00**	18.7	75	**5:15**	22.3	45	**4:45**
Wilson Middle School	80	25	7.0	2.7	157	**4:25**	18.7	75	**5:40**	22.3	45	**5:10**
Wright Elementary School	80	25	9.9	2.2	266	**6:15**	18.7	75	**7:30**	22.3	45	**7:00**
Xavier High School	80	25	12.0	2.3	309	**6:55**	18.7	75	**8:10**	22.3	45	**7:40**
YMCA-Stoney Point	80	25	1.4	1.5	55	**2:40**	11.9	48	**3:30**	77.2	155	**5:15**
					Maximum for EPZ:	**7:25**		**Maximum:**	**8:35**		**Maximum:**	**9:10**
					Average for EPZ:	**4:25**		**Average:**	**5:30**		**Average:**	**5:55**

Table 8-10. Summary of Transit-Dependent Bus Routes

Route	No. of Buses	Route Description	Length (mi.)
1	2	Services Subareas 1 - 3	30.1
2	3	Services Subarea 4	18.8
3	4	Services Subarea 5	15.5
4	2	Services Subareas 6 - 8	17.8
5	3	Services Subareas 9 - 11	9.2
6	2	Services Subareas 12 & 13	25.8
7	12	Services Subarea 14 - North	32.8
8	12	Services Subarea 14 - Central	23.9
9	11	Services Subarea 14 -South	18.9
10	11	Services Subarea 15 - West	11.5
11	11	Services Subarea 15 - East	17.3
12	12	Services Subarea 16 - North	16.5
13	11	Services Subarea 16 - South	15.1
14	4	Services Subarea 17 & 18	12.7
15	3	Services Subarea 19 - 22	15.9
16	9	Services Subarea 23 - West	17.9
17	9	Services Subarea 23 - Central	18.8
18	9	Services Subarea 23 - East	18.1
19	4	Services Subarea 24 - West	9.9
20	5	Services Subarea 24 - Central	13.9
21	5	Services Subarea 24 - East	12.6
Total:	**144**		

Table 8-11. Transit-Dependent Evacuation Time Estimates - Good Weather

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
1	1	90	30.1	51.2	35	30	**2:35**	20.2	48	5	10	97	30	**5:50**
1	2	120	30.1	52.9	34	30	**3:05**	20.2	48	5	10	97	30	**6:20**
2	1	90	18.8	4.4	255	30	**6:15**	21.8	52	5	10	89	30	**9:25**
2	2 & 3	120	18.8	4.6	243	30	**6:35**	21.8	52	5	10	89	30	**9:45**
3	1	90	15.5	7.5	124	30	**4:05**	22.0	53	5	10	92	30	**7:15**
3	2	105	15.5	7.5	125	30	**4:20**	22.0	53	5	10	93	30	**7:35**
3	3 & 4	120	15.5	7.7	120	30	**4:30**	22.0	53	5	10	91	30	**7:40**
4	1	90	17.8	47.5	22	30	**2:25**	15.4	37	5	10	71	30	**5:00**
4	2	120	17.8	51.0	21	30	**2:55**	15.4	37	5	10	71	30	**5:30**
5	1	90	9.2	41.1	13	30	**2:15**	2.8	7	5	10	35	30	**3:45**
5	2 & 3	120	9.2	37.8	15	30	**2:45**	9.2	22	5	10	49	30	**4:45**
6	1	90	25.8	55.0	28	30	**2:30**	20.2	48	5	10	92	30	**5:40**
6	2	120	25.8	55.0	28	30	**3:00**	20.2	48	5	10	93	30	**6:10**
7	1 & 2	90	32.8	8.6	229	30	**5:50**	21.8	52	5	10	114	30	**9:25**
7	3 & 4	95	32.8	8.7	225	30	**5:50**	21.8	52	5	10	114	30	**9:25**
7	5 & 6	100	32.8	8.8	224	30	**5:55**	21.8	52	5	10	111	30	**9:25**
7	7 & 8	105	32.8	8.9	221	30	**6:00**	21.8	52	5	10	109	30	**9:30**
7	9 & 10	110	32.8	9.0	219	30	**6:00**	21.8	52	5	10	109	30	**9:30**
7	11 & 12	120	32.8	9.3	212	30	**6:05**	21.8	52	5	10	108	30	**9:35**
8	1 & 2	90	23.9	6.2	232	30	**5:55**	21.8	52	5	10	100	30	**9:15**
8	3 & 4	95	23.9	6.2	230	30	**5:55**	21.8	52	5	10	100	30	**9:15**
8	5 & 6	100	23.9	6.4	225	30	**5:55**	21.8	52	5	10	100	30	**9:15**
8	7 & 8	105	23.9	6.4	223	30	**6:00**	21.8	52	5	10	97	30	**9:15**
8	9 & 10	110	23.9	6.5	220	30	**6:00**	21.8	52	5	10	97	30	**9:15**
8	11 & 12	120	23.9	6.8	211	30	**6:05**	21.8	52	5	10	96	30	**9:20**
9	1 & 2	90	18.9	3.6	313	30	**7:15**	21.8	52	5	10	90	30	**10:25**
9	3 & 4	95	18.9	3.8	297	30	**7:05**	21.8	52	5	10	90	30	**10:15**
9	5 & 6	100	18.9	3.9	295	30	**7:05**	21.8	52	5	10	90	30	**10:15**
9	7 & 8	105	18.9	3.9	292	30	**7:10**	21.8	52	5	10	90	30	**10:20**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
9	9 & 10	110	18.9	3.9	289	30	**7:10**	21.8	52	5	10	90	30	**10:20**
9	11	120	18.9	4.0	284	30	**7:15**	21.8	52	5	10	90	30	**10:25**
10	1 & 2	90	11.5	2.9	240	30	**6:00**	21.8	52	5	10	81	30	**9:00**
10	3 & 4	95	11.5	2.9	239	30	**6:05**	21.8	52	5	10	81	30	**9:05**
10	5 & 6	100	11.5	3.0	230	30	**6:00**	21.8	52	5	10	81	30	**9:00**
10	7 & 8	105	11.5	3.0	229	30	**6:05**	21.8	52	5	10	81	30	**9:05**
10	9	110	11.5	3.0	227	30	**6:10**	21.8	52	5	10	81	30	**9:10**
10	10 & 11	120	11.5	3.2	214	30	**6:05**	21.8	52	5	10	81	30	**9:05**
11	1 & 2	90	17.3	3.4	301	30	**7:05**	21.8	52	5	10	87	30	**10:10**
11	3 & 4	95	17.3	3.6	291	30	**7:00**	21.8	52	5	10	87	30	**10:05**
11	5 & 6	100	17.3	3.6	289	30	**7:00**	21.8	52	5	10	87	30	**10:05**
11	7 & 8	105	17.3	3.6	287	30	**7:05**	21.8	52	5	10	87	30	**10:10**
11	9 & 10	110	17.3	3.6	285	30	**7:05**	21.8	52	5	10	87	30	**10:10**
11	11	120	17.3	4.0	260	30	**6:50**	21.8	52	5	10	87	30	**9:55**
12	1 & 2	90	16.5	8.9	111	30	**3:55**	54.9	132	5	10	170	30	**9:45**
12	3 & 4	95	16.5	9.1	109	30	**3:55**	54.9	132	5	10	170	30	**9:45**
12	5 & 6	100	16.5	9.0	110	30	**4:00**	54.9	132	5	10	167	30	**9:45**
12	7 & 8	105	16.5	9.2	108	30	**4:05**	54.9	132	5	10	166	30	**9:50**
12	9 & 10	110	16.5	9.2	108	30	**4:10**	54.9	132	5	10	165	30	**9:55**
12	11 & 12	120	16.5	9.3	107	30	**4:20**	54.9	132	5	10	165	30	**10:05**
13	1 & 2	90	15.1	5.8	155	30	**4:35**	54.9	132	5	10	163	30	**10:15**
13	3 & 4	95	15.1	5.9	154	30	**4:40**	54.9	132	5	10	163	30	**10:20**
13	5 & 6	100	15.1	5.9	153	30	**4:45**	54.9	132	5	10	163	30	**10:25**
13	7 & 8	105	15.1	6.0	151	30	**4:50**	54.9	132	5	10	163	30	**10:30**
13	9 & 10	110	15.1	6.1	149	30	**4:50**	54.9	132	5	10	163	30	**10:30**
13	11	120	15.1	6.2	147	30	**5:00**	54.9	132	5	10	163	30	**10:40**
14	1	90	12.7	32.2	24	30	**2:25**	54.9	132	5	10	215	30	**9:00**
14	2	105	12.7	34.6	22	30	**2:40**	54.9	132	5	10	211	30	**9:10**
14	3 & 4	120	12.7	36.0	21	30	**2:55**	54.9	132	5	10	204	30	**9:20**
15	1	90	15.9	48.0	20	30	**2:20**	15.4	37	5	10	69	30	**4:55**
15	2 & 3	120	15.9	50.2	19	30	**2:50**	15.4	37	5	10	69	30	**5:25**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
16	1 & 2	90	17.9	3.2	337	30	**7:40**	64.5	155	5	10	193	30	**14:15**
16	3 & 4	95	17.9	3.5	308	30	**7:15**	64.5	155	5	10	193	30	**13:50**
16	5 & 6	100	17.9	3.5	306	30	**7:20**	64.5	155	5	10	193	30	**13:55**
16	7 & 8	110	17.9	3.6	302	30	**7:25**	64.5	155	5	10	193	30	**14:00**
16	9	120	17.9	3.6	297	30	**7:30**	64.5	155	5	10	193	30	**14:05**
17	1	90	18.8	3.4	330	30	**7:30**	64.5	155	5	10	194	30	**14:05**
17	2	95	18.8	3.4	329	30	**7:35**	64.5	155	5	10	194	30	**14:10**
17	3	100	18.8	3.4	328	30	**7:40**	64.5	155	5	10	194	30	**14:15**
17	4	105	18.8	3.5	327	30	**7:45**	64.5	155	5	10	194	30	**14:20**
17	5	110	18.8	3.5	325	30	**7:45**	64.5	155	5	10	194	30	**14:20**
17	6 & 7	115	18.8	3.7	303	30	**7:30**	64.5	155	5	10	194	30	**14:05**
17	8 & 9	120	18.8	3.7	301	30	**7:35**	64.5	155	5	10	194	30	**14:10**
18	1	90	18.1	3.4	320	30	**7:20**	64.6	155	5	10	194	30	**13:55**
18	2	95	18.1	3.4	319	30	**7:25**	64.6	155	5	10	194	30	**14:00**
18	3	100	18.1	3.5	314	30	**7:25**	64.6	155	5	10	194	30	**14:00**
18	4	105	18.1	3.5	312	30	**7:30**	64.6	155	5	10	194	30	**14:05**
18	5	110	18.1	3.5	309	30	**7:30**	64.6	155	5	10	194	30	**14:05**
18	6 & 7	115	18.1	3.5	308	30	**7:35**	64.6	155	5	10	194	30	**14:10**
18	8 & 9	120	18.1	3.5	306	30	**7:40**	64.6	155	5	10	194	30	**14:15**
19	1	90	9.9	3.1	192	30	**5:15**	76.9	185	5	10	212	30	**12:40**
19	2	95	9.9	3.1	190	30	**5:15**	76.9	185	5	10	212	30	**12:40**
19	3	100	9.9	3.2	188	30	**5:20**	76.9	185	5	10	212	30	**12:45**
19	4	110	9.9	3.4	174	30	**5:15**	76.9	185	5	10	212	30	**12:40**
20	1	90	13.9	3.8	218	30	**5:40**	76.9	185	5	10	219	30	**13:10**
20	2	95	13.9	3.9	216	30	**5:45**	76.9	185	5	10	219	30	**13:15**
20	3	100	13.9	3.9	213	30	**5:45**	76.9	185	5	10	219	30	**13:15**
20	4	110	13.9	4.2	200	30	**5:40**	76.9	185	5	10	219	30	**13:10**
20	5	120	13.9	4.3	195	30	**5:45**	76.9	185	5	10	219	30	**13:15**
21	1	90	12.6	4.0	189	30	**5:10**	64.6	155	5	10	185	30	**11:35**
21	2	95	12.6	4.0	188	30	**5:15**	64.6	155	5	10	185	30	**11:40**
21	3	100	12.6	4.1	184	30	**5:15**	64.6	155	5	10	185	30	**11:40**

Route Number	Bus Number	One-Wave						Distance to R.C. (miles)	Two-Wave					
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
21	4	110	12.6	4.3	174	30	**5:15**	64.6	155	5	10	185	30	**11:40**
21	5	120	12.6	4.3	175	30	**5:25**	64.6	155	5	10	185	30	**11:50**
						Maximum ETE:	**7:45**						**Maximum ETE:**	**14:20**
						Average ETE:	**5:40**						**Average ETE:**	**10:30**

Table 8-12. Transit-Dependent Evacuation Time Estimates – Rain

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
1	1	100	30.1	46.5	39	40	**3:00**	20.2	61	5	10	115	40	**6:55**
1	2	130	30.1	48.3	37	40	**3:30**	20.2	61	5	10	115	40	**7:25**
2	1	100	18.8	4.1	275	40	**6:55**	21.8	65	5	10	107	40	**10:45**
2	2 & 3	130	18.8	4.3	260	40	**7:10**	21.8	65	5	10	107	40	**11:00**
3	1	100	15.5	6.6	142	40	**4:45**	22.0	66	5	10	108	40	**8:35**
3	2	115	15.5	6.4	145	40	**5:00**	22.0	66	5	10	106	40	**8:50**
3	3 & 4	130	15.5	6.4	144	40	**5:15**	22.0	66	5	10	106	40	**9:05**
4	1	100	17.8	42.8	25	40	**2:45**	15.4	46	5	10	85	40	**5:55**
4	2	130	17.8	47.4	23	40	**3:15**	15.4	46	5	10	85	40	**6:25**
5	1	100	9.2	34.5	16	40	**2:40**	2.8	8	5	10	39	40	**4:25**
5	2 & 3	130	9.2	37.7	15	40	**3:05**	9.2	28	5	10	57	40	**5:25**
6	1	100	25.8	50.0	31	40	**2:55**	20.2	61	5	10	110	40	**6:45**
6	2	130	25.8	50.0	31	40	**3:25**	20.2	61	5	10	109	40	**7:15**
7	1 & 2	100	32.8	8.8	224	40	**6:05**	21.8	65	5	10	128	40	**10:15**
7	3 & 4	105	32.8	8.9	222	40	**6:10**	21.8	65	5	10	128	40	**10:20**
7	5 & 6	110	32.8	9.0	219	40	**6:10**	21.8	65	5	10	128	40	**10:20**
7	7 & 8	115	32.8	9.1	217	40	**6:15**	21.8	65	5	10	128	40	**10:25**
7	9 & 10	120	32.8	9.2	215	40	**6:15**	21.8	65	5	10	128	40	**10:25**
7	11 & 12	130	32.8	9.4	209	40	**6:20**	21.8	65	5	10	128	40	**10:30**
8	1 & 2	100	23.9	5.8	246	40	**6:30**	21.8	65	5	10	114	40	**10:25**
8	3 & 4	105	23.9	5.9	243	40	**6:30**	21.8	65	5	10	114	40	**10:25**
8	5 & 6	110	23.9	6.0	239	40	**6:30**	21.8	65	5	10	114	40	**10:25**
8	7 & 8	115	23.9	6.1	234	40	**6:30**	21.8	65	5	10	114	40	**10:25**
8	9 & 10	120	23.9	6.2	231	40	**6:35**	21.8	65	5	10	114	40	**10:30**
8	11 & 12	130	23.9	6.5	222	40	**6:35**	21.8	65	5	10	114	40	**10:30**
9	1 & 2	100	18.9	3.4	336	40	**8:00**	21.8	65	5	10	107	40	**11:50**
9	3 & 4	105	18.9	3.4	334	40	**8:00**	21.8	65	5	10	107	40	**11:50**
9	5 & 6	110	18.9	3.5	325	40	**7:55**	21.8	65	5	10	107	40	**11:45**
9	7 & 8	115	18.9	3.5	323	40	**8:00**	21.8	65	5	10	107	40	**11:50**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
9	9 & 10	120	18.9	3.5	320	40	**8:00**	21.8	65	5	10	107	40	**11:50**
9	11	130	18.9	3.6	315	40	**8:05**	21.8	65	5	10	107	40	**11:55**
10	1 & 2	100	11.5	2.8	247	40	**6:30**	21.8	65	5	10	97	40	**10:10**
10	3 & 4	105	11.5	2.8	243	40	**6:30**	21.8	65	5	10	97	40	**10:10**
10	5 & 6	110	11.5	2.9	241	40	**6:35**	21.8	65	5	10	97	40	**10:15**
10	7 & 8	115	11.5	2.9	239	40	**6:35**	21.8	65	5	10	97	40	**10:15**
10	9	120	11.5	2.9	236	40	**6:40**	21.8	65	5	10	97	40	**10:20**
10	10 & 11	130	11.5	3.0	231	40	**6:45**	21.8	65	5	10	97	40	**10:25**
11	1 & 2	100	17.3	3.2	320	40	**7:40**	21.8	65	5	10	105	40	**11:30**
11	3 & 4	105	17.3	3.3	318	40	**7:45**	21.8	65	5	10	105	40	**11:35**
11	5 & 6	110	17.3	3.3	316	40	**7:50**	21.8	65	5	10	105	40	**11:40**
11	7 & 8	115	17.3	3.3	314	40	**7:50**	21.8	65	5	10	105	40	**11:40**
11	9 & 10	120	17.3	3.3	312	40	**7:55**	21.8	65	5	10	105	40	**11:45**
11	11	130	17.3	3.5	300	40	**7:50**	21.8	65	5	10	105	40	**11:40**
12	1 & 2	100	16.5	8.3	120	40	**4:20**	54.9	165	5	10	203	40	**11:25**
12	3 & 4	105	16.5	8.4	118	40	**4:25**	54.9	165	5	10	203	40	**11:30**
12	5 & 6	110	16.5	8.4	117	40	**4:30**	54.9	165	5	10	203	40	**11:35**
12	7 & 8	115	16.5	8.6	115	40	**4:30**	54.9	165	5	10	203	40	**11:35**
12	9 & 10	120	16.5	8.6	115	40	**4:35**	54.9	165	5	10	203	40	**11:40**
12	11 & 12	130	16.5	8.8	113	40	**4:45**	54.9	165	5	10	203	40	**11:50**
13	1 & 2	100	15.1	5.7	159	40	**5:00**	54.9	165	5	10	200	40	**12:00**
13	3 & 4	105	15.1	5.7	158	40	**5:05**	54.9	165	5	10	200	40	**12:05**
13	5 & 6	110	15.1	5.7	158	40	**5:10**	54.9	165	5	10	200	40	**12:10**
13	7 & 8	115	15.1	5.9	154	40	**5:10**	54.9	165	5	10	200	40	**12:10**
13	9 & 10	120	15.1	5.9	153	40	**5:15**	54.9	165	5	10	200	40	**12:15**
13	11	130	15.1	6.1	149	40	**5:20**	54.9	165	5	10	200	40	**12:20**
14	1	100	12.7	30.9	25	40	**2:45**	54.9	165	5	10	255	40	**10:45**
14	2	115	12.7	31.1	25	40	**3:00**	54.9	165	5	10	245	40	**10:45**
14	3 & 4	130	12.7	32.2	24	40	**3:15**	54.9	165	5	10	235	40	**10:50**
15	1	100	15.9	42.8	22	40	**2:45**	15.4	46	5	10	82	40	**5:50**
15	2 & 3	130	15.9	47.4	20	40	**3:10**	15.4	46	5	10	82	40	**6:15**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
16	1 & 2	100	17.9	3.1	342	40	**8:05**	64.5	194	5	10	236	40	**16:10**
16	3 & 4	105	17.9	3.2	340	40	**8:05**	64.5	194	5	10	236	40	**16:10**
16	5 & 6	110	17.9	3.2	338	40	**8:10**	64.5	194	5	10	236	40	**16:15**
16	7 & 8	120	17.9	3.4	318	40	**8:00**	64.5	194	5	10	236	40	**16:05**
16	9	130	17.9	3.4	314	40	**8:05**	64.5	194	5	10	236	40	**16:10**
17	1	100	18.8	3.2	348	40	**8:10**	64.5	194	5	10	237	40	**16:20**
17	2	105	18.8	3.3	346	40	**8:15**	64.5	194	5	10	237	40	**16:25**
17	3	110	18.8	3.3	345	40	**8:15**	64.5	194	5	10	237	40	**16:25**
17	4	115	18.8	3.5	326	40	**8:05**	64.5	194	5	10	237	40	**16:15**
17	5	120	18.8	3.5	325	40	**8:05**	64.5	194	5	10	237	40	**16:15**
17	6 & 7	125	18.8	3.5	323	40	**8:10**	64.5	194	5	10	237	40	**16:20**
17	8 & 9	130	18.8	3.5	321	40	**8:15**	64.5	194	5	10	237	40	**16:25**
18	1	100	18.1	3.6	306	40	**7:30**	64.6	194	5	10	238	40	**15:40**
18	2	105	18.1	3.6	305	40	**7:30**	64.6	194	5	10	238	40	**15:40**
18	3	110	18.1	3.7	297	40	**7:30**	64.6	194	5	10	238	40	**15:40**
18	4	115	18.1	3.7	296	40	**7:35**	64.6	194	5	10	238	40	**15:45**
18	5	120	18.1	3.7	294	40	**7:35**	64.6	194	5	10	238	40	**15:45**
18	6 & 7	125	18.1	3.7	291	40	**7:40**	64.6	194	5	10	238	40	**15:50**
18	8 & 9	130	18.1	3.8	289	40	**7:40**	64.6	194	5	10	238	40	**15:50**
19	1	100	9.9	2.8	210	40	**5:50**	76.9	231	5	10	261	40	**15:00**
19	2	105	9.9	2.9	207	40	**5:55**	76.9	231	5	10	261	40	**15:05**
19	3	110	9.9	2.9	204	40	**5:55**	76.9	231	5	10	261	40	**15:05**
19	4	120	9.9	3.0	200	40	**6:00**	76.9	231	5	10	261	40	**15:10**
20	1	100	13.9	3.4	249	40	**6:30**	76.9	231	5	10	269	40	**15:45**
20	2	105	13.9	3.4	247	40	**6:35**	76.9	231	5	10	269	40	**15:50**
20	3	110	13.9	3.4	244	40	**6:35**	76.9	231	5	10	269	40	**15:50**
20	4	120	13.9	3.5	239	40	**6:40**	76.9	231	5	10	269	40	**15:55**
20	5	130	13.9	3.7	228	40	**6:40**	76.9	231	5	10	269	40	**15:55**
21	1	100	12.6	3.7	202	40	**5:45**	64.6	194	5	10	227	40	**13:45**
21	2	105	12.6	3.7	202	40	**5:50**	64.6	194	5	10	227	40	**13:50**
21	3	110	12.6	3.7	202	40	**5:55**	64.6	194	5	10	227	40	**13:55**

Route Number	Bus Number	One-Wave							Two-Wave					
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
21	4	120	12.6	3.7	203	40	**6:05**	64.6	194	5	10	227	40	**14:05**
21	5	130	12.6	3.7	204	40	**6:15**	64.6	194	5	10	227	40	**14:15**
						Maximum ETE:	**8:15**						**Maximum ETE:**	**16:25**
						Average ETE:	**6:10**						**Average ETE:**	**12:10**

Table 8-13. Transit Dependent Evacuation Time Estimates – Snow

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
1	1	110	30.1	41.2	44	50	**3:25**	20.2	81	5	10	143	50	**8:15**
1	2	140	30.1	41.4	44	50	**3:55**	20.2	81	5	10	143	50	**8:45**
2	1	110	18.8	3.9	287	50	**7:30**	21.8	87	5	10	133	50	**12:20**
2	2 & 3	140	18.8	4.1	277	50	**7:50**	21.8	87	5	10	134	50	**12:40**
3	1	110	15.5	6.3	147	50	**5:10**	22.0	88	5	10	130	50	**9:55**
3	2	125	15.5	6.5	144	50	**5:20**	22.0	88	5	10	134	50	**10:10**
3	3 & 4	140	15.5	6.3	147	50	**5:40**	22.0	88	5	10	134	50	**10:30**
4	1	110	17.8	39.6	27	50	**3:10**	15.4	62	5	10	112	50	**7:10**
4	2	140	17.8	39.8	27	50	**3:40**	15.4	62	5	10	105	50	**7:35**
5	1	110	9.2	34.4	16	50	**3:00**	2.8	11	5	10	44	50	**5:00**
5	2 & 3	140	9.2	35.7	15	50	**3:25**	9.2	37	5	10	74	50	**6:25**
6	1	110	25.8	45.0	34	50	**3:15**	20.2	81	5	10	141	50	**8:05**
6	2	140	25.8	45.0	34	50	**3:45**	20.2	81	5	10	135	50	**8:30**
7	1 & 2	110	32.8	7.9	249	50	**6:50**	21.8	87	5	10	151	50	**11:55**
7	3 & 4	115	32.8	8.0	245	50	**6:50**	21.8	87	5	10	172	50	**12:15**
7	5 & 6	120	32.8	8.1	244	50	**6:55**	21.8	87	5	10	172	50	**12:20**
7	7 & 8	125	32.8	8.2	241	50	**7:00**	21.8	87	5	10	172	50	**12:25**
7	9 & 10	130	32.8	8.2	239	50	**7:00**	21.8	87	5	10	172	50	**12:25**
7	11 & 12	140	32.8	8.4	235	50	**7:05**	21.8	87	5	10	172	50	**12:30**
8	1 & 2	110	23.9	5.2	277	50	**7:20**	21.8	87	5	10	155	50	**12:30**
8	3 & 4	115	23.9	5.3	271	50	**7:20**	21.8	87	5	10	156	50	**12:30**
8	5 & 6	120	23.9	5.3	269	50	**7:20**	21.8	87	5	10	156	50	**12:30**
8	7 & 8	125	23.9	5.4	267	50	**7:25**	21.8	87	5	10	156	50	**12:35**
8	9 & 10	130	23.9	5.4	264	50	**7:25**	21.8	87	5	10	156	50	**12:35**
8	11 & 12	140	23.9	5.7	252	50	**7:25**	21.8	87	5	10	156	50	**12:35**
9	1 & 2	110	18.9	3.1	368	50	**8:50**	21.8	87	5	10	146	50	**13:50**
9	3 & 4	115	18.9	3.1	366	50	**8:55**	21.8	87	5	10	135	50	**13:45**
9	5 & 6	120	18.9	3.1	364	50	**8:55**	21.8	87	5	10	135	50	**13:45**
9	7 & 8	125	18.9	3.2	352	50	**8:50**	21.8	87	5	10	135	50	**13:40**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
9	9 & 10	130	18.9	3.2	350	50	**8:50**	21.8	87	5	10	135	50	**13:40**
9	11	140	18.9	3.3	345	50	**8:55**	21.8	87	5	10	135	50	**13:45**
10	1 & 2	110	11.5	2.4	285	50	**7:25**	21.8	87	5	10	124	50	**12:05**
10	3 & 4	115	11.5	2.5	281	50	**7:30**	21.8	87	5	10	124	50	**12:10**
10	5 & 6	120	11.5	2.5	279	50	**7:30**	21.8	87	5	10	124	50	**12:10**
10	7 & 8	125	11.5	2.5	276	50	**7:35**	21.8	87	5	10	124	50	**12:15**
10	9	130	11.5	2.5	275	50	**7:35**	21.8	87	5	10	124	50	**12:15**
10	10 & 11	140	11.5	2.6	269	50	**7:40**	21.8	87	5	10	124	50	**12:20**
11	1 & 2	110	17.3	2.9	356	50	**8:40**	21.8	87	5	10	132	50	**13:25**
11	3 & 4	115	17.3	2.9	354	50	**8:40**	21.8	87	5	10	132	50	**13:25**
11	5 & 6	120	17.3	3.0	346	50	**8:40**	21.8	87	5	10	132	50	**13:25**
11	7 & 8	125	17.3	3.0	345	50	**8:40**	21.8	87	5	10	132	50	**13:25**
11	9 & 10	130	17.3	3.0	343	50	**8:45**	21.8	87	5	10	132	50	**13:30**
11	11	140	17.3	3.2	329	50	**8:40**	21.8	87	5	10	132	50	**13:25**
12	1 & 2	110	16.5	8.7	114	50	**4:35**	54.9	220	5	10	263	50	**13:45**
12	3 & 4	115	16.5	8.7	114	50	**4:40**	54.9	220	5	10	262	50	**13:50**
12	5 & 6	120	16.5	8.7	114	50	**4:45**	54.9	220	5	10	262	50	**13:55**
12	7 & 8	125	16.5	8.9	111	50	**4:50**	54.9	220	5	10	262	50	**14:00**
12	9 & 10	130	16.5	9.1	109	50	**4:50**	54.9	220	5	10	262	50	**14:00**
12	11 & 12	140	16.5	9.3	106	50	**5:00**	54.9	220	5	10	262	50	**14:10**
13	1 & 2	110	15.1	5.4	169	50	**5:30**	54.9	220	5	10	260	50	**14:35**
13	3 & 4	115	15.1	5.3	170	50	**5:35**	54.9	220	5	10	260	50	**14:40**
13	5 & 6	120	15.1	5.3	170	50	**5:40**	54.9	220	5	10	260	50	**14:45**
13	7 & 8	125	15.1	5.5	166	50	**5:45**	54.9	220	5	10	260	50	**14:50**
13	9 & 10	130	15.1	5.5	165	50	**5:45**	54.9	220	5	10	260	50	**14:50**
13	11	140	15.1	5.7	160	50	**5:50**	54.9	220	5	10	260	50	**14:55**
14	1	110	12.7	27.5	28	50	**3:10**	54.9	220	5	10	257	50	**12:15**
14	2	125	12.7	28.7	27	50	**3:25**	54.9	220	5	10	258	50	**12:30**
14	3 & 4	140	12.7	29.4	26	50	**3:40**	54.9	220	5	10	258	50	**12:45**
15	1	110	15.9	39.3	24	50	**3:05**	15.4	62	5	10	105	50	**7:00**
15	2 & 3	140	15.9	39.6	24	50	**3:35**	15.4	62	5	10	103	50	**7:25**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
16	1 & 2	110	17.9	2.7	391	50	**9:15**	64.5	258	5	10	302	50	**19:40**
16	3 & 4	115	17.9	2.8	389	50	**9:15**	64.5	258	5	10	317	50	**20:00**
16	5 & 6	120	17.9	2.8	377	50	**9:10**	64.5	258	5	10	317	50	**19:55**
16	7 & 8	130	17.9	2.9	374	50	**9:15**	64.5	258	5	10	317	50	**20:00**
16	9	140	17.9	3.0	356	50	**9:10**	64.5	258	5	10	317	50	**19:55**
17	1	110	18.8	2.9	394	50	**9:15**	64.5	258	5	10	319	50	**20:00**
17	2	115	18.8	2.9	393	50	**9:20**	64.5	258	5	10	321	50	**20:05**
17	3	120	18.8	3.0	380	50	**9:10**	64.5	258	5	10	321	50	**19:55**
17	4	125	18.8	3.0	379	50	**9:15**	64.5	258	5	10	321	50	**20:00**
17	5	130	18.8	3.0	378	50	**9:20**	64.5	258	5	10	321	50	**20:05**
17	6 & 7	135	18.8	3.0	377	50	**9:25**	64.5	258	5	10	321	50	**20:10**
17	8 & 9	140	18.8	3.1	363	50	**9:15**	64.5	258	5	10	321	50	**20:00**
18	1	110	18.1	3.4	321	50	**8:05**	64.6	258	5	10	319	50	**18:50**
18	2	115	18.1	3.4	320	50	**8:05**	64.6	258	5	10	311	50	**18:40**
18	3	120	18.1	3.4	320	50	**8:10**	64.6	258	5	10	311	50	**18:45**
18	4	125	18.1	3.5	313	50	**8:10**	64.6	258	5	10	311	50	**18:45**
18	5	130	18.1	3.5	312	50	**8:15**	64.6	258	5	10	311	50	**18:50**
18	6 & 7	135	18.1	3.5	307	50	**8:15**	64.6	258	5	10	311	50	**18:50**
18	8 & 9	140	18.1	3.5	306	50	**8:20**	64.6	258	5	10	311	50	**18:55**
19	1	110	9.9	2.7	221	50	**6:25**	76.9	308	5	10	345	50	**18:25**
19	2	115	9.9	2.7	219	50	**6:25**	76.9	308	5	10	343	50	**18:25**
19	3	120	9.9	2.8	215	50	**6:25**	76.9	308	5	10	343	50	**18:25**
19	4	130	9.9	2.8	210	50	**6:30**	76.9	308	5	10	343	50	**18:30**
20	1	110	13.9	3.1	269	50	**7:10**	76.9	308	5	10	349	50	**19:15**
20	2	115	13.9	3.1	267	50	**7:15**	76.9	308	5	10	351	50	**19:20**
20	3	120	13.9	3.2	265	50	**7:15**	76.9	308	5	10	351	50	**19:20**
20	4	130	13.9	3.3	252	50	**7:15**	76.9	308	5	10	351	50	**19:20**
20	5	140	13.9	3.4	246	50	**7:20**	76.9	308	5	10	351	50	**19:25**
21	1	110	12.6	3.4	219	50	**6:20**	64.6	258	5	10	300	50	**16:45**
21	2	115	12.6	3.5	219	50	**6:25**	64.6	258	5	10	298	50	**16:50**
21	3	120	12.6	3.5	217	50	**6:30**	64.6	258	5	10	298	50	**16:55**

Route Number	Bus Number	One-Wave						Two-Wave						
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R.C. (miles)	Travel Time to R.C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
21	4	130	12.6	3.5	216	50	**6:40**	64.6	258	5	10	298	50	**17:05**
21	5	140	12.6	3.5	215	50	**6:45**	64.6	258	5	10	298	50	**17:10**
						Maximum ETE:	**9:25**						**Maximum ETE:**	**20:10**
						Average ETE:	**6:55**						**Average ETE:**	**14:35**

Table 8-14. Medical Facility and Group Home Evacuation Time Estimates - Good Weather

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Asbury House	Ambulatory	90	1	20	20	3.7	4.5	50	**2:40**
Bickford Cottage	Ambulatory	90	1	46	30	12.7	4.7	162	**4:45**
Cottage Grove Place	Ambulatory	90	1	99	30	17.9	3.7	288	**6:50**
	Bedridden	90	15	1	15	17.9	3.6	295	**6:40**
Crestview Acres Care Center	Ambulatory	90	1	80	30	17.8	6.0	178	**5:00**
	Bedridden	90	15	20	30	17.8	6.0	178	**5:00**
Emeritus at Silver Pines	Ambulatory	90	1	47	30	17.8	12.2	88	**3:30**
Emery Place	Ambulatory	90	1	64	30	17.8	6.0	178	**5:00**
Evergreen Estates I	Ambulatory	90	1	50	30	12.5	5.6	133	**4:15**
Evergreen Estates II	Ambulatory	90	1	25	25	12.4	5.3	139	**4:15**
Evergreen Estates III	Ambulatory	90	1	39	30	11.8	5.3	133	**4:15**
Foundation 2	Ambulatory	90	1	30	30	11.8	5.3	133	**4:15**
Garnett Place	Ambulatory	90	1	49	30	18.4	3.7	296	**7:00**
Heritage Nursing and Evergreen Estates	Ambulatory	90	1	95	30	13.1	5.6	139	**4:20**
	Bedridden	90	15	35	30	13.1	5.6	139	**4:20**
Hiawatha Care Center	Ambulatory	90	1	97	30	11.5	2.9	235	**5:55**
	Bedridden	90	15	12	30	11.5	2.9	235	**5:55**
Higley Mansion Care Center	Ambulatory	90	1	43	30	17.0	3.3	309	**7:10**
	Bedridden	90	15	7	30	17.0	3.3	309	**7:10**
Irving Point	Ambulatory	90	1	110	30	4.5	2.2	122	**4:05**
Keystone Cedars	Ambulatory	90	1	66	30	12.7	5.9	128	**4:10**
Kingston Hill	Ambulatory	90	1	25	25	14.1	5.4	156	**4:35**
Linn Manor Care Center	Ambulatory	90	1	33	30	17.7	6.0	177	**5:00**
	Bedridden	90	15	5	30	17.7	6.0	177	**5:00**
Living Center East	Ambulatory	90	1	90	30	17.9	3.5	309	**7:10**
	Bedridden	90	15	3	30	17.9	3.5	309	**7:10**

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Manor Care Health Services	Ambulatory	90	1	85	30	7.6	2.2	204	**5:25**
	Bedridden	90	15	20	30	7.6	2.2	204	**5:25**
Meadow View Memory Care Village	Ambulatory	90	1	68	30	7.6	4.6	99	**3:40**
Mercy Hallmar Residential Care	Ambulatory	90	1	53	30	18.0	3.5	312	**7:15**
	Bedridden	90	15	2	30	18.0	3.5	312	**7:15**
Mercy Medical Center	Ambulatory	90	1	92	30	6.8	2.1	194	**5:15**
	Bedridden	90	15	213	30	6.8	2.1	194	**5:15**
Meth-Wick Community - Arbor Place	Ambulatory	90	1	32	30	15.1	5.7	159	**4:40**
Meth-Wick Community - Brendelwood	Ambulatory	90	1	50	30	15.1	5.7	159	**4:40**
Meth-Wick Community - Custom Care	Ambulatory	90	1	32	30	15.1	5.7	159	**4:40**
Meth-Wick Community - Deer Ridge	Ambulatory	90	1	100	30	15.1	5.7	159	**4:40**
Meth-Wick Community - Greenwood Terrace	Ambulatory	90	1	106	30	15.1	5.7	159	**4:40**
Meth-Wick Community - The Manor	Ambulatory	90	1	172	30	15.1	5.7	159	**4:40**
	Bedridden	90	15	3	30	15.1	5.7	159	**4:40**
Meth-Wick Community - The Woodlands	Ambulatory	90	1	55	30	15.1	5.7	159	**4:40**
	Bedridden	90	15	10	30	15.1	5.7	159	**4:40**
Milestones Adult Day Health Center	Ambulatory	90	1	70	30	15.2	5.7	160	**4:40**
Milestones in Marion	Ambulatory	90	1	55	30	12.9	4.7	164	**4:45**
Northbrook Manor Care Center	Ambulatory	90	1	130	30	13.3	5.9	136	**4:20**
Oldorf Hospice House of Mercy	Ambulatory	90	1	12	12	12.8	2.9	264	**6:10**
Prairie Hills Senior Living	Ambulatory	90	1	86	30	6.6	4.5	88	**3:30**

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Promise House	Ambulatory	90	1	20	20	13.3	3.0	266	**6:20**
REM Iowa Developmental Services (8)	Ambulatory	90	1	65	30	13.3	3.1	261	**6:25**
REM Iowa Developmental Services (9)	Ambulatory	90	1	75	30	15.1	3.4	267	**6:30**
Ridge View Assisted Living	Ambulatory	90	1	88	30	6.5	4.5	87	**3:30**
Rock Ridge Residential Care Facility	Ambulatory	90	1	35	30	13.3	46.2	17	**2:20**
Sacred Heart Convent	Ambulatory	90	1	33	30	8.8	2.5	213	**5:35**
St. Luke's Hospital	Ambulatory	90	1	330	30	6.7	2.1	191	**5:15**
	Bedridden	90	15	90	30	6.7	2.1	191	**5:15**
St. Luke's Living Center West	Ambulatory	90	1	75	30	17.7	3.5	305	**7:05**
	Bedridden	90	15	10	30	17.7	3.5	305	**7:05**
Summit Pointe Living Community	Ambulatory	90	1	202	30	10.9	6.1	107	**3:50**
Tanager Place	Ambulatory	90	1	68	30	4.5	5.3	51	**2:55**
Villages at Marion	Ambulatory	90	1	84	30	10.9	4.7	139	**4:20**
West Ridge Care Center	Ambulatory	90	1	40	30	13.9	5.8	145	**4:25**
	Bedridden	90	15	20	30	13.9	5.8	145	**4:25**
Willow Gardens Care Center	Ambulatory	90	1	71	30	18.2	5.2	208	**5:30**
	Bedridden	90	15	20	30	18.2	5.2	208	**5:30**
Winslow House Care Center	Ambulatory	90	1	45	30	13.4	5.9	137	**4:20**
	Bedridden	90	15	5	30	13.4	5.9	137	**4:20**
								Maximum ETE:	**7:15**
								Average ETE:	**5:05**

Table 8-15. Medical Facility and Group Home Facility Evacuation Time Estimates – Rain

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Asbury House	Ambulatory	100	1	20	20	3.7	3.4	65	**3:05**
Bickford Cottage	Ambulatory	100	1	46	30	12.7	4.5	169	**5:00**
Cottage Grove Place	Ambulatory	100	1	99	30	17.9	3.5	309	**7:20**
	Bedridden	100	15	1	15	17.9	3.1	342	**7:40**
Crestview Acres Care Center	Ambulatory	100	1	80	30	17.8	6.0	179	**5:10**
	Bedridden	100	15	20	30	17.8	6.0	179	**5:10**
Emeritus at Silver Pines	Ambulatory	100	1	47	30	17.8	10.2	105	**3:55**
Emery Place	Ambulatory	100	1	64	30	17.8	6.0	177	**5:10**
Evergreen Estates I	Ambulatory	100	1	50	30	12.5	4.6	163	**4:55**
Evergreen Estates II	Ambulatory	100	1	25	25	12.4	4.8	157	**4:45**
Evergreen Estates III	Ambulatory	100	1	39	30	11.8	4.7	149	**4:40**
Foundation 2	Ambulatory	100	1	30	30	11.8	4.7	149	**4:40**
Garnett Place	Ambulatory	100	1	49	30	18.4	3.5	318	**7:30**
Heritage Nursing and Evergreen Estates	Ambulatory	100	1	95	30	13.1	4.8	164	**4:55**
	Bedridden	100	15	35	30	13.1	4.8	164	**4:55**
Hiawatha Care Center	Ambulatory	100	1	97	30	11.5	2.6	263	**6:35**
	Bedridden	100	15	12	30	11.5	2.6	263	**6:35**
Higley Mansion Care Center	Ambulatory	100	1	43	30	17.0	3.1	329	**7:40**
	Bedridden	100	15	7	30	17.0	3.1	329	**7:40**
Irving Point	Ambulatory	100	1	110	30	4.5	2.1	129	**4:20**
Keystone Cedars	Ambulatory	100	1	66	30	12.7	5.7	135	**4:25**
Kingston Hill	Ambulatory	100	1	25	25	14.1	5.4	158	**4:45**
Linn Manor Care Center	Ambulatory	100	1	33	30	17.7	6.0	178	**5:10**
	Bedridden	100	15	5	30	17.7	6.0	178	**5:10**
Living Center East	Ambulatory	100	1	90	30	17.9	3.3	329	**7:40**
	Bedridden	100	15	3	30	17.9	3.3	329	**7:40**

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Manor Care Health Services	Ambulatory	100	1	85	30	7.6	2.1	215	**5:45**
	Bedridden	100	15	20	30	7.6	2.1	215	**5:45**
Meadow View Memory Care Village	Ambulatory	100	1	68	30	7.6	4.6	100	**3:50**
Mercy Hallmar Residential Care	Ambulatory	100	1	53	30	18.0	3.3	332	**7:45**
	Bedridden	100	15	2	30	18.0	3.3	332	**7:45**
Mercy Medical Center	Ambulatory	100	1	92	30	6.8	2.1	193	**5:25**
	Bedridden	100	15	213	30	6.8	2.1	193	**5:25**
Meth-Wick Community - Arbor Place	Ambulatory	100	1	32	30	15.1	5.7	158	**4:50**
Meth-Wick Community - Brendelwood	Ambulatory	100	1	50	30	15.1	5.7	158	**4:50**
Meth-Wick Community - Custom Care	Ambulatory	100	1	32	30	15.1	5.7	158	**4:50**
Meth-Wick Community - Deer Ridge	Ambulatory	100	1	100	30	15.1	5.7	158	**4:50**
Meth-Wick Community - Greenwood Terrace	Ambulatory	100	1	106	30	15.1	5.7	158	**4:50**
Meth-Wick Community - The Manor	Ambulatory	100	1	172	30	15.1	5.7	158	**4:50**
	Bedridden	100	15	3	30	15.1	5.7	158	**4:50**
Meth-Wick Community - The Woodlands	Ambulatory	100	1	55	30	15.1	5.7	158	**4:50**
	Bedridden	100	15	10	30	15.1	5.7	158	**4:50**
Milestones Adult Day Health Center	Ambulatory	100	1	70	30	15.2	5.7	159	**4:50**
Milestones in Marion	Ambulatory	100	1	55	30	12.9	4.5	172	**5:05**
Northbrook Manor Care Center	Ambulatory	100	1	130	30	13.3	5.7	140	**4:30**
Oldorf Hospice House of Mercy	Ambulatory	100	1	20	20	12.8	2.7	284	**6:45**
Prairie Hills Senior Living	Ambulatory	100	1	65	30	6.6	4.4	90	**3:40**

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Promise House	Ambulatory	100	1	75	30	13.3	2.8	284	**6:55**
REM Iowa Developmental Services (8)	Ambulatory	100	1	35	30	13.3	2.8	284	**6:55**
REM Iowa Developmental Services (9)	Ambulatory	100	1	33	30	15.1	3.1	290	**7:00**
Ridge View Assisted Living	Ambulatory	100	1	330	30	6.5	4.1	94	**3:45**
Rock Ridge Residential Care Facility	Ambulatory	100	1	75	30	13.3	42.6	19	**2:30**
Sacred Heart Convent	Ambulatory	100	1	202	30	8.8	2.3	230	**6:00**
St. Luke's Hospital	Ambulatory	100	1	330	30	6.7	2.1	189	**5:20**
	Bedridden	100	15	90	30	6.7	2.1	189	**5:20**
St. Luke's Living Center West	Ambulatory	100	1	75	30	17.7	3.3	325	**7:35**
	Bedridden	100	15	10	30	17.7	3.3	325	**7:35**
Summit Pointe Living Community	Ambulatory	100	1	202	30	10.9	5.5	119	**4:10**
Tanager Place	Ambulatory	100	1	68	30	4.5	5.9	46	**3:00**
Villages at Marion	Ambulatory	100	1	84	30	10.9	4.2	154	**4:45**
West Ridge Care Center	Ambulatory	100	1	40	30	13.9	5.1	164	**4:55**
	Bedridden	100	15	20	30	13.9	5.1	164	**4:55**
Willow Gardens Care Center	Ambulatory	100	1	71	30	18.2	5.0	219	**5:50**
	Bedridden	100	15	20	30	18.2	5.0	219	**5:50**
Winslow House Care Center	Ambulatory	100	1	45	30	13.4	5.7	141	**4:35**
	Bedridden	100	15	5	30	13.4	5.7	141	**4:35**
								Maximum ETE:	**7:45**
								Average ETE:	**5:25**

Table 8-16. Medical Facility and Group Home Evacuation Time Estimates – Snow

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Asbury House	Ambulatory	110	1	20	20	3.7	3.4	64	**3:15**
Bickford Cottage	Ambulatory	110	1	46	30	12.7	3.8	201	**5:45**
Cottage Grove Place	Ambulatory	110	1	99	30	17.9	3.0	363	**8:25**
	Bedridden	110	15	1	15	17.9	2.9	368	**8:15**
Crestview Acres Care Center	Ambulatory	110	1	80	30	17.8	5.6	191	**5:35**
	Bedridden	110	15	20	30	17.8	5.6	191	**5:35**
Emeritus at Silver Pines	Ambulatory	110	1	47	30	17.8	9.4	114	**4:15**
Emery Place	Ambulatory	110	1	64	30	17.8	5.1	207	**5:50**
Evergreen Estates I	Ambulatory	110	1	50	30	12.5	4.0	187	**5:30**
Evergreen Estates II	Ambulatory	110	1	25	25	12.4	4.0	186	**5:25**
Evergreen Estates III	Ambulatory	110	1	39	30	11.8	4.0	178	**5:20**
Foundation 2	Ambulatory	110	1	30	30	11.8	4.0	178	**5:20**
Garnett Place	Ambulatory	110	1	49	30	18.4	3.1	358	**8:20**
Heritage Nursing and Evergreen Estates	Ambulatory	110	1	95	30	13.1	4.0	195	**5:35**
	Bedridden	110	15	35	30	13.1	4.0	195	**5:35**
Hiawatha Care Center	Ambulatory	110	1	97	30	11.5	2.5	278	**7:00**
	Bedridden	110	15	12	30	11.5	2.5	278	**7:00**
Higley Mansion Care Center	Ambulatory	110	1	43	30	17.0	2.7	371	**8:35**
	Bedridden	110	15	7	30	17.0	2.7	371	**8:35**
Irving Point	Ambulatory	110	1	110	30	4.5	2.0	132	**4:35**
Keystone Cedars	Ambulatory	110	1	66	30	12.7	4.6	164	**5:05**
Kingston Hill	Ambulatory	110	1	25	25	14.1	4.2	200	**5:35**
Linn Manor Care Center	Ambulatory	110	1	33	30	17.7	5.6	189	**5:30**
	Bedridden	110	15	5	30	17.7	5.6	189	**5:30**
Living Center East	Ambulatory	110	1	90	30	17.9	2.8	381	**8:45**
	Bedridden	110	15	3	30	17.9	2.8	381	**8:45**

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Manor Care Health Services	Ambulatory	110	1	85	30	7.6	2.0	224	**6:05**
	Bedridden	110	15	20	30	7.6	2.0	224	**6:05**
Meadow View Memory Care Village	Ambulatory	110	1	68	30	7.6	3.4	133	**4:35**
Mercy Hallmar Residential Care	Ambulatory	110	1	53	30	18.0	2.8	384	**8:45**
	Bedridden	110	15	2	30	18.0	2.8	384	**8:45**
Mercy Medical Center	Ambulatory	110	1	92	30	6.8	2.1	195	**5:35**
	Bedridden	110	15	213	30	6.8	2.1	195	**5:35**
Meth-Wick Community - Arbor Place	Ambulatory	110	1	32	30	15.1	4.5	201	**5:45**
Meth-Wick Community - Brendelwood	Ambulatory	110	1	50	30	15.1	4.5	201	**5:45**
Meth-Wick Community - Custom Care	Ambulatory	110	1	32	30	15.1	4.5	201	**5:45**
Meth-Wick Community - Deer Ridge	Ambulatory	110	1	100	30	15.1	4.5	201	**5:45**
Meth-Wick Community - Greenwood Terrace	Ambulatory	110	1	106	30	15.1	4.5	201	**5:45**
Meth-Wick Community - The Manor	Ambulatory	110	1	172	30	15.1	4.5	201	**5:45**
	Bedridden	110	15	3	30	15.1	4.5	201	**5:45**
Meth-Wick Community - The Woodlands	Ambulatory	110	1	55	30	15.1	4.5	201	**5:45**
	Bedridden	110	15	10	30	15.1	4.5	201	**5:45**
Milestones Adult Day Health Center	Ambulatory	110	1	70	30	15.2	4.5	202	**5:45**
Milestones in Marion	Ambulatory	110	1	55	30	12.9	3.8	205	**5:45**
Northbrook Manor Care Center	Ambulatory	110	1	130	30	13.3	4.7	171	**5:15**
Oldorf Hospice House of Mercy	Ambulatory	110	1	20	20	12.8	2.6	301	**7:15**

Special Facility	Resident	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Prairie Hills Senior Living	Ambulatory	110	1	65	30	6.6	3.5	113	**4:15**
Promise House	Ambulatory	110	1	75	30	13.3	2.7	299	**7:20**
REM Iowa Developmental Services (8)	Ambulatory	110	1	35	30	13.3	2.7	299	**7:20**
REM Iowa Developmental Services (9)	Ambulatory	110	1	33	30	15.1	2.8	320	**7:40**
Ridge View Assisted Living	Ambulatory	110	1	330	30	6.5	3.5	111	**4:15**
Rock Ridge Residential Care Facility	Ambulatory	110	1	75	30	13.3	36.1	22	**2:45**
Sacred Heart Convent	Ambulatory	110	1	202	30	8.8	2.2	241	**6:25**
St. Luke's Hospital	Ambulatory	110	1	330	30	6.7	2.1	192	**5:35**
	Bedridden	110	15	90	30	6.7	2.1	192	**5:35**
St. Luke's Living Center West	Ambulatory	110	1	75	30	17.7	2.8	376	**8:40**
	Bedridden	110	15	10	30	17.7	2.8	376	**8:40**
Summit Pointe Living Community	Ambulatory	110	1	202	30	10.9	4.5	145	**4:45**
Tanager Place	Ambulatory	110	1	68	30	4.5	5.4	50	**3:10**
Villages at Marion	Ambulatory	110	1	84	30	10.9	3.6	183	**5:25**
West Ridge Care Center	Ambulatory	110	1	40	30	13.9	4.1	205	**5:45**
	Bedridden	110	15	20	30	13.9	4.1	205	**5:45**
Willow Gardens Care Center	Ambulatory	110	1	71	30	18.2	4.4	249	**6:30**
	Bedridden	110	15	20	30	18.2	4.4	249	**6:30**
Winslow House Care Center	Ambulatory	110	1	45	30	13.4	4.7	172	**5:15**
	Bedridden	110	15	5	30	13.4	4.7	172	**5:15**
								Maximum ETE:	**8:45**
								Average ETE:	**6:05**

Table 8-17. Homebound Special Needs Population Evacuation Time Estimates

Vehicle Type	People Requiring Vehicle	Vehicles deployed	Stops	Weather Conditions	Mobiliza-tion Time (min)	Loading Time at 1st Stop (min)	Travel to Subsequent Stops (min)	Total Loading Time at Subsequent Stops (min)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Buses	906	95	10	Normal	90	5	216	60	37	**6:50**
				Rain	100		240		41	**7:30**
				Snow	110		276		45	**8:20**
Wheelchair Buses	251		3	Normal	90		Combined with Above			
				Rain	100					
				Snow	110					
Ambulances	15	10	2	Normal	90	15	30	15	32	**3:05**
				Rain	100		33		36	**3:20**
				Snow	110		38		38	**3:40**
									Maximum ETE:	**8:20**
									Average ETE:	**5:30**

Table 8-18. Homebound Special Needs Persons Evacuation Time Estimates - Second Wave for Ambulatory/Wheelchair Bound

Vehicle Type	People Requiring Vehicle	Vehicles deployed	Stops	Weather Conditions	One Wave ETE[1] (hr:min)	Unload Passengers (min)	Driver Rest (min)	Travel Time Back to EPZ[2] (min)	Travel to All Stops (min)	Total Loading Time at All Stops (min)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Buses	1157	92	13	Normal	4:20	5	10	39	234	65	8	**10:25**
				Rain	4:55	5	10	49	260		9	**11:35**
				Snow	5:30	5	10	65	299		10	**13:05**
											Maximum ETE:	**13:05**
											Average ETE:	**11:45**

[1] Average ETE to TRC from Table 8-7 through Table 8-9, respectively

[2] Average of travel time from EPZ boundary to TRC from Table 8-7 through Table 8-9, respectively

Table 8-19. Correctional Facility Evacuation Time Estimates

Facility Name	Weather Conditions	Mobilization (min)	Number of Buses	Loading Rate (min per person)	Number of Inmates	Total Loading Time (min)	Distance to EPZ Boundary (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Anchor Center	Normal	90	1	2	26	52	4.3	85	**3:50**
	Rain	100						94	**4:10**
	Snow	110						92	**4:15**
Hinzman Center	Normal	90	2	2	86	132	4.5	77	**5:00**
	Rain	100						98	**5:30**
	Snow	110						97	**5:40**
Linn County Correctional Center	Normal	90	7	2	401	132	5.7	103	**5:25**
	Rain	100						149	**6:25**
	Snow	110						143	**6:25**
Lary Nelson Center	Normal	90	2	2	93	132	4.5	77	**5:00**
	Rain	100						98	**5:30**
	Snow	110						97	**5:40**
								Maximum ETE:	**6:25**
								Average ETE:	**5:15**

9 TRAFFIC MANAGEMENT STRATEGY

This section discusses the suggested traffic control and management strategy that is designed to expedite the movement of evacuating traffic. The resources required to implement this strategy include:

- Personnel with the capabilities of performing the planned control functions of traffic guides (preferably, not necessarily, law enforcement officers).
- The Manual of Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA) of the U.S.D.O.T. provides guidance for Traffic Control Devices to assist these personnel in the performance of their tasks. All state and most county transportation agencies have access to the MUTCD, which is available on-line: http://mutcd.fhwa.dot.gov which provides access to the official PDF version.
- A plan, that defines all locations, provides necessary details and is documented in a format that is readily understood by those assigned to perform traffic control.

The functions to be performed in the field are:

1. Facilitate evacuating traffic movements that safely expedite travel out of the EPZ.
2. Discourage traffic movements that move evacuating vehicles in a direction which takes them significantly closer to the power plant, or which interferes with the efficient flow of other evacuees.

The terms "facilitate" and "discourage" are employed rather than "enforce" and "prohibit" to indicate the need for flexibility in performing the traffic control function. There are always legitimate reasons for a driver to prefer a direction other than that indicated. For example:

- A driver may be traveling home from work or from another location, to join other family members prior to evacuating.
- An evacuating driver may be travelling to pick up a relative, or other evacuees.
- The driver may be an emergency worker en route to perform an important activity.

The implementation of a plan must also be flexible enough for the application of sound judgment by the traffic guide.

The traffic management plan is the outcome of the following process:

1. The detailed traffic control tactics discussed in the “DAEC Emergency Planning Zone Traffic Management Plan”, dated October 2014 (DAEC TMP), serve as the basis of the traffic management plan, as per NUREG/CR-7002.
2. Computer analysis of the evacuation traffic flow environment (See Figures 7-3 through 7-10).

   This analysis identifies the best routing and those critical intersections that experience pronounced congestion. Any critical intersections that would benefit from traffic or access control which are not identified in the existing offsite plans are suggested as additional TCPs and ACPs. Five additional TCPs were identified which would benefit ETE. One additional ACP was identified to stop the external

traffic from entering the EPZ after 2 hours. See Appendix G for more detail.

3. The TCPs and ACPs defined in the exiting TMP, the new TCPs and ACP (for the stop of external traffic), and how they were applied in this study, are discussed in Appendix G.
4. Consultation with emergency management and law enforcement personnel.

   Trained personnel who are experienced in controlling traffic and are aware of the likely evacuation traffic patterns have reviewed the control tactics at the additional TCPs and ACP.
5. Prioritization of TCPs and ACPs.

   Application of traffic and access control at some TCPs and ACPs will have a more pronounced influence on expediting traffic movements than at other TCPs and ACPs. For example, TCPs controlling traffic originating from areas in close proximity to the power plant could have a more beneficial effect on minimizing potential exposure to radioactivity than those TCPs located far from the power plant. These priorities should be assigned by state/local emergency management representatives and by law enforcement personnel.

The use of Intelligent Transportation Systems (ITS) technologies can reduce manpower and equipment needs, while still facilitating the evacuation process. Dynamic Message Signs (DMS) can be placed within the EPZ to provide information to travelers regarding traffic conditions, route selection, and reception center information. DMS can also be placed outside of the EPZ to warn motorists to avoid using routes that may conflict with the flow of evacuees away from the power plant. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees en route through their vehicle stereo systems. Automated Traveler Information Systems (ATIS) can also be used to provide evacuees with information. Internet websites can provide traffic and evacuation route information before the evacuee begins their trip, while on board navigation systems (GPS units), cell phones, and pagers can be used to provide information en route. These are only several examples of how ITS technologies can benefit the evacuation process. Consideration should be given that ITS technologies be used to facilitate the evacuation process, and any additional signage placed should consider evacuation needs.

The ETE analysis treated all controlled intersections that are existing ACP or TCP locations in the offsite agency plans as being controlled by actuated signals. Appendix K, Table K-2 identifies those intersections that were modeled as TCPs.

The ETE calculations reflect the assumption that all “external-external” trips are interdicted and diverted after 2 hours have elapsed from the ATE, in accordance with federal guidance. All transit vehicles and other responders entering the EPZ to support the evacuation are assumed to be unhindered by personnel manning ACPs (for purposes of diverting through traffic) and TCPs. The ACPs as discussed in the DAEC TMP will prevent any vehicles from entering the EPZ once the evacuation has been completed. Study Assumptions 12 and 13 in Section 2.3 discuss ACP and TCP staffing schedules and operations in greater detail.

10 EVACUATION ROUTES

Evacuation routes are comprised of two distinct components:

- Routing from a Subarea being evacuated to the boundary of the Evacuation Region and thence out of the EPZ.
- Routing of transit-dependent evacuees from the EPZ boundary to reception centers.

Evacuees will select routes within the EPZ in such a way as to minimize their exposure to risk. This expectation is met by the DYNEV II model routing traffic away from the location of the plant, to the extent practicable. The DTRAD model satisfies this behavior by routing traffic so as to balance traffic demand relative to the available highway capacity to the extent possible. See Appendices B through D for further discussion.

The routing of transit-dependent evacuees from the EPZ boundary to reception centers is designed to minimize the amount of travel outside the EPZ, from the points where these routes cross the EPZ boundary.

Figure 10-1 maps the general population reception centers and temporary relocation centers (TRCs) for evacuees. The major evacuation routes for the EPZ are presented in Figure 10-2.

It is assumed that all school evacuees will be taken to the appropriate TRC and subsequently be picked up by parents or guardians. Transit-dependent evacuees are transported to the nearest reception center for each county. This study does not consider the transport of evacuees from reception centers to congregate care centers, if the counties do make the decision to relocate evacuees.

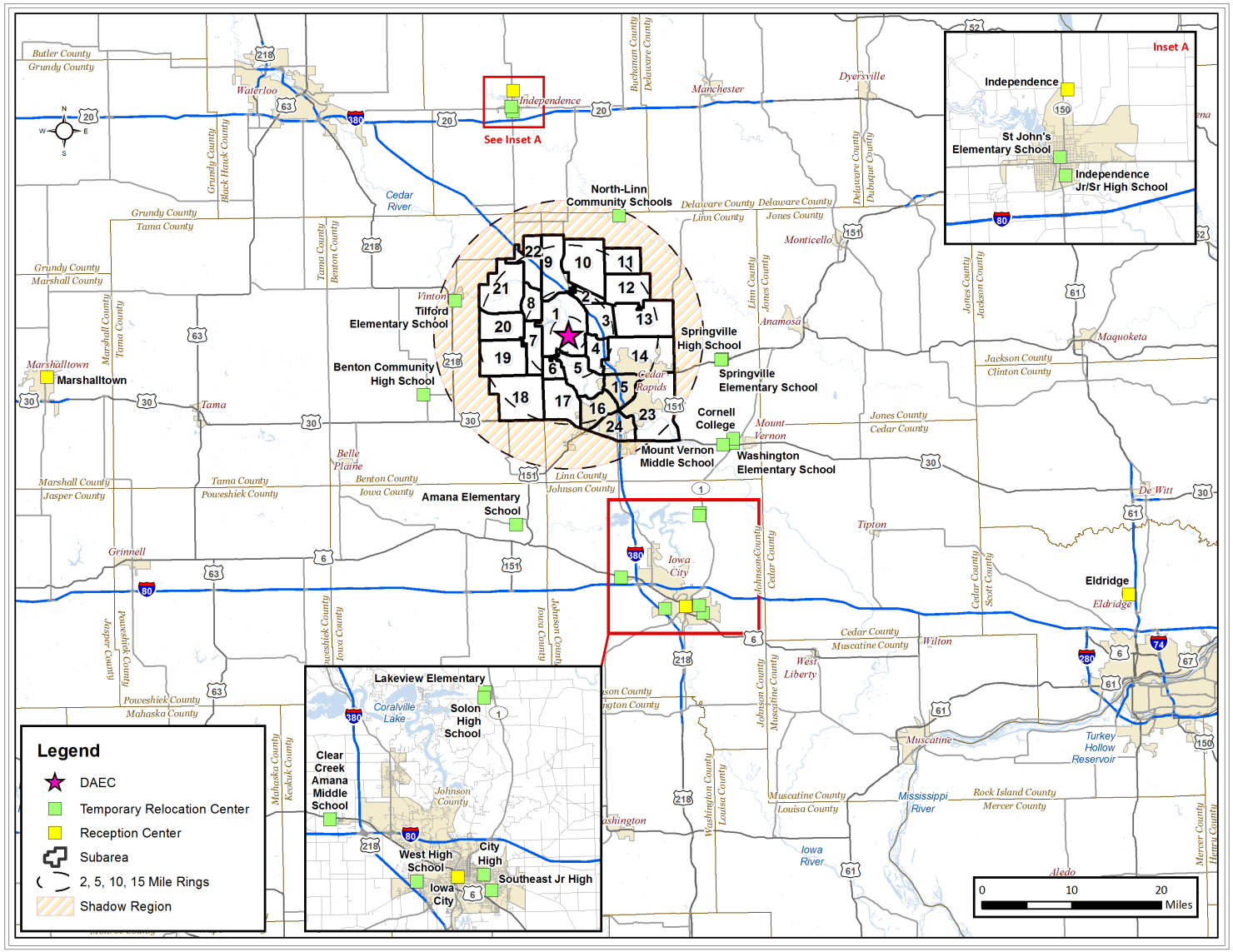


Figure 10-1. General Population and Temporary Relocation Centers

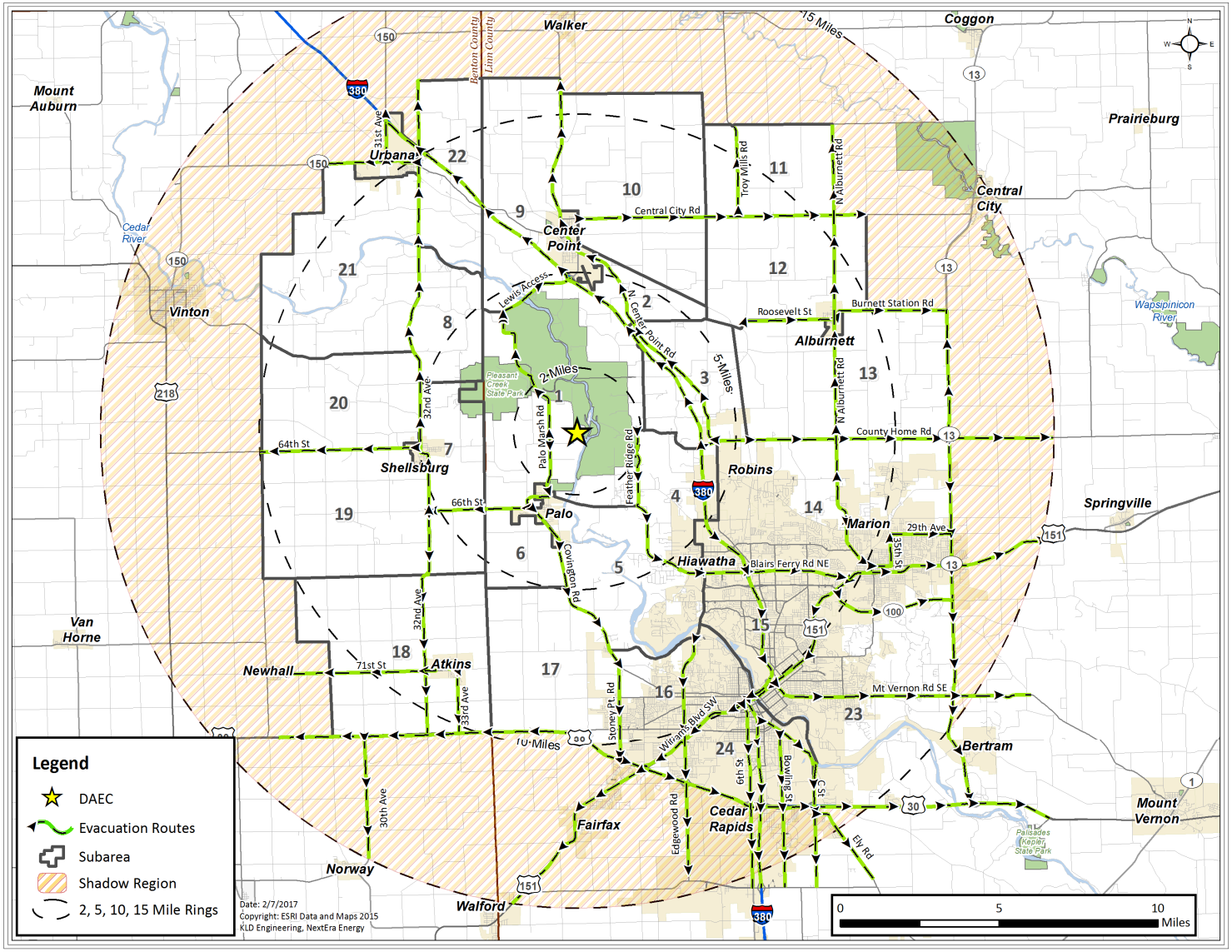


Figure 10-2. Evacuation Route Map

11 SURVEILLANCE OF EVACUATION OPERATIONS

There is a need for surveillance of traffic operations during the evacuation. There is also a need to clear any blockage of roadways arising from accidents or vehicle disablement. Surveillance can take several forms.

1. Traffic control personnel, located at traffic control and access control points, provide fixed-point surveillance.
2. Ground patrols may be undertaken along well-defined paths to ensure coverage of those highways that serve as major evacuation routes.
3. Aerial surveillance of evacuation operations may also be conducted using helicopter or fixed-wing aircraft, if available.
4. Cellular phone calls (if cellular coverage exists) from motorists may also provide direct field reports of road blockages.

These concurrent surveillance procedures are designed to provide coverage of the entire EPZ as well as the area around its periphery. It is the responsibility of the counties to support an emergency response system that can receive messages from the field and be in a position to respond to any reported problems in a timely manner. This coverage should quickly identify, and expedite the response to any blockage caused by a disabled vehicle.

Tow Vehicles

In a low-speed traffic environment, any vehicle disablement is likely to arise due to a low-speed collision, mechanical failure or the exhaustion of its fuel supply. In any case, the disabled vehicle can be pushed onto the shoulder, thereby restoring traffic flow. Past experience in other emergencies indicates that evacuees who are leaving an area often perform activities such as pushing a disabled vehicle to the side of the road without prompting.

While the need for tow vehicles is expected to be low under the circumstances described above, it is still prudent to be prepared for such a need. Consideration should be given that tow trucks with a supply of gasoline be deployed at strategic locations within, or just outside, the EPZ. These locations should be selected so that:

- They permit access to key, heavily loaded, evacuation routes.
- Responding tow trucks would most likely travel counter-flow relative to evacuating traffic.

Consideration should also be given that the state and county emergency management agencies encourage gas stations to remain open during the evacuation.

12 CONFIRMATION TIME

It is necessary to confirm that the evacuation process is effective in the sense that the public is complying with the advisory to evacuate. The EPZ county and state radiological emergency plans do not discuss a procedure for confirming evacuation. Should procedures not already exist, we suggest an alternative or complementary approach.

The procedure we suggest employs a stratified random sample and a telephone survey. The size of the sample is dependent on the expected number of households that do not comply with the advisory to evacuate. We believe it is reasonable to assume, for the purpose of estimating sample size that at least 80 percent of the population within the EPZ will comply with the advisory to evacuate. On this basis, an analysis could be undertaken (see Table 12-1) to yield an estimated sample size of approximately 300.

The confirmation process should start at about 2 hours after the advisory to evacuate, which is when approximately 90 percent of evacuees have completed their mobilization activities (see Table 5-9). At this time, virtually all evacuees will have departed on their respective trips and the local telephone system will be largely free of traffic.

As indicated in Table 12-1, approximately 7½ person hours are needed to complete the telephone survey. If six people are assigned to this task, each dialing a different set of telephone exchanges (e.g., each person can be assigned a different set of subareas), then the confirmation process will extend over a timeframe of about 75 minutes. Thus, the confirmation should be completed before the evacuated area is cleared. Of course, fewer people would be needed for this survey if the evacuation region were only a portion of the EPZ. Use of modern automated computer controlled dialing equipment or other technologies (e.g., reverse 911 or equivalent) can significantly reduce the manpower requirements and the time required to undertake this type of confirmation survey.

If this method is indeed used by the offsite agencies, consideration should be given to maintain a list of telephone numbers within the EPZ in the EOC at all times. Such a list could be purchased from vendors and should be periodically updated. As indicated above, the confirmation process should not begin until 2 hours after the advisory to evacuate, to ensure that households have had enough time to mobilize. This 2-hour timeframe will enable telephone operators to arrive at their workplace, obtain a call list and prepare to make the necessary phone calls.

Should the number of telephone responses (i.e., people still at home) exceed 20 percent, then the telephone survey should be repeated after an hour's interval until the confirmation process is completed.

Other techniques should also be considered. After traffic volumes decline, the personnel manning TCPs can be redeployed to travel through residential areas to observe and to confirm evacuation activities.

Table 12-1. Estimated Number of Telephone Calls Required for Confirmation of Evacuation

Problem Definition

Estimate number of phone calls, n, needed to ascertain the proportion, F of households that have not evacuated.

Reference: Burstein, H., Attribute Sampling, McGraw Hill, 1971

Given:

- No. of households plus other facilities, N, within the EPZ (est.) = 86,500
- Est. proportion, F, of households that will not evacuate = 0.20
- Allowable error margin, e: 0.05
- Confidence level, α: 0.95 (implies A = 1.96)

Applying Table 10 of cited reference,

$$p = F + e = 0.25; \;\; q = 1 - p = 0.75$$

$$n = \frac{A^2 pq + e}{e^2} = 308$$

Finite population correction:

$$n_F = \frac{nN}{n + N - 1} = 307$$

Thus, some 300 telephone calls will confirm that approximately 20 percent of the population has not evacuated. If only 10 percent of the population does not comply with the advisory to evacuate, then the required sample size, n_F = 215.

Est. Person Hours to complete 300 telephone calls

Assume:

- Time to dial using touch tone (random selection of listed numbers): 30 seconds
- Time for 6 rings (no answer): 36 seconds
- Time for 4 rings plus short conversation: 60 sec.
- Interval between calls: 20 sec.

Person Hours:

$$\frac{300[30 + 0.8(36) + 0.2(60) + 20]}{3600} = 7.6$$

APPENDIX A

Glossary of Traffic Engineering Terms

A. GLOSSARY OF TRAFFIC ENGINEERING TERMS

Table A-1. Glossary of Traffic Engineering Terms

Term	Definition
Analysis Network	A graphical representation of the geometric topology of a physical roadway system, which is comprised of directional links and nodes.
Link	A network link represents a specific, one-directional section of roadway. A link has both physical (length, number of lanes, topology, etc.) and operational (turn movement percentages, service rate, free-flow speed) characteristics.
Measures of Effectiveness	Statistics describing traffic operations on a roadway network.
Node	A network node generally represents an intersection of network links. A node has control characteristics, i.e., the allocation of service time to each approach link.
Origin	A location attached to a network link, within the EPZ or Shadow Region, where trips are generated at a specified rate in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations.
Prevailing Roadway and Traffic Conditions	Relates to the physical features of the roadway, the nature (e.g., composition) of traffic on the roadway and the ambient conditions (weather, visibility, pavement conditions, etc.).
Service Rate	Maximum rate at which vehicles, executing a specific turn maneuver, can be discharged from a section of roadway at the prevailing conditions, expressed in vehicles per second (vps) or vehicles per hour (vph).
Service Volume	Maximum number of vehicles which can pass over a section of roadway in one direction during a specified time period with operating conditions at a specified Level of Service (The Service Volume at the upper bound of Level of Service, E, equals Capacity). Service Volume is usually expressed as vehicles per hour (vph).
Signal Cycle Length	The total elapsed time to display all signal indications, in sequence. The cycle length is expressed in seconds.
Signal Interval	A single combination of signal indications. The interval duration is expressed in seconds. A signal phase is comprised of a sequence of signal intervals, usually green, yellow, red.

Term	Definition
Signal Phase	A set of signal indications (and intervals) which services a particular combination of traffic movements on selected approaches to the intersection. The phase duration is expressed in seconds.
Traffic (Trip) Assignment	A process of assigning traffic to paths of travel in such a way as to satisfy all trip objectives (i.e., the desire of each vehicle to travel from a specified origin in the network to a specified destination) and to optimize some stated objective or combination of objectives. In general, the objective is stated in terms of minimizing a generalized "cost". For example, "cost" may be expressed in terms of travel time.
Traffic Density	The number of vehicles that occupy one lane of a roadway section of specified length at a point in time, expressed as vehicles per mile (vpm).
Traffic (Trip) Distribution	A process for determining the destinations of all traffic generated at the origins. The result often takes the form of a Trip Table, which is a matrix of origin-destination traffic volumes.
Traffic Simulation	A computer model designed to replicate the real-world operation of vehicles on a roadway network, so as to provide statistics describing traffic performance. These statistics are called Measures of Effectiveness.
Traffic Volume	The number of vehicles that pass over a section of roadway in one direction, expressed in vehicles per hour (vph). Where applicable, traffic volume may be stratified by turn movement.
Travel Mode	Distinguishes between private auto, bus, rail, pedestrian and air travel modes.
Trip Table or Origin-Destination Matrix	A rectangular matrix or table, whose entries contain the number of trips generated at each specified origin, during a specified time period, that are attracted to (and travel toward) each of its specified destinations. These values are expressed in vehicles per hour (vph) or in vehicles.
Turning Capacity	The capacity associated with that component of the traffic stream which executes a specified turn maneuver from an approach at an intersection.

APPENDIX B

DTRAD: Dynamic Traffic Assignment and Distribution Model

B. DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL

This section describes the integrated dynamic trip assignment and distribution model named DTRAD (Dynamic Traffic Assignment and Distribution) that is expressly designed for use in analyzing evacuation scenarios. DTRAD employs logit-based path-choice principles and is one of the models of the DYNEVII System. The DTRAD module implements path-based *Dynamic Traffic Assignment* (DTA) so that time dependent Origin-Destination (OD) trips are "assigned" to routes over the network based on prevailing traffic conditions.

To apply the DYNEV II System, the analyst must specify the highway network, link capacity information, the time-varying volume of traffic generated at all origin centroids and, optionally, a set of accessible candidate destination nodes on the periphery of the EPZ for selected origins. DTRAD calculates the optimal dynamic trip distribution (i.e., trip destinations) and the optimal dynamic trip assignment (i.e., trip routing) of the traffic generated at each origin node traveling to its set of candidate destination nodes, so as to minimize evacuee travel "cost".

Overview of Integrated Distribution and Assignment Model

The underlying premise is that the selection of destinations and routes is intrinsically coupled in an evacuation scenario. That is, people in vehicles seek to travel out of an area of potential risk as rapidly as possible by selecting the "best" routes. The model is designed to identify these "best" routes in a manner that realistically distributes vehicles from origins to destinations and routes them over the highway network, in a consistent and optimal manner, reflecting evacuee behavior.

For each origin, a set of "candidate destination nodes" is selected by the software logic and by the analyst to reflect the desire by evacuees to travel away from the power plant and to access major highways. The specific destination nodes within this set that are selected by travelers and the selection of the connecting paths of travel, are both determined by DTRAD. This determination is made by a logit-based path choice model in DTRAD, so as to minimize the trip "cost", as discussed later.

The traffic loading on the network and the consequent operational traffic environment of the network (density, speed, throughput on each link) vary over time as the evacuation takes place. The DTRAD model, which is interfaced with the DYNEV simulation model, executes a succession of "sessions" wherein it computes the optimal routing and selection of destination nodes for the conditions that exist at that time.

Interfacing the DYNEV Simulation Model with DTRAD

The DYNEV II system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. An algorithm was developed to support the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next. Another algorithm executes a "mapping" from the specified "geometric" network (link-node analysis network) that represents the physical highway system, to a "path" network that represents the vehicle [turn] movements. DTRAD computations are performed on the "path" network: DYNEV simulation model, on the "geometric" network.

DTRAD Description

DTRAD is the DTA module for the DYNEV II System.

When the road network under study is large, multiple routing options are usually available between trip origins and destinations. The problem of loading traffic demands and propagating them over the network links is called Network Loading and is addressed by DYNEVII using macroscopic traffic simulation modeling. Traffic assignment deals with computing the distribution of the traffic over the road network for given O-D demands and is a model of the route choice of the drivers. Travel demand changes significantly over time, and the road network may have time dependent characteristics, e.g., time-varying signal timing or reduced road capacity because of lane closure, or traffic congestion. To consider these time dependencies, DTA procedures are required.

The DTRAD DTA module represents the dynamic route choice behavior of drivers, using the specification of dynamic origin-destination matrices as flow input. Drivers choose their routes through the network based on the travel cost they experience (as determined by the simulation model). This allows traffic to be distributed over the network according to the time-dependent conditions. The modeling principles of D-TRAD include:

- It is assumed that drivers not only select the best route (i.e., lowest cost path) but some also select less attractive routes. The algorithm implemented by DTRAD archives several "efficient" routes for each O-D pair from which the drivers choose.
- The choice of one route out of a set of possible routes is an outcome of "discrete choice modeling". Given a set of routes and their generalized costs, the percentages of drivers that choose each route is computed. The most prevalent model for discrete choice modeling is the logit model. DTRAD uses a variant of Path-Size-Logit model (PSL). PSL overcomes the drawback of the traditional multinomial logit model by incorporating an additional deterministic path size correction term to address path overlapping in the random utility expression.
- DTRAD executes the TA algorithm on an abstract network representation called "the path network" which is built from the actual physical link-node analysis network. This execution continues until a stable situation is reached: the volumes and travel times on the edges of the path network do not change significantly from one iteration to the next. The criteria for this convergence are defined by the user.
- Travel "cost" plays a crucial role in route choice. In DTRAD, path cost is a linear summation of the generalized cost of each link that comprises the path. The generalized cost for a link, a, is expressed as

  $$c_a = \alpha t_a + \beta l_a + \gamma s_a ,$$

  where c_a is the generalized cost for link a, and α, β, and γ are cost coefficients for link travel time, distance, and supplemental cost, respectively. Distance and supplemental costs are defined as invariant properties of the network model, while travel time is a dynamic property dictated by prevailing traffic conditions. The DYNEV simulation model

computes travel times on all edges in the network and DTRAD uses that information to constantly update the costs of paths. The route choice decision model in the next simulation iteration uses these updated values to adjust the route choice behavior. This way, traffic demands are dynamically re-assigned based on time dependent conditions. The interaction between the DTRAD traffic assignment and DYNEV II simulation models is depicted in Figure B-1. Each round of interaction is called a Traffic Assignment Session (TA session). A TA session is composed of multiple iterations, marked as loop B in the figure.

- The supplemental cost is based on the "survival distribution" (a variation of the exponential distribution).The Inverse Survival Function is a "cost" term in DTRAD to represent the potential risk of travel toward the plant:

  $s_a = - \beta \ln (p), 0 \leq p \leq l ; \beta > 0$

  $p = \frac{d_n}{d_0}$

  d_n = Distance of node, n, from the plant
  d_0 =Distance from the plant where there is zero risk
  β = Scaling factor

The value of d_o = 25 miles, the outer distance of the study area. Note that the supplemental cost, s_a, of link, a, is (high, low), if its downstream node, n, is (near, far from) the power plant.

Network Equilibrium

In 1952, John Wardrop wrote:

> *Under equilibrium conditions traffic arranges itself in congested networks in such a way that no individual trip-maker can reduce his path costs by switching routes.*

The above statement describes the "User Equilibrium" definition, also called the "Selfish Driver Equilibrium". It is a hypothesis that represents a [hopeful] condition that evolves over time as drivers search out alternative routes to identify those routes that minimize their respective "costs". It has been found that this "equilibrium" objective to minimize costs is largely realized by most drivers who routinely take the same trip over the same network at the same time (i.e., commuters). Effectively, such drivers "learn" which routes are best for them over time. Thus, the traffic environment "settles down" to a near-equilibrium state.

Clearly, since an emergency evacuation is a sudden, unique event, it does not constitute a long-term learning experience which can achieve an equilibrium state. Consequently, DTRAD was not designed as an equilibrium solution, but to represent drivers in a new and unfamiliar situation, who respond in a flexible manner to real-time information (either broadcast or observed) in such a way as to minimize their respective costs of travel.

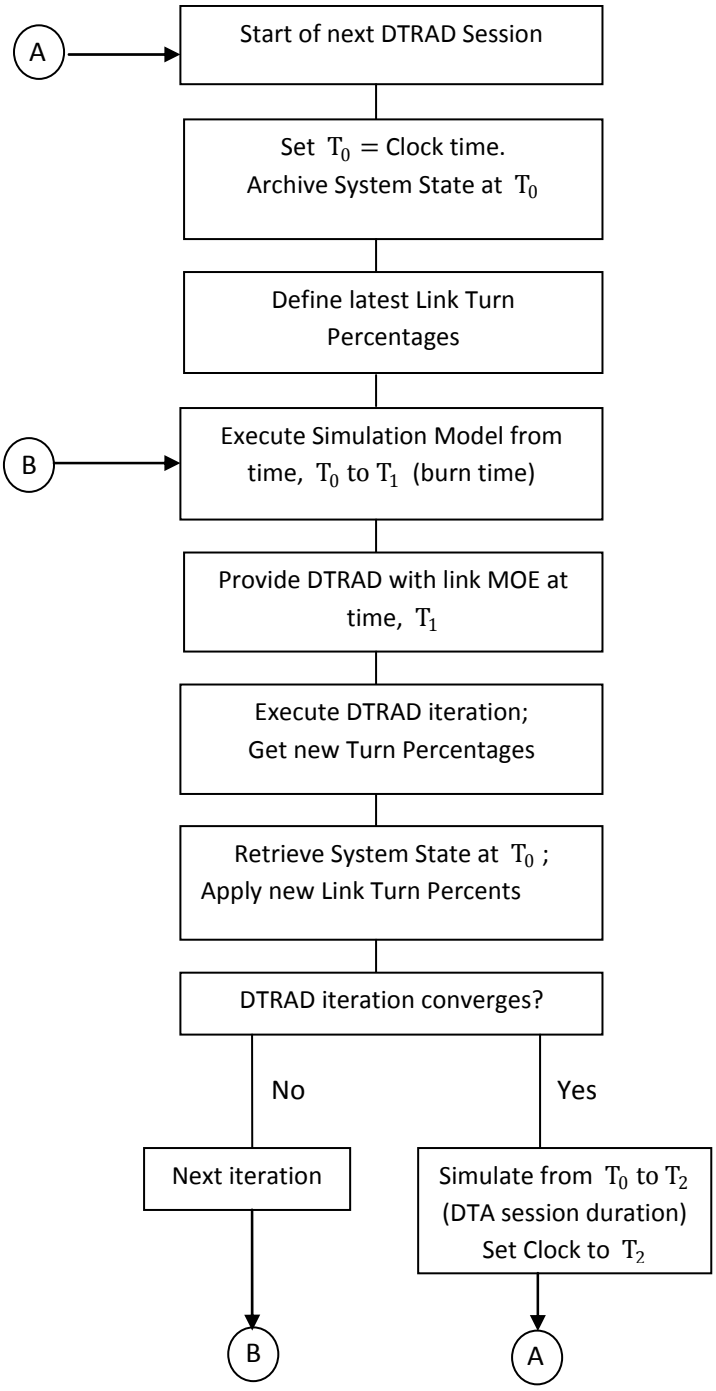


Figure B-1. Flow Diagram of Simulation-DTRAD Interface

APPENDIX C

DYNEV Traffic Simulation Model

C. DYNEV TRAFFIC SIMULATION MODEL

The DYNEV traffic simulation model is a *macroscopic* model that describes the operations of traffic flow in terms of aggregate variables: vehicles, flow rate, mean speed, volume, density, queue length, *on each link*, for each turn movement, during each Time Interval (simulation time step). The model generates trips from "sources" and from Entry Links and introduces them onto the analysis network at rates specified by the analyst based on the mobilization time distributions. The model simulates the movements of all vehicles on all network links over time until the network is empty. At intervals, the model outputs Measures of Effectiveness (MOE) such as those listed in Table C-1.

Model Features Include:

- Explicit consideration is taken of the variation in density over the time step; an iterative procedure is employed to calculate an average density over the simulation time step for the purpose of computing a mean speed for moving vehicles.
- Multiple turn movements can be serviced on one link; a separate algorithm is used to estimate the number of (fractional) lanes assigned to the vehicles performing each turn movement, based, in part, on the turn percentages provided by the DTRAD model.
- At any point in time, traffic flow on a link is subdivided into two classifications: queued and moving vehicles. The number of vehicles in each classification is computed. Vehicle spillback, stratified by turn movement for each network link, is explicitly considered and quantified. The propagation of stopping waves from link to link is computed within each time step of the simulation. There is no "vertical stacking" of queues on a link.
- Any link can accommodate "source flow" from zones via side streets and parking facilities that are not explicitly represented. This flow represents the evacuating trips that are generated at the source.
- The relation between the number of vehicles occupying the link and its storage capacity is monitored every time step for every link and for every turn movement. If the available storage capacity on a link is exceeded by the demand for service, then the simulator applies a "metering" rate to the entering traffic from both the upstream feeders and source node to ensure that the available storage capacity is not exceeded.
- A "path network" that represents the specified traffic movements from each network link is constructed by the model; this path network is utilized by the DTRAD model.
- A two-way interface with DTRAD: (1) provides link travel times; (2) receives data that translates into link turn percentages.
- Provides MOE to animation software, EVAN
- Calculates ETE statistics

All traffic simulation models are data-intensive. Table C-2 outlines the necessary input data elements.

To provide an efficient framework for defining these specifications, the physical highway environment is represented as a network. The unidirectional links of the network represent roadway sections: rural, multi-lane, urban streets or freeways. The nodes of the network generally represent intersections or points along a section where a geometric property changes (e.g. a lane drop, change in grade or free flow speed).

Figure C-1 is an example of a small network representation. The freeway is defined by the sequence of links, (20,21), (21,22), and (22,23). Links (8001, 19) and (3, 8011) are Entry and Exit links, respectively. An arterial extends from node 3 to node 19 and is partially subsumed within a grid network. Note that links (21,22) and (17,19) are grade-separated.

Table C-1. Selected Measures of Effectiveness Output by DYNEV II

Measure	Units	Applies To
Vehicles Discharged	Vehicles	Link, Network, Exit Link
Speed	Miles/Hours (mph)	Link, Network
Density	Vehicles/Mile/Lane	Link
Level of Service	LOS	Link
Content	Vehicles	Network
Travel Time	Vehicle-hours	Network
Evacuated Vehicles	Vehicles	Network, Exit Link
Trip Travel Time	Vehicle-minutes/trip	Network
Capacity Utilization	Percent	Exit Link
Attraction	Percent of total evacuating vehicles	Exit Link
Max Queue	Vehicles	Node, Approach
Time of Max Queue	Hours:minutes	Node, Approach
Route Statistics	Length (mi); Mean Speed (mph); Travel Time (min)	Route
Mean Travel Time	Minutes	Evacuation Trips; Network

Table C-2. Input Requirements for the DYNEV II Model

HIGHWAY NETWORK

- Links defined by upstream and downstream node numbers
- Link lengths
- Number of lanes (up to 9) and channelization
- Turn bays (1 to 3 lanes)
- Destination (exit) nodes
- Network topology defined in terms of downstream nodes for each receiving link
- Node Coordinates (X,Y)
- Nuclear Power Plant Coordinates (X,Y)

GENERATED TRAFFIC VOLUMES

- On all entry links and source nodes (origins), by Time Period

TRAFFIC CONTROL SPECIFICATIONS

- Traffic signals: link-specific, turn movement specific
- Signal control treated as fixed time or actuated
- Location of traffic control points (these are represented as actuated signals)
- Stop and Yield signs
- Right-turn-on-red (RTOR)
- Route diversion specifications
- Turn restrictions
- Lane control (e.g. lane closure, movement-specific)

DRIVER'S AND OPERATIONAL CHARACTERISTICS

- Driver's (vehicle-specific) response mechanisms: free-flow speed, discharge headway
- Bus route designation.

DYNAMIC TRAFFIC ASSIGNMENT

- Candidate destination nodes for each origin (optional)
- Duration of DTA sessions
- Duration of simulation "burn time"
- Desired number of destination nodes per origin

INCIDENTS

- Identify and Schedule of closed lanes
- Identify and Schedule of closed links

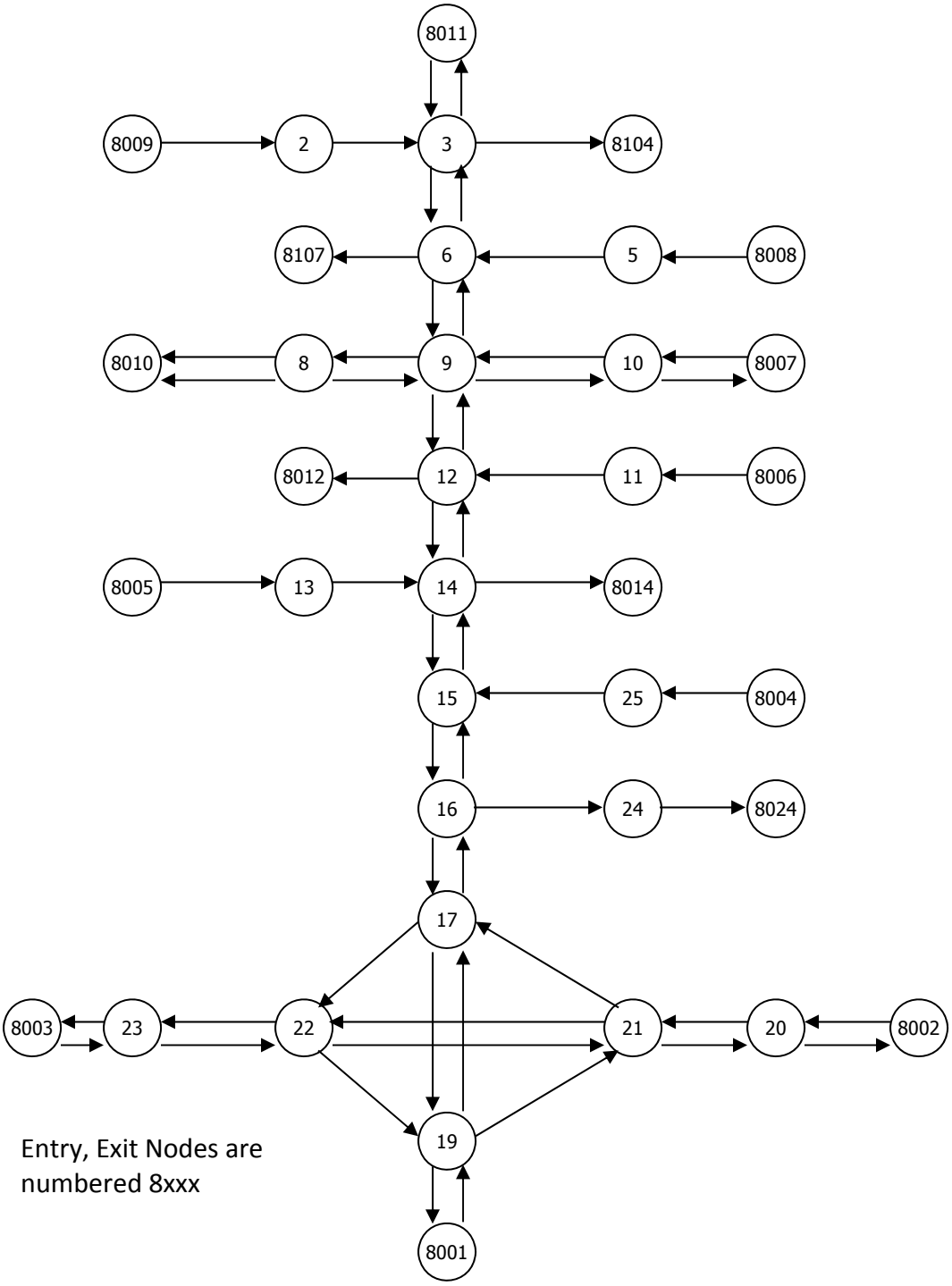


Figure C-1. Representative Analysis Network

C.1 Methodology

C.1.1 The Fundamental Diagram

It is necessary to define the fundamental diagram describing flow-density and speed-density relationships. Rather than "settling for" a triangular representation, a more realistic representation that includes a "capacity drop", (I-R)$Q_{max,}$ at the critical density when flow conditions enter the forced flow regime, is developed and calibrated for each link. This representation, shown in Figure C-2, asserts a constant free speed up to a density, k_f, and then a linear reduction in speed in the range, $k_f \le k \le k_c = 45$ vpm, the density at capacity. In the flow-density plane, a quadratic relationship is prescribed in the range, $k_c < k \le k_s = 95$ vpm which roughly represents the "stop-and-go" condition of severe congestion. The value of flow rate, Q_s, corresponding to k_s, is approximated at $0.7\,RQ_{max}$. A linear relationship between k_s and k_j completes the diagram shown in Figure C-2. Table C-3 is a glossary of terms.

The fundamental diagram is applied to moving traffic on every link. The specified calibration values for each link are: (1) Free speed, v_f ; (2) Capacity, Q_{max} ; (3) Critical density, $k_c = 45$ vpm ; (4) Capacity Drop Factor, R = 0.9 ; (5) Jam density, k_j . Then, $v_c = \frac{Q_{max}}{k_c}$, $k_f = k_c - \frac{(V_f - V_c)\,k_c^2}{Q_{max}}$. Setting $\bar{k} = k - k_c$, then $Q = RQ_{max} - \frac{RQ_{max}}{8333}\,\bar{k}^2$ for $0 \le \bar{k} \le \bar{k}_s = 50$. It can be shown that $Q = (0.98 - 0.0056\,\bar{k})\,RQ_{max}$ for $\bar{k}_s \le \bar{k} \le \bar{k}_j$, where $\bar{k}_s = 50$ and $\bar{k}_j = 175$.

C.1.2 The Simulation Model

The simulation model solves a sequence of "unit problems." Each unit problem computes the movement of traffic on a link, for each specified turn movement, over a specified time interval (TI) which serves as the simulation time step for all links. Figure C-3 is a representation of the unit problem in the time-distance plane. Table C-3 is a glossary of terms that are referenced in the following description of the unit problem procedure.

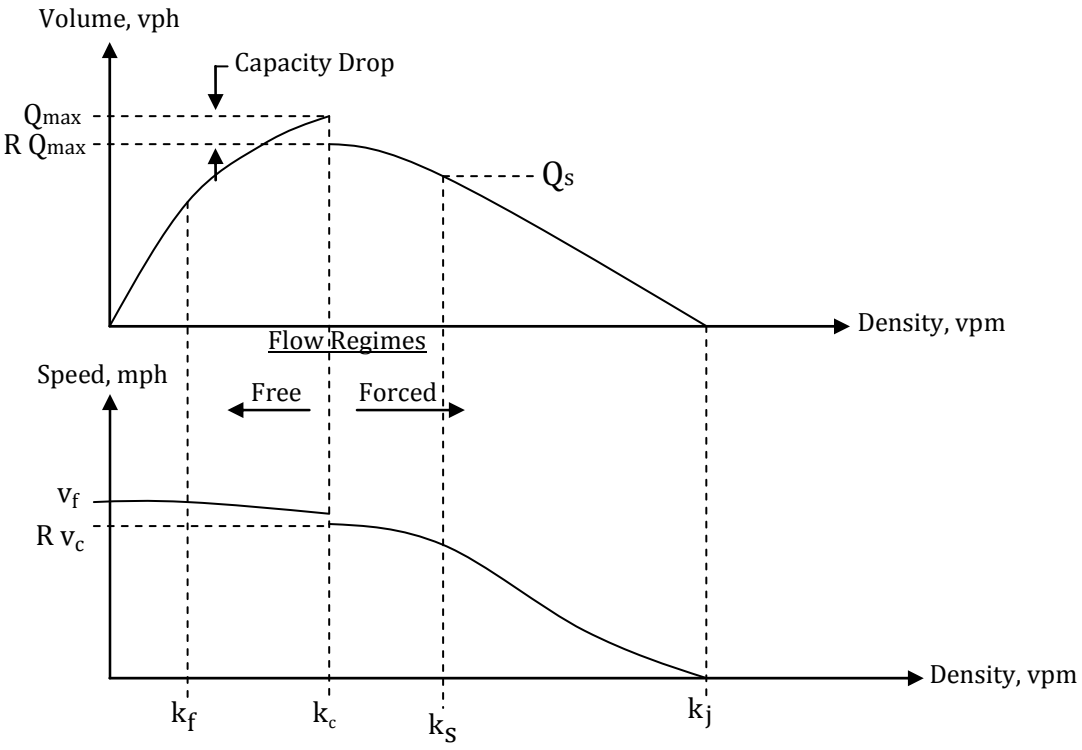


Figure C-2. Fundamental Diagrams

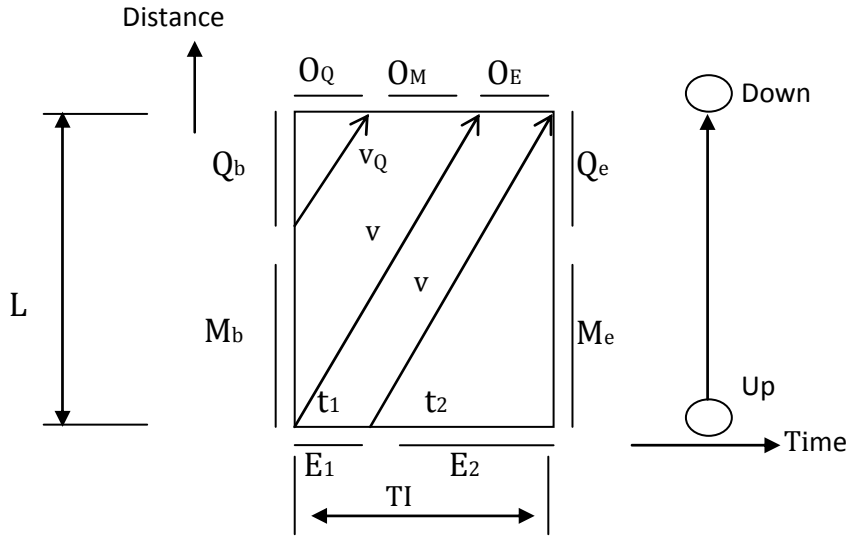


Figure C-3. A UNIT Problem Configuration with $t_1 > 0$

Table C-3. Glossary

Cap	The maximum number of vehicles, of a particular movement, that can discharge from a link within a time interval.
E	The number of vehicles, of a particular movement, that enter the link over the time interval. The portion, E_{TI}, can reach the stop-bar within the TI.
G/C	The green time: cycle time ratio that services the vehicles of a particular turn movement on a link.
h	The mean queue discharge headway, seconds.
k	Density in vehicles per lane per mile.
$\bar{k}$	The average density of moving vehicles of a particular movement over a TI, on a link.
L	The length of the link in feet.
L_b , L_e	The queue length in feet of a particular movement, at the [beginning, end] of a time interval.
LN	The number of lanes, expressed as a floating point number, allocated to service a particular movement on a link.
L_v	The mean effective length of a queued vehicle including the vehicle spacing, feet.
M	Metering factor (Multiplier): 1.
M_b , M_e	The number of moving vehicles on the link, of a particular movement, that are moving at the [beginning, end] of the time interval. These vehicles are assumed to be of equal spacing, over the length of link upstream of the queue.
O	The total number of vehicles of a particular movement that are discharged from a link over a time interval.
O_Q , O_M , O_E	The components of the vehicles of a particular movement that are discharged from a link within a time interval: vehicles that were Queued at the beginning of the TI; vehicles that were Moving within the link at the beginning of the TI; vehicles that Entered the link during the TI.
P_x	The percentage, expressed as a fraction, of the total flow on the link that executes a particular turn movement, x.

Q_b , Q_e	The number of queued vehicles on the link, of a particular turn movement, at the [beginning, end] of the time interval.
Q_{max}	The maximum flow rate that can be serviced by a link for a particular movement in the absence of a control device. It is specified by the analyst as an estimate of link capacity, based upon a field survey, with reference to the HCM.
R	The factor that is applied to the capacity of a link to represent the "capacity drop" when the flow condition moves into the forced flow regime. The lower capacity at that point is equal to RQ_{max} .
RCap	The remaining capacity available to service vehicles of a particular movement after that queue has been completely serviced, within a time interval, expressed as vehicles.
S_x	Service rate for movement x, vehicles per hour (vph).
t_1	Vehicles of a particular turn movement that enter a link over the first t_1 seconds of a time interval, can reach the stop-bar (in the absence of a queue down-stream) within the same time interval.
TI	The time interval, in seconds, which is used as the simulation time step.
v	The mean speed of travel, in feet per second (fps) or miles per hour (mph), of moving vehicles on the link.
v_Q	The mean speed of the last vehicle in a queue that discharges from the link within the TI. This speed differs from the mean speed of moving vehicles, v.
W	The width of the intersection in feet. This is the difference between the link length which extends from stop-bar to stop-bar and the block length.

The formulation and the associated logic presented below are designed to solve the unit problem for each sweep over the network (discussed below), for each turn movement serviced on each link that comprises the evacuation network, and for each TI over the duration of the evacuation.

Given = Q_b , M_b , L , TI , E_0 , LN , G/C , h , L_v , R_0 , L_c , E , M
Compute = O , Q_e , M_e
Define $O = O_Q + O_M + O_E$; $E = E_1 + E_2$

1. For the first sweep, s = 1, of this TI, get initial estimates of mean density, k_0 , the R – factor, R_0 and entering traffic, E_0 , using the values computed for the final sweep of the prior TI. For each subsequent sweep, $s > 1$, calculate $E = \sum_i P_i \ O_i + S$ where P_i , O_i are the relevant turn percentages from feeder link, i, and its total outflow (possibly metered) over this TI; S is the total source flow (possibly metered) during the current TI.
   Set iteration counter, n = 0, $k = k_0$, and $E = E_0$.

2. Calculate v (k) such that $k \leq 130$ using the analytical representations of the fundamental diagram.
   Calculate $Cap = \frac{Q_{max}(TI)}{3600} \left(G/C\right) LN$, in vehicles, this value may be reduced due to metering
   Set $R = 1.0$ if $G/C < 1$ or if $k \leq k_c$; Set $R = 0.9$ only if $G/C = 1$ and $k > k_c$
   Calculate queue length, $L_b = Q_b \frac{L_v}{LN}$

3. Calculate $t_1 = TI - \frac{L}{V}$. If $t_1 < 0$, set $t_1 = E_1 = O_E = 0$; Else, $E_1 = E \frac{t_1}{TI}$.

4. Then $E_2 = E - E_1$; $t_2 = TI - t_1$

5. If $Q_b \geq Cap$, then
   $O_Q = Cap$, $O_M = O_E = 0$
   If $t_1 > 0$, then
   $Q'_e = Q_b + M_b + E_1 - Cap$
   Else
   $Q'_e = Q_b - Cap$
   End if
   Calculate Q_e and M_e using Algorithm A (below)

6. Else $(Q_b < Cap)$
   $O_Q = Q_b$, $RCap = Cap - O_Q$

7. If $M_b \leq RCap$, then

8. If $t_1 > 0$, $O_M = M_b$, $O_E = \min\left(RCap - M_b, \frac{t_1\ Cap}{TI}\right) \geq 0$

$Q'_e = E_1 - O_E$

If $Q'_e > 0$, then

Calculate Q_e, M_e with Algorithm A

Else

$Q_e = 0$, $M_e = E_2$

End if

Else $(t_1 = 0)$

$O_M = \left(\frac{v(TI) - L_b}{L - L_b}\right) M_b$ and $O_E = 0$

$M_e = M_b - O_M + E$; $Q_e = 0$

End if

9. Else $(M_b > RCap)$

$O_E = 0$

If $t_1 > 0$, then

$O_M = RCap$, $Q'_e = M_b - O_M + E_1$

Calculate Q_e and M_e using Algorithm A

10. Else $(t_1 = 0)$

$M_d = \left[\left(\frac{v(TI) - L_b}{L - L_b}\right) M_b\right]$

If $M_d > RCap$, *then*

$O_M = RCap$

$Q'_e = M_d - O_M$

Apply Algorithm A to calculate Q_e and M_e

Else

$O_M = M_d$

$M_e = M_b - O_M + E$ and $Q_e = 0$

End if

End if

End if

End if

11. Calculate a new estimate of average density, $\bar{k}_n = \frac{1}{4}[k_b + 2\,k_m + k_e]$,

where k_b = density at the beginning of the TI

k_e = density at the end of the TI

k_m = density at the mid-point of the TI

All values of density apply only to the moving vehicles.

If $|\bar{k}_n - \bar{k}_{n-1}| > \epsilon$ and $n < N$

where $N = \max$ number of iterations, and ϵ is a convergence criterion, then

12. set $n = n + 1$, and return to step 2 to perform iteration, n, using $k = \bar{k}_n$.
End if

Computation of unit problem is now complete. Check for excessive inflow causing spillback.

13. If $Q_e + M_e > \frac{(L-W)\,LN}{L_v}$, then

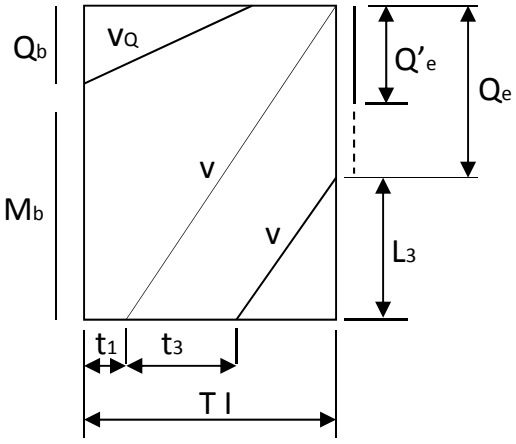
The number of excess vehicles that cause spillback is: $SB = Q_e + M_e - \frac{(L-W)\cdot LN}{L_v}$, where W is the width of the upstream intersection. To prevent spillback, meter the outflow from the feeder approaches and from the source flow, S, during this TI by the amount, SB. That is, set

$$M = 1 - \frac{SB}{(E+S)} \geq 0 \text{ , where M is the metering factor (over all movements).}$$

This metering factor is assigned appropriately to all feeder links and to the source flow, to be applied during the next network sweep, discussed later.

Algorithm A

This analysis addresses the flow environment over a TI during which moving vehicles can join a standing or discharging queue. For the case shown, $Q_b \leq Cap$, with $t_1 > 0$ and a queue of length, Q'_e, formed by that portion of M_b and E that reaches the stop-bar within the TI, but could not discharge due to inadequate capacity. That is, $Q_b + M_b + E_1 > Cap$. This queue length, $Q'_e = Q_b + M_b + E_1 - Cap$ can be extended to Q_e by traffic entering the approach during the current TI, traveling at speed, v, and reaching the rear of the queue within the TI. A portion of the entering vehicles, $E_3 = E\,\frac{t_3}{TI}$, will likely join the queue. This analysis calculates t_3 , Q_e and M_e for the input values of L, TI, v, E, t, L_v, LN, Q'_e .



When $t_1 > 0$ and $Q_b \leq Cap$:

Define: $L'_e = Q'_e\,\frac{L_v}{LN}$. From the sketch, $L_3 = v(TI - t_1 - t_3) = L - (Q'_e + E_3)\frac{L_v}{LN}$. Substituting $E_3 = \frac{t_3}{TI}\,E$ yields: $-vt_3 + \frac{t_3}{TI}\,E\,\frac{L_v}{LN} = L - v(TI - t_1) - L'_e$. Recognizing that the first two terms on the right hand side cancel, solve for t_3 to obtain:

$$t_3 = \frac{L'_e}{\left[v - \frac{E}{TI}\frac{L_v}{LN}\right]} \qquad \text{such that} \quad 0 \le t_3 \le TI - t_1$$

If the denominator, $\left[v - \frac{E}{TI}\frac{L_v}{LN}\right] \le 0$, set $t_3 = TI - t_1$.

$$\text{Then, } Q_e = Q'_e + E\,\frac{t_3}{TI} \quad , \qquad M_e = E\left(1 - \frac{t_1 + t_3}{TI}\right)$$

The complete Algorithm A considers all flow scenarios; space limitation precludes its inclusion, here.

C.1.3 Lane Assignment

The "unit problem" is solved for each turn movement on each link. Therefore it is necessary to calculate a value, LN_x , of allocated lanes for each movement, x. If in fact all lanes are specified by, say, arrows painted on the pavement, either as full lanes or as lanes within a turn bay, then the problem is fully defined. If however there remain un-channelized lanes on a link, then an analysis is undertaken to subdivide the number of these physical lanes into turn movement specific virtual lanes, LN_x.

C.2 Implementation

C.2.1 Computational Procedure

The computational procedure for this model is shown in the form of a flow diagram as Figure C-4. As discussed earlier, the simulation model processes traffic flow for each link independently over TI that the analyst specifies; it is usually 60 seconds or longer. The first step is to execute an algorithm to define the sequence in which the network links are processed so that as many links as possible are processed after their feeder links are processed, within the same network sweep. Since a general network will have many closed loops, it is not possible to guarantee that every link processed will have all of its feeder links processed earlier.

The processing then continues as a succession of time steps of duration, TI, until the simulation is completed. Within each time step, the processing performs a series of "sweeps" over all network links; this is necessary to ensure that the traffic flow is synchronous over the entire network. Specifically, the sweep ensures continuity of flow among all the network links; in the context of this model, this means that the values of E, M, and S are all defined for each link such that they represent the synchronous movement of traffic from each link to all of its outbound links. These sweeps also serve to compute the metering rates that control spillback.

Within each sweep, processing solves the "unit problem" for each turn movement on each link. With the turn movement percentages for each link provided by the DTRAD model, an algorithm

allocates the number of lanes to each movement serviced on each link. The timing at a signal, if any, applied at the downstream end of the link, is expressed as a G/C ratio, the signal timing needed to define this ratio is an input requirement for the model. The model also has the capability of representing, with macroscopic fidelity, the actions of actuated signals responding to the time-varying competing demands on the approaches to the intersection.

The solution of the unit problem yields the values of the number of vehicles, O, that discharge from the link over the time interval and the number of vehicles that remain on the link at the end of the time interval as stratified by queued and moving vehicles: Q_e and M_e. The procedure considers each movement separately (multi-piping). After all network links are processed for a given network sweep, the updated consistent values of entering flows, E; metering rates, M; and source flows, S are defined so as to satisfy the "no spillback" condition. The procedure then performs the unit problem solutions for all network links during the following sweep.

Experience has shown that the system converges (i.e. the values of E, M and S "settle down" for all network links) in just two sweeps if the network is entirely under-saturated or in four sweeps in the presence of extensive congestion with link spillback. (The initial sweep over each link uses the final values of E and M, of the prior TI). At the completion of the final sweep for a TI, the procedure computes and stores all measures of effectiveness for each link and turn movement for output purposes. It then prepares for the following time interval by defining the values of Q_b and M_b for the start of the next TI as being those values of Q_e and M_e at the end of the prior TI. In this manner, the simulation model processes the traffic flow over time until the end of the run. Note that there is no space-discretization other than the specification of network links.

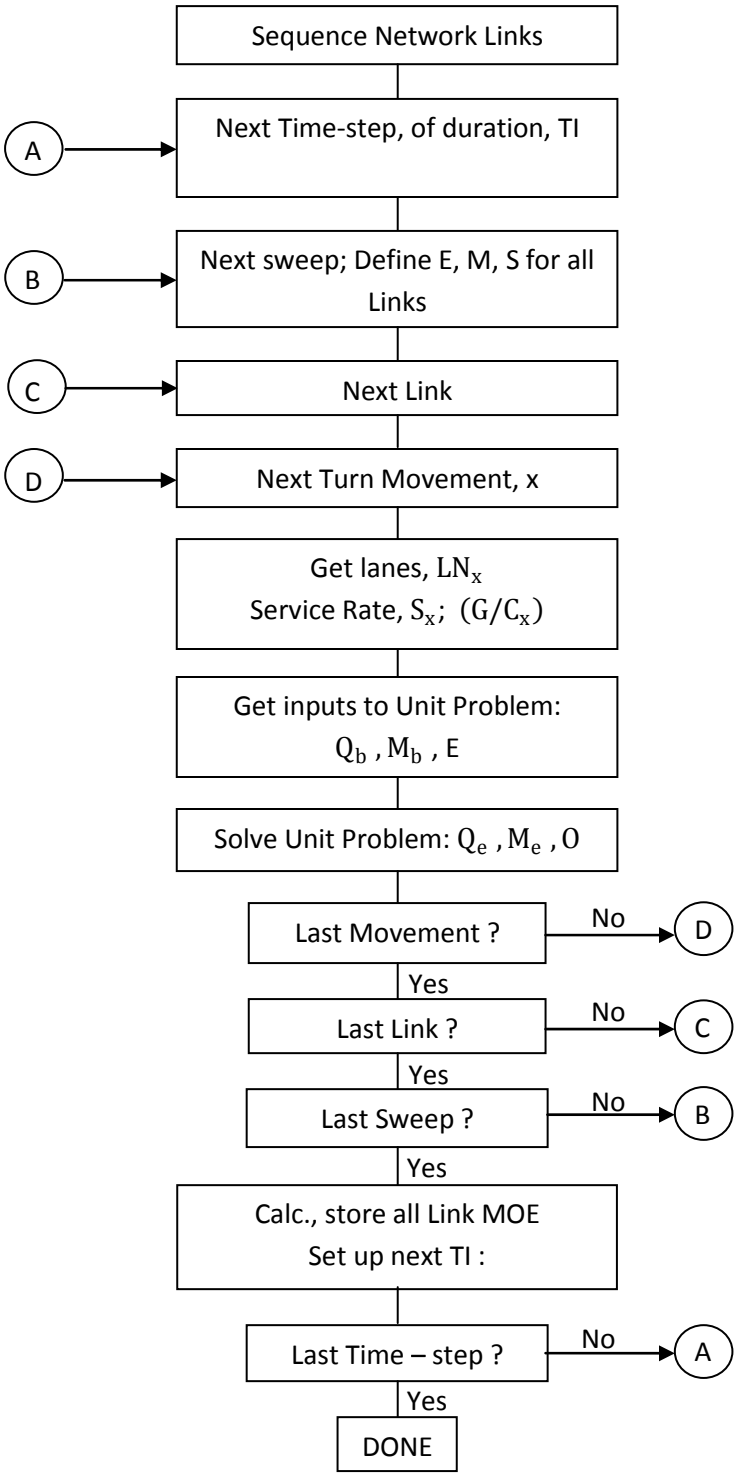


Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)

C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD)

The DYNEV II system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. Thus, an algorithm was developed to identify an appropriate set of destination nodes for each origin based on its location and on the expected direction of travel. This algorithm also supports the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next.

Figure B-1 depicts the interaction of the simulation model with the DTRAD model in the DYNEV II system. As indicated, DYNEV II performs a succession of DTRAD "sessions"; each such session computes the turn link percentages for each link that remain constant for the session duration, $[T_0, T_2]$, specified by the analyst. The end product is the assignment of traffic volumes from each origin to paths connecting it with its destinations in such a way as to minimize the network-wide cost function. The output of the DTRAD model is a set of updated link turn percentages which represent this assignment of traffic.

As indicated in Figure B-1, the simulation model supports the DTRAD session by providing it with operational link MOE that are needed by the path choice model and included in the DTRAD cost function. These MOE represent the operational state of the network at a time, $T_1 \leq T_2$, which lies within the session duration, $[T_0, T_2]$. This "burn time", $T_1 - T_0$, is selected by the analyst. For each DTRAD iteration, the simulation model computes the change in network operations over this burn time using the latest set of link turn percentages computed by the DTRAD model. Upon convergence of the DTRAD iterative procedure, the simulation model accepts the latest turn percentages provided by the DTA model, returns to the origin time, T_0, and executes until it arrives at the end of the DTRAD session duration at time, T_2. At this time the next DTA session is launched and the whole process repeats until the end of the DYNEV II run.

Additional details are presented in Appendix B.

APPENDIX D

Detailed Description of Study Procedure

D. DETAILED DESCRIPTION OF STUDY PROCEDURE

This appendix describes the activities that were performed to compute Evacuation Time Estimates. The individual steps of this effort are represented as a flow diagram in Figure D-1. Each numbered step in the description that follows corresponds to the numbered element in the flow diagram.

Step 1

The first activity was to obtain EPZ boundary information, including the new boundary of Subarea 24 (no longer includes the area south of US-30). A GIS base map was created with the EPZ and Subarea boundaries clearly identified. The base map extends beyond the Shadow Region which extends approximately 15 miles (radially) from the power plant location. The base map incorporates the local roadway topology, a suitable topographic background, and the EPZ boundary.

Step 2

2010 Census block population and Census population growth (using 2015[1] population estimates published by the US Census) information was obtained in GIS format. This information was used to project the resident population within the EPZ and Shadow Region to the year 2016 and to define the spatial distribution and demographic characteristics of the population within the study area. In 2012, the transient data were obtained from county/state emergency management agencies, from phone calls to transient attractions, and estimations based on parking lot capacity. These data are maintained in this study based on discussion with NextEra. NextEra provided updated information for all schools, medical facilities and correctional facilities in the EPZ. Employee data were updated using the U.S. Census OnTheMap tool. Any population that was within Subarea 24 south of US-30 was removed as per the change in the EPZ boundary.

Step 3

A kickoff meeting was conducted in 2012 with major stakeholders (state and county emergency managers, on-site and off-site utility emergency managers, local and state law enforcement agencies, state department of transportation). The purpose of the kickoff meeting was to present an overview of the work effort, identify key agency personnel, and indicate the data requirements for the study. Specific requests for information were presented to county emergency managers. Unique features of the study area were discussed to identify the local concerns that should be addressed by the ETE study.

Step 4

Next, a physical survey of the roadway system in the study area was conducted to determine

[1] The annual population estimates prepared by the Census Bureau for the entire U.S. involve an extensive data gathering process. As such, population estimates are a year behind – 2015 data are released in 2016. The schedule for release of Census data is provided on the Census website: http://www.census.gov/popest/schedule.html

the geometric properties of the highway sections, the channelization of lanes on each section of roadway, whether there are any turn restrictions or special treatment of traffic at intersections, the type and functioning of traffic control devices, gathering signal timings for pre-timed traffic signals, and to make the necessary observations needed to estimate realistic values of roadway capacity. Roadway characteristics were also verified using aerial imagery.

Step 5

The data from the 2012 telephone survey of households within the EPZ was used to identify household dynamics, trip generation characteristics, and evacuation-related demographic information of the EPZ population. This information was used to determine important study factors including the average number of evacuating vehicles used by each household, and the time required to perform pre-evacuation mobilization activities.

Step 6

A computerized representation of the physical roadway system, called a link-node analysis network, was developed using the UNITES software (see Section 1.3) developed by KLD. Once the geometry of the network was completed, the network was calibrated using the information gathered during the road survey (Step 4) and information obtained from aerial imagery. Estimates of highway capacity for each link and other link-specific characteristics were introduced to the network description. Traffic signal timings were input accordingly. The link-node analysis network was imported into a GIS map. 2010 Census data (extrapolated to 2016 using annual growth rates based on 2015 Census populations estimates) were overlaid in the map, and origin centroids where trips would be generated during the evacuation process were assigned to appropriate links.

Step 7

The EPZ is subdivided into 24 Subareas. Based on wind direction and speed, Regions (groupings of Subareas) that may be advised to evacuate, were developed.

The need for evacuation can occur over a range of time-of-day, day-of-week, seasonal and weather-related conditions. Scenarios were developed to capture the variation in evacuation demand, highway capacity and mobilization time, for different time of day, day of the week, time of year, and weather conditions.

Step 8

The input stream for the DYNEV II model, which integrates the dynamic traffic assignment and distribution model, DTRAD, with the evacuation simulation model, was created for a prototype evacuation case – the evacuation of the entire EPZ for a representative scenario.

Step 9

After creating this input stream, the DYNEV II System was executed on the prototype evacuation case to compute evacuating traffic routing patterns consistent with the appropriate NRC guidelines. DYNEV II contains an extensive suite of data diagnostics which check the completeness and consistency of the input data specified. The analyst reviews all warning and error messages produced by the model and then corrects the database to create an input

stream that properly executes to completion.

The model assigns destinations to all origin centroids consistent with a (general) radial evacuation of the EPZ and Shadow Region. The analyst may optionally supplement and/or replace these model-assigned destinations, based on professional judgment, after studying the topology of the analysis highway network. The model produces link and network-wide measures of effectiveness as well as estimates of evacuation time.

Step 10

The results generated by the prototype evacuation case are critically examined. The examination includes observing the animated graphics (using the EVAN software – see Section 1.3 – which operates on data produced by DYNEV II) and reviewing the statistics output by the model. This is a labor-intensive activity, requiring the direct participation of skilled engineers who possess the necessary practical experience to interpret the results and to determine the causes of any problems reflected in the results.

Essentially, the approach is to identify those bottlenecks in the network that represent locations where congested conditions are pronounced and to identify the cause of this congestion. This cause can take many forms, either as excess demand due to high rates of trip generation, improper routing, a shortfall of capacity, or as a quantitative flaw in the way the physical system was represented in the input stream. This examination leads to one of two conclusions:

- The results are satisfactory; or
- The input stream must be modified accordingly.

This decision requires, of course, the application of the user's judgment and experience based upon the results obtained in previous applications of the model and a comparison of the results of the latest prototype evacuation case iteration with the previous ones. If the results are satisfactory in the opinion of the user, then the process continues with Step 13. Otherwise, proceed to Step 11.

Step 11

There are many "treatments" available to the user in resolving apparent problems. These treatments range from decisions to reroute the traffic by assigning additional evacuation destinations for one or more sources, imposing turn restrictions where they can produce significant improvements in capacity, changing the control treatment at critical intersections so as to provide improved service for one or more movements, adding minor routes (which are paved and traversable) that were not previously modelled but may assist in an evacuation and increase the available roadway network capacity, or in prescribing specific treatments for channelizing the flow so as to expedite the movement of traffic along major roadway systems. Such "treatments" take the form of modifications to the original prototype evacuation case input stream. All treatments are designed to improve the representation of evacuation behavior.

Step 12

As noted above, the changes to the input stream must be implemented to reflect the modifications undertaken in Step 11. At the completion of this activity, the process returns to Step 9 where the DYNEV II System is again executed.

Step 13

Evacuation of transit-dependent evacuees and special facilities are included in the evacuation analysis. Fixed routing for transit buses and for school buses, ambulances, and other transit vehicles are introduced into the final prototype evacuation case data set. DYNEV II generates route-specific speeds over time for use in the estimation of evacuation times for the transit dependent and special facility population groups.

Step 14

The prototype evacuation case was used as the basis for generating all region and scenario-specific evacuation cases to be simulated. This process was automated through the UNITES user interface. For each specific case, the population to be evacuated, the trip generation distributions, the highway capacity and speeds, and other factors are adjusted to produce a customized case-specific data set.

Step 15

All evacuation cases are executed using the DYNEV II System to compute ETE. Once results are available, quality control procedures are used to assure the results are consistent, dynamic routing is reasonable, and traffic congestion/bottlenecks are addressed properly.

Step 16

Once vehicular evacuation results are accepted, average travel speeds for transit and special facility routes are used to compute evacuation time estimates for transit-dependent permanent residents, schools, hospitals, and other special facilities.

Step 17

The simulation results are analyzed, tabulated and graphed. The results are then documented, as required by NUREG/CR-7002.

Step 18

Following the completion of documentation activities, the ETE criteria checklist (see Appendix N) is completed. An appropriate report reference is provided for each criterion provided in the checklist.

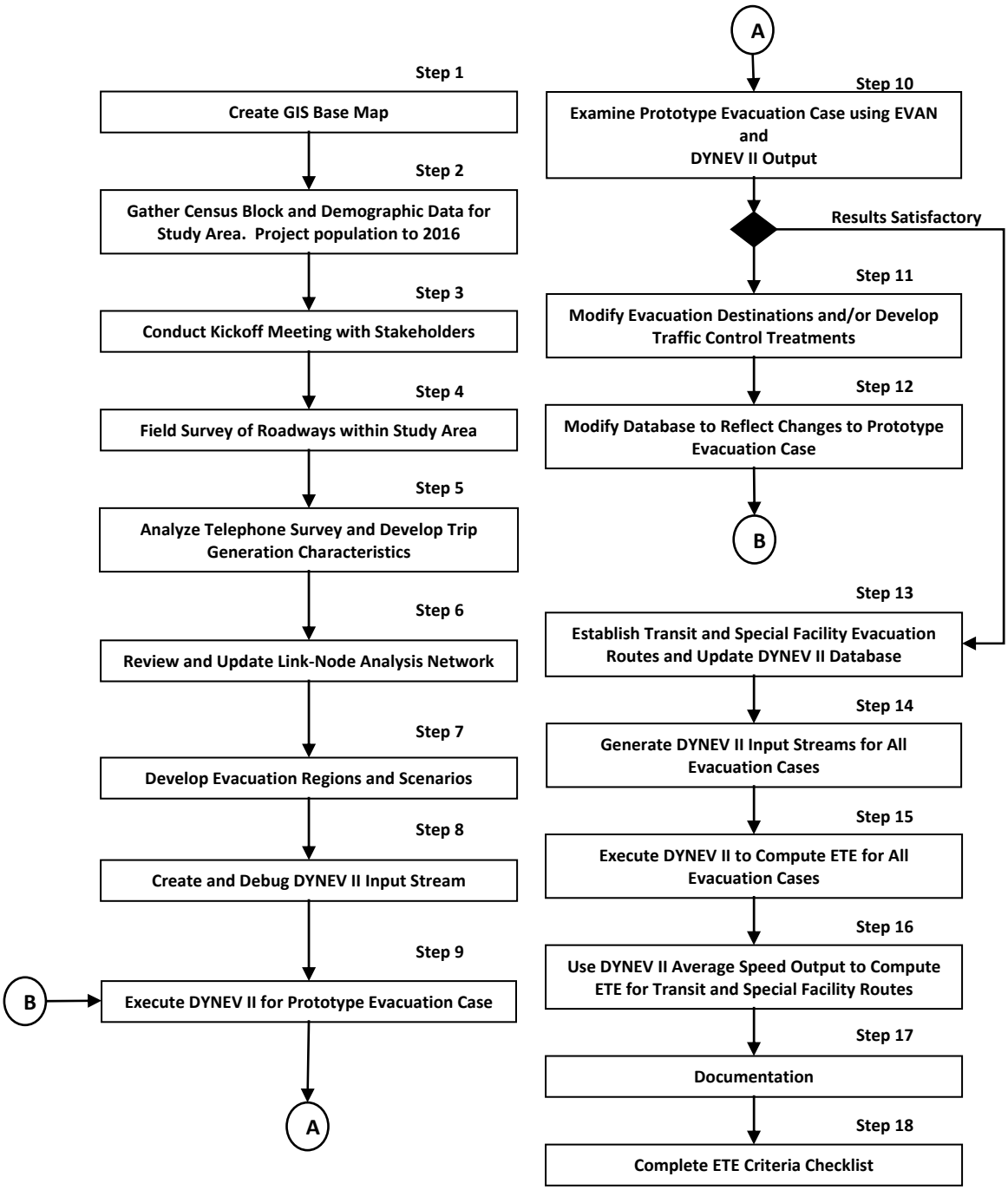


Figure D-1. Flow Diagram of Activities

APPENDIX E

Special Facility Data

E. SPECIAL FACILITY DATA

The following tables list population information, as of November 2016, for special facilities, transient attractions, and major employers that are located within the DAEC EPZ. Special facilities are defined as schools, pre-schools, day care centers (Table E-1), hospitals and other medical care facilities (Table E-2), and correctional facilities (Table E-6). OnTheMap employment data (see Section 3, sub-section 3.4) is summarized in the table for major employers (Table E-3). Transient population data is included in the tables for recreational areas (Table E-4) and lodging facilities (Table E-5).

Each table is grouped by county. The location of the facility is defined by its straight-line distance (miles) and direction (magnetic bearing) from the center point of the plant.

Maps of each school, pre-school, day care center, medical facility, recreational area, lodging facility and correctional facility are also provided. Figure E-1 provides an overview map of all schools, pre-schools, and day care centers in the EPZ, while Figure E-2 through Figure E-5 provide detailed maps of the schools, pre-schools, and day care centers, sorted alphabetically. Figure E-6 maps each of the medical facilities in the EPZ. Figure E-7 maps locations within the EPZ where employees commute to work from outside the EPZ. Recreational areas (Figure E-8) and lodging facilities (Figure E-9 and Figure E-10) map the transient attractions within the EPZ. Finally, Figure E-11 maps the correctional facilities within the EPZ.

Table E-1. Schools, Pre-Schools and Daycares within the EPZ

Subarea	Distance (miles)	Direc-tion	School Name	Street Address	Municipality	Enroll-ment	Staff
BENTON COUNTY, IA							
7	4.9	W	Shellsburg Elementary School & Preschool	203 Canton St	Shellsburg	278	14
18	8.7	SSW	Atkins Elementary School	217 4th Ave	Atkins	241	12
18	8.8	SSW	Early Beginnings Preschool/Daycare	402 Cardinal Ave	Atkins	132	7
22	9.9	NNW	Center Point Intermediate School (Urbana)	202 W Main St	Urbana	347	17
22	9.9	NNW	Kid Zone Daycare (Urbana)	202 W Main St	Urbana	11	1
					Benton County Subtotal:	*1,009*	*51*
LINN COUNTY, IA							
4	5.3	SE	Five Seasons LC - Viola Gibson	6101 Gibson Dr NE	Cedar Rapids	152	13
4	5.3	SE	Viola Gibson Elementary School	6101 Gibson Dr NE	Cedar Rapids	500	25
5	6.5	SE	Children's Corner	4750 42nd St NE	Cedar Rapids	95	8
5	6.6	SE	KidsPoint North Learning Center & Preschool	4650 42nd St NE	Chicago	162	14
5	5.9	SSE	Xavier High School	6300 42nd St NE	Cedar Rapids	721	36
9	5.8	N	Center Point Elementary School (CP)	101 Palo Rd	Center Point	340	17
9	6.1	N	Center Point Urbana High School (CP)	145 Iowa St	Center Point	466	23
9	6.1	N	Center Point Urbana Middle School (CP)	613 Summit St	Center Point	350	18
9	6.1	N	Children Prevail	427 Franklin St	Center Point	44	4
9	5.8	N	Kid Zone Daycare & Learning Center	101 Palo Rd	Center Point	47	4
9	6.2	N	Little People Daycare & Learning Center	702 Main St	Center Point	47	4
9	6.1	N	Pointer Pup Preschool (Center Point)	613 Summit St	Center Point	147	12
12	8.8	ENE	Alburnett Schools (K-12)	131 Roosevelt St	Alburnett	644	32
12	8.8	ENE	Kids Inc. - Alburnett	131 Roosevelt St	Alburnett	17	1
14	10.0	ESE	Apple Kids Marion School District	600 10th Ave	Marion	144	12
14	8.6	ESE	Bowman Woods Elementary	151 Boyson Rd NE	Cedar Rapids	485	24
14	9.8	ESE	Busy Bee Daycare Inc.	2650 10th St	Marion	49	4
14	8.7	E	Echo Hill Elementary	400 Echo Hill Rd	Marion	604	30
14	10.4	ESE	Emerson Elementary	1400 10th Ave	Marion	171	14
14	6.3	SE	Essential Montessori School of Hiawatha	1350 Blairs Ferry Rd	Hiawatha	20	2
14	9.7	ESE	Excelsior Middle School	3555 N. 10th St	Marion	972	49
14	6.8	ESE	Five Seasons Learning Center - Nixon	200 Nixon Dr	Cedar Rapids	100	8
14	11.3	ESE	HACAP Head Start - Marion	3405 7th Ave Suite 100	Marion	63	5
14	10.6	ESE	Hand in Hand - 35th Avenue	3524 35th Ave	Marion	146	12

Subarea	Distance (miles)	Direc-tion	School Name	Street Address	Municipality	Enroll-ment	Staff
14	6.8	SE	Hand in Hand - Hiawatha	103 N. Center Pt. Rd	Hiawatha	109	9
14	9.6	ESE	Hand in Hand - Linn Grove Elementary	2301 50th St	Marion	85	7
14	7.2	ESE	Hand in Hand - Tower Lane	1300 Tower Lane NE	Cedar Rapids	96	8
14	6.6	SE	Hiawatha Elementary School	603 Emmons St	Hiawatha	450	22
14	10.1	ESE	Indian Creek Elementary	2900 Indian Creek Rd	Marion	528	26
14	11.2	ESE	Kids Inc. - Marion LC	1100 35th St	Marion	173	14
14	7.7	SE	La Petite Academy	1350 Blairs Ferry Rd	Cedar Rapids	125	10
14	7.2	ESE	Lily Pad Daycare & Preschool	6880 Council St NE	Cedar Rapids	84	7
14	12.0	ESE	Linn Grove Elementary	2301 50th St	Marion	579	29
14	9.8	ESE	Linn-Mar Compass Program	2999 N. 10th St	Marion	72	3
14	9.8	ESE	Linn-Mar High School	2999 N. 10th St	Marion	2,113	106
14	11.3	ESE	Linn-Mar High School Success Program	1055 Linden Dr, Suite B	Marion	8	1
14	7.0	SE	Little Lambs Christian Preschool	201 First Ave	Hiawatha	44	4
14	6.7	ESE	Little Learners Inc.	950 Robins Sq. Dr	Robins	75	6
14	6.0	SE	Mother Goose Learning Center	1355 Boyson Loop	Hiawatha	90	8
14	6.8	ESE	Nixon Elementary School	200 Nixon Dr	Cedar Rapids	365	18
14	9.5	ESE	Novak Elementary	401 29th Ave	Marion	572	29
14	8.6	ESE	Oak Ridge Middle School	4901 Alburnett Rd	Marion	754	38
14	10.8	ESE	Our Little Haven	2770 18th Ave	Marion	212	18
14	10.2	ESE	St. Joseph Catholic School	1430 14th St	Marion	139	7
14	10.2	ESE	St. Joseph Early Childhood Daycare	1430 14th St	Marion	60	5
14	10.2	ESE	St. Joseph Preschool	1430 14th St	Marion	53	4
14	5.7	SE	The Hiawatha Day School	1771 Boyson Sq. Dr	Hiawatha	135	11
14	6.6	SE	The Robyn's Nest	150 9th Ave	Hiawatha	24	1
14	11.1	ESE	Wee Wisdom (Marion)	3500 29th Ave	Marion	18	2
14	7.0	ESE	Westfield Elementary	901 East Main St NE	Robins	421	21
14	10.7	ESE	Wilkins Elementary	2127 27th St	Marion	445	22
15	8.6	SE	Apple Kids - Noelridge	3511 Oakland Rd NE	Cedar Rapids	43	4
15	9.8	SE	Arthur Elementary School (K-5)	2630 B Ave NE	Cedar Rapids	350	18
15	9.4	SE	Calvery Christian Preschool	327 35th St NE	Cedar Rapids	81	7
15	9.0	ESE	Caring Corner Christian Daycare & Preschool	5200 Northland Ave NE	Cedar Rapids	156	13
15	7.4	SE	Children's Weekday Ministry-Lovely Lane	2424 42nd St NE	Cedar Rapids	131	11
15	8.6	SE	Child's Discovery Montessori Preschool	2957 Center Pt. Rd NE	Cedar Rapids	40	3

Subarea	Distance (miles)	Direc-tion	School Name	Street Address	Municipality	Enroll-ment	Staff
15	9.9	SE	Coe College	1220 1st Ave NE	Cedar Rapids	1,357	100
15	8.4	SE	Five Season Learning Center - Wright (Age 3-5)	1524 Hollywood Blvd NE	Cedar Rapids	88	7
15	9.8	SE	Five Seasons Learning Center - Arthur	2630 B Ave NE	Cedar Rapids	60	5
15	10.0	SE	Franklin Middle School	300 20th St NE	Cedar Rapids	650	32
15	9.2	SE	Garfield Elementary School	1201 Maplewood Dr NE	Cedar Rapids	250	12
15	7.2	SE	Good Shepard Lutheran School (Pre-K - 8th)	2900 42nd St NE	Cedar Rapids	9	1
15	8.3	SE	Harding Middle School	4801 Golf St NE	Cedar Rapids	820	41
15	8.4	SE	Holloway House Learning Center	3636 Cottage Grove Ave SE	Cedar Rapids	16	7
15	8.5	SE	Isaac Newton Christian Academy & Preschool	1635 Linmar Dr NE	Cedar Rapids	238	20
15	8.9	SE	Jungle Friends	3336 Prairie Dr NE	Cedar Rapids	70	6
15	7.2	SE	Kennedy High School	4545 Wenig Rd NE	Cedar Rapids	1,900	95
15	9.1	SE	Kenwood Elementary School	3700 E Ave NE	Cedar Rapids	450	22
15	7.0	SE	Kids Kampus Learning Center	5150 Blairs Forest Way NE	Cedar Rapids	131	11
15	9.0	ESE	Kindercare Learning Center #292	5351 N Park Pl NE	Cedar Rapids	95	8
15	9.4	SE	Mount Mercy University	1330 Elmhurst Dr NE	Cedar Rapids	1,104	113
15	7.4	SE	Pierce Elementary School	4343 Marilyn Dr NE	Cedar Rapids	380	19
15	9.9	SE	Polk Alternative School	1500 B Ave NE	Cedar Rapids	75	4
15	9.6	SE	Regis Middle School	735 Prairie Dr NE	Cedar Rapids	335	17
15	9.0	ESE	Rockwell Collins Child Development Center D	5245 Northland Ave NE	Cedar Rapids	448	37
15	10.0	SE	St. Matthew Preschool	125 24th St NE	Cedar Rapids	92	8
15	10.0	SE	St. Matthew School	125 24th St NE	Cedar Rapids	165	8
15	10.0	SE	St. Matthew's Child Care Program	125 24th St NE	Cedar Rapids	230	10
15	7.9	SE	St. Pius X Child Care Program	4901 Council St NE	Cedar Rapids	82	7
15	7.9	SE	St. Pius X Preschool	4901 Council St NE	Cedar Rapids	89	7
15	7.9	SE	St. Pius X School	4901 Council St NE	Cedar Rapids	338	17
15	8.5	SE	Summit Preschool	1010 Regent St NE	Cedar Rapids	16	1
15	8.5	SE	Summit School (Pre-K - 6th)	1010 Regent St NE	Cedar Rapids	116	6
15	8.4	SE	Wright Elementary School	1524 Hollywood Blvd NE	Cedar Rapids	360	18
16	9.7	SSE	Cleveland Elementary School	2200 1st Ave NW	Cedar Rapids	400	20
16	9.1	S	Coolidge Elementary School	6225 1st Ave SW	Cedar Rapids	500	25
16	9.1	S	Five Seasons Learning Center - Coolidge (Age 3-5)	6225 1st Ave SW	Cedar Rapids	108	9
16	9.9	SSE	HACAP Head Start - Olivet	230 10th St NW	Cedar Rapids	32	3
16	9.2	SSE	Harrison Elementary School	1310 11th St NW	Cedar Rapids	400	20

Subarea	Distance (miles)	Direc-tion	School Name	Street Address	Municipality	Enroll-ment	Staff
16	10.2	SSE	Harvest Christian DC & Learning Center	4070 22nd Ave SW	Cedar Rapids	208	17
16	9.4	SSE	Hoover Elementary School	4141 Johnson Ave NW	Cedar Rapids	390	20
16	8.4	SSE	Jackson Elementary School	1300 38th St NW	Cedar Rapids	380	19
16	9.4	SSE	Josiah's Playground	1911 E Ave NW	Cedar Rapids	98	8
16	9.4	S	Kindercare Learning Center - West	310 Burdette Dr SW	Cedar Rapids	96	8
16	9.6	SSE	LaSalle Intermediate School	3700 First Ave NW	Cedar Rapids	188	9
16	9.7	SSE	Linn County Child Development Center	520 11th St NW	Cedar Rapids	68	6
16	9.8	SSE	Little Cupcakes Child Care	215 Edgewood Rd SW	Cedar Rapids	59	5
16	8.6	SSE	Madison Elementary School	1341 Woodside Dr NW	Cedar Rapids	280	14
16	9.3	SSE	Mother Goose Daycare	4840 Richmar Ct NW	Cedar Rapids	93	8
16	9.8	SSE	My Iman Montessori Preschool	2999 1st Ave SW	Cedar Rapids	43	4
16	8.6	S	Noah's Ark Preschool	6455 E. Ave NW	Cedar Rapids	50	4
16	9.7	SSE	Roosevelt Middle School	300 13th St NW	Cedar Rapids	575	29
16	9.3	SSE	Share & Care Christian Preschool	4210 Johnson Ave NW	Cedar Rapids	32	3
16	9.2	SSE	St. James Kids Club Daycare	1430 Ellis Blvd NW	Cedar Rapids	134	11
16	9.0	SSE	St. Jude’s Daycare	621 Edgewood Rd NW	Cedar Rapids	69	6
16	9.6	SSE	St. Jude’s Elementary School	3700 First Ave NW	Cedar Rapids	106	5
16	9.6	SSE	St. Jude’s Preschool	3700 First Ave NW	Cedar Rapids	45	4
16	8.5	SSE	Taft Middle and Alternative School	5200 E Ave NW	Cedar Rapids	600	30
16	8.7	SSE	Truman Elementary School	441 W Post Rd NW	Cedar Rapids	270	14
16	9.8	SSE	We Teach 2	4370 16th Ave: Cypress Plaza	Cedar Rapids	102	8
17	9.1	S	YMCA-Stoney Point	300 Stoney Point Rd	Cedar Rapids	117	10
23	11.5	SE	All Saints Catholic School	720 29th St SE	Cedar Rapids	199	10
23	11.5	SE	All Saints Daycare	720 29th St SE	Cedar Rapids	56	5
23	11.5	SE	All Saints Preschool	720 29th St SE	Cedar Rapids	98	8
23	11.2	ESE	Ascension Lutheran Preschool	2210 Grand Ave	Marion	20	2
23	10.3	SE	Bethany Lutheran Moms Morning Out	2202 Forrest Dr SE	Cedar Rapids	20	2
23	11.0	SE	Cedar Valley Christian High School	3636 Cottage Grove Ave SE	Cedar Rapids	60	3
23	11.0	SE	Cedar Valley Christian Preschool	3636 Cottage Grove Ave SE	Cedar Rapids	15	1
23	11.0	SE	Cedar Valley Christian School (7-8)	3636 Cottage Grove Ave SE	Cedar Rapids	18	1
23	11.0	SE	Cedar Valley Christian School (K-6)	3636 Cottage Grove Ave SE	Cedar Rapids	77	4
23	10.4	SE	Cedar Valley Montessori School	110 5th Ave SE	Cedar Rapids	150	12

Subarea	Distance (miles)	Direc-tion	School Name	Street Address	Municipality	Enroll-ment	Staff
23	11.8	SE	Erskine Elementary School	600 36th St SE	Cedar Rapids	380	19
23	10.9	ESE	Francis Marion Intermediate	2301 3rd Ave	Marion	300	25
23	11.3	SE	Grant Wood Elementary	645 26th St SE	Cedar Rapids	420	21
23	11.0	SE	HACAP Head Start - Jane Boyd	943 14th Ave SE	Cedar Rapids	36	3
23	10.1	SE	HACAP Head Start-Urban Family Resource	1328 2nd Ave SE	Cedar Rapids	40	3
23	10.7	SE	HACAP Horizons	819 5th St SE	Cedar Rapids	42	4
23	10.4	SE	Johnson Elementary School	355 18th St SE	Cedar Rapids	400	20
23	10.3	SE	KidsPoint Downtown Learning Center & Preschool	318 5th St SE	Cedar Rapids	221	18
23	10.9	ESE	Marion High School	675 S. 15th St	Marion	638	53
23	10.5	SE	McKinley Middle School	620 10th St SE	Cedar Rapids	510	26
23	10.9	SE	Metro High School	1212 7th St SE	Cedar Rapids	425	21
23	10.9	SE	Metro Parent - Child Center	1212 7th St SE	Cedar Rapids	34	3
23	10.2	SE	St. Paul's Parents Day Out	1340 3rd Ave SE	Cedar Rapids	108	9
23	10.2	SE	St. Paul's Preschool FOCUS	1340 3rd Ave SE	Cedar Rapids	40	3
23	10.8	ESE	Starry Elementary	700 S. 15th St	Marion	378	32
23	10.5	SE	The ARC of East Central Childcare Program	680 2nd St SE	Cedar Rapids	88	7
23	10.1	SE	The Cedar Rapids Day School	615 1st Ave SE	Cedar Rapids	200	17
23	10.5	ESE	Vernon Middle School	1350 4th Ave	Marion	622	52
23	10.4	SE	Washington High School	2205 Forest Dr SE	Cedar Rapids	1,400	70
24	12.8	SSE	ASAC Heart of Iowa Child	4050 Bowling St SW	Cedar Rapids	85	7
24	11.4	SSE	Four Oaks Day Program	1924 D St SW	Cedar Rapids	48	4
24	11.8	SSE	Grant Elementary School/Preschool	254 Outlook Dr SW	Cedar Rapids	365	18
24	11.4	SSE	HACAP Head Start Hayes Center	1924 D St SW	Cedar Rapids	40	3
24	10.2	SSE	Jefferson Senior High School	1243 20th St SW	Cedar Rapids	1,525	76
24	10.9	SSE	Kaplan University	3165 Edgewood Pkwy SW	Cedar Rapids	303	51
24	10.2	SSE	Kinder Kollege	350 3rd Ave SW	Cedar Rapids	58	5
24	11.4	SSE	St. Ludmila Catholic Center	215 21st Ave SW	Cedar Rapids	71	4
24	11.4	SSE	St. Ludmila Daycare	215 21st Ave SW	Cedar Rapids	20	2
24	11.4	SSE	St. Ludmila Preschool	215 21st Ave SW	Cedar Rapids	22	2
24	10.3	SSE	Taylor Elementary School/Preschool	720 7th Ave SW	Cedar Rapids	315	16
24	12.0	SSE	Teddy Bear Childcare Center	2730 Bowling St SW	Cedar Rapids	88	7
24	10.2	SSE	Trinity Lane Preschool	400 3rd Ave SW	Cedar Rapids	42	4

Subarea	Distance (miles)	Direc-tion	School Name	Street Address	Municipality	Enroll-ment	Staff
24	10.1	SSE	Trinity Lutheran Childcare	1361 7th Ave SW	Cedar Rapids	10	1
24	10.1	SSE	Trinity Lutheran School District	1361 7th Ave SW	Cedar Rapids	178	9
24	10.7	SSE	Van Buren Elementary School	2525 29th St SW	Cedar Rapids	370	18
24	11.5	SSE	Wilson Middle School	2301 J St SW	Cedar Rapids	400	20
					Linn County Subtotal:	*41,458*	*2,522*
					EPZ Total:	**42,467**	**2,573**

Table E-2. Medical Facilities within the EPZ

Subarea	Distance (miles)	Direc-tion	Facility Name	Street Address	Municipality	Capacity	Secured Unit Capacity	Bus Capacity Required	Ambulance Capacity Required
BENTON COUNTY, IA									
7	4.9	W	Rock Ridge Residential Care	401 Canton St	Shellsburg	35	0	35	0
					Benton County Subtotal:	*35*	*0*	*35*	*0*
LINN COUNTY, IA									
4	6.0	SE	Promise House	1320 Litchfield Dr	Hiawatha	20	20	20	0
14	11.2	ESE	Bickford Cottage	1100 Linden Dr	Marion	46	7	46	0
14	6.4	ESE	Emery Place	901 South Mentzer Rd	Robins	64	19	64	0
14	5.9	SE	Hiawatha Care Center	405 North 15th Ave	Hiawatha	109	0	97	12
14	7.8	ESE	Keystone Cedars	6325 Rockwell Dr NE	Cedar Rapids	66	16	66	0
14	11.2	ESE	Milestones in Marion	1080 Cardinal Dr	Marion	55	0	55	0
14	7.4	ESE	Northbrook Manor Care Center	6420 Council St NE	Cedar Rapids	130	0	130	0
14	6.1	SE	Oldorf Hospice House of Mercy	315 18th Ave	Hiawatha	12	0	12	0
14	6.1	SE	REM Iowa Developmental Services (8)	1220 Industrial Ave	Hiawatha	65	0	65	0
14	5.3	ESE	REM Iowa Developmental Services (9)	1395 Stamy Rd	Hiawatha	75	0	75	0
14	11.0	ESE	Summit Pointe Living Community	3505 English Glen Ave	Marion	202	0	202	0
14	10.2	ESE	Winslow House Care Center	3456 Indian Creek Rd	Marion	50	0	45	5
15	10.1	SE	Manor Care Health Services	1940 1st Ave NE	Cedar Rapids	105	0	85	20
15	9.3	SE	Sacred Heart Convent	1125 Prairie Dr NE	Cedar Rapids	33	0	33	0
15	10.0	SE	St. Luke's Hospital	1026 A Ave NE	Cedar Rapids	420	74	330	90
16	9.8	SSE	Evergreen Estates I	3410 12th Ave SW	Cedar Rapids	50	0	50	0
16	9.8	SSE	Evergreen Estates II	307 Edgewood Rd SW	Cedar Rapids	25	0	25	0

Subarea	Distance (miles)	Direc-tion	Facility Name	Street Address	Municipality	Capacity	Secured Unit Capacity	Bus Capacity Required	Ambulance Capacity Required
16	9.5	SSE	Evergreen Estates III	2204 Johnson Ave NW	Cedar Rapids	39	0	39	0
16	9.9	SSE	Foundation 2	3015 12 Ave. SW	Cedar Rapids	30	0	30	0
16	9.7	SSE	Heritage Nursing and Rehabilitation	200 Clive Dr SW	Cedar Rapids	130	24	95	35
16	9.9	SSE	Kingston Hill	202 12th St NW	Cedar Rapids	25	0	25	0
16	9.0	SSE	Meadow View Memory Care Village	3005 F Ave NW	Cedar Rapids	68	0	68	0
16	9.1	SSE	Meth-Wick Community	1224 13th St NW	Cedar Rapids	560	97	547	13
16	8.8	SSE	Milestones Adult Day Health Center	1725 O Ave NW	Cedar Rapids	70	13	70	0
16	9.0	SSE	Prairie Hills Senior Living	2903 F Ave NW	Cedar Rapids	86	0	86	0
16	9.0	SSE	Ridge View Assisted Living	2975 F Ave NW	Cedar Rapids	88	0	88	0
16	9.0	SSE	West Ridge Care Center	3131 F Ave NW	Cedar Rapids	60	15	40	20
23	10.2	SE	Cottage Grove Place	2115 1st Ave SE	Cedar Rapids	100	35	99	1
23	10.9	ESE	Crestview Acres, Inc.	1485 Grand Ave	Marion	100	21	80	20
23	9.5	SE	Garnett Place	202 35th St Dr SE # 123	Cedar Rapids	49	5	49	0
23	10.9	SE	Higley Mansion Care Center	860 17th St SE	Cedar Rapids	50	0	43	7
23	10.7	SE	Irving Point	910 7th Ave SE	Cedar Rapids	110	0	110	0
23	10.6	ESE	Linn Manor Care Center	1140 Elim Dr	Marion	38	0	33	5
23	10.4	SE	Living Center East	1220 5th Ave SE	Cedar Rapids	93	0	90	3
23	10.5	SE	Mercy Hallmar Care Center	701 10th St SE	Cedar Rapids	55	0	53	2
23	10.5	SE	Mercy Medical Center	411 10th St SE Suite 2300	Cedar Rapids	305	20	92	213
23	10.3	SE	St. Luke's Living Center West	1050 4th Ave SE	Cedar Rapids	85	0	75	10
23	12.0	SE	Tanager Place	2309 C Ave SW	Cedar Rapids	68	0	68	0
23	9.7	ESE	Villages at Marion	365 Marion Blvd	Marion	84	20	84	0
23	11.3	ESE	Willow Gardens Care Center	455 31st St	Marion	91	0	71	20
24	11.6	SSE	Asbury House	378 27th Ave SW	Cedar Rapids	20	0	20	0
24	12.3	SSE	Emeritus at Silver Pines	136 36th Ave SW	Cedar Rapids	47	0	47	0
					Linn County Subtotal:	*3,978*	*386*	*3,502*	*476*
					EPZ Total:	**4,013**	**386**	**3,537**	**476**

Table E-3. Major Employers within the EPZ

Subarea	Distance (miles)	Direc-tion	Facility Name	Street Address	Municipality	Employees (Max Shift)	Employees (Non-EPZ)	Employees Vehicles
BENTON COUNTY, IA								
Various locations throughout the EPZ						207	90	81
					Benton County Subtotal:	*207*	*90*	*81*
LINN COUNTY, IA								
Various locations throughout the EPZ						74,097	32,160	29,239
					Linn County Subtotal:	*74,097*	*32,160*	*29,239*
					EPZ Total[1]:	**74,304**	**32,250**	**29,320**

[1] The major employer locations identified by the Census Bureau are shown in Figure E-7. The locations are represented by circles which increase in size proportional to the number of non-EPZ Employees present in each Census Block. Note that most of the major employer locations are concentrated in the Cities of Cedar Rapids, Hiawatha, and Marion in Linn County. The data was supplemented by the plant employment (575 employees during the max shift, 43.4% of which commute from outside the EPZ, or 250 commuting employees during the max shift) provided by NextEra Energy.

Table E-4. Recreational Areas within the EPZ

Subarea	Distance (miles)	Direc-tion	Facility Name	Street Address	Municipality	Phone	Transients	Vehicles
BENTON COUNTY, IA								
21	8.4	WNW	Benton City Park	60th St	Vinton	(319) 472-4942	95	60
21	8.4	NW	Wildcat Bluff Park	57th St Trl	Urbana	-	10	6
						Benton County Subtotal:	*105*	*66*
LINN COUNTY, IA								
1	2.6	WNW	Pleasant Creek State Park	4530 McClintock Rd	Palo	(319) 436-7716	100	44
5	7.1	SSE	Ushers Ferry Historical Village	5926 Seminole Valley Trl NE	Cedar Rapids	(319) 286-5763	225	100
13	6.9	E	Tuma Soccer Complex	3239 C Ave Extension	Marion	(319) 373-0500	1013	450
14	6.3	SE	Cedar Valley Nature Trail	Boyson Rd	Hiawatha	(319) 892-6457	25	20
14	5.4	SE	Eastern Iowa Sports Complex	1100 N 18th Ave	Hiawatha	(310) 210-2634	135	60
23	10.6	SE	Brucemore, A National Trust Historical Site	2160 Linden Dr SE	Cedar Rapids	(319) 362-7375	1400	622
24	10.4	SSE	Cedar Rapids Ice Arena	1100 Rockford Rd SW	Cedar Rapids	(319) 247-0340	725	322
24	10.4	SSE	Cedar Rapids Kernels Baseball Club	950 Rockford Rd SW	Cedar Rapids	(319) 363-3887	1050	467
24	12.5	SSE	Hawkeye Downs	4400 6th St SW	Cedar Rapids	(319) 365-8656	675	300
						Linn County Subtotal:	*5,348*	*2,385*
						EPZ Total:	**5,453**	**2,451**

Table E-5. Lodging Facilities within the EPZ

Subarea	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Phone	Transients	Vehicles
LINN COUNTY, IA								
9	6.1	N	Relax Inn	421 Franklin St	Center Point	(319) 849-9050	17	7
14	10.8	ESE	Marion Motel	2330 7th Ave	Marion	(319) 377-1546	60	20
14	12.4	ESE	Microtel Inn & Suites	5500 Dryer Ave	Marion	(319) 373-7400	83	41
15	8.0	SE	Baymont Inn & Suites	1220 Park Pl NE	Cedar Rapids	(319) 378-8000	306	77
15	9.5	ESE	Best Western Longbranch	90 Twixt Town Rd	Cedar Rapids	(319) 377-6386	155	77
15	7.5	SE	Collins Inn & Suites	2025 Werner Ave NE	Cedar Rapids	(319) 378-8888	230	58
15	8.2	SE	Comfort Inn North	5055 Rockwell Dr	Cedar Rapids	(319) 393-8247	97	48
15	7.0	SE	Days Inn & Suites	2215 Blairs Ferry Rd NW	Cedar Rapids	(319) 378-3948	147	74
15	8.1	SE	Hampton Inn & Suites	1130 Park Pl NE	Cedar Rapids	(319) 832-1130	93	93
15	7.7	SE	Hawthorn Suites by Wyndham	4444 Czech Lane NE	Cedar Rapids	(319) 294-8700	246	62
15	8.0	SE	Holiday Inn Express	1230 Collins Rd NE	Cedar Rapids	(319) 294-9407	141	71
15	8.0	SE	Homewood Suites	1140 Park Pl NE	Cedar Rapids	(319) 378-1140	114	76
15	8.2	SE	Main Stay Suites	5145 Rockwell Dr NE	Cedar Rapids	(319) 363-7829	67	67
15	8.1	SE	Marriott Hotel	1200 Collins Rd NE	Cedar Rapids	(319) 393-6600	471	185
15	7.6	SE	Residence Inn	1900 Dodge Rd NE	Cedar Rapids	(319) 395-0111	125	63
16	9.9	SSE	Best Western Coopers Mill	100 F Ave NW	Cedar Rapids	(319) 366-5323	141	71
16	10.0	SSE	Budget Inn	3100 16th Ave SW	Cedar Rapids	(319) 363-8101	137	54
16	9.9	SSE	Rodeway Inn	4011 16th Ave SW	Cedar Rapids	(319) 396-5000	143	48
17	9.7	SSW	Ced Rel Motel	11901 16th Ave SW	Cedar Rapids	(319) 446-7100	18	18
23	9.6	ESE	Quality Inn	4747 1 Ave SE	Cedar Rapids	(319) 393-8800	135	53
24	11.9	SSE	Aspen Inn	3233 Southridge Dr SW	Cedar Rapids	(319) 363-9999	151	38
24	12.2	SSE	Clarion Hotel	525 33rd Ave NW	Cedar Rapids	(319) 366-8671	312	78
24	12.0	SSE	Econo Lodge	622 33rd Ave SW	Cedar Rapids	(319) 363-8888	107	42
24	12.0	SSE	Economy Inn & Suites	3245 Southgate Pl SW	Cedar Rapids	(319) 365-4339	40	20
24	12.0	SSE	Hampton Inn	3265 6h St SW	Cedar Rapids	(319) 364-8144	368	74
24	12.1	SSE	Holiday Inn Express & Suites	3320 Southgate Ct SW	Cedar Rapids	(319) 399-5025	70	70
24	12.1	SSE	Hometown Inn & Suites	3315 Southgate Ct SW	Cedar Rapids	(319) 362-9012	448	112
24	12.0	SSE	Howard Johnson Inn	616 33rd Ave SW	Cedar Rapids	(319) 366-2475	200	100
24	12.2	SSE	Motel 6	3325 Southgate Ct SW	Cedar Rapids	(319) 366-7523	208	104

Subarea	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Phone	Transients	Vehicles
24	12.0	SSE	Quality Inn	390 33rd Ave SW	Cedar Rapids	(319) 363-7934	216	54
24	12.0	SSE	Red Roof Inn	3243 S. Ridge Dr SW	Cedar Rapids	(319) 364-2000	200	100
24	12.0	SSE	Super 8 East	400 33rd Ave SW	Cedar Rapids	(319) 363-1755	104	52
24	12.0	SSE	Super 8 West	720 33rd Ave SW	Cedar Rapids	(319) 362-6002	104	52
						Linn County Subtotal:	*5,454*	*2,159*
						EPZ TOTAL:	**5,454**	**2,159**

Table E-6. Correctional Facilities within the EPZ

Subarea	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Capacity	Secured Unit Capacity	Bus Capacity Required	Ambulance Capacity Required
LINN COUNTY, IA									
23	10.4	SE	Linn County Correctional Center	53 3rd Ave Bridge	Cedar Rapids	401	401	401	0
24	11.6	SSE	Anchor Center	3115 12th St SE	Cedar Rapids	26	0	26	0
24	11.5	SSE	Hinzman Center	1051 29th Ave	Cedar Rapids	86	0	86	0
24	11.5	SSE	Lary Nelson Center	1001 29th Ave	Cedar Rapids	93	93	93	0
					Linn County Subtotal:	*606*	*494*	*606*	*0*
					EPZ Total:	**606**	**494**	**606**	**0**

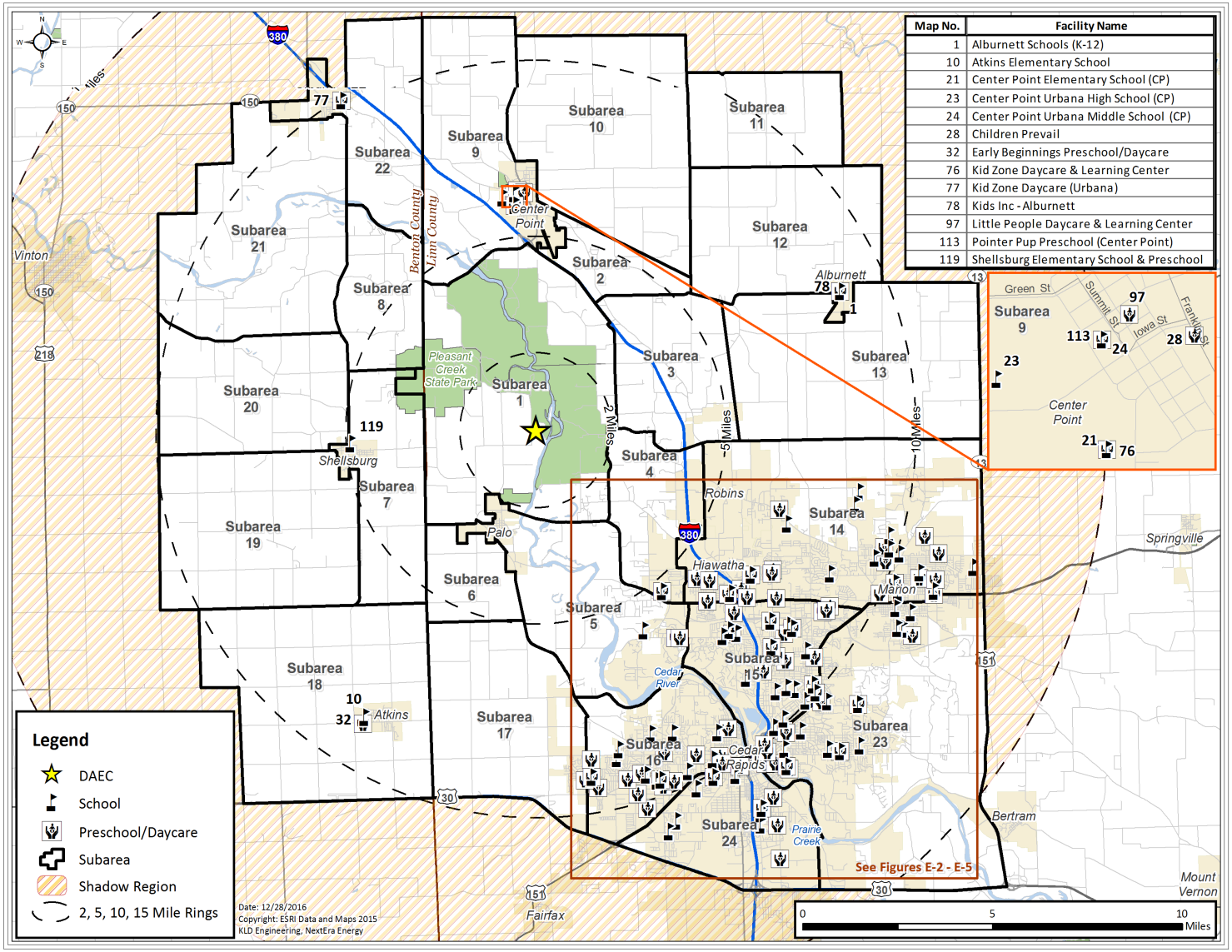
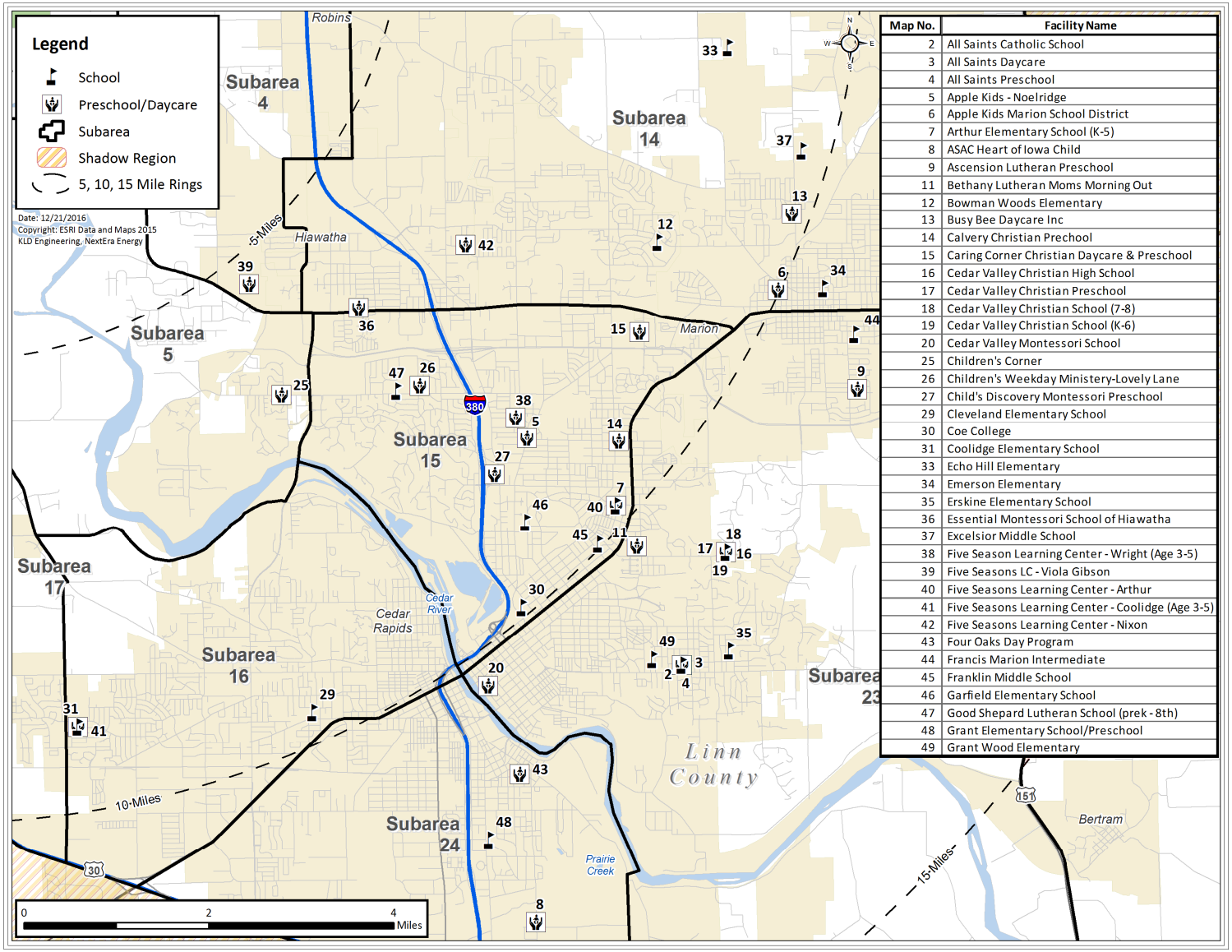
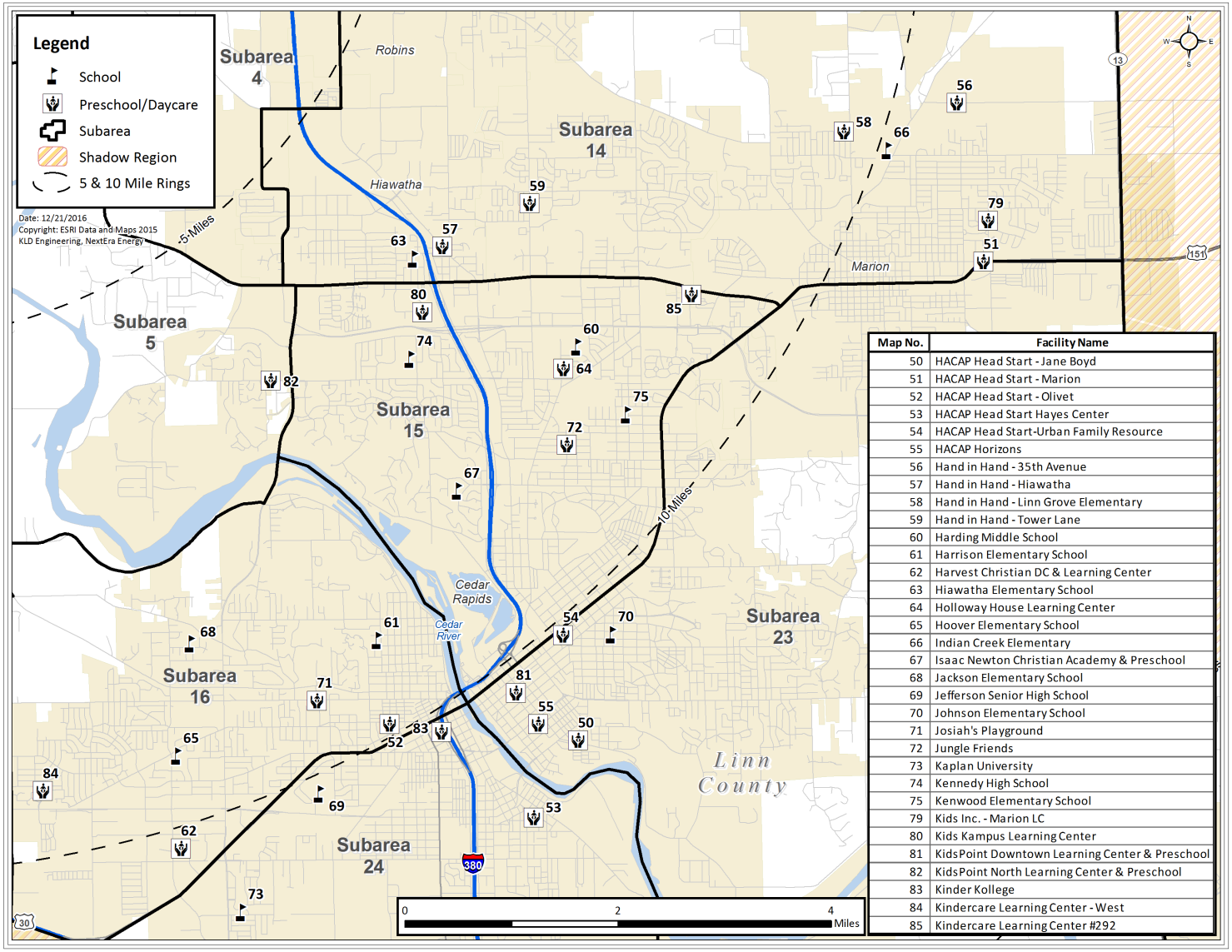


Figure E-1. Overview of Schools, Pre-Schools and Daycares within the EPZ



Map No.	Facility Name
2	All Saints Catholic School
3	All Saints Daycare
4	All Saints Preschool
5	Apple Kids - Noelridge
6	Apple Kids Marion School District
7	Arthur Elementary School (K-5)
8	ASAC Heart of Iowa Child
9	Ascension Lutheran Preschool
11	Bethany Lutheran Moms Morning Out
12	Bowman Woods Elementary
13	Busy Bee Daycare Inc
14	Calvery Christian Prechool
15	Caring Corner Christian Daycare & Preschool
16	Cedar Valley Christian High School
17	Cedar Valley Christian Preschool
18	Cedar Valley Christian School (7-8)
19	Cedar Valley Christian School (K-6)
20	Cedar Valley Montessori School
25	Children's Corner
26	Children's Weekday Ministery-Lovely Lane
27	Child's Discovery Montessori Preschool
29	Cleveland Elementary School
30	Coe College
31	Coolidge Elementary School
33	Echo Hill Elementary
34	Emerson Elementary
35	Erskine Elementary School
36	Essential Montessori School of Hiawatha
37	Excelsior Middle School
38	Five Season Learning Center - Wright (Age 3-5)
39	Five Seasons LC - Viola Gibson
40	Five Seasons Learning Center - Arthur
41	Five Seasons Learning Center - Coolidge (Age 3-5)
42	Five Seasons Learning Center - Nixon
43	Four Oaks Day Program
44	Francis Marion Intermediate
45	Franklin Middle School
46	Garfield Elementary School
47	Good Shepard Lutheran School (prek - 8th)
48	Grant Elementary School/Preschool
49	Grant Wood Elementary

Figure E-2. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with A-G)



Map No.	Facility Name
50	HACAP Head Start - Jane Boyd
51	HACAP Head Start - Marion
52	HACAP Head Start - Olivet
53	HACAP Head Start Hayes Center
54	HACAP Head Start-Urban Family Resource
55	HACAP Horizons
56	Hand in Hand - 35th Avenue
57	Hand in Hand - Hiawatha
58	Hand in Hand - Linn Grove Elementary
59	Hand in Hand - Tower Lane
60	Harding Middle School
61	Harrison Elementary School
62	Harvest Christian DC & Learning Center
63	Hiawatha Elementary School
64	Holloway House Learning Center
65	Hoover Elementary School
66	Indian Creek Elementary
67	Isaac Newton Christian Academy & Preschool
68	Jackson Elementary School
69	Jefferson Senior High School
70	Johnson Elementary School
71	Josiah's Playground
72	Jungle Friends
73	Kaplan University
74	Kennedy High School
75	Kenwood Elementary School
79	Kids Inc. - Marion LC
80	Kids Kampus Learning Center
81	KidsPoint Downtown Learning Center & Preschool
82	KidsPoint North Learning Center & Preschool
83	Kinder Kollege
84	Kindercare Learning Center - West
85	Kindercare Learning Center #292

Figure E-3. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with H-K)

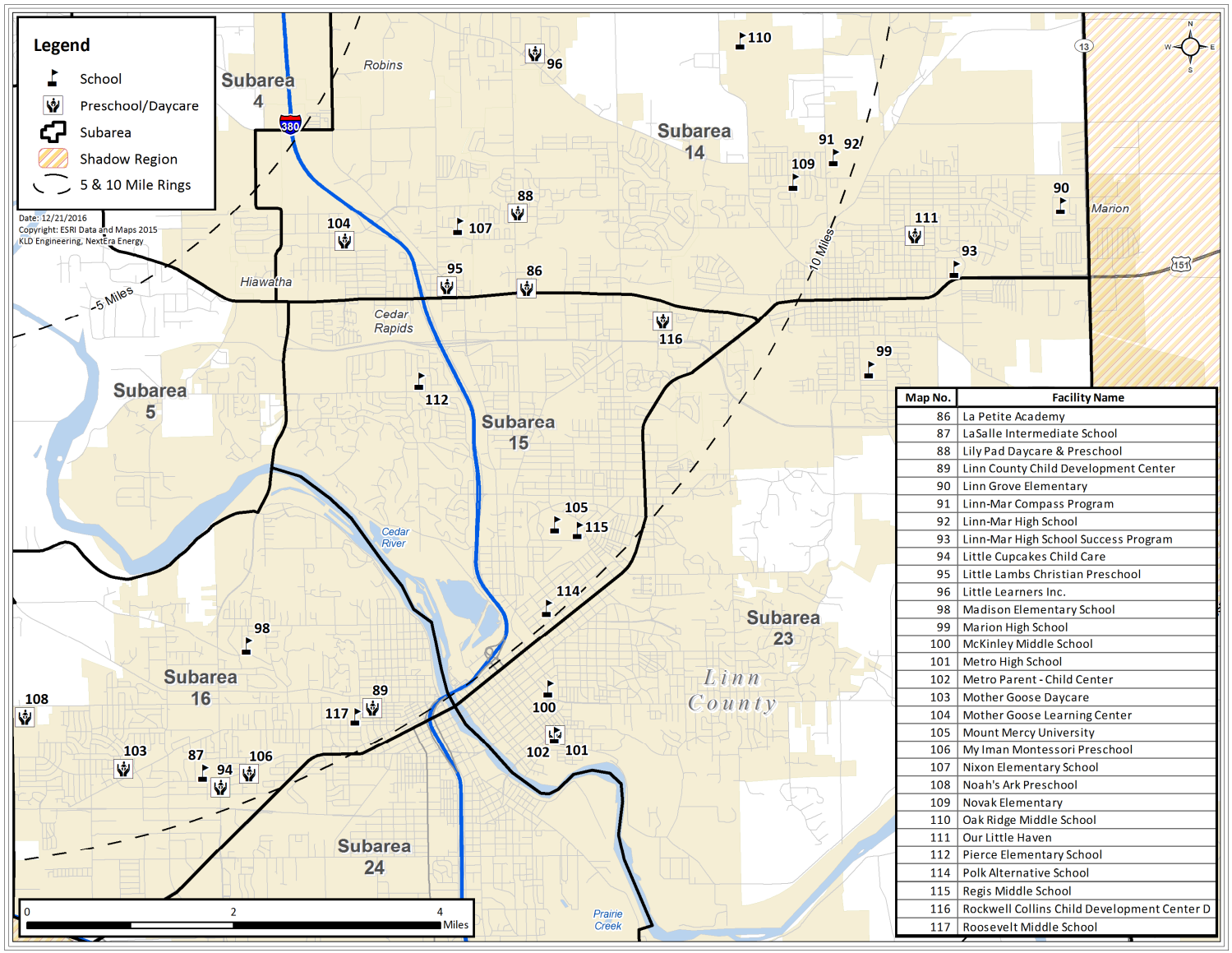
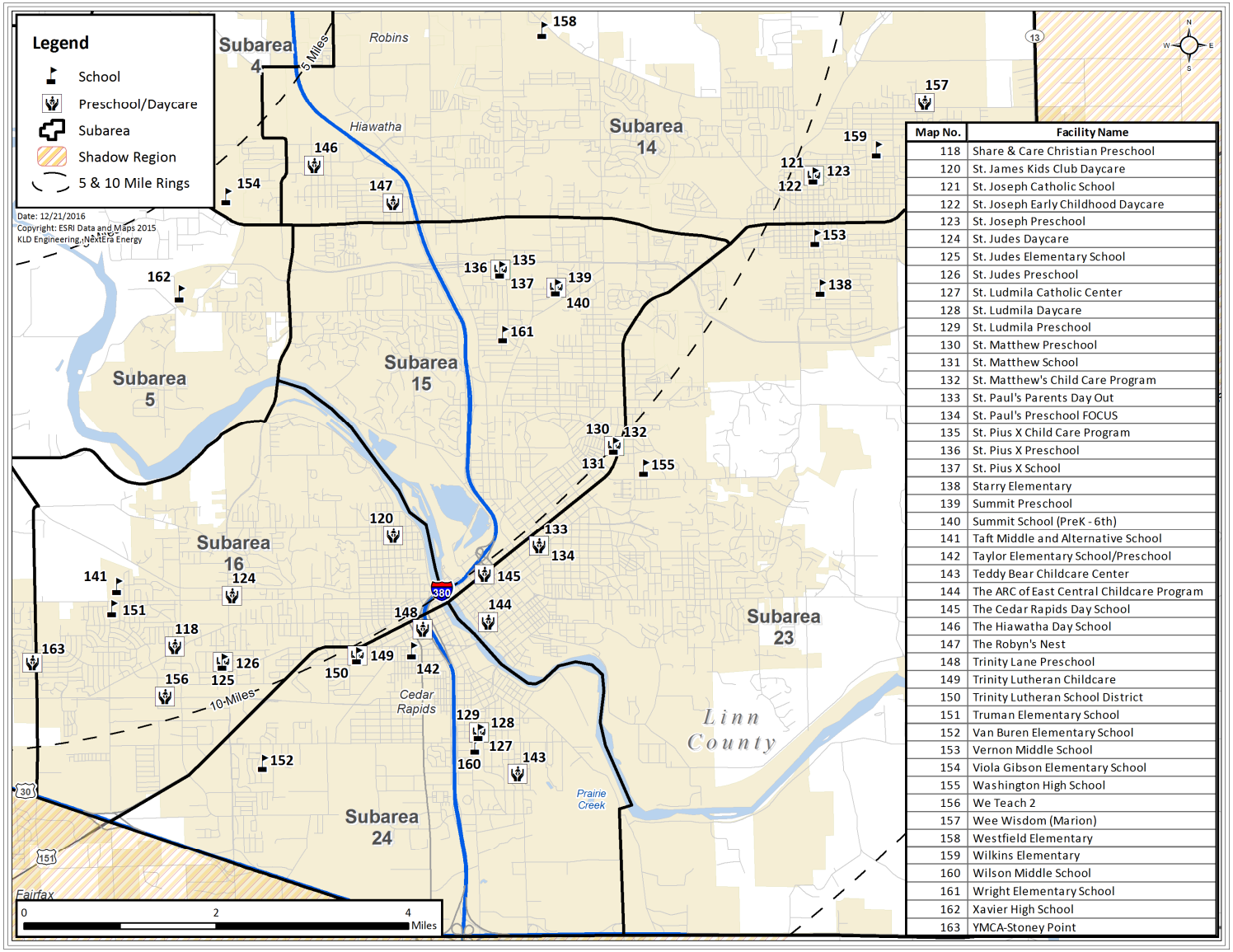
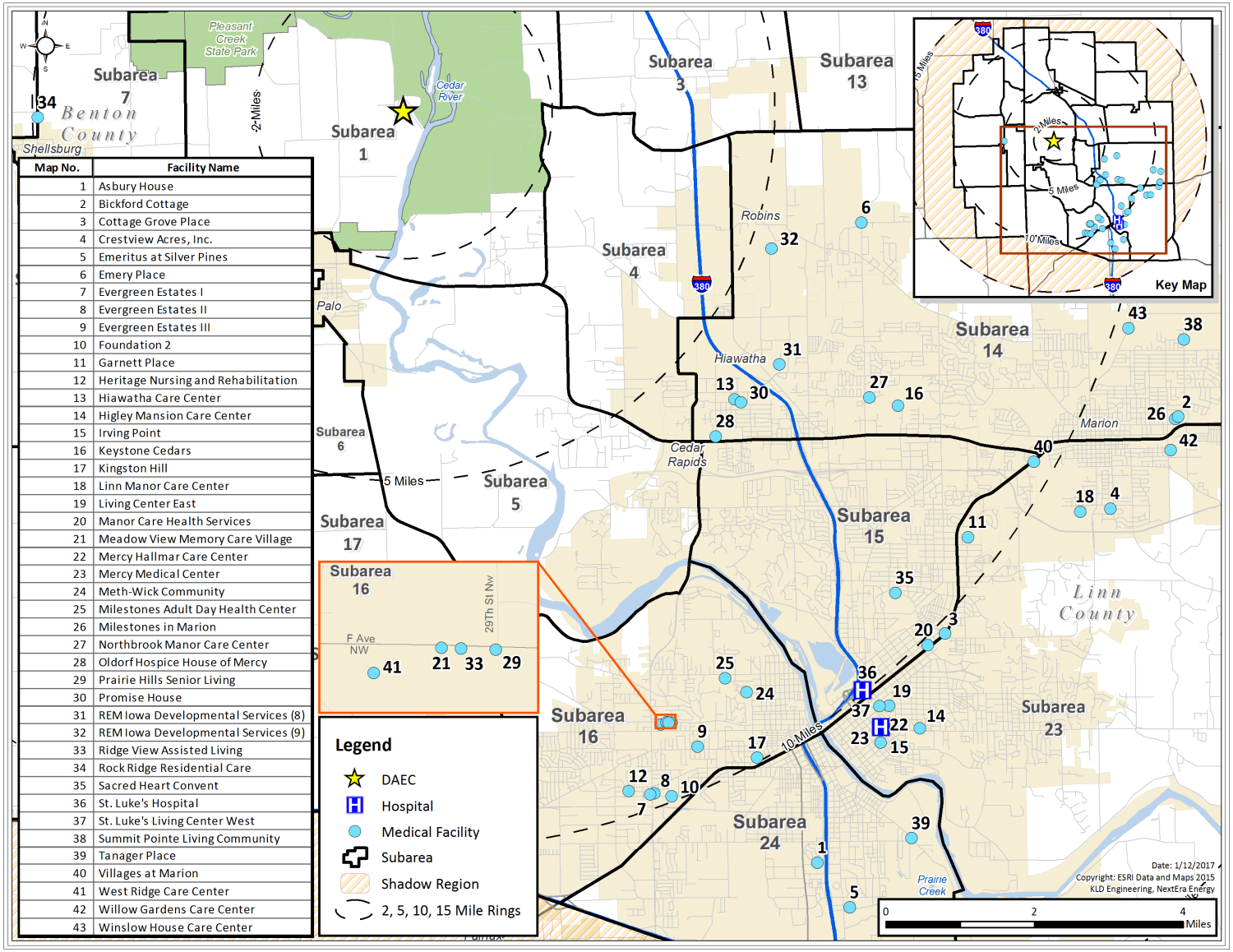


Figure E-4. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with L-R)



Map No.	Facility Name
118	Share & Care Christian Preschool
120	St. James Kids Club Daycare
121	St. Joseph Catholic School
122	St. Joseph Early Childhood Daycare
123	St. Joseph Preschool
124	St. Judes Daycare
125	St. Judes Elementary School
126	St. Judes Preschool
127	St. Ludmila Catholic Center
128	St. Ludmila Daycare
129	St. Ludmila Preschool
130	St. Matthew Preschool
131	St. Matthew School
132	St. Matthew's Child Care Program
133	St. Paul's Parents Day Out
134	St. Paul's Preschool FOCUS
135	St. Pius X Child Care Program
136	St. Pius X Preschool
137	St. Pius X School
138	Starry Elementary
139	Summit Preschool
140	Summit School (PreK - 6th)
141	Taft Middle and Alternative School
142	Taylor Elementary School/Preschool
143	Teddy Bear Childcare Center
144	The ARC of East Central Childcare Program
145	The Cedar Rapids Day School
146	The Hiawatha Day School
147	The Robyn's Nest
148	Trinity Lane Preschool
149	Trinity Lutheran Childcare
150	Trinity Lutheran School District
151	Truman Elementary School
152	Van Buren Elementary School
153	Vernon Middle School
154	Viola Gibson Elementary School
155	Washington High School
156	We Teach 2
157	Wee Wisdom (Marion)
158	Westfield Elementary
159	Wilkins Elementary
160	Wilson Middle School
161	Wright Elementary School
162	Xavier High School
163	YMCA-Stoney Point

Figure E-5. Cedar Rapids Area Schools, Pre-Schools and Daycares within the EPZ (Name Starts with S-Z)



Map No.	Facility Name
1	Asbury House
2	Bickford Cottage
3	Cottage Grove Place
4	Crestview Acres, Inc.
5	Emeritus at Silver Pines
6	Emery Place
7	Evergreen Estates I
8	Evergreen Estates II
9	Evergreen Estates III
10	Foundation 2
11	Garnett Place
12	Heritage Nursing and Rehabilitation
13	Hiawatha Care Center
14	Higley Mansion Care Center
15	Irving Point
16	Keystone Cedars
17	Kingston Hill
18	Linn Manor Care Center
19	Living Center East
20	Manor Care Health Services
21	Meadow View Memory Care Village
22	Mercy Hallmar Care Center
23	Mercy Medical Center
24	Meth-Wick Community
25	Milestones Adult Day Health Center
26	Milestones in Marion
27	Northbrook Manor Care Center
28	Oldorf Hospice House of Mercy
29	Prairie Hills Senior Living
30	Promise House
31	REM Iowa Developmental Services (8)
32	REM Iowa Developmental Services (9)
33	Ridge View Assisted Living
34	Rock Ridge Residential Care
35	Sacred Heart Convent
36	St. Luke's Hospital
37	St. Luke's Living Center West
38	Summit Pointe Living Community
39	Tanager Place
40	Villages at Marion
41	West Ridge Care Center
42	Willow Gardens Care Center
43	Winslow House Care Center

Figure E-6. Medical Facilities within the EPZ

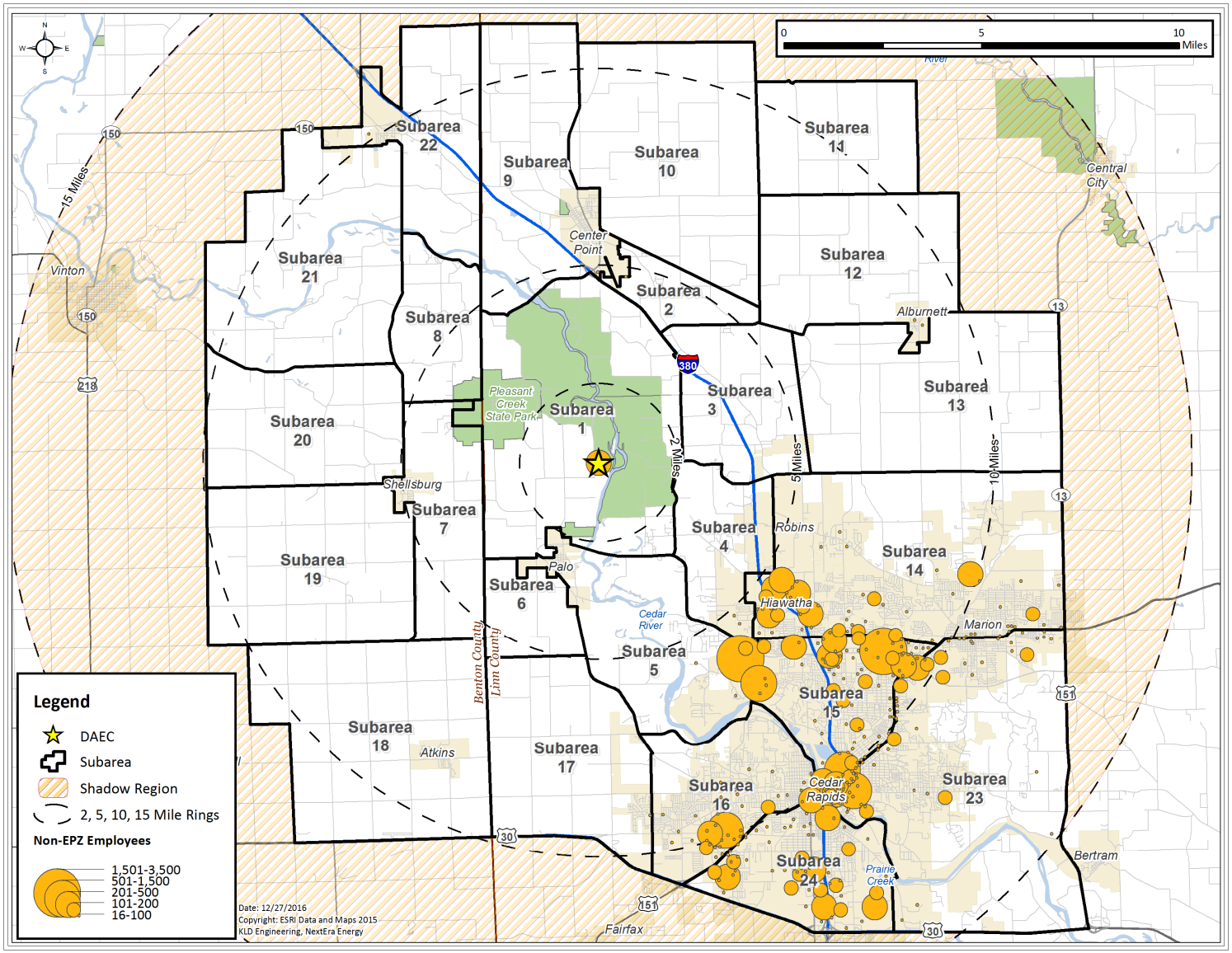


Figure E-7. Employment Locations within the EPZ which Attract Employees from Outside the EPZ

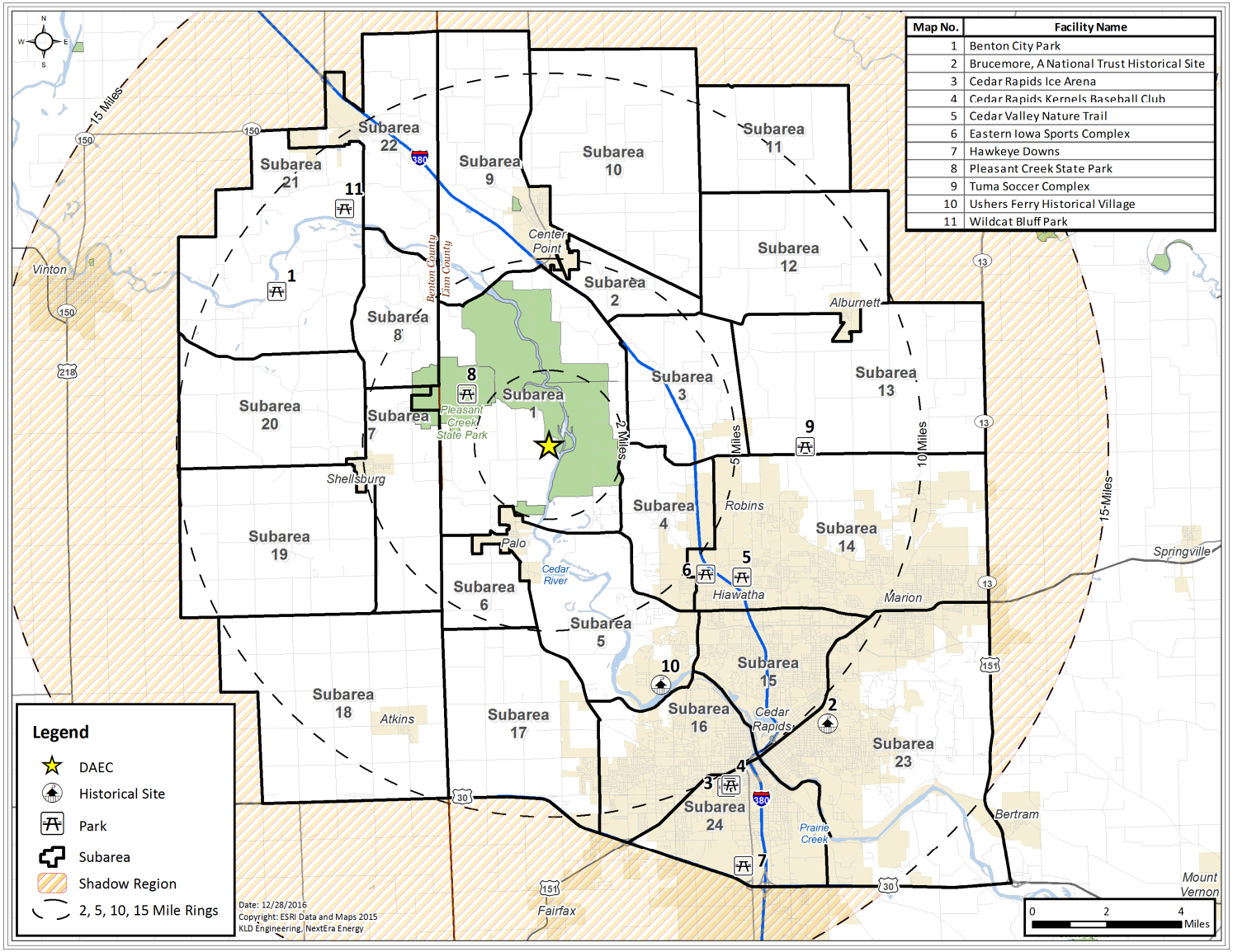


Figure E-8. Recreational Areas within the EPZ

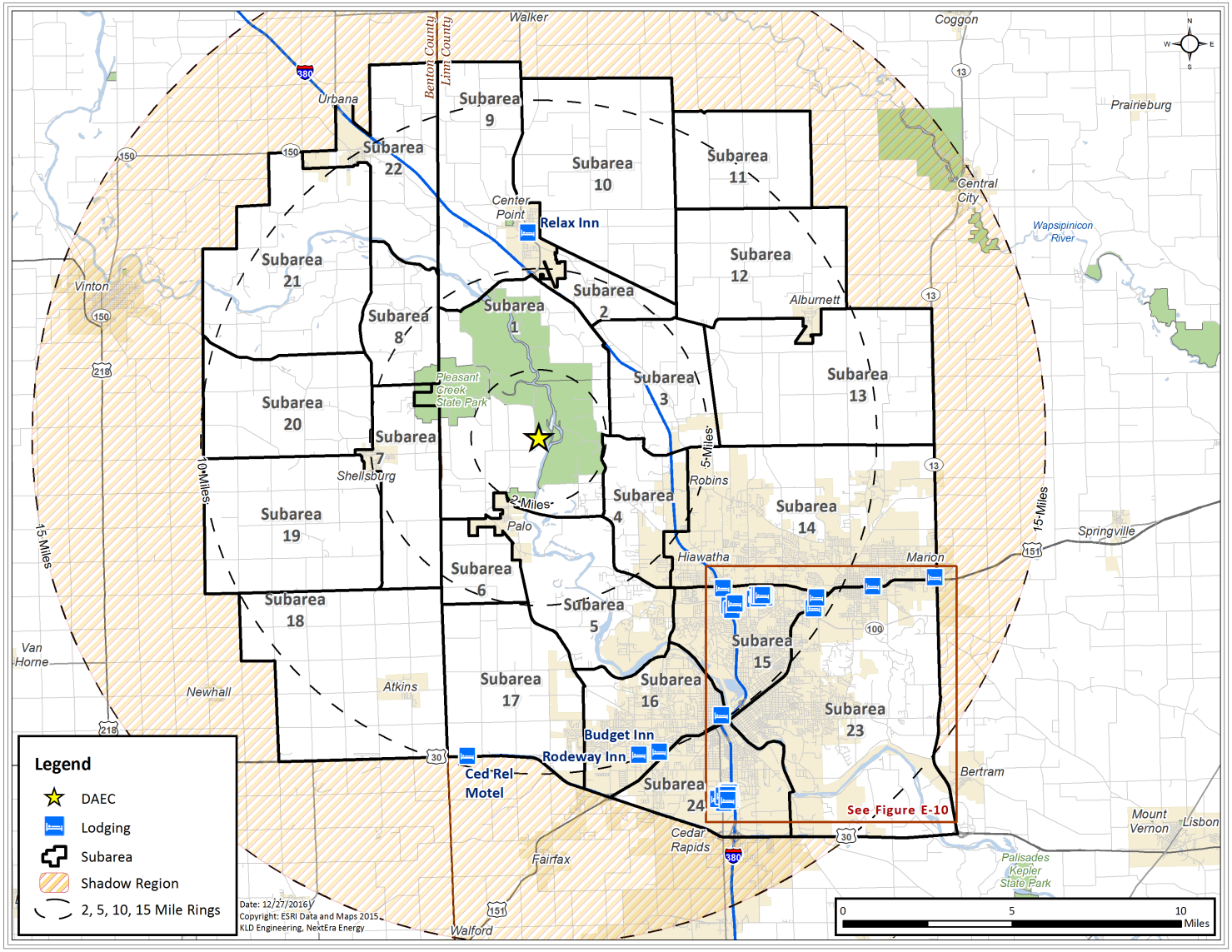
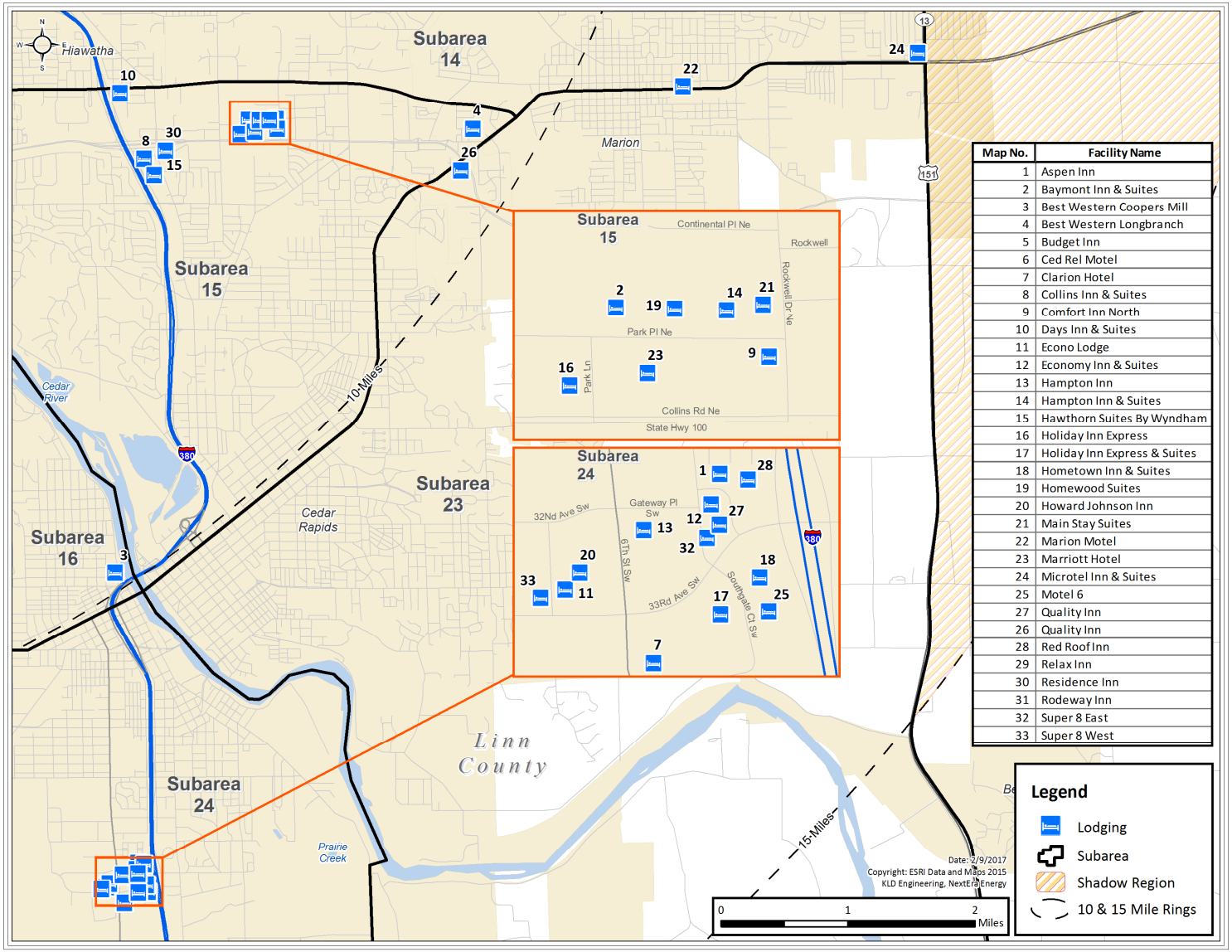


Figure E-9. Lodging Facilities within the EPZ (1 of 2)



Map No.	Facility Name
1	Aspen Inn
2	Baymont Inn & Suites
3	Best Western Coopers Mill
4	Best Western Longbranch
5	Budget Inn
6	Ced Rel Motel
7	Clarion Hotel
8	Collins Inn & Suites
9	Comfort Inn North
10	Days Inn & Suites
11	Econo Lodge
12	Economy Inn & Suites
13	Hampton Inn
14	Hampton Inn & Suites
15	Hawthorn Suites By Wyndham
16	Holiday Inn Express
17	Holiday Inn Express & Suites
18	Hometown Inn & Suites
19	Homewood Suites
20	Howard Johnson Inn
21	Main Stay Suites
22	Marion Motel
23	Marriott Hotel
24	Microtel Inn & Suites
25	Motel 6
27	Quality Inn
26	Quality Inn
28	Red Roof Inn
29	Relax Inn
30	Residence Inn
31	Rodeway Inn
32	Super 8 East
33	Super 8 West

Figure E-10. Lodging Facilities within the EPZ (2 of 2)

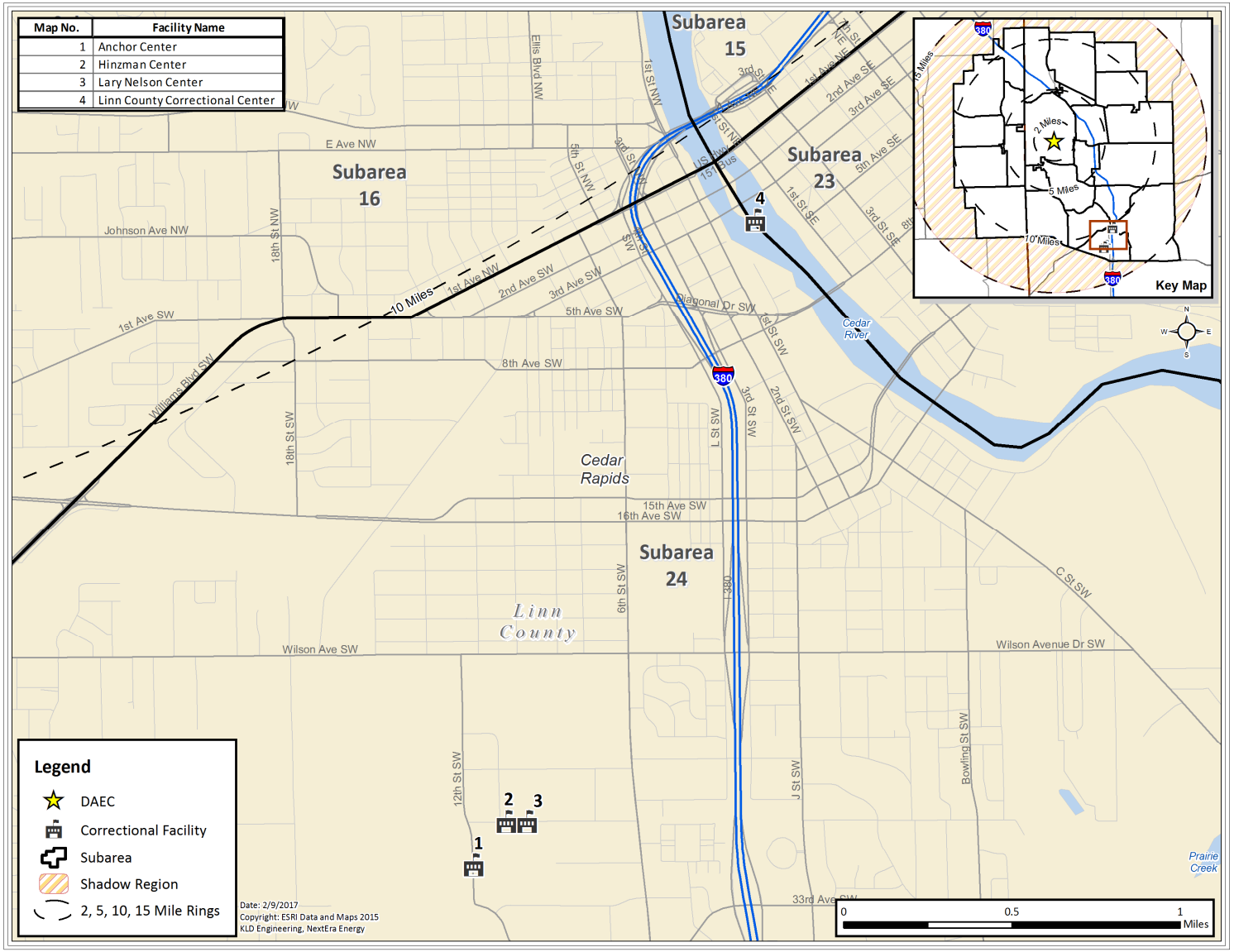


Figure E-11. Correctional Facilities within the EPZ

APPENDIX F

Telephone Survey

F. TELEPHONE SURVEY

F.1 Introduction

The development of evacuation time estimates for the DAEC EPZ requires the identification of travel patterns, car ownership and household size of the population within the EPZ. Demographic information can be obtained from Census data. The use of this data has several limitations when applied to emergency planning. First, the Census data do not encompass the range of information needed to identify the time required for preliminary activities (mobilization) that must be undertaken prior to evacuating the area. Secondly, Census data do not contain attitudinal responses needed from the population of the EPZ and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by conducting a telephone survey of a representative sample of the EPZ population. The survey is designed to elicit information from the public concerning family demographics and estimates of response times to well defined events. The design of the survey includes a limited number of questions of the form “What would you do if …?” and other questions regarding activities with which the respondent is familiar (“How long does it take you to …?”)

F.2 Survey Instrument and Sampling Plan

The telephone survey discussed herein was performed in 2012 for the Duane Arnold Energy Center Development of Evacuation Time Estimates Technical Report (TR) - 529, dated December, 2012. The EPZ population has increased approximately 5.1% (an increase of 9,456 people) between the 2010 Census and 2016. Even though a portion of Subarea 24, south of US-30 (5,218 people) has been removed, several subareas – specifically Subareas that include Cedar Rapids, Hiawatha, Robins and Marion – have grown in population resulting in an overall increase in population from the 2012 study.

Although the population has increased, the population demographics have not significantly changed. According to the U.S. Census Bureau's American Community Survey (ACS)[1], conducted in 2015, the median household income in Linn County was $72,714 in 2012 and $74,136 in 2015 – a difference of approximately 5%. In Benton County, the median household income was $67,487 in 2012 and $70,982 in 2014[2] - a difference of about 5 percent. The average household size for Linn County was 2.49 in 2012 and 2.41 in 2015 – a difference of approximately 3 percent. In Benton County, the household size of 2.52 has not changed from 2012 to 2014[3]. Given the insignificant changes in demographics, the behavioral responses to the survey questions are not likely to change significantly. Thus, the use of the 2012 telephone survey results is justified.

Attachment A presents the final survey instrument used for the 2012 survey. A draft of the instrument was submitted to stakeholders for comment. Comments were received and the survey instrument was modified accordingly, prior to conducting the survey.

Following the completion of the instrument, a sampling plan was developed. A sample size of approximately 500 **completed** survey forms yields results with a sampling error of ±4.4% at the 95% confidence level. The sample must be drawn from the EPZ population. Consequently, a list of zip codes in the EPZ was developed using GIS software. This list is shown in Table F-1. Along with each zip code, an estimate of the population and number of households in each area was determined by overlaying Census data and the EPZ boundary, again using GIS software. The proportional number of desired completed survey interviews for each area was identified, as shown in Table F-1. Note that the average household size computed in Table F-1 was an estimate for sampling purposes only and was not used in the ETE study.

The completed survey adhered to the sampling plan.

[1] http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

[2] Data are available through 2014 only.

[3] Data are available through 2014 only.

Table F-1. DAEC Telephone Survey Sampling Plan

Zip Code	Population within EPZ (2010)*	Households	Required Sample
52202	1,128	428	3
52206	2,151	795	5
52213	4,337	1,691	10
52214	101	35	0
52227	258	119	1
52233	6,859	3,229	19
52302	34,952	14,936	89
52315	7	4	0
52324	2,094	831	5
52328	2,618	874	5
52332	1,817	796	5
52341	1,154	477	3
52345	1,092	422	3
52349	1,163	488	3
52352	232	82	1
52401	1,484	966	6
52402	38,448	17,601	105
52403	23,290	10,875	65
52404	33,839	15,945	95
52405	23,323	10,351	62
52411	7,137	2,555	15
Total	**187,484**	**83,500**	**500**
		Average Household Size:	**2.25**
		Total Sample Required:	**500**

*The EPZ boundary was digitized in GIS early in the project from a paper map in order to develop the sampling plan. Later, the EPZ boundary GIS shapefile was received from NextEra, accounting for the small (1%) difference in EPZ population relative to Table 3-1.

F.3 Survey Results

The results of the survey fall into two categories. First, the household demographics of the area can be identified. Demographic information includes such factors as household size, automobile ownership, and automobile availability. The distributions of the time to perform certain pre-evacuation activities are the second category of survey results. These data are processed to develop the trip generation distributions used in the evacuation modeling effort, as discussed in Section 5.

A review of the survey instrument reveals that several questions have a “don’t know” (DK) or “refused” entry for a response. It is an accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a DK response for a few questions or who refuses to answer a few questions. To address the issue of occasional DK/refused responses from a large sample, the practice is to assume that the distribution of these responses is the same as the underlying distribution of the positive responses. In effect, the DK/refused responses are ignored and the distributions are based upon the positive data that is acquired.

F.3.1 Household Demographic Results

Household Size

Figure F-1 presents the distribution of household size within the EPZ based on the responses to the telephone survey. The average household contains 2.40 people. The estimated household size (2.25 persons) used to determine the survey sample (Table F-1) was drawn from the 2010 Census data. The difference between the Census data and survey data is 6.7%, which exceeds the sampling error of ±4.5%. There are many possible explanations for this difference including potential survey bias due to the high number of landline surveys used and the boundaries of the zip codes sampled not aligning with EPZ boundaries. The U.S. Census estimate of 2.25 people per household should be used for this study. This results in a more conservative estimate when determining the number of households and evacuating vehicles.

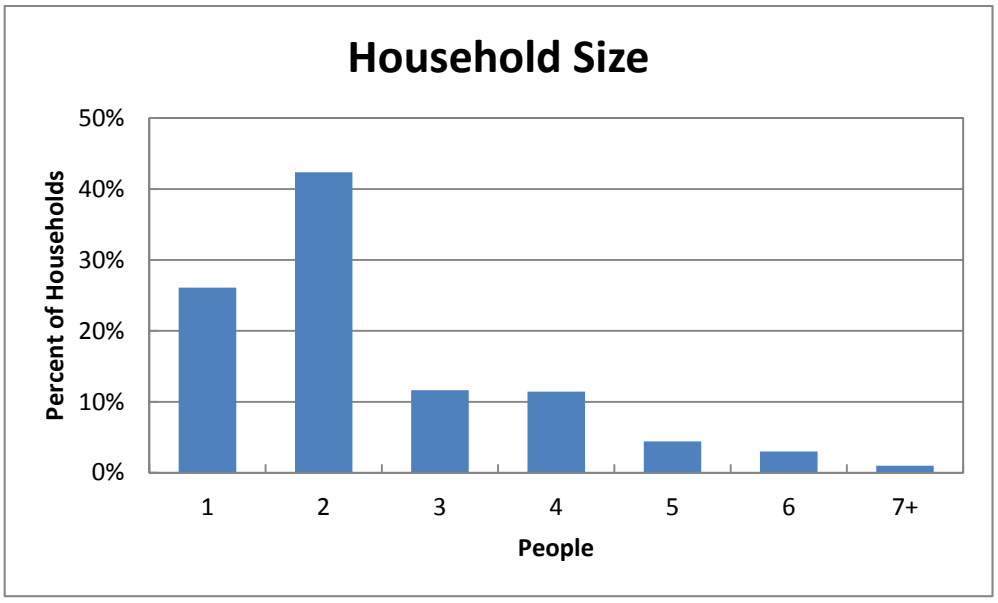


Figure F-1. Household Size in the EPZ

Automobile Ownership

The average number of automobiles available per household in the EPZ is 1.93. It should be noted that 5.4 percent of households do not have access to an automobile. The distribution of automobile ownership is presented in Figure F-2. and Figure F-4 present the automobile availability by household size. Note that the majority of households without access to a car are single person households. As expected, nearly all households of 2 or more people have access to at least one vehicle.

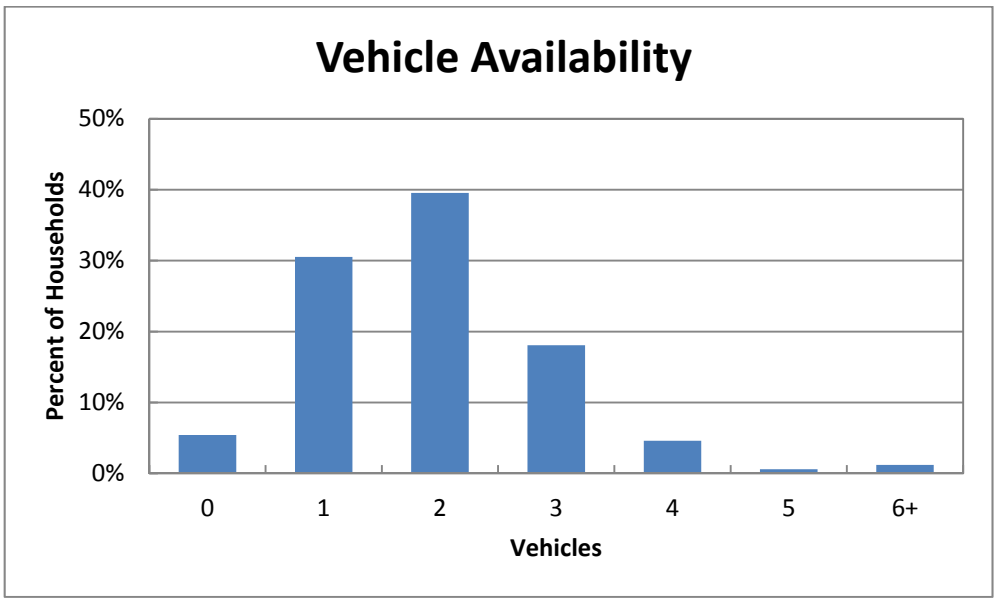


Figure F-2. Household Vehicle Availability

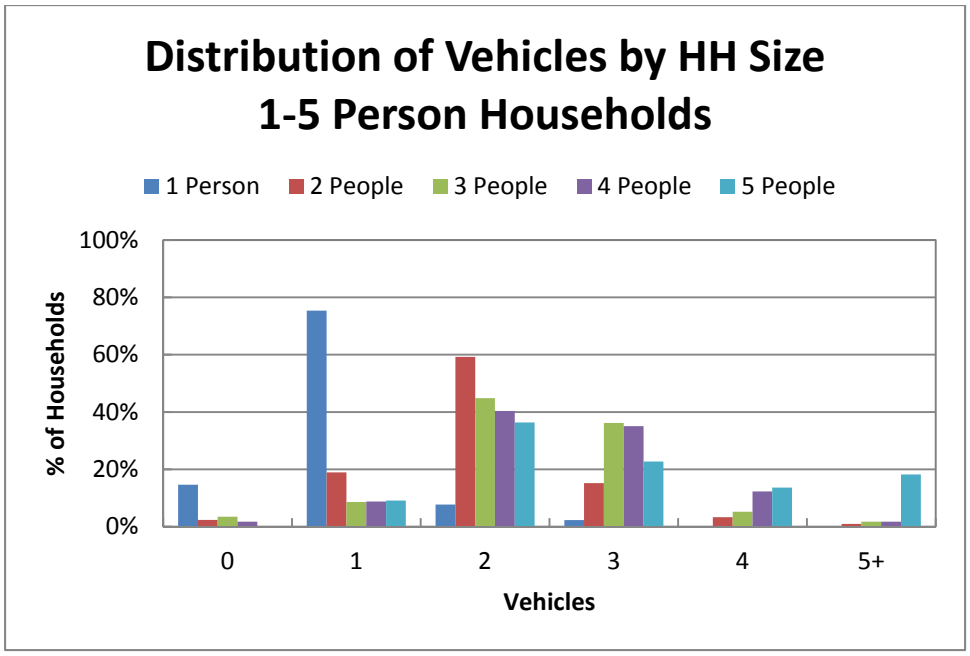


Figure F-3. Vehicle Availability - 1 to 5 Person Households

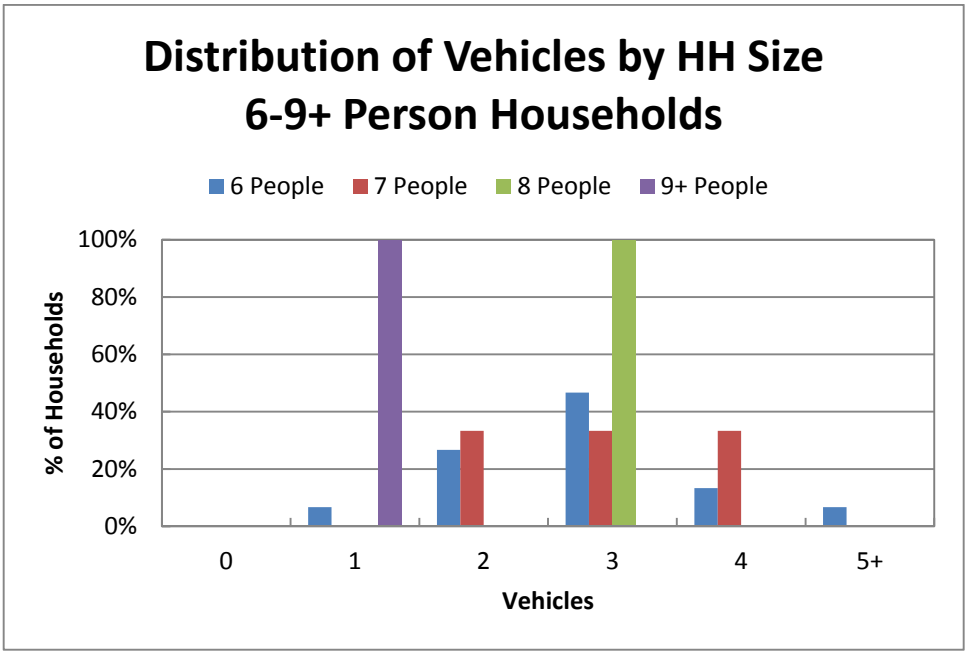


Figure F-4. Vehicle Availability - 6 to 9+ Person Households

Ridesharing

The proportion (72%) of the households surveyed (who do not own a vehicle) responded that they would share a ride with a neighbor, relative, or friend if a car was not available to them when advised to evacuate in the event of an emergency. Note, however, that only those households that responded they have no access to a vehicle, or they don't know how many vehicles are available, or refused to answer the question regarding vehicle availability – a total of 29 households out of the sample size of 500 – answered this question. Thus, the results are not statistically significant. As such, the NRC recommendation of 50% ridesharing is used throughout this study. Figure F-5 presents this response.

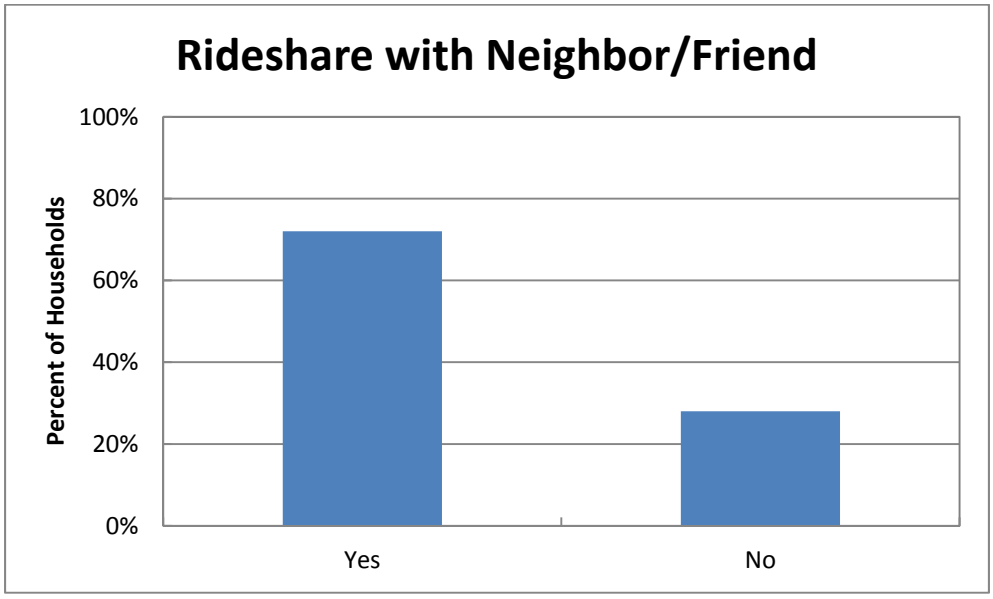


Figure F-5. Household Ridesharing Preference

Commuters

Figure F-6 presents the distribution of the number of commuters in each household. Commuters are defined as household members who travel to work or college on a daily basis. The data shows an average of 1.02 commuters in each household in the EPZ, and 58% of households have at least one commuter.

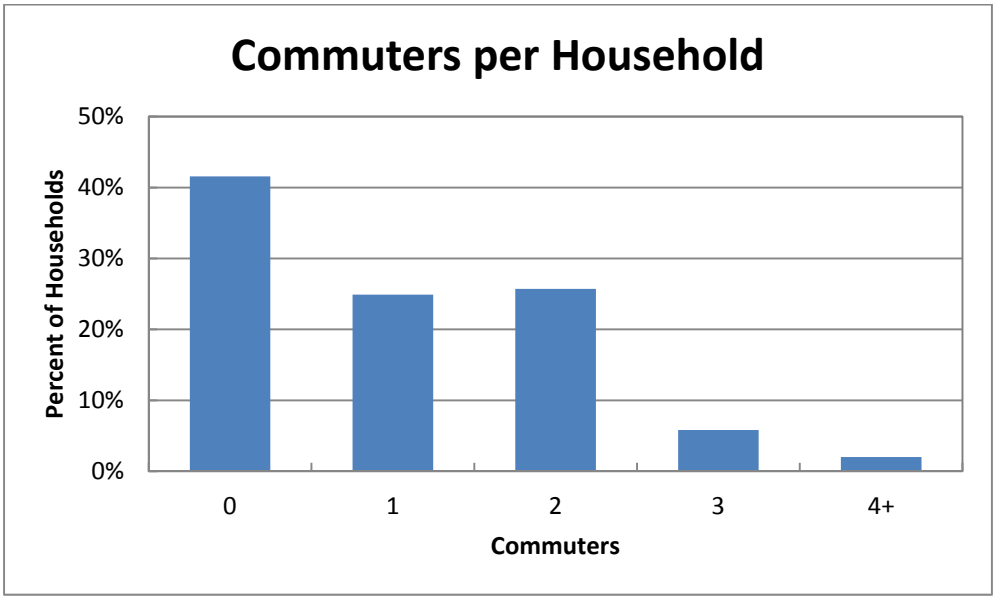


Figure F-6. Commuters in Households in the EPZ

Commuter Travel Modes

Figure F-7 presents the mode of travel that commuters use on a daily basis. The vast majority of commuters use their private automobiles to travel to work or college. The data shows an average of 1.10 employees per vehicle, assuming 2 people per vehicle – on average – for carpools.

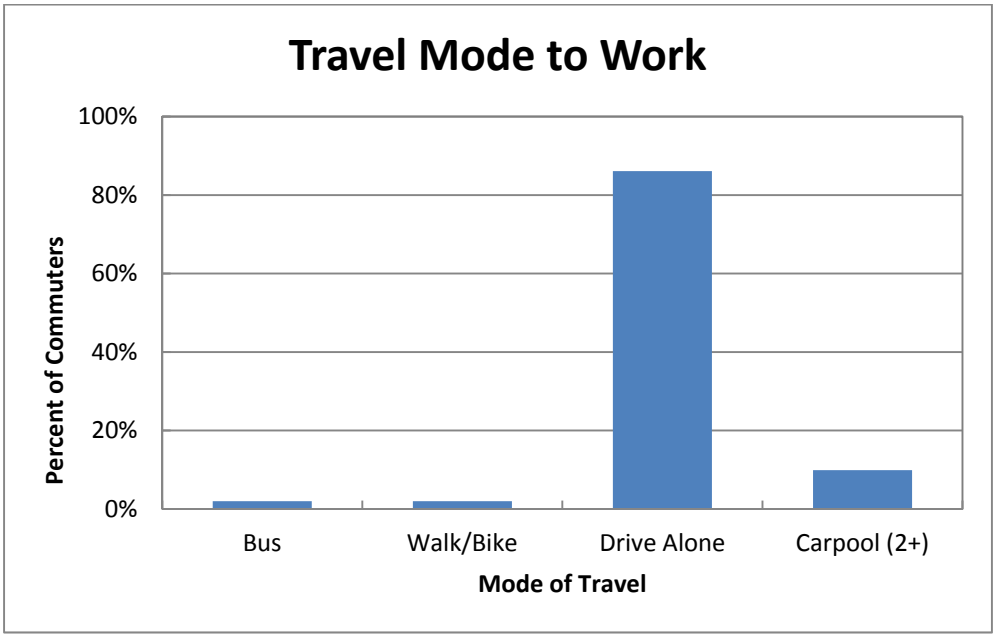


Figure F-7. Modes of Travel in the EPZ

F.3.2 Evacuation Response

Several questions were asked to gauge the population's response to an emergency. These are now discussed:

"How many of the vehicles would your household use during an evacuation?" The response is shown in Figure F-8. On average, evacuating households would use 1.26 vehicles.

"Would your family await the return of other family members prior to evacuating the area?" Of the survey participants who responded, 42 percent said they would await the return of other family members before evacuating and 58 percent indicated that they would not await the return of other family members.

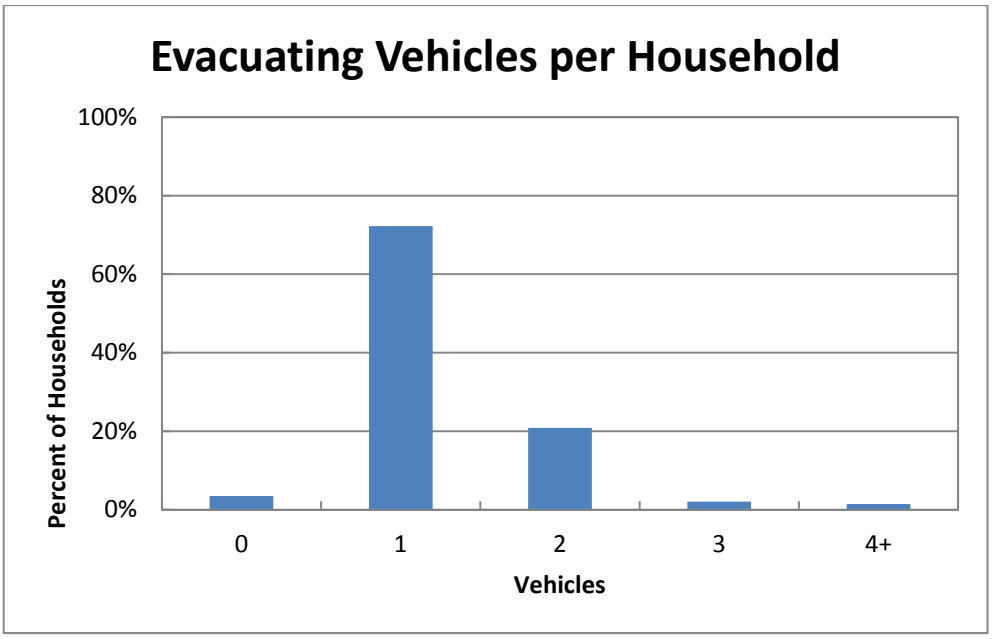


Figure F-8. Number of Vehicles Used for Evacuation

"If you have a household pet, would you take your pet with you if you were asked to evacuate the area?" Based on responses from the survey, 68 percent of households do have a family pet. Of the households with pets, about 89 percent of them indicated that they would take their pets, as shown in Figure F-9. The data discussed are for informational purposes only and were not used in this study.

"If you were told that you could not take your pet to the evacuation center, would you evacuate?" As shown in Figure F-10, 42 percent of those households with pets would not evacuate if they were told they could not take their pet with them to the evacuation center. The data discussed are for informational purposes only and were not used in this study.

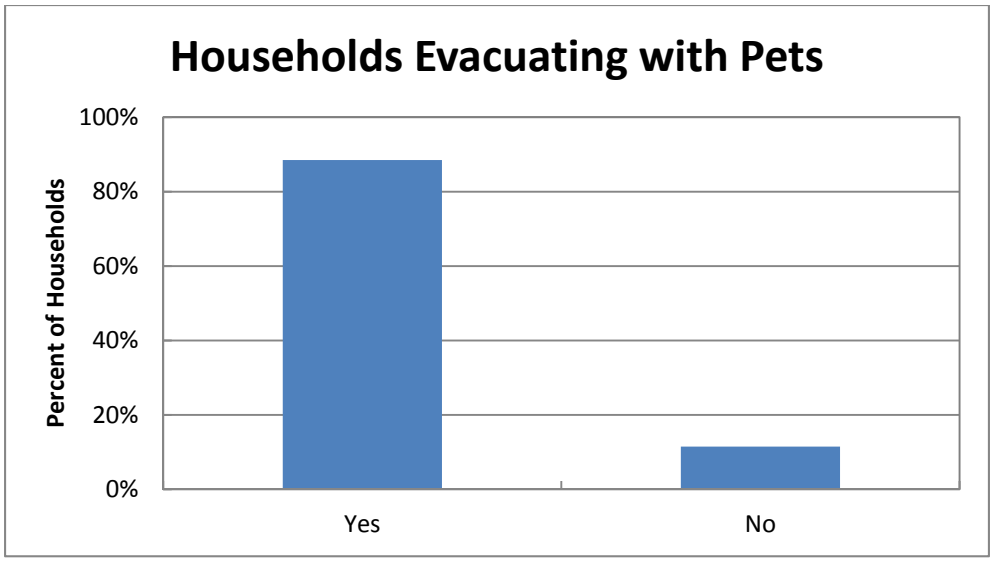


Figure F-9. Households Evacuating with Pets

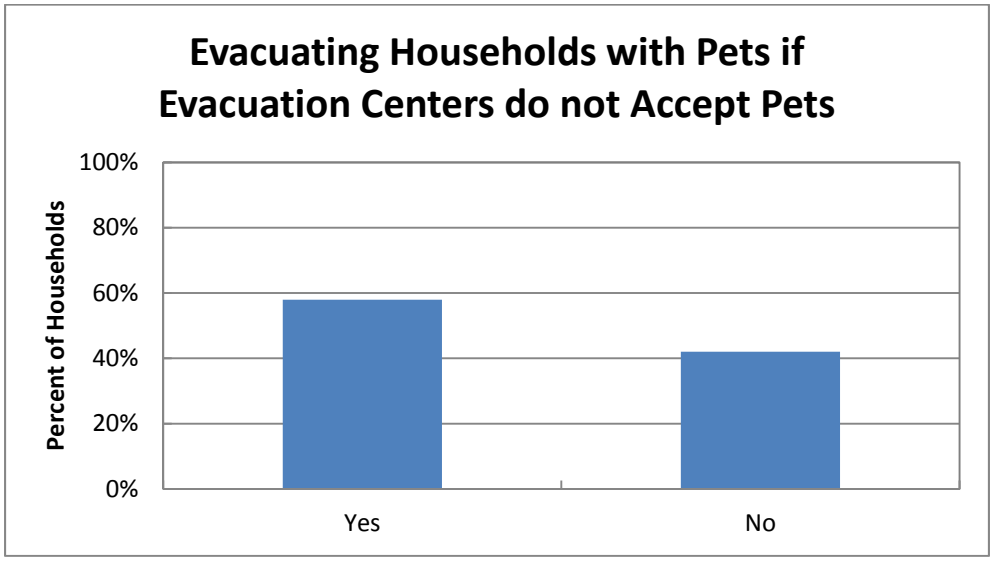


Figure F-10. Households with Pets that would Evacuate if Evacuation Centers do not Accept Pets

"If local emergency officials asked you to evacuate to a designated shelter would you…" This question is designed to determine where residents would go upon hearing the advisory to evacuate. It gives the respondent four options to choose from. The responses to this question are shown graphically in Figure F-11. The data discussed are for informational purposes only and were not used in this study.

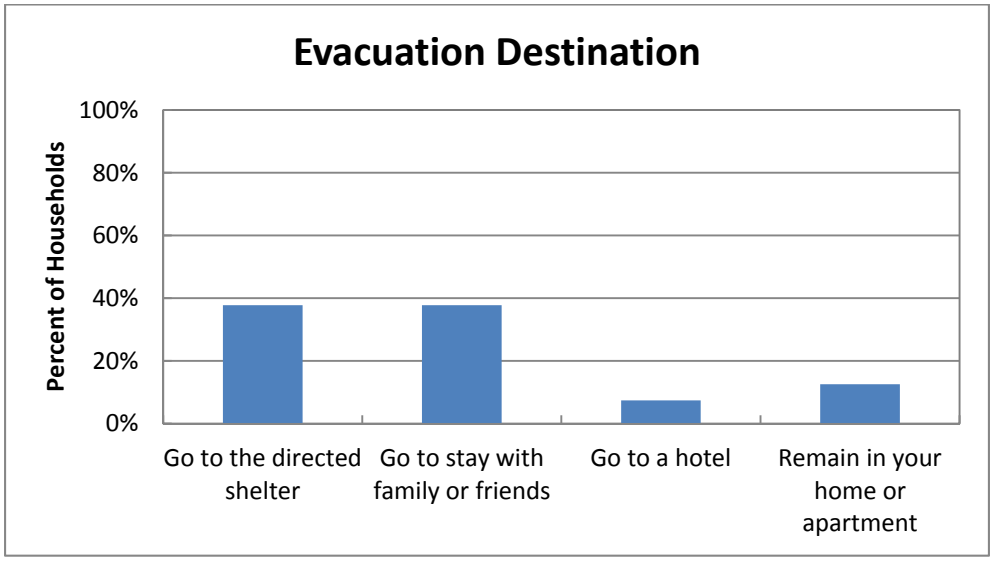


Figure F-11. Evacuation Destinations

"Emergency officials advise you to take shelter at home in an emergency. Would you?" This question is designed to elicit information regarding compliance with instructions to shelter in place. The results indicate that 88 percent of households who are advised to shelter in place would do so; the remaining 12 percent would choose to evacuate the area. Note the baseline ETE study assumes 20 percent of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002. Thus, the data obtained is slightly less than the federal guidance. Appendix M (Table M-2) includes a sensitivity study to estimate the impact on ETE of using the lesser (12%) shadow evacuation (non-compliance of shelter advisory) based on the telephone survey results.

"Emergency officials advise you to take shelter at home now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you?" This question is designed to elicit information specifically related to the possibility of a staged evacuation. That is, asking a population to shelter in place now and then to evacuate after a specified period of time. Results indicate that 75 percent of households would follow instructions and delay the start of evacuation until so advised, while the balance of 25 percent would choose to begin evacuating immediately.

F.3.3 Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder's experience.

The mobilization distributions provided below are the result of having applied the analysis described in Section 5.4.1 on the component activities of the mobilization.

"How long does it take the commuter to complete preparation for leaving work/college?"
Figure F-12 presents the cumulative distribution; in all cases, the activity is completed within 60 minutes. Approximately 95% can leave within 30 minutes.

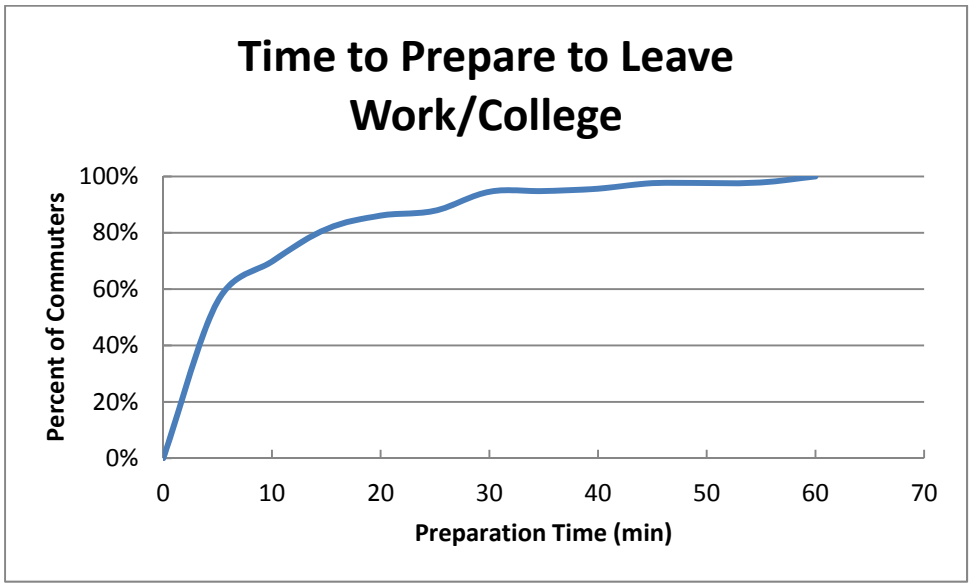


Figure F-12. Time Required to Prepare to Leave Work/College

"How long would it take the commuter to travel home?" Figure F-13 presents the work to home travel time for the EPZ. Approximately 82% of commuters can arrive home within 20 minutes of leaving work; all within 45 minutes.

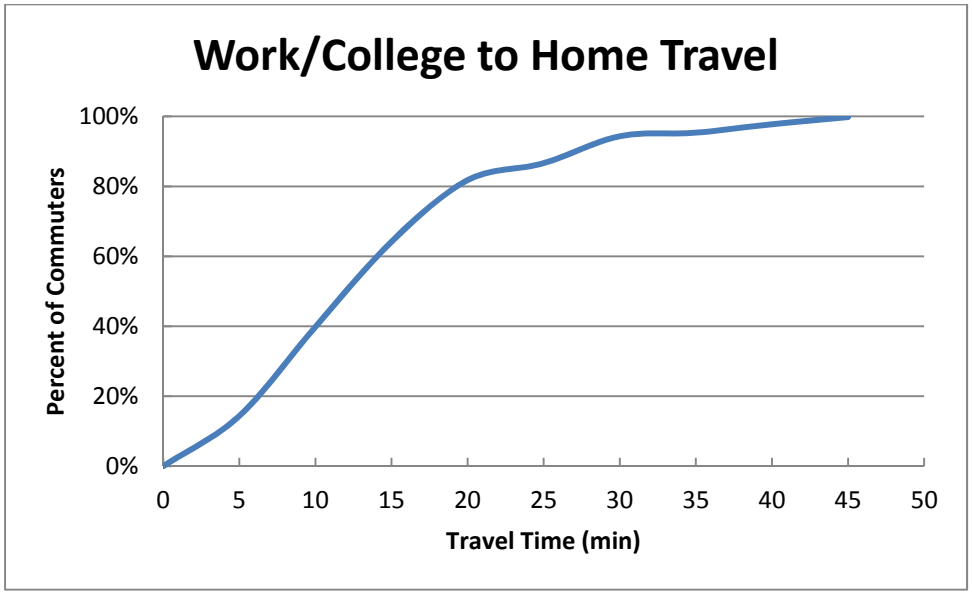


Figure F-13. Time to Travel Home from Work/College

"How long would it take the family to pack clothing, secure the house, and load the car?" Figure F-14 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family's preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities.

The distribution shown in Figure F-14 has a long "tail." Approximately 91% of households can be ready to leave home within 60 minutes; the remaining households require up to an additional 1 hour and 15 minutes.

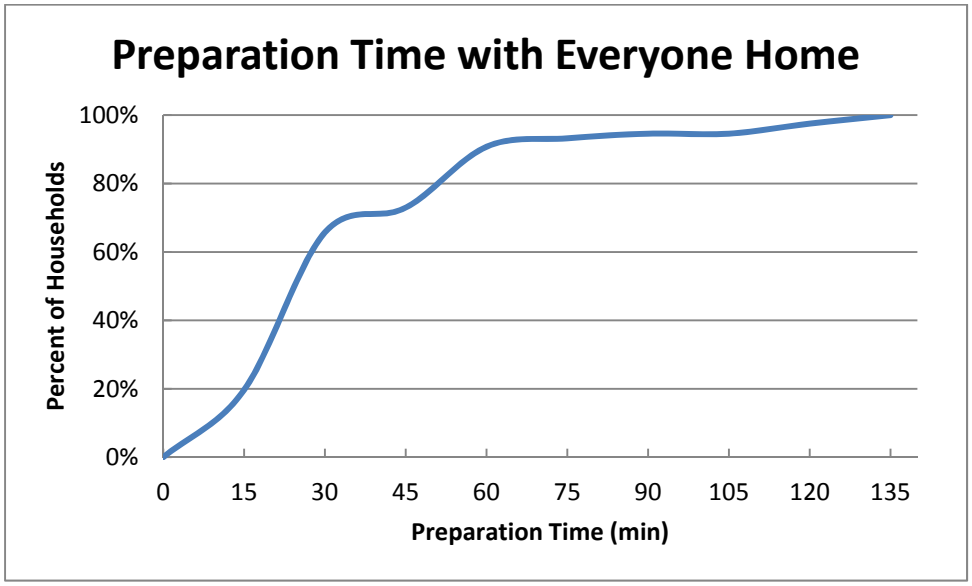


Figure F-14. Time to Prepare Home for Evacuation

"How long would it take you to clear 6 to 8 inches of snow from your driveway?" During adverse, snowy weather conditions, an additional activity must be performed before residents can depart on the evacuation trip. Although snow scenarios assume that the roads and highways have been plowed and are passable (albeit at lower speeds and capacities), it may be necessary to clear a private driveway prior to leaving the home so that the vehicle can access the street. Figure F-15 presents the time distribution for removing 6 to 8 inches of snow from a driveway. The time distribution for clearing the driveway has a long tail; about 96 percent of driveways are passable within 60 minutes. The last driveway is cleared two hours after the start of this activity. Note that those respondents (46%) who answered that they would not take time to clear their driveway were assumed to be ready immediately at the start of this activity. Essentially they would drive through the snow on the driveway to access the roadway and begin their evacuation trip.

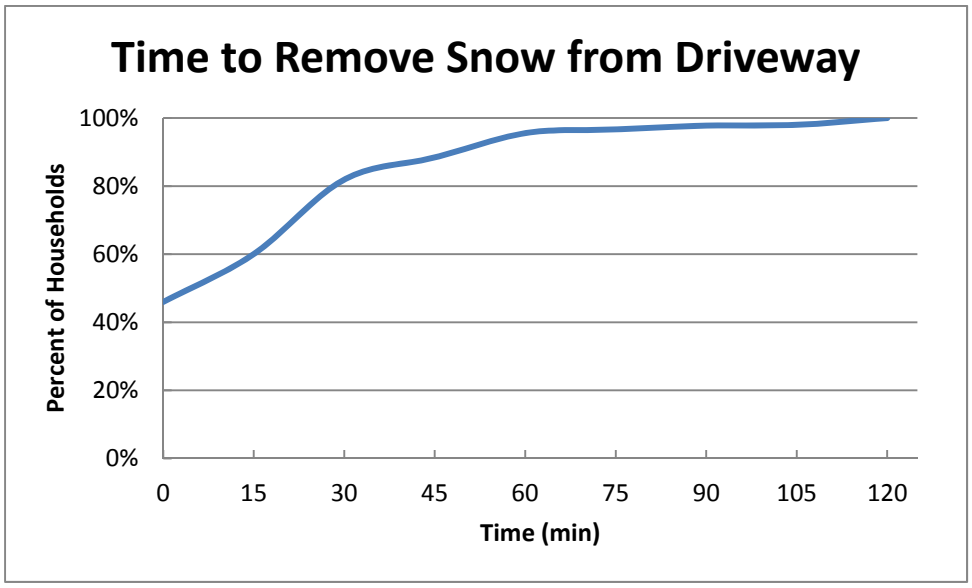


Figure F-15. Time to Clear Driveway of 6"-8" of Snow

F.4 Conclusions

The telephone survey provides valuable, relevant data associated with the EPZ population, which have been used to quantify demographics specific to the EPZ, and "mobilization time" which can influence evacuation time estimates.

ATTACHMENT A

Telephone Survey Instrument

Telephone Survey Instrument

Hello, my name is _____ and I'm working on a survey for your local emergency management agency to identify local behavior during emergency situations. This information will be used for emergency planning and will be shared with local officials to enhance emergency response plans in your area for all hazards; emergency planning for some hazards may require evacuation. Your responses will greatly contribute to local emergency preparedness. I will not ask for your name or any personal information, and the survey will take less than 10 minutes to complete.

COL. 1	Unused
COL. 2	Unused
COL. 3	Unused
COL. 4	Unused
COL. 5	Unused
Sex	COL. 8
	1 Male
	2 Female

INTERVIEWER: ASK TO SPEAK TO THE HEAD OF HOUSEHOLD OR THE SPOUSE OF THE HEAD OF HOUSEHOLD. (Terminate call if not a residence.)

DO NOT ASK:

1A.	Record area code. To Be Determined	COL. 9-11	
1B.	Record exchange number. To Be Determined	COL. 12-14	
2.	What is your home zip code?	COL. 15-19	
3A.	In total, how many running cars, or other vehicles are usually available to the household? (DO NOT READ ANSWERS)	COL. 20	SKIP TO
		1 ONE	Q. 4
		2 TWO	Q. 4
		3 THREE	Q. 4
		4 FOUR	Q. 4
		5 FIVE	Q. 4
		6 SIX	Q. 4
		7 SEVEN	Q. 4
		8 EIGHT	Q. 4
		9 NINE OR MORE	Q. 4
		0 ZERO (NONE)	Q. 3B
		X DON'T KNOW/REFUSED	Q. 3B
3B.	In an emergency, could you get a ride out of the area with a neighbor or friend?	COL. 21	
		1 YES	
		2 NO	
		X DON'T KNOW/REFUSED	
4.	How many people usually live in this household? (DO NOT READ ANSWERS)	COL. 22	COL. 23
		1 ONE	0 TEN
		2 TWO	1 ELEVEN
		3 THREE	2 TWELVE
		4 FOUR	3 THIRTEEN
		5 FIVE	4 FOURTEEN
		6 SIX	5 FIFTEEN

	7 SEVEN	6 SIXTEEN	
	8 EIGHT	7 SEVENTEEN	
	9 NINE	8 EIGHTEEN	
		9 NINETEEN OR MORE	
		X DON'T KNOW/REFUSED	

5.	How many adults in the household commute to a job, or to college on a daily basis?	COL. 24	SKIP TO
		0 ZERO	Q. 9
		1 ONE	Q. 6
		2 TWO	Q. 6
		3 THREE	Q. 6
		4 FOUR OR MORE	Q. 6
		5 DON'T KNOW/REFUSED	Q. 9

INTERVIEWER: For each person identified in Question 5, ask Questions 6, 7, and 8.

6. Thinking about commuter #1, how does that person usually travel to work or college? (REPEAT QUESTION FOR EACH COMMUTER)

	Commuter #1	Commuter #2	Commuter #3	Commuter #4
	COL. 25	COL. 26	COL. 27	COL. 28
Bus	1	1	1	1
Walk/Bicycle	2	2	2	2
Drive Alone	3	3	3	3
Carpool-2 or more people	4	4	4	4
Don't know/Refused	5	5	5	5

7. How much time on average, would it take Commuter #1 to travel home from work or college? (REPEAT QUESTION FOR EACH COMMUTER) (DO NOT READ ANSWERS)

COMMUTER #1				COMMUTER #2			
COL. 29		COL. 30		COL. 31		COL. 32	
1	5 MINUTES OR LESS	1	46-50 MINUTES	1	5 MINUTES OR LESS	1	46-50 MINUTES
2	6-10 MINUTES	2	51-55 MINUTES	2	6-10 MINUTES	2	51-55 MINUTES
3	11-15 MINUTES	3	56 – 1 HOUR	3	11-15 MINUTES	3	56 – 1 HOUR
4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES	6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2	7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2

			HOURS				HOURS
8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)	8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)
9	41-45 MINUTES	9		9	41-45 MINUTES	9	
		0				0	
		X	DON'T KNOW /REFUSED			X	DON'T KNOW /REFUSED

COMMUTER #3				COMMUTER #4			
COL. 33		COL. 34		COL. 35		COL. 36	
1	5 MINUTES OR LESS	1	46-50 MINUTES	1	5 MINUTES OR LESS	1	46-50 MINUTES
2	6-10 MINUTES	2	51-55 MINUTES	2	6-10 MINUTES	2	51-55 MINUTES
3	11-15 MINUTES	3	56 – 1 HOUR	3	11-15 MINUTES	3	56 – 1 HOUR
4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES	6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS	7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)	8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)
9	41-45 MINUTES	9		9	41-45 MINUTES	9	
		0				0	
		X	DON'T KNOW /REFUSED			X	DON'T KNOW /REFUSED

8. Approximately how much time does it take Commuter #1 to complete preparation for leaving work or college prior to starting the trip home? (REPEAT QUESTION FOR EACH COMMUTER) (DO NOT READ ANSWERS)

COMMUTER #1				COMMUTER #2			
COL. 37		COL. 38		COL. 39		COL. 40	
1	5 MINUTES OR LESS	1	46-50 MINUTES	1	5 MINUTES OR LESS	1	46-50 MINUTES
2	6-10 MINUTES	2	51-55 MINUTES	2	6-10 MINUTES	2	51-55 MINUTES
3	11-15 MINUTES	3	56 – 1 HOUR	3	11-15 MINUTES	3	56 – 1 HOUR
4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR	6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1

			45 MINUTES				HOUR 45 MINUTES
7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS	7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)	8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)
9	41-45 MINUTES	9		9	41-45 MINUTES	9	
		0				0	
		X	DON'T KNOW /REFUSED			X	DON'T KNOW /REFUSED

COMMUTER #3

COL. 41		COL. 42	
1	5 MINUTES OR LESS	1	46-50 MINUTES
2	6-10 MINUTES	2	51-55 MINUTES
3	11-15 MINUTES	3	56 – 1 HOUR
4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)
9	41-45 MINUTES	9	
		0	
		X	DON'T KNOW /REFUSED

COMMUTER #4

COL. 43		COL. 44	
1	5 MINUTES OR LESS	1	46-50 MINUTES
2	6-10 MINUTES	2	51-55 MINUTES
3	11-15 MINUTES	3	56 – 1 HOUR
4	16-20 MINUTES	4	OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5	21-25 MINUTES	5	BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6	26-30 MINUTES	6	BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)
9	41-45 MINUTES	9	
		0	
		X	DON'T KNOW /REFUSED

9. If you were advised by local authorities to evacuate, how much time would it take the household to pack clothing, medications, secure the house, load the car, and complete preparations prior to evacuating the area? (DO NOT READ ANSWERS)

COL. 45		COL. 46	
1	LESS THAN 15 MINUTES	1	3 HOURS TO 3 HOURS 15 MINUTES
2	15-30 MINUTES	2	3 HOURS 16 MINUTES TO 3 HOURS 30 MINUTES
3	31-45 MINUTES	3	3 HOURS 31 MINUTES TO 3 HOURS 45 MINUTES
4	46 MINUTES – 1 HOUR	4	3 HOURS 46 MINUTES TO 4 HOURS
5	1 HOUR TO 1 HOUR 15 MINUTES	5	4 HOURS TO 4 HOURS 15 MINUTES
6	1 HOUR 16 MINUTES TO 1 HOUR 30 MINUTES	6	4 HOURS 16 MINUTES TO 4 HOURS 30 MINUTES
7	1 HOUR 31 MINUTES TO 1 HOUR 45 MINUTES	7	4 HOURS 31 MINUTES TO 4 HOURS 45 MINUTES
8	1 HOUR 46 MINUTES TO 2 HOURS	8	4 HOURS 46 MINUTES TO 5 HOURS

9 2 HOURS TO 2 HOURS 15 MINUTES
0 2 HOURS 16 MINUTES TO 2 HOURS 30 MINUTES
X 2 HOURS 31 MINUTES TO 2 HOURS 45 MINUTES
Y 2 HOURS 46 MINUTES TO 3 HOURS
Z WILL NOT EVACUATE

9 5 HOURS TO 5 HOURS 30 MINUTES
0 5 HOURS 31 MINUTES TO 6 HOURS
X OVER 6 HOURS (SPECIFY _____)

COL. 47
1 DON'T KNOW/REFUSED

---

10. If there is 6-8" of snow on your driveway or curb, would you need to shovel out to evacuate? If yes, how much time, on average, would it take you to clear the 6-8" of snow to move the car from the driveway or curb to begin the evacuation trip? Assume the roads are passable. (DO NOT READ RESPONSES)

COL. 48
1 LESS THAN 15 MINUTES
2 15-30 MINUTES
3 31-45 MINUTES
4 46 MINUTES – 1 HOUR
5 1 HOUR TO 1 HOUR 15 MINUTES
6 1 HOUR 16 MINUTES TO 1 HOUR 30 MINUTES
7 1 HOUR 31 MINUTES TO 1 HOUR 45 MINUTES
8 1 HOUR 46 MINUTES TO 2 HOURS
9 2 HOURS TO 2 HOURS 15 MINUTES
0 2 HOURS 16 MINUTES TO 2 HOURS 30 MINUTES
X 2 HOURS 31 MINUTES TO 2 HOURS 45 MINUTES
Y 2 HOURS 46 MINUTES TO 3 HOURS
Z NO, WILL NOT SHOVEL OUT

COL. 49
1 OVER 3 HOURS (SPECIFY _____)
2 DON'T KNOW/REFUSED

---

11. Please choose one of the following (READ ANSWERS):

A. I would await the return of household commuters to evacuate together.

B. I would evacuate independently and meet other household members later.

COL. 50
1 A
2 B
X DON'T KNOW/REFUSED

---

12. How many vehicles would your household use during an evacuation? (DO NOT READ ANSWERS)

COL. 51
1 ONE
2 TWO
3 THREE
4 FOUR
5 FIVE
6 SIX
7 SEVEN
8 EIGHT
9 NINE OR MORE

		0	ZERO (NONE)
		X	DON'T KNOW/REFUSED
13A.	Emergency officials advise you to take shelter at home in an emergency. Would you: (READ ANSWERS) A. SHELTER; or B. EVACUATE	COL. 52	
		1	A
		2	B
		X	DON'T KNOW/REFUSED
13B.	Emergency officials advise you to take shelter at home now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you: (READ ANSWERS) A. SHELTER; or B. EVACUATE	COL. 53	
		1	A
		2	B
		X	DON'T KNOW/REFUSED

14A. If you have a household pet, would you take your pet with you if you were asked to evacuate the area? (READ ANSWERS)

COL. 54		SKIP TO
1	DON'T HAVE A PET	Q. 15
2	YES	Q. 14 B
3	NO	Q. 15
X	DON'T KNOW/REFUSED	Q. 15

14B. If you were told that you could not take your pet to the evacuation center, would you evacuate? (READ ANSWERS)

COL. 55	
1	YES
2	NO
X	DON'T KNOW/REFUSED

15. If local emergency officials asked you to evacuate to a designated shelter would you: (READ ANSWERS)

COL. 56	
1	GO TO THE DIRECTED SHELTER
2	GO TO STAY WITH FAMILY OR FRIENDS
3	GO TO A HOTEL
4	REMAIN IN YOUR HOME OR APARTMENT
X	DON'T KNOW/REFUSED

Thank you very much. _____

(TELEPHONE NUMBER CALLED)

IF REQUESTED:

For additional information, contact your Local Emergency Management Agency during normal business hours.

County	EMA Phone
Benton	(319) 472-4519
Linn	(319) 892-6500

APPENDIX G

Traffic Management Plan

G. TRAFFIC MANAGEMENT PLAN

NUREG/CR-7002 indicates that the existing TCPs and ACPs identified by the offsite agencies should be used in the evacuation simulation modeling. The traffic and access control plans for the EPZ were provided in the document "DAEC Emergency Planning Zone Traffic Management Plan (TMP)," dated October 2014. The TMP was reviewed and the TCPs and ACPs were modeled accordingly.

G.1 Traffic Control Points

As discussed in Section 9, traffic control points at intersections (which are controlled) are modeled as actuated signals. If an intersection has a pre-timed signal, stop, or yield control, and the intersection is identified as a traffic control point, the control type was changed to an actuated signal in the DYNEV II system.

Table K-2 provides the control type and node number for those nodes which are controlled. If the existing control was changed due to the point being a TCP, the control type is indicated as "TCP-Actuated" or "TCP-Uncontrolled" in Table K-2. The TCPs within the study area are mapped as green dots in Figure G-1. These TCPS are concentrated along the I-380 ramps and US-151B. They would be manned during evacuation by traffic guides who would direct evacuees in the proper direction and facilitate the flow of traffic through the intersections.

As discussed in Section 7.3, there is significant traffic congestion in competing directions (east-west and north-south) at intersections within the population centers of the EPZ. Assigning police officers to perform traffic control at each of these intersections will have minimal benefit due to the heavy congestion along competing approaches. The main thoroughfare on I-380 southbound is operating at LOS F for several hours, as shown in Figures 7-3 through 7-10. Positioning police officers at ramps to facilitate access to the interstate would have minimal benefit as the main thoroughfare is already heavily congested and will meter the flow of traffic on the ramps.

The congestion patterns identified in Section 7.3 and shown in Figures 7-3 through 7-10 did identify five critical intersections that would benefit from traffic control. These newly identified TCPs are shown as yellow dots in Figure G-1 and are identified below:

- Iowa 1 & Martelle Road
- US-151 & Springville Road
- Iowa 1 & Cedar River Road
- Iowa 1 & Iowa 382 NE
- 21st Ave & 77th Street

Normally, these intersections are stop-controlled. As discussed in Section 9, TCPs operate similar to actuated signals as traffic guides are providing green time to each competing direction. By making these intersections TCPs, their capacity increases significantly, thereby aiding evacuation. Figure G-2 through Figure G-6 provide schematics of these TCPs.

G.2 Access Control Points

The TMP defines ACPs as intersections that will be manned after the evacuation has been completed to prevent people from entering the evacuated area (both for security and for safety reasons). NUREG/CR-7002 (Section 2.5.3) defines access control somewhat differently, wherein ACPs are established during the evacuation to stop the flow of through (external) traffic through the EPZ. Doing so reserves the capacity on major through routes for evacuees, rather than traffic that is passing through the area.

As defined in Section 3.6, the major through routes in the EPZ are US-30 and I-380. This study assumes (in accordance with federal guidance) that the following four ACP intersections will be manned within 120 minutes after the ATE to stop the flow of through traffic in the EPZ:

- The interchange of I-380 & Wright Brothers Blvd (ACP #24N in the existing TMP) – divert the flow of northbound traffic on I-380
- The interchange of I-380 & 31st Avenue/Iowa 150 (ACP #22B in the existing TMP) – divert the flow of southbound traffic on I-380
- Intersection of US-30/218/73rd St & 30th Ave (ACP #18H in the existing TMP) – divert the flow of eastbound traffic on US-30
- Intersection of US-30 & Iowa 1 (new ACP) – divert the flow of westbound traffic on US-30

Figure G-1 maps the existing ACPs (shown as blue dots) identified in the TMP. The ACPs are predominately located at intersections which give access to the EPZ. The newly identified ACP is shown as a red dot in Figure G-1. A schematic for the new ACP is shown in Figure G-7.

The ACPs (except for the four listed above) would be manned by traffic guides after the evacuation is complete. The guides will restrict unauthorized access into the EPZ.

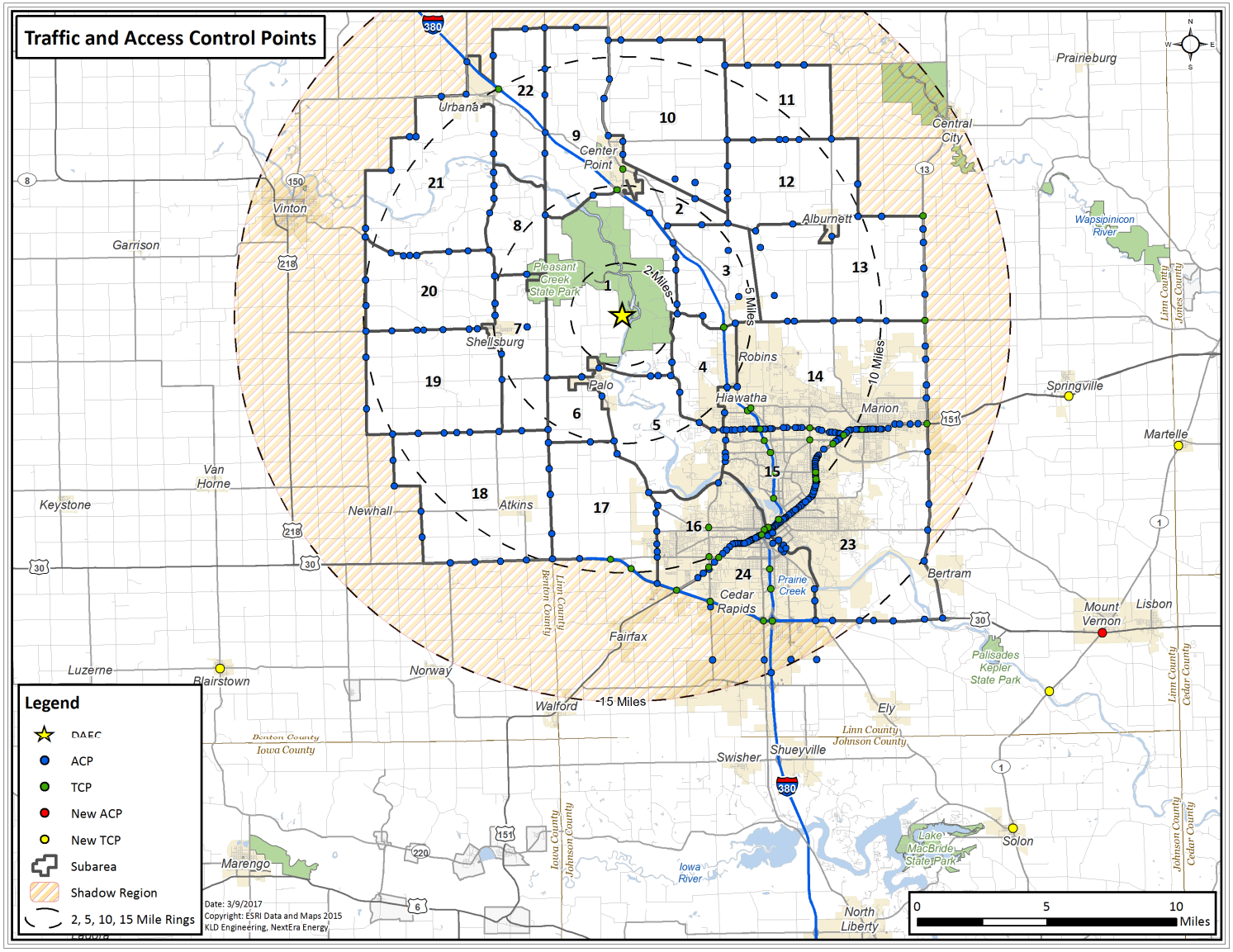


Figure G-1. Traffic and Access Control Points for the Duane Arnold Energy Center

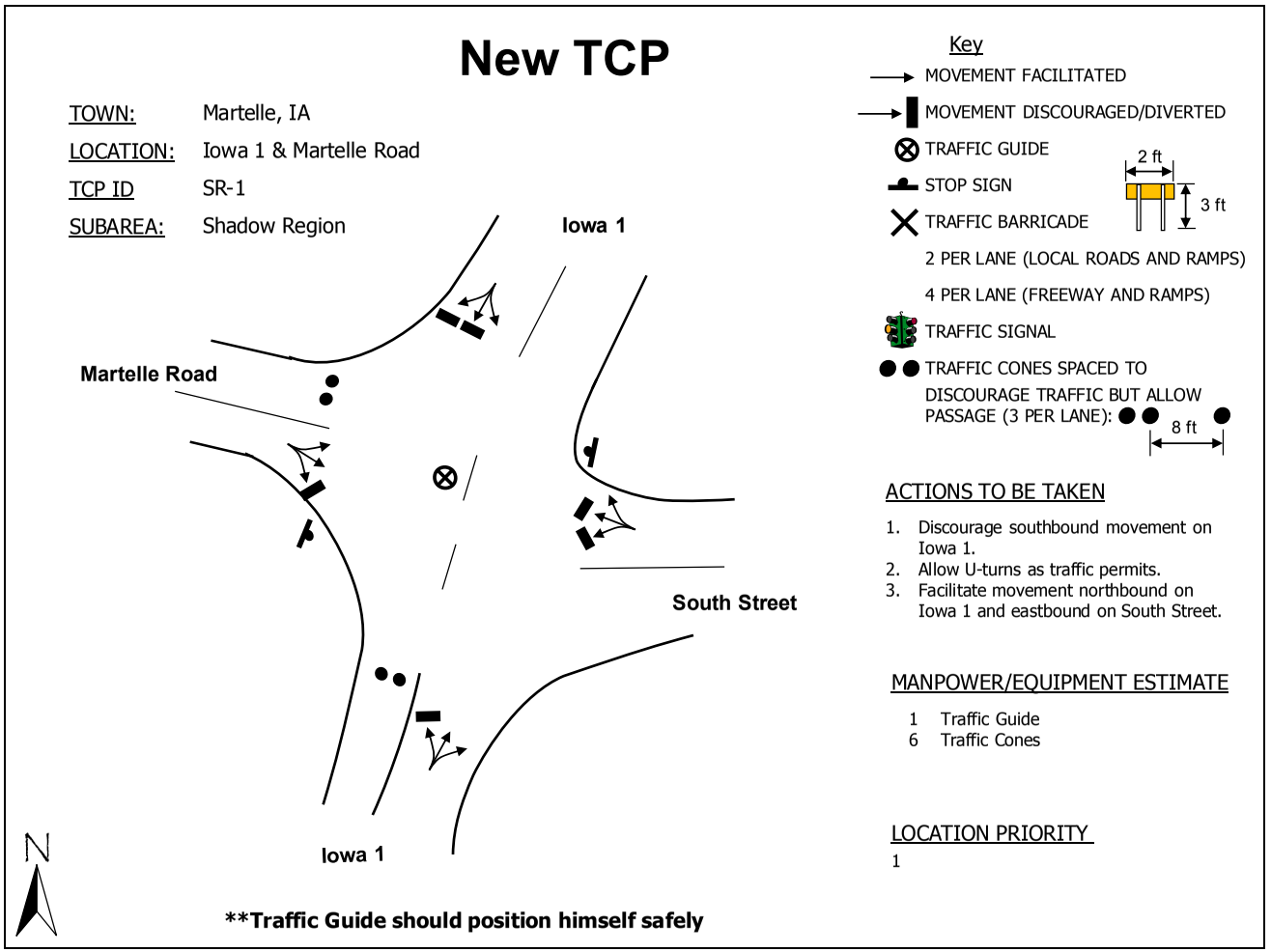


Figure G-2. New TCP Schematic – Iowa 1 and Martelle Rd

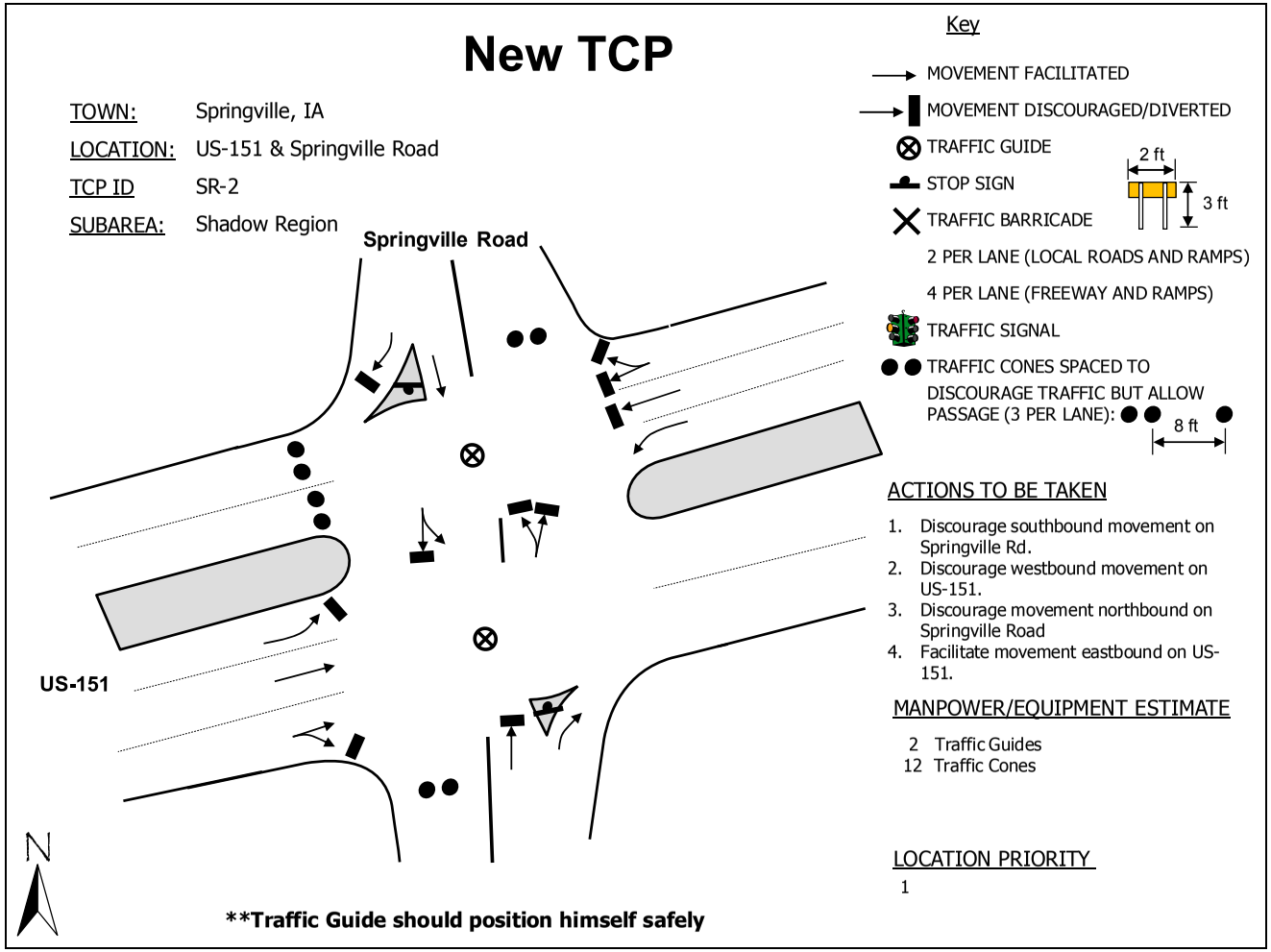


Figure G-3. New TCP Schematic – US-151 and Springville Rd

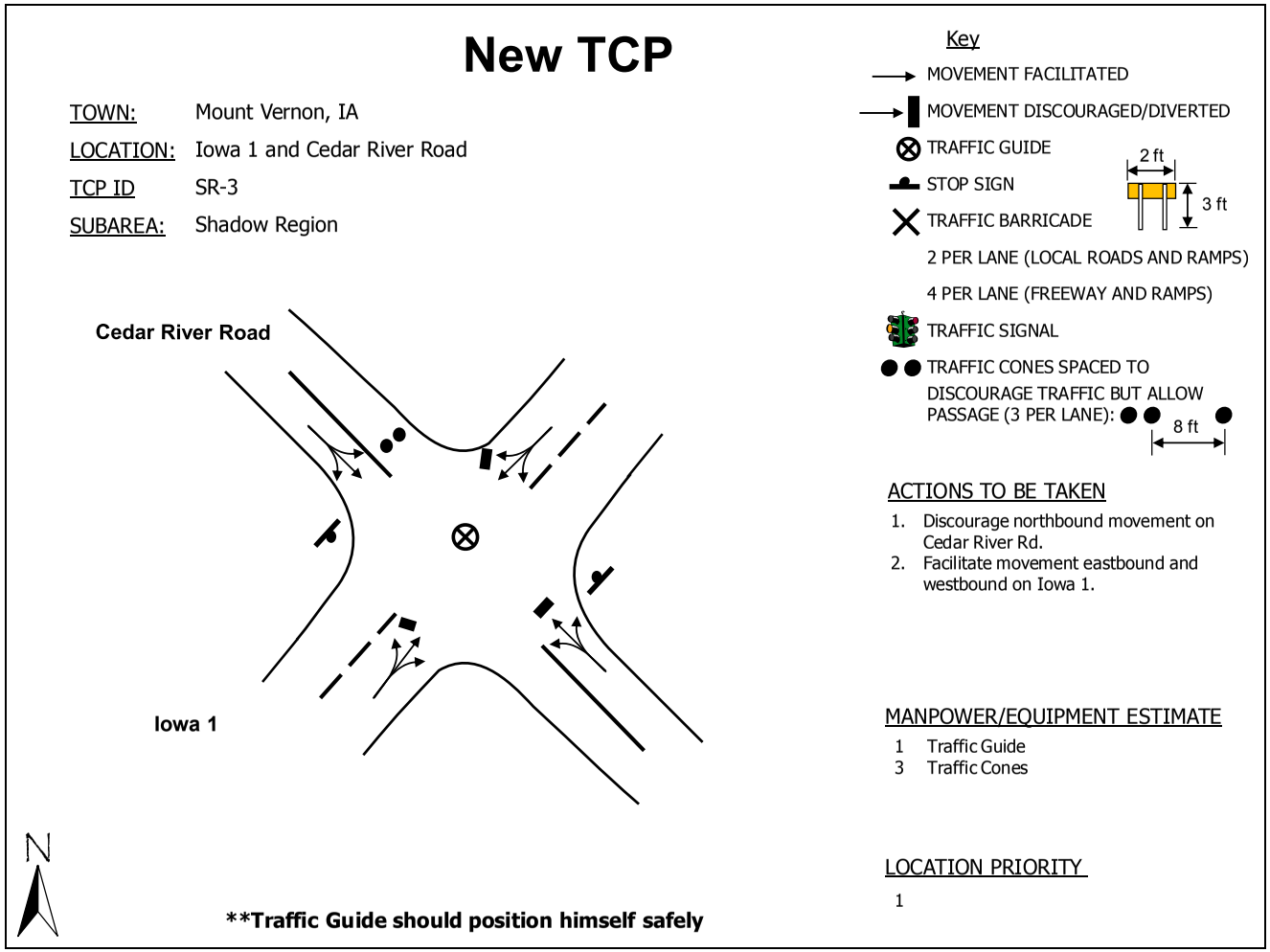


Figure G-4. New TCP Schematic – Iowa 1 and Cedar River Rd

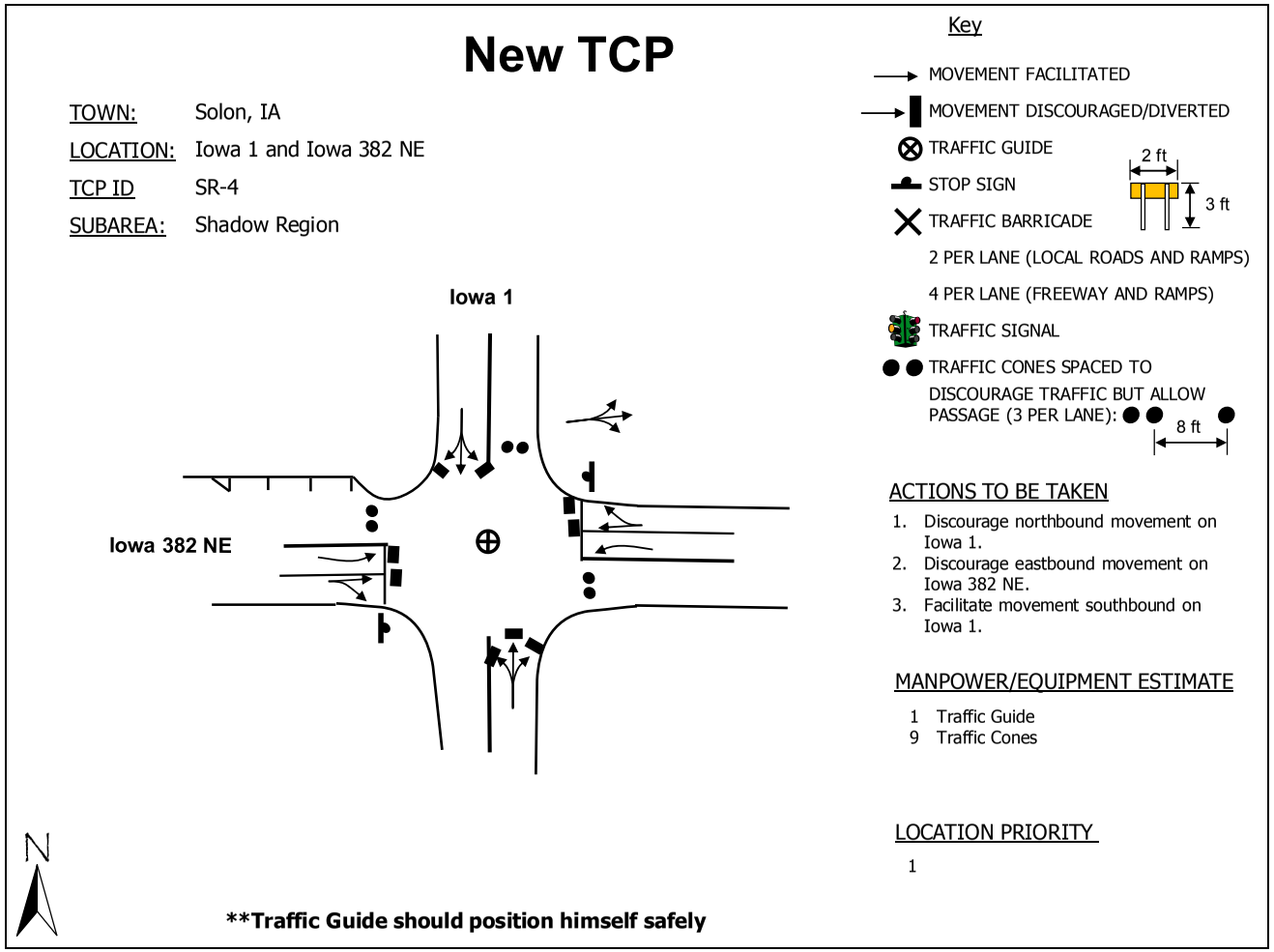


Figure G-5. New TCP Schematic – Iowa 1 and Iowa 382 NE

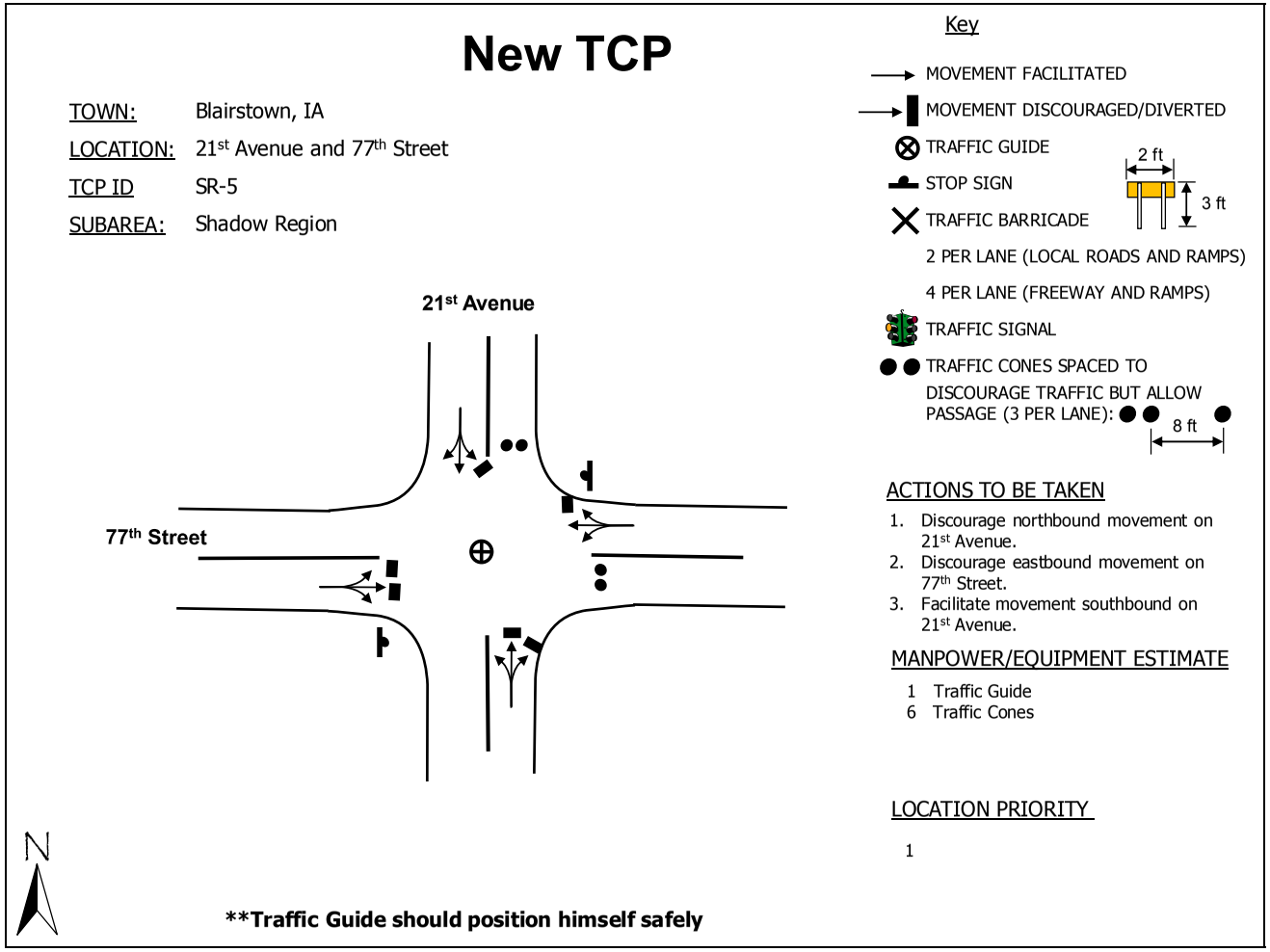


Figure G-6. New TCP Schematic – 21st Ave and 77th St

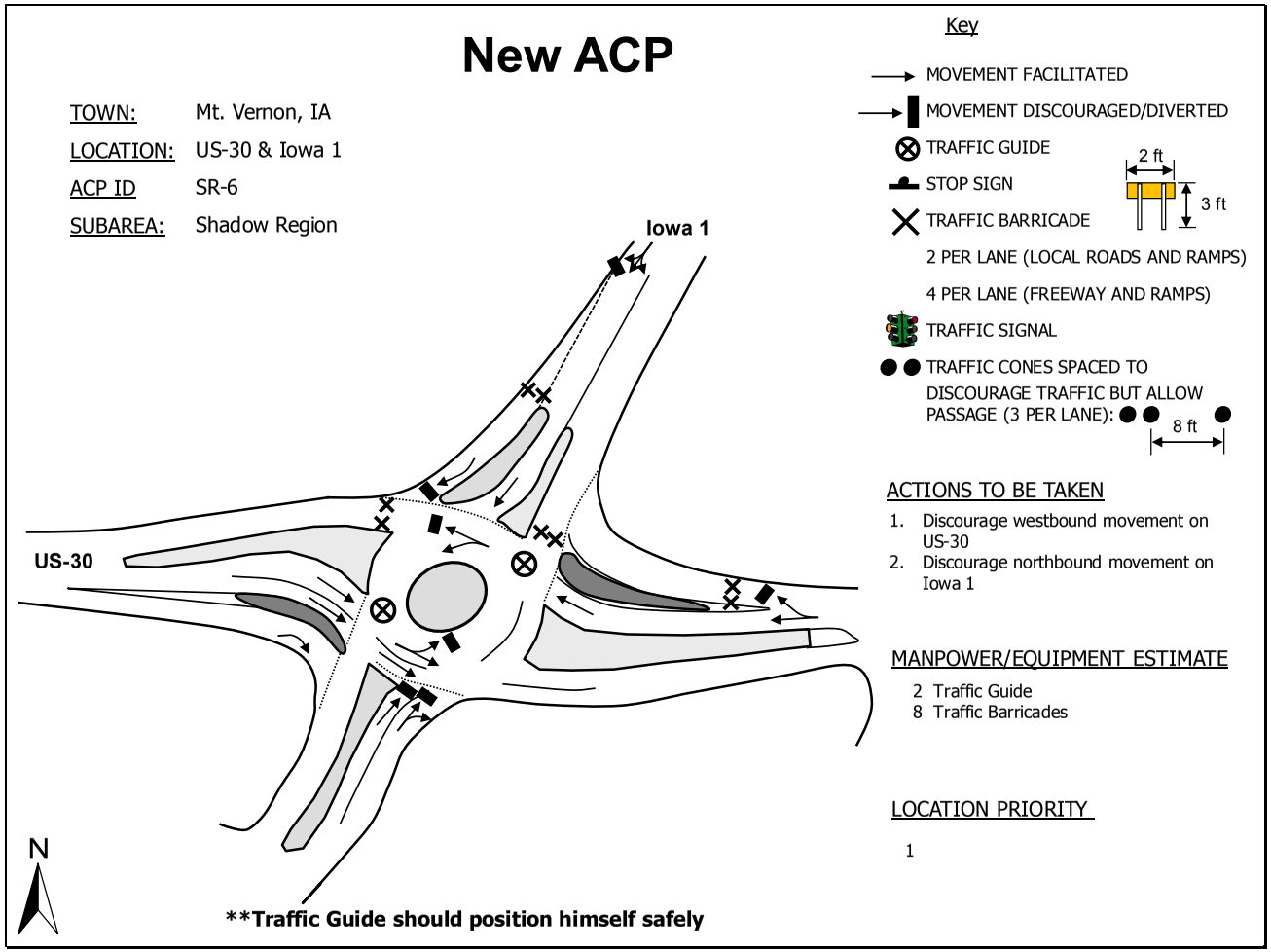


Figure G-7. New ACP Schematic – US-30 and Iowa 1

APPENDIX H

Evacuation Regions

H EVACUATION REGIONS

This appendix presents the evacuation percentages for each Evacuation Region (Table H-1) and maps of all Evacuation Regions (Figure H-1 through Figure H-38). The percentages presented in Table H-1 are based on the methodology discussed in assumption 8of Section 2.2 and shown in Figure 2-1.

Note the baseline ETE study assumes 20 percent of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002.

Table H-1. Percent of Subarea Population Evacuating for Each Region

Region	Description Wind Direction From	Subarea																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Regions																									
R01	2-Mile Ring	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R02	5-Mile Ring	100%	100%	100%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R03	Full EPZ	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Evacuate 2-Mile Radius and Downwind to 5 Miles																									
R04	NNW, N	100%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R05	NNE, NE, ENE	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R06	E, ESE, SE	100%	20%	20%	20%	20%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R07	SSE	100%	100%	20%	20%	20%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R08	S	100%	100%	100%	20%	20%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R09	SSW, SW	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R10	WSW	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R11	W	100%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R12	WNW, NW	100%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Evacuate 2-Mile Radius and Downwind to the EPZ Boundary																									
R13	N	100%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	100%	100%
R14	NNE	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	100%
R15	NE	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%
R16	ENE	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%
R17	E	100%	20%	20%	20%	20%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%
R18	ESE	100%	20%	20%	20%	20%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%
R19	SE	100%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%
R20	SSE	100%	100%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	20%	20%
R21	S	100%	100%	100%	20%	20%	20%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	20%	20%
R22	SSW	100%	100%	100%	20%	20%	20%	20%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	100%	20%	20%
R23	SW	100%	100%	100%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

Region	Description Wind Direction From	Subarea																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R24	WSW	100%	100%	100%	100%	20%	20%	20%	20%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R25	W	100%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	100%	20%
R26	WNW	100%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	100%	100%
R27	NW	100%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	100%	100%
R28	NNW	100%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	100%	100%
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 5 Miles																									
R29	5-Mile Radius	100%	100%	100%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R30	NNW, N	100%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R31	NNE, NE, ENE	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R32	E, ESE, SE	100%	20%	20%	20%	20%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R33	SSE	100%	100%	20%	20%	20%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R34	S	100%	100%	100%	20%	20%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R35	SSW, SW	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R36	WSW	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R37	W	100%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R38	WNW, NW	100%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Subarea(s) Shelter-in-Place until 90% ETE for Region R01, then Evacuate										Subarea(s) Shelter-in-Place						Subarea(s) Evacuate									

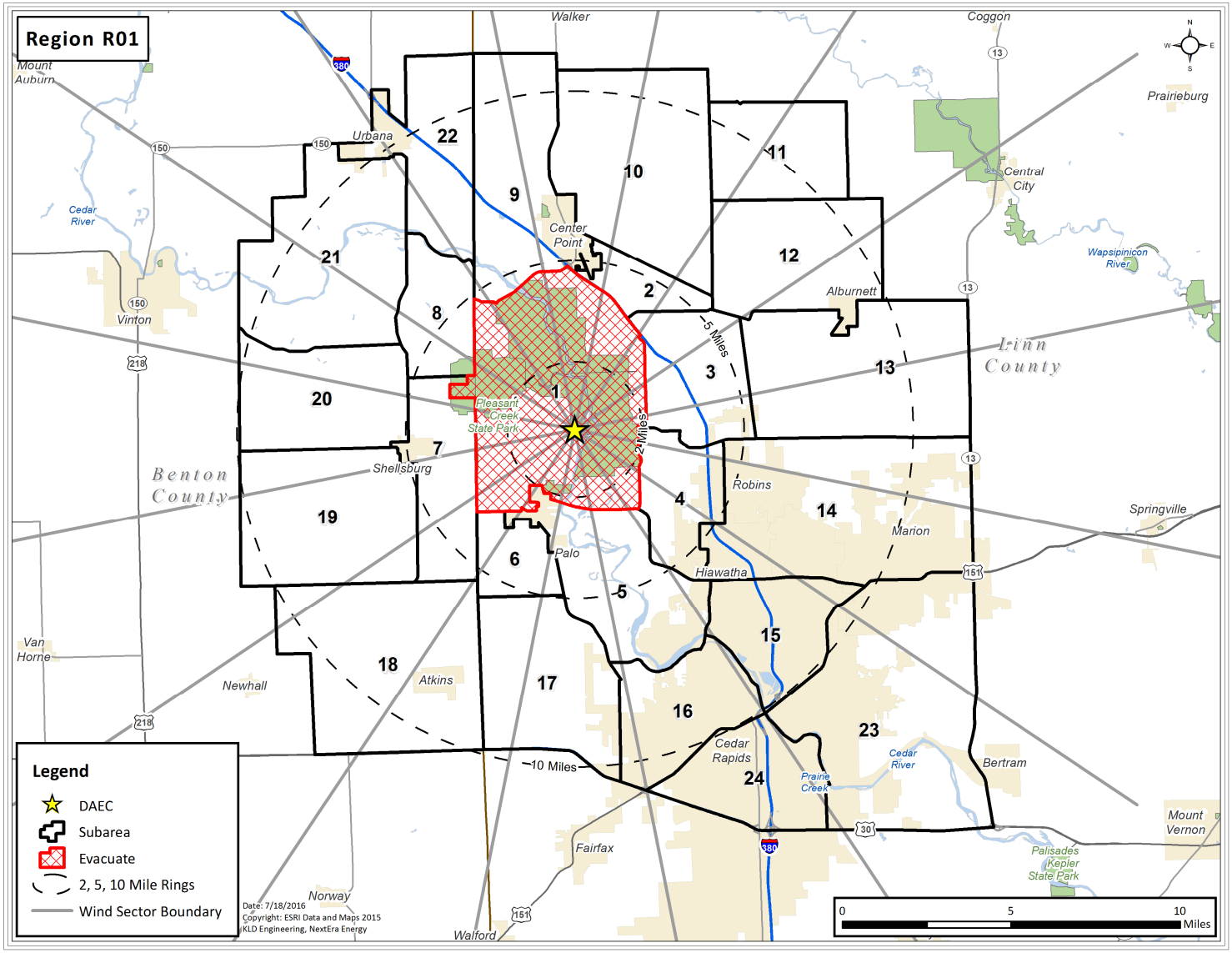
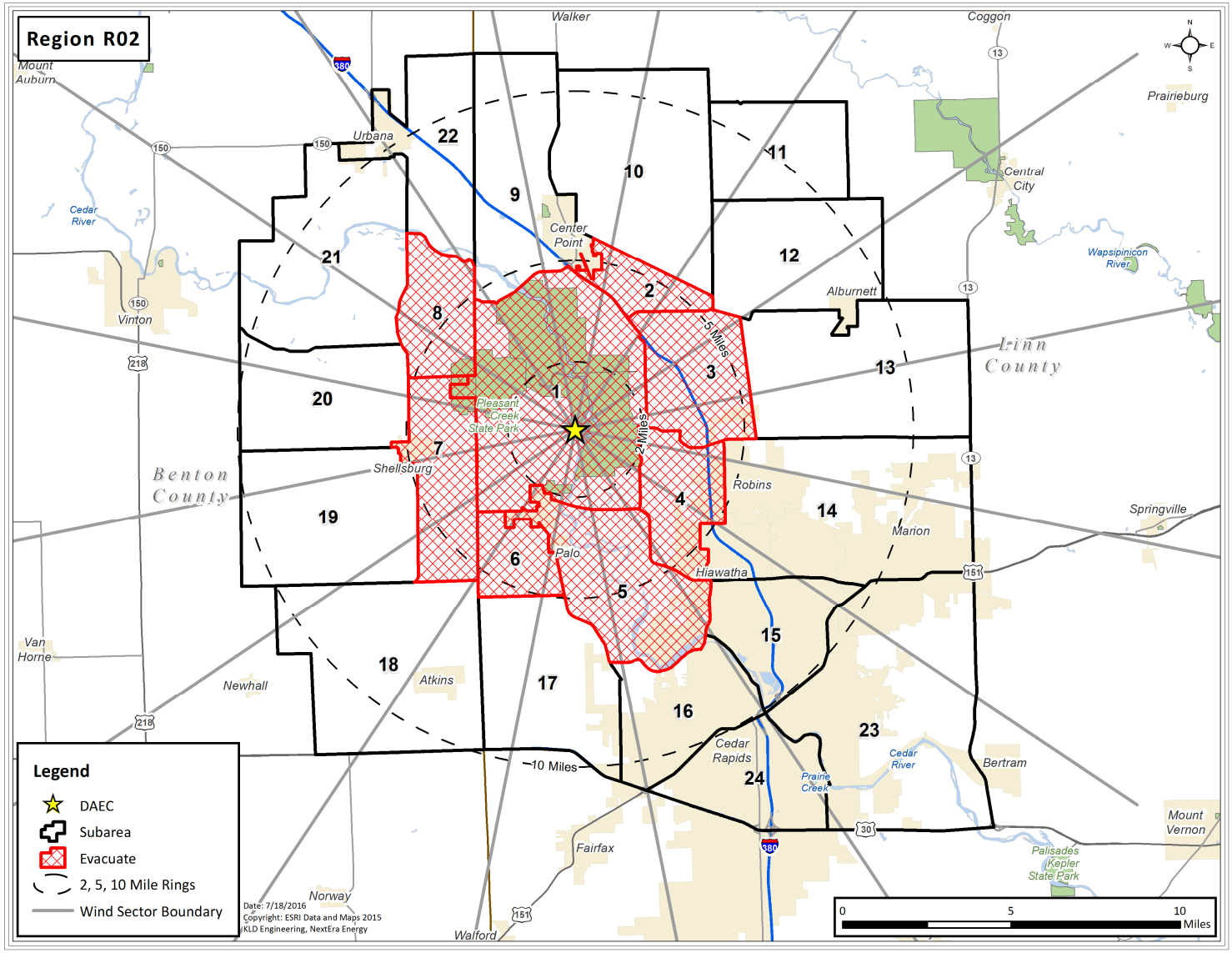


Figure H-1. Region R01



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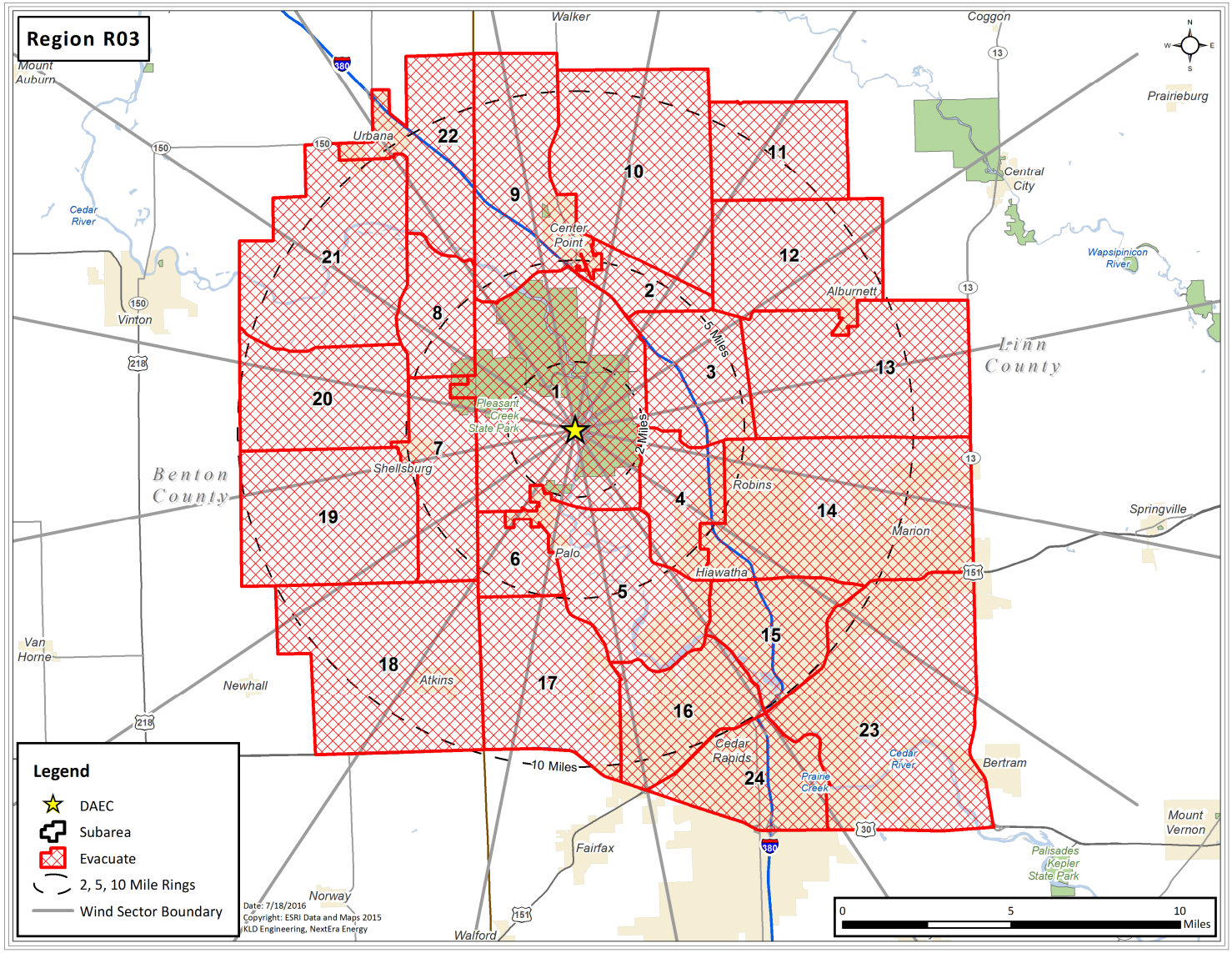

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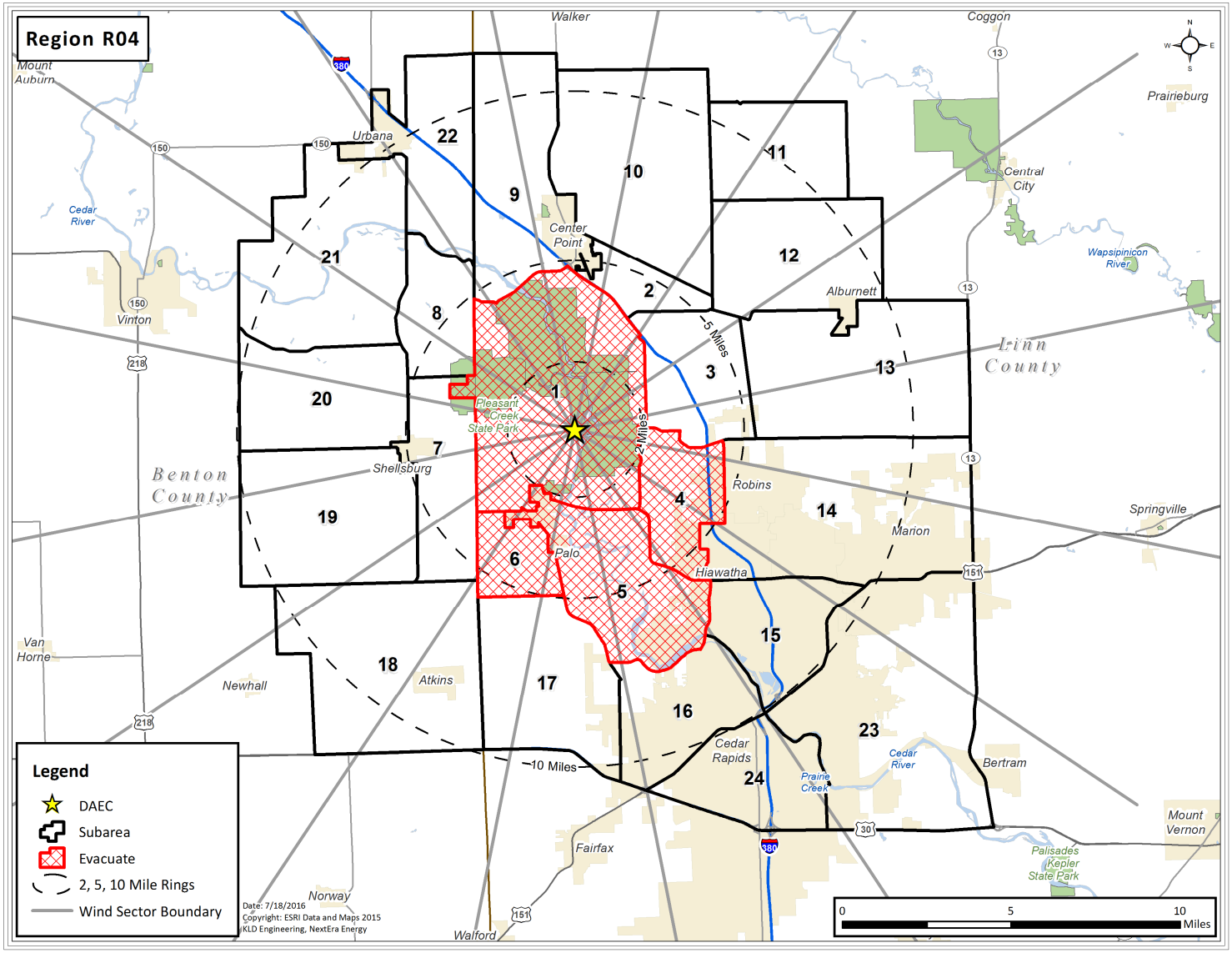

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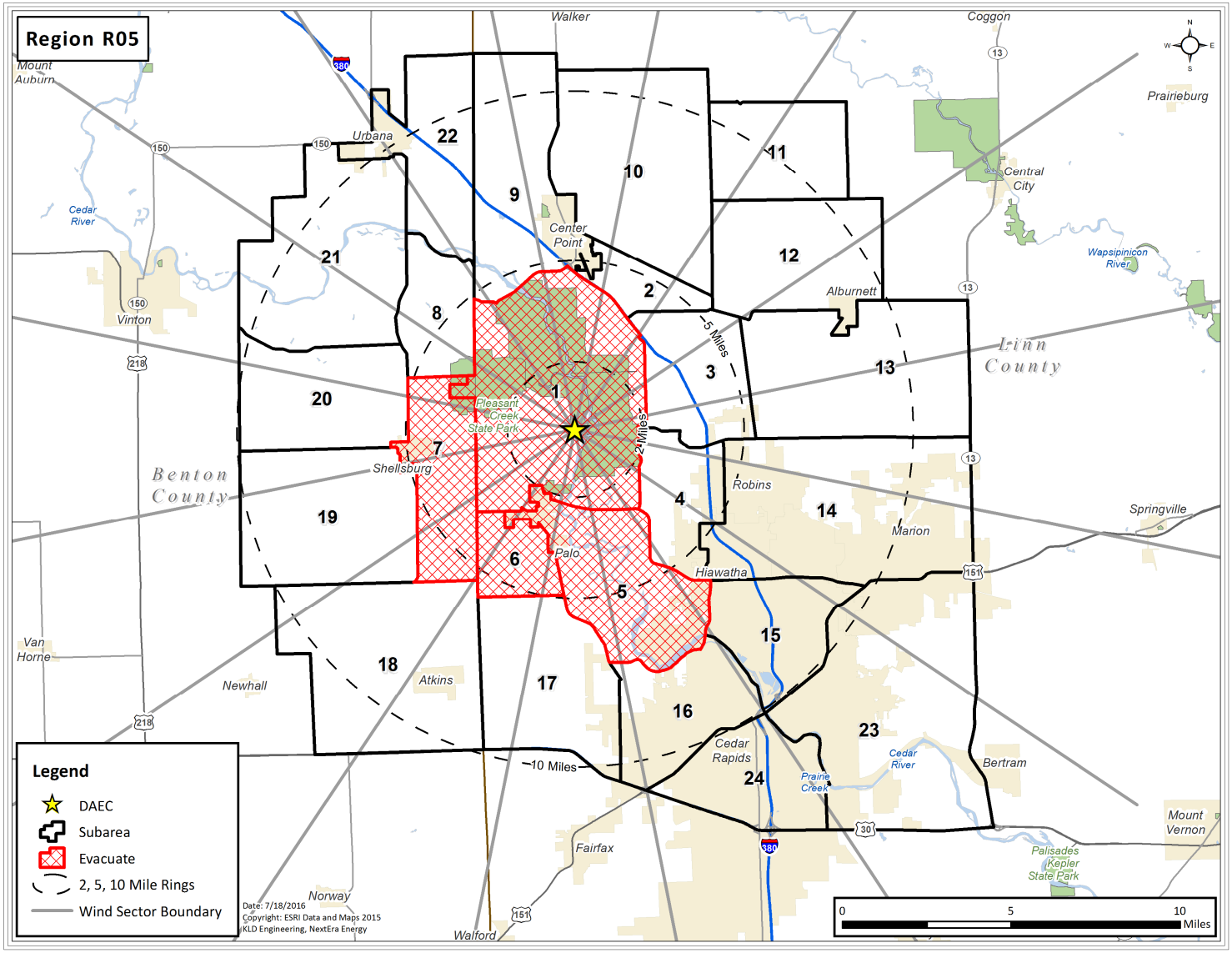

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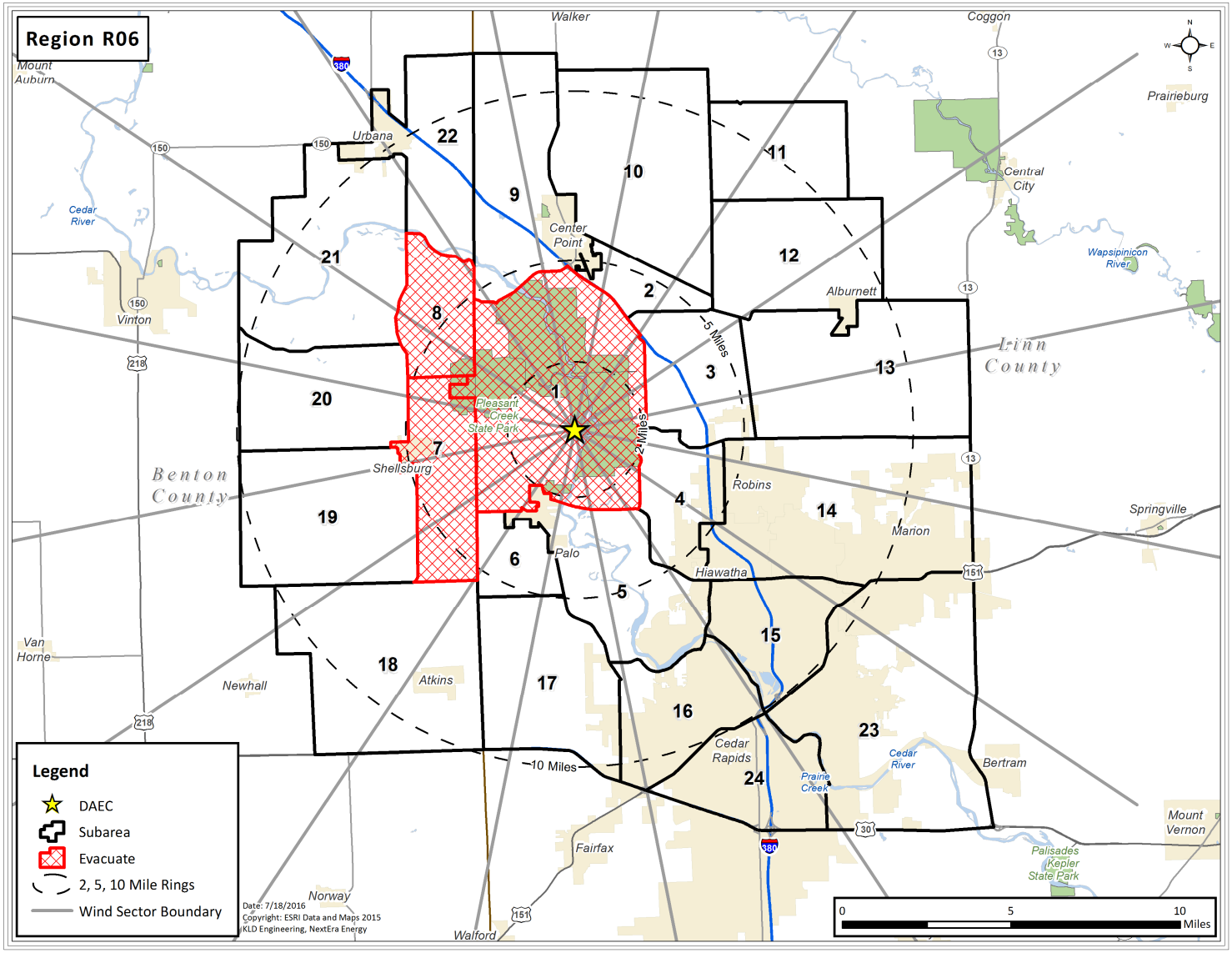

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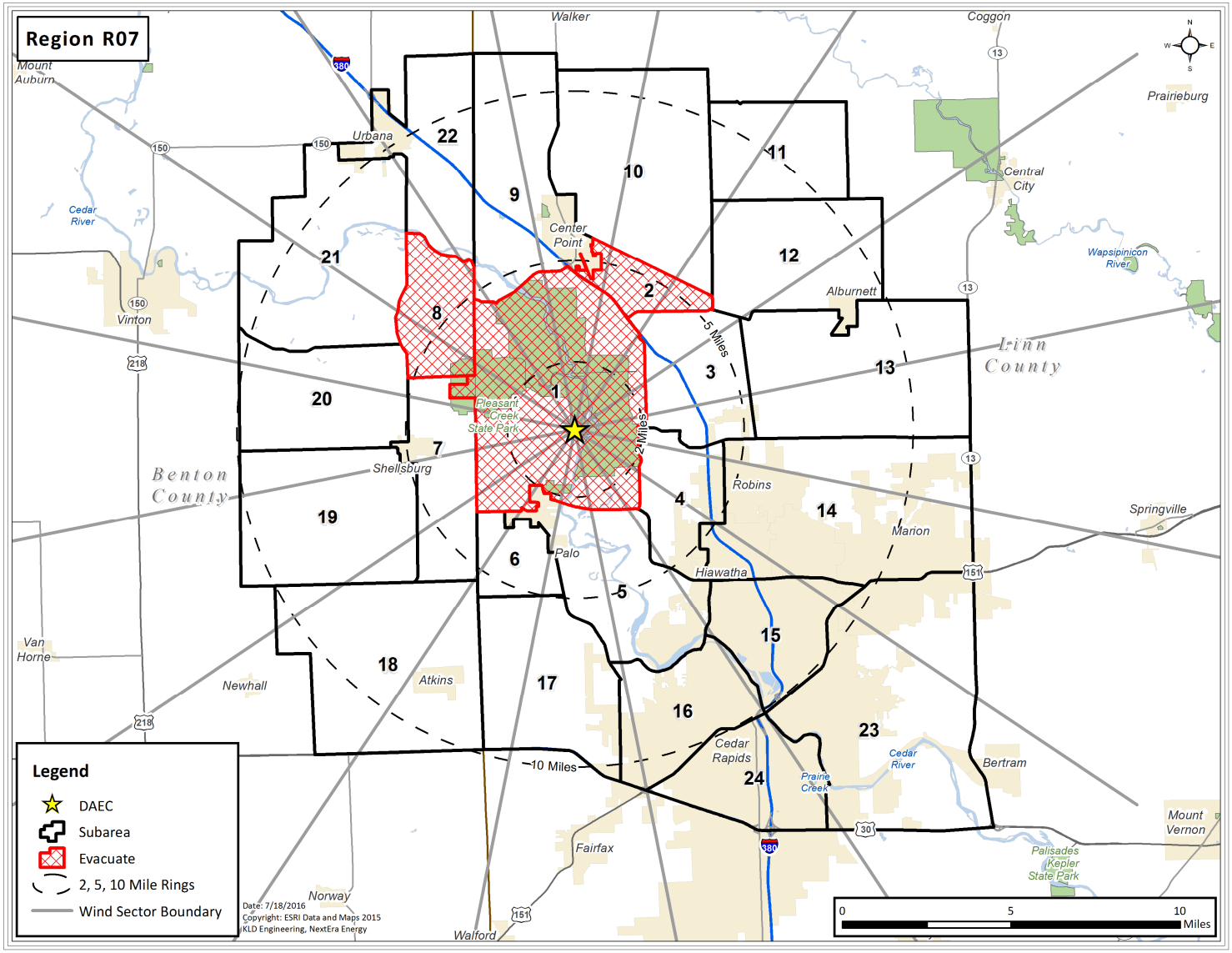

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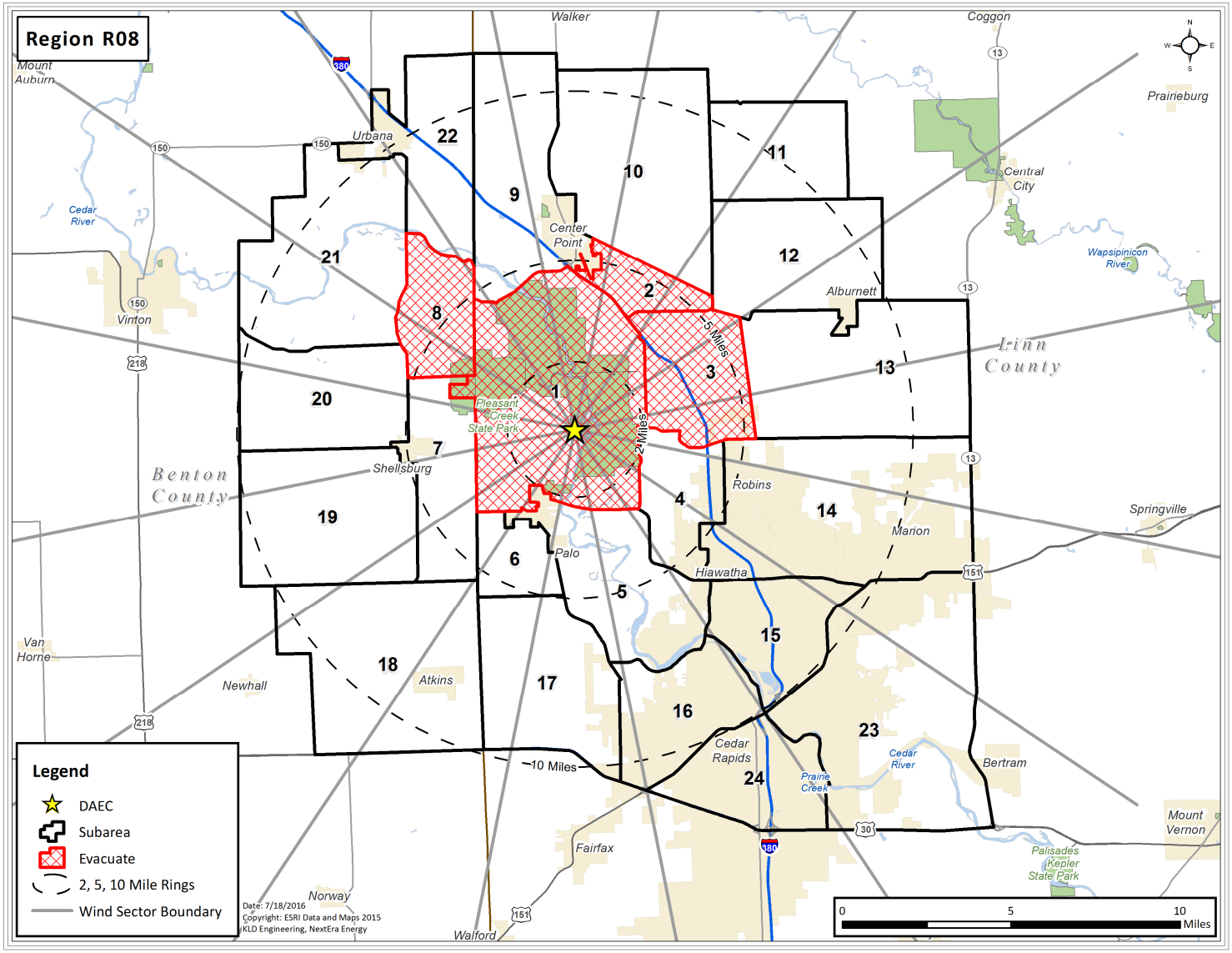

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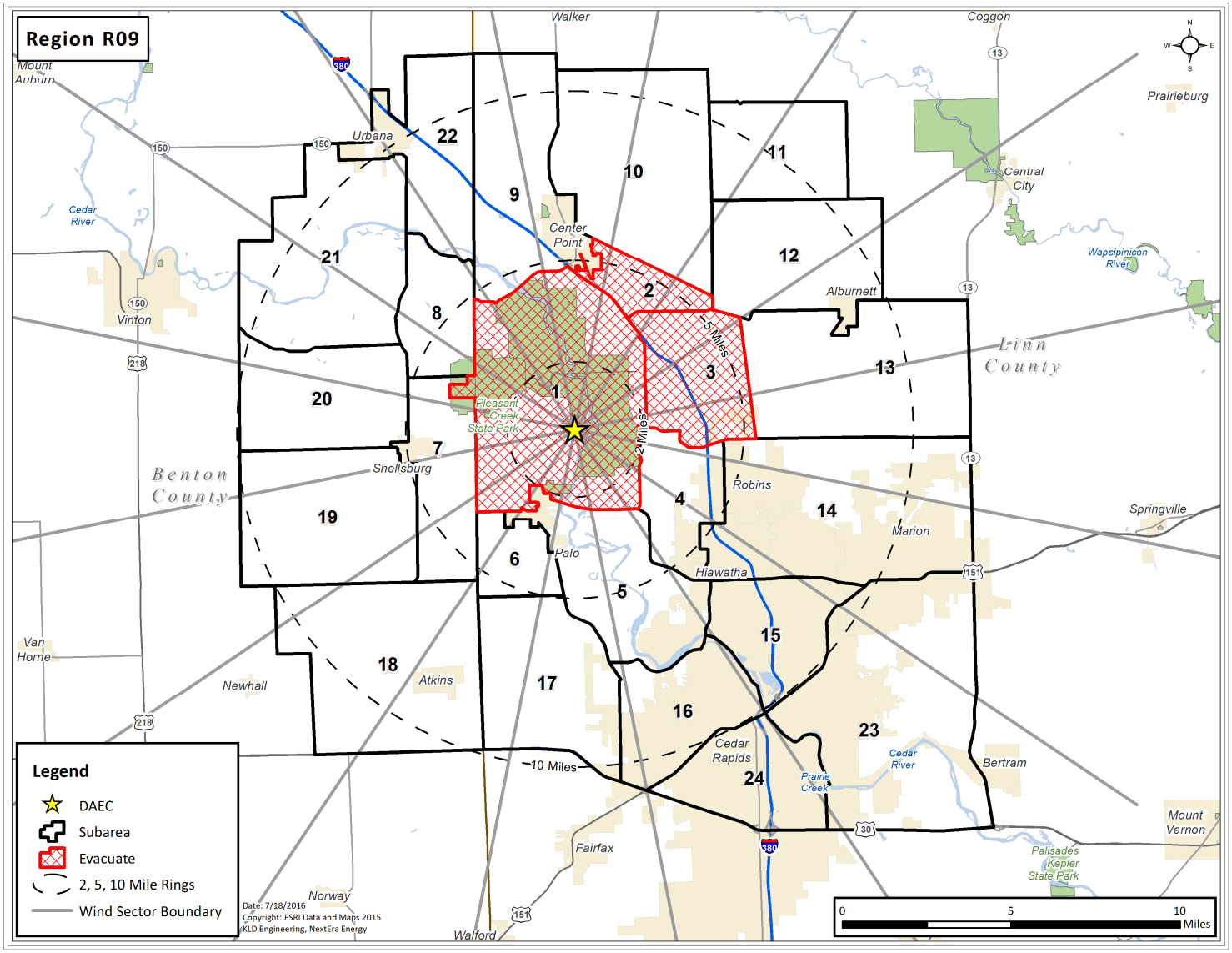

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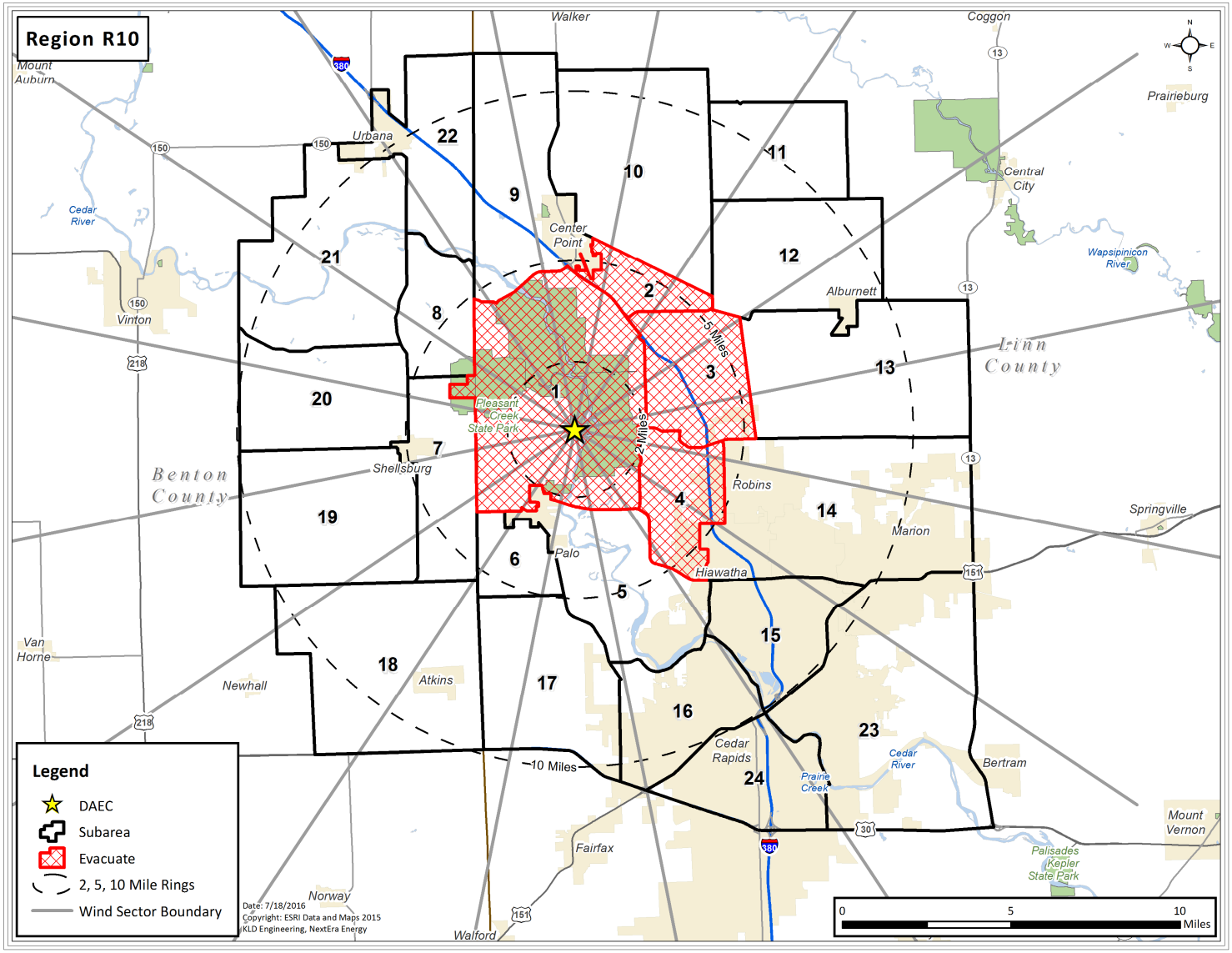

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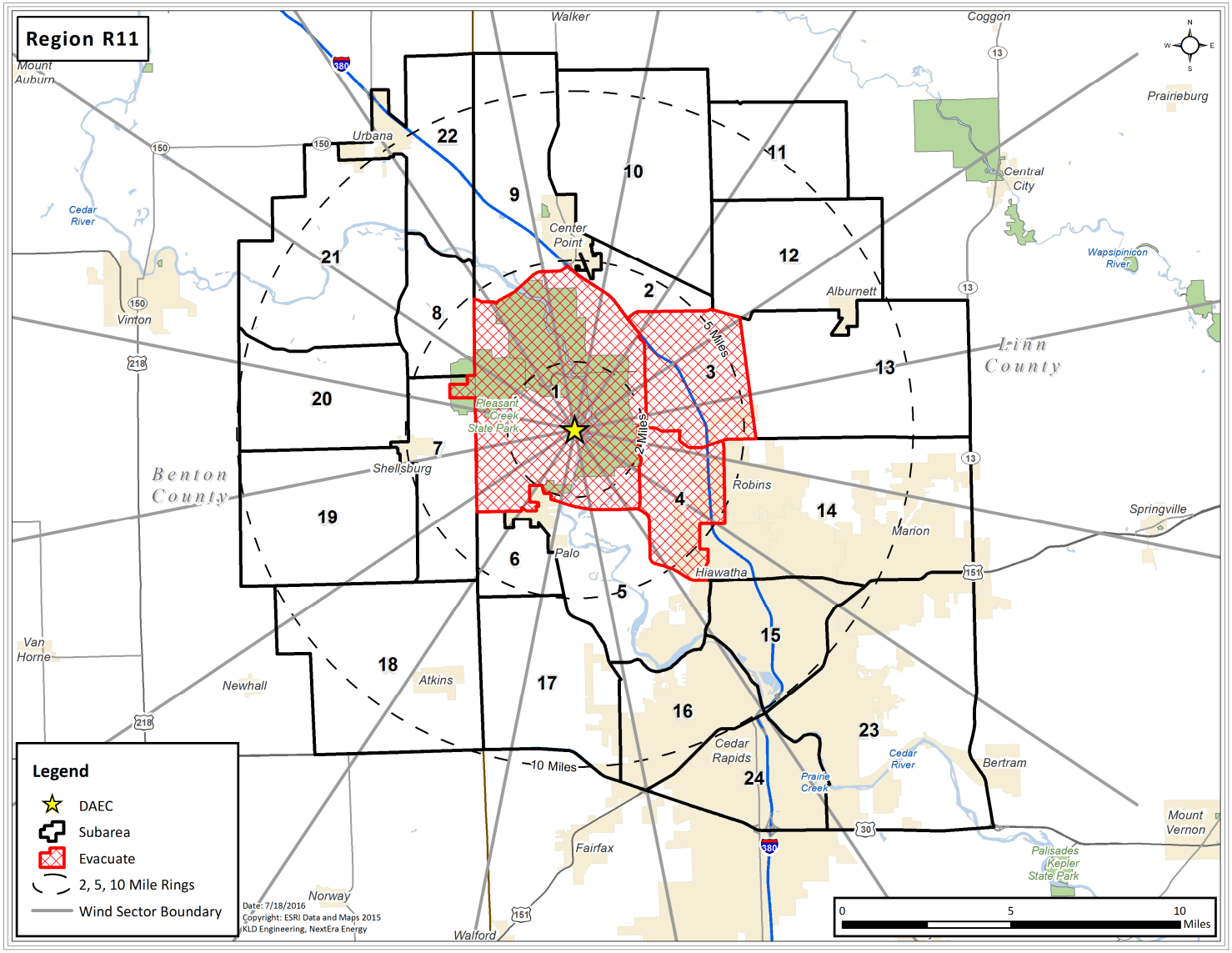

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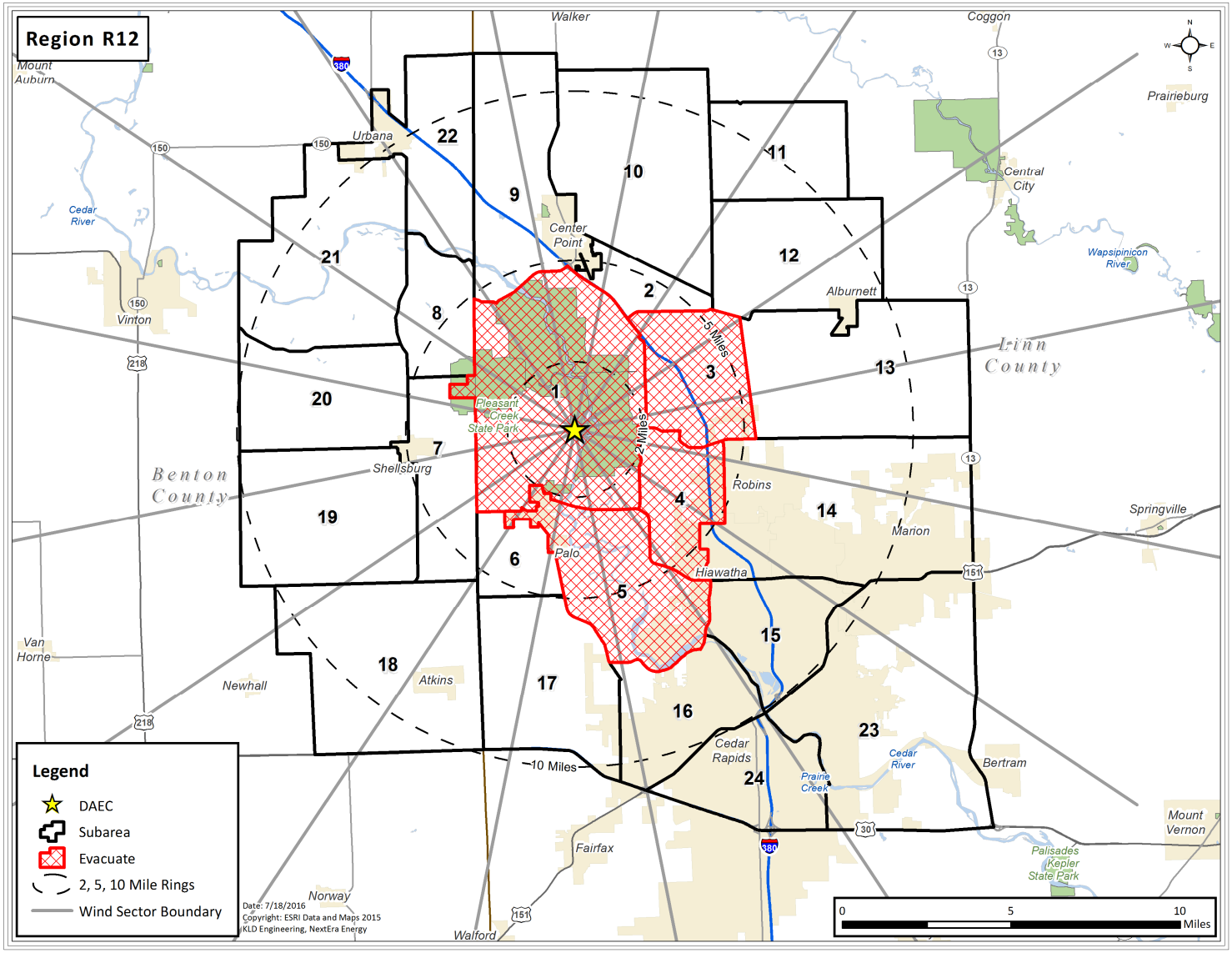

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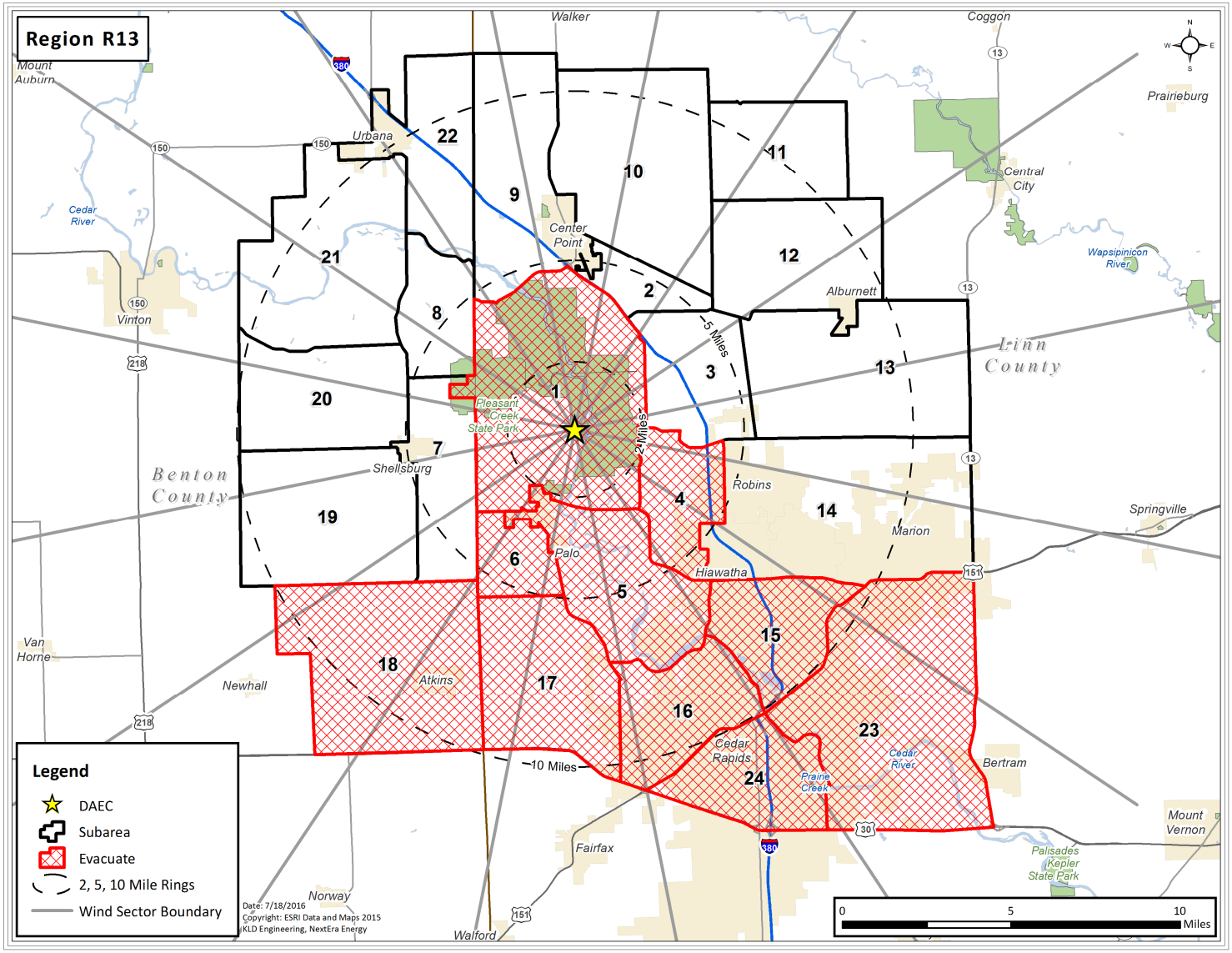

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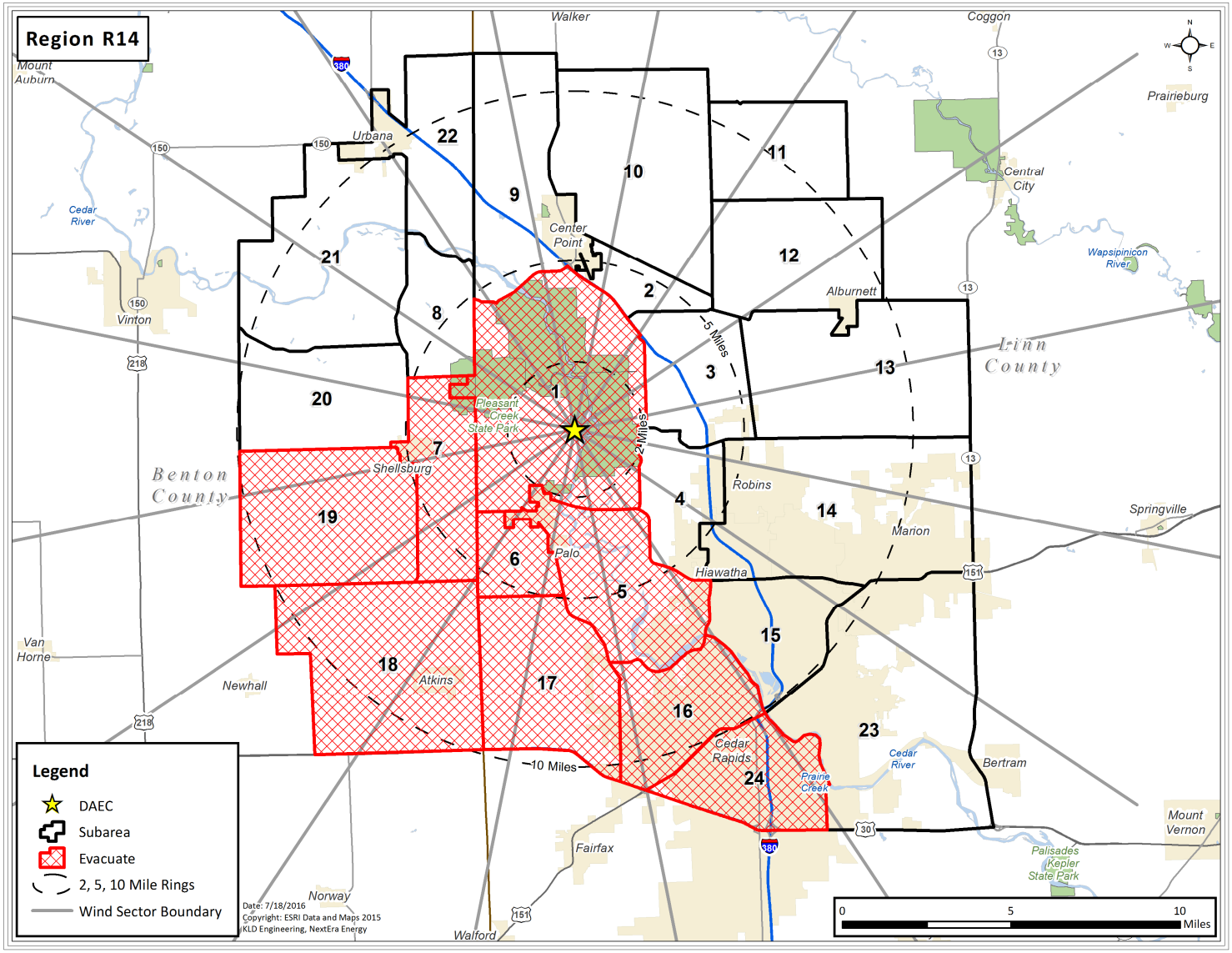
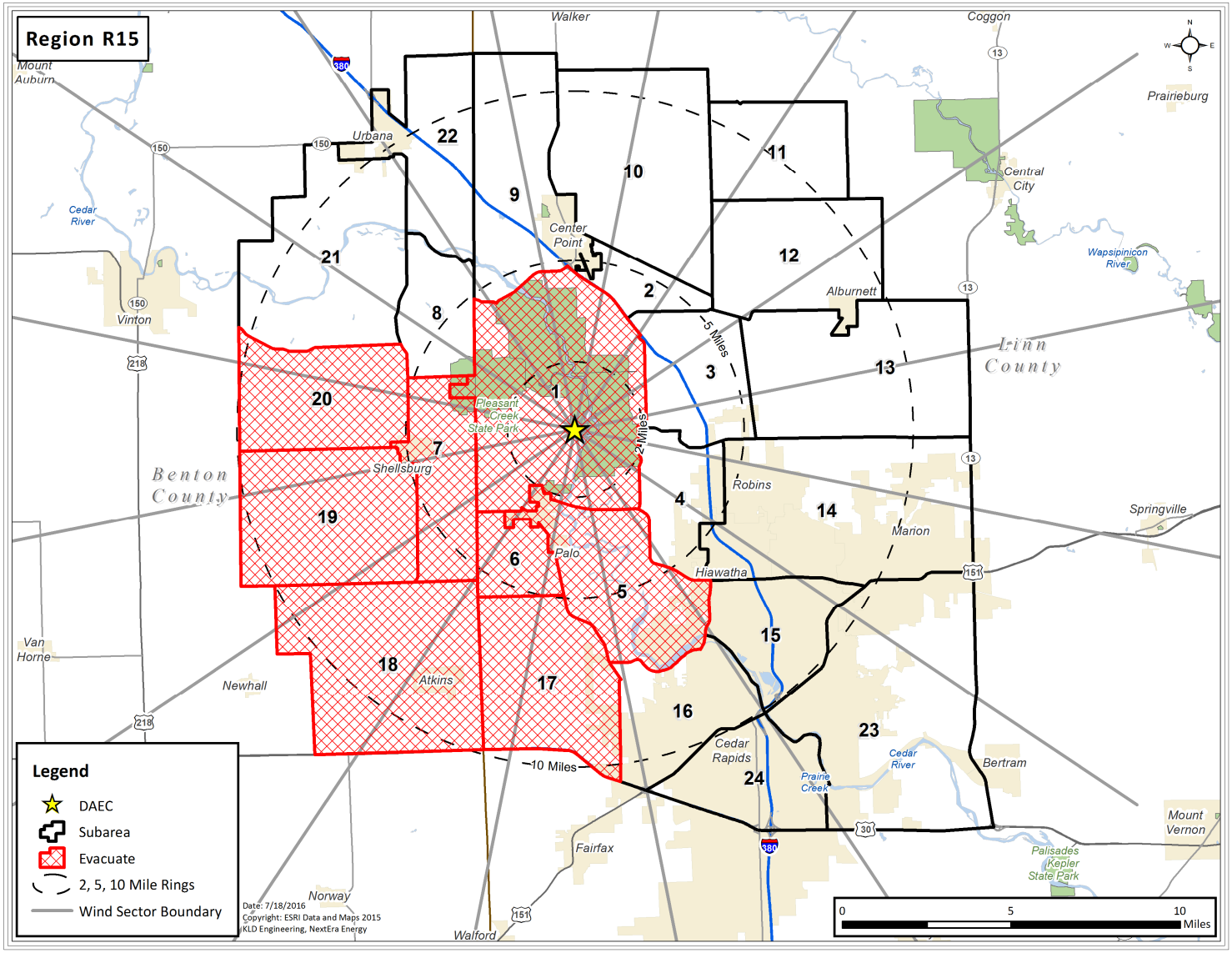


Figure H-14 Region R14



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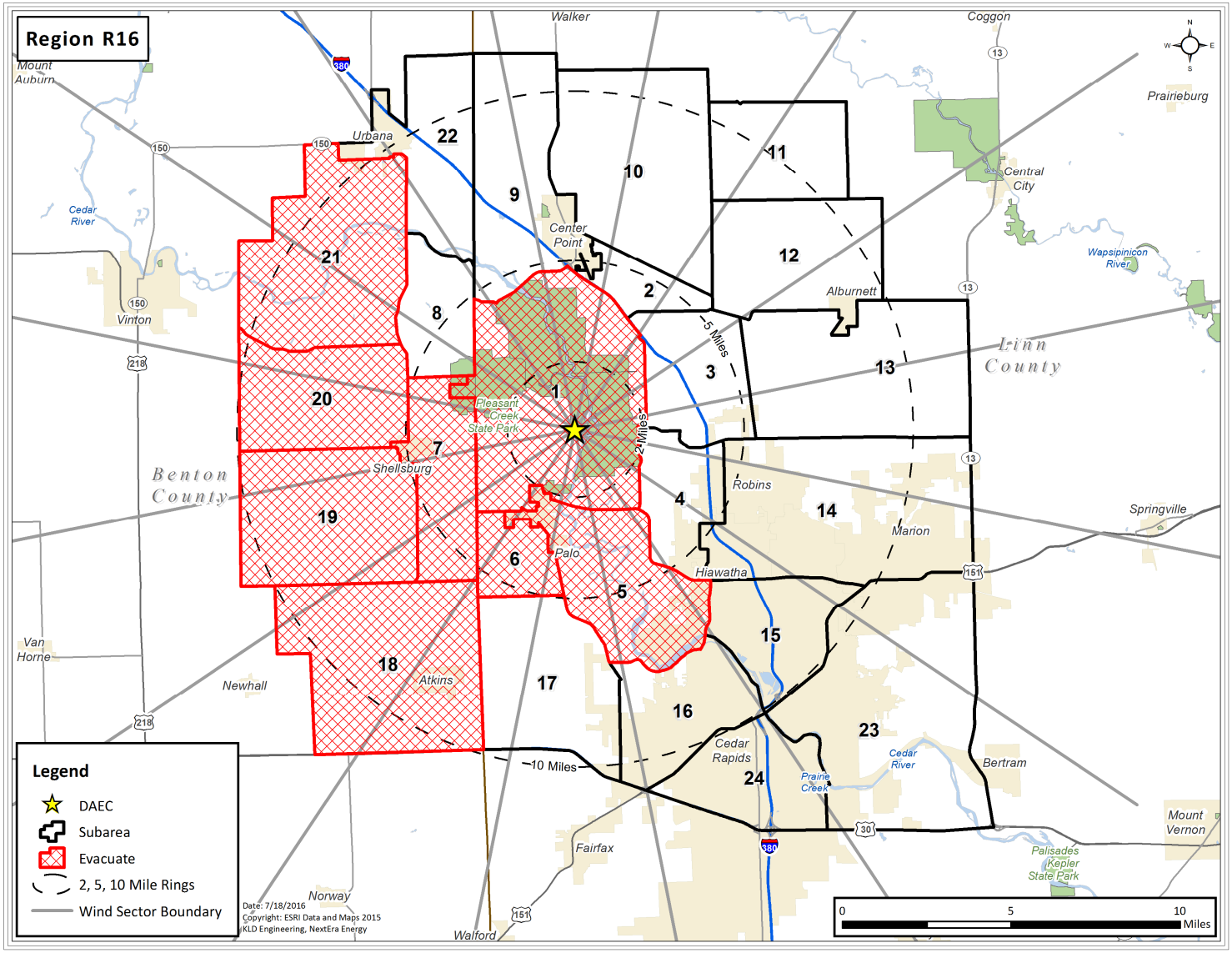
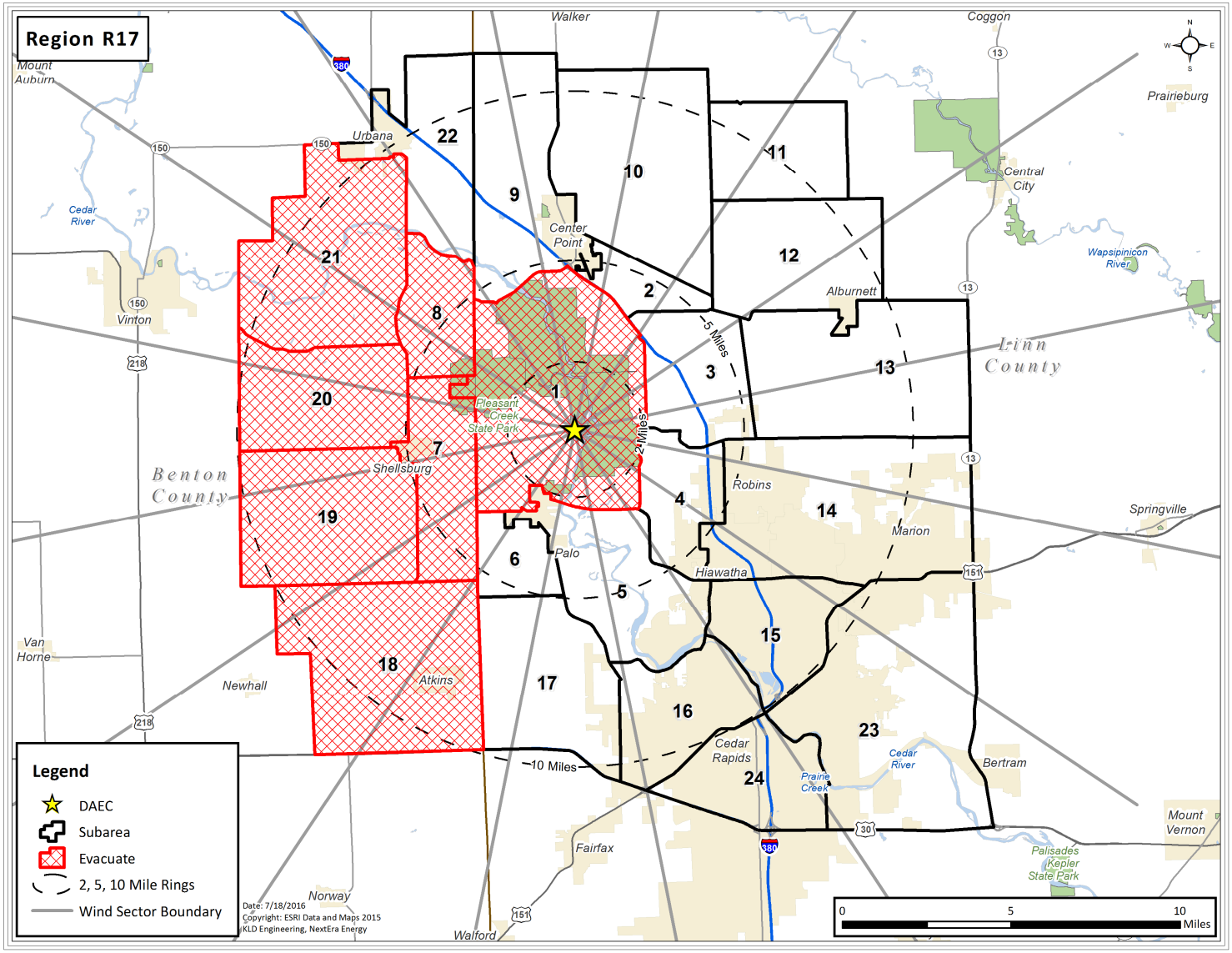


Figure H-16 Region R16



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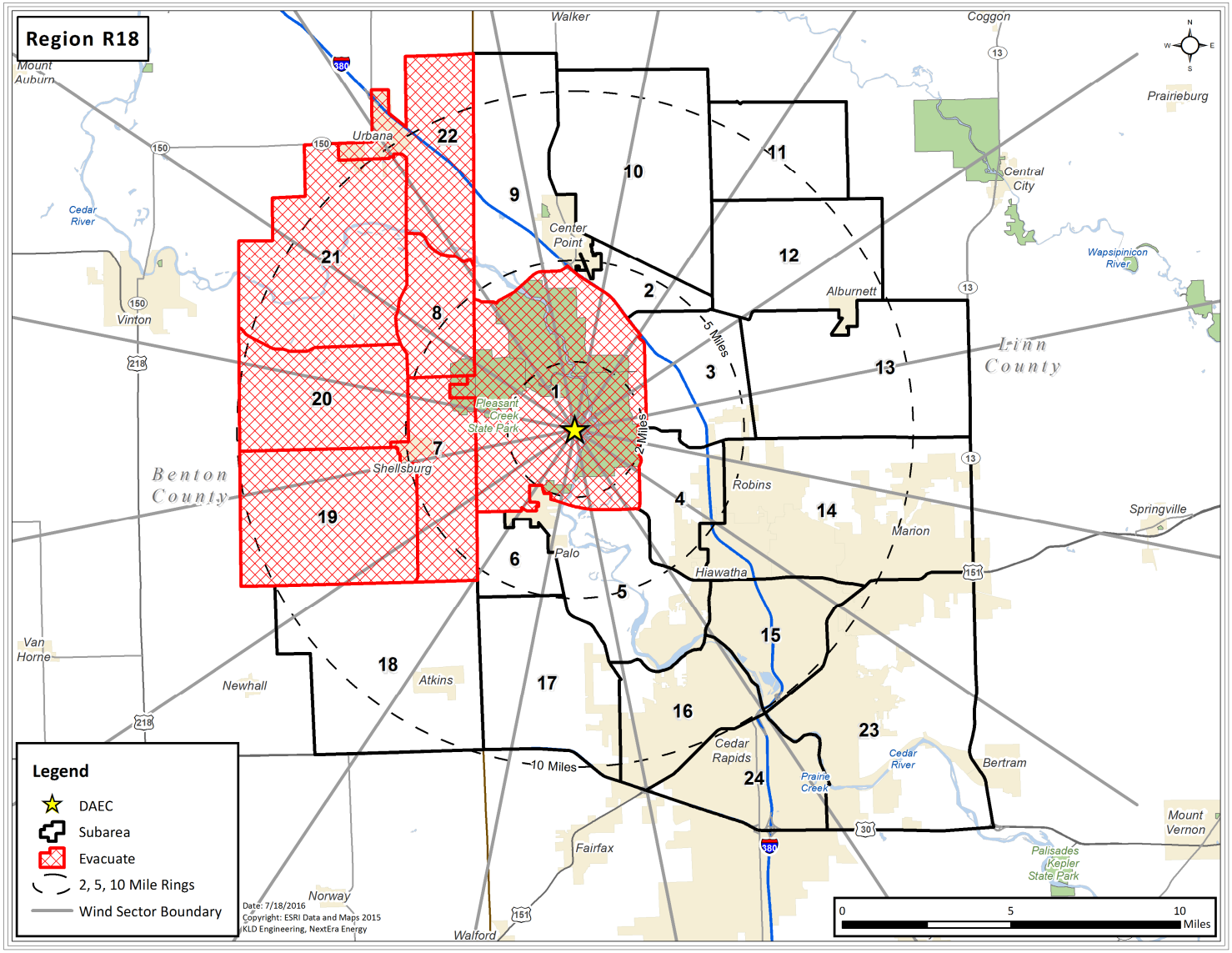

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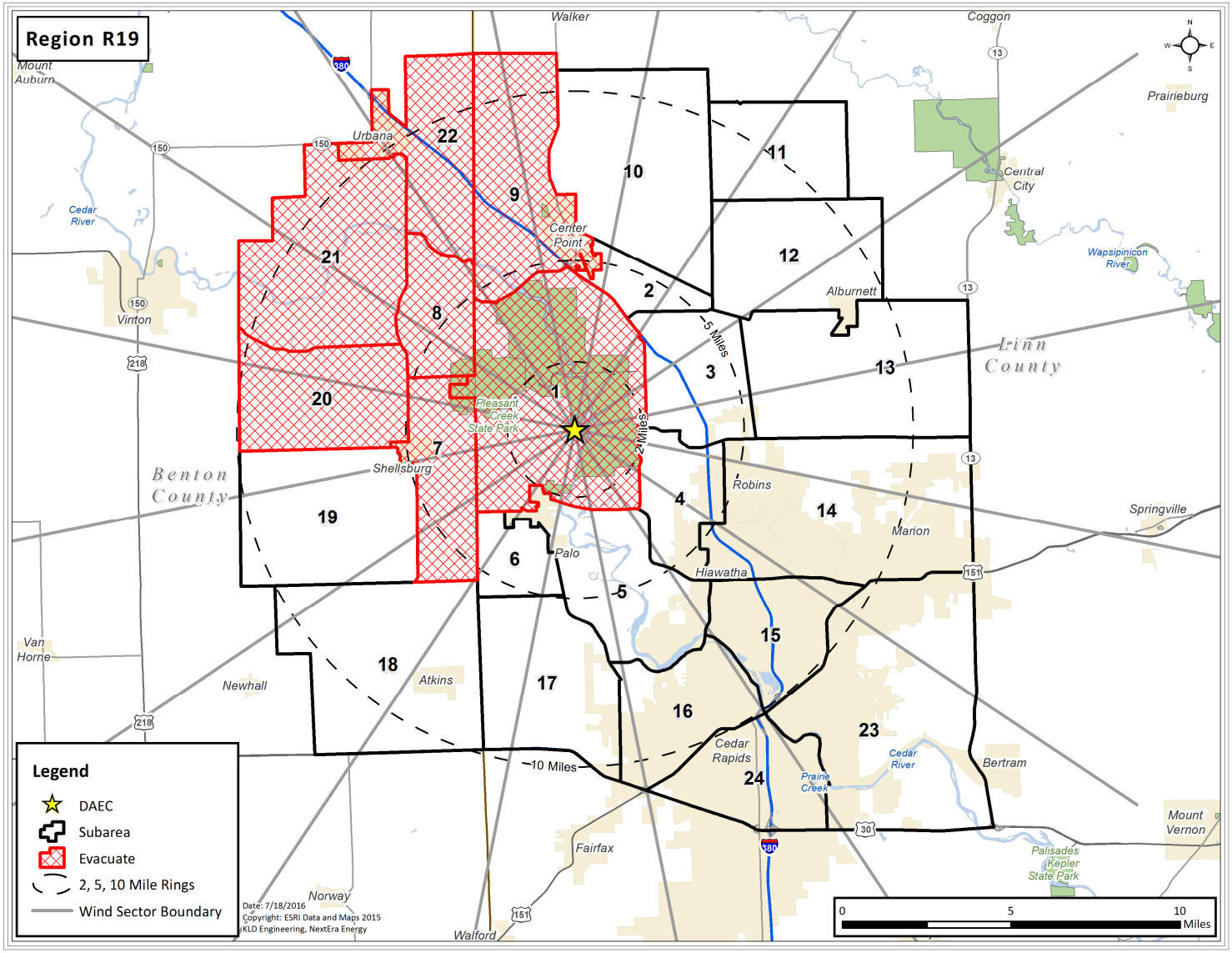

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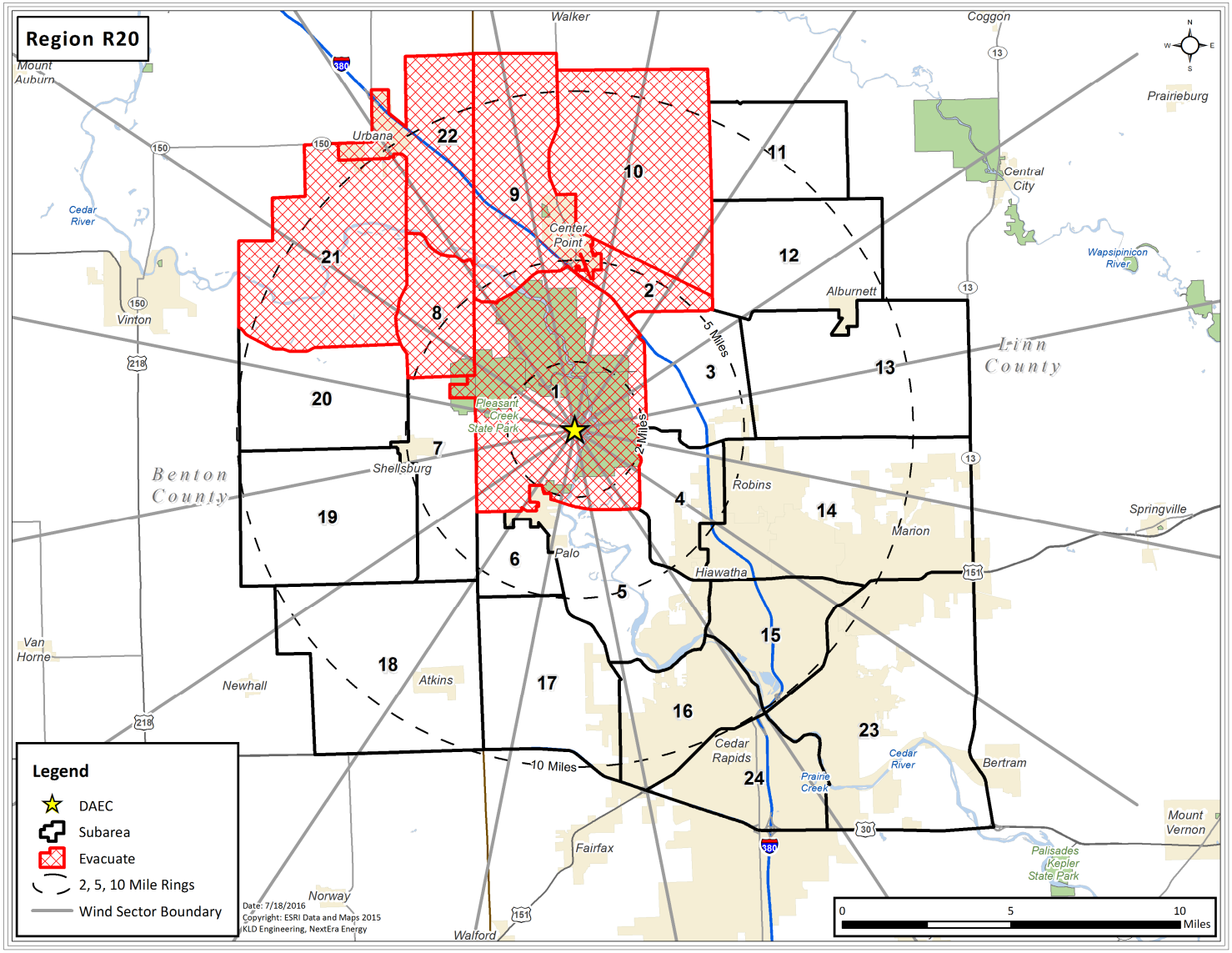


Figure H-20 Region R20

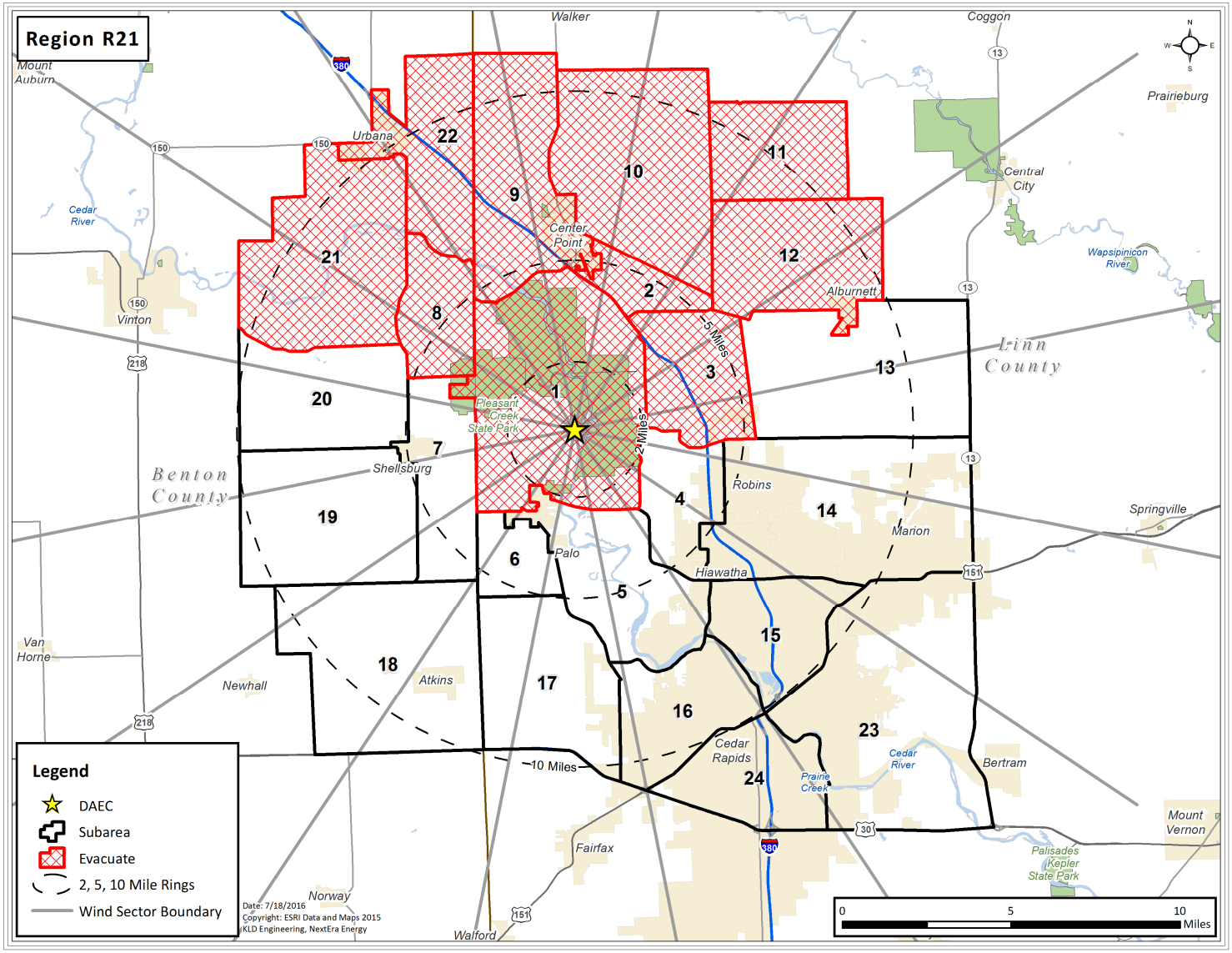


Figure H-21 Region R21

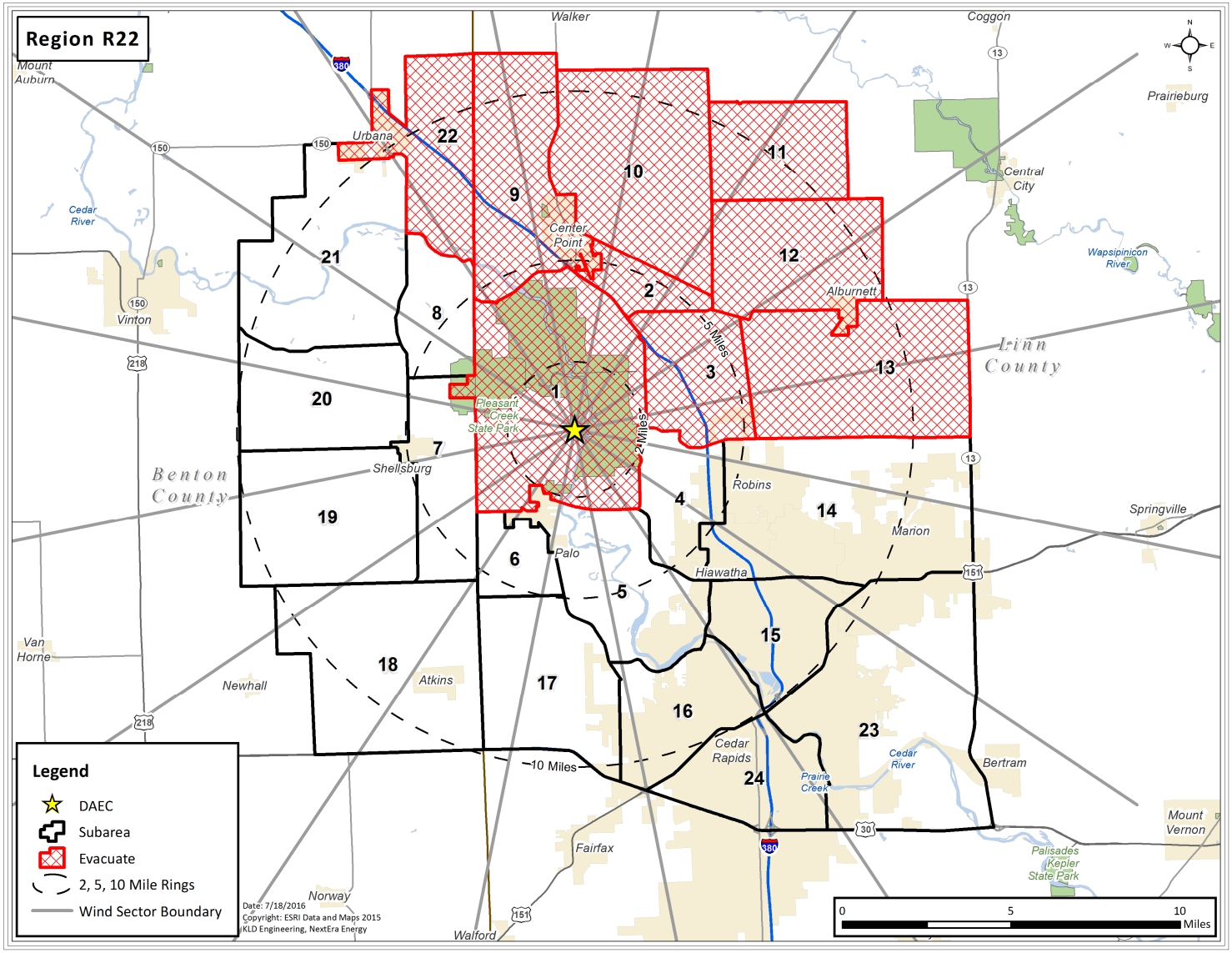


Figure H-22 Region R22

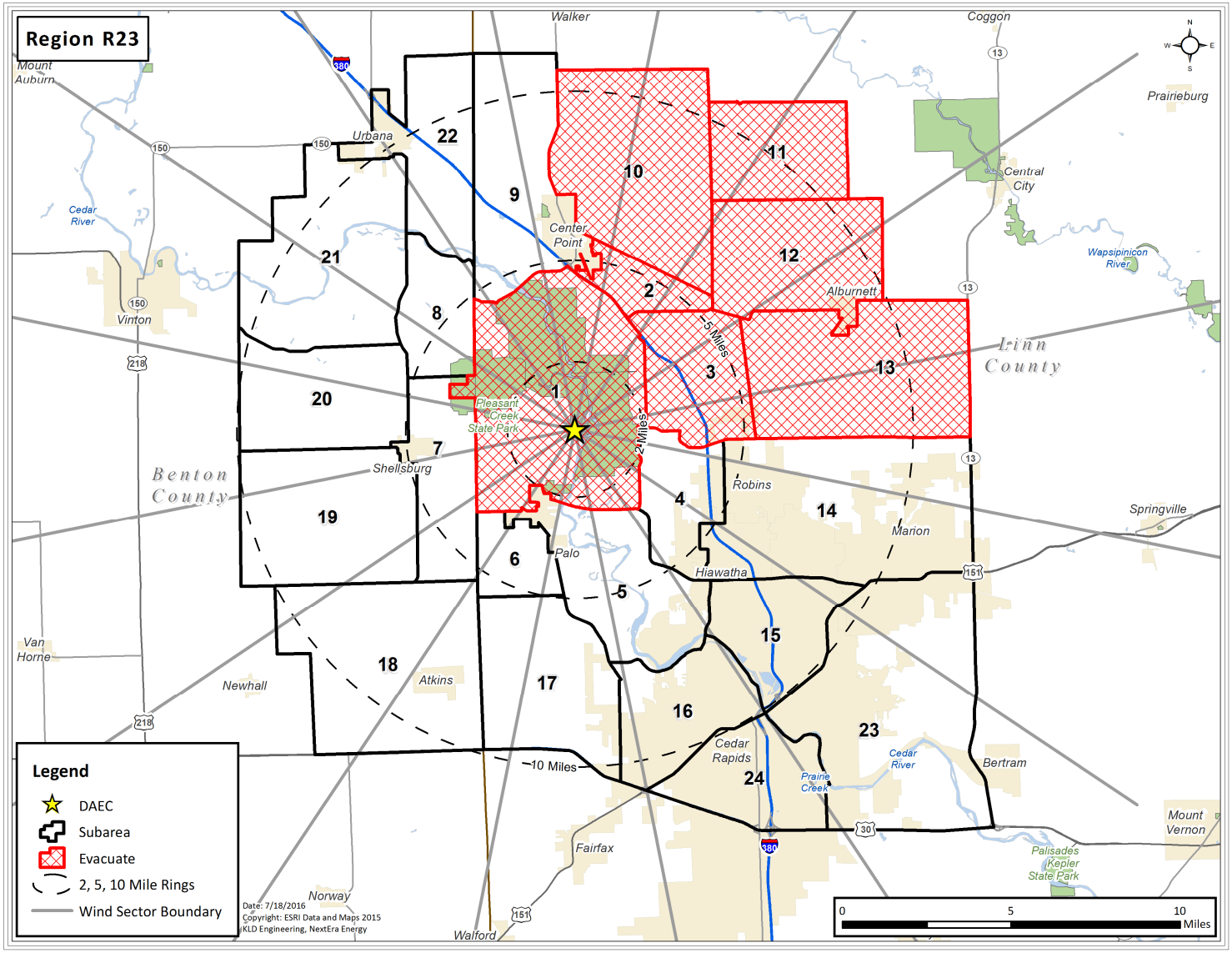
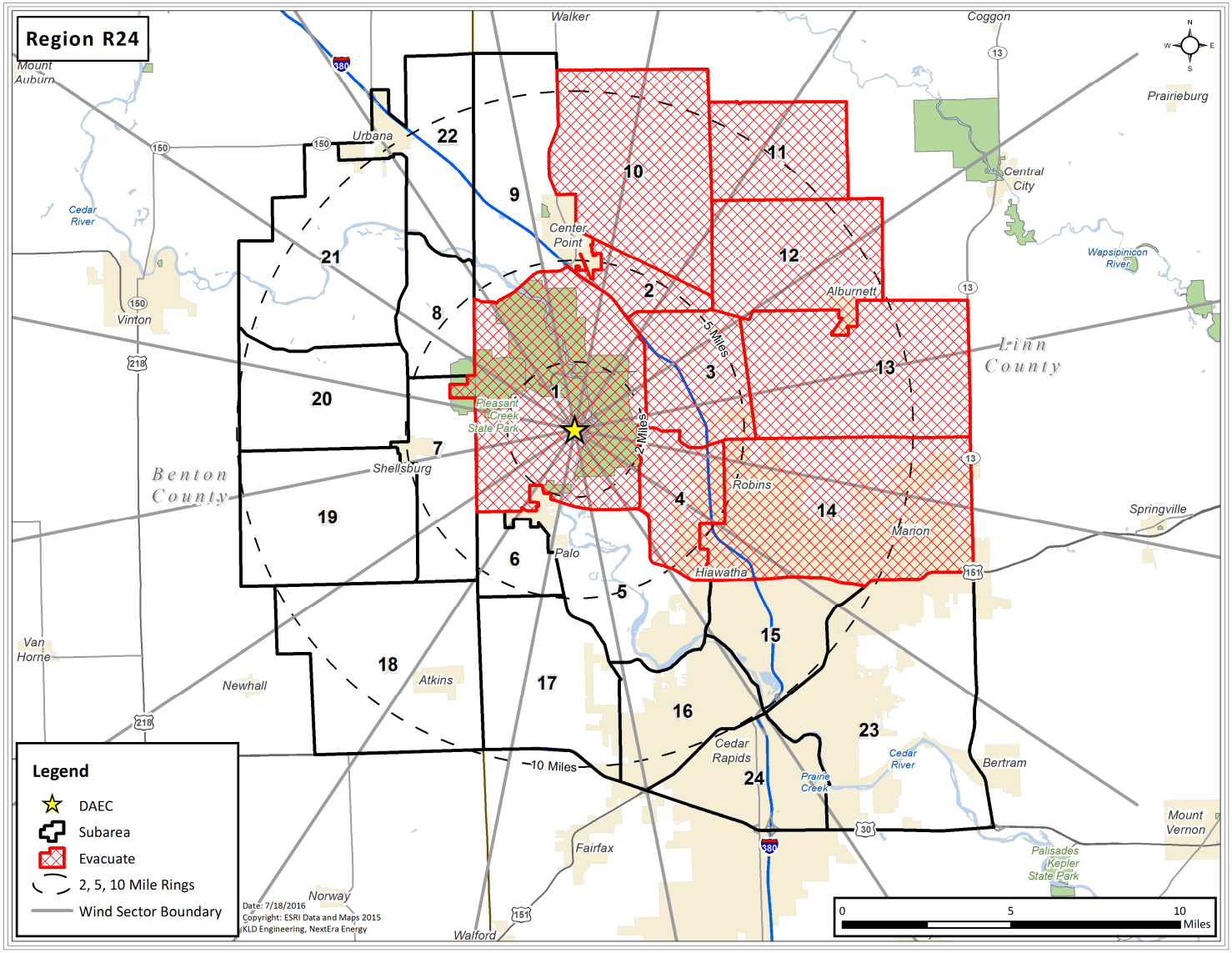


Figure H-23 Region R23



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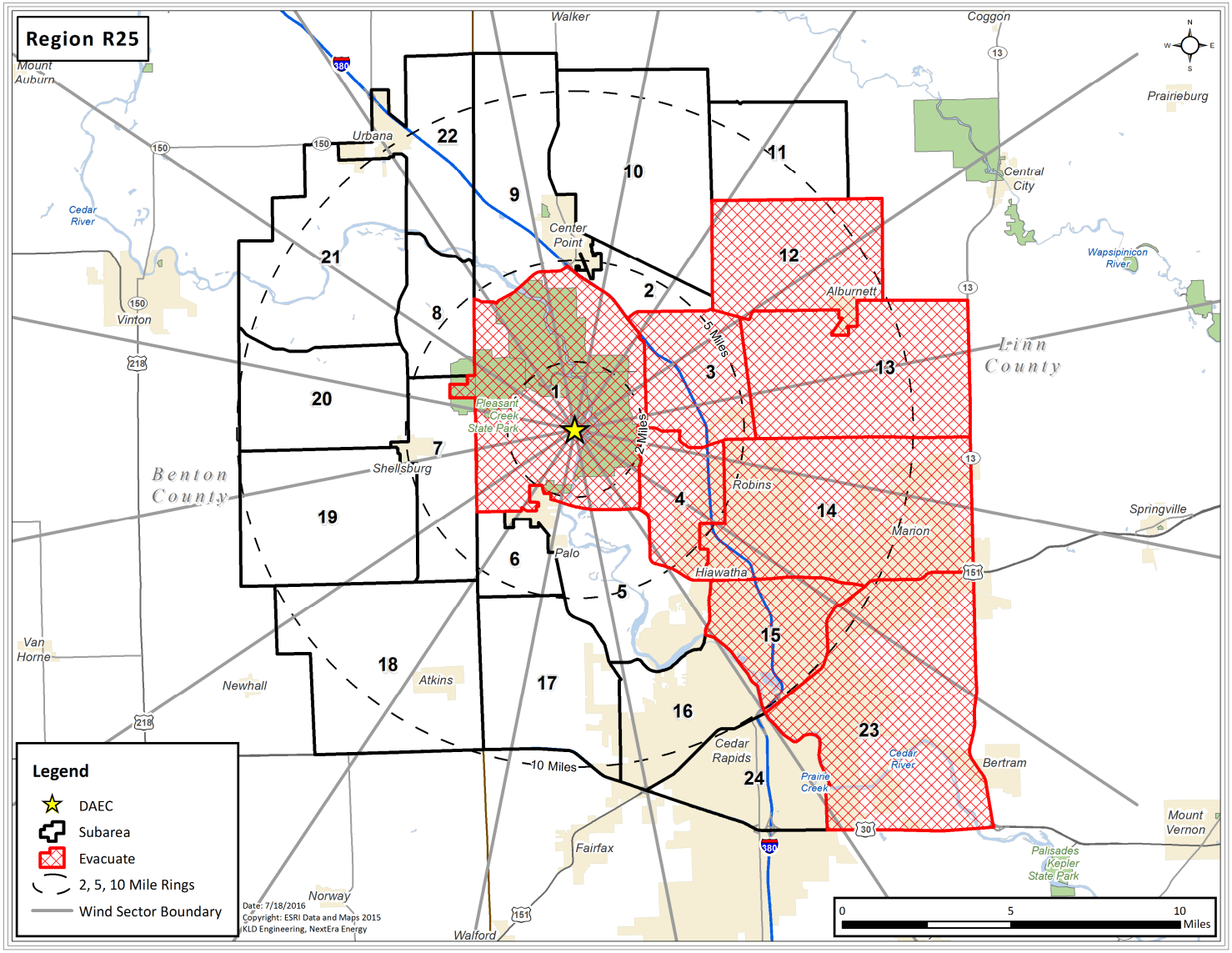
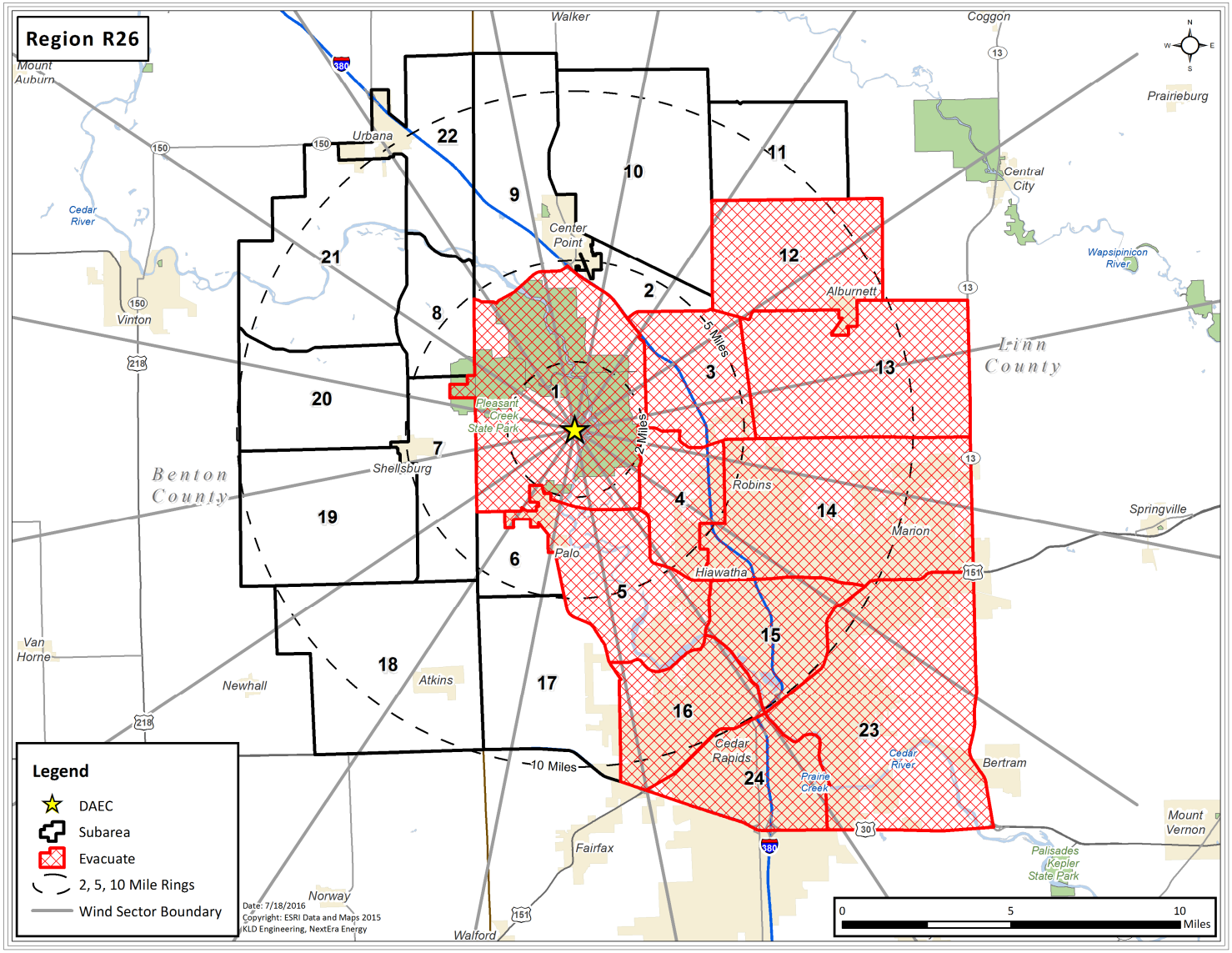


Figure H-25 Region R25



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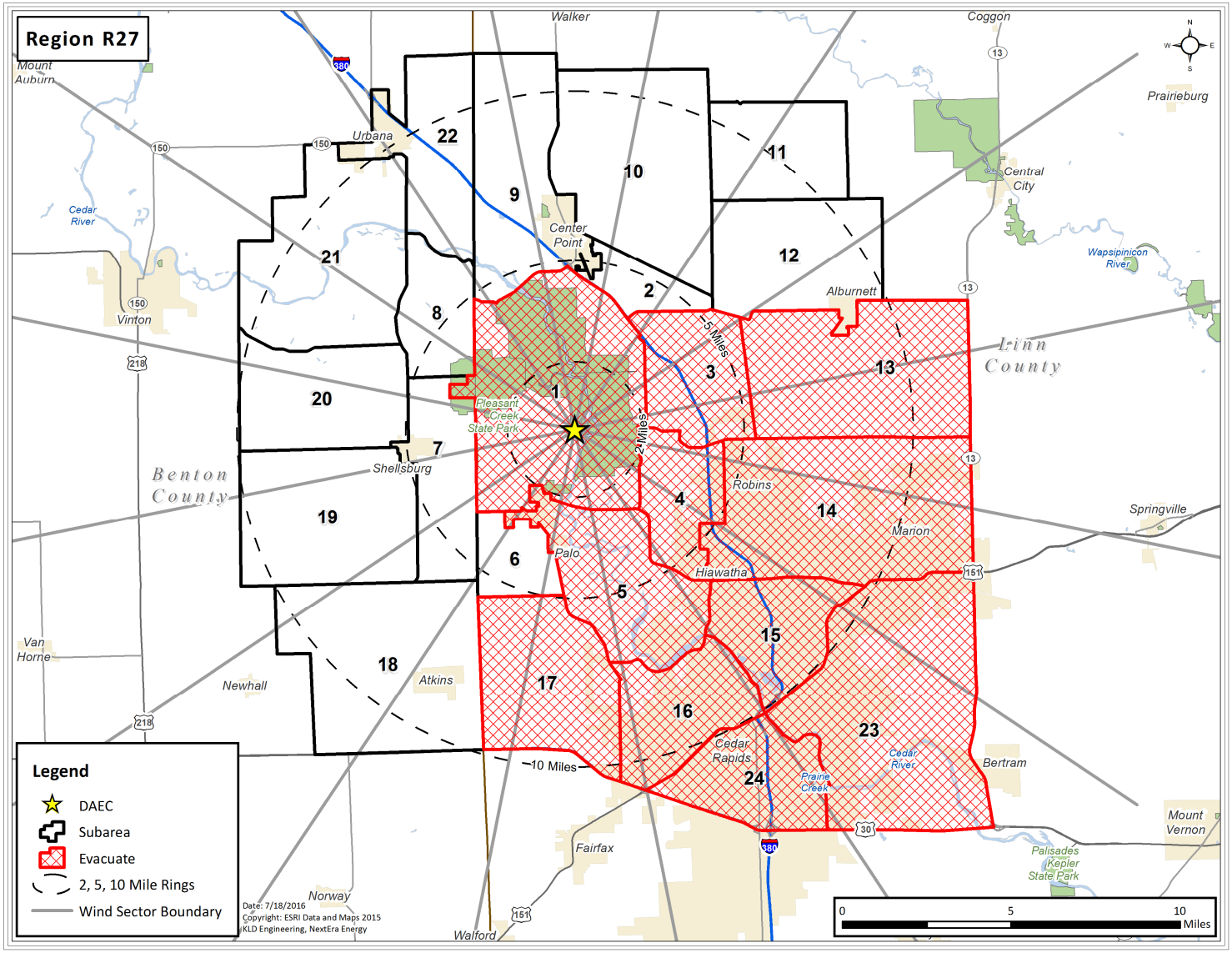

Figure H-27 Region R27

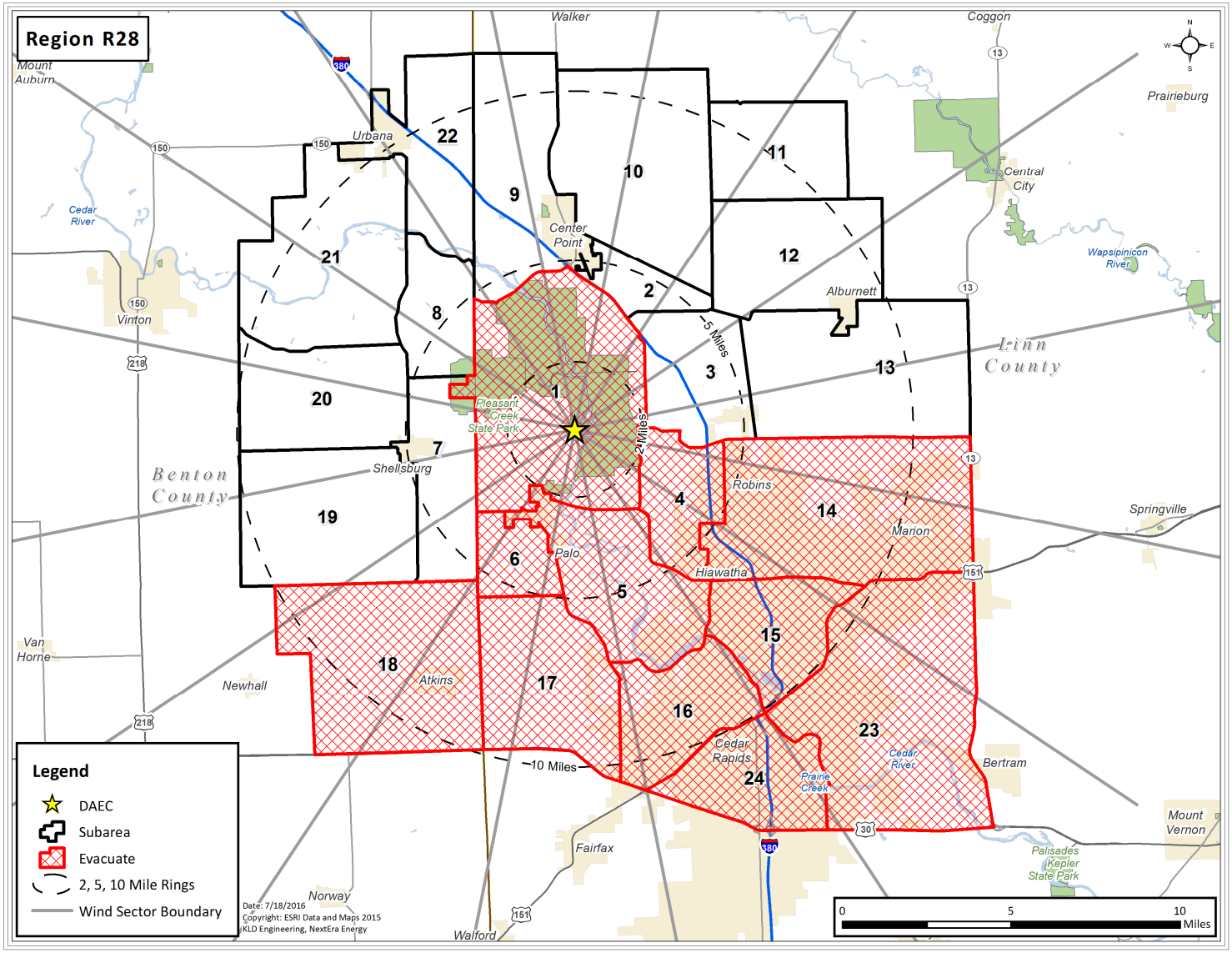

Figure H-28 Region R28

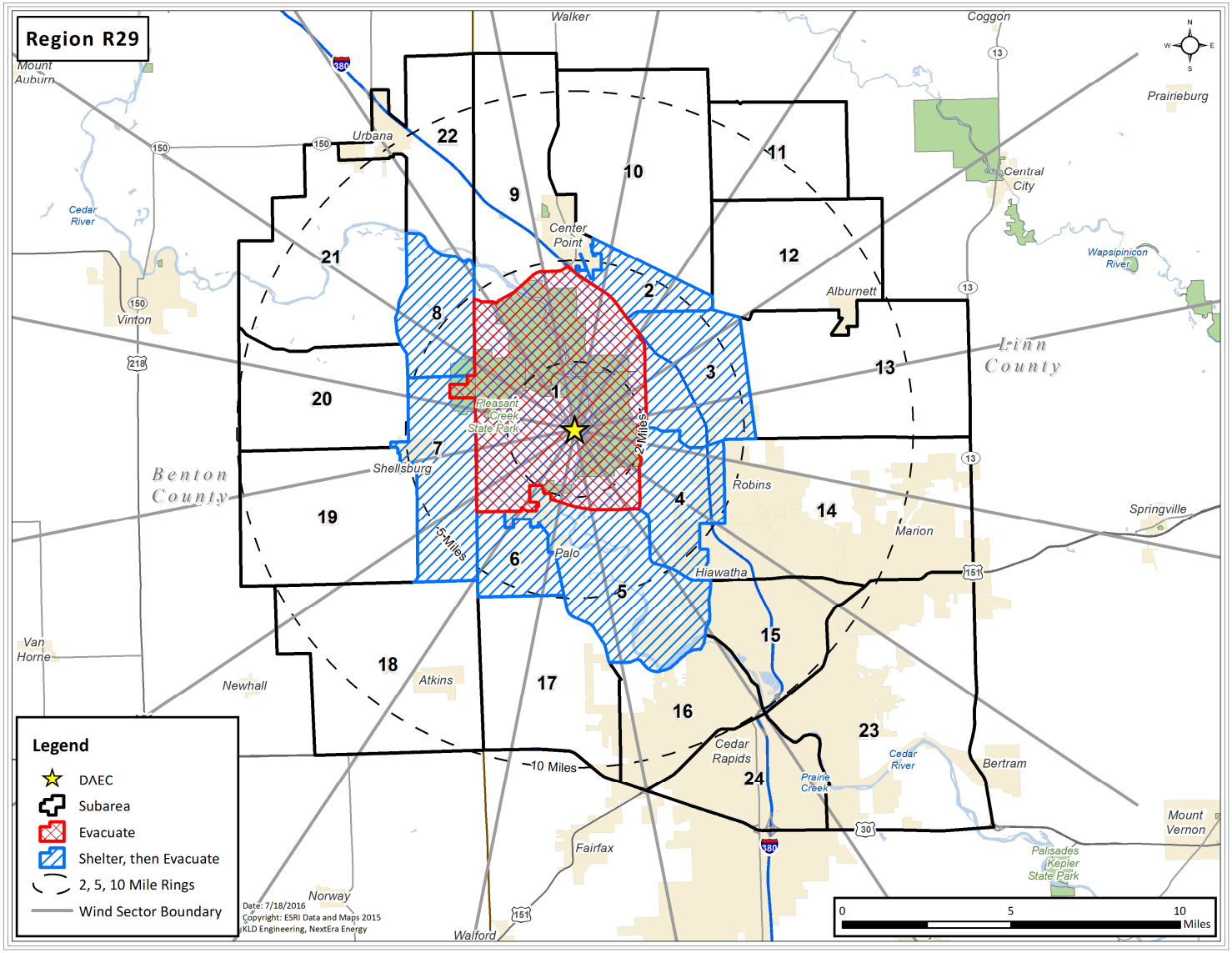

Figure H-29 Region R29

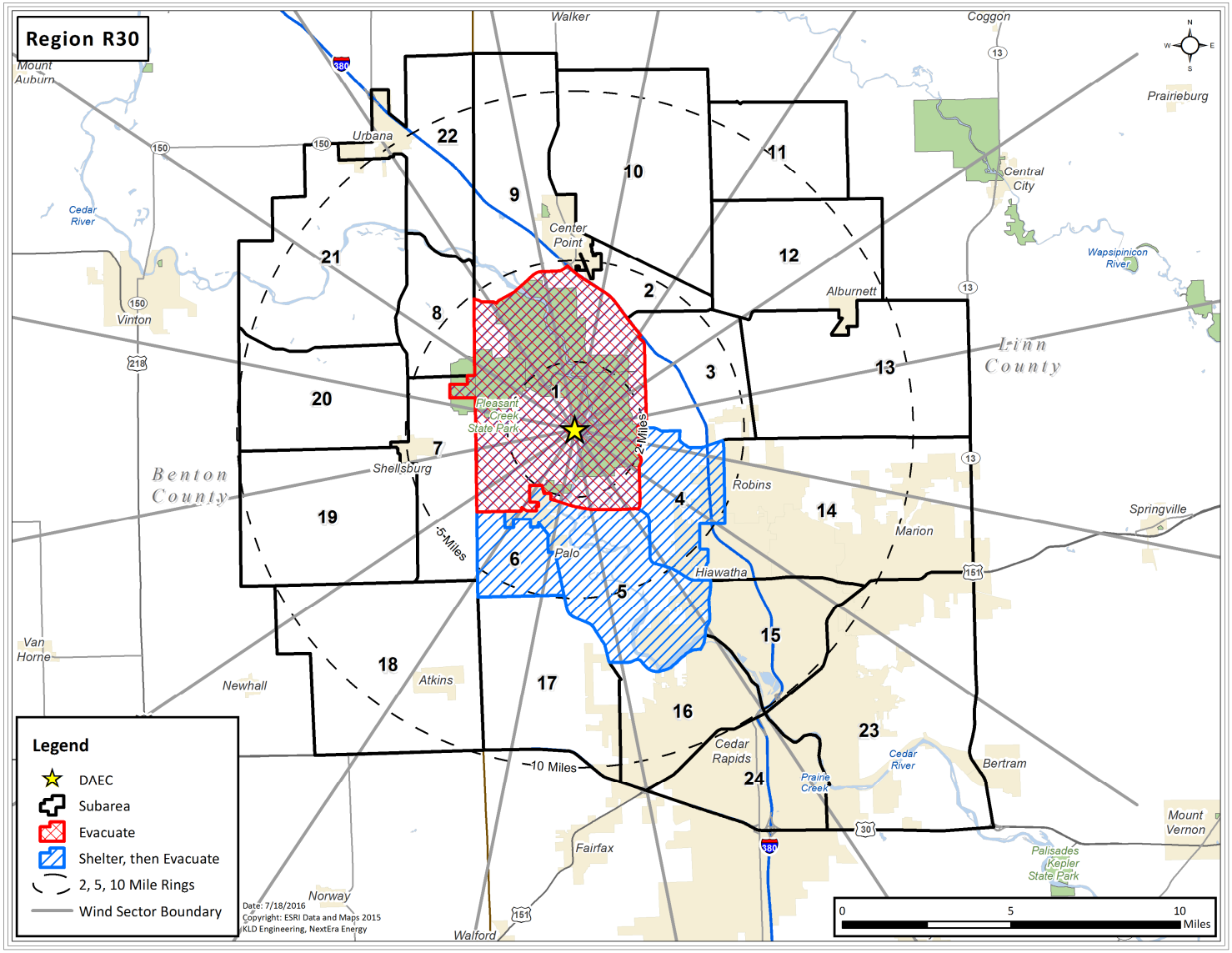

Figure H-30 Region R30

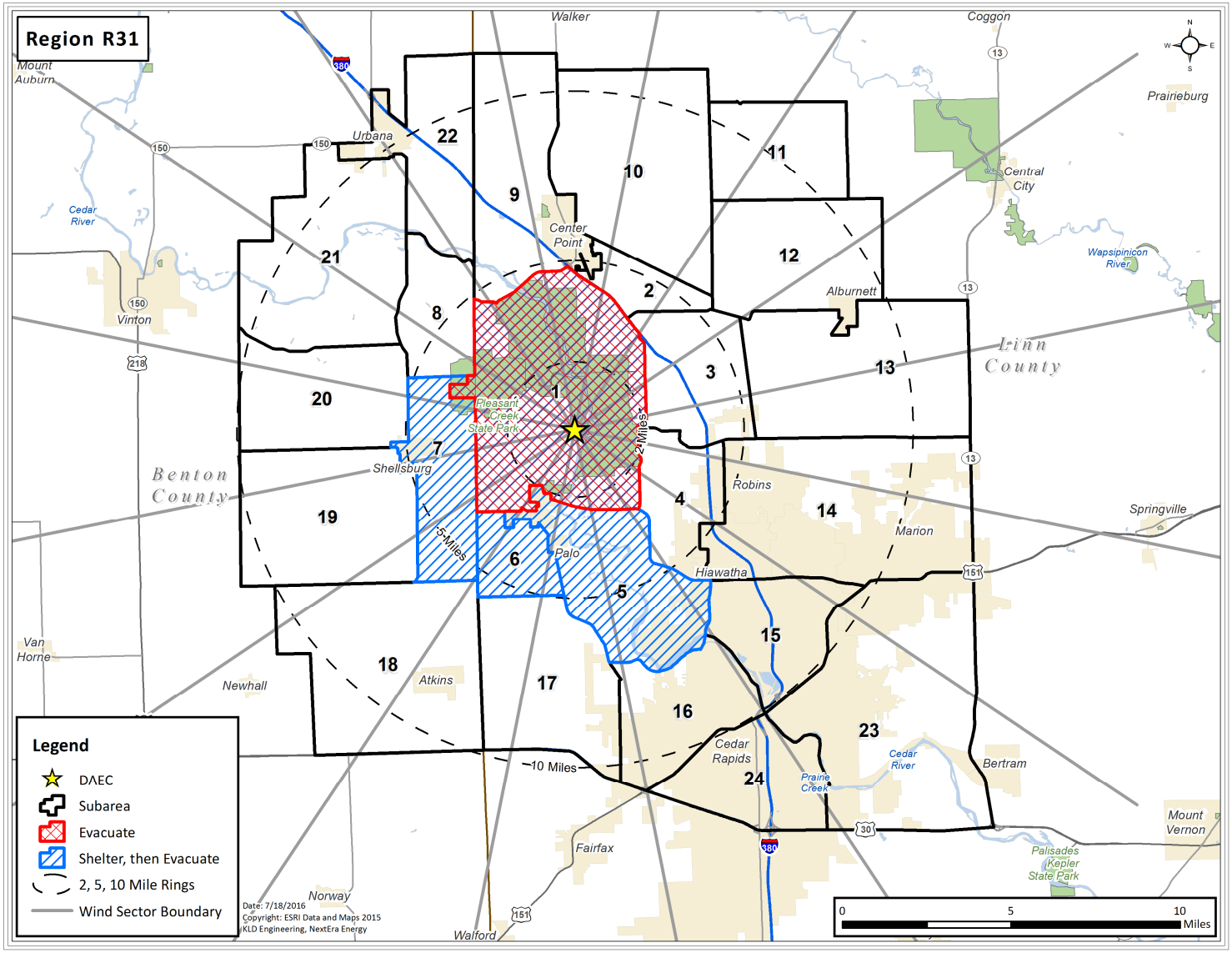

Figure H-31 Region R31

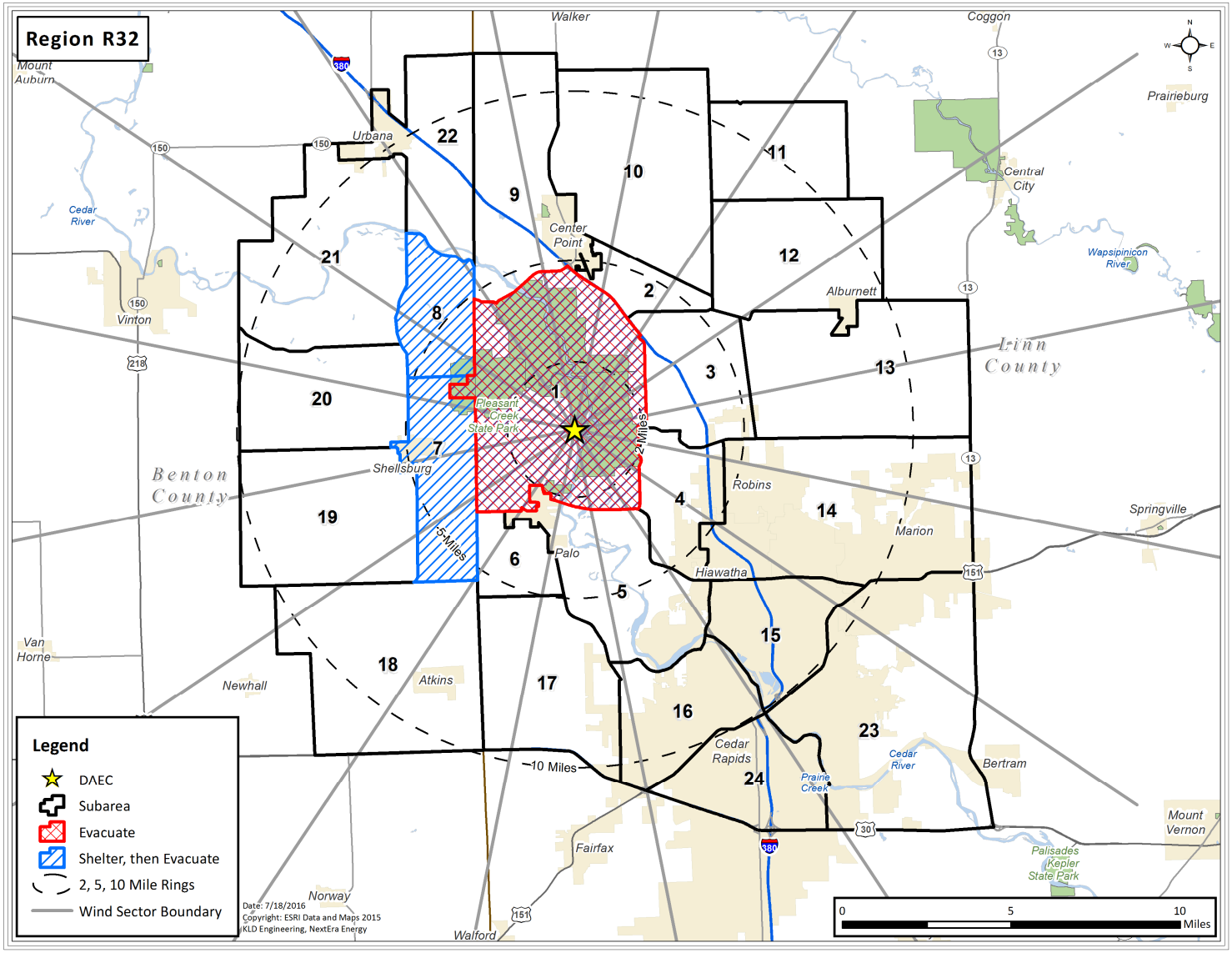

Figure H-32 Region R32

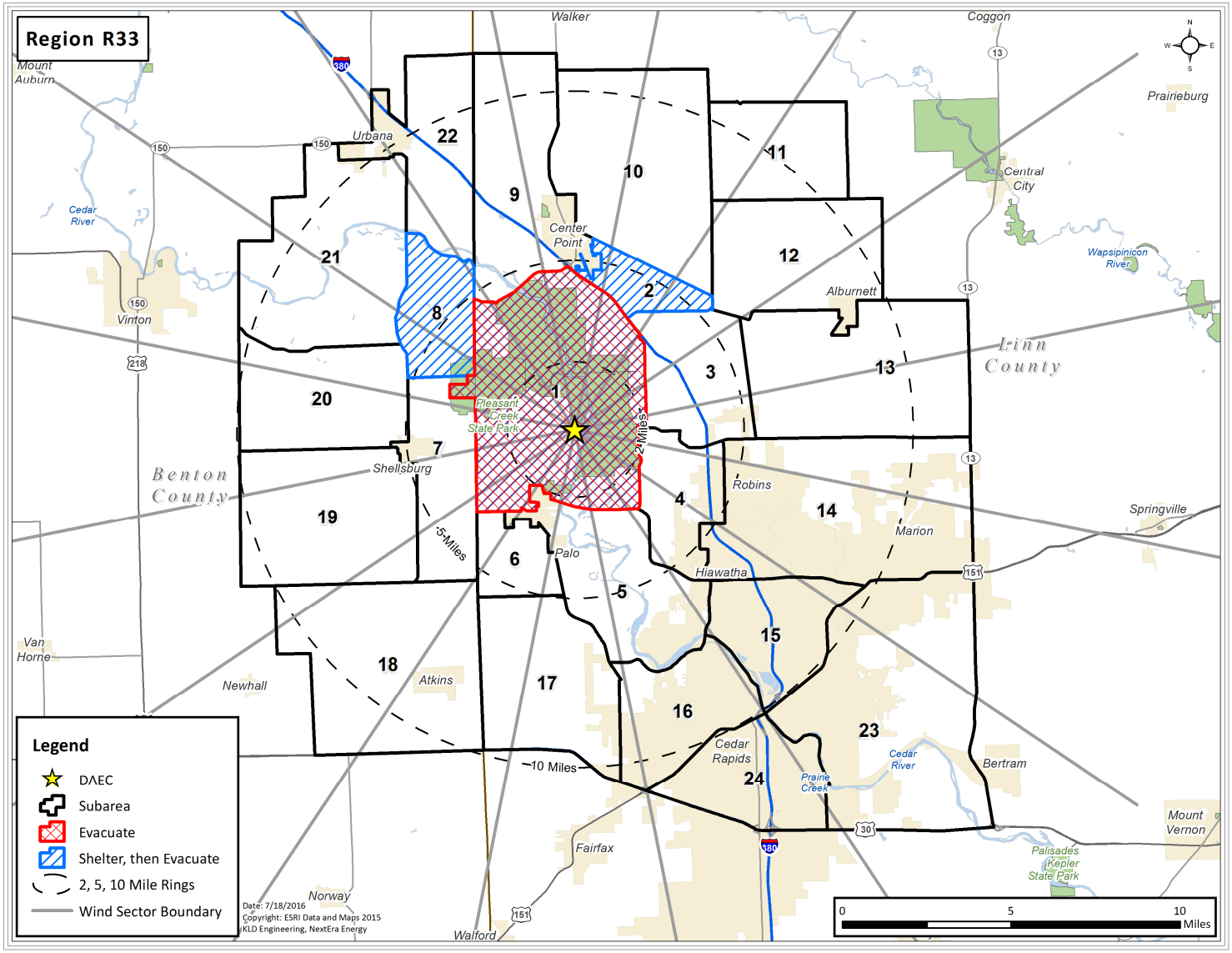

Figure H-33 Region R33

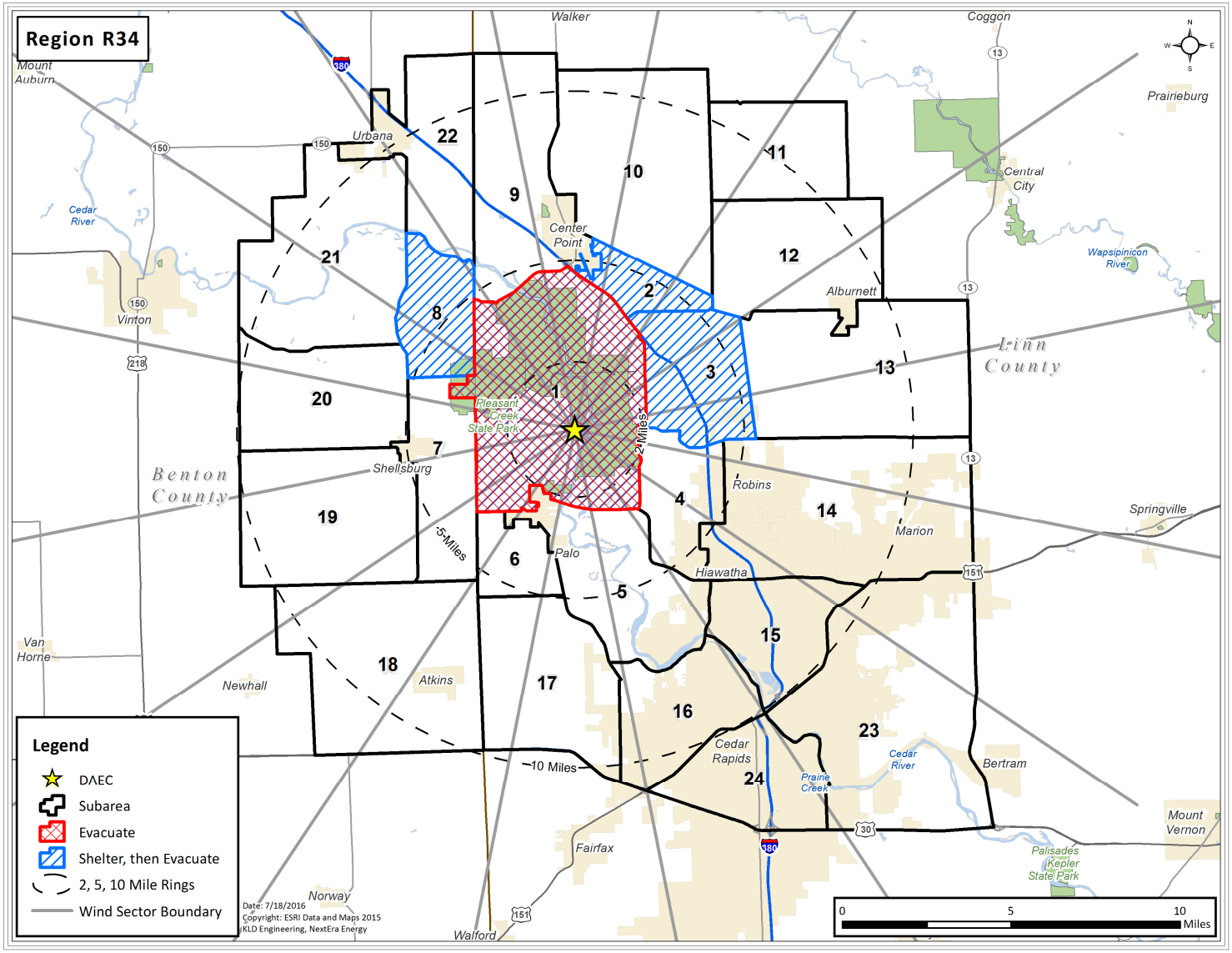

Figure H-34 Region R34

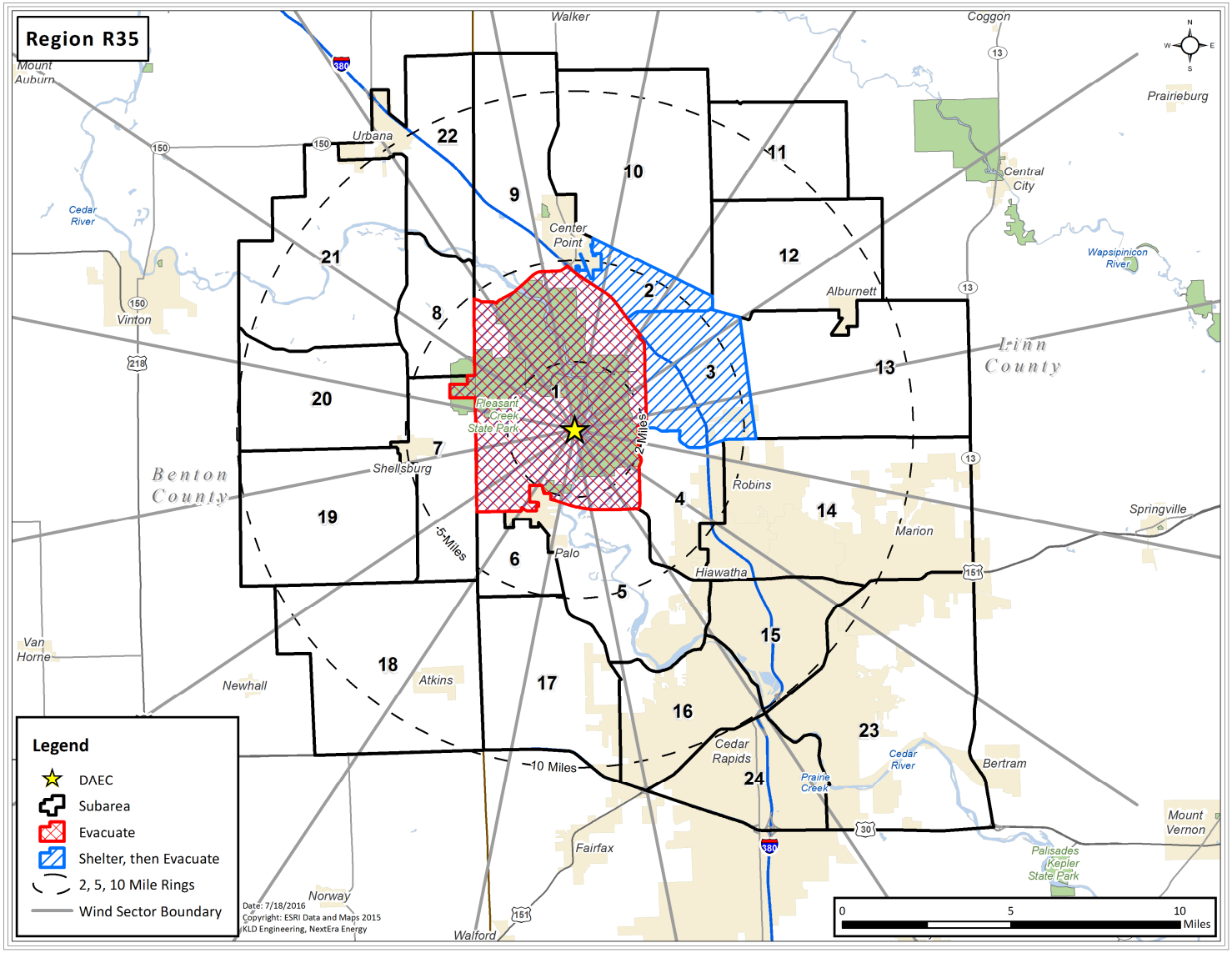

Figure H-35 Region R35

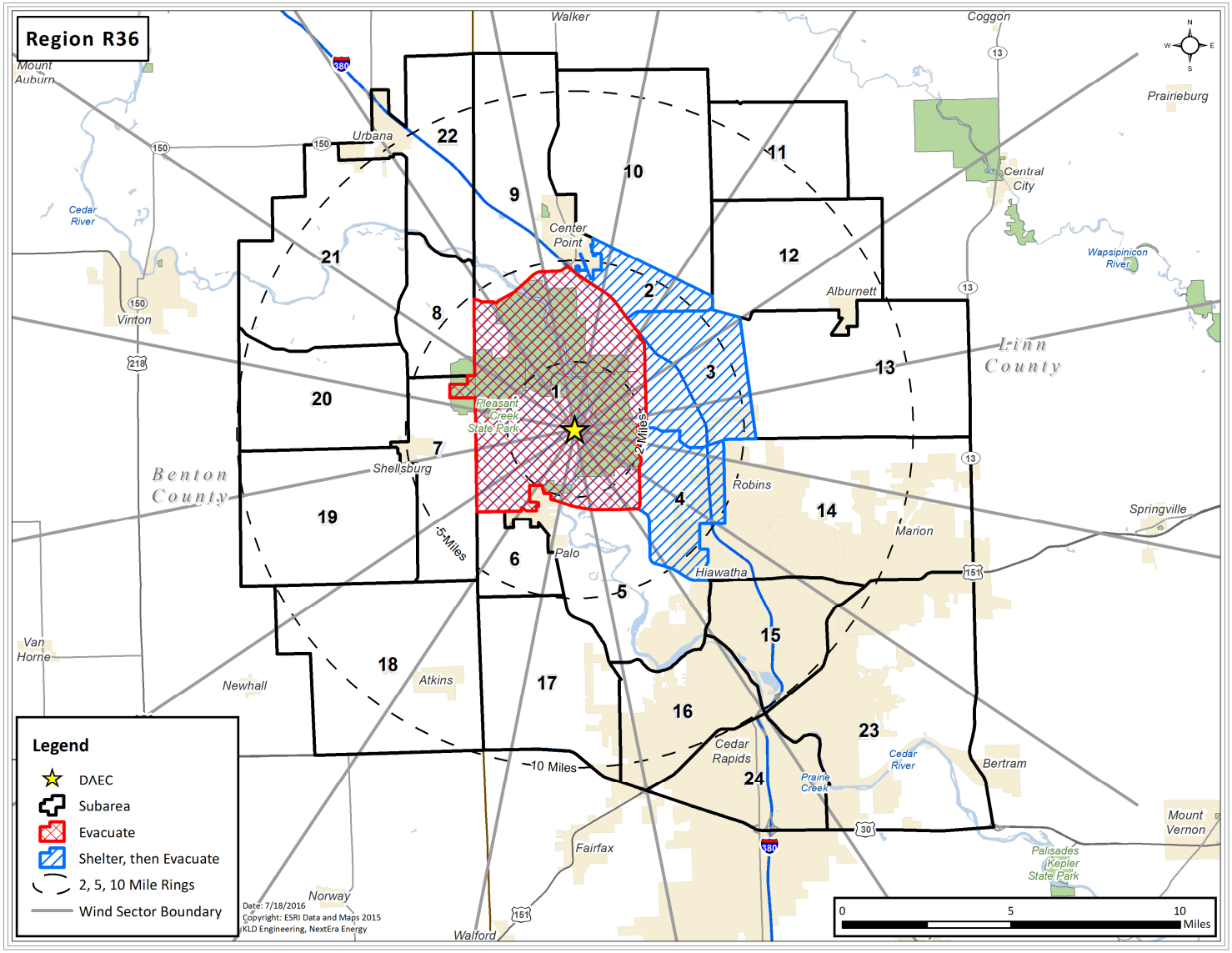

Figure H-36 Region R36

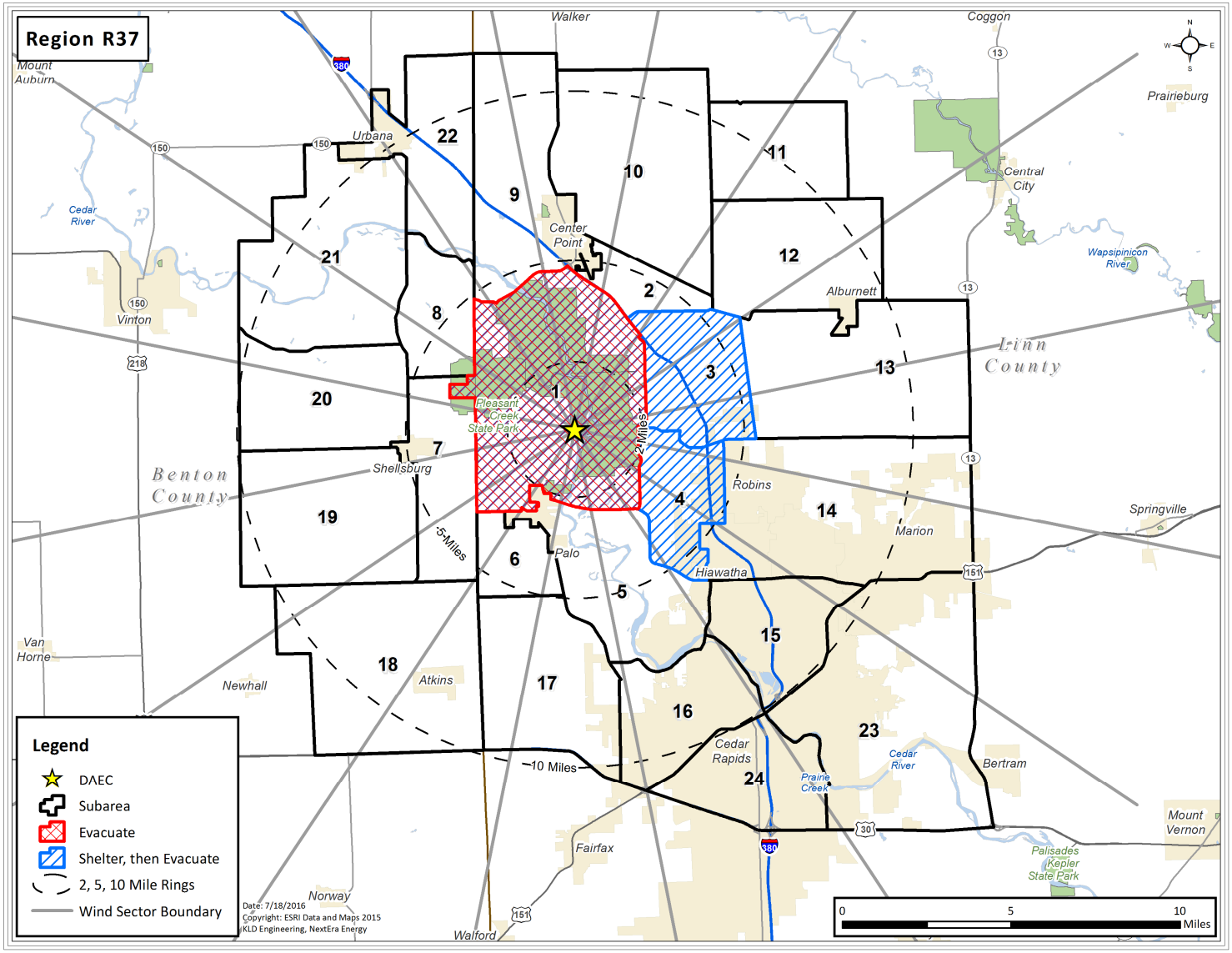

Figure H-37 Region R37

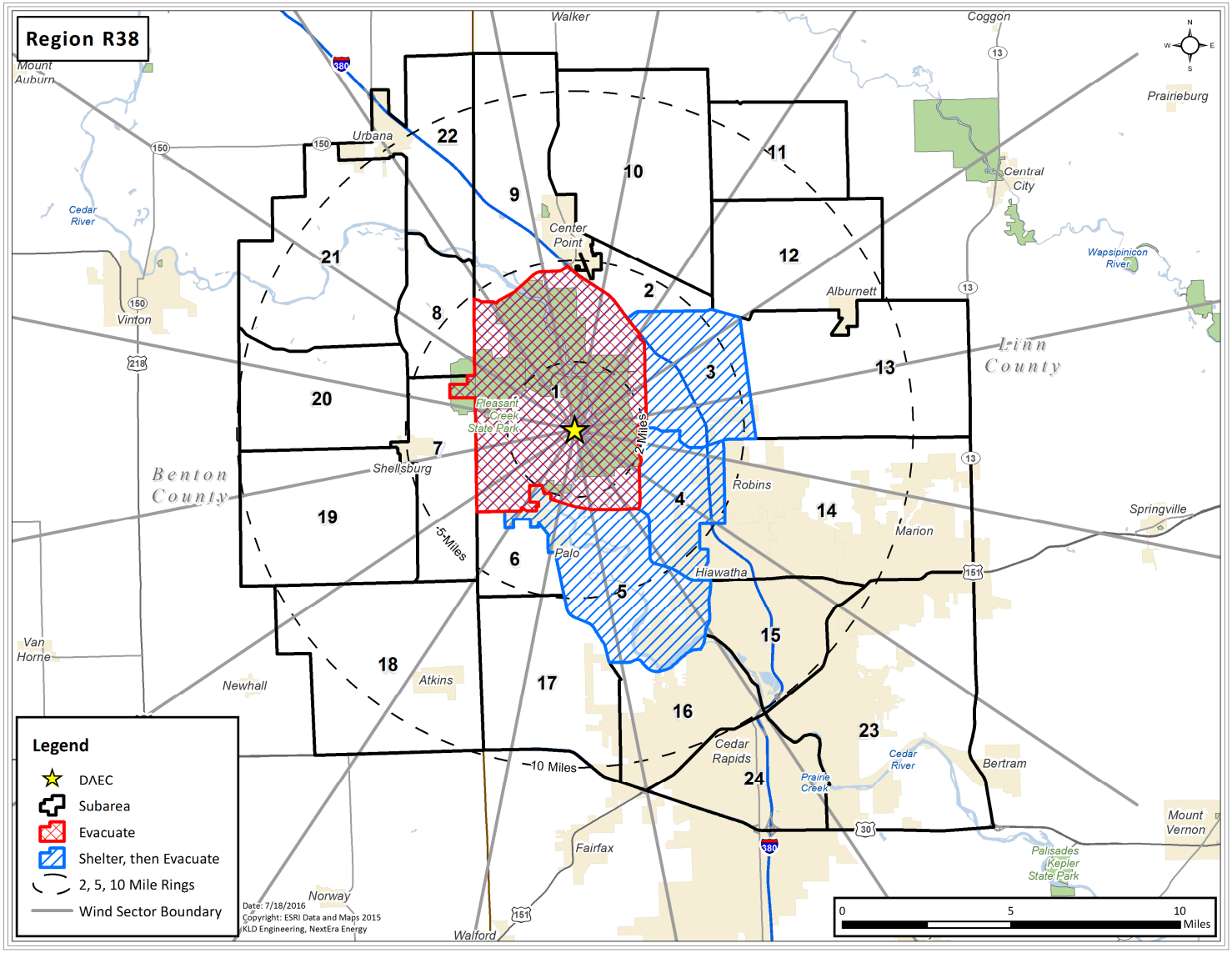

Figure H-38 Region R38

APPENDIX J

Representative Inputs to and Outputs from the DYNEV II System

J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM

This appendix presents data input to and output from the DYNEV II System. Table J-1 provides the volume and queues for the ten highest volume signalized intersections in the study area. Refer to Table K-2 and the figures in Appendix K for a map showing the geographic location of each intersection.

Table J-2 provides source (vehicle loading) and destination information for several roadway segments (links) in the analysis network. Refer to Table K-1 and the figures in Appendix K for a map showing the geographic location of each link.

Table J-3 provides network–wide statistics (average travel time, average speed and number of vehicles) for an evacuation of the entire EPZ (Region R03) for each scenario. As expected, Scenario 8 which is a snow (winter, midweek, snow) scenario during a midweek day condition, exhibits the slower average speed and longer average travel time than all other scenarios.

Table J-4 provides statistics (average speed and travel time) for the major evacuation routes – Interstate-380, US-30, and US-151B – for an evacuation of the entire EPZ (Region R03) under Scenario 1 conditions. As discussed in Section 7.3 and shown in Figures 7-3 through 7-8, US-151B in both directions, US-30 eastbound, and I-380 southbound are congested for most of the evacuation. As such, the average speeds are comparably slower (and travel times longer) on these major roadways than other major evacuation routes.

Table J-5 provides the number of vehicles discharged and the cumulative percent of total vehicles discharged for each link exiting the analysis network, for an evacuation of the entire EPZ (Region R03) under Scenario 1 conditions. Refer to Table K-1 and the figures in Appendix K for a map showing the geographic location of each link.

Figure J-1 through Figure J-14 plot the trip generation time versus the ETE for each of the 14 Scenarios considered. The distance between the trip generation and ETE curves is the travel time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. For low population density sites, the curves are close together, indicating short travel times and minimal traffic congestion. For higher population density sites, the curves are farther apart indicating longer travel times and the presence of traffic congestion. As seen in Figure J-1 through Figure J-14, the curves are significantly spatially separated as a result of the traffic congestion in the EPZ, which was discussed in detail in Section 7.3. The maximum travel time is about 3 to 5 hours for non-special scenarios, on average.

Table J-1. Characteristics of the Ten Highest Volume Signalized Intersections

Node	Location	Intersection Control	Approach (Up Node)	Total Volume (Veh)	Max. Turn Queue (Veh)
172	US-151B & 16th Ave SW	TCP - Actuated	626	3,786	220
			625	6,711	378
			664	10,888	652
			890	9,698	786
			TOTAL	31,083	-
155	IA-13 & Secrist Rd	Actuated	559	9,014	175
			319	16,450	450
			394	842	0
			TOTAL	26,306	-
154	US-151B & IA-13	TCP - Actuated	159	9,420	115
			487	10,841	75
			559	5,169	0
			TOTAL	25,430	-
156	IA-13 & Mt. Vernon Rd	Actuated	394	11,659	177
			988	9,825	61
			1025	44	0
			TOTAL	21,528	-
628	16th Ave SW & 18th St SW	Actuated	404	9,044	1020
			890	8,976	311
			889	2,440	847
			TOTAL	20,460	-
1105	US-151B & 6th St	TCP - Actuated	1107	12,568	1828
			1300	2,054	400
			1303	5,359	1036
			TOTAL	19,981	-
180	US-151B & Edgewood Rd SW	TCP - Actuated	405	1,184	33
			625	11,444	367
			1046	6,964	205
			TOTAL	19,592	-
890	16th Ave SW & 23rd St	Actuated	172	8,975	525
			628	9,521	976
			891	0	0
			TOTAL	18,496	-

Node	Location	Intersection Control	Approach (Up Node)	Total Volume (Veh)	Max. Turn Queue (Veh)
673	US-151B & 18th ST NW	Actuated	664	6,075	1043
			731	4,578	332
			972	7,724	164
			TOTAL	18,377	-
262	33rd Ave SW & 6th St	Actuated	261	8,026	729
			883	4,598	163
			884	5,726	1129
			TOTAL	18,350	-

Table J-2. Sample Simulation Model Input

Link Number	Vehicles Entering Network on this Link	Directional Preference	Destination Nodes	Destination Capacity
359	16	SW	8003	4,500
			8618	4,500
1229	49	W	8003	4,500
			8090	1,700
			8587	1,700
598	200	SE	8983	1,700
			8618	4,500
			8216	1,700
1403	342	SE	8618	4,500
			8983	1,700
			8216	1,700
995	284	SE	8618	4,500
			8983	1,700
			8216	1,700
1346	313	S	8619	1,700
			8983	1,700
			8618	4,500
728	71	SE	8618	4,500
			8983	1,700
			8216	1,700
1418	100	SE	8619	1,700
			8983	1,700
			8618	4,500
820	954	SE	8983	1,700
			8618	4,500
			8216	1,700
244	184	W	8003	4,500
			8090	1,700
			8587	1,700

Table J-3. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03)

Scenario	1	2	3	4	5	6	7
Network-Wide Average Travel Time (Min/Veh-Mi)	7.4	8.3	6.2	7.1	6.3	7.5	8.3
Network-Wide Average Speed (mph)	8.1	7.2	9.6	8.5	9.5	8.0	7.2
Total Vehicles Exiting Network	165,760	165,440	135,775	136,052	127,951	168,035	168,294
Scenario	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Network-Wide Average Travel Time (Min/Veh-Mi)	9.1	6.2	6.8	7.5	6.2	6.7	7.4
Network-Wide Average Speed (mph)	6.6	9.8	8.8	8.1	9.6	9.0	8.1
Total Vehicles Exiting Network	168,749	133,048	133,315	132,999	126,556	135,044	165,551

Table J-4. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1)

Elapsed Time (hours)																			
		1		2		3		4		5		6		7		8		9	
Route#	Length (miles)	Speed (mph)	Travel Time (min)	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time
I-380 SB	27.7	5.8	288.9	4.2	392.5	4.8	344.6	7.6	218.2	8.2	201.9	13.5	123.0	70.0	23.8	70.0	23.8	70.0	23.8
I-380 NB	29.7	70.0	25.4	69.9	25.4	70.0	25.4	70.0	25.4	60.0	29.6	70.0	25.4	70.0	25.4	70.0	25.4	70.0	25.4
US-30 EB	22.8	57.0	24.0	7.5	182.8	14.8	92.8	8.8	155.9	9.5	144.4	6.4	215.4	38.4	35.7	63.8	21.5	63.8	21.5
US-30 WB	22.8	46.8	29.3	23.3	58.7	13.2	103.9	11.1	123.3	13.2	103.8	10.2	133.8	12.8	107.4	40.5	33.8	63.8	21.5
US-151B EB	8.3	2.3	217.0	1.5	327.8	1.4	344.8	1.9	260.9	4.9	102.2	9.8	50.9	41.5	12.0	41.5	12.0	41.5	12.0
US-151B WB	9.6	2.9	194.7	1.6	353.0	2.2	265.4	2.5	232.5	8.9	64.2	36.0	15.9	48.0	12.0	48.7	11.8	48.7	11.8

Table J-5. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1

Network Exit Link	Elapsed Time (hours)								
	1	2	3	4	5	6	7	8	9
	Cumulative Vehicles Discharged by the Indicated Time								
	Cumulative Percent of Vehicles Discharged by the Indicated Time								
187	87	299	338	343	343	343	343	343	343
	1%	1%	1%	0%	0%	0%	0%	0%	0%
194	172	452	496	499	499	499	499	499	499
	1%	1%	1%	1%	0%	0%	0%	0%	0%
203	1,972	5,703	7,828	8,889	9,699	9,743	9,743	9,743	9,743
	11%	14%	12%	11%	9%	8%	7%	7%	6%
230	354	1,205	1,342	1,364	1,364	1,364	1,364	1,364	1,364
	2%	3%	2%	2%	1%	1%	1%	1%	1%
259	99	306	343	347	347	347	347	347	347
	1%	1%	1%	0%	0%	0%	0%	0%	0%
299	674	2,319	3,940	5,220	6,100	6,107	6,107	6,107	6,107
	4%	6%	6%	6%	6%	5%	5%	4%	4%
888	51	259	309	316	316	316	316	316	316
	0%	1%	0%	0%	0%	0%	0%	0%	0%
1109	1,418	2,928	4,514	6,045	7,565	9,026	10,554	12,093	13,408
	8%	7%	7%	7%	7%	8%	8%	8%	8%
1580	75	226	251	252	252	252	252	252	252
	0%	1%	0%	0%	0%	0%	0%	0%	0%
1716	443	1,228	2,044	2,645	3,145	3,146	3,146	3,146	3,146
	3%	3%	3%	3%	3%	3%	2%	2%	2%
1717	200	1,147	1,440	1,480	1,480	1,480	1,480	1,480	1,480
	1%	3%	2%	2%	1%	1%	1%	1%	1%
1745	157	589	659	666	666	666	666	666	666
	1%	1%	1%	1%	1%	1%	0%	0%	0%
1872	1,549	3,089	4,620	6,148	7,676	9,204	10,789	12,324	13,568
	9%	7%	7%	7%	8%	8%	8%	8%	8%
1879	4,435	8,916	13,390	17,867	22,338	26,812	31,289	34,221	35,441
	26%	21%	21%	21%	22%	23%	23%	23%	22%
1977	1,037	2,324	3,745	5,043	6,347	7,704	9,099	10,072	10,761
	6%	6%	6%	6%	6%	6%	7%	7%	7%
1992	831	1,810	2,388	3,311	4,697	6,105	7,469	8,761	9,824
	5%	4%	4%	4%	5%	5%	6%	6%	6%
1996	309	1,209	2,907	4,605	6,067	7,296	8,454	9,660	10,737
	2%	3%	5%	6%	6%	6%	6%	6%	7%

Network Exit Link	Elapsed Time (hours)								
	1	2	3	4	5	6	7	8	9
	Cumulative Vehicles Discharged by the Indicated Time								
	Cumulative Percent of Vehicles Discharged by the Indicated Time								
2008	746	2,147	3,562	4,977	6,391	7,806	9,221	10,636	12,051
	4%	5%	6%	6%	6%	7%	7%	7%	8%
2058	2,195	5,060	8,386	11,495	14,697	17,849	20,946	23,889	25,853
	13%	12%	13%	14%	14%	15%	15%	16%	16%
2062	367	905	1,290	1,847	2,344	2,885	3,468	4,011	4,364
	2%	2%	2%	2%	2%	2%	3%	3%	3%

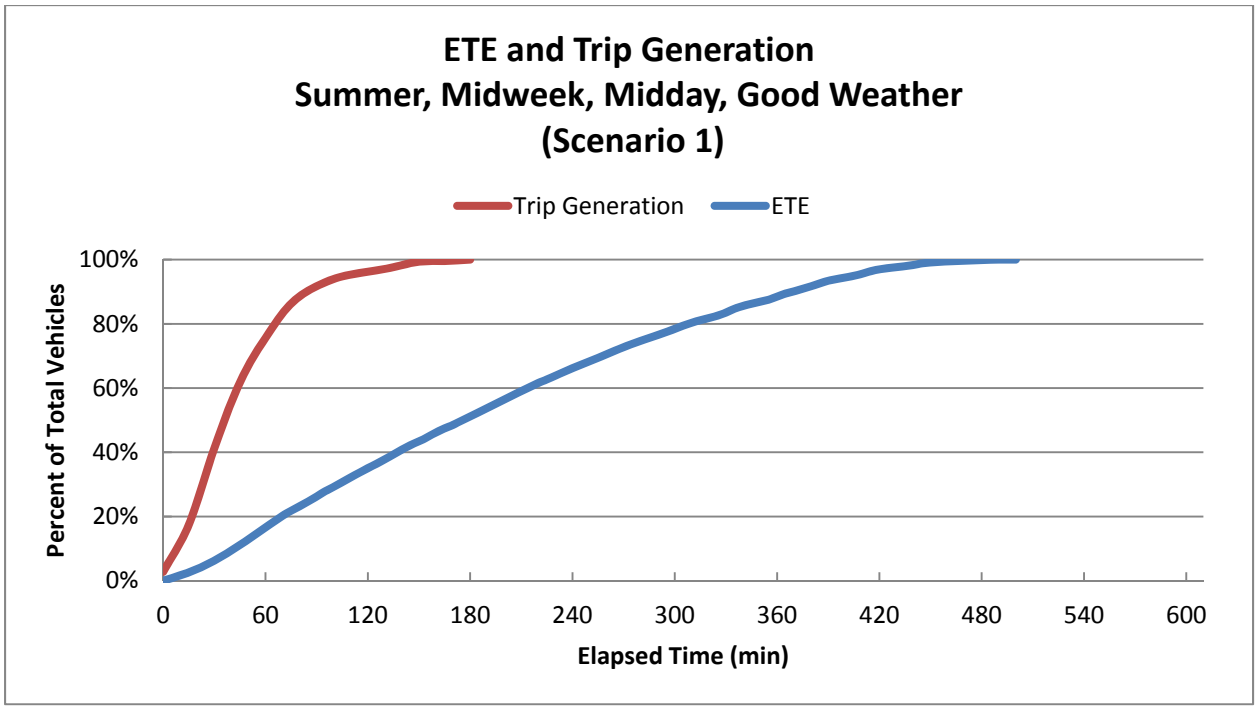

Figure J-1. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)

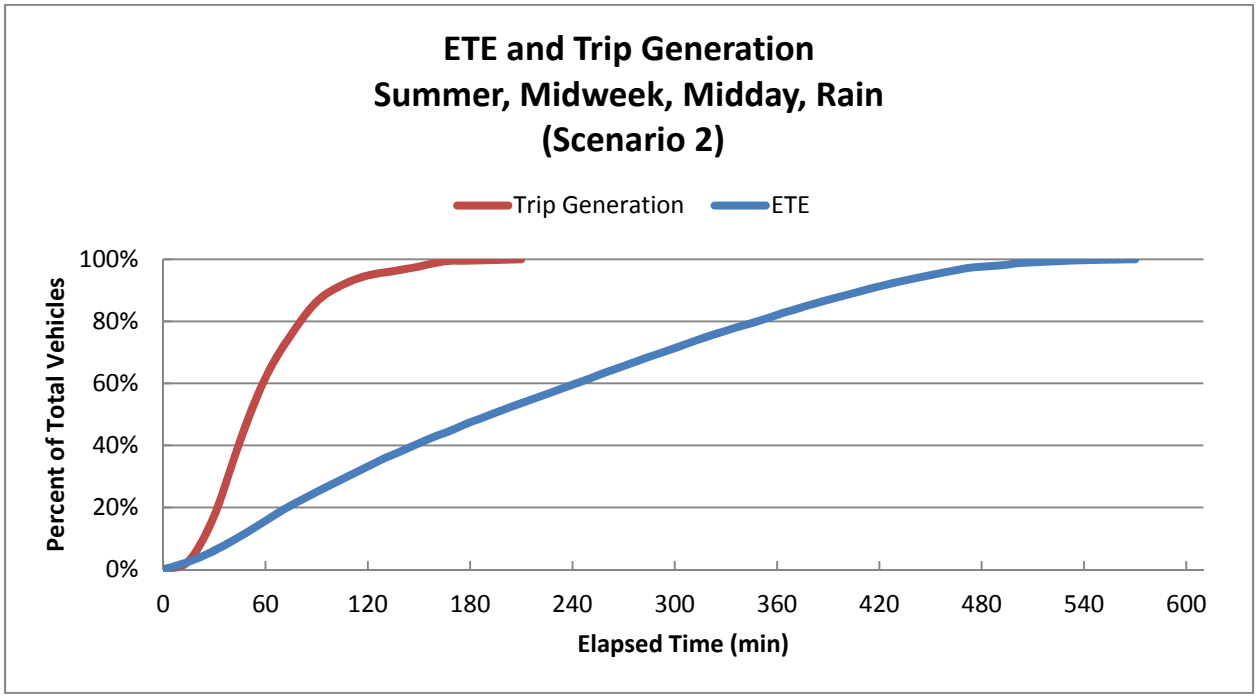

Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)

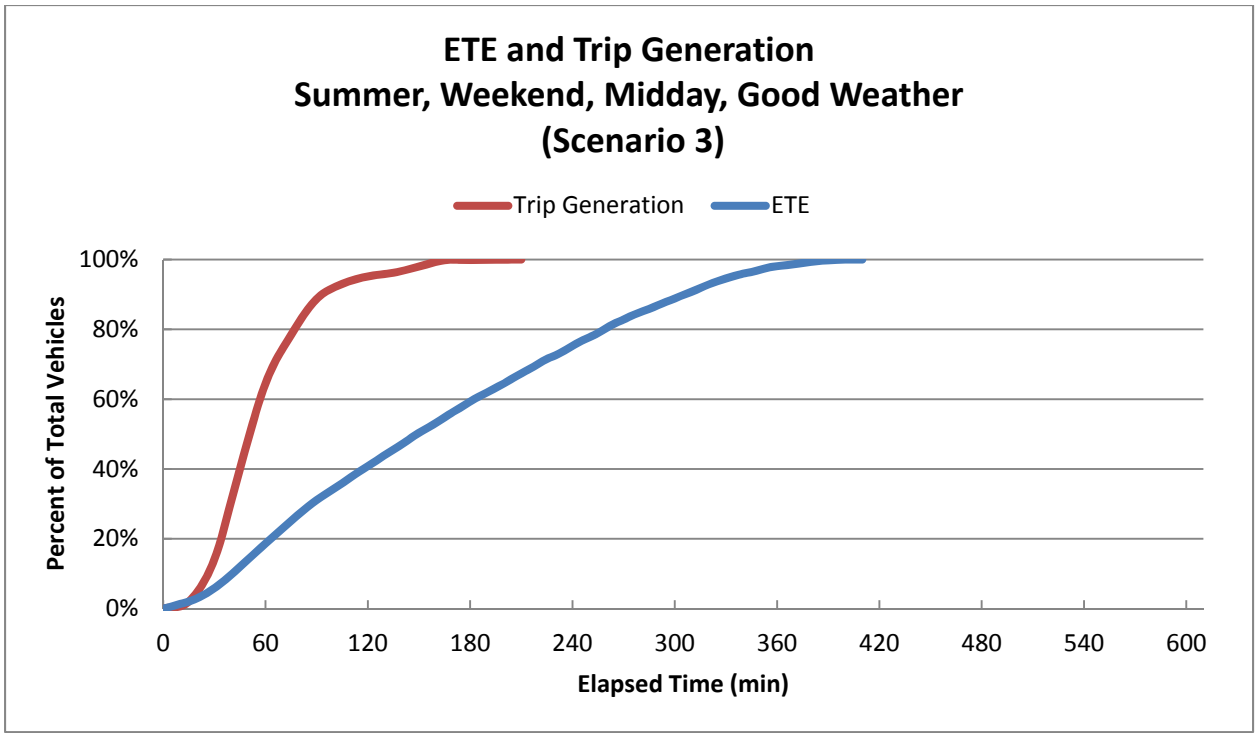

Figure J-3. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)

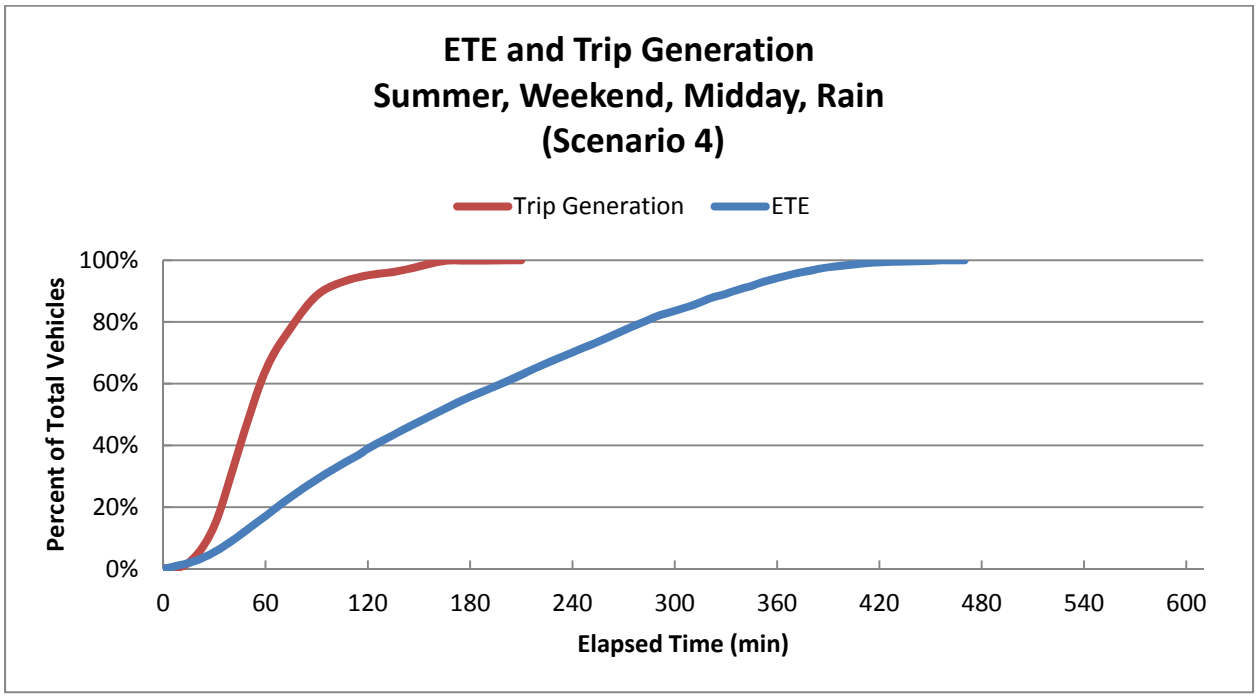

Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)

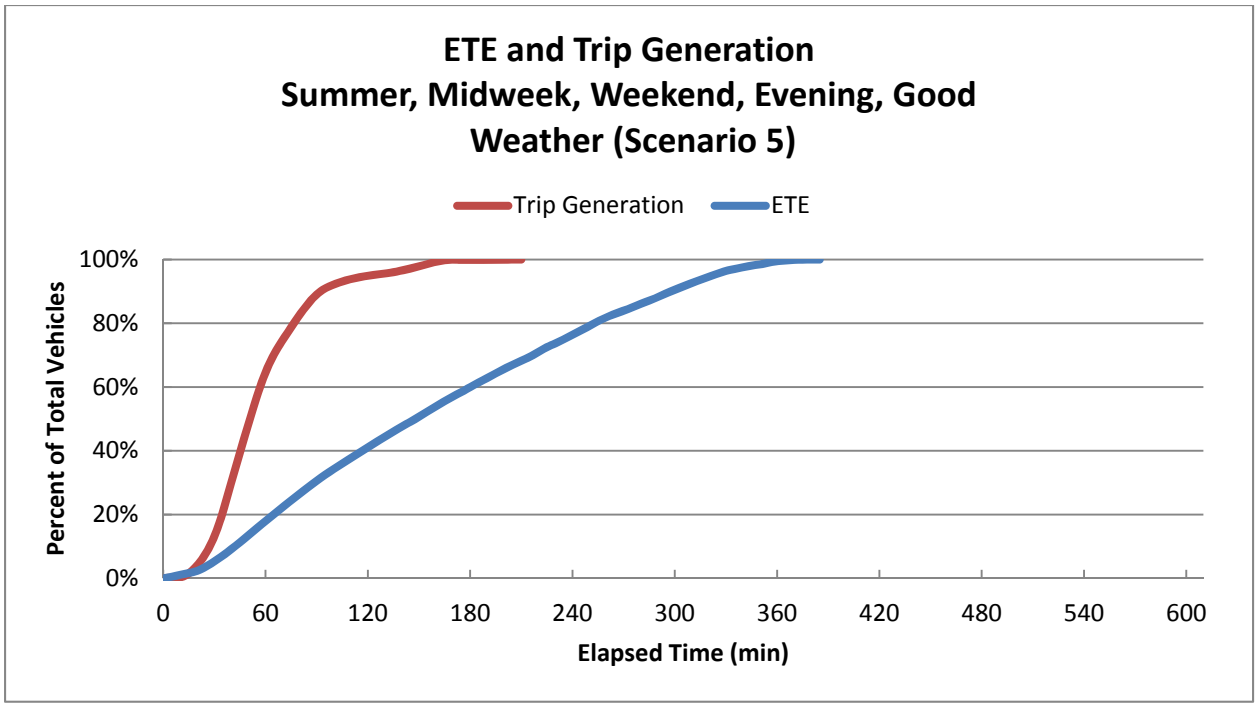

Figure J-5. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)

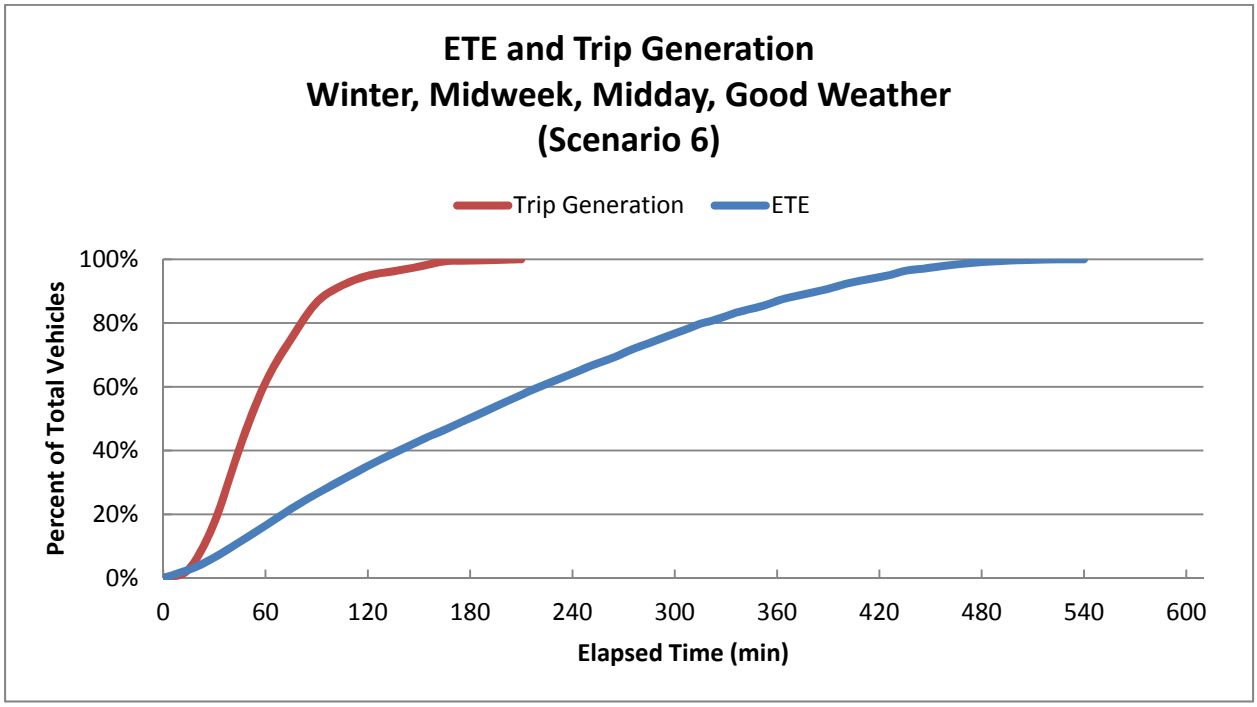

Figure J-6. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)

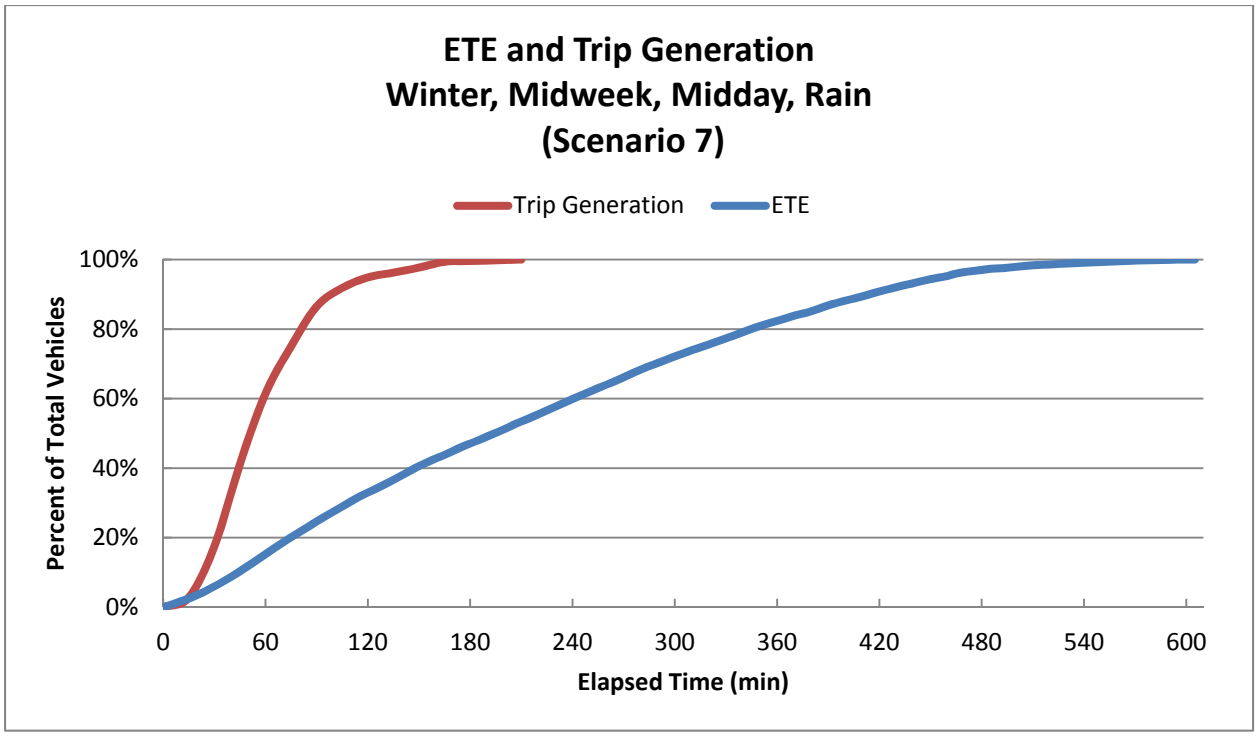

Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7)

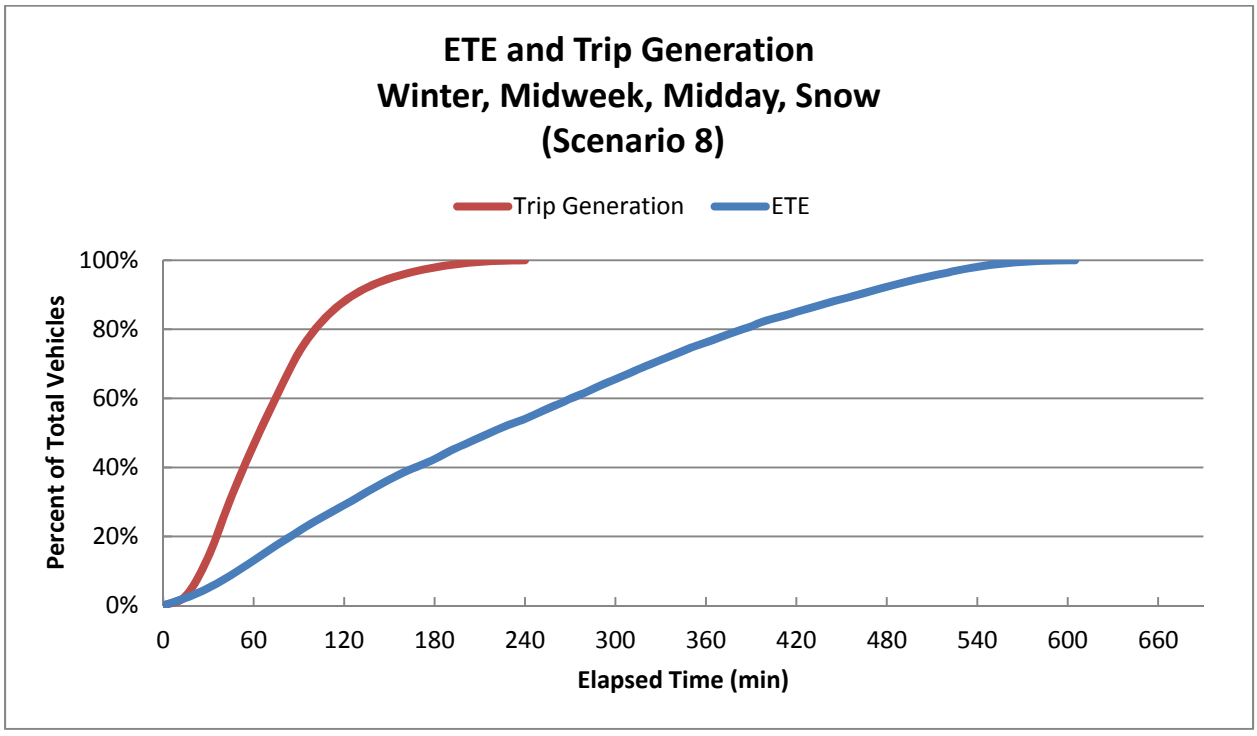

Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Snow (Scenario 8)

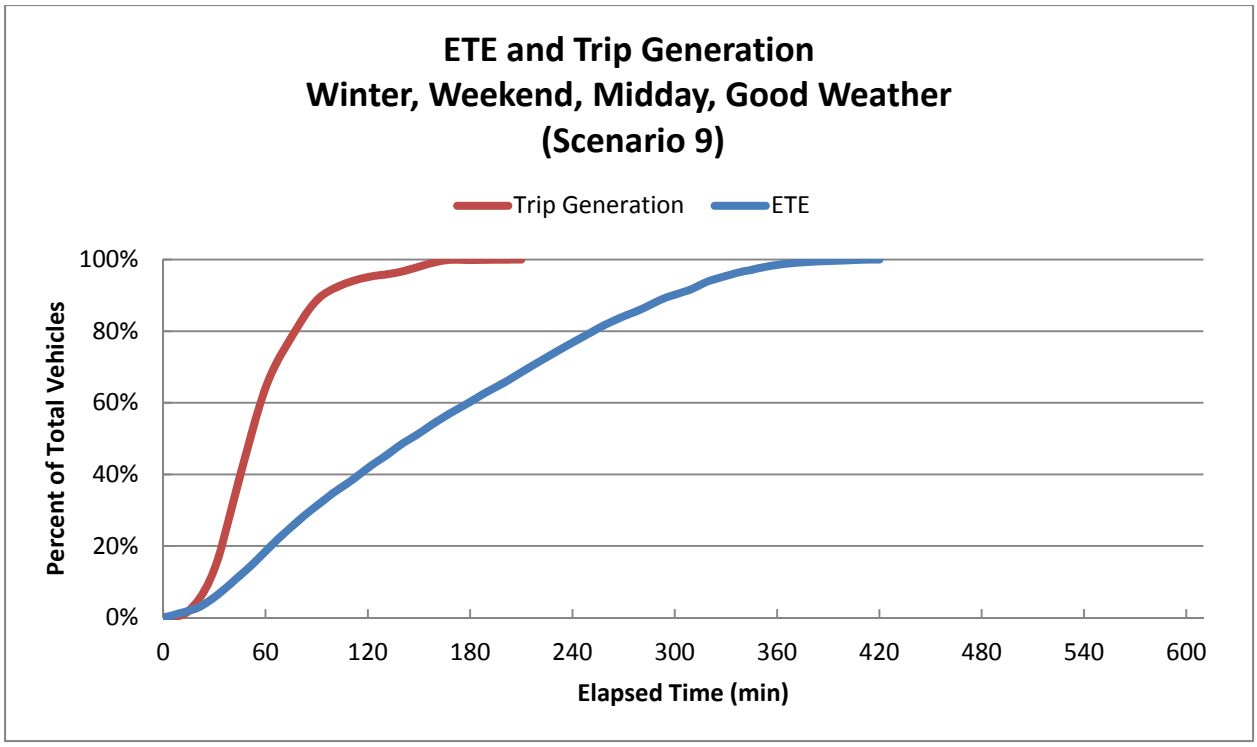

Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9)

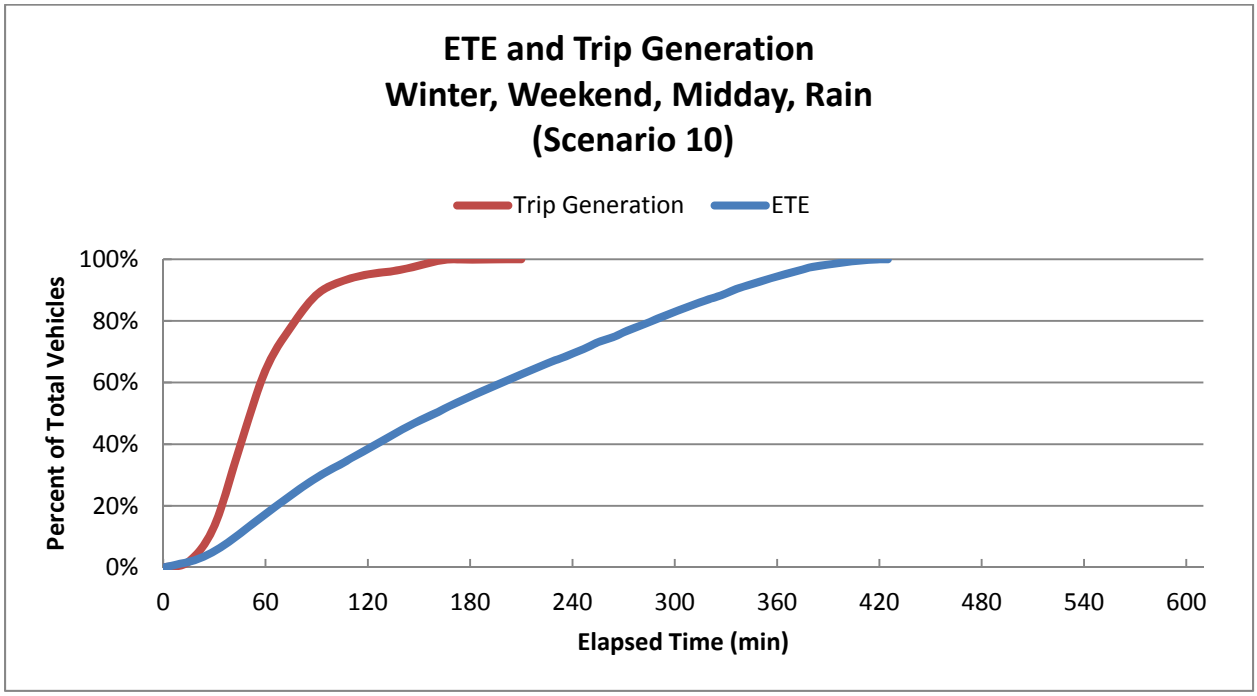

Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 10)

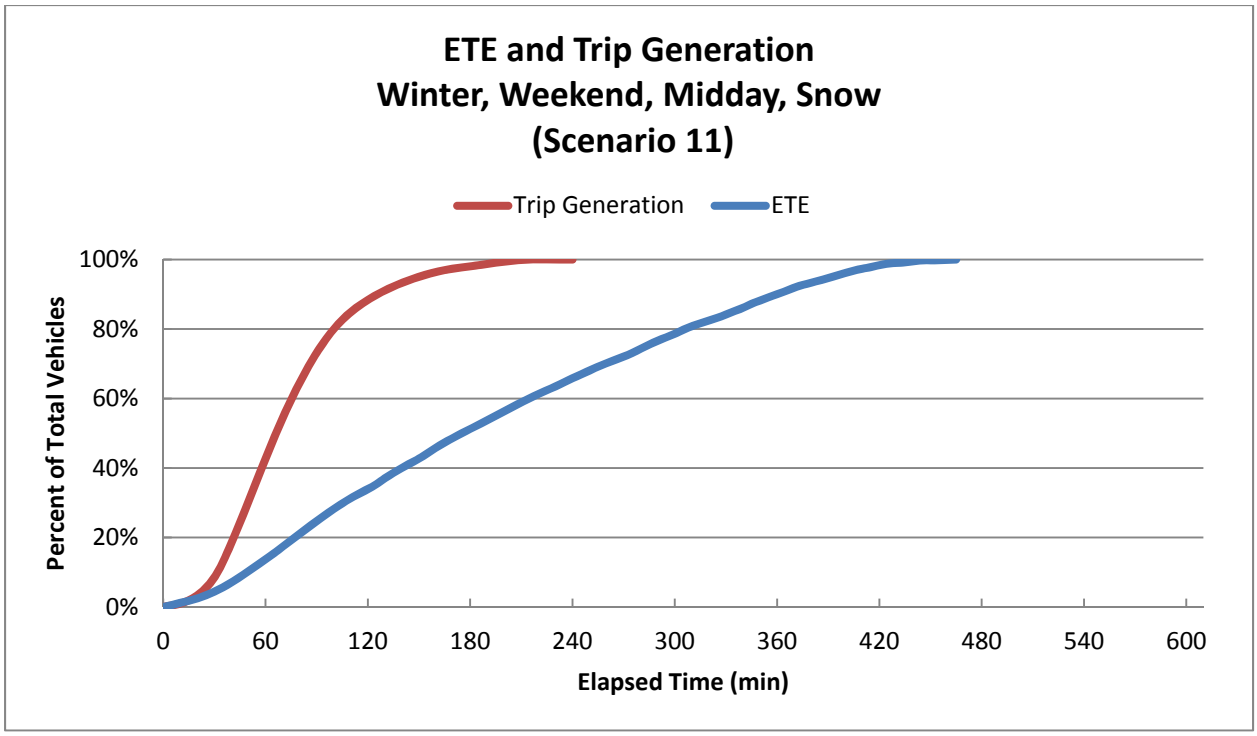

Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Snow (Scenario 11)

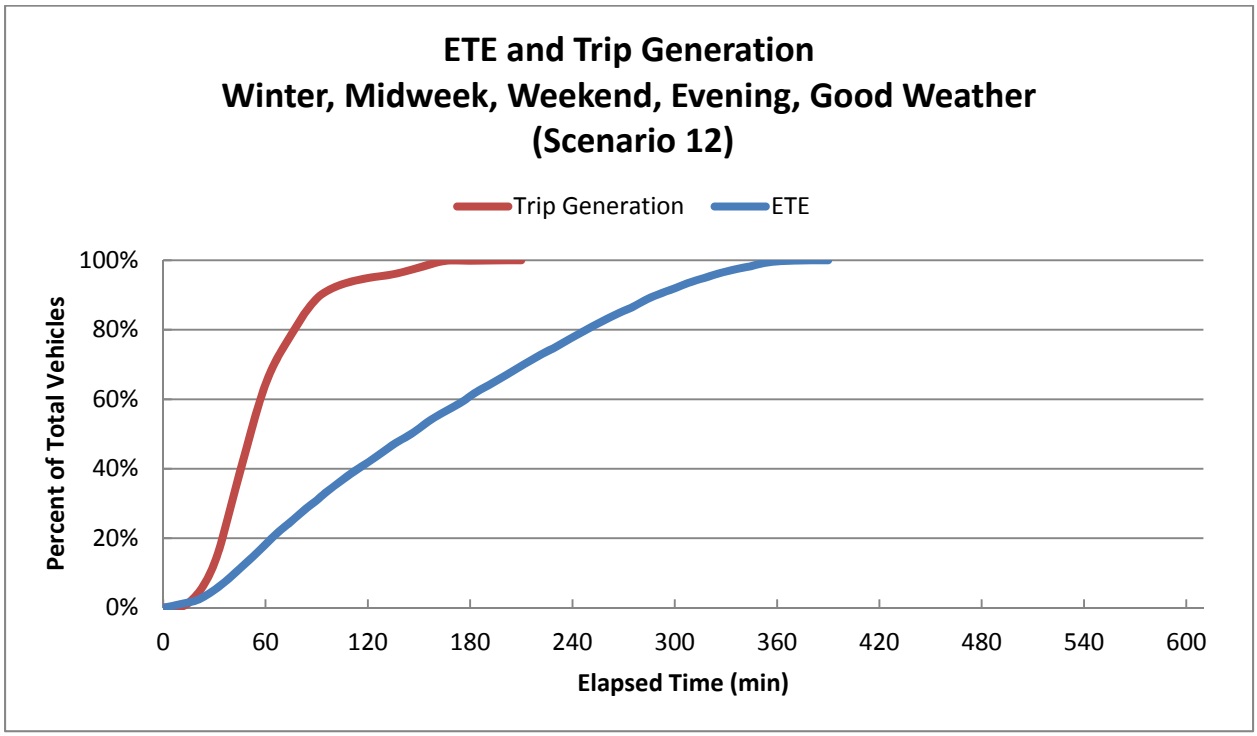

Figure J-12. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12)

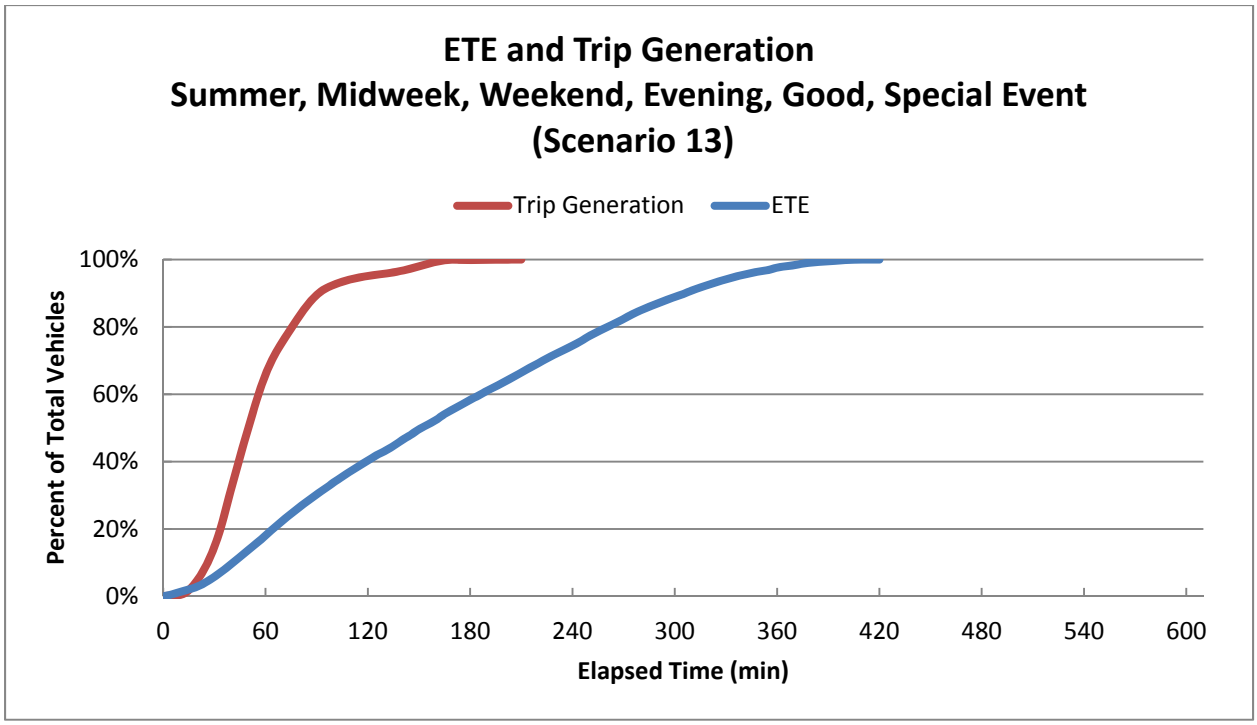

Figure J-13. ETE and Trip Generation: Summer, Evening, Good Weather, Special Event (Scenario 13)

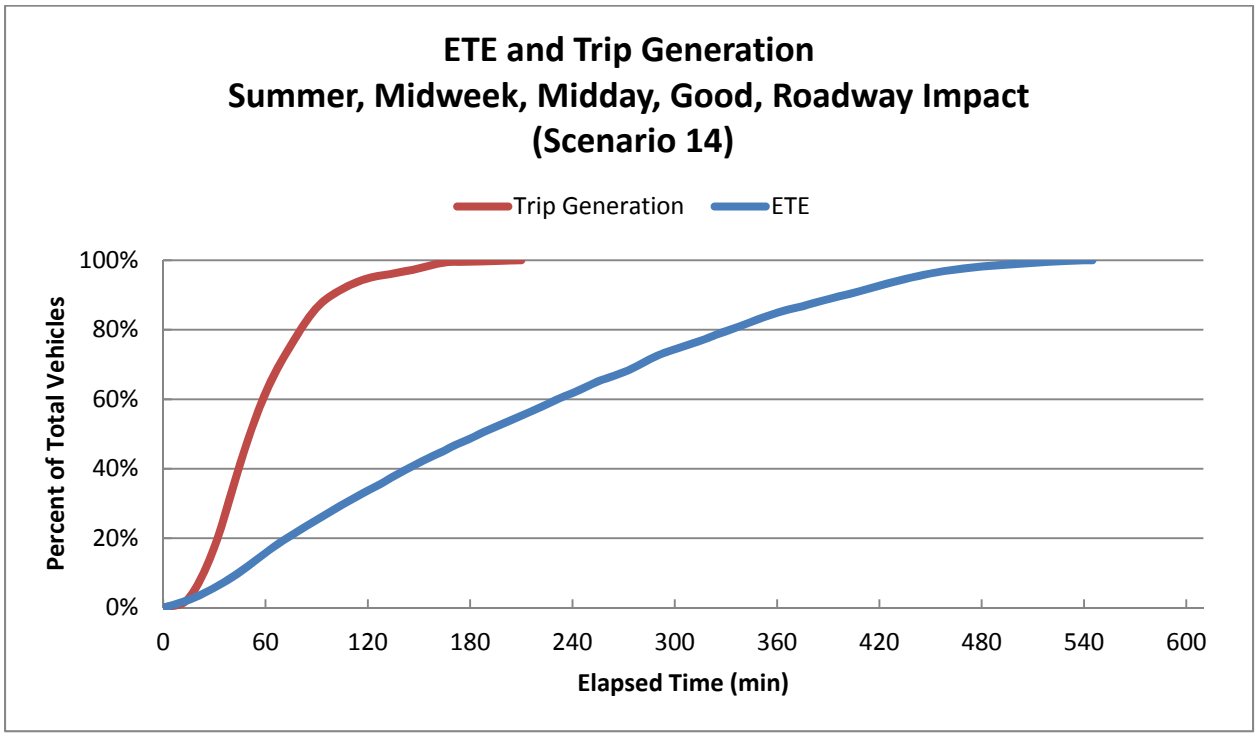

Figure J-14. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14)

APPENDIX K

Evacuation Roadway Network

K. EVACUATION ROADWAY NETWORK

As discussed in Section 1.3, a link-node analysis network was constructed to model the roadway network within the study area. Figure K-1 provides an overview of the link-node analysis network. The figure has been divided up into 30 more detailed figures (Figure K-2 through Figure K-32) which show each of the links and nodes in the network.

The analysis network was calibrated using the observations made during the field survey conducted in February 2012 as well as observations from Google Earth in late 2016/early 2017. Table K-1 lists the characteristics of each roadway section modeled in the ETE analysis. Each link is identified by its road name and the upstream and downstream node numbers. The geographic location of each link can be observed by referencing the grid map number provided in Table K-1. The roadway type identified in Table K-1 is generally based on the following criteria:

- Freeway: limited access highway, 2 or more lanes in each direction, high free flow speeds
- Freeway ramp: ramp on to or off of a limited access highway
- Major arterial: 3 or more lanes in each direction
- Minor arterial: 2 or more lanes in each direction
- Collector: single lane in each direction
- Local roadways: single lane in each direction, local roads with low free flow speeds

The term, "No. of Lanes" in Table K-1 identifies the number of lanes that extend throughout the length of the link. Many links have additional lanes on the immediate approach to an intersection (turn pockets); these have been recorded and entered into the input stream for the DYNEV II System.

As discussed in Section 1.3, lane width and shoulder width were not physically measured during the road survey. Rather, estimates of these measures were based on visual observations and recorded images.

Table K-2 identifies each node in the network that is controlled and the type of control (stop sign, yield sign, pre-timed signal, actuated signal, traffic control point) at that node. Uncontrolled nodes are not included in Table K-2. The location of each node can be observed by referencing the grid map number provided.

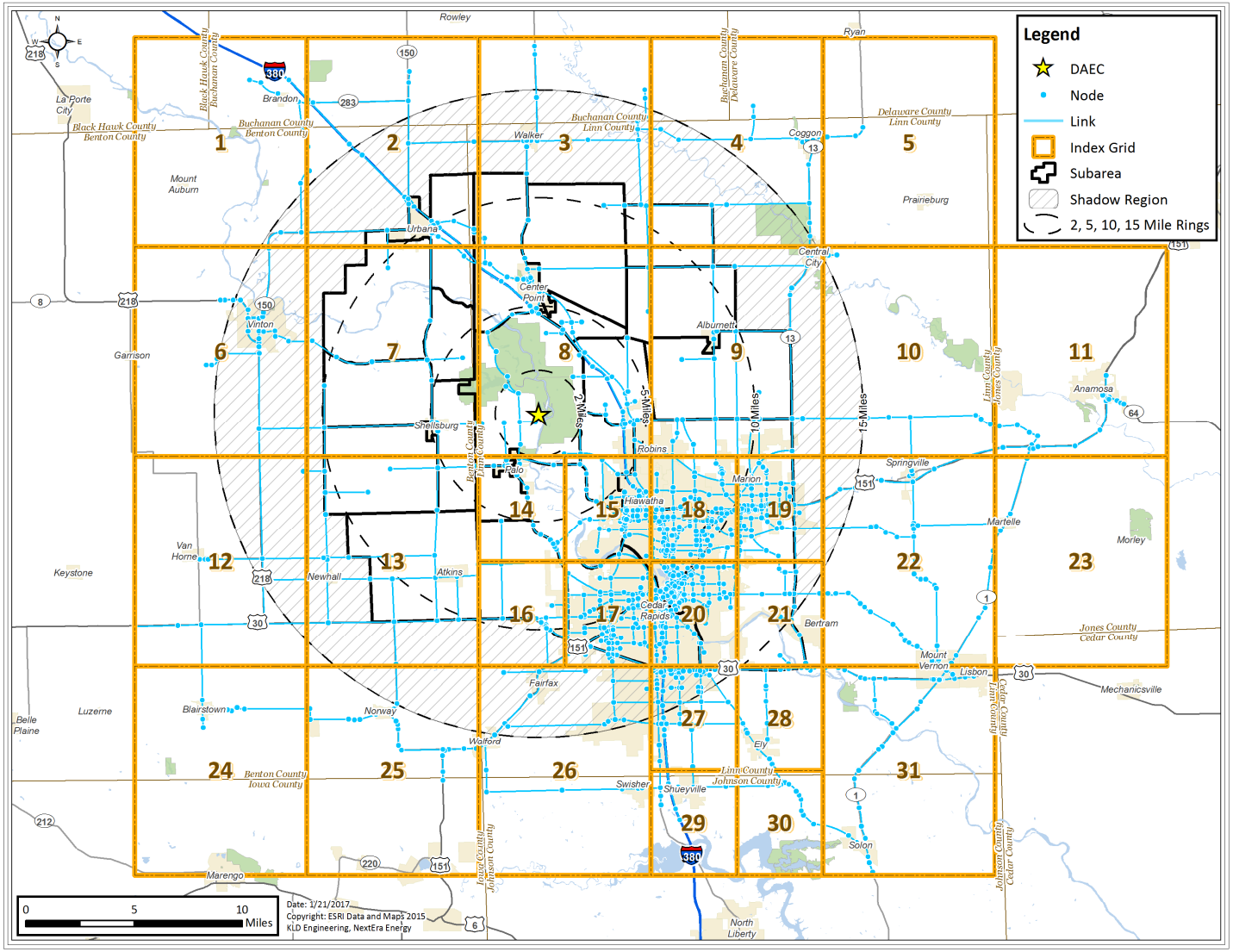

Figure K-1. Duane Arnold Energy Center Link-Node Analysis Network

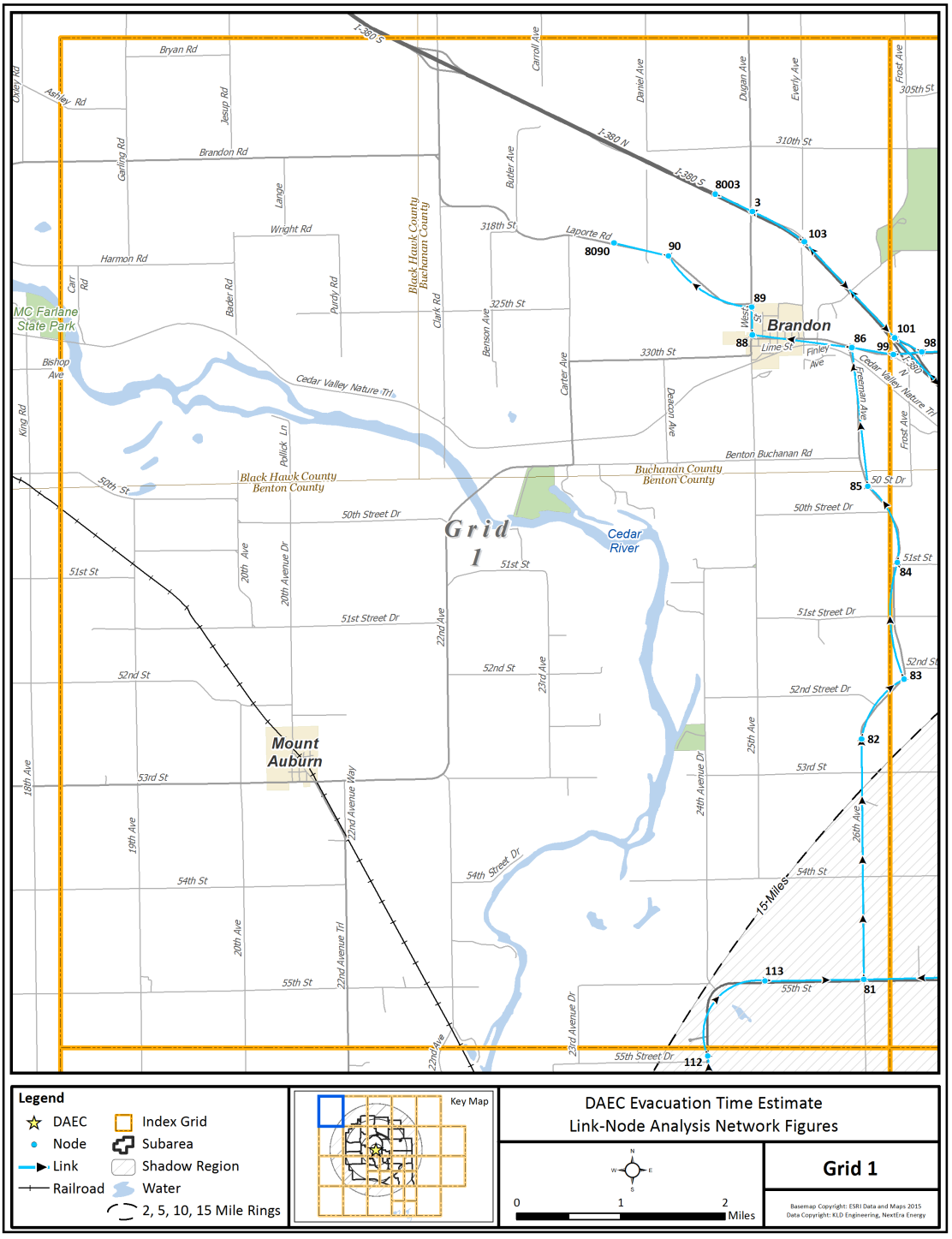

Figure K-2. Link-Node Analysis Network – Grid 1

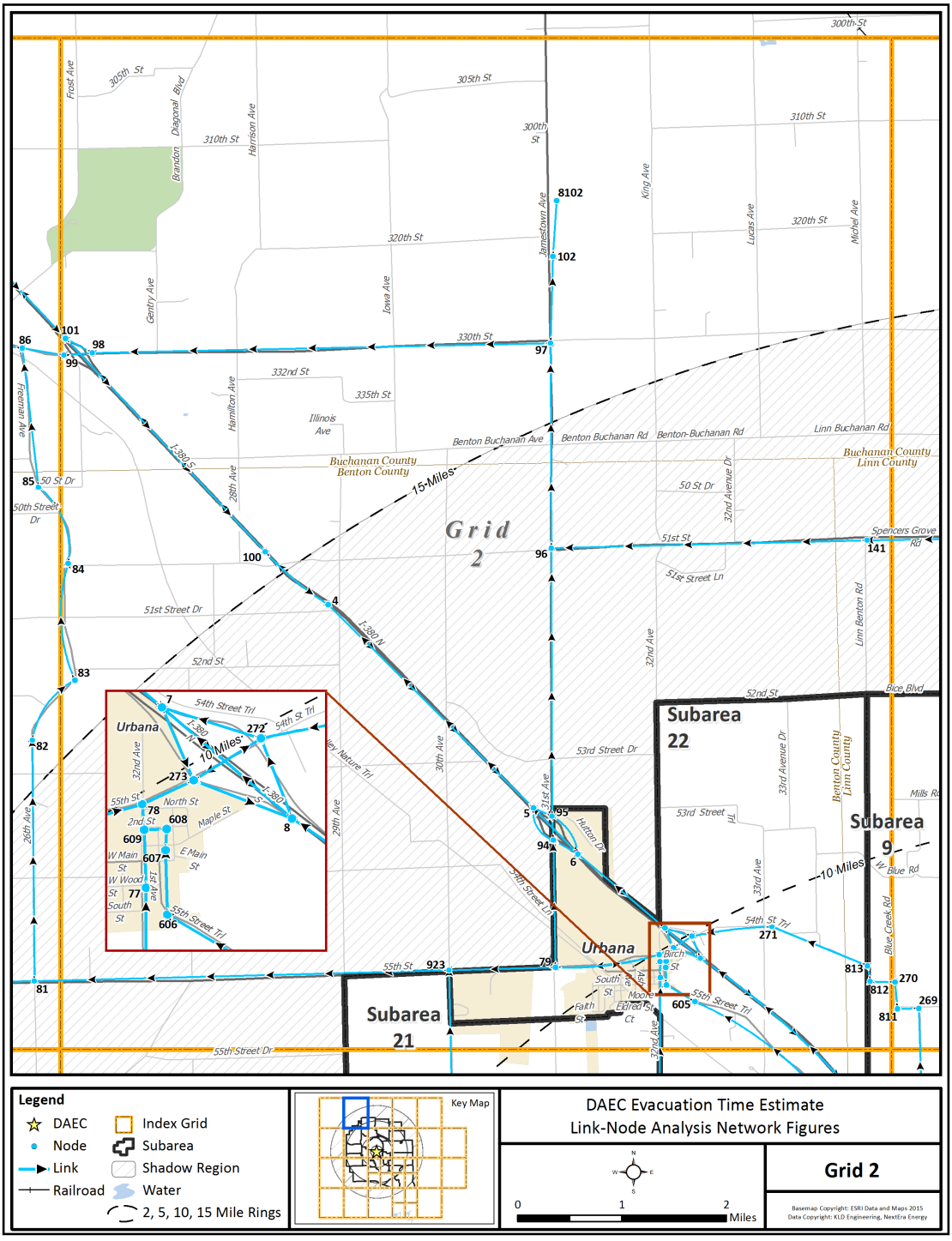

Figure K-3. Link-Node Analysis Network – Grid 2

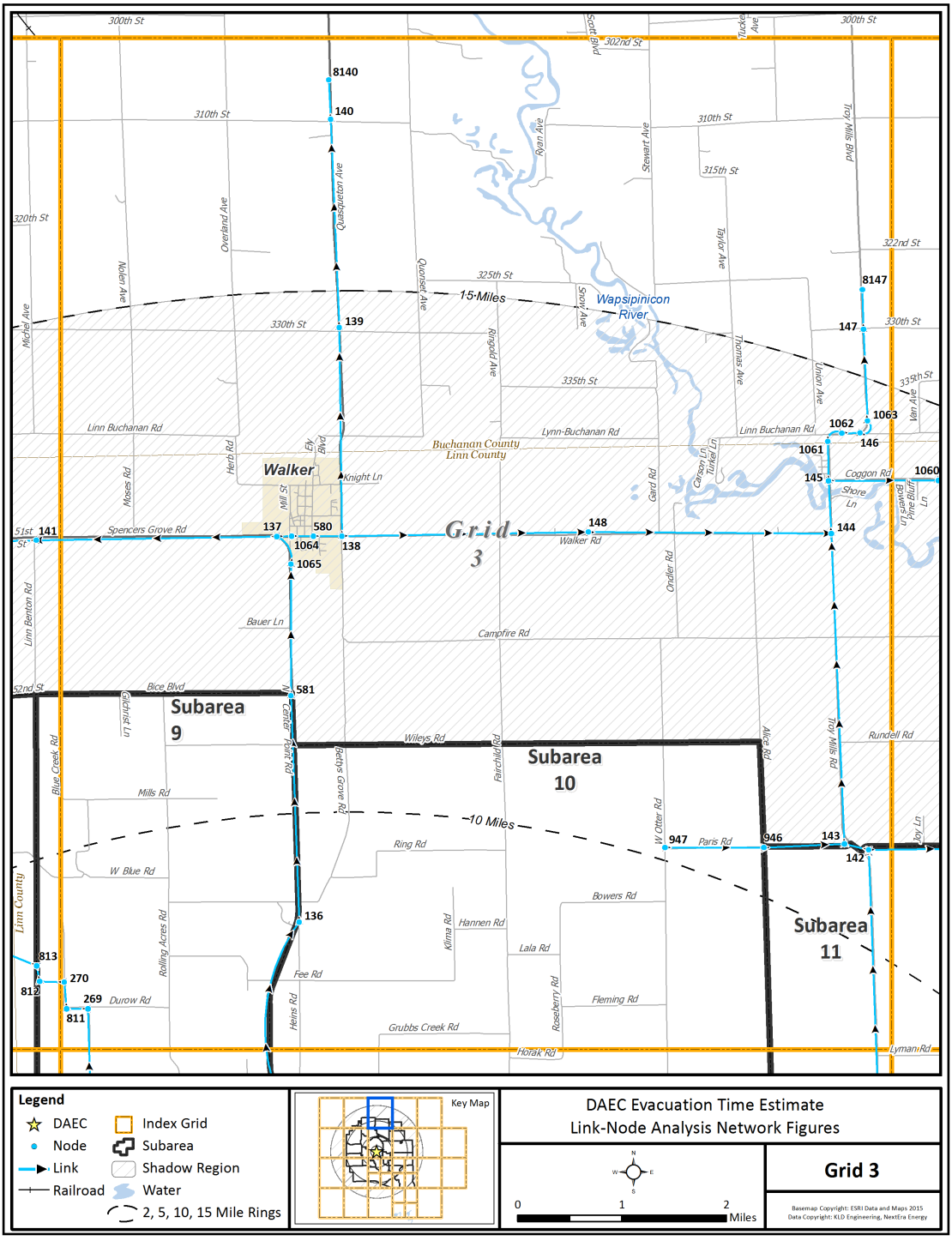

Figure K-4. Link-Node Analysis Network – Grid 3

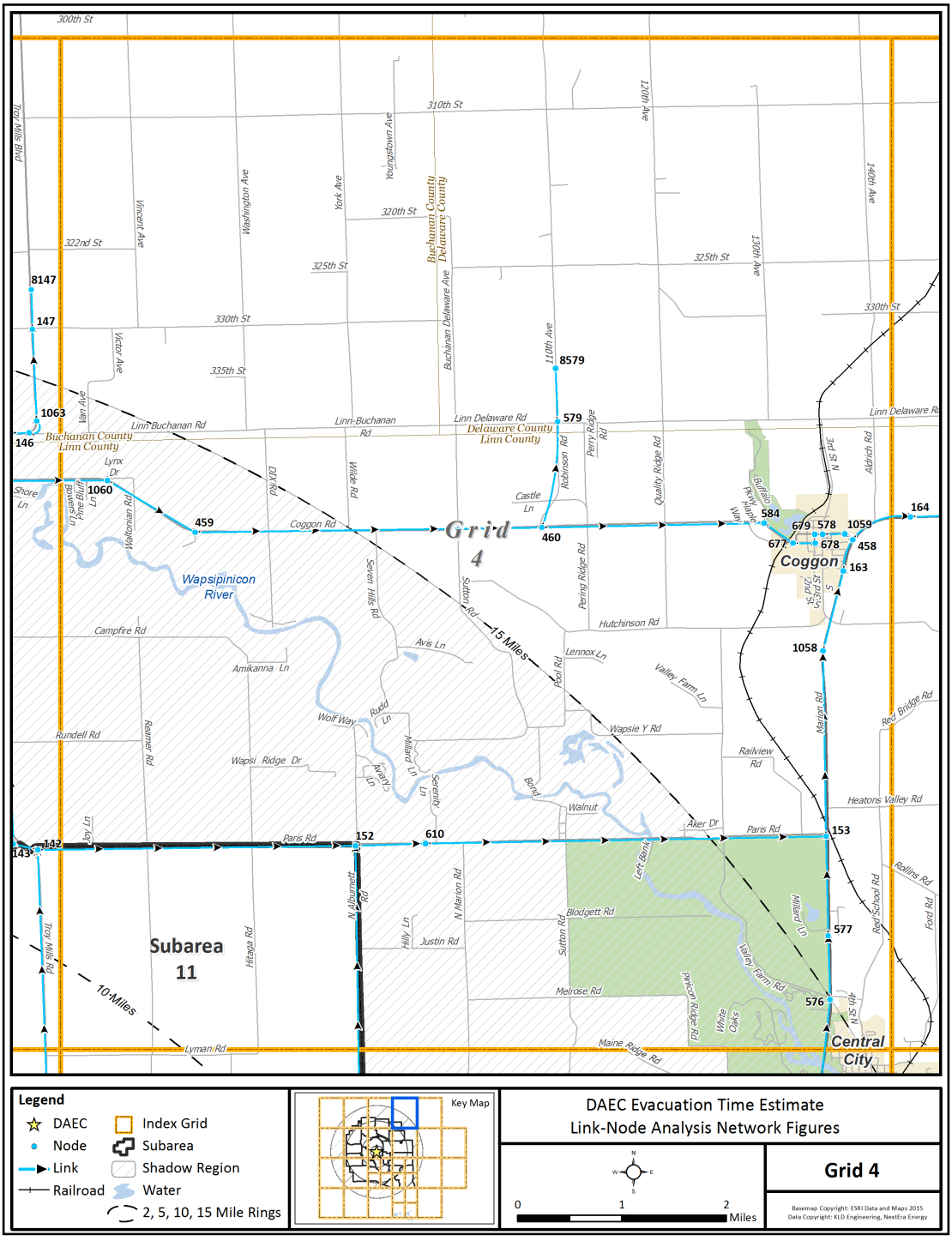

Figure K-5. Link-Node Analysis Network – Grid 4

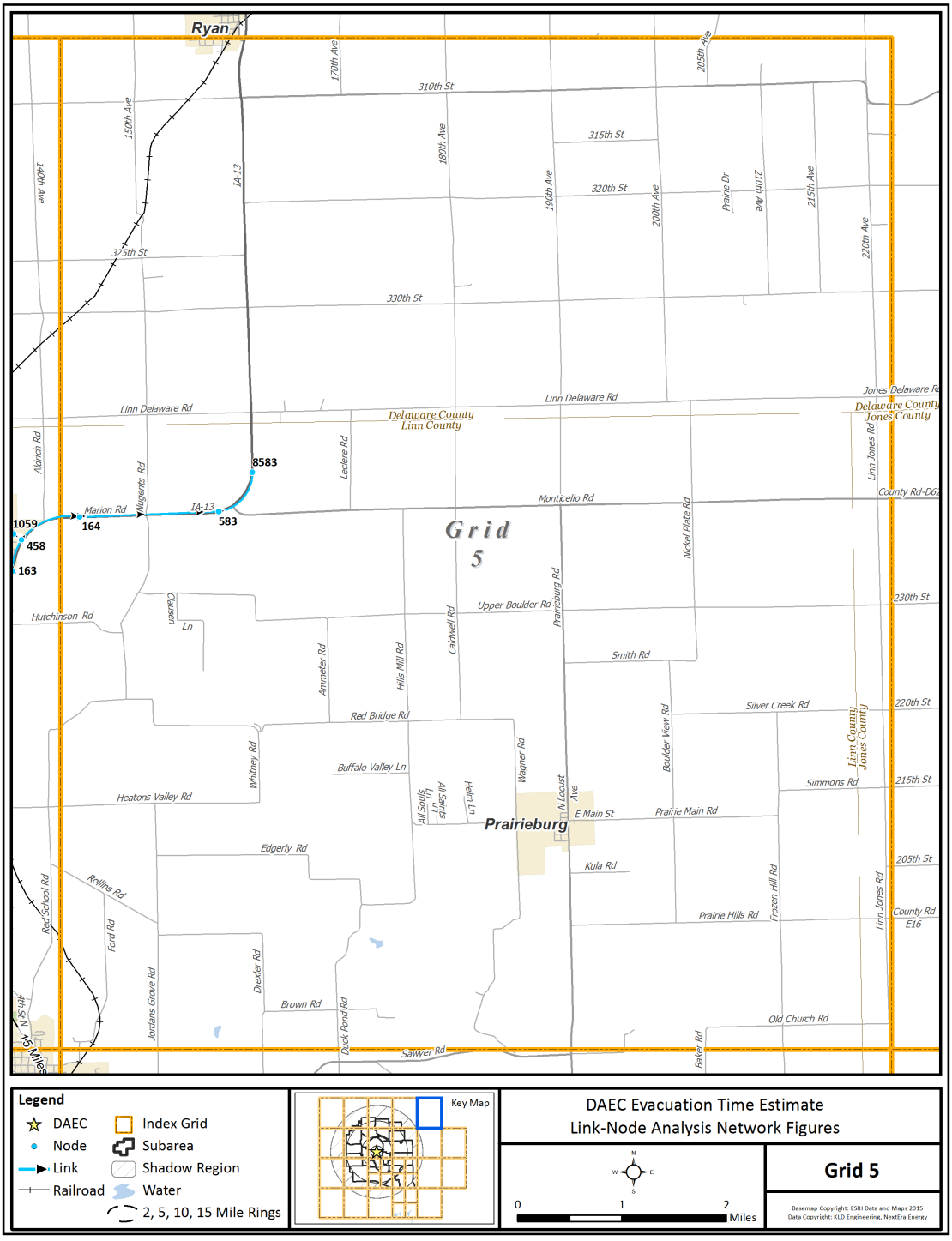

Figure K-6. Link-Node Analysis Network – Grid 5

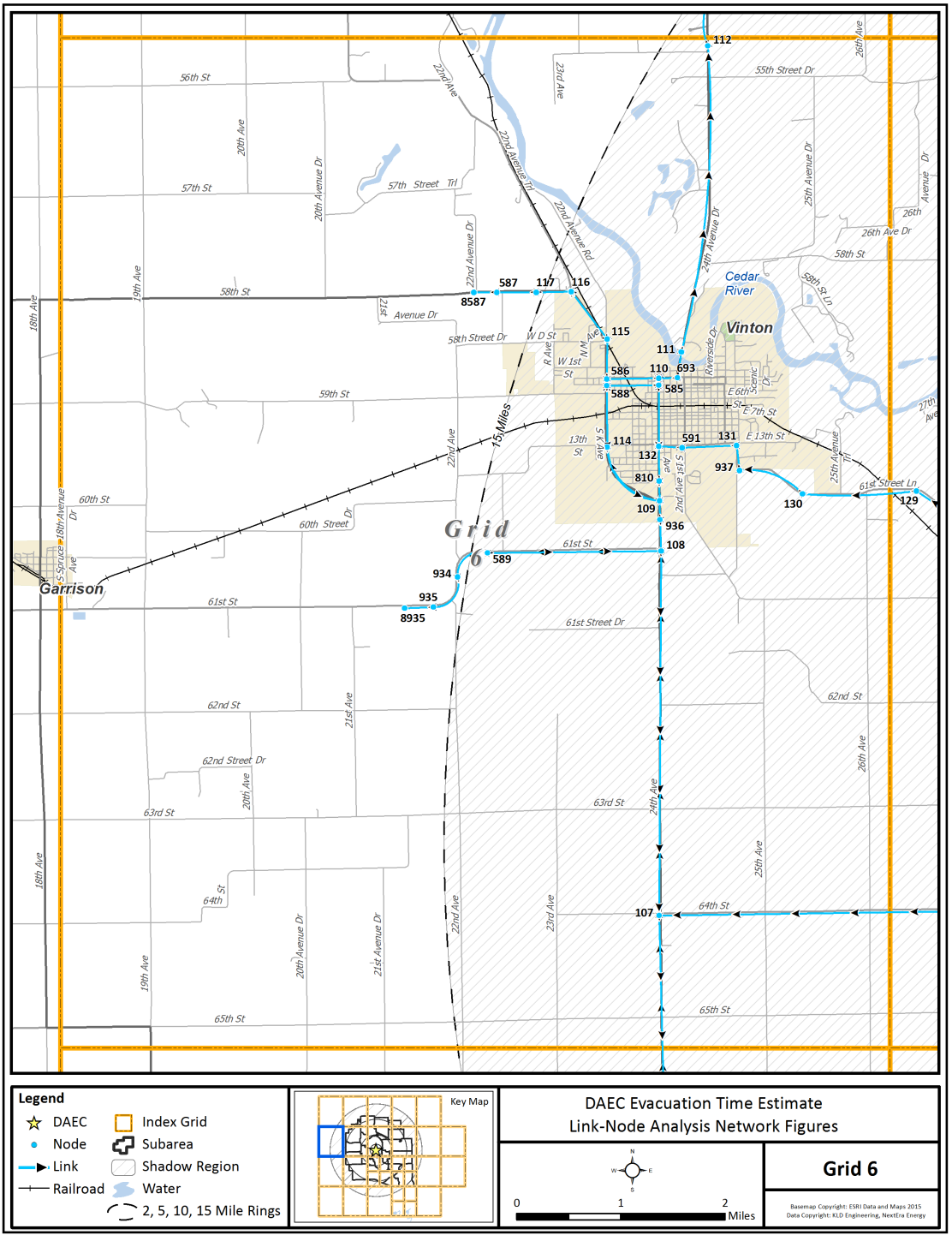

Figure K-7. Link-Node Analysis Network – Grid 6

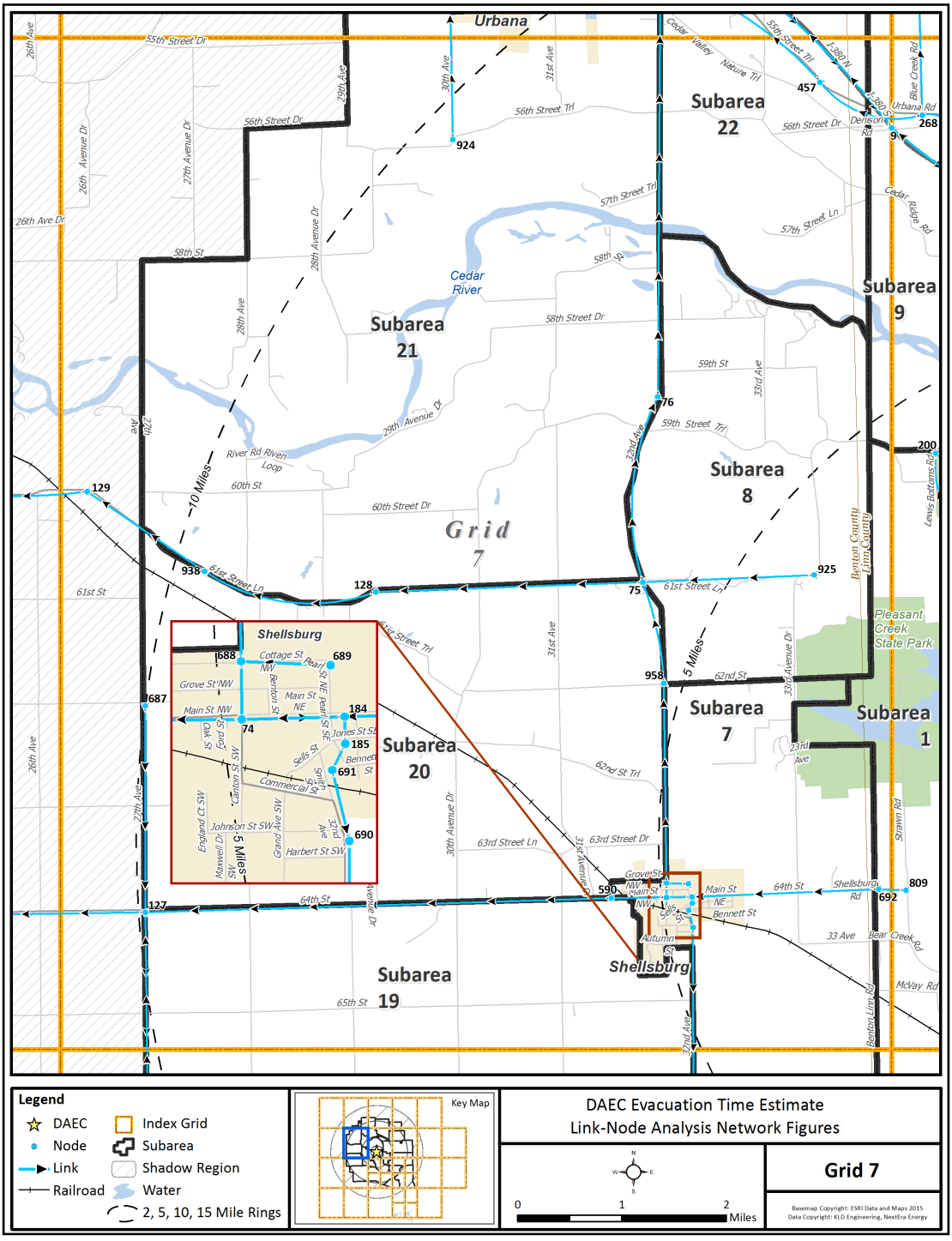

Figure K-8. Link-Node Analysis Network – Grid 7

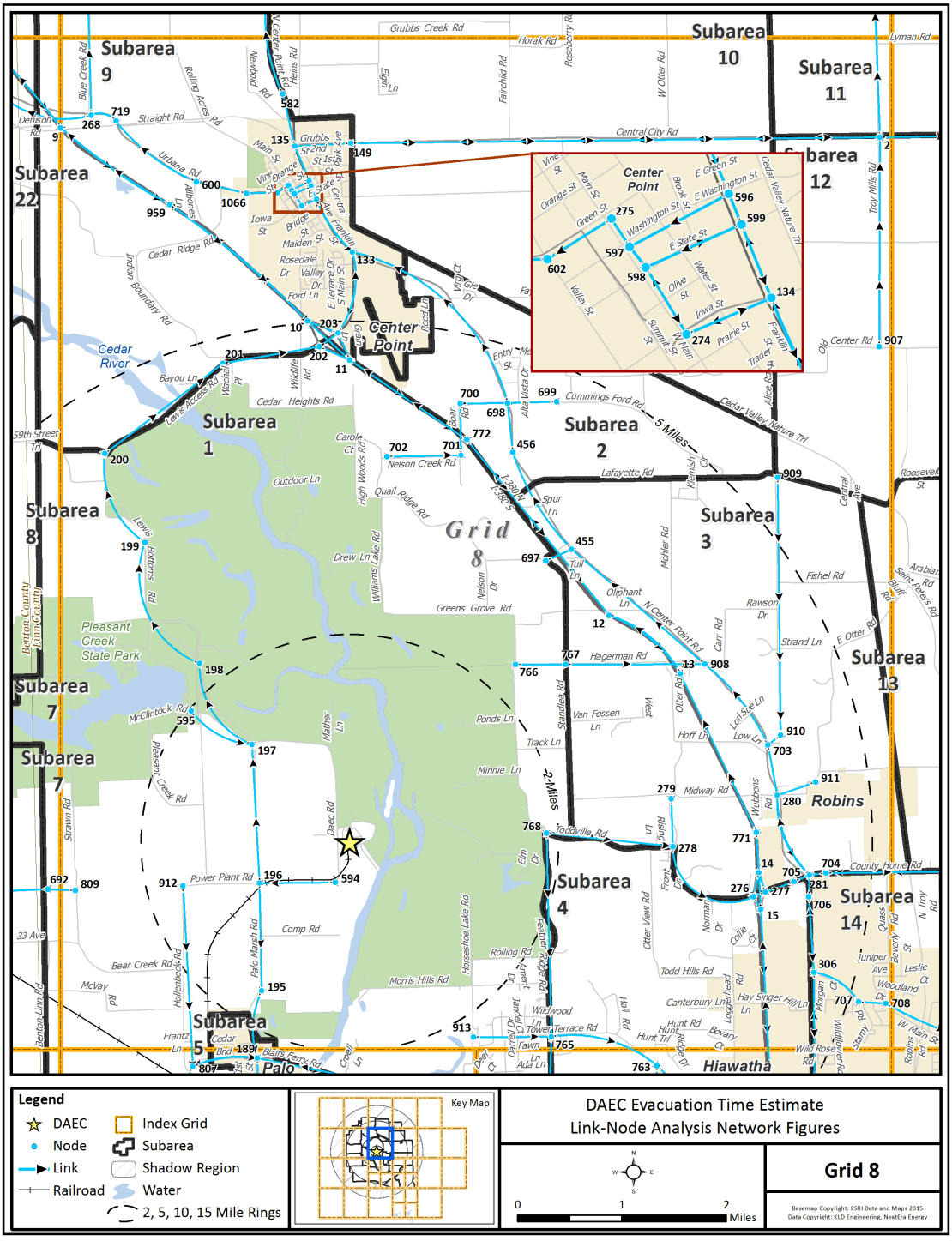

Figure K-9. Link-Node Analysis Network – Grid 8

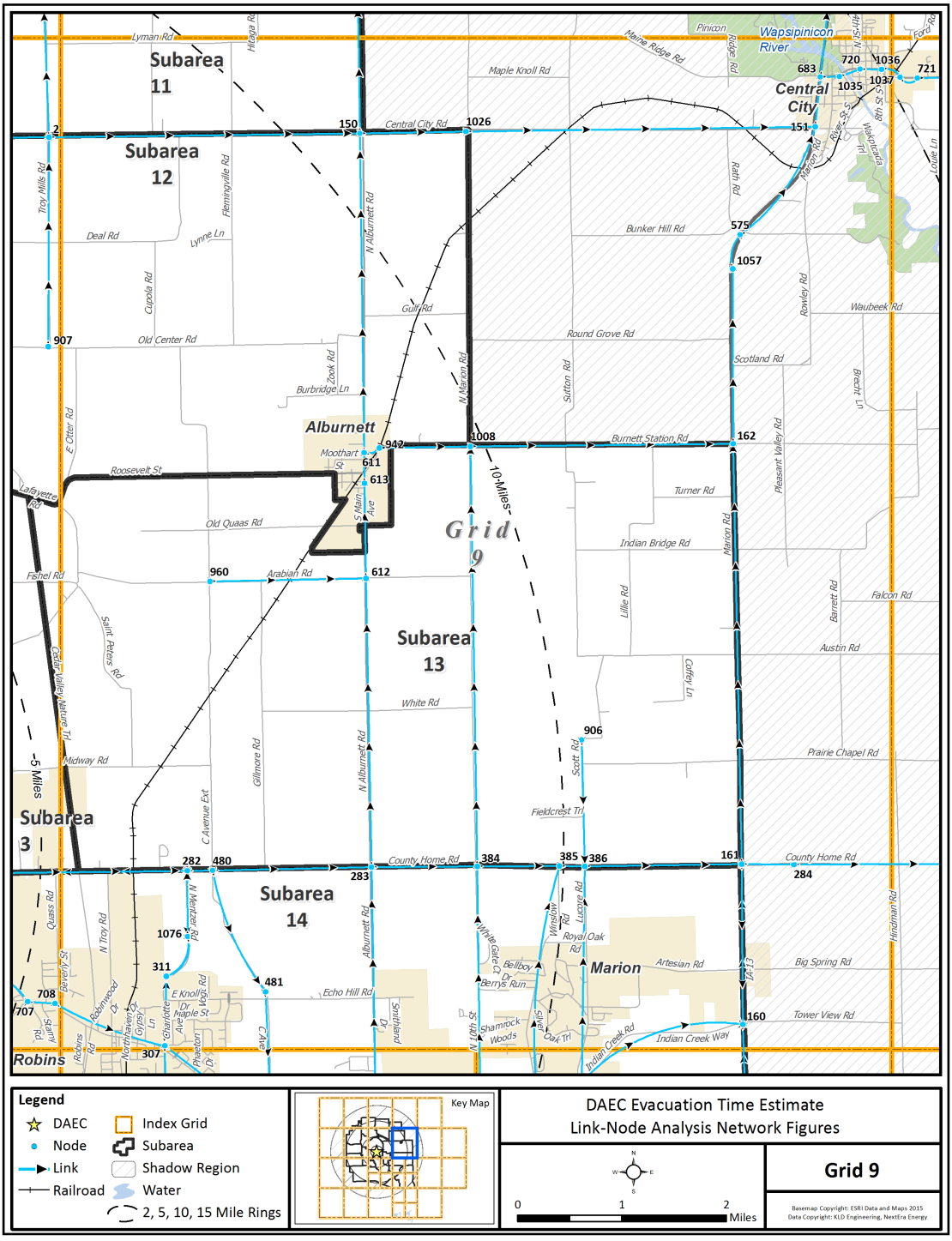

Figure K-10. Link-Node Analysis Network – Grid 9

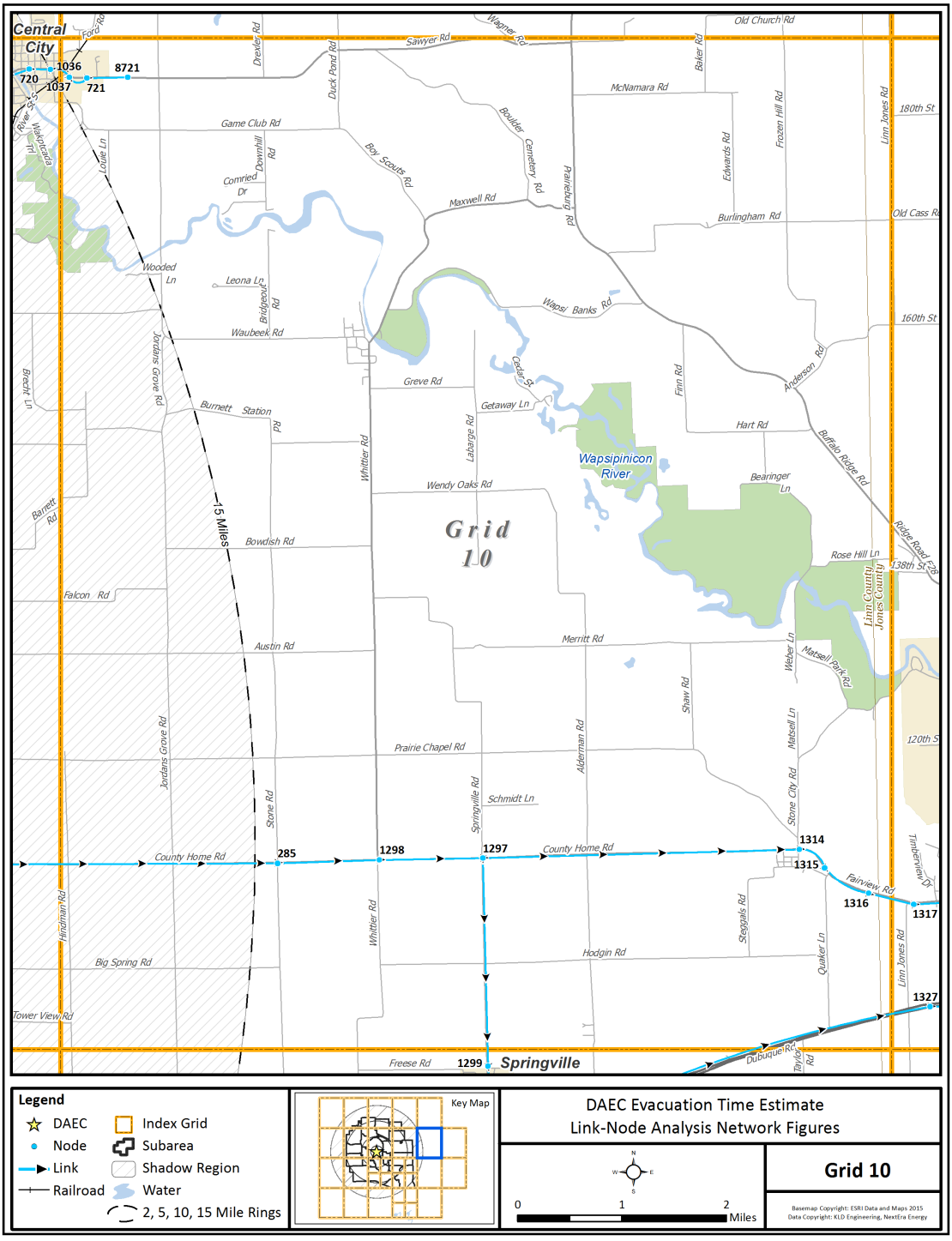

Figure K-11. Link-Node Analysis Network – Grid 10

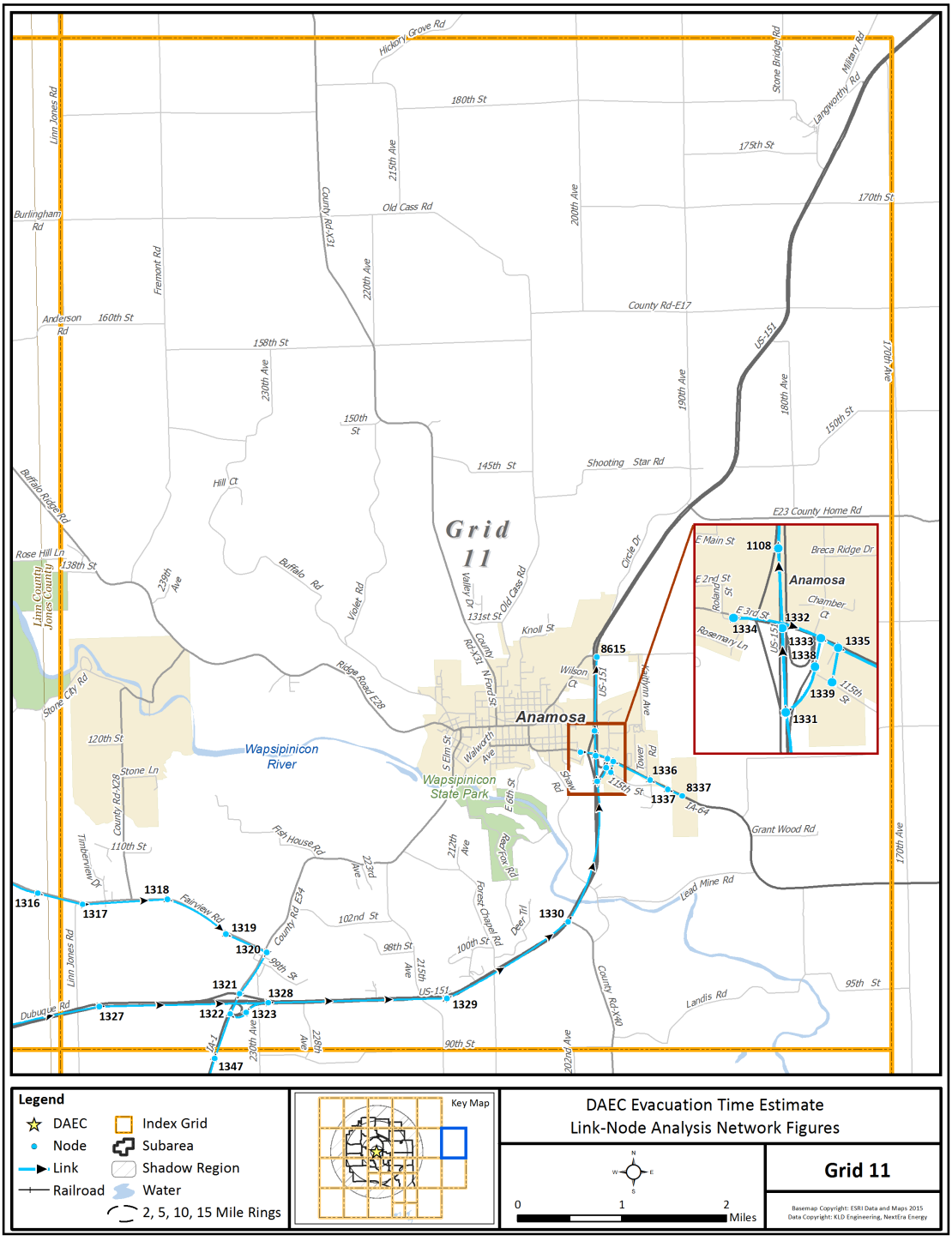

Figure K-12. Link-Node Analysis Network – Grid 11

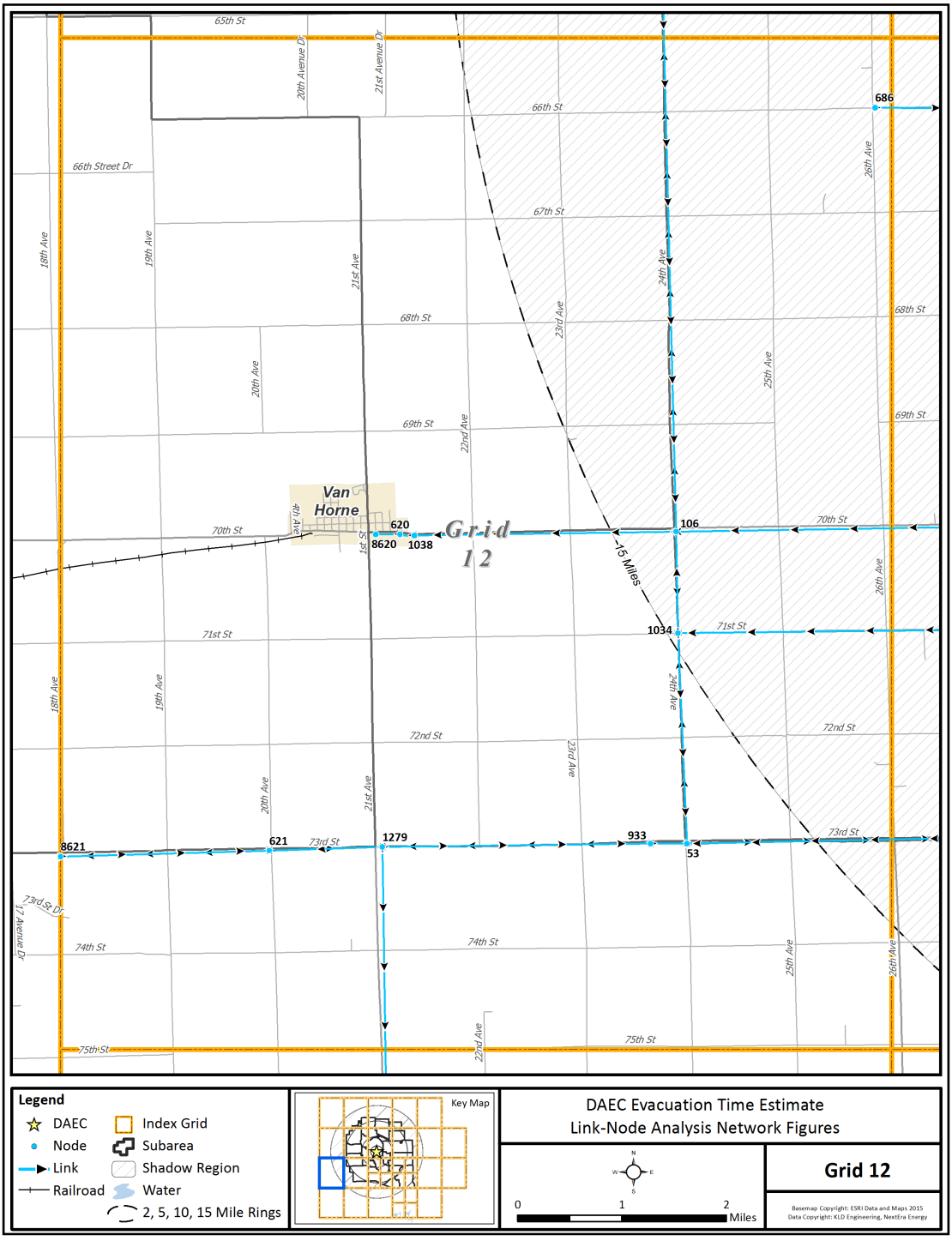

Figure K-13. Link-Node Analysis Network – Grid 12

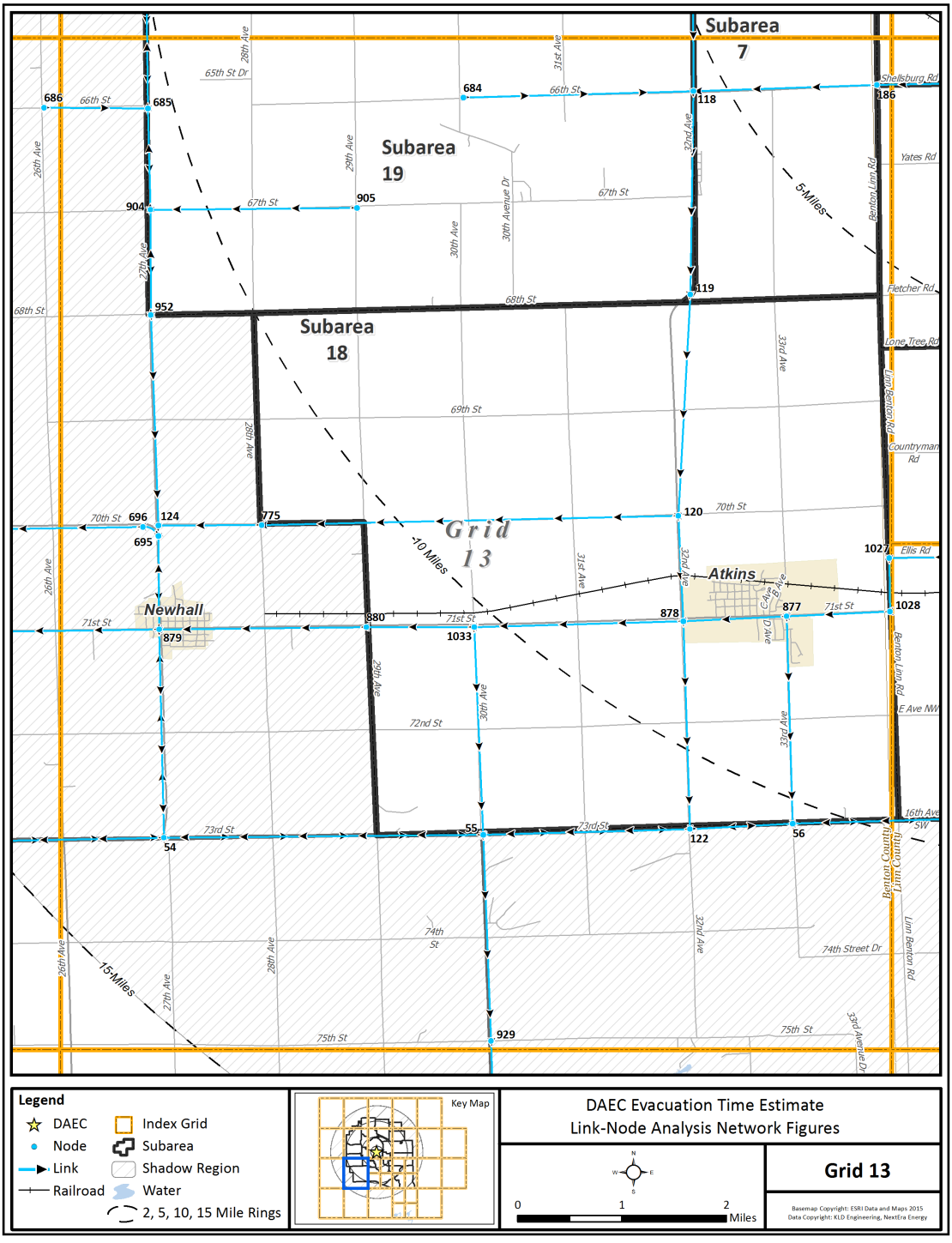

Figure K-14. Link-Node Analysis Network – Grid 13

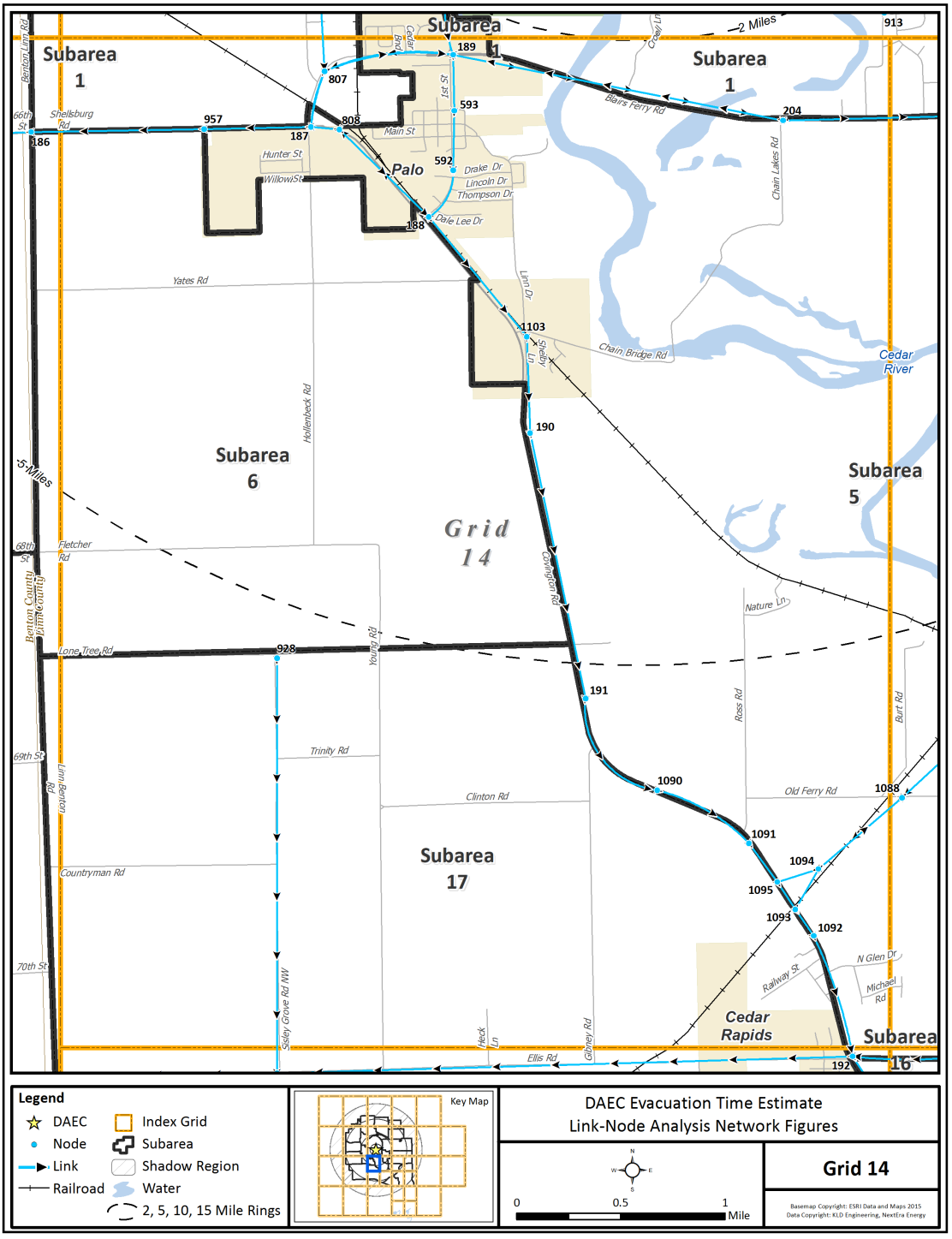

Figure K-15. Link-Node Analysis Network – Grid 14

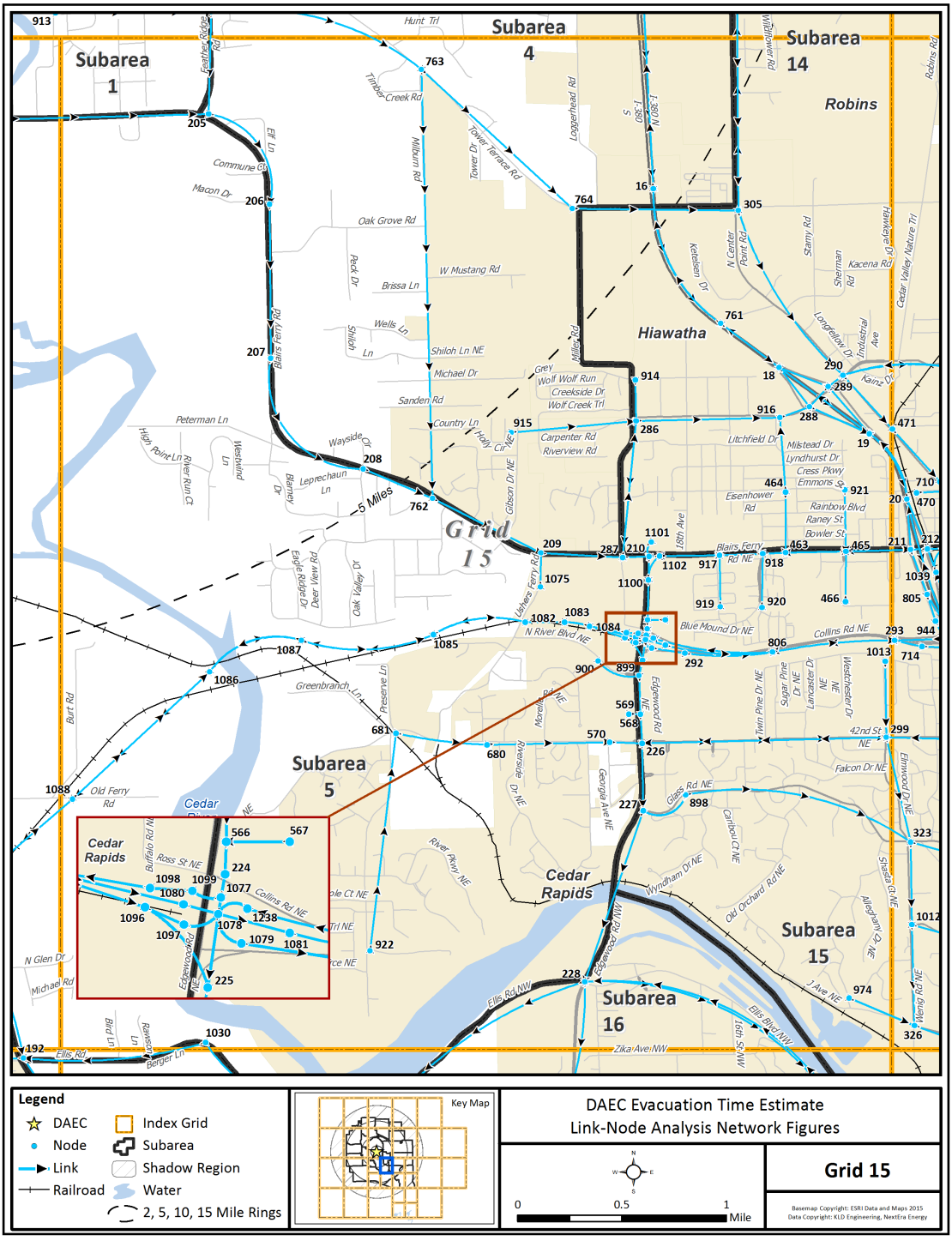

Figure K-16. Link-Node Analysis Network – Grid 15

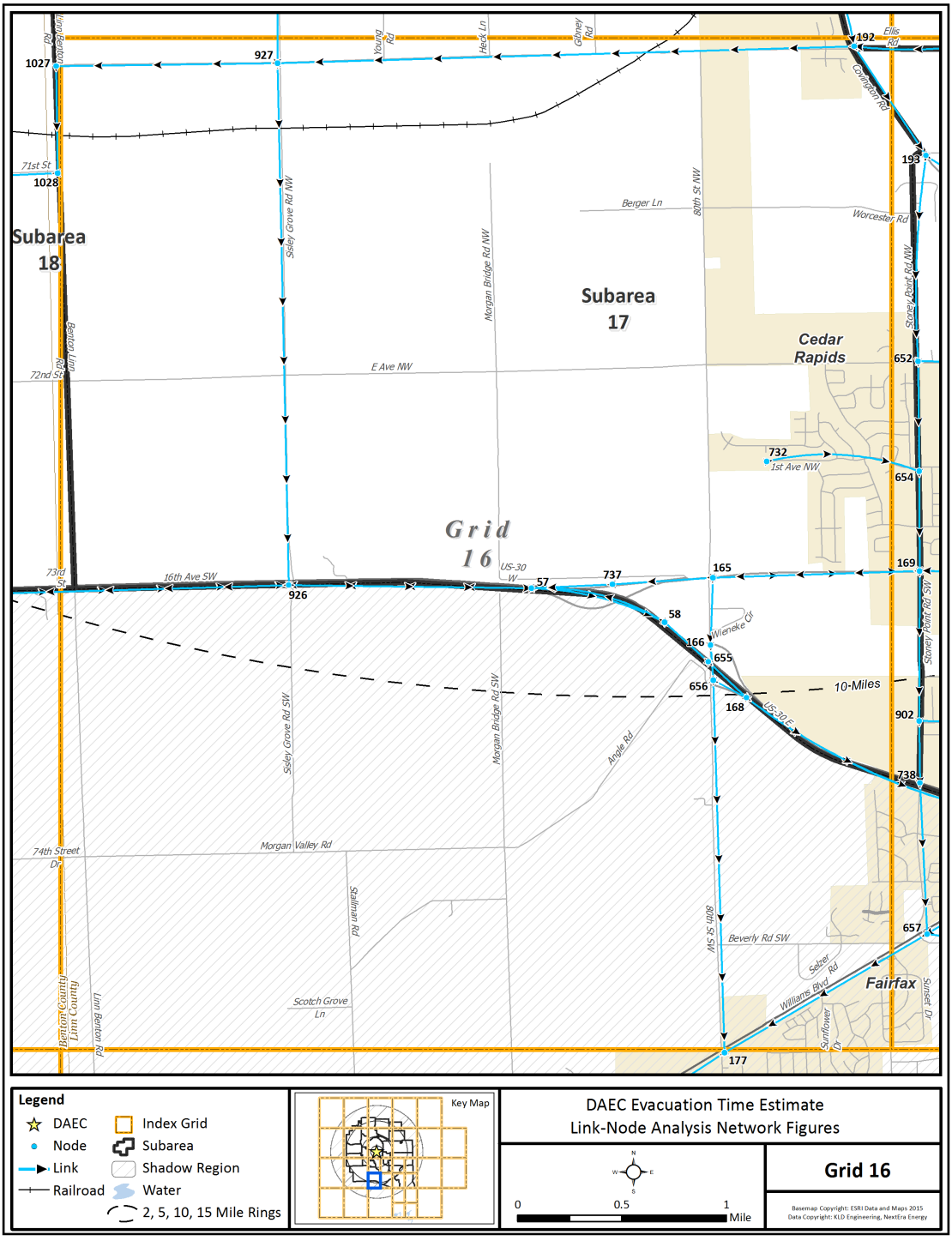

Figure K-17. Link-Node Analysis Network – Grid 16

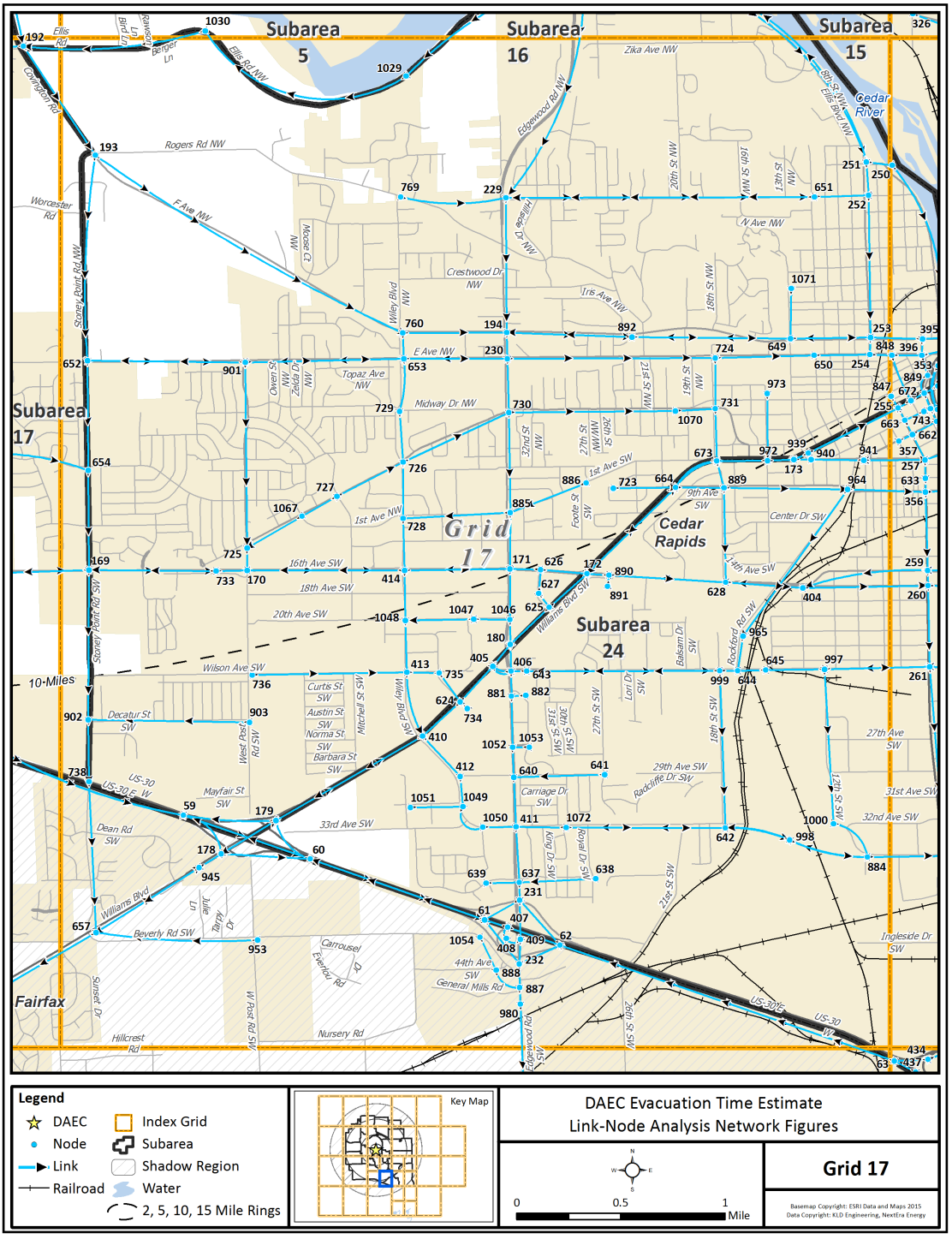

Figure K-18. Link-Node Analysis Network – Grid 17

Figure K-19. Link-Node Analysis Network – Grid 18

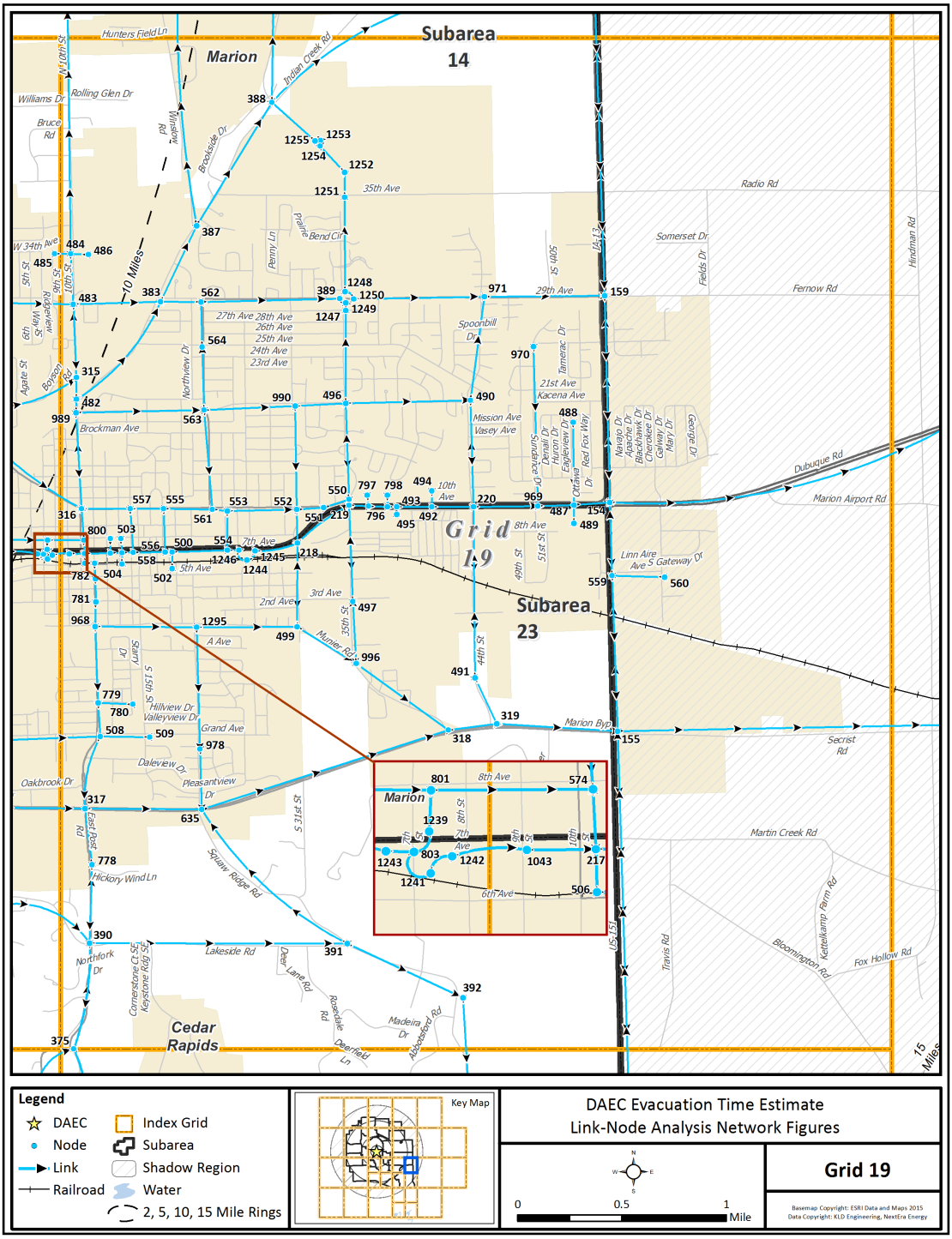

Figure K-20. Link-Node Analysis Network – Grid 19

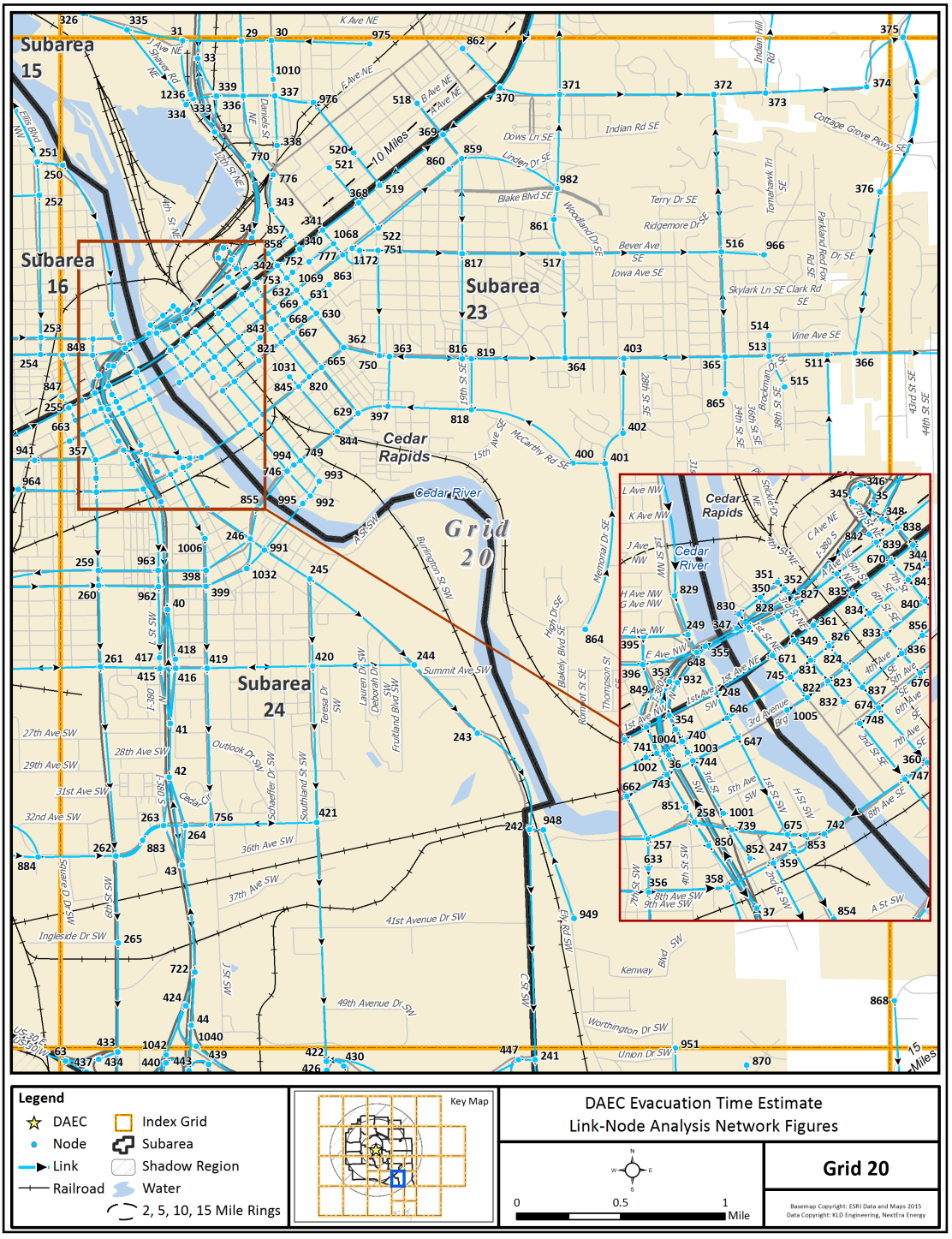

Figure K-21. Link-Node Analysis Network – Grid 20

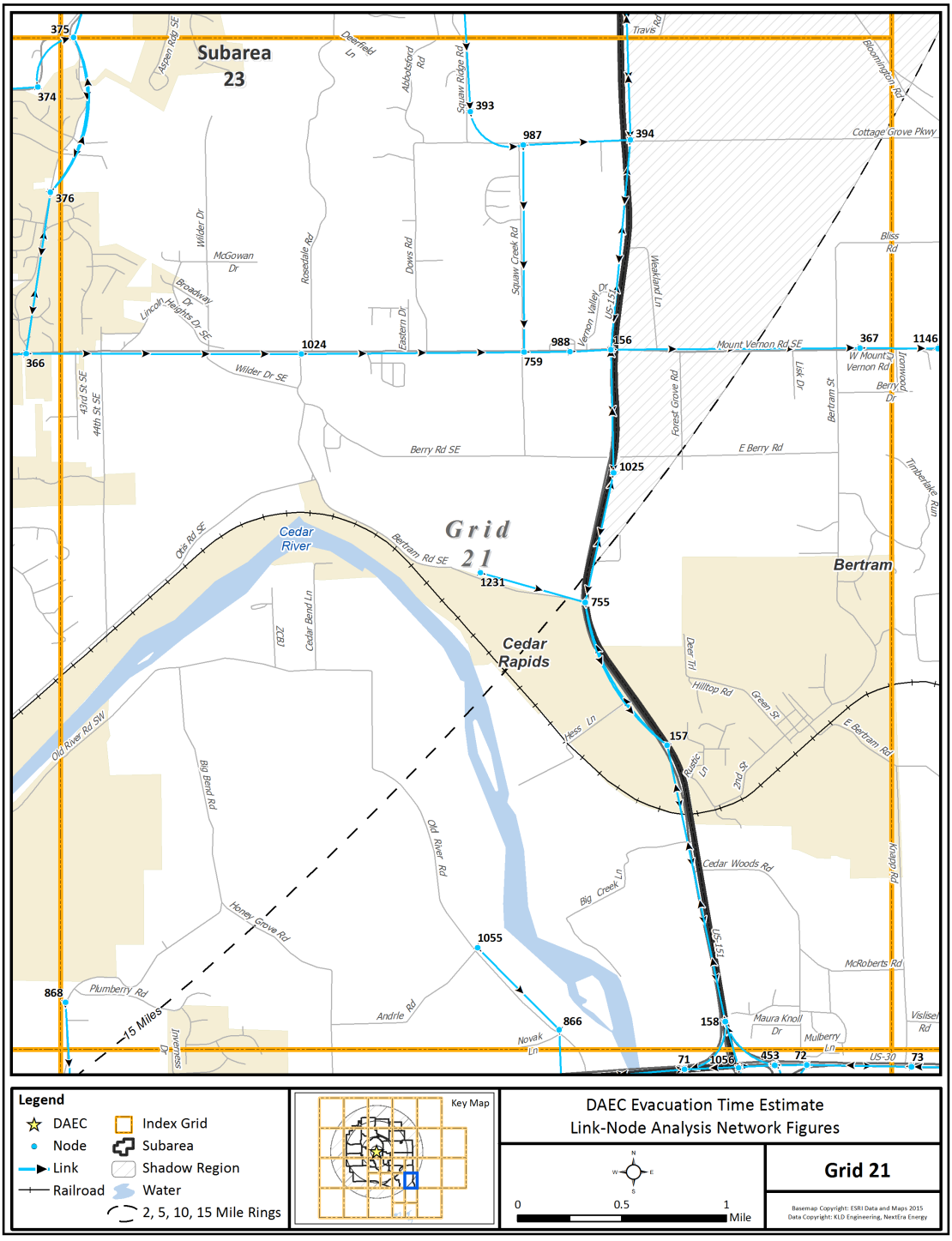

Figure K-22. Link-Node Analysis Network – Grid 21

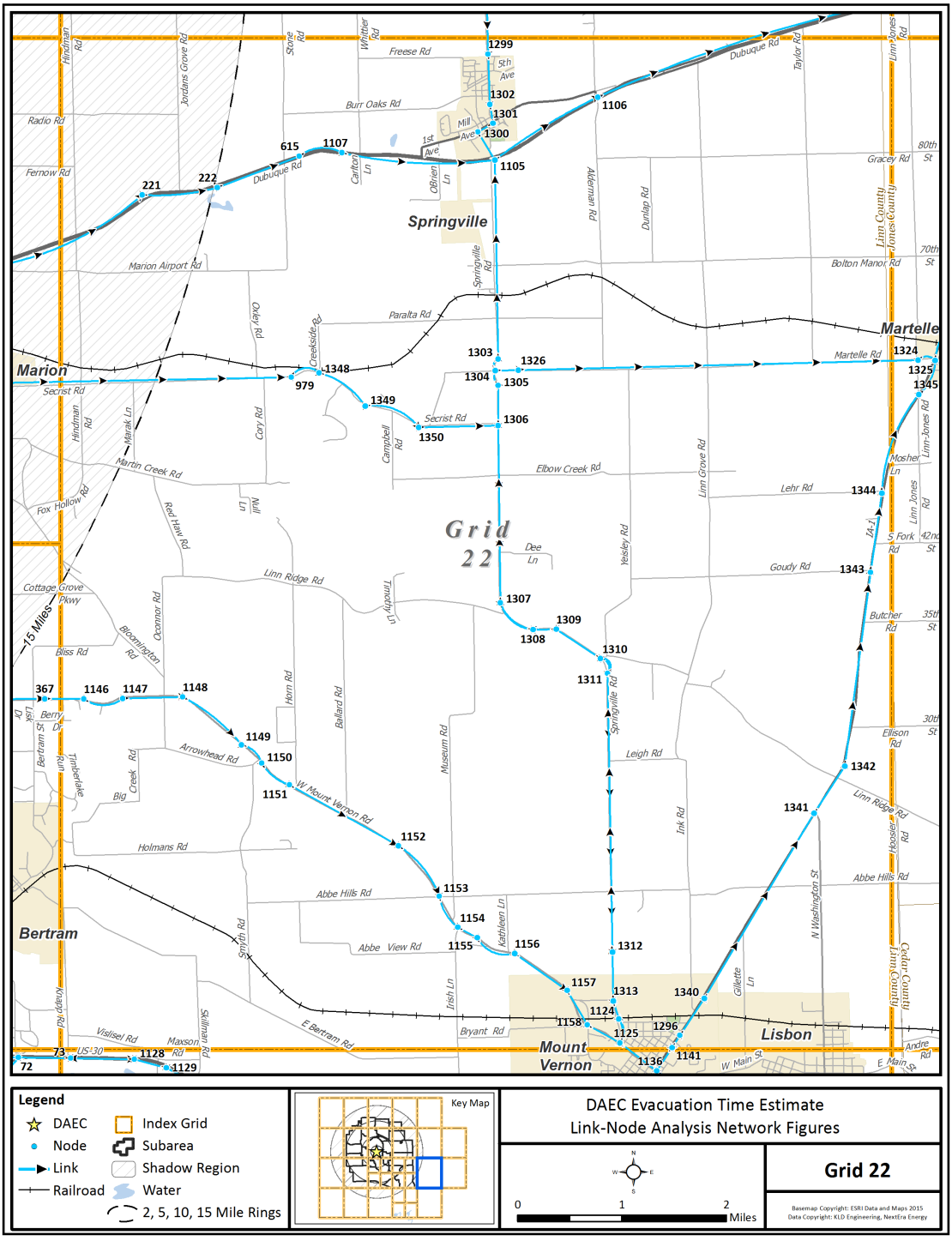

Figure K-23. Link-Node Analysis Network – Grid 22

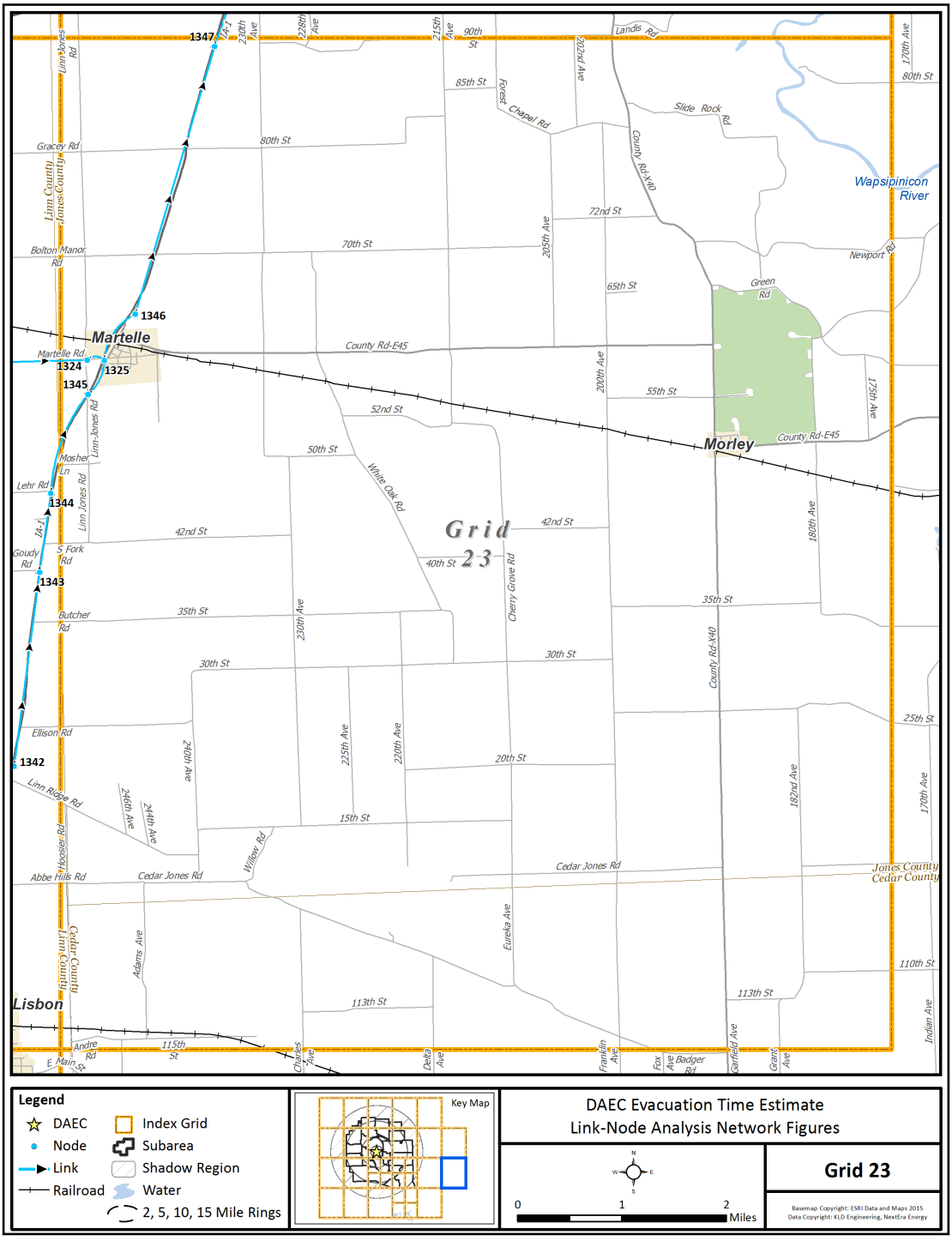

Figure K-24. Link-Node Analysis Network – Grid 23

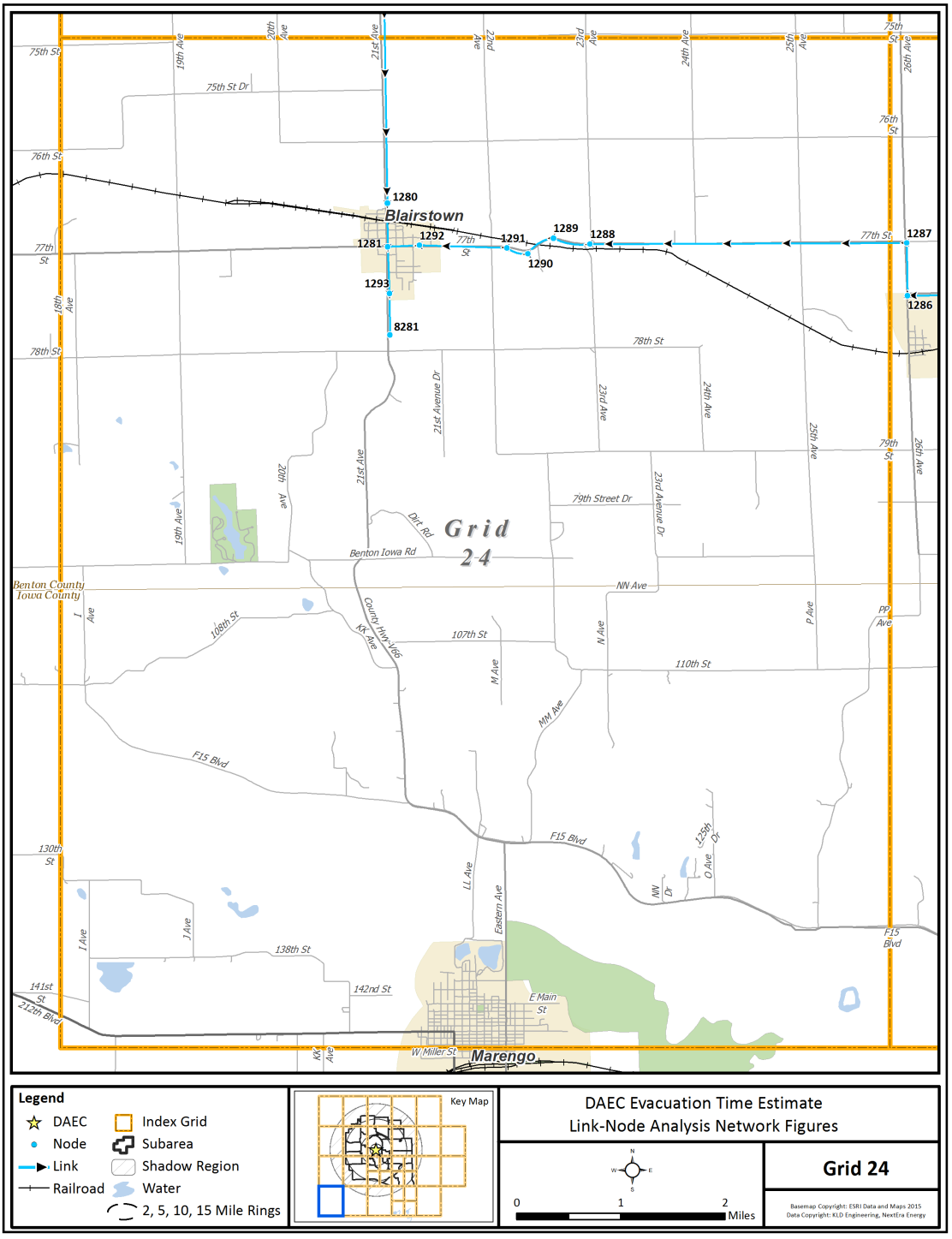

Figure K-25. Link-Node Analysis Network – Grid 24

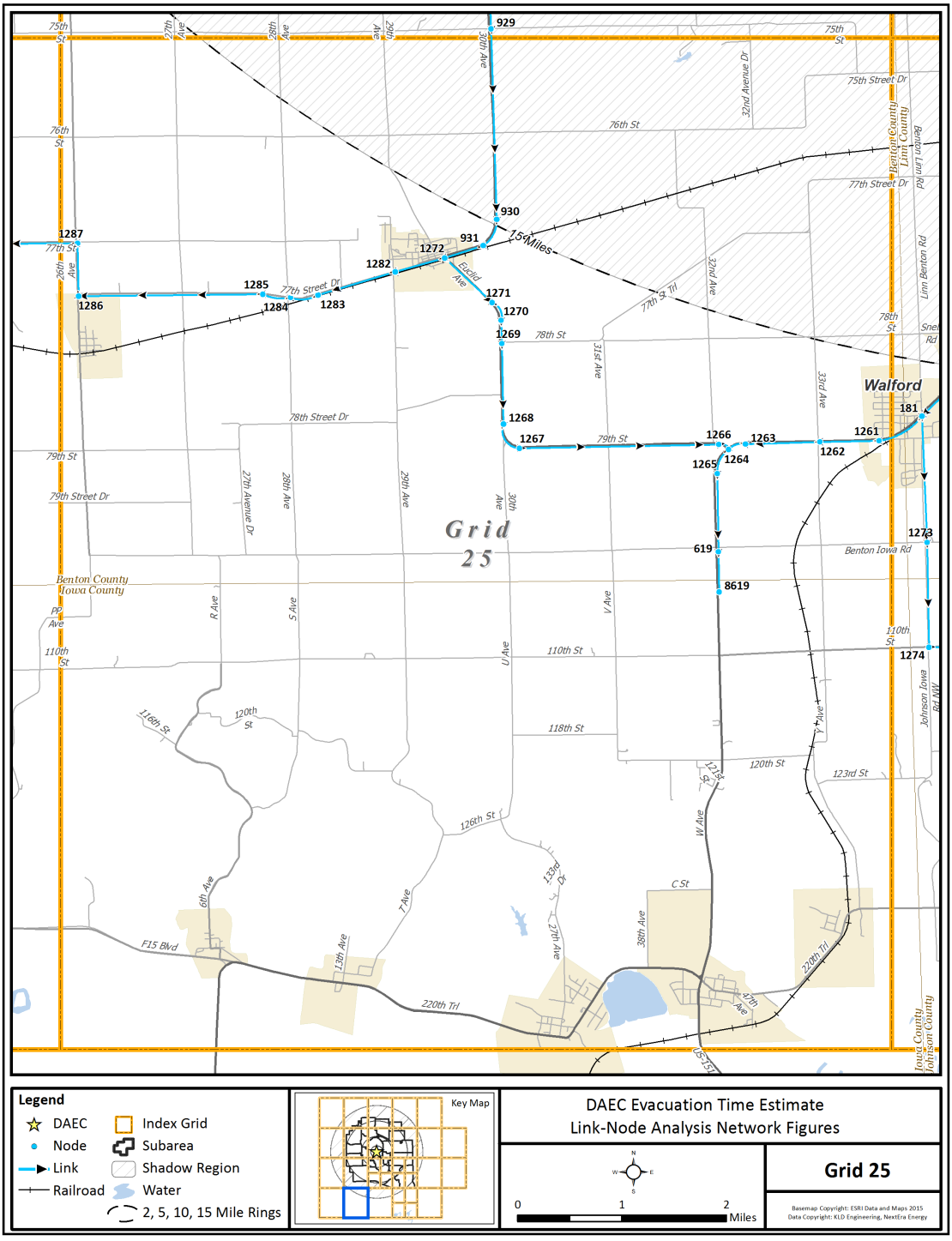

Figure K-26. Link-Node Analysis Network – Grid 25

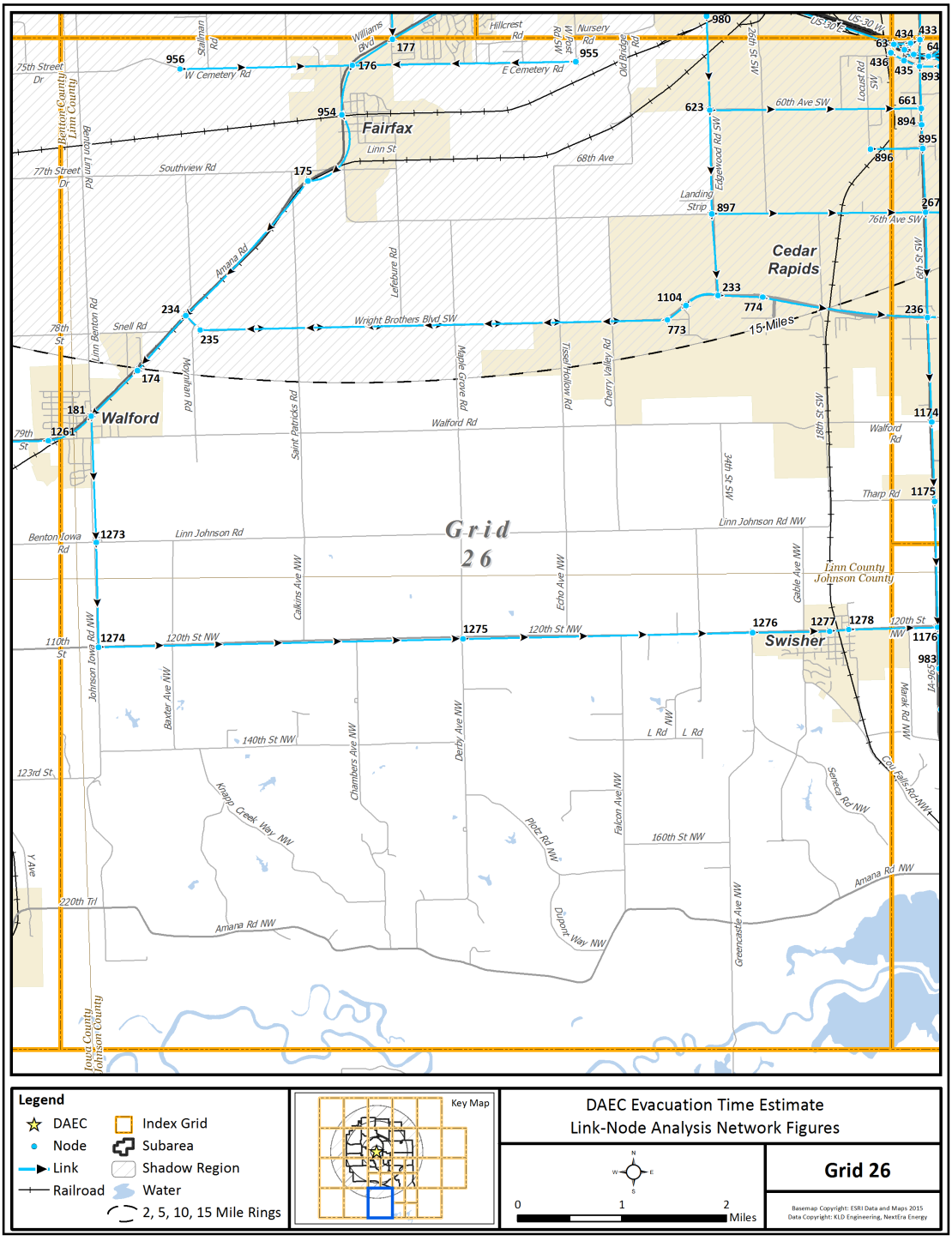

Figure K-27. Link-Node Analysis Network – Grid 26

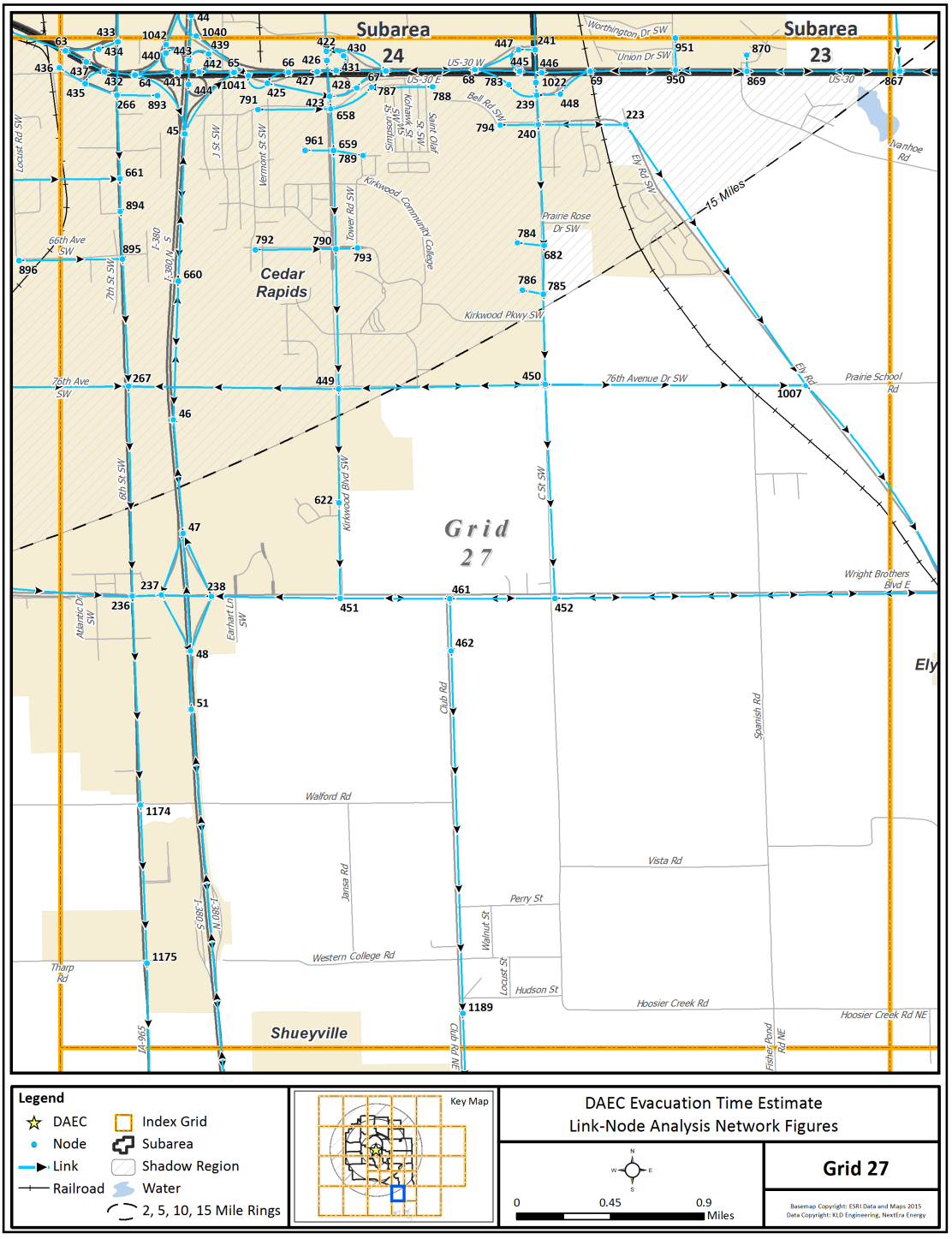

Figure K-28. Link-Node Analysis Network – Grid 27

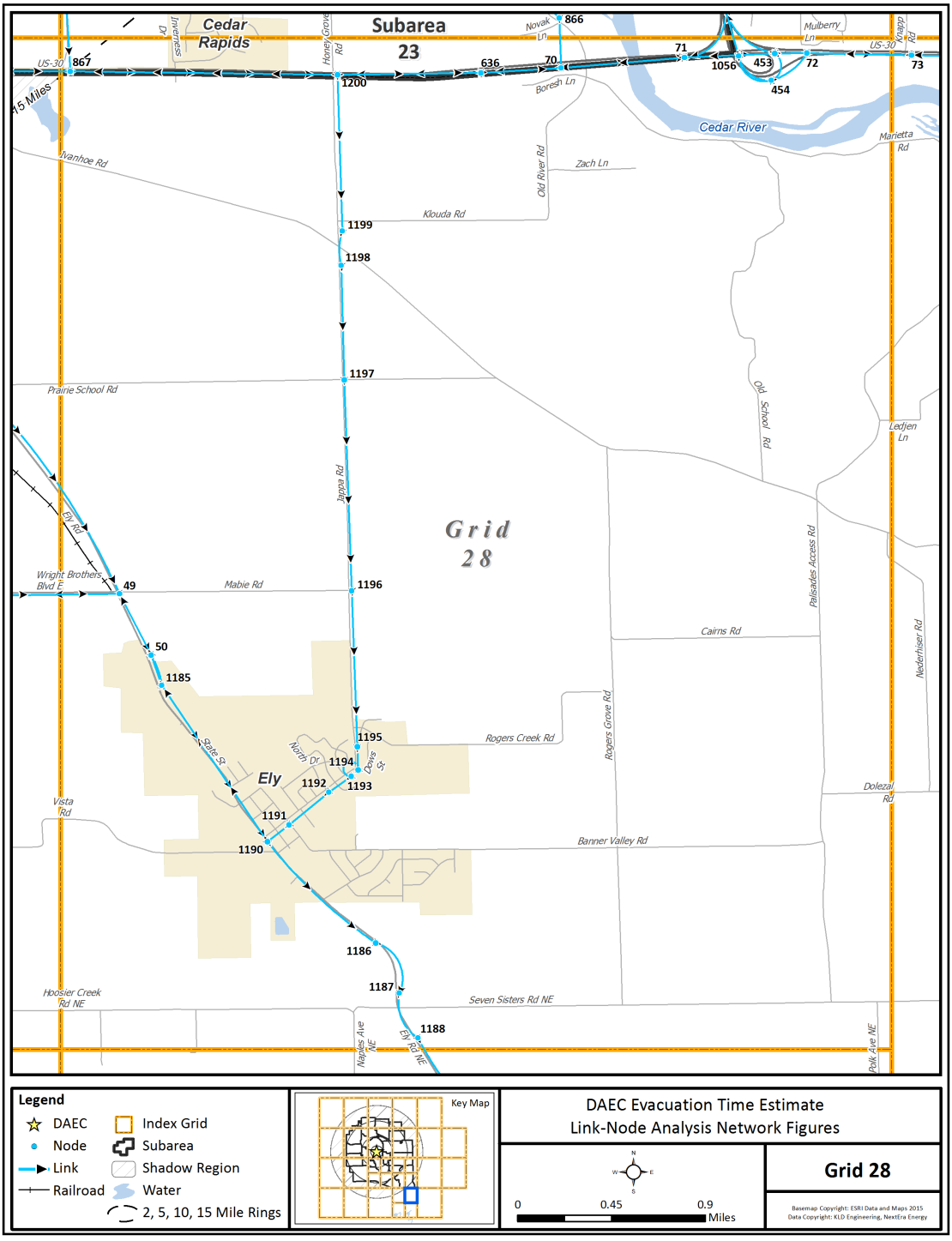

Figure K-29. Link-Node Analysis Network – Grid 28

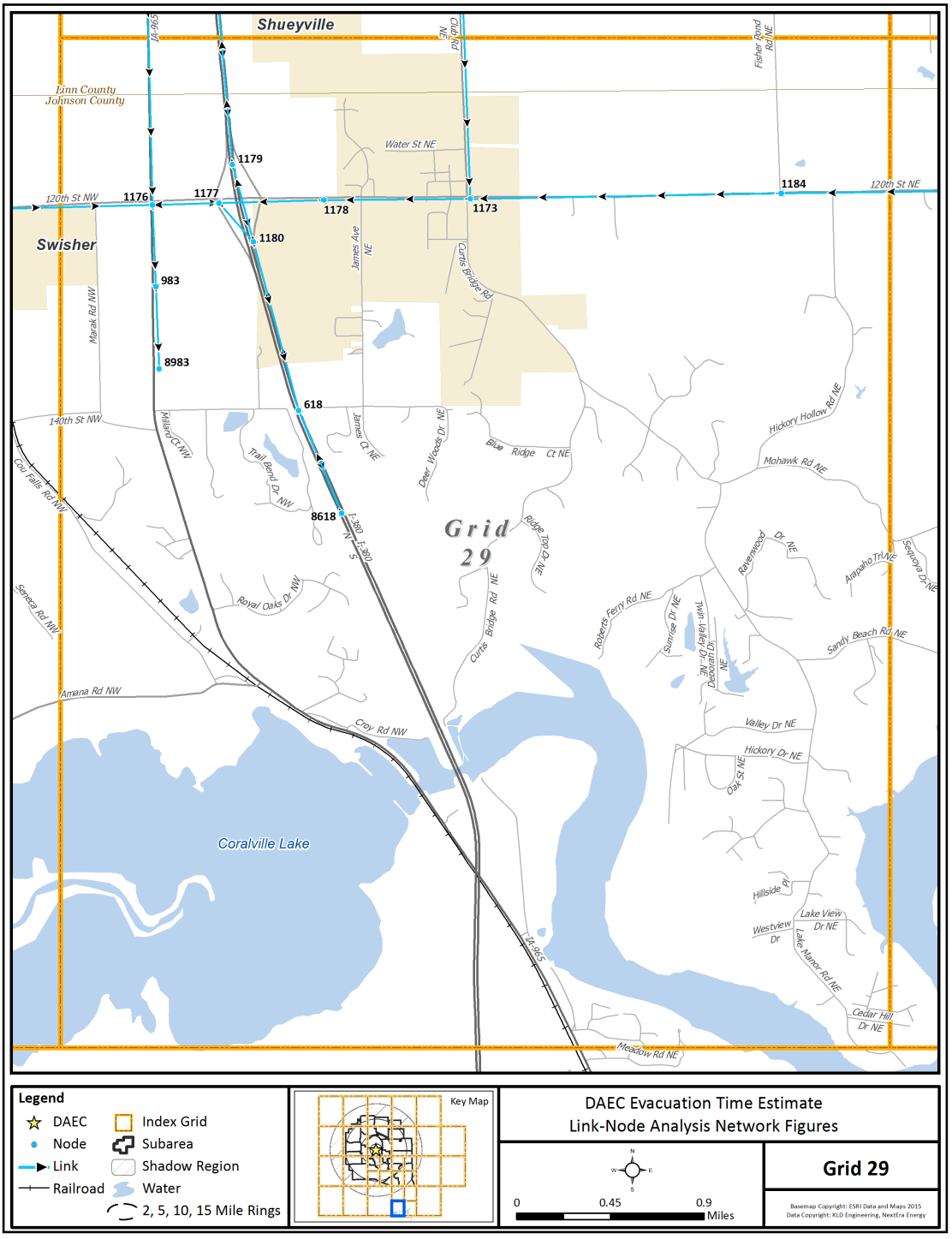

Figure K-30. Link-Node Analysis Network – Grid 29

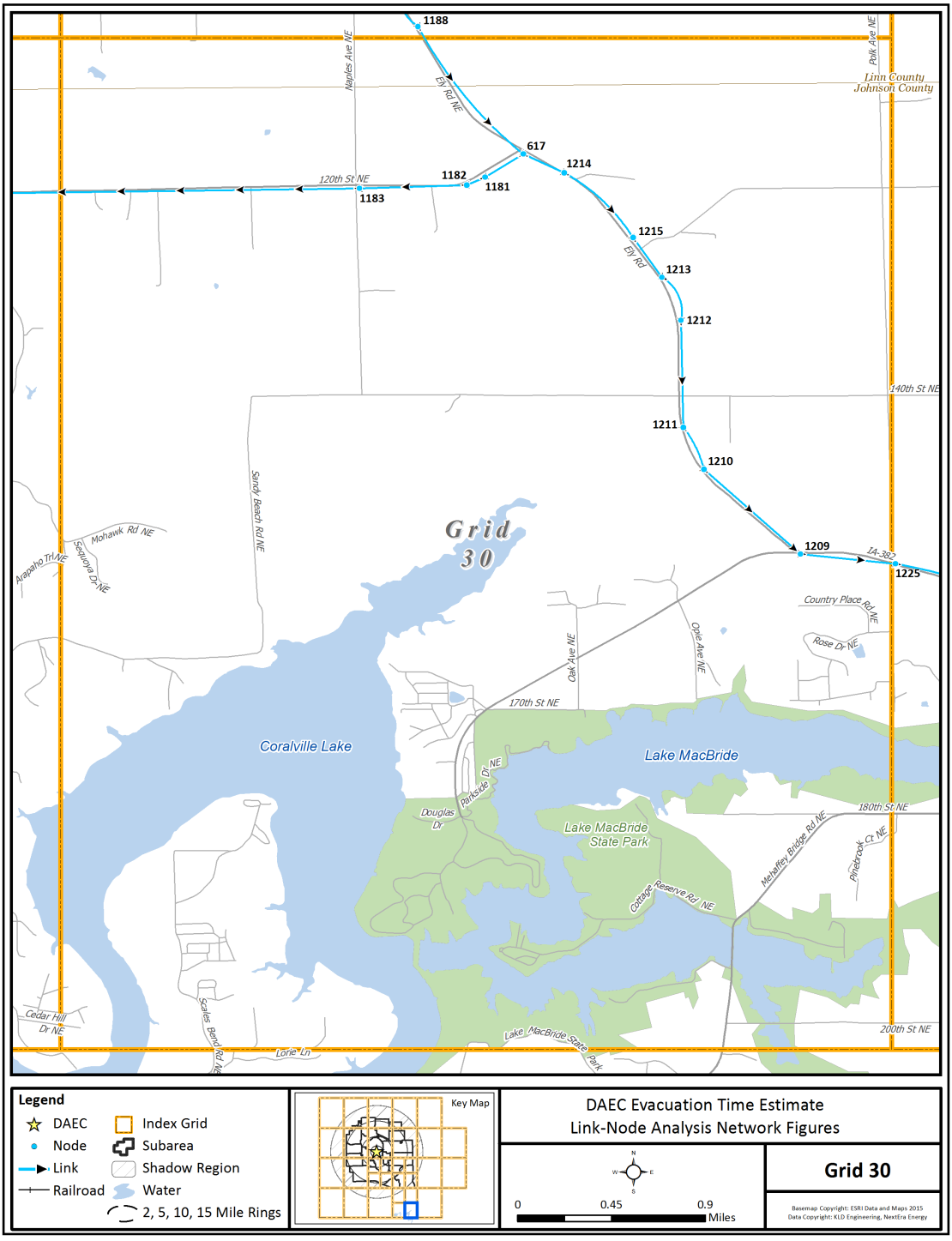

Figure K-31. Link-Node Analysis Network – Grid 30

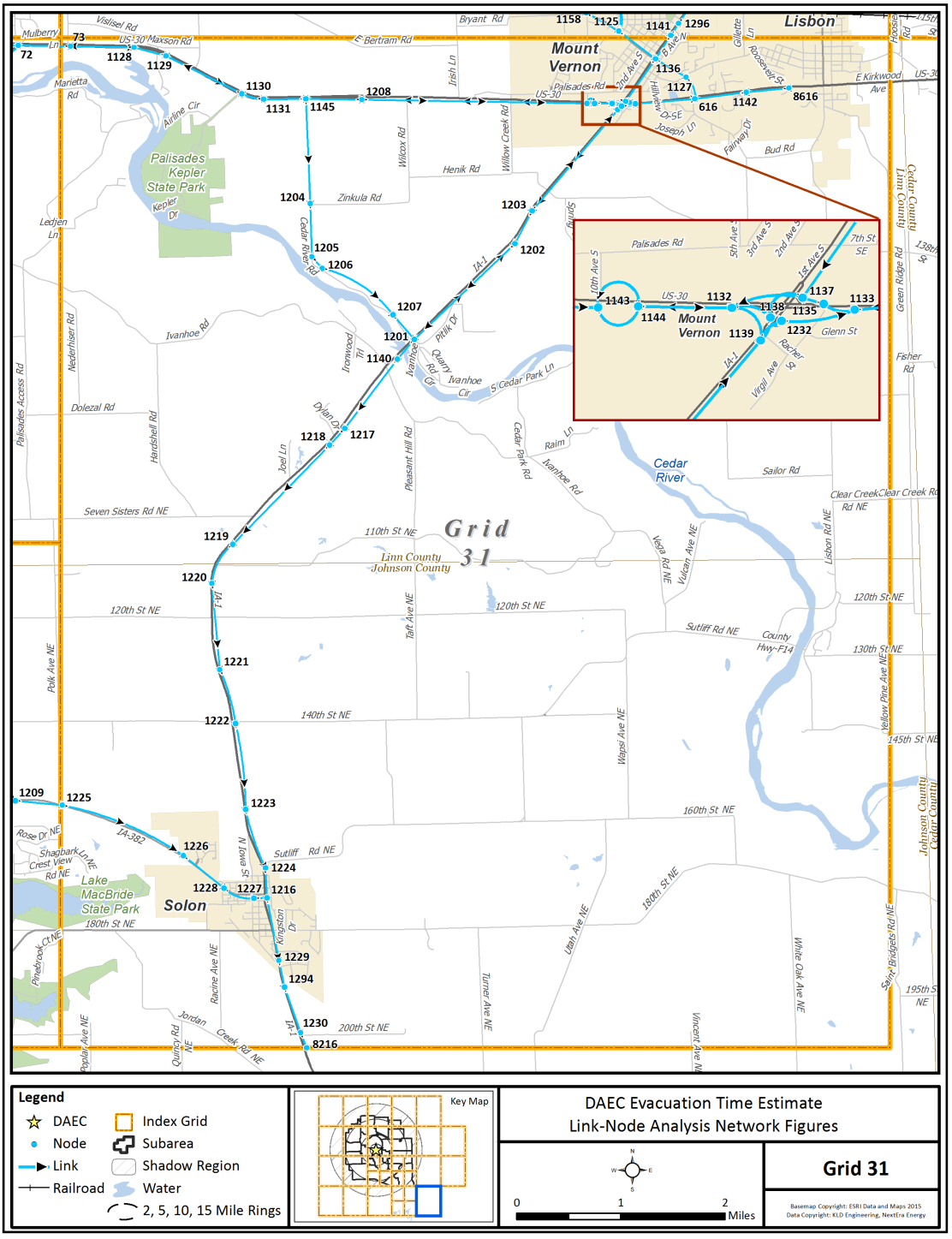

Figure K-32. Link-Node Analysis Network – Grid 31

Table K-1. Evacuation Roadway Network Characteristics

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1	2	142	TROY MILLS RD	COLLECTOR	15159	1	12	4	1700	45	3
2	2	149	CENTRAL CITY RD	COLLECTOR	26743	1	10	2	1700	45	8
3	2	150	CENTRAL CITY RD	COLLECTOR	15719	1	10	2	1700	45	9
4	3	103	I-380	FREEWAY	3041	2	12	4	2250	70	1
5	4	5	I-380	FREEWAY	14628	2	12	4	2250	70	2
6	4	100	I-380	FREEWAY	4163	2	12	4	2250	70	2
7	5	4	I-380	FREEWAY	14628	2	12	4	2250	70	2
8	5	6	I-380	FREEWAY	3235	2	12	4	2250	70	2
9	5	94	I-380 OFF RAMP TO 31ST AVE	FREEWAY RAMP	2003	1	12	4	1700	45	2
10	6	5	I-380	FREEWAY	3235	2	12	4	2250	70	2
11	6	7	I-380	FREEWAY	5773	2	12	4	2250	70	2
12	6	95	I-380 OFF RAMP TO 31ST AVE	FREEWAY RAMP	2368	1	12	4	1700	45	2
13	7	6	I-380	FREEWAY	5773	2	12	4	2250	70	2
14	7	8	I-380	FREEWAY	2374	2	12	4	2250	70	2
15	7	273	I-380 OFF RAMP	FREEWAY RAMP	1104	1	12	4	1750	45	2
16	8	7	I-380	FREEWAY	2374	2	12	4	2250	70	2
17	8	9	I-380	FREEWAY	13377	2	12	4	2250	70	2
18	8	272	I-380 OFF RAMP	FREEWAY RAMP	1194	1	12	4	1750	45	2
19	9	8	I-380	FREEWAY	13380	2	12	4	2250	70	2
20	9	959	I-380	FREEWAY	6757	2	12	4	2250	70	8
21	10	11	I-380	FREEWAY	2897	2	12	4	2250	70	8
22	10	959	I-380	FREEWAY	9155	2	12	4	2250	70	8
23	11	10	I-380	FREEWAY	2897	2	12	4	2250	70	8
24	11	203	I-380 OFF RAMP TO LEWIS ACCESS RD	FREEWAY RAMP	1474	1	12	4	1750	45	8

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
25	11	772	I-380	FREEWAY	7154	2	12	4	2250	70	8
26	12	13	I-380	FREEWAY	4727	2	12	4	2250	70	8
27	12	772	I-380	FREEWAY	11445	2	12	4	2250	70	8
28	13	12	I-380	FREEWAY	4746	2	12	4	2250	70	8
29	13	771	I-380	FREEWAY	8909	2	12	4	2250	70	8
30	14	15	I-380	FREEWAY	1866	2	12	4	2250	70	8
31	14	276	I-380 OFF RAMP TO COUNTRY HOME RD	FREEWAY RAMP	1241	1	12	4	1750	45	8
32	14	771	I-380	FREEWAY	2053	2	12	4	2250	70	8
33	15	14	I-380	FREEWAY	1866	2	12	4	2250	70	8
34	15	16	I-380	FREEWAY	10938	2	12	4	2250	70	8
35	16	15	I-380	FREEWAY	10938	2	12	4	2250	70	8
36	16	761	I-380	FREEWAY	3953	2	12	4	2250	70	15
37	18	19	I-380	FREEWAY	2831	2	12	4	2250	70	15
38	18	288	I-380 OFF RAMP FROM BOYSON RD	FREEWAY RAMP	1258	1	12	4	1750	45	15
39	18	761	I-380	FREEWAY	1848	2	12	4	2250	70	15
40	19	18	I-380	FREEWAY	2831	2	12	4	2250	70	15
41	19	20	I-380	FREEWAY	1950	2	12	10	2250	70	18
42	19	289	I-380 OFF RAMP FROM BOYSON RD	FREEWAY RAMP	1585	1	12	4	1750	45	15
43	20	19	I-380	FREEWAY	1965	2	12	10	2250	70	18
44	20	21	I-380	FREEWAY	3325	2	12	10	2250	70	18
45	20	211	I-380 OFF RAMP TO BLAIRS FERRY RD	FREEWAY RAMP	1287	1	12	4	1750	45	18
46	21	20	I-380	FREEWAY	3326	2	12	10	2250	70	18
47	21	23	I-380	FREEWAY	2294	3	12	10	2250	70	18
48	22	298	IA-100 OFF RAMP TO I-380	FREEWAY RAMP	423	2	12	4	1750	45	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
49	22	713	ON-RAMP I-380	FREEWAY RAMP	784	2	12	4	1900	45	18
50	23	21	I-380	FREEWAY	2294	3	12	10	2250	70	18
51	23	25	I-380	FREEWAY	2099	3	12	10	2250	70	18
52	23	715	OFF-RAMP I-380	FREEWAY RAMP	633	1	12	4	1700	45	18
53	24	25	ON-RAMP I-380	FREEWAY RAMP	1245	1	12	4	1700	45	18
54	24	985	42ND ST NE	MINOR ARTERIAL	462	2	12	0	1900	45	18
55	25	23	I-380	FREEWAY	2099	3	12	10	2250	70	18
56	25	26	I-380	FREEWAY	1214	3	12	5	2250	70	18
57	25	297	OFF-RAMP I-380	FREEWAY RAMP	1109	1	12	4	1750	45	18
58	26	25	I-380	FREEWAY	1214	3	12	5	2250	70	18
59	26	27	I-380	FREEWAY	2648	3	12	5	2250	70	18
60	26	324	I-380 OFF RAMP	FREEWAY RAMP	1146	2	12	4	1750	45	18
61	27	26	I-380	FREEWAY	2648	3	12	5	2250	70	18
62	27	28	I-380	FREEWAY	1583	3	12	4	2250	70	18
63	28	27	I-380	FREEWAY	1583	3	12	4	2250	70	18
64	28	33	I-380	FREEWAY	1894	3	12	4	2250	70	18
65	28	1234	I-380 OFF RAMP	FREEWAY RAMP	680	1	12	4	1750	45	18
66	29	31	J AVE	COLLECTOR	1491	1	12	4	1700	45	20
67	29	336	CENTER POINT RD	MINOR ARTERIAL	1396	2	12	4	1900	45	20
68	30	29	J AVE	COLLECTOR	756	1	12	4	1750	45	20
69	31	29	J AVE	COLLECTOR	1491	1	12	2	1750	45	20
70	31	1236	10TH ST	COLLECTOR	1392	1	12	4	1750	45	20
71	32	33	I-380	FREEWAY	1927	3	12	4	2250	70	20
72	32	339	I-380 OFF RAMP	FREEWAY RAMP	917	1	12	4	1750	45	20
73	32	770	I-380	FREEWAY	1214	4	12	4	2250	70	20
74	33	28	I-380	FREEWAY	1894	3	12	4	2250	70	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
75	33	32	I-380	FREEWAY	1928	3	12	4	2250	70	20
76	34	35	I-380	FREEWAY	762	3	12	4	2250	70	20
77	34	770	I-380	FREEWAY	1864	4	12	4	2250	70	20
78	35	34	I-380	FREEWAY	762	3	12	4	2250	70	20
79	35	347	I-380	FREEWAY	2825	3	12	4	2250	70	20
80	36	37	I-380	FREEWAY	2691	3	12	4	2250	70	20
81	36	353	I-380	FREEWAY	1136	3	12	4	2250	70	20
82	37	36	I-380	FREEWAY	2691	3	12	4	2250	70	20
83	37	40	I-380	FREEWAY	2739	3	12	4	2250	70	20
84	40	37	I-380	FREEWAY	2739	3	12	4	2250	70	20
85	40	41	I-380	FREEWAY	2890	3	12	4	2250	70	20
86	40	417	I-380 OFF RAMP TO WILSON AVE	FREEWAY RAMP	1238	1	12	4	1700	45	20
87	41	40	I-380	FREEWAY	2890	3	12	4	2250	70	20
88	41	42	I-380	FREEWAY	1365	3	12	4	2250	70	20
89	41	416	I-380 OFF RAMP TO WILSON AVE	FREEWAY RAMP	1402	1	12	4	1750	45	20
90	42	41	I-380	FREEWAY	1365	2	12	4	2250	70	20
91	42	43	I-380	FREEWAY	2254	3	12	4	2250	70	20
92	42	263	I-380 OFF RAMP TO 33RD AVE SW	FREEWAY RAMP	1245	1	12	4	1750	45	20
93	43	42	I-380	FREEWAY	2254	3	12	4	2250	70	20
94	43	264	I-380 OFF RAMP TO 33RD AVE SW	FREEWAY RAMP	996	1	12	4	1750	45	20
95	43	722	I-380	FREEWAY	2734	3	12	4	2250	70	20
96	44	443	I-380	FREEWAY	1147	2	12	4	2250	70	27
97	44	722	I-380	FREEWAY	1363	3	12	4	2250	70	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
98	45	65	I-380 OFF RAMP TO US-30	FREEWAY RAMP	2016	1	12	4	1700	45	27
99	45	444	I-380	FREEWAY	1260	2	12	4	2250	70	27
100	45	660	I-380	FREEWAY	3735	2	12	4	2250	70	27
101	46	47	I-380	FREEWAY	2894	2	12	4	2250	70	27
102	46	660	I-380	FREEWAY	3526	2	12	4	2250	70	27
103	47	46	I-380	FREEWAY	2894	2	12	4	2250	70	27
104	47	48	I-380	FREEWAY	2988	2	12	4	2250	70	27
105	47	237	I-380 OFF RAMP TO WRIGHT BROTHERS BLVD	FREEWAY RAMP	1652	1	12	4	1750	45	27
106	48	47	I-380	FREEWAY	2988	2	12	4	2250	70	27
107	48	51	I-380	FREEWAY	1480	2	12	4	2250	70	27
108	48	238	I-380 OFF RAMP TO WRIGHT BROTHERS BLVD	FREEWAY RAMP	1487	1	12	4	1750	45	27
109	49	50	ELY RD	COLLECTOR	1747	1	12	3	1700	55	28
110	49	452	WRIGHT BROTHERS BLVD	COLLECTOR	9966	1	12	8	1700	55	27
111	50	49	ELY RD	COLLECTOR	1747	1	12	3	1700	55	28
112	50	1185	ELY RD	COLLECTOR	823	1	12	3	1700	55	28
113	51	48	I-380	FREEWAY	1480	2	12	4	2250	70	27
114	51	1179	I-380	FREEWAY	11854	2	12	4	2250	70	27
115	53	54	US - 30	MINOR ARTERIAL	15556	2	12	8	1900	55	12
116	53	933	US - 30	MINOR ARTERIAL	1831	2	12	8	1900	60	12
117	53	1034	US-218	COLLECTOR	10669	1	10	3	1700	60	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
118	54	53	US - 30	MINOR ARTERIAL	15556	2	12	8	1900	55	12
119	54	55	US - 30	MINOR ARTERIAL	16137	2	12	8	1900	65	13
120	54	879	27TH AVE	COLLECTOR	10539	1	10	4	1700	45	13
121	55	54	US - 30	MINOR ARTERIAL	16137	2	12	8	1900	65	13
122	55	122	US - 30	MINOR ARTERIAL	10471	2	12	8	1900	65	13
123	55	929	30TH AVE	COLLECTOR	10450	1	12	4	1700	55	13
124	56	122	US - 30	MINOR ARTERIAL	5198	2	12	8	1900	65	13
125	56	926	US - 30	FREEWAY	10758	2	12	8	2250	65	16
126	57	58	US - 30	FREEWAY	3490	2	12	8	2250	65	16
127	57	926	US - 30	FREEWAY	6138	2	12	8	2250	65	16
128	58	57	US - 30	FREEWAY	3506	2	12	8	2250	65	16
129	58	655	US - 30	FREEWAY	1497	2	12	8	2250	65	16
130	59	60	US - 30	FREEWAY	3396	2	12	8	2250	65	17
131	59	168	US - 30	FREEWAY	7477	2	12	8	2250	65	16
132	59	178	US-151B ON RAMP	FREEWAY RAMP	1441	1	12	4	1750	40	17
133	60	59	US - 30	FREEWAY	3396	2	12	8	2250	65	17
134	60	61	US - 30	FREEWAY	4679	2	12	8	2250	65	17
135	60	179	US-30 EXIT RAMP TO US-151B	FREEWAY RAMP	1353	1	12	4	1750	60	17
136	61	60	US - 30	FREEWAY	4679	2	12	8	2250	65	17
137	61	232	US-30 OFF RAMP	FREEWAY RAMP	1421	1	12	4	1700	45	17
138	61	407	US - 30	FREEWAY	614	2	12	8	2250	60	17
139	62	63	US - 30	FREEWAY	8964	2	12	8	2250	60	17
140	62	231	US-30 OFF RAMP	FREEWAY RAMP	1538	1	12	4	1750	55	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
141	62	407	US - 30	FREEWAY	1400	2	12	8	2250	60	17
142	63	62	US - 30	FREEWAY	8964	2	12	8	2250	60	17
143	63	437	US - 30	FREEWAY	602	2	12	8	2250	60	27
144	64	45	I-380 ON RAMP FROM US-30	FREEWAY RAMP	2081	1	12	4	1700	45	27
145	64	432	US - 30	FREEWAY	771	2	12	8	2250	60	27
146	64	441	US - 30	FREEWAY	1074	2	12	8	2250	60	27
147	65	66	US - 30	FREEWAY	1383	2	12	8	2250	60	27
148	65	442	US - 30	FREEWAY	884	2	12	8	2250	60	27
149	66	65	US - 30	FREEWAY	1383	2	12	8	2250	60	27
150	66	427	US - 30	FREEWAY	713	2	12	8	2250	60	27
151	67	68	US - 30	FREEWAY	2256	2	12	8	2250	60	27
152	67	422	US-30 OFF RAMP	FREEWAY RAMP	1620	1	12	4	1750	45	27
153	67	431	US - 30	FREEWAY	1256	2	12	8	2250	60	27
154	68	67	US - 30	FREEWAY	2256	2	12	8	2250	60	27
155	68	445	US - 30	FREEWAY	1139	2	12	8	2250	65	27
156	68	783	US-30 OFF RAMP	FREEWAY RAMP	950	1	12	4	1700	45	27
157	69	446	US - 30	FREEWAY	1231	2	12	8	2250	65	27
158	69	950	US - 30	FREEWAY	2165	2	12	8	2250	65	27
159	70	71	US - 30	FREEWAY	3133	2	12	8	2250	60	28
160	70	636	US - 30	FREEWAY	2023	3	12	8	2250	65	28
161	71	70	US - 30	FREEWAY	3133	2	12	8	2250	60	28
162	71	453	US - 30	FREEWAY	2287	2	12	8	2250	60	28
163	72	73	US - 30	FREEWAY	2647	2	12	8	2250	60	28
164	72	453	US - 30	FREEWAY	810	2	12	8	2250	60	28
165	73	72	US - 30	FREEWAY	2647	2	12	8	2250	60	28
166	73	1128	US - 30	FREEWAY	3212	2	12	8	2250	60	31
167	74	184	MAIN ST	COLLECTOR	1281	1	12	4	1125	25	7

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
168	74	590	CO TRUNK RD E30	COLLECTOR	2787	1	10	5	1125	25	7
169	74	688	CO TRUNK HWY W26	COLLECTOR	723	1	12	2	1700	45	7
170	75	76	CO TRUNK HWY W26	COLLECTOR	9631	1	10	3	1700	60	7
171	75	128	CO TRUNK HWY E24	COLLECTOR	13500	1	12	4	1700	50	7
172	76	77	CO TRUNK HWY W26	COLLECTOR	21831	1	10	3	1700	60	7
173	77	609	CO TRUNK HWY W26	COLLECTOR	807	1	10	0	1700	45	2
174	78	79	SUNSET ST	COLLECTOR	5311	1	12	6	1700	55	2
175	78	273	SUNSET ST	COLLECTOR	786	1	12	4	1700	45	2
176	79	78	SUNSET ST	COLLECTOR	5308	1	12	6	1700	55	2
177	79	94	31ST AVE	COLLECTOR	6455	1	12	10	1700	65	2
178	79	923	US-150	COLLECTOR	5377	1	12	6	1700	55	2
179	81	82	CO HWY V71	COLLECTOR	12197	1	10	3	1700	45	1
180	82	83	CO HWY V71	COLLECTOR	3855	1	10	3	1700	45	1
181	83	84	CO HWY V71	COLLECTOR	6011	1	10	3	1700	55	2
182	84	85	CO HWY V71	COLLECTOR	4296	1	10	3	1700	55	2
183	85	86	FREEMAN AVE	COLLECTOR	7084	1	10	3	1700	55	1
184	86	88	CO HWY D48	COLLECTOR	5070	1	12	4	1700	45	1
185	86	99	CO HWY D48	COLLECTOR	2141	1	10	3	1700	65	1
186	88	89	CO HWY D48	COLLECTOR	1397	1	12	4	1700	45	1
187	89	90	CO HWY D48	COLLECTOR	5104	1	12	4	1700	40	1
188	94	6	I-380 ON RAMP FROM 31ST AVE	FREEWAY RAMP	1432	1	12	4	1700	45	2
189	94	95	31ST AVE	COLLECTOR	1200	1	12	4	1700	45	2
190	95	5	I-380 ON RAMP FROM 31ST AVE	FREEWAY RAMP	1028	1	12	4	1700	45	2

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
191	95	96	31ST AVE	COLLECTOR	13578	1	12	4	1700	65	2
192	96	97	31ST AVE	COLLECTOR	10397	1	10	6	1700	65	2
193	97	98	330TH ST	COLLECTOR	23174	1	10	3	1700	65	2
194	97	102	31ST AVE	COLLECTOR	4388	1	10	6	1700	65	2
195	98	99	CO HWY D48	COLLECTOR	1434	1	10	3	1700	65	2
196	98	101	I-380 ON RAMP FROM CO HWY D48	FREEWAY RAMP	1540	1	15	10	1700	45	2
197	99	86	CO HWY D48	COLLECTOR	2141	1	10	3	1700	65	1
198	99	98	CO HWY D48	COLLECTOR	1434	1	10	3	1700	65	2
199	100	4	I-380	FREEWAY	4164	2	12	4	2250	70	2
200	100	101	I-380	FREEWAY	14789	2	12	4	2250	70	2
201	101	100	I-380	FREEWAY	14789	2	12	4	2250	70	2
202	101	103	I-380	FREEWAY	6681	2	12	4	2250	70	1
203	103	3	I-380	FREEWAY	3041	2	12	4	2250	70	1
204	103	101	I-380	FREEWAY	6681	2	12	4	2250	70	1
205	106	107	US-218	COLLECTOR	31746	1	10	3	1700	60	12
206	106	1034	US-218	COLLECTOR	5148	1	10	3	1700	60	12
207	106	1038	County HWY E44	COLLECTOR	13233	1	10	2	1700	55	12
208	107	106	US-218	COLLECTOR	31746	1	10	3	1700	60	12
209	107	108	US-218	COLLECTOR	18488	1	12	8	1700	60	6
210	108	107	US-218	COLLECTOR	18488	1	12	8	1700	60	6
211	108	589	61ST ST	COLLECTOR	8797	1	12	4	1575	35	6
212	108	936	US-218	COLLECTOR	1589	1	12	4	1700	45	6
213	109	114	US-218	COLLECTOR	4084	1	12	8	1700	55	6
214	109	810	US-150	MINOR ARTERIAL	1005	2	12	4	1900	45	6
215	109	936	US-218	MINOR ARTERIAL	969	2	12	4	1900	45	6

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
216	110	585	US-150	COLLECTOR	375	1	12	4	1125	25	6
217	110	586	3RD ST	COLLECTOR	2633	1	12	4	1575	35	6
218	110	693	3RD ST	COLLECTOR	956	1	12	0	1575	35	6
219	111	112	US-150	COLLECTOR	15648	1	10	3	1700	65	6
220	111	693	US-150	COLLECTOR	1311	1	12	4	1575	35	6
221	112	113	US-150	COLLECTOR	5702	1	10	3	1700	55	1
222	113	81	US-150	COLLECTOR	5003	1	10	3	1700	65	1
223	114	109	US-218	COLLECTOR	4086	1	12	8	1700	55	6
224	114	588	US-218	COLLECTOR	3098	1	12	4	1750	45	6
225	115	116	US-218	COLLECTOR	3023	1	10	3	1700	45	6
226	115	586	US-218	COLLECTOR	2015	1	10	3	1575	35	6
227	116	115	US-218	COLLECTOR	3023	1	10	3	1700	45	6
228	116	117	US-218	COLLECTOR	1768	1	10	3	1700	65	6
229	117	116	US-218	COLLECTOR	1768	1	10	3	1700	65	6
230	117	587	US-218	COLLECTOR	1998	1	10	3	1700	65	6
231	118	119	CO TRUNK HWY W26	COLLECTOR	10285	1	10	3	1700	65	13
232	119	120	CO TRUNK HWY W26	COLLECTOR	11221	1	10	3	1700	55	13
233	120	775	County HWY E44	COLLECTOR	21060	1	12	4	1700	45	13
234	120	878	CO TRUNK HWY W26	COLLECTOR	5348	1	12	4	1700	45	13
235	122	55	US - 30	MINOR ARTERIAL	10471	2	12	8	1900	65	13
236	122	56	US - 30	MINOR ARTERIAL	5198	2	12	8	1900	65	13
237	124	695	27TH AVE	COLLECTOR	536	1	10	4	1350	30	13
238	127	107	CO TRUNK RD E30	COLLECTOR	15967	1	10	5	1700	65	6
239	127	685	27TH AVE	COLLECTOR	10536	1	10	4	1700	50	7

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
240	128	938	CO TRUNK HWY E24	COLLECTOR	9001	1	12	4	1700	50	7
241	129	130	CO TRUNK HWY E24	COLLECTOR	5785	1	12	2	1700	45	6
242	130	937	10TH AVE	COLLECTOR	3504	1	12	2	1700	40	6
243	131	591	E 13TH ST	COLLECTOR	2762	1	14	2	1575	35	6
244	132	585	US-150	COLLECTOR	3076	1	12	4	1125	25	6
245	132	810	US-150	COLLECTOR	1762	1	12	4	1350	30	6
246	133	134	FRANKLIN ST	COLLECTOR	3252	1	12	4	1700	45	8
247	133	203	LEWIS ACCESS RD	COLLECTOR	4286	1	12	4	1750	45	8
248	134	133	FRANKLIN ST	COLLECTOR	3254	1	12	4	1750	45	8
249	134	274	IOWA ST	COLLECTOR	819	1	12	4	1575	35	8
250	134	599	FRANKLIN ST	LOCAL ROADWAY	708	1	10	4	1575	35	8
251	135	149	CENTRAL CITY RD	COLLECTOR	2838	1	10	2	1700	45	8
252	135	582	N CENTER POINT RD	COLLECTOR	2726	1	10	3	1350	30	8
253	135	596	FRANKLIN ST	LOCAL ROADWAY	1896	1	10	4	1575	35	8
254	136	581	N CENTER POINT RD	COLLECTOR	11455	1	10	3	1700	55	3
255	137	141	CO HWY D62	COLLECTOR	12163	1	10	3	1700	45	3
256	137	1064	CO HWY D62	COLLECTOR	744	1	10	0	1125	25	3
257	138	139	CO RD W35	COLLECTOR	10585	1	10	3	1700	60	3
258	138	148	CO HWY D62	COLLECTOR	12466	1	10	3	1700	45	3
259	139	140	CO RD W35	COLLECTOR	10544	1	10	3	1700	50	3
260	141	96	CO HWY D62	COLLECTOR	15963	1	10	3	1700	45	2
261	142	143	TROY MILLS RD	COLLECTOR	1267	1	12	4	1700	45	3
262	142	152	PARIS RD	COLLECTOR	16053	1	10	3	1700	60	4
263	143	144	TROY MILLS RD	COLLECTOR	15728	1	12	4	1700	45	3
264	144	145	TROY MILLS RD	COLLECTOR	2682	1	12	4	1700	45	3
265	145	1060	COGGON RD	COLLECTOR	5543	1	10	3	1700	45	3

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
266	145	1061	TROY MILLS RD	COLLECTOR	1986	1	12	4	1700	45	3
267	146	1063	TROY MILLS RD	COLLECTOR	851	1	12	4	1700	40	3
268	148	144	CO HWY D62	COLLECTOR	12272	1	10	3	1700	45	3
269	149	2	CENTRAL CITY RD	COLLECTOR	26743	1	10	2	1700	45	8
270	149	135	CENTRAL CITY RD	COLLECTOR	2838	1	10	2	1700	45	8
271	150	152	N ALBURNETT RD	COLLECTOR	15185	1	10	3	1700	65	4
272	150	1026	CENTRAL CITY RD	COLLECTOR	5363	1	12	6	1700	60	9
273	151	683	IA-13	MINOR ARTERIAL	2548	2	10	8	1900	60	9
274	152	610	PARIS RD	COLLECTOR	3540	1	10	3	1575	35	4
275	153	1058	IA-13	COLLECTOR	9402	1	12	4	1700	60	4
276	154	159	IA-13	MINOR ARTERIAL	5231	2	10	10	1900	45	19
277	154	221	US-151B	MINOR ARTERIAL	12135	2	12	4	1900	55	19
278	154	559	IA-13	MINOR ARTERIAL	1862	2	12	4	1750	65	19
279	155	394	IA-13	MINOR ARTERIAL	10649	2	12	4	1900	65	19
280	155	559	IA-13	MINOR ARTERIAL	3939	2	12	4	1750	65	19
281	155	979	SECRIST RD	COLLECTOR	18589	1	12	2	1700	50	22
282	156	367	MT VERNON RD	COLLECTOR	6300	1	10	5	1700	45	21
283	156	394	IA-13	MINOR ARTERIAL	5332	2	12	5	1900	65	21
284	156	1025	IA-13	MINOR ARTERIAL	3125	2	12	4	1900	75	21
285	157	158	IA-13	MINOR ARTERIAL	7149	2	12	4	1900	75	21

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
286	157	755	IA-13	MINOR ARTERIAL	4249	2	12	4	1900	75	21
287	158	71	IA-13 OFF RAMP TO US-30	FREEWAY RAMP	1740	1	12	4	1700	50	28
288	158	157	IA-13	MINOR ARTERIAL	7149	2	12	4	1900	75	21
289	158	1056	IA-13 OFF RAMP TO US-30	FREEWAY RAMP	1222	2	12	4	1900	45	21
290	159	154	IA-13	MINOR ARTERIAL	5231	2	10	10	1750	45	19
291	159	160	IA-13	MINOR ARTERIAL	7817	2	10	10	1900	45	19
292	160	159	IA-13	MINOR ARTERIAL	7817	2	10	10	1900	45	19
293	160	161	IA-13	MINOR ARTERIAL	8118	2	10	10	1750	65	9
294	161	160	IA-13	MINOR ARTERIAL	8118	2	10	10	1900	65	9
295	161	162	IA-13	MINOR ARTERIAL	21294	2	10	6	1750	70	9
296	161	284	COUNTRY HOME RD	COLLECTOR	2623	1	10	2	1700	65	9
297	162	1057	IA-13	MINOR ARTERIAL	8854	2	12	3	1900	60	9
298	163	458	IA-13	COLLECTOR	1654	1	12	4	1700	60	4
299	164	583	IA-13	COLLECTOR	7015	1	12	4	1700	60	5
300	165	166	80TH ST SW	COLLECTOR	1707	1	12	8	1700	45	16
301	165	169	16TH AVE SW	COLLECTOR	5236	1	12	6	1750	65	16
302	165	737	US-30 ON-RAMP	FREEWAY RAMP	2540	2	12	4	1900	45	16
303	166	656	80TH ST SW	COLLECTOR	889	1	12	8	1700	45	16

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
304	168	59	US - 30	FREEWAY	7477	2	12	8	2250	65	16
305	168	655	US - 30	FREEWAY	1323	2	12	8	2250	65	16
306	169	165	16TH AVE SW	COLLECTOR	5236	1	12	6	1700	65	16
307	169	733	16TH AVE SW	COLLECTOR	3224	1	12	4	1700	45	17
308	169	902	STONEY POINT RD SW	COLLECTOR	3796	1	12	4	1700	40	17
309	170	414	16TH AVE SW	MINOR ARTERIAL	3985	2	12	4	1750	45	17
310	170	733	16TH AVE SW	MINOR ARTERIAL	783	2	12	4	1900	45	17
311	171	414	16TH AVE SW	MINOR ARTERIAL	2675	2	12	4	1750	45	17
312	171	626	16TH AVE SW	MINOR ARTERIAL	773	2	12	4	1900	45	17
313	171	1046	EDGEWOOD RD SW	MINOR ARTERIAL	1289	2	12	4	1750	45	17
314	172	625	US-151B	MINOR ARTERIAL	1286	3	12	4	1750	60	17
315	172	626	16TH AVE SW	MAJOR ARTERIAL	1187	3	12	10	1900	45	17
316	172	664	US-151B	MINOR ARTERIAL	3124	2	12	4	1750	60	17
317	172	890	16TH AVE SW	MINOR ARTERIAL	553	2	12	4	1750	45	17
318	173	939	US-151B	MINOR ARTERIAL	408	2	12	0	1750	45	17
319	173	940	5TH AVE	COLLECTOR	442	1	12	4	1700	40	17
320	173	972	US-151B	COLLECTOR	661	2	12	2	1750	60	17
321	174	181	US-151B	COLLECTOR	3286	1	12	4	1700	60	26

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
322	175	234	US-151B	COLLECTOR	9209	1	12	4	1750	60	26
323	176	954	US-151B	COLLECTOR	2580	1	12	4	1700	45	26
324	177	176	US-151B	COLLECTOR	2437	1	12	4	1700	55	26
325	178	60	US-30 ON RAMP FROM US-151B	FREEWAY RAMP	2257	1	12	4	1700	45	17
326	178	179	US-151B	MINOR ARTERIAL	1621	2	12	6	1750	60	17
327	178	945	US-151B	MINOR ARTERIAL	659	2	10	6	1900	65	17
328	179	59	US-30 ON RAMP FROM US-151B	FREEWAY RAMP	2345	1	12	4	1700	45	17
329	179	178	US-151B	MINOR ARTERIAL	1621	2	12	6	1750	60	17
330	179	410	US-151B	MINOR ARTERIAL	4288	2	12	6	1750	60	17
331	180	405	US-151B	MAJOR ARTERIAL	718	3	12	4	1750	60	17
332	180	406	EDGEWOOD RD SW	MAJOR ARTERIAL	685	3	12	0	1750	45	17
333	180	625	US-151B	MAJOR ARTERIAL	1357	3	12	4	1750	60	17
334	181	1261	US-151B	COLLECTOR	2552	1	12	4	1700	50	26
335	181	1273	1ST ST N	COLLECTOR	6399	1	11	1	1700	40	26
336	184	74	MAIN ST	COLLECTOR	1281	1	12	4	1125	25	7
337	184	185	PEARL ST	COLLECTOR	338	1	12	4	1350	30	7
338	185	184	PEARL ST	COLLECTOR	338	1	12	4	1350	30	7
339	185	691	CO TRUNK HWY W26	COLLECTOR	366	1	10	3	1575	35	7
340	186	118	SHELLSBURG RD	COLLECTOR	9284	1	10	3	1700	55	13

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
341	187	807	BLAIRS FERRY RD NE	COLLECTOR	1457	1	12	8	1700	45	14
342	187	808	County HWY W36	COLLECTOR	722	1	12	4	1700	45	14
343	187	957	SHELLSBURG RD	COLLECTOR	2707	1	10	3	1700	55	14
344	188	808	County HWY W36	COLLECTOR	3167	1	12	4	1700	45	14
345	188	1103	County HWY W36	COLLECTOR	3920	1	12	6	1700	60	14
346	189	204	BLAIRS FERRY RD NE	COLLECTOR	8523	1	12	4	1700	50	14
347	189	593	CO HWY W36	COLLECTOR	1419	1	10	0	1575	35	14
348	189	807	BLAIRS FERRY RD NE	COLLECTOR	3314	1	12	8	1700	45	14
349	190	191	County HWY W36	COLLECTOR	6881	1	12	6	1700	60	14
350	191	1090	County HWY W36	COLLECTOR	3178	1	12	6	1700	45	14
351	192	193	F AVE	COLLECTOR	3307	1	12	6	1700	45	16
352	192	927	ELLIS RD	COLLECTOR	14582	1	12	4	1700	45	16
353	193	652	STONEY POINT ROAD	COLLECTOR	5227	1	12	4	1575	35	17
354	193	760	F AVE	COLLECTOR	9008	1	12	6	1750	40	17
355	194	230	EDGEWOOD RD SW	MINOR ARTERIAL	662	2	12	4	1750	45	17
356	194	892	F AVE	COLLECTOR	3173	1	12	2	1700	55	17
357	195	189	CO HWY W36	COLLECTOR	3484	1	10	4	1700	65	8
358	196	195	CO HWY W36	COLLECTOR	5451	1	10	4	1700	65	8
359	196	197	CO HWY W36	COLLECTOR	7029	1	12	4	1700	45	8
360	197	198	LEWIS BOTTOMS RD	COLLECTOR	5161	1	12	3	1700	65	8
361	198	199	LEWIS BOTTOMS RD	COLLECTOR	7342	1	12	3	1700	65	8
362	199	200	LEWIS BOTTOMS RD	COLLECTOR	5170	1	12	3	1700	60	8
363	200	201	LEWIS ACCESS RD	COLLECTOR	7509	1	12	3	1700	65	8
364	201	202	LEWIS ACCESS RD	COLLECTOR	4965	1	12	3	1700	65	8

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
365	202	11	I-380 ON RAMP FROM LEWIS ACCESS RD	FREEWAY RAMP	1673	1	12	4	1700	50	8
366	202	203	LEWIS ACCESS RD	COLLECTOR	1161	1	12	4	1750	45	8
367	203	10	I-380 ON RAMP FROM LEWIS ACCESS RD	FREEWAY RAMP	1662	1	12	4	1700	45	8
368	203	133	LEWIS ACCESS RD	COLLECTOR	4273	1	12	4	1750	45	8
369	204	189	BLAIRS FERRY RD NE	COLLECTOR	8522	1	12	4	1700	50	14
370	204	205	BLAIRS FERRY RD NE	COLLECTOR	6442	1	10	4	1700	55	15
371	205	206	BLAIRS FERRY RD NE	COLLECTOR	3054	1	10	4	1700	45	15
372	206	207	BLAIRS FERRY RD NE	COLLECTOR	3909	1	10	4	1700	45	15
373	207	208	BLAIRS FERRY RD NE	COLLECTOR	4116	1	10	4	1700	45	15
374	208	762	BLAIRS FERRY RD NE	COLLECTOR	1903	1	10	4	1700	55	15
375	209	287	BLAIRS FERRY RD NE	COLLECTOR	2076	1	10	4	1700	50	15
376	210	1100	EDGEWOOD RD NW	MINOR ARTERIAL	595	2	12	4	1750	45	15
377	210	1102	BLAIRS FERRY RD NE	COLLECTOR	271	1	12	4	1700	40	15
378	211	212	BLAIRS FERRY RD NE	MINOR ARTERIAL	432	2	12	4	1750	45	18
379	211	465	BLAIRS FERRY RD NE	MINOR ARTERIAL	1631	2	12	2	1750	40	15
380	211	805	I-380 ACCESS RD	MAJOR ARTERIAL	1212	3	12	4	1900	45	18
381	212	20	I-380 ON RAMP FROM BLAIRS FERRY RD	FREEWAY RAMP	1364	1	12	4	1700	45	18
382	212	211	BLAIRS FERRY RD NE	MINOR ARTERIAL	432	2	12	4	1750	40	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
383	212	1169	BLAIRS FERRY RD NE	MINOR ARTERIAL	430	2	12	4	1750	45	18
384	213	214	BLAIRS FERRY RD NE	MINOR ARTERIAL	2739	2	12	4	1750	45	18
385	213	1019	CENTER POINT RD NE	MINOR ARTERIAL	1779	2	12	4	1750	45	18
386	213	1169	BLAIRS FERRY RD NE	MINOR ARTERIAL	1432	3	12	4	1750	45	18
387	214	213	BLAIRS FERRY RD NE	MINOR ARTERIAL	2739	2	12	4	1750	45	18
388	214	1020	COUNCIL ST NE	MINOR ARTERIAL	2060	2	12	4	1750	45	18
389	214	1073	BLAIRS FERRY RD NE	MINOR ARTERIAL	1752	2	12	0	1750	45	18
390	215	476	C AVE	MINOR ARTERIAL	2354	2	12	2	1750	40	18
391	215	572	BLAIRS FERRY RD NE	MINOR ARTERIAL	1858	2	12	0	1750	45	18
392	215	1171	C AVE	MINOR ARTERIAL	202	2	12	0	1750	45	18
393	216	505	US-151B	MINOR ARTERIAL	668	2	12	4	1750	35	18
394	216	547	US-151B	MINOR ARTERIAL	1434	2	12	4	1750	45	18
395	217	506	10TH ST	COLLECTOR	245	1	12	4	1350	30	19
396	217	574	10TH ST	COLLECTOR	342	1	10	2	1750	25	19
397	217	799	US-151B	COLLECTOR	656	1	12	4	1750	45	19
398	218	219	US-151B	MINOR ARTERIAL	1627	2	12	4	1750	45	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
399	218	499	31ST ST	COLLECTOR	2122	1	12	4	1350	30	19
400	219	497	35TH ST	COLLECTOR	2442	1	12	4	1350	30	19
401	219	550	35TH ST	COLLECTOR	144	1	12	4	1350	30	19
402	219	795	US-151B	MINOR ARTERIAL	494	2	12	4	1750	45	19
403	220	490	44TH ST	COLLECTOR	2703	1	12	4	1350	30	19
404	220	491	44TH ST	COLLECTOR	4327	1	12	4	1700	40	19
405	220	969	US-151B	MINOR ARTERIAL	1636	2	12	4	1900	55	19
406	221	222	US-151B	MINOR ARTERIAL	3817	2	12	4	1900	65	22
407	222	615	US-151B	MINOR ARTERIAL	4450	2	12	4	1900	65	22
408	223	240	ELY RD	COLLECTOR	2219	1	12	4	1750	40	27
409	223	1007	ELY RD	COLLECTOR	8040	1	12	3	1700	55	27
410	224	566	EDGEWOOD RD NW	MINOR ARTERIAL	229	2	12	0	1750	40	15
411	224	1077	EDGEWOOD RD NW	MINOR ARTERIAL	164	2	12	4	1900	45	15
412	225	899	EDGEWOOD RD NW	MINOR ARTERIAL	403	2	12	4	1750	45	15
413	226	227	EDGEWOOD RD NW	MINOR ARTERIAL	1703	2	12	4	1750	45	15
414	226	299	42ND ST NE	MINOR ARTERIAL	6176	2	12	4	1750	40	15
415	227	228	EDGEWOOD RD NW	MINOR ARTERIAL	4584	2	12	4	1750	55	15
416	227	898	GLASS RD NE	COLLECTOR	1296	1	10	4	1350	30	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
417	228	229	EDGEWOOD RD NW	MINOR ARTERIAL	6216	2	12	4	1750	45	17
418	228	251	ELLIS BLVD NW	COLLECTOR	9242	1	12	2	1575	35	15
419	228	1029	ELLIS RD	COLLECTOR	5284	1	12	4	1700	45	15
420	229	194	EDGEWOOD RD NW	MINOR ARTERIAL	3421	2	12	4	1750	45	17
421	229	651	O AVE	LOCAL ROADWAY	7804	1	10	4	1575	35	17
422	230	653	E AVE	COLLECTOR	2628	1	12	3	1700	45	17
423	230	724	E AVE	COLLECTOR	5264	1	12	0	1700	40	17
424	230	730	EDGEWOOD RD SW	MINOR ARTERIAL	1364	2	12	4	1750	45	17
425	231	61	US-30 ON RAMP FROM EDGEWOOD RD	FREEWAY RAMP	1018	1	12	4	1700	45	17
426	231	409	EDGEWOOD RD SW	MINOR ARTERIAL	990	2	12	4	1900	45	17
427	232	62	US-30 ON RAMP FROM EDGEWOOD RD	FREEWAY RAMP	1130	1	12	4	1700	45	17
428	232	887	EDGEWOOD RD SW	MINOR ARTERIAL	600	2	10	4	1750	45	17
429	233	774	WRIGHT BROTHERS BLVD	COLLECTOR	2262	1	12	8	1700	45	26
430	233	1104	WRIGHT BROTHERS BLVD	COLLECTOR	1764	1	10	8	1700	65	26
431	234	174	US-151B	COLLECTOR	3701	1	12	4	1700	60	26
432	234	235	WRIGHT BROTHERS BLVD	COLLECTOR	1056	1	10	8	1700	65	26

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
433	235	234	WRIGHT BROTHERS BLVD	COLLECTOR	1056	1	10	8	1750	65	26
434	235	773	WRIGHT BROTHERS BLVD	COLLECTOR	23609	1	10	8	1700	65	26
435	236	237	WRIGHT BROTHERS BLVD	COLLECTOR	734	1	12	4	1750	40	27
436	236	1174	6TH ST	COLLECTOR	5306	1	12	6	1700	60	27
437	237	48	I-380 ON RAMP FROM WRIGHT BROTHERS BLVD	FREEWAY RAMP	1604	1	12	4	1700	45	27
438	237	236	WRIGHT BROTHERS BLVD	COLLECTOR	735	1	12	4	1750	40	27
439	238	47	I-380 ON RAMP FROM WRIGHT BROTHERS BLVD	FREEWAY RAMP	1752	1	12	4	1700	45	27
440	238	237	WRIGHT BROTHERS BLVD	COLLECTOR	1274	1	12	4	1750	35	27
441	239	240	C ST SW	MINOR ARTERIAL	752	2	12	4	1750	45	27
442	239	448	US-30 ON RAMP	FREEWAY RAMP	591	1	12	4	1700	45	27
443	240	223	ELY RD	COLLECTOR	2219	1	12	3	1700	50	27
444	240	239	C ST SW	COLLECTOR	752	1	12	2	1750	45	27
445	240	682	C ST SW	MINOR ARTERIAL	3065	2	12	4	1750	45	27
446	241	447	US-30 ON-RAMP	FREEWAY RAMP	412	1	12	2	1700	45	27
447	241	1022	C ST SW	COLLECTOR	840	1	12	4	1700	45	27
448	242	241	C ST SW	COLLECTOR	5843	1	10	0	1750	45	20
449	243	242	C ST SW	COLLECTOR	2971	1	10	0	1700	45	20
450	244	243	C ST SW	COLLECTOR	2357	1	10	3	1700	45	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
451	244	420	WILSON AVE	COLLECTOR	2568	1	12	0	1700	45	20
452	245	244	C ST SW	COLLECTOR	3430	1	12	2	1575	35	20
453	245	420	BOWLING ST SW	COLLECTOR	2209	1	12	4	1700	45	20
454	246	398	15TH AVE SW	MINOR ARTERIAL	1377	2	12	4	1900	45	20
455	246	991	C ST SW	COLLECTOR	453	1	12	2	1575	35	20
456	247	359	8TH AVE	COLLECTOR	360	1	12	2	1575	35	20
457	247	854	1ST ST SW	COLLECTOR	1204	1	12	4	1700	45	20
458	248	354	US-151B	MAJOR ARTERIAL	791	3	12	4	1750	45	20
459	248	646	1ST ST NW	MINOR ARTERIAL	428	2	12	4	1750	40	20
460	249	395	F AVE	MINOR ARTERIAL	676	2	12	4	1900	45	20
461	249	648	1ST ST NW	MAJOR ARTERIAL	307	3	12	4	1750	40	20
462	250	829	1ST ST NW	COLLECTOR	4054	1	10	3	1575	35	20
463	251	228	ELLIS BLVD NW	COLLECTOR	9286	1	12	2	1750	35	15
464	251	250	PENN AVE NW	COLLECTOR	657	1	12	4	1125	25	17
465	251	252	ELLIS BLVD NW	COLLECTOR	852	1	12	4	1700	45	17
466	252	253	ELLIS BLVD NW	COLLECTOR	3608	1	12	4	1750	45	17
467	252	651	O AVE	LOCAL ROADWAY	1377	1	10	4	1575	35	17
468	253	254	ELLIS BLVD NW	COLLECTOR	431	1	12	4	1700	45	17
469	253	395	F AVE	COLLECTOR	1313	1	10	0	1700	45	20
470	253	649	F AVE	COLLECTOR	2023	1	10	10	1750	40	17
471	254	848	E AVE	COLLECTOR	558	1	12	4	1700	40	17
472	255	663	6TH ST	MINOR ARTERIAL	362	2	12	4	1750	30	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
473	255	672	US-151B	MAJOR ARTERIAL	372	3	12	4	1750	45	20
474	255	939	US-151B	MINOR ARTERIAL	2543	2	12	4	1750	45	17
475	256	672	US-151B	MAJOR ARTERIAL	390	3	12	4	1750	45	20
476	256	741	L ST	MAJOR ARTERIAL	428	4	12	4	1750	50	20
477	257	258	5TH AVE	MINOR ARTERIAL	748	1	12	4	1750	45	20
478	257	633	6TH ST	MINOR ARTERIAL	457	2	12	4	1900	30	20
479	257	941	5TH AVE	COLLECTOR	1551	1	12	4	1700	40	20
480	258	257	5TH AVE	MINOR ARTERIAL	747	1	12	4	1750	45	20
481	258	739	DIAGONAL DR SW	MINOR ARTERIAL	581	2	12	4	1750	40	20
482	258	850	I-380 ON-RAMP	FREEWAY RAMP	421	2	12	4	1900	45	20
483	259	260	6TH ST	MINOR ARTERIAL	388	2	12	0	1750	45	20
484	259	404	15TH AVE SW	MINOR ARTERIAL	3207	2	12	4	1900	45	17
485	260	261	6TH ST	MINOR ARTERIAL	2060	2	12	0	1750	45	20
486	260	962	16TH AVE SW	MINOR ARTERIAL	1519	2	12	4	1900	40	20
487	261	262	6TH ST	MINOR ARTERIAL	4809	2	12	4	1750	45	20
488	261	415	WILSON AVE	COLLECTOR	1511	1	12	4	1750	45	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
489	261	997	WILSON AVE	COLLECTOR	2668	1	12	0	1750	40	17
490	262	265	6TH ST	MINOR ARTERIAL	2214	2	12	0	1900	45	20
491	262	883	33RD AVE SW	MINOR ARTERIAL	817	2	12	4	1900	45	20
492	263	43	I-380 ON RAMP FROM 33RD AVE SW	FREEWAY RAMP	1099	1	12	4	1700	45	20
493	263	264	33RD AVE SW	MINOR ARTERIAL	552	2	12	4	1750	45	20
494	263	883	33RD AVE SW	MINOR ARTERIAL	654	2	12	4	1900	45	20
495	264	42	I-380 ON RAMP FROM 33RD AVE SW	FREEWAY RAMP	1304	1	12	4	1700	45	20
496	264	263	33RD AVE SW	MINOR ARTERIAL	552	2	12	4	1750	45	20
497	264	756	33RD AVE SW	MINOR ARTERIAL	635	2	12	4	1900	45	20
498	265	433	6TH ST	MINOR ARTERIAL	2759	2	12	4	1750	45	20
499	266	435	WACONIA AVE	FREEWAY RAMP	856	1	12	4	1350	30	27
500	266	661	6TH ST	MINOR ARTERIAL	2129	2	12	6	1750	65	27
501	267	236	6TH ST	COLLECTOR	5328	1	12	6	1750	65	27
502	268	269	BLUE CREEK RD	COLLECTOR	5994	1	12	4	1700	45	8
503	268	457	CO HWY E2W	COLLECTOR	5706	1	12	4	1700	45	7
504	269	811	DURROW RD	COLLECTOR	1085	1	12	4	1700	40	3
505	270	812	E URBANA RD	COLLECTOR	1249	1	12	4	1700	40	2

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
506	271	272	54TH STREET TRAIL	COLLECTOR	4061	1	12	4	1750	45	2
507	272	7	I-380 ON RAMP	FREEWAY RAMP	1438	1	12	4	1700	45	2
508	272	273	SUNSET ST	COLLECTOR	1105	1	12	4	1700	45	2
509	273	8	I-380 ON RAMP	FREEWAY RAMP	1468	1	12	4	1700	45	2
510	273	78	SUNSET ST	COLLECTOR	786	1	12	4	1700	45	2
511	273	272	SUNSET ST	COLLECTOR	1104	1	12	4	1750	45	2
512	274	134	IOWA ST	COLLECTOR	819	1	12	4	1575	35	8
513	274	598	MAIN ST	COLLECTOR	697	1	12	4	1700	45	8
514	275	597	MAIN ST	COLLECTOR	298	1	12	4	1700	45	8
515	275	602	GREEN ST	LOCAL ROADWAY	670	1	12	4	1350	30	8
516	276	15	I-380 ON RAMP FROM COUNTRY HOME RD	FREEWAY RAMP	763	1	12	4	1700	45	8
517	276	277	COUNTRY HOME RD	COLLECTOR	657	1	12	4	1700	45	8
518	277	14	I-380 ON RAMP FROM COUNTRY HOME RD	FREEWAY RAMP	1035	1	12	4	1700	45	8
519	277	276	COUNTRY HOME RD	COLLECTOR	656	1	12	4	1750	45	8
520	277	705	COUNTRY HOME RD	COLLECTOR	1530	1	12	4	1700	45	8
521	278	276	COUNTRY HOME RD	COLLECTOR	5516	1	12	4	1750	45	8
522	279	278	OTTER RD	COLLECTOR	2437	1	12	4	1700	45	8
523	280	281	N CENTER POINT RD	COLLECTOR	4449	1	10	5	1750	60	8
524	280	703	N CENTER POINT RD	COLLECTOR	2596	1	10	5	1700	60	8
525	281	280	N CENTER POINT RD	COLLECTOR	4434	1	12	4	1700	60	8
526	281	704	COUNTRY HOME RD	MINOR ARTERIAL	846	2	12	2	1900	55	8
527	281	705	COUNTRY HOME RD	MINOR ARTERIAL	858	2	12	4	1900	45	8

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
528	281	706	N CENTER POINT RD	COLLECTOR	1101	1	10	4	1700	45	8
529	282	480	COUNTRY HOME RD	COLLECTOR	1302	1	12	2	1700	55	9
530	282	704	COUNTRY HOME RD	COLLECTOR	9698	1	12	2	1700	55	9
531	282	1076	N MENTZE RD	COLLECTOR	3342	1	10	2	1575	35	9
532	283	384	COUNTRY HOME RD	COLLECTOR	5348	1	12	4	1700	45	9
533	283	612	N ALBURNETT RD	COLLECTOR	14622	1	10	3	1700	65	9
534	284	285	COUNTRY HOME RD	COLLECTOR	15913	1	10	2	1700	65	10
535	285	1298	COUNTRY HOME RD	COLLECTOR	5148	1	10	2	1000	65	10
536	286	287	MILLER RD	COLLECTOR	3468	1	12	3	1700	40	15
537	286	916	BOYSON RD	COLLECTOR	3633	1	12	4	1750	45	15
538	287	210	BLAIRS FERRY RD NE	COLLECTOR	667	1	12	4	1750	45	15
539	287	286	MILLER RD	COLLECTOR	3468	1	12	3	1700	40	15
540	288	19	I-380 ON RAMP FROM BOYSON RD	FREEWAY RAMP	1661	1	12	4	1700	45	15
541	288	289	BOYSON RD	COLLECTOR	700	1	12	4	1750	45	15
542	289	18	I-380 ON RAMP FROM BOYSON RD	FREEWAY RAMP	1329	1	12	4	1700	45	15
543	289	288	BOYSON RD	COLLECTOR	700	1	12	4	1750	45	15
544	289	290	BOYSON RD	COLLECTOR	471	1	12	4	1750	45	15
545	290	289	BOYSON RD	COLLECTOR	471	1	12	4	1750	45	15
546	290	471	N CENTER POINT RD	MINOR ARTERIAL	1848	2	10	4	1900	45	15
547	290	565	BOYSON RD	COLLECTOR	2701	1	10	0	1700	40	18
548	291	214	COUNCIL ST NE	MINOR ARTERIAL	4227	2	12	4	1750	35	18
549	291	312	BOYSON RD	COLLECTOR	5383	1	12	4	1750	45	18
550	291	565	BOYSON RD	COLLECTOR	3932	1	10	0	1700	40	18
551	292	806	IA-100	FREEWAY RAMP	2221	2	12	10	1900	65	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
552	293	294	IA-100	FREEWAY	4119	2	12	2	1900	50	18
553	293	714	IA-100 OFF RAMP TO I-380	FREEWAY RAMP	710	1	12	4	1700	45	18
554	293	806	IA-100	FREEWAY	3105	2	12	10	1900	65	15
555	294	293	IA-100	FREEWAY	4119	2	12	4	1900	50	18
556	294	295	IA-100	MINOR ARTERIAL	1362	2	12	3	1750	45	18
557	294	711	IA-100 OFF RAMP TO I-380	FREEWAY RAMP	897	1	12	4	1700	45	18
558	295	294	IA-100	MINOR ARTERIAL	1362	2	12	3	1900	50	18
559	295	321	COUNCIL ST NE	COLLECTOR	2674	1	12	4	1750	35	18
560	295	533	IA-100	MINOR ARTERIAL	2567	2	12	4	1750	45	18
561	296	22	OFF-RAMP I-380	FREEWAY RAMP	356	2	12	4	1750	45	18
562	297	24	42ND ST NE	COLLECTOR	441	2	12	4	1750	45	18
563	297	715	OFF-RAMP I-380	FREEWAY RAMP	1643	1	12	4	1700	45	18
564	298	302	OFF-RAMP I-380	FREEWAY RAMP	395	2	12	4	1750	45	18
565	298	716	IA-100 ON RAMP FROM I-380	FREEWAY RAMP	409	2	12	4	1900	45	18
566	299	226	42ND ST NE	MINOR ARTERIAL	6177	2	12	4	1750	40	15
567	299	323	WENIG RD NE	COLLECTOR	2728	1	10	4	1350	30	18
568	299	985	42ND ST NE	COLLECTOR	2276	1	12	4	1700	45	18
569	300	320	CENTER POINT RD NE	MINOR ARTERIAL	2447	2	12	4	1750	45	18
570	300	984	IA-100 ON RAMP FROM I-380	FREEWAY RAMP	473	2	12	4	1900	45	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
571	301	300	CENTER POINT RD NE	MINOR ARTERIAL	341	2	12	4	1750	45	18
572	301	302	IA-100 OFF RAMP TO I-380	FREEWAY RAMP	1220	2	12	4	1750	45	18
573	302	296	IA-100 ON RAMP FROM I-380	FREEWAY RAMP	389	2	12	4	1750	45	18
574	302	1039	ON-RAMP I-380	FREEWAY RAMP	1646	1	12	4	1700	45	18
575	303	475	C AVE	MINOR ARTERIAL	359	2	12	2	1900	45	18
576	303	536	IA-100	MINOR ARTERIAL	1348	2	12	4	1750	45	18
577	303	1171	C AVE	MINOR ARTERIAL	2182	2	12	2	1750	40	18
578	304	528	US-151B	MINOR ARTERIAL	1900	2	12	4	1750	45	18
579	304	547	US-151B	MINOR ARTERIAL	1410	2	12	4	1750	45	18
580	304	876	IA-100	MINOR ARTERIAL	1768	2	12	4	1900	45	18
581	305	290	N CENTER POINT RD	COLLECTOR	4986	1	12	2	1750	45	15
582	305	306	N CENTER POINT RD	COLLECTOR	8288	1	12	2	1700	55	15
583	306	305	N CENTER POINT RD	COLLECTOR	8288	1	10	2	1700	55	15
584	306	706	N CENTER POINT RD	COLLECTOR	3849	1	10	4	1700	45	8
585	306	707	W MAIN ST	COLLECTOR	2773	1	10	0	1700	45	8
586	307	308	E MAIN ST	COLLECTOR	6832	1	10	2	1750	45	18
587	307	311	N MENTZE RD	COLLECTOR	3529	1	12	4	1350	30	9
588	307	814	S MENTZE RD	COLLECTOR	7687	1	12	4	1575	35	18
589	308	309	E ROBINS RD	COLLECTOR	7039	1	10	2	1350	30	18
590	308	479	C AVE	COLLECTOR	957	1	12	4	1700	40	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
591	309	815	ALBURNETT RD	COLLECTOR	688	1	12	4	1700	45	18
592	309	1260	ALBURNETT RD	COLLECTOR	1740	1	12	3	1700	40	18
593	310	283	ALBURNETT RD	COLLECTOR	10964	1	10	3	1700	55	9
594	310	1256	ALBURNETT RD	COLLECTOR	1950	1	10	3	1700	55	18
595	311	307	N MENTZE RD	COLLECTOR	3509	1	12	4	1350	30	9
596	311	1076	N MENTZE RD	COLLECTOR	2429	1	10	2	1700	45	9
597	312	313	BOYSON RD	COLLECTOR	3659	1	10	3	1700	40	18
598	312	476	C AVE	MINOR ARTERIAL	2056	2	12	4	1750	40	18
599	312	479	C AVE	MINOR ARTERIAL	3389	2	12	2	1900	40	18
600	313	314	BOYSON RD	COLLECTOR	4170	1	10	3	1750	40	18
601	314	315	BOYSON RD	COLLECTOR	3177	1	10	3	1700	40	18
602	314	316	CENTRAL AVE	COLLECTOR	4140	1	12	4	1750	25	18
603	315	482	10TH ST	COLLECTOR	549	1	10	2	1750	35	19
604	315	483	10TH ST	COLLECTOR	1857	1	12	4	1750	35	19
605	316	557	10TH AVE	COLLECTOR	1233	1	10	4	1350	30	19
606	316	574	10TH ST	COLLECTOR	799	1	10	2	1750	25	19
607	316	989	10TH ST	COLLECTOR	2438	1	10	2	1350	30	19
608	317	635	IA-100	MINOR ARTERIAL	2948	2	12	3	1750	60	19
609	317	778	E POST RD SE	MINOR ARTERIAL	1429	2	10	2	1900	50	19
610	318	319	IA-100	MINOR ARTERIAL	1232	2	12	3	1900	60	19
611	319	155	IA-100	MINOR ARTERIAL	3060	2	12	3	1750	60	19
612	319	491	44TH ST	COLLECTOR	1290	1	12	4	1700	40	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
613	320	297	42ND ST NE	MINOR ARTERIAL	629	2	12	4	1750	45	18
614	320	327	CENTER POINT RD	COLLECTOR	4089	1	10	4	1750	30	18
615	320	986	42ND ST NE	MINOR ARTERIAL	323	2	12	2	1900	40	18
616	321	467	COUNCIL ST NE	COLLECTOR	1565	1	12	4	1350	30	18
617	321	531	42ND ST NE	COLLECTOR	1281	1	12	2	1700	40	18
618	321	986	42ND ST NE	COLLECTOR	1648	1	12	4	1700	40	18
619	322	380	OAKLAND RD NE	COLLECTOR	2312	1	12	4	1575	35	18
620	322	472	OLD MARION RD NE	COLLECTOR	2562	1	12	2	1750	35	18
621	322	531	42ND ST NE	COLLECTOR	599	1	12	4	1700	40	18
622	323	1012	WENIG RD NE	COLLECTOR	2088	1	12	4	1700	45	18
623	323	1014	GLASS RD NE	COLLECTOR	2615	1	12	4	1700	45	18
624	324	325	32ND ST NE	MINOR ARTERIAL	503	2	12	2	1750	45	18
625	324	717	I-380 ON RAMP	FREEWAY RAMP	525	2	12	4	1900	45	18
626	325	26	I-380 ON RAMP	FREEWAY RAMP	1432	1	12	4	1700	45	18
627	325	324	32ND ST NE	MINOR ARTERIAL	504	2	12	2	1750	45	18
628	325	1018	32ND ST NE	MINOR ARTERIAL	627	2	12	2	1900	40	18
629	326	335	J AVE	COLLECTOR	1175	1	10	0	1700	45	18
630	327	329	CENTER POINT RD	COLLECTOR	1258	1	12	4	1750	45	18
631	327	1017	32ND ST NE	COLLECTOR	954	1	12	4	1700	40	18
632	327	1018	32ND ST NE	MINOR ARTERIAL	167	2	12	4	1900	40	18
633	328	382	32ND ST NE	COLLECTOR	5416	1	12	4	1575	35	18
634	328	1017	32ND ST NE	MINOR ARTERIAL	387	2	12	4	1900	40	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
635	329	29	CENTER POINT RD	MINOR ARTERIAL	2716	2	12	4	1750	40	18
636	329	331	COLDSTREAM AVE NE	MINOR ARTERIAL	675	2	12	4	1750	45	18
637	329	718	29TH ST NE	COLLECTOR	481	1	12	4	1700	45	18
638	330	377	29TH ST NE	COLLECTOR	6691	1	12	4	1750	35	18
639	330	718	29TH ST NE	COLLECTOR	444	1	12	4	1700	45	18
640	331	332	COLDSTREAM AVE NE	MINOR ARTERIAL	499	2	12	4	1750	45	18
641	331	1235	COLDSTREAM AVE NE	MINOR ARTERIAL	134	2	12	4	1900	45	18
642	332	28	I-380 ON RAMP	FREEWAY RAMP	1271	1	12	4	1700	45	18
643	332	331	COLDSTREAM AVE NE	MINOR ARTERIAL	499	2	12	4	1750	45	18
644	333	32	I-380 ON RAMP	FREEWAY RAMP	1004	1	12	4	1700	45	20
645	333	339	H AVE	COLLECTOR	589	1	12	4	1750	45	20
646	334	333	SHAVER RD NE	COLLECTOR	226	1	12	4	1750	45	20
647	335	31	J AVE	COLLECTOR	1431	1	10	0	1700	45	18
648	335	334	SHAVER RD NE	COLLECTOR	2421	1	12	4	1700	45	20
649	336	337	H AVE	COLLECTOR	792	1	12	4	1700	45	20
650	336	339	H AVE	MINOR ARTERIAL	687	1	12	4	1750	45	20
651	336	776	CENTER POINT RD	MINOR ARTERIAL	2167	2	12	4	1900	45	20
652	337	336	H AVE	COLLECTOR	792	1	12	4	1700	45	20
653	337	976	H AVE	COLLECTOR	999	1	12	2	1575	35	20
654	338	337	OAKLAND RD NE	COLLECTOR	1260	1	12	4	1350	30	20
655	339	33	I-380 ON RAMP FROM H AVE	FREEWAY RAMP	1065	1	12	4	1700	45	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
656	339	333	H AVE	COLLECTOR	589	1	12	4	1750	45	20
657	339	336	H AVE	COLLECTOR	687	1	12	4	1700	45	20
658	340	341	US-151B	MINOR ARTERIAL	745	2	12	4	1750	40	20
659	340	342	US-151B	MINOR ARTERIAL	706	2	12	4	1750	45	20
660	341	340	US-151B	MINOR ARTERIAL	745	2	12	4	1750	45	20
661	341	368	US-151B	MINOR ARTERIAL	1158	2	12	4	1750	40	20
662	342	340	US-151B	MINOR ARTERIAL	706	2	12	4	1750	40	20
663	342	344	US-151B	MINOR ARTERIAL	734	2	12	4	1750	45	20
664	342	753	10TH ST	MINOR ARTERIAL	386	2	12	4	1750	40	20
665	342	858	10TH ST	COLLECTOR	388	1	12	4	1750	40	20
666	343	857	12TH ST NE	MINOR ARTERIAL	815	2	12	4	1900	45	20
667	344	342	US-151B	MINOR ARTERIAL	734	2	12	4	1750	40	20
668	344	670	US-151B	MINOR ARTERIAL	418	2	12	0	1750	45	20
669	344	838	8TH ST	MINOR ARTERIAL	366	2	12	0	1750	30	20
670	345	346	I-380 ON RAMP	FREEWAY RAMP	296	1	12	4	1350	30	20
671	346	35	I-380 ON RAMP	FREEWAY RAMP	400	1	12	4	1350	30	20
672	347	35	I-380	FREEWAY	2826	3	12	4	2250	70	20
673	347	355	I-380	FREEWAY	554	3	12	4	2250	70	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
674	348	34	I-380 ON RAMP	FREEWAY RAMP	866	1	12	4	1700	45	20
675	348	345	8TH ST NE	COLLECTOR	520	1	12	4	1700	40	20
676	349	671	US-151B	MINOR ARTERIAL	398	2	12	4	1750	45	20
677	349	828	2ND ST NE	MINOR ARTERIAL	440	2	12	4	1750	35	20
678	350	351	B AVE NE	COLLECTOR	354	1	12	4	1575	35	20
679	351	352	I-380 ON RAMP FROM US-151B	FREEWAY RAMP	148	1	12	4	1350	30	20
680	352	347	I-380 ON RAMP FROM US-151B	FREEWAY RAMP	936	1	12	4	1700	45	20
681	353	36	I-380	FREEWAY	1137	3	12	4	2250	70	20
682	353	355	I-380	FREEWAY	777	3	12	4	2250	70	20
683	354	256	US-151B	MAJOR ARTERIAL	388	3	12	4	1750	45	20
684	354	932	I-380 ON RAMP FROM US-151B	FREEWAY RAMP	521	2	12	4	1900	45	20
685	355	347	I-380	FREEWAY	554	3	12	4	2250	70	20
686	355	353	I-380	FREEWAY	773	3	12	4	2250	70	20
687	356	259	6TH ST	MINOR ARTERIAL	1985	2	12	0	1750	45	20
688	356	358	8TH AVE	COLLECTOR	1201	1	10	4	1700	40	20
689	357	662	3RD AVE	MINOR ARTERIAL	387	2	12	4	1750	35	20
690	358	963	L ST SW	COLLECTOR	2110	1	12	2	1575	35	20
691	359	358	8TH AVE	COLLECTOR	783	1	12	2	1575	35	20
692	359	1006	2ND T SW	COLLECTOR	1842	1	12	2	1350	30	20
693	360	747	8TH AVE	MINOR ARTERIAL	424	2	10	2	1750	40	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
694	360	749	3RD ST SE	COLLECTOR	1507	1	12	2	1750	30	20
695	360	845	8TH AVE	MINOR ARTERIAL	1131	2	10	2	1750	40	20
696	361	349	US-151B	MINOR ARTERIAL	376	2	12	0	1750	45	20
697	361	826	3RD ST SE	COLLECTOR	395	1	12	4	1750	30	20
698	361	835	US-151B	MINOR ARTERIAL	763	2	12	0	1750	45	20
699	362	630	10TH ST	MINOR ARTERIAL	1111	2	12	4	1750	40	20
700	362	665	8TH AVE	MINOR ARTERIAL	753	2	10	2	1750	40	20
701	362	750	MT VERNON RD	MINOR ARTERIAL	934	2	12	0	1750	35	20
702	363	397	15TH ST SE	COLLECTOR	1270	1	12	4	1350	30	20
703	363	750	MT VERNON RD	MINOR ARTERIAL	250	2	12	2	1750	35	20
704	363	816	MT VERNON RD	MINOR ARTERIAL	1838	2	12	0	1750	35	20
705	364	403	MT VERNON RD	MINOR ARTERIAL	1484	2	12	2	1750	40	20
706	364	819	MT VERNON RD	MINOR ARTERIAL	2368	2	12	2	1750	35	20
707	365	403	MT VERNON RD	MINOR ARTERIAL	2567	2	12	2	1750	40	20
708	365	513	MT VERNON RD	MINOR ARTERIAL	1118	2	12	0	1750	35	20
709	365	516	34TH ST SE	COLLECTOR	2669	1	12	2	1350	30	20
710	366	376	E POST RD SE	COLLECTOR	4139	1	12	2	1575	35	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
711	366	511	MT VERNON RD	MINOR ARTERIAL	706	2	12	0	1750	35	20
712	366	1024	MT VERNON RD	COLLECTOR	6961	1	10	5	1700	45	21
713	367	1146	MT VERNON RD	COLLECTOR	1964	1	11	4	1700	45	22
714	368	341	US-151B	MINOR ARTERIAL	1158	2	12	4	1750	40	20
715	368	519	US-151B	MINOR ARTERIAL	694	2	12	4	1750	40	20
716	369	370	US-151B	MINOR ARTERIAL	1871	3	12	4	1750	40	20
717	369	519	US-151B	MINOR ARTERIAL	2049	2	12	4	1750	40	20
718	370	369	US-151B	MINOR ARTERIAL	1871	2	12	4	1750	40	20
719	370	371	COTTAGE GROVE WOODS SE	COLLECTOR	1514	1	12	4	1350	30	20
720	370	871	US-151B	MINOR ARTERIAL	2929	2	12	4	1750	40	18
721	371	372	COTTAGE GROVE WOODS SE	COLLECTOR	3907	1	12	4	1750	25	20
722	371	873	FOREST DR SE	COLLECTOR	2872	1	12	2	1575	35	20
723	372	373	COTTAGE GROVE WOODS SE	COLLECTOR	1316	1	12	4	1700	45	20
724	372	516	34TH ST SE	COLLECTOR	3996	1	12	4	1350	30	20
725	373	374	COTTAGE GROVE WOODS SE	COLLECTOR	2562	1	12	4	1700	45	20
726	373	758	INDIAN HILL RD SE	COLLECTOR	4777	1	12	2	1350	30	18
727	374	375	COTTAGE GROVE WOODS SE	COLLECTOR	1708	1	12	4	1700	40	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
728	375	376	E POST RD SE	COLLECTOR	4154	1	12	2	1575	35	21
729	375	390	E POST RD SE	COLLECTOR	2717	1	10	2	1700	50	19
730	376	366	E POST RD SE	COLLECTOR	4139	1	12	2	1750	35	20
731	376	375	E POST RD SE	COLLECTOR	4162	1	12	2	1575	35	21
732	377	330	29TH ST NE	COLLECTOR	6691	1	12	2	1750	35	18
733	377	378	US-151B	MINOR ARTERIAL	1368	2	12	4	1750	40	18
734	377	757	29TH ST NE	COLLECTOR	2087	1	12	4	1575	35	18
735	377	871	US-151B	MINOR ARTERIAL	1071	2	12	4	1750	40	18
736	378	377	US-151B	MINOR ARTERIAL	1368	2	12	4	1750	40	18
737	378	382	32ND ST NE	COLLECTOR	906	1	12	2	1750	35	18
738	378	523	US-151B	MINOR ARTERIAL	1235	2	12	4	1750	40	18
739	379	523	US-151B	MINOR ARTERIAL	1336	2	12	4	1750	40	18
740	379	526	US-151B	MINOR ARTERIAL	1016	2	12	4	1750	40	18
741	380	328	OAKLAND RD NE	COLLECTOR	2034	1	12	4	1750	35	18
742	381	379	38TH ST	COLLECTOR	996	1	12	0	1750	30	18
743	381	524	C AVE	COLLECTOR	1291	1	12	4	1350	30	18
744	382	328	32ND ST NE	COLLECTOR	5416	1	12	4	1750	35	18
745	382	378	32ND ST NE	COLLECTOR	907	1	12	2	1750	35	18
746	383	387	INDIAN CREEK RD	COLLECTOR	2134	1	12	4	1700	45	19
747	383	562	29TH AVE	COLLECTOR	1022	1	10	0	1575	35	19
748	384	385	COUNTRY HOME RD	COLLECTOR	4160	1	12	3	1700	55	9
749	384	1008	N MARION RD	COLLECTOR	21284	1	12	2	1700	45	9
750	385	386	COUNTRY HOME RD	COLLECTOR	1272	1	12	3	1700	55	9

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
751	386	161	COUNTRY HOME RD	COLLECTOR	7936	1	12	4	1750	55	9
752	387	385	WINSLOW RD	COLLECTOR	14195	1	12	0	1700	45	9
753	387	388	INDIAN CREEK RD	COLLECTOR	3658	1	10	4	1575	35	19
754	388	160	INDIAN CREEK RD	COLLECTOR	8952	1	10	4	1575	35	9
755	388	386	LUCORE RD	COLLECTOR	10909	1	12	0	1700	45	9
756	389	1249	29TH AVE	COLLECTOR	193	1	10	0	900	20	19
757	390	375	E POST RD SE	COLLECTOR	2720	1	10	2	1700	50	19
758	390	391	CO TRUNK RD E44	COLLECTOR	6516	1	10	3	1700	50	19
759	390	778	E POST RD SE	COLLECTOR	1991	1	12	2	1700	50	19
760	391	392	CO TRUNK RD E44	COLLECTOR	3231	1	12	4	1700	45	19
761	391	635	CO TRUNK RD E44	COLLECTOR	5068	1	12	4	1750	45	19
762	392	393	CO TRUNK RD E44	COLLECTOR	3193	1	12	4	1700	45	21
763	393	987	COTTAGE GROVE PKWY	COLLECTOR	1693	1	10	2	1700	55	21
764	394	155	IA-13	MINOR ARTERIAL	10649	2	12	4	1750	65	19
765	394	156	IA-13	MINOR ARTERIAL	5305	2	12	5	1750	65	21
766	395	253	F AVE	COLLECTOR	1313	1	12	0	1750	45	20
767	395	396	3RD ST NW	COLLECTOR	420	1	12	4	1700	45	20
768	396	648	E AVE	COLLECTOR	845	1	12	4	1750	40	20
769	396	849	3RD ST NW	MINOR ARTERIAL	527	2	12	4	1900	40	20
770	397	363	15TH ST SE	COLLECTOR	1271	1	12	4	1350	30	20
771	397	629	12TH AVE SE	COLLECTOR	785	1	12	4	1350	30	20
772	398	399	J ST W	COLLECTOR	404	1	12	4	1575	35	20
773	398	963	15TH AVE SW	MINOR ARTERIAL	1219	2	12	4	1900	45	20
774	399	419	J ST W	COLLECTOR	2082	1	12	4	1750	35	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
775	399	1032	16TH AVE SW	COLLECTOR	1131	1	12	4	1700	40	20
776	400	818	MCCARTHY RD SE	COLLECTOR	2995	1	10	4	1575	35	20
777	401	400	MCCARTHY RD SE	COLLECTOR	815	1	10	4	1575	35	20
778	401	402	MEMORIAL DR SE	COLLECTOR	949	1	10	4	1575	35	20
779	402	403	MEMORIAL DR SE	COLLECTOR	1891	1	10	0	1750	35	20
780	403	364	MT VERNON RD	MINOR ARTERIAL	1484	2	12	2	1900	40	20
781	403	365	MT VERNON RD	MINOR ARTERIAL	2568	2	12	2	1750	40	20
782	404	260	16TH AVE SW	MINOR ARTERIAL	3172	2	12	4	1750	40	17
783	404	628	16TH AVE SW	MINOR ARTERIAL	1951	2	12	4	1750	45	17
784	405	180	US-151B	MINOR ARTERIAL	718	2	12	4	1750	60	17
785	405	406	WILSON AVE	MINOR ARTERIAL	490	2	12	4	1750	45	17
786	405	624	US-151B	MINOR ARTERIAL	1223	2	12	4	1750	60	17
787	406	405	WILSON AVE	MINOR ARTERIAL	486	2	12	4	1750	45	17
788	406	643	WILSON AVE	COLLECTOR	397	1	12	0	1750	40	17
789	406	881	EDGEWOOD RD SW	MAJOR ARTERIAL	635	3	12	0	1750	45	17
790	407	61	US - 30	FREEWAY	614	2	12	8	2250	60	17
791	407	62	US - 30	FREEWAY	1400	2	12	8	2250	60	17
792	408	407	US-30 ON RAMP FROM EDGEWOOD RD	FREEWAY RAMP	364	1	12	4	1350	30	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
793	409	232	EDGEWOOD RD SW	MINOR ARTERIAL	628	2	12	4	1900	45	17
794	409	408	US-30 ON RAMP FROM EDGEWOOD RD	FREEWAY RAMP	413	1	12	4	1350	30	17
795	410	179	US-151B	MINOR ARTERIAL	4288	2	12	6	1750	60	17
796	410	412	WILEY BLVD SW	MINOR ARTERIAL	1400	2	12	4	1900	45	17
797	410	624	US-151B	MINOR ARTERIAL	1286	2	12	4	1750	60	17
798	411	637	EDGEWOOD RD SW	MINOR ARTERIAL	1420	2	12	4	1750	45	17
799	411	1072	33RD AVE SW	MINOR ARTERIAL	1266	2	12	4	1900	45	17
800	412	1049	WILEY BLVD SW	MINOR ARTERIAL	773	2	12	4	1750	45	17
801	413	410	WILEY BLVD SW	MINOR ARTERIAL	1674	2	12	4	1750	45	17
802	413	735	WILSON AVE SW	COLLECTOR	822	1	12	4	1700	40	17
803	414	170	16TH AVE SW	MINOR ARTERIAL	3985	2	12	4	1750	45	17
804	414	171	16TH AVE SW	MINOR ARTERIAL	2675	2	12	4	1750	45	17
805	414	1048	WILEY BLVD SW	MINOR ARTERIAL	1264	2	12	4	1750	45	17
806	415	41	I-380 ON RAMP FROM WILSON AVE	FREEWAY RAMP	1415	1	12	4	1700	45	20
807	415	261	WILSON AVE	COLLECTOR	1511	1	12	4	1750	45	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
808	415	416	WILSON AVE	COLLECTOR	397	1	12	4	1750	45	20
809	416	415	WILSON AVE	COLLECTOR	397	1	12	4	1750	45	20
810	416	418	I-380 ON RAMP FROM WILSON AVE	FREEWAY RAMP	234	1	12	4	1700	45	20
811	416	419	WILSON AVE	COLLECTOR	792	1	12	4	1750	45	20
812	417	415	I-380 OFF RAMP TO WILSON AVE	FREEWAY RAMP	276	2	12	4	1750	45	20
813	418	40	I-380 ON RAMP FROM WILSON AVE	FREEWAY RAMP	1276	1	12	4	1700	45	20
814	419	416	WILSON AVE	COLLECTOR	792	1	12	4	1750	45	20
815	419	420	WILSON AVE	COLLECTOR	2683	1	12	0	1700	40	20
816	419	756	J ST W	COLLECTOR	3979	1	12	4	1575	35	20
817	420	244	WILSON AVE	COLLECTOR	2568	1	12	0	1700	45	20
818	420	419	WILSON AVE	COLLECTOR	2683	1	12	0	1750	40	20
819	420	421	BOWLING ST SW	MINOR ARTERIAL	3961	2	10	3	1900	50	20
820	421	422	BOWLING ST SW	MINOR ARTERIAL	6069	2	12	0	1750	50	20
821	421	756	33RD AVE SW	COLLECTOR	2687	1	12	4	1700	45	20
822	422	426	BOWLING ST SW	MINOR ARTERIAL	233	2	12	4	1900	45	27
823	422	430	US-30 ON RAMP	FREEWAY RAMP	454	1	12	4	1350	30	27
824	423	428	US-30 ON RAMP	FREEWAY RAMP	714	1	12	4	1700	45	27
825	423	658	KIRKWOOD BLVD SW	MINOR ARTERIAL	323	2	12	0	1750	45	27
826	424	1040	I-380 OFF RAMP	FREEWAY RAMP	1154	1	12	4	1700	45	20
827	424	1042	US-30 ON RAMP FROM I-380	FREEWAY RAMP	1348	1	12	4	1700	45	20
828	425	66	US-30 ON RAMP	FREEWAY RAMP	616	1	12	4	1700	45	27

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
829	425	423	KIRKWOOD BLVD ON RAMP	FREEWAY RAMP	1614	1	12	4	1750	45	27
830	426	423	BOWLING ST SW	MINOR ARTERIAL	921	2	12	4	1750	45	27
831	427	66	US - 30	FREEWAY	713	2	12	8	2250	60	27
832	427	431	US - 30	FREEWAY	488	2	12	8	2250	60	27
833	428	67	US-30 ON RAMP	FREEWAY RAMP	866	1	12	4	1700	45	27
834	430	431	US-30 ON RAMP	FREEWAY RAMP	480	1	12	4	1350	30	27
835	431	67	US - 30	FREEWAY	1256	2	12	8	2250	60	27
836	431	427	US - 30	FREEWAY	488	2	12	8	2250	60	27
837	432	64	US - 30	FREEWAY	771	2	12	8	2250	60	27
838	432	437	US - 30	FREEWAY	526	2	12	8	2250	60	27
839	433	266	6TH ST	COLLECTOR	1354	2	12	4	1750	45	27
840	433	434	US-30 ON RAMP	FREEWAY RAMP	515	1	12	4	1700	40	27
841	434	63	US-30 ON RAMP	FREEWAY RAMP	848	1	12	4	1700	45	27
842	434	433	US-30 OFF RAMP	FREEWAY RAMP	515	1	12	4	1750	30	27
843	435	432	US-30 ON RAMP	FREEWAY RAMP	594	1	12	4	1350	30	27
844	436	435	WACONIA AVE	FREEWAY RAMP	770	1	12	4	1350	30	27
845	437	63	US - 30	FREEWAY	602	2	12	8	2250	60	27
846	437	432	US - 30	FREEWAY	526	2	12	8	2250	60	27
847	439	442	US-30 ON RAMP FROM I-380	FREEWAY RAMP	628	1	12	4	1350	30	27
848	440	443	I-380 ON RAMP FROM US-30	FREEWAY RAMP	767	1	16	5	1350	30	27
849	441	64	US - 30	FREEWAY	1074	2	12	8	2250	60	27
850	441	440	I-380 ON RAMP FROM US-30	FREEWAY RAMP	730	1	16	5	1350	30	27
851	441	442	US - 30	FREEWAY	555	2	12	8	2250	60	27
852	442	65	US - 30	FREEWAY	884	2	12	8	2250	60	27

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
853	442	441	US - 30	FREEWAY	555	3	12	8	2250	60	27
854	443	44	I-380	FREEWAY	1147	2	12	4	2250	70	27
855	443	439	I-380 OFF RAMP TO US-30	FREEWAY RAMP	680	1	12	4	1350	30	27
856	443	444	I-380	FREEWAY	602	3	12	4	2250	70	27
857	444	45	I-380	FREEWAY	1260	2	12	4	2250	70	27
858	444	443	I-380	FREEWAY	602	3	12	4	2250	70	27
859	445	68	US - 30	FREEWAY	1139	2	12	8	2250	65	27
860	445	446	US - 30	FREEWAY	558	2	12	8	2250	65	27
861	445	447	US-30 OFF RAMP	FREEWAY RAMP	889	1	12	4	1350	30	27
862	446	69	US - 30	FREEWAY	1231	2	12	8	2250	65	27
863	446	445	US - 30	FREEWAY	558	2	12	8	2250	65	27
864	447	68	US-30 ON-RAMP	FREEWAY RAMP	1228	1	12	2	1700	45	27
865	447	241	C ST SW ON RAMP	FREEWAY RAMP	412	1	12	4	1750	30	27
866	448	69	US-30 ON RAMP	FREEWAY RAMP	962	1	12	4	1700	45	27
867	449	267	CO HWY E66	COLLECTOR	5320	1	12	2	1750	45	27
868	449	450	CO HWY E66	COLLECTOR	5232	1	12	2	1700	45	27
869	449	622	CO TRUNK RD W54	COLLECTOR	2891	1	10	0	1700	45	27
870	450	449	CO HWY E66	COLLECTOR	5232	1	12	2	1700	45	27
871	450	452	C ST SW	COLLECTOR	5433	1	12	4	1700	45	27
872	450	1007	CO HWY E66	COLLECTOR	6606	1	12	2	1700	45	27
873	451	238	WRIGHT BROTHERS BLVD	COLLECTOR	3259	1	12	4	1750	35	27
874	451	461	WRIGHT BROTHERS BLVD	COLLECTOR	2775	1	12	8	1700	55	27
875	452	49	WRIGHT BROTHERS BLVD	COLLECTOR	9966	1	12	8	1700	55	27
876	452	461	WRIGHT BROTHERS BLVD	COLLECTOR	2659	1	12	3	1700	50	27

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
877	453	71	US - 30	FREEWAY	2287	2	12	8	2250	60	28
878	453	72	US - 30	FREEWAY	810	2	12	8	2250	60	28
879	453	158	IA-13 ON RAMP FROM US-30	FREEWAY RAMP	1729	1	12	4	1700	45	28
880	453	454	US-30 OFF RAMP TO IA-13	FREEWAY RAMP	827	1	12	4	1700	45	28
881	454	72	US-30 ON RAMP FROM IA-13	FREEWAY RAMP	1143	1	12	4	1700	45	28
882	454	1056	IA-13 ON RAMP	FREEWAY RAMP	1085	1	12	4	1700	45	28
883	455	456	N CENTER POINT RD	COLLECTOR	5767	1	12	4	1700	60	8
884	456	698	N CENTER POINT RD	COLLECTOR	2514	1	12	4	1700	50	8
885	457	605	CO HWY E2W	COLLECTOR	7927	1	12	4	1700	45	2
886	458	164	IA-13	COLLECTOR	3294	1	12	4	1700	60	4
887	459	460	COGGON RD	COLLECTOR	17536	1	10	3	1700	50	4
888	460	579	ROBINSON RD	COLLECTOR	5440	1	12	2	1700	50	4
889	460	584	COGGON RD	COLLECTOR	11238	1	12	3	1700	55	4
890	461	451	WRIGHT BROTHERS BLVD	COLLECTOR	2775	1	12	8	1700	55	27
891	461	452	WRIGHT BROTHERS BLVD	COLLECTOR	2659	1	12	3	1700	50	27
892	461	462	CLUB RD	COLLECTOR	1329	1	12	2	1700	40	27
893	462	1189	CLUB RD	COLLECTOR	9199	1	12	2	1700	40	27
894	463	465	BLAIRS FERRY RD NE	MINOR ARTERIAL	1528	2	12	2	1900	40	15
895	463	918	BLAIRS FERRY RD NE	MINOR ARTERIAL	579	2	12	2	1900	35	15
896	464	463	12TH AVE	COLLECTOR	1534	1	12	4	1750	30	15
897	464	916	12TH AVE	COLLECTOR	1892	1	12	4	1350	30	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
898	465	211	BLAIRS FERRY RD NE	MINOR ARTERIAL	1630	2	12	4	1750	40	15
899	465	463	BLAIRS FERRY RD NE	MINOR ARTERIAL	1528	2	12	2	1900	40	15
900	466	465	SHOPPING CENTER ENTRANCE	COLLECTOR	1269	1	12	4	1750	30	15
901	467	380	COUNCIL ST NE	COLLECTOR	887	1	12	4	1350	30	18
902	468	467	HOLLYWOOD BLVD NE	COLLECTOR	508	1	12	4	1350	30	18
903	469	213	N CENTER POINT RD	MINOR ARTERIAL	1946	2	10	4	1750	45	18
904	470	469	EMMONS ST	COLLECTOR	820	1	10	4	1750	30	18
905	471	710	N CENTER POINT RD	COLLECTOR	1794	1	10	4	1700	45	18
906	472	322	OLD MARION RD NE	COLLECTOR	2563	1	12	2	1575	35	18
907	472	475	OLD MARION RD NE	COLLECTOR	1580	1	12	4	1350	30	18
908	473	472	F AVE	COLLECTOR	812	1	12	4	1750	30	18
909	473	535	F AVE	MINOR ARTERIAL	433	2	12	4	1750	30	18
910	474	472	F AVE	LOCAL ROADWAY	610	1	12	4	1750	30	18
911	475	303	C AVE	MINOR ARTERIAL	359	1	12	2	1750	45	18
912	475	472	OLD MARION RD NE	COLLECTOR	1580	1	12	4	1750	30	18
913	475	527	C AVE	COLLECTOR	2804	1	12	4	1350	30	18
914	476	215	C AVE	MINOR ARTERIAL	2354	2	12	4	1750	45	18
915	476	312	C AVE	MINOR ARTERIAL	2056	2	12	2	1750	40	18
916	477	476	BRENTWOOD DR NE	COLLECTOR	1052	1	12	4	1750	30	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
917	478	476	ASHTON PL NE	COLLECTOR	1175	1	12	4	1750	30	18
918	479	308	C AVE	COLLECTOR	957	1	12	2	1750	40	18
919	479	312	C AVE	MINOR ARTERIAL	3389	2	12	4	1750	40	18
920	480	283	COUNTRY HOME RD	COLLECTOR	8022	1	10	2	1700	55	9
921	480	481	C AVE	COLLECTOR	6750	1	12	3	1700	50	9
922	481	308	C AVE	COLLECTOR	6915	1	12	3	1750	50	18
923	482	315	10TH ST	COLLECTOR	549	1	12	2	1575	35	19
924	482	383	INDIAN CREEK RD	COLLECTOR	3304	1	12	4	1750	45	19
925	482	989	10TH ST	COLLECTOR	337	1	10	2	1750	30	19
926	483	315	10TH ST	COLLECTOR	1857	1	12	4	1575	35	19
927	483	383	29TH AVE	COLLECTOR	2210	1	10	0	1575	35	19
928	483	484	10TH ST	COLLECTOR	1281	1	12	4	1750	35	19
929	484	384	10TH ST	COLLECTOR	14752	1	12	3	1700	45	9
930	484	483	10TH ST	COLLECTOR	1280	1	12	4	1750	35	19
931	485	484	33RD AVE	COLLECTOR	410	1	12	4	1750	30	19
932	486	484	LINN-MAR HIGH SCHOOL	COLLECTOR	441	1	12	4	1750	30	19
933	487	154	US-151B	MINOR ARTERIAL	910	2	12	4	1750	55	19
934	488	487	EAGLEVIEW DRIVE	LOCAL ROADWAY	2090	1	12	4	1750	30	19
935	489	487	EAGLEVIEW DRIVE	LOCAL ROADWAY	472	1	12	4	1750	30	19
936	490	220	44TH ST	COLLECTOR	2703	1	12	4	1750	30	19
937	490	971	44TH ST	COLLECTOR	2646	1	12	2	1350	30	19
938	491	220	44TH ST	COLLECTOR	4327	1	12	4	1750	40	19
939	491	319	44TH ST	COLLECTOR	1290	1	12	4	1700	40	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
940	492	220	US-151B	MINOR ARTERIAL	1047	2	12	4	1750	45	19
941	493	492	US-151B	MINOR ARTERIAL	892	2	12	4	1750	45	19
942	494	492	FIRE DEPARTMENT ENTRANCE	COLLECTOR	404	1	12	4	1750	30	19
943	495	493	KATZ DR	COLLECTOR	195	1	12	4	1750	30	19
944	496	490	MCGOWAN BLVD	COLLECTOR	3155	1	12	2	1575	35	19
945	496	550	35TH ST	COLLECTOR	2435	1	12	2	1350	30	19
946	496	1247	35TH ST	COLLECTOR	2354	1	12	2	1350	30	19
947	497	219	35TH ST	COLLECTOR	2442	1	12	4	1750	30	19
948	497	996	35TH ST	COLLECTOR	1572	1	12	4	1350	30	19
949	499	218	31ST ST	COLLECTOR	2122	1	12	4	1750	30	19
950	499	996	OLD HWY 94	COLLECTOR	1754	1	12	2	1575	35	19
951	500	554	US-151B	MINOR ARTERIAL	1397	2	12	4	1900	45	19
952	501	558	US-151B	COLLECTOR	284	1	12	4	1700	45	19
953	502	500	19TH ST	COLLECTOR	416	1	12	4	1350	30	19
954	503	501	13TH ST	COLLECTOR	359	1	12	4	1750	30	19
955	504	501	13TH ST	COLLECTOR	285	1	12	4	1750	30	19
956	505	1243	US-151B	MINOR ARTERIAL	2180	2	12	4	1700	45	18
957	506	217	10TH ST	COLLECTOR	245	1	12	2	1750	30	19
958	506	507	6TH AVE	COLLECTOR	245	1	12	4	1350	30	19
959	507	782	11TH ST	COLLECTOR	395	1	12	4	1575	35	19
960	508	317	11TH ST	MINOR ARTERIAL	1889	2	12	4	1750	35	19
961	509	508	GRAND AVE	COLLECTOR	1248	1	12	4	1750	30	19
962	510	508	GRAND AVE	COLLECTOR	2491	1	12	4	1750	30	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
963	511	366	MT VERNON RD	MINOR ARTERIAL	706	2	12	4	1750	45	20
964	511	513	MT VERNON RD	MINOR ARTERIAL	1476	2	12	0	1750	35	20
965	512	511	42ND ST SE	COLLECTOR	3153	1	12	4	1750	30	20
966	513	365	MT VERNON RD	MINOR ARTERIAL	1118	2	12	0	1750	35	20
967	513	511	MT VERNON RD	MINOR ARTERIAL	1476	2	12	0	1750	35	20
968	514	513	38TH ST	COLLECTOR	520	1	12	4	1750	30	20
969	515	513	38TH ST	COLLECTOR	885	1	12	4	1750	30	20
970	516	365	34TH ST SE	COLLECTOR	2669	1	12	4	1750	30	20
971	516	372	34TH ST SE	COLLECTOR	3996	1	12	4	1750	30	20
972	517	364	FOREST DR SE	COLLECTOR	2640	1	12	4	1350	30	20
973	517	516	BEAVER AVE SE	COLLECTOR	3996	1	12	2	1350	30	20
974	517	861	FOREST DR SE	COLLECTOR	912	1	12	2	1575	35	20
975	518	369	19TH AVE	COLLECTOR	1034	1	12	0	1750	30	20
976	519	368	US-151B	MINOR ARTERIAL	694	2	12	4	1750	40	20
977	519	369	US-151B	MINOR ARTERIAL	2049	2	12	4	1750	40	20
978	519	520	16TH AVE	COLLECTOR	1055	1	12	2	1575	35	20
979	520	519	16TH AVE	COLLECTOR	1055	1	12	0	1750	30	20
980	520	976	16TH AVE	COLLECTOR	1634	1	12	2	1575	35	20
981	521	368	15TH AVE	COLLECTOR	1155	1	12	0	1750	30	20
982	522	368	15TH AVE	COLLECTOR	811	1	12	4	1750	30	20
983	522	860	3RD AVE SE	MAJOR ARTERIAL	2333	3	12	4	1900	35	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
984	523	378	US-151B	MINOR ARTERIAL	1235	2	12	4	1750	40	18
985	523	379	US-151B	MINOR ARTERIAL	1336	2	12	4	1750	40	18
986	524	382	C AVE	COLLECTOR	1263	1	12	4	1350	30	18
987	524	523	35TH AVE	COLLECTOR	877	1	12	0	1750	30	18
988	525	379	38TH AVE	COLLECTOR	1054	1	12	4	1750	30	18
989	526	379	US-151B	MINOR ARTERIAL	1016	2	12	4	1750	40	18
990	526	528	US-151B	MINOR ARTERIAL	2042	2	12	4	1750	40	18
991	527	381	C AVE	COLLECTOR	891	1	12	4	1350	30	18
992	527	526	40TH ST	COLLECTOR	1590	1	12	0	1750	30	18
993	528	304	US-151B	MINOR ARTERIAL	1901	2	12	4	1750	45	18
994	528	526	US-151B	MINOR ARTERIAL	2046	2	12	4	1750	40	18
995	529	528	SHOPPING CENTER ENTRANCE	LOCAL ROADWAY	353	2	12	4	1750	30	18
996	530	528	SHOPPING CENTER ENTRANCE	LOCAL ROADWAY	333	2	12	4	1750	30	18
997	531	321	42ND ST NE	COLLECTOR	1281	1	12	4	1750	40	18
998	531	322	42ND ST NE	COLLECTOR	599	1	12	2	1700	40	18
999	532	531	GOLF ST	LOCAL ROADWAY	588	1	12	4	1350	30	18
1000	533	534	ROCKWELL DR NE	MINOR ARTERIAL	618	2	12	0	1900	30	18
1001	533	535	IA-100	MINOR ARTERIAL	1463	2	12	4	1750	45	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1002	534	533	ROCKWELL DR NE	MINOR ARTERIAL	618	2	12	0	1750	30	18
1003	534	571	ROCKWELL DR NE	MINOR ARTERIAL	1836	2	12	0	1750	30	18
1004	535	303	IA-100	MINOR ARTERIAL	1345	2	12	4	1750	45	18
1005	535	473	F AVE	COLLECTOR	433	1	12	4	1350	30	18
1006	536	537	IA-100	MINOR ARTERIAL	484	2	12	4	1750	45	18
1007	537	538	IA-100	MINOR ARTERIAL	1091	2	12	4	1750	45	18
1008	538	545	IA-100	MINOR ARTERIAL	1101	2	12	4	1750	45	18
1009	539	536	SHOPPING CENTER ENTRANCES	LOCAL ROADWAY	271	1	12	4	1750	30	18
1010	540	536	SHOPPING CENTER ENTRANCES	LOCAL ROADWAY	346	1	12	4	1750	30	18
1011	541	537	NORTHLAND AVE NE	COLLECTOR	1067	1	12	4	1750	35	18
1012	541	572	NORTHLAND AVE NE	COLLECTOR	1037	1	12	4	1750	35	18
1013	542	537	SHOPPING CENTER ENTRANCES	COLLECTOR	383	1	12	4	1750	30	18
1014	543	538	SHOPPING CENTER ENTRANCES	COLLECTOR	198	1	12	4	1750	30	18
1015	544	538	SHOPPING CENTER ENTRANCES	COLLECTOR	300	1	12	4	1750	30	18
1016	545	304	IA-100	MINOR ARTERIAL	962	3	12	4	1750	45	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1017	546	545	SHOPPING CENTER ENTRANCES	MINOR ARTERIAL	411	2	12	4	1750	30	18
1018	547	216	US-151B	MINOR ARTERIAL	1434	2	12	4	1750	45	18
1019	547	304	US-151B	MINOR ARTERIAL	1410	1	12	4	1750	45	18
1020	548	547	ARMAR DR SE	COLLECTOR	568	1	12	4	1750	30	18
1021	549	1044	6TH AVE	COLLECTOR	1234	1	12	4	1750	30	18
1022	550	219	35TH ST	MINOR ARTERIAL	144	1	12	4	1750	30	19
1023	550	496	35TH ST	COLLECTOR	2435	1	12	4	1350	30	19
1024	551	550	10TH AVE	COLLECTOR	670	1	10	4	1350	30	19
1025	552	218	31ST ST	COLLECTOR	853	1	12	4	1750	30	19
1026	552	551	10TH AVE	COLLECTOR	688	1	10	4	1350	30	19
1027	553	552	10TH AVE	COLLECTOR	1755	1	10	4	1350	30	19
1028	553	554	25TH AVE	COLLECTOR	997	1	12	2	1350	30	19
1029	554	1246	US-151B	COLLECTOR	298	1	12	2	1350	30	19
1030	555	556	18TH ST	COLLECTOR	1094	1	12	4	1350	30	19
1031	555	561	10TH AVE	COLLECTOR	1232	1	10	4	1350	30	19
1032	556	500	US-151B	MINOR ARTERIAL	172	2	12	4	1900	45	19
1033	557	555	10TH AVE	COLLECTOR	843	1	10	4	1350	30	19
1034	557	558	14TH ST	COLLECTOR	1109	1	10	4	1350	30	19
1035	558	556	US-151B	MINOR ARTERIAL	810	2	12	4	1900	45	19
1036	559	154	IA-13	MINOR ARTERIAL	1862	2	12	4	1750	65	19
1037	559	155	IA-13	MINOR ARTERIAL	3940	2	12	4	1750	65	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1038	560	559	LINN AIRE AVE	LOCAL ROADWAY	1328	1	12	4	1750	30	19
1039	561	553	10TH AVE	COLLECTOR	374	1	10	4	1350	30	19
1040	562	383	29TH AVE	COLLECTOR	1022	1	10	0	1575	35	19
1041	562	389	29TH AVE	COLLECTOR	3503	1	10	0	1575	35	19
1042	563	561	24TH ST	COLLECTOR	2521	1	10	4	1350	30	19
1043	563	564	24TH ST	COLLECTOR	1606	1	10	4	1350	30	19
1044	563	990	MCGOWAN BLVD	COLLECTOR	2303	1	12	2	1575	35	19
1045	564	562	24TH ST	COLLECTOR	1132	1	10	4	1350	30	19
1046	565	290	BOYSON RD	COLLECTOR	2704	1	10	0	1750	40	18
1047	565	291	BOYSON RD	COLLECTOR	3931	1	10	0	1750	40	18
1048	566	224	EDGEWOOD RD NW	MINOR ARTERIAL	229	2	12	4	1750	45	15
1049	566	1100	EDGEWOOD RD NW	MINOR ARTERIAL	1009	2	12	4	1900	40	15
1050	567	566	SHOPPING CENTER	LOCAL ROADWAY	447	2	12	4	1750	30	15
1051	568	226	EDGEWOOD RD NW	MINOR ARTERIAL	741	2	12	4	1750	45	15
1052	569	568	OFFICE BLDG DRIVEWAY	LOCAL ROADWAY	292	1	12	4	1350	30	15
1053	570	226	42ND ST NE	MINOR ARTERIAL	810	2	12	4	1750	45	15
1054	571	215	BLAIRS FERRY RD NE	MINOR ARTERIAL	2865	2	12	0	1750	45	18
1055	571	534	ROCKWELL DR NE	COLLECTOR	1836	1	12	0	1350	30	18
1056	571	1073	BLAIRS FERRY RD NE	MINOR ARTERIAL	804	2	12	0	1750	45	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1057	572	573	BLAIRS FERRY RD NE	MINOR ARTERIAL	2379	2	12	0	1750	45	18
1058	573	1045	BLAIRS FERRY RD NE	COLLECTOR	2262	1	12	0	1750	45	18
1059	574	217	10TH ST	COLLECTOR	342	1	10	2	1750	25	19
1060	574	316	10TH ST	COLLECTOR	799	1	10	2	1750	25	19
1061	575	151	IA-13	MINOR ARTERIAL	6739	2	10	3	1900	60	9
1062	576	577	IA-13	MINOR ARTERIAL	3230	2	10	8	1900	55	4
1063	577	153	IA-13	COLLECTOR	5028	1	10	12	1700	60	4
1064	578	1059	E LINN ST	LOCAL ROADWAY	1109	1	10	0	1700	45	4
1065	580	138	CO HWY D62	COLLECTOR	1450	1	10	4	1125	25	3
1066	581	1065	N CENTER POINT RD	COLLECTOR	6676	1	10	3	1700	45	3
1067	582	136	N CENTER POINT RD	COLLECTOR	9739	1	10	3	1700	65	3
1068	584	677	COGGON RD	COLLECTOR	1767	1	12	3	1700	40	4
1069	585	110	US-150	COLLECTOR	375	1	12	4	1125	25	6
1070	585	132	US-150	COLLECTOR	3076	1	12	4	1125	25	6
1071	585	588	W 4TH ST	COLLECTOR	2638	1	12	4	1750	35	6
1072	586	115	US-218	COLLECTOR	2015	1	10	3	1575	35	6
1073	586	588	US-218	COLLECTOR	342	1	12	4	1750	35	6
1074	588	114	US-218	COLLECTOR	3098	1	12	4	1700	45	6
1075	588	586	US-218	COLLECTOR	342	1	12	4	1575	35	6
1076	589	108	61ST ST	LOCAL ROADWAY	8797	1	12	4	1575	35	6
1077	589	934	61ST ST	COLLECTOR	2141	1	12	4	1575	35	6
1078	590	127	CO TRUNK RD E30	COLLECTOR	23568	1	10	5	1700	65	7
1079	591	132	E 13TH ST	COLLECTOR	1178	1	12	2	1575	35	6
1080	592	188	CO HWY W36	COLLECTOR	1381	1	10	0	1575	35	14

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1081	593	592	CO HWY W36	COLLECTOR	1507	1	10	0	1350	30	14
1082	594	196	POWER PLANT DR	COLLECTOR	3834	1	12	3	1700	40	8
1083	595	197	MCCLINTOCK RD	COLLECTOR	3600	1	12	4	1700	45	8
1084	596	135	FRANKLIN ST	LOCAL ROADWAY	1896	1	10	4	1575	35	8
1085	596	597	E WASHINGTON ST	COLLECTOR	1002	1	12	4	1350	30	8
1086	596	599	FRANKLIN ST	LOCAL ROADWAY	292	1	10	4	1575	35	8
1087	597	275	MAIN ST	COLLECTOR	298	1	12	4	1700	45	8
1088	597	598	MAIN ST	COLLECTOR	234	1	12	4	1700	45	8
1089	598	274	MAIN ST	COLLECTOR	697	1	12	4	1700	45	8
1090	598	597	MAIN ST	COLLECTOR	234	1	12	4	1700	45	8
1091	598	599	STATE ST	LOCAL ROADWAY	934	1	12	4	1350	30	8
1092	599	134	FRANKLIN ST	LOCAL ROADWAY	708	1	10	4	1575	35	8
1093	599	596	FRANKLIN ST	LOCAL ROADWAY	292	1	10	4	1575	35	8
1094	599	598	STATE ST	LOCAL ROADWAY	934	1	12	4	1350	30	8
1095	600	719	CO HWY E2W	COLLECTOR	5119	1	12	2	1700	60	8
1096	602	1066	GREEN ST	LOCAL ROADWAY	1571	1	12	4	1350	30	8
1097	605	606	CO HWY E2W	LOCAL ROADWAY	1681	1	12	0	1125	25	2
1098	606	607	E JEFFERSON ST	LOCAL ROADWAY	896	1	12	4	1350	30	2
1099	607	608	E JEFFERSON ST	LOCAL ROADWAY	297	1	12	4	1350	30	2

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1100	608	609	BIRCH ST	LOCAL ROADWAY	311	1	12	4	1350	30	2
1101	609	78	CO TRUNK HWY W26	COLLECTOR	356	1	12	4	1700	45	2
1102	610	153	PARIS RD	COLLECTOR	20256	1	10	3	1700	60	4
1103	611	150	N ALBURNETT RD	COLLECTOR	16169	1	10	6	1700	65	9
1104	611	942	BURNETT STATION RD	COLLECTOR	842	1	12	4	1350	30	9
1105	612	613	N ALBURNETT RD	COLLECTOR	4811	1	10	4	1350	30	9
1106	613	611	N ALBURNETT RD	COLLECTOR	1552	1	10	4	1350	30	9
1107	615	1107	US-151B	MINOR ARTERIAL	2256	2	12	4	1900	65	22
1108	616	1133	US - 30	COLLECTOR	3028	1	12	8	1700	40	31
1109	616	1142	US - 30	COLLECTOR	2627	1	12	8	1700	50	31
1110	617	1181	120TH ST NE	COLLECTOR	1123	1	12	0	1700	40	30
1111	617	1214	ELY RD	COLLECTOR	1138	1	12	3	1700	55	30
1112	618	1180	I-380	FREEWAY	4436	2	12	4	2250	70	29
1113	621	1279	US - 30	COLLECTOR	5723	1	12	8	1700	60	12
1114	622	451	CO TRUNK RD W54	COLLECTOR	2420	1	10	8	1700	45	27
1115	623	661	60TH AVE SW	COLLECTOR	10692	1	12	4	1750	45	26
1116	623	897	EDGEWOOD RD SW	COLLECTOR	5263	1	10	10	1700	65	26
1117	624	405	US-151B	MINOR ARTERIAL	1223	2	12	4	1750	60	17
1118	624	410	US-151B	MINOR ARTERIAL	1286	2	12	4	1750	60	17
1119	625	172	US-151B	MINOR ARTERIAL	1286	3	12	4	1750	60	17
1120	625	180	US-151B	MINOR ARTERIAL	1357	3	12	4	1750	60	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1121	626	171	16TH AVE SW	COLLECTOR	773	1	12	4	1750	45	17
1122	626	172	16TH AVE SW	MAJOR ARTERIAL	1187	3	12	10	1750	45	17
1123	627	625	TRENT ST	COLLECTOR	440	1	12	4	1750	30	17
1124	627	626	TRENT ST	COLLECTOR	601	1	12	4	1350	30	17
1125	628	404	16TH AVE SW	MINOR ARTERIAL	1951	2	12	4	1900	45	17
1126	628	890	16TH AVE SW	MINOR ARTERIAL	2966	2	12	4	1750	45	17
1127	629	665	8TH ST SE	COLLECTOR	1487	1	12	4	1750	30	20
1128	629	844	12TH AVE SE	COLLECTOR	705	1	12	4	1700	40	20
1129	630	362	10TH ST	MINOR ARTERIAL	1111	2	12	4	1750	40	20
1130	630	631	10TH ST	COLLECTOR	375	1	12	4	1750	40	20
1131	631	630	10TH ST	COLLECTOR	375	2	12	4	1750	40	20
1132	631	632	10TH ST	MINOR ARTERIAL	396	1	12	4	1750	40	20
1133	631	668	4TH AVE SE	COLLECTOR	722	1	12	4	1350	30	20
1134	632	631	10TH ST	MINOR ARTERIAL	396	2	12	4	1750	40	20
1135	632	753	10TH ST	MINOR ARTERIAL	394	2	12	4	1750	40	20
1136	632	777	3RD AVE SE	MINOR ARTERIAL	1472	2	12	4	1900	35	20
1137	633	356	6TH ST	MINOR ARTERIAL	358	2	12	4	1750	30	20
1138	634	317	IA-100	MINOR ARTERIAL	1947	2	12	4	1750	45	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1139	635	318	IA-100	MINOR ARTERIAL	6549	2	12	3	1900	60	19
1140	636	70	US - 30	FREEWAY	2023	2	12	8	2250	65	28
1141	636	1200	US - 30	FREEWAY	3627	2	12	8	2250	65	28
1142	637	231	EDGEWOOD RD SW	MINOR ARTERIAL	446	2	12	4	1750	45	17
1143	638	637	37TH AVE	LOCAL ROADWAY	1930	1	12	4	1750	30	17
1144	639	637	37TH AVE	LOCAL ROADWAY	843	1	12	4	1750	30	17
1145	640	411	EDGEWOOD RD SW	MINOR ARTERIAL	1261	2	12	4	1750	45	17
1146	641	640	29TH AVE	LOCAL ROADWAY	2302	1	12	4	1750	30	17
1147	642	998	33RD AVE SW	MINOR ARTERIAL	1667	2	12	2	1900	40	17
1148	642	1072	33RD AVE SW	COLLECTOR	4037	1	12	4	1750	45	17
1149	643	406	WILSON AVE	MINOR ARTERIAL	397	2	12	0	1750	40	17
1150	643	999	WILSON AVE	COLLECTOR	4885	1	12	0	1700	40	17
1151	644	645	WILSON AVE	COLLECTOR	710	1	12	0	900	20	17
1152	644	999	WILSON AVE	COLLECTOR	457	1	12	0	1750	40	17
1153	645	644	WILSON AVE	COLLECTOR	710	1	12	0	900	20	17
1154	645	997	WILSON AVE	COLLECTOR	1484	1	12	0	1750	40	17
1155	646	647	1ST ST NW	MINOR ARTERIAL	338	2	12	4	1750	40	20
1156	646	740	2ND AVE	MAJOR ARTERIAL	771	1	12	4	1750	35	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1157	647	675	1ST ST NW	MINOR ARTERIAL	1659	2	12	4	1750	40	20
1158	648	248	1ST ST NW	MINOR ARTERIAL	668	2	12	4	1750	40	20
1159	648	825	A AVE NE	MAJOR ARTERIAL	877	3	12	4	1750	40	20
1160	649	253	F AVE	COLLECTOR	2023	1	10	10	1750	40	17
1161	649	892	F AVE	COLLECTOR	4018	1	10	10	1700	55	17
1162	650	254	E AVE	COLLECTOR	1416	1	16	0	1700	40	17
1163	651	229	O AVE	LOCAL ROADWAY	7804	1	10	4	1750	35	17
1164	651	252	O AVE	LOCAL ROADWAY	1377	1	10	4	1575	35	17
1165	652	654	STONEY POINT ROAD	COLLECTOR	2785	1	12	2	1575	35	17
1166	652	901	E AVE	COLLECTOR	4004	1	12	3	1700	45	17
1167	653	230	E AVE	COLLECTOR	2628	1	12	3	1750	45	17
1168	653	729	WILEY BLVD NW	COLLECTOR	1343	1	12	4	1700	40	17
1169	653	901	E AVE	COLLECTOR	4009	1	12	3	1700	45	17
1170	654	169	STONEY POINT ROAD	COLLECTOR	2526	1	12	2	1750	35	17
1171	655	58	US - 30	FREEWAY	1397	2	12	8	2250	65	16
1172	655	168	US - 30	FREEWAY	1323	2	12	8	2250	65	16
1173	656	168	US-30 ON RAMP	FREEWAY RAMP	949	1	12	4	1700	50	16
1174	656	177	80TH STREET SW	COLLECTOR	9438	1	12	2	1700	50	16
1175	657	177	US-151B	COLLECTOR	5933	1	10	6	1700	65	16
1176	657	945	US-151B	COLLECTOR	3087	1	10	6	1700	65	17
1177	658	423	KIRKWOOD BLVD SW	COLLECTOR	323	1	12	0	1750	45	27

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1178	658	659	KIRKWOOD BLVD SW	MINOR ARTERIAL	1054	2	12	2	1750	45	27
1179	659	658	KIRKWOOD BLVD SW	MINOR ARTERIAL	1055	2	12	2	1750	45	27
1180	659	790	KIRKWOOD BLVD SW	MINOR ARTERIAL	2501	2	10	0	1750	45	27
1181	660	45	I-380	FREEWAY	3735	2	12	4	2250	70	27
1182	660	46	I-380	FREEWAY	3526	2	12	4	2250	70	27
1183	661	894	6TH ST	MINOR ARTERIAL	830	2	12	6	1900	65	27
1184	662	257	6TH ST	MINOR ARTERIAL	721	2	12	4	1750	30	20
1185	662	743	3RD AVE	MAJOR ARTERIAL	693	1	12	4	1750	35	20
1186	663	662	6TH ST	MINOR ARTERIAL	406	2	12	4	1750	30	20
1187	664	172	US-151B	MINOR ARTERIAL	3124	3	12	4	1750	60	17
1188	664	673	US-151B	MINOR ARTERIAL	1265	2	12	4	1750	60	17
1189	664	889	8TH AVE	COLLECTOR	1221	1	12	2	1575	35	17
1190	665	362	8TH AVE	MINOR ARTERIAL	753	2	10	2	1750	40	20
1191	665	667	8TH ST	COLLECTOR	1143	1	12	0	1350	30	20
1192	665	820	8TH AVE	MINOR ARTERIAL	398	2	10	2	1750	40	20
1193	667	630	5TH AVE SE	COLLECTOR	760	1	12	4	1750	30	20
1194	667	668	8TH ST	COLLECTOR	401	1	12	0	1350	30	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1195	668	669	8TH ST	MINOR ARTERIAL	396	2	12	0	1750	30	20
1196	668	843	4TH AVE SE	COLLECTOR	390	1	12	4	1350	30	20
1197	669	632	3RD AVE SE	MINOR ARTERIAL	721	2	12	4	1750	30	20
1198	669	754	8TH ST	MINOR ARTERIAL	409	3	12	0	1750	30	20
1199	670	344	US-151B	COLLECTOR	418	2	12	0	1750	45	20
1200	670	835	US-151B	MINOR ARTERIAL	761	2	12	0	1750	45	20
1201	670	841	7TH ST	MINOR ARTERIAL	377	2	12	4	1750	30	20
1202	671	248	US-151B	COLLECTOR	1027	2	12	4	1750	45	20
1203	671	745	1ST ST NE	COLLECTOR	423	1	12	4	1750	35	20
1204	672	255	US-151B	MAJOR ARTERIAL	372	3	12	4	1750	45	20
1205	672	256	US-151B	MAJOR ARTERIAL	389	3	12	4	1750	45	20
1206	673	664	US-151B	MINOR ARTERIAL	1270	2	12	4	1750	60	17
1207	673	889	18TH ST SW	COLLECTOR	706	1	12	2	1700	40	17
1208	673	972	US-151B	MINOR ARTERIAL	1286	2	12	4	1750	60	17
1209	674	360	3RD ST SE	COLLECTOR	1110	1	12	4	1750	30	20
1210	674	676	5TH AVE SE	MAJOR ARTERIAL	822	2	12	4	1900	30	20
1211	675	247	1ST ST NW	COLLECTOR	263	1	12	4	1750	40	20
1212	675	739	DIAGONAL DR SW	COLLECTOR	853	2	12	2	1750	40	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1213	676	821	5TH AVE SE	MINOR ARTERIAL	728	2	12	4	1900	30	20
1214	676	836	5TH ST SE	COLLECTOR	418	2	12	4	1750	30	20
1215	677	678	W VINTON ST	LOCAL ROADWAY	1120	1	12	0	1700	40	4
1216	678	679	2ND ST N	LOCAL ROADWAY	465	1	10	0	1700	40	4
1217	679	578	E LINN ST	LOCAL ROADWAY	414	1	10	0	1700	40	4
1218	680	570	42ND ST NE	COLLECTOR	3105	1	12	0	1700	45	15
1219	681	680	42ND ST NE	COLLECTOR	2322	1	12	0	1700	45	15
1220	682	785	C ST SW	COLLECTOR	1234	2	12	4	1900	45	27
1221	683	576	IA-13	COLLECTOR	4550	1	10	8	1700	55	4
1222	683	1035	CO HWY E 16	COLLECTOR	968	1	12	4	1575	35	9
1223	684	118	66TH ST	LOCAL ROADWAY	11622	1	10	3	1575	35	13
1224	685	127	27TH AVE	COLLECTOR	10536	1	10	4	1700	50	7
1225	685	904	27TH AVE	COLLECTOR	5128	1	10	4	1700	50	13
1226	686	685	66TH ST	LOCAL ROADWAY	5240	1	10	0	1575	35	13
1227	687	127	27TH AVE	COLLECTOR	10458	1	10	0	1700	50	7
1228	688	74	CO TRUNK HWY W26	COLLECTOR	723	1	12	2	1700	40	7
1229	688	958	CO TRUNK HWY W26	COLLECTOR	10108	1	12	2	1700	45	7
1230	689	688	COTTAGE ST NW	LOCAL ROADWAY	1119	1	10	0	1350	30	7
1231	690	118	CO TRUNK HWY W26	COLLECTOR	8900	1	10	3	1700	65	7

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1232	691	690	CO TRUNK HWY W26	COLLECTOR	913	1	10	3	1700	45	7
1233	692	184	64TH ST	COLLECTOR	9448	1	12	2	1700	45	7
1234	693	110	3RD ST	COLLECTOR	956	1	12	0	1575	35	6
1235	693	111	US-150	COLLECTOR	844	1	12	4	1575	35	6
1236	695	696	County HWY E44	COLLECTOR	918	1	12	4	1700	40	13
1237	695	879	27TH AVE	COLLECTOR	4741	1	10	4	1700	45	13
1238	696	106	County HWY E44	COLLECTOR	15054	1	12	4	1700	45	12
1239	697	455	QUAIL RIDGE RD	LOCAL ROADWAY	1429	1	12	0	1700	40	8
1240	698	133	N CENTER POINT RD	COLLECTOR	11410	1	12	4	1750	45	8
1241	699	698	CUMMINGS FORD RD	LOCAL ROADWAY	2484	1	12	0	1700	45	8
1242	700	698	CUMMINGS FORD RD	LOCAL ROADWAY	2384	1	12	0	1700	45	8
1243	701	700	BOAR RD	LOCAL ROADWAY	2633	1	12	2	1700	40	8
1244	702	701	NETSON CREEK RD	LOCAL ROADWAY	3743	1	12	2	1700	40	8
1245	703	280	N CENTER POINT RD	COLLECTOR	2596	1	12	4	1700	60	8
1246	703	908	N CENTER POINT RD	COLLECTOR	5231	1	10	5	1700	60	8
1247	704	281	COUNTRY HOME RD	COLLECTOR	844	2	12	2	1750	55	8
1248	704	282	COUNTRY HOME RD	COLLECTOR	9698	1	12	2	1700	55	9
1249	705	277	COUNTRY HOME RD	COLLECTOR	1530	1	12	4	1700	45	8
1250	705	281	COUNTRY HOME RD	MINOR ARTERIAL	856	2	12	4	1750	45	8
1251	706	281	N CENTER POINT RD	COLLECTOR	1098	1	10	4	1750	45	8
1252	706	306	N CENTER POINT RD	COLLECTOR	3846	1	10	4	1700	45	8
1253	707	306	W MAIN ST	COLLECTOR	2760	1	12	4	1700	40	8

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1254	707	708	W MAIN ST	COLLECTOR	1390	1	10	0	1700	45	8
1255	708	307	W MAIN ST	COLLECTOR	5959	1	10	0	1700	45	9
1256	709	634	MENARDS LN	LOCAL ROADWAY	341	1	12	0	1750	30	18
1257	710	469	N CENTER POINT RD	COLLECTOR	330	2	10	4	1750	45	18
1258	711	301	IA-100 OFF RAMP TO I-380	FREEWAY RAMP	414	2	12	4	1750	45	18
1259	713	23	ON-RAMP I-380	FREEWAY RAMP	968	1	12	4	1700	45	18
1260	713	24	ON-RAMP I-380	FREEWAY RAMP	1795	1	12	4	1750	45	18
1261	714	22	IA-100 OFF RAMP TO I-380	FREEWAY RAMP	672	2	12	4	1750	45	18
1262	715	1170	OFF-RAMP I-380	FREEWAY RAMP	542	2	12	4	1750	45	18
1263	716	300	IA-100 ON RAMP FROM I-380	FREEWAY RAMP	644	2	12	4	1750	45	18
1264	717	27	I-380 ON-RAMP	FREEWAY RAMP	1022	1	12	4	1700	45	18
1265	717	332	I-380 ON RAMP	FREEWAY RAMP	1309	1	12	4	1750	45	18
1266	718	329	29TH ST NE	COLLECTOR	481	2	12	4	1750	45	18
1267	718	330	29TH ST NE	COLLECTOR	444	1	12	4	1750	45	18
1268	719	268	CO HWY E2W	COLLECTOR	1323	1	12	2	1700	60	8
1269	720	1036	CO HWY E 16	COLLECTOR	1078	1	12	4	1575	35	9
1270	722	43	I-380	FREEWAY	2734	3	12	4	2250	70	20
1271	722	44	I-380	FREEWAY	1363	2	12	4	2250	70	20
1272	722	424	US-30 ON RAMP FROM I-380	FREEWAY RAMP	883	2	12	4	1900	45	20
1273	723	664	8TH AVE	COLLECTOR	1580	1	12	0	1750	35	17
1274	724	650	E AVE	COLLECTOR	2500	1	12	0	1700	40	17
1275	724	731	18TH ST NW	COLLECTOR	1283	1	12	4	1750	40	17
1276	725	170	W POST RD SW	COLLECTOR	561	1	12	4	1750	35	17
1277	726	728	WILEY BLVD SW	COLLECTOR	1429	2	12	4	1750	35	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1278	726	730	JOHNSON AVE NW	COLLECTOR	2956	2	12	4	1750	40	17
1279	727	726	JOHNSON AVE NW	COLLECTOR	1890	2	12	4	1750	40	17
1280	727	1067	JOHNSON AVE NW	COLLECTOR	1013	1	12	4	1700	40	17
1281	728	414	WILEY BLVD SW	COLLECTOR	1325	2	12	4	1750	35	17
1282	729	726	WILEY BLVD NW	COLLECTOR	1291	1	12	4	1750	35	17
1283	730	885	EDGEWOOD RD SW	MINOR ARTERIAL	2542	2	12	4	1750	45	17
1284	730	1070	JOHNSON AVE NW	MINOR ARTERIAL	4217	2	12	4	1900	40	17
1285	731	673	18TH ST NW	COLLECTOR	1331	1	12	4	1750	40	17
1286	732	654	1ST AVE NW	COLLECTOR	3907	1	12	4	1575	35	16
1287	733	169	16TH AVE SW	COLLECTOR	3223	1	12	4	1750	45	17
1288	733	170	16TH AVE SW	COLLECTOR	783	2	12	4	1750	45	17
1289	734	624	DRIVEWAY	LOCAL ROADWAY	252	2	12	4	1750	25	17
1290	735	624	WESTDALE DR SW	COLLECTOR	904	2	12	4	1750	35	17
1291	736	413	WILSON AVE SW	COLLECTOR	3912	1	12	4	1750	40	17
1292	737	57	US-30 ON-RAMP	FREEWAY RAMP	2048	1	12	4	1700	45	16
1293	738	657	STONEY POINT RD SW	COLLECTOR	3824	1	12	4	1750	40	17
1294	739	258	DIAGONAL DR SW	COLLECTOR	581	2	12	2	1750	40	20
1295	739	675	DIAGONAL DR SW	COLLECTOR	853	2	12	4	1750	40	20
1296	740	741	2ND AVE	MAJOR ARTERIAL	424	1	12	4	1750	35	20
1297	740	1004	3RD ST SW	MINOR ARTERIAL	206	2	12	4	1750	40	20
1298	741	743	L ST	MAJOR ARTERIAL	357	4	12	4	1750	40	20
1299	741	1002	2ND AVE	COLLECTOR	178	1	12	4	1575	35	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1300	742	853	DIAGONAL DR SW	COLLECTOR	291	2	12	2	1900	40	20
1301	743	744	3RD AVE	MAJOR ARTERIAL	443	1	12	4	1750	35	20
1302	743	851	L ST	MAJOR ARTERIAL	572	4	12	4	1900	45	20
1303	744	647	3RD AVE	MINOR ARTERIAL	774	1	12	4	1750	35	20
1304	744	1003	3RD ST SW	MINOR ARTERIAL	150	3	12	4	1750	40	20
1305	745	646	2ND AVE SE	COLLECTOR	1143	1	12	4	1750	35	20
1306	745	822	1ST ST NE	COLLECTOR	406	1	12	4	1750	35	20
1307	746	855	12TH AVE SE	COLLECTOR	1238	2	12	4	1900	45	20
1308	746	992	2ND ST E	COLLECTOR	866	1	12	2	1575	35	20
1309	747	742	8TH AVE	COLLECTOR	1485	2	10	2	1900	40	20
1310	747	746	2ND ST SE	COLLECTOR	1517	1	12	2	1750	30	20
1311	748	674	5TH AVE SE	COLLECTOR	376	1	12	4	1750	30	20
1312	748	747	2ND ST SE	COLLECTOR	1093	1	12	4	1750	30	20
1313	749	993	3RD ST SE	COLLECTOR	701	1	12	2	1575	35	20
1314	749	994	12TH AVE SE	COLLECTOR	197	1	12	4	1700	40	20
1315	750	362	MT VERNON RD	MINOR ARTERIAL	933	2	12	2	1750	35	20
1316	750	363	MT VERNON RD	MINOR ARTERIAL	249	2	12	0	1900	35	20
1317	751	750	15TH ST SE	COLLECTOR	2671	1	12	4	1750	30	20
1318	751	817	BEAVER AVE SE	COLLECTOR	2131	1	12	2	1350	30	20
1319	752	1068	2ND AVE SE	LOCAL ROADWAY	768	1	12	0	1750	35	20
1320	753	342	10TH ST	COLLECTOR	386	2	12	4	1750	40	20
1321	753	632	10TH ST	COLLECTOR	394	2	12	4	1750	40	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1322	753	754	2ND AVE SE	COLLECTOR	729	1	12	4	1750	35	20
1323	754	344	8TH ST	COLLECTOR	365	2	12	0	1750	30	20
1324	754	841	2ND AVE SE	COLLECTOR	378	1	12	4	1750	35	20
1325	755	157	IA-13	MINOR ARTERIAL	4261	2	12	4	1900	75	21
1326	755	1025	IA-13	MINOR ARTERIAL	3359	2	12	4	1750	75	21
1327	756	264	33RD AVE SW	COLLECTOR	635	2	12	4	1750	45	20
1328	756	421	33RD AVE SW	COLLECTOR	2687	1	12	4	1700	45	20
1329	757	758	30TH ST DR	COLLECTOR	4563	1	12	4	1575	35	18
1330	758	390	30TH ST DR	COLLECTOR	3486	1	12	4	1750	35	18
1331	759	988	MT VERNON RD	COLLECTOR	1165	1	10	5	1700	45	21
1332	760	194	F AVE	COLLECTOR	2600	1	12	6	1750	40	17
1333	760	653	WILEY BLVD NW	COLLECTOR	654	1	12	4	1700	40	17
1334	761	16	I-380	FREEWAY	3952	2	12	4	2250	70	15
1335	761	18	I-380	FREEWAY	1848	2	12	4	2250	70	15
1336	762	209	BLAIRS FERRY RD NE	COLLECTOR	3090	1	10	4	1750	55	15
1337	763	762	MILBURN RD	COLLECTOR	10866	1	12	4	1700	40	15
1338	763	764	TOWER TERRACE RD	COLLECTOR	5195	1	12	4	1700	40	15
1339	764	305	TOWER TERRACE RD	COLLECTOR	4195	1	12	4	1700	40	15
1340	765	205	FEATHER RIDGE RD	COLLECTOR	2586	1	12	4	1700	40	15
1341	765	763	TOWER TERRACE RD	COLLECTOR	5648	1	12	4	1700	40	8
1342	766	767	HAGERMAN RD	COLLECTOR	2536	1	12	4	1700	40	8
1343	767	908	HAGERMAN RD	COLLECTOR	7029	1	12	4	1700	40	8
1344	768	278	TODDVILLE RD	COLLECTOR	6415	1	12	4	1575	35	8
1345	768	765	FEATHER RIDGE RD	COLLECTOR	10327	1	12	4	1700	40	8

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1346	769	229	ROGERS RD NW	COLLECTOR	2679	1	12	4	1750	35	17
1347	770	32	I-380	FREEWAY	1214	4	12	4	2250	70	20
1348	770	34	I-380	FREEWAY	1856	4	12	4	2250	70	20
1349	771	13	I-380	FREEWAY	8909	2	12	4	2250	70	8
1350	771	14	I-380	FREEWAY	1997	2	12	4	2250	70	8
1351	772	11	I-380	FREEWAY	7120	2	12	4	2250	70	8
1352	772	12	I-380	FREEWAY	11445	2	12	4	2250	70	8
1353	773	235	WRIGHT BROTHERS BLVD	COLLECTOR	23609	1	10	8	1700	65	26
1354	773	1104	WRIGHT BROTHERS BLVD	COLLECTOR	1195	1	10	8	1700	65	26
1355	774	236	WRIGHT BROTHERS BLVD	COLLECTOR	8397	2	12	8	1750	45	26
1356	775	124	County HWY E44	COLLECTOR	5230	1	12	4	1700	45	13
1357	776	343	COE RD NE	COLLECTOR	900	2	12	4	1900	45	20
1358	777	981	3RD AVE SE	MAJOR ARTERIAL	297	3	12	4	1900	35	20
1359	777	1068	13TH ST SE	COLLECTOR	364	3	12	4	1750	30	20
1360	778	317	E POST RD SE	COLLECTOR	1429	1	12	2	1750	50	19
1361	778	390	E POST RD SE	COLLECTOR	1991	1	10	2	1750	50	19
1362	779	508	11TH ST	COLLECTOR	851	1	12	4	1750	35	19
1363	780	779	F AVE	COLLECTOR	882	1	12	4	1750	35	19
1364	781	968	11TH ST	COLLECTOR	621	1	12	4	1750	35	19
1365	782	781	11TH ST	COLLECTOR	588	1	12	4	1575	35	19
1366	783	239	US-30 OFF RAMP	FREEWAY RAMP	774	2	12	4	1750	45	27
1367	784	682	DRIVEWAY	LOCAL ROADWAY	674	1	12	4	1750	25	27
1368	785	450	C ST SW	COLLECTOR	2290	1	12	4	1700	45	27

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1369	786	785	DRIVEWAY	LOCAL ROADWAY	545	1	12	4	1125	25	27
1370	787	658	MILLER AVE DR SW	COLLECTOR	1181	1	12	4	1750	40	27
1371	788	787	MILLER AVE DR SW	COLLECTOR	1546	1	12	4	1700	40	27
1372	789	659	KIRKWOOD CT SW	COLLECTOR	757	1	12	2	1750	35	27
1373	790	449	KIRKWOOD BLVD SW	COLLECTOR	3548	1	10	0	1700	45	27
1374	791	658	MILLER AVE SW	COLLECTOR	1848	1	12	4	1750	35	27
1375	792	790	66TH AVE SW	COLLECTOR	2031	1	12	4	1750	40	27
1376	793	790	66TH AVE SW	COLLECTOR	549	1	12	4	1750	40	27
1377	794	240	EDISON SW	COLLECTOR	963	1	12	4	1750	40	27
1378	795	796	US-151B	COLLECTOR	474	2	12	4	1750	45	19
1379	796	493	US-151B	COLLECTOR	233	2	12	4	1750	45	19
1380	797	795	DRIVEWAY	LOCAL ROADWAY	284	1	12	4	1750	25	19
1381	798	796	DRIVEWAY	LOCAL ROADWAY	292	1	12	4	1750	25	19
1382	799	501	US-151B	COLLECTOR	289	1	12	4	1750	45	19
1383	800	799	12TH ST	COLLECTOR	360	1	12	4	1750	30	19
1384	801	574	8TH AVE	COLLECTOR	919	1	12	4	1750	30	19
1385	801	1239	7TH ST	COLLECTOR	235	1	12	4	1350	30	18
1386	802	573	LINDALE DR	COLLECTOR	1228	1	12	4	1750	40	18
1387	803	1241	US-151B	COLLECTOR	189	1	12	2	900	20	18
1388	804	801	8TH AVE	COLLECTOR	3462	1	12	4	1700	40	18
1389	805	21	I-380 ON-RAMP	FREEWAY RAMP	884	2	12	4	1900	40	18
1390	805	944	I-380 ACCESS RD	COLLECTOR	701	1	12	4	1700	45	18
1391	806	293	IA-100	FREEWAY	3105	2	12	10	1900	65	15
1392	806	1238	IA-100 OFF RAMP	FREEWAY RAMP	3041	2	12	10	1900	50	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1393	807	187	BLAIRS FERRY RD NE	COLLECTOR	1459	1	12	8	1700	45	14
1394	807	189	BLAIRS FERRY RD NE	COLLECTOR	3309	1	12	8	1700	45	14
1395	808	187	County HWY W36	COLLECTOR	588	1	12	4	1700	45	14
1396	808	188	County HWY W36	COLLECTOR	3034	1	12	4	1700	45	14
1397	809	692	E SHELLSBURG RD	COLLECTOR	1393	1	12	4	1700	40	8
1398	810	109	US-150	COLLECTOR	1005	2	12	4	1900	45	6
1399	810	132	US-150	COLLECTOR	1762	1	12	4	1350	30	6
1400	811	270	DURROW RD	COLLECTOR	718	1	12	4	1700	40	3
1401	812	813	LINN BENTON RD	COLLECTOR	815	1	12	4	1700	40	2
1402	813	271	54TH STREET TRAIL	COLLECTOR	4781	1	12	4	1700	45	2
1403	814	291	S MENTZE RD	COLLECTOR	915	2	12	4	1750	35	18
1404	815	314	ALBURNETT RD	COLLECTOR	2825	1	12	4	1750	45	18
1405	815	483	29TH AVE	COLLECTOR	3900	1	12	4	1750	35	18
1406	816	363	MT VERNON RD	MINOR ARTERIAL	1838	2	12	2	1900	35	20
1407	816	819	MT VERNON RD	MINOR ARTERIAL	242	2	12	0	1750	35	20
1408	817	517	BEAVER AVE SE	COLLECTOR	2564	1	12	2	1350	30	20
1409	817	816	19TH ST SE	COLLECTOR	2659	1	12	4	1750	30	20
1410	817	859	19TH ST SE	COLLECTOR	2417	1	12	4	1750	30	20
1411	818	397	MCCARTHY RD SE	COLLECTOR	2114	1	10	4	1350	30	20
1412	818	819	19TH ST SE	COLLECTOR	1300	1	12	4	1750	30	20
1413	819	364	MT VERNON RD	MINOR ARTERIAL	2368	2	12	0	1900	35	20
1414	819	816	MT VERNON RD	MINOR ARTERIAL	242	2	12	2	1750	35	20
1415	820	665	8TH AVE	COLLECTOR	398	2	10	2	1750	40	20
1416	820	845	8TH AVE	COLLECTOR	369	2	10	2	1750	40	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1417	821	667	5TH AVE SE	MINOR ARTERIAL	390	2	12	4	1900	30	20
1418	821	820	7TH ST SE	COLLECTOR	1138	2	12	4	1750	35	20
1419	822	823	3RD AVE SE	COLLECTOR	399	1	12	4	1750	35	20
1420	823	824	3RD AVE SE	COLLECTOR	352	2	12	4	1750	35	20
1421	823	831	2ND ST NE	COLLECTOR	411	2	12	4	1750	35	20
1422	824	826	3RD ST SE	COLLECTOR	411	1	12	4	1750	30	20
1423	824	833	3RD AVE SE	MAJOR ARTERIAL	797	3	12	4	1750	35	20
1424	824	837	3RD ST SE	COLLECTOR	397	1	12	4	1750	30	20
1425	825	671	1ST ST NE	COLLECTOR	554	2	12	4	1750	35	20
1426	825	828	A AVE NE	COLLECTOR	474	2	12	4	1750	40	20
1427	826	361	3RD ST SE	COLLECTOR	395	2	12	4	1750	30	20
1428	826	824	3RD ST SE	COLLECTOR	411	1	12	4	1750	30	20
1429	826	831	2ND AVE SE	MAJOR ARTERIAL	355	3	12	4	1750	35	20
1430	827	352	3RD ST SE	COLLECTOR	297	1	12	4	1350	30	20
1431	827	1237	A AVE NE	COLLECTOR	734	2	12	4	1750	35	20
1432	828	350	US-151B OFF RAMP TO I-380	FREEWAY RAMP	389	1	12	4	1750	45	20
1433	828	827	A AVE NE	COLLECTOR	365	2	12	4	1750	35	20
1434	829	249	1ST ST NW	MAJOR ARTERIAL	688	3	10	3	1900	35	20
1435	830	350	A AVE NE	COLLECTOR	402	1	12	4	1750	35	20
1436	830	825	1ST ST NE	COLLECTOR	254	1	12	4	1750	35	20
1437	831	349	2ND ST NE	COLLECTOR	396	1	12	4	1750	35	20
1438	831	745	2ND AVE SE	COLLECTOR	400	1	12	4	1750	35	20
1439	832	823	2ND ST NE	COLLECTOR	397	1	12	4	1750	35	20
1440	833	834	5TH ST SE	COLLECTOR	409	1	12	4	1750	30	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1441	833	840	3RD AVE SE	COLLECTOR	768	3	12	4	1750	35	20
1442	834	826	2ND AVE SE	MAJOR ARTERIAL	790	3	12	4	1750	35	20
1443	834	835	5TH ST SE	COLLECTOR	385	1	12	4	1750	30	20
1444	835	361	US-151B	COLLECTOR	763	2	12	0	1750	45	20
1445	835	670	US-151B	COLLECTOR	761	2	12	0	1750	45	20
1446	836	833	5TH ST SE	COLLECTOR	370	2	12	4	1750	30	20
1447	836	837	4TH AVE SE	COLLECTOR	790	1	12	4	1750	30	20
1448	837	674	3RD ST SE	COLLECTOR	402	1	12	4	1750	30	20
1449	838	348	8TH ST	COLLECTOR	259	2	12	4	1900	35	20
1450	838	839	A AVE NE	COLLECTOR	389	2	12	4	1750	35	20
1451	839	670	7TH ST	MAJOR ARTERIAL	371	3	12	4	1750	30	20
1452	839	838	A AVE NE	COLLECTOR	389	1	12	4	1750	35	20
1453	840	669	3RD AVE SE	COLLECTOR	391	3	12	4	1750	35	20
1454	840	843	7TH ST SE	MINOR ARTERIAL	371	2	12	4	1900	35	20
1455	841	834	2ND AVE SE	MAJOR ARTERIAL	782	4	12	4	1750	35	20
1456	841	840	7TH ST	COLLECTOR	411	2	12	4	1750	30	20
1457	842	839	7TH ST	MINOR ARTERIAL	169	2	12	4	1750	30	20
1458	843	821	7TH ST SE	MINOR ARTERIAL	420	2	12	4	1900	35	20
1459	843	856	4TH AVE SE	COLLECTOR	353	1	12	4	1350	30	20
1460	844	749	12TH AVE SE	COLLECTOR	1188	1	12	2	1750	40	20
1461	845	360	8TH AVE	COLLECTOR	1131	2	10	2	1750	40	20
1462	845	820	8TH AVE	COLLECTOR	370	2	10	2	1750	40	20
1463	845	844	6TH ST SE	COLLECTOR	1500	1	12	4	1350	30	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1464	846	1233	COLDSTREAM AVE NE	COLLECTOR	542	1	12	4	1750	35	18
1465	847	255	6TH ST	COLLECTOR	340	1	12	4	1750	30	20
1466	848	396	E AVE	COLLECTOR	759	1	12	4	1700	40	20
1467	848	672	5TH ST SW	COLLECTOR	1245	1	12	4	1750	30	20
1468	849	256	3RD ST NW	COLLECTOR	463	1	12	4	1750	40	20
1469	850	37	I-380 ON-RAMP	FREEWAY RAMP	1199	1	12	4	1700	45	20
1470	851	258	L ST	MAJOR ARTERIAL	260	2	12	4	1750	45	20
1471	852	739	3RD ST SW	COLLECTOR	522	1	12	4	1750	40	20
1472	853	247	8TH AVE	COLLECTOR	298	1	12	0	1750	35	20
1473	853	675	DIAGONAL DR SW	COLLECTOR	265	2	12	2	1750	40	20
1474	854	246	C ST SW	COLLECTOR	1326	1	12	4	1750	45	20
1475	855	246	12TH AVE SE	COLLECTOR	769	2	12	4	1750	45	20
1476	856	836	4TH AVE SE	COLLECTOR	415	1	12	4	1750	30	20
1477	857	340	12TH ST NE	COLLECTOR	402	2	12	4	1750	45	20
1478	857	858	A AVE NE	COLLECTOR	729	1	12	4	1750	35	20
1479	858	838	A AVE NE	COLLECTOR	764	2	12	4	1750	35	20
1480	859	369	19TH ST SE	COLLECTOR	766	1	12	4	1750	30	20
1481	859	817	19TH ST SE	COLLECTOR	2417	1	12	4	1350	30	20
1482	859	982	LINDER DR SE	COLLECTOR	2610	1	12	2	1575	35	20
1483	860	859	3RD AVE SE	COLLECTOR	414	1	12	4	1750	35	20
1484	861	982	FOREST DR SE	COLLECTOR	794	1	12	2	1575	35	20
1485	862	370	21ST ST NE	COLLECTOR	1392	1	12	4	1750	30	20
1486	863	631	4TH AVE SE	COLLECTOR	756	1	12	4	1750	30	20
1487	864	401	MEMORIAL DR SE	COLLECTOR	4310	1	12	4	1575	35	20
1488	865	365	34TH ST SE	COLLECTOR	928	2	12	4	1750	35	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1489	866	70	OLD RIVER RD	LOCAL ROADWAY	1270	1	12	4	1700	40	28
1490	867	869	US - 30	FREEWAY	3863	2	12	8	2250	65	27
1491	867	1200	US - 30	FREEWAY	6753	2	12	8	2250	65	28
1492	868	867	HONEY GROVE RD	COLLECTOR	2053	1	12	4	1700	40	21
1493	869	867	US - 30	FREEWAY	3863	2	12	8	2250	65	27
1494	869	950	US - 30	FREEWAY	1805	2	12	8	2250	65	27
1495	870	869	CO TRUNK RD W8E	COLLECTOR	412	1	12	4	1350	30	27
1496	871	370	US-151B	COLLECTOR	2925	2	12	4	1750	40	18
1497	871	377	US-151B	COLLECTOR	1071	2	12	4	1750	40	18
1498	872	871	27TH ST NE	COLLECTOR	2395	1	12	4	1750	35	18
1499	873	871	27TH ST DR SE	COLLECTOR	501	1	12	4	1750	35	18
1500	874	523	35TH AVE	COLLECTOR	1790	1	12	0	1750	30	18
1501	875	526	40TH ST	COLLECTOR	2691	1	12	4	1750	30	18
1502	876	634	IA-100	COLLECTOR	3972	2	12	4	1750	45	18
1503	877	56	STATE HWY 279	COLLECTOR	10500	1	12	4	1700	45	13
1504	877	878	PARK RIDGE RD	COLLECTOR	5233	1	12	4	1700	45	13
1505	878	122	CO TRUNK HWY W26	COLLECTOR	10527	1	12	4	1700	45	13
1506	878	1033	71ST ST	COLLECTOR	10567	1	12	4	1700	45	13
1507	879	54	27TH AVE	COLLECTOR	10539	1	10	4	1700	45	13
1508	879	695	27TH AVE	COLLECTOR	4741	1	10	4	1700	45	13
1509	879	1034	71ST ST	COLLECTOR	15772	1	12	4	1575	35	12
1510	880	879	71ST ST	COLLECTOR	10469	1	12	4	1700	45	13
1511	881	1052	EDGEWOOD RD SW	MINOR ARTERIAL	1296	3	12	0	1750	45	17
1512	882	881	DRIVEWAY	LOCAL ROADWAY	354	1	12	4	1750	25	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1513	883	262	33RD AVE SW	COLLECTOR	815	2	12	4	1750	45	20
1514	883	263	33RD AVE SW	COLLECTOR	652	2	12	4	1750	45	20
1515	884	262	33RD AVE SW	MINOR ARTERIAL	1961	2	12	4	1750	45	20
1516	884	998	33RD AVE SW	MINOR ARTERIAL	2024	2	12	2	1900	40	17
1517	885	171	EDGEWOOD RD SW	MINOR ARTERIAL	1424	2	12	4	1750	45	17
1518	885	728	1ST AVE NW	COLLECTOR	2717	1	12	4	1750	40	17
1519	886	885	1ST AVE NW	COLLECTOR	2068	1	12	4	1750	40	17
1520	887	980	EDGEWOOD RD SW	COLLECTOR	426	1	10	4	1700	45	17
1521	888	887	BEVERLY ROAD	LOCAL ROADWAY	764	1	12	4	1750	40	17
1522	889	628	18TH ST SW	COLLECTOR	2391	1	12	4	1750	40	17
1523	889	964	8TH AVE	COLLECTOR	3137	1	12	2	1575	35	17
1524	890	172	16TH AVE SW	COLLECTOR	553	2	12	4	1750	45	17
1525	890	628	16TH AVE SW	COLLECTOR	2966	2	12	4	1750	45	17
1526	891	890	23RD ST	COLLECTOR	284	1	12	4	1750	25	17
1527	892	194	F AVE	COLLECTOR	3173	1	10	10	1750	55	17
1528	892	649	F AVE	COLLECTOR	4018	1	12	2	1750	55	17
1529	893	266	WACONIA CT SW	COLLECTOR	1020	1	12	4	1750	35	27
1530	894	895	6TH ST	COLLECTOR	1199	1	12	6	1750	65	27
1531	895	267	6TH ST	COLLECTOR	3235	1	12	6	1750	65	27
1532	896	895	66TH AVE	COLLECTOR	2622	1	12	4	1750	40	27
1533	897	233	EDGEWOOD RD SW	COLLECTOR	4131	1	10	10	1750	65	26
1534	897	267	CO HWY E66	COLLECTOR	10809	1	12	4	1750	45	26
1535	898	227	GLASS RD NE	COLLECTOR	1310	1	10	4	1750	30	15
1536	898	323	GLASS RD NE	COLLECTOR	5949	1	10	4	1350	30	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1537	899	568	EDGEWOOD RD NW	MINOR ARTERIAL	968	2	12	4	1900	45	15
1538	900	899	N RIVER BLVD NE	COLLECTOR	1145	1	12	4	1750	40	15
1539	901	652	E AVE	COLLECTOR	4004	1	12	3	1700	45	17
1540	901	653	E AVE	COLLECTOR	4009	1	12	3	1700	45	17
1541	901	725	W POST RD SW	COLLECTOR	4714	1	12	4	1575	35	17
1542	902	738	STONEY POINT RD SW	COLLECTOR	1572	1	12	4	1700	40	17
1543	903	902	DECATUR ST SW	COLLECTOR	4091	1	12	4	1575	35	17
1544	904	685	27TH AVE	COLLECTOR	5128	1	10	4	1700	50	13
1545	904	952	27TH AVE	COLLECTOR	5331	1	10	4	1700	50	13
1546	905	904	67TH ST	LOCAL ROADWAY	10424	1	12	4	1575	35	13
1547	906	386	SCOTT RD	COLLECTOR	6416	1	12	4	1700	40	9
1548	907	2	TROY MILLS RD	COLLECTOR	10607	1	12	4	1700	45	8
1549	908	455	N CENTER POINT RD	COLLECTOR	8879	1	10	5	1700	60	8
1550	909	910	CO HWY W45	COLLECTOR	13058	1	12	4	1700	55	8
1551	910	703	CO HWY W45	COLLECTOR	817	1	12	4	1700	45	8
1552	911	280	MIDWAY RD	COLLECTOR	2034	1	12	4	1575	35	8
1553	912	807	HOLLENBECK RD	COLLECTOR	9151	1	12	4	1700	40	8
1554	913	765	TOWER TERRACE RD	COLLECTOR	3946	1	12	4	1700	40	8
1555	914	286	MILLER RD	COLLECTOR	1046	1	12	4	1700	40	15
1556	915	286	CARPENTER RD	COLLECTOR	3170	1	12	4	1575	35	15
1557	916	288	BOYSON RD	COLLECTOR	782	1	12	4	1750	45	15
1558	917	918	BLAIRS FERRY RD NE	MINOR ARTERIAL	1090	2	12	2	1900	35	15
1559	917	1102	BLAIRS FERRY RD NE	MINOR ARTERIAL	1510	2	12	2	1900	35	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1560	918	463	BLAIRS FERRY RD NE	MINOR ARTERIAL	579	2	12	2	1900	35	15
1561	918	917	BLAIRS FERRY RD NE	MINOR ARTERIAL	1090	2	12	2	1900	35	15
1562	919	917	N PINE DR NE	COLLECTOR	1309	1	12	4	1575	35	15
1563	920	918	N PINE DR NE	COLLECTOR	1367	1	12	4	1575	35	15
1564	921	465	10TH AVE	COLLECTOR	1561	1	12	4	1750	35	15
1565	922	681	SEMINOLE VALLEY RD NE	COLLECTOR	5553	1	12	4	1575	35	15
1566	923	81	US-150	COLLECTOR	20969	1	12	6	1700	55	2
1567	924	923	30TH AVE	COLLECTOR	9167	1	12	4	1575	35	7
1568	925	75	CO TRUNK HWY E24	COLLECTOR	8667	1	12	4	1575	35	7
1569	926	56	US - 30	FREEWAY	10758	2	12	8	2250	65	16
1570	926	57	US - 30	FREEWAY	6138	2	12	8	2250	65	16
1571	927	926	SISLEY GROVE RD SW	COLLECTOR	13220	1	12	2	1575	35	16
1572	927	1027	ELLIS RD	COLLECTOR	5598	1	12	4	1700	45	16
1573	928	927	SISLEY GROVE RD SW	COLLECTOR	10529	1	12	2	1575	35	14
1574	929	930	30TH AVE	COLLECTOR	9669	1	12	4	1700	55	25
1575	930	931	30TH AVE	COLLECTOR	1539	1	12	4	1700	40	25
1576	931	1272	30TH AVE	COLLECTOR	2036	1	12	4	1575	35	25
1577	932	355	I-380 ON RAMP FROM US-151B	FREEWAY RAMP	695	1	12	4	1700	45	20
1578	933	53	US - 30	MINOR ARTERIAL	1831	2	12	8	1900	60	12
1579	933	1279	US - 30	COLLECTOR	13570	1	12	8	1700	60	12
1580	934	935	61ST ST	COLLECTOR	2253	1	12	4	1575	35	6
1581	936	108	US-218	COLLECTOR	1589	1	12	4	1700	45	6

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1582	936	109	US-218	MINOR ARTERIAL	969	2	12	4	1900	45	6
1583	937	131	10TH AVE	COLLECTOR	1269	1	12	2	1575	35	6
1584	938	129	CO TRUNK HWY E24	COLLECTOR	7331	1	12	4	1700	50	7
1585	939	173	US-151B	MINOR ARTERIAL	408	2	12	4	1900	45	17
1586	939	255	US-151B	COLLECTOR	2543	2	12	0	1750	45	17
1587	940	939	5TH AVE	COLLECTOR	183	2	12	4	1750	40	17
1588	940	941	5TH AVE	COLLECTOR	1335	1	12	4	1700	40	17
1589	941	257	5TH AVE	COLLECTOR	1551	1	12	4	1750	40	20
1590	941	940	5TH AVE	COLLECTOR	1334	1	12	4	1700	40	17
1591	942	1008	BURNETT STATION RD	COLLECTOR	4588	1	12	4	1700	55	9
1592	943	216	BLAIRS FERRY RD NE	COLLECTOR	290	1	12	4	1750	35	18
1593	944	296	I-380 ACCESS RD	MINOR ARTERIAL	395	2	12	4	1750	45	18
1594	945	178	US-151B	MINOR ARTERIAL	659	2	10	6	1750	65	17
1595	945	657	US-151B	COLLECTOR	3087	1	10	6	1750	65	17
1596	946	143	PARIS RD	COLLECTOR	4072	1	12	4	1575	35	3
1597	947	946	PARIS RD	COLLECTOR	5001	1	12	4	1575	35	3
1598	948	242	ELY RD SW	COLLECTOR	351	1	12	4	1575	35	20
1599	949	948	ELY RD SW	COLLECTOR	2371	1	12	4	1700	40	20
1600	950	69	US - 30	FREEWAY	2165	2	12	8	2250	65	27
1601	950	869	US - 30	FREEWAY	1805	2	12	8	2250	65	27
1602	951	950	EAST RD SW	COLLECTOR	814	1	12	2	1575	35	27
1603	952	124	27TH AVE	COLLECTOR	10661	1	10	4	1700	50	13
1604	952	904	27TH AVE	COLLECTOR	5330	1	10	4	1700	50	13
1605	953	657	BEVERLY ROAD	COLLECTOR	4100	1	12	2	1750	40	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1606	954	175	US-151B	COLLECTOR	4535	1	12	4	1700	45	26
1607	955	176	E CEMETARY RD	COLLECTOR	11299	1	12	2	1700	40	26
1608	956	176	W CEMETARY RD	COLLECTOR	8697	1	12	2	1700	40	26
1609	957	186	SHELLSBURG RD	COLLECTOR	4376	1	10	3	1700	55	14
1610	958	75	CO TRUNK HWY W26	COLLECTOR	5254	1	12	2	1700	45	7
1611	959	9	I-380	FREEWAY	6754	2	12	4	2250	70	8
1612	959	10	I-380	FREEWAY	9152	2	12	4	2250	70	8
1613	960	612	ALBURNETT RD	COLLECTOR	7886	1	12	2	1700	40	9
1614	961	659	KIRKWOOD CT SW	COLLECTOR	719	1	12	2	1750	35	27
1615	962	399	16TH AVE SW	COLLECTOR	1194	2	12	4	1900	40	20
1616	962	417	L ST SW	COLLECTOR	1796	1	12	2	1700	40	20
1617	963	259	15TH AVE SW	COLLECTOR	1510	2	12	4	1750	45	20
1618	963	962	L ST SW	COLLECTOR	417	1	12	2	1700	40	20
1619	964	356	8TH AVE	COLLECTOR	1974	1	12	0	1750	35	17
1620	964	965	ROCKFORD RD SW	COLLECTOR	4568	1	12	2	1575	35	17
1621	965	644	ROCKFORD RD SW	COLLECTOR	888	1	12	2	1700	40	17
1622	966	516	BEAVER AVE SE	COLLECTOR	1080	1	12	2	1350	30	20
1623	967	378	32ND ST NE	COLLECTOR	2461	1	12	2	1750	35	18
1624	968	779	11TH ST	COLLECTOR	1937	1	12	4	1750	35	19
1625	968	1295	1ST AVE	COLLECTOR	2564	1	12	2	1575	35	19
1626	969	487	US-151B	COLLECTOR	911	2	12	4	1750	55	19
1627	970	969	50TH ST	COLLECTOR	4046	1	12	2	1575	35	19
1628	971	159	29TH AVE	COLLECTOR	3041	1	10	0	1575	35	19
1629	972	173	US-151B	MAJOR ARTERIAL	661	3	12	4	1900	60	17
1630	972	673	US-151B	COLLECTOR	1286	2	12	2	1750	60	17
1631	973	972	15TH ST NW	COLLECTOR	1699	1	12	2	1750	30	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1632	974	326	J AVE	COLLECTOR	1795	1	12	2	1700	40	15
1633	975	30	J AVE	COLLECTOR	2497	1	12	2	1700	40	20
1634	976	337	H AVE	COLLECTOR	999	1	12	2	1575	35	20
1635	976	520	16TH AVE	COLLECTOR	1634	1	12	2	1575	35	20
1636	977	565	ROBINS RD	COLLECTOR	4068	1	12	2	1575	35	18
1637	978	635	S 22ND ST	COLLECTOR	1527	1	12	2	1750	40	19
1638	979	1348	SECRIST RD	COLLECTOR	1615	1	12	6	1700	40	22
1639	980	623	EDGEWOOD RD SW	COLLECTOR	4773	1	10	4	1700	45	26
1640	981	522	3RD AVE SE	MAJOR ARTERIAL	836	3	12	4	1900	35	20
1641	981	1172	BEAVER AVE SE	COLLECTOR	212	1	12	2	1350	30	20
1642	982	371	FOREST DR SE	COLLECTOR	2390	1	12	2	1575	35	20
1643	984	294	IA-100 ON RAMP FROM I-380	FREEWAY RAMP	827	1	12	4	1700	45	18
1644	985	24	42ND ST NE	COLLECTOR	460	1	12	0	1750	45	18
1645	985	299	42ND ST NE	COLLECTOR	2276	1	12	4	1750	45	18
1646	986	320	42ND ST NE	COLLECTOR	323	2	12	4	1750	40	18
1647	986	321	42ND ST NE	COLLECTOR	1648	1	12	2	1750	40	18
1648	987	394	COTTAGE GROVE PKWY	COLLECTOR	2708	1	10	2	1700	55	21
1649	987	759	SQUAW CREEK RD	COLLECTOR	5244	1	12	2	1575	35	21
1650	988	156	MT VERNON RD	MINOR ARTERIAL	1034	2	10	5	1750	45	21
1651	989	316	10TH ST	COLLECTOR	2436	1	10	2	1750	30	19
1652	989	482	10TH ST	COLLECTOR	337	1	10	2	1750	30	19
1653	989	563	MCGOWAN BLVD	COLLECTOR	3245	1	12	2	1575	35	19
1654	990	496	MCGOWAN BLVD	COLLECTOR	1278	1	12	2	1575	35	19
1655	990	552	31ST ST	COLLECTOR	2627	1	12	2	1350	30	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1656	991	245	C ST SW	COLLECTOR	1369	1	12	2	1350	30	20
1657	992	995	14TH AVE SE	COLLECTOR	268	1	12	2	1575	35	20
1658	993	749	3RD ST SE	COLLECTOR	701	1	12	2	1750	35	20
1659	993	992	14TH AVE SE	COLLECTOR	441	1	12	2	1575	35	20
1660	994	746	12TH AVE SE	COLLECTOR	229	2	12	4	1750	40	20
1661	995	991	14TH AVE SE	COLLECTOR	1537	1	12	2	1575	35	20
1662	996	318	OLD HWY 94	COLLECTOR	2878	1	12	2	1575	35	19
1663	996	497	35TH ST	COLLECTOR	1572	1	12	2	1575	35	19
1664	997	261	WILSON AVE	COLLECTOR	2668	1	12	0	1750	40	17
1665	997	645	WILSON AVE	COLLECTOR	1484	1	12	0	1750	40	17
1666	997	1000	12TH ST SW	COLLECTOR	3927	1	12	2	1575	35	17
1667	998	642	33RD AVE SW	MINOR ARTERIAL	1668	2	12	2	1900	40	17
1668	998	884	33RD AVE SW	MINOR ARTERIAL	2025	2	12	2	1900	40	17
1669	999	642	18TH ST SW	COLLECTOR	3984	1	12	2	1575	35	17
1670	999	643	WILSON AVE	COLLECTOR	4885	1	12	0	1750	40	17
1671	999	644	WILSON AVE	COLLECTOR	457	1	12	0	1700	40	17
1672	1000	884	12TH ST SW	COLLECTOR	1264	1	12	2	1575	35	17
1673	1001	744	3RD ST SW	MINOR ARTERIAL	930	2	12	4	1750	40	20
1674	1002	663	2ND AVE	COLLECTOR	535	1	12	4	1750	35	20
1675	1003	740	3RD ST SW	MINOR ARTERIAL	188	3	12	4	1750	40	20
1676	1004	354	3RD ST SW	MINOR ARTERIAL	232	2	12	4	1750	40	20
1677	1005	822	3RD AVE SE	COLLECTOR	358	1	12	4	1750	35	20
1678	1006	398	J ST SW	COLLECTOR	801	1	12	2	1350	30	20
1679	1007	49	ELY RD	COLLECTOR	6400	1	12	3	1700	55	27

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1680	1008	162	BURNETT STATION RD	COLLECTOR	13285	1	12	4	1750	55	9
1681	1009	571	ROCKWELL DR NE	COLLECTOR	2157	1	12	2	1750	35	18
1682	1010	30	OAKLAND RD NE	COLLECTOR	989	1	12	4	1350	30	20
1683	1011	330	OAKLAND RD NE	COLLECTOR	1888	2	12	4	1750	45	18
1684	1012	326	WENIG RD NE	COLLECTOR	2559	1	12	4	1700	45	18
1685	1012	846	COLDSTREAM AVE NE	COLLECTOR	2105	1	12	2	1575	35	18
1686	1013	299	WENIG RD NE	COLLECTOR	1915	1	12	2	1750	35	15
1687	1014	324	GLASS RD NE	COLLECTOR	283	1	12	4	1750	45	18
1688	1015	328	OAKLAND RD NE	COLLECTOR	988	2	12	4	1750	40	18
1689	1016	325	I-380 OFF RAMP	FREEWAY RAMP	415	1	12	4	1750	45	18
1690	1017	327	32ND ST NE	COLLECTOR	954	2	12	4	1750	40	18
1691	1017	328	32ND ST NE	COLLECTOR	385	1	12	4	1750	40	18
1692	1018	325	32ND ST NE	MINOR ARTERIAL	626	2	12	2	1750	40	18
1693	1018	327	32ND ST NE	COLLECTOR	167	1	12	0	1750	40	18
1694	1019	301	CENTER POINT RD NE	COLLECTOR	359	2	12	4	1750	45	18
1695	1020	295	COUNCIL ST NE	COLLECTOR	400	2	12	4	1750	45	18
1696	1021	1019	51ST ST NE	COLLECTOR	1245	1	12	2	1750	35	18
1697	1021	1020	51ST ST NE	COLLECTOR	1422	1	12	2	1750	35	18
1698	1022	239	C ST SW	COLLECTOR	319	2	12	4	1750	45	27
1699	1024	759	MT VERNON RD	COLLECTOR	5629	1	10	5	1700	45	21
1700	1025	156	IA-13	MINOR ARTERIAL	3125	2	12	4	1750	75	21
1701	1025	755	IA-13	MINOR ARTERIAL	3359	2	12	4	1900	75	21
1702	1026	151	CENTRAL CITY RD	COLLECTOR	17644	1	12	6	1700	60	9

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1703	1027	1028	BENTON LINN RD	COLLECTOR	2706	1	12	4	1700	45	13
1704	1028	877	PARK RIDGE RD	COLLECTOR	5232	1	12	4	1700	40	13
1705	1029	1030	ELLIS RD	COLLECTOR	5722	1	12	4	1700	45	17
1706	1030	192	ELLIS RD	COLLECTOR	4648	1	12	4	1700	45	17
1707	1031	845	6TH ST SE	COLLECTOR	339	1	12	4	1750	30	20
1708	1032	246	16TH AVE SW	COLLECTOR	759	1	12	4	1750	45	20
1709	1032	991	16TH AVE SW	COLLECTOR	639	1	12	4	1700	40	20
1710	1033	55	30TH AVE	COLLECTOR	10523	1	12	4	1350	30	13
1711	1033	880	71ST ST	COLLECTOR	5449	1	12	4	1700	45	13
1712	1034	53	US-218	COLLECTOR	10669	1	10	3	1700	60	12
1713	1034	106	US-218	COLLECTOR	5148	1	10	3	1700	60	12
1714	1035	720	CO HWY E 16	COLLECTOR	1104	1	12	4	1575	35	9
1715	1036	1037	CO HWY E 16	COLLECTOR	1073	1	12	4	1575	35	10
1716	1037	721	CO HWY E 16	COLLECTOR	942	1	12	4	1575	35	10
1717	1038	620	County HWY E44	COLLECTOR	724	1	10	2	1700	55	12
1718	1039	212	ON-RAMP I-380	FREEWAY RAMP	636	2	12	4	1750	45	18
1719	1039	1169	I-380 OFF RAMP TO BLAIRS FERRY RD NE	FREEWAY RAMP	703	1	12	0	1125	25	18
1720	1040	1041	I-380 OFF RAMP	FREEWAY RAMP	1666	1	12	4	1700	45	27
1721	1041	425	I-380 OFF RAMP	FREEWAY RAMP	541	1	12	4	1700	45	27
1722	1042	64	US-30 ON RAMP FROM I-380	FREEWAY RAMP	1129	1	12	4	1700	45	27
1723	1043	217	US-151B	COLLECTOR	392	1	12	4	1750	45	19
1724	1044	505	6TH AVE	COLLECTOR	317	1	12	4	1750	30	18
1725	1045	216	BLAIRS FERRY RD NE	COLLECTOR	624	1	12	0	1750	45	18
1726	1046	180	EDGEWOOD RD SW	MAJOR ARTERIAL	625	3	12	0	1750	45	17
1727	1047	1046	20TH AVE SW	COLLECTOR	921	1	12	0	1750	45	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1728	1047	1048	20TH AVE SW	COLLECTOR	1738	1	12	0	1750	45	17
1729	1048	413	WILEY BLVD SW	MINOR ARTERIAL	1318	2	12	4	1750	45	17
1730	1049	1050	WILEY BLVD SW	MINOR ARTERIAL	799	2	12	4	1750	45	17
1731	1050	411	WILEY BLVD SW	MINOR ARTERIAL	847	2	12	4	1750	45	17
1732	1051	1049	31ST AVE SW	LOCAL ROADWAY	1320	1	16	0	1750	40	17
1733	1052	640	EDGEWOOD RD SW	MINOR ARTERIAL	755	3	12	0	1750	45	17
1734	1053	1052	DRIVEWAY	LOCAL ROADWAY	422	1	12	0	1750	35	17
1735	1054	888	BEVERLY ROAD	LOCAL ROADWAY	923	1	12	4	1700	40	17
1736	1055	866	OLD RIVER RD	LOCAL ROADWAY	2923	1	12	4	1700	40	21
1737	1056	158	IA-13 ON RAMP	FREEWAY RAMP	1251	2	12	4	1900	45	21
1738	1056	454	IA-13 OFF RAMP TO US-30	FREEWAY RAMP	1083	2	12	4	1900	45	28
1739	1057	575	IA-13	MINOR ARTERIAL	1831	2	12	3	1900	60	9
1740	1058	163	IA-13	COLLECTOR	4182	1	12	4	1700	60	4
1741	1059	458	E LINN ST	LOCAL ROADWAY	492	1	10	0	1700	45	4
1742	1060	459	COGGON RD	COLLECTOR	5154	1	10	3	1700	45	4
1743	1061	1062	TROY MILLS RD	COLLECTOR	1057	1	12	4	1700	40	3
1744	1062	146	TROY MILLS RD	COLLECTOR	938	1	12	4	1700	45	3
1745	1063	147	TROY MILLS RD	COLLECTOR	4631	1	12	4	1700	45	3

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1746	1064	580	CO HWY D62	COLLECTOR	1098	1	10	0	1125	25	3
1747	1065	137	N CENTER POINT RD	COLLECTOR	1631	1	10	3	1700	45	3
1748	1066	600	GREEN ST	LOCAL ROADWAY	2670	1	12	4	1350	30	8
1749	1067	725	JOHNSON AVE NW	COLLECTOR	1613	1	12	4	1700	40	17
1750	1068	341	13TH ST SE	COLLECTOR	439	2	12	4	1750	30	20
1751	1069	753	DRIVEWAY	LOCAL ROADWAY	217	1	12	0	1750	30	20
1752	1070	731	JOHNSON AVE NW	COLLECTOR	1017	1	12	4	1750	40	17
1753	1071	649	13TH ST NW	LOCAL ROADWAY	1264	1	16	0	1750	35	17
1754	1072	411	33RD AVE SW	COLLECTOR	1266	1	12	4	1750	45	17
1755	1072	642	33RD AVE SW	COLLECTOR	4037	1	12	4	1700	45	17
1756	1073	214	BLAIRS FERRY RD NE	MINOR ARTERIAL	1752	2	12	0	1750	45	18
1757	1073	571	BLAIRS FERRY RD NE	MINOR ARTERIAL	804	2	12	0	1750	45	18
1758	1074	1073	DWY	LOCAL ROADWAY	433	1	12	0	1750	30	18
1759	1075	209	USHERS FERRY RD	LOCAL ROADWAY	861	1	12	0	1750	40	15
1760	1076	282	N MENTZE RD	COLLECTOR	3342	1	10	2	1700	45	9
1761	1076	311	N MENTZE RD	COLLECTOR	2438	1	10	2	1575	35	9
1762	1077	224	EDGEWOOD RD NW	MINOR ARTERIAL	164	2	12	0	1900	40	15
1763	1077	1078	EDGEWOOD RD NW	MINOR ARTERIAL	120	2	12	4	1750	45	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1764	1077	1099	IA-100 ON RAMP FOROM EDGEWOOD RD NW	FREEWAY RAMP	209	1	12	4	1700	40	15
1765	1078	225	EDGEWOOD RD NW	MINOR ARTERIAL	521	2	12	4	1900	45	15
1766	1078	1077	EDGEWOOD RD NW	MINOR ARTERIAL	120	2	12	0	1900	40	15
1767	1078	1079	IA-100	MINOR ARTERIAL	275	2	12	4	1900	40	15
1768	1079	292	IA-100	MINOR ARTERIAL	844	2	12	4	1900	40	15
1769	1080	1081	IA-100	FREEWAY	774	2	12	10	2250	55	15
1770	1081	806	IA-100	FREEWAY RAMP	2728	2	12	10	1900	45	15
1771	1082	1083	IA-100	FREEWAY	999	2	12	10	2250	55	15
1772	1082	1085	IA-100	FREEWAY	2396	2	12	10	2250	55	15
1773	1083	1082	IA-100	FREEWAY	999	2	12	10	2250	55	15
1774	1083	1084	IA-100	FREEWAY	645	2	12	10	2250	55	15
1775	1084	1080	IA-100	FREEWAY	1197	2	12	10	2250	55	15
1776	1084	1083	IA-100	FREEWAY	645	2	12	10	2250	55	15
1777	1084	1096	IA-100 Off Ramp to Edgewood Rd NW	LOCAL ROADWAY	941	1	12	0	1700	40	15
1778	1085	1082	IA-100	FREEWAY	2398	2	12	10	2250	55	15
1779	1085	1087	IA-100	FREEWAY	3395	2	12	10	2250	55	15
1780	1086	1087	IA-100	FREEWAY	2606	2	12	10	2250	55	15
1781	1086	1088	IA-100	FREEWAY	4724	2	12	10	2250	55	15
1782	1087	1085	IA-100	FREEWAY	3393	2	12	10	2250	55	15
1783	1087	1086	IA-100	FREEWAY	2607	2	12	10	2250	55	15
1784	1088	1086	IA-100	FREEWAY	4724	2	12	10	2250	55	15
1785	1088	1094	IA-100	FREEWAY	2775	2	12	10	2250	55	14

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1786	1090	1091	County HWY W36	COLLECTOR	2708	1	12	6	1700	45	14
1787	1091	1095	County HWY W36	COLLECTOR	1218	1	12	6	1700	45	14
1788	1092	192	County HWY W36	COLLECTOR	3221	1	12	6	1700	45	14
1789	1093	1092	County HWY W36	COLLECTOR	819	1	12	6	1700	45	14
1790	1093	1094	IA-100 ON RAMP FROM COVINGTON RD	FREEWAY RAMP	1182	1	12	4	1700	40	14
1791	1094	1088	IA-100	FREEWAY	2775	2	12	10	2250	55	14
1792	1094	1095	IA-100 OFF RAMP TO COVINGTON RD	FREEWAY RAMP	1095	1	12	4	1700	40	14
1793	1095	1093	County HWY W36	COLLECTOR	827	1	12	6	1700	45	14
1794	1096	225	IA-100	COLLECTOR	732	1	12	0	1700	40	15
1795	1096	1097	IA-100 OFF RAMP TO EDGEWOOD RD NW	FREEWAY RAMP	300	2	12	4	1900	40	15
1796	1097	1078	IA-100 OFF RAMP TO EDGEWOOD RD NW	FREEWAY RAMP	259	2	12	4	1750	40	15
1797	1098	1084	IA-100 ON RAMP FROM EDGEWOOD RD NW	FREEWAY RAMP	944	1	12	4	1700	40	15
1798	1099	1098	IA-100 ON RAMP FROM EDGEWOOD RD NW	FREEWAY RAMP	298	1	12	4	1700	40	15
1799	1100	566	EDGEWOOD RD NW	MINOR ARTERIAL	1009	2	12	4	1750	45	15
1800	1100	1102	EDGEWOOD RD NW	COLLECTOR	692	1	12	0	1575	35	15
1801	1101	210	DRIVEWAY	LOCAL ROADWAY	381	1	12	0	1750	35	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1802	1102	210	BLAIRS FERRY RD NE	MAJOR ARTERIAL	271	1	12	2	1750	35	15
1803	1102	917	BLAIRS FERRY RD NE	MINOR ARTERIAL	1511	2	12	2	1900	35	15
1804	1103	190	County HWY W36	COLLECTOR	2305	1	12	6	1700	60	14
1805	1104	233	WRIGHT BROTHERS BLVD	COLLECTOR	1769	1	10	8	1750	65	26
1806	1104	773	WRIGHT BROTHERS BLVD	COLLECTOR	1195	1	10	8	1700	65	26
1807	1105	1106	US-151B	MINOR ARTERIAL	6119	2	12	4	1900	65	22
1808	1106	1327	US-151B	MINOR ARTERIAL	17609	2	12	4	1900	65	10
1809	1107	1105	US-151B	MINOR ARTERIAL	7767	2	12	4	1750	65	22
1810	1124	1125	8TH AVE NW	COLLECTOR	1288	1	12	0	1350	30	22
1811	1124	1313	8TH AVE NW	COLLECTOR	955	1	12	0	1700	40	22
1812	1125	1124	8TH AVE NW	COLLECTOR	1249	1	12	0	1350	30	22
1813	1125	1136	W. MT VERNON RD	COLLECTOR	2334	1	12	0	1750	30	31
1814	1127	616	E 1ST ST	COLLECTOR	1217	1	12	0	1575	35	31
1815	1128	73	US - 30	FREEWAY	3204	2	12	8	2250	60	31
1816	1128	1129	US - 30	FREEWAY	1672	2	12	8	2250	60	31
1817	1129	1128	US - 30	FREEWAY	1647	2	12	8	2250	60	31
1818	1129	1130	US - 30	FREEWAY	4308	2	12	8	2250	60	31
1819	1130	1129	US - 30	FREEWAY	3941	2	12	8	2250	60	31
1820	1130	1131	US - 30	FREEWAY	1131	2	12	8	2250	60	31
1821	1131	1130	US - 30	FREEWAY	1129	2	12	8	2250	60	31
1822	1131	1145	US - 30	FREEWAY	2139	2	12	8	2250	60	31
1823	1132	1138	US - 30	COLLECTOR	394	2	12	0	1900	25	31

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1824	1132	1139	US - 30	COLLECTOR	472	1	12	0	1575	35	31
1825	1132	1144	US - 30	COLLECTOR	892	1	12	1	1700	40	31
1826	1133	616	US - 30	COLLECTOR	2585	1	12	8	1700	40	31
1827	1133	1135	US - 30	COLLECTOR	308	2	12	2	1900	60	31
1828	1135	1137	US - 30	COLLECTOR	213	1	12	2	1125	25	31
1829	1136	1127	E 1ST ST	COLLECTOR	1811	1	12	0	1700	40	31
1830	1136	1137	HWY 1	COLLECTOR	2642	1	11	0	1700	40	31
1831	1136	1141	HWY 1	COLLECTOR	1420	1	11	0	1700	40	31
1832	1137	1132	US - 30	COLLECTOR	689	1	12	8	1700	40	31
1833	1137	1138	US-30	COLLECTOR	423	1	12	0	1125	25	31
1834	1138	1139	HWY 1	COLLECTOR	240	1	12	0	1575	35	31
1835	1138	1232	US - 30	COLLECTOR	118	2	12	0	1900	25	31
1836	1139	1203	HWY 1	COLLECTOR	6725	1	11	4	1700	50	31
1837	1139	1232	HWY 1	COLLECTOR	280	1	12	0	1575	35	31
1838	1140	1217	HWY 1	COLLECTOR	4418	1	11	4	1700	50	31
1839	1141	1136	HWY 1	COLLECTOR	1419	1	12	0	1750	30	31
1840	1141	1296	HWY 1	COLLECTOR	735	1	11	0	1700	40	22
1841	1142	616	US - 30	COLLECTOR	2626	1	12	8	1700	50	31
1842	1143	1144	US - 30	COLLECTOR	491	1	12	8	900	20	31
1843	1143	1208	US - 30	COLLECTOR	11404	1	12	1	1700	55	31
1844	1144	1132	US - 30	COLLECTOR	892	1	12	8	1700	55	31
1845	1144	1143	US - 30	COLLECTOR	616	1	12	8	900	20	31
1846	1145	1131	US - 30	FREEWAY	2138	2	12	8	2250	60	31
1847	1145	1204	CEDAR RIVER RD	COLLECTOR	5307	1	12	2	1700	40	31
1848	1145	1208	US - 30	MINOR ARTERIAL	2845	2	12	1	1900	55	31
1849	1146	1147	MT VERNON RD	COLLECTOR	2055	1	11	4	1575	35	22
1850	1147	1148	MT VERNON RD	COLLECTOR	3028	1	11	4	1700	45	22

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1851	1148	1149	MT VERNON RD	COLLECTOR	3843	1	11	4	1700	45	22
1852	1149	1150	MT VERNON RD	COLLECTOR	1439	1	11	4	1700	45	22
1853	1150	1151	MT VERNON RD	COLLECTOR	1804	1	11	4	1700	45	22
1854	1151	1152	W. MT VERNON RD	COLLECTOR	6314	1	11	4	1700	45	22
1855	1152	1153	W. MT VERNON RD	COLLECTOR	3316	1	11	4	1700	40	22
1856	1153	1154	W. MT VERNON RD	COLLECTOR	1852	1	11	4	1700	40	22
1857	1154	1155	W. MT VERNON RD	COLLECTOR	1119	1	11	4	1700	45	22
1858	1155	1156	W. MT VERNON RD	COLLECTOR	2153	1	11	4	1575	35	22
1859	1156	1157	W. MT VERNON RD	COLLECTOR	3242	1	11	4	1700	45	22
1860	1157	1158	W. MT VERNON RD	COLLECTOR	2026	1	10	0	1350	30	22
1861	1158	1125	W. MT VERNON RD	COLLECTOR	1881	1	10	0	1350	30	22
1862	1169	212	BLAIRS FERRY RD NE	MINOR ARTERIAL	430	3	12	4	1750	45	18
1863	1169	213	BLAIRS FERRY RD NE	MINOR ARTERIAL	1432	2	12	4	1750	45	18
1864	1170	298	OFF-RAMP I-380	FREEWAY RAMP	398	2	12	4	1750	45	18
1865	1170	716	OFF-RAMP I-389 TO IA-100	FREEWAY RAMP	449	1	12	4	1350	30	18
1866	1171	215	C AVE	MINOR ARTERIAL	202	1	12	2	1750	40	18
1867	1171	303	C AVE	MINOR ARTERIAL	2182	2	12	0	1750	45	18
1868	1172	751	BEAVER AVE SE	COLLECTOR	463	1	12	2	1350	30	20
1869	1173	1178	120TH ST NE	COLLECTOR	3708	1	12	0	1700	40	29
1870	1174	1175	6TH ST	COLLECTOR	4010	1	12	6	1700	60	27
1871	1175	1176	6TH ST	COLLECTOR	6390	1	12	6	1750	60	29
1872	1176	983	6TH ST	COLLECTOR	2078	1	12	6	1700	60	29
1873	1176	1177	120TH ST NW	COLLECTOR	1680	1	12	4	1700	40	29
1874	1177	1176	120TH ST NW	COLLECTOR	1681	1	12	4	1750	40	29

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1875	1177	1180	I-380 ON RAMP	FREEWAY RAMP	1313	1	12	0	1700	45	29
1876	1178	1177	120TH ST NW	COLLECTOR	2659	1	12	4	1700	40	29
1877	1179	51	I-380	FREEWAY	11825	2	12	4	2250	70	27
1878	1179	1180	I-380	FREEWAY	2023	2	12	4	2250	70	29
1879	1180	618	I-380	FREEWAY	4436	2	12	4	2250	70	29
1880	1180	1179	I-380	FREEWAY	2023	2	12	4	2250	70	29
1881	1181	1182	120TH ST NE	COLLECTOR	509	1	12	0	1700	40	30
1882	1182	1183	120TH ST NE	COLLECTOR	2703	1	12	0	1700	40	30
1883	1183	1184	120TH ST NE	COLLECTOR	10315	1	12	0	1700	40	30
1884	1184	1173	120TH ST NE	COLLECTOR	7869	1	12	0	1700	40	29
1885	1185	50	ELY RD	COLLECTOR	822	1	12	3	1700	55	28
1886	1185	1190	ELY RD	COLLECTOR	4770	1	12	3	1700	55	28
1887	1186	1187	ELY RD	COLLECTOR	1555	1	12	3	1700	55	28
1888	1187	1188	ELY RD	COLLECTOR	1267	1	12	3	1700	55	28
1889	1188	617	ELY RD	COLLECTOR	4208	1	12	3	1700	55	30
1890	1189	1173	CLUB RD NE	COLLECTOR	4960	1	12	2	1700	40	29
1891	1190	1185	ELY RD	COLLECTOR	4769	1	12	3	1700	55	28
1892	1190	1186	ELY RD	COLLECTOR	3759	1	12	3	1700	55	28
1893	1191	1190	DOWS ST	COLLECTOR	692	1	12	0	1575	35	28
1894	1192	1191	DOWS ST	COLLECTOR	1295	1	12	0	1575	35	28
1895	1193	1192	DOWS ST	COLLECTOR	701	1	12	0	1700	40	28
1896	1194	1193	DOWS ST	COLLECTOR	259	1	12	0	1700	40	28
1897	1195	1194	JAPPA RD	COLLECTOR	580	1	12	0	1700	40	28
1898	1196	1195	JAPPA RD	COLLECTOR	3957	1	12	0	1700	40	28
1899	1197	1196	JAPPA RD	COLLECTOR	5341	1	12	0	1700	40	28
1900	1198	1197	JAPPA RD	COLLECTOR	2897	1	12	0	1700	40	28
1901	1199	1198	JAPPA RD	COLLECTOR	878	1	12	0	1700	40	28
1902	1200	636	US - 30	FREEWAY	3626	2	12	8	2250	65	28

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1903	1200	867	US - 30	FREEWAY	6752	2	12	8	2250	65	28
1904	1200	1199	JAPPA RD	COLLECTOR	3959	1	12	0	1700	40	28
1905	1201	1140	HWY 1	COLLECTOR	1325	1	11	4	1700	50	31
1906	1201	1202	HWY 1	COLLECTOR	7022	1	11	4	1700	50	31
1907	1202	1201	HWY 1	COLLECTOR	6975	1	11	4	1750	50	31
1908	1202	1203	HWY 1	COLLECTOR	1883	1	11	4	1700	50	31
1909	1203	1139	HWY 1	COLLECTOR	6725	1	11	4	1700	50	31
1910	1203	1202	HWY 1	COLLECTOR	1847	1	11	4	1700	50	31
1911	1204	1205	CEDAR RIVER RD	COLLECTOR	2702	1	12	2	1700	50	31
1912	1205	1206	CEDAR RIVER RD	COLLECTOR	787	1	12	2	1700	50	31
1913	1206	1207	CEDAR RIVER RD	COLLECTOR	4354	1	12	2	1700	40	31
1914	1207	1201	CEDAR RIVER RD	COLLECTOR	1652	1	12	2	1750	40	31
1915	1208	1143	US - 30	COLLECTOR	11404	1	12	1	1700	55	31
1916	1208	1145	US - 30	MINOR ARTERIAL	2845	2	12	1	1900	55	31
1917	1209	1225	HIGHWAY 382 NE	COLLECTOR	2416	1	12	3	1700	45	30
1918	1210	1209	ELY RD	COLLECTOR	3253	1	12	3	1700	55	30
1919	1211	1210	ELY RD	COLLECTOR	1186	1	12	3	1700	45	30
1920	1212	1211	ELY RD	COLLECTOR	2711	1	12	3	1700	55	30
1921	1213	1212	ELY RD	COLLECTOR	1245	1	12	3	1700	55	30
1922	1214	1215	ELY RD	COLLECTOR	2410	1	12	3	1700	55	30
1923	1215	1213	ELY RD	COLLECTOR	1245	1	12	3	1700	55	30
1924	1216	1229	HWY 1	COLLECTOR	3233	1	11	0	1575	35	31
1925	1217	1218	HWY 1	COLLECTOR	1124	1	11	4	1700	50	31
1926	1218	1219	HWY 1	COLLECTOR	7037	1	11	4	1700	50	31
1927	1219	1220	HWY 1	COLLECTOR	2295	1	11	4	1700	40	31
1928	1220	1221	HWY 1	COLLECTOR	4385	1	11	4	1700	50	31
1929	1221	1222	HWY 1	COLLECTOR	2853	1	11	4	1700	50	31

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1930	1222	1223	HWY 1	COLLECTOR	4398	1	11	4	1700	50	31
1931	1223	1224	HWY 1	COLLECTOR	3141	1	11	4	1700	40	31
1932	1224	1216	HWY 1	COLLECTOR	1521	1	11	0	1750	35	31
1933	1225	1226	HIGHWAY 382 NE	COLLECTOR	6677	1	12	3	1700	55	31
1934	1226	1228	HIGHWAY 382 NE	COLLECTOR	2615	1	12	3	1700	55	31
1935	1227	1216	HIGHWAY 382 NE	COLLECTOR	659	1	12	0	1750	35	31
1936	1228	1227	HIGHWAY 382 NE	COLLECTOR	1660	1	12	0	1575	35	31
1937	1229	1294	HWY 1	COLLECTOR	1375	1	11	4	1700	45	31
1938	1231	755	BERTRAM RD SE	LOCAL ROADWAY	2755	1	12	2	1700	40	21
1939	1232	1133	US - 30	COLLECTOR	709	2	12	0	1900	30	31
1940	1233	332	COLDSTREAM AVE NE	MINOR ARTERIAL	226	2	12	4	1750	35	18
1941	1234	331	I-380 OFF RAMP	FREEWAY RAMP	591	2	12	4	1750	45	18
1942	1234	1235	I-380 OFF RAMP	FREEWAY RAMP	633	1	14	2	1700	40	18
1943	1235	329	COLDSTREAM AVE NE	MINOR ARTERIAL	541	2	12	4	1750	45	18
1944	1236	333	10TH ST	COLLECTOR	129	2	12	4	1750	45	20
1945	1237	835	5TH ST NE	COLLECTOR	390	1	12	0	1750	30	20
1946	1237	839	A AVE NE	COLLECTOR	774	2	12	4	1750	35	20
1947	1238	1078	IA-100 OFF RAMP	MINOR ARTERIAL	220	2	12	0	1750	40	15
1948	1239	803	7TH ST	COLLECTOR	162	1	12	2	900	20	18
1949	1241	1242	US-151B	COLLECTOR	169	1	12	2	900	20	18
1950	1242	1043	US-151B	COLLECTOR	430	1	12	2	1350	30	18
1951	1243	803	US-151B	COLLECTOR	160	1	12	2	1350	30	18
1952	1244	1245	US-151B	COLLECTOR	317	2	12	2	900	20	19
1953	1245	218	US-151B	MINOR ARTERIAL	1097	2	12	4	1750	45	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1954	1246	1244	US-151B	COLLECTOR	363	1	12	2	900	20	19
1955	1247	1249	35TH ST	COLLECTOR	200	1	12	2	1350	30	19
1956	1248	1251	35TH ST	COLLECTOR	2389	1	12	2	1350	30	19
1957	1249	1250	29TH AVE	COLLECTOR	226	1	10	0	900	20	19
1958	1250	971	29TH AVE	COLLECTOR	3304	1	10	0	1575	35	19
1959	1250	1248	29TH AVE	COLLECTOR	295	1	10	0	900	20	19
1960	1251	1252	35TH ST	COLLECTOR	632	1	12	2	1350	30	19
1961	1252	1254	35TH ST	COLLECTOR	909	1	12	2	1350	30	19
1962	1253	1255	35TH ST	COLLECTOR	149	1	12	2	900	20	19
1963	1254	1253	35TH ST	COLLECTOR	155	1	12	2	900	20	19
1964	1255	388	35TH ST	COLLECTOR	1467	1	12	2	1350	30	19
1965	1256	310	ALBURNETT RD	COLLECTOR	1943	1	10	3	1700	55	18
1966	1256	1259	ALBURNETT RD	COLLECTOR	547	1	12	3	1700	40	18
1967	1257	1259	ALBURNETT RD	COLLECTOR	550	1	12	3	900	20	18
1968	1258	1260	ALBURNETT RD	COLLECTOR	541	1	12	3	900	20	18
1969	1259	1256	ALBURNETT RD	COLLECTOR	303	1	12	3	1700	45	18
1970	1259	1258	ALBURNETT RD	COLLECTOR	540	1	12	3	900	20	18
1971	1260	309	ALBURNETT RD	COLLECTOR	1433	1	12	3	1700	45	18
1972	1260	1257	ALBURNETT RD	COLLECTOR	494	1	12	3	900	20	18
1973	1261	1262	US-151B	COLLECTOR	2987	1	12	4	1700	50	25
1974	1262	1263	US-151B	COLLECTOR	3772	1	12	4	1700	50	25
1975	1263	1264	US-151B	COLLECTOR	913	1	12	4	1700	40	25
1976	1264	1265	US-151B	COLLECTOR	1384	1	12	4	1700	40	25
1977	1265	619	US-151B	COLLECTOR	3950	1	12	4	1700	50	25
1978	1266	1264	30TH AVE	COLLECTOR	585	1	11	1	1125	25	25
1979	1267	1266	30TH AVE	COLLECTOR	10076	1	11	1	1350	30	25
1980	1268	1267	30TH AVE	COLLECTOR	1608	1	11	1	1125	25	25
1981	1269	1268	30TH AVE	COLLECTOR	4070	1	11	1	1350	30	25

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
1982	1270	1269	30TH AVE	COLLECTOR	1172	1	11	1	1350	30	25
1983	1271	1270	30TH AVE	COLLECTOR	1090	1	11	1	1125	25	25
1984	1272	1271	EUCLID AVE	COLLECTOR	3282	1	11	1	1350	30	25
1985	1272	1282	77TH STREET DR	COLLECTOR	2605	1	10	3	1575	35	25
1986	1273	1274	LINN BENTON RD SW	COLLECTOR	5312	1	11	1	1700	40	26
1987	1274	1275	120TH ST NW	COLLECTOR	18446	1	11	1	1700	40	26
1988	1275	1276	120TH ST NW	COLLECTOR	14641	1	11	1	1700	40	26
1989	1276	1277	120TH ST NW	COLLECTOR	3893	1	11	1	1575	35	26
1990	1277	1278	120TH ST NW	COLLECTOR	969	1	11	1	1575	35	26
1991	1278	1176	120TH ST NW	COLLECTOR	4495	1	11	1	1700	40	29
1992	1279	621	US - 30	COLLECTOR	5723	1	12	8	1700	60	12
1993	1279	933	US - 30	COLLECTOR	13570	1	12	8	1700	60	12
1994	1279	1280	21ST AVE	COLLECTOR	18647	1	11	1	1700	40	12
1995	1280	1281	21ST AVE	COLLECTOR	2217	1	11	1	1750	35	24
1996	1281	1293	21ST AVE	COLLECTOR	2368	1	11	1	1700	40	24
1997	1282	1283	77TH STREET DR	COLLECTOR	4079	1	10	3	1700	45	25
1998	1283	1284	77TH STREET DR	COLLECTOR	1407	1	10	3	1700	40	25
1999	1284	1285	77TH STREET DR	COLLECTOR	1425	1	10	3	1700	40	25
2000	1285	1286	77TH STREET DR	COLLECTOR	9330	1	10	3	1700	45	25
2001	1286	1287	26TH AVE	COLLECTOR	2667	1	10	5	1700	40	25
2002	1287	1288	77TH ST	COLLECTOR	16025	1	10	3	1700	40	24
2003	1288	1289	77TH ST	COLLECTOR	1909	1	10	3	1575	35	24
2004	1289	1290	77TH ST	COLLECTOR	1541	1	10	3	1575	35	24
2005	1290	1291	77TH ST	COLLECTOR	1114	1	10	3	1575	35	24
2006	1291	1292	77TH ST	COLLECTOR	4427	1	10	3	1700	40	24
2007	1292	1281	77TH ST	COLLECTOR	1614	1	11	0	1750	35	24
2008	1294	1230	HWY 1	COLLECTOR	2447	1	11	4	1700	55	31

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
2009	1295	499	1ST AVE	COLLECTOR	2545	1	12	2	1575	35	19
2010	1295	978	S 22ND ST	COLLECTOR	3081	1	12	2	1700	40	19
2011	1296	1340	HWY 1	COLLECTOR	2240	1	11	0	1700	40	22
2012	1297	1299	SPRINGVILLE RD	COLLECTOR	10535	1	12	1	1700	50	10
2013	1297	1314	COUNTRY HOME RD	COLLECTOR	16011	1	10	2	1700	50	10
2014	1298	1297	COUNTRY HOME RD	COLLECTOR	5232	1	10	2	1700	65	10
2015	1299	1302	BROADWAY ST	COLLECTOR	2532	1	12	1	1350	30	22
2016	1300	1105	6TH ST	COLLECTOR	1642	1	12	0	1750	40	22
2017	1301	1300	1ST AVE	COLLECTOR	869	1	12	0	1350	30	22
2018	1302	1301	BROADWAY ST	COLLECTOR	989	1	12	0	1350	30	22
2019	1303	1105	SPRINGVILLE RD	COLLECTOR	10078	1	12	1	1750	50	22
2020	1304	1303	SPRINGVILLE RD	COLLECTOR	667	1	12	1	1700	50	22
2021	1304	1326	MARTELLE RD	COLLECTOR	1177	1	10	0	1350	30	22
2022	1305	1304	SPRINGVILLE RD	COLLECTOR	804	1	12	1	1700	50	22
2023	1306	1305	SPRINGVILLE RD	COLLECTOR	2030	1	12	1	1700	50	22
2024	1306	1307	SPRINGVILLE RD	COLLECTOR	8977	1	12	1	1700	50	22
2025	1307	1306	SPRINGVILLE RD	COLLECTOR	8977	1	12	1	1750	50	22
2026	1307	1308	SPRINGVILLE RD	COLLECTOR	2219	1	12	1	1700	45	22
2027	1308	1307	SPRINGVILLE RD	COLLECTOR	2218	1	12	1	1700	45	22
2028	1308	1309	SPRINGVILLE RD	COLLECTOR	1172	1	12	1	1700	45	22
2029	1309	1308	SPRINGVILLE RD	COLLECTOR	1172	1	12	1	1700	45	22
2030	1309	1310	SPRINGVILLE RD	COLLECTOR	2665	1	12	1	1700	45	22
2031	1310	1309	SPRINGVILLE RD	COLLECTOR	2665	1	12	1	1700	45	22
2032	1310	1311	SPRINGVILLE RD	COLLECTOR	1006	1	12	1	1700	45	22
2033	1311	1310	SPRINGVILLE RD	COLLECTOR	966	1	12	1	1700	45	22
2034	1311	1312	SPRINGVILLE RD	COLLECTOR	14096	1	12	1	1700	50	22
2035	1312	1311	SPRINGVILLE RD	COLLECTOR	14096	1	12	1	1700	50	22
2036	1312	1313	8TH AVE NW	COLLECTOR	2481	1	12	0	1700	40	22

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
2037	1313	1124	8TH AVE NW	COLLECTOR	955	1	12	0	1700	40	22
2038	1313	1312	8TH AVE NW	COLLECTOR	2481	1	12	0	1700	40	22
2039	1314	1315	COUNTRY HOME RD	COLLECTOR	1672	1	10	2	1700	50	10
2040	1315	1316	COUNTRY HOME RD	COLLECTOR	2618	1	10	2	1700	50	10
2041	1316	1317	COUNTRY HOME RD	COLLECTOR	2341	1	10	2	1700	50	10
2042	1317	1318	COUNTRY HOME RD	COLLECTOR	4273	1	10	2	1700	50	11
2043	1318	1319	COUNTRY HOME RD	COLLECTOR	3471	1	10	2	1700	50	11
2044	1319	1320	COUNTRY HOME RD	COLLECTOR	2257	1	10	2	1700	40	11
2045	1320	1321	HWY 1	COLLECTOR	2508	1	12	0	1575	35	11
2046	1321	1322	HWY 1	COLLECTOR	1122	1	12	0	1700	40	11
2047	1322	1323	US-151 ON RAMP	FREEWAY RAMP	836	1	12	4	1700	40	11
2048	1323	1328	US-151 ON RAMP	FREEWAY RAMP	1253	1	12	4	1700	40	11
2049	1324	1325	MARTELLE RD	COLLECTOR	945	1	10	0	1750	35	23
2050	1325	1346	HWY 1	COLLECTOR	2921	1	12	2	1575	35	23
2051	1326	1324	MARTELLE RD	COLLECTOR	20214	1	10	0	1700	40	22
2052	1327	1328	US-151	MINOR ARTERIAL	8542	2	12	4	1900	65	11
2053	1328	1329	US-151	MINOR ARTERIAL	9046	2	12	4	1900	65	11
2054	1329	1330	US-151	MINOR ARTERIAL	7280	2	12	4	1900	65	11
2055	1330	1331	US-151	MINOR ARTERIAL	7365	2	12	4	1900	65	11
2056	1331	1332	US-151	MINOR ARTERIAL	1319	2	12	4	1900	65	11
2057	1331	1338	US-151 OFF RAMP	FREEWAY RAMP	856	1	12	0	1700	40	11
2058	1332	1108	US-151	MINOR ARTERIAL	1246	2	12	4	1900	65	11
2059	1333	1335	HWY 64	COLLECTOR	312	1	10	2	1750	40	11

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
2060	1334	1333	HWY 64	COLLECTOR	1409	1	10	2	1750	40	11
2061	1335	1336	HWY 64	COLLECTOR	2082	1	10	2	1700	40	11
2062	1336	1337	HWY 64	COLLECTOR	1020	1	10	2	1700	50	11
2063	1338	1333	US-151 OFF RAMP	FREEWAY RAMP	454	1	12	0	1750	40	11
2064	1339	1335	GRANT WOOD DR	LOCAL ROADWAY	551	1	12	0	1750	35	11
2065	1340	1341	HWY 1	COLLECTOR	10893	1	12	2	1700	50	22
2066	1341	1342	HWY 1	COLLECTOR	2852	1	12	2	1700	50	22
2067	1342	1343	HWY 1	COLLECTOR	9905	1	12	2	1700	50	22
2068	1343	1344	HWY 1	COLLECTOR	4048	1	12	2	1700	50	22
2069	1344	1345	HWY 1	COLLECTOR	5413	1	12	2	1700	50	23
2070	1345	1325	HWY 1	COLLECTOR	1938	1	12	2	1750	35	23
2071	1346	1347	HWY 1	COLLECTOR	14132	1	12	2	1700	50	23
2072	1347	1322	HWY 1	COLLECTOR	2399	1	12	2	1700	50	11
2073	1348	1349	SECRIST RD	COLLECTOR	2928	1	12	6	1700	40	22
2074	1349	1350	SECRIST RD	COLLECTOR	3036	1	12	6	1700	40	22
2075	1350	1306	SECRIST RD	COLLECTOR	4010	1	12	6	1750	50	22
2076	8003	3	I-380	FREEWAY	2079	2	12	4	2250	70	1
2077	8616	1142	US - 30	COLLECTOR	2166	1	12	8	1700	50	31
2078	8618	618	I-380	FREEWAY	2827	2	12	4	2250	70	29
2079	8621	621	US - 30	COLLECTOR	10547	1	12	8	1700	60	12
Exit Link	3	8003	I-380	FREEWAY	2079	2	12	4	2250	70	1
Exit Link	90	8090	CO HWY D48	COLLECTOR	2839	1	12	4	1700	40	1
Exit Link	102	8102	31ST AVE	COLLECTOR	2824	1	10	6	1700	65	2
Exit Link	140	8140	CO RD W35	COLLECTOR	1987	1	10	3	1700	50	3
Exit Link	147	8147	TROY MILLS RD	COLLECTOR	2021	1	12	4	1700	45	3
Exit Link	579	8579	ROBINSON RD	COLLECTOR	2714	1	12	4	1700	50	4
Exit Link	583	8583	IA-13	COLLECTOR	2791	1	12	4	1700	60	5

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Map Number
Exit Link	587	8587	US-218	COLLECTOR	1169	1	10	3	1700	65	6
Exit Link	618	8618	I-380	FREEWAY	2827	2	12	4	2250	70	29
Exit Link	619	8619	US-151B	COLLECTOR	2028	1	12	4	1700	50	25
Exit Link	620	8620	County HWY E44	COLLECTOR	1236	1	10	2	1700	55	12
Exit Link	621	8621	US - 30	COLLECTOR	10547	1	12	8	1700	60	12
Exit Link	721	8721	CO HWY E 16	COLLECTOR	2073	1	12	4	1575	35	10
Exit Link	935	8935	61ST ST	COLLECTOR	1448	1	12	4	1575	35	6
Exit Link	983	8983	6TH ST	COLLECTOR	2077	1	12	6	1700	60	29
Exit Link	1108	8615	US-151	MINOR ARTERIAL	3747	2	12	4	1900	65	11
Exit Link	1142	8616	US - 30	COLLECTOR	2165	1	12	8	1700	50	31
Exit Link	1230	8216	HWY 1	COLLECTOR	843	1	11	4	1700	55	31
Exit Link	1293	8281	21ST AVE	COLLECTOR	2118	1	11	1	1700	40	24
Exit Link	1337	8337	HWY 64	COLLECTOR	799	1	10	2	1700	50	11

Table K-2. Nodes in the Link-Node Analysis Network which are Controlled

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
2	5415491	3540199	Stop	8
7	5362616	3551395	TCP - Uncontrolled	2
22	5417520	3478539	TCP - Actuated	18
24	5418682	3476238	TCP - Actuated	18
29	5420659	3468277	Actuated	20
30	5421415	3468290	Stop	20
45	5419223	3440297	TCP - Uncontrolled	27
49	5438561	3428655	Stop	28
53	5321741	3453166	Stop	12
54	5337294	3453478	Stop	13
55	5353431	3453632	Stop	13
56	5369089	3454189	Stop	13
57	5385980	3454416	TCP - Uncontrolled	16
65	5420472	3441852	TCP - Uncontrolled	27
66	5421855	3441857	TCP - Uncontrolled	27
67	5424311	3441894	Yield	27
70	5449723	3441970	Stop	28
74	5362707	3501692	Stop	7
75	5361500	3517650	Stop	7
77	5362394	3548887	Stop	2
78	5362340	3550048	Stop	2
86	5330141	3580758	Stop	1
94	5356979	3555848	Stop	2
95	5356916	3557046	Stop	2
96	5356892	3570624	Stop	2
97	5356851	3581020	Yield	2
106	5321191	3468972	Stop	12
107	5320398	3500708	Stop	6
108	5320490	3519196	Stop	6
109	5320406	3521753	Stop	6
110	5320376	3527970	Stop	6
118	5364060	3491269	Stop	13
122	5363898	3453917	Stop	13
124	5337013	3469291	Stop	13
127	5336363	3500940	Stop	7
132	5320384	3524519	Stop	6
133	5388838	3534385	TCP - Actuated	8
134	5387018	3537056	Stop	8
135	5385916	3539734	Stop	8
137	5385011	3571222	Stop	3
143	5413697	3555653	Stop	3

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
144	5413039	3571367	Stop	3
151	5454213	3540717	Stop	9
152	5430979	3555566	Stop	4
153	5454771	3556029	Stop	4
154	5450960	3482218	TCP - Actuated	19
155	5451153	3476420	Actuated	19
156	5450989	3460467	Actuated	21
159	5450824	3487447	Stop	19
160	5450567	3495260	Stop	9
161	5450506	3503378	TCP - Actuated	9
162	5450071	3524668	TCP - Actuated	9
165	5390560	3454687	Yield	16
168	5391413	3451647	TCP - Uncontrolled	16
169	5395793	3454855	Actuated	17
170	5399799	3454850	Actuated	17
171	5406459	3454888	TCP - Actuated	17
172	5408414	3454766	TCP - Actuated	17
176	5388822	3441327	Stop	26
177	5390861	3442661	Stop	26
178	5399149	3447658	TCP - Actuated	17
179	5400531	3448505	TCP - Actuated	17
180	5406472	3452974	TCP - Actuated	17
184	5363988	3501722	Stop	7
187	5380421	3491723	Stop	14
188	5383399	3489436	Stop	14
189	5384016	3493549	Stop	14
192	5394137	3468144	Stop	16
194	5406375	3460881	TCP - Actuated	17
196	5384130	3502415	Stop	8
197	5383760	3509434	Stop	8
202	5387170	3529587	TCP - Uncontrolled	8
203	5388113	3530264	TCP - Actuated	8
205	5398815	3492052	Stop	15
209	5407212	3480933	Actuated	15
210	5409952	3480848	Pretimed	15
211	5416559	3481019	TCP - Actuated	18
212	5416990	3481042	TCP - Actuated	18
213	5418851	3481075	Actuated	18
214	5421577	3481342	Actuated	18
215	5426997	3481248	TCP - Actuated	18
216	5433955	3479929	TCP - Actuated	18
217	5437682	3480917	TCP - Actuated	19

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
218	5443063	3481181	Actuated	19
219	5444368	3482143	Actuated	19
220	5447507	3482100	Actuated	19
225	5409785	3478219	Yield	15
226	5409771	3476118	Actuated	15
227	5409797	3474415	Pretimed	15
228	5408321	3470075	Actuated	15
229	5406359	3464302	Actuated	17
230	5406394	3460219	Actuated	17
231	5406704	3446482	TCP - Actuated	17
232	5406699	3444864	Stop	17
233	5407311	3429682	TCP - Actuated	26
234	5380394	3428667	TCP - Actuated	26
236	5417896	3428565	Actuated	27
238	5419903	3428562	Actuated	27
239	5428142	3441276	Actuated	27
240	5428177	3440525	Actuated	27
241	5428090	3442435	Actuated	27
242	5427948	3448277	Stop	20
244	5425037	3452449	Stop	20
245	5422394	3454627	Stop	20
246	5420884	3455646	Actuated	20
247	5419183	3457461	Actuated	20
248	5418000	3459874	TCP - Actuated	20
252	5415540	3464361	Stop	17
253	5415587	3460754	Actuated	17
254	5415573	3460323	Stop	17
255	5416286	3458968	Actuated	20
256	5416948	3459344	Actuated	20
257	5416969	3457646	Actuated	20
258	5417672	3457900	Actuated	20
259	5417034	3454847	Actuated	20
260	5417043	3454459	Actuated	20
261	5417087	3452400	Actuated	20
262	5417473	3447606	Actuated	20
263	5418691	3448367	Actuated	20
264	5419243	3448367	TCP - Actuated	20
266	5417507	3441279	Actuated	27
267	5417800	3433893	Actuated	27
272	5363988	3550966	TCP - Actuated	2
273	5363052	3550381	TCP - Actuated	2
274	5386265	3536733	Stop	8

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
275	5385595	3537760	Stop	8
276	5409091	3501738	TCP - Actuated	8
278	5405012	3504267	Stop	8
280	5410305	3506865	Stop	8
281	5411928	3502839	Actuated	8
282	5422468	3503048	Stop	9
283	5431791	3503234	Stop	9
286	5409622	3484275	Stop	15
287	5409285	3480823	Actuated	15
288	5414004	3484634	TCP - Actuated	15
289	5414477	3485150	TCP - Actuated	15
290	5414851	3485437	TCP - Actuated	15
291	5421450	3485567	Actuated	18
295	5421633	3478883	Actuated	18
296	5417361	3478857	TCP - Actuated	18
297	5419123	3476250	TCP - Actuated	18
298	5417943	3478546	Actuated	18
299	5415946	3476270	Actuated	15
300	5418995	3478600	Actuated	18
301	5418967	3478939	Actuated	18
302	5417749	3478890	TCP - Actuated	18
303	5427007	3478864	TCP - Actuated	18
304	5431770	3478111	TCP - Actuated	18
305	5412209	3489609	Stop	15
306	5412153	3497897	Stop	8
307	5421334	3494168	Stop	9
308	5426748	3490000	Actuated	18
309	5433471	3487992	Stop	18
312	5426832	3485655	Actuated	18
314	5434455	3484703	Actuated	18
315	5437474	3485374	Stop	19
316	5437605	3482055	Actuated	19
317	5437695	3474455	Actuated	19
318	5446878	3476445	Stop	19
319	5448099	3476605	Stop	19
320	5419752	3476273	Actuated	18
321	5421721	3476210	Actuated	18
322	5423599	3476154	Stop	18
323	5416561	3473612	Stop	18
324	5419305	3472805	Actuated	18
325	5419740	3472552	TCP - Actuated	18
326	5416660	3468966	Stop	18

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
327	5420456	3472245	Actuated	18
328	5421796	3472226	Actuated	18
329	5420560	3470991	Actuated	18
330	5421483	3470951	Actuated	18
331	5419885	3470972	Actuated	18
332	5419386	3470972	TCP - Actuated	18
333	5419435	3466808	TCP - Actuated	20
336	5420707	3466882	Stop	20
337	5421499	3466883	Stop	20
339	5420020	3466879	TCP - Actuated	20
340	5422133	3462998	Actuated	20
341	5422710	3463470	Actuated	20
342	5421571	3462570	Actuated	20
344	5420993	3462117	Actuated	20
348	5420522	3462511	TCP - Uncontrolled	20
349	5419185	3460666	Actuated	20
350	5418674	3461317	Actuated	20
354	5417292	3459522	TCP - Actuated	20
356	5416983	3456832	Actuated	20
360	5421213	3458807	Actuated	20
361	5419481	3460897	Actuated	20
362	5423248	3460505	Actuated	20
363	5424405	3460270	Stop	20
364	5428852	3460237	Stop	20
365	5432903	3460261	Actuated	20
366	5436201	3460360	Actuated	20
368	5423629	3464174	Actuated	20
369	5425762	3465899	Actuated	20
370	5427214	3467079	Actuated	20
371	5428715	3466924	Stop	20
372	5432622	3466920	Actuated	20
375	5437409	3468370	Stop	19
377	5428174	3470886	TCP - Actuated	18
378	5428118	3472253	TCP - Actuated	18
379	5428162	3474818	Actuated	18
380	5422484	3474140	Stop	18
382	5427212	3472261	Stop	18
383	5439605	3487295	Actuated	19
384	5437139	3503260	Stop	9
385	5441299	3503283	Stop	9
386	5442570	3503260	Stop	9
388	5442413	3492352	Stop	19

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
389	5444129	3487377	Yield	19
394	5451477	3465776	Stop	21
395	5416900	3460719	Stop	20
396	5416890	3460300	Stop	20
397	5424374	3459000	Stop	20
398	5419763	3454847	Stop	20
399	5419755	3454443	Stop	20
402	5430318	3458336	Stop	20
403	5430336	3460227	Actuated	20
405	5406020	3452416	Actuated	17
406	5406487	3452289	Actuated	17
410	5404246	3450646	Actuated	17
411	5406611	3448345	Actuated	17
413	5403845	3452261	Actuated	17
414	5403784	3454842	Actuated	17
415	5418598	3452359	Actuated	20
416	5418995	3452364	TCP - Actuated	20
419	5419786	3452361	Actuated	20
420	5422469	3452419	Stop	20
421	5422564	3448459	Stop	20
422	5422806	3442394	Actuated	27
423	5422895	3441245	Actuated	27
433	5417524	3442633	TCP - Actuated	27
442	5419588	3441861	TCP - Uncontrolled	27
449	5423120	3433824	Stop	27
450	5428350	3433940	Stop	27
451	5423162	3428513	Stop	27
452	5428596	3428513	Stop	27
455	5399905	3519331	Stop	8
458	5456101	3571058	Stop	4
461	5425937	3428502	Stop	27
463	5413401	3480941	Stop	15
465	5414929	3480978	Actuated	15
467	5421756	3474646	Stop	18
469	5417536	3482509	Actuated	18
472	5425675	3477656	Actuated	18
475	5427007	3478505	Stop	18
476	5426869	3483599	Actuated	18
482	5437474	3484825	Actuated	19
483	5437396	3487230	Actuated	19
484	5437332	3488509	Actuated	19
487	5450053	3482152	Actuated	19

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
490	5447436	3484802	Stop	19
492	5446460	3482102	Actuated	19
493	5445568	3482104	Actuated	19
496	5444282	3484721	Stop	19
499	5443054	3479059	Stop	19
500	5439893	3480955	Stop	19
501	5438627	3480934	Actuated	19
505	5434467	3480358	Actuated	18
507	5437934	3480674	Stop	19
508	5438080	3476283	Actuated	19
511	5435497	3460308	Actuated	20
513	5434021	3460286	Actuated	20
516	5432808	3462928	Stop	20
519	5424162	3464619	Actuated	20
523	5428053	3473486	Actuated	18
524	5427177	3473523	Stop	18
526	5428687	3475688	Actuated	18
528	5430214	3477026	Actuated	18
531	5423002	3476200	Stop	18
533	5424200	3478892	Actuated	18
535	5425663	3478901	Actuated	18
536	5428355	3478861	Actuated	18
537	5428839	3478859	Actuated	18
538	5429928	3478802	Actuated	18
545	5431024	3478693	Actuated	18
547	5432889	3478969	Actuated	18
550	5444363	3482287	Stop	19
552	5443040	3482033	Stop	19
554	5441289	3481003	Stop	19
555	5439681	3482050	Stop	19
556	5439720	3480957	Stop	19
557	5438838	3482050	Stop	19
558	5438911	3480943	Stop	19
559	5451019	3480357	Actuated	19
561	5440913	3482038	Stop	19
562	5440627	3487289	Stop	19
563	5440705	3484551	Stop	19
564	5440659	3486157	Stop	19
565	5417524	3485646	Stop	18
566	5409913	3479245	Actuated	15
568	5409732	3476858	Yield	15
571	5424134	3481345	Actuated	18

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
572	5428828	3480963	Pretimed	18
573	5431140	3480443	Actuated	18
574	5437665	3481258	Actuated	19
578	5454604	3571331	Stop	4
580	5386853	3571240	Stop	3
585	5320384	3527595	Stop	6
586	5317744	3527926	Stop	6
588	5317746	3527584	Actuated	6
591	5321559	3524434	Stop	6
592	5384017	3490624	Stop	14
593	5384052	3492131	Stop	14
597	5385758	3537511	Stop	8
598	5385902	3537328	Stop	8
599	5386753	3537712	Stop	8
607	5362665	3549408	Stop	2
608	5362680	3549705	Stop	2
609	5362369	3549693	Stop	2
612	5431518	3517854	Stop	9
613	5431427	3522664	Stop	9
616	5490203	3439629	Stop	31
617	5448767	3414163	Yield	30
622	5423129	3430933	Stop	27
624	5405197	3451512	Actuated	17
625	5407453	3453911	Actuated	17
626	5407231	3454864	Stop	17
628	5411926	3454548	Actuated	17
630	5422549	3461368	Actuated	20
631	5422292	3461641	Actuated	20
632	5422051	3461956	Actuated	20
634	5435748	3474479	Actuated	18
635	5440643	3474441	Actuated	19
637	5406695	3446928	Actuated	17
640	5406554	3449604	Actuated	17
642	5411914	3448313	Stop	17
644	5412226	3452303	Stop	17
646	5418174	3459483	Actuated	20
647	5418339	3459187	Actuated	20
648	5417716	3460479	TCP - Actuated	20
649	5413564	3460729	Actuated	17
650	5414157	3460304	Stop	17
651	5414163	3464321	Stop	17
652	5395754	3460166	Stop	17

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
653	5403766	3460218	Stop	17
654	5395777	3457381	Stop	17
656	5390576	3452095	TCP - Uncontrolled	16
657	5395977	3445665	Actuated	17
658	5422926	3440924	Actuated	27
659	5422988	3439871	Actuated	27
661	5417582	3439152	Actuated	27
662	5416651	3458293	Actuated	20
663	5416459	3458650	Actuated	20
664	5410652	3456946	Actuated	17
665	5422690	3459999	Actuated	20
667	5421964	3460883	Stop	20
668	5421720	3461201	Stop	20
669	5421480	3461516	Actuated	20
670	5420664	3461859	Actuated	20
671	5418860	3460435	Actuated	20
672	5416609	3459152	Actuated	20
673	5411696	3457621	Actuated	17
674	5420477	3459638	Actuated	20
675	5419091	3457708	Actuated	20
679	5454190	3571338	Stop	4
682	5428318	3437463	Actuated	27
685	5336481	3490404	Stop	13
688	5362696	3502416	Stop	7
693	5321332	3527989	Stop	6
695	5337013	3468755	Stop	13
698	5396673	3526729	Stop	8
703	5409828	3509416	Stop	8
716	5418351	3478573	Yield	18
720	5456492	3543637	Stop	9
725	5399799	3455412	Stop	17
726	5403751	3457596	Actuated	17
728	5403751	3456167	Actuated	17
730	5406426	3458855	Actuated	17
731	5411658	3458951	Actuated	17
739	5418241	3457783	Actuated	20
740	5417488	3459131	Actuated	20
741	5417107	3458946	Actuated	20
743	5417261	3458624	Actuated	20
744	5417650	3458836	Actuated	20
745	5419131	3460109	Actuated	20
746	5421817	3457365	Actuated	20

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
747	5420874	3458553	Actuated	20
749	5422152	3457628	Actuated	20
750	5424156	3460289	Actuated	20
753	5421804	3462262	Actuated	20
754	5421217	3461829	Actuated	20
756	5419878	3448383	Stop	20
758	5434694	3471662	Stop	18
759	5448791	3460400	Stop	21
760	5403742	3460872	Stop	17
762	5404480	3482320	Stop	15
765	5398886	3494637	Stop	8
779	5438025	3477134	Actuated	19
781	5437965	3479691	Stop	19
782	5437956	3480280	Stop	19
785	5428306	3436229	Stop	27
790	5423043	3437371	Actuated	27
795	5444861	3482115	Actuated	19
796	5445335	3482105	Actuated	19
799	5438338	3480931	Actuated	19
803	5436648	3480902	Yield	18
807	5380763	3493137	Stop	14
816	5426242	3460218	Actuated	20
817	5426249	3462877	Stop	20
819	5426484	3460218	Actuated	20
820	5422377	3459753	Actuated	20
821	5421662	3460637	Stop	20
822	5419389	3459796	Actuated	20
823	5419701	3460045	Actuated	20
824	5419979	3460262	Actuated	20
825	5418506	3460861	TCP - Actuated	20
826	5419720	3460582	Actuated	20
828	5418946	3461035	Actuated	20
831	5419440	3460363	Actuated	20
833	5420596	3460767	Actuated	20
834	5420332	3461080	Actuated	20
835	5420080	3461371	Actuated	20
836	5420820	3460473	Actuated	20
837	5420226	3459952	Actuated	20
838	5420753	3462392	Actuated	20
839	5420443	3462157	Actuated	20
840	5421181	3461265	Actuated	20
841	5420927	3461588	Actuated	20

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
843	5421406	3460970	Stop	20
844	5423083	3458366	Stop	20
845	5422105	3459503	Actuated	20
848	5416131	3460300	Stop	20
858	5421340	3462881	Actuated	20
859	5426233	3465294	Actuated	20
861	5428566	3463744	Stop	20
867	5437324	3441882	Stop	28
869	5433461	3441883	Stop	27
871	5428204	3469815	Actuated	18
873	5428705	3469796	Stop	18
877	5368773	3464685	Stop	13
878	5363546	3464439	Stop	13
879	5337063	3464015	Stop	13
881	5406498	3451654	Actuated	17
884	5415512	3447573	Stop	17
885	5406464	3456313	Actuated	17
887	5406706	3444264	Actuated	17
889	5411873	3456938	Stop	17
890	5408965	3454723	Actuated	17
895	5417647	3437124	Actuated	27
899	5409701	3477825	Actuated	15
902	5395781	3451059	Stop	17
904	5336624	3485278	Stop	13
908	5406634	3513512	Stop	8
916	5413254	3484361	Stop	15
917	5411733	3480880	Stop	15
918	5412822	3480921	Stop	15
923	5351714	3549244	Stop	2
926	5379843	3454496	Stop	16
927	5379561	3467713	Stop	16
939	5414015	3457825	Actuated	17
950	5431656	3441913	Stop	27
962	5418561	3454431	Stop	20
963	5418544	3454848	Stop	20
969	5449143	3482119	Stop	19
971	5447783	3487426	Stop	19
972	5412981	3457632	Actuated	17
976	5422481	3466717	Yield	20
982	5428665	3464531	Stop	20
990	5443006	3484660	Stop	19
991	5421233	3455357	Stop	20

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
992	5422405	3456729	Stop	20
993	5422626	3457111	Stop	20
995	5422210	3456545	Stop	20
996	5444544	3478133	Stop	19
1007	5434956	3433909	Stop	27
1008	5436787	3524541	Stop	9
1019	5418967	3479299	Actuated	18
1020	5421633	3479283	Actuated	18
1027	5373964	3467641	Stop	13
1034	5321292	3463825	Stop	12
1046	5406461	3453599	Actuated	17
1048	5403803	3453578	Actuated	17
1049	5405262	3448849	Actuated	17
1052	5406524	3450359	Actuated	17
1067	5401193	3456224	Stop	17
1068	5422989	3463131	Actuated	20
1073	5423329	3481353	Actuated	18
1078	5409857	3478735	Actuated	15
1095	5392230	3472565	Stop	14
1102	5410223	3480856	Yield	15
1105	5480020	3487796	TCP - Actuated	22
1125	5486347	3443072	Stop	22
1133	5487186	3439374	Yield	31
1135	5486891	3439431	Stop	31
1136	5488201	3441653	Actuated	31
1137	5486686	3439489	Yield	31
1138	5486380	3439299	Yield	31
1143	5484744	3439397	Yield	31
1144	5485123	3439405	Yield	31
1169	5417420	3481053	Yield	18
1173	5426455	3413023	Stop	29
1176	5418409	3412868	TCP - Actuated	29
1190	5442306	3422377	Stop	28
1200	5444077	3441796	Yield	28
1201	5475993	3427433	TCP - Actuated	31
1209	5455776	3404032	Stop	30
1216	5468532	3399097	TCP - Actuated	31
1227	5467874	3399072	Stop	31
1228	5466343	3399600	Stop	31
1232	5486489	3439268	Yield	31
1239	5436736	3481018	Yield	18
1246	5441587	3480998	Yield	19

Node	X Coordinate[1] (ft)	Y Coordinate[1] (ft)	Control Type	Grid Map Number
1249	5444285	3487275	Yield	19
1254	5443634	3491235	Yield	19
1259	5433428	3490397	Yield	18
1260	5433494	3489732	Yield	18
1264	5365837	3421878	Stop	25
1269	5354381	3427238	Yield	25
1274	5375980	3411863	Stop	26
1279	5306341	3452995	Yield	12
1281	5306649	3432134	TCP - Actuated	24
1286	5332976	3429649	Stop	25
1295	5440509	3479047	Stop	19
1297	5479418	3503682	Yield	10
1298	5474186	3503596	Stop	10
1306	5480187	3474337	TCP - Actuated	22
1320	5510489	3498911	Stop	11
1325	5502285	3477635	TCP - Actuated	23
1333	5527733	3508719	Actuated	11
1335	5528006	3508568	Actuated	11

[1]Coordinates are in the North American Datum of 1983 Iowa North State Plane Zone

APPENDIX L

Subarea Boundaries

L. SUBAREA BOUNDARIES

Subarea 1 — County: Linn

Defined as the area within the following boundary: Bounded on the north by Lewis Access Road and I-380, on the east by Standlea Road, Toddville Road and Feather Ridge Road, on the south by Blairs Ferry Road NE, the Palo City border and Shellsburg Road, and on the west by Benton Linn Road, Pleasant Creek State Park and the Linn/Benton County line. Includes the immediate vicinity around DAEC in rural Linn County.

Subarea 2 — County: Linn

Defined as the area within the following boundary: Bounded on the north by the Cedar Valley Nature Trail, on the east by County Highway W45, on the south by County Highway E28, on the southwest by I-380, and on the west by the Center Point City border. Includes rural Linn County.

Subarea 3 — County: Linn

Defined as the area within the following boundary: Bounded on the north by County Highway E28, on the east by the Cedar Valley Nature Trail, on the south by County Home Road and Toddville Road, and on the west by Standlea road and I-380. Includes Toddville and rural Linn County.

Subarea 4 — County: Linn

Defined as the area within the following boundary: Bounded on the north by Toddville Road and County Home road, on the east by N Center Point Road, Tower Terrace Road and Miller Road, on the south by Blairs Ferry Road NE, and on the west by Feather Ridge Road. Includes the area northwest of Cedar Rapids and rural Linn County.

Subarea 5 — County: Linn

Defined as the area within the following boundary: Bounded on the north by Blairs Ferry Road NE, on the east by Edgewood Road NW, on the south by Ellis Road, and on the west by County Highway W36 and the Palo City Border. Includes NW/NE Cedar Rapids, Palo, Covington and rural Linn County.

Subarea 6 — County: Linn

Defined as the area within the following boundary: Bounded on the north by Shellsburg Road and the Palo City Border, on the east by County Highway W36, on the south by County Trunk Road E40, and on the west by Benton Linn Road. Includes rural Linn County.

Subarea 7 County: Benton

Defined as the area within the following boundary: Bounded on the north by 62nd Street, on the east by Pleasant Creek State Park, the Linn/Benton County Line and Benton Linn Road, on the south by Fletcher Road and on the west by County Trunk Highway W26 and the Shellsburg City Border. Includes Shellsburg and rural Benton County.

Subarea 8 County: Benton

Defined as the area within the following boundary: Bounded on the north by the Cedar River, on the east by the Linn/Benton County Line, on the south by 62nd Street, and on the west by County Trunk Highway W26. Includes Shellsburg and rural Benton County.

Subarea 9 County: Linn

Defined as the area within the following boundary: Bounded on the north by County Highway D66, on the east by N Center Point Road and the Center Point City Border, on the south by Lewis Access Road, and on the west by the Linn/Benton County Line. Includes Center Point and rural Linn County.

Subarea 10 County: Linn

Defined as the area within the following boundary: Bounded on the north by Wileys Road, on the east by County Highway W45, on the south by the Cedar Valley Nature Trail, and on the west by the Center Point City Border and North Center Point Road. Includes rural Linn County.

Subarea 11 County: Linn

Defined as the area within the following boundary: Bounded on the north by Paris Road, on the east by N Alburnett Road, on the south by Central City Road, and on the west by Alice Road. Includes rural Linn County.

Subarea 12 County: Linn

Defined as the area within the following boundary: Bounded on the north by Central City Road, on the east by N Marion Road, on the south by Burnett Station Road, the Alburnett City Border and County Highway E28, and on the west by County Highway W45. Includes Alburnett and rural Linn County.

Subarea 13 County: Linn

Defined as the area within the following boundary: Bounded on the north by County Highway E28, the Alburnett City Border and Burnett Station Road, on the east by Route 13, on the south by County Home Road, and on the west by the Cedar Valley Nature Trail. Includes rural Linn County.

Subarea 14 County: Linn

Defined as the area within the following boundary: Bounded on the north by County Home Road, on the east by Route 13, on the south by US-151 and Blairs Ferry Road, and on the west by Miller Road, Tower Terrace Road and N Center Point Road. Includes Hiawatha, Robins, NE Cedar Rapids, Marion and rural Linn County.

Subarea 15 County: Linn

Defined as the area within the following boundary: Bounded on the north by Blairs Ferry Road, on the east by US-151, on the southwest by the Cedar River, and on the west by Edgewood Road. Includes NE Cedar Rapids.

Subarea 16 County: Linn

Defined as the area within the following boundary: Bounded on the north by Ellis Road, Edgewood Road, on the northeast by the Cedar River, on the southeast by US-151, on the south by US-30, and on the west by Stony Point Road and County Highway W36. Includes a portion of SW Cedar Rapids and of NW Cedar Rapids.

Subarea 17 County: Linn

Defined as the area within the following boundary: Bounded on the north by County Trunk Road E40, on the east by County Highway W36 and Stony Point Road, on the south by US-30, and on the west by Benton Linn Road. Includes SW/NW Cedar Rapids and rural Linn County.

Subarea 18 County: Benton

Defined as the area within the following boundary: Bounded on the north by Fletcher Road, on the east by Benton Linn Road, on the south by US-30 and on the west by 29th Avenue, County Highway E44 and 28th Avenue. Includes Atkins and rural Benton County.

Subarea 19 County: Benton

Defined as the area within the following boundary: Bounded on the north by County Trunk Road E30, on the northeast by the Shellsburg City Border, on the east by County Trunk Highway W26, on the south by Fletcher Road and 68th Street, and on the west by County Trunk Highway W14. Includes rural Benton County.

Subarea 20 County: Benton

Defined as the area within the following boundary: Bounded on the north by County Trunk Highway E24, on the east by County Trunk Highway W26, on the southeast by the Shellsburg City Border, on the south by County Trunk Road E30, and on the west by County Trunk Highway W14. Includes rural Benton County.

Subarea 21 County: Benton

Defined as the area within the following boundary: Bounded on the north by 55th Street, 30th Avenue, and the Urbana City Border, on the east by County Trunk Highway W26, on the south by County Trunk Highway E24, on the west by 27th Avenue extended, and on the northwest by 58th Street, 28th Avenue, 56th Street Drive and 29th Avenue. Includes rural Benton County.

Subarea 22 County: Benton

Defined as the area within the following boundary: Bounded on the north by County Highway D66, on the east by the Linn/Benton County Border, on the south by the Cedar River, and on the west by County Trunk Highway W26, the Urbana City Border, and 32nd Avenue. Includes Urbana and rural Benton County.

Subarea 23 County: Linn

Defined as the area within the following boundary: Bounded on the north by US-151, on the east by Route 13, on the south by US-30, on the southwest by C Street SW and the Cedar River, and on the west by Edgewood Road NW. Includes SE/SW Cedar Rapids, Marion, and rural Linn County.

Subarea 24 County: Linn

Defined as the area within the following boundary: Bounded on the northeast by the Cedar River, on the east by C Street SW, on the south by US-30, on the west and northwest by US-151. Includes a portion of SW Cedar Rapids.

APPENDIX M

Evacuation Sensitivity Studies

M. EVACUATION SENSITIVITY STUDIES

This appendix presents the results of a series of sensitivity analyses. These analyses are designed to identify the sensitivity of the ETE to changes in some base evacuation conditions.

M.1 Effect of Changes in Trip Generation Times

A sensitivity study was performed to determine whether changes in the estimated trip generation time have an effect on the ETE for the entire EPZ. Specifically, if the tail of the mobilization distribution were truncated (i.e., if those who responded most slowly to the Advisory to Evacuate could be persuaded to respond much more rapidly) or expanded, how would the ETE be affected? The case considered was Scenario 6, Region 3; a winter, midweek, midday, good weather evacuation of the entire EPZ. Table M-1 presents the results of this study.

Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study

Trip Generation Period	Evacuation Time Estimate for Entire EPZ	
	90th Percentile	100th Percentile
2 Hours 30 minutes	6:15	8:30
3 Hours 30 minutes (Base)	6:25	9:00
4 Hours 30 minutes	6:25	9:00

Reducing the trip generation time by 1 hour reduces the 90th and 100th percentile ETE by 10 minutes and 30 minutes, respectively. Increasing the mobilization time by 1 hour does not impact the 90th or 100th percentile ETE. As discussed in Section 7.3, traffic congestion persists within the EPZ for about 8 hours and 10 minutes due to the significant traffic volume within the population centers of Cedar Rapids, Hiawatha and Marion. As such, the ETE is not dictated by the trip generation time, but by the time needed to clear the congestion within the EPZ.

M.2 Effect of Changes in the Number of People in the Shadow Region Who Relocate

A sensitivity study was conducted to determine the effect on ETE of changes in the percentage of people who decide to relocate from the Shadow Region. The case considered was Scenario 6, Region 3; a winter, midweek, midday, good weather evacuation for the entire EPZ. The movement of people in the Shadow Region has the potential to impede vehicles evacuating from an Evacuation Region within the EPZ. Refer to Sections 3.2 and 7.1 for additional information on population within the Shadow Region.

Table M-2 presents the ETE for each of the cases considered. The results show that eliminating the shadow evacuation has a marginal impact on the 90th and 100th percentile ETE – 10 minutes and 15 minutes, respectively. Tripling the shadow percentage increases the ETE by 20 minutes for both the 90th percentile and 100th percentiles. A full evacuation of the shadow region increases the 90th and 100th percentile ETE by 20 minutes and 55 minutes, respectively – a significant change.

Note, the telephone survey results presented in Appendix F indicate that 12 percent of households would elect to evacuate if advised to shelter, which differs from the assumption of 20 percent non-compliance suggested in NUREG/CR-7002. A sensitivity study was considered using a 12 percent shadow evacuation and the 90th and 100th percentile ETEs were minimally affected – 15 minutes at the 100th percentile and no impact at the 90th percentile.

Reducing the shadow evacuation has a marginal impact on ETE because the traffic congestion in the population centers of Cedar Rapids, Hiawatha and Marion is significant and dictates the ETE. Increasing the shadow evacuation, however, does have a significant impact on ETE because the additional vehicles using roadways outside the EPZ reduces the available roadway capacity for EPZ evacuees thereby exacerbating the traffic congestion in the major population centers.

Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study

Percent Shadow Evacuation	Evacuating Shadow Vehicles	Evacuation Time Estimate for Entire EPZ	
		90th Percentile	100th Percentile
0	0	6:15	8:45
12	3,054	6:25	8:45
20 (Base)	5,090	6:25	9:00
60	15,270	6:45	9:20
100	25,450	6:45	9:55

M.3 Effect of Changes in EPZ Resident Population

A sensitivity study was conducted to determine the effect on ETE of changes in the resident population within the study area (EPZ plus Shadow Region). As population in the study area changes over time, the time required to evacuate the public may increase, decrease, or remain the same. Since the ETE is related to the demand to capacity ratio present within the study area, changes in population will cause the demand side of the equation to change and could impact ETE.

As per the NRC's response to the Emergency Planning Frequently Asked Question (EPFAQ) 2013-001, the ETE population sensitivity study must be conducted to determine what percentage increase in permanent resident population causes an increase in the 90th percentile ETE of 25 percent or 30 minutes, whichever is less. The sensitivity study must use the scenario with the longest 90th percentile ETE (excluding the roadway impact scenario and the special event scenario if it is a 1 day per year special event).

Thus, the sensitivity study was conducted using the following planning assumptions:

1. The percent change in population within the study area was increased up to 10%. Changes in population were applied to permanent residents only (as per federal guidance), in both the EPZ and the Shadow Region.
2. The transportation infrastructure remained fixed (as presented in Appendix K); the presence of future proposed roadway changes and/or highway capacity improvements was not considered.
3. The study was performed for the 2-Mile Region (R01), the 5-Mile Region (R02) and the entire EPZ (R03).
4. The scenario (excluding roadway impact and special event) which yielded the highest 90th percentile ETE values was selected as the case to be considered in this sensitivity study (Scenario 8 – Winter, Midweek, Midday, Snow Condition).

Table M-3 presents the results of the sensitivity study. Section IV of Appendix E to 10 CFR Part 50, and NUREG/CR-7002, Section 5.4, require licensees to provide an updated ETE analysis to the NRC when a population increase within the EPZ causes the longest 90th percentile ETE values (for the 2-Mile Region, 5-Mile Region or entire EPZ) to increase by 25 percent or 30 minutes, whichever is less. Note that all of the base ETE values are greater than 2 hours; thus, 25 percent of the base ETE is always greater than 30 minutes. Therefore, 30 minutes is the lesser and is the criterion for updating.

Those percent population changes which result in a 90th percentile ETE change greater than the 30 minutes are highlighted in red below – a 10% or greater increase in the full EPZ population. NextEra will have to estimate the full EPZ population on an annual basis. If the full EPZ population increases by 10% or more, an updated ETE analysis will be needed.

Table M-3. ETE Variation with Population Change

Resident Population (EPZ + 20% Shadow Region)	Base	Population Change		
		8%	9%	10%
	198,764	209,168	216,653	218,640
ETE for 90th Percentile				
Region	**Base**	**Population Change**		
		8%	**9%**	**10%**
2-MILE	2:05	2:05	2:10	2:10
5-MILE	2:15	2:15	2:15	2:15
FULL EPZ	7:40	8:05	8:05	**8:10**
ETE for 100th Percentile				
Region	**Base**	**Population Change**		
		8%	**9%**	**10%**
2-MILE	4:00	4:00	4:00	4:00
5-MILE	4:05	4:05	4:05	4:05
FULL EPZ	10:05	11:20	11:20	11:20

M.4 Effect of Changes to EPZ Boundary

M.4.1 Introduction

As discussed in Section 1, the Linn County Emergency Management Commission requested to reduce the size of the DAEC EPZ – specifically the portion of Subarea 24 south of US-30 – in 2013. The modification to the EPZ is shown in Figure 1-1 (repeated as Figure M-1 for reference). In early 2016, KLD conducted Phase 1 of this project to identify whether or not the change in the EPZ boundary impacted the ETE. Phase 1 was an "apples to apples" comparison wherein the roadway system modeled and the population from the 2012 ETE study were maintained. The objective of the "apples to apples" comparison was to ensure that any change in ETE was the result of the change in EPZ boundary. Phase 1 found decreases in ETE of up to 40 minutes when reducing the EPZ size, as documented in *Duane Arnold Energy Center Evacuation Time Estimate for Emergency Planning Zone Change Phase 1* (KLD TR-827), dated May 11, 2016. Since this report summarizes the ETE with the modified EPZ and 2016 data (including roadway changes), a sensitivity study was conducted to determine the impact on ETE due to the modified EPZ alone utilizing the 2016 inputs.

M.4.2 Methodology

As discussed in Section 1.3, the 2012 link-node analysis network, shown in Figure M-2, was updated for this study to incorporate all roadway changes made between 2012 and 2016. There have been several major roadway changes within the study area, including the construction of multiple traffic circles in the City of Marion, the Iowa Highway 100 Extension Project in Cedar Rapids, and the construction of two traffic circles in Mount Vernon, where several temporary relocation centers are located. Figure 1-3 and Figure K-1 (repeated as Figure M-3 for reference) shows the link-node analysis network used in this study.

A comparison of Figure M-2 and Figure M-3 clearly shows that the link-node analysis network has been extended well beyond the 15-mile federally suggested study area (10-mile radial EPZ plus an additional 5-mile Shadow Region). In the 2012 study, US-30 eastbound was modelled as a 2-lane freeway with a capacity of approximately 2,250 vehicles per hour (vph) per lane (4,500 vph for the two-lane road), terminating just east of the interchange with IA-13 at approximately 15 miles from the DAEC, in accordance with federal guidance. Approximately 3.5 miles east of that, US-30 eastbound narrows to a single lane with a capacity of 1,700 vph. An additional 2 miles east of the drop to a single lane, US-30 eastbound enters two consecutive single lane traffic circles in Mount Vernon. The radius and angle of entry of the traffic circles is such that vehicles slow down to less than 20 miles per hour when traversing the circle. This effectively reduces the capacity of US-30 eastbound to 900 vph (20% of what it was in the 2012 ETE study). This significant decrease in capacity resulted in widespread rerouting within Cedar Rapids and Marion and necessitated the consideration of additional evacuation routes beyond the 15-mile study area used in the 2012 ETE study. Index grids 10, 11, and 22 through 31 in Figure M-3 show the additional routes south and east of the EPZ that were considered to compensate for the significant reduction in capacity (note the capacity of the road itself was not reduced, rather

the way the road was modeled in the analysis reflected a reduction in capacity) along US-30 eastbound leaving the EPZ.

Additionally, the change to the boundary of Subarea 24 reduces the number of vehicles evacuating from the Subarea as shown in Table M-4. Those permanent residents that live in the portion of Subarea 24 that has been removed are now included as part of the Shadow Region. Table M-5 compares the 2012 ETE vehicular demand estimates, 2016 vehicular demand estimates with the existing EPZ boundary and 2016 vehicular demand estimates with proposed EPZ boundary change resulting from the proposed EPZ change.

Once the link-node analysis network and population were updated, evacuation simulations were run using the DYNEV-II modeling system.

M.4.3 Assumptions

The sensitivity study was conducted using the following planning assumptions:

1. The vehicle estimates presented in Table M-5 were used.
2. Two cases were considered:
    a. Existing EPZ Boundary
    b. Proposed EPZ Boundary (Removal of the portion of Subarea 24 south of US-30)
3. All cases utilized the extended link-node analysis network.
4. Two different scenarios (temporal variations) and three different regions (wind strength/direction) were considered to bound the potential impact of the Subarea 24 boundary change.
    a. Scenario 6 – winter, midweek, midday with good weather was chosen because it represents maximum employment and schools in session which accounts for most of the days of the year. It is also the scenario with the largest number of evacuating vehicles (see Table 6-4).
    b. Scenario 1 – summer, weekday, midday with good weather was also chosen because it represents the largest population during summer conditions (no school is in summer session, at lower enrollment levels than during the regular school year).
    c. Regions R01, R02 and R03 were considered as they represent the evacuation radii emphasized in the federal guidance – 2 miles, 5 miles and full EPZ (approximately 10 miles, though extending to approximately 15 miles in the vicinity of Cedar Rapids), respectively.

M.4.4 Results

Table M-6 presents the ETE results for the existing and proposed EPZ boundary using the expanded roadway network and 2016 demand estimates, for each of the cases discussed above (see Section M.4.3). As shown in the table, the ETE for the 90th percentile remained the same for the 2-mile (R01) and 5-mile (R02) regions for both scenarios considered, which is to be expected as the proposed portion of Subarea 24 to be removed is located well beyond 5-miles from the plant. The 90th percentile ETE for the full EPZ (R03) decreased by 30 minutes and by 35 minutes for Scenario 1 and Scenario 6, respectively.

The 100th percentile ETE for Regions R01 and R02 were not impacted by the reduction in evacuating vehicles caused by the EPZ change. The 100th percentile ETE for Region R03 decreased by 1 hour and 10 minutes for Scenario 1 and by 35 minutes for Scenario 6.

As discussed in Section 7.3, Cedar Rapids is severely congested throughout most of the evacuation. The evacuation of Kirkwood Community College (with 4,000 commuting students and 665 staff members), Yellowbook's marketing headquarters, and the additional residential population in the area in the southern portion of Subarea 24 exacerbates this congestion and prolongs ETE. These additional vehicles access either US-30 eastbound or I-380 southbound to evacuate the area. The ramps to access these routes are single lane ramps, which are overwhelmed by the large volume of traffic emanating from the college, Yellowbook, and surrounding neighborhoods. The elimination of the area south of US-30 from Subarea 24 results in Kirkwood Community College and Yellowbook not evacuating, and reduces congestion in the area significantly, explaining the significant decrease in ETE for Region R03.

Figure M-4 and Figure M-5 display the entire EPZ (Region R03) evacuation rates for the existing and proposed EPZ boundaries for Scenario 1 and Scenario 6, respectively. These charts show that the ETE trends are similar, but the proposed EPZ boundary change displays 100% of the vehicles evacuating sooner (8 hours and 20 minutes and 9 hours for Scenario 1 and Scenario 6, respectively) due to the decrease in evacuating vehicles (9,231 vehicles) within the DAEC EPZ.

The results are clear: the change in the EPZ boundary significantly decreases ETE as there are fewer vehicles evacuating, which reduces traffic congestion in the City of Cedar Rapids.

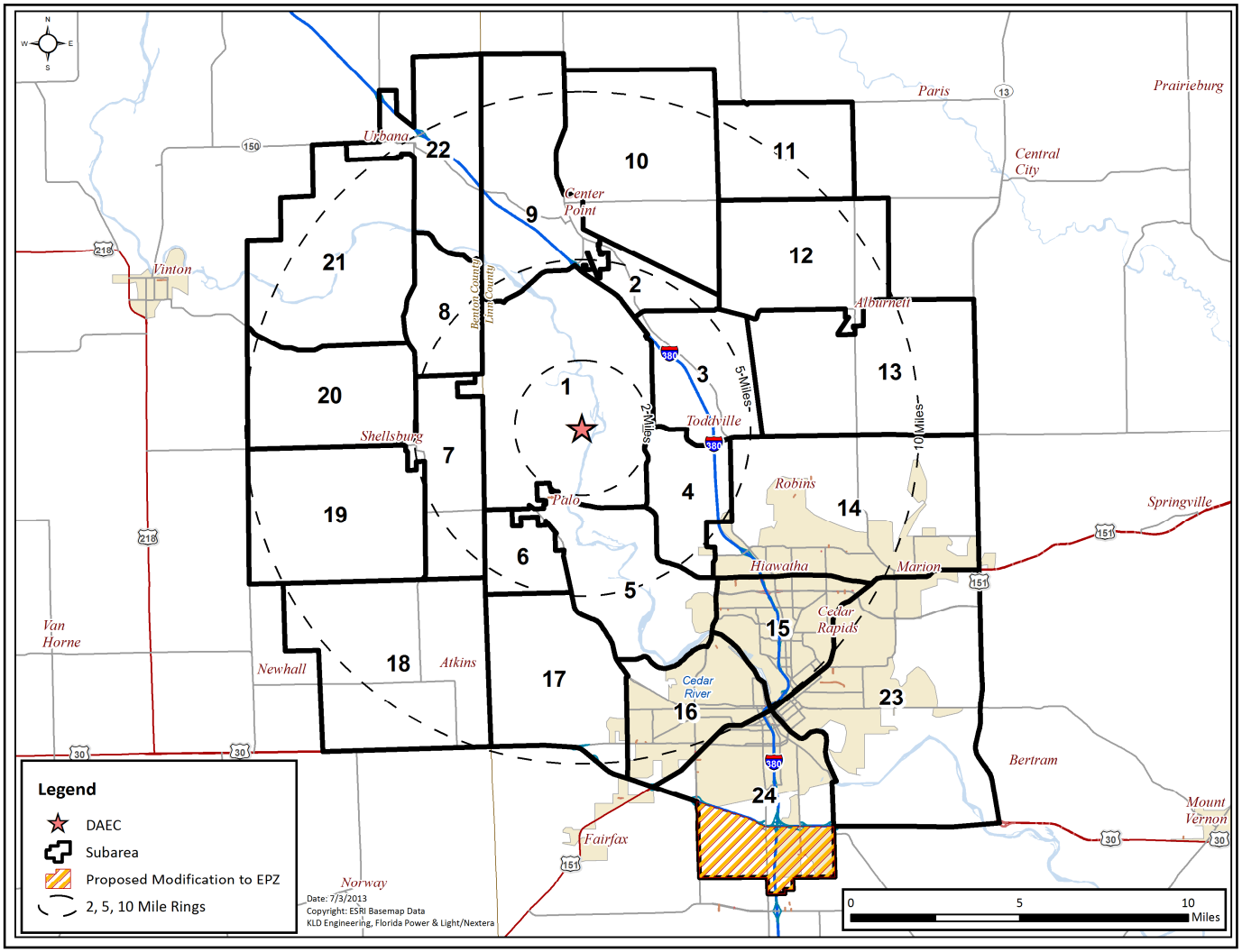

Figure M-1. Proposed Modification to EPZ

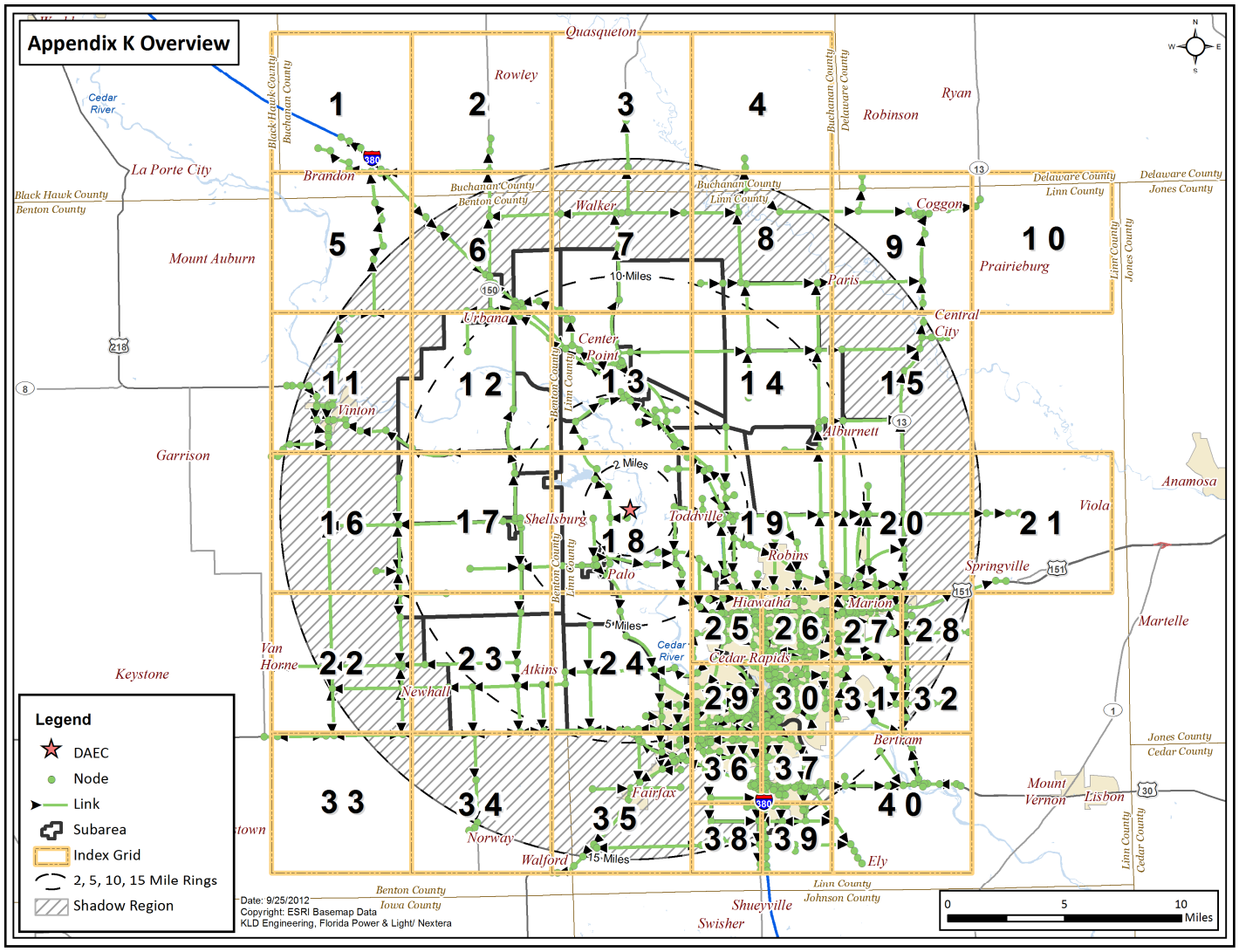

Figure M-2. 2012 Link-Node Analysis Network

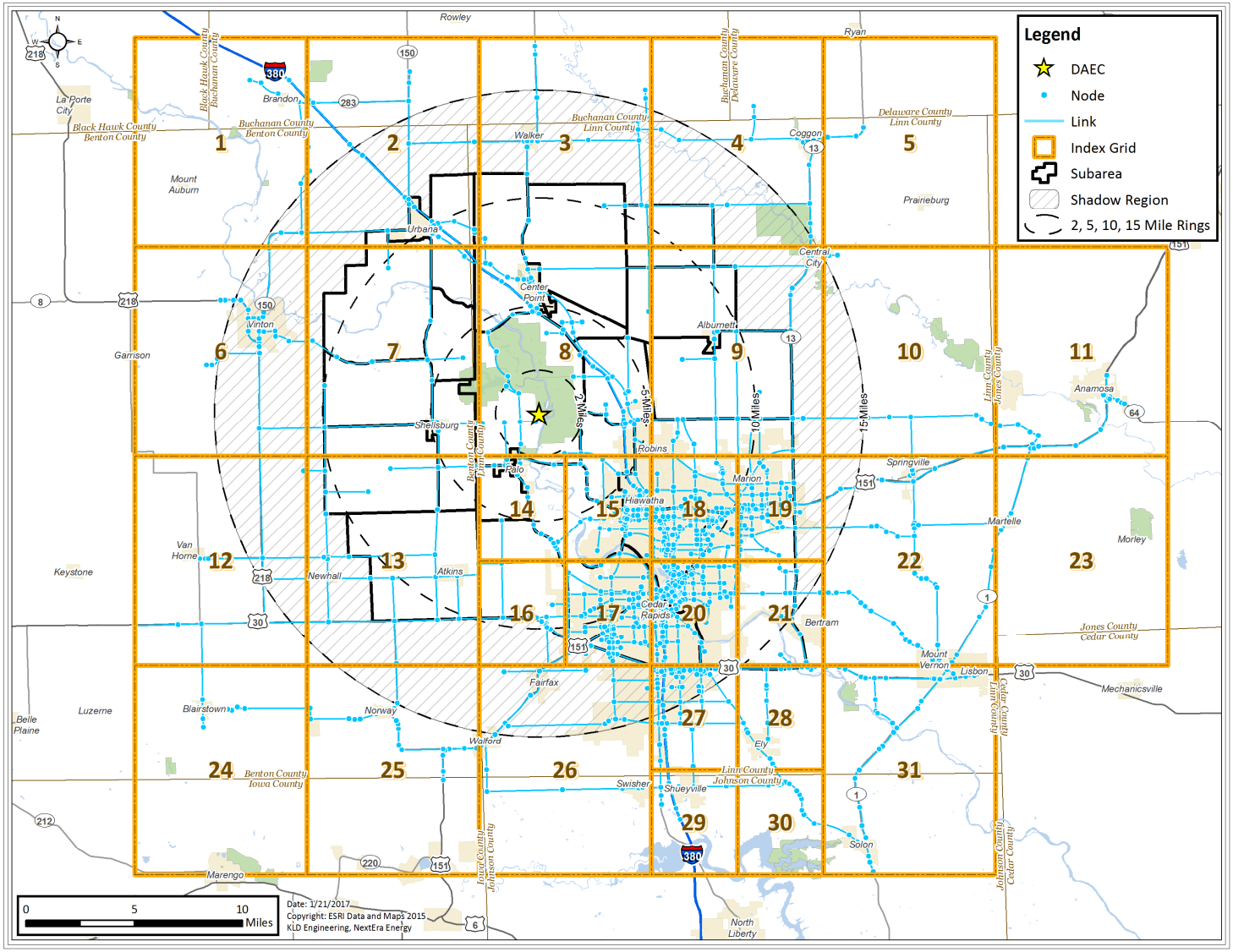

Figure M-3. 2016 Link-Node Analysis Network

Table M-4. 2016 Population and Vehicles within the Removed Portion of Subarea 24

Population Group	People	Vehicles
Residents	5,427	3,039
Employees	2,548	2,316
Transients	149	50
Schoolchildren	5,382	190
College Students	4,000	3,636
Total	**17,506**	**9,231**

Table M-5. Comparison of Vehicle Demand

Population Group	Evacuating Vehicles		
	2012 Study	2016 Existing EPZ Boundary	2016 Proposed EPZ Boundary Change
Residents	104,765	111,548	108,509
Employees	28,469	31,636	29,320
Transients	4,660	4,660	4,610
Special Facilities	632	632	632
Shadow Region	10,812	11,223	14,262
Cedar Rapids Freedom Festival (Special Event)	5,833	5,833	5,833
College Students	6,440	5,742	2,106
School Buses	1,622	1,800	1,610
Transit Buses	272	288	288
External Traffic	4,756	7,058	7,058
Total	**168,261**	**180,420**	**174,228**

Table M-6. ETE Variation with EPZ Boundary & Population Change

90th Percentile ETE (hr:min)						
	Scenario 1 (Summer, Weekday , Midday, Good Weather)			Scenario 6 (Winter, Midweek, Midday, Good Weather)		
Region	Existing EPZ Boundary	Proposed EPZ Change	Difference	Existing EPZ Boundary	Proposed EPZ Change	Difference
2-Mile (R01)	1:40	1:40	0:00	1:40	1:40	0:00
5-Mile (R02)	2:00	2:00	0:00	2:00	2:00	0:00
Full EPZ (R03)	6:40	6:10	-0:30	7:00	6:25	-0:35
100th Percentile ETE (hr:min)						
	Scenario 1 (Summer, Weekday , Midday, Good Weather)			Scenario 6 (Winter, Midweek, Midday, Good Weather)		
Region	Existing EPZ Boundary	Proposed EPZ Change	Difference	Existing EPZ Boundary	Proposed EPZ Change	Difference
2-Mile (R01)	3:30	3:30	0:00	3:30	3:30	0:00
5-Mile (R02)	3:35	3:35	0:00	3:35	3:35	0:00
Full EPZ (R03)	9:30	8:20	-1:10	9:35	9:00	-0:35

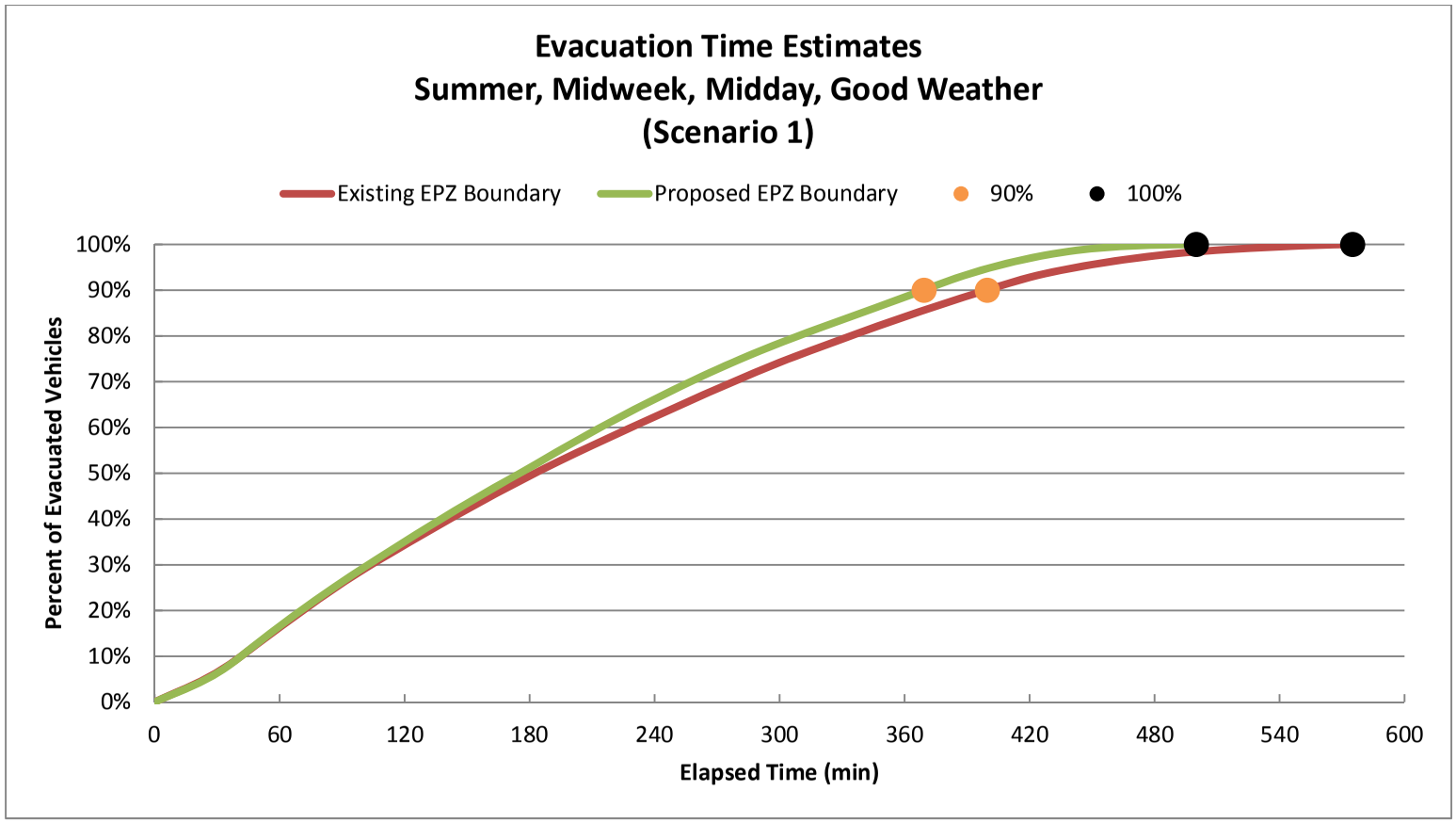

Figure M-4. ETE and EPZ Boundary Change – Scenario 1

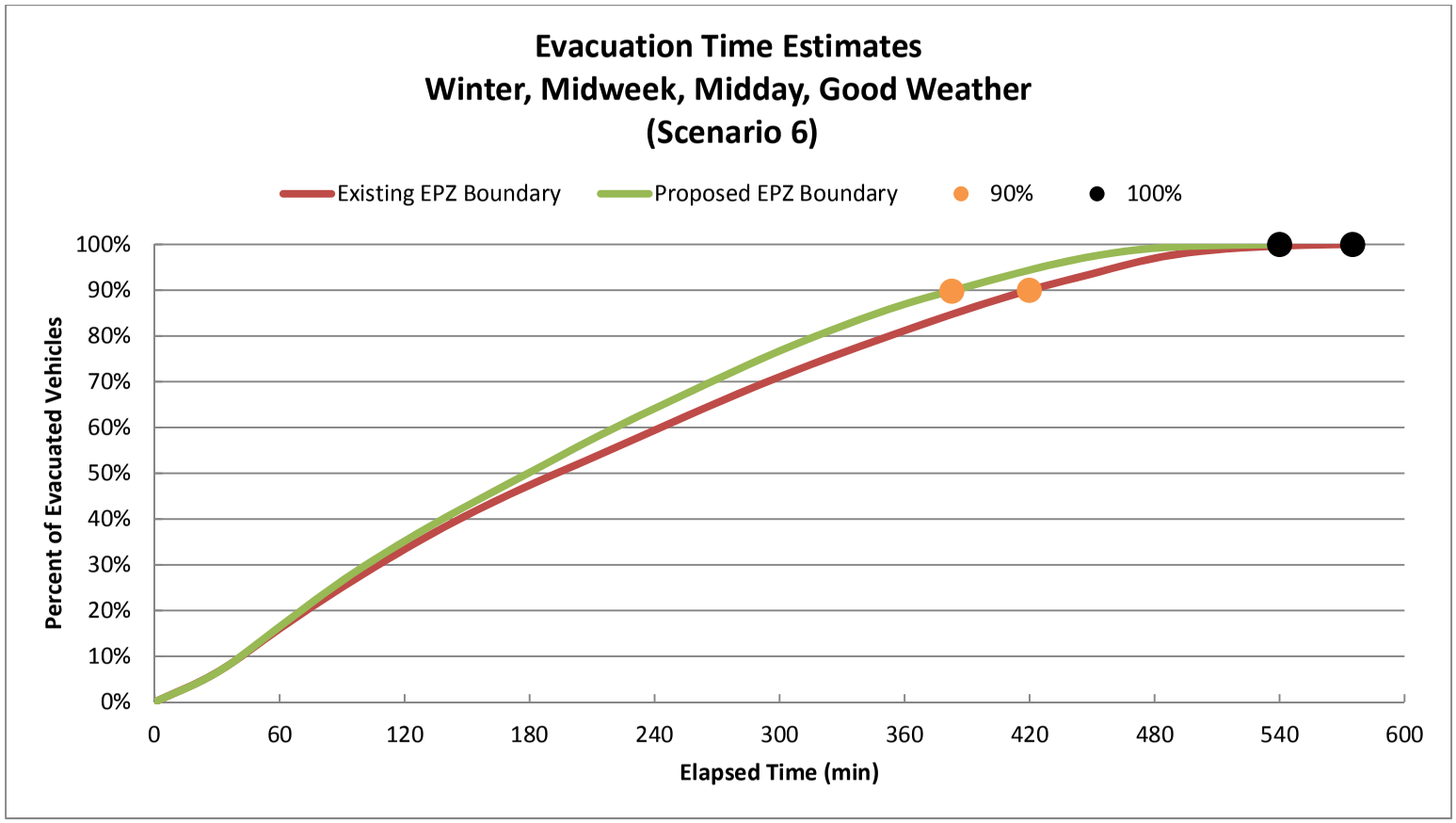

Figure M-5. ETE and EPZ Boundary Change – Scenario 6

APPENDIX N

ETE Criteria Checklist

N. ETE CRITERIA CHECKLIST

Table N-1. ETE Review Criteria Checklist

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
1.0 Introduction		
a. The emergency planning zone (EPZ) and surrounding area should be described.	Yes	Section 1
b. A map should be included that identifies primary features of the site, including major roadways, significant topographical features, boundaries of counties, and population centers within the EPZ.	Yes	Figures 1-2, 3-1
c. A comparison of the current and previous ETE should be provided and includes similar information as identified in Table 1-1, "ETE Comparison," of NUREG/CR-7002.	Yes	Table 1-3
1.1 Approach		
a. A discussion of the approach and level of detail obtained during the field survey of the roadway network should be provided.	Yes	Section 1.3
b. Sources of demographic data for schools, special facilities, large employers, and special events should be identified.	Yes	Sections 2.1, 3, 8
c. Discussion should be presented on use of traffic control plans in the analysis.	Yes	Section 2.3, Section 9, Appendix G
d. Traffic simulation models used for the analyses should be identified by name and version.	Yes	Section 1.3, Table 1-3, Appendix B, Appendix C

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
e. Methods used to address data uncertainties should be described.	Yes	Section 3 – avoid double counting Section 5, Appendix F – 4.5% sampling error at 95% confidence interval for telephone survey
1.2 Assumptions		
a. The planning basis for the ETE includes the assumption that the evacuation should be ordered promptly and no early protective actions have been implemented.	Yes	Section 2.3 – Assumption 1 Section 5.1
b. Assumptions consistent with Table 1-2, "General Assumptions," of NUREG/CR-7002 should be provided and include the basis to support their use.	Yes	Sections 2.2, 2.3
1.3 Scenario Development		
a. The ten scenarios in Table 1-3, Evacuation Scenarios, should be developed for the ETE analysis, or a reason should be provided for use of other scenarios.	Yes	Tables 2-1, 6-2
1.3.1 Staged Evacuation		
a. A discussion should be provided on the approach used in development of a staged evacuation.	Yes	Sections 5.4.2, 7.2
1.4 Evacuation Planning Areas		
a. A map of EPZ with emergency response planning areas (ERPAs) should be included.	Yes	Figure 6-1
b. A table should be provided identifying the ERPAs considered for each ETE calculation by downwind direction in each sector.	Yes	Tables 6-1, 7-5, H-1

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. A table similar to Table 1-4, "Evacuation Areas for a Staged Evacuation Keyhole," of NUREG/CR-7002 should be provided and includes the complete evacuation of the 2, 5, and 10 mile areas and for the 2 mile area/5 mile keyhole evacuations.	Yes	Tables 7-3, 7-4
2.0 Demand Estimation		
a. Demand estimation should be developed for the four population groups, including permanent residents of the EPZ, transients, special facilities, and schools.	Yes	Permanent residents, employees, transients – Section 3, Appendix E Special facilities, schools – Section 8, Appendix E
2.1 Permanent Residents and Transient Population		
a. The US Census should be the source of the population values, or another credible source should be provided.	Yes	Section 3.1
b. Population values should be adjusted as necessary for growth to reflect population estimates to the year of the ETE.	Yes	Section 3.1 – 2010 Census data projected to 2016
c. A sector diagram should be included, similar to Figure 2-1, "Population by Sector," of NUREG/CR-7002, showing the population distribution for permanent residents.	Yes	Figure 3-2
2.1.1 Permanent Residents with Vehicles		
a. The persons per vehicle value should be between 1 and 2 or justification should be provided for other values.	Yes	1.79 persons per vehicle based on telephone survey results – see Table 1-3
b. Major employers should be listed.	Yes	Section 3.4

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
2.1.2 Transient Population		
a. A list of facilities which attract transient populations should be included, and peak and average attendance for these facilities should be listed. The source of information used to develop attendance values should be provided.	Yes	Sections 3.3, Appendix E
b. The average population during the season should be used, itemized and totaled for each scenario.	Yes	Tables 3-6, 3-7 and Appendix E itemize the transient population and employee estimates. These estimates are multiplied by the scenario specific percentages provided in Table 6-3 to estimate average transient population by scenario.
c. The percent of permanent residents assumed to be at facilities should be estimated.	Yes	Sections 3.3, 3.4
d. The number of people per vehicle should be provided. Numbers may vary by scenario, and if so, discussion on why values vary should be provided.	Yes	Sections 3.3, 3.4
e. A sector diagram should be included, similar to Figure 2-1 of NUREG/CR-7002, showing the population distribution for the transient population.	Yes	Figure 3-7 – transients Figure 3-9 – employees
2.2 Transit Dependent Permanent Residents		
a. The methodology used to determine the number of transit dependent residents should be discussed.	Yes	Section 8.1, Table 8-1
b. Transportation resources needed to evacuate this group should be quantified.	Yes	Section 8.1, Tables 8-5, 8-10
c. The county/local evacuation plans for transit dependent residents should be used in the analysis.	Yes	Sections 8.1, 8.4

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
d. The methodology used to determine the number of people with disabilities and those with access and functional needs who may need assistance and do not reside in special facilities should be provided. Data from local/county registration programs should be used in the estimate, but should not be the only set of data.	Yes	Section 8.5
e. Capacities should be provided for all types of transportation resources. Bus seating capacity of 50% should be used or justification should be provided for higher values.	Yes	Section 2.3 – Assumption 8 Sections 3.5, 8.1, 8.2, 8.3
f. An estimate of this population should be provided and information should be provided that the existing registration programs were used in developing the estimate.	Yes	Table 8-1 – transit dependents Section 8.5 – special needs
g. A summary table of the total number of buses, ambulances, or other transport needed to support evacuation should be provided and the quantification of resources should be detailed enough to assure double counting has not occurred.	Yes	Sections 8.3, 8.4 – page 8-6 Table 8-5
2.3 Special Facility Residents		
a. A list of special facilities, including the type of facility, location, and average population should be provided. Special facility staff should be included in the total special facility population.	Yes	Appendix E, Table E-2 lists facilities, type, location, and population
b. A discussion should be provided on how special facility data was obtained.	Yes	Section 8.3

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. The number of wheelchair and bed-bound individuals should be provided.	Yes	Section 8.3, Table 8-4
d. An estimate of the number and capacity of vehicles needed to support the evacuation of the facility should be provided.	Yes	Section 8.3 Tables 8-4, 8-5
e. The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) should be discussed when appropriate.	Yes	Section 8.4
2.4 Schools		
a. A list of schools including name, location, student population, and transportation resources required to support the evacuation, should be provided. The source of this information should be provided.	Yes	Tables 8-2, E-1 Section 8.2
b. Transportation resources for elementary and middle schools should be based on 100% of the school capacity.	Yes	Table 8-2
c. The estimate of high school students who will use their personal vehicle to evacuate should be provided and a basis for the values used should be discussed.	Yes	Section 8.2
d. The need for return trips should be identified if necessary.	Yes	Section 8.4
2.5.1 Special Events		
a. A complete list of special events should be provided and includes information on the population, estimated duration, and season of the event.	Yes	Section 3.8

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
b. The special event that encompasses the peak transient population should be analyzed in the ETE.	Yes	Section 3.8
c. The percent of permanent residents attending the event should be estimated.	Yes	Section 3.8
2.5.2 Shadow Evacuation		
a. A shadow evacuation of 20 percent should be included for areas outside the evacuation area extending to 15 miles from the NPP.	Yes	Section 2.2 – Assumption 2 Figures 2-1, 7-1 Section 3.2
b. Population estimates for the shadow evacuation in the 10 to 15 mile area beyond the EPZ are provided by sector.	Yes	Section 3.2 Figure 3-5 Table 3-5
c. The loading of the shadow evacuation onto the roadway network should be consistent with the trip generation time generated for the permanent resident population.	Yes	Section 5 – Table 5-9
2.5.3 Background and Pass Through Traffic		
a. The volume of background traffic and pass through traffic is based on the average daytime traffic. Values may be reduced for nighttime scenarios.	Yes	Sections 3.6, 3.7, 6 Tables 3-8, 6-3, 6-4
b. Pass through traffic is assumed to have stopped entering the EPZ about two hours after the initial notification.	Yes	Section 2.3 – Assumption 12 Section 3.6 Table 6-3 – External Through Traffic footnote

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
2.6 Summary of Demand Estimation		
a. A summary table should be provided that identifies the total populations and total vehicles used in analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand used in each scenario.	Yes	Tables 3-9, 3-10
3.0 Roadway Capacity		
a. The method(s) used to assess roadway capacity should be discussed.	Yes	Section 4
3.1 Roadway Characteristics		
a. A field survey of key routes within the EPZ has been conducted.	Yes	Section 1.3
b. Information should be provided describing the extent of the survey, and types of information gathered and used in the analysis.	Yes	Section 1.3
c. A table similar to that in Appendix A, "Roadway Characteristics," of NUREG/CR-7002 should be provided.	Yes	Appendix K, Table K-1
d. Calculations for a representative roadway segment should be provided.	Yes	Section 4
e. A legible map of the roadway system that identifies node numbers and segments used to develop the ETE should be provided and should be similar to Figure 3-1, "Roadway Network Identifying Nodes and Segments," of NUREG/CR-7002.	Yes	Appendix K, Figures K-1 through K-32 present the entire link-node analysis network at a scale suitable to identify all links and nodes

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
3.2 Capacity Analysis		
a. The approach used to calculate the roadway capacity for the transportation network should be described in detail and identifies factors that should be expressly used in the modeling.	Yes	Section 4
b. The capacity analysis identifies where field information should be used in the ETE calculation.	Yes	Section 1.3, Section 4
3.3 Intersection Control		
a. A list of intersections should be provided that includes the total number of intersections modeled that are unsignalized, signalized, or manned by response personnel.	Yes	Appendix K, Table K-2
b. Characteristics for the 10 highest volume intersections within the EPZ are provided including the location, signal cycle length, and turn lane queue capacity.	Yes	Table J-1
c. Discussion should be provided on how signal cycle time is used in the calculations.	Yes	Section 4.1, Appendix C
3.4 Adverse Weather		
a. The adverse weather condition should be identified and the effects of adverse weather on mobilization time should be considered.	Yes	Table 2-2, Section 2.3 – Assumption 15 Mobilization time – Table 2-2, Section 5.3 (page 5-10)
b. The speed and capacity reduction factors identified in Table 3-1, "Weather Capacity Factors," of NUREG/CR-7002 should be used or a basis should be provided for other values.	Yes	Table 2-2 – based on HCM 2010. The factors provided in Table 3-1 of NUREG/CR-7002 are from HCM 2000.

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. The study identifies assumptions for snow removal on streets and driveways, when applicable.	Yes	Section 5.3 – page 5-10 Appendix F – Section F.3.3
4.0 Development of Evacuation Times		
4.1 Trip Generation Time		
a. The process used to develop trip generation times should be identified.	Yes	Section 5
b. When telephone surveys are used, the scope of the survey, area of survey, number of participants, and statistical relevance should be provided.	Yes	Appendix F
c. Data obtained from telephone surveys should be summarized.	Yes	Appendix F
d. The trip generation time for each population group should be developed from site specific information.	Yes	Section 5, Appendix F
4.1.1 Permanent Residents and Transient Population		
a. Permanent residents are assumed to evacuate from their homes but are not assumed to be at home at all times. Trip generation time includes the assumption that a percentage of residents will need to return home prior to evacuating.	Yes	Section 5 discusses trip generation for households with and without returning commuters. Table 6-3 presents the percentage of households with returning commuters and the percentage of households either without returning commuters or with no commuters. Appendix F presents the percent households who will await the return of commuters. Section 2.3, Assumption 17.

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
b. Discussion should be provided on the time and method used to notify transients. The trip generation time discusses any difficulties notifying persons in hard to reach areas such as on lakes or in campgrounds.	Yes	Section 5.4.3
c. The trip generation time accounts for transients potentially returning to hotels prior to evacuating.	Yes	Section 5, Figure 5-1
d. Effect of public transportation resources used during special events where a large number of transients should be expected should be considered.	Yes	Section 3.8
e. The trip generation time for the transient population should be integrated and loaded onto the transportation network with the general public.	Yes	Section 5, Table 5-9
4.1.2 Transit Dependent Residents		
a. If available, existing plans and bus routes should be used in the ETE analysis. If new plans should be developed with the ETE, they have been agreed upon by the responsible authorities.	Yes	Section 8.4 – page 8-8. Pre-established bus routes do not exist. Basic bus routes were developed for the ETE analysis – see Figures 8-2 and 8-3, Table 8-10. State and local emergency management agencies reviewed and approved the ETE study including these prescribed routes.
b. Discussion should be included on the means of evacuating ambulatory and non-ambulatory residents.	Yes	Sections 8.4, 8.5
c. The number, location, and availability of buses, and other resources needed to support the demand estimation should be provided.	Yes	Sections 8.4, 8.5 Table 8-5

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
d. Logistical details, such as the time to obtain buses, brief drivers, and initiate the bus route should be provided.	Yes	Section 8.4, Figure 8-1
e. Discussion should identify the time estimated for transit dependent residents to prepare and travel to a bus pickup point, and describes the expected means of travel to the pickup point.	Yes	Section 8.4, page 8-8
f. The number of bus stops and time needed to load passengers should be discussed.	Yes	Sections 8.4, 8.5 Tables 8-11 through 8-13
g. A map of bus routes should be included.	Yes	Figure 8-2 and 8-3
h. The trip generation time for non-ambulatory persons includes the time to mobilize ambulances or special vehicles, time to drive to the home of residents, loading time, and time to drive out of the EPZ should be provided.	Yes	Section 8.5 Tables 8-17 and 8-18
i. Information should be provided to supports analysis of return trips, if necessary.	Yes	Sections 8.4 and 8.5 Figure 8-1 Tables 8-11 through 8-13
4.1.3 Special Facilities		
a. Information on evacuation logistics and mobilization times should be provided.	Yes	Section 8.4 Tables 8-14 through 8-16, and Table 8-19
b. Discussion should be provided on the inbound and outbound speeds.	Yes	Section 8.4

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. The number of wheelchair and bed-bounds individuals should be provided, and the logistics of evacuating these residents should be discussed.	Yes	Section 8.4 Tables 8-4, 8-14 through 8-16
d. Time for loading of residents should be provided	Yes	Section 8.4
e. Information should be provided that indicates whether the evacuation can be completed in a single trip or if additional trips should be needed.	Yes	Section 8.4
f. If return trips should be needed, the destination of vehicles should be provided.	Yes	Section 8.4
g. Discussion should be provided on whether special facility residents are expected to pass through the reception center prior to being evacuated to their final destination.	Yes	Section 8.4
h. Supporting information should be provided to quantify the time elements for the return trips.	Yes	Section 8.4
4.1.4 Schools		
a. Information on evacuation logistics and mobilization time should be provided.	Yes	Section 8.4 Tables 8-7 through 8-9
b. Discussion should be provided on the inbound and outbound speeds.	Yes	School bus routes are presented in Table 8-6 School bus speeds are presented in Tables 8-7 through 8-9 Section 8.4 discusses inbound and outbound speeds

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. Time for loading of students should be provided.	Yes	Tables 8-7 through 8-9, discussion in Section 8.4
d. Information should be provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	Yes	Section 8.4 – page 8-6 Table 8-5
e. If return trips are needed, the destination of school buses should be provided.	Yes	Table 8-3, Figure 10-1
f. If used, reception centers should be identified. Discussion should be provided on whether students are expected to pass through the reception center prior to being evacuated to their final destination.	Yes	Table 8-3. Students are transported to TRCs where they will be picked up by parents or guardians
g. Supporting information should be provided to quantify the time elements for the return trips.	Yes	Tables 8-7 through 8-9 provide time needed to arrive at reception center, which could be used to compute a second wave evacuation if necessary
4.2 ETE Modeling		
a. General information about the model should be provided and demonstrates its use in ETE studies.	Yes	DYNEV II (Ver. 4.0.19.2) System. Section 1.3, Table 1-3, Appendix B, Appendix C
b. If a traffic simulation model is not used to conduct the ETE calculation, sufficient detail should be provided to validate the analytical approach used. All criteria elements should have been met, as appropriate.	No	Not applicable as a traffic simulation model was used

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
4.2.1 Traffic Simulation Model Input		
a. Traffic simulation model assumptions and a representative set of model inputs should be provided.	Yes	Appendices B and C describe the simulation model assumptions and algorithms Table J-2 – model inputs
b. A glossary of terms should be provided for the key performance measures and parameters used in the analysis.	Yes	Appendix A Tables C-1 and C-2
4.2.2 Traffic Simulation Model Output		
a. A discussion regarding whether the traffic simulation model used must be in equilibration prior to calculating the ETE should be provided.	Yes	Appendix B
b. The minimum following model outputs should be provided to support review: 1. Total volume and percent by hour at each EPZ exit node. 2. Network wide average travel time. 3. Longest queue length for the 10 intersections with the highest traffic volume. 4. Total vehicles exiting the network. 5. A plot that provides both the mobilization curve and evacuation curve identifying the cumulative percentage of evacuees who have mobilized and exited the EPZ. 6. Average speed for each major evacuation route that exits the EPZ.	Yes	1. Table J-5. 2. Table J-3. 3. Table J-1. 4. Table J-3. 5. Figures J-1 through J-14 (one plot for each scenario considered). 6. Table J-4. Network wide average speed also provided in Table J-3.

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. Color coded roadway maps should be provided for various times (i.e., at 2, 4, 6 hrs., etc.) during a full EPZ evacuation scenario, identifying areas where long queues exist including level of service (LOS) "E" and LOS "F" conditions, if they occur.	Yes	Figures 7-3 through 7-10
4.3 Evacuation Time Estimates for the General Public		
a. The ETE should include the time to evacuate 90% and 100% of the total permanent resident and transient population	Yes	Tables 7-1 and 7-2
b. The ETE for 100% of the general public should include all members of the general public. Any reductions or truncated data should be explained.	Yes	Section 5.4 – truncating survey data to eliminate statistical outliers Table 7-2 – 100th percentile ETE for general population
c. Tables should be provided for the 90 and 100 percent ETEs similar to Table 4-3, "ETEs for Staged Evacuation Keyhole," of NUREG/CR-7002.	Yes	Tables 7-3 and 7-4
d. ETEs should be provided for the 100 percent evacuation of special facilities, transit dependent, and school populations.	Yes	Sections 8.4 through 8.6 Tables 8-7 through 8-9, 8-11 through 8-19
5.0 Other Considerations		
5.1 Development of Traffic Control Plans		
a. Information that responsible authorities have approved the traffic control plan used in the analysis should be provided.	Yes	Section 9, Appendix G.

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
b. A discussion of adjustments or additions to the traffic control plan that affect the ETE should be provided.	Yes	Sections 2, 9, Appendix G.
5.2 Enhancements in Evacuation Time		
a. The results of assessments for improvement of evacuation time should be provided.	Yes	Appendix M
b. A statement or discussion regarding presentation of enhancements to local authorities should be provided.	Yes	A draft ETE report was provided to state and county agencies for review. Comments provided by agencies were incorporated into the final report.
5.3 State and Local Review		
a. A list of agencies contacted and the extent of interaction with these agencies should be discussed.	Yes	Table 1-1
b. Information should be provided on any unresolved issues that may affect the ETE.	Yes	No unresolved issues after review by the offsite agencies.
5.4 Reviews and Updates		
a. A discussion of when an updated ETE analysis is required to be performed and submitted to the NRC.	Yes	Appendix M, Section M.3
5.5 Reception Centers and Temporary Relocation Centers		
a. A map of temporary relocation centers and reception centers should be provided.	Yes	Figure 10-1
b. If return trips are required, assumptions used to estimate return times for buses should be provided.	Yes	Section 8.4 discusses a multi-wave evacuation procedure. Figure 8-1

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. It should be clearly stated if it is assumed that passengers are left at the reception center and are taken by separate buses to a temporary relocation center.	Yes	Section 2.3 – Assumption 5 Section 10

Technical Reviewer _____ Date _____

Supervisory Review _____ Date _____