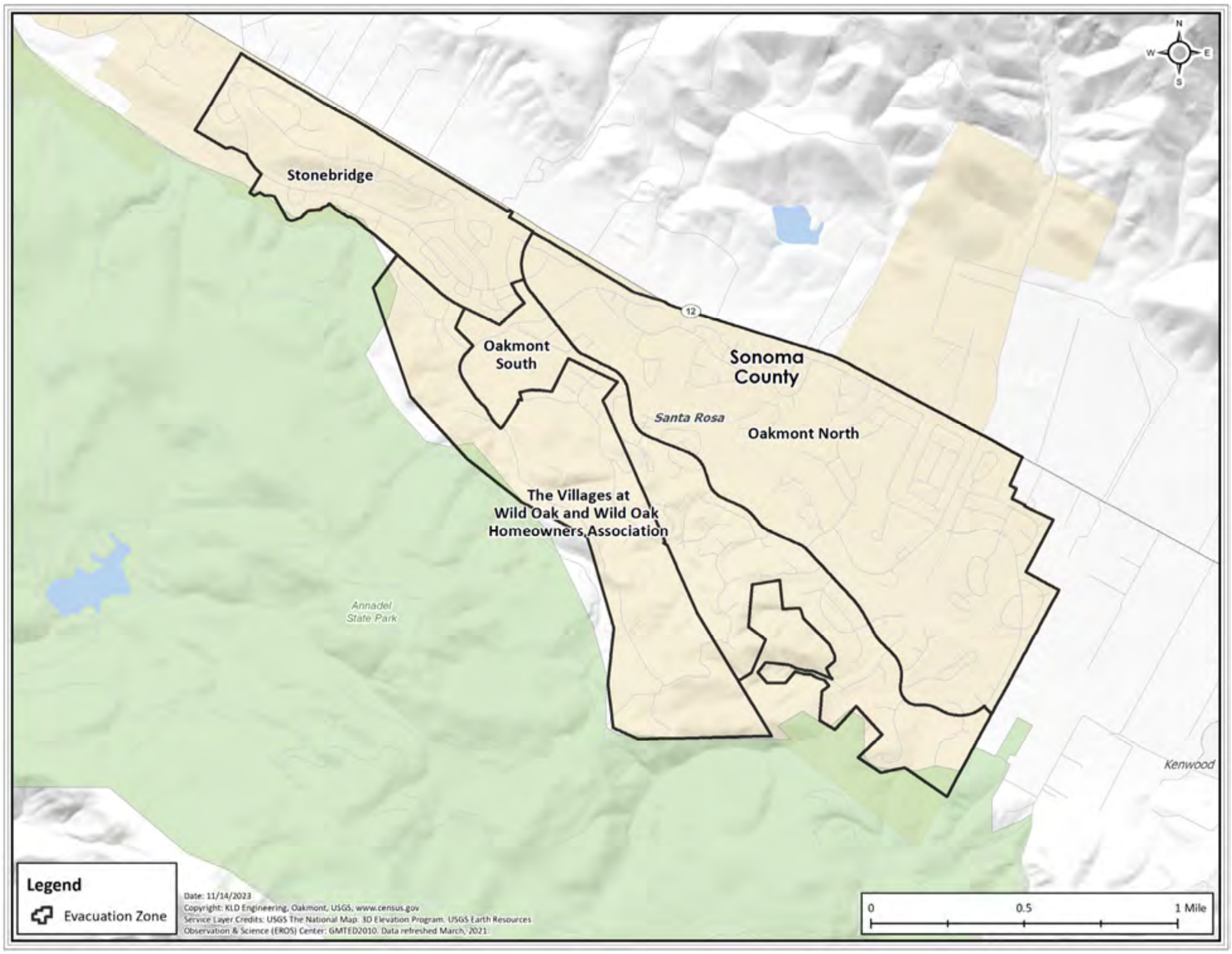
Oakmont Village Association &
Wild Oak Community

Wildfire Evacuation Study



Work performed for the Oakmont Village Association & the Wild Oak Community, by:

KLD Engineering, P.C.
1601 Veterans Memorial Highway, Suite 340
Islandia, NY 11749
E-mail: kweinisch@kldcompanies.com

December 18, 2023 **Final Report, Rev. 0** **KLD TR – 1382**

Table of Contents

1 INTRODUCTION 1-1
1.1 Location of the Study Area 1-1
1.2 Overview of the ETE Process 1-1
1.3 Data Estimates 1-3
1.4 Study Methodological Assumptions 1-4
1.5 Study Assumptions 1-5
2 DEMAND ESTIMATION 2-1
2.1 Permanent Residents 2-1
2.2 Shadow Population 2-3
2.2.1 Los Guilicos 2-4
2.3 Visitors 2-4
2.4 Employees 2-5
2.5 Oakmont Gardens 2-6
2.6 External Traffic 2-6
2.7 Background Traffic 2-6
2.8 Summary of Demand 2-7
3 ESTIMATION OF HIGHWAY CAPACITY 3-1
3.1 Capacity Estimations on Approaches to Intersections 3-2
3.2 Capacity Estimation along Sections of Highway 3-4
3.3 Application to the Oakmont Village Association & Wild Oak Community 3-6
3.3.1 Two-Lane Roads 3-6
3.3.2 Multilane Highway 3-6
3.3.3 Intersections 3-7
3.4 Simulation and Capacity Estimation 3-7
3.5 Boundary Conditions 3-8
4 ESTIMATION OF TRIP GENERATION TIME 4-1
4.1 Background 4-1
4.2 Fundamental Considerations 4-2
4.3 Estimated Time Distributions of Activities Preceding Event 5 (Departure) 4-3
4.4 Calculation of Trip Generation Time Distribution 4-4
4.4.1 Statistical Outliers 4-5
5 EVACUATION TIME ESTIMATES 5-1
5.1 Evacuation Cases 5-1
5.2 Patterns of Traffic Congestion during Evacuation 5-2
5.3 Evacuation Rates 5-4
5.4 General Population Evacuation Time Estimate Results 5-4
5.5 Effect of Direction of Wildfire Approach 5-5
5.5.1 Closure on Highway 12 Eastbound 5-6
5.5.2 Closure on Highway 12 Westbound 5-6
5.6 Oakmont Gardens Evacuation Time Estimate Results 5-7

List of Appendices

A. DEMOGRAPHIC SURVEY A-1
A.1 Introduction A-1
A.2 Survey Instrument and Sampling Plan A-1
A.3 Survey Results A-1
A.3.1 Household Demographic Results A-2
A.3.2 Evacuation Response A-3
A.3.3 Emergency Communications A-5
A.3.4 Informational Purposes Only A-6
B. EVACUATION SENSITIVITY STUDIES B-1
B.1 No Notice Evacuation B-1
B.2 Effect of Reducing the Evacuation Demand – One Vehicle per Household B-1
B.3 Time to Establish Access Control B-2
B.4 Sequential Evacuation B-2
B.5 Traffic Management Plan B-3
B.6 Channel Drive B-4
B.7 New Residential Developments B-4
B.8 Contraflow Along Highway 12 .... B-5

List of Figures

Figure 1-1. Study Area Location 1-10
Figure 2-1. Evacuation Zone Boundaries 2-12
Figure 2-2. Census Boundaries within the Study Area 2-13
Figure 2-3. Shadow Region 2-14
Figure 2-4. Visitor Attractions and Retirement Community within the Study Area 2-15
Figure 2-5. Contractual Workers within Oakmont and Wild Oak 2-16
Figure 3-1. Fundamental Diagrams 3-9
Figure 4-1. Events and Activities Preceding the Evacuation Trip 4-11
Figure 4-2. Time Distributions for Evacuation Mobilization Activities 4-12
Figure 4-3. Comparison of Data Distribution and Normal Distribution 4-13
Figure 4-4. Comparison of Trip Generation Distributions 4-14
Figure 5-1. Congestion Patterns at 30 Minutes after the Evacuation Order 5-11
Figure 5-2. Congestion Patterns at 1 Hour after the Evacuation Order 5-12
Figure 5-3. Congestion Patterns at 2 Hours after the Evacuation Order 5-13
Figure 5-4. Congestion Patterns at 3 Hours and 30 Minutes after the Evacuation Order 5-14
Figure 5-5. Congestion Patterns at 4 Hours and 30 Minutes after the Evacuation Order 5-15
Figure 5-6. Evacuation Time Estimates - Scenario 1 5-16
Figure 5-7. Evacuation Time Estimates - Scenario 2 5-16
Figure 5-8. Evacuation Time Estimates - Scenario 3 5-17
Figure 5-9. Evacuation Time Estimates - Scenario 4 5-17
Figure 5-10. Evacuation Time Estimates – Forced Evacuation Direction 5-18
Figure A-1. Rideshare with Neighbor/Friend A-8
Figure A-2. Household Size in the Study Area A-8
Figure A-3. Commuters Per Household A-9
Figure A-4. Number of Days Commuting Per Week A-9
Figure A-5. Travel Mode to Work A-10
Figure A-6. Households in Evacuation Zones A-10
Figure A-7. Number of Evacuating Vehicles Per Household A-11
Figure A-8. Evacuation Vehicle Usage– 1 to 4 Person Households A-11
Figure A-9. Functional Vehicle Transportation Needs A-12
Figure A-10. Evacuation Without a Personal Vehicle A-12
Figure A-11. Shelter Locations A-13
Figure A-12. Number of Seasonal Residents Per Household A-13
Figure A-13. Time of Year Seasonal Residents Live in the Community A-14
Figure A-14. Recreational Vehicles During an Evacuation A-14
Figure A-15. Recreational Vehicle Parking A-15
Figure A-16. Recreational Vehicle Parking During a Red Flag Warning A-15
Figure A-17. Households Evacuating with Pets/Animals A-16
Figure A-18. Contractual Workers' Vehicles at the Household A-16
Figure A-19. Contractual Workers Time Spent at the Household A-17
Figure A-20. Cell Phone Coverage A-17
Figure A-21. Emergency Alert Registration A-18
Figure A-22. Emergency Alert Notifications A-18
Figure A-23. Notification of a Neighbor/Friend A-19

Figure A-24. Method to Notify a Neighbor/Friend A-19
Figure A-25. Meet Your Neighbors Membership A-20
Figure A-26. Neighborhood Leaders A-20
Figure A-27. Oakmont Emergency Preparedness Committee Zone Communicator A-21
Figure A-28. Local News Sources A-21
Figure A-29. Glass Fire Departure Time A-22
Figure A-30. Glass Fire Evacuation Time A-22
Figure B-1. Evacuation Time Estimates – Access Control Establish Time Sensitivity Study B-9

List of Tables

Table 1-1. Stakeholder Interaction 1-7
Table 1-2. Evacuation Scenario Definitions 1-7
Table 1-3. Evacuation Regions 1-8
Table 1-4. Notification Distribution 1-9
Table 2-1. County Population Change from April 1, 2020 to July 1, 2022 2-8
Table 2-2. Municipality Population Change from April 1, 2020 to July 1, 2022 2-8
Table 2-3. Permanent Resident Population by Evacuation Zone 2-8
Table 2-4. Permanent Resident Population and Vehicles by Evacuation Zone 2-8
Table 2-5. Visitor Attractions within the Study Area 2-9
Table 2-6. Employees and Employee Vehicles by Evacuation Zone 2-9
Table 2-7. Study Area External Traffic 2-10
Table 2-8. Summary of Population Demand 2-11
Table 2-9. Summary of Vehicle Demand 2-11
Table 3-1. Level of Service Definitions 3-9
Table 4-1. Event Sequence for Evacuation Activities 4-8
Table 4-2. Time Distribution for Notifying the Public 4-8
Table 4-3. Time Distribution for Employees to Prepare to Leave Work 4-8
Table 4-4. Time Distribution for Commuters to Travel Home 4-9
Table 4-5. Time Distribution for Population to Prepare to Leave Home 4-9
Table 4-6. Mapping Distributions to Events 4-9
Table 4-7. Description of the Distributions 4-10
Table 4-8. Trip Generation Histograms for Oakmont and Wild Oak Populations 4-10
Table 5-1. Percent of Population Groups Evacuating for Various Scenarios 5-8
Table 5-2. Vehicle Estimates by Scenario 5-8
Table 5-3. Time to Clear 90% of Oakmont and Wild Oak 5-9
Table 5-4. Time to Clear 100% of Oakmont and Wild Oak 5-9
Table 5-5. Evacuation Time Estimates for Direction of Wildfire Approach 5-10
Table 5-6. Oakmont Gardens Evacuation Time Estimates 5-10
Table A-1. Completed Surveys by Evacuation Zone A-7
Table B-1. Evacuation Time Estimates for No Notice Evacuation Sensitivity Study B-7
Table B-2. Evacuation Time Estimates for Reduction in Demand B-7
Table B-3. Evacuation Time Estimates for Access Control Establishment Time Sensitivity Study B-7
Table B-4. Evacuation Time Estimates for Sequential Evacuation Sensitivity Study B-7
Table B-5. Evacuation Time Estimates for Additional Sensitivity Studies B-7
Table B-6. Evacuation Time Estimates for Contraflow B-8

EXECUTIVE SUMMARY

Wildfires, and the impacts thereof, are a critical issue facing the world. One of the most critical concerns during a wildfire is the availability of transportation services. Under normal circumstances, the transportation system provides capacity for evacuation and allows for emergency responders to enter an area at risk. During a wildfire, however, the transportation system can become inadequate due to unsafe roadway conditions, abandoned vehicles blocking the roadway, and/or traffic congestion. Due to the proximity of Oakmont and Wild Oak to natural and undeveloped lands and the recent occurrence of wildfires, Oakmont and Wild Oak residents are concerned with the vulnerability of the village. This study identifies congestion patterns, provides ***Evacuation Time Estimates (ETE)*** for a combination of circumstances, including time of day, day of week, season, and weather/roadway conditions and analyzes "what-if" scenarios for a potential evacuation of Oakmont and Wild Oak. The objective of this study is to estimate evacuation times and test different tactics for reducing evacuation time so as to build a robust emergency preparedness and education plan to protect public health and safety in Oakmont and Wild Oak in the event of a wildfire emergency.

Oakmont and Wild Oak are located within the City of Santa Rosa in Sonoma County, California. Oakmont and Wild Oak are located approximately 7 miles east of downtown Santa Rosa, CA and 60 miles west of Sacramento, CA. According to the Oakmont Village Association, there are 5,048 permanent residents in Oakmont and Wild Oak (4,540 Oakmont Village Association Residents, 140 Oakmont Gardens Residents, 106 Wild Oak residents, and 262 Wild Oaks Homeowners Association residents). These communities are divided into four[1] evacuation zones. Figure 2-1 is a map of the evacuation zones which comprise Oakmont and Wild Oak.

Oakmont and Wild Oak have two ingress/egress routes that give residents access to Highway 12: Oakmont Drive and Pythian Road. The key finding of this study is that the available roadway supply (evacuation routes and roadway network) is not sufficient to service the evacuation demand (number of evacuating vehicles) within the community/village in a timely fashion. Under normal circumstances, there are approximately 4,000 resident vehicles that leave Oakmont and Wild Oak and approximately 5,244 external traffic vehicles that utilize Highway 12 (see Section 2). Since both egress routes out of the village give access to is Highway 12 and the traffic along Highway 12 is substantial, an evacuation of these communities is delayed significantly. Figure B-1 displays the level of congestion present within Oakmont and Wild Oak when the access control establish time decreases or increases from the 120-minute base assumption. When the access control establish time is decreased the number of external traffic vehicles traveling along Highway 12 also decreases providing Oakmont and Wild Oak resident vehicles additional capacity along Highway 12 to evacuate. Therefore, adding additional capacity or egress routes onto an already congested Highway 12 does not have significant impacts on the evacuation of these communities; see Section 5 and Appendix B for further discussion.

[1] The City of Santa Rosa has Oakmont Village divided into three zones, Oakmont North, Oakmont South, and Stonebridge. For the purposes of this study, Oakmont South is divided even further to represent the Wild Oak Community.

Reducing the vehicular demand within Oakmont and Wild Oak, by recommending one vehicle per household be used to evacuate for example, however, can decrease the 90th percentile ETE by 55 minutes (see Appendix B, sub-section B.2).

Critical Findings

- An online demographic survey was conducted of the people living and working in Oakmont and Wild Oak; 1,104 households responded to the survey. The survey gathered demographic information (average household size, vehicle ownership, etc.), behavioral responses (would evacuees listen to advisories issued by local officials, and time to complete mobilization activities. The responses to the survey indicated it would take at most 4 hours and 45 minutes to mobilize and evacuate all the population within Oakmont and Wild Oak. See Section 4 and Appendix A.
- The 90th percentile ETE range from 2 hours to 4 hours and 25 minutes, see Section 5 and Table 5-3.
- The 100th percentile ETE are dictated by the time needed to mobilize rather than by traffic congestion, see Section 5 and Table 5-4.
- Depending on the origin of the wildfire, evacuees from Oakmont and Wild Oak can be forced either towards Santa Rosa (westbound) or Kenwood (eastbound). Forcing evacuees east or westbound (or losing the ability to go westbound or eastbound, respectively) increases the 90th and 100th percentile ETE significantly. See Section 5, sub-section 5.5.
- Reducing the mobilization time (or giving too little notice) creates congestion within the communities such that ETE are dictated by traffic congestion rather than mobilization time. See Appendix B, sub-section B.1.
- Reducing the evacuation demand (number of vehicles) by recommending each household only use one vehicle to evacuate reduces the 90th percentile ETE significantly. See Appendix B, sub-section B.2.
- Assuming authorities are able to stop through vehicles utilizing Highway 12 (using access control), the longer it takes to establish access control along Highway 12, the longer the ETE will be. Reducing through traffic on Highway 12 has the largest benefit to the evacuation of Oakmont and Wild Oak. See Figure B-1 and Appendix B, sub-section B.3.
- A sequential, or staged, evacuation of Wild Oak, Stonebridge, Oakmont South and Oakmont North can reduce the 90th percentile ETE for Wild Oak by 45 minutes. See Appendix B, sub-section B.4.
- A sensitivity study was conducted to determine whether implementing a Traffic Management Plan (TMP) with police officers at critical intersections – Traffic Control Points (TCPs) – would impact ETE. The study found that the TMP would not impact ETE as the congestion along Highway 12 is too significant. See Appendix B, sub-section B.5.

- Having an alternative egress road (Channel Drive) that does not connect onto Highway 12 reduces the 90th percentile ETE by one (1) hour and 5 minutes. See Appendix B, sub-section B.6.
- A sensitivity study was conducted to determine the impacts to ETE when adding the new residential developments at Elnoka and Mahonia Glen. This will also include the construction of a new Emergency Vehicle Access (EVA) Road, south of the Elnoka development, that connects into Stonebridge Road. The study found that the 90th percentile ETE decreases by 55 minutes. This is due to the EVA Road which provides access to Melita Road (a good alternate egress point for Oakmont residents.) See Appendix B, sub-section B.7.
- A sensitivity study was conducted wherein the inbound lanes of Highway 12 are used as additional outbound evacuation lanes (contraflow) westbound towards Santa Rosa. When compared to forcing evacuation towards Santa Rose without contraflow the 90th and 100th percentile ETE is decreased by 15 minutes – not a significant change. See Appendix B, sub-section B.8.

Recommendations

- A steering committee comprised of the various stakeholders in Oakmont Village Association and Wild Oak Community should be established to ensure that the critical findings and recommendations of this study are considered and implemented in emergency preparedness and education plans.
- Develop and distribute public information pamphlets to provide important information to the public to help them prepare for a wildfire emergency. Public information should include:
    - Prepare home in advance, have a bag ready to go
    - Know where to reunite with family
    - Know where to pick-up school children when schools are in session[2]
    - Locations of reception centers (i.e., shelters)
    - Evacuation routes, both west and east of Oakmont
    - Having a vehicle available to evacuate and parking vehicles facing the nearest evacuation route
    - Know how to open your garage door when the electricity has been shut off
    - Know which Evacuation Zone you live in.
    - Evacuate only when advised to do so. Voluntary evacuation or evacuation of individuals not within the declared evacuation zone could impede mandatory evacuation traffic flow.
    - Which emergency alert systems are available and how to register/opt-in to those systems

[2] Applicable for the Wild Oak Community

    - Recommend only using one vehicle per household to evacuate, by educating the benefit of using one vehicle per household.

- Critical facilities (e.g., Oakmont Gardens) should maintain evacuation plans specific to the facility and periodically review it with the Oakmont Village Association leadership.
- Provide clear and concise messaging during a wildfire evacuation order or warning to ensure that only those areas at risk will evacuate. If Oakmont North is the only area at risk, messaging should be clear that only Oakmont North should evacuate. Voluntary evacuation outside of the area at risk could impeded those within the area at risk.
- Develop a registry for non-institutionalized mobility impaired and persons with access and functional needs, including those who do not own or have access to a private vehicle (the "transit dependent population") and which entity (i.e., Oakmont Village Association, Meet Your Neighbor (MYN) group or other local entity) will create and maintain.
- Identify evacuation zones which can be clearly communicated to the public.
- Identify if there are dynamic message signs/variable message signs available to communicate important information to the public during an emergency, identify where these signs are, who controls the signs and how to mobilize the signs during an emergency.
- Identify the emergency officers in charge of establishing access control along Highway 12 to divert traffic away from Oakmont and Wild Oak. Diverting external traffic vehicles away from Oakmont and Wild Oak as quickly as possible plays a key role in the evacuation of Oakmont and Wild Oak residents.
- Oakmont and Wild Oak need at least 4 hours and 45 minutes to mobilize and evacuate. Less notice will result in more congestion and longer evacuation times.
- Every effort should be made to allow vehicles to go both eastbound and westbound along Highway 12. Any traffic disruptions in either direction, forcing evacuees to only go one way, will significantly delay the evacuation of Oakmont and Wild Oak.
- If possible, Channel Drive should be open to evacuees.
- A staged evacuation, implementing TCPs or implementing contraflow is not recommended as the benefits to evacuation are minimal.

Table 5-3. Time to Clear 90% of Oakmont and Wild Oak

		Summer			
Scenario:		**(1)**	**(2)**	**(3)**	**(4)**
Region	**Evacuation Zones**	**Midweek**		**Weekend**	
		Midday	**Evening**	**Midday**	**Evening**
R01	**ON**	4:05	2:20	3:40	2:20
R02	**OS**	2:55	2:00	2:30	2:00
R03	**SB**	3:45	2:00	3:30	2:00
R04	**WO**	3:00	2:00	2:30	2:00
R05	**OS/WO**	3:05	2:00	2:45	2:00
R06	**SB/WO**	3:45	2:00	3:35	2:00
R07	**OS/WO/SB**	3:50	2:00	3:40	2:00
R08	**ON/SB**	4:05	2:20	3:45	2:20
R09	**ON/SB**	4:20	2:25	3:50	2:25
R10	**ON/OS/SB**	4:15	2:30	3:55	2:30
R11	**All**	4:25	2:30	4:00	2:30

Table 5-4. Time to Clear 100% of Oakmont and Wild Oak

		Summer			
Scenario:		**(1)**	**(2)**	**(3)**	**(4)**
Region	**Evacuation Zones**	**Midweek**		**Weekend**	
		Midday	**Evening**	**Midday**	**Evening**
R01	**ON**	4:45	4:45	4:45	4:45
R02	**OS**	4:45	4:45	4:45	4:45
R03	**SB**	4:45	4:45	4:45	4:45
R04	**WO**	4:45	4:45	4:45	4:45
R05	**OS/WO**	4:45	4:45	4:45	4:45
R06	**SB/WO**	4:45	4:45	4:45	4:45
R07	**OS/WO/SB**	4:45	4:45	4:45	4:45
R08	**ON/SB**	4:45	4:45	4:45	4:45
R09	**ON/SB**	4:45	4:45	4:45	4:45
R10	**ON/OS/SB**	4:45	4:45	4:45	4:45
R11	**All**	4:45	4:45	4:45	4:45

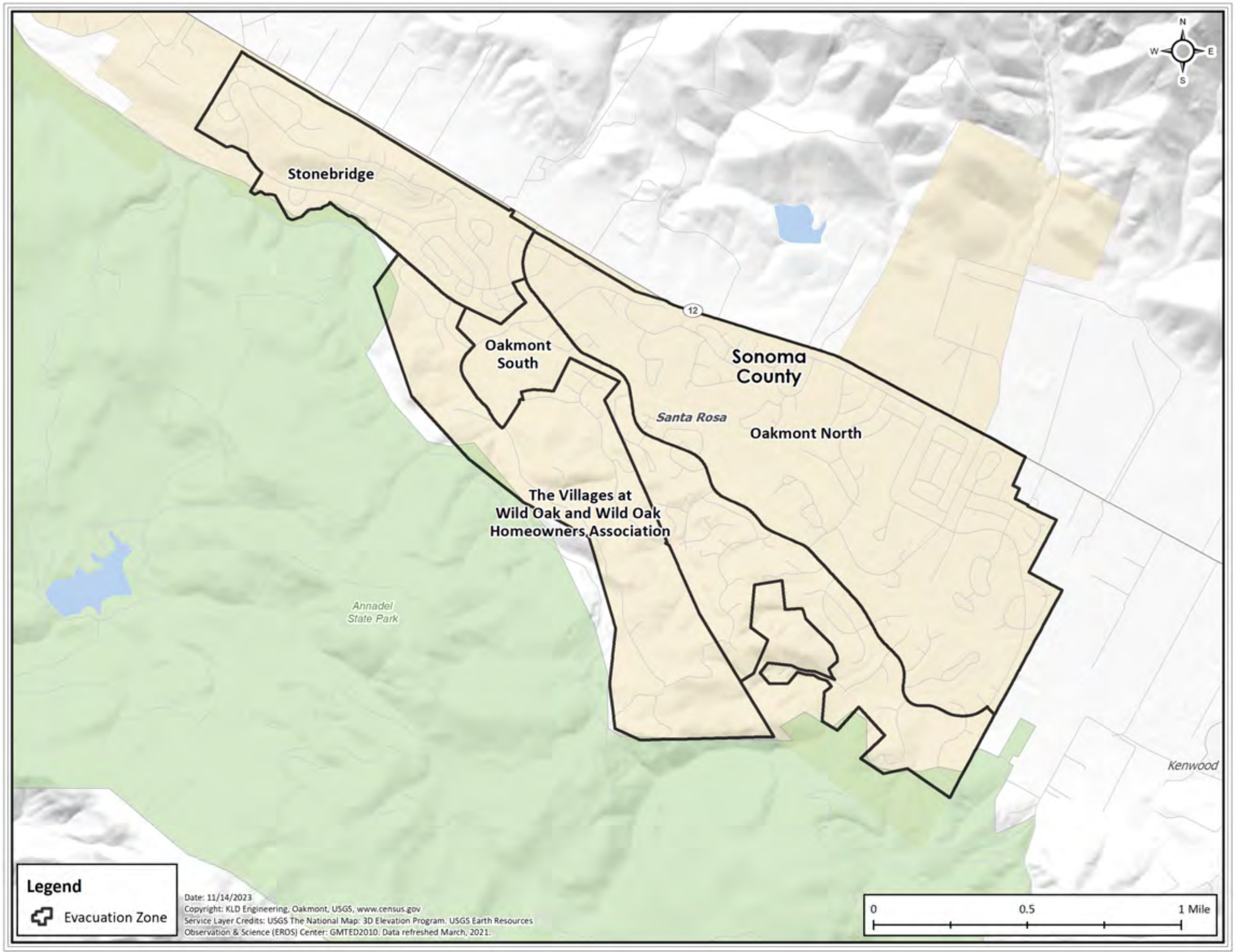


Figure 2-1. Evacuation Zone Boundaries

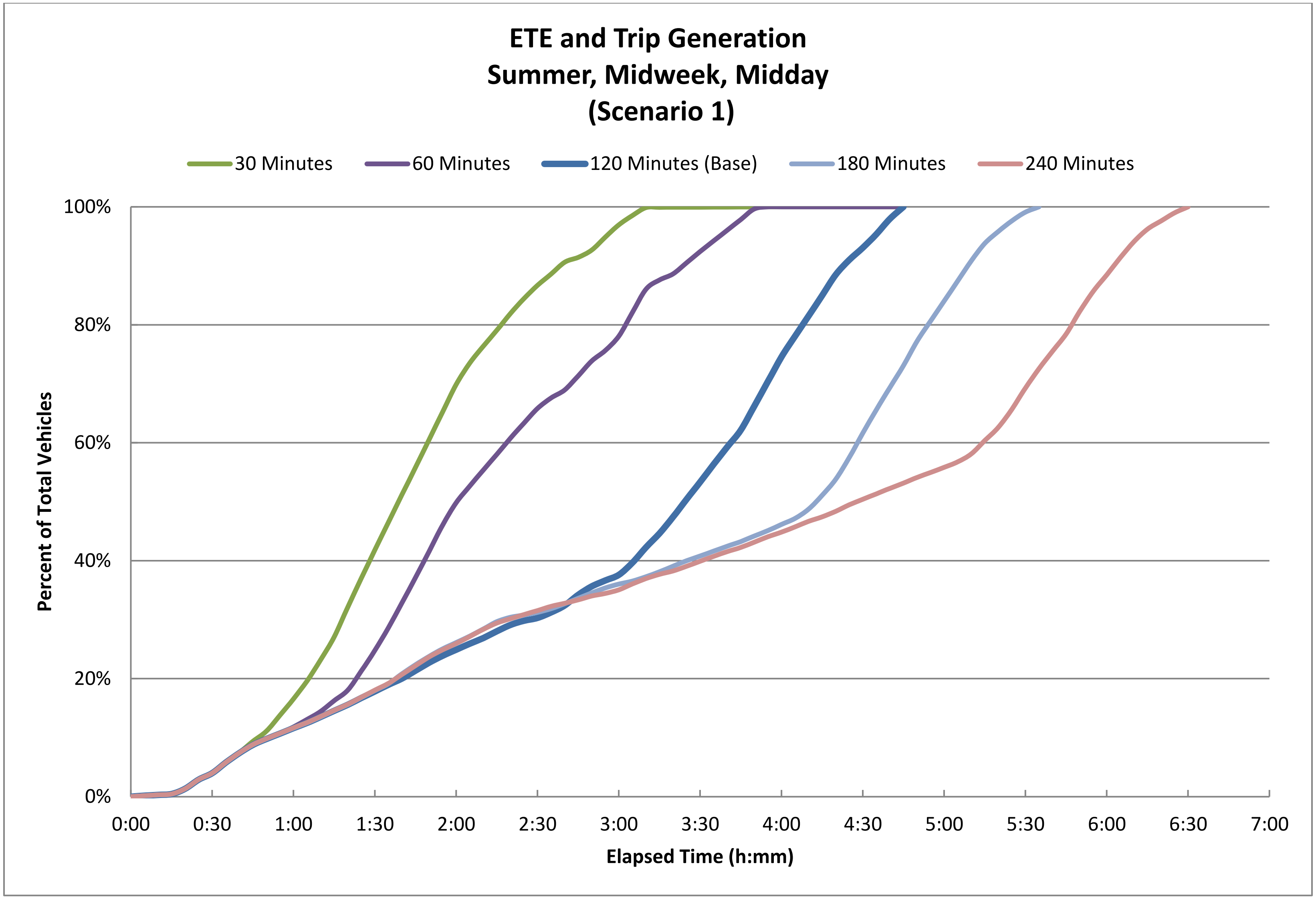


Figure B-1. Evacuation Time Estimates - Access Control Establish Time Sensitivity Study

1 INTRODUCTION

This report describes the analyses undertaken to examine anticipated traffic conditions and evacuation time estimates (ETE) associated with various evacuation responses and alternative management strategies that could be used by Oakmont and Wild Oak. This study will inform the Oakmont Village Association and the Wild Oak Community emergency planning.

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.

1.1 Location of the Study Area

Oakmont and Wild Oak are located within the City of Santa Rosa in Sonoma County, California. Oakmont and Wild Oak are located approximately 7 miles east of downtown Santa Rosa, CA and 60 miles west of Sacramento, CA. Figure 1-1 displays the area surrounding the community. This map identifies the cities in the area and the major roadways.

1.2 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 scope of work in discussions with representatives from the Oakmont Village Association and the Wild Oak Community.
    b. Attended meetings with local stakeholders to define methodology.
    c. Conducted a detailed field survey of the highway system and of area traffic conditions within Oakmont and Wild Oak and the Shadow Region[1].
    d. Obtained demographic data from Oakmont Village Association and the 2020 Census (See Section 2.1) extrapolated to September 2023 using annual growth rates that are computed from the 2022 Census population estimates.
    e. Conducted a demographic survey of Oakmont and Wild Oak residents via an online platform, supplemented with paper surveys. . Responses were collected from July 21st to August 23rd, 2023.
    f. Obtained data (to the extent available) for Oakmont Gardens and of visitors/tourists, service providers, and transportation resources available. The majority of this data was provided by the Oakmont Village Association and the Wild Oak Community and internet searches where no data was received.

[1] An evacuation in the shadow region occurs when residents evacuate from areas beyond the officially designated evacuation area (evacuation zones). This phenomenon can cause unwanted congestion and increase clearance times for people in the areas of actual risk.

2. Estimated distribution of trip generation times representing the time required by various population groups (permanent residents, employees, and tourists) to prepare (mobilize) for the evacuation trip. These estimates were based upon the demographic survey results and notification time assumptions (see Section 4 and Appendix A).
3. Defined Evacuation Scenarios. These scenarios reflect the variation in demand, in trip generation distribution and in highway capacities, associated with different days of week and time of day. The scenarios selected were based on the peak wildfire season (summer). See Table 1-2.
4. Estimated demand for transit services for persons at Oakmont Gardens.
5. Prepared the input streams for the DYNEV II[2] system which computes ETE.
    a. Estimated the evacuation traffic demand, based on the available information derived from Census data, from data provided by local stakeholders, and from the demographic survey.
    b. Created the link-node representation of the evacuation network, which was used as the basis for the computer analysis that calculates the ETE.
    c. Applied the procedures specified in the 2022 Highway Capacity Manual (HCM[3]) to the data acquired during the field survey, to estimate the capacity of all roadway segments comprising the evacuation routes.
    d. Calculated the evacuating traffic demand 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 wildfire.
6. Executed the DYNEV II model to determine optimal evacuation routing and compute ETE for all residents, visitors and employees ("general population") with access to private vehicles. Generated a complete set of ETE for all specified Scenarios.
7. Simulated bounding cases of wildfire scenarios wherein all vehicles are forced eastbound or westbound on Highway 12.
8. Documented ETE results.
9. Tested what-if scenarios to evaluate alternative management strategies that could be used in response to wildfire situations.

[2] A traffic/evacuation simulation model (Dynamic Evacuation Simulation Model, or DYNEV-II) is used to compute ETE. The DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment. The DYNEV model was developed by KLD under contract with the Federal Emergency Management Agency (FEMA) and was independently validated by the U.S. Nuclear Regulatory Commission (NRC).

[3] Highway Capacity Manual (HCM 2022), Transportation Research Board, National Research Council, 2022.

1.3 Data Estimates

1. The permanent resident population was based the data provided by Oakmont Village Association and the 2020 U.S. Census population from the Census Bureau website[4] extrapolated to September 2023 using annual growth rates that are computed from the 2022 Census population estimates. A methodology, referred to as the "area ratio method," was employed to estimate the population within portions of census blocks that are divided by the Evacuation Zone boundaries. It is assumed that the population is evenly distributed across a census block in order to employ the area ratio method.
2. The existing Santa Rosa Evacuation Zones were used to identify regions, with one region split to separate Oakmont and Wild Oak.
3. Employment data was provided by the Oakmont Village Association. This data was used to estimate the number of employees commuting into the study area.
4. Employee vehicle occupancies were based on the results of the demographic survey. In this study, 1.03 employees per vehicle were used in the study. In addition, it is assumed there are two people per carpool, on average.
5. Approximately 52% of the population within the Shadow Region, and within the Evacuation Zones not advised to evacuate, will voluntarily evacuate. This is based on the results of the demographic survey given within the study area. See Appendix A for further details.
6. The relationship between permanent resident population and evacuating vehicles were based on the Census and the results of the demographic survey. Based upon the results of the survey, there are 1.35 evacuating vehicles per household. This value was multiplied by the number of occupied households (adjusted for group homes) within each Census block to compute the number of evacuating vehicles within the Evacuation Zones.
7. Population estimates at tourist facilities (golf course, restaurant, wineries) and Oakmont Gardens were based on the data received from the Oakmont Village Association and Wild Oak Community, supplemented by internet searches and aerial imagery of parking spaces where data was missing.
8. Employment is assumed to be reduced slightly (96%) for summer scenarios. This was based on the estimation that 50% of the employees commuting into the Evacuation Zones were on vacation for a week during the approximate 12 weeks of summer. It was further estimated that those taking vacation were uniformly dispersed throughout the summer

[4] www.census.gov

with approximately 4% of employees vacationing each week. It was further estimated that only 10% of the employees were working in the evenings and during the weekends.

1.4 Study Methodological Assumptions

1. One hundred percent (100%) of the people told to evacuate, will do so.
2. Evacuees drive safely, travel away from the hazard to the extent practicable given the highway network, and obey all control devices and traffic guides.
3. Vehicles may travel through the study area (external-external trips) at the start of a hazard. After the advisory to evacuate is announced, these pass-through travelers also must evacuate. External traffic vehicles primarily utilize Highway 12 to pass through the area. Dynamic and variable message signs are assumed to be strategically positioned outside of the hazard area at logical diversion points to attempt to divert traffic away from the hazardous area within Oakmont and Wild Oak. As such, it is assumed this pass-through (external) traffic ceases 2 hours after the advisory to evacuate to allow police to mobilize personnel and equipment to block the roadways and to allow time for commuters to return home and unite with family. Average Annual Daily Traffic (AADT) along Highway 12 was based on data obtained from Caltrans.
4. The Evacuation Zones and Shadow Region identified in Figure 1-1 serve as the study area.
5. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating hazard that requires immediate evacuation (no red flag announcement/evacuation warning provided), and included the following:
    a. Evacuation order is announced coincident with local emergency alerts (CivicReady, Nixle, SoCo Alert, SRFD website, NOAA WX radio, registered landline, social media, local news and similar communication systems).
    b. As no red flag announcement or warning is provided, the mobilization of the general population commences within 15 minutes after the evacuation order.
    c. ETE are measured relative to the evacuation order.
6. Evacuation movements (paths of travel) are generally outbound relative to the hazard to the extent permitted by the highway network. All major evacuation routes are used in the analysis.
7. Visitors/tourists are assumed to be at their peak during weekends in the summer. Weekdays have less visitors/tourists than weekends.
8. External Traffic is estimated to be reduced by 60% during evening scenarios (Scenarios 2 and 4).

9. Two different hazard scenarios were considered. The ‘base case’ scenario allowed evacuees to travel in any direction, meaning all roadways were viable evacuation routes. The first hazard scenario was a wildfire event that forced evacuees to evacuate towards Santa Rosa, meaning roadways going east were closed. The second hazard scenario was a wildfire event that forced evacuees towards Sonoma, meaning roadways going west were closed.
10. Trip generation time (also known as mobilization time, or the time required by evacuees to prepare for the evacuation) is based upon the results of the demographic survey.
11. Based on the results of the demographic survey, 16.9% of the households in the evacuation zones have at least 1 commuter; 19.3% of households await the return of household members before beginning their evacuation trip, based on the demographic survey results. Therefore, 3.3% (19.3% x 16.9% = 3.3%) of households have commuters and will await the return of those commuters prior to beginning their evacuation trip. Until access control is established, nothing will prevent these commuters from returning to their households.
12. Regions that are considered are defined in Table 1-3.
13. This study does not assume that roadways are empty at the start of the first time period. Rather, there is an initialization period (often referred to as “fill time in traffic simulation) wherein the traffic volumes from the first time period were loaded onto roadways in the study area. The amount of initialization/fill traffic that is loaded on the roadways in the study area at the start of the first time period depends on the scenario and the region being evacuated.

1.5 Study Assumptions

1. Table 1-4 displays the notification time distribution (the time required for evacuees to receive notification of an evacuation) that is assumed for the study.
2. Bus needs are computed for the evacuation of residents at Oakmont Gardens (185 residents max; none of which require skilled nursing).

3. Transit vehicle capacities:
    a. It is assumed that 4 buses, 1 minibus and 1 van are sufficient to evacuate 60%[5] of Oakmont Gardens residents based on transportation needs during the Glass fire.
4. The maximum bus speed is assumed to be 45 miles per hour in uncongested environments.
5. Transit vehicles mobilization times:
    a. Due to the existing contract between Oakmont Gardens and a local transportation company, it is assumed that buses that evacuate Oakmont Gardens arrive within 45 minutes of the advisory to evacuate.
6. Transit Vehicle loading times:
    a. Buses for Oakmont Gardens are loaded in 40 minutes.
    b. Concurrent loading on multiple buses is assumed.
7. It is assumed that drivers for all transit vehicles were available.
8. It is assumed that Los Guilicos is evacuated.

[5] The remaining 40% of Oakmont Garden residents evacuate by car or with family from Oakmont.

Table 1-1. Stakeholder Interaction

Stakeholder	Type of Interaction				
	Attended meetings to define methodology and data requirements	Assisted in data collection	Advertised demographic survey to residents	Reviewed the demographic survey instrument	Reviewed and approved all project assumptions
Oakmont Village Association	X	X	X	X	X
Wild Oak Homeowners Association	X		X		

Table 1-2. Evacuation Scenario Definitions

Scenario	Season	Day of Week	Time of Day
1	Summer	Midweek	Midday
2	Summer	Midweek	Evening
3	Summer	Weekend	Midday
4	Summer	Weekend	Evening

Table 1-3. Evacuation Regions

Region	Zone	Evacuation Zones			
		Oakmont North	Oakmont South	Stonebridge	The Villages at Wild Oak and Wild Oak Homeowners Association
R01	Oakmont North (ON)	X			
R02	Oakmont South (OS)		X		
R03	Stonebridge (SB)			X	
R04	The Villages at Wild Oak and Wild Oak Homeowners Association (WO)				X
R05	OS/WO		X		X
R06	SB/WO			X	X
R07	OS/SB/WO		X	X	X
R08	ON/SB	X		X	
R09	ON/OS	X	X		
R10	ON/OS/SB	X	X	X	
R11	All	X	X	X	X
Zone(s) Not Evacuating				Zone(s) Evacuating	

Table 1-4. Notification Distribution

Elapsed Time (Minutes)	Cumulative Percent Notified	Elapsed Time (Minutes)	Cumulative Percent Notified
0	0%	35	59%
5	4%	40	75%
10	7%	45	90%
15	13%	50	93%
20	23%	55	97%
25	33%	60	100%
30	43%		

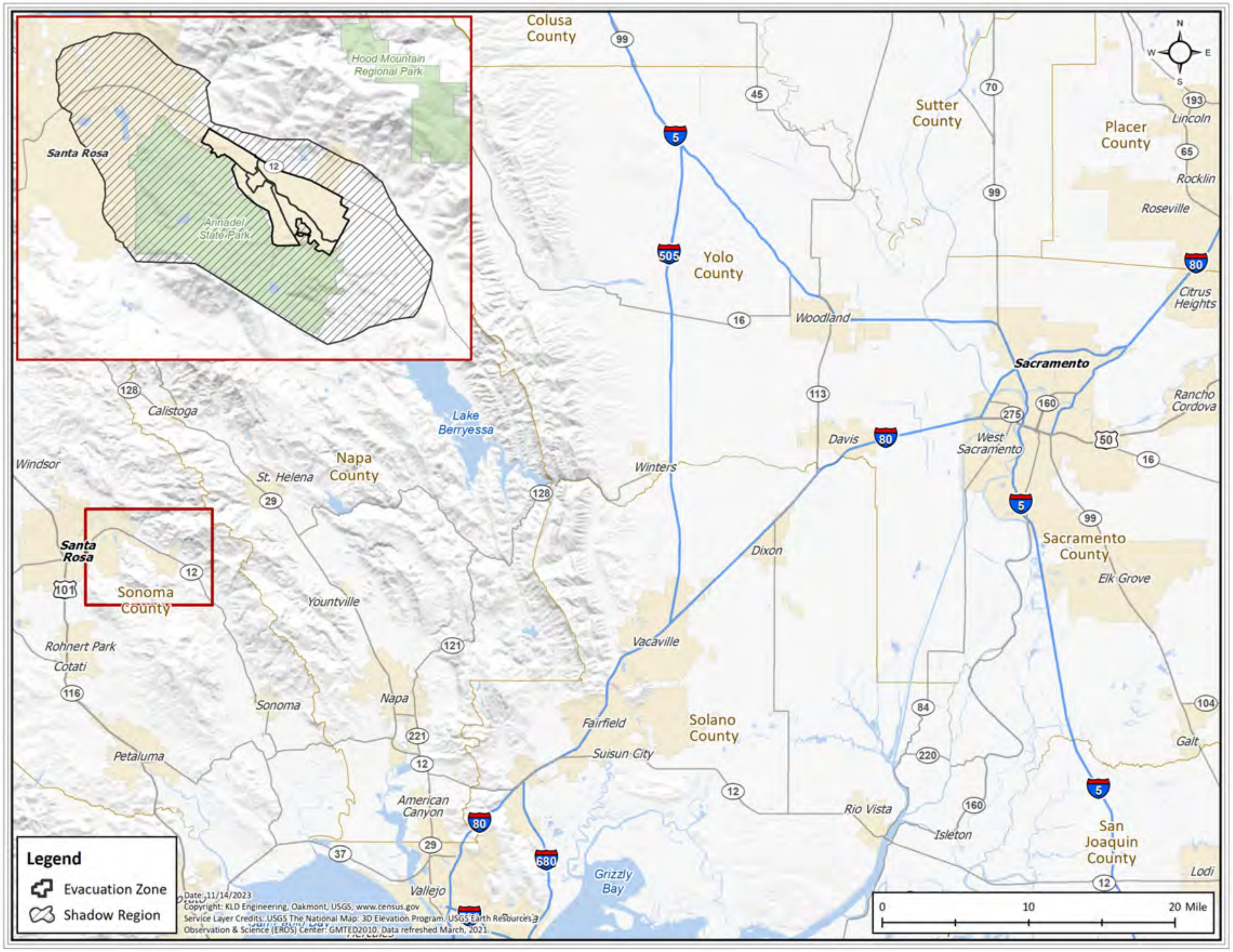


Figure 1-1. Study Area Location

2 DEMAND ESTIMATION

This section discusses the estimates of demand, expressed in terms of people and vehicles, which constitute a critical element in developing an evacuation plan. This section also documents the sources of data, as well as the methodology used to extract relevant data from these sources. These estimates consist of three components:

1. An estimate of population within Oakmont and Wild Oak, stratified into groups (e.g., resident, visitor, employee, special facilities, etc.).
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.

Our primary source of population data, the 2020 Census, is not adequate for directly estimating visitors who enter Oakmont and Wild Oak throughout the year. These non-residents (visitors) may dwell in Oakmont and Wild Oak 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 dines within Oakmont and Wild Oak could be counted as a resident, again as an employee and once again as a visitor.
- A visitor who visits a winery and spends time at a golf course, then dines at a restaurant could be counted three times.

Analysis of the population characteristics of the study area indicates the need to identify three distinct groups:

- Permanent residents – people who are year-round residents of Oakmont and Wild Oak.
- Visitors – people who reside outside of Oakmont and Wild Oak but enter the area for a specific purpose (visiting family/friends, recreation) and then leave the area.
- Employees – people who reside outside of Oakmont and Wild Oak and commute to work within Oakmont and Wild Oak on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups are presented for each evacuation zone in Oakmont and Wild Oak. The evacuation zone boundaries are shown in Figure 2-1.

2.1 Permanent Residents

The permanent resident population estimates are based upon the 2023 population data provided by Oakmont Village Association (OVA) and the 2020 Census data obtained from the U.S. Census Bureau[1]. The total 2023 resident population is available for Oakmont and Wild Oak. For areas

[1] www.census.gov

outside Oakmont and Wild Oak (Shadow Region, See Section 2.2), the 2020 Census data and the annual population estimates were used in absence of the 2023 resident population counts.

The permanent resident population is estimated by cutting the census block polygons by evacuation zone boundaries. A ratio of the original area of each census block and the updated area (after cutting) is multiplied by the total block population. This methodology (referred to as the "area ratio method") assumes that the population is evenly distributed across a census block. To estimate the distribution of the 2023 resident population within Oakmont and Wild Oak, the population within each census block (after applying "area ratio method") was adjusted proportionally based on the ratio of the total 2020 population to the total 2023 population.

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, 2020 with data from the census being published on September 16, 2021. 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 – 2022 data are released in 2023.

The 2020 Census population data from the Census Bureau website was extrapolated to 2023 using annual growth rates computed from the 2022 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 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, 2020 to July 1, 2022[3]. The population change and annual growth rate for the county and municipality in the Shadow Region are provided in Table 2-1 and Table 2-2, respectively. Figure 2-2 shows the county and municipality boundaries identified by the Census Bureau.

The permanent resident population, as per the 2020 Census, for the Shadow Region was projected to 2023 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 2020. The compound growth formula can be solved for g as shown in Equation 2.

Equation 1

$$(Compound\ Growth\ for\ X\ years): Population\ 202X = Population\ 2020\ (1 + g)^{x}$$

Equation 2

$$(Solving\ for\ the\ annual\ growth\ rate): g = (Population\ 202X \div Population\ 2020)^{1/x} - 1$$

[2] https://www.census.gov/quickfacts/fact/table/US/PST045222 The QuickFacts website provides statistics for all states, counties, cities and towns with a population of 5,000 or more.
[3] The schedule for release of Census data is provided on the Census website: http://www.census.gov/popest/schedule.html

The 2020 and 2022 population data provided in Table 2-1 and Table 2-2 were used in Equation 2 to compute the annual growth rate for the county and municipality in the study area using X = 2.25 (2 years and 3 months from April 1, 2020 to July 1, 2022). The computed annual growth rate for the county and municipality is summarized in the final column of Table 2-1 and Table 2-2, 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 Shadow Region, then the county growth rate was used. County growth rates are available for the entire Shadow Region and were used (in the absence of municipal data) as they are the finest level of detail available for the Shadow Region. Thus, state data was not used.

The Census Bureau does not provide population data specific to the Shadow Region boundary. 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 Shadow Region. All other blocks outside of the Shadow Region were not considered as part of the Shadow Region population, even if they are located within one of the municipalities or counties that intersects the Shadow Region. The appropriate annual growth rate was applied to each census block in the Shadow Region depending on where the block is located. The population was extrapolated, using Equation 1, to October 1, 2023 as the base year for this study.

Table 2-3 provides the permanent resident population within the study area, by evacuation zone, for 2020 (based on the most recent U.S. Census) and for 2023 (based on the data provided by OVA). As indicated, the permanent resident population within Oakmont and Wild Oak has increased by +5.45% since the 2020 Census.

To estimate the number of evacuating vehicles, the 2023 resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household. The average household size (1.65 persons/household) was estimated using the demographic survey results (see Appendix A, Sub-section A.3.1). The number of evacuating vehicles per household (1.35 vehicles/household – See Appendix A, Sub-section A.3.2) was also adapted from the demographic survey results. Permanent resident population and vehicle estimates are presented in Table 2-4.

2.2 Shadow Population

A portion of the population living outside Oakmont and Wild Oak may elect to evacuate without having been instructed to do so. This phenomenon is known as ***"shadow evacuation."*** Shadow evacuees consume space on the same roadways used by people evacuating from the area at risk. This can cause delays and prolong evacuation time for those leaving the area at risk. This study considered the Shadow Region shown in Figure 2-3. Based on the demographic survey (see Appendix A, Sub-section A.3.2), it is estimated that 52% of the permanent resident population, based on U.S. Census Bureau data, in this Shadow Region will elect to evacuate.

Shadow population characteristics (household size, evacuating vehicles per household, mobilization time) are assumed to be the same as that of the permanent resident population within Oakmont and Wild Oak. There are 21,211 permanent residents and 17,165 vehicles in the Shadow Region.

2.2.1 Los Guilicos

Los Guilicos is a homeless shelter located in the Shadow Region. It is located across Highway 12 from Oakmont and Wild Oak. It is estimated that this homeless shelter can house up to 150 people. The Santa Rosa City or Sanoma County will decide if and where this homeless shelter is evacuated to during an emergency. It is assumed that these residents do not own any personal vehicles and will be bused out of the area during an emergency. It is estimated that 150 people that reside at this location would require 5 buses (30 passengers per bus) to evacuate. Since the county or the city decides if this homeless shelter evacuates, it is assumed that all or no residents would evacuate during an emergency. Hence, no shadow evacuation percentage is applied for this population group.

2.3 Visitors

Visitors are defined as those people (who are not permanent residents, nor commuting employees) who enter Oakmont and Wild Oak for a specific purpose (visiting, recreation). Visitors may spend less than one day or stay overnight in Oakmont and Wild Oak. As displayed in Figure 2-4, there are three visitor attractions within Oakmont and four attractions right outside of Oakmont (within Shadow Region).

Valley of the Moon Club is a restaurant with a golf course. According to Valley of the Moon Club staff, the golf course attracts approximately 400 golfers, on average, each day with 40% of them being Oakmont residents. The restaurant attracts 125 guests each day with 80% of them being local to the area. As local residents that visit this location are already included as permanent residents, there are approximately 240 (400 x 60% = 240) golfers and 25 (125 x 20% = 25) guests at the restaurant that live outside Oakmont and Wild Oak. In order to estimate the number of vehicles evacuating from Valley of the Moon Club, it was assumed that the parking lot (123 vehicles[4]) operates at maximum capacity at peak times. Hence, there are approximately 265 visitors in 123 vehicles at Valley of the Moon Club at peak times.

Wild Oak Saddle Club is a private-equity club which can also be booked for special events and weddings. Data provided by the Oakmont Village Association indicated that Wild Oak Saddle Club attracts 100 visitors during peak times and 125 visitors during large events. To be conservative, 125 visitors was used in this study. Similar to the Valley of the Moon Club it was assumed that 60% of these visitors are not local to the area. In order to estimate the number of vehicles evacuating from Wild Oak Saddle Club, the parking lot (120 vehicles[10]) is 80%[5] full during peak

[4] Provided by Oakmont Village Association.
[5] Based on the ratio of 100 visitors during peak times and 125 visitors during large events.

times. Hence, there are approximately 60 visitors (100 x 60% = 60) in 58 vehicles (120 x 80% x 60% = 58) at the Wild Oak Saddle Club during peak times.

Mei-Don Chinese Cuisine is a restaurant within Oakmont. Data provided by the Oakmont Village Association indicated there are a total of 38 parking spaces available for this facility. Similar to the restaurant at Valley of the Moon, it was assumed that 20% of the visitors for Mei-Don Chinese Cuisine visit outside of Oakmont and Wild Oak. Assuming parking lots are at capacity during peak times, there are 8 vehicles visiting Mei-Don Chinese Cuisine at peak times. Since the number of visitors was not available, it was assumed that visitors travel as a family to this location, hence, the average household size (2.6 people per household for the City of Santa Rosa[6]) from the 2020 Census data[7] was used to estimate the number of visitors. There are 21 visitors (8 x 2.6 = 21) in 8 vehicles during peak times.

In addition to the facilities within Oakmont, there are four wineries located on the north side of Highway 12 (Sonoma Highway) which can impact the evacuation of Oakmont and Wild Oak residents. As such, these facilities are included inside this study. These four facilities have a total parking capacity of 341 vehicles, as provided by the Oakmont Village Association. Assuming all facilities are full during peak times with non-Oakmont and Wild Oak residents, there are total of 886 visitors (assuming 2.6 people per vehicle) in 341 vehicles within these four wineries.

In total, there are 1,232 visitors evacuating in 530 vehicles from Oakmont and Wild Oak. Table 2-5 presents visitor population and vehicle estimates for Oakmont and Wild Oak.

2.4 Employees

Employees who work within Oakmont and Wild Oak fall into two categories:

- Those who live and work in Oakmont and Wild Oak
- Those who live outside of Oakmont and Wild Oak and commute to jobs within Oakmont and Wild Oak

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 Oakmont and Wild Oak who will evacuate along with the permanent resident population.

The demographic survey results indicate that approximately 44% of the households within Oakmont and Wild Oak hire contractual workers (See Appendix A). It is conservatively assumed that all these workers live outside of Oakmont and Wild Oak. The estimates of the contractual workers were based on the 2020 Census data which contains housing unit data at census block level. To estimate the evacuating employee vehicles, a vehicle occupancy of 1.03 employees per vehicle obtained from the demographic survey (see Appendix A, Sub-section A.3.1) was used to determine the number of evacuating employee vehicles.

[6] It was assumed that majority of the visitors that drive to Oakmont drive from Santa Rosa City.
[7] https://www.census.gov/quickfacts/fact/table/santarosacitycalifornia/PST045222

Figure 2-5 displays the distribution of contractual workers within Oakmont and Wild Oak. Table 2-6 presents employee and vehicle estimates commuting into Oakmont and Wild Oak by evacuation zone.

2.5 Oakmont Gardens

As per discussions with the Oakmont Village Association, Oakmont Gardens is a vibrant senior living facility located in Oakmont. All residents who are transit dependent within Oakmont reside within Oakmont Gardens and it is assumed that all other transit dependents outside of Oakmont Gardens can get a ride out with a neighbor or friend during an emergency. Oakmont Gardens currently has 140 residents and none of these residents require skilled nursing. Approximately 60% of these residents (84 residents) would need transportation assistance during an emergency. The remaining 40% (56 residents) would evacuate by car or with family members from Oakmont. Oakmont Gardens has four (4) buses on contract call and one minibus and one van on site.

2.6 External Traffic

Vehicles will be traveling through the study area (external-external trips) at the time of an event. After the Evacuation Order is announced, these through-travelers will also evacuate. These through vehicles are assumed to travel on Highway 12 (Sonoma Hwy) traversing the study area. It is assumed that this traffic will continue for the first 120 minutes following the Evacuation Order.

Average Annual Daily Traffic (AADT) data was obtained from Caltrans[8] to estimate the number of vehicles per hour on Highway 12 (Sonoma Hwy). 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 2-7. The DDHV is then multiplied by 2 hours (access control establish time) to estimate the total number of external vehicles loaded on the analysis network. As indicated, there are 5,244 vehicles traversing Highway 12 as external-external trips prior to the activation of access control and the diversion of this traffic. This number is reduced by 60% for evening scenarios (Scenarios 2 and 4) as discussed in Section 5.

2.7 Background Traffic

Section 4 discusses the time needed for the people in the study area to mobilize and begin their evacuation trips. As shown in Table 4-8, 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 study area. All

[8] https://dot.ca.gov/programs/traffic-operations/census/

traffic is loaded within these 14 time periods. 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.

In traffic simulations, the network is initially empty. Thus, for this study, the network needs to be filled (to represent routine traffic conditions just prior to an evacuation order) so that system performance can be assessed under a more realistic set of conditions. As such, there is a initialization time period (often referred to as “fill time” in traffic simulation) wherein the anticipated traffic volumes from the start of evacuation (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. There are 643 vehicles on the roadways in the study area at the end of fill time for an evacuation of the entire study area under Scenario 1 (summer, midweek, midday, normal) conditions.

2.8 Summary of Demand

A summary of population and vehicle demand within the study area is provided in Table 2-8 and Table 2-9, respectively. This summary includes all population groups described in this section. A total of 18,833 people and 20,066 vehicles (14,832 evacuating vehicles and 5,244 external vehicles) are considered in this study.

Table 2-1. County Population Change from April 1, 2020 to July 1, 2022

County	2020 Population	2022 Population	Percent Change	Annual Growth Rate
Sonoma	488,875	482,650	-1.27%	-0.57%

Table 2-2. Municipality Population Change from April 1, 2020 to July 1, 2022

Municipality	2020 Population	2022 Population	Percent Change	Annual Growth Rate
Sonoma County, CA				
Santa Rosa	178,128	177,181	-0.53%	-0.24%

Table 2-3. Permanent Resident Population by Evacuation Zone

Evacuation Zone	2020 Population	2023 Extrapolated Population
Oakmont North[9]	2,840	3,078
Oakmont South	747	811
Stonebridge	733	791
The Villages at Wild Oak and Wild Oak Homeowners Association	467	368
TOTAL	**4,787**	**5,048**
Population Growth (2020 – 2023):		**+5.45%**
Shadow Region	21,387	21,211
Los Guilicos[10]	50	150
STUDY AREA TOTAL	**26,224**	**26,409**

Table 2-4. Permanent Resident Population and Vehicles by Evacuation Zone

Evacuation Zone	2023 Extrapolated Population	Resident Vehicles
Oakmont North	3,078	2,414[11]
Oakmont South	811	662
Stonebridge	791	647
The Villages at Wild Oak and Wild Oak Homeowners Association	368	301
TOTAL	**5,048**	**4,024**
Shadow Region	21,211	17,165
Los Guilicos	150	10[12]
STUDY AREA TOTAL	**26,409**	**21,199**

[9] Includes 140 residents at Oakmont Gardens.
[10] Data provided by Oakmont Village Association.
[11] Includes 10 vehicles for Oakmont Gardens. (equivalent to 4 buses, 1 minibus and 1 van).
[12] One bus is equivalent to 2 passenger cars due to the longer vehicle type and more sluggish vehicle operating characteristics.

Table 2-5. Visitor Attractions within the Study Area

Evacuation Zone	Facility Name	Facility Type	Street	Municipality	Visitors	Vehicles
Oakmont North	Valley of the Moon Club	Golf Course	7025 Oakmont Dr	Santa Rosa	265	123
Oakmont South	Mei-Don Chinese Cuisine	Restaurant	6576 Oakmont Dr	Santa Rosa	21	8
Oakmont South	Wild Oak Saddle Club	Private Club	550 White Oak Dr	Santa Rosa	60	58
Shadow Region	Annadel Estate Winery	Winery	6687 Sonoma Hwy	Santa Rosa	260	100
Shadow Region	Ledson Winery & Vineyards	Winery	7335 CA-12	Kenwood	179	69
Shadow Region	NovaVine/Novabackyard	Vine/Plant Nursery	6735 Sonoma Hwy	Santa Rosa	273	105
Shadow Region	St. Francis Winery & Vineyards	Winery	100 Pythian Rd	Santa Rosa	174	67
				STUDY AREA TOTAL	**1,232**	**530**

Table 2-6. Employees and Employee Vehicles by Evacuation Zone

Evacuation Zone	Employees	Employee Vehicles
Oakmont North	819	800
Oakmont South	213	199
Stonebridge	216	211
The Villages at Wild Oak and Wild Oak Homeowners Association	125	122
TOTAL	**1,373**	**1,332**

Table 2-7. Study Area External Traffic

Up Node	Down Node	Road Name	Direction	AADT[13]	K-Factor[14]	D-Factor[14]	Hourly Volume	External Traffic
8127	246	Highway 12	Eastbound	24,500	0.107	0.5	1,311	2,622
8086	86	Highway 12	Westbound	24,500	0.107	0.5	1,311	2,622
							TOTAL:	**5,244**

[13] Caltrans Traffic Census Program
[14] HCM 2022

Table 2-8. Summary of Population Demand

Evacuation Zone	Residents	Visitors	Employees	Los Guilicos	External Traffic	Total
Oakmont North	3,078	265	819	0	0	4,162
Oakmont South	811	81	213	0	0	1,105
Stonebridge	791	0	216	0	0	1,007
The Villages at Wild Oak and Wild Oak Homeowners Association	368	0	125	0	0	493
Shadow Region	11,030[15]	886	0	150	0	12,066
Total	**16,078**	**1,232**	**1,373**	**150**	**0**	**18,833**

Table 2-9. Summary of Vehicle Demand

Evacuation Zone	Residents	Visitors	Employees	Los Guilicos	External Traffic	Total
Oakmont North	2,414[17]	123	800	0	0	3,337
Oakmont South	662	66	199	0	0	927
Stonebridge	647	0	211	0	0	858
The Villages at Wild Oak and Wild Oak Homeowners Association	301	0	122	0	0	423
Shadow Region	8,926[18]	341	0	10	5,244	14,521
Total	**12,950**	**530**	**1,332**	**10**	**5,244**	**20,066**

[15] There are 21,211 residents within the Shadow Region. Fifty-two percent (52%) of them would choose to evacuate during an emergency at Oakmont and Wild Oak. (21,211 x 0.52 = 11,030).
[17] Oakmont Gardens has 4 buses, 1 minibus and 1 van available to evacuate. This is the equivalent to 10 passenger vehicles ((4 x 2) + 1 + 1 = 10) inside the simulation model.
[18] There are 17,165 resident vehicles within the Shadow Region. Fifty-two percent (52%) of them would evacuate (17,165 x 0.52 = 8,926).

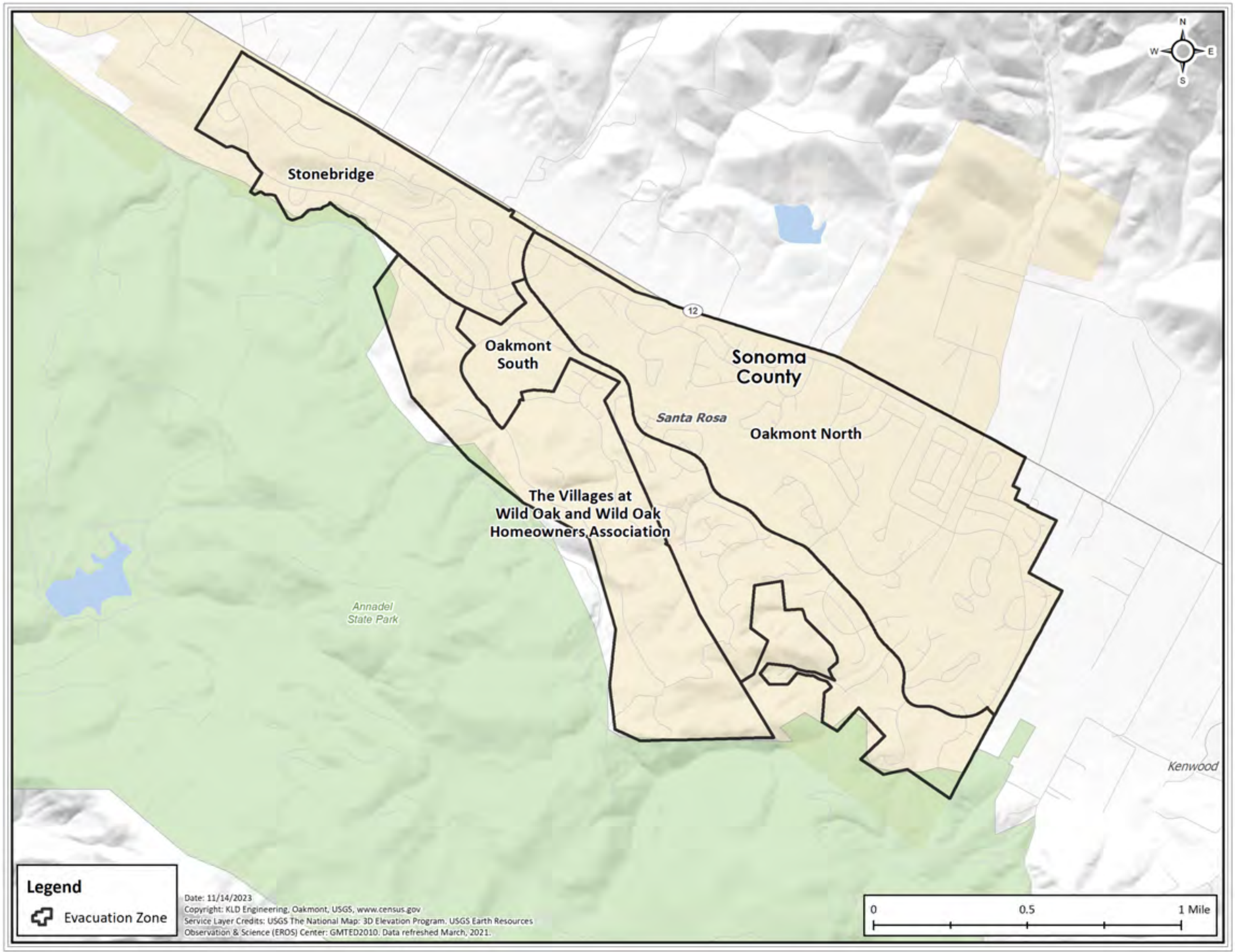


Figure 2-1. Evacuation Zone Boundaries

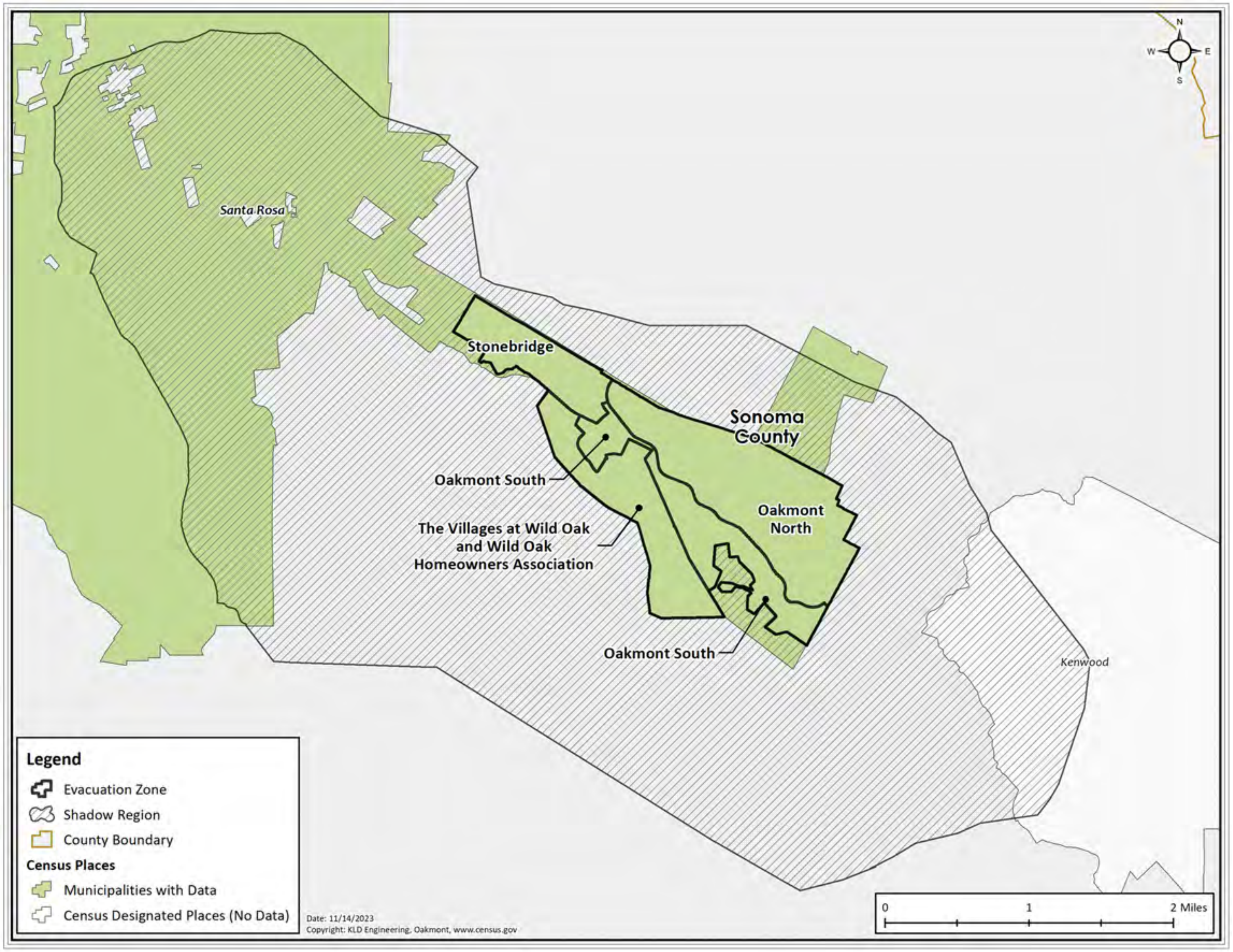


Figure 2-2. Census Boundaries within the Study Area

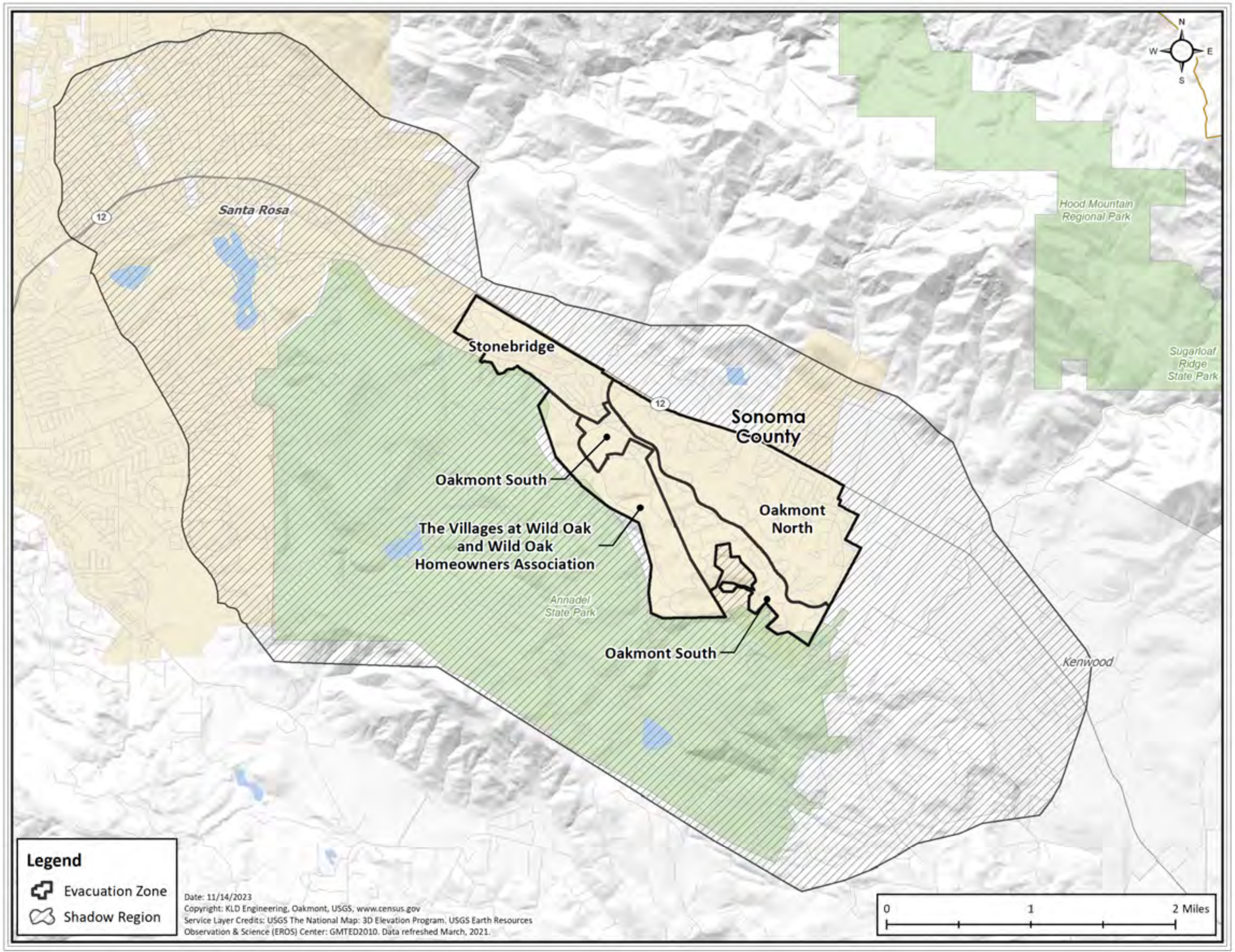


Figure 2-3. Shadow Region

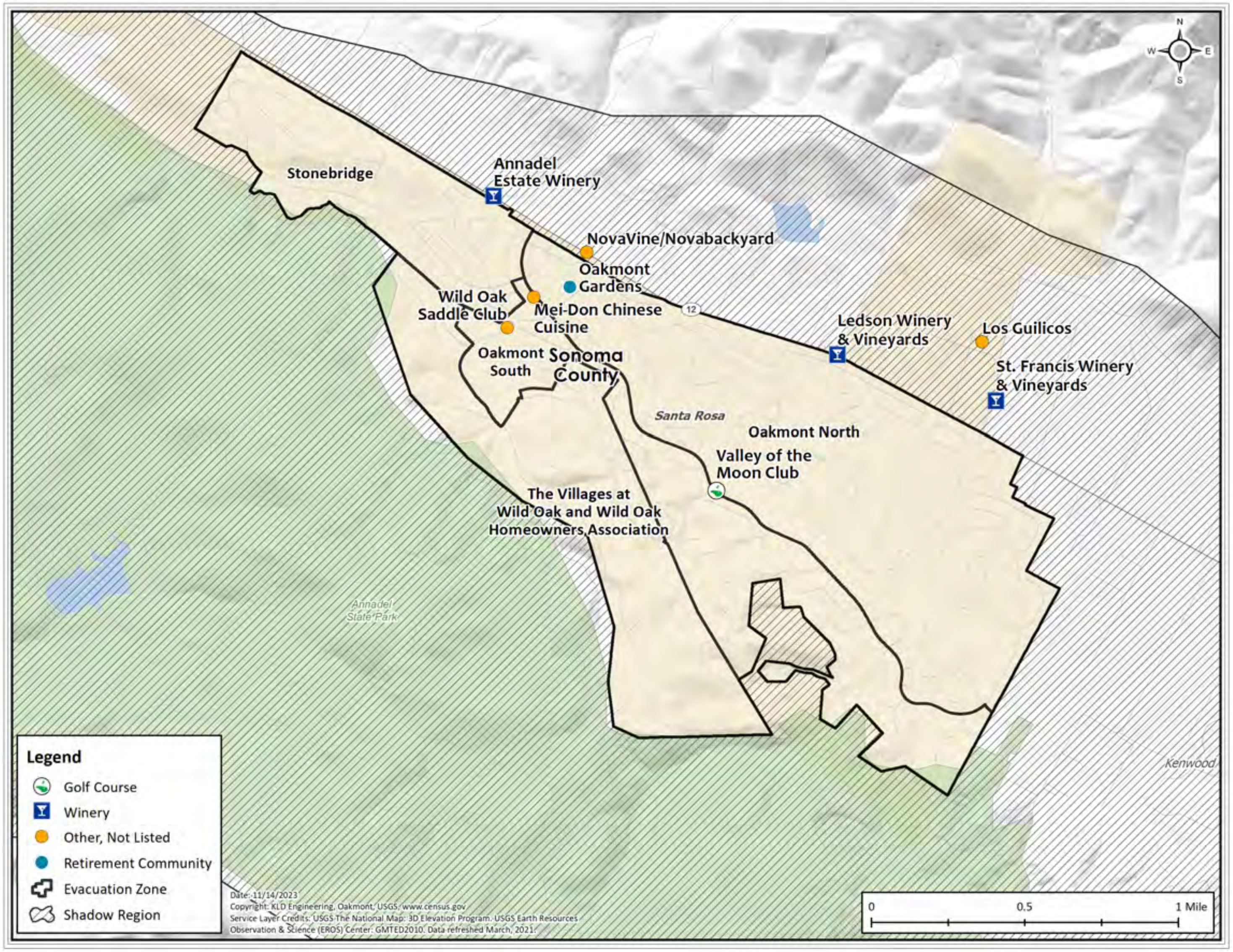


Figure 2-4. Visitor Attractions and Retirement Community within the Study Area

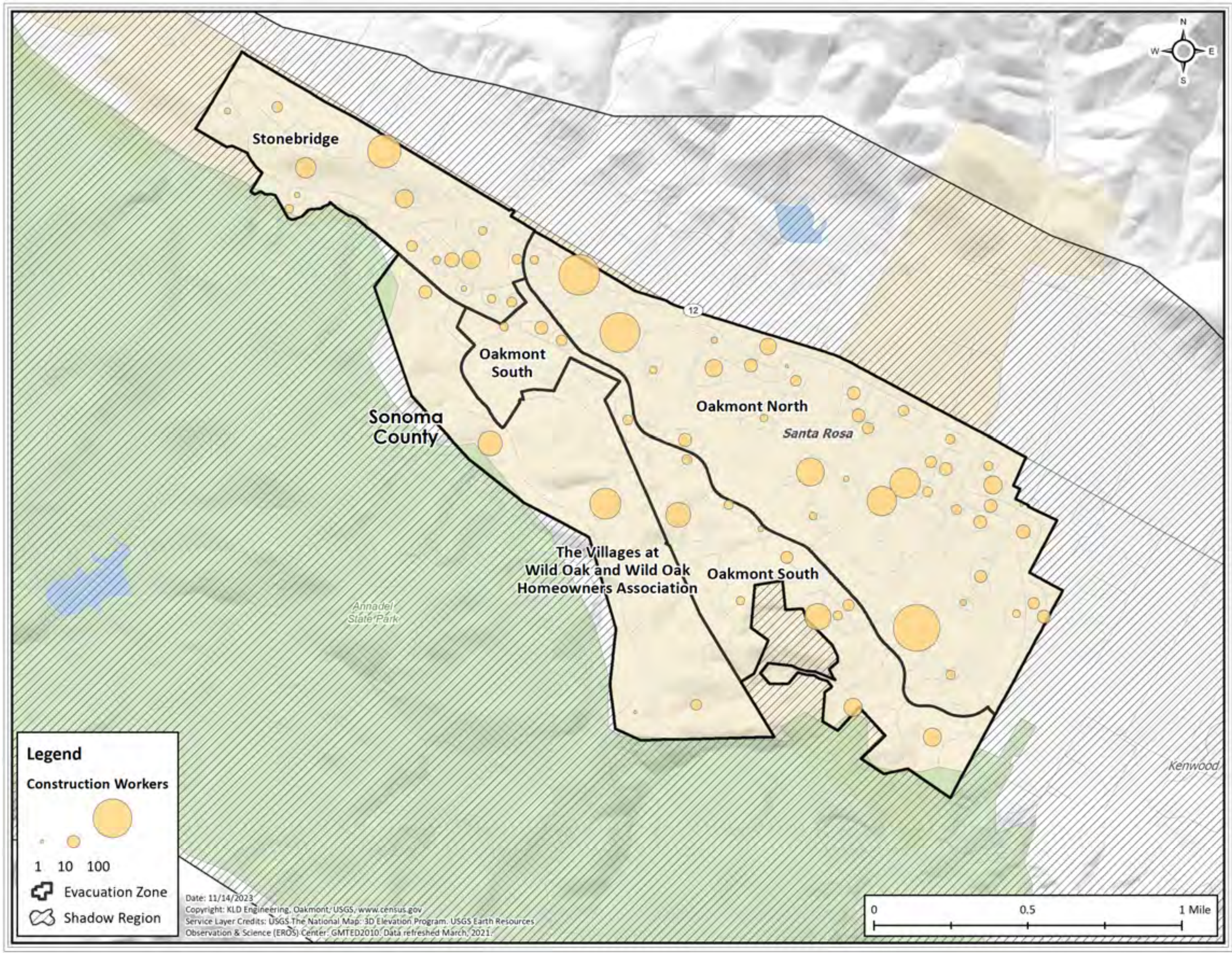


Figure 2-5. Contractual Workers within Oakmont and Wild Oak

3 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 ***2022 Highway Capacity Manual (HCM 2022)*****.** This section discusses how the capacity of the roadway network was estimated.

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),*** see Table 3-1. 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.

Thus, in simple terms, a service volume is the maximum traffic that can travel on a road and still maintain a certain perceived level of quality to a driver based on the A, B, C, rating system (LOS). Any additional vehicles above the service volume would drop the rating to a lower letter grade.

This distinction is illustrated in Exhibit 12-37 of the HCM 2022. 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, smoke)

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 FFS and capacity based on the HCM 2022. 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. The FFS ranged from 15 mph to 50 mph within the Oakmont and Wild Oak area. Capacity is estimated from the procedures of the HCM 2022. For example, HCM 2022 Exhibit 7-1(b) shows the sensitivity of SV at the upper bound of LOS D to grade (capacity is the SV at the upper bound of LOS E). The amount of traffic that can flow on a roadway is effectively governed by vehicle speed and spacing. The faster that vehicles can travel when closely spaced, the higher the amount of flow.

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.

3.1 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 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,

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

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[1]. The resulting values for h_m always satisfy the condition:

$$h_m \geq h_{sat}$$

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 2022.

[1]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.

The above discussion is necessarily brief given the scope of this Evacuation Time Estimate (ETE) report and the complexity of the subject of intersection capacity. In fact, Chapters 19, 20 and 21 in the HCM 2022 address this topic. The factors, F_1, F_2, ..., influencing saturation flow rate are identified in equation (19-8) of the HCM 2022.

The traffic signals within Oakmont and the 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.

3.2 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 3-1 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[2] 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. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

Since the principal objective of ETE 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 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 2022 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.

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

3.3 Application to the Oakmont Village Association & Wild Oak Community

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:

2022 Highway Capacity Manual (HCM 2022)
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
- Multilane Highways (at-grade)

Each of these classifications will be discussed below.

3.3.1 Two-Lane Roads

Ref: HCM 2022 Chapter 15

Two lane roads comprise the majority of highways within the study area. 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 study area are classified as “Class I”, with "level terrain"; some are “rolling terrain”.
- “Class II” highways are mostly those within urban and suburban centers.

3.3.2 Multilane Highway

Ref: HCM 2022 Chapter 12

Exhibit 12-8 of the HCM 2022 presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,300 pc/h, for free-speeds of 45 to 70 mph, respectively. Based on observation, the multilane highways outside of urban areas within the study area service traffic with free-speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand and 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 multilane highways outside of urban areas.

3.3.3 Intersections

Ref: HCM 2022 Chapters 19, 20, 21, 22

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 19 (signalized intersections), Chapters 20, 21 (un-signalized intersections) and Chapter 22 (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.

3.4 Simulation and Capacity Estimation

Chapter 6 of the HCM 2022 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 involving several HCM chapters. 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 a study area operating under evacuation conditions. 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 2022 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) 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 2022, as described earlier.

It is important to note that simulation represents a mathematical representation of an assumed set of conditions using the best available knowledge and understanding of traffic flow and available inputs. Simulation should not be assumed to be a prediction of what will happen under any event because a real evacuation can be impacted by an infinite number of things – many of which will differ from these test cases – and many others cannot be taken into account with the tools available.

3.5 Boundary Conditions

The link-node analysis network used for this study is finite. The analysis network extends well beyond Oakmont and Wild Oak in order to model intersections with other major population areas and evacuation routes beyond the study area. However, the network does have an end at the destination (exit) nodes. 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 3.3.1 above) and multilane highways (Section 3.3.2 above). The 25% reduction in capacity is based on the prevalence of actuated traffic signals outside the study area and the fact that the evacuating traffic volume ("main street") will be more significant than the competing traffic volume ("side street") at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

Table 3-1. Level of Service Definitions

Level of Service (LOS)	Definition
LOS A	Free flow and high-speed operating conditions.
LOS B	Stable flow with slight delays.
LOS C	Stable flow with acceptable delays.
LOS D	Approaching unstable flow. Density increases faster, and speed begins to decline.
LOS E	Traffic operating at or near capacity. Intolerable delay.
LOS F	Forced flow (jammed).

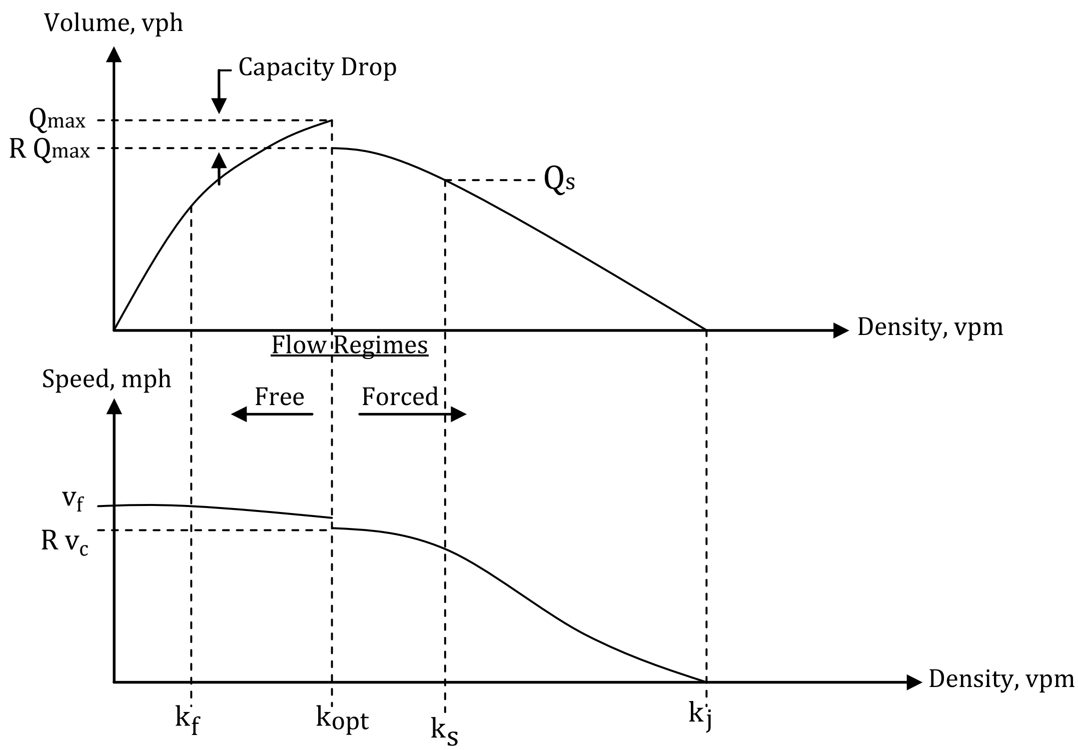


Figure 3-1. Fundamental Diagrams

4 ESTIMATION OF TRIP GENERATION TIME

It is general practice for planners to 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 demographic survey. We define the sum of these distributions of elapsed times as the ***Trip Generation Time Distribution***. This section documents how the trip generation time distributions were estimated.

4.1 Background

In general, during a wildfire emergency, priorities are given to protecting public health and safety, preservation of property and resource conservation. Depending on the severity, wind speed and direction of the wildfire, emergency officials may issue warnings that include evacuation to best protect public health and safety.

As a Planning Basis, this study adopts a conservative posture of a rapidly escalating wildfire, wherein evacuation is required, ordered promptly and no early protective actions (no red flag announcements/evacuation warnings) are implemented when calculating the Trip Generation Time. In these analyses, we have assumed:

1. The ***Evacuation Order*** will be announced coincident with local emergency alerts (e.g., CivicReady, SoCo Alert, Nixle, SRFD website, NOAA WX radio, registered landline, social media, local news and similar communication systems).
2. Mobilization of the general population will commence within 15 minutes after the evacuation order, as no red flag announcements/evacuation warnings were provided.
3. The ***evacuation time estimates (ETE)*** are measured relative to the Evacuation Order.

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.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

The notification process consists of two events:

1. Transmitting information using the alert and notification systems mentioned above.
2. Receiving and correctly interpreting the information that is transmitted.

The population within Oakmont and Wild Oak is engaged in a wide variety of activities at any given time. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an event.

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 Oakmont and Wild Oak at the time the emergency is declared. These people may be commuters, shoppers and other travelers who reside within Oakmont and Wild Oak 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 (USNRC Development of ETE Studies for Nuclear Power Plants, January 2005), 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 Oakmont and Wild Oak. 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 Oakmont and Wild Oak might be notified by text message, television and/or radio (if available). Those well outside of Oakmont and Wild Oak might be notified by word-of-mouth, with potentially longer time lags. Furthermore, the spatial distribution of the Oakmont and Wild Oak populations 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 4.3 of NUREG/CR-7002, Rev. 1 (USNRC Criteria for ETE Studies, February 2021), the information required to compute trip generation times for an emergency evacuation is typically obtained from a demographic survey of residents. Such a survey was conducted for this study. Appendix A presents the survey sampling results, survey instrument, and raw survey results. The remaining discussion will focus on the application of the trip generation data obtained from the demographic survey to the development of the ETE documented in this report.

4.2 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 in Table 4-1.

These relationships are shown graphically in Figure 4-1.

- 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 (e.g., 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 of Oakmont and Wild Oak will follow sequence (c) of Figure 4-1. A household within Oakmont and Wild Oak 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 4-1(a). A household within Oakmont and Wild Oak that has no commuters at work, or that will not await the return of any commuters, will follow the second sequence of Figure 4-1(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 4-1(b). Visitors will always follow one of the sequences of Figure 4-1(b). Some visitors 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 4-1, that the Trip Generation time (i.e., 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) 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.

4.3 Estimated Time Distributions of Activities Preceding Event 5 (Departure)

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 → 2

A demographic survey of Oakmont and Wild Oak residents was conducted to study evacuation behavior of the population within the community. The survey results were used to create the notification time distribution. The survey asked specific questions about notifying neighbors and friends during an emergency using various methods such as phone calls, text messages, social media, and in person conversations. Based on the results, all (100%) population groups (residents, employees, tourists, etc.) can be notified of an emergency within 60 minutes. Since the survey was statistically significant at the 95% confidence level, it can be assumed that the population within the community will behave similarly to the survey respondents. The distribution of Activity 1 → 2 shown in Table 4-2 reflects data obtained by the demographic survey. This distribution is plotted in Figure 4-2.

Given the uncertainty in some critical assumptions, several sensitivity studies were conducted as part of this work effort to determine the elasticity of the evacuation time estimates to those assumptions; see Appendix B.

Distribution No. 2, Prepare to Leave Work: Activity 2 → 3

It is reasonable to expect that the vast majority of business enterprises within Oakmont and Wild Oak will elect to shut down following notification and most employees would leave work quickly. Commuters, who work outside the village/community could, in all probability, also leave quickly since facilities outside the village/community would remain open and other personnel would remain. Essential workers, like medical personnel, responsible for patients would require additional time to secure their facility. The distribution of Activity 2 → 3 shown in Table 4-3 reflects data obtained by the demographic survey. This distribution is plotted in Figure 4-2.

Distribution No. 3, Travel Home: Activity 3 → 4

This distribution is plotted in Figure 4-2 and listed in Table 4-4. This distribution reflects the data provided directly by households that responded to the demographic survey.

Distribution No. 4, Prepare to Leave Home: Activity 2, 4 → 5

This distribution represents the time needed by residents to pack essential items. This distribution reflects the data provided directly by households that responded to the demographic survey and is plotted in Figure 4-2 and listed in Table 4-5.

4.4 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 → 4) must precede Activity 4 → 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 as shown 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 4-6 presents the summing procedure to arrive at each designated distribution.

Table 4-7 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

4.4.1 Statistical Outliers

Some portion of the surveys conducted, respondents answered "Prefer not to say." to some questions or choose to not respond to a question (see Appendix A). 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 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 individually 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 <u>overall</u> mobilization time/trip generation distributions, the following principles are used:

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

2) The individual mobilization activities (receive notification, prepare to leave work, travel home, prepare home) are reviewed for outliers, and then the overall trip generation distributions are created;

3) Outliers can be eliminated either because the response reflects a special population (e.g., Oakmont Gardens) 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 3.66 standard deviations from the mean are allowed to be considered outliers, with gaps in the histogram expected. Values more than 3.66 standard deviations from the mean were removed.

    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 4-3.

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, indicating that the network loads faster for the first 80-85% of the vehicles, potentially causing more (and earlier) congestion than otherwise modeled;
    - The last 10-15% 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 in each). In general, these are additive, using weighting based upon the probability distributions of each element; Figure 4-4 presents the combined trip generation distributions designated A, C, and D. 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. 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, and D, properly displaced with respect to one another, are tabulated in Table 4-8 (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.

Table 4-1. 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

Table 4-2. Time Distribution for Notifying the Public

Elapsed Time (Minutes)	Percent of Population Notified
0	0%
5	4%
10	7%
15	13%
20	23%
25	33%
30	43%
35	59%
40	75%
45	90%
50	93%
55	97%
60	100%

Table 4-3. Time Distribution for Employees to Prepare to Leave Work

Elapsed Time (Minutes)	Cumulative Percent Returning Home	Elapsed Time (Minutes)	Cumulative Percent Returning Home
0	0%	40	87%
5	22%	45	90%
10	44%	50	92%
15	60%	55	92%
20	72%	60	93%
25	76%	75	97%
30	83%	90	100%
35	84%		

NOTE: The survey data used was normalized to distribute the "Prefer not to say" 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 “Prefer not to say” responders, if the event takes place, would be the same as those responders who provided estimates.

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

Elapsed Time (Minutes)	Cumulative Percent Returning Home	Elapsed Time (Minutes)	Cumulative Percent Returning Home
0	0	45	82%
5	4%	50	85%
10	9%	55	85%
15	18%	60	89%
20	32%	75	92%
25	48%	90	93%
30	67%	105	97%
35	75%	120	100%
40	78%		

NOTE: The survey data used was normalized to distribute the "Prefer not to say." response.

Table 4-5. Time Distribution for Population to Prepare to Leave Home

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0%
15	7.8%
30	41.0%
45	60.4%
60	80.1%
75	87.6%
90	92.7%
105	94.4%
120	97.8%
135	99.4%
150	100.0%

NOTE: The survey data used was normalized to distribute the "Prefer not to say" response.

Table 4-6. 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

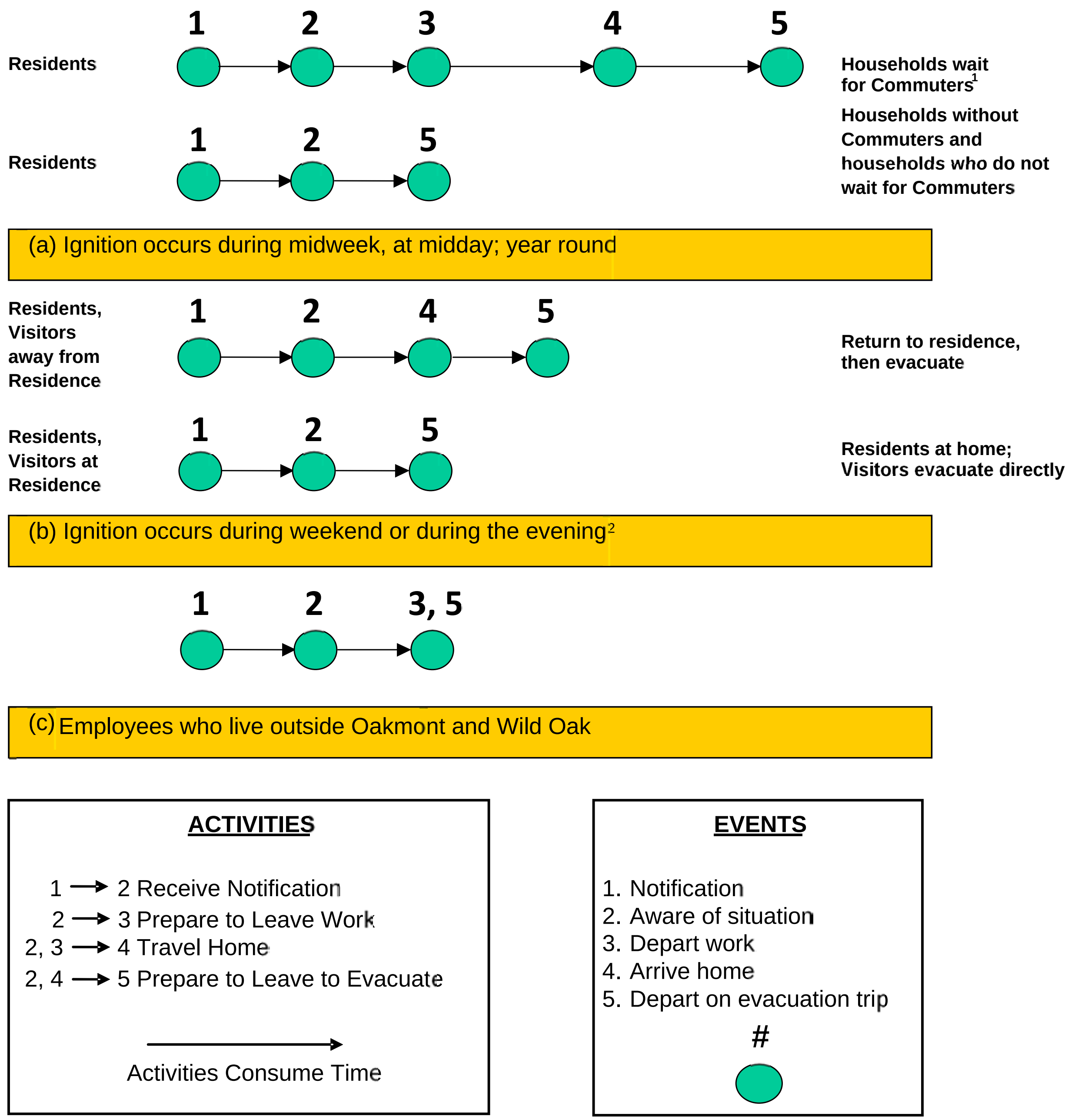
Table 4-7. Description of the Distributions

Distribution	Description
A	Time distribution of commuters departing place of work (Event 3). Also applies to employees (year-round and seasonal) who work within Oakmont and Wild Oak who live outside, and to visitors within Oakmont and Wild Oak.
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).

Table 4-8. Trip Generation Histograms for Oakmont and Wild Oak Populations[1]

Time Period	Duration	Percent of Total Trips Generated Within Indicated Time Period			
		Employees (Year-round and Seasonal) (Distribution A)	Transients (Distribution A)	Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)
1	15	2%	2%	0%	0%
2	15	13%	13%	0%	3%
3	15	27%	27%	0%	10%
4	30	45%	45%	6%	42%
5	15	6%	6%	10%	18%
6	15	3%	3%	14%	12%
7	15	3%	3%	15%	6%
8	15	1%	1%	14%	3%
9	15	0%	0%	11%	3%
10	30	0%	0%	15%	3%
11	15	0%	0%	6%	0%
12	30	0%	0%	6%	0%
13	30	0%	0%	2%	0%
14	30	0%	0%	1%	0%
15	600	0%	0%	0%	0%

[1] Shadow vehicles are loaded onto the analysis network using Distribution C.



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

Figure 4-1. Events and Activities Preceding the Evacuation Trip

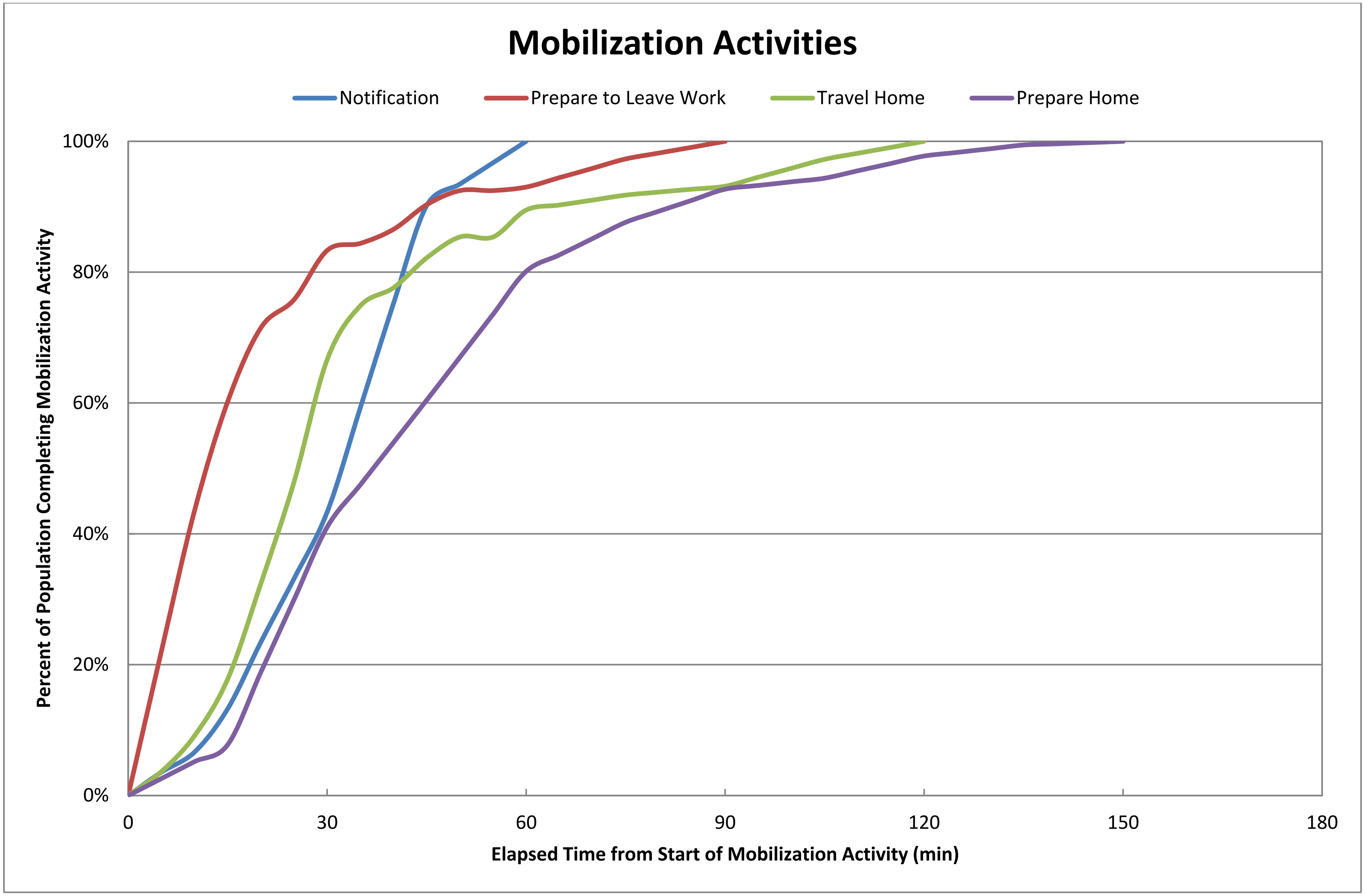


Figure 4-2. Time Distributions for Evacuation Mobilization Activities

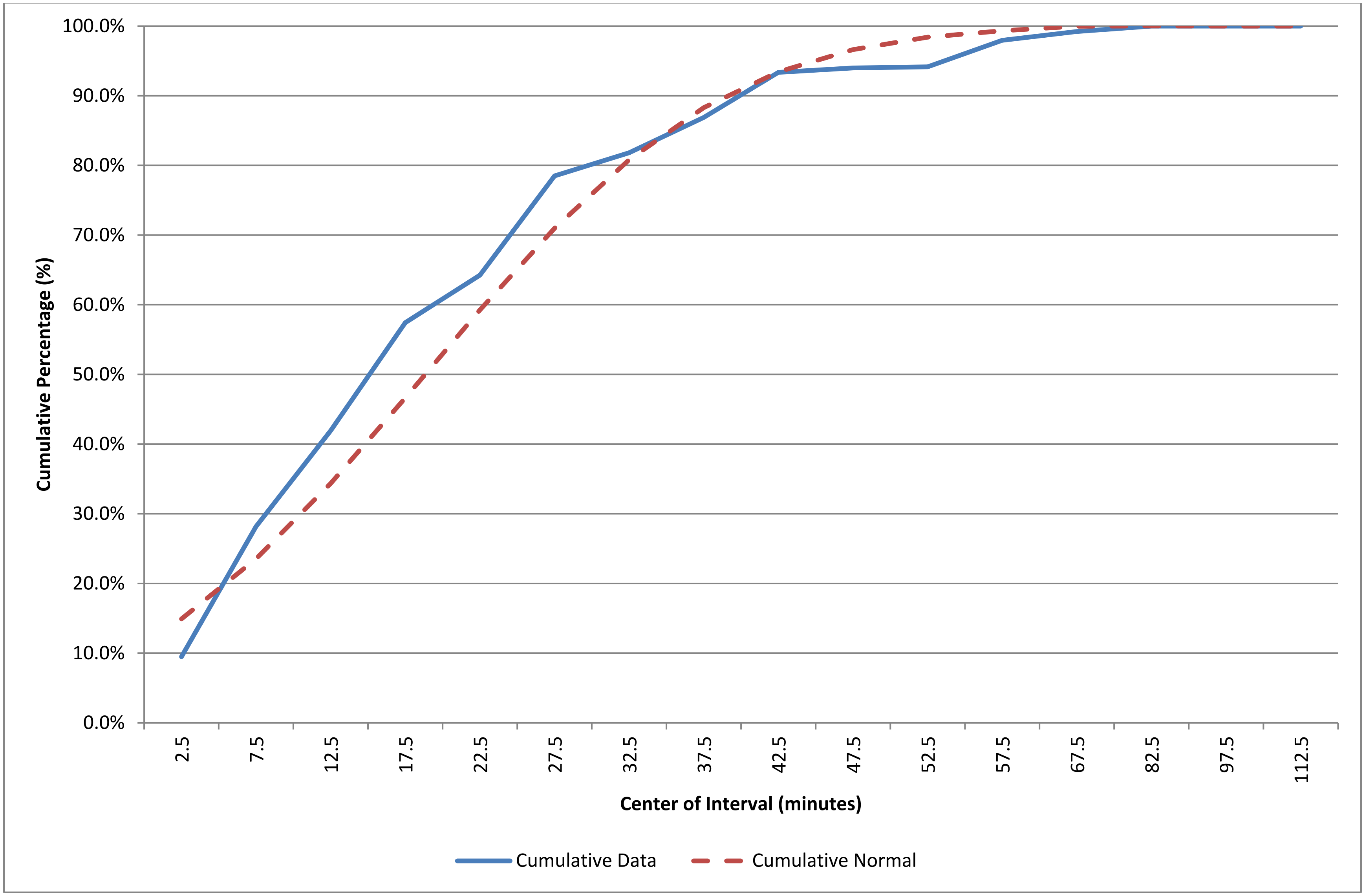


Figure 4-3. Comparison of Data Distribution and Normal Distribution

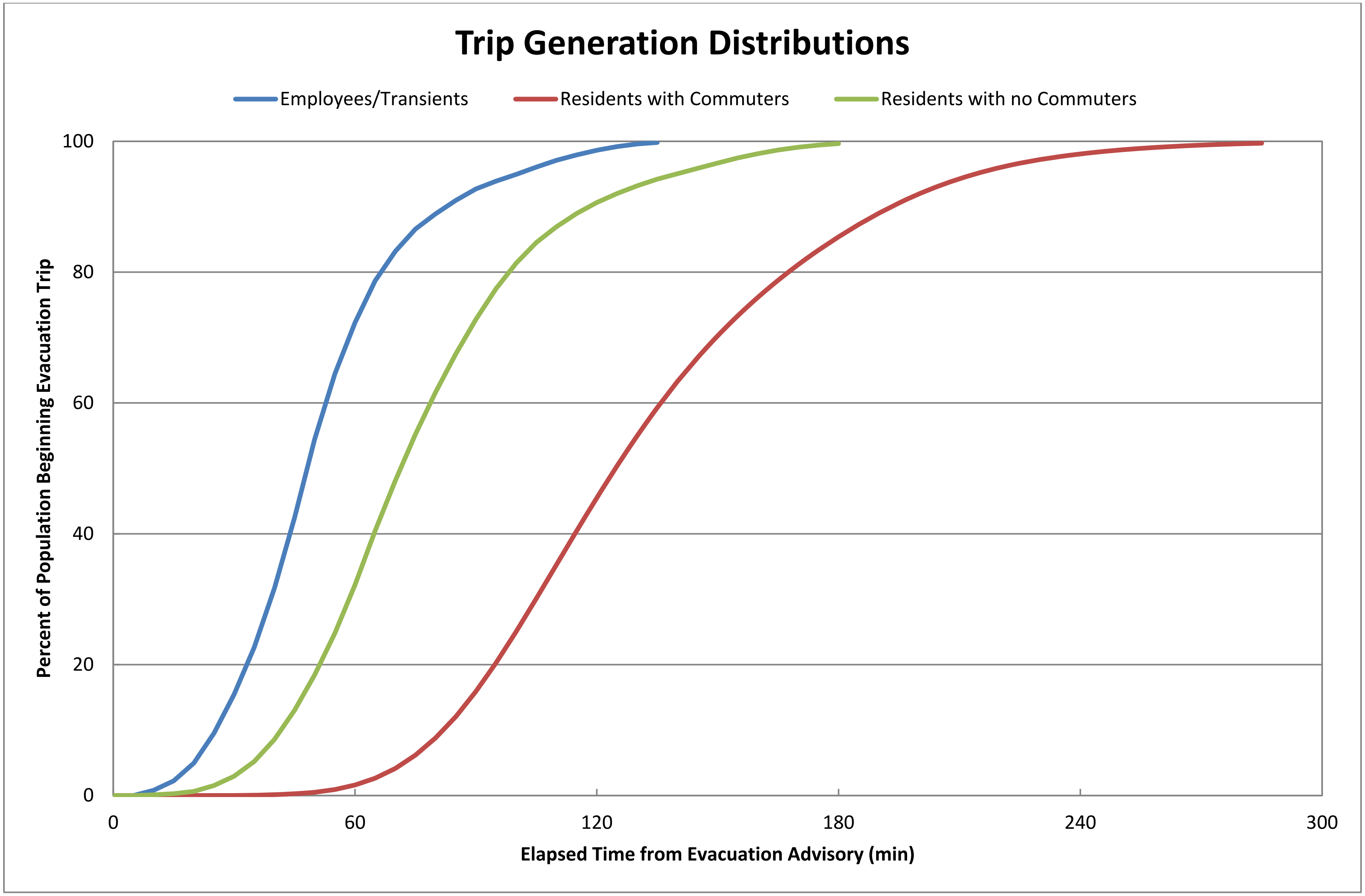


Figure 4-4. Comparison of Trip Generation Distributions

5 EVACUATION TIME ESTIMATES

5.1 Evacuation Cases

This section discusses the spatial and temporal variations in evacuation situations. The regions outlined in the study were created based on various geometric areas that would be evacuated in response to a wildfire emergency. The scenarios outlined in the study were created based on the various temporal changes that affect the number of vehicles evacuating during a wildfire emergency. This section provides an overview of all the possible evacuation cases that were studied. An evacuation "case" defines a combination of Evacuation Region and Evacuation Scenario. For this specific study, the definitions of "Region" and "Scenario" are as follows:

Region A grouping of evacuating Evacuation Zones or an individual Evacuation Zone, that must be evacuated in response to a wildfire emergency.

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

A total of 11 Regions were defined which encompass all the groupings of Evacuation Zones considered. These Regions are defined in Table 1-3 by showing which Evacuation Zone evacuates for each Region. Evacuation Zones marked with a red "X" evacuate for that given Region. The Evacuation Zone boundaries are identified in Figure 2-1.

Regions R01 through R04 represent evacuations of each individual Evacuation Zone by itself. Regions R05 through R10 are evacuations of combinations of Evacuation Zones based on the origin of a potential wildfire and prevailing winds. Lastly, Region R11 is the evacuation of all Evacuation Zones at once.

A total of 4 Scenarios were evaluated for all Regions. Thus, there are a total of 44 (11 x 4 = 44) evacuation cases. Table 1-2 is a description of all scenarios.

The percentage of each population group estimated to be in Oakmont and Wild Oak during an emergency is summarized in Table 5-1. Table 5-2 presents the number of evacuating vehicles for each scenario based on the demand summarized in Section 2 and the scenario percentages in Table 5-1 for Region R11 – all Evacuation Zones. The scenario percentages were determined as follows:

- The number of residents with commuters during the week (when workforce is at its peak) is equal to 3%, which is the product of approximately 17% (the number of households with at least one commuter) and about 19% (the number of households with a commuter that would await the return of the commuter prior to evacuating). It is estimated for weekend and evening scenarios (scenarios 2 through 4) that 10% of households with returning commuters during the week (3%) will have a commuter at work during those times. Thus, scenarios 2 through 4 have 0.3% (10% x 3%) of households with returning commuters.

- Employment is estimated to be 96% during the week and 10% in the evenings and during the weekends. See assumption 8 in Section 1.3.
- Visitors peak (100%) during the weekend, midday. Visitors are reduced to 85% for midweek, midday and reduced to 5% for evenings.
- Transit vehicles for Los Guilicos and Oakmont Gardens are 100% for all scenarios as it is assumed that Los Guilicos and Oakmont Gardens residents are present for all scenarios.
- External traffic is estimated to be 100% for all midday scenarios, while it is less (40%) during evening scenarios.
- The shadow percentages are 52% (see assumption 5 in Section 1.3) for all scenarios.

5.2 Patterns of Traffic Congestion during Evacuation

Figure 5-1 through Figure **5-5** illustrate the patterns of traffic congestion that arise when the entire study area evacuates (Region R11) during a summer, midweek, midday period under normal 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 2022, page 5-5):

> *The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have reached a point that most users would consider unsatisfactory*, as described by a specified service measure value (or combination of service measure values). However, analysts may be interested in knowing just how bad the LOS F condition is, particularly for planning applications where different alternatives may be compared. Several measures are available for describing individually, or in combination, the severity of a LOS F condition:
>
> - ***Demand-to-capacity ratios*** describe the extent to which demand exceeds capacity during the analysis period (e.g., by 1%, 15%).
> - ***Duration of LOS F*** describes how long the condition persists (e.g., 15 min, 1 h, 3 h).
> - ***Spatial extent measures*** describe the areas affected by LOS F conditions. They 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. Congestion develops around concentrations of population and traffic bottlenecks.

Figure 5-1 displays the congestion patterns in the study area 30 minutes after the ***evacuation order***. Pronounced congestion develops along Highway 12, which services external through trips near Oakmont and Wild Oak. The two signalized intersections (Oakmont Drive and Pythian Road) leading out of Oakmont and Wild Oak (to gain access on to Highway 12) are also operating at LOS

F. At this time, approximately 7% of vehicles have begun their evacuation trip and 4% of evacuating vehicles have successfully evacuated the area.

At 1 hour after the evacuation order, congestion begins to build within Oakmont and Wild Oak, as shown in Figure 5-2. Oakmont Drive westbound and northbound from Cliffwood Drive and Riven Rock Way, respectively, is operating at LOS F. Wild Oak Drive is also congested for approximately half a mile, as those residents from Wild Oak look for acceptable gaps at the stop sign with Oakmont Drive (also experiencing significant congestion). To the east, as Oakmont Drive is congested, residents of Oakmont North utilize Valley Oaks Drive and Oak Leaf Drive to gain access to Pythian Road. At this time, approximately 42% of vehicles have begun their evacuation trip and 12% of evacuating vehicles have successfully evacuated the area.

Figure 5-3 displays the peak congestion within Oakmont and Wild Oak at 2 hours after the evacuation order. The majority of the roads that give access to Oakmont Drive and Pythian Road are operating at LOS F conditions. Oakmont Drive is congested (LOS F) throughout the community/village. Highway 12 is also operating at LOS F throughout the study area. At this time, the external traffic vehicles that traverse the study area are stopped and diverted. Evacuees from North Phythian Drive are experiencing severe delays (LOS D), as those from the wineries and the homeless shelter, north of Highway 12, compete with Oakmont residents to gain access to Highway 12. Approximately 92% of vehicles have begun their evacuation trip and 25% of evacuating vehicles have successfully evacuated the area. The large difference between these two percentages indicate the level of congestion present within the study area during this time.

At 3 hours and 30 minutes after the evacuation order, as shown in Figure 5-4, some roads within Oakmont no longer experience severe congestion especially in Oakmont South (south of Oakmont North and east of Wild Oak). At this time, the external traffic along Highway 12 has been diverted for 1 hour and 30 minutes, which provides more roadway capacity on Highway 12 for Oakmont and Wild Oak residents. Even though residents in Oakmont and Wild Oak is still congested, the congestion is clearing much more rapidly compared to when the external traffic was utilizing Highway 12. At this time, approximately 99% of vehicles have begun their evacuation trip and 53% of evacuating vehicles have successfully evacuated the area.

At 4 hours and 30 minutes after the evacuation order, nearly all traffic congestion (LOS F) within Oakmont has dissipated, while all of Wild Oak is free of congestion (operating at LOS A), as shown in Figure **5**-**5**. Congestion still persists along Pythian Road, Oak Leaf Drive and White Oak Drive, which clears 15 minutes later at 4 hours and 45 minutes after the evacuation order. Anyone who departs after this time encounters no traffic congestion or delays within Oakmont and Wild Oak. The last of the vehicles (1%) continue to mobilize within the area for evacuation until 4 hours and 45 minutes (the trip mobilization time) after the evacuation order. The last remnants of congestion on Highway 12 southbound clears at four hours and 55 minutes after the evacuation order.

5.3 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 5-6 through Figure 5-9. These figures indicate the rate at which traffic flows out of Oakmont and Wild Oak under indicated conditions. One figure is presented for each scenario 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. The evacuating population mobilizes over 4 hours and 45 minutes, as discussed in Section 4. This disperses evacuees over a lengthy period of time; thus, as seen in Figure 5-6 through Figure 5-9, the maximum travel time experienced is approximately 2 hours and 30 minutes for midday scenarios and 20 minutes for evening scenarios. The large gap between curves for the midday scenarios is due to the external traffic that is along Highway 12 delaying those evacuating from within Oakmont and Wild Oak. For evening scenarios external traffic is reduced by 60%, hence, the shorter travel time (smaller gap between curves).

As indicated in these figures, there is typically a long "tail" to these distributions. The “tail” is the time needed to evacuate the last ten percent of population. As shown in these figures, the tail starts around 2 hours and 30 minutes after the evacuation order for evening scenarios and ends at 4 hours and 45 minutes after the evacuation order when mobilization time is complete. The tail can be caused by traffic congestion for densely populated areas as more than ten percent of the population is delayed at bottlenecks. The evacuation tail for Oakmont and Wild Oak, however, is due to prolonged mobilization times for more than ten percent of the evacuating population.

Vehicles begin to evacuate an area slowly at first (moderate slope for the ETE curve), as people respond to the evacuation order at different rates. Then traffic demand builds rapidly (slope of ETE curve increases significantly). As more routes clear, the aggregate rate of egress slows (slope of ETE curve flattens) since many vehicles have already left Oakmont and Wild Oak. 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 study area.

5.4 General Population Evacuation Time Estimate Results

Table 5-3 and Table 5-4 present the ETE values for all evacuation regions and scenarios for both the 90th and 100th percentiles, respectively. The 100th percentile ETE equals 4:45 (Hours:Minutes) for all scenarios. Since the trip generation time is also 4 hours and 45 minutes, an ETE equal to the trip mobilization time implies that traffic congestion clears within Oakmont and Wild Oak prior to or at the same time as the completion of mobilization time. When Oakmont North and Oakmont South evacuate together (Regions R09, R10, and R11) for a Midweek Midday Scenario, the 100th Percentile ETE is dictated by congestion for all other cases the 100th Percentile ETE is dictated by mobilization time. This indicates that the quicker the evacuation population is mobilized (faster notification, less time to prepare home, leave work and drive home), the quicker the area will be evacuated (100th percentile ETE can be reduced). The 90th percentile ETE ranges between 2:00 and 4:25 for all scenarios and regions.

The 90th percentile ETE for Regions R01 through R04 range between 2:30 and 4:05 for midday scenarios and between 2:00 and 2:20 for evening scenarios, as shown in Table 5-3. Regions R01 through R04 represent each evacuation zone evacuating independently. As shown in Section 2, Table 2-3, Oakmont North houses the majority of the residents within the area. Hence, Oakmont North (Region R01) has the highest 90th percentile ETE when evacuating alone. Even though Stonebridge, Region R03, doesn't have as many residents, the 90th percentile ETE is comparable to Region R01 as Stonebridge residents only have one way out (Stone Bridge Road) of the area.

The 90th percentile ETE for Regions R05 through R10 range between 2:45 and 4:20 for midday scenarios and between 2:00 and 2:30 for evening scenarios, as shown in Table 5-3. Regions R05 through R10 represent combination of evacuation zones. The 90th percentile ETE is the highest (4:20 for Midday and 2:30 for Evening) for Region R09 and R10, when Oakmont North and Oakmont South evacuate together. The 90th percentile ETE is the lowest when Oakmont South and Wild Oak evacuate together (Region R05). There are approximately 1,000 resident vehicles (See Table 2-4) evacuating within these two evacuation zones and since Oakmont North and Stonebridge are only under voluntary evacuation, they have additional roadway capacity to leave the area.

The 90th percentile ETE for all evacuation zones evacuating at once (Region R11) is on average 4 hours and 15 minutes for midday scenarios and 2 hours and 30 minutes for evening scenarios, as shown in Table 5-3. Traffic congestion within Oakmont and Wild Oak clears at approximately 4 hours and 45 minutes after the evacuation order as discussed in Section 5.2 and shown in Figure 5-1 through Figure 5-5. This is also illustrated in Figure 5-6 for Scenario 1, midweek midday. As shown in Figure 5-7 and Figure 5-9, traffic congestion is considerably less for evening scenarios when compared to midday scenarios. The roadway system within Oakmont and Wild Oak feeds into Highway 12 with two access points, Oakmont Drive and Pythian Road. As the external traffic along Highway 12 is at its peak (midday scenarios), it delays the evacuation of Oakmont and Wild Oak residents. When the external traffic is reduced (evening scenarios), however, vehicles from Oakmont and Wild Oak can occupy more of the capacity along Highway 12, hence reducing congestion and the 90th percentile ETE.

5.5 Effect of Direction of Wildfire Approach

Depending on the ignition point of the fire and winds during the emergency, a wildfire could force evacuees towards a certain direction out of Oakmont Village. Two cases were considered to simulate potential lane closures caused by flames or smoke from the wildfire:

1. Highway 12 Eastbound is closed near Lawndale Road forcing Oakmont and Wild Oak residents west towards Santa Rosa.
2. Highway 12 Westbound is closed near Melita Road forcing Oakmont and Wild Oak residents east towards Kenwood.

These two cases were run for Scenario 1, Region 11; the results are presented in Table 5-5.

5.5.1 Closure on Highway 12 Eastbound

This case was run to represent a wildfire event that is near Lawndale Road wherein the flames and/or smoke are blocking Highway 12 Eastbound. The road closure is located such that all evacuees from Oakmont and Wild Oak are forced westbound towards Santa Rosa. Highway 12 Westbound is still passable at this location but it is only utilized by external traffic vehicles.

As shown in Table 5-5, the 90th percentile ETE is 6:10 and the 100th percentile ETE is 6:35 when Oakmont and Wild Oak evacuees are forced westbound. The 90th and 100th percentile ETEs increase by 1:45 and 1:50, respectively, when compared to the base case scenario. As shown in Figure 5-10, the ETE curve for evacuation forced eastbound is not significantly impacted until 2 hours after the evacuation order. The traffic within Oakmont and Wild Oak starts to subside at around 3 hours (increased slope on the ETE curve) for the Base ETE while the Hwy 12 closure eastbound ETE curve is unchanged from 2 hours to approximately 3 hours and 15 minutes; indicating the level of congestion that is present within the network between these two times. The closure on Highway 12 Eastbound forces all evacuees westbound, only giving evacuees one general destination (Santa Rosa). This reduces the total available roadway capacity and delays ETE for Oakmont and Wild Oak.

5.5.2 Closure on Highway 12 Westbound

This case was run to represent a wildfire event that is near Melita Road wherein the flames and/or smoke are blocking Highway 12 Westbound. The road closure is located such that all evacuees from Oakmont and Wild Oak are forced eastbound towards Kenwood. Highway 12 Eastbound is still passable at this location but it is only utilized by external traffic vehicles.

The 90th percentile ETE is 5:30 and the 100th percentile ETE is 6:05 when Oakmont and Wild Oak evacuees are forced eastbound. The 90th and 100th percentile ETEs increase by 1 hour and 5 minutes and 1 hour and 20 minutes, respectively, when compared to base case scenario. As shown in Figure 5-10, the Base ETE curve and the Hwy 12 Closure Westbound curve have a significant separation (30-minutes) at approximately 1 hour and 45 minutes after the evacuation order. After this time, the separation between these two curves increases to up to approximately 1 hour, indicating that the evacuation of Oakmont and Wild Oak is delayed by approximately 1 hour if they are forced to travel towards Kenwood. When compared to a forced evacuation towards Santa Rosa, the increase in ETE is not as significant as vehicles are only allowed to make a right turn out of Oakmont Village compared to an only left turn.

5.6 Oakmont Gardens Evacuation Time Estimate Results

This section details the computation of evacuation time estimates for transit vehicles. The demand for transit service reflects the needs of Oakmont Gardens residents.

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

The procedure for computing transit dependent ETE is to:

- Estimate demand for transit service (discussed in Section 2).
- Estimate time to perform all transit functions.
- Estimate route travel times out of the area at risk.

Data provided by Oakmont Village Association indicated that transit vehicles for Oakmont Gardens can mobilize within 45 minutes and the passenger can be loaded onto 4 buses, 1 minibus and 1 van within 40 minutes.

The travel distance along the shortest path out of the area was estimated using GIS mapping software. Vehicle travel times are computed using average speeds computed by DYNEV. Table 5-6 presents the Oakmont Gardens evacuation time estimates using the above procedures.

For example, the ETE is computed as 45 + 28 + 40 = 1:55 (rounded up to nearest 5 minutes). Here, 28 minutes is the time to travel 0.5 miles at 1.1 mph, the average speed output by the model for this route at 45 minutes. The ETE for Oakmont Gardens is shorter than the 90^{th} percentile ETE for the general population.

Table 5-1. Percent of Population Groups Evacuating for Various Scenarios

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Visitors	Shadow	Oakmont Gardens	Los Guilicos	External Through Traffic
1	3.0%	97.0%	96%	85%	52%	100%	100%	100%
2	0.3%	99.7%	10%	5%	52%	100%	100%	40%
3	0.3%	99.7%	10%	100%	52%	100%	100%	100%
4	0.3%	99.7%	10%	5%	52%	100%	100%	40%

Households with Returning Commuters......... Households of Oakmont and Wild Oak residents who await the return of commuters prior to beginning the evacuation trip.
Households without Returning Commuters ... Households of Oakmont and Wild Oak residents who do not have commuters or will not await the return of commuters prior to beginning the evacuation trip.
Employees .... Contractual workers and service providers who live outside Oakmont and Wild Oak.
Visitors...People who are in Oakmont and Wild Oak visiting.
Shadow..Residents in the shadow region who will spontaneously decide to relocate during the evacuation.
Oakmont Gardens and Transit Vehicles ....Vehicle-equivalents present on the road during evacuation servicing Oakmont Gardens and transit-dependent people (1 bus is equivalent to 2 passenger vehicles).
External Through Traffic ....Traffic on Highway 12 at the start of the evacuation. This traffic is stopped by access control 2 hours after the evacuation begins.

Table 5-2. Vehicle Estimates by Scenario[3]

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Visitors	Shadow	Oakmont Gardens	Los Guilicos	External Through Traffic	Total Scenario Vehicles
1	133	3,881	1,279	451	8,926	10	10	5,244	19,934
2	13	4,001	133	27	8,926	10	10	2,098	15,218
3	13	4,001	133	530	8,926	10	10	5,244	18,867
4	13	4,001	133	27	8,926	10	10	2,098	15,218

[3] Vehicle estimates are for an evacuation of Oakmont and Wild Oak (Region R11).

Table 5-3. Time to Clear 90% of Oakmont and Wild Oak

		Summer			
Scenario:		(1)	(2)	(3)	(4)
Region	Evacuation Zones	Midweek		Weekend	
		Midday	Evening	Midday	Evening
R01	ON	4:05	2:20	3:40	2:20
R02	OS	2:55	2:00	2:30	2:00
R03	SB	3:45	2:00	3:30	2:00
R04	WO	3:00	2:00	2:30	2:00
R05	OS/WO	3:05	2:00	2:45	2:00
R06	SB/WO	3:45	2:00	3:35	2:00
R07	OS/WO/SB	3:50	2:00	3:40	2:00
R08	ON/SB	4:05	2:20	3:45	2:20
R09	ON/SB	4:20	2:25	3:50	2:25
R10	ON/OS/SB	4:15	2:30	3:55	2:30
R11	All	4:25	2:30	4:00	2:30

Table 5-4. Time to Clear 100% of Oakmont and Wild Oak

		Summer			
Scenario:		(1)	(2)	(3)	(4)
Region	Evacuation Zones	Midweek		Weekend	
		Midday	Evening	Midday	Evening
R01	ON	4:45	4:45	4:45	4:45
R02	OS	4:45	4:45	4:45	4:45
R03	SB	4:45	4:45	4:45	4:45
R04	WO	4:45	4:45	4:45	4:45
R05	OS/WO	4:45	4:45	4:45	4:45
R06	SB/WO	4:45	4:45	4:45	4:45
R07	OS/WO/SB	4:45	4:45	4:45	4:45
R08	ON/SB	4:45	4:45	4:45	4:45
R09	ON/SB	4:45	4:45	4:45	4:45
R10	ON/OS/SB	4:45	4:45	4:45	4:45
R11	All	4:45	4:45	4:45	4:45

Table 5-5. Evacuation Time Estimates for Direction of Wildfire Approach

90% ETE	
Base	4:25
Closure on Highway 12 Eastbound	6:10
Closure on Highway 12 Westbound	5:30
100% ETE	
Base	4:45
Closure on Highway 12 Eastbound	6:35
Closure on Highway 12 Westbound	6:05

Table 5-6. Oakmont Gardens Evacuation Time Estimates

Bus Route	Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Oakmont Gardens	45	0.5	1.1	28	40	**1:55**

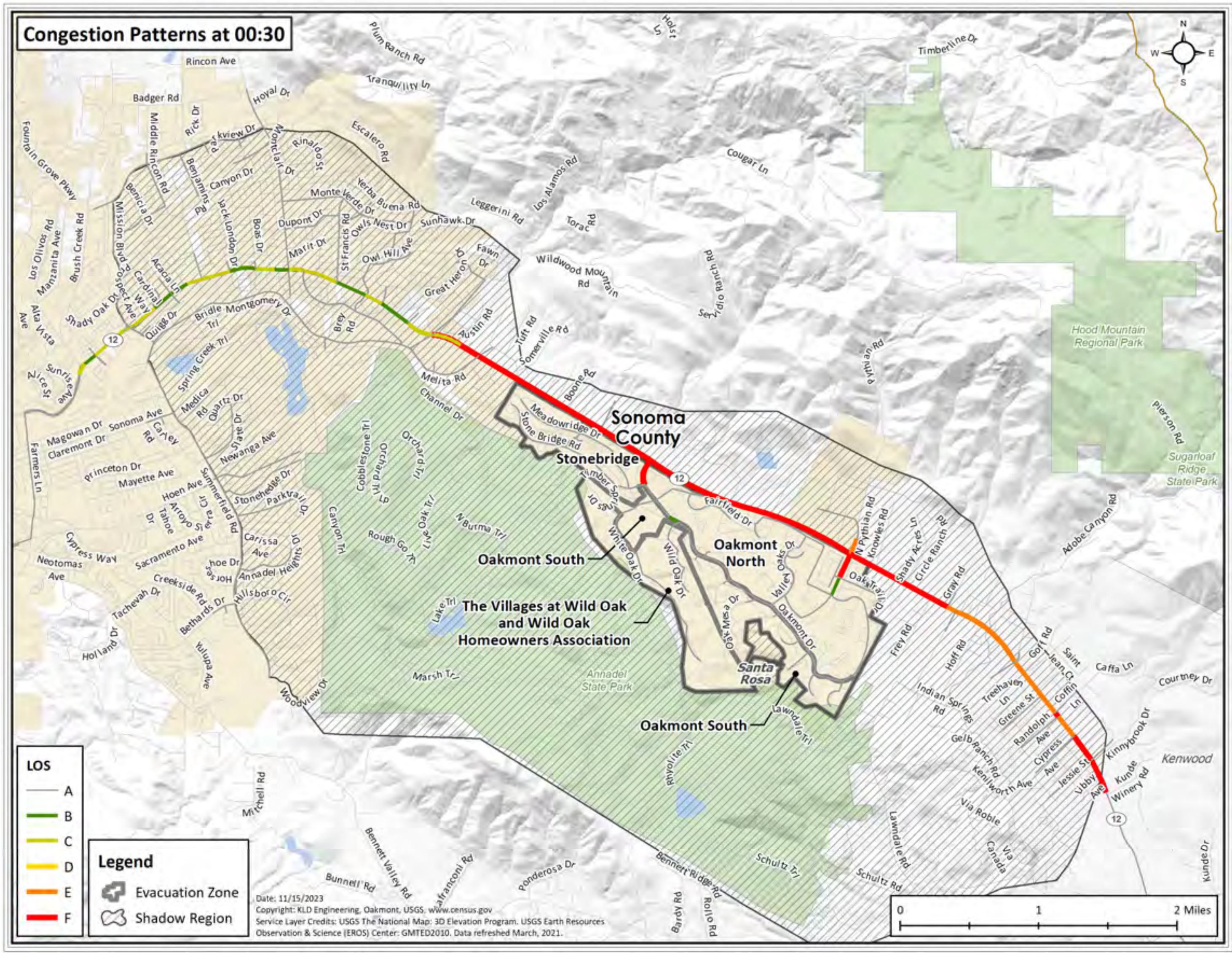


Figure 5-1. Congestion Patterns at 30 Minutes after the Evacuation Order

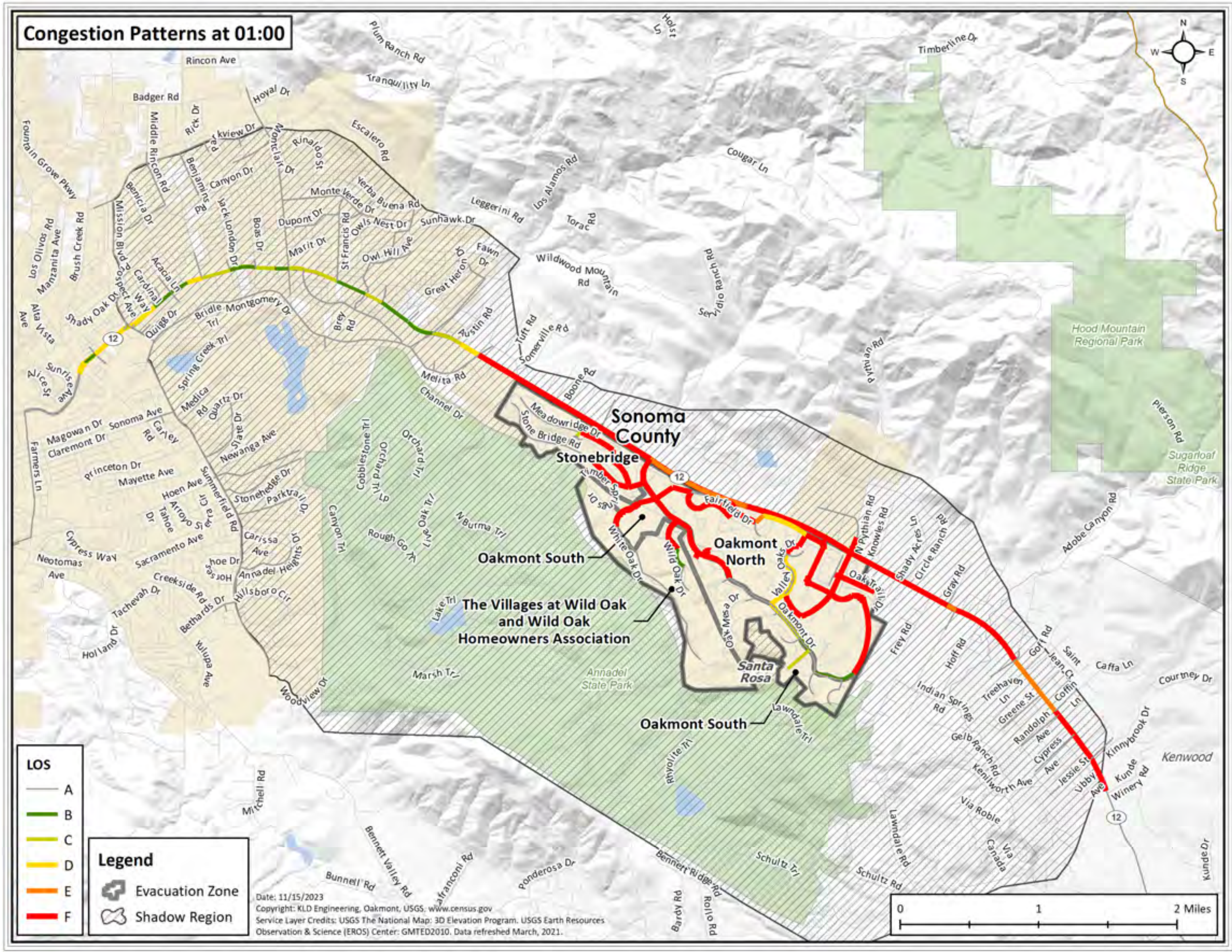


Figure 5-2. Congestion Patterns at 1 Hour after the Evacuation Order

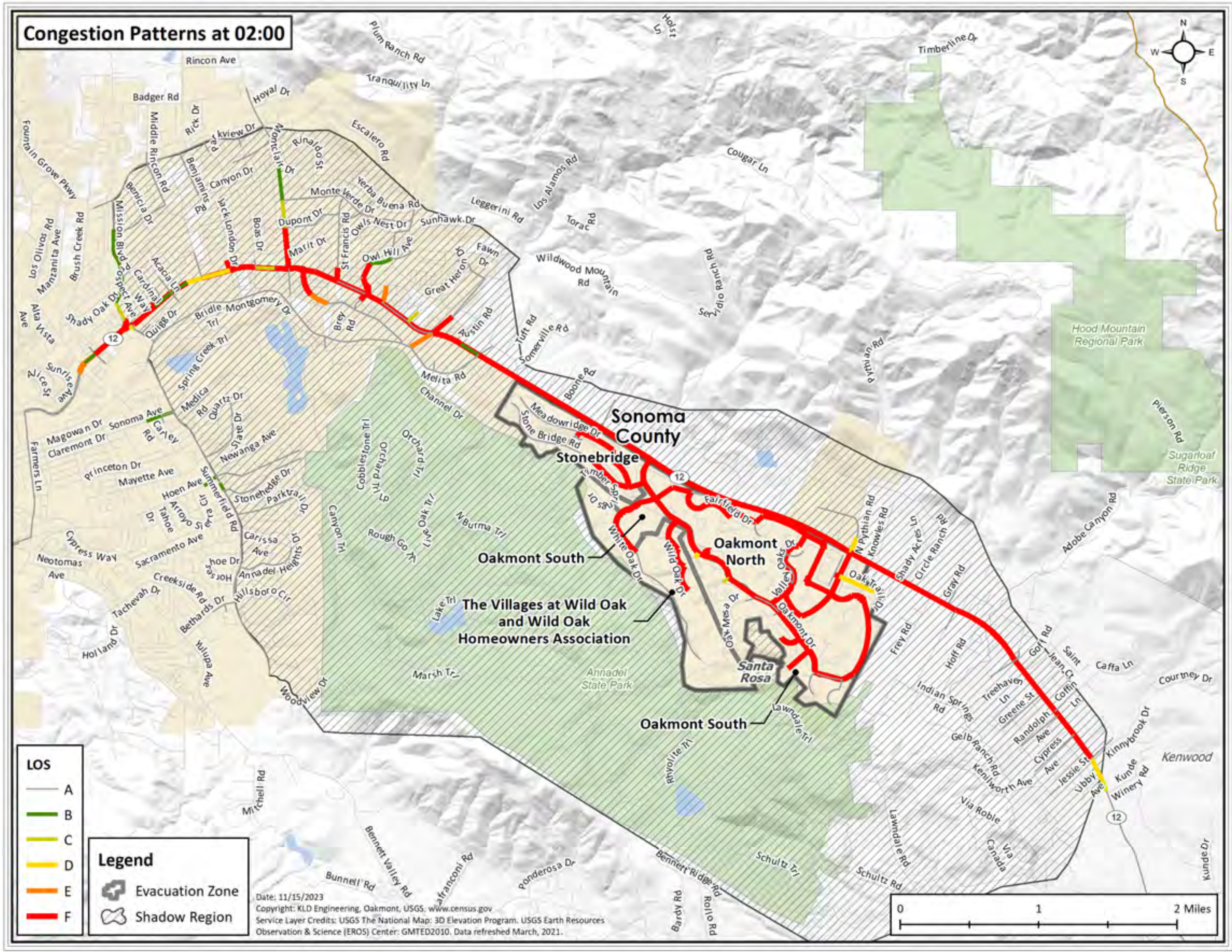


Figure 5-3. Congestion Patterns at 2 Hours after the Evacuation Order

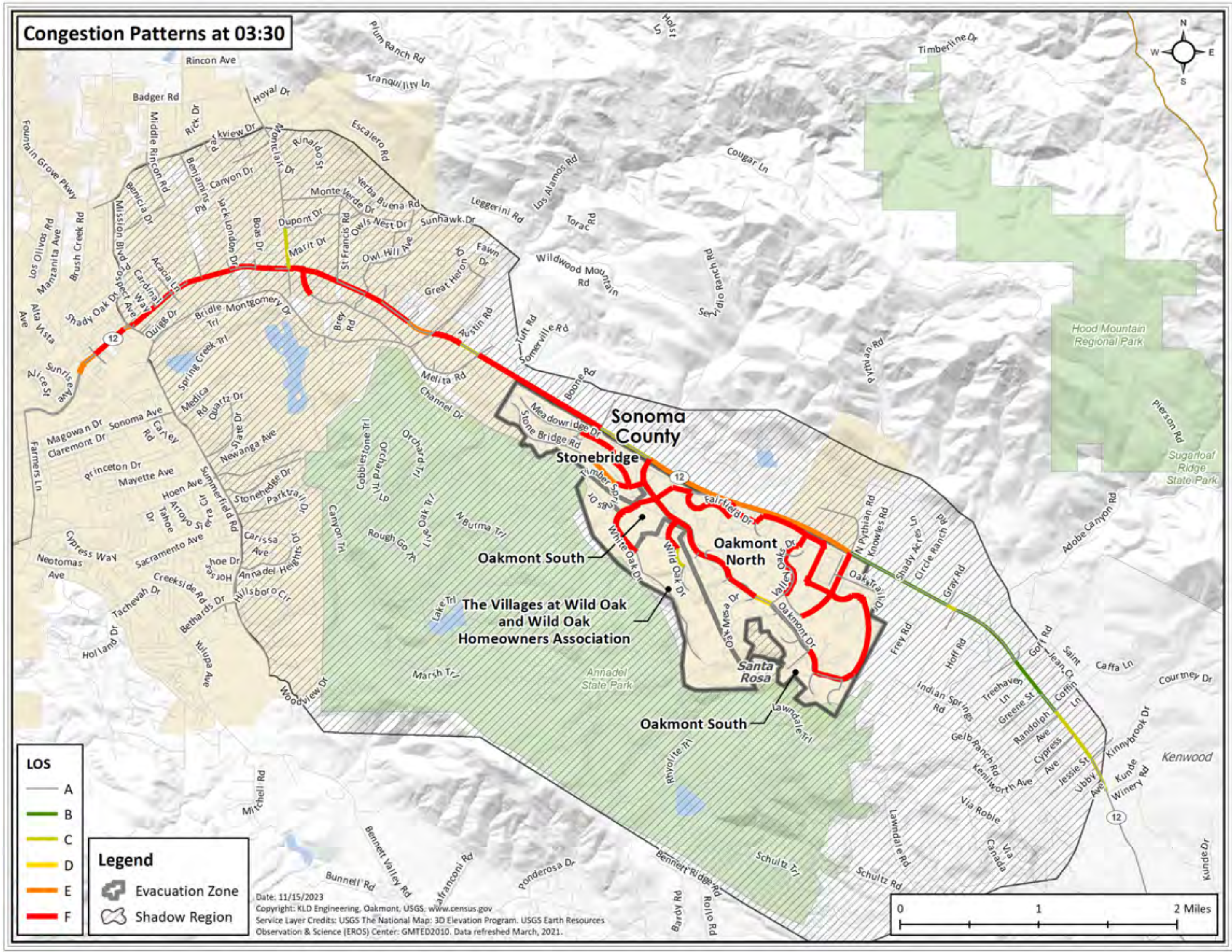


Figure 5-4. Congestion Patterns at 3 Hours and 30 Minutes after the Evacuation Order

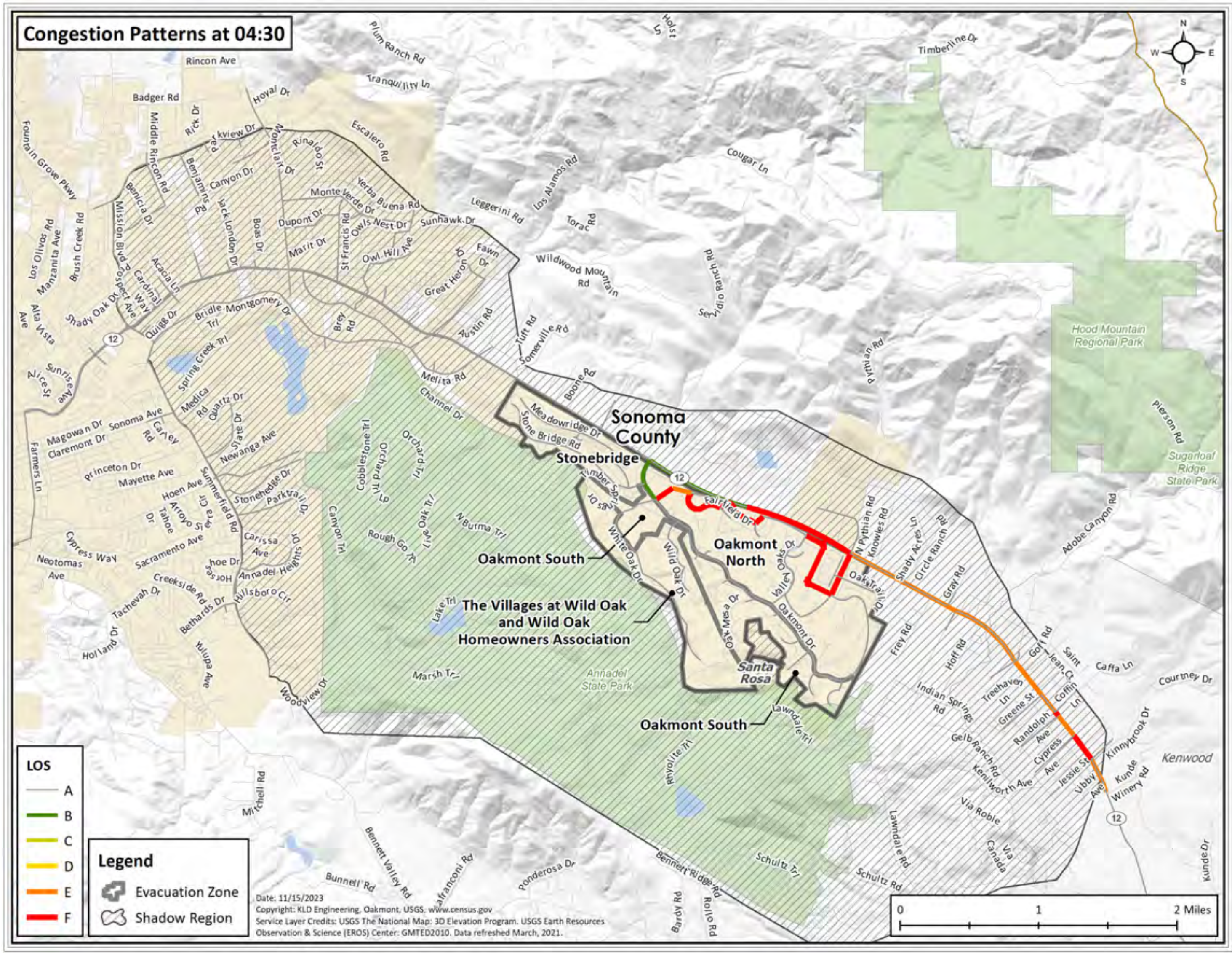


Figure 5-5. Congestion Patterns at 4 Hours and 30 Minutes after the Evacuation Order

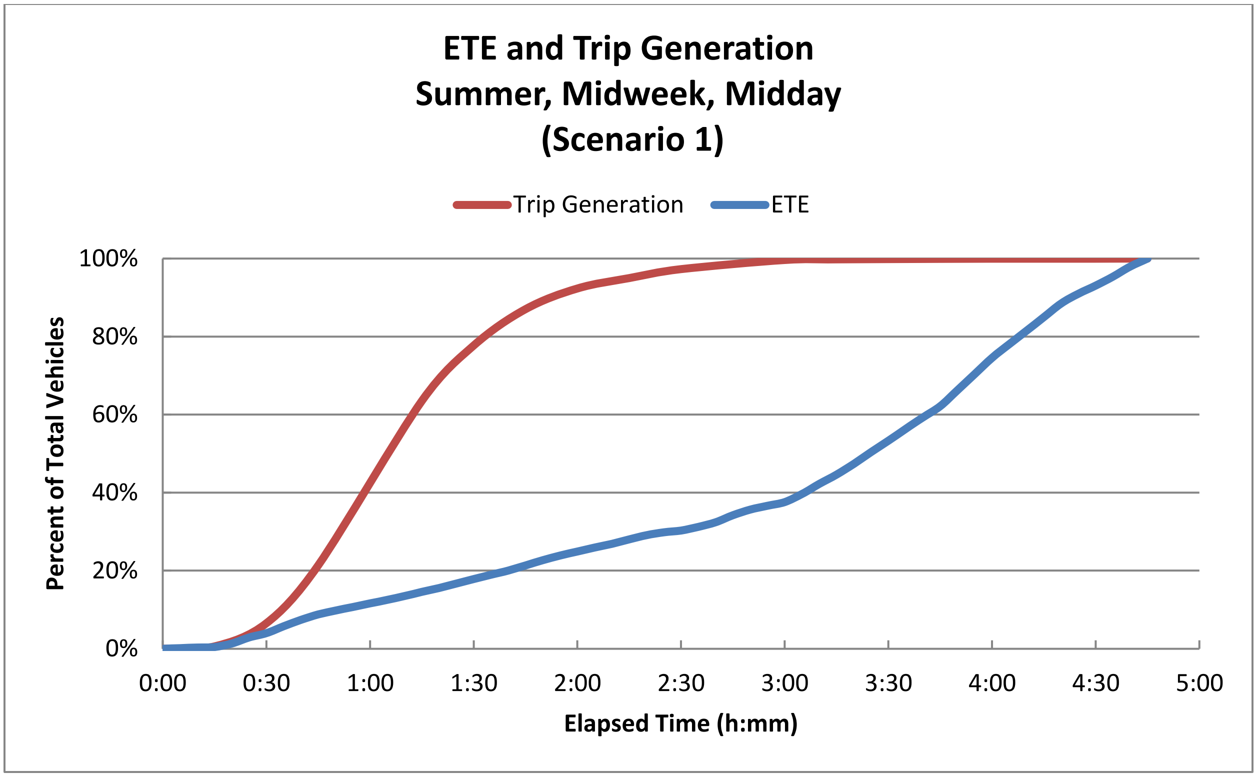


Figure 5-6. Evacuation Time Estimates - Scenario 1

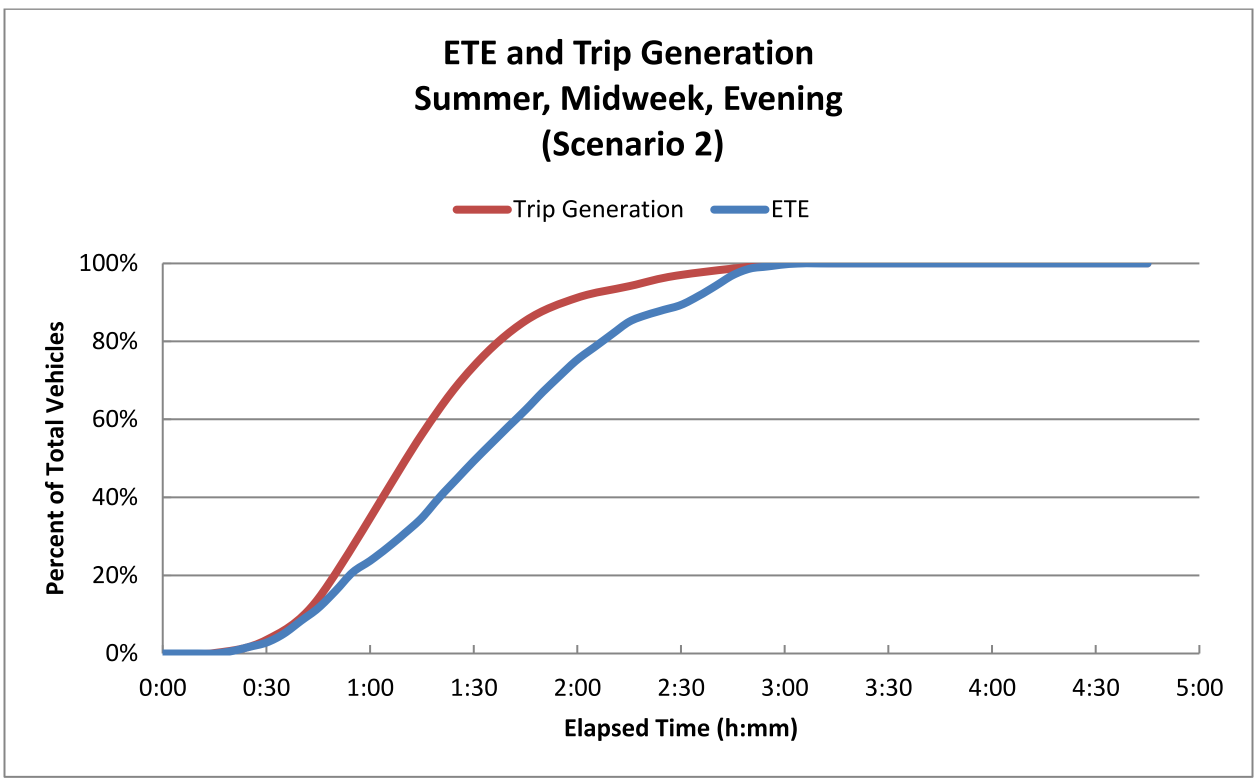


Figure 5-7. Evacuation Time Estimates - Scenario 2

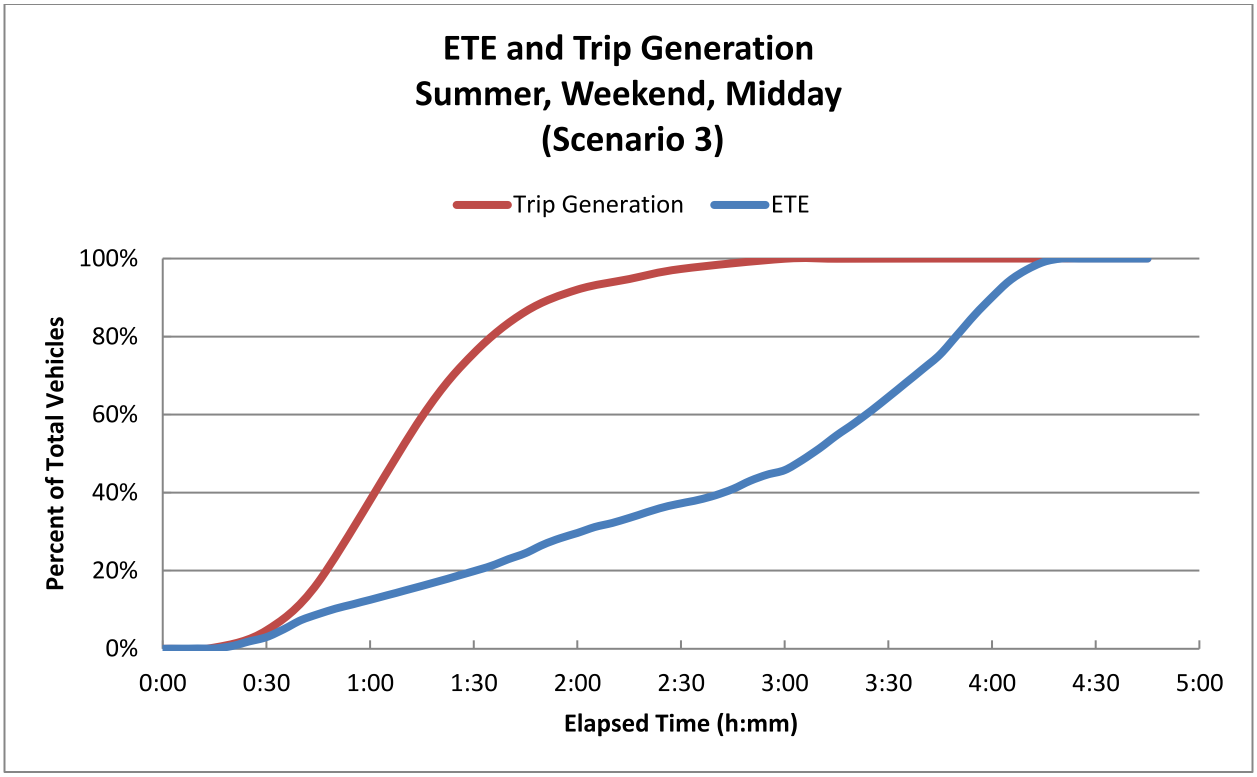


Figure 5-8. Evacuation Time Estimates - Scenario 3

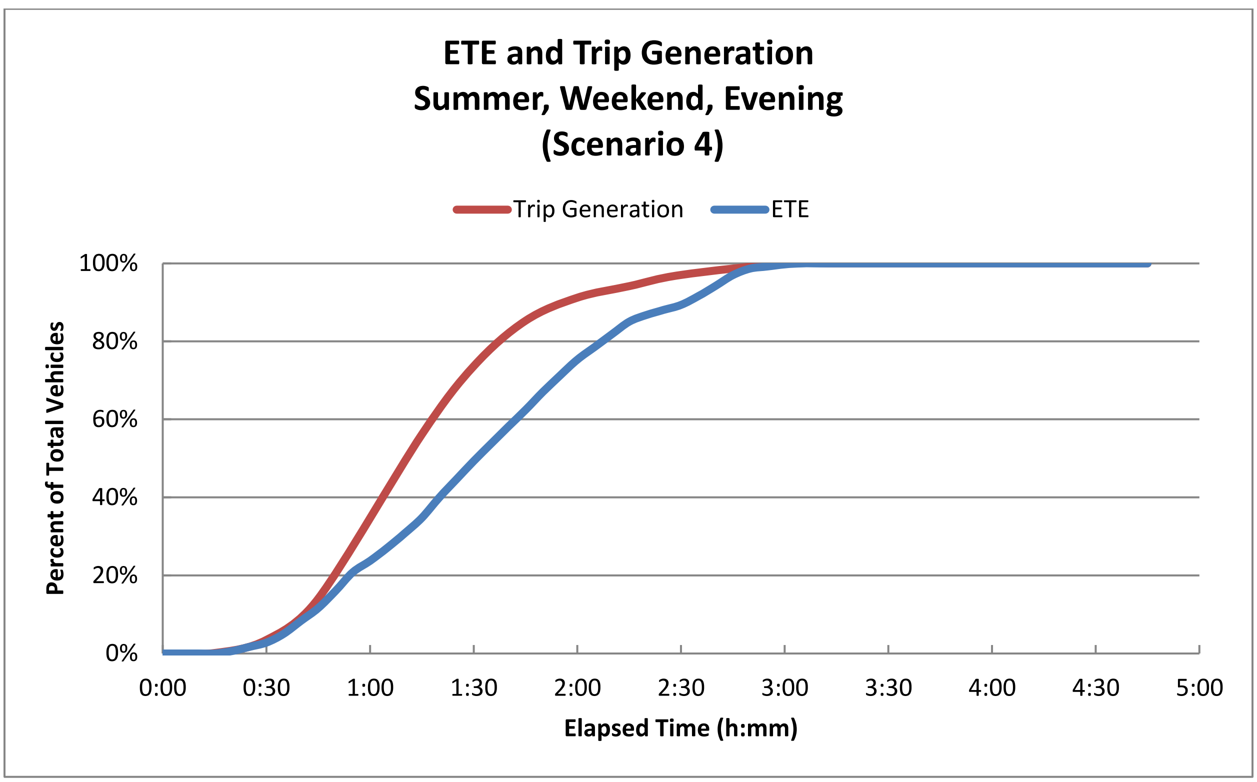


Figure 5-9. Evacuation Time Estimates - Scenario 4

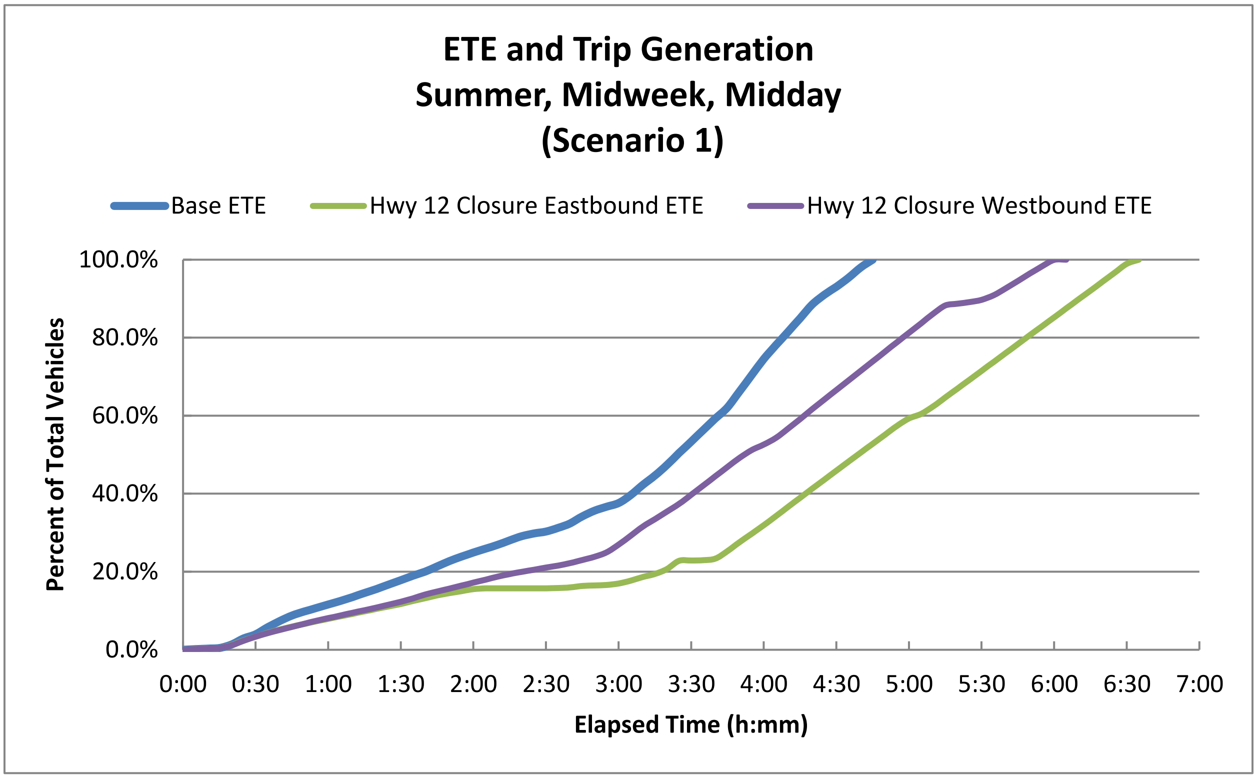


Figure 5-10. Evacuation Time Estimates – Forced Evacuation Direction

APPENDIX A

Demographic Survey

A. DEMOGRAPHIC SURVEY

A.1 Introduction

The development of evacuation time estimates for Oakmont and Wild Oak requires the identification of travel patterns, car ownership and household size of the population within the area. Demographic information can be obtained from Census data; however, 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 Oakmont and Wild Oak and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by conducting a demographic survey of a representative sample of the study area 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 …?").

A.2 Survey Instrument and Sampling Plan

Attachment A presents the final survey instrument used for the demographic 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.

The demographic survey was conducted through an online form. The website was advertised to the community from July 21, 2023 through August 23, 2023. During the survey period, a total of 1,104 surveys were completed by residents of Oakmont and Wild Oak and employees working in the community, which corresponds to a sampling error of ±2.3% at the 95% confidence level based on the estimated number of households (2,807 households) from the extrapolated 2023 population (4,631 people) using the 2020 census data (see Section 2.1). Table A-1 shows the number of completed surveys by evacuation zone within Oakmont and Wild Oak.

A.3 Survey Results

The results of the survey fall into four five categories. The first category is household demographic information. Household demographic information includes such factors as household size, automobile availability, and commuters. The second category of survey results is about evacuation responses regarding how residents in the study area would respond to an evacuation. The third category includes emergency communication responses. The fourth category of survey results are based on questions requested for informational purposes by the Oakmont Village Association and the Wild Oak Community. The final category of results contains time distributions for performing certain pre-evacuation activities. The time distribution data are processed to develop the trip generation distributions used in the evacuation modeling effort and are discussed in Section 4.

A review of the survey instrument reveals that several questions have a "Don't Know" (DK) or "Prefer not to say" option for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a DK or "Prefer not to say" response for a few questions. To address the issue of occasional DK/declined 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/declined responses are ignored, and the distributions are based upon the positive data that is acquired.

A.3.1 Household Demographic Results

Ridesharing

Based on the survey results, 27.8% of the households responded that they could share a ride with a neighbor, relative, or friend if a car was not available to them when advised to evacuate,11.1% stated they are unsure and 4.8% have other arrangements for exiting, and the remaining 56.3% stated they would not share a ride, as shown in Figure A-1.

Household Size

Figure A-2 presents the distribution of household size within Oakmont and Wild Oak based on the responses to the demographic survey. The average household contains 1.65 people.

Commuters

Figure A-3 presents the distribution of the number of commuters in each household for Oakmont and Wild Oak. Commuters are defined as household members who travel to work or college on a daily basis. The data shows an average of 0.21 commuters per household within Oakmont and Wild Oak and approximately 17% of households in the evacuation zones have at least one commuter. Of the households with commuters, 17.5% of commuters only commute one day per week, 18.9% commute two days per week, 20.2% commute three days per week, 12.7% commute four days per week, and 30.7% commute five days per week or more, as shown in Figure A-4.

Commuter Travel Modes

Figure A-5 presents the mode of travel that commuters use on a daily basis. The vast majority (95.4%) of commuters use their private automobiles to travel to work. The data shows an average of 1.03 employees per vehicle, assuming 2 people per vehicle – on average – for carpools.

A.3.2 Evacuation Response

Several questions were asked to gauge the population's response to an emergency. These are now discussed:

"Which evacuation zone do you live in?" The response is shown in Figure A-6. This question was used to determine which part of Oakmont or Wild Oak the respondent lives in. This question was also used to eliminate any responses that came from outside of Oakmont or Wild Oak. Based on the responses, 51.6% of respondents are located in Oakmont North, 19.0% are in Oakmont South, 18.1% are in Stonebridge, 10.9% are in the Villages at Wild Oak and Wild Oak HOA, and 0.4% are in Oakmont Gardens.

"How many vehicles would your household use during an evacuation?" The response is shown in Figure A-7. On average, evacuating households would use 1.35 vehicles. Five households (0.4% of respondents) stated they would not use any vehicles to evacuate. Figure A-8 presents automobile usage by household size.

"Do you or anyone in your household require assisted transportation (bus, medical van, wheelchair accessible vehicle, ambulance, or other type of special vehicle)? Please specify the type of assisted transportation and the number of people in need." Of the survey participants who responded, 1.5% of households stated they would need transportation assistance to evacuate. Of the households that require transportation assistance, 11.1% of households require a bus, 5.5% of households require a medical bus/van, 72.2% of households require a wheelchair-accessible vehicle, 5.6% of households require an ambulance, and 5.6% of households require some other form of transportation, as shown in Figure A-9.

"If an evacuation warning was issued in or near Oakmont/Wild Oak, what would you do to leave Oakmont/Wild Oak? Of the survey participants who responded, approximately 19% said they would await the return of other family members before evacuating and approximately 81% indicated they would not await the return of other family members.

"If an evacuation warning was issued near Oakmont and one household member was at home alone without a vehicle and other household members could not re-enter Oakmont, what would you do?" Based on the responses, approximately 87% of the households would request a ride out with a neighbor or friend, approximately 12% would hail an emergency vehicle for assistance, and approximately 1% would walk, bike, scooter, or use a golf cart, as shown in Figure A-10.

"If emergency officials had NOT ordered your evacuation zone to leave during a nearby emergency, would you evacuate?" This question is designed to elicit information regarding compliance with instructions to not evacuate by emergency officials. The results indicate that 47.7% of households who are not within the ordered evacuation zone would not evacuate; the remaining 52.3% would choose to evacuate the area even though they were not ordered to. Therefore, 52.3% of the population within the shadow region and within the outside of evacuation zones not advised to evacuate will voluntarily evacuate.

"If emergency officials advise you to evacuate due to an emergency, where would you evacuate?" Based on the responses received, approximately 54.8% of households would evacuate to a friend/relative's home, 37.3% would evacuate to a hotel, motel, or campground, 1.5% would evacuate to an evacuation shelter, 5.3% would evacuate to a second/seasonal home, and 1.1% would not evacuate. See Figure A-11 for complete results.

"Of the people who live in your household, are any seasonal residents? How many people only reside in your household for part of the year?" Based on the responses, approximately 5% of households include seasonal residents and about 95% of households do not include seasonal residents. Of the households that include seasonal residents, 30.8% of households include one seasonal resident, 61.5% of households include two seasonal residents, and 7.7% of households include three or more seasonal residents, as shown in Figure A-12.

"Which season(s) do they (seasonal residents) live in Oakmont or Wild Oak?" Based on the responses of households with seasonal residents, 17.2% of residents live in the community in the Spring, 31.3% of residents live in the community in the Summer, 30.3% of residents live in the community in the Fall, and 21.2% of residents live in Oakmont and Wild Oak in the Winter, as shown in Figure A-13.

"Do you own a recreational vehicle/RV? Would you drive or tow your RV to leave Oakmont/Wild Oak during an evacuation?" Based on the responses, approximately 5% of households do own an RV and approximately 95% of households do not own an RV. Of the households that own RVs, 52.5% of households would drive or tow their RV during an evacuation, 25.5% would maybe drive or tow their RV during an evacuation, and 22.0% would not or probably not tow or drive their RV during an evacuation, as shown in Figure A-14.

"Where do you usually park your recreational vehicle?" Of the households that own RVs, 11.9% would park their RV on their driveway or property, 67.8% would park their RV in a nearby lot within Oakmont and Wild Oak, and 20.3% would park their RV outside of Oakmont and Wild Oak, as shown in Figure A-15.

"Where would your RV be parked during a red flag warning?" Of the households that own RVs, 50.9% would park their RV on their driveway or property, 30.5% would park their RV in a nearby lot within Oakmont and Wild Oak, and 18.6% would park their RV outside of Oakmont and Wild Oak, as shown in Figure A-16.

"Do you have any pets?" Based on the responses, 55.4% of households do not own pets and 44.6% of households own pets.

"What type of pet(s) and/or animal(s) do you have?" Of the households that have pets, 60.4% own dogs and 39.6% own cats.

"What would you do with your pet(s) and/or animal(s) if you had to evacuate?" Of the households that have pets, 6.5% of households would take their pets with them to a shelter, 92.3% would take their pet with them somewhere else, and 1.2% would leave their pet at home, as shown in Figure A-17.

"Do you have a pet go-bag or kit?" Of the households that have pets, 74.5% have go-bags/kits and 25.5% do not have go-bags/kits.

"Do you have an evacuation go-bag in the home or car?" Based on the responses, 64.7% of households have a go-bag and 35.3% do not have a go-bag.

"Do you have an evacuation checklist at home? (e.g., actions to take before evacuating, such as closing all windows)?" Based on the responses, 58.2% of households have a checklist and 41.8% of households do not have a checklist.

"Do you have workers, such as cleaners, care-givers, and landscapers, in/at your home regularly?" Approximately 44% of respondents answered that they do have contractual workers at their household regularly and about 56% of respondents do not have contractual workers at their households regularly.

"During the average week, how many workers' vehicles come to your home?" Of the households that have contractual workers come to their home, 80.3% of respondents' workers bring only one vehicle to the household, 15.5% of respondents' workers bring two vehicles to the household, and 4.2% of respondents' workers bring three or more vehicles to the household, as shown in Figure A-18.

"On average, how long do these workers stay at your home?" Of the households that have contractual workers come to their home, 15.3% of respondents' workers stay 30 minutes or less at the home, 21.6% of workers stay between 31 to 60 minutes at the home, 21.3% of workers stay 1 hour to 1 hour and 30 minutes at the home, 20.3% of workers stay 1 hour and 31 minutes to 2 hours at the home, and 21.5% of workers stay 2 hours and 30 minutes at the home. These percentages can be seen in Figure A-19.

A.3.3 Emergency Communications

"How would you rate the cell phone coverage in your area?" Figure A-20 presents how the respondents rated cell phone coverage in their area. The purpose of this question was to gain insight into how well a cell phone-based alert and/or notification would be received. As shown in the figure, 91.2% of respondents rated cell phone coverage as normally reliable in their area. 8.4% of respondents rated their cell phone coverage as poor/unreliable, and 0.4% of respondents do not have a cell phone.

"Have you signed up for electronic notices to your devices for evacuation warnings, etc.? If so, which one(s)?" Figure A-21 displays the percentages of respondents who have opted into their local emergency alert and warning systems by method. 23.1% of households indicated that they registered for CivicReady (Santa Rosa), 30.3% registered for SoCo Alert (Sonoma Co), 21.3% registered for Nixle (Napa Co), 13.8% use the NOAA Weather radio, 8.8% indicated they are opted in for other emergency alerts and a few (2.7%) indicated they are not registered in any emergency alert/warning system.

"If you have already signed up for electronic notices for evacuation warnings to your devices, which options did you set up to receive notifications?" Based on the responses of households, 45.7% of households receive texts to their cell phones, 13.2% receive phone calls to their cell phones, 7.9% receive phone calls to their landlines, 15.1% receive emails, 14.8% use the NOAA Weather radio, and 3.3% are not registered for alerts, as shown in Figure A-22.

"If emergency officials notified you to evacuate, who would you notify?" This question is designed to elicit information regarding notification between residents in the study area. Based on the respondents who elected to answer, 30.7% would notify a neighbor or friend, 30.7% would notify a neighborhood leader, 28.9% would notify relatives, and 9.7% would not notify anyone, as shown in Figure A-23.

"How would you notify your neighbors, friends, and/or Neighborhood Leaders to evacuate?" Based on the responses received, 27.7% of households would notify others in person, 31.4% would notify by text message, 31.4% would notify by phone call, 5.7% would notify by email, and a few indicated they would use another method to notify others (1.0%). A small percentage (2.8%) of respondents would not notify anyone. Figure A-24 displays these percentages.

A.3.4 Informational Purposes Only

"Has your neighborhood joined Meet Your Neighbors (MYN)?" Based on the responses, 31.3% of households have joined Meet Your Neighbors and 13.1% of households have not joined Meet Your Neighbors, 40.9% of households do not know if their neighborhood has joined Meet Your Neighbors, and 14.7% are not familiar with Meet Your Neighbors, as shown in Figure A-25.

"Are you a Meet Your Neighbors (MYN) neighborhood leader or a former COPE neighborhood leader?" Based on the responses, 11.3% of respondents are a Meet Your Neighbors neighborhood leader or former COPE neighborhood leader, while 67.5% are not a current or former leader, and 21.2% of respondents are not familiar with Meet Your Neighbors, as shown in Figure A-26.

"Are you an Oakmont Emergency Preparedness Committee (OPEC) Zone Communicator?" Based on the responses, 4.8% of respondents are OEPC Zone Communicators and 81.7% are not OEPC Zone Communicators, while 13.5% of respondents are not familiar with what a Zone Communicator is. These percentages can be seen in Figure A-27.

"What are your sources for local (Oakmont/Wild Oak) news?" Based on the responses, 42.8% of households use the Oakmont News, 28.2% use Inside Oakmont (formerly Oakmont Online), 3.7% use the Wild Oak Newsletter, 20.3% use NextDoor, and 1.3% use Kenwood News. 2.4% of respondents get their news from another source and 1.3% do not have any sources for local news, as shown in Figure A-28.

"During the Glass fire in September 2020, evacuations were called for Oakmont in the early evening. Approximately what time did you leave your home?" As shown in Figure A-29, 40.1% of households left between 6 PM and 8 PM, 17.6% of households left between 8 PM to 10 PM, 10.0% left between 10 PM and 12 AM and 1.7% left after midnight. A percentage of residents were home but did not evacuate (0.9%), and 29.7% of households did not live in the area or were away during the fire.

"During the Glass fire in September 2020, how long did it take from leaving your home to exit Oakmont and reach relatively clear traffic? And you felt safe, and out of danger?" Based on the responses, 22.9% of households took less than 15 minutes to evacuate, 21.3% took between 16 through 30 minutes, 23.1% took between 31 to 60 minutes, 20.4% took over 1 hour but less than 2 hours, 9.0% took over 2 hours but less than 3 hours, 2.4% took over 3 hours but less than 4 hours, and 0.9% took more than 4 hours. The results can be seen in Figure A-30.

Table A-1. Completed Surveys by Evacuation Zone

Evacuation Zone	Number of Completed Surveys
Oakmont North (generally between Hwy 12 & Oakmont Dr)	570
Oakmont South (closer to Trione-Annadel SP, but excluding Wild Oak)	210
Stonebridge	200
The Villages at Wild Oak and Wild Oak HOA	120
Oakmont Gardens	4
TOTAL:	**1,104**

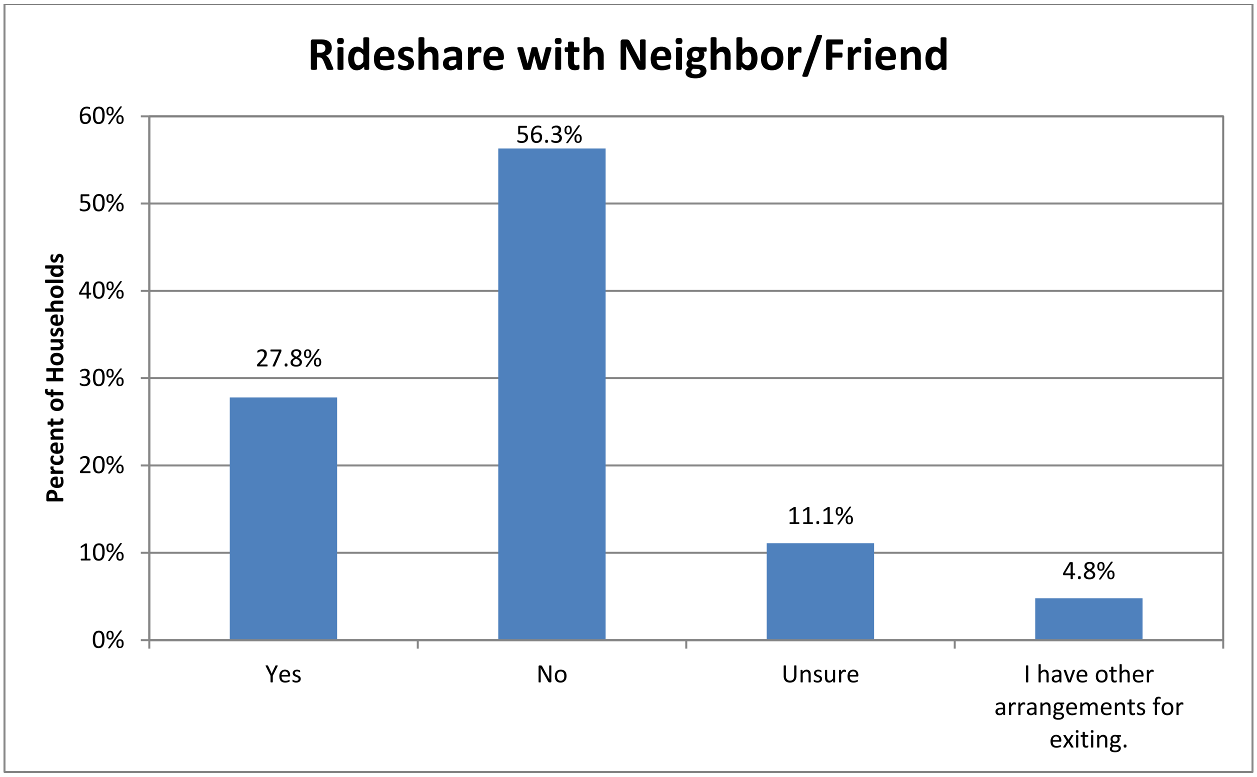


Figure A-1. Rideshare with Neighbor/Friend

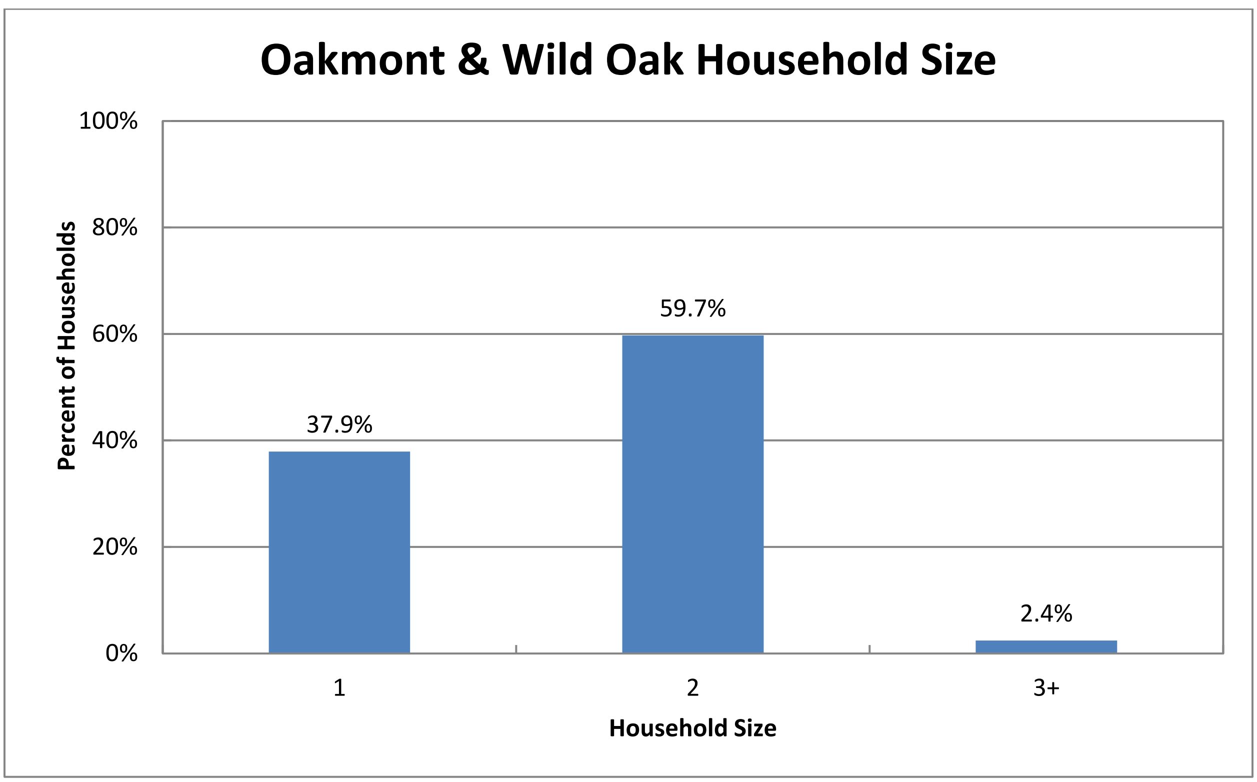


Figure A-2. Household Size in the Study Area

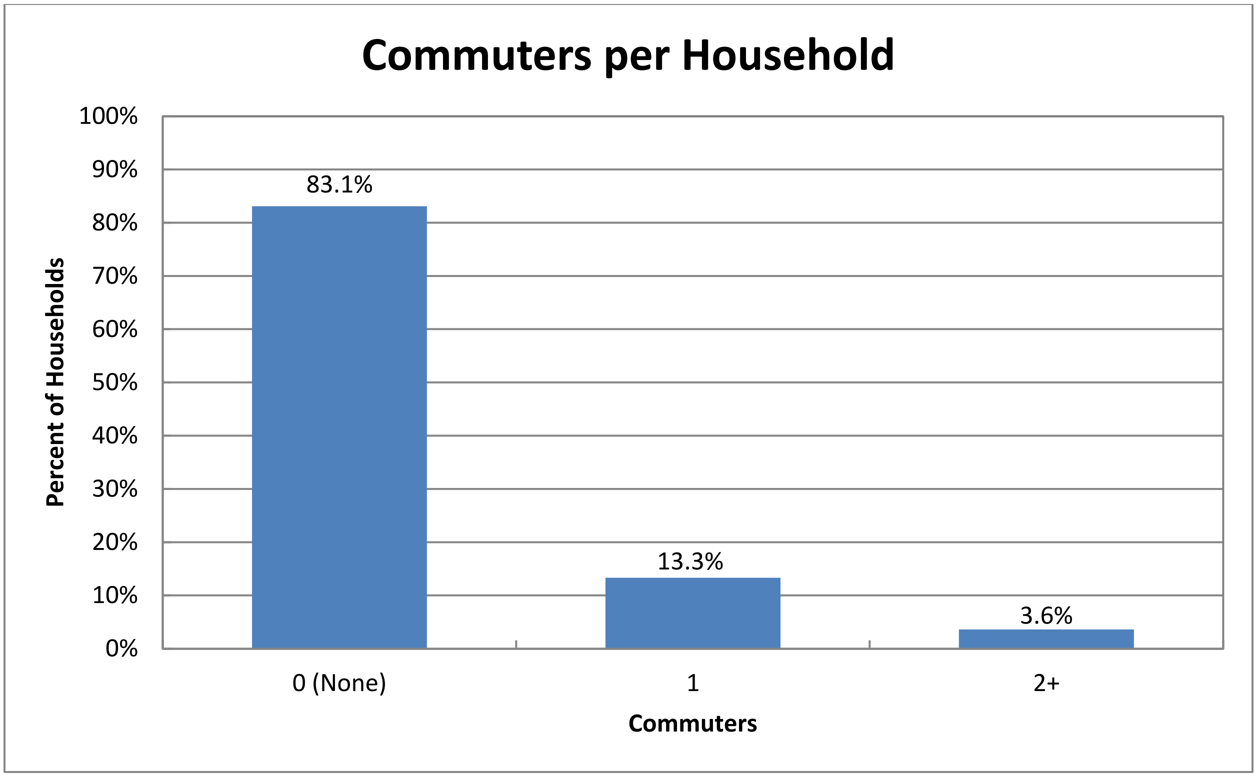


Figure A-3. Commuters Per Household

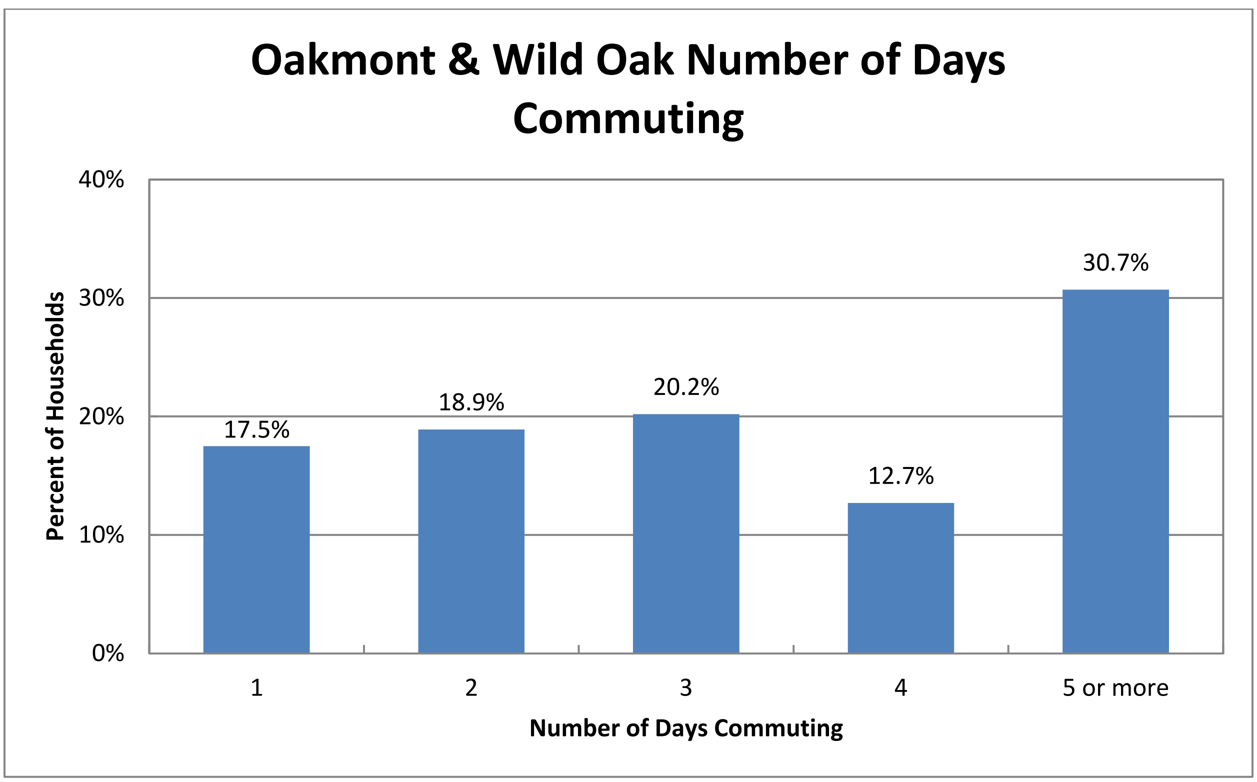


Figure A-4. Number of Days Commuting Per Week

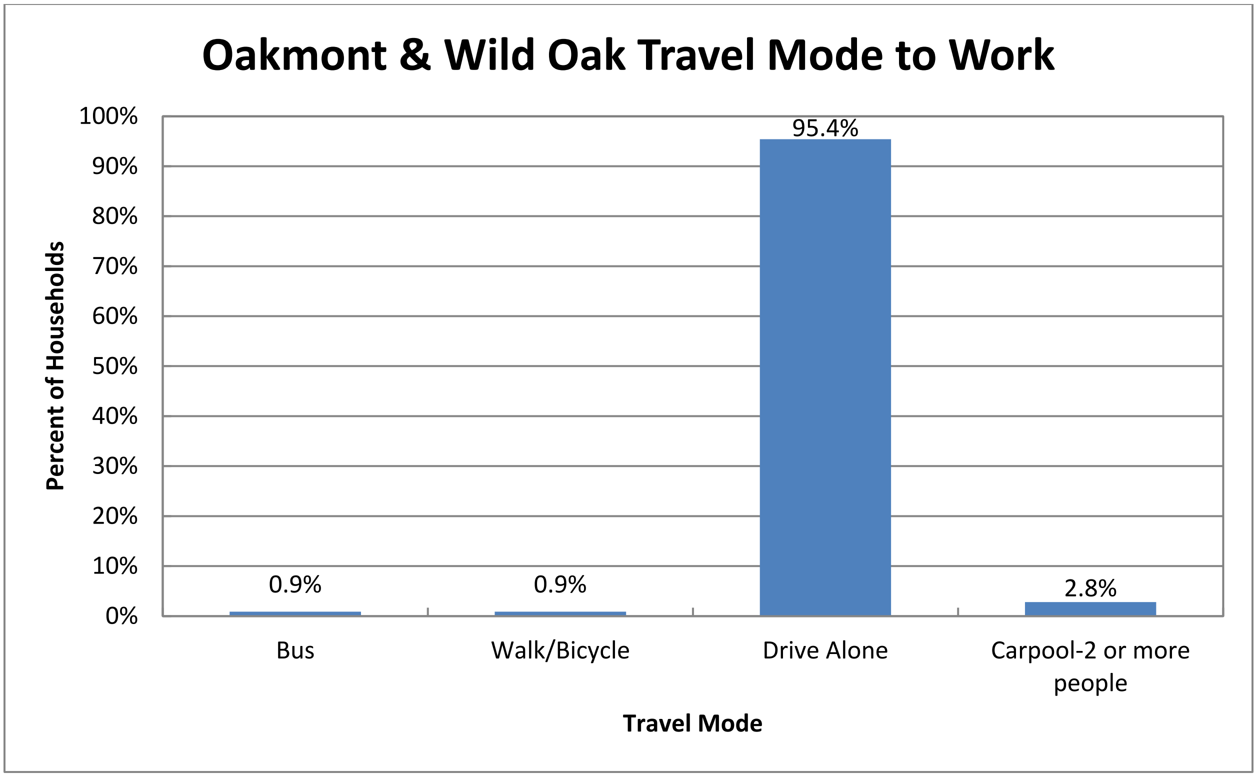


Figure A-5. Travel Mode to Work

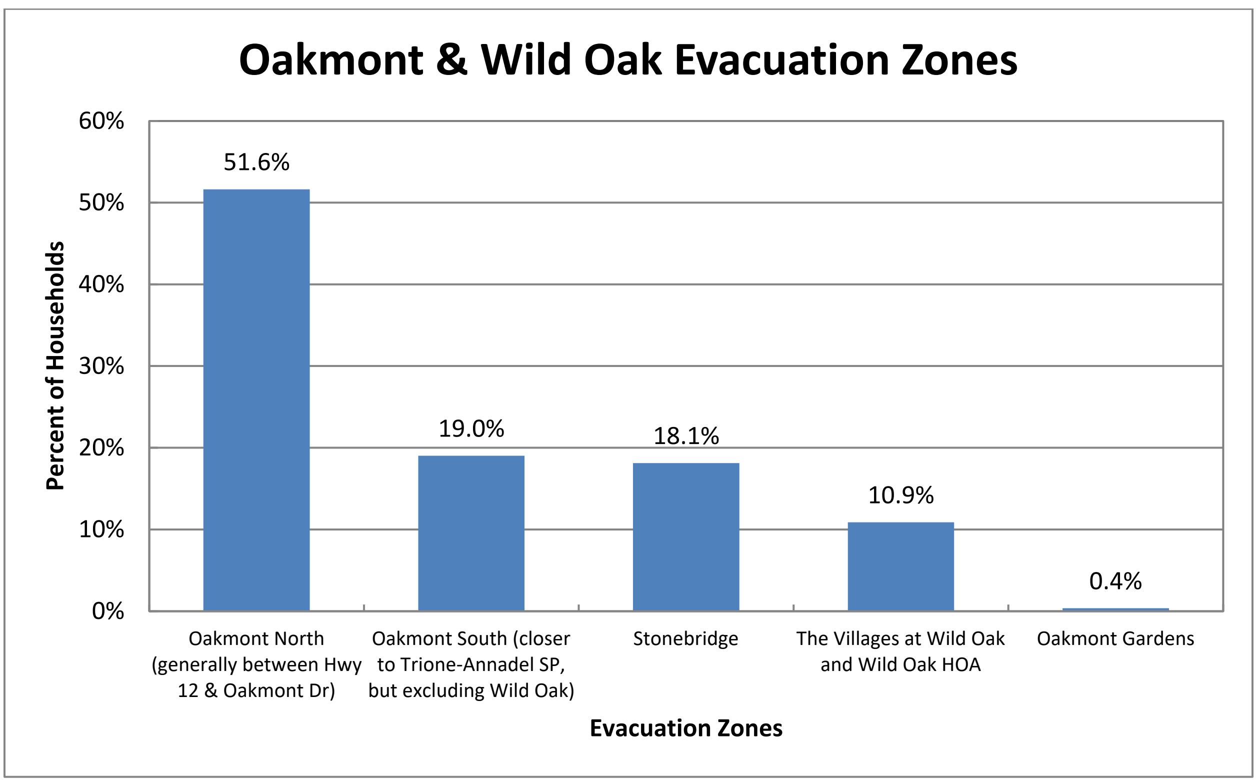


Figure A-6. Households in Evacuation Zones

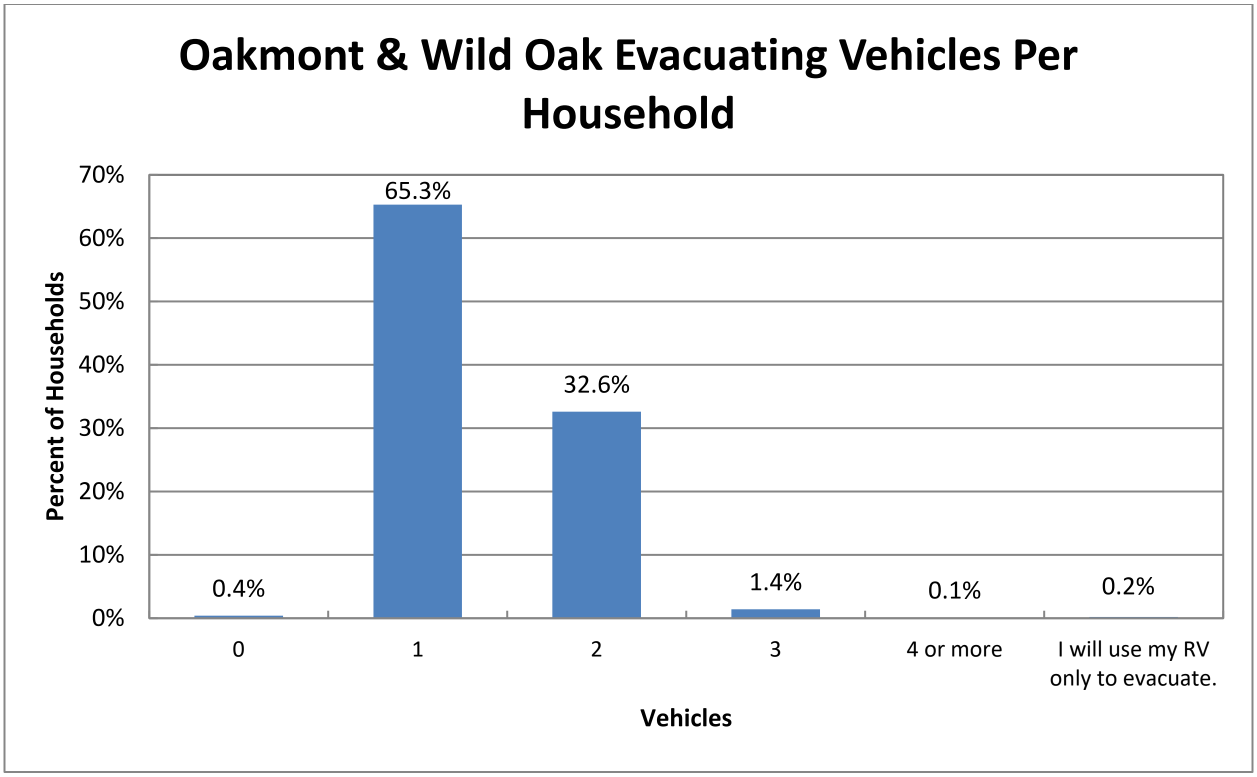


Figure A-7. Number of Evacuating Vehicles Per Household

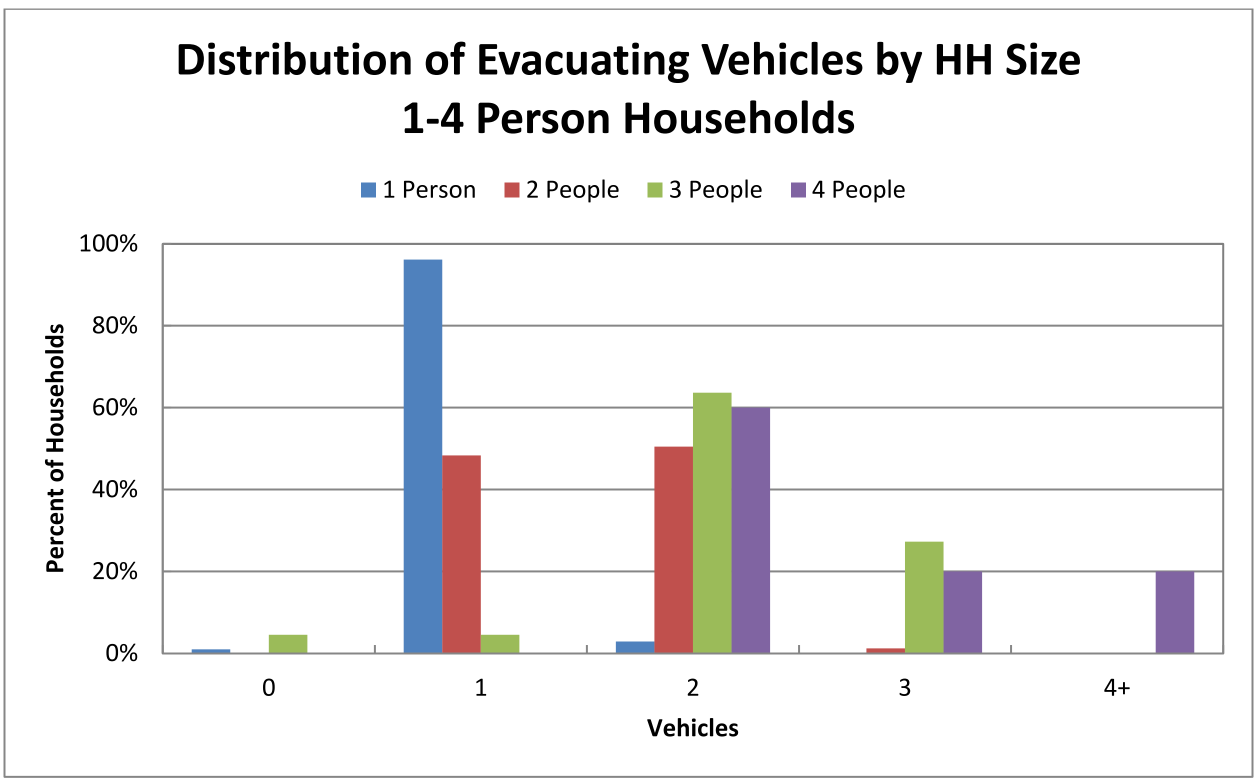


Figure A-8. Evacuation Vehicle Usage– 1 to 4 Person Households

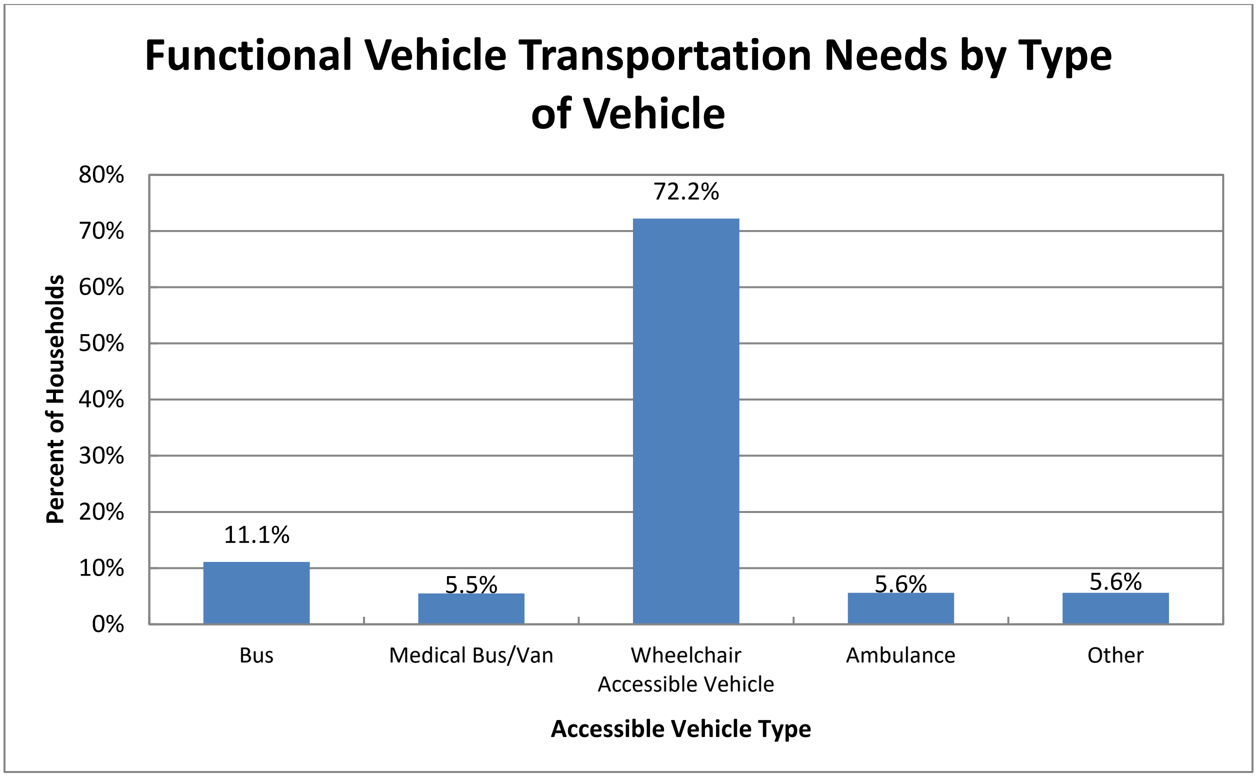


Figure A-9. Functional Vehicle Transportation Needs

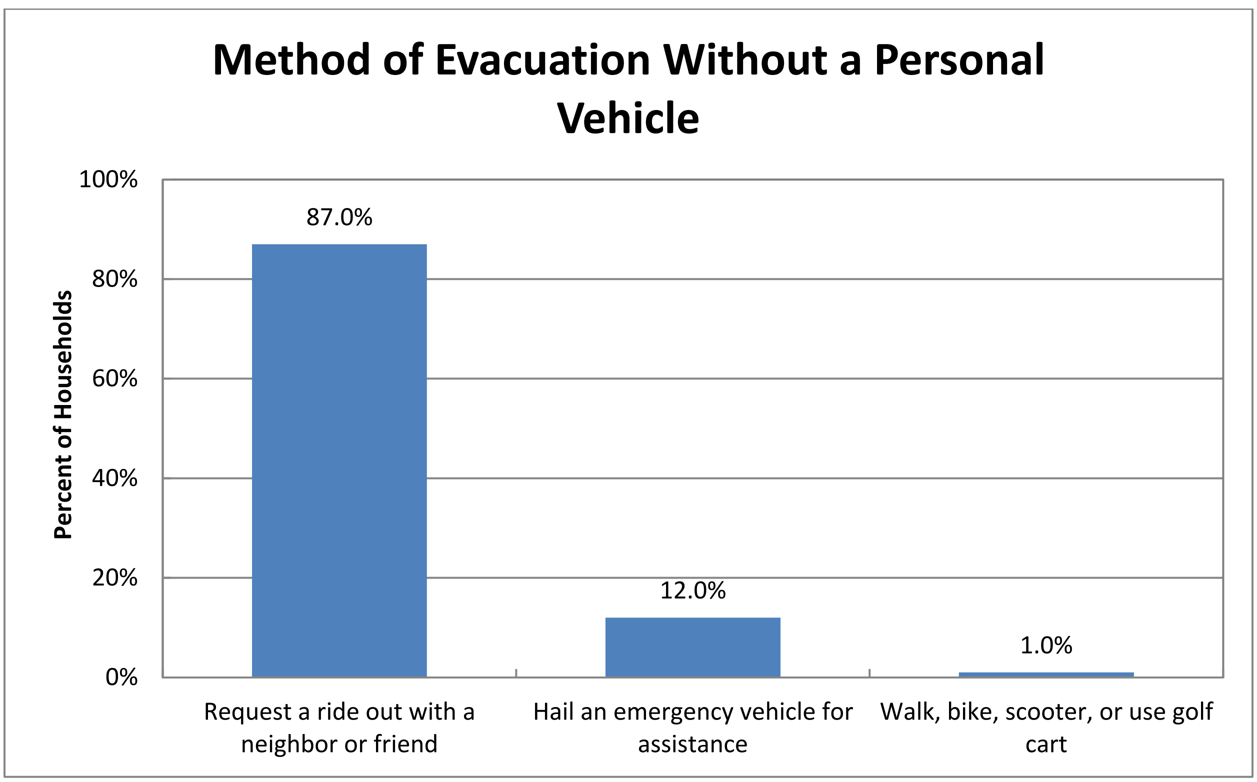


Figure A-10. Evacuation Without a Personal Vehicle

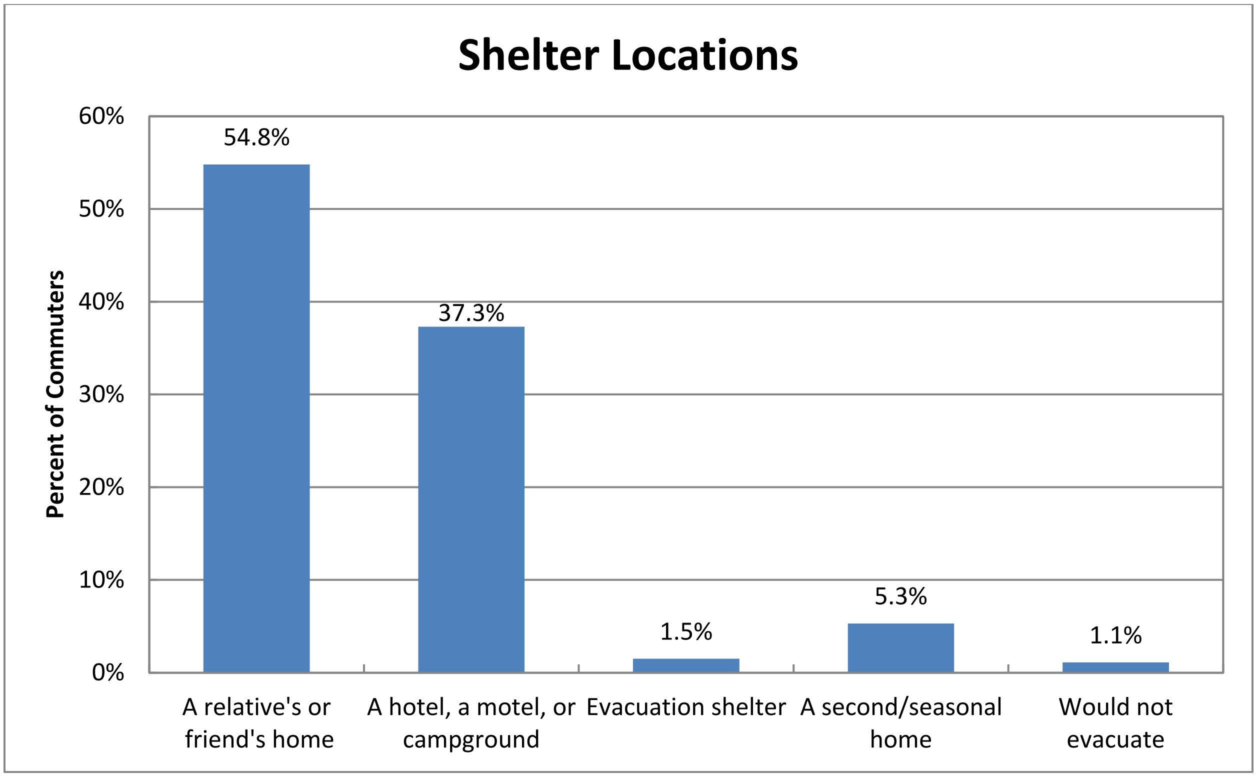


Figure A-11. Shelter Locations

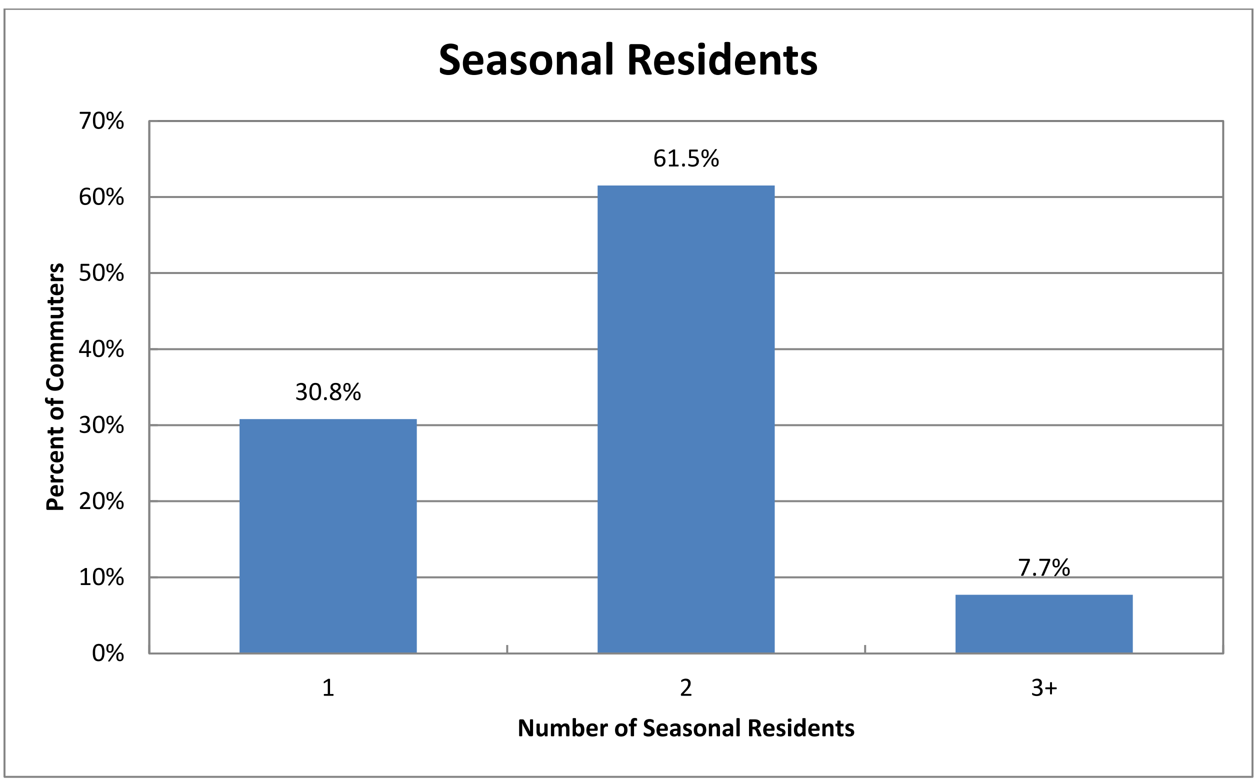


Figure A-12. Number of Seasonal Residents Per Household

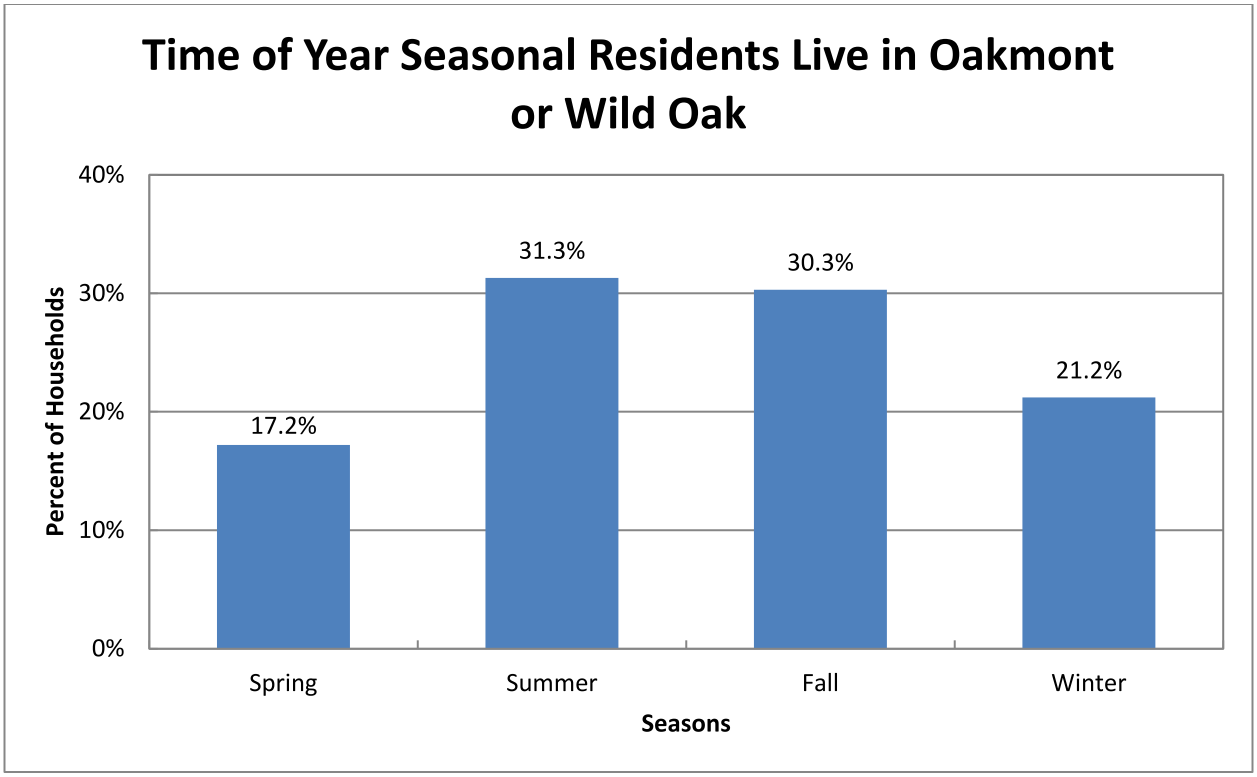


Figure A-13. Time of Year Seasonal Residents Live in the Community

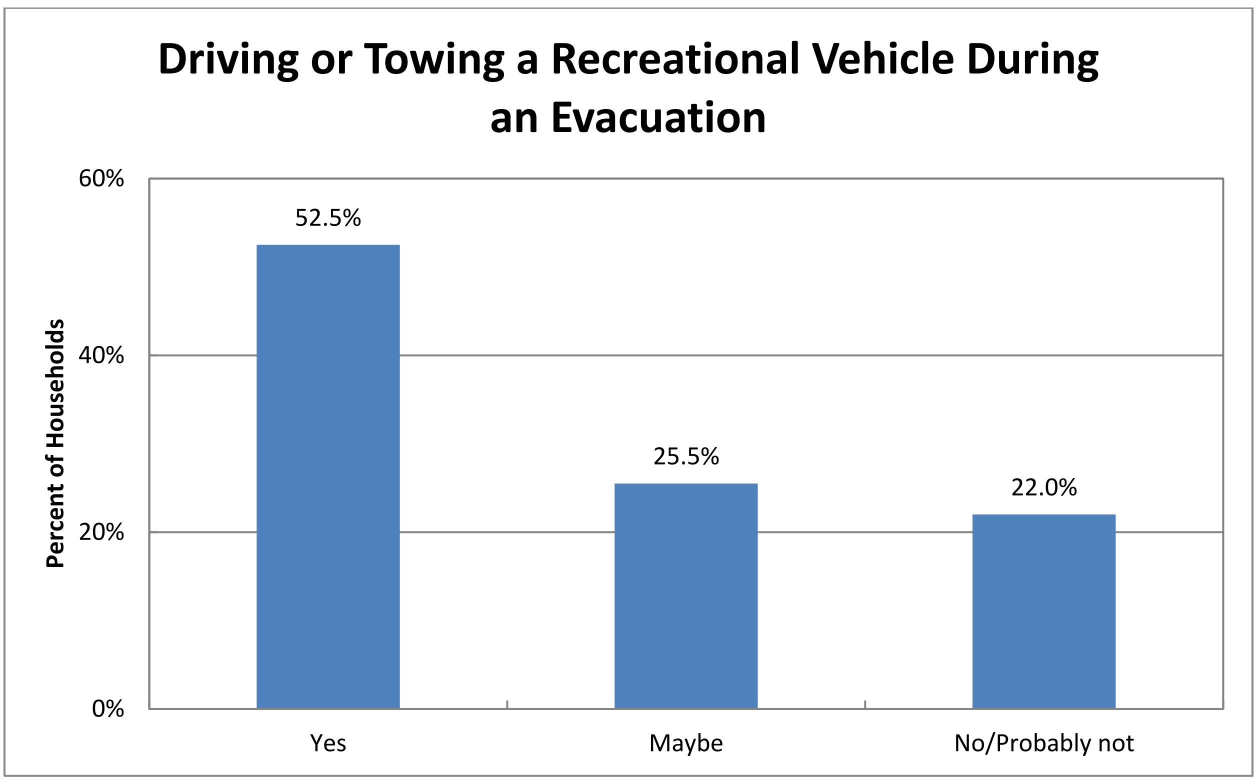


Figure A-14. Recreational Vehicles During an Evacuation

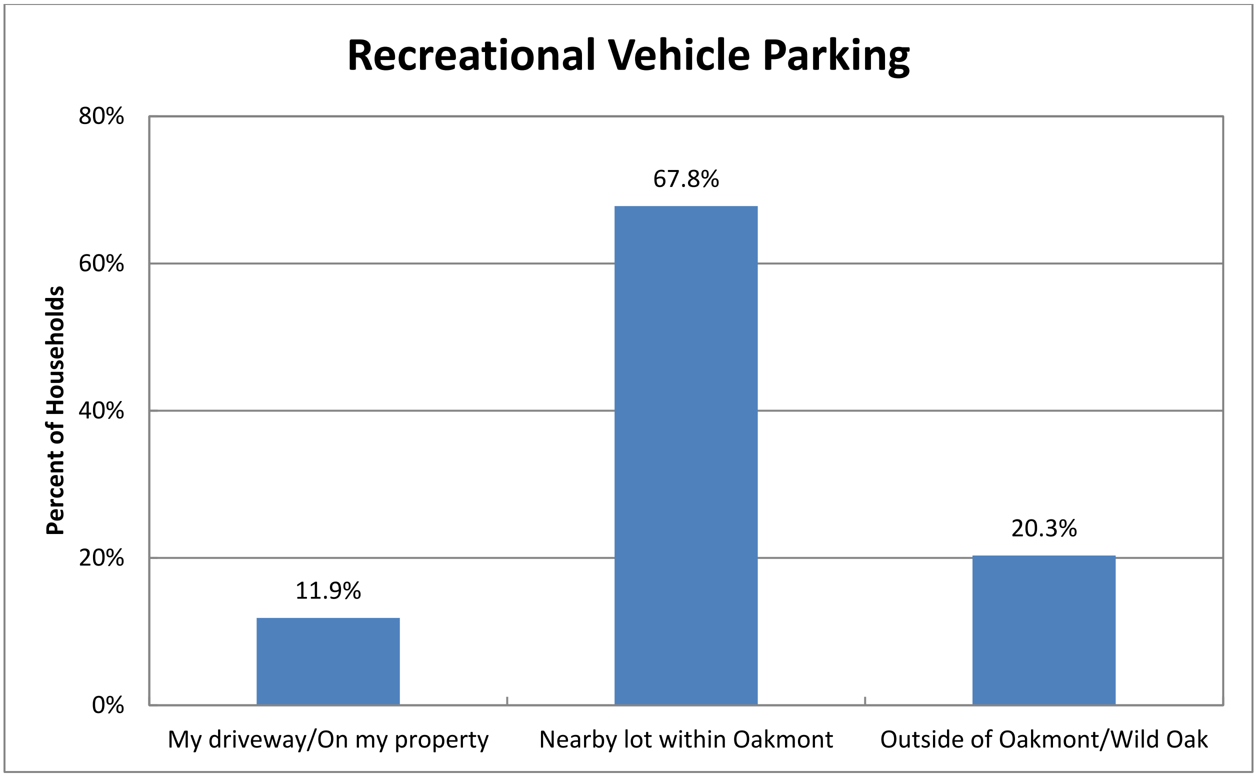


Figure A-15. Recreational Vehicle Parking

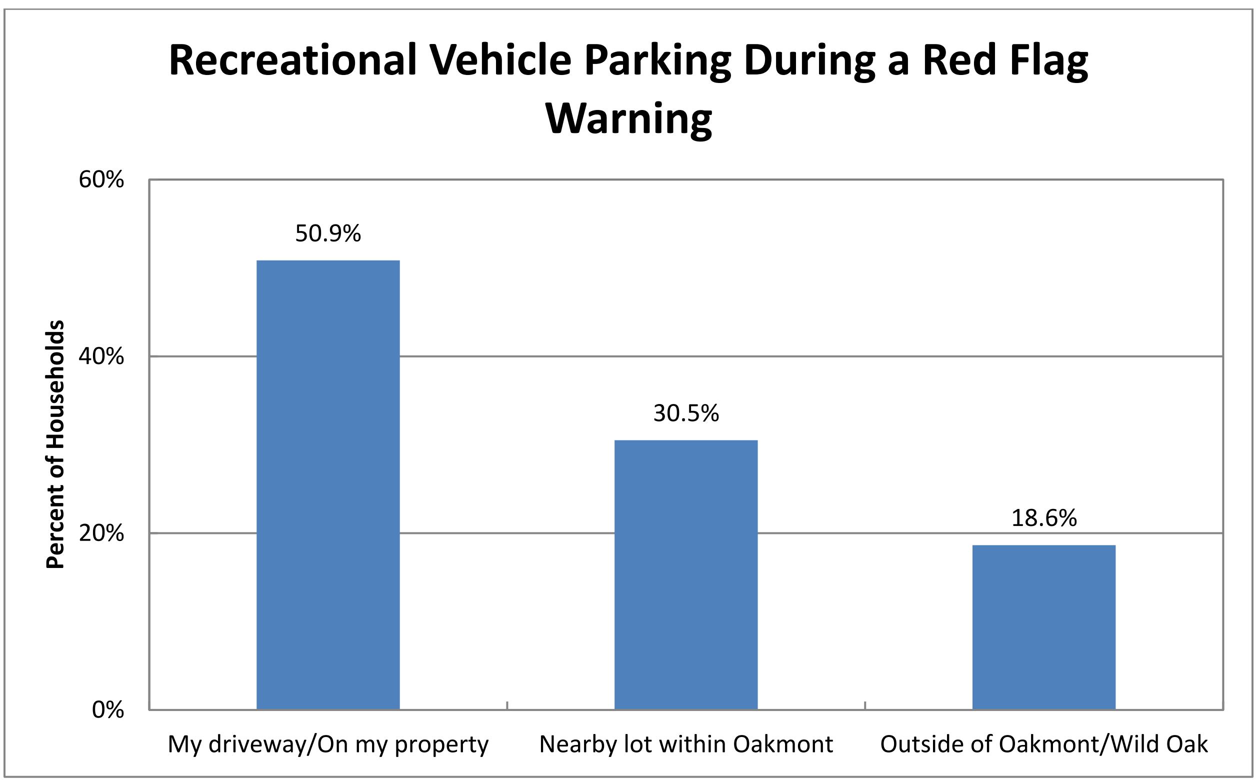


Figure A-16. Recreational Vehicle Parking During a Red Flag Warning

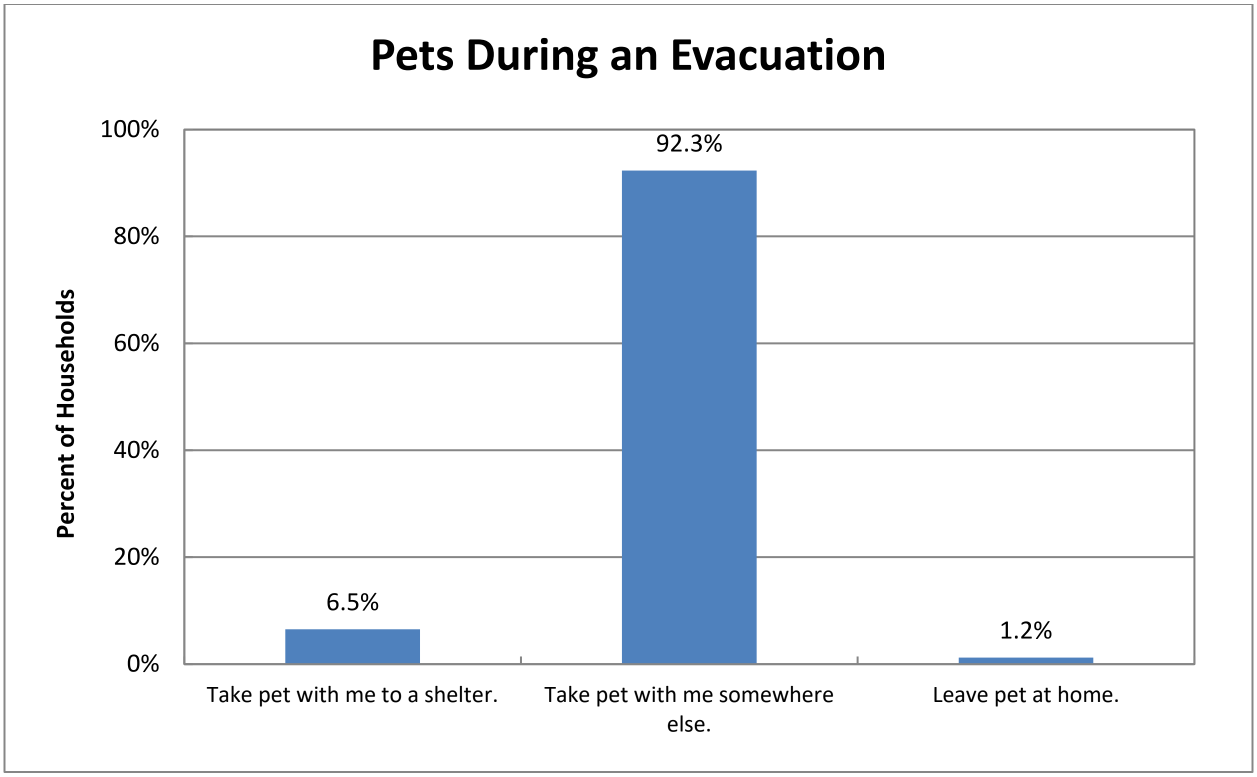


Figure A-17. Households Evacuating with Pets/Animals

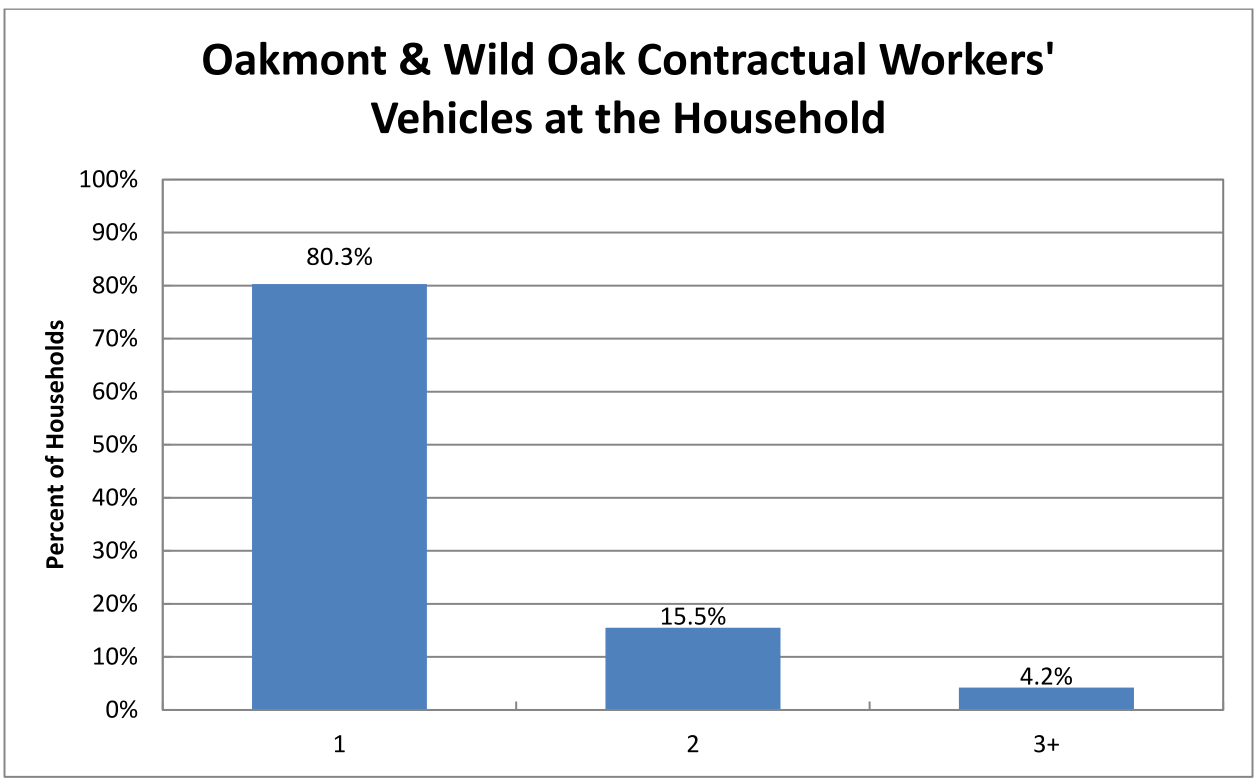


Figure A-18. Contractual Workers' Vehicles at the Household

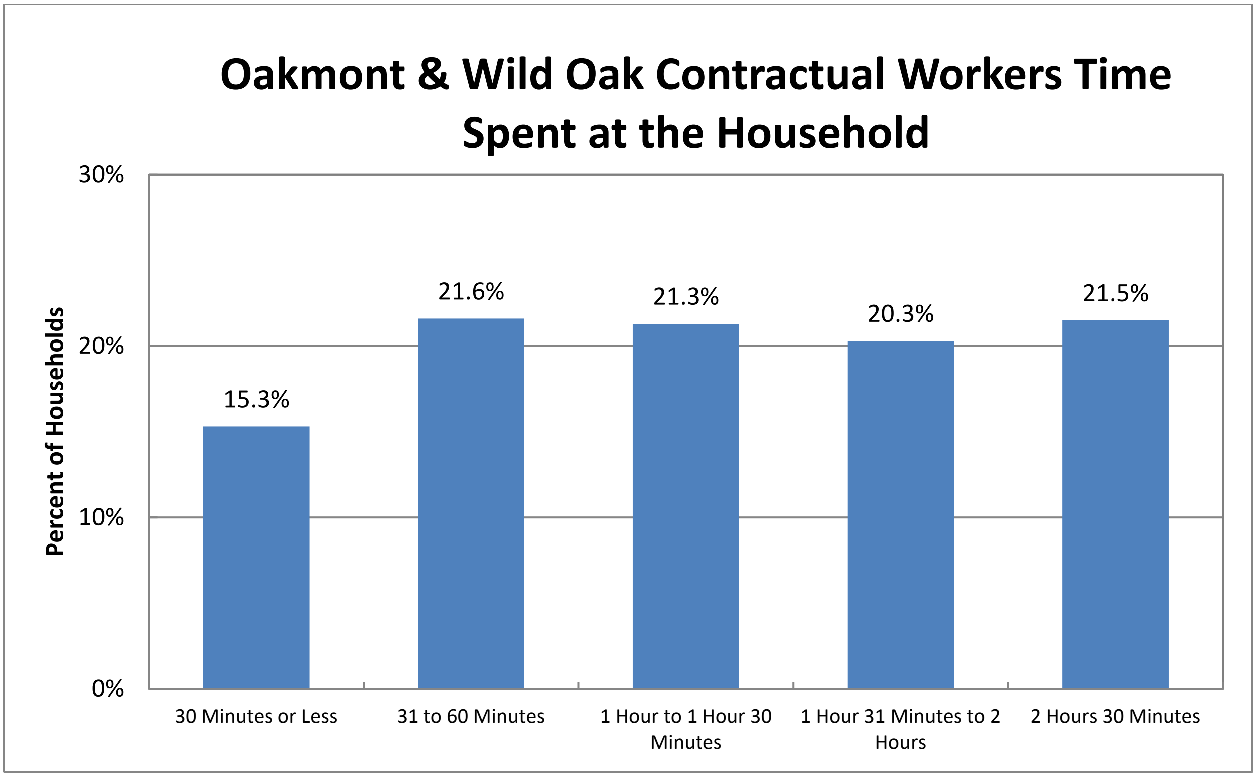


Figure A-19. Contractual Workers Time Spent at the Household

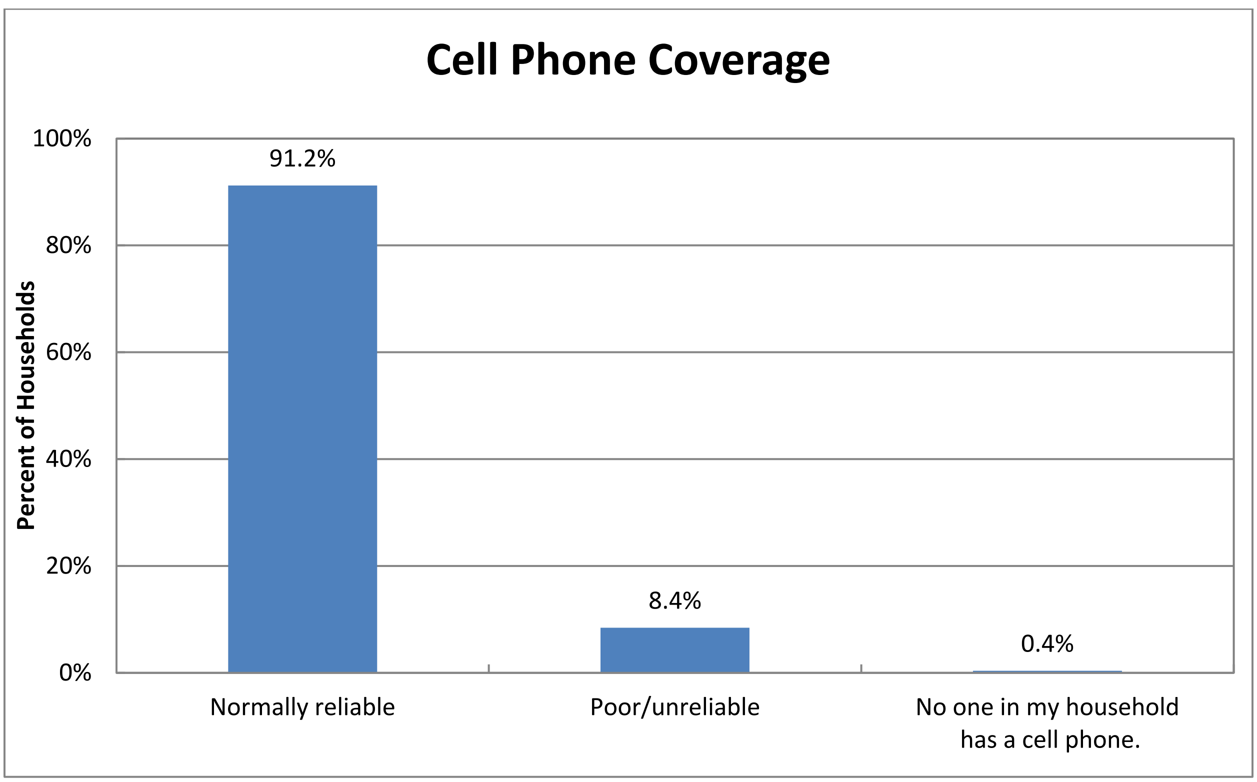


Figure A-20. Cell Phone Coverage

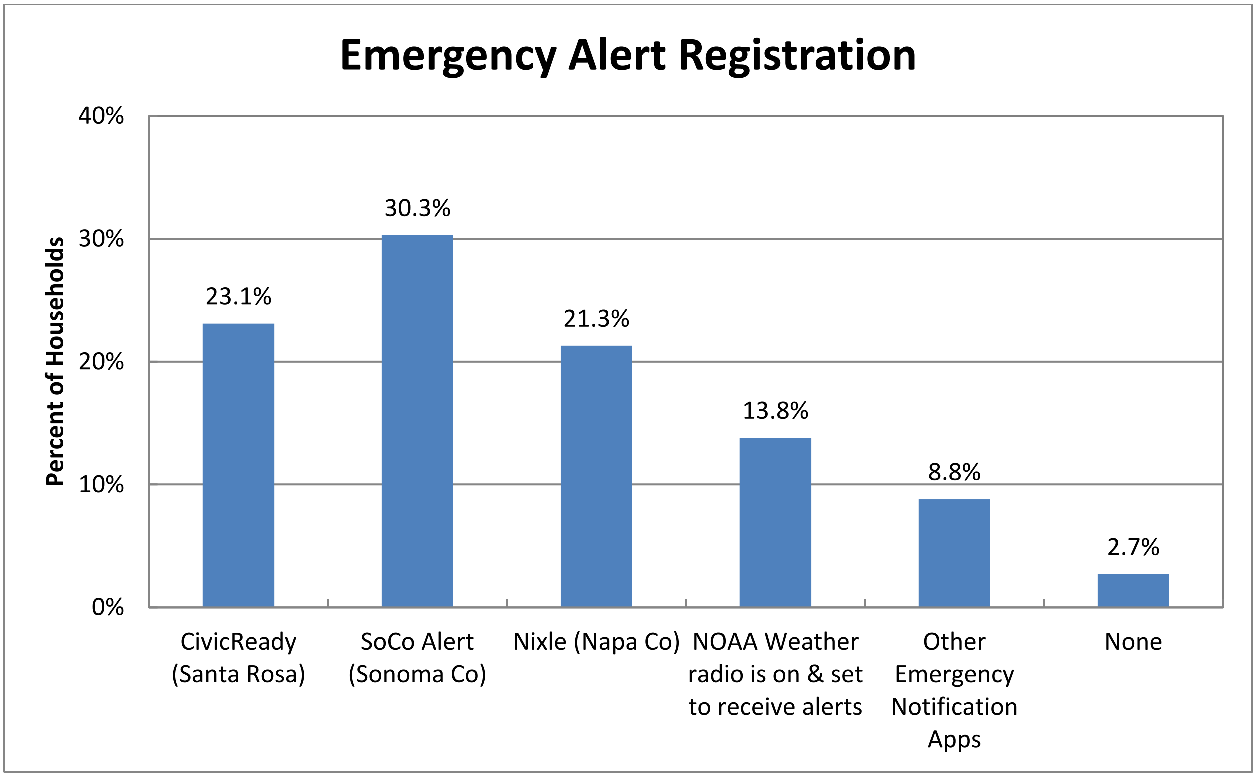


Figure A-21. Emergency Alert Registration

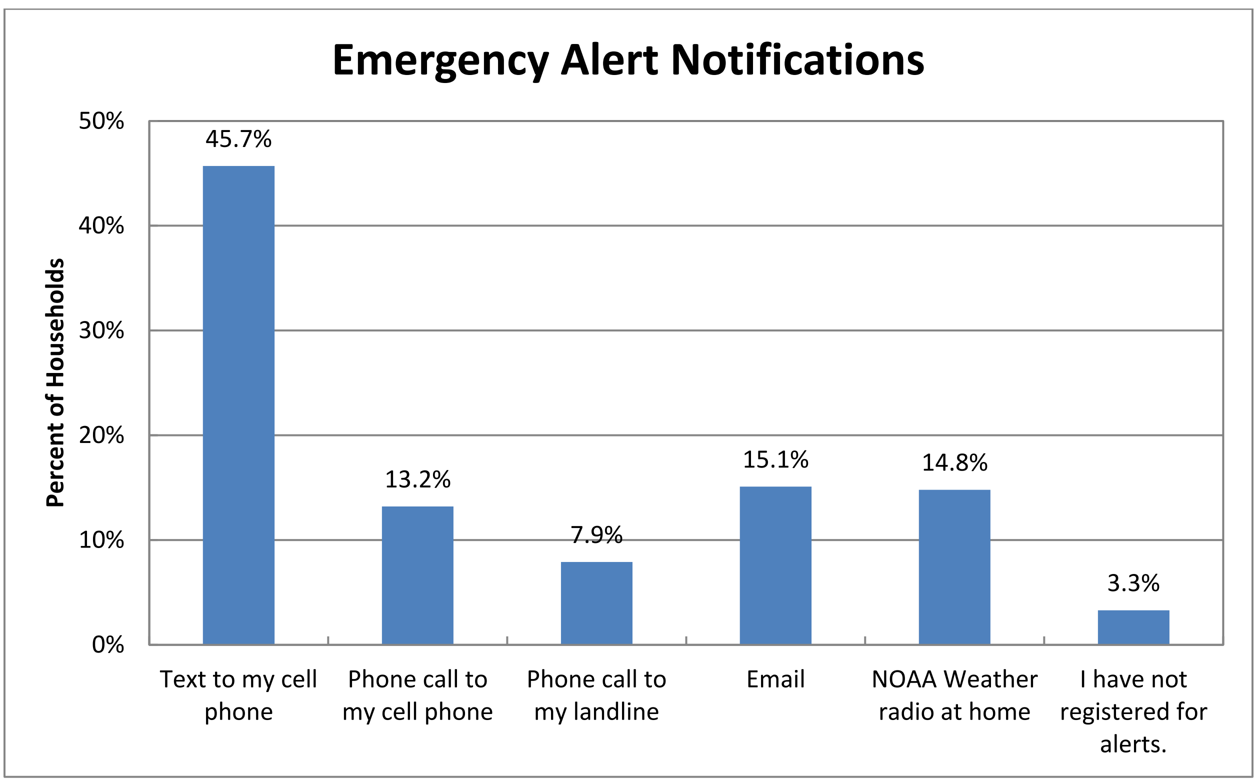


Figure A-22. Emergency Alert Notifications

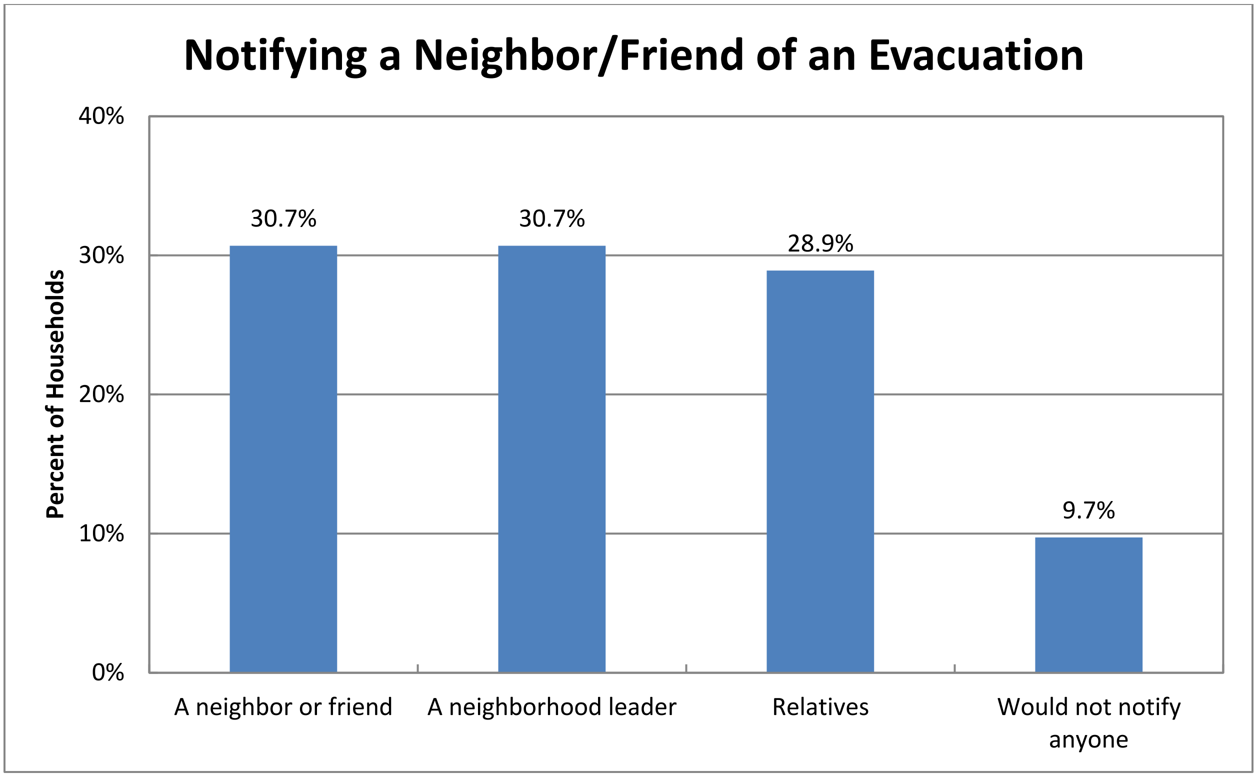


Figure A-23. Notification of a Neighbor/Friend

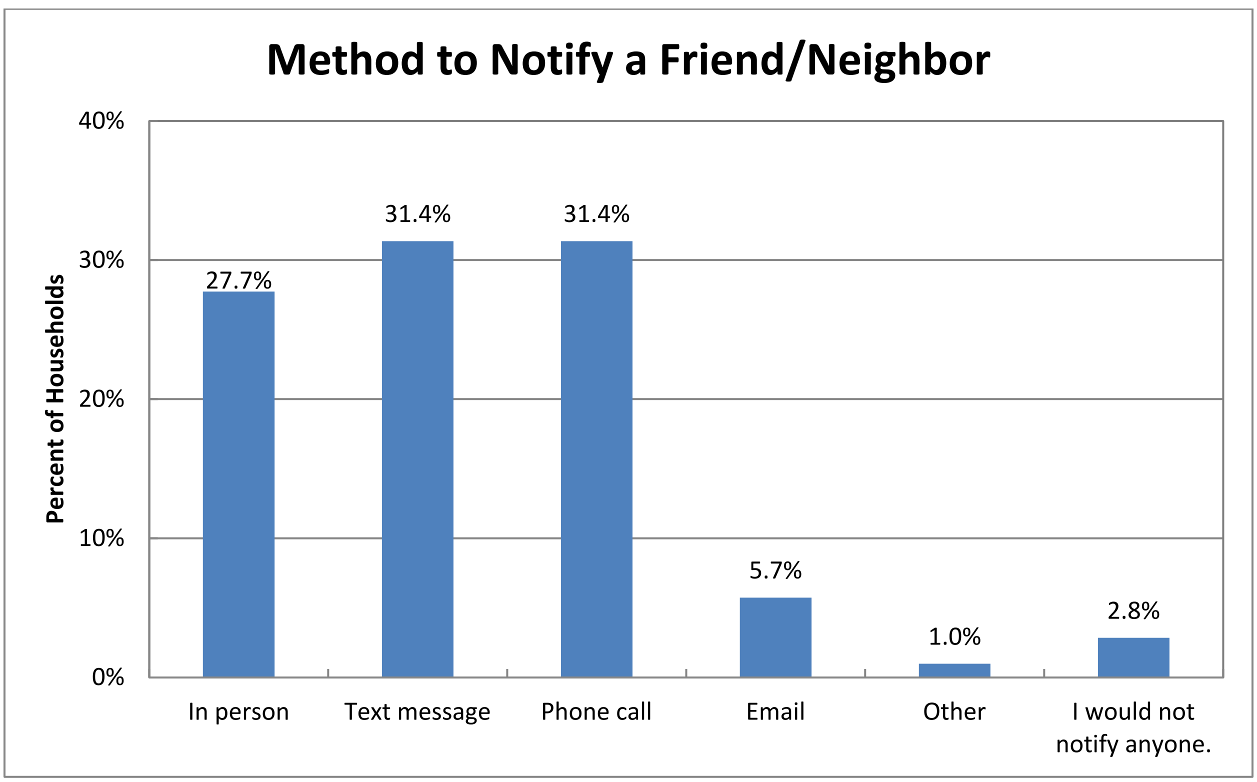


Figure A-24. Method to Notify a Neighbor/Friend

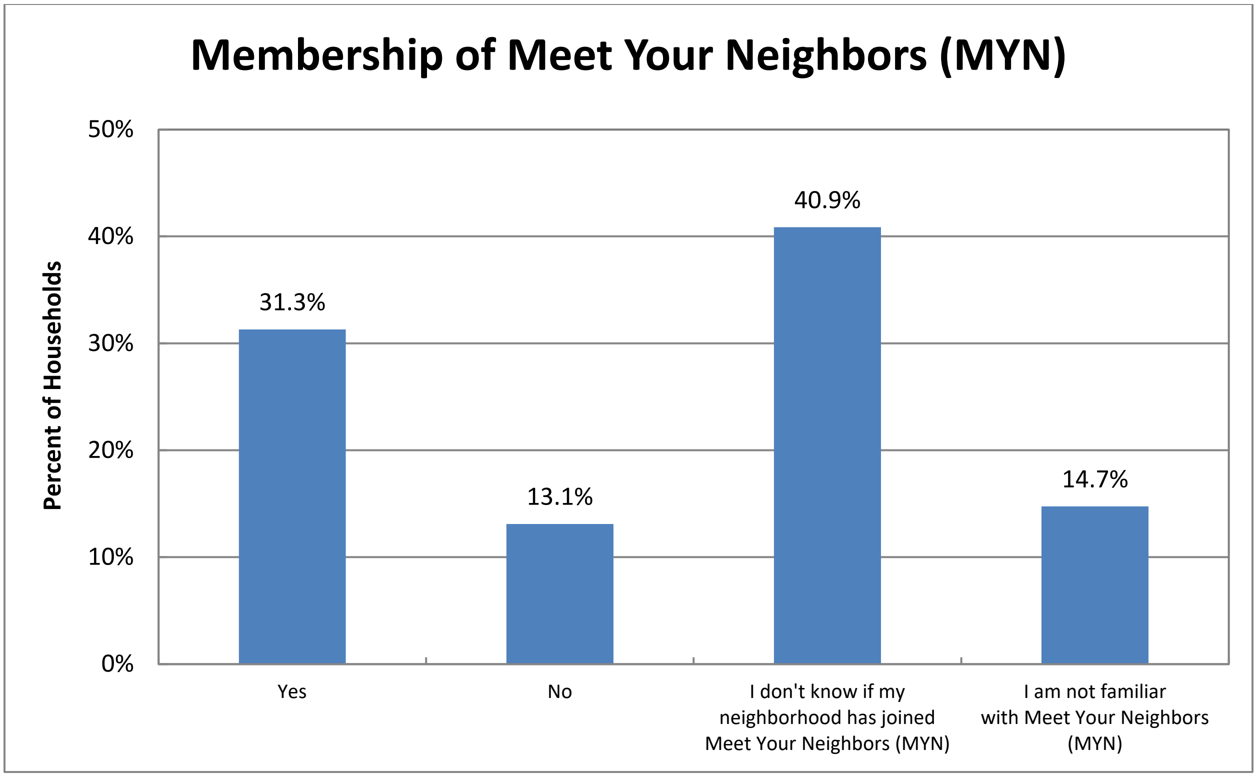


Figure A-25. Meet Your Neighbors Membership

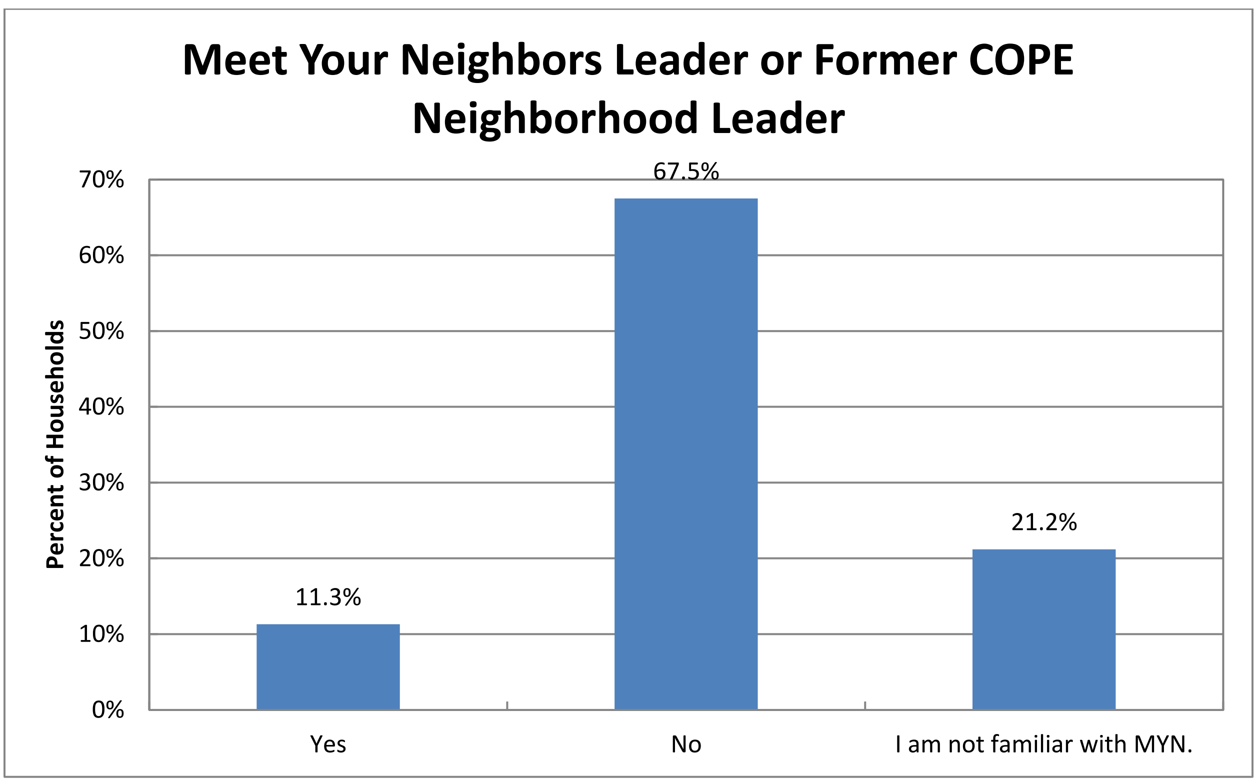


Figure A-26. Neighborhood Leaders

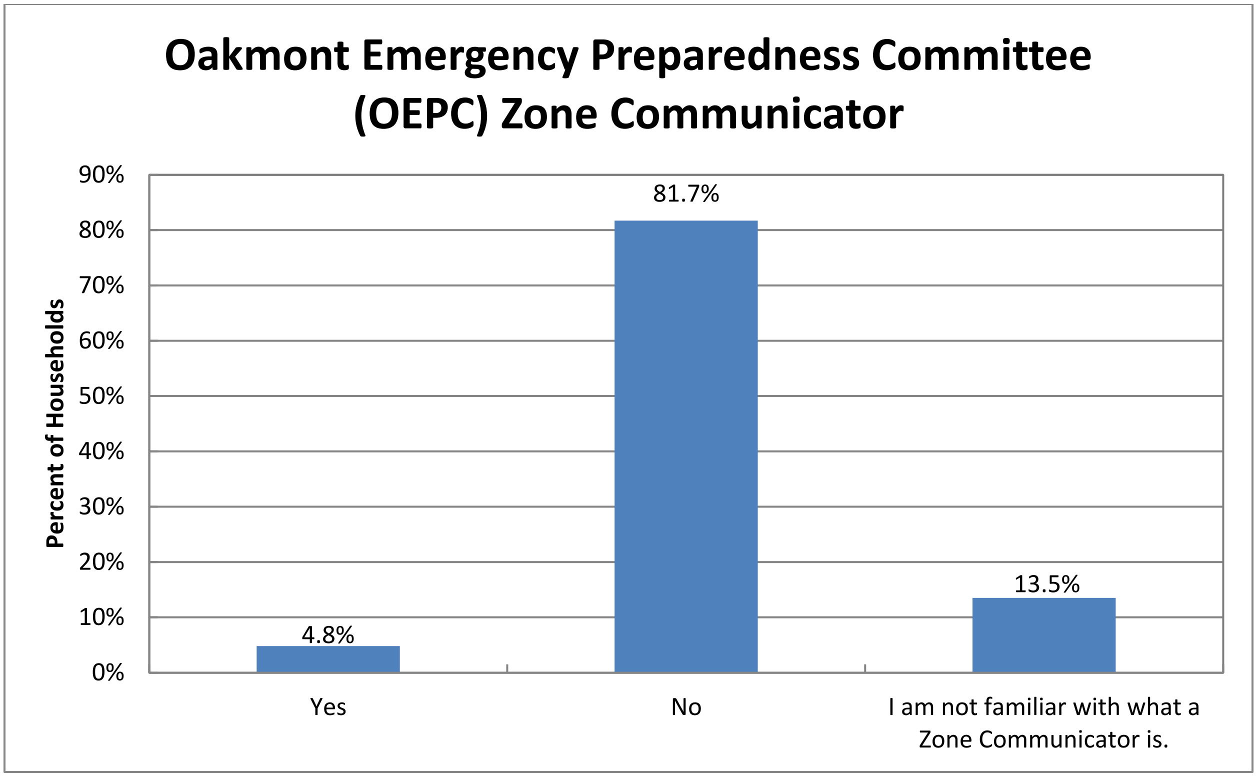


Figure A-27. Oakmont Emergency Preparedness Committee Zone Communicator

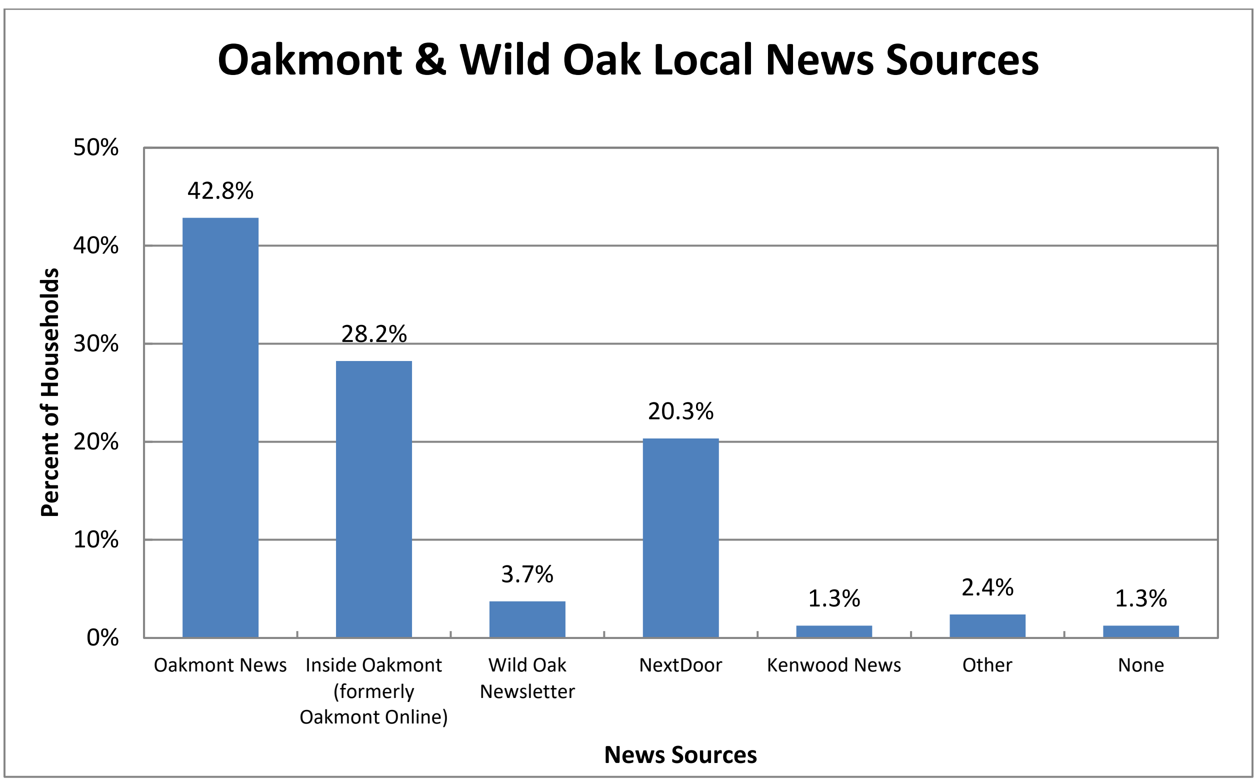


Figure A-28. Local News Sources

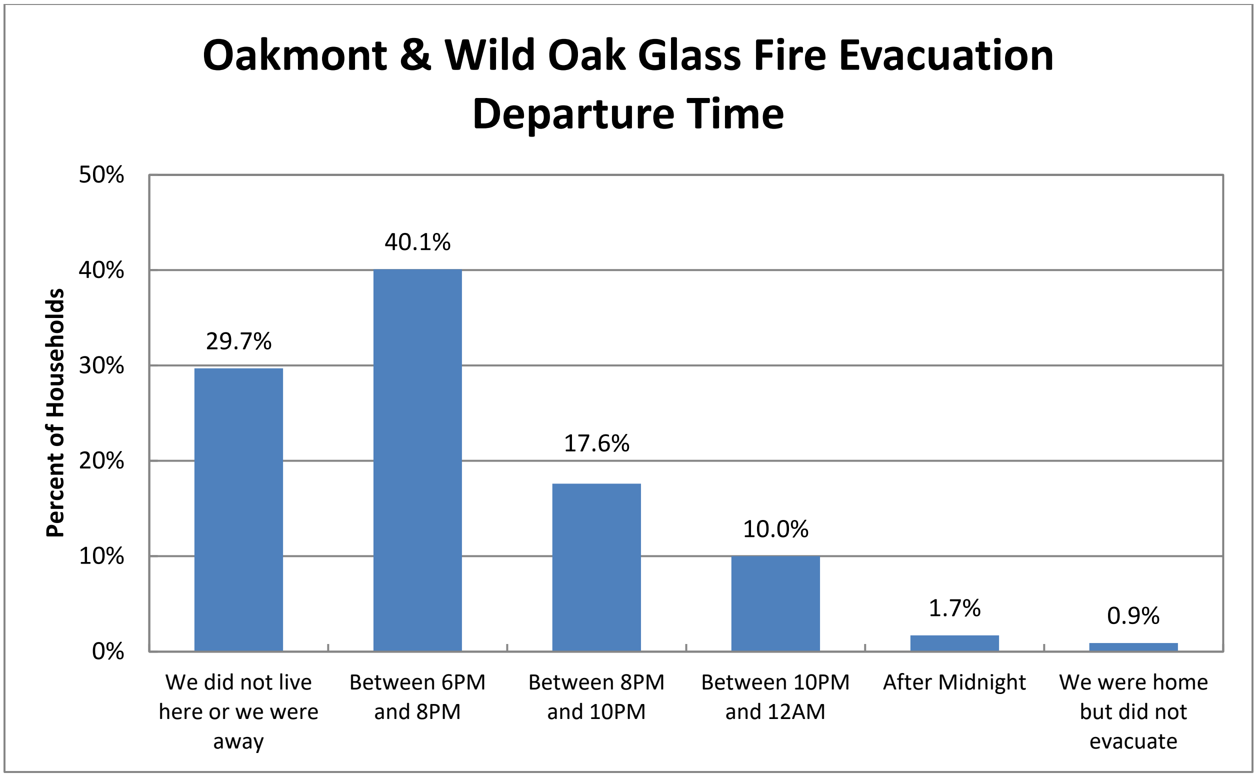


Figure A-29. Glass Fire Departure Time

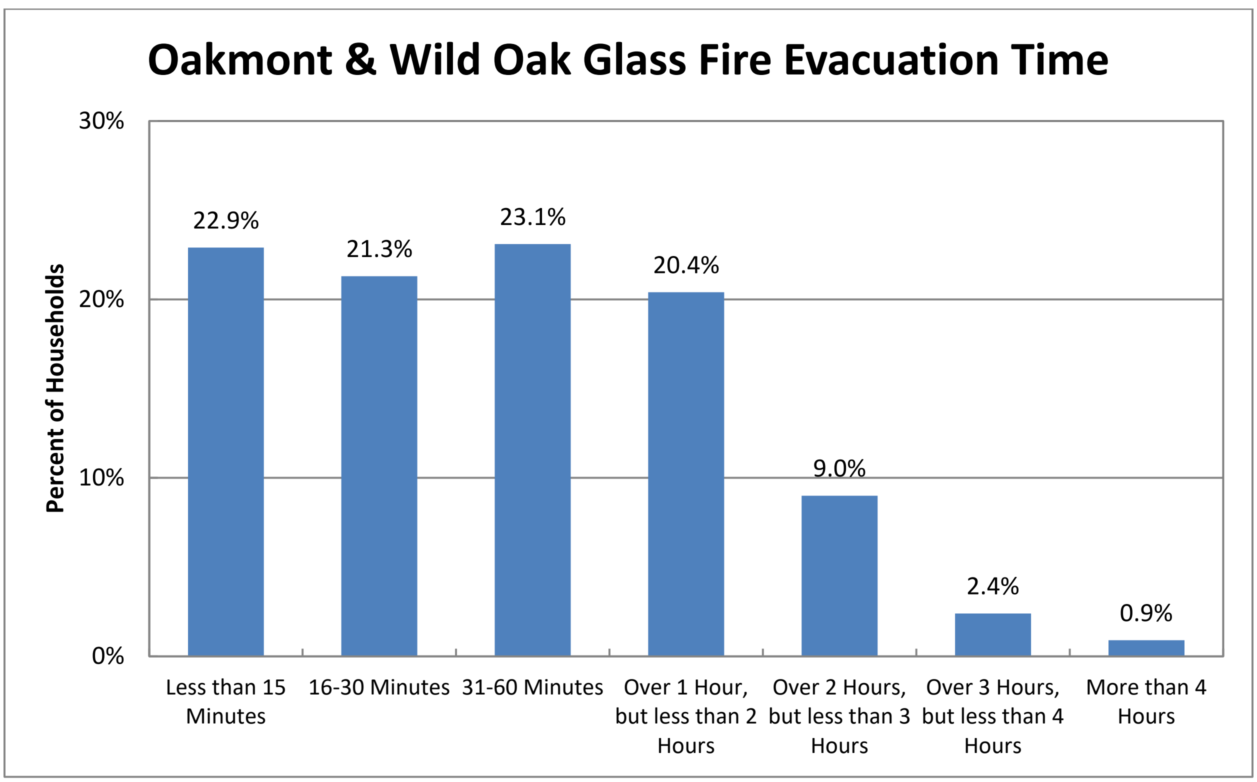


Figure A-30. Glass Fire Evacuation Time

ATTACHMENT A

Demographic Survey Instrument

Oakmont Village Association and Wild Oak Community Emergency Evacuation Study

* Indicates required question

Purpose

PLEASE PROVIDE ONLY ONE RESPONSE PER HOUSEHOLD.

We are asking for your help in our effort to enhance safety and evacuation education among our residents. The Oakmont Emergency Planning Committee, with Meet Your Neighbors and the AD HOC Emergency Evacuation Committee are asking residents to respond to this survey to better understand the key factors that influence evacuations in our community in the event of an emergency.

Thank you for taking your time to respond to this survey. We estimate it will take approximately 10-15 minutes to complete it.

Your responses will help us improve our evacuation education and emergency preparedness as a community. Oakmont and Wild Oak residents are both included in the survey because we all must evacuate through Oakmont.

Please complete only ONE survey per household.
Please NO names and NO personal information should be included in any of your answers.

The survey includes questions designed to estimate the time needed by residents and visitors to prepare to evacuate.

It will be best to fill out the survey online, but if you need to fill out the your response on a paper copy , the OVA office will have copies for Oakmont residents that can be completed while at the office and placed in a secured collection box.

Please submit your survey response by Thursday, August 17th.

1. 1. Which evacuation zone do you live in? *

Mark only one oval.

- ⬭ Oakmont North (generally between Hwy 12 & Oakmont Dr)
- ⬭ Oakmont South (closer to Trione-Annadel SP, but excluding Wild Oak)
- ⬭ Stonebridge
- ⬭ The Villages at Wild Oak and Wild Oak HOA
- ⬭ Oakmont Gardens
- ⬭ Not within Oakmont or the Wild Oak communities
- ⬭ I Don't Know

2. 2. In total, how many vehicles will you use to evacuate?

Mark only one oval.

- 0
- 1
- 2
- 3
- 4 or more
- I will use my golf cart only to evacuate.
- I will use my RV only to evacuate.

3. 3. If you do not have a car or are unable to drive your car, do you have a pre-arranged plan to get a ride out of the area with a relative, neighbor or friend who live in Oakmont?

Mark only one oval.

- Yes
- No
- Unsure
- Not applicable (I have a car)
- I have other arrangements for exiting.

4. 4. How many people usually live in this household?

Mark only one oval.

- 1
- 2
- 3
- 4 or more

Assisted Transportation

5. 5A. Do you or anyone in your household require assisted transportation (bus, medical van, wheelchair accessible vehicle, ambulance, or other type of special vehicle)?

Mark only one oval.

- ◯ Yes
- ◯ No *Skip to question 8*

Assisted Transportation

6. 5B. Please specify the type of assisted transportation and the number of people in need:

Mark only one oval per row.

	0	1	2	3	4	More than 4
Bus	◯	◯	◯	◯	◯	◯
Medical Van	◯	◯	◯	◯	◯	◯
Wheelchair Accessible Vehicle	◯	◯	◯	◯	◯	◯
Ambulance	◯	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯	◯

7. If you marked "Other" for Question 5B, Please Specify:

____

8. 6. If you were advised by local authorities to evacuate due to an emergency, 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?

Mark only one oval.

- Less than 15 minutes
- 15-30 Minutes
- 31-45 Minutes
- 46 Minutes - 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- 1 Hour 16 Minutes to 1 Hour 30 Minutes
- 1 Hour 31 Minutes to 1 Hour 45 Minutes
- 1 Hour 46 Minutes to 2 Hours
- Over 2 Hours, but less than 2 Hour 15 Minutes
- 2 Hours 16 Minutes to 2 Hours 30 Minutes
- 2 Hours 31 Minutes to 2 Hours 45 Minutes
- 2 Hours 46 Minutes to 3 Hours
- Over 3 Hours, but less than 3 Hour 15 Minutes
- 3 Hours 16 Minutes to 3 Hours 30 Minutes
- 3 Hours 31 Minutes to 3 Hours 45 Minutes
- 3 Hours 46 Minutes to 4 Hours
- Over 4 Hours, but less than 4 Hour 15 Minutes
- 4 Hours 16 Minutes to 4 Hours 30 Minutes
- 4 Hours 31 Minutes to 4 Hours 45 Minutes
- 4 Hours 46 Minutes to 5 Hours
- Over 5 Hours, but less than 5 Hour 15 Minutes
- 5 Hours 16 Minutes to 5 Hours 30 Minutes
- 5 Hours 31 Minutes to 6 Hours
- Over 6 Hours
- Will not evacuate

9. If Over 6 Hours for Question 6, Please Specify Time:

____

10. 7. If an evacuation WARNING (not an evacuation ORDER) was issued in or near Oakmont/Wild Oak and your other household member(s) were away and could not re-enter Oakmont/Wild Oak, what would you do to leave Oakmont/Wild Oak?

Please note: An evacuation "warning" comes before an evacuation "order."

Mark only one oval.

- I would await the return of household members to evacuate together.
- I would evacuate independently and meet other household members later.
- Not Sure

11. 8. If an evacuation warning was issued near Oakmont/Wild Oak and one household member was at home alone without a vehicle (or cannot drive) and other household members could not re-enter Oakmont/Wild Oak, what would you do?

Mark only one oval.

- Request a ride out with a neighbor or friend
- Hail an emergency vehicle for assistance
- Other: _______________________________

12. 9. If emergency officials had NOT ordered your evacuation zone to leave during a nearby emergency, would you:

Mark only one oval.

- Evacuate
- Not evacuate
- Not sure

13. 10. If emergency officials advise you to evacuate due to an emergency, where would you evacuate?

Mark only one oval.

- A relative's or friend's home
- Evacuation shelter
- A hotel, a motel, or campground
- A second/seasonal home
- Would not evacuate
- Other: ______________________

Seasonal Residents

14. 11. Of the people who live in your household, are any seasonal residents?

A seasonal resident is someone who does not reside in the household for most of the year.

Mark only one oval.

- Yes *Skip to question 15*
- No *Skip to question 17*

Seasonal Residents

15. 12. How many people only reside in your household for part of the year?

Mark only one oval.

- 0/None *Skip to question 17*
- 1
- 2
- 3
- 4
- More than 4

16. 13. Which season(s) do they live in Oakmont or Wild Oak? (check all that apply)

Check all that apply.

- [ ] Spring
- [ ] Summer
- [ ] Fall
- [ ] Winter
- [ ] Not Applicable

Recreational Vehicles (RV)

17. 14. Do you own a recreational vehicle/RV (such as a motorhome, camper van, trailer)?

Mark only one oval.

- ( ) Yes *Skip to question 18*
- ( ) No *Skip to question 21*

Skip to question 21

Recreational Vehicles (RV)

18. 15. Would you drive or tow your RV to leave Oakmont/Wild Oak during an evacuation?

Mark only one oval.

- ( ) Yes
- ( ) Maybe
- ( ) No/Probably not

19. 16A. Where do you usually park your recreational vehicle?

Mark only one oval.

- ◯ My driveway/On my property
- ◯ Nearby lot within Oakmont
- ◯ Outside of Oakmont/Wild Oak

20. 16B. Where would your RV be parked during a red flag warning?

Mark only one oval.

- ◯ My driveway/On my property
- ◯ Nearby lot within Oakmont
- ◯ Outside of Oakmont/Wild Oak

Mode of Travel

21. 17. How many adults in the household commute to a job, or other similar routine? *

Mark only one oval.

- ◯ 0 (NONE) *Skip to question 70*
- ◯ 1 *Skip to question 22*
- ◯ 2 *Skip to question 24*
- ◯ 3 *Skip to question 26*
- ◯ 4 or more *Skip to question 28*

Mode of Travel

22. 18. How many days a week does each commuter travel to work (does not work remotely)? *

Mark only one oval per row.

	1	2	3	4	5 or more
Commuter 1	⬭	⬭	⬭	⬭	⬭

23. 19. Thinking about each commuter, how does each person usually travel to work or similar routine commitment?

Mark only one oval per row.

	Bus	Walk/Bicycle	Drive Alone	Carpool- 2 or more people	Don't know
Commuter 1	⬭	⬭	⬭	⬭	⬭

Skip to question 30

Mode of Travel

24. 18. How many days a week does each commuter travel to work (does not work remotely)? *

Mark only one oval per row.

	1	2	3	4	5 or more
Commuter 1	⬭	⬭	⬭	⬭	⬭
Commuter 2	⬭	⬭	⬭	⬭	⬭

25. 19. Thinking about each commuter, how does each person usually travel to work or similar routine commitment?

Mark only one oval per row.

	Bus	Walk/Bicycle	Drive Alone	Carpool- 2 or more people	Don't know
Commuter 1	⬭	⬭	⬭	⬭	⬭
Commuter 2	⬭	⬭	⬭	⬭	⬭

Skip to question 32

Mode of Travel

26. 18. How many days a week does each commuter travel to work (does not work remotely)? *

Mark only one oval per row.

	1	2	3	4	5 or more
Commuter 1	⬭	⬭	⬭	⬭	⬭
Commuter 2	⬭	⬭	⬭	⬭	⬭
Commuter 3	⬭	⬭	⬭	⬭	⬭

27. 19. Thinking about each commuter, how does each person usually travel to work or similar routine commitment?

Mark only one oval per row.

	Bus	Walk/Bicycle	Drive Alone	Carpool- 2 or more people	Don’t know
Commuter 1	⬭	⬭	⬭	⬭	⬭
Commuter 2	⬭	⬭	⬭	⬭	⬭
Commuter 3	⬭	⬭	⬭	⬭	⬭

Skip to question 36

Mode of Travel

28. 18. How many days a week does each commuter travel to work (does not work remotely)? *

Mark only one oval per row.

	1	2	3	4	5 or more
Commuter 1	⬭	⬭	⬭	⬭	⬭
Commuter 2	⬭	⬭	⬭	⬭	⬭
Commuter 3	⬭	⬭	⬭	⬭	⬭
Commuter 4	⬭	⬭	⬭	⬭	⬭

29. 19. Thinking about each commuter, how does each person usually travel to work or similar routine commitment?

Mark only one oval per row.

	Bus	Walk/Bicycle	Drive Alone	Carpool- 2 or more people	Don't know
Commuter 1	⬭	⬭	⬭	⬭	⬭
Commuter 2	⬭	⬭	⬭	⬭	⬭
Commuter 3	⬭	⬭	⬭	⬭	⬭
Commuter 4	⬭	⬭	⬭	⬭	⬭

Skip to question 42

Travel Home

30. 20-1. How much time on average, would it take Commuter #1 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

31. If Over 2 Hours for Question 20-1, Please Specify:

____

Skip to question 50

Travel Home

32. 20-1. How much time on average, would it take Commuter #1 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

33. If Over 2 Hours for Question 20-1, Please Specify:

____

34. 20-2. How much time on average, would it take Commuter #2 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

35. If Over 2 Hours for Question 20-2, Please Specify:

____

Skip to question 52

Travel Home

36. 20-1. How much time on average, would it take Commuter #1 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

37. If Over 2 Hours for Question 20-1, Please Specify:

____

38. 20-2. How much time on average, would it take Commuter #2 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

39. If Over 2 Hours for Question 20-2, Please Specify:

40. 20-3. How much time on average, would it take Commuter #3 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

41. If Over 2 Hours for Question 20-3, Please Specify:

____

Skip to question 56

Travel Home

42. 20-1. How much time on average, would it take Commuter #1 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

43. If Over 2 Hours for Question 20-1, Please Specify:

____

44. 20-2. How much time on average, would it take Commuter #2 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

45. If Over 2 Hours for Question 20-2, Please Specify:

____

46. 20-3. How much time on average, would it take Commuter #3 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

47. If Over 2 Hours for Question 20-3, Please Specify:

____

48. 20-4. How much time on average, would it take Commuter #4 to travel home from work or similar routine commitment?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Prefer not to say

49. If Over 2 Hours for Question 20-4, Please Specify:

Skip to question 62

Preparation to leave work

50. 21-1. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #1 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #1 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

51. If Over 2 Hours for Question 21-1, Please Specify:

____

Skip to question 70

Preparation to leave Work

52. 21-1. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #1 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #1 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

53. If Over 2 Hours for Question 21-1, Please Specify:

54. 21-2. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #2 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #2 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

55. If Over 2 Hours for Question 21-2, Please Specify:

____

Skip to question 70

Preparation to leave Work

56. 21-1. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #1 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #1 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

57. If Over 2 Hours for Question 21-1, Please Specify:

____

58. 21-2. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #2 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #2 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

59. If Over 2 Hours for Question 21-2, Please Specify:

____

60. 21-3. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #3 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #3 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

61. If Over 2 Hours for Question 21-3, Please Specify:

____

Skip to question 70

Preparation to leave Work

62. 21-1. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #1 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #1 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

63. If Over 2 Hours for Question 21-1, Please Specify:

64. 21-2. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #2 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #2 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

65. If Over 2 Hours for Question 21-2, Please Specify:

____

66. 21-3. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #3 was at work/similar routine commtiment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #3 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

67. If Over 2 Hours for Question 21-3, Please Specify:

68. 21-4. If an evacuation warning was issued near Oakmont/Wild Oak and Commuter #4 was at work/similar routine commitment, approximately how much time would it take to complete preparation for leaving work or similar routine commitment to drive home?

Mark only one oval.

- 5 Minutes or Less
- 6-10 Minutes
- 11-15 Minutes
- 16-20 Minutes
- 21-25 Minutes
- 26-30 Minutes
- 31-35 Minutes
- 36-40 Minutes
- 41-45 Minutes
- 46-50 Minutes
- 51-55 Minutes
- 56 Minutes to 1 Hour
- Over 1 Hour, but less than 1 Hour 15 Minutes
- Between 1 Hour 16 Minutes and 1 Hour 30 Minutes
- Between 1 Hour 31 Minutes and 1 Hour 45 Minutes
- Between 1 Hour 46 Minutes and 2 Hours
- Over 2 Hours
- Commuter #4 would not return to Oakmont/Wild Oak until after the emergency.
- Prefer not to say

69. If Over 2 Hours for Question 21-4, Please Specify:

____

Skip to question 70

Pet Questions

70. 22. Do you have any pet(s) and/or animal(s)? *

Mark only one oval.

- ◯ Yes
- ◯ No *Skip to question 74*

Pet Questions

71. 23. What type of pet(s) and/or animal(s) do you have?

Check all that apply.

- ☐ Dog(s)
- ☐ Cat(s)
- ☐ Horse(s)
- ☐ Not Applicable

72. 24. What would you do with your pet(s) and/or animal(s) if you had to evacuate?

Mark only one oval.

- ◯ Take pet with me to a shelter.
- ◯ Take pet with me somewhere else.
- ◯ Leave pet at home.

73. 25. Do you have a pet go-bag or kit?

Mark only one oval.

- ◯ Yes
- ◯ No

Emergency Alerting System

74. 26. How would you rate the cell phone coverage in your area?

Mark only one oval.

- ◯ Normally reliable
- ◯ Poor/unreliable
- ◯ No one in my household has a cell phone.

75. 27. Have you signed up for electronic notices to your devices for evacuation warnings, etc.? If so, which one(s)? (Check all that apply.)

Check all that apply.

- ☐ CivicReady (Santa Rosa)
- ☐ SoCo Alert (Sonoma Co)
- ☐ Nixle (Napa Co)
- ☐ NOAA Weather radio is on & set to receive alerts
- ☐ Other Emergency Notification Apps
- ☐ None

76. 28. If you have already signed up for electronic notices for evacuation warnings to your devices, which options did you set up to receive notifications? (Check all that apply.)

Check all that apply.

- ☐ Text to my cell phone
- ☐ Phone call to my cell phone
- ☐ Phone call to my landline
- ☐ Email
- ☐ NOAA Weather radio at home
- ☐ I have not registered for alerts.

Notification

77. 29A. If emergency officials notified you to evacuate, who would you notify? (check all that apply)

Check all that apply.

- [ ] A neighbor or friend
- [ ] A neighborhood leader
- [ ] Would not notify anyone
- [ ] Relatives
- [ ] Don't know

78. 29B. How would you notify your neighbors, friends, and/or Neighborhood Leaders to evacuate?

Check all that apply.

- [ ] In person
- [ ] Text message
- [ ] Phone call
- [ ] Email
- [ ] Social Media
- [ ] I would not notify anyone.
- [ ] Other: ____________________

79. 29C. How long would it take you to notify your neighbors or friends to evacuate?

Please leave this question blank if you would not notify anyone.

Mark only one oval.

- ( ) 15 Minutes or less
- ( ) 16-30 Minutes
- ( ) 31-60 Minutes
- ( ) Over 1 Hour

80. If Over 1 Hour for Question 29C, Please Specify:

____

Additional Questions

81. 30. Do you have an evacuation go-bag in the home or car?

Mark only one oval.

- ( ) Yes
- ( ) No

82. 31. Do you have an evacuation check-list at home? (e.g., actions to take before evacuating, such as closing all windows)

Mark only one oval.

- ( ) Yes
- ( ) No

83. 32. Has your neighborhood joined Meet Your Neighbors (MYN)?

Mark only one oval.

- ( ) Yes
- ( ) No
- ( ) I don't know if my neighborhood has joined Meet Your Neighbors (MYN)
- ( ) I am not familiar with Meet Your Neighbors (MYN)

84. 33. Are you a Meet Your Neighbors (MYN) neighborhood leader or a former COPE neighborhood leader?

Mark only one oval.

- Yes
- No
- I am not familiar with MYN.

85. 34. Are you an Oakmont Emergency Preparedness Committee (OEPC) Zone Communicator?

Mark only one oval.

- Yes
- No
- I am not familiar with what a Zone Communicator is.

86. 35. What are your sources for local (Oakmont/Wild Oak) news?

Check all that apply.

- Oakmont News
- Inside Oakmont (formerly Oakmont Online)
- Wild Oak Newsletter
- NextDoor
- None
- Other: ____________________

Contractual Workers

87. 36. Do you have workers, such as cleaners, care-givers, and landscapers, in/at your home regularly?

Mark only one oval.

- Yes
- No *Skip to question 90*

Contractual Workers

88. 37. During the average week, how many workers' vehicles come to your home?

Mark only one oval.

- 1
- 2
- 3
- 4
- More than 4

89. 38. On average, how long do these workers stay at your home?

Mark only one oval.

- 30 Minutes or Less
- 31 to 60 Minutes
- 1 Hour to 1 Hour 30 Minutes
- 1 Hour 31 Minutes to 2 Hours
- More than 2 Hours

Glass Fire

90. 39A. During the Glass fire in September 2020, evacuations were called for Oakmont in the early evening. Approximately what time did you leave your home?

Mark only one oval.

- We did not live here or we were away
- 6:00 PM on the day the fire crossed Highway 12 into Oakmont
- 6:30 PM
- 7:00 PM
- 7:30 PM
- 8:00 PM
- 8:30 PM
- 9:00 PM
- 9:30 PM
- 10:00 PM
- 10:30 PM
- 11:00 PM
- 11:30 PM
- Midnight
- After Midnight
- We were home but did not evacuate

Glass Fire

91. 39B. During the Glass fire in September 2020, how long did it take from leaving your home to exit Oakmont and reach relatively clear traffic? And you felt safe, and out of danger?

Mark only one oval.

- Less than 15 Minutes
- 16-30 Minutes
- 31-60 Minutes
- Over 1 Hour, but less than 2 Hours
- Over 2 Hours, but less than 3 Hours
- Over 3 Hours, but less than 4 Hours
- More than 4 Hours
- Not Applicable

APPENDIX B

Evacuation Sensitivity Studies

“What-if” Scenarios

B. EVACUATION SENSITIVITY STUDIES

This appendix presents the results of a series of sensitivity analyses, or "what-if" analyses. These analyses are designed to identify the sensitivity of the Evacuation Time Estimate (ETE) to changes in some base evacuation conditions.

B.1 No Notice Evacuation

A sensitivity study was performed to determine if an evacuation with little to no notice would have an impact on ETE. During a "no notice" evacuation, evacuees will get little to no advance notice to evacuate. As such, evacuees will have less time to pack bags and will have no time to wait for commuters to return. This will reduce the overall trip generation (mobilization) times for each evacuating population group within the study area. This sensitivity study considers whether reducing the estimated trip generation time would impact the ETE. Scenario 1 – a summer, midweek, midday with normal conditions for Region R11 (all evacuation zones evacuating at once) was considered for this "what-if" sensitivity. Results are tabulated in Table B-1. Trip generation times of two (2) hours and three (3) hours were tested.

As shown in Table B-1, if evacuees are forced to mobilize in 2 hours, the 90th and 100th percentile ETE increases by 15 minutes and 20 minutes, respectively. If evacuees have 3 hours to mobilize, the 90th percentile ETE increases by 5 minutes and the 100th percentile ETE increase by 10 minutes. As discussed in Section 5, the traffic congestion within Oakmont and Wild Oak lasts for about four (4) hours and 45 minutes. When reducing mobilization time to less than 4 hours and 45 minutes, the 100th percentile ETE is dictated by congestion instead of by the evacuee mobilization time (base case). Additionally, when the mobilization times are reduced, more evacuees are on the roadways at the same time, further reducing the available roadway capacity, which increases congestion and increases the 90th percentile ETE.

B.2 Effect of Reducing the Evacuation Demand – One Vehicle per Household

The relationship between supply and demand is critical in estimating evacuation time. Evacuation travel supply is the ability of the roadway network to service the traffic demand (number of evacuating vehicles) during an emergency. In this context, when the demand exceeds the supply (available capacity), congestion occurs causing delay and prolonging the evacuation. The roadway capacity is often difficult to increase as it is expensive and difficult to widen existing infrastructure or build additional roadways. Thus, it is good practice to attempt to reduce the evacuating traffic demand such that demand does not exceed capacity. The demographic survey of Oakmont and Wild Oak indicated permanent residents would use approximately 1.35 vehicles per household during an evacuation (see Appendix A). A sensitivity study was conducted to determine the effect on ETE when the permanent resident evacuating vehicles per household was reduced to one vehicle per household.

As seen in Table B-2, during the base case scenario, residents evacuate in 4,014 vehicles. When the number of evacuation vehicles per household is reduced to one, the number of evacuating vehicles used by residents is reduced to 2,975 – an approximate 26% reduction in traffic demand[1]. The case considered was Scenario 1 – a summer, midweek, midday, with normal conditions for Region R11 (all evacuation zones evacuating at once). When the evacuation traffic demand is reduced by approximately 26%, the 90th percentile ETE is reduced by 55 minutes and the 100th percentile ETE remains the same. Reducing the number of evacuating resident vehicles by 26% significantly reduces the 90th percentile ETE, as there is more roadway capacity available to evacuees. However, the 100th percentile ETE remains the same, as the trip mobilization time dictates the 100th percentile ETE and not congestion (see Section 5). The public should be educated on the importance of taking as few vehicles as possible during an evacuation.

B.3 Time to Establish Access Control

As discussed in Section 5, through traffic along Highway 12 contributes to the delays and congestion caused within Oakmont and Wild Oak during an evacuation. These vehicles occupy space along Highway 12, thereby reducing the available roadway capacity for evacuees. A sensitivity study was performed to determine if establishing access control along Highway 12 to divert this traffic quicker (resulting in less through vehicles) or slower (resulting in more through vehicles) has an impact on ETE. The case considered was Scenario 1 – a summer, midweek, midday, with normal conditions for Region R11, all evacuation zones evacuating at once.

Table B-3 presents the 90th and 100th percentile ETE results for this sensitivity study. When access control is established in 30 minutes, the 90th percentile ETE decreases by 1 hour and 45 minutes - a significant change. On the other hand, when the access control is established in 240 minutes, the 90th percentile ETE increases by 1 hour and 40 minutes.

Since the time to establish access control determines the number of through vehicles that enter the study area, the sooner the access control is established, the more capacity is available along Highway 12. As a result, congestion is reduced allowing vehicles to evacuate from Oakmont and Wild Oak more quickly, reducing the 90th percentile ETE. This is graphically shown in Figure B-1.

The 100th percentile ETE is not impacted when reducing the time to establish access control since it is dictated by evacuee mobilization time and not congestion. When the access control established time is increased to 180 and 240 minutes, the 100th percentile ETE increases by 50 minutes and 1 hour and 45 minutes, respectively. Increasing the number of external vehicles along Highway 12 reduces the available roadway capacity for Oakmont and Wild Oak residents which increases the congestion and prolongs the ETE.

B.4 Sequential Evacuation

Depending on the location of the wildfire, residents of Oakmont and Wild Oak could be evacuated sequentially[2] instead of all at once. A sensitivity study was performed to determine the effects of evacuating Oakmont North, Oakmont South, Stonebridge, and Wild Oak sequentially. Residents

[1] Shadow Region resident vehicles were reduced from 8,926 vehicles to 6,612.
[2] Also referred to as a staged evacuation.

of Wild Oak would be allowed to evacuate first while Oakmont North, Oakmont South and Stonebridge remained home to prepare for evacuation. The evacuation of each evacuation zone after Wild Oak is staged by a 30-minute delay. Stonebridge residents evacuate 30 minutes after the evacuation order, Oakmont South residents evacuate 60 minutes after the evacuation order and finally Oakmont North residents evacuate 90 minutes after the evacuation order. The case considered was Scenario 1 – a summer, midweek, midday, with normal conditions for Region R11, all evacuation zones evacuating at once.

Table B-4 presents the 90th and 100th percentile ETE results for this sensitivity study. As shown in Table B-4, the 90th and 100th percentile ETE are not impacted significantly (5 and 10-minute differences in the 90th and 100th percentile ETE, respectively) if the evacuation of these four evacuation zones are done sequentially or all at once. Since the majority of the residents live within Oakmont North, delaying the evacuation of this zone by 90-minutes delays the 90th and 100th percentile ETE. However, when comparing the time it takes to clear Wild Oak when all zones are evacuated, the 90th percentile ETE for Wild Oak is reduced by 45 minutes (a significant change) when Wild Oak is allowed to evacuate first while other zones shelter-in-place. For other evacuation zones, the time it takes for each individual zone to clear is not significantly different (changes of at most 10 minutes) when compared to the base case. If the wildfire threatens the community of Wild Oak, its residents should be given priority in an evacuation as it could reduce their ETE significantly.

B.5 Traffic Management Plan

A Traffic Management Plan (TMP) is typically designed for an area that is prone to wildfires to expedite the movement of evacuating traffic during an emergency. 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).
- Guidance is provided by the Manual of Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA) of the U.S.D.O.T. 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 written plan that defines all Traffic Control Point (TCP) and Access Control Point (ACP) locations, provides necessary details and is documented in a format that is readily understood by those assigned to perform traffic control. TCPs are typically established within the area of risk to expedite the flow of traffic out of the area. ACPs are typically established on the boundary of the area of risk to stop the flow of traffic into the area.

The functions to be performed in the field are:

- Facilitate evacuating traffic movements that safely expedite travel out of the area at risk.
- Discourage traffic movements that move evacuating vehicles in a direction which takes them significantly closer to the area of risk, or which interferes with the efficient flow of other evacuees.

This sensitivity study considered establishing TCPs at the following locations to facilitate the flow of evacuees from Oakmont and Wild Oak:

1. The intersection of Highway 12 and Oakmont Drive forcing evacuees westbound
2. The intersection of Highway 12 and Phythian Road forcing evacuees eastbound.

Table B-5 represents the 90th and 100th percentile ETE results when these TCPs are implemented for an evacuation of Scenario 1, Region 11. As seen in the table, the 90th and 100th percentile ETE results are not impacted by the addition of TCPs at these locations. At both TCP locations, evacuees from Oakmont and Wild Oak would be directed onto Highway 12, which is heavily congested, as discussed previously. Access to Highway 12, using Oakmont Drive and Pythian Road, would also be congested. As such, the roadways are congested in competing directions (east/west versus north/south) and manual traffic control will provide little to no benefit in a congested environment such as this.

B.6 Channel Drive

Oakmont and Wild Oak only have two evacuation roads that allow them to exit their community/village, Oakmont Drive and Pythian Road. Both of these roads lead directly onto Highway 12. Since congestion on Highway 12 delays residents evacuating from Oakmont and Wild Oak, a sensitivity study was performed to determine if allowing vehicles to exit Oakmont and Wild Oak along Channel Drive, on the south side of the community, has an impact on ETE. Vehicles that utilize Channel Road could evacuate toward Santa Rosa without needing to access Highway 12. Based on the location of Channel Drive, it is assumed that residents of Wild Oak would primarily utilize this evacuation route, and residents of Oakmont North, Oakmont South, and Stonebridge would use Channel Drive in addition to Oakmont Drive and Pythian Road. Scenario 1 – a summer, midweek, midday, with normal conditions for Region R11 (all evacuation zones evacuating at once) was considered.

Table B-5 presents the 90th and 100th percentile ETE results for this sensitivity study. As shown in Table B-5, the 90th percentile ETE decreases by 1 hour and 5 minutes. This is due to evacuating vehicles utilizing Channel Drive avoiding the congestion on Highway 12 entirely. Additionally, less vehicles utilize Highway 12 thereby reducing congestion on Highway 12 and Oakmont Drive and Pythian Road. There is no impact to the 100th percentile ETE because the 100th percentile ETE is dictated by the permanent resident mobilization time and not traffic congestion.

B.7 New Residential Developments

A sensitivity study was performed to quantify the impact of new residential developments (Elnoka and Mahonia Glen) and adding a third roadway (access point) to Highway 12 and Melita Road due to the Elnoka development. The case considered was Scenario 1 – a summer, midweek, midday, with normal conditions for Region R11, all evacuation zones evacuating at once.

Elnoka[3] is a Senior Age Restricted Community project that will be located on the south side of Highway 12 and northwest of Oakmont and Wild Oak. Based on the Elnoka website, the community will have 272 residential units, which will result in 367 vehicles added to the evacuation demand for this sensitivity study (272 residents x 1.35 evacuating vehicles per household = 367 vehicles). The development of the Elnoka community might include the construction of an EVA road that connects Stonebridge Road, near the existing Happy Tails Dog Park, to the Elnoka Community. If constructed, the proposed EVA road will provide an additional access point to Highway 12 and Melita Road for Oakmont residents.

The Mahonia Glen[4] project proposes the development of affordable residential housing located at the northwest corner of Highway 12 and Calistoga Road. This development consists of 99 residential units expected to be completed in 2024. The 99-units will result in an additional 134 vehicles to the evacuation demand for this sensitivity study (99 residents x 1.35 evacuating vehicles per household = 134 vehicles).

Table B-5 presents the 90th and 100th percentile ETE results for this sensitivity study. The 90th percentile ETE decreases by 55 minutes if the EVA road is built – a significant change. Not only does the EVA road give Oakmont residents a 3rd access point to Highway 12, more significantly, it gives access to Melita Road. Since Highway 12 is already congested with external traffic and shadow evacuation, having an alternative access point to evacuate for Oakmont residents reduced the 90th percentile ETE significantly. The 100th percentile ETE remains the same, as the permanent resident mobilization time dictates the 100th percentile ETE and not traffic congestion.

B.8 Contraflow Along Highway 12

A sensitivity study was conducted wherein the inbound lanes of Highway 12 are used as additional outbound evacuation lanes (contraflow) westbound towards Santa Rosa. The eastbound lanes along Highway 12 from Melita Road to Pythian Road were closed to eastbound traffic and both lanes were utilized for westbound traffic. It was assumed that the contraflow would be established by police/emergency workers after 2 hours from the evacuation order. The case considered was Scenario 1 – a summer, midweek, midday, with normal conditions for Region R11, all evacuation zones evacuating at once. As this is only considered westbound, the sensitivity results were compared to a closure on Highway 12 Eastbound case and not the base case (see Section 5.5.1).

As shown in Table B-6, contraflowing Highway 12 has minimal impacts on ETE: 15-minute decreases in both the 90th and 100th percentile ETE. Even though the capacity is increased traveling towards Santa Rosa for the contraflow case, it is not substantial enough to decrease the ETE significantly, as those evacuating from Oakmont and Wild Oak still need to access Highway 12, which is still heavily utilized by through traffic in the westbound direction, at stop-controlled intersections along Oakmont Drive and Pythian Road.

[3] https://www.srcity.org/2568/Elnoka-Senior-Community
[4] https://www.midpen-housing.org/property/mahonia-glen/

Implementing contraflow can be a challenge. Essentially, TCPs need to be established at every street that intersects Highway 12 between Melita Road to Pythian Road (about 20 intersections) to ensure vehicles do not turn into oncoming traffic. Clear signage needs to be strategically placed in the proximity of the contraflow to ensure drivers understand what is going on to reduce the likelihood of traffic incidents. The decreases in ETE (15 minutes) are not significant enough to justify the manpower and resources required to implement contraflow. In addition, implementing contraflow would also eliminate a safe path for ingress emergency response vehicles to reach areas in danger and/or in need of support.

Table B-1. Evacuation Time Estimates for No Notice Evacuation Sensitivity Study

No Notice Evacuation (Shorter Mobilization Time)	90th Percentile ETE	100th Percentile ETE
2:00	4:40	5:05
3:00	4:30	4:55
4:45 (Base)	4:25	4:45

Table B-2. Evacuation Time Estimates for Reduction in Demand

Evacuating Vehicles per Household	Resident Vehicles	90th Percentile ETE	100th Percentile ETE
1.35 (Base)	**4,014**	4:25	4:45
1.00	**2,975**	3:30	4:45

Table B-3. Evacuation Time Estimates for Access Control Establishment Time Sensitivity Study

Access Control Activation	Through Traffic Vehicles	90th Percentile ETE	100th Percentile ETE
30 Minutes	**1,312**	2:40	4:45
60 Minutes	**2,622**	3:25	4:45
120 Minutes (Base)	**5,244**	4:25	4:45
180 Minutes	**7,866**	5:10	5:35
240 Minutes	**10,488**	6:05	6:30

Table B-4. Evacuation Time Estimates for Sequential Evacuation Sensitivity Study

Sequential Evacuation All Zones		
	90th Percentile ETE	100th percentile ETE
Base	4:25	4:45
Sequential	4:30	4:55
Wild Oak		
Base	3:40	4:45
Sequential	2:55	4:45
Stonebridge		
Base	4:15	4:45
Sequential	4:25	4:45
Oakmont South		
Base	3:40	4:45
Sequential	3:30	4:45
Oakmont North		
Base	4:25	4:45
Sequential	4:30	4:55

Table B-5. Evacuation Time Estimates for Additional Sensitivity Studies

Additional Sensitivity Studies	90th Percentile ETE	100th percentile ETE
Base	4:25	4:45
TCP at Oakmont Drive and Pythian Road (Appendix B.5)	4:25	4:45
Channel Drive (Appendix B.6)	3:20	4:45
New Residential Developments (Appendix B.7)	3:30	4:45

Table B-6. Evacuation Time Estimates for Contraflow

Type of Contraflow	90th Percentile ETE	100th Percentile ETE
No Contraflow (Closure on Highway 12 Eastbound case - Section 5.5.1)	6:10	6:35
Contraflow	5:55	6:20

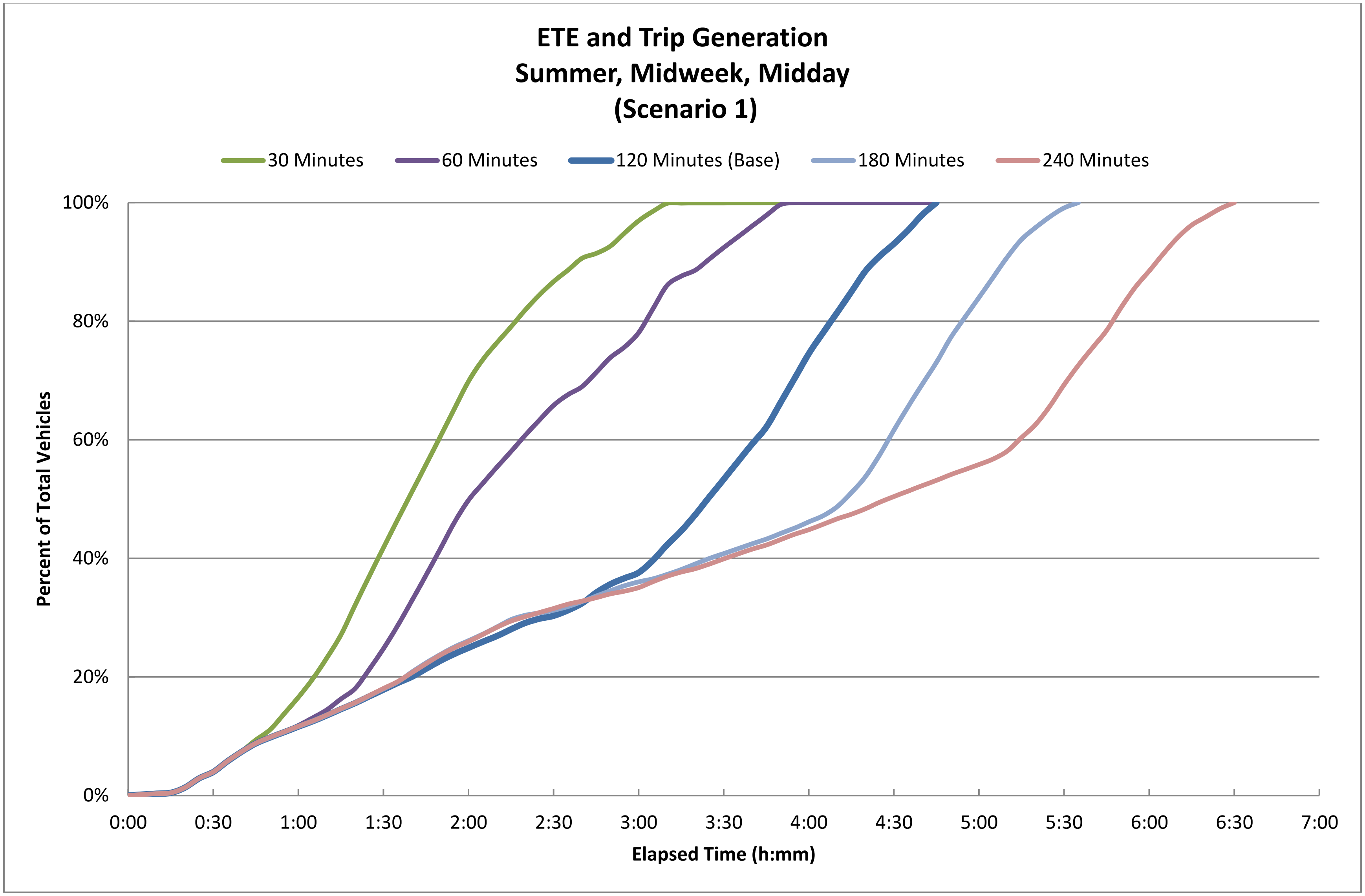


Figure B-1. Evacuation Time Estimates – Access Control Establish Time Sensitivity Study