KITTELSON & ASSOCIATES
155 Grand Avenue, Suite 505
Oakland, CA 94612
P 510.839.1742

TECHNICAL MEMORANDUM

September 23, 2024 Project# 29359

To: Reema Shakra
Rincon Consultants, Inc.

From: Mike Aronson, P.E; Grace Carsky; Poppy Yang

RE: Glendale Safety Element: Evacuation Analysis

Introduction

Kittelson & Associates, Inc. (Kittelson) has prepared an evacuation analysis for the City of Glendale, California in support of the city's General Plan Safety Element update. The evaluation considers two (2) representative evacuation scenarios and provides the city with estimates of roadway capacity constraints and travel time considerations during evacuations. The analysis helps identify locations where there is a greater potential for traffic congestion and need for additional control measures in the event of an evacuation.

This evacuation evaluation is consistent with requirements outlined in Assembly Bill (AB) 747[1] and Senate Bill (SB) 99[2]. These laws require agencies to evaluate the resiliency of their transportation system, the capacity of evacuation routes, and identify key routes for community areas with only one access point.

The memorandum includes the following sections:

- Introduction, including legislative requirements and analysis scenarios
- Methodology
- Evacuation analysis results
- Evacuation planning considerations and recommendations.

LEGISLATIVE REQUIREMENTS

Recent California legislation, including Assembly Bill (AB) 747, requires local agencies to review accessibility and evacuation routes when specific elements within the General Plan or other emergency planning documents are completed or updated.

- **Assembly Bill 747** requires that the Safety Element be reviewed and updated to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios. This is a

[1] https://openstates.org/ca/bills/20192020/AB747/
[2] https://openstates.org/ca/bills/20192020/SB99/

requirement for all Safety Elements or updates to Hazard Mitigation Plans completed after January 2022.

ROADWAY NETWORK

The City of Glendale is located in the central area of Los Angeles County, California (Figure 1). It is bounded by the cities of Burbank to the west, Pasadena to the east, Los Angeles to the south, and La Cañada Flintridge to the north.

State Routes

State Route 2 (SR-2) is a state highway that runs southeast-northwest through the City of Glendale. It provides access to the city via several interchanges, including those at Colorado Street and Mountain Street. SR-2 transitions from a freeway to an arterial road, known as Glendale Boulevard, as it continues southeast into Los Angeles.

State Route 134 (SR-134) is an east-west freeway that connects Glendale to Pasadena in the east and Burbank in the west. The portion of SR-134 running through Glendale is a fully access-controlled freeway with multiple interchanges, including those at Brand Boulevard and Central Avenue. This route is a major corridor serving both residential neighborhoods and commercial districts within the city.

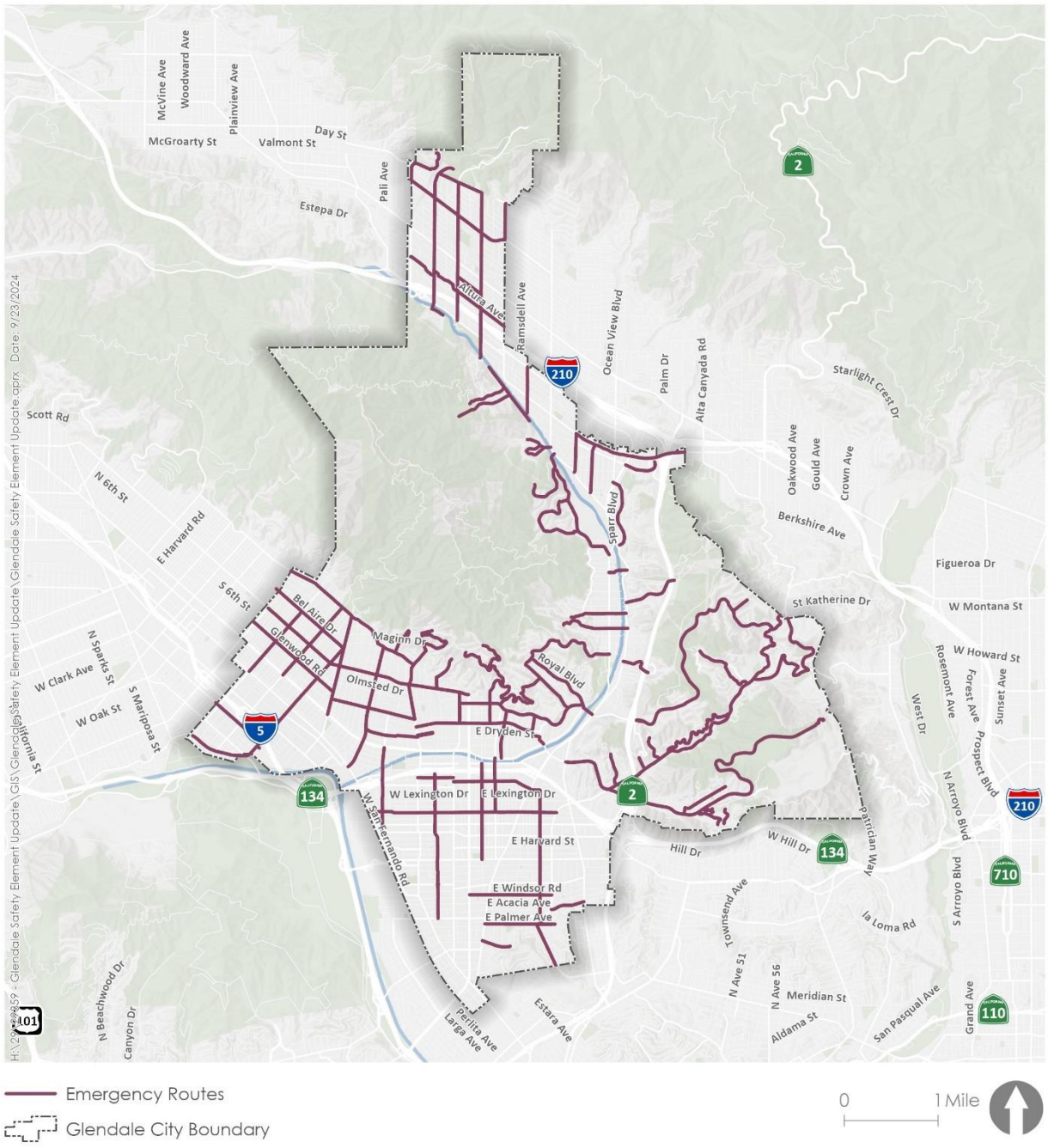
State Route 210 (SR-210) is an east-west freeway that skirts the northern edge of Glendale. It connects the city to La Cañada Flintridge in the west and Pasadena in the east. SR-210 is fully access-controlled, with interchanges providing access to Glendale, including a freeway-freeway interchange at SR-2.

Local Road Network

There are several arterial and collector roads that complement the state highways and are also likely to be used for evacuation purposes, depending on the evacuation scenario, including but not limited to:

- Brand Boulevard
- Central Avenue
- Colorado Street
- Glenoaks Boulevard
- Foothill Boulevard

Figure 1: Glendale Roadway Network and Evacuation Routes



Roadway Network and Emergency Routes
Glendale Safety Element Update
Glendale, CA

KITTELSON & ASSOCIATES

Source: City of Glendale, Kittelson & Associates, 2024

ANALYSIS SCENARIOS

The evacuation analysis considers the following two representative evacuation scenarios:

- **Wildfire Scenario #1** – Wildfire ignites in the Verdugo Mountains/San Rafael Hills in east Glendale
- **Landslide Scenario #2** – Landslide occurs in the San Gabriel Mountains in north Glendale

These scenarios do not represent every possible emergency that could affect Glendale, but they do represent the highest likelihood emergencies that may stress different parts of the road system. The evacuation scenarios were chosen in discussion with City staff, including Glendale Police Department and Glendale Fire Department, to represent likely emergencies for the Safety Element purposes.

Time Frames

Each evacuation scenario is compared to weekday PM peak hour traffic conditions (between 4PM to 6PM) for two time frames, base year and future year.

BASE YEAR

The base year evaluation is representative of evacuations with existing traffic levels. The available Glendale Travel Demand Model uses a base year of 2021.

FUTURE YEAR

The future year traffic levels include development allowable under the current Glendale General Plan. Outside of Glendale, the traffic forecasts include travel that would be generated by the 2040 demographic forecasts for the entire region provided by the Southern California Association of Governments (SCAG) for travel forecasting.

Methodology

Assumptions regarding travel patterns for evacuees were developed based on recent research. The following sections describe the tools and inputs used for the evacuation analysis.

EVACUATION MODELING

Travel Modeling Tools

The evacuation analysis uses the City of Glendale Travel Demand Model ("travel model"). The current travel model was calibrated and validate for a 2021 base year and includes a 2040 future scenario with 2040 land use forecasts and transportation improvement assumptions.

The travel model represents all land uses in the City of Glendale grouped into transportation analysis zones (TAZs) (Figure 2). The travel model includes a representative roadway network (generally all streets except for local residential streets). Each road segment is coded with functional classification, number of lanes, uncongested speed, and an estimate of the typical hourly capacity. The travel model estimates vehicle trips generated by each land use, distributes the trips to a variety of likely destinations, and assigns each origin-destination pair to the best route. The travel model also assesses congestion and iteratively diverts traffic to alternative routes until congestion is balanced between all available routes.

Affected Areas

The areas that would be affected by each emergency scenario were identified based on the California Department of Forestry and Fire Protection (CAL FIRE) Fire Hazard Severity Zones mapping and consultation with Glendale city staff and emergency responders. The affected areas were overlaid with the Glendale TAZs to identify the numbers of people that would need to be evacuated.

Time Period

Transportation activity was modeled for one worst-case time period, based on the weekday PM peak hour (between 4PM to 6PM) when non-evacuation traffic and congestion would be at its highest levels. Peak evacuation traffic was assumed to occur during this period involving the specified area within the city.

H:\29\29359 - Glendale Safety Element Update\GIS\Glendale Safety Element Update.aprx Date: 9/23/2024

Glendale Traffic Analysis Zones

Glendale City Boundary

0 1 Mile

Roadway Network and Emergency Routes
Glendale Safety Element Update
Glendale, CA

KITTELSON & ASSOCIATES

Number of Evacuation Trips

If a fire occurs during the night, most residents would be home but most employees would not be at their workplace. If a fire occurs during the workday, most employees would be at their workplace but many residents would not be at their homes. The evacuation analysis conservatively assumes that 75 percent of residents and 75 percent of employees would need to evacuate during a fire event.

Depending on the order received, a proportion of residents, employees, and visitors will choose to evacuate. When a zone is assigned an Evacuation Order, it is assumed that 90 percent of residents, employees, and visitors will evacuate and approximately 10 percent will remain behind. The estimated factors are based on survey results from people impacted by prior fires in California in UC Berkeley's Review of California Wildfire Evacuations from 2017 to 2019.[3]

Based on vehicle ownership data from the United States Census American Community Survey (ACS)[4], there are a weighted average of 1.6 vehicles per household in Glendale. Therefore, the number of evacuating households is multiplied by 1.6 to estimate residential vehicles. Each evacuating employee is assumed to use one vehicle.

Evacuation Destinations

Likely evacuation destinations were identified in consultation with city staff:

- Clark Magnet School, Glendale Civic Auditorium, and Glendale High School are used to estimate evacuation trips leaving Glendale towards the north and the south in the base and future years.
    - For the wildfire scenario, Clark Magnet School and Glendale High School were chosen as evacuation destinations.
    - For the landslide scenario, Glendale Civic Auditorium and Glendale High School were chosen as evacuation destinations.
- Burbank and Pasadena are also used as evacuation destinations for evacuees leaving Glendale.

The percentage of trips heading for each evacuation destination were assigned based on the location and direction of the evacuation. The majority of trips were typically assigned to the nearest destination within Glendale if the evacuation route would not cross the affected fire or landslide area. However, smaller percentages of trips from each neighborhood were assumed to want to travel in the other directions, particularly if they could reach shelter with family or friends.

[3] This assumption is based in knowledge that there is a certain contingent of people who will not evacuate, even when under official notice. See Wong, S., Broader, J. and Shaheen, P., 2022. *Review of California Wildfire Evacuations from 2017 to 2019*. [online] Escholarship.org. Available at: <https://escholarship.org/uc/item/5w85z07g>

[4] U.S. Census Bureau. "Household Size by Vehicles Available." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B08201, 2022, https://data.census.gov/table/ACSDT5Y2022.B08201?q=b08201&g=160XX00US0613214&moe=false. Accessed on May 2, 2024.

The distribution of the destinations is not intended to represent a precise distribution of the routes that would be taken during an evacuation.

Roadway Capacity

Traffic congestion, as measured by the demand volume-to-capacity ratio, was modeled using the default average capacities for each roadway. The scenarios conservatively represent conditions without implementation of any evacuation strategies, such as manual traffic control or contraflow lanes, which could increase roadway capacity in one direction versus the other.

Travel Times

The travel model includes formulas which estimate how much travel speeds decrease based on the demand volume versus the capacity and the type of road. These formulas are based on standard travel forecasting practice. Travel times for evacuation trips are estimated by identifying the best route between origins and destinations with the congested speeds and summing the congested travel times on each road segment along the route.

LIMITATIONS

The results of this evaluation are intended to identify potential congested locations during modeled representative evacuation scenarios. These scenarios were developed based on conservative assumptions and modeling techniques that reflect current understanding of evacuation analysis. These scenarios are intended to model a potential range of different evacuation scenarios but not all possible scenarios.

The scenarios represent potential emergencies occurring in portions of the City of Glendale. Actual emergencies may occur at other locations in and around the city and the specific conditions of an emergency evacuation could result in evacuation behavior that diverges from the definitions and assumptions used for this analysis. As a result, the identified scenarios and evacuation constraints represent informed estimates of the most likely potential evacuation scenario footprints and capacity constraints based on available data.

Evacuation Analysis Results

Evacuation analysis was conducted for the analysis peak hour (between 4PM to 6PM) for conditions with no evacuation and for the two (2) different evacuation scenarios. The analysis is presented for the base year and future year.

BASE YEAR NO EVACUATION CONDITIONS

The PM peak analysis hour volumes were compared to road capacities for weekday conditions without an emergency evacuation event. These congestion conditions can be compared to the congestion conditions with an evacuation event to determine where additional traffic management may be needed during an emergency.

Base Year

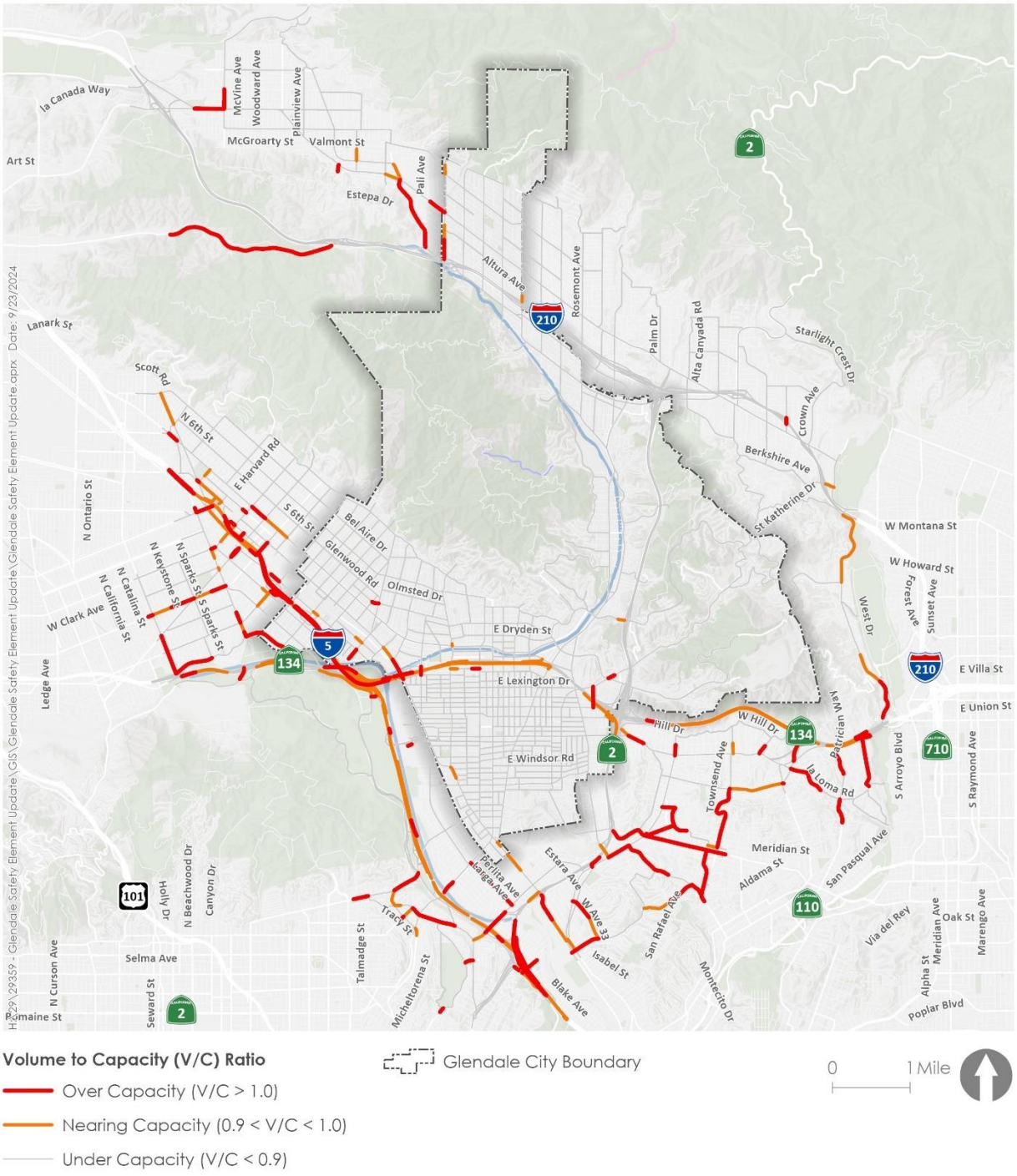
The PM peak hour (between 4PM to 6PM) modeling for the base year without an evacuation event indicates roadway conditions near or over capacity in the following locations within the City of Glendale (Figure 3):

- I-5 west of Glendale (northwest of I-5/SR-134 interchange)
- SR-134 between I-5/SR-134 interchange and Concord St

Beyond the city limit, the base year scenario indicates roadway conditions near or over capacity in the following locations:

- I-5 going through Burbank, near I-5/SR-134 interchange, and several I-5 ramp locations, e.g. at Los Feliz Blvd and Fletcher Dr
- Along SR-210: La Tuna Canyon Rd and Tujunga Canyon Blvd
- Along SR-2: N San Fernando Rd (between SR-2 and Hallett Ave), Eagle Rock Blvd and El Paso Dr (between SR-2 and Terrace 49), York Blvd (between SR-2 and N Avenue 54), Colorado Blvd (between SR-2 and College View Ave)

Figure 3: Base Year PM Peak Hour Congestion Locations, No Evacuation



Source: Kittelson & Associates using Glendale travel model, 2024

Future Year

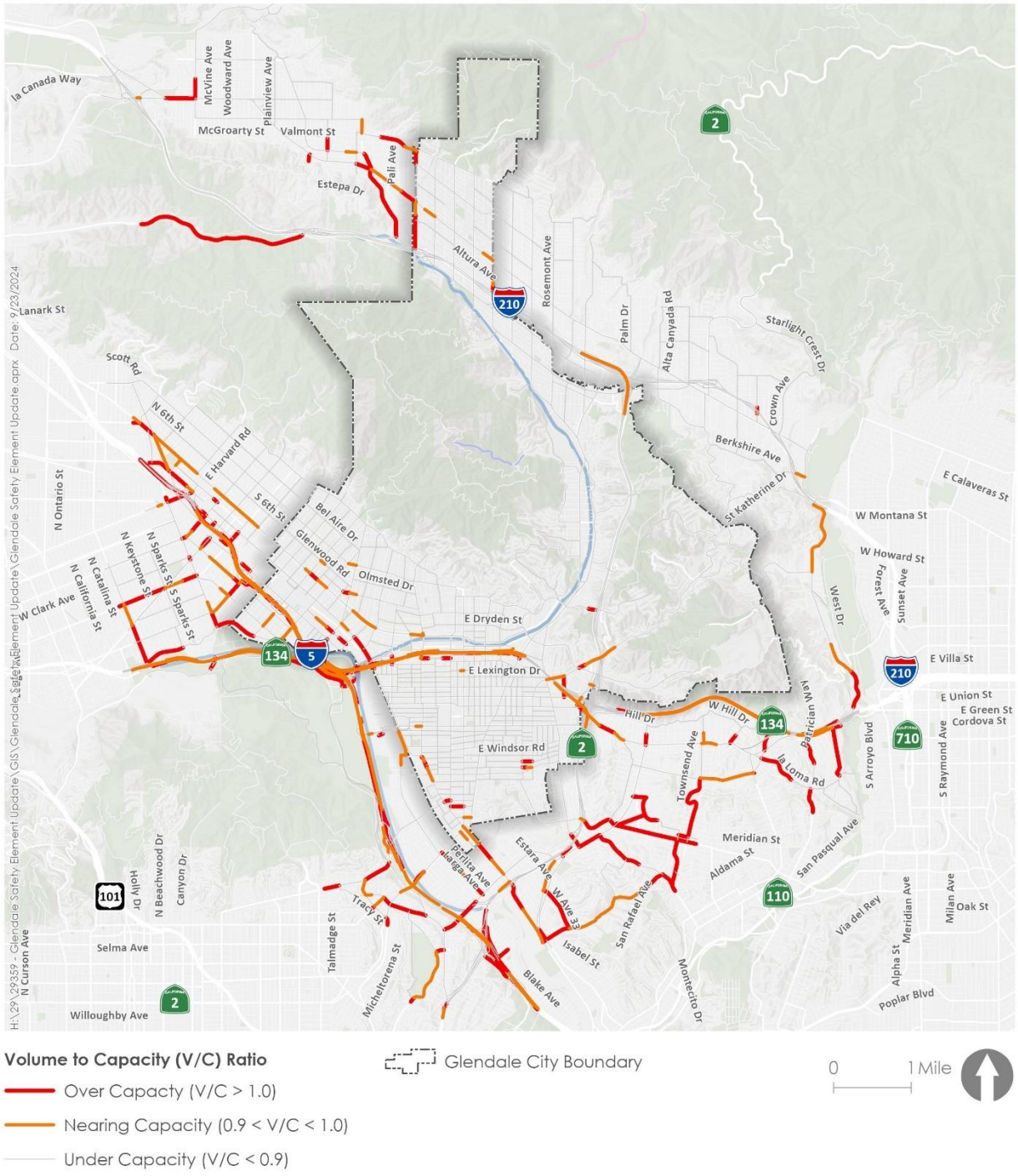
The PM peak hour (between 4PM to 6PM) modeling for the future year with the proposed General Plan (Mobility and Land Use Elements) and without an evacuation event forecasts roadway conditions near or over capacity in the following locations within the City of Glendale (Figure 4):

- I-5 in west Glendale (northwest of I-5/SR-134 interchange).
- SR-134: between the I-5 SR-134 interchange and Concord St, N Central Ave and N Jackson St, Geneva St and N Glendale Ave
- Small sections of some roadways:
    - San Fernando Rd between S Pacific Ave and W Acacia Ave
    - W Laurel St between S Central Ave and S Brand Blvd

Beyond the city limit, the future year scenario indicates roadway conditions near or over capacity in the following locations:

- I-5 southwest of Glendale, going through Burbank, near I-5/SR interchange, and several I-5 ramp locations, e.g. at Los Feliz Blvd and Fletcher Dr
- Along SR-210: La Tuna Canyon Rd and Tujunga Canyon Blvd
- Along SR-2: N San Fernando Rd (between SR-2 and Hallett Ave), Eagle Rock Blvd and El Paso Dr (between SR-2 and Terrace 49), York Blvd (between SR-2 and N Avenue 54), Colorado Blvd (between SR-2 and College View Ave)

Figure 4: Future Year PM Peak Hour Congestion Locations, No Evacuation



Source: Kittelson & Associates using Glendale travel model, 2024

SCENARIO 1: WILDFIRE IN EAST GLENDALE

Under this scenario, a fire ignites in the Verdugo Mountains / San Rafael Hills in east Glendale, initiating an evacuation order for communities in the eastern half of Glendale, such as College Hills, Glenoaks Canyon, Rancho San Rafael, and Emerald Isle (Figure 5). Residents and workers are given orders to evacuate to Clark Magnet School or Glendale High School. Table 1 shows the estimated number of households and employees in the affected area by transportation analysis zone (TAZ) as well as the total estimated evacuation trips for this scenario.

Base Year

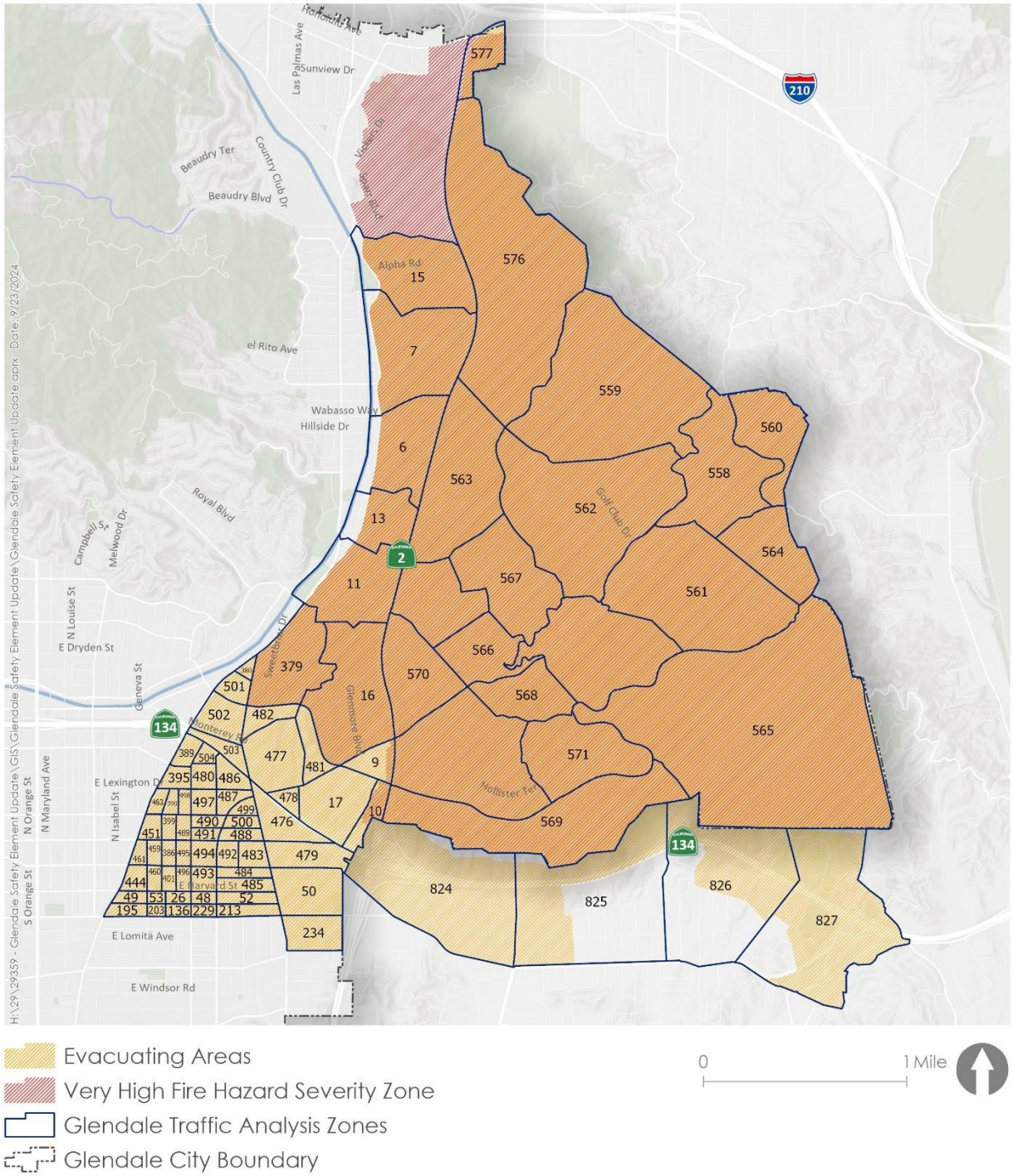
If an evacuation were to occur due to a wildfire in the Verdugo Mountains, the analysis estimates over-capacity conditions on several roadways in the City as shown in Figure 6. Specifically, the roadways where demand volumes are projected to be at or exceed road capacity with the City of Glendale include:

- Along I-5: west of Glendale (west of I-5/SR-134 interchange, similar to no evacuation conditions), segments close to SR-134/SR-2 interchange
- Along SR-210: Lowell Ave (between SR-210 and Foothill Blvd), Pennsylvania Ave (between SR-210 and Los Olivos Ln), New York Ave (between Foothill Blvd and Santa Carlotta St)
- SR-134 between I-5/SR-134 interchange and Concord St (similar to no evacuation conditions)
- Along SR-2 between Camino San Rafael and SR-134

Beyond the city limit, the base year scenario estimates congestion in the following locations:

- I-5 going through Burbank, near I-5/SR interchange, and several I-5 ramp locations, e.g. at Los Feliz Blvd and Fletcher Dr
- Additional length of I-5 west of Glendale
- Along SR-210: La Tuna Canyon Rd and Tujunga Canyon Blvd
- Along SR-2: N San Fernando Rd (between SR-2 and Hallett Ave), Eagle Rock Blvd and El Paso Dr (between SR-2 and Terrace 49), York Blvd (between SR-2 and N Avenue 54), Colorado Blvd (between SR-2 and College View Ave)
- Additional length of roadways southeast of Glendale connecting to SR-134 and SR-2.
- Linda Vista Ave between SR-134 and SR-210
- Chevy Chase Dr and Highland Dr connecting to SR-210 northwest of Glendale

Figure 5: Evacuating Area, Wildfire Scenario



Source: Kittelson & Associates, 2024

Table 1: Affected Population and Peak Hour Evacuation Trips, Scenario 1 in East Glendale Wildfire

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
6	US-CA-XLA-GLN-E026	394	85	494	394	85	494
7	US-CA-XLA-GLN-E017	410	0	454	410	0	455
9	US-CA-XLA-GLN-E038	171	25	202	171	28	204
10	US-CA-XLA-GLN-E042	4	79	57	5	81	59
11	US-CA-XLA-GLN-E026	0	3,704	2,500	0	3,708	2,503
13	US-CA-XLA-GLN-E026	519	44	605	519	45	605
15	US-CA-XLA-GLN-E017	380	33	443	383	31	445
16	US-CA-XLA-GLN-E038	421	17	465	421	17	465
17	US-CA-XLA-GLN-E042	244	4,593	3,364	244	4,594	3,364
26	Q1585	98	0	68	98	0	68
48	Q1585	58	9	67	58	9	67
49	Q1585	134	25	109	134	27	111
50	Q1585	333	319	556	333	329	563
52	Q1585	195	29	222	195	30	222
53	Q1585	73	0	51	73	0	51

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
136	Q1585	34	112	99	34	114	100
195	Q1585	68	117	127	68	121	129
203	Q1585	40	128	114	40	131	116
213	Q1585	133	194	268	133	192	267
229	Q1585	65	57	106	65	59	107
234	Q1585	501	302	716	501	300	714
379	US-CA-XLA-GLN-E038	351	7	384	351	7	383
380	US-CA-XLA-GLN-E038	0	84	57	0	83	56
386	Q1585	165	30	174	165	32	176
389	Q1585	101	120	191	101	118	190
390	Q1585	220	0	205	220	0	205
395	Q1585	241	108	296	241	109	296
399	Q1585	170	0	159	170	0	159
401	Q1585	95	29	85	95	36	89
444	Q1585	99	147	169	99	147	169
451	Q1585	101	106	166	101	103	164

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
459	Q1585	148	40	164	148	40	165
460	Q1585	92	30	84	92	29	83
461	Q1585	129	169	235	129	166	233
463	Q1585	89	172	198	89	172	198
476	Q1585	411	107	445	411	106	445
477	US-CA-XLA-GLN-E042	262	61	324	264	63	327
478	US-CA-XLA-GLN-E042	81	0	87	81	0	87
479	Q1585	441	36	474	441	36	474
480	Q1585	344	0	335	344	0	335
481	US-CA-XLA-GLN-E042	146	77	209	146	76	209
482	US-CA-XLA-GLN-E042	78	0	85	78	0	85
483	Q1585	225	50	261	225	51	262
484	Q1585	133	36	162	133	36	161
485	Q1585	251	35	283	251	37	285
486	Q1585	92	22	116	92	24	117
487	Q1585	173	28	193	173	27	192

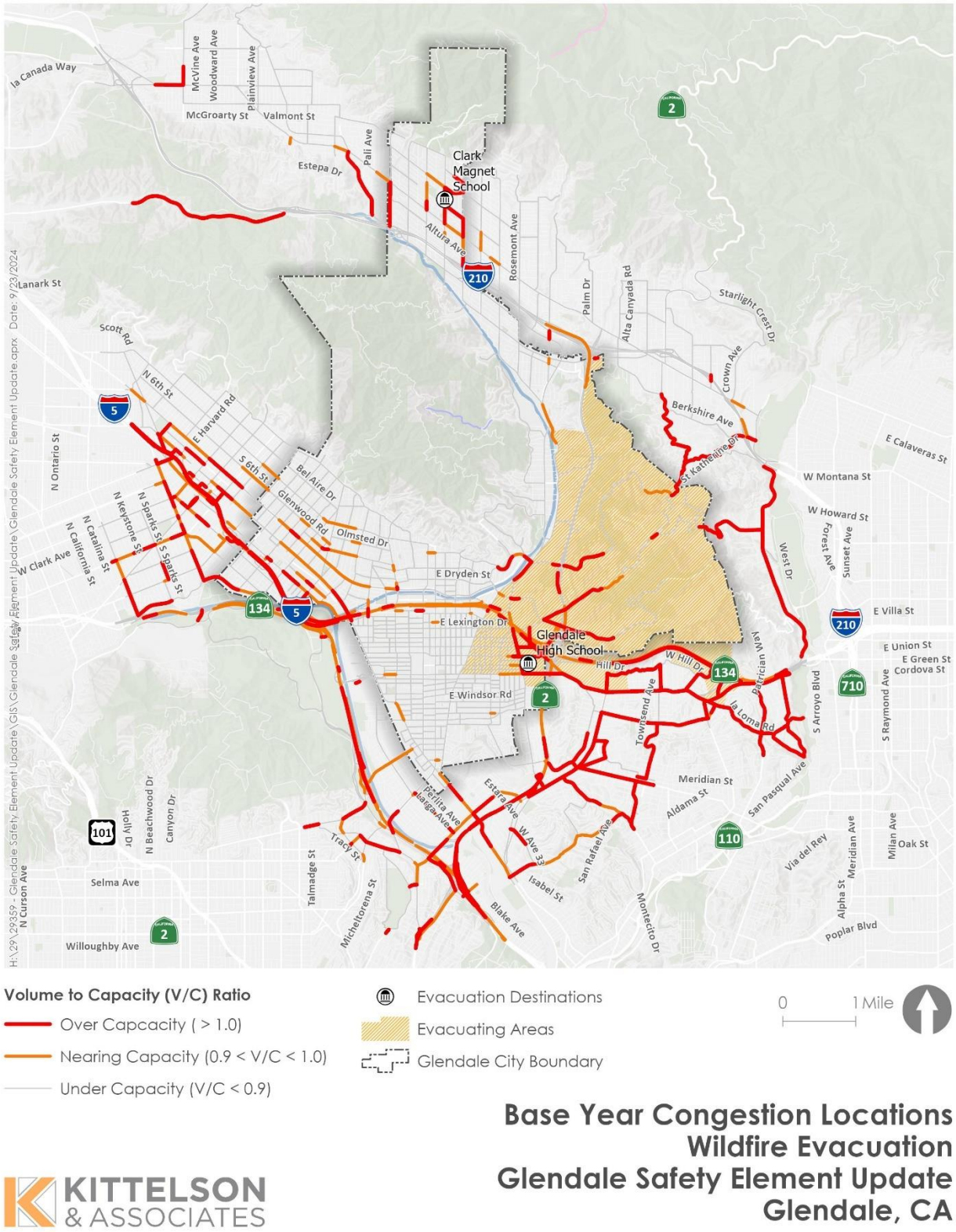
Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
488	Q1585	203	25	222	203	26	222
489	Q1585	158	0	147	158	0	147
490	Q1585	116	0	118	116	0	117
491	Q1585	129	0	131	130	0	132
492	Q1585	82	73	132	82	75	133
493	Q1585	177	215	328	177	216	328
494	Q1585	175	131	265	175	132	266
495	Q1585	152	34	164	153	34	165
496	Q1585	87	126	145	87	124	144
497	Q1585	282	0	285	282	0	285
498	Q1585	160	0	149	160	0	149
499	Q1585	63	72	112	63	74	114
500	Q1585	257	0	259	257	0	259
501	US-CA-XLA-GLN-E038	43	23	62	43	25	64
502	US-CA-XLA-GLN-E042	178	257	366	178	256	366
503	US-CA-XLA-GLN-E042	34	0	37	34	0	37

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
503	Q1585	34	0	37	34	0	37
504	Q1585	84	0	91	84	0	91
558	US-CA-XLA-GLN-E030	245	0	359	246	0	361
559	US-CA-XLA-GLN-E018	533	1	781	533	0	780
560	US-CA-XLA-GLN-E030	120	0	176	120	0	176
561	US-CA-XLA-GLN-E040	74	0	107	73	0	107
562	US-CA-XLA-GLN-E029	328	24	496	328	125	564
563	US-CA-XLA-GLN-E027	90	0	100	90	0	100
564	US-CA-XLA-GLN-E041	134	0	196	134	0	196
565	US-CA-XLA-GLN-E044	0	158	107	0	159	107
566	US-CA-XLA-GLN-E039	51	0	75	53	0	77
567	US-CA-XLA-GLN-E028	348	0	510	348	0	510
568	US-CA-XLA-GLN-E040	32	0	47	33	0	48
569	US-CA-XLA-GLN-E044	289	0	417	290	0	419
570	US-CA-XLA-GLN-E039	230	0	336	230	0	336
571	US-CA-XLA-GLN-E044	193	0	278	193	0	278

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
572	US-CA-XLA-GLN-E040	80	0	117	83	0	122
573	US-CA-XLA-GLN-E040	150	39	246	150	39	246
574	US-CA-XLA-GLN-E043	268	60	426	268	60	427
575	US-CA-XLA-GLN-E027	202	0	296	202	0	296
576	US-CA-XLA-GLN-E018	0	0	0	0	0	0
577	US-CA-XLA-GLN-E018	0	1,450	979	0	1,519	1,025
824	Q1177	471	747	1,150	526	646	1,157
826	Q1177	699	1,000	1,636	752	876	1,624
827	Q1177	350	1,530	1,514	377	1,343	1,425

Source: City of Glendale Travel Demand Model; Kittelson & Associates, Inc., 2024

Figure 6: Congestion Locations, Wildfire Scenario, Base Year



Source: Kittelson & Associates using Glendale travel model, 2024

Future Year

With peak evacuation from a wildfire in the Verdugo Mountains in the future year, the analysis predicts over-capacity conditions on several roadways in the city as shown in Figure 7. In addition to the locations listed for the base year, the roadways where demand volumes are projected to be at or exceed road capacity with the City of Glendale include:

- All I-5 segments in the west of Glendale
- Segments in parallel to I-5 in the northwest of Glendale: W Kenneth Rd, Glenwood Rd, 5th St, W Glenoaks Blvd, San Fernando Rd, Grand Central Ave, Flower St
- SR-134: between I-5/SR-134 interchange and Concord St, N Central Ave and N Jackson St, Geneva St and N Glendale Ave (similar to no evacuation conditions)
- Scattered segments, e.g. San Fernando Rd between S Pacific Ave and W Acacia Ave, W Laurel St between S Central Ave and S Brand Blvd (similar to no evacuation conditions)
- Along SR-2 between Camino San Rafael and SR-134

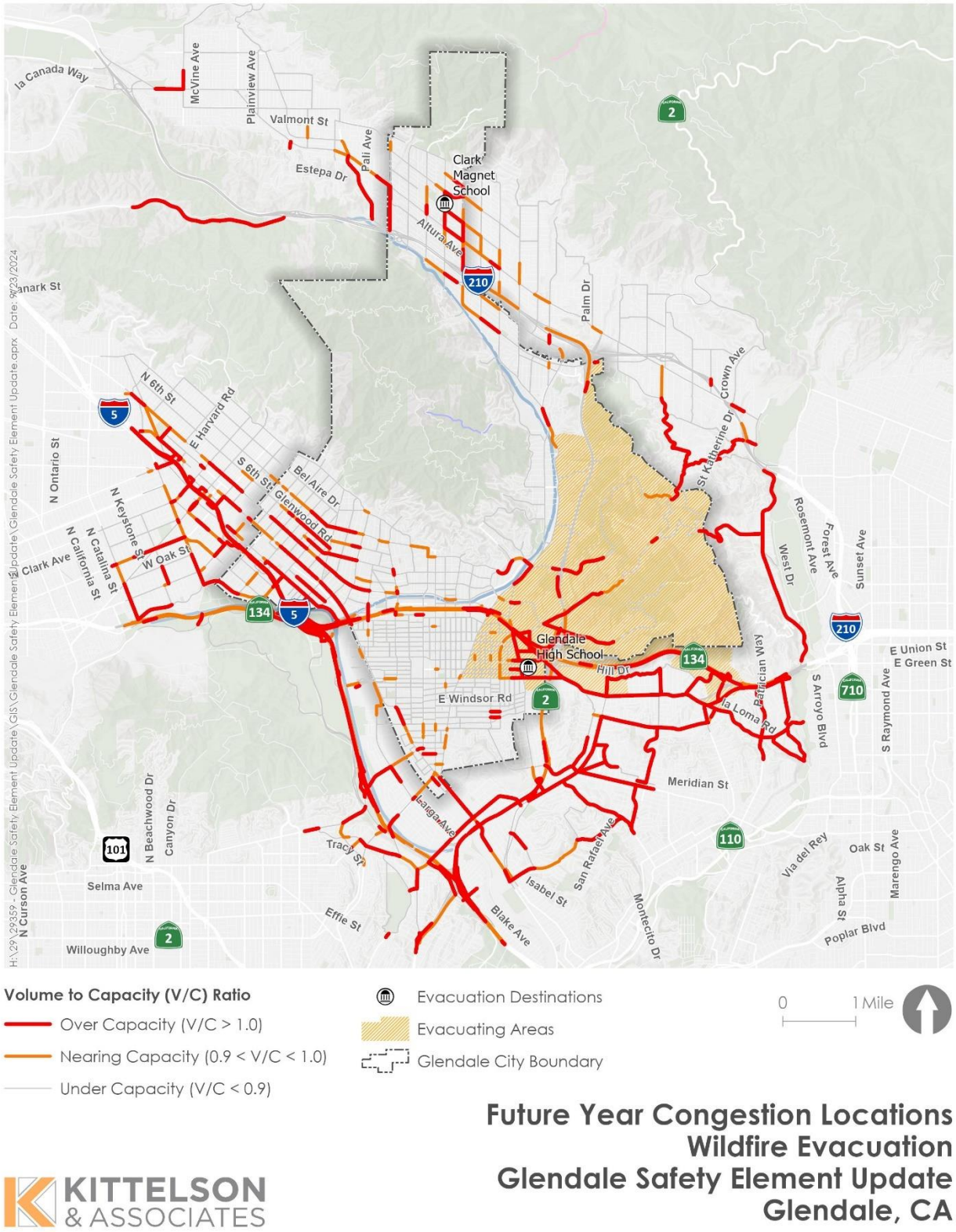
Beyond the city limit, the future year scenario indicates congestion in the following locations:

- I-5 going through Burbank, near I-5/SR interchange, and several I-5 ramp locations, e.g. at Los Feliz Blvd and Fletcher Dr
- Additional length of I-5 west of Glendale
- Along SR-210: La Tuna Canyon Rd and Tujunga Canyon Blvd
- Along SR-2: N San Fernando Rd (between SR-2 and Hallett Ave), Eagle Rock Blvd and El Paso Dr (between SR-2 and Terrace 49), York Blvd (between SR-2 and N Avenue 54), Colorado Blvd (between SR-2 and College View Ave)
- Additional length of roadways southeast of Glendale connecting to SR-134 and SR-2: Atwater Ave, N San Fernando Rd, Fletcher Dr
- Linda Vista Ave between SR-134 and SR-210
- Chevy Chase Dr and Highland Dr connecting to SR-210 northeast of Glendale

Travel Times

Travel times between Glendale neighborhoods and various evacuation destinations are listed in Table 2 With base year traffic levels, an evacuation event would add up to 30 minutes to the time to reach the Clark Magnet School, up to 36 minutes to reach safety in Pasadena, and up to 21 minutes to Glendale High School. With future year traffic levels, an evacuation event would add up to 40 minutes to the time to the Clark Magnet School, up to 40 minutes to Pasadena, and up to 25 minutes to Glendale High School.

Figure 7: Congestion Locations, Scenario 1 Verdugo Mountains Wildfire, Future Year



Source: Kittelson & Associates using Glendale travel model, 2024

Table 2: Travel Times (Minutes), Scenario 1 East Glendale Wildfire

Origin and Destination	Base Year No Evacuation	Base Year Scenario 1	Future Year No Evacuation	Future Year Scenario 1
From Montecito Park				
To Clark Magnet School	7.6	10.4	8.0	20.2
To Glendale High School	6.9	9.3	6.9	12.5
East towards Pasadena	17.9	19.3	21.4	23.5
From Emerald Isle				
To Clark Magnet School	12.7	23.2	13.0	37.7
To Glendale High School	9.5	17.0	9.5	25.3
East towards Pasadena	16.4	25.8	19.8	34.3
From Chevy Chase				
To Clark Magnet School	11.7	19.8	12.0	34.1
To Glendale High School	8.2	14.3	8.5	22.7
East towards Pasadena	15.4	22.4	18.8	30.7
From Woodbury				
To Clark Magnet School	11.0	13.8	11.5	23.7
To Glendale High School	3.2	4.8	3.2	7.9
East towards Pasadena	19.0	20.3	22.5	24.6
From Glenoaks Canyon				
To Clark Magnet School	13.0	29.9	13.5	39.7
To Glendale High School	4.8	21.1	4.8	23.3
East towards Pasadena	20.8	36.0	24.3	40.2

Source: Kittelson & Associates using City of Glendale Travel Demand Model, 2024

SCENARIO 2: LANDSLIDE IN NORTH GLENDALE

Under this scenario, a landslide occurs in the San Gabriel Mountains in north Glendale, which is presumed to necessitate the evacuation order for people in north Glendale (Figure 8). Residents and workers are given orders to evacuate to Glendale Civic Auditorium or Glendale High School. Table 3 shows the number of households and employees in the affected area as well as the total estimated evacuation trips for this scenario.

Base Year

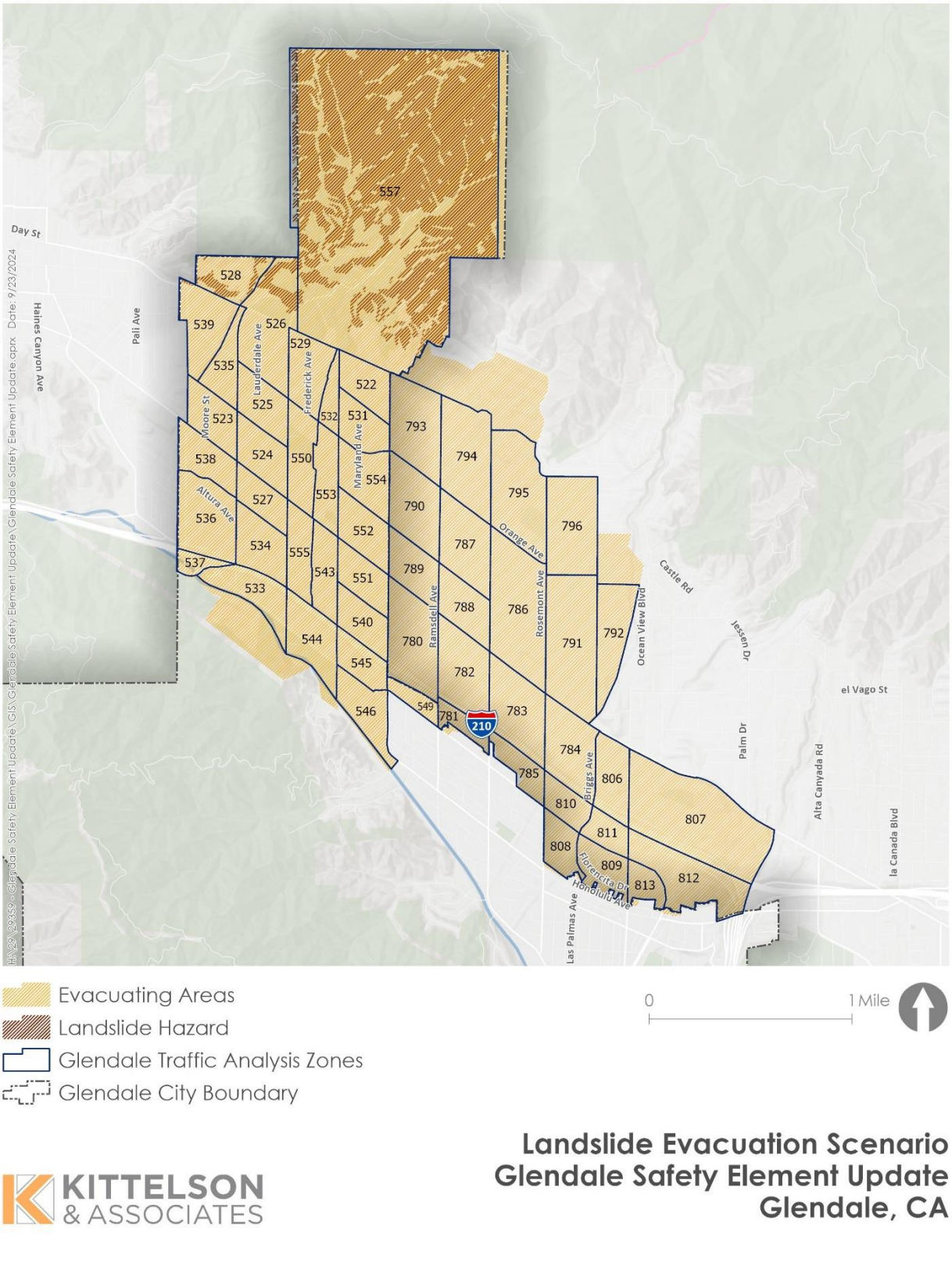
With peak evacuation from a landslide in the San Gabriel Mountains in north Glendale in the base year, the analysis indicates over-capacity conditions on several roadways in the city as shown in Figure 9. Specifically, the roadways where demand volumes are projected to be at or exceed road capacity include within the City of Glendale include:

- I-5 west of Glendale (west of I-5/SR-134 interchange).
- SR-134 between I-5/SR-134 interchange and Concord St
- SR-2 north of SR-134
- Segments in the east of Glendale in parallel to SR2, including N Verdugo Rd, Camino San Rafael, Royal Blvd, and E Chevy Chase Dr.
- Segments in the north of Glendale connecting to SR-210, including Lowell Ave, Boston Ave, Dunsmore Ave, New York Ave, Pennsylvania Ave, Ramsdell Ave, Honolulu Ave, Montrose Ave, and La Crescenta Ave

Beyond the city limit, the base year scenario indicates congestion in the following locations:

- I-5 going through Burbank, near I-5/SR-134 interchange, and several I-5 ramp locations, e.g. at Los Feliz Blvd and Fletcher Dr
- Along SR-210: La Tuna Canyon Rd
- Some segments of SR-2 to the southeast of Glendale
- Along SR-2: N San Fernando Rd (between SR-2 and Hallett Ave), Eagle Rock Blvd and El Paso Dr (between SR-2 and Terrace 49), York Blvd (between SR-2 and N Avenue 54), Colorado Blvd (between SR-2 and College View Ave)
- Linda Vista Ave between SR-134 and SR-210
- Chevy Chase Dr and Highland Dr connecting to SR-210 northeast of Glendale

Figure 8: Evacuating Area, Scenario 2 Landslide in North Glendale



Source: Kittelson & Associates, 2024

Table 3: Affected Population and Peak Hour Evacuation Trips, Scenario 2 Landslide

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
522	US-CA-XLA-GLN-E002	142	0	211	314	0	212
523	US-CA-XLA-GLN-E003	144	202	349	316	202	349
524	US-CA-XLA-GLN-E003	150	175	341	331	172	339
525	US-CA-XLA-GLN-E003	146	55	255	322	55	255
526	US-CA-XLA-GLN-E002	211	0	313	463	0	313
527	US-CA-XLA-GLN-E005	209	113	366	430	110	364
528	US-CA-XLA-GLN-E001	45	0	67	100	0	67
529	US-CA-XLA-GLN-E002	188	0	279	413	0	279
531	US-CA-XLA-GLN-E002	143	42	241	315	42	241
532	US-CA-XLA-GLN-E002	46	10	75	102	10	76
533	US-CA-XLA-GLN-E007	105	2	147	216	1	147
534	US-CA-XLA-GLN-E005	230	0	317	471	0	318
535	US-CA-XLA-GLN-E003	95	0	141	209	0	141
536	US-CA-XLA-GLN-E005	224	0	310	460	0	310
537	US-CA-XLA-GLN-E007	0	19	13	0	19	13

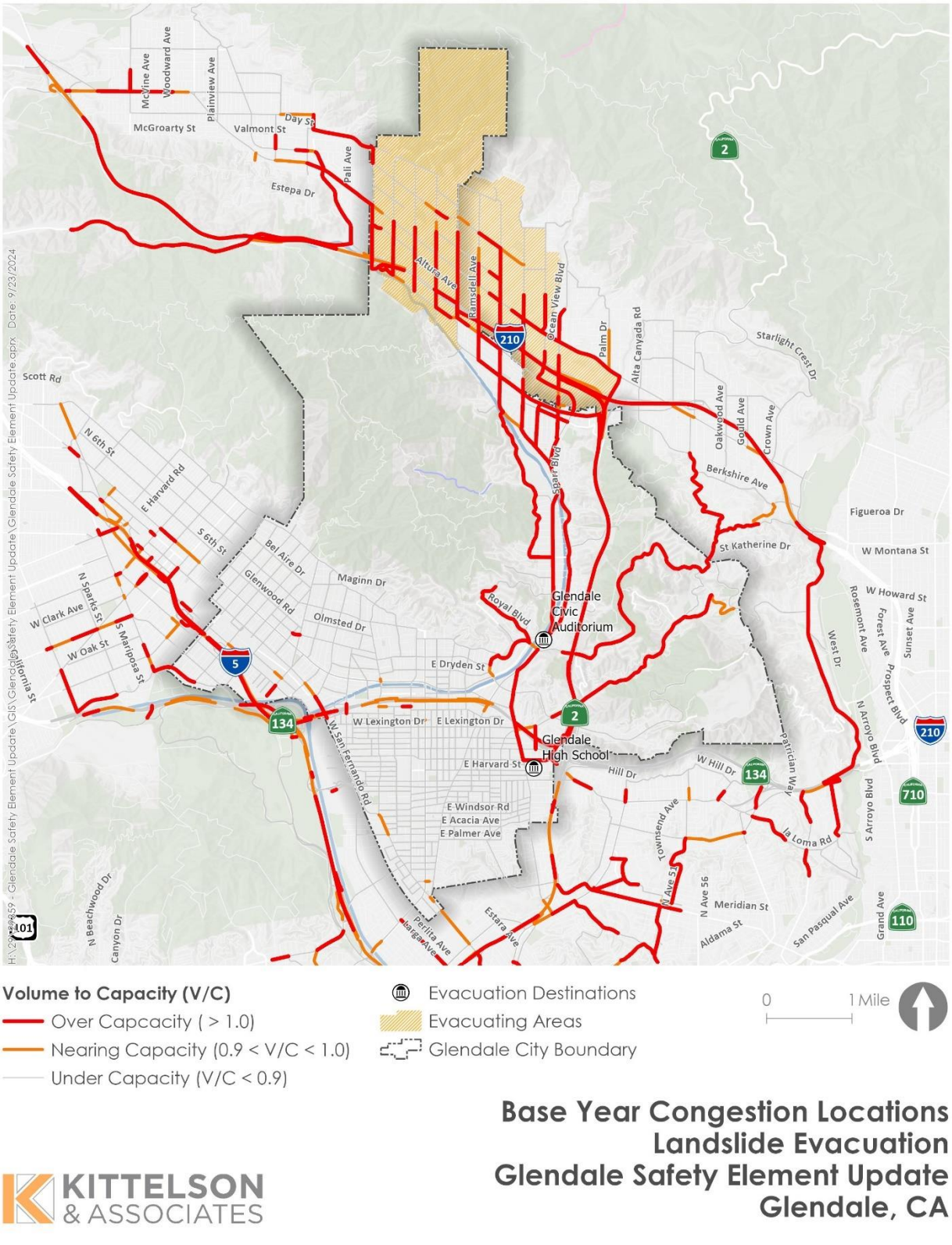
Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
538	US-CA-XLA-GLN-E005	90	205	262	183	201	259
539	US-CA-XLA-GLN-E002	187	0	277	411	0	277
540	US-CA-XLA-GLN-E006	304	53	447	610	53	447
543	US-CA-XLA-GLN-E006	137	62	232	283	63	233
544	US-CA-XLA-GLN-E007	120	0	166	246	0	166
545	US-CA-XLA-GLN-E007	166	21	244	340	21	244
546	US-CA-XLA-GLN-E007	219	48	332	443	49	332
549	Community	306	4	408	600	4	408
550	US-CA-XLA-GLN-E004	113	65	212	250	63	211
551	US-CA-XLA-GLN-E006	222	96	370	454	106	378
552	US-CA-XLA-GLN-E004	262	192	518	577	193	519
553	US-CA-XLA-GLN-E004	81	175	238	178	175	238
554	US-CA-XLA-GLN-E004	210	0	311	462	0	312
555	US-CA-XLA-GLN-E006	134	64	228	274	65	229
557	US-CA-XLA-GLN-E001	23	26	51	51	26	52
780	Community	258	403	614	570	413	663

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
781	Community	129	133	262	288	137	286
782	Community	193	1,588	1,328	426	1,617	1,379
783	Community	275	399	634	736	387	758
784	Community	206	265	453	551	259	547
785	Community	138	132	273	372	129	338
786	Mountain	272	1,660	1,490	548	1,604	1,452
787	Mountain	276	222	524	582	232	549
788	Mountain	183	443	548	387	461	572
789	Alabama	91	882	720	194	917	750
790	Alabama	276	222	524	582	230	548
791	Mountain	564	440	1,065	1,298	449	1,179
792	Mountain	188	721	742	432	734	787
793	Henrietta/Briggterrace	196	45	321	431	45	321
794	Henrietta/Teasley	228	45	368	767	45	548
795	Henrietta/Teasley	228	67	383	767	67	563
796	Henrietta/Teasley	342	67	552	1,145	67	818

Evacuating TAZ	Evacuation Zones	Base Year Households	Base Year Employment	Base Year Evacuation Trips	Future Households	Future Employment	Future Evacuation Trips
806	Community	123	215	293	248	208	307
807	Community	372	543	815	752	528	864
808	Community	372	107	521	752	104	577
809	Community	371	456	756	750	445	806
810	Community	372	107	521	752	104	577
811	Community	247	451	602	498	440	633
812	Community	372	107	521	752	104	577
813	Community	247	215	443	498	208	476

Source: City of Glendale Travel Demand Model; Kittelson & Associates, Inc., 2024

Figure 9: Congestion Locations, Scenario 2 Landslide in North Glendale, Base Year



Source: Kittelson & Associates using Glendale travel model, 2024

Future Year

With peak evacuation from a landslide in the San Gabriel Mountains in north Glendale in the future year, the analysis predicts over-capacity conditions on several roadways in the city as shown in Figure 10. Most congestion locations would be the same as those identified for the base year. In addition to the locations listed for the base year, the roadways where demand volumes are projected to be at or exceed road capacity within the City of Glendale include:

- Scattered segments, e.g. San Fernando Rd between S Pacific Ave and W Acacia Ave, E Garfield Ave and E Acacia Ave between S Adam St and S Chevy Chase Dr.
- N Glendale Ave (between SR-134 and E Doran St) connecting to SR-134
- Santa Carlotta St/Orange Ave between Dunsmore Ave and Pennsylvania Ave in the east of Glendale

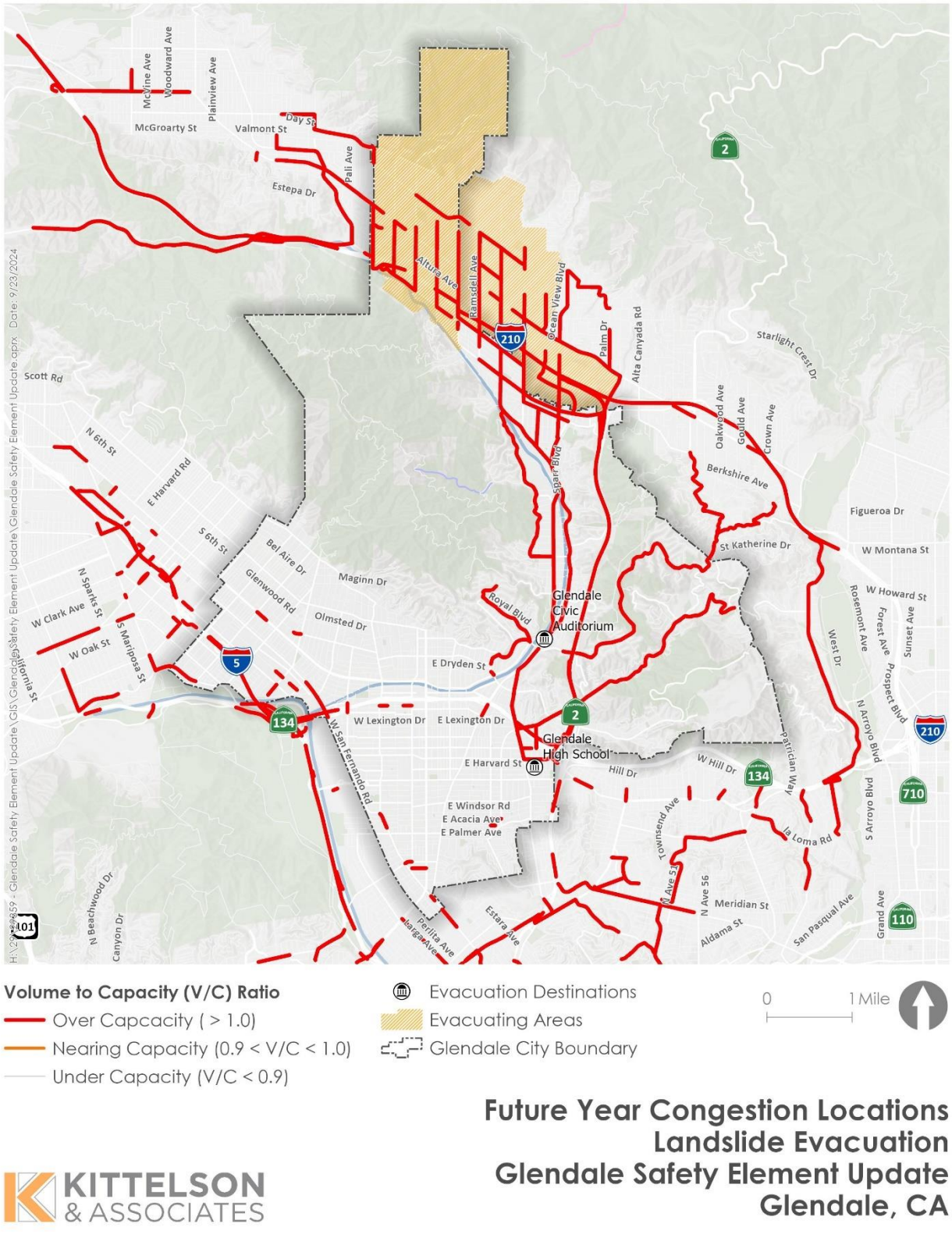
Beyond the city limit, the future year scenario indicates congestion in the following locations:

- Glendale Blvd and Hyperion Ave to the southwest of Glendale, connecting to I-5
- Yosemite Dr between Townsend Ave and N Figueroa St
- Additional length of segments north of SR-210, including Palm Dr, Ocean View Blvd, and Los Amigo St

Travel Times

Travel times between Glendale neighborhoods and various evacuation destinations are listed in Table 2 With base year traffic levels, an evacuation event would add up to 70 minutes to the time to reach the Glendale Civic Auditorium, up to 70 minutes to reach safety in Pasadena, and up to 79 minutes to Glendale High School. With future year traffic levels, an evacuation event would add up to 99 minutes to the time from north Glendale to the Glendale Civic Auditorium, up to 121 minutes to Pasadena, and up to 110 minutes to Glendale High School.

Figure 10: Congestion Locations, Scenario 2 Landslide in North Glendale, Future Year



Source: Kittelson & Associates using Glendale travel model, 2024

Table 4: Travel Times (Minutes), Scenario 2 Landslide

Origin and Destination	Base Year No Evacuation	Base Year Scenario 2	Future Year No Evacuation	Future Year Scenario 2
From Crescenta Highlands N				
To Glendale Civic Auditorium	10.3	69.9	10.5	99.0
To Glendale High School	12.2	78.9	12.5	109.6
East towards Pasadena	19.5	70.3	23.1	121.1
From Dunsmore Park				
To Glendale Civic Auditorium	9.0	68.7	9.2	97.8
To Glendale High School	11.0	77.7	11.2	108.5
East towards Pasadena	18.2	69.1	21.8	120.0
From Crescenta Highlands S				
To Glendale Civic Auditorium	8.6	66.0	8.7	94.2
To Glendale High School	10.5	75.0	10.7	104.8
East towards Pasadena	17.8	66.4	21.3	116.3
From Honolulu Avenue				
To Glendale Civic Auditorium	8.4	58.3	8.5	84.1
To Glendale High School	10.3	67.3	10.4	94.7
East towards Pasadena	17.5	58.7	21.0	106.2

Source: Kittelson & Associates using City of Glendale Travel Demand Model, 2024

Evacuation Planning Considerations

This section describes evacuation projects and strategies that may be considered to improve the capacity and resilience of the city's roadway network to support future evacuation events. The projects and strategies were identified based on previous congestion and evacuation studies, review of recent evacuation efforts, and effective evacuation planning practices identified by US Department of Transportation (USDOT) and Federal Highway Administration (FHWA). The strategies are organized into five categories:

1. Roadway Management
2. Communications
3. Vulnerable Populations
4. Public Education
5. Resource Management

ROADWAY MANAGEMENT

This section includes infrastructure-related strategies that will aid in improving the capacity of the evacuation roadway network, which can be a challenging element in a successful evacuation. For each infrastructure-related treatment, it is necessary to consider downstream capacity limitations and identify if those limits nullify the potential benefits of the treatment as well as other competing roadway design needs to serve other functions and goals. Table 5 outlines each of these strategies and provides a brief description of the strategy and desired outcomes.

Of these strategies, the most effective for increasing evacuation capacity would be those that involve manual control of traffic combined with contra flow operations that allow evacuation on both inbound and outbound lanes of streets, combined with maintaining clear passages for emergency vehicles.

Table 5: Roadway and Intersection Capacity and Resilience Related Strategies

Strategy	Recommendations	Responsible Department
Limited/unlimited contra flow on unlimited access arterials	Establish temporary control points to temporarily close inbound travel lanes on selected unlimited access arterials (such as parkways and boulevards) to allow outbound traffic to utilize these lanes during evacuation.	Glendale Public Works (Engineering), Glendale Police Department
Closure of inbound lanes on selected roads	Establish temporary control points to close inbound lanes on selected roadways utilized for evacuation routes to prevent drivers on these routes from entering the city while evacuation is underway.	Glendale Police Department, Glendale Public Works (Engineering)
Restrict left-turn movements	Establish temporary control points to minimize left-turn movements along evacuation routes and on roads leading to evacuation routes.	Glendale Public Works (Engineering), Glendale Police Department
Stage tow trucks	Consider how to stage tow trucks at bottleneck locations along evacuation routes to help detect and clear minor crashes and maintain traffic flows.	Glendale Police Department, Glendale Public Works (Fleet Services)
Adjust signal timing	Increase the green time and/or progression band for through movements leading out of an evacuation zone.	Glendale Public Works (Engineering)
Signal operation during power outage	Install signal battery backups in case signal operations need to be maintained during a power outage. Consider using channeling devices, static signs, and coning strategies to manage intersection flow during power outage if the signals lack power.	Glendale Public Works (Engineering)
Additional access routes	Identify and communicate with communities that have one or two access points. Prioritize adding additional access to communities which are currently served by only one or two access points.	Glendale Public Works (Engineering)

Strategy	Recommendations	Responsible Department
Public Transit	Develop transportation solutions such as the use of a bus system for evacuating individuals with special needs (such as those with mobility limitations).	Glendale Public Works (Transit), Glendale Beeline Transit
Traffic control points	Establish traffic control points (i.e., locations along designated evacuation routes with emergency management personnel) to maintain a greater degree of evacuation management. These locations could enhance the efficiency of an evacuation, reduce public confusion, and allow increased operational flexibility during an evacuation.	Glendale Police Department
Vegetation clearing/management	Maintain evacuation roadways and shoulders to clear them of trees, vegetation, and debris that would block travel lanes and shoulders for evacuating and emergency operation vehicles.	Glendale Public Works (Maintenance Services), Glendale Fire Department

COMMUNICATIONS

This section describes communication strategies that address how information may be shared among agencies, organizations, and the general public for evacuations. During an emergency evacuation event, two types of communication take place: (1) communication among entities involved in the management of response, and (2) communication between the City and the general public. Table 6 outlines each of these strategies and provides a brief description of the strategy and desired outcomes.

Table 6. Communication Strategies for Evacuations

Strategy	Recommendations	Responsible Department
Establish and maintain communications	Strengthen and maintain communication among coordinating emergency event agencies. This could be achieved through systems such as the Public Information Emergency System and Emergency Satellite Communications.	Glendale Fire Department, Glendale Communications Manager
Variable/Dynamic Message Signage	Use variable message board equipment and targeted installation of permanent dynamic message signs on evacuation routes to improve communication and reduce public confusion.	Glendale Public Works (Maintenance Services)
Public Posts and Flyers	Post signs and flyers in public places, such as businesses, community centers, and parks, with instructions on where to go in an evacuation and key evacuation information. Signs and flyers should be posted in multiple languages.	Glendale Public Works (Maintenance Services), Community Services and Parks
Traffic Control Center	Implement a traffic control center which would have up to the minute reports on traffic patterns and can communicate directly with emergency officers via broadcast media, social media, and other emergency communications channels (e.g., Everbridge, Genesis) to let drivers know about roadway congestion and conditions and direct them to alternate routes.	Glendale Public Works (Engineering), Glendale Communications Manager, Glendale IT Department
Traffic counters/CCTV cameras	Install traffic counters and/or CCTV cameras on freeways, which can help assess traffic flow, volume of vehicles evacuating, and monitor incidents during emergency evacuation events. Caltrans currently has two cameras in the proximity of	Glendale Public Works (Engineering)

Strategy	Recommendations	Responsible Department
	Glendale: SR-2 at Colorado Street and SR-134 at Glendale Avenue.	

VULNERABLE POPULATIONS

This section identifies strategies specifically for evacuation of vulnerable populations.[5] The city can use demographic data and U.S. Census data to identify vulnerable population locations and communities. City staff and emergency response teams may work with specialized organizations such as hospitals, medical associations, public service organizations, public health staff, and other providers or community groups to identify and locate relevant population segments and the types of assistance needed. Public awareness and messaging of programs and resources to help vulnerable populations needs to be communicated ahead of time. Table 7 outlines considerations by need.

Table 7: Additional Steps for Evacuation of Vulnerable Populations

Special Need	Recommendations	Responsible Department
Visually impaired	May be reluctant to leave familiar surroundings when the request for evacuation comes from a stranger. People who are blind or partially sighted may have to depend on their guide dogs and/or others to lead them to safety. Partner with neighboring cities/private/non-profit agencies to provide adequate paratransit services for those who need assistance in an evacuation.	Community Engagement Response Team
Hearing impaired	May need additional evacuation warning resources. Include visual aids such as pictures or maps to reinforce key messages during evacuations. Continue to provide written updates via communication channels, such as Everbridge and Genesis, and on social media channels.	Community Engagement Response Team
Mobility impaired	May need special assistance such as paratransit. Partner with neighboring cities/private/non-profit agencies to provide adequate paratransit services for those who need assistance in an evacuation.	Community Engagement Response Team, Beeline Transit
People without vehicles	Emphasize the importance of carpooling with neighbors or other community members. Provide information on transit routes and transit stops. Identify areas that would benefit from a carpooling program (e.g., communities with limited ingress/egress). Coordinate with neighbors, local businesses, and local transit to identify volunteers for carpooling at the local level. For businesses or commercial centers, identify if there are commercial vehicles (e.g., delivery trucks) that can be used for evacuation of people or supplies.	Community Engagement Response Team

[5] *Using Highways for No-Notice Evacuations: Five Planning Considerations*, FHWA, Accessed August 2022.

Special Need	Recommendations	Responsible Department
Non-English-speaking persons	Provide bilingual or multilingual materials to support communication with non-English speaking populations during evacuation. Communications should be created in English, Armenian, Spanish, Tagalog, and Korean.	Community Engagement Response Team
People with medical conditions	Communicate in advance the location and availability of hospitals or facilities with emergency/life-sustaining medical equipment that residents can go to during an evacuation. Identify the transportation mode of transfers to other facilities, based on the criticality of patients/clients and type of health needs.	Community Engagement Response Team
Unhoused (Homeless) population	Arrange for food, shelter, and transportation for unhoused (homeless) population. Offer age-appropriate emergency and evacuation information to homeless children.	Community Engagement Response Team

PUBLIC EDUCATION

Sharing information is a critical element to help educate the general public on how to prepare in advance for an evacuation. The public education strategies the city may consider include:

- Defining the meaning of different types of evacuation orders;
- Sharing how evacuation orders are declared and communicated to the public;
- Providing information on preparations to carry out in advance (such as emergency "go" kits or family evacuation plans);
- Conducting a public affair campaign(s) to distribute easy-to-read evacuation maps with alternate routes;
- Providing information on available transportation options, including for vulnerable populations; and
- Providing information on evacuation shelters and support services offered during evacuation.
- Providing regular emergency preparedness trainings in multiple languages at convenient, accessible locations.
- Building capacity of resilience hubs, CBOs, and other community groups to support community-based disaster preparedness efforts through direct or passthrough funding, grant writing support, information sharing, etc.

RESOURCE MANAGEMENT

Evacuations are resource-intensive events that require significant personnel, facilities, and equipment to implement successfully. The City should determine what resources are available as well as what resources will be needed for staff to perform their responsibilities during an evacuation successfully, which can include the following:

- Clarity on staff roles and expertise available, including number of staff available to help people evacuate from homes and other buildings
- Facilities available (e.g., traffic operations center, shelters, etc.);
- Available information systems to support the evacuation (e.g., ITS, computer networks, ancillary hardware such as cameras, road sensor loops, etc.);
- Communication systems (e.g., landline, mobile phones, radio system, email, sirens);
- Vehicles/transports (e.g., staff transport, tow trucks, transit vehicles, heavy equipment); and,
- Miscellaneous materials to support implementation of evacuation strategies (e.g., traffic cones, channeling devices, static signs).

If critical resource gaps are identified, the City may look to work with other evacuation entities to determine additional resources and needs. The City may also work with private sector entities to expand the resource base. For example, utilities companies may keep cell and internet services running in vulnerable communities during public safety power shutoffs. Private service companies such as ambulance operators and towing companies can provide additional assets during evacuation. These companies can clarify what is expected of them during a potential evacuation event to ensure their services are available, when needed.

Next Steps

This memorandum describes the results of the evacuation analysis as well as evacuation planning considerations and strategies to help improve the capacity and resilience of the City of Glendale's roadway network to support future evacuation events. This information will be used to frame supportive policies for the Safety Element update. These strategies and policies can be used to identify potential evacuation resiliency improvements throughout the city.