FEHR PEERS

Draft Memorandum

Date: February 27, 2023

To: Marlene Subhashini and Thai-Chau Le, City of Foster City

From: Mike Hawkins and Terence Zhao, Fehr & Peers

Subject: Foster City AB 747 Emergency Evacuation Assessment

SF22-1249

Fehr & Peers has completed a general, programmatic assessment of emergency evacuation routes for the City of Foster City. This assessment is consistent with Assembly Bill 747 (AB 747) requirements. AB 747 is a recently adopted piece of state legislation relating to emergency access. It 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 requirement for all safety elements or updates to a Local Hazard Mitigation Plan (LMHP) completed after January of 2022.

This document is intended to provide an assessment of roadway capacity under a representative scenario of reasonably foreseeable evacuation conditions and should not be considered an evacuation plan. Please note that emergency evacuation can occur due to any number of events, that emergency events requiring evacuation are inherently unpredictable by nature, as is individual behavior related to evacuation events. For example, driver behavior can be disorderly; evacuation progress can proceed in a nonlinear fashion (for example, it is anticipated that evacuees would vacate at a rate that more closely resembles a bell curve from the time that the evacuation order is issued); and there is general unpredictability in operational issues, such as power issues that would trigger traffic signals to operate in "red flash mode" in which traffic would need to proceed through intersections in an all-way stop configuration. These are conditions which would affect the total evacuation time estimated in our assessment that are beyond the scope of our assessment. The City should develop evacuation contingency plans for other scenarios not described in this study.

As such, this assessment is intended to provide the City with a broad understanding of the capacity of the transportation system during an evacuation scenario; it does not provide a guarantee that evacuations will follow modeling that is used for analysis purposes, nor can it

guarantee that the findings are applicable to any or all situations. This document may be used to highlight where City staff may want to focus specific efforts to improve evacuation efficiency, such as through the recommendations provided in "Strategies to Reduce Evacuation Times".

Moreover, as emergency evacuation assessment is an emerging field, there is no established standard methodology. We have adopted existing methodologies in transportation planning that, in our knowledge and experience, we believe are the most appropriate within the limits presented by the tools and data available and the budgetary and time constraints in our scope of work, and by the current knowledge and state of the practice.

While this assessment should help the City better prepare for hazard-related events and the associated evacuations, the City should take care in planning for any potential evacuation scenario. Fehr & Peers cannot and does not guarantee the efficacy of any of the information used from this assessment as such would be beyond our professional duty and capability. We would be happy to conduct additional analyses in further detail, analyze different scenarios, or employ other methodologies, if desired.

Executive Summary

Given the inherent uncertainty associated with any evacuation scenario, emergency evacuation assessments must rely on representative evacuation scenarios developed from available studies and input from hazard experts. For the purposes of this analysis, a flooding event resulting from a failure at the Lower Crystal Springs Dam was selected as the representative evacuation scenario for this Emergency Evacuation Assessment. This event was selected based on the 2021 San Mateo *Multi-Jurisdictional Local Hazard Mitigation Plan (LHMP)*[1]and discussions with Foster City's emergency service providers because it includes several general features that are associated with a range of reasonably foreseeable evacuation scenarios.

This evacuation assessment is provided for two representative time periods: weekday night and weekday midday conditions. This provides information about evacuation conditions when the most residents are in Foster City (weekday night) and when the most workers are in Foster City (weekday midday) to provide a range of representative scenarios that Foster City can use to inform evacuation planning.

Foster City has a limited number of roadways that provide access in and out of the City and the total capacity for available evacuation routes is estimated to be just over 17,000 vehicles per hour. This representative scenario would require a full citywide evacuation, with different areas and evacuation routes becoming inaccessible between 1.5 and 6 hours. This study compares the cumulative evacuation vehicle demand to the available capacity of egress routes until the time that the evacuation routes are no longer passable. All evacuation links are assumed to be inaccessible after three hours, resulting in a total evacuation capacity of **36,125 vehicles.** The total future evacuation demand under these representative scenarios, including the build out of the current General Plan and 2023-2031 Housing Element, would range from **32,738 – 35,791 vehicles**. These vehicle demand estimates rely on conservative assumptions, such as that all households will evacuate all vehicles rather than leaving some behind, no residents or employees shelter in-place, and that 100 percent of employees drive alone and will evacuate alone in their own vehicle. Therefore, under this representative scenario, the roadway capacity would be adequate to accommodate the anticipated future vehicle demand. This memorandum presents a range of strategies that the City can take to increase the capacity of roadways (supply-side strategies) and reduce the vehicular demand to prepare for the range of evacuation scenarios that could arise.

[1] https://www.smcgov.org/media/53476/download?inline=

Representative Evacuation Scenario

Fehr & Peers and City staff worked together to identify evacuation scenarios appropriate for analysis in this context. The four highest risk categories for Foster City in the 2021 San Mateo *LHMP*, in order, are (1) Sea Level Rise/Climate Change, (2) Flooding, (3) Dam Failure, and (4) Earthquake. For the purposes of this analysis, a flooding event resulting from a failure at the Lower Crystal Springs Dam, located west of Foster City, was selected as the representative evacuation scenario for this Emergency Evacuation Assessment. This event was selected based on the LHMP and discussions with Foster City's emergency service providers because it includes several general features that are associated with a range of reasonably foreseeable evacuation scenarios:

- A high-risk scenario identified in the LHMP (per Table 9-12 of the LHMP) that would necessitate citywide evacuations, as opposed to a "shelter in place" response.
- A clear outcome that could be modeled based on available studies.
- The closure of several evacuation roadways and a change to roadway capacity over time, thus requiring emergency operators and the public to adapt to evolving circumstances.

As a result, the following scenarios were considered but ultimately not selected as the basis of this analysis because they would result in reduced evacuation traffic levels:

- A major earthquake event, considered independently of any major infrastructure failure, which was rejected as the default emergency response is to "shelter in place."
- A major earthquake event leading to major infrastructure failure, which was rejected as failure of infrastructure in the wake of an earthquake is unpredictable and results in similar outcomes (e.g., closure of evacuation routes and changing conditions over time), whereas a comparable scenario – the failure of the Lower Crystal Springs Dam – was considered a more defined scenario.
- Sea-level rise or other major inundation resulting from seawater, which was considered to be comparatively less likely given the City's recent efforts to make its coastline more resilient.
- A gas-related leak or explosion, which was ruled out due to the limited geographic nature of such events, as any such event would likely only require parts of the City to be evacuated.
- Wildfire, which is considered to be a low risk for the City of Foster City in the 2021 San

Mateo *Multijurisdictional Local Hazard Mitigation Plan*.

While the remainder of this analysis is based on assumptions associated with the representative scenario, the features of this representative scenario could apply to a wide range of evacuation scenarios, including other high-risk scenarios identified in the LHMP. Emergency scenarios that require evacuation are inherently difficult to predict and it is plausible that any number of scenarios may cause the need for an evacuation of part of or all of Foster City. It is also plausible that some combination of emergencies could occur that would put further strain on the transportation network. For example, an earthquake could cause a dam failure. For more information on other emergency scenarios, see the 2021 San Mateo *LHMP*. The recommendations presented in the "Strategies to Reduce Evacuation Times" are meant to help the City plan for a range of potential evacuation scenarios to increase the capacity of roadways during an evacuation (supply-side strategies) and reduce the vehicular demand.

The representative scenario is specifically defined as the results of inundation modeling by the San Francisco Public Utilities Commission, which operates the Dam, as part of its Lower Crystal Springs Dam Safety Program. This modeling is required by the California Department of Water Resources (DWR) under California Water Code section 6161, and the modeling results may be accessed via the DWR's website, under its Division of Safety of Dams (DSOD). While these inundation modeling results form the basis of the characteristics of the representative evacuation scenario, especially relating to the precise depth and movement of floodwater on the evacuation routes, the main assumptions of this scenario definition are generally summarized as follows:

- The Dam is assumed to fail on a sunny day.
- The floodwater that will impact Foster City will have flowed westward from the bayfront parts of the City of San Mateo, with floodwater reaching the western boundaries of Foster City between 1.5 and 2 hours after the initial failure of the Dam.
- The time at which the floodwater will reach other parts of Foster City varies – generally speaking, the areas lying west of Central Lake will see flooding by 3 to 4 hours following the initial failure of the Dam, while those areas lying east of Central Lake will see flooding by 5 to 6 hours following the initial failure of the Dam.
- The amount of floodwater expected to be present in Foster City varies by locations, with maximum flood depths ranging from less than 1ft in some areas to over 8ft in others. However, virtually all locations within Foster City are expected to be inundated in some fashion.
- Two evacuation time periods are used for the dam failure and flood scenario: weekday night and weekday midday conditions.

Although “shelter in place” is usually feasible for many emergency scenarios, such as floods or earthquakes, this evacuation analysis assumes a citywide evacuation to represent a true “stress test” of the City’s evacuation routes under the largest evacuation event with the highest demand for capacity possible. Therefore, no “shelter in place” is assumed, and all residents, employees and visitors are the subject of the evacuation order.

Evacuation Capacity and Demand

Evacuation assessment is an emerging field, and there is no established standard methodology. We have adopted a methodology in transportation planning that, in our knowledge and experience, we believe is the most appropriate. First we estimate the available capacity of egress routes until the time that they are no longer passable due to flooding (about 3 hours). Then we estimate the cumulative evacuation vehicle demand over that time period, and compare the two. We have completed this analysis for two time periods for future plus Housing Element 2023-2031 conditions. Finally, we break the data down by Traffic Analysis Zone (TAZ) and by time to inundation. A TAZ is an area delineated by local transportation officials for tabulating land use and traffic-related data in travel demand models, usually consisting of one or more census blocks, block groups, or census tracts.

Evacuation Roadways and Capacities

Foster City has a limited number of roadways that provide access in and out of the City. They are listed in **Table 1** alongside their capacities. The capacities, which are also used for this analysis, are based on those found in the C/CAG-VTA Travel Demand Model (the "Model"), last updated in 2020. Note that under a dam failure/flooding scenario, US 101 north of SR 92 is forecast to be flooded, requiring that the California Highway Patrol (CHP) divert traffic on US 101 north and south of Foster City to other routes (e.g., northbound US 101 to westbound SR 92 to I-280). The flooding across US 101 north of Foster City would also require that through trips on SR 92 would be diverted (e.g., eastbound trips on SR 92 to southbound US 101) or stopped (e.g., westbound trips on SR 92 stopped at the toll plaza). As through traffic would be stopped on SR 92 after evacuation orders are given due to the dam failure and flooding, the full capacity of SR 92 would be available for outbound Foster City evacuees under this scenario. This capacity analysis does not include use of any contra-flow lanes for outbound evacuees as inbound lanes may be needed for emergency vehicle access to supplement first responders located within Foster City.

It is expected that all of these roadways will become inaccessible at some point, which is represented by the floodwater advancement in the representative scenario. **Table 1** lists the estimated time for this to occur for each roadway. **Table 2** lists the estimated total amount of evacuation capacity available before all links become inaccessible. While the assumptions included in Tables 1 and 2 are based on the representative scenario as previously described, it is possible that other combinations of roadways may have reduced capacity or may be inaccessible under a range of emergency scenarios. For example, an earthquake could cause the San Mateo Bridge to be unusable. Therefore, the representative scenario presents information about evolving roadway capacities over time that can be used for a range of evacuation scenarios.

Table 1: Evacuation Roadways and Capacities

Evacuation Roadway	Capacity (vehicles/hour)	Expected Inundation Time (hours after initial dam failure)
Fashion Island Blvd	900	1 to 1.5
State Route 92 westbound	7,600	2 to 3 (access ramps)
State Route 92 eastbound	5,850	3 to 3.5 (Metro Center Blvd/Foster City Blvd ramps) 2 to 3 (all other access ramps)
Hillsdale Blvd	2,700	2 to 3
Links Total	**17,050**	All links inaccessible 3 hours after event

Table 2: Evacuation Capacity Over Time

Hours After Initial Dam Failure	Capacity (vehicles)	Notes
0 - 1	17,050	All roadways are available during this timeframe
1 - 2	16,150	Fashion Island Blvd not available during this timeframe
2 – 3	2,925	During this timeframe, only State Route 92 eastbound will likely be available via the Metro Center Blvd/Foster City Blvd ramps – the throughput is assumed to be at 50% of mainline capacity
Total Capacity	**36,125**	All links inaccessible 3 hours after event

East Third Avenue is a major arterial in the north of Foster City. However, flood modeling indicates that it is among the first locations within Foster City to be inaccessible, and it leads directly to areas that are modelled to be fully inaccessible before Foster City. Therefore, it is not available for evacuation use under this scenario.

Furthermore, the capacities of State Route 92 as shown represent their mainline capacities, and this analysis will assume that measures can be in place to manage and maximize traffic flow at ramps onto State Route 92 so that evacuation traffic can take full advantage of the full mainline capacities.

Evacuation Demand

The number of residents, anticipated vehicle ownership per household, and employees in Foster City were referenced to estimate the number of vehicles that would need to evacuate.

Residential and Employment Populations

Table 3 summarizes land use information at the TAZ level for all TAZs within Foster City using information for number of households and residents as well as number of employees found in the Cumulative (2040) scenario of the Model which has been adjusted to account for residential growth associated with the Housing Element 2023-2031. These numbers represent the best approximation of Foster City's future residential and employment populations, accounting for new developments, including a full build-out of developments contained within its General Plan and Housing Element 2023-2031 sites. The land use information from the Existing (2020) scenario of the Model are also shown in **Table 3** for reference and comparison, but they are not used as part of this analysis.

Evacuation Vehicle Demand

Table 4 summarizes census data from the 2016-2020 American Community Survey (ACS) 5-Year data on household vehicle ownership for Foster City census tracts. As shown, the vast majority of households in Foster City own either one or two vehicles, and that the total number of vehicles owned by households within Foster City averages to just under two vehicles per household.

Table 3: Residential and Employment Populations

TAZ	Cumulative (2040) Model Scenario Including Housing Element			Existing (2020) Model Scenario		
	Total Households	Total Population	Total Employment	Total Households	Total Population	Total Employment
1654	56	144	10,668	48	110	6,543
1612	3,412	8,065	1,370	889	1,995	839
1655	1,777	4,212	9,078	1,178	2,494	5,563
1966	1,295	3,106	296	977	2,550	182
1970	2,115	4,843	447	1,539	3,589	458
1971	1,386	3,957	473	1,380	3,590	218
1972	869	2,599	716	887	2,667	477
1973	3,602	8,581	455	1,535	4,147	224
1541	80	189	1,451	2	5	890
1967	1,420	4,087	999	1,342	3,691	818
1968	1,573	4,154	298	1,309	3,630	258
1969	1,827	4,560	263	1,352	3,463	337
Total	**19,412**	**48,496**	**26,514**	12,438	31,931	16,807

Source: C/CAG-VTA Model, 2020

Table 4: Household Vehicle Ownership

Census Tract	0 vehicle	1 vehicle	2 vehicles	3 vehicles	4 or more vehicles	Sum
6081608001	31	579	561	126	65	1,362
6081608002	16	369	613	247	62	1,307
6081608013	45	356	745	139	74	1,359
6081608023	20	162	414	85	119	800
6081608024	62	372	488	141	120	1,183
6081608025	208	1,006	887	144	30	2,275
6081608100	92	324	605	190	103	1,314
6081608200	42	386	616	243	87	1,374
6081608300	59	416	487	225	82	1,269
Total Households	575	3,970	5,416	1,540	742	12,243
% of Households	5%	32%	44%	13%	6%	-
Total Vehicles	0	3,970	10,832	4,620	2,968	**22,390**
					Average Vehicles per Household	**1.83**

Source : 2016-2020 ACS 5-year data

Evacuation Demand Assumptions

This section synthesizes population and vehicle ownership assumptions to calculate total vehicle demand according to the timing of evacuations, roughly broken into two evacuation possibilities.

Weekday Night

The first time period is an evacuation occurring during the late night hours on a weeknight, when it is assumed that the employment population will be mostly absent, but the entire residential population will be present. While the majority of employment in Foster City is office/life science employment, we assume that ten percent of retail employment is working an overnight shift and would all need to evacuate. Residential assumptions are the most conservative possible: it assumes that every household in Foster City is occupied and will take every vehicle they own with them as part of the evacuation.

As the total numbers of residents and households used for this analysis are estimated 2040 land use forecasts from the C/CAG Model, they are larger than the Census vehicle ownership data that is based on current population numbers. To identify total auto ownership levels for 2040, the proportional allocation of households by vehicle ownership levels in the census data are applied to the model population figures using the current percentage distribution of household vehicle ownership. This calculation is shown in **Table 5**.

Table 5: Household Vehicle Ownership for Model Cumulative (2040) Scenario

Scenario	0 vehicle	1 vehicle	2 vehicles	3 vehicles	4 or more vehicles	Sum
Total Households (Census figures)	575	3,970	5,416	1,540	742	12,243
% Breakdown of Households by Vehicle Ownership	5%	32%	44%	13%	6%	-
Households by Vehicle Ownership (extrapolated Using Census Household vehicle ownership breakdowns and household figures from Model Cumulative scenario)	912	6,295	8,587	2,442	1,176	19,412
Total Vehicles (Model Cumulative scenario)	0	6,295	17,175	7,325	4,706	**35,501**

Source: 2016-2020 ACS 5-year data, C/CAG-VTA Model

Weekday Midday

The second time period is an evacuation occurring in the middle of a workday, when the residential population of Foster City is much smaller than during a weekday night as residents are outside Foster City at their jobs or for other reasons, but the employment population would be present in full numbers. For this analysis, two population profiles for an evacuation of this type are considered:

- The first population profile is the more conservative –at time of evacuation, 100 percent of the employment population will be present at work, and 100 percent of those workers will have driven alone to work in their personal vehicle and evacuate with that vehicle; a number of Foster City residents are at home at the time of evacuation – specifically, 25 percent of the total residential evacuation demand will also be present.
- The second population profile has a slightly lower evacuation profile that is more consistent with home-based-work mode share profiles for Foster City employee commutes, but still conservative – 100 percent of workers are at their local place of work, but 90 percent are auto drivers – that is, 10 percent of workers will have either been part of a carpool or used some other means of getting to work.

Table 6 shows a summary of estimated evacuation demand for each of the time periods analyzed and for the two weekday population profiles. It also groups the TAZs by approximate inundation time based on the dam inundation mapping by the San Francisco Public Utilities Commission. Capacities of outbound roadway links, as presented in **Table 1**, are replicated for reference and

comparison. As shown, the evacuation demand (32,738 – 35,791) is lower than the evacuation capacity (36,125) in all three sets of assumptions.

Table 6: Summary of Estimated Evacuation Demand

TAZ	Expected Inundation (hours after initial dam failure)	Total Households	Total Population	Total Employment	Weekday Night	Weekday Midday - All Employees Drive Alone	Weekday Midday - 90% of Employees Drive Alone
1654	2	56	144	10,668	192	10,694	9,627
1655	3	1,777	4,212	9,078	3,355	9,890	8,983
1966	3	1,295	3,106	296	2,369	888	858
1541	3	80	189	1,451	161	1,488	1,342
1612	3+	3,412	8,065	1,370	6,241	2,930	2,793
1972	3+	869	2,599	716	1,614	1,113	1,042
1968	3+	1,573	4,154	298	2,880	1,017	987
1970	3+	2,115	4,843	447	3,877	1,414	1,369
1971	3+	1,386	3,957	473	2,551	1,107	1,059
1973	3+	3,602	8,581	455	6,601	2,102	2,056
1967	3+	1,420	4,087	999	2,605	1,648	1,548
1969	3+	1,827	4,560	263	3,344	1,098	1,072
Total for areas inaccessible by hour 2		56	144	10,668	192	10,694	9,627
Total for areas inaccessible by hour 3		3,152	7,507	10,825	5,885	12,266	11,184
Total for areas not inaccessible by hour 3		16,204	40,845	5,021	29,714	12,429	11,927
Total		19,412	48,496	26,514	**35,791**	**35,389**	**32,738**

Potential Future Evacuation Planning

As the total evacuation demand levels for a full city-wide evacuation under a dam failure/flood scenario during two time periods are near capacity levels, it is recommended that the City of Foster City and the San Mateo Consolidated Fire Department, Office of Emergency Services continue to collaborate with the San Mateo County Department of Emergency Management (SMC DEM) to create a Working Group of interagency partners to develop a detailed Evacuation Plan to address a citywide evacuation. It is anticipated that interagency partners may include City staff, SMC DEM staff, the San Mateo Consolidated Fire Department, the San Mateo County Sheriff, and other agency staff that would have evacuation or traffic control responsibilities. Potential elements of a citywide evacuation plan may include respective agency evacuation responsibilities, improved communication systems/technology, advanced warning systems, identification of residents without vehicles that are in need of evacuation assistance, evacuation plans for schools and senior residential facilities, office/life science employee daytime evacuation notification and management strategies, scenario planning, strategies to reduce evacuation times, multi-city evacuation coordination strategies, early evacuation notification areas, local traffic management strategies, vehicle crash emergency clearance crews, and/or local evacuation shelters/centers for hazards where shelter-in-place is called for.

The following provides additional context for evacuation planning considerations.

Evacuees Without Access to a Vehicle

As shown in **Table 4**, five percent of all households residing in Foster City do not own a vehicle. While this number may be a useful proxy for the number of evacuees likely to need assistance evacuating, the number may be higher depending on the specific timing of the evacuation. For example, in a workday evacuation, it is likely that a number of workers in Foster City will have gotten to work without driving their own vehicle and need transportation; if the evacuation occurs during the school day, it is likely that many schoolchildren will need transportation even if they are theoretically part of households that have vehicles available, as it would be difficult and inadvisable to attempt to have them picked up.

The City may want to consider a program that ensures a more accurate estimate of the number of individuals needing assistance, and that there are programs in place to ensure that there is transportation options available for those who need them. Examples of programs that the City can implement include:

- Encourage establishing carpool arrangements between neighbors to provide rides during evacuation situations through education and existing tools such as ZoneHaven or Nextdoor
- Establish plans for evacuation of areas with concentrated vulnerable populations, such as senior centers and schools, to designated evacuation centers
- Coordinate plans to commit public transportation vehicles, school buses, and other shuttle vehicles (such as employer-offered shuttle buses) to providing transportation for evacuees needing assistance

Evacuation on Other Modes

Individuals who are able and willing to evacuate on foot, using bicycles, or other modes should be encouraged to do so using sidewalks and trails.

There are several pedestrian/bicycle paths that are available for residents to evacuate Foster City without using the major vehicle evacuation paths. These paths include a footbridge across the O'Neil Slough in the south end of Foster City, at Egress bridge, at the base of the Marina Lagoon, at Wheelhouse Lane near Sea Cloud Park, and along portions of the Bay Trail. These paths provides access for nonmotorized modes to Clipper Drive, Concourse Place, and Island Parkway in Belmont and Redwood City. Nearby residents should be notified of the existence of this link and instructed on its use, and anyone able and willing to use this route should be welcome to.

Stranded Evacuees

In preparation of the unfortunate situation where it is not possible to evacuate everyone from within Foster City prior to all roadways being inaccessible, the City should develop clear protocol and guidance for stranded individuals that provide alternative ways to safety. The City should consider doing the following:

- Identify taller buildings in which individuals can seek refuge in higher floors; proactively identify which buildings are most likely to be safest in the event of an emergency
- Investigate the possibility of temporarily sheltering stranded individuals in boats

These considerations should be made in light of the fact that there is likely to be a non-negligible period of time in which all land routes into Foster City are impassable for emergency response vehicles.

Strategies to Reduce Evacuation Times

As a target for further investigation and study to strengthen its evacuation readiness, there are a number of potential measures and efforts the City can undertake that may reduce evacuation times, which can be categorized into supply-side and demand-side strategies.

Supply-side Strategies

Supply-side strategies focus on managing and increasing the supply for evacuation capacity – that is, increasing the amount of evacuation vehicle throughput.

Additional Evacuation Routes

All of Foster City's roadway links to areas beyond its boundaries are located within its northern third: there are no external links south of Hillsdale Boulevard or east of the Foster City Boulevard on-ramps for State Route 92. Large swathes of Foster City, namely its entire southeastern half, must drive across town to reach an evacuation gateway.

These concerns surrounding evacuation should be part of any future considerations by the City to create additional roadways and bridges, especially in the southeast parts of Foster City, which is the farthest from the evacuation routes. For example, the potential Edgewater Boulevard – Island Drive bridge that would connect Foster City with Redwood Shores could provide an additional evacuation route in the southeast of Foster City.

Roadway Capacity Management

Another key area of concern is maintaining an acceptable standard of roadway operations to ensure that the evacuation capacity of the roadway network is not degraded.

First and foremost, the City should make every effort to coordinate with emergency responders across agencies to ensure the availability of personnel to direct traffic. Presence of personnel can enable such capacity-boosting measures as directing vehicles to use contraflow lanes or shoulders to maximize throughput where possible.

In particular, the ramps onto State Route 92 should be a particular point of emphasis. The mainline lanes of the highway have high capacity and can allow large numbers of vehicles to evacuate so long as the on-ramps to the highway do not become bottlenecks. The presence of personnel can help maximize ramp capacities by guiding evacuating vehicles to form multiple

lanes on on-ramps, using shoulders as necessary, and by helping direct traffic to facilitate smoother merges from the on-ramps onto the mainline lanes for the large volumes of traffic.

Moreover, having on-scene personnel who can respond to ongoing conditions – such as potential signal failures, hazardous roadway conditions, or changes in routing in real time is also a crucial asset in an inherently unpredictable situation.

Other Supply-Side Strategies

Other supply-side strategies to consider can include:

- Create a plan for clearing disaster-induced roadway hazards along key evacuation routes
- Work with Caltrans and other regional agencies to investigate limiting accessibility to major regional routes to facilitate evacuation: for example, limiting SR-92 and/or US-101 to only evacuation traffic and redirecting general traffic elsewhere
- Create an "evacuation mode" for signal systems that can maximize traffic flows, or protocol for deactivating certain signals in favor of personnel on-site to direct traffic

Demand-Side Strategies

Demand-side strategies focus on managing the demand for evacuation capacity – that is, managing evacuation volumes to move as many people as efficiently as possible within existing capacity constraints.

Limiting the Number of Evacuation Vehicles

Reducing the number of evacuating vehicles is a key aspect of reducing evacuation demand. As shown in **Table 4**, each household in Foster City owns, on average, just under two vehicles, and almost one in five households own three or more vehicles. The evacuation vehicle demand from residents can be significantly reduced if each household were to limit themselves to evacuating in no more than one vehicle, as shown in **Table 7**.

In addition to being advised or required to take no more than a certain number of vehicles per household, residents should also be advised to not make return trips after they have evacuated, or to stay away if they were not in Foster City when evacuation orders are given. This measure can also reduce vehicle volumes and, crucially, reduce contraflow traffic. However, it must be implemented in conjunction with coordinated efforts to evacuate anyone within Foster City without access to a vehicle as described earlier, as to avoid situations such as parents needing to return to Foster City following an evacuation order to pick up their children from school.

Table 7: Summary of Estimated Evacuation Demand – One Vehicle Per Household

TAZ	Expected Inundation (hours after initial dam failure)	Total Households	Total Population	Total Employment	Weekday Night	Weekday Midday - All Employees Drive Alone	Weekday Midday - 90% of Employees Drive Alone
1654	2	56	144	10,668	143	10,681	9,615
1655	3	1,777	4,212	9,078	1,799	9,501	8,594
1966	3	1,295	3,106	296	1,235	605	575
1541	3	80	189	1,451	90	1,470	1,325
1612	3+	3,412	8,065	1,370	3,253	2,183	2,046
1972	3+	869	2,599	716	853	923	851
1968	3+	1,573	4,154	298	1,502	673	643
1970	3+	2,115	4,843	447	2,025	951	906
1971	3+	1,386	3,957	473	1,338	803	756
1973	3+	3,602	8,581	455	3,446	1,313	1,268
1967	3+	1,420	4,087	999	1,361	1,337	1,237
1969	3+	1,827	4,560	263	1,744	698	672
Total for areas inaccessible by hour 2		56	144	10,668	143	10,681	9,615
Total for areas inaccessible by hour 3		3,152	7,507	10,825	3,125	11,576	10,493
Total for areas not inaccessible by hour 3		16,204	40,845	5,021	15,523	8,882	8,380
Total		19,412	48,496	26,514	**18,791**	**31,139**	**28,488**

Other Demand-Side Strategies

Other demand-side strategies to consider can include:

- Improve communications and advance disaster alerts, with the goal of maximizing the evacuation time window
- Dynamic route guidance and monitoring for evacuees, with the goal of ensuring evacuees know their evacuation routes, that evacuees are directed away from routes that are inaccessible, and evacuation traffic is balanced across gateways
- Phased evacuations, with the goal of prioritizing areas that will need to evacuate earlier, potentially utilizing Zonehaven
- Faster clearing of road closures
- Street parking management on high hazard days