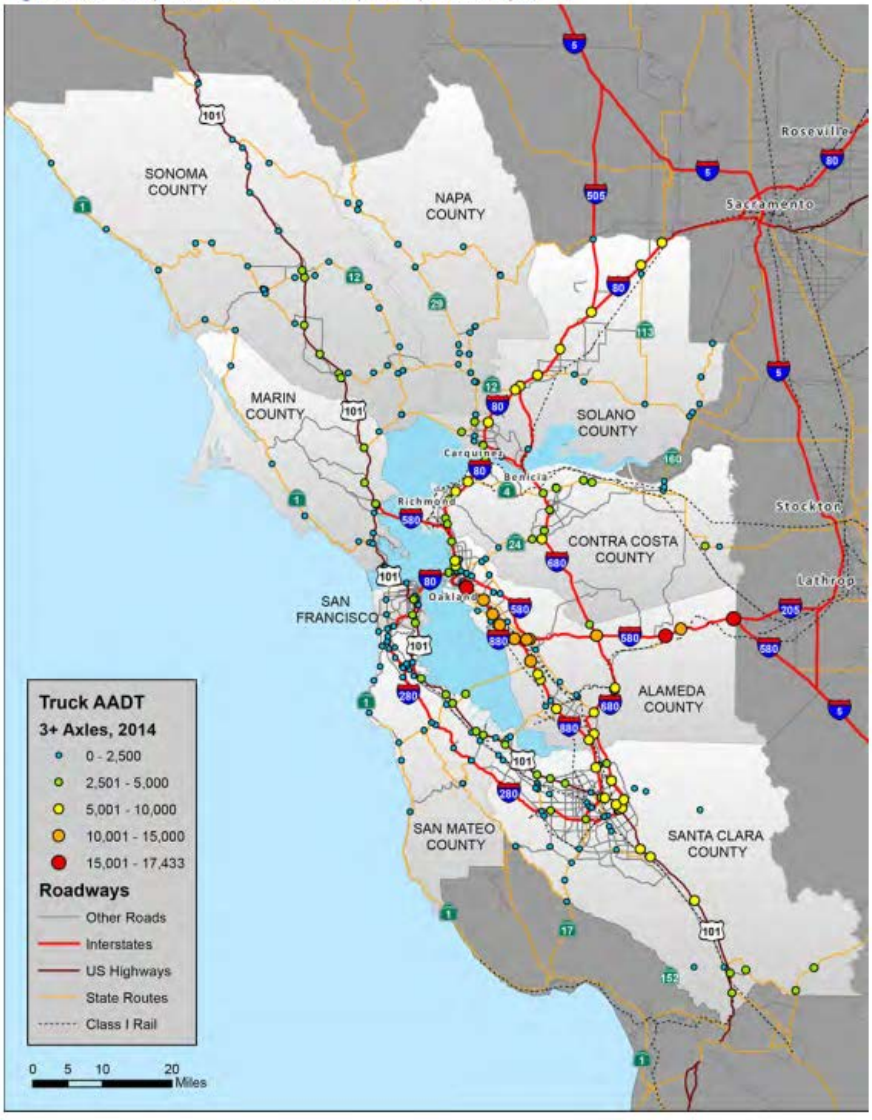
# GROCERY SUPPLY CHAIN RESILIENCE IN THE SAN FRANCISCO BAY AREA

## *FINDINGS AND STRATEGIC RECOMMENDATIONS*

Figure 4.2 Bay Area Truck Volumes (Three-plus Axles), 2014




Source: Caltrans 2012 GIS truck count data; Cambridge Systematics, Inc.

Task IV Outcomes, November 2019

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This report was developed for the Bay Areas Urban Areas Security Initiative by Filler Security Strategies in collaboration with the Institute for Public Research at CNA. Philip J. Palin is the principal author.

The Bay Areas Urban Areas Security Initiative sustains and improves regional capacity to prevent, protect against, mitigate, respond to, and recover from terrorist attacks and catastrophic disasters.

This report is designed to facilitate discussion by local, state, and federal emergency management agencies and will be followed by a proposed Strategy for Resilience of the Bay Areas Grocery Supply Chain.

# EXECUTIVE SUMMARY

In the event of a Bay Area catastrophe, survivors will need to eat. Widespread failure of the electrical grid, disruption of transportation networks, reduced availability of fuel and other challenges will complicate, delay, and potentially diminish preexisting flows of groceries into the Bay Area. Given millions of survivors and a potentially very long-term recovery calendar, expediting restoration – and potential redirection – of these flows will be essential.

Five Distribution Centers are the source for approximately 80 percent of groceries currently consumed by 8 million residents of the Bay Area. These Distribution Centers are likely to survive a major seismic event. Resupply of the Distribution Centers should not be seriously disrupted. If these key supply nodes can continue to operate at capacity, they are able to move the grocery volumes necessary to feed such a large population.

Velocity of supply will, however, be a significant challenge. Many retail locations may not survive. The ability of surviving retail locations to transmit demand signals may be lost. The ability to conduct retail financial transactions will be complicated and potentially reduced. Transportation of food into the most heavily impacted areas will be delayed and disrupted. Reestablishing sufficient velocity of supply – even surged and redirected supply – will be essential and very difficult.

Unless private sector volume and velocity of grocery distribution is quickly reestablished, the population's demand for food will soon exceed the ability of the public sector to respond and gap-fill. The longer supply remains insufficient – or simply uncertain – the more the population will hoard available supply, deepening and extending disruption of the grocery supply chain. Speedy restoration of flow is a strategic necessity to save lives and support overall response and recovery.

**Currently there is no credible, sustained, and systematic strategy for enhancing the resilience of the grocery supply chain in the San Francisco Bay Area.** The grocery sector is unfamiliar with the potential consequences of a catastrophic earthquake and public sector plans to engage these consequences. The public sector is unfamiliar with grocery sector resources and requirements. The current priorities and predispositions of each sector are as likely to conflict with each other as support each other.

This is a complicated problem that will not be quickly or easily resolved. This report's core recommendation is for both private and public sectors to begin *a process of sustained engagement* that can over time create the mutual understanding and trust that will serve as a foundation for practical strategic and operational progress. Identifying a party or parties that will proactively facilitate this process is a crucial first step.

## BAY AREA GROCERY DEMAND

The twelve counties in the Bay Areas Urban Area Security Initiative (BAUASI, map at right) are coincident with the Combined Statistical Area (CSA) for San Jose-San Francisco-Oakland plus the Salinas Metropolitan Statistical Area (incorporating all of Monterey County).


Based on US Census reports for this geographic area, over 8 million people reside in the BAUASI counties. According to the US Department of Agriculture, the average adult in the United States consumes 1996 pounds of food per year. The average census household in the US expends over $7700 per year on food.

Since the 1980s the proportion of expenditures on Food-Away-From-Home (FAFH) has generally increased. The US Department of Labor, Bureau of Labor Statistics (BLS) has found that in 2017 the average US household expended $4363 on Food-At-Home (FAH) and $3365 on Food-Away-From-Home.

Consumer behavior can, however, vary widely by region, urban-versus-rural, income level and by urban neighborhood. For example, the BLS analysis found that, "San Francisco-area households spent $4487, or 50.3 percent, of their food dollars on food at home and $4431 (49.7 percent) on food away from home." Further, while the average household in the San Francisco-Oakland-Hayward metropolitan area spends about $1000 per year more on food than the average US household, food expenditures in the Bay Area are lower than the average US household as a proportion of total consumer expenditures.

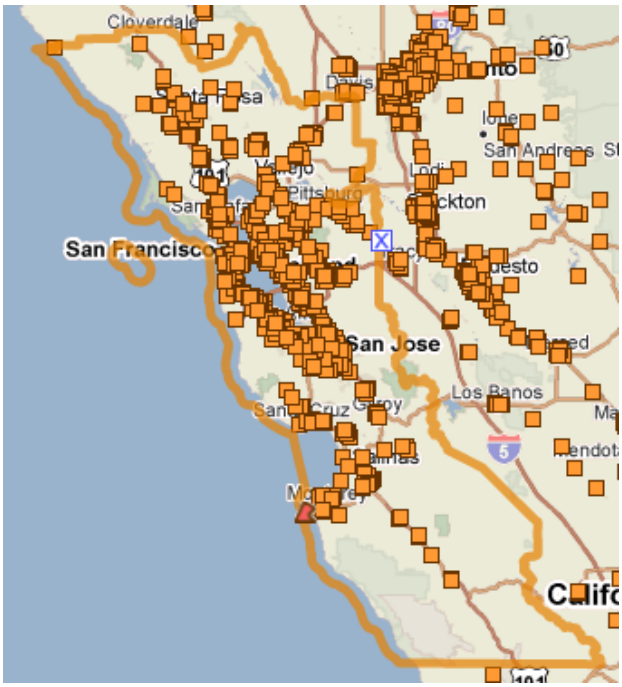
The Bay Area is in the forefront of change in how people eat. Meal-kits, restaurant delivery services, online grocery shopping, and corporate food services are all more prominent in the Bay Area than in most of the United States. But, at least to date, these alternatives generate a small fraction of demand expressed for traditional grocery consumption. For example, in 2017 the meal-kit market for the entire United States was estimated to generate between $900 million and $1 billion in sales. In 2019 total US sales for all forms of online food delivery are projected to reach $22 billion. The traditional grocery market in Northern California alone generates over $32 billion in sales per year.

For the 8 million residents of the BAUASI counties, **grocery stores provide roughly half of all food purchased and a much higher percentage of shelf-stable foods purchased. Especially in the aftermath of a catastrophic event the flow of these shelf-stable foods will be crucial to fulfilling the food demand of survivors**. In the event of long-term loss of the electrical grid and other disruptions, the traditional grocery supply chain will be challenged to maintain prior FAH flows, even while demand is likely to surge to close-the-gap created by the loss of Food-Away-From-Home channels of supply.

## BAY AREA GROCERY SUPPLY

Given this challenge the BAUASI has identified the principal sources of supply for regional grocery flows (see Addendum B) and has engaged in an initial set of meetings and discussions with owners/operators of roughly eighty percent of these grocery flows.

According to the Nielsen Trade Dimensions database there are 429 full-service conventional grocery stories in the BAUASI region. According to the United States Department of Agriculture there are 4254 retailers certified to conduct SNAP (Supplemental Nutrition Assistance Program) transactions in the twelve counties.




*Above are locations of "full-service conventional" grocery stores in the twelve-county BAUASI region and nearby. Generated by PolicyMap.*

But as is the case in most of the United States, this expansive retail grocery network is served by highly concentrated sources of supply.

Distribution of mass-produced consumer packaged goods – including shelf-stable foods such as cereal, canned goods, dried fruits, and milled grain – are especially concentrated as a result of higher volume purchases to sustain lower retail prices. Five sources of supply handle over 80 percent of the groceries purchased in the BAUASI region.[1]

- Albertsons (Safeway): 24 to 26 percent of grocery flows
- Super Store Industries: 21 to 23 percent of grocery flows
- C&S Wholesale Grocers: 11 to 13 percent of grocery flows
- UNFI (Supervalu): 11 to 13 percent
- Walmart: 10 to 12 percent

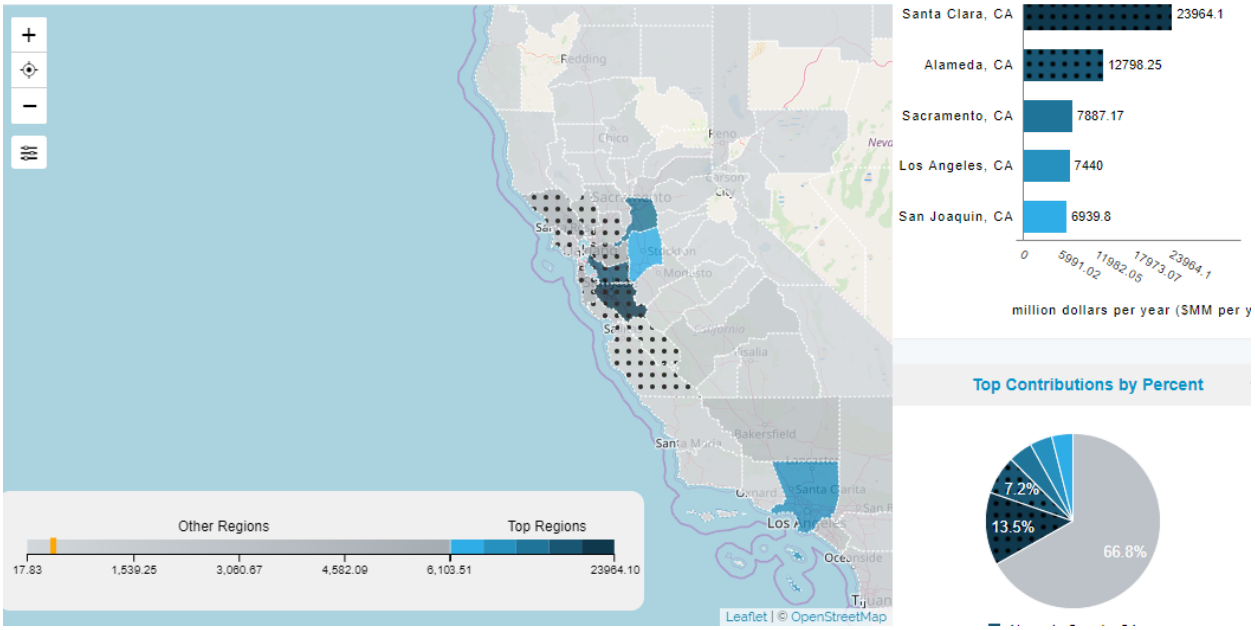
Four of these five sources are grocery operators in other regions of the United States that participate in preexisting networks of supply flowing along the entire Pacific coast and beyond. For example, Bay Area distributors are also involved in supplying the Southern California, Portland, and Puget Sound regions.

While these five are clear Bay Area market leaders, over $6 billion in FAH market demand is served by other grocery distributors. There is only modest overlap between food distributors who serve FAH and FAFH demand. Costco, Sam's Club, Smart & Final and a few other sources of "grocery" also serve the restaurant sector. But these do not typically represent significant proportional flows of food.

[1] *These flow estimates are derived from data provided by Shelby Market Shares, Nielsen Trade Dimensions, and discussions with grocery supply chain owners/operators serving the Bay Areas. The grocery industry is highly competitive and is quickly changing. Precision is treacherous, but these comparative proportions reflect the reality in mid-2019.*

## BAY AREA GROCERY FLOWS

According to the several data-streams aggregated by the FEWSION project at Northern Arizona University, the food consumed by residents of the BAUASI counties originates and is processed nationwide. For example, of the finished food products (not meat or seafood, not beverages, and not milled grains) consumed by residents of the twelve counties, roughly one-quarter (by dollar value) originate in the Bay Area, with the remainder originating far outside the Bay Area.




But from these widely dispersed points of origin, processed foods converge on five grocery Distribution Centers managed by the market leaders identified on the prior page. By concentrating volume, logistical costs per unit can be minimized. Having many products in a single place can also increase the speed and accuracy of delivery to a large number of diverse retail locations. *Each* of the Distribution Centers serving the BAUASI counties carry between 12,000 and 25,000 specific products and transport more than 1 million cases of products per week. The product inventory in these large Distribution Centers turns-over roughly every three to six weeks depending on the season and specific product.

Four of the five market leaders have their Distribution Centers in a twenty-mile crescent of southern San Joaquin County. Walmart currently has its Distribution Center east of Reno, Nevada. (See Addendum A for more details on each of these Distribution Centers.)

Groceries are delivered to retail locations using trucks and vans. Three of the five market leading distributors also own and manage their trucking fleets and directly employ their drivers. Interstate 580 across the Altamont Pass is a principal delivery channel. Because of the concentration of Walmart stores in the South Bay and San Jose, the intersection of the I-580 with the I-680 is nearly as important to Walmart as to the other distributors. Alternative routes are available and used, but according to CALTRANS Annual Average Daily Truck Traffic on the I-580 can be four-times the I-80's truck count.

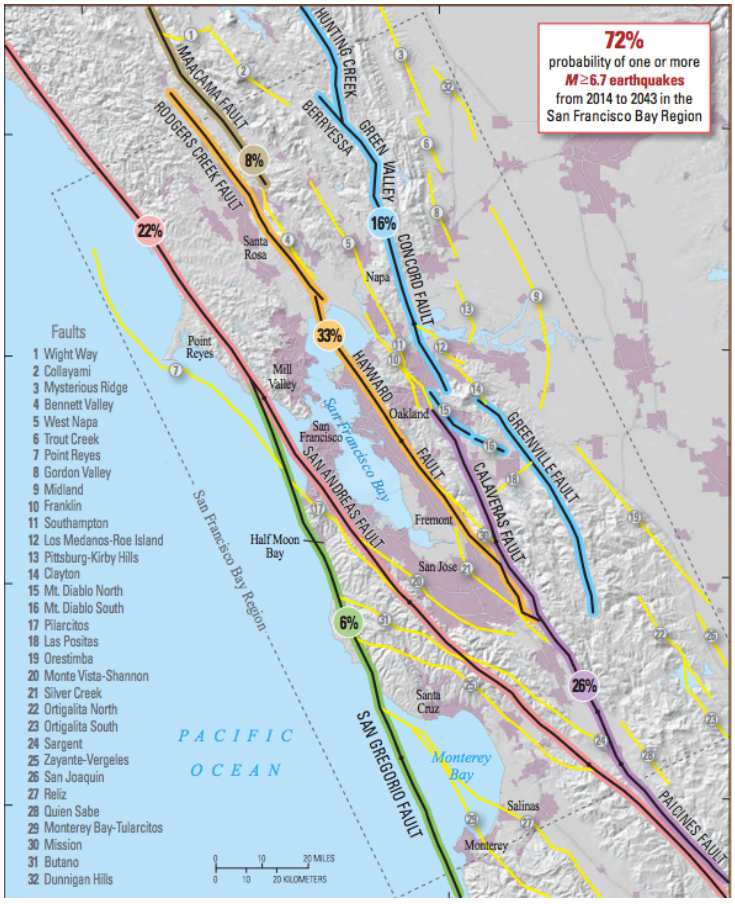
## POTENTIAL CATASTROPHIC RISK

Short of catastrophe, contemporary demand and supply networks demonstrate considerable resilience. Supply chain owners and operators are accustomed to managing disruption of flows and adapting behavior to maintain flows.

But especially hard-hitting, wide-area, and long-lasting destructive events are outside the experience of all but a few supply chain professionals. The flow of groceries can be seriously disrupted by a wide range of events. Pandemics involving large portions of the population, extreme flooding associated with Atmospheric Rivers, successful cyberattacks, and long-term loss of electricity – whatever the cause – can all seriously impact the grocery supply chain.

The United States Geological Survey estimates there is a greater than seventy-percent probability of a 6.7 earthquake or worse occurring in the Bay Area between now and 2043. A major rupture along any one of several faults in the Bay Area could cause a cascade of consequences involving the electrical grid, telecommunications, financial transaction systems, transportation networks, and more.

Depending on the scope and scale of the seismic event, it may be difficult to transport groceries into the impact zone. Even when and where groceries can be delivered, the ability to buy and sell may be disrupted for an extended period of time. In areas where the electrical grid is unable to be quickly restored, consumer demand is likely to change dramatically.




Secondary and tertiary consequences will influence the grocery supply chain. If an earthquake reduces refinery operations in the Bay Area, grocery distributors will still need fuel for transportation and potentially for back-up generation.

One USGS analysis of a major shift of the Hayward fault includes these reasonable outcomes: 800 deaths and 16,000 nonfatal injuries from shaking alone, plus property and direct business interruption losses of more than $82 billion from shaking, liquefaction, and landslides; the average east-bay resident could lose water service for six weeks, some for as long as six months; about 450 large fires could result in a loss of residential and commercial building floor area equivalent to more than 52,000 single-family homes and cause property (building and content) losses approaching $30 billion.

## POTENTIAL IMPEDIMENTS TO GROCERY FLOW

Between June 19 and August 1, 2019, the BAUASI made site visits to each of the Distribution Centers identified in Addendum A. Prior to these site visits a three-page overview was provided for the grocery distributors to review. Follow-on discussions with Distribution Center and crisis management personnel, confirmed and amplified the strategic context set out by the overview. Grocery distributors share concerns raised by BAUASI and are prepared to work with the BAUASI and others to mitigate the risk to grocery flows resulting from a catastrophic earthquake.

In considering the prospect of a catastrophic earthquake in the Bay Area, grocery distributors referenced several similar operational concerns. Three were often mentioned as being of highest priority:

**Loss of Retail Outlets**: Contemporary supply chains depend on the "pull" of demand nodes to direct the flow from supply nodes. Even the temporary loss of communication with retail locations can be dis-orienting and disruptive to grocery flows. Long-term loss of several retail outlets – or the inability of these retail outlets to conduct financial transactions – could be debilitating to some supply chain players, even if Distribution Centers, trucking fleets, and resupply channels continue close to normal. Back-up power generation and alternative communication/transaction capabilities are currently uncommon among Bay Area grocery retailers.

**Loss of Transportation Routes**: Grocery flow into the most densely populated Bay Area neighborhoods depends on a comparatively few channels across the Diablo Range and/or the Bay. Maximizing access to and flow through surviving links will be crucial to feeding survivors. In the most densely populated areas, truck access may be complicated by collapsed roadways and buildings on roadways. Cross-docking and/or other measures to transfer product from large trucks to smaller conveyances will need to be considered.

**Non-availability of Fuel**: Many Bay Area seismic projections anticipate a loss of regional refining capacity. Having access to fuel is crucial to the grocery supply chain. Trucks, truckers, and fuel are not only needed to supply those survivors directly impacted by the event. The same grocery network that is feeding survivors will need to continue feeding millions of others across Northern California.

There are many other operational concerns. The current process of exploration and discussion has not been designed to empirically confirm any top priorities. It was, however, remarkable how these same three concerns were volunteered by grocery distributors involved in these early discussions.

Given the location of the major grocery Distribution Centers (see Addendum A), the Bay Area is fortunate that these essential sources of grocery volume and velocity are unlikely to be directly impacted by the seismic event. The susceptibility of levees in the San Joaquin Delta to seismic shaking and liquefaction is a matter of ongoing study. As BAUASI and the grocery distributors collaborate to mitigate risk to the grocery sector, the potential for levee failure impacting transportation routes and facility operations should receive sustained attention.

## ANALYSIS AND STRATEGIC RECOMMENDATIONS

The supply nodes that fulfill more than 80 percent of Bay Area grocery demand do not face a direct seismic risk.

The supply nodes that fulfill more than 70 percent of Bay Area grocery demand are within 100 miles of the vast majority of the Bay Area's population.

The trucks, vans, and drivers on which delivery of groceries depend are "staged" from locations not at direct seismic risk.

Three of the five largest sources of grocery flow in the Bay Area are not retail operators. These sources of supply are predisposed to maximum flexibility in selling and delivering to expressed demand and shifts in expressed demand.

Four of the five largest sources of grocery flow in the Bay Area are important local nodes in huge national networks of grocery flow. Capacity exists to surge and redirect grocery flow.

Some of the sources of significant grocery flow in the Bay Area will be key sources of strategic capacity for catastrophic events in Southern California, Portland, Puget Sound, the Pacific Islands, Alaska, and as far east as Salt Lake City.

Serious and long-term disruption of the electrical grid, telecommunications, telecomputing, transportation networks, fuel systems and more will seriously challenge the persistence and adaptation of grocery flow in the Bay Area. Among the most consequential operational questions to engage before a major event are:

- How will post-event status of retail locations be rapidly assessed and widely communicated?
- How will the capabilities of surviving retail locations be rapidly reestablished?
- How can flow of groceries to survivors be maximized where retail locations have *not* survived?
- How can survivors express demand and receive supply when typical financial transaction systems are non-operational?
- How can disruptions to delivery of groceries be mitigated in advance and resolved in real-time?
- How can access to fuel by supply nodes and related trucking fleets be best assured?
- How can re-supply of grocery Distribution Centers be best assured?

Since completing interviews with the grocery distributors, these issues have been discussed with local, state, and federal emergency management officials. **Currently, coherent policies and procedures are not in place to seriously engage – much less mitigate – potential supply chain challenges**. These are unresolved issues of catastrophe preparedness and private-public collaboration that are found in high-risk regions world-wide.

There are good reasons for the Bay Areas Urban Areas Security Initiative to seek to solve what many other jurisdictions have been unable to solve. First, there is a real need and urgency to enhance the ability to deliver food to earthquake survivors. Second the BAUASI has a track record of effectively engaging other especially difficult problems. Third, unlike in many other jurisdictions, this study has found that the private-sector strategic capacity for delivering food will remain mostly intact after a major seismic event.

Grocery distributors are prepared to collaborate with local, state, federal and other parties to maximize persistence and adaption of grocery flows in the Bay Area following a major seismic event. Most grocery distributors are, however, unlikely to participate in typical public sector planning activities. It is much more likely that grocery distributors will respond to public sector planning outputs and participate in realistic Supply Chain Resilience tabletop exercises.

The challenges to enhanced private-public collaboration in maintaining food flows during a potential catastrophe are not, however, only matters of policy and procedure. There are also issues of shared – *and profoundly divergent* – understanding and purpose. Grocery – and other crucial supply chains – serving dense populations are complex adaptive systems. Efforts to "control" complex adaptive systems often increase dissonance and disruption rather than the opposite. Collaborative private-public efforts to enhance the resilience and speed recovery of wide-area, high volume, high velocity demand and supply networks often involve practices that conflict with traditional commercial behaviors and emergency management good-practices. What works for less than catastrophic events involving more linear networks and systems will often not work in a catastrophic context.

Given this context, attempts at short-term fixes could actually aggravate threats to Supply Chain Resilience. Resilient flows of information, financial transactions, and much more for foods, pharmaceuticals, medical goods, refined fuels and other crucial commodities require a long-term strategy of private-public engagement. For this purpose and based on the findings of this project, it is recommended that:

1. The Bay Areas Urban Area Security Initiative establish a **permanent task force on Supply Chain Resilience** with appropriate staff support. It is recommended that this task force host at least one annual internal workshop. The purpose of this workshop would be to update the findings of the existing grocery report, develop a similar understanding for other key supply chains, and identify major shifts in supply chain ownership, operations, and/or structure.
2. The Bay Areas Urban Area Security Initiative and the task force recommended above, undertake a **collaborative relationship with the California Resiliency Alliance** to engage grocery and other key supply chain owners and operators with the aim of conducting consultations, workshops, and exercises as appropriate. As a civic-sector organization focused on business resilience, CRA is seen as capable of narrowing the current gap between public and private approaches, policies, and procedures.
3. The Bay Areas Urban Area Security Initiative Supply Chain Resilience task force and the California Resiliency Alliance explicitly **engage with local, state, and federal efforts related to "coordination of cross-sector operations, including stabilization of key supply chains and community lifelines…" (ESF-14)**. This wider work would be designed to influence the long-term policy and strategy context for private-public collaboration in catastrophe response and recovery.

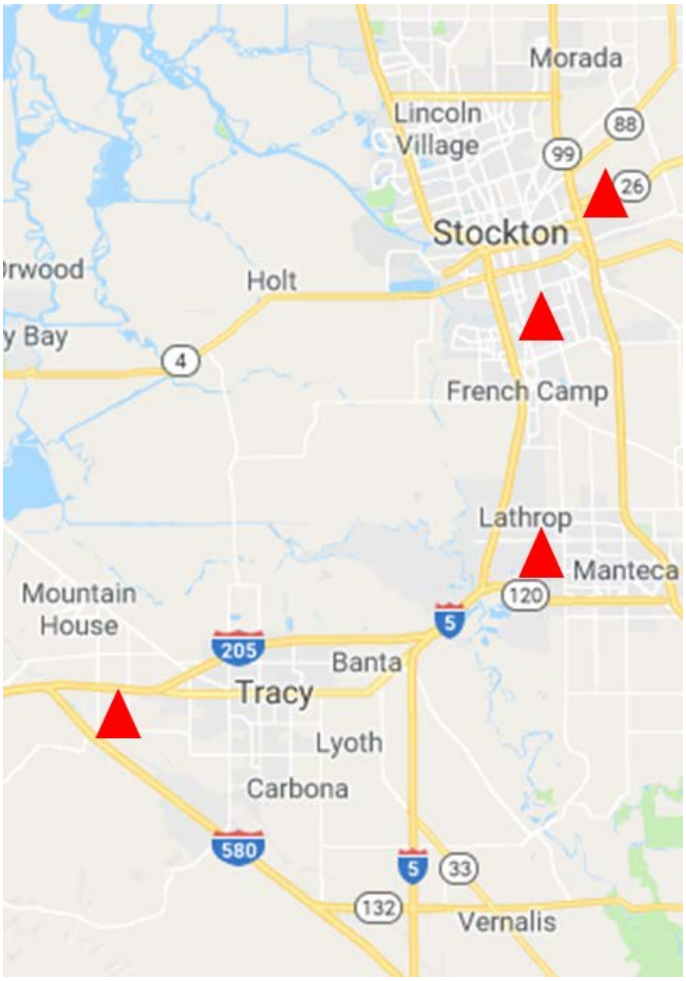
## ADDENDUM A: Principal Sources of Grocery Supply

Grocery sales are dynamic and highly competitive. Precise data on grocery flows are difficult to generate. But both published sources and private conversations indicate the following proportions to be roughly accurate for the broad San Francisco Bay area.

- Albertsons (Safeway): 24 to 26 percent of grocery flows
- Super Store Industries: 21 to 23 percent of grocery flows
- C&S Wholesale Grocers: 11 to 13 percent of grocery flows
- UNFI (Supervalu): approximately 11 to 13 percent
- Walmart: approximately 10 to 12 percent

In a Major Trading Area where grocery sales exceed $32 billion per year there are several other grocery distributors, including Costco, Smart & Final, Trader Joes, Grocery Outlet and others. But each of these other distributors generate less than ten percent of total grocery flows. At least 80 percent of total grocery flows originate with the five sources identified above.

Four of these five sources have their principal distribution centers – crucial nodes of volume and velocity – within the same thirty-mile crescent of southern San Joaquin County. All four depend on the same transportation, fuel, telecommunications, and electrical power infrastructures.




**North to South**

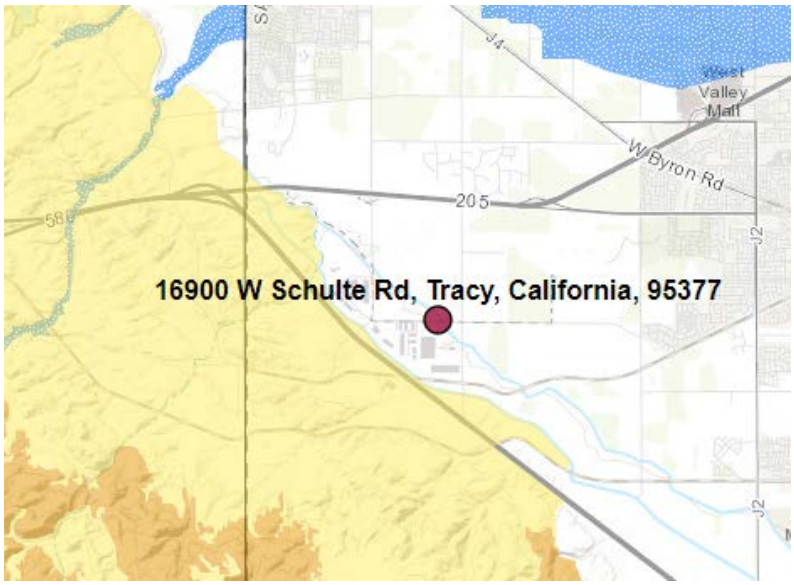
UNFI (Supervalu)
C&S Wholesale Grocers
Super Store Industries
Albertsons (Safeway)

## Albertsons (Safeway)

This more than two-million square foot facility is the principal source of bulk grocery supply for Safeway, Albertsons, and related banners in the San Francisco Bay Area. According to several grocery industry sources, Albertsons serves roughly a quarter of total grocery flows in the San Francisco Bay area. Albertsons is headquartered in Boise, Idaho.

The Distribution Center is at 16900 West Schulte Road in Tracy (right), just northeast of Interstate-580. The facility distributes dry grocery, frozen foods, fresh produce, bakery goods, beverages and health/beauty products using a fleet of more than 180 trucks, 230 vans, and 650 refrigerated trailers. Roughly 2500 loads per week are received at the facility. Roughly 1740 outbound loads are delivered per week. A truck maintenance facility is also on the property. A 30,000-gallon fuel facility serves the trucking fleet and is available to refuel backup-generation. (This Tracy DC is also the source of groceries for the Albertsons retail network in Hawaii, flowing through the Port of Oakland.)

The California Office of Emergency Services provides MyHazards as an online tool for roughly estimating exposure of specific locations to earthquake, flood, fire, and tsunami risk. According to this tool (right), the Albertsons Distribution Center is not at direct risk of these threats.

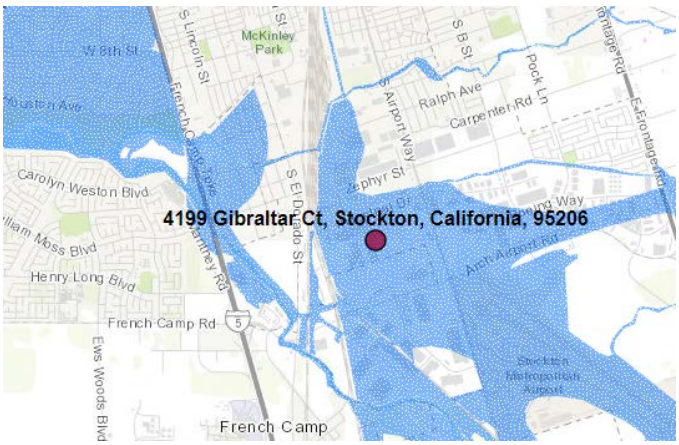


## C&S Wholesale Grocers

Principal source of bulk grocery supply for Target, Foodsco, SavMor and many smaller independent retailers in the Bay Area, including single-store operators. Roughly ten percent of Bay Area grocery flows originate from what is called the Tracy Distribution Center. This facility also serves Southern California, Hawaii and the Pacific Northwest. C&S is headquartered in Keene, New Hampshire.

The C&S Distribution Center, located at 4199 Gibraltar Court in Stockton, occupies more than 800,000 square feet, including freezer operations. Diesel generators on site can support continued dry grocery operations for up to 72 hours before needing to be refueled. Penske manages a dedicated fleet of outbound tractors and drivers. This fleet includes smaller "light" trucks and "short-haul" trucks for delivery into urban centers, as well as tractors for double-trailers over long distances.

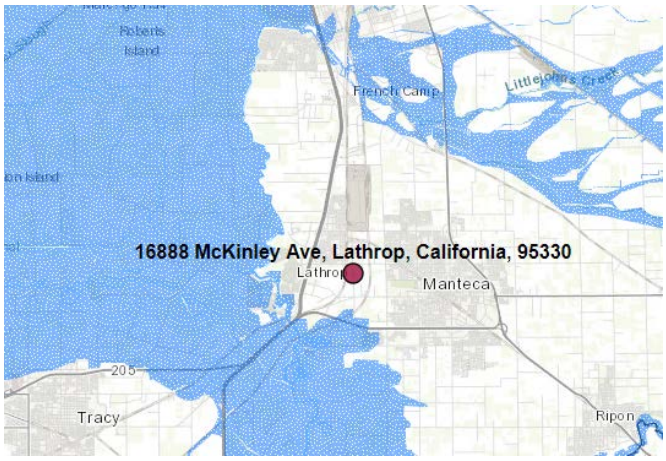
According to MyHazard's (right), the Distribution Center is in the 100-year flood plain for the San Joaquin river delta. The Distribution Center is not highly susceptible to liquefaction, direct seismic effects, or wildfires.



## Super Store Industries

Principal source of bulk grocery supply for Lucky, SaveMart, FoodMaxx, Nob Hill, Raley's and related banners in the San Francisco Bay Area. SSI may represent twenty percent or more of total grocery flows in the San Francisco Bay Area. Super Store Industries is owned by SaveMart and Raley's.

Super Store Industries (SSI) operates a more-than 800,000 square-foot Distribution Center (above) at 16888 McKinley Avenue in Lathrop, east of Interstate-5. The facility has back-up electrical generation to continue operating for 72 hours without refueling. Super Store Industries procures, receives, picks, and palletizes bulk grocery for its owners/customers. Distribution and delivery are conducted by trucking fleets owned and operated by others. SSI also operates a large dairy product facility in Turlock. But Lathrop is the principal source of grocery volume and velocity.




According to the California Office of Emergency Service's MyHazards mapping function (right), the Lathrop Distribution Center is not highly susceptible to liquefaction, direct seismic effects, wildfires, or 100-year flood events. 100-year flooding may isolate the facility and there is a direct threat of 200-year flooding or levee failure.

## UNFI (Supervalu)

Principal source of supply for bulk groceries to Whole Foods, Lunardis, Mar-val, Cardenas, and many other independent retailers in the Bay Area. Roughly ten percent of grocery flows serving the Bay Area originate from the UNFI Stockton Distribution Center, the largest of the company's facilities on the West Coast. UNFI is headquartered in Providence, Rhode Island.

The UNFI (Supervalu) Stockton Distribution Center, located at 1990 Piccoli Road, is over 950,000 square feet. Diesel generator back-up is in place to support full operations. Refueling would be needed about every eight hours to maintain operations. Approximately 10,000 gallons of diesel fuel are available on site. Two water reservoirs (far left in above image) support emergency fire suppression. Distribution Center employees and truck-drivers are represented by the Teamster's Union. Delivery trucks are refueled on site.

According to MyHazards, the Distribution Center is in the 100-year flood plain for the San Joaquin river delta. The Distribution Center is not highly susceptible to liquefaction, direct seismic effects, or wildfires.

## WALMART

Walmart supercenters and Neighborhood Markets supply up to twelve percent of groceries consumed in the Bay Area. Walmart is most prominent in the South Bay and San Jose. The company has a new grocery distribution center under construction in Shafter, California, scheduled to begin operations in the second half of 2020. Today Walmart stores in the Bay Area are supplied primarily from a Distribution Center near Clark, Nevada (east of Reno).

This Walmart Distribution Center is located at 2195 NV-439 in Sparks, roughly 270 miles from San Jose, connecting most of the way using Interstate 80. The Distribution Center is approximately 890,000 square feet in size. A large Distribution Center for Jet.com (a Walmart ecommerce subsidiary) is approximately 1000 feet south. Walmart has its own large trucking fleet of directly employed drivers, sometimes supplemented by 3PLs (Third Party Logistics) with long-term contracts. A truck maintenance facility is co-located with the Distribution Center.

Temporary snow closures of Interstate 80 between the Distribution Center and the Bay Area are not unusual but have not seriously disrupted the Walmart grocery supply chain. Western Nevada is susceptible to seismic risk. The Olinghhouse Fault Zone (red on the USGS map to the right) is last known to have ruptured on December 26, 1869 (estimated M6.7).