CHAPTER 2.2

FREIGHT SYSTEM CONDITION AND PERFORMANCE

Monitoring is the key to transportation system improvement; real solutions must be based on sound data. While California and its partners have carefully invested scarce resources in detection systems and analysis methodologies, much more data is needed, particularly for the less-traveled portions of the freight network. Further investment in data collection across all modes and facilities is needed.

Under MAP-21, US DOT will establish performance measures to guide states in highway-related freight decisions, but that process has yet to be completed. This chapter presents performance measures based on the six CFMP goals. It is anticipated that many of these measures will adopted by US DOT, but others go even further than what may be needed nationally, addressing non-highway modes and associated issues such as air quality, greenhouse gases and community impact reduction in more depth and regulatory oversight. This chapter will be amended at a later date to be consistent with the final federal guidance.

The condition and performance of the freight system is presented in alignment with the six CFMP goals:

- Economic Competitiveness
- Safety and Security
- Freight System Infrastructure Preservation
- Environmental Stewardship
- Congestion Relief
- Innovative Technology and Practices

The following summarized list of proposed metrics by facility type precedes detailed information by three categories: freight infrastructure, congestion, and safety.

Highway Metrics

- Pavement conditions
- Roadway bridge conditions
- Truck travel speed
- Truck hours of delay
- Highway bottlenecks/chokepoints
- Corridor reliability buffer index
- Roadway truck collision fatalities and injuries

Rail Metrics

- Train height clearances
- Track weight accommodation
- Posted maximum train speeds
- Rail bottlenecks/chokepoints
- Railroad grade crossing fatalities and injuries

Seaport Metrics

- Navigation channel depths
- Waterway bridge clearance

HIGHWAY SYSTEM

PAVEMENT

According to the Caltrans 2013 State of the Pavement Report, distressed pavement is considered in poor condition when it contains significant to extensive cracks or provides a poor ride. Pavement in this category would trigger Capital Preventive Maintenance (CAPM) rehabilitation or reconstruction projects. The Caltrans 2013 Five-Year Maintenance Plan states that for every dollar spent on pavement preventive maintenance, four dollars can be saved on future pavement repairs. This highlights the importance of being proactive about funding preventive maintenance projects.

Most highway pavement damage is caused by heavy vehicles. Fully loaded, multi-axle trucks weighing up to 80,000 pounds (40 tons) produce "as much pavement wear as up to 10,000 automobiles," states the 2006 Road Maintenance Issue Brief by the Sacramento Area Council of Governments. Pavement along highways that see a high volume of traffic from heavy trucks is thicker by design, with greater reinforcement; however, according to the 2006 findings of national transportation research organization, California road conditions in major urban areas are still some of the worst in the nation.[25] This suggests that despite the greater reinforcement along these busy corridors, staying on top of the constant wear, particularly from heavy trucks, is more than can be accomplished with limited pavement maintenance budgets.

In 2011, of the total 49,518 highway lane miles in California at that time, 12,333 (25 percent) were in distressed condition. In 2013, partly due to a change in roadway project priorities that shifted more funds directly to pavement preservation and rehabilitation, the number of distressed lane miles was down to 7,821 (16 percent). Of the proposed federal Primary Freight Network (PFN) system within the State, which consists of approximately 17,585 lane miles, 1,866 miles (10.6 percent) were considered distressed in 2011. The current State Highway Freight Network equals approximately 26,753 total lane miles. Of those, 2,656, or 9.9 percent, were distressed in 2011. For details regarding the number of total distressed lane miles by Caltrans district, see the most current Caltrans State of the Pavement Report that is available at: http://www.dot.ca.gov/hq/maint/Pavement/Pavement_Program/PDF/2013_SOP_FINAL-Dec_2013-1-24-13.pdf

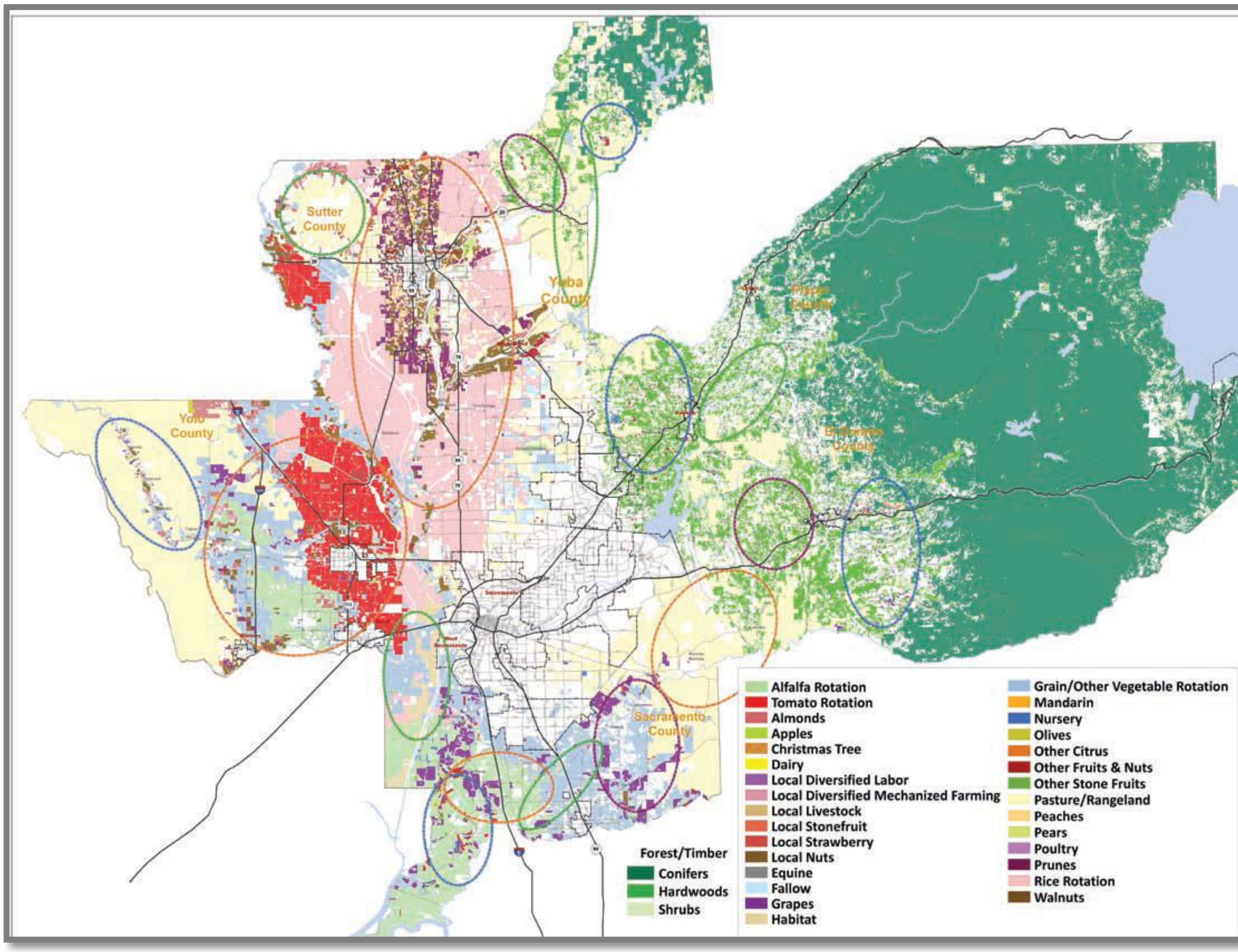
Potential Areas for Roadway Deterioration – Regional Overviews

Many local roads that provide first- and last-mile access to critical freight facilities have much poorer pavement conditions than the State Highway System (SHS) and often are not constructed to accommodate the heavy loads they must bear. Industries such as agriculture/food product, wood product, mining, and machinery/manufacturing may exacerbate roadway damage, especially along high-volume local freight routes.

Within the 16 northernmost counties that comprise the North State Super Region, the top three commodity groups by value are agriculture and food products, wood products, and machinery manufacturing. Routes used by the timber industry are typically owned by Caltrans, the US Forest Service, the National Park Service, and the Bureau of Land Management. Generally, wood product activity occurs in the northern and coastal counties, agriculture activity occurs in the Sacramento Valley counties, and machinery manufacturing within Nevada County.

Approximately 70 percent of the land in the six-county greater Sacramento region is agricultural, forest, or other open space (see Figure 42), which closely coincides with heavy concentrations of truck activity. Truck traffic and agriculture is dense along the Sutter-Yuba county border, the western Sutter County border, and in the heart of Yolo County. Forest/timber is heavy in east El Dorado and Placer counties as well as northern Yuba County.

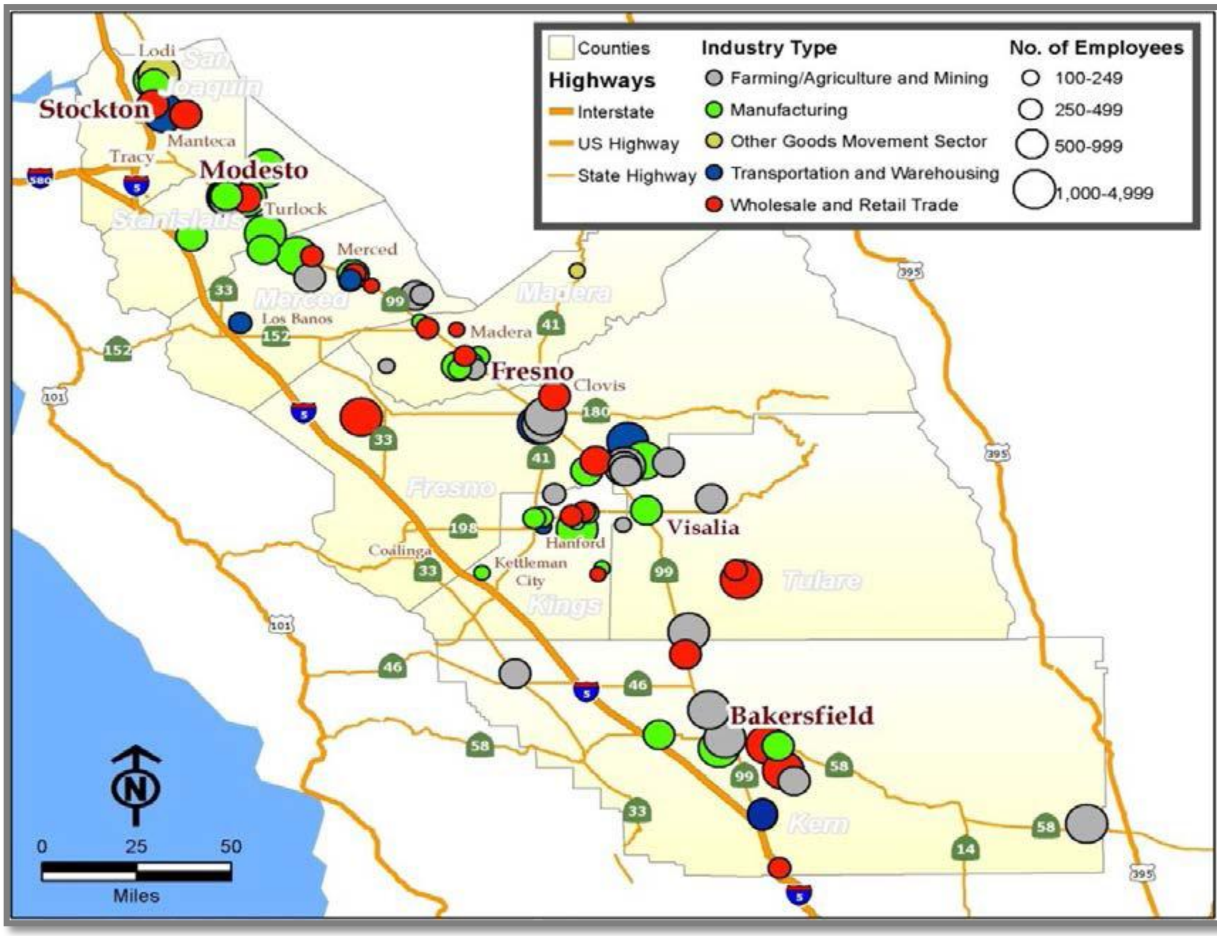
FIGURE 42. RURAL-URBAN CONNECTIONS STRATEGY (RUCS) AGRICULTURAL THEME MAP



Key: Large-Scale Agriculture (orange circles)
Open Space and Recreation (green circles)
Large Lot Residential (purple circles)
Small-Scale Agriculture and Agritourism (blue circles)

In the San Joaquin Valley (Valley), goods movement-dependent businesses are concentrated along State Route (SR) 99, as shown in Figure 43 These industries include food growing and production; food processing and packaging; oil refineries and mineral mining operations; and trucking, transportation, warehousing, and distribution services. The expanding petroleum and natural gas industries in the southern portion of the Valley, while not relying heavily on highway routes included in the Primary Freight Network, is very dependent on State highways and local roads for access to numerous extraction and processing locations.

FIGURE 43. LOCATIONS OF KEY GOODS MOVEMENT BUSINESSES IN THE VALLEY



Source: San Joaquin Valley Interregional Goods Movement Plan, 2013

According to the *San Francisco Bay Area Freight Mobility Study* (Cambridge, 2014), by weight, the top three commodities carried by trucks in the San Francisco Bay Area are waste/scrap, nonmetal mineral products, and gravel. In 2011, the highest truck traffic volumes occurred along I-880 and I-580; however, especially in densely populated areas such as the Bay Area, pavement issues also occur around ports and warehousing/distribution areas, as well on first- and last-mile movements.

Most of the agricultural production, food manufacturing, transportation, and warehousing activities within the five-county Central Coast region are clustered along US 101 and in areas near Watsonville in Santa Cruz and Monterey counties. According to the 2012 Association of Monterey Bay Area Governments' (AMBAG) *Central Coast California Commercial Flows Study*, most truck movement occurs around the cities of Santa Maria, San Luis Obispo (transportation/warehousing), Salinas, Monterey, and Santa Cruz. Truck drivers have expressed concern about increasing traffic congestion along US 101 in the Santa Barbara, Atascadero, and Prunedale areas.

In the Eastern Sierra/Owens Valley area, heavy truck traffic exists along US 395, which runs from the border with Nevada to Interstate 15. According to the Caltrans 2006 *Goods Movement Study for US 395 Corridor*, most (87 percent) northbound trips along the corridor originate from Southern California, and southbound trips (54 percent) begin in Nevada. In 2006, the most common types of goods included miscellaneous manufacturing, general freight, food/kindred product, farm products, and empties.

Much of the heavy truck traffic within the Southern California Association of Governments (SCAG) and San Diego regions is due to freight transport to or from the seaports, inland regional distribution centers, manufacturing locations, and the border with Mexico. The volume of truck traffic in this region is among the highest in the nation and thus presents a tremendous pavement management challenge, particularly for local roads that may not have been designed to handle the number of heavy trucks that now traverse them. Because the region's truck travel is so extensive, they require focused tracking and reporting beyond the scope of this Plan.

In general, agricultural activity is concentrated in the Imperial Valley, portions of San Diego County and areas of Ventura County. There is no significant timber production. Mining activity includes sand/gravel/crushed stone for construction, specialized mineral extraction in the desert region, and oil production.

ROADWAY BRIDGES

According to the Caltrans *State of California's Highway Bridge Inventory Annual Report* 2012/13, 52 percent of the State's bridges are on the SHS and consist of overcrossings or undercrossings. These highway bridges have an average age of 42 years. Bridge health is critical to freight movement because bridge closures can require trip redirection, lengthening travel time, wasting fuel, reducing efficiency, and delaying emergency deliveries and services.

One way to measure bridge performance is to track the number of structurally deficient and/or functionally obsolete bridges. A structurally deficient bridge is one with routine maintenance concerns that do not pose a safety risk or one that is frequently flooded. A bridge is classified by the Federal Highway Administration (FHWA) as functionally obsolete if it fails to meet its design criteria, by either its deck geometry, its load-carrying capacity, its vertical or horizontal clearances, or the roadway alignment of its approach. According to the federal *State Transportation Statistics* document, in 2012, California had 7,156 structurally deficient/functionally obsolete bridges of a total of 24,812, equaling 28.8 percent.

Because bridges categorized as either structurally deficient or functionally obsolete do not necessarily present safety issues, Caltrans currently measures bridge performance by reporting the number of "distressed" bridges having an identified rehabilitation, replacement, scour, or seismic need. It is anticipated that future federal guidance will specify performance metrics for bridges.

Another aspect of bridge performance for goods movement is their capacity for handling oversized loads, either by weight or dimension. When bridges cannot handle these permitted loads, freight routing is less than optimal. For these oversize loads, Caltrans has a special permitting system that identifies appropriate routes for the particular load. In some cases where extraordinary curve and height clearances are needed, the route may require hundreds of miles of additional travel.

RAIL SYSTEM

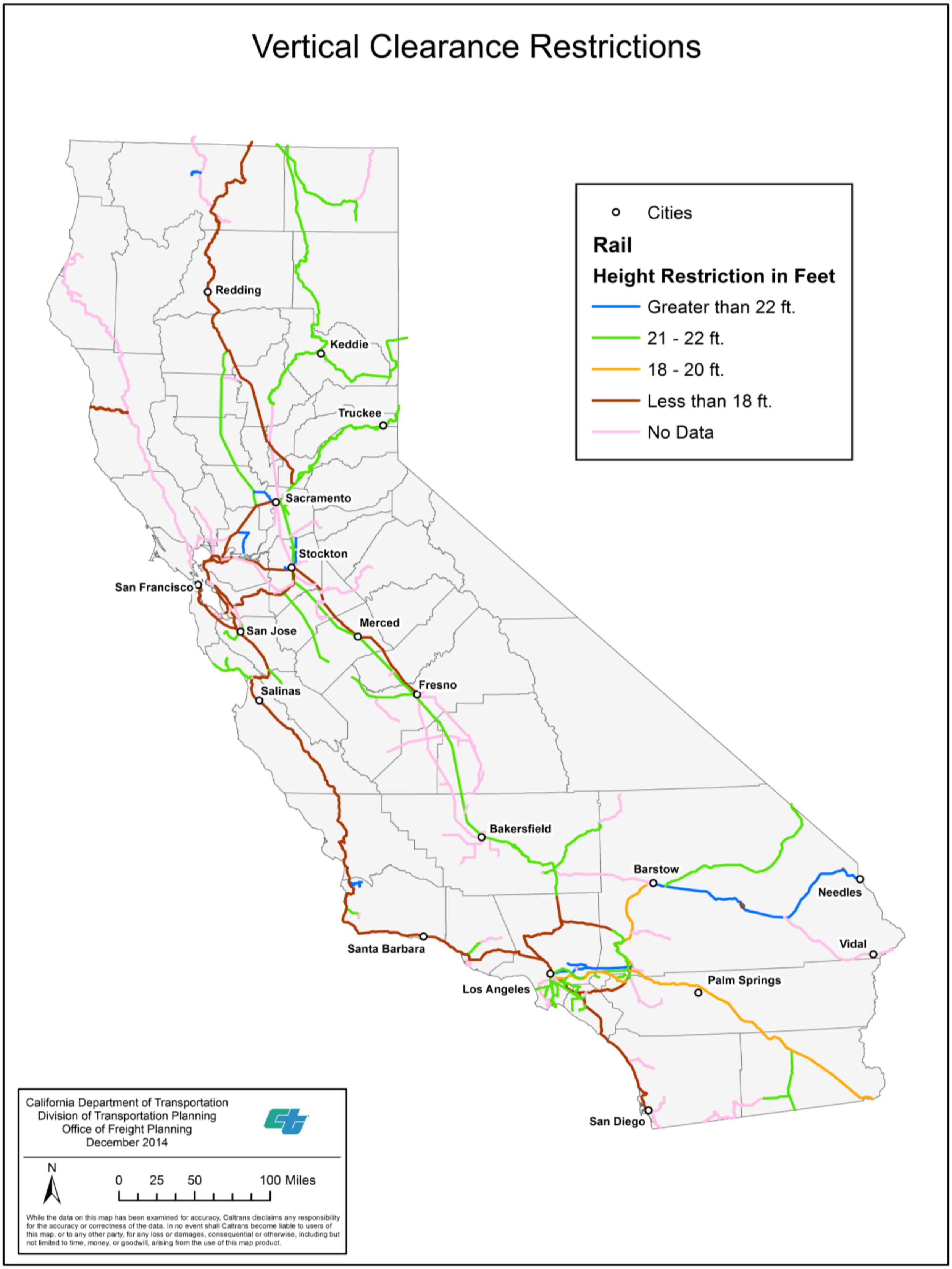
The Class I railroads, Union Pacific Rail Road (UPRR) and BNSF Railway (BNSF), own and operate 79 percent of the track mileage in California. They control system maintenance and infrastructure and, each year, originate over 3 million carloads in the state and terminate and over 3.1 million. As track and other infrastructure are critical to sustaining freight rail service, the Class I Railroads ensure their operating track is well maintained. Short line freight rail owners and operators tend to have fewer resources and find maintenance upkeep more of a challenge. Accordingly, it is common that short line railroads operate at slower speeds and have lighter rail car weights.

Train Height Clearances

By stacking two freight containers on a single rail car, a practice known as double-stacking, railroads can reduce costs and save energy. But double-stacking requires sufficient vertical clearance – typically 19 feet for international boxes and 20 feet 6 inches for domestic boxes.[26] In California, all four of the primary freight intermodal corridors – BNSF Transcontinental, UP Sunset, UP Donner, and Tehachapi – have sufficient vertical clearances for double-stack service. Height limitations, some of which preclude double-stacking along Class I and major short line railroad routes, are shown in Figures 44 and 45. A more detailed listing can be found in Appendix C of the CSRP at:

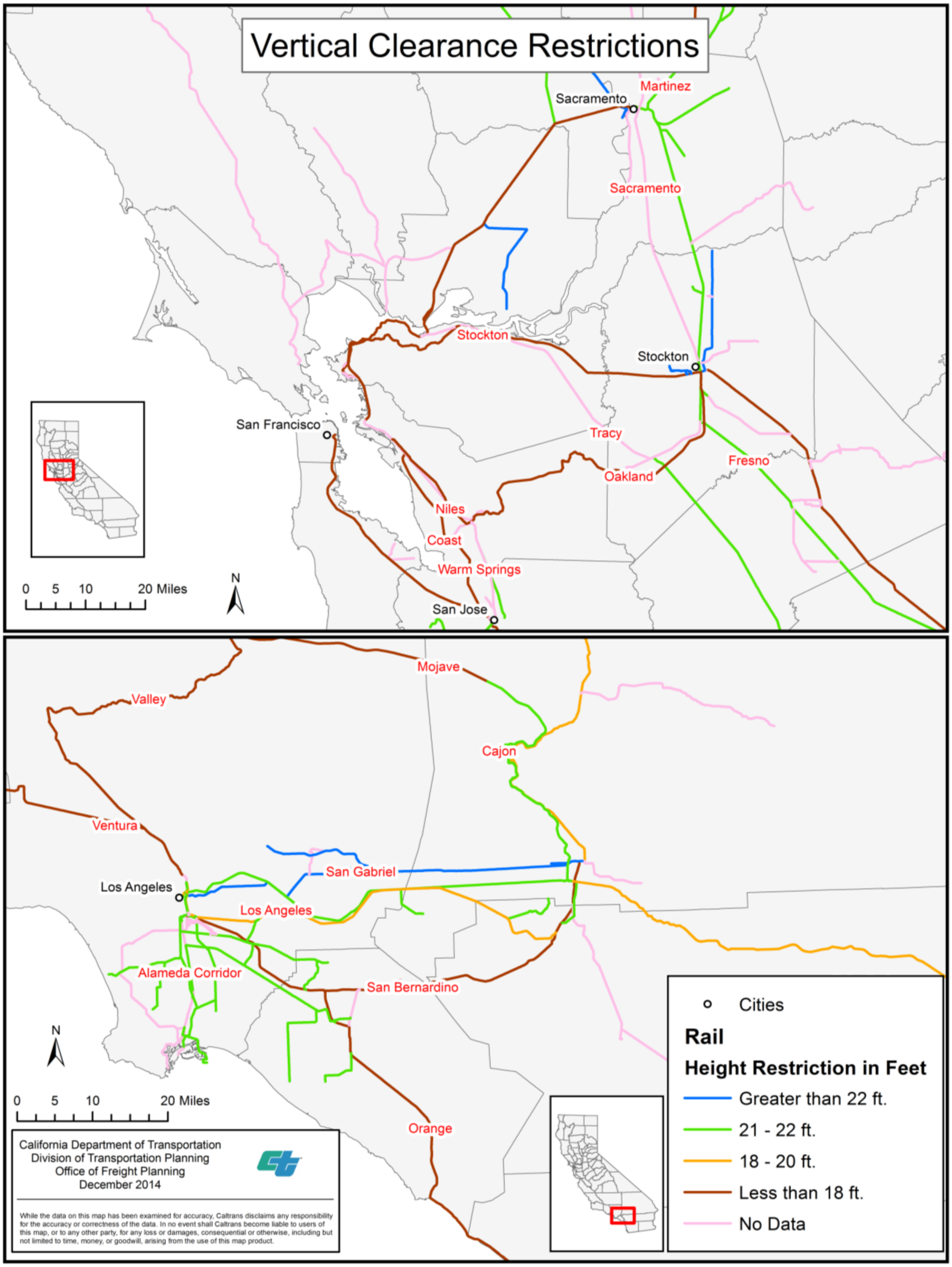
http://californiastaterailplan.dot.ca.gov/docs/Final_Copy_2013_CSRP_Appendices.pdf

FIGURE 44. RAIL HEIGHT LIMITATIONS



Source: Caltrans, Division of Transportation Planning (DOTP)

FIGURE 45. RAIL HEIGHT LIMITATIONS – NORTHERN AND SOUTHERN CALIFORNIA



Source: Caltrans, Division of Transportation Planning (DOTP)

Track Weight Accommodation

In the mid-1990s, the maximum accepted railcar weight was increased from 263,000 to 286,000 pounds (2013 California State Rail Plan). Railroads wishing to keep their Class I status were required to accommodate this greater weight. The ability of a rail line to support cars of a given weight depends on track conditions, rail weight or gauge, and the capacity and condition of weight-bearing structures such as bridges. Over 95 percent of California's Class I network is generally able to handle the greater weight with only 1.2 percent of total track miles (39 miles in Orange County) rated for less than the standard. Weight data is not currently available for 120.5 miles of Class I track along the San Diego, Olive, and San Gabriel subdivisions.

Although short lines are important for access to industrial sites and transporting heavy loads to last-mile final destinations, larger Class I railroad infrastructure tends to be in better condition. Generally, short line track rail is lighter-weight than Class I rail. Additionally, the tie and ballast conditions of short line track are typically inferior to Class I track, though some short line railroads have excellent track conditions, and short lines often lack an active signaling system. As a result, short line train speeds are generally lower (typically 40 miles per hours, or less for freight trains) and operations are less automated. Only 27.2 percent (283.7 miles) of reported short line mileage in California can accommodate the 286,000-pound maximum; 19 percent can accommodate up to 263,000 pounds; and 19.2 percent are reported to have a maximum capacity of under 263,000 pounds.[27] No weight restriction data is available on 362.6 miles (34.7 percent) of major freight short line track.[28] Although current conditions are probably adequate for existing business, inability to handle standard modern rolling stock will place California short line carriers at a competitive disadvantage when competing for new business. Recognizing the critical importance of short line rail service for industrial and other heavy load purposes and the need to retain those industries, some states have funding programs that support short line railroads. California does not have such a program. **It is a recommendation of the CFMP that the creation of a California short line railroad funding program be investigated.**

SEAPORTS

NAVIGATION CHANNEL DEPTHS

Efficient inbound and outbound movement at California seaports is critical for the State's economic health. To preserve maritime transportation infrastructure, channels and harbors for all ports must be dredged and maintained to adequate navigable depths to accommodate the size of ships the ports are designed to handle. In addition to the State's 12 ports, there are 16 waterways that require minimum vessel depths. The following table indicates minimum channel depths, as determined by the US Army Corp of Engineers (USACE), necessary to handle the largest vessels calling at California ports in 2011. The second column shows actual channel depths as listed in the 2013 *American Association of Port Authorities (AAPA) Seaport Directory*. (Figures are for planning purposes only and are not intended for use in navigation decision making.)

TABLE 16. MINIMUM SEAPORT CHANNEL DEPTH

Channel	USACE	AAPA
San Diego Harbor	39'	37'-47'
Long Beach Harbor	68'	76'
Los Angeles Harbor	57'	53'
Port Hueneme	39'	35' MLLW*
Redwood City Harbor	38'	30'*
San Francisco Bay Entrance	47'	--
San Francisco Harbor	45'	55'
Oakland Harbor	45'	50'
Richmond Harbor	47'	38'
San Pablo Bay and Mare Island Strait	42'	--
Carquinez Strait	42'	38'
Suisun Bay Channel	42'	--
San Joaquin River	40'	--
Stockton	40'	35'*
Sacramento River	34'	30'
Humboldt Harbor and Bay	34'	38'*

** Mean Lower Low Water (Figures are for planning purposes only and not intended for use in navigation decision making.)*

WATERWAY BRIDGE CLEARANCE

The configuration of some California ports requires vessels to heed minimum bridge clearances to avoid collisions. Vertical clearance is measured as the distance from the mean high-water level (high tide) to the bottom of the structural span. Table 17 shows minimum vertical bridge height information for major California seaport bridges.[29] Access to the inland ports of Stockton and West Sacramento may require navigation under smaller fixed bridges and draw bridges. (Figures are for planning purposes only and not intended for use in navigation decision making.)

FIGURE 46. GERALD DESMOND BRIDGE, PORT OF LONG BEACH

Source: Caltrans

TABLE 17. MAJOR BRIDGE VERTICAL CLEARANCES

San Diego-Coronado Bay		
	West Span	156’
	Middle Spans	175’-195’
	East Span	214’
Vincent Thomas		165’
	Middle Span	
Gerald Desmond		
	Current	155’
	New	200’
San Mateo-Hayward		135’
San Francisco-Oakland Bay		
	West	204’-220’
	East	112’
Golden Gate		
	Center	225’
	North Pier	213’
	South Pier	211’
Richmond-San Rafael		
	West Channel	185’
Carquinez		
	North Span	146’
	South Span	132’
Martinez UP Rail Bridge		135’
Rio Vista Bridge		146’

(Figures are for planning purposes only and not intended for use in navigation decision making.)

AIRPORTS RUNWAY CONDITION AND CAPACITY

Eleven of California’s top twelve air cargo-carrying airports also have commercial passenger service, with Mather Airport being the exception. Runway pavement is regularly inspected by federal and State officials for conditions and other compliance measures. These assessments ensure California’s runways are maintained in “good” or better condition. Airport infrastructure, other than runways, is typically maintained by municipalities or regional airport systems.

In 2012, Caltrans contracted with System Metrics Group to determine if the top cargo airports have the capacity to handle future air cargo demand. According to the *California Air Cargo Groundside Needs Study,*[30] California airports have sufficient capacity to meet 2040 demand.

MULTIMODAL CONGESTION

Traffic congestion occurs when the capacity of a transportation system is unable to match or exceed demand. The concept applies to railroads, port facilities, and airports, as well as to highways and surface streets. For many decades after the Interstate highway system was completed, population and vehicle miles traveled continued to increase, while road and highway capacity increased only slightly. Today, traffic congestion is chronic, impacting freight as well as passenger travel. Even the non-highway modes are challenged. Fortunately California's Class I railroads, seaports, and airports have been making substantial investments to expand their capacity and reduce costly congestion; however, as much larger ships make calls at California's seaports, the ports and their supporting land-side systems will be challenged to handle the additional volume of traffic and containers. Congestion will be a serious challenge. Besides causing frustration, congestion wastes time, raises business costs and consumer prices, and increases emission of harmful pollutants.

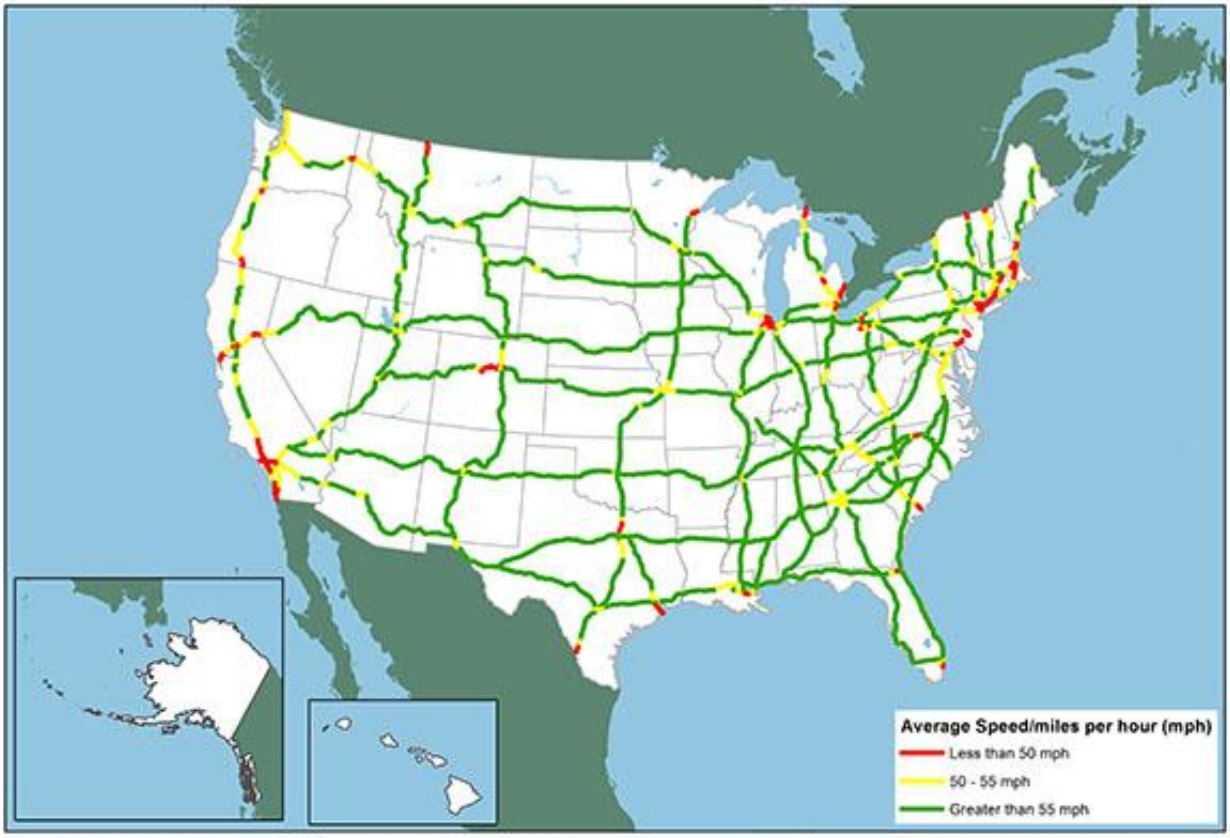
FIGURE 47. PORT OF LONG BEACH TERMINAL EXIT GATES

Source: Caltrans

TRUCK TRAVEL SPEED

When terrain and weather conditions are taken into account, the average travel speed is a good indicator of congestion. In cooperation with private industry, the FHWA tracks speed and travel time reliability at 250 freight-significant California highway infrastructure locations, yielding data on more than 500,000 trucks annually.[31] Average truck speeds generally drop below 55 mph near major urban areas, border crossings, and gateways, and in mountainous terrain. As shown in the map below, large stretches of slower-than-average truck speeds exist on the state's most heavily traveled freight corridors and in urban areas. Slower travel speeds reduce the number of trips per truck per day, resulting in diminished efficiency, elevated costs, and more pollution. The reduced trip numbers also negatively impact the fiscal viability of trucking firms and independent truck drivers.

FIGURE 48. AVERAGE TRUCK SPEEDS ON SELECTED INTERSTATE HIGHWAYS: 2011



Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Performance Measurement Program, 2012.

Posted Maximum Train Speeds

The Federal Railroad Administration (FRA) categorizes train tracks into six classes, segregated by maximum speed limits.

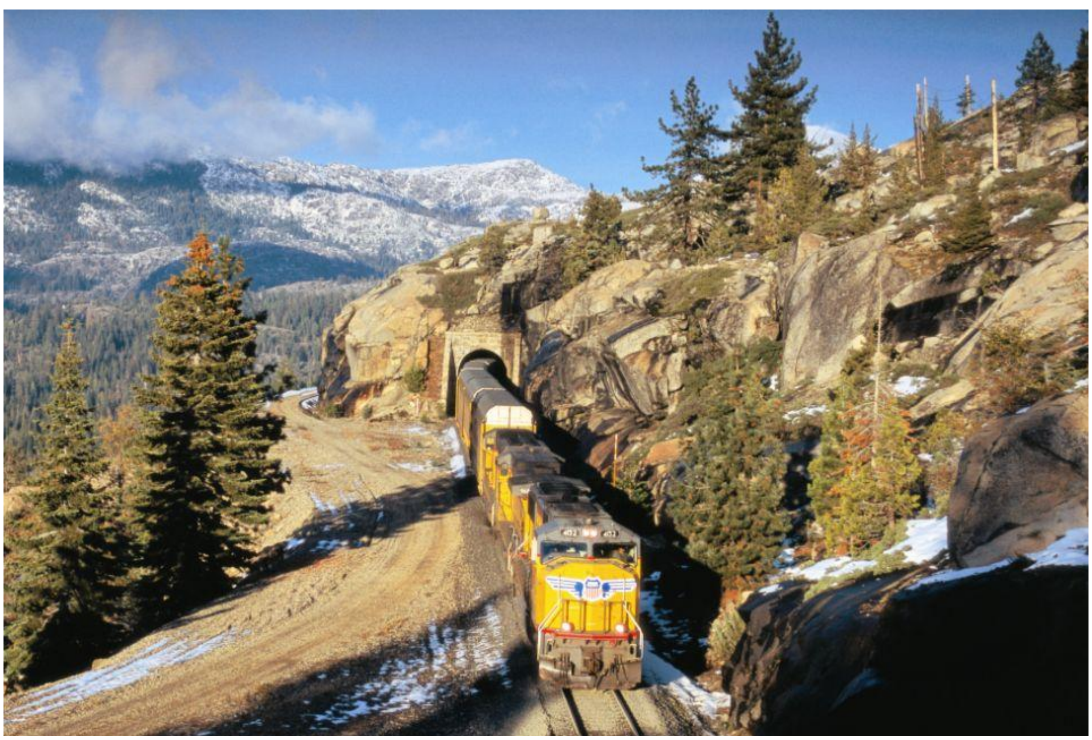
Class I	10 mph	38.5 Miles
Class 2	25 mph	380.2 Miles
Class 3	40 mph	794.8 Miles
Class 4	60 mph	1,086.1 Miles
Class 5	80 mph	1,167.2 Miles
Class 6	110 mph	None

Higher track speeds are linked with better system conditions and faster delivery times, typically equating to more efficient freight movement. Upgrading track and related facilities to allow higher travel speeds can be a cost-effective investment. Among the factors contributing to reduced speed are:

- Shared track with passenger train service
- Insufficient sidings
- Classification yard locations
- Heavy freight and/or vehicle traffic
- Steep terrain
- Curved rail geometry
- Tunnels
- Limited number of tracks
- Lighter track gauge and low tie/ballast strength

The CSRP identified the following subdivisions and associated lengths in each region that are restricted to speeds of 40 mph (Class 3) or lower.

FIGURE 49. UNION PACIFIC NEAR DONNER PASS



Source: Union Pacific

TABLE 18. CSRP RAIL SUBDIVISIONS RESTRICTED TO 40 MPH (CLASS 3) OR LOWER

	Subdivision	Length in Miles
Central Coast California Region	Ventura	29.4
	Santa Barbara	113.2
	Coast	126.1
Central Valley California Region	Bakersfield	2.3
	Part of Stockton	10.0
	Fresno	29.4
	Part of Sacramento	12.8
Northern California Region	Martinez	42.0
	Roseville	159.4
	Canyon	92.0
	Winnemucca	21.2
	Part of Sacramento	9.4
	Part of Stockton	12.4
	Niles Canyon	6.3
	Valley	54.7
	Oakland	47.6
	Gateway	87.5
	Tracy	53.6
	Black Butte	50.9
Southern California Region	Cajon	15.8
	Yuma	7.4
	San Bernardino	11.0
	Alameda Corridor	17.3
	Mojave – UP	70.1
	Mojave – BNSF	7.1
	Alhambra	4.0
	Los Angeles	5.5
	Cima	6.4
	San Diego	15.0
	Orange	16.8
	Authority Valley	38.5
	Olive	5.4
	San Gabriel	33.3

(Figures are for planning purposes only and not intended for use in navigation decision making.)

Truck Hours Of Delay

The longer freight sits in traffic, the higher the prices of the delayed products and services. As previously mentioned, efficiency diminishes as the number of trips per day per truck is reduced, and same-day vehicle turnaround use is lost. According to the 2013 *Caltrans Mobility Performance Report*, California vehicles were delayed a total of 95.7 million hours in 2010,[32] which equates to an opportunity cost (lost value in terms of salaries and wages) of $1.4 billion, or $3.9 million per day. The 2013 *Caltrans Executive Fact Booklet* reports that, in 2011, annual (automobile and truck) VHD at the 35 mph threshold dropped to 86.5 million, with the dramatic reduction was attributable to the recession. [As described within the truck travel speed measure, there is a discrepancy between what Caltrans considers as a delay threshold (35 mph) and FHWA (55 mph).]

Highway Bottlenecks/Chokepoints

Congestion can be caused by several factors, including the number and width of lanes; the location, spacing, and type of interchanges; shoulder widths; pavement conditions; gaps in the freeway system; vehicle volume; mixed-mode user conflicts; roadway geometry; merges or weaving at transition ramps; steep grades; traffic incidents; road work; special events; and weather. Bottlenecks and chokepoints are common causes of congestion. The following segments within California, identified by national rank, were included among the FHWA's top 250 US Freight Bottleneck locations. All are along the Primary Freight Network.

TABLE 19. FHWA TOP 250 US HIGHWAY FREIGHT BOTTLENECKS

Rank	Location
10	Los Angeles: SR 60 @ SR 57
33	Los Angeles: I-710 @ I-105
36	San Bernardino: I-10 @I-15
41	Oakland: I-80 @ I-580/I-880
57	Corona: I-15 @ SR 91
61	Oakland: I-880 @ I-238
77	Los Angeles: I-110 @ I-105
110	Los Angeles: SR 91 @ SR 55
116	Sacramento I-80 @ I-5
119	Los Angeles I-405 @ I-605
134	San Rafael: I-580 @ US 101
141	Sacramento: I-80 @ SR 51
143	Los Angeles: SR 134 @ SR 2
154	Sacramento: I-80 @ I-305
160	San Diego: I-5 @ SR 163

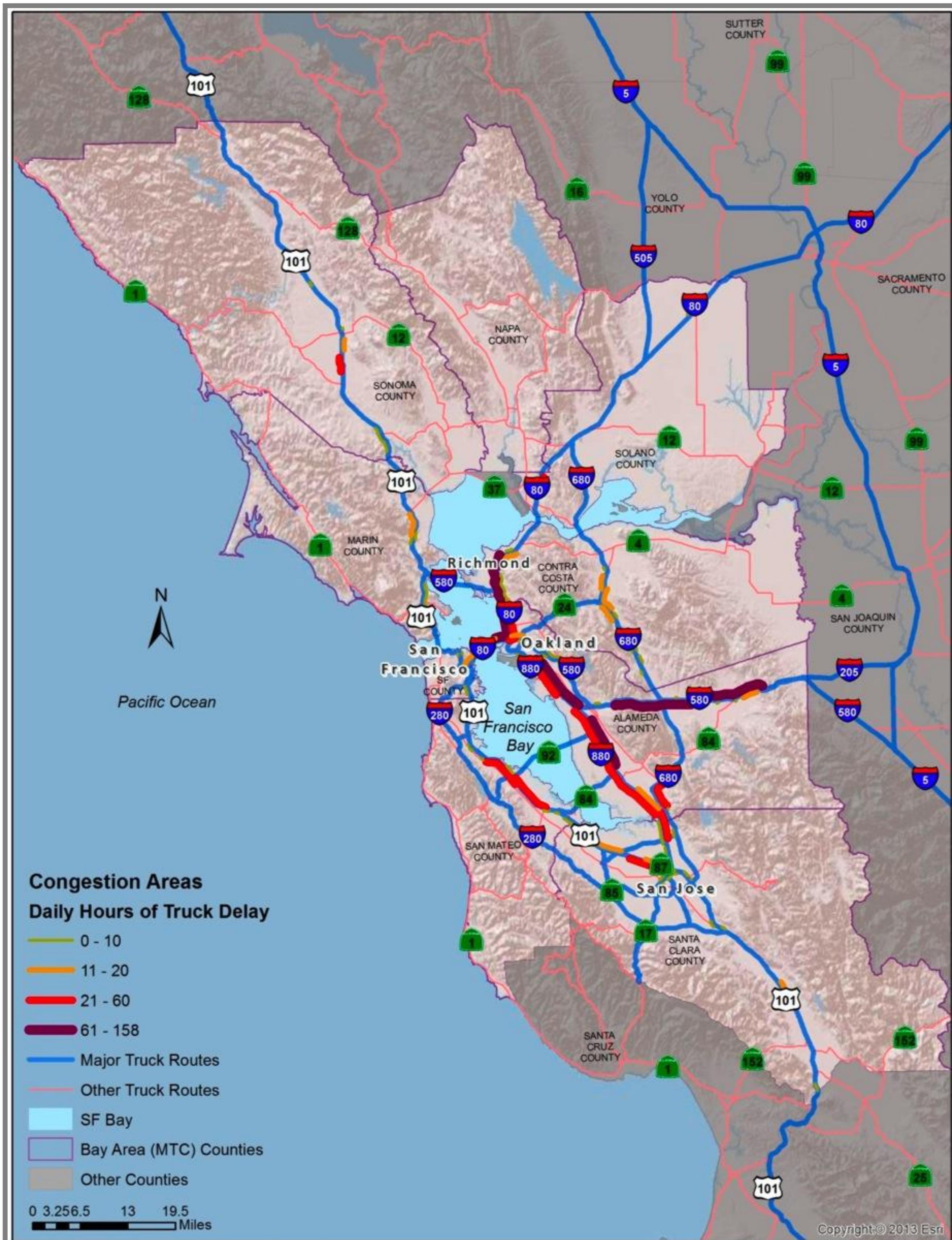
Other congested areas throughout the State have been identified in an assortment of state, regional and local plans, reports, and studies. These documents represent congestion in a variety of ways – by delay, level of service, volume, on a daily or peak-period basis, among others. Caltrans has installed automated vehicle detection devices that record vehicle classifications, travel speed, and vehicle volumes along many highway corridors. Data from these devices is used to create maps depicting bottlenecks and congestion points along the various roadway segments, information which assists in planning analysis and project identification. Shortfalls of this system include: theft of copper wiring and other system components, unreliable results due to a high rate of device failure, delays in data availability due to processing time, and disruptions in data collection due to roadway repair. Due to these limitations, some of the resulting maps do not accurately portray congestion. For example, traffic backups along the Mexican border in the San Diego region are not shown in current maps. In addition, bottlenecks along SR 99, one of the busiest goods movement corridors in the state, are not reflected. According to the 2013 *San Joaquin Valley Interregional Goods Movement Plan,* current congestion along this corridor will worsen, hindering efficient movement of goods to, from, and within the Valley. A more reliable and accurate method of collecting and presenting congestion is needed.

Figure 50 from the 2014 *San Francisco Bay Area Freight Mobility Study* identifies areas of heaviest congestion by direction and daily hours of truck delay. This is an example of how Caltrans may want to track and depict truck congestion in the future.

There are several remedies for congestion. Some of these include:

- Increasing capacity (passing lanes, intersection improvements, turn pockets, turnouts)
- Reducing demand
- Separating modes (rail grade crossing separations)
- Minimizing incident clearance times
- Preventing accidents (interchange/geometry improvements)
- Improving pavement quality
- Improving operations (integrated corridor management, ramp metering, signal timing)
- Encouraging use of alternative modes (rail, barge)
- Adding truck-only lanes or dedicated truck facilities

FIGURE 50. AVERAGE DAILY TOTAL TRUCK DELAYS IN THE BAY AREA



Source: San Francisco Bay Area Freight Mobility Study, March 2014, Prepared By Cambridge Systematics, Inc.

RAIL BOTTLENECKS/CHOKEPOINTS

As with reduced track speeds, rail bottlenecks and chokepoints are primarily caused by limitations in track capacity, class or structural strength, limitations in rail yard capacity, steep grades, track geometry, conflicts with passenger service, and double-stack height limitations. The 2013 CSRP identified the following main line and intermodal bottlenecks and chokepoints:

1. UPRR Mojave Subdivision, Kern Junction to Mojave (Tehachapi Trade Corridor)
2. BNSF San Bernardino Subdivision
3. BNSF Cajon Subdivision (Barstow to Keenbrook)
4. UPRR Sunset Route (Yuma Subdivision)
5. UPRR Alhambra and Los Angeles Subdivisions
6. UPRR Mojave Subdivision, Rancho to Keenbrook (Cajon Area)
7. San Diego and Arizona Eastern Railroad
8. Colton Crossing (previously intersecting UPRR and BNSF tracks now have grade separation through a Trade Corridor Improvement Fund project)
9. UPRR Martinez Subdivision (Oakland to Martinez)
10. UPRR Oakland Subdivision
11. BNSF Mainline Stockton to Bakersfield (San Joaquin Corridor)

CORRIDOR RELIABILITY BUFFER INDEX

Truck drivers may lose a competitive edge if shipments are late and need to consistently predict actual arrival times. Average travel time for a corridor does not directly translate into expected delays for individual trips along that corridor. By deriving a reliable, corridor-specific "buffer index" to calculate specific extra time to add to average travel time, the chances of arriving on time increase dramatically. This "buffer index" comes from the collection of travel time data on the heaviest traffic days and comparing those to average travel time. For example, if it usually takes 20 minutes for a trip, and the buffer index is 40 percent, an additional eight minutes (20 minutes x 0.4 = 8 minutes, or 28 minutes total) should be allowed for that stretch to ensure on-time arrival over 90 percent of the time.

Appendix B of the *Caltrans Mobility Performance Report 2010* (dated July 2013) discusses Corridor Travel Time Reliability along most of the Corridor Mobility Improvement Account (CMIA) freeway segments throughout the state (many of which are also on the PFN). The report considers travel time (the time required to travel from one end of a defined corridor to the other) an important measurement tool used to monitor corridor congestion. Travel time reliability refers to the consistency or dependability of travel times, measured day-to-day or across different times of day. The 2010 report analyzed travel time reliability day-to-day, across all weekdays in the calendar year.

The least reliable CMIA corridors in 2010, as measured by the buffer time index (BTI) during peak congestion, were:

1. Westbound I–80, Alameda County, BTI: 79 percent in the AM peak.
2. Westbound SR–22, Orange County, BTI: 75 percent in the AM peak.
3. Eastbound SR–91, Orange County, BTI: 74 percent in the PM peak.
4. Northbound SR–57, Orange County, BTI: 70 percent in the PM peak.
5. Southbound SR–57, Orange County, BTI: 67 percent in the PM peak.

SAFETY

Safety is important for the entire passenger and freight transportation system. Identifying incident trends can shed light on potential infrastructure and possible operational adjustments that Caltrans and other infrastructure owners/operators can make. In addition, improved technology can eliminate or reduce the severity of certain accidents. California's freight system is generally safe, but when collisions do occur, the consequences can be extreme because of the large mass of freight vehicles and their loads. For more detailed discussion of safety and security, please see Chapter 3.5.

INJURIES AND FATALITIES

Roadway Truck Collisions

In 2012, the California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS) reported that of the 2,758 total number of fatal traffic collisions for the year, 235 involved trucks, and the truck driver was at fault in only 75 of the incidents, indicating that in fatal collisions between cars and trucks, automobile drivers are far more likely to be a fault than truck drivers. Of the total number of 159,696 injury collisions in 2012, there were 5,092 involving trucks and 2,211 where the truck driver was at fault. Drivers in passenger cars alone or pulling trailers were at fault in 1,323 fatal and 97,223 injury collisions. Of the total 2,286 collisions in which truck drivers were at fault, 907 were due to unsafe speed and 751 due to unsafe lane changes or improper turning. A more relevant ratio of casualty/injury per truck usage would be based on the number of truck miles traveled on an annual basis; however, this information is not currently available.

Railroad Grade Crossing

According to the 2013 US DOT, FRA, *Railroad Safety Statistics Preliminary Annual Report*, California had 9,296 grade crossings in 2011. In 2012, there were 32 casualties and 126 nonfatal (injury) accidents at roadway-rail grade crossings. The report does not differentiate between the number of freight and passenger train incidents; however, it is recommended that freight numbers be separated. Railroad grade separations can completely eliminate this type of collision as well as providing many other measurable benefits for air quality and delay reduction.

Economic Competitiveness

Innovative Technology and Practices

Technology and innovation are keys to global leadership. Many opportunities exist to track the effectiveness of new technologies – the new zero- and near-zero-emission technologies, for example – especially those in the early stages of commercialization. To effectively monitor progress, coordination must be established between Caltrans and agencies that track innovative demonstration and deployment progress, such as the regional air districts, regional transportation commissions, the California Air Resources Board, and the California Energy Commission. The California Freight Advisory Committee provides opportunities to partner with many of these agencies. Where there is a lag in the implementation of new technologies in some sectors of the industry, extra effort can be made to address the shortfall. Measurement and tracking of freight travel speed, reliability, and turn time (trip) improvements before and after technology project implementation could help to bolster the case for further investment in such technologies. Chapter 3.6 presents current and projected ITS deployments (by public and private entities involved in freight operations) that will maximize and increase the safety and efficiency of California's freight transportation system.

Environmental Stewardship

Environmental stewardship broadly refers to taking responsibility for improving environmental quality and achieving sustainability goals.

California is a global leader in striving for environmental sustainability. Each freight mode has already significantly reduced air pollution emissions and other negative impacts as measured over decades. With the State's laws requiring less-polluting fuels, lower emitting vehicles and equipment, and cleaner operating procedures, the air Californians breathe is dramatically cleaner than it was prior to the implementation of the State's air and water pollution reduction programs. However, more work is needed. California still has among the most polluted air basins in the country (South Coast and San Joaquin Valley) and freight related emissions are significant contributors to that pollution, particularly diesel soot.

The following pollutants (typically products of fossil fuel combustion or industrial processes) are flagged by the EPA as "criteria pollutants," or pollutants that cause smog, acid rain, and other health hazards. These pollutants are tracked and serve as appropriate measures.

- Ozone (O3)
- Respirable particulate matter (PM10)
- Fine particulate matter (PM2.5)
- Carbon Monoxide (Co)
- Nitrogen Dioxide (No2)
- Sulfur Dioxide (So2)
- Lead

Some emission concentrations are measured in parts per million (ppm), others in parts per cubic meter (m^3). One part per million is equivalent to one drop of liquid in approximately 13 gallons. To protect the most sensitive individuals in our communities, California and US EPA establish ambient air quality standards (AAQS) for several pollutants that define clean air. AAQS defines the maximum amount of a pollutant that can be present in outdoor air without harm to public health. Emissions standards are more stringent in California.[33]

Assembly Bill (AB) 32 (2006, Nunez) the Global Warming Solutions Act, requires California to reduce greenhouse gases (GHG) that trap heat in the atmosphere to 1990 levels by 2020, and to continue reductions beyond 2020. For the longer term, Governor Brown committed California to emitting 80 percent fewer emissions than 1990 levels by 2050 and has established a parallel transportation target. State and federal GHG targets for the following gases also need to be met:

- Carbon Dioxide (Co2)
- Methane (Ch4)
- Nitrous Oxide (N2o)
- Fluorinated Gases [Including Sulfur Hexaflouride (Sf6), Nitrogen Triflouride (Nf3), Hydrocarbons (Hfc), And Perfluorocarbons (Pfc)]

According to ARB, transportation is the largest contributor to GHG emissions and is the primary source of smog formation and toxic air pollution in the State. Tailpipe emissions account for about 38 percent of the total inventory. Freight vehicles and equipment are responsible for approximately 10 percent of statewide total emissions, 70 percent of diesel particulate matter emissions, and 45 percent of nitrogen oxide emissions.

The largest emissions category within the transportation sector is "on-road", which consists of passenger vehicles (cars, motorcycles, and light-duty trucks), heavy-duty trucks, and buses. ARB annually inventories greenhouse gases in million "tonnes"[34] of CO_2 equivalent.

California is committed to achieving multi-pollutant emission reduction goals through a continuous process. This will begin with transitioning from the existing diesel-dependent freight system into one that operates with significant numbers of zero- and near-zero-emissions engines and alternative transportation fuels. California budgeting supports the transition to low-carbon transportation and provides incentives for pre-commercial demonstration of advanced freight technology to move cargo. Parallel support is also necessary for associated infrastructure in addition to implementation of logistical/efficiency improvements to reduce the emission impacts of moving freight. In short, the freight sector must become more efficient, reliable, clean, and low carbon. This transition will likely include widespread use of alternative transportation fuels, such as electricity, hydrogen, and renewable fuels.

Tracking and measurement are necessary to ensure reductions. There are currently 15 designated air basins in California that are designated for tracking ozone, nitrogen dioxide, PM10, sulfates, and visibility reducing particles. These geographic areas vary in size, depending on the pollutant, the location of emissions sources, meteorology, and topographic features. Counties (or portions of counties) are designated areas for tracking carbon monoxide, sulfur dioxide, lead, and hydrogen sulfide. Some counties span more than one air basin. Table 21 (page 135) represents the attainment status of criteria pollutants for all California counties and their associated air basins.[35]

As of 2013, all designated areas are in attainment (meet or are below required emissions levels) for nitrogen oxides (NO_x), sulfur dioxide (SO_2), and lead. For ozone (O_3), ten of the State's 58 counties have attained the standard and 40 are in nonattainment (the remaining are unclassified, nonattainment-transitional, or have a combined status). According to ARB, both the South Coast Air Basin and the San Joaquin Valley are considered extreme nonattainment for the national 2008 eight-hour ozone standard. In the fine particulate matter (PM2.5) category, 22 counties are in attainment and 17 in nonattainment (the remaining are unclassified or a combination). Only four counties are in attainment for respirable particulate matter (PM10) – all but a few are in nonattainment. In the carbon monoxide (CO) category, 32 counties are in attainment, and the remaining 26 are unclassified or straddle the two if within more than one air basin. For information, please visit ARB's Air Quality Designations page: Http://www.arb.ca.gov/desig/adm/adm.htm.

FIGURE 51. ENERGY FUELING OPTIONS

Source: Port of Long Beach

CONCLUSION

It is vital to track the condition and performance of the multimodal freight system across a wide range of attributes so that the effectiveness of investment goals and objectives can be documented. Such measurements ensure limited capital and operations resources are applied where they are most needed and confirm the value of those investments. With so many ambitious goals, it is necessary to know which approaches are working and to what extent they serve the intentions of their funding programs. As national freight performance measures are developed and implemented, California will implement and likely add to them so that the success of California's initiatives can be accurately tracked.

FIGURE 52. RAIL CONNECTOR TO ALAMEDA CORRIDOR, PORT OF LONG BEACH

Source: Port of Long Beach