CITY AND COUNTY OF SAN FRANCISCO
BOARD OF SUPERVISORS

BUDGET AND LEGISLATIVE ANALYST

1390 Market Street, Suite 1150, San Francisco, CA 94102
(415) 552-9292 FAX (415) 252-0461

POLICY ANALYSIS REPORT

To: Supervisor Wiener

From: Budget and Legislative Analyst's Office

Date: January 13, 2015

Re: California Fire Code Governing Street Width and Specifications for Fire Engines in San Francisco

SUMMARY OF REQUESTED ACTION

Pursuant to your request, the Budget and Legislative Analyst has analyzed the sections of the California Fire Code governing maximum allowable distance between a building and a fire apparatus access road, as well as the minimum allowable width of the access road itself. This report identifies the circumstances under which the local fire code official may approve exceptions to the Code requirements governing access road distance and width. It also describes the features of fire response vehicles that are more maneuverable and are used on smaller streets in cities nationwide. Lastly, it describes the vehicle replacement plan adopted by the Fire Commission in 2009, and the specifications used during the Department's most recent acquisition of fire engines and trucks.

EXECUTIVE SUMMARY

The San Francisco Fire Code requires that streets accessed by fire engines and fire trucks (fire apparatus access roads) have minimum widths of 20 feet, but this requirement can conflict with the City's policies to improve pedestrian safety

San Francisco must incorporate the minimum street width requirements set by the California Fire Code, which is not targeted to urban, dense and built-out cities such as San Francisco. Construction of pedestrian safety improvements, such as side walk widening or curb extensions, can result in streets with minimum widths of less than 20 feet. Under the Fire Code, the Fire Chief has the authority to prohibit such pedestrian safety improvements (termed "traffic calming" by the Code) if these improvements result in street widths of less than 20 feet.

The Board of Supervisors has adopted legislation to better reconcile the City's pedestrian safety improvement policies with the Fire Code's minimum street width requirements, including:

(1) A Fire Code provision that unobstructed sidewalks or medians of 6 inches or less in height count toward the 20-foot minimum;

(2) Establishment of a Street Design Review Committee, comprised of City officials including the Fire Chief, for the purpose of facilitating "the resolution, at a high administrative level, of policy conflicts and project-specific conflicts in the design and engineering phase of an individual (street) project"; and

(3) A resolution urging the California State Legislature to adopt legislation allocating local jurisdictions flexibility to amend local fire code street width standards in order to maximize pedestrian and bicyclist safety goals.

Many of the City's streets in older neighborhoods have widths of less than 20 feet. As a result, it is important that the Fire Department purchase emergency vehicles that are able to operate on streets that have less than 20 feet of clear width, as at least some of these streets will serve as the fire apparatus access road for buildings and residents.

The Fire Department lacks policies to design and purchase fire engines and trucks to accommodate traffic calming and pedestrian safety improvements or maneuver on the City's narrow streets

The Fire Department does not have a formal policy to consider traffic calming or pedestrian safety improvements when planning for the purchase of fire engines or fire trucks. The Department's Apparatus and Vehicle Replacement Plan does not address the issue, nor does the Apparatus and Vehicle Replacement Plan discuss vehicle design or features that could accommodate the City's narrower streets.

Other cities and towns across the United States also have small streets and sharp turns and have purchased specialized vehicles that can operate in these environments. The vehicles are not necessarily smaller than their counterparts, but are thoughtfully designed to incorporate features that improve their operability. Such features include rear-mounted pumpers on fire engines and the use of short-jacked ladders on fire trucks.

Rear-Mounted Pumpers[1]

While the Fire Department has incorporated some recommended size-reducing features into its newly purchased fire engines, the Department should consider incorporating additional features, such as pumpers in which the water pump and the pump operator panel are mounted at the rear rather than the side of the fire engine, thus reducing the fire engine width and wheel base and increasing maneuverability. Although the Department considers the rear-mounted pumper to be impractical, because the 1,200 feet of hose that are currently deployed from the back of the engine would have to be unloaded from the side of an engine with a rear-mounted pump, the Department has not tested a rear-mounted pumper on San Francisco streets.[2] The County of Orange,

[1] A fire engine is also referred to as a "pumper", and carries a water tank and hose allowing an initial attack on a fire pending connection to the fire hydrant or other water supply. In the rear mounted pumper, the water pump and the pump operator panel are at the rear of the engine.

[2] According to the Fire Department's Assistant Deputy Chief for Operations, the Fire Department purchased a rear engine rescue squad in 1996 that had drivability problems due to the weight distribution. A rescue squad engine differs from a pumper engine in that the rescue squad engine is designed to carry rescue equipment, such as ladders and jaws, and typically has a smaller water tank.

Florida purchased rear-mount pumper engines that deploy some length of hose from the rear rather than the side, partially addressing the concerns of the Department.

The Use of Short-Jacked Ladders on Aerial Trucks

The trucks that carry aerial ladders must be able to deploy jacks that extend from the truck and provide stabilization. Once the jacks of existing fire trucks are deployed, the width of the truck is 17'9" for existing trucks and 16' for the six recently-purchased trucks, so 20' of clear street width on the street should be enough space to fully deploy the jacks. If the street cannot accommodate the 16' to 17'9" ladder extension, the Department is able to employ a practice known as short-jacking, which means that it extends the jacks to half of their full width, or only extends jacks on one side of the truck.

According to the Fire Department's Assistant Deputy Chief for Operations, many truck manufacturers changed their designs so that the truck jacks cannot be short-jacked in an effort to prevent the trucks from tipping over when ladders over 100' are extended. However, certain types of trucks continue to have jacks that can be operated at shorter than their fully extended length. Aerial ladder trucks that use an H-style jack, which means that the stabilizer is attached to the outwardly extended arm at a 90-degree angle, can shorten the length of the arm if need be. The other main style of jack is known as the A-frame, which extends out from the truck at a 45 degree-angle down to the ground. This style is more difficult to short-jack. In its fleet, the Department has a mix of both H and A-frame style jacks.

Numerous manufacturers continue to produce aerial ladder trucks with H-style jacks, including Rosenbauer, Ferrara and Smeal. Ferrara produces 57' and 77' ladder trucks with two H-style jacks in the rear, and no jacks in the front. Longer ladder trucks produced by this company use four H-jacks.

Policy Consideration

In order to ensure that Fire Department vehicles are appropriate to the size of San Francisco streets, the Board of Supervisors should request the Department to (1) incorporate consideration of traffic calming or pedestrian safety improvements into the Department's Apparatus and Vehicle Replacement Plan; and (2) report on the availability of alternative vehicles that accommodate the City's traffic calming or pedestrian safety improvements, such as fire trucks that provide a tight turning radius, ladder trucks with H-frame stabilizers, or rear mounted pumpers (discussed above), as part of each appropriation request for new fire trucks or engines.

INTRODUCTION

Efforts are underway nationwide to reconcile the desire for smaller, interconnected, pedestrian and bike-friendly streets with the ability of emergency responders to operate and maneuver vehicles, such as fire trucks and ambulances. In 2007, the Congress for a New Urbanism (CNU), the U.S. Environmental Protection Agency, and fire marshals from across the United States, formed the Emergency Response and Street Design Initiative. One of the goals of the Initiative is to foster a dialogue about grid design, street width, traffic safety, and emergency vehicle response needs between city planners and fire officials.

Underlying the work of the Initiative is the shared value that life safety is important, and that efforts to reduce fatalities from fire and traffic accidents should both be prioritized. Research illustrates that grid designs with highly connected, narrower streets lead to fewer traffic fatalities and improved emergency response times; this is the typical street pattern in existing residential developments in San Francisco, as well as in newly developed projects. As demonstrated by the research of Peter Swift, a professional engineer in several states and contributor to the work of the Congress for a New Urbanism, street width is positively correlated with injuries from traffic accidents. In a report released in 1997 and later updated, Swift analyzed accident reports in the City of Longmont, Colorado, and examined the size and type of streets on which the accidents occurred. He found that increasing local residential street width, curb-to-curb, from 24 feet to 36 feet was associated with a 485% increase in injuries related to traffic accidents.[3]

The California Fire Code dictates requirements for fire apparatus access roads, including the width of the road. It grants the local fire code official the authority to decrease or increase the required width of an access road under a range of circumstances, including that a decrease in street width will improve safety generally. This report reviews the circumstances under which an exception to the Code might be made, as well as some of the features used on smaller and more maneuverable fire vehicles.

CALIFORNIA FIRE CODE GOVERNING FIRE APPARATUS ACCESS ROADS[4]

Regional and national fire codes were not common until the 1970s. In 2000, several non-profit organizations that previously published building and fire codes were merged to form the International Code Council (ICC). Since then, the ICC has published the International Fire Code which is revised triennially. The most recent edition of the Code was released in 2012, and adopted with modifications by the state of California in 2013. It will remain in effect until 2016. Forty-two states have adopted the International Fire Code, as well as the District of Columbia, Guam and Puerto Rico.

[3] Swift, Peter, Dan Painter and Matthew Goldstein. "Residential Street Typology and Injury Accident Frequency." Congress for a New Urbanism, 1997.

[4] This section is informed by the work of Patrick Siegman, a Principal with Nelson/Nygaard Consulting Associates.

Adoption of the San Francisco Fire Code

San Francisco repeals the existing Fire Code every three years and replaces it with the State and International Fire Code provisions. Chapter 5 of the International Fire Code outlines requirements for Fire Service Features, including fire apparatus access roads. While California did not adopt Chapter 5 of the International Fire Code, San Francisco's Fire Code, adopted by the Board of Supervisors in September 2013, states that the City and County adopted all 2012 International Fire Code provisions not adopted by the state. As a result, the City did adopt Chapter 5.

According to Chapter 5 of the adopted Code, fire apparatus access roads are defined as roads that provide apparatus access from a fire station to a facility, building or portion thereof. This is a general term inclusive of all other terms such as fire lane, public street, private street, parking lot lane, and access roadway.

Chapter 5 governs the allowable distance between a building and fire apparatus access road. It also specifies the required width of a fire apparatus access road. Generally, the Fire Code sets:

- The unobstructed width of fire apparatus access roads at no less than 20 feet; and
- The unobstructed vertical clearance at no less than 13 feet, 6 inches.

The Fire Code also gives the local fire official authority to:

- Determine the turning radius for fire apparatus; and
- Prohibit installation of traffic calming devices.

Relevant sections of Chapter 5 are in Appendix I to this report.

An analysis of the Fire Code underscores three key points.

First, the Code does not dictate a width requirement for every street in a jurisdiction.

It states instead that every facility or building, or a portion thereof, constructed or moved after the initial adoption of the Code, which took place in the 1970s, shall have a fire apparatus access road maintained in accordance with Code specifications. In other words, as long as one road serving a building meets the requirements of the Code, the law does not require other roadways serving the same building to also meet the requirements for an apparatus access road. Given that the front of most buildings in San Francisco faces only one street, the fronting street is usually the fire access road.

Second, section 503.4.1 of the Code prohibits traffic calming measures unless approved by the local fire official.

This code provision was newly added to the ICC fire code language during the 2012 revision. This provision grants the local code official the authority to reject proposed traffic calming devices, and requires that the code official weigh in on each calming measure as it is considered.

Third, the Fire Code grants the local fire official the authority to modify the distance between a building and a fire access road, as well as the width of a fire apparatus access road itself, under a range of circumstances outlined in the Code.

The local fire official can increase the distance between a building and a fire access road, or in other words, exempt a building from having direct access to a road that meets the specifications for a fire apparatus access road, if the building is equipped with an approved automatic sprinkler system, or if an apparatus access road cannot be installed due to any number of conditions, including location on property and topography, and an alternative means of protection is provided.

As for the width of the fire apparatus access road itself, Chapter 5 of the Code grants the local fire official the authority to require an increase in minimum access widths where the 20 feet of clear width is inadequate for fire and rescue operations.

In 2009, fire officials, including Carl Wren of the Emergency Prevention Division at the Austin Fire Department, testified before the International Code Council (ICC) in favor of modifying the code language to explicitly state that the fire official could also decrease the required width for a fire apparatus access road. Opponents of the change argued that the local fire official is already granted the authority to decrease the required width under several sections in Chapter 1 of the Fire Code, in the section entitled "Applicability." The relevant sections are listed in Appendix II to this report.

The Applicability Code sections describe circumstances where the Code does not apply, (buildings constructed prior to Code adoption), as well as cases where the Code may be optional (historic buildings), and where the fire official has flexibility (changes of use or occupancy). The final section, "Matters Not Provided For," provides broad authority to the fire code official to reduce the street width requirement if it can be said that doing so is essential for the public safety of an existing or proposed activity. Given the evidence that reducing street width and employing traffic calming devices lowers the number of traffic fatalities and injuries in the community, the local fire official could make an argument for a reduction in width on a fire apparatus access road.

Pedestrian Safety Improvements and Fire Apparatus Access Roads in the San Francisco Fire Code

The Board of Supervisors amended the Fire Code in June 2013 to specify that sidewalks and medians of six inches or less in height, and which did not contain utility poles, streetlights or other objects, do not constitute an obstruction of the fire access road (Ordinance No. 115-13). This provision was included in the new Fire Code in September 2013.

The ordinance amending the Fire Code found that "pedestrian safety and reduction of pedestrian fatalities at intersections and other legal crosswalk are important City policy objectives…..Installation of 'bulb outs' at intersections and crosswalks or medians, will enhance pedestrian safety". The ordinance further states that the "Board of Supervisors does not intend to amend the California Fire Code, reduce the powers of the fire code official, or compromise fire safety. This legislation intends only to interpret what

constitutes an obstruction of a fire apparatus access road under California Fire Code Section 503.4".

According to discussion in the June 3, 2013 Land Use and Economic Development Committee hearing on the Fire Code amendment, the legislation was intended to clarify that the minimum 20-foot road width includes unobstructed sidewalk and median extensions of no more than 6 inches in height.

The Committee hearing included a package of legislation intended to reconcile pedestrian safety improvements with fire apparatus access road requirements. Other legislation adopted by the Board of Supervisors included:

- An ordinance amending the Administrative Code to establish a Street Design Review Committee (Ordinance No. 115-13), consisting of City officials including the Fire Chief, to "facilitate the resolution at a high administrative level of policy conflicts and project-specific conflicts in the design and engineering phase of an individual (street) project";[5] and
- A resolution urging the California State Legislature to adopt legislation allocating local jurisdictions flexibility to amend local fire code street width standards in order to maximize pedestrian and bicyclist safety goals (Resolution No. 185-13). According to Supervisor Wiener in the June 3, 2013 Land Use and Economic Development Committee hearing, fire code provisions are not always targeted toward the needs of dense, urban environments. According to the resolution, the state fire code elevates the life safety concerns of those in buildings over those walking or riding on our public streets.

New San Francisco Developments are Not Governed by Appendix D of the International Fire Code

The Division of Planning and Research of the San Francisco Fire Department asserts that the San Francisco Fire Code requires a minimum unobstructed 26' wide fire access road for streets associated with new developments where the new buildings are greater than 30' in height from the lowest level of fire department vehicle access and are not fitted with sprinklers. These streets shall be located a minimum of 15' and a maximum of 30' from the buildings and shall be parallel to one entire side of the buildings.

These provisions, including the 26' unobstructed street width requirement, are included in Section 105 of Appendix D of the International Fire Code. Adherence to the 26' unobstructed street width requirement is not mandatory unless Appendix D itself is adopted by the jurisdiction in question. According to Judy Boiajian of the City Attorney's Office, San Francisco has not adopted Appendix D, and thus the Fire Department cannot assert that fire access streets in new developments must be 26' unobstructed wide.

[5] The Street Design Review Committee consists of the following officials or their designees: Mayor, Director of Public Works, Director of Transportation, Director of Planning, Public Utilities Commission General Manager, Director of Economic and Workforce Development, and Fire Chief.

Applying the Fire Code

Given that San Francisco has dozens of blocks of small, residential side streets that serve as the fire apparatus access road and have less than 20 feet of clear width, especially when parking is allowed on one side of the street, fire code officials have likely approved numerous construction and improvement projects since the 1970s that did not comply with the clear width requirement included in the Fire Code.

When a homeowner or property owner whose property is only accessible via one of San Francisco's existing slender streets engages in a project that reconstructs a portion of the building, then the project must have approval from building and fire code officials. As the road itself cannot be widened retroactively, the project must receive an exception from the street width requirement, or demonstrate that it has an approved automatic sprinkler system that permits it to be located more than 150 feet from a fire apparatus access road.

Examples of streets that fall into the category of having less than 20 feet of clear width and that likely serve as fire apparatus access roads include Laussat, Rose, Lily, Hickory, Linden, Ivy and Germania in the Lower Haight and Hayes Valley neighborhoods, Delmar and Downey in Haight-Ashbury, and Oakwood, Linda, Lapidge, Lexington, and San Carlos, in the Mission District, as well as countless others.

As for new developments, the Fire Department has asserted that the provisions of Appendix D apply, which is contrary to the conclusion drawn by the City Attorney.

EMERGENCY VEHICLE DESIGN FOR NARROW STREETS

As previously discussed, many San Francisco streets already have less than twenty feet of clear width, and many may only have between 10 and 14 feet of clear width, especially when taking into account size reductions due to parking, power poles, and other obstacles. Further, as the Fire Code grants broad authority to the local code official to approve street width reductions for bike lanes, curb extensions and other public safety measures that are deemed essential for the safety of an existing or proposed activity, it is likely that additional City streets may see reductions in their number of feet of clear width in the future.

As a result, it is important that the Fire Department purchase emergency vehicles that are able to operate on streets that have less than 20 feet of clear width, as at least some of these streets will serve as the fire apparatus access road for buildings and residents. As for the Department's existing fleet, it is necessary to conduct drills and field tests with current vehicles to determine whether the fleet can serve buildings on existing narrow streets.

The Fire Department's Apparatus and Vehicle Replacement Plan, adopted by the Fire Commission in 2009, does not address the size or maneuverability of fire engines and fire trucks, nor does it contain a policy on how these vehicles should be adapted to San Francisco's narrow streets.

Features of Maneuverable Vehicles

For a fire engine or truck to be considered maneuverable on San Francisco streets, it must be able to both quickly reach the scene of a fire, and then operate efficiently once it arrives. Other cities and towns across the United States also have small streets and sharp turns and have purchased specialized vehicles that can operate in these environments. The vehicles are not necessarily smaller than their counterparts, but are thoughtfully designed to incorporate features that improve their operability.

Features that improve the functioning of engines and trucks on smaller streets include:

- **A tight turning radius**. At the request of the Milwaukee, Wisconsin, Fire Department, Pierce Manufacturing developed fire trucks with greater cramp angles and better clearance between truck wheels and chassis, allowing for a tighter turning radius. Neil Lipski, former Deputy Fire Chief of the Milwaukee Fire Department, states that Pierce's TAK-4 Independent Suspension, which has a 45° cramp angle, delivers a substantially better turning radius than the Department's previous vehicles.
- **Rear-mount pumpers.** On rear-mount engine pumpers, water pumps and pump control panels are attached at the rear of the vehicle, making it substantially easier for firefighters to connect hoses when working in close quarters. In contrast, firefighters using an engine with side-mount pumps must have room to work beside the engine to connect the hoses. The hoses, which become less flexible when charged with water, must then have room to run from the pump to wherever the hose is being deployed. Rear-mount pumpers are often more maneuverable because the rear-mount design has a shorter wheelbase than a side-mount pumper of the same size, and can provide greater compartment space than an equal-size fire engine with a side-mount pump. The Anaheim Fire Department purchased two rear-mount pumpers in 2012 from Crimson Fire. The new engines are a few feet shorter than the old engines, while also having additional storage space and superior turning ability.
- **Roll-up doors for equipment compartments on vehicles.** Many departments nationwide have switched to trucks that have roll-up doors on all compartments. Older fire trucks are often equipped with swing-out doors, which require more room for the firefighters working around the vehicle.
- **Ground ladders that can be retrieved manually.** San Francisco fire engines already have ground ladders attached to the sides of fire engines where they can be easily retrieved manually. These ladders do not require the same amount of space needed for motorized ladder storage racks.
- **Stabilizers for aerial ladder trucks which can deploy in small spaces.** Ladder trucks with stabilizers that fully deploy in less than 15 feet of width, and that can be short jacked within a width of 9 feet, are preferable for fighting fires on small streets. Nantucket, Massachusetts, has purchased a Rosenbauer Aerial Raptor ladder truck that has a maximum spread of 14'9" when fully deployed, and

which occupies 8'10" of width when short jacked. This ladder truck is also designed to provide the maneuverability needed for the slender streets of Nantucket, and for the narrow streets of Europe, for which the Rosenbauer trucks were first designed.

SAN FRANCISCO VEHICLE REPLACEMENT PLAN AND SPECIFICATIONS FOR FIRE ENGINES AND TRUCKS

Vehicle Replacement Plan for the Fire Department

In 2009, the San Francisco Fire Commission revised the Apparatus and Vehicle Replacement Plan for the Fire Department. It determined that the Department needed the following mix of front-line and relief vehicles to meet its mission. According to the Fire Commission, vehicles that have reached the end of their useful life span for front-line service, which occurs at the ten-year old mark, may serve in a relief capacity until they are 15 years old and in good operating condition.

Exhibit 1: Front-Line and Relief Units Needed by the Fire Department to Meet Mission

Apparatus	Front-Line Units	Relief Units	Total Units Required
Truck	20*	8	27
Engine	44*	15	57
Ambulance	43	N/A	43
Heavy Rescue Vehicles	2	1	3
Field Command Vehicles	16	4	19
Headquarters Command Vehicles	19	4	23

*2 engines and 1 truck have been added to the front-line unit totals to account for the new Stations 51 and 4, which have opened since the 2009 resolution passed.
Source: San Francisco Fire Commission

Given that fewer than the recommended number of vehicles were purchased between 2007 and 2009, and in order to mitigate the fiscal impact of an accelerated purchasing plan, the Fire Commission recommended that additional vehicles be purchased over a three-year period as outlined in the chart below to ensure that the Department had a reliable mix of front-line and relief units in its fleet.

Exhibit 2: Recommended Vehicle Purchasing Plan, FY 2010-2013

Apparatus	2010-11	2011-12	2012-13
Truck	6	6	4
Engine	10	10	7
Ambulance	5	5	5
Field Command Vehicles	2	4	4
Headquarters Command Vehicles	5	5	5

Source: San Francisco Fire Commission

The current vehicle fleet mix for the Department is shown in Exhibit 3 below. According to the Department's Assistant Deputy Chief for Operations, the Department continues to utilize vehicles that are ten years and older as front-line vehicles. Similarly, the Department operates some relief vehicles that have been in service for longer than 15 years.

Exhibit 3: Current San Francisco Fire Department Vehicle Fleet

Apparatus	Front-Line Units	Front-Line Units >10 yrs old	Relief Units	Relief Units >15 yrs old	Total Units in Fleet (as of May, 2014)	Total Units Required	Units Required Less Units in Fleet	Units Operating within Useful Life Span**, as defined by the Fire Commission
Truck	20*	16	4	4	24	28*	4	4
Engine	44*	28	10	10	54	59*	5	16
Ambulance	43	23	N/A	N/A	43	43	0	20
Heavy Rescue Vehicles	2	2	1	0	3	3	0	1
Field Command Vehicles (5 yrs front line, 5 yrs relief)	16	7	4	4	20	20	0	9
Headquarters Command Vehicles (5 yrs front line, 5 yrs relief)	10	8	1	1	11	23	12	2

*2 engines and 1 truck have been added to the front-line unit totals to account for the new Stations 51 and 4, which have opened since the 2009 resolution passed.

**As defined by the Fire Commission, the useful life span for front-line vehicles is 0-10 years old. The useful life span for relief vehicles is 11-15 years old.

The Fire Department ordered ten fire engines in February of 2013 at a cost of $492,947 per unit or $4,929,700 for ten units. These engines were purchased under an agreement between the Department and Crimson Fire, Inc., which began in September 2009 and was extended in September 2012.

The Fire Department ordered six fire trucks in January of 2014 at a cost $858,845 per unit, or $5,153,070 for six units. These trucks were purchased under an agreement between the Department and Crimson Fire, Inc., effective from November 2013 through October 2016.

These new vehicles are not included in Exhibit 3 above as they have not yet been put into service. According to the Fire Department's Finance Director, the first batch of fire engines from this order has been received, but the remainder of the engines and all of the trucks are still under construction. Under the two-year budget, FY 2013-14 and FY 2014-15, approved last year, the Department was allocated funds for two additional fire

engines to be purchased in FY 2014-15. However, those funds were reallocated to finance the purchase of a new fire boat that was approved by the Board of Supervisors in May of 2014. The FY 2015-16 budget includes $1,010,578 to purchase two additional fire engines.

The Department's 2010 Administrative Bulletin specifies engine and truck height, width, and weight, as shown in the exhibit below.

Exhibit 4: 2010 Administrative Bulletin Engine and Truck Specifications

	ENGINES	TRUCKS
Outside Tire Extremity	8'2"	8'3"
Vehicle width (with mirrors)	10'4"	10'1"
Truck width with one jack extended	n/a	12'9"
Truck width with two jacks extended	n/a	17'9"
Vehicle height	11'	12'
Length of vehicle	30'	57'
Gross vehicle weight	40,400 lbs	70,000 lbs
Street grades maximum	26% maximum	26% maximum
Approach and departure	15% maximum	15% maximum
Truck aerial operations	n/a	14% maximum

Source: San Francisco Fire Department 2010 Administrative Bulletin

The Department is in the process of revising the Administrative Bulletin section containing vehicle specifications.

Changes in Fire Engine and Truck Size over Time

The Fire Department does not have "as built" records on the size specifications for engines and trucks, and therefore, cannot show how vehicle length, width and height have changed over time. All purchased vehicles are accepted through the Department of Administrative Services' Central Shops and inspected to make sure that they meet the Fire Department's required specifications in the Request for Proposals (RFP) documents. According to the Assistant Deputy Chief, the size of the Department's trucks and engines has remained relatively constant over the past few decades, although sizes vary depending on the manufacturer. He states that the small increases in vehicle width that have occurred are due to tightened emission standards and the need to include additional engine components.

The exhibit below compares the specifications for:

(1) Engines in the RFP issued by the Department in March 2005 to the most recent engine purchase in 2013; and

(2) Trucks in the RFP issued by the Department in May 2008 to the most recent purchase in 2014.

As shown in the exhibit below, the total width of engines has remained constant at 10'2" from 2005 to 2013 while the total width of trucks has increased by 2" from 10'2" in 2008 to 10'4' in 2014. The width of trucks with two jacks extended has decreased by 1'9", from 17'9" in 2008 to 16' in 2014.

Exhibit 5: Changes in Pumper Engine and Aerial Ladder Truck Specifications

	Pumper Engine		Aerial Ladder Truck	
Specification	**2005**	**2013**	**2008**	**2014**
Cab body width	8'	8'2"	8'	8'3"
Vehicle width (with mirrors)	10'2"	10'2"	10'2"	10'4"
Vehicle height	10'	11'	11'3"	12'
Length of vehicle	28'8"	29'2"	57'4"	57'
Gross vehicle weight	40,400 lbs	40,400 lbs	70,000 lbs	67,000 lbs
Street grades maximum	22%	26% maximum	22%	26% maximum
Angle of Approach	14-15 degrees minimum	15% maximum	15% minimum	15% maximum
Angle of Departure	13 to 14 degrees minimum	15% maximum	15 degrees minimum	15% maximum
Truck aerial operations	n/a	n/a	*	14% maximum
Truck width with two jacks extended	n/a	n/a	17'9"	16'

Source: San Francisco Fire Department 2005 and 2008 RFPs and current contracts with Crimson Fire, Inc.

*RFP specifications for this measurement were not available.

The Department does have three fire engines out of 54 total that are 2-3" narrower and 2' shorter than the other engines, and that are used in the hillier areas of the City. These vehicles were purchased eleven years ago from Ferrara Fire Apparatus, Inc., and have a smaller cab area than the other engines. As stated in a letter from Ferrara, these engines are no longer made due to their inability to pass updated smog laws.

The Department asserts that it can service buildings on all of the City's streets, including the narrowest streets that may only have 10-13' of clear width. In the case of narrow streets like Bright Street, for example, it may only be possible to maneuver one engine onto the street, thus requiring that equipment from additional vehicles be carried onto the street from adjoining streets.

The Use of Rear-Pumper Engines in San Francisco

The Department has incorporated some of the recommended size-reducing features into its newly purchased fire engines. The engine RFP specifications, for example, require that roll-up doors be used for side body compartments, and that efforts be made to keep the turning radius of the engine as short as possible, with no more than a 27' curb-to-curb maximum radius.

As for the use of rear pumpers on engines, which are used elsewhere and are believed to save space at the scene of the fire as well has reducing the wheel base and improving maneuverability, the Assistant Deputy Chief believes that this configuration would be difficult on San Francisco's narrow streets. The Department's engines currently carry 1,200 feet of hose that is deployed from the back of the vehicle. The hose is unloaded from the rear of the truck, and would have to be unloaded from the side if the pumper were in the rear. While the Assistant Deputy Chief states that offloading the hose from the side of the truck would be infeasible due to the narrow width of many streets, the rear pumper arrangement has not actually been tested on San Francisco city streets.

The Assistant Deputy Chief also states that placement of the pumper in the rear of the truck would shift the weight distribution of the vehicle. The placement of the pumper in the middle of the engine ensures that the weight is centrally distributed, while a rear placement would make the vehicle heavier at the back, potentially hindering movement throughout the City's hilly and narrow topography. According to the Assistant Deputy Chief, the Fire Department did purchase a rear engine rescue squad[6] made by Spartan in 1996, which was removed from service in 2000 because it had several drivability and maintenance access problems due to the weight distribution.

As stated previously, Anaheim, California, purchased two rear-mount pumper engines from Crimson Fire in 2012. Each engine without additional equipment cost $527,000. The engines are 29'8" long and stand 9'5" high; these measurements are slightly smaller than the pumper engine specifications issued by the San Francisco Fire Department in its 2014 RFP. By moving the pump from the middle of the engine to the rear, Crimson was able to add two additional equipment compartments to the vehicle.

The majority of the large fire truck manufacturers including E-ONE, Pierce, KME, Rosenbauer, and Ferrara, all produce a rear-mount pumper engine. The County of Orange, Florida, purchased a rear-mount pumper from E-ONE that appears to contain at least some hose storage space at the back of the truck, which would address the Assistant Deputy Chief's concern about the need to unload the hose on the side of the engine. Exhibit 6 includes a picture of that particular engine and its hose storage space.

[6] A rescue squad engine differs from a pumper engine in that the rescue squad engine is designed to carry rescue equipment, such as ladders and jaws, and typically has a smaller water tank.

Exhibit 6: Rear-Mount Pumper Engine Produced by E-ONE for the County of Orange, Florida

Source: E-ONE

The Use of Short-Jacked Ladders on Aerial Trucks

The trucks that carry aerial ladders must be able to deploy jacks that extend from the truck and provide stabilization. Once the jacks of existing fire trucks are deployed, the width of the truck is 17'9" for existing trucks and 16' for the six recently-purchased trucks, so 20' of clear street width on the street should be enough space to fully deploy the jacks. According to the Assistant Deputy Chief, it is not ideal for the jacks to rest on the sidewalk, even if they are able to reach it, because the sidewalks are often not engineered to handle the weight of the jacks and may not provide a stable surface. The Department is able to employ a practice known as short-jacking, which means that it extends the jacks to half of their full width, or only extends jacks on one side of the truck.

The Department utilizes the short-jacking practice only in cases where it is impossible to fully extend the truck jacks. According to the Assistant Deputy Chief, many truck manufacturers changed their designs so that the truck jacks cannot be short-jacked in an effort to prevent the trucks from tipping over when ladders over 100' are extended.

That said, certain types of trucks continue to have jacks that can be operated at shorter than their fully extended length. Aerial ladder trucks that use an H-style jack, which means that the stabilizer is attached to the outwardly extended arm at a 90-degree angle, can shorten the length of the arm if need be. The other main style of jack is known as the A-frame, which extends out from the truck at a 45 degree-angle down to the ground. This style is more difficult to short-jack. In its fleet, the Department has a mix of both H and A frame style jacks.

Numerous manufacturers continue to produce aerial ladder trucks with H-style jacks, including Rosenbauer, Ferrara and Smeal. Ferrara produces 57' and 77' ladder trucks with two H-style jacks in the rear, and no jacks in the front. Longer ladder trucks produced by this company use four H-jacks.

The Process for Reviewing Traffic Calming Measures

The Fire Department does not have a formal policy to consider traffic calming or pedestrian safety improvements when planning for the purchase of fire engines or fire trucks. The Department's Apparatus and Vehicle Replacement Plan does not address the issue. According to the presentation by the Fire Department representative to the June 3, 2013, Land Use and Economic Development Committee meeting, the Department's "biggest concern is the operational needs of the Department". They "have difficulty bridging the gap of what provides the best pedestrian safety and what allows for operational needs and does not limit Fire Department vehicle access."

While the Fire Code gives the Fire Chief the authority to prohibit traffic calming and pedestrian safety improvements, the Fire Department and Fire Commission do not have an official policy about traffic calming measures. The Department aims to review each traffic calming measure, including bike lanes and bulb outs (curb extensions), that is proposed to determine whether it will inhibit engine and truck operability on a particular fire access road.

Proposals for traffic calming measures are submitted to the Transportation Advisory Staff Committee of the San Francisco Municipal Transportation Agency (SFMTA); the Fire Department is a member of the committee. If the proposal requires Fire Department review, the Bureau of Fire Prevention examines the proposal for any Fire Code impacts, and involves other staff from the Department as needed. Then the plan is marked either "opposed" or "not opposed." Plan review might involve setting up cones at a particular intersection and testing whether a truck or engine is still able to pass through quickly, or deploy fire equipment.

Also, as noted above, the Board of Supervisors amended the Administrative Code to create the Street Design Advisory Committee, of which the Fire Chief is a representative.

CONCLUSION

The Fire Code adopted by the Board of Supervisors in 2013, based on the State's Fire Code, sets minimum street widths to allow fire engine and fire truck access, but these minimum widths can conflict with the City's policies to improve pedestrian safety. The Board of Supervisors has taken actions to better reconcile Fire Code requirements with the City's pedestrian safety polices.

The Fire Department should do more to align its priorities for fire apparatus access and fire safety with the City's goals for pedestrian safety. The Department's Apparatus and Vehicle Replacement Plan, which sets the criteria for purchasing fire engines and fire trucks, does not address how street and sidewalk features to increase pedestrian safety, such as sidewalk bulb outs, can be accommodated by fire apparatus. Alternative fire apparatus designs are available that may allow more flexibility in minimum street width requirements.

Policy Consideration

In order to ensure that Fire Department vehicles are appropriate to the size of San Francisco streets, the Board of Supervisors should request the Department to (1) incorporate consideration of traffic calming or pedestrian safety improvements into the Department's Apparatus and Vehicle Replacement Plan; and (2) report on the availability of alternative vehicles that accommodate the City's traffic calming or pedestrian safety improvements, such as fire trucks that provide a tight turning radius, ladder trucks with H-frame stabilizers, or rear mounted pumpers (discussed above), as part of each appropriation request for new fire trucks or engines.

Appendix I
California Fire Code, Chapter 5, Section 503

503.1 Where required. Fire apparatus access roads shall be provided and maintained in accordance with Sections 503.1.1 through 503.1.3.

503.1.1 Buildings and facilities. Approved fire apparatus access roads shall be provided for every facility, building or portion of a building hereafter constructed or moved into or within the jurisdiction. The fire apparatus access road shall comply with the requirements of this section and shall extend to within 150 feet of all portions of the facility and all portions of the exterior walls of the first story of the building as measured by an approved route around the exterior of the building or facility.

Exception: The fire code official is authorized to increase the dimension of 150 feet where:

1) The building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.
2) Fire apparatus access roads cannot be installed because of location on property, topography, waterways, nonnegotiable grades or other similar conditions, and an approved alternative means of fire protection is provided.
3) There are not more than two Group R-3 or Group U occupancies.

503.1.2 Additional access. The fire code official is authorized to require more than one fire apparatus access road based on the potential for impairment of a single road by vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

503.2 Specifications. Fire apparatus access roads shall be installed and arranged in accordance with Sections 503.2.1 through 503.2.8.

(a) Roads. Required access roads from every building to a public street shall be all-weather, hard-surfaced (suitable for use by fire apparatus) right-of-way not less than 20 feet in width. Such right-of-way shall be unobstructed and maintained only as access to the public street.

Exception: The enforcing agency may waive or modify this requirement if in his opinion such all-weather hard-surfaced condition is not necessary in the interest of public safety and welfare.

503.2.1 Dimensions. Fire apparatus access roads shall have an unobstructed width of not less than 20 feet, exclusive of shoulders, except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than 13 feet 6 inches.

503.2.2 Authority. The fire code shall have the authority to require an increase in the minimum access widths where they are inadequate for fire or rescue operations.

503.2.5 Dead Ends. Dead-end fire apparatus access roads in excess of 150 feet (45 720 mm) in length shall be provided with an approved area for turning around fire apparatus. **503.4 Obstruction of fire apparatus access roads.** Fire apparatus access roads shall not be obstructed in any manner, including the

parking of vehicles. The minimum widths and clearances established in Section 503.2.1 shall be maintained at all times.

503.4.2 Turning radius. The required turning radius of a fire apparatus access road shall be determined by the fire code official.

503.4.1 Traffic calming devices. Traffic calming devices shall be prohibited unless approved by the fire code official.

Appendix II
California Fire Code, Chapter 1, Section 102

102.1 Construction and design provisions. The construction and design provisions of this code shall apply to:

1) Structures, facilities, and conditions arising after the adoption of this code.

2) Existing structures, facilities, and conditions not legally in existence at the time of adoption of this code.

3) Existing structures, facilities and conditions when required in Chapter 11.

4) Existing structures, facilities and conditions which, in the opinion of the fire code official, constitute a distinct hazard to life or property.

102.3 Change of use or occupancy. ...Subject to the approval of the fire code official, the use or occupancy of an existing structure shall be allowed to be changed and the structure is allowed to be occupied for purposes in other groups without conforming to all the requirements of this code and the California Building Code for those groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

102.5 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or moving of buildings or structures shall not be mandatory for existing buildings or structures identified and classified by the state or local jurisdiction as historic buildings when such buildings or structures do not constitute a distinct hazard to life or property. Fire protection in designated historic buildings and structures shall be provided in accordance with an approved fire protection plan.

102.8 Matters not provided for. Requirements that are essential for the public safety of an existing or proposed activity, building or structure, or for the safety of the occupants thereof, which are not specifically provided for by this code shall be determined by the fire code official.