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RESOLUTION NO. 2016-65

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF FREMONT MAKING EXPRESS FINDINGS THAT MODIFICATIONS TO THE 2016 CALIFORNIA BUILDING STANDARDS CODE ARE REASONABLY NECESSARY DUE TO LOCAL CONDITIONS

WHEREAS, on October 11, 2016, the City Council introduced Ordinances XX-2016 and XX-2016 adopting and amending the 2016 California Building Standards Code; and

WHEREAS, California Health and Safety Code Sections 17958, 17958.5, 17958.7, and 18941.5 authorize the City to modify the building standards contained in the California Building Standards Code and other regulations adopted under Health and Safety Code Section 17922 if found by the City Council to be reasonably necessary because of local climatic, geologic, or topographic conditions; and

WHEREAS, the City Council has considered and reviewed the October 11, 2016 staff report discussing the proposed amendments to the 2016 California Building Standards Code, the presentations by staff, the proposed ordinances the November 1, 2016 staff report, and the proposed findings and has held public hearings to receive input from the community on November 1, 2016.

NOW THEREFORE, THE CITY COUNCIL OF THE CITY OF FREMONT HEREBY RESOLVES AS FOLLOWS:

SECTION 1. Reasonably Necessary Amendments Due to Local Conditions.

(a) The proposed amendments to the 2016 California Building Standards Code are found to be reasonably necessary because of local climatic, geological or topographical conditions.

(b) The City Council finds that the conditions listed in Attachment 1 attached hereto and incorporated herein are, in fact, local climatic, geological and topographical conditions.

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(c) The conditions listed in Attachment 1 make the amendments to the 2016 California Building Standards Code described in Attachment 1 and contained in the ordinances referenced above reasonably necessary for the reasons stated in Attachment 1 and in the October 11, 2016 and November 1, 2016 staff reports.

ADOPTED November 1, 2016 by the City Council of the City of Fremont by the following vote:

AYES:	Mayor Harrison; Vice Mayor Mei; Councilmembers Chan, Bacon and Jones
NOES:	None
ABSENT:	None
ABSTAIN:	None

Bill Harrison
Mayor

ATTEST:

City Clerk

APPROVED AS TO FORM:

Deputy City Attorney

ATTACHMENT 1

FINDINGS

CITY OF FREMONT MODIFICATIONS TO THE 2016 CALIFORNIA BUILDING STANDARDS CODE DETERMINED TO BE REASONABLY NECESSARY BECAUSE OF LOCAL CONDITIONS

INTRODUCTION

City of Fremont Ordinances XX-2016 and XX-2016 contain amendments, deletions and additions to the building standards contained in the 2016 California Building Code, 2016 Mechanical Code, 2016 Electrical Code, 2016 Plumbing Code, 2016 Residential Code and the 2016 California Fire Code. These modifications are reasonably necessary because of the climatic, geologic, and topographic conditions found in the City of Fremont. In accordance with Health and Safety Code Sections 17958, 17958.5, 17958.7, and 18941.5, this document describes the climatic, geologic, and topographic conditions found in the City of Fremont and the specific modifications and the local conditions determined by the City of Fremont to make each modification to the building standards codes reasonably necessary.

PART I: LOCAL CONDITIONS

A. Profile of the City of Fremont

The City of Fremont encompasses an area of roughly 90 square miles, with a resident population of approximately 220,000 people. The physical location of the City is in the southern portion of Alameda County, with the City of Union City to the north, City of Newark to the west, City of San Jose and City of Milpitas to the south and the unincorporated areas of Alameda County to the east.

The City of Fremont has a large supply of diverse and high quality housing units, and a wide range of industries including a variety of high technology, alternative energy, and life science firms, a vehicle assembly plant, warehousing and distribution businesses, and a city center with several million square feet of office, retail, and medical facilities.

The balance of developed and undeveloped open lands has been a goal of the City of Fremont and is reflected in the steep forested ridges and foothills to the northeast, bay lands to the west, and some vast open spaces including: Central Park, Quarry Lakes, Coyote Hills, Vargas Plateau, Mission Peak and Ardenwood Forrest regional parks and the Don Edwards National Wildlife Refuge which are scattered throughout the City.

Winding through the City of Fremont are two major interstate highways; Interstate 880, known as the Nimitz Freeway, and Interstate 680, known as the Sinclair Freeway as well as State Routes 84, 38 and 262. The Union Pacific and Bay Area Rapid Transit railroad tracks also wind through the City of Fremont.

B. Local Conditions Create Potential for Major Fires and Earthquakes

The climatic, geologic, and topographic conditions found in the City of Fremont create a heightened risk of large loss fires and damaging earthquakes, making changes and modifications to the 2016 California Building Code, 2016 Mechanical Code, 2016 Electrical Code, 2016 Plumbing Code, 2016 Residential Building Code, 2016 California Existing Building Code, 2016 California Energy Code, 2016 California Green Building Standards and the 2016 California Fire Code reasonably necessary in order to provide a reasonable degree of fire and life safety in this community. These conditions are discussed in detail below.

1. Climatic conditions

a. *Precipitation.* The weather patterns within the City of Fremont are moderately affected by the Pacific Ocean and the San Francisco Bay, which extends the seasonal growing patterns of the vegetation. The normal annual precipitation ranges from eight to thirty inches (8" to 30") per year with an average of approximately fifteen inches (15") per year. Ninety percent (90%) falls during the months of November through April, and ten percent (10%) from May through October. The City of Fremont has experienced a major drought in the past and it is likely the pattern will continue in the future. Drought conditions create more frequent and larger fire incidents, especially wild fire events in the hill areas of the City.

b. *Relative Humidity.* Humidity generally ranges from 60% during daytime to 80% at night. Humidity can frequently drop to 40% during the summer months and occasionally drops lower.

c. *Fog.* Radiation fog from the Central Valley enters the Bay Area through the Carquinez Strait during wintertime offshore flow. It can also spill into the Fremont area over the Sunol Pass from the Livermore Valley. Dense fog can develop overnight when these conditions include a moist lower layer (i.e. following recent rain), clear skies and calm winds. Dense fog is not very common, but can have a great impact upon transportation because of reduced visibility.

d. *Temperatures.* Temperatures have been recorded as high as 109°F. Average summer highs are in the 80°F range.

e. *Winds.* Prevailing winds are from the west or northwest. However, winds are experienced from virtually every direction at one time or another. Velocities are generally in the 8 mph to 10 mph range, gusting to 25 to 35 mph, particularly during the summer months. Extreme winds, up to 85 mph, have been known to occur.

Analysis. These local climatic conditions affect the acceleration, intensity, and size of fires in the community. The dry winds result in increased demand for emergency response by the Fire Department by drying the fuel load and increasing the risk of ignition, and by spreading fire more rapidly and across a broader area. The winds can have a tremendous impact upon wildland fires, wood shake and shingle roof fires and fires involving the interiors of buildings. In building fires, winds can force fires back into the building and create a blow torch effect, while preventing "natural" ventilation and cross-ventilation efforts. In developed areas of the City, fires can occur in buildings, rubbish, vehicles, and vegetation on vacant lots. In undeveloped and hillside areas of the City, there is a risk of large vegetation fires. Times of little

or no rainfall, combined with low humidity and high temperatures, create extremely hazardous conditions, particularly as they relate to wood shake and shingle roof fires and conflagrations. If a fire occurs, local dry conditions combined with high winds create the risk of potential fire storms. At other times, reduced visibility and traffic accidents due to dense fog can increase demand on emergency services and increase emergency response time.

In addition, local residential development has been occurring in hillside areas adjacent to the historically designated hazardous fire area. These developments increase the chance of wild fire, while simultaneously being located further from fire stations, delaying critical response times.

2. Geological or topographical conditions

a. *Seismic Hazard.* A table from a 1998 Association of Bay Area Governments publication shows that the southern section of the Hayward Fault is slipping at a rate of 9 mm/year and is capable of generating an earthquake with a moment magnitude of 7.0. As of September 1998, the southern section of the Hayward Fault was identified as having a 23% possibility of generating a major earthquake in the next 30 years.[1] Fremont is a narrow and long city. The Hayward Fault traverses the City in a longitudinal direction; consequently, most sites in the City will be subject to a near-fault effect, and can expect significant damage or collapse of buildings. Secondary impacts could include ruptured gas lines, collapsed power lines, and breaks in the water distribution system.

The proximity of the northern segment of the Hayward Fault must also be taken into consideration. The northern segment has been estimated to be capable of generating a magnitude 7.1 earthquake with a 28% possibility of an occurrence in the next 30 years. Due to proximity and directivity effects[2] and shaking amplification,[3] a major earthquake on the northern segment of the Hayward Fault can be anticipated to cause substantial damage in Fremont.

The combined probability of damage to buildings in the City of Fremont as a result of an earthquake along either segment of the Hayward Fault stands above 28% in the next 30 years.

b. *Soil Conditions.* Surface soils in Fremont vary from bay mud (very expansive) to alluvial fan material (moderately to highly expansive). Expansive soils swell and shrink with variations in moisture content resulting in (1) differential "settlement" of structures, and (2) variations in surface storm water runoff. In addition, soft soil in combination with the presence of a high water table can cause liquefaction in some sites in the event of major earthquake shaking. Structures built on soils prone to liquefaction have a greater probability of severe damage in an earthquake than buildings on other soil types.

Landslides and mudslides have been experienced within the City of Fremont, along Interstate 680 south of Curtner Road, in Niles Canyon and on the westerly slopes of Mission Peak, Mt. Allison and Monument Peak. When slopes fail and landslides occur in the developed areas, creeks and streams below the slide area become dammed with slide debris, which results in flooding. Additionally, landslides often block access roads in the hill area due to slope failure. This has occurred in the past on major single access roads in the City such as Morrison Canyon

Road, Mill Creek Road, Interstate 680, Niles Canyon Road, and Sabercat Road which lie downhill from the areas subject to landslides and slope instability.

c. *Vegetation.* Dry grass and brush are common in the hilly and open space areas during six to eight months of each year. The woodland areas along Niles Canyon, Morrison Canyon, Mission Creek and various other canyons in the hills have stands of eucalyptus, oaks, redwoods and other broad-leafed evergreen trees. The dropped dried leaves, branches, dead trees and undergrowth of brush within these hills and canyons contribute to fuel-loading. The fire danger presented by these conditions is exacerbated by dry hot winds associated with the summer months (May through October). Many of these areas experience wildland fires that threaten nearby buildings - particularly those with wood roofs or wood siding. During the dry season, more fire department resources can be occupied with vegetation fires, which occasionally results in fewer resources being available for structure fires, than during the rest of the year.

d. *Hills, Creeks, Canals, Freeways, Railways, Housing Tracts, Large Buildings and Building Complexes*. Fremont is characterized by hills, creeks, canals, freeways, railways, housing tracts, large buildings and building complexes. All of these surface features, both natural and manmade, have a major adverse effect upon the road and street layout in this community, including major traffic routes. These conditions limit the number, and cause indirect routing of major arterial streets for normal traffic as well as emergency vehicle response.

e. *Terrain.* Areas with buildings include level, sloping and rolling terrain. This terrain is not dissimilar to terrain in other locations which have already experienced major conflagrations.

f. *Roads and Streets*. During the peak a.m. and p.m. traffic periods, the City experiences very heavy traffic congestion at key intersections and near freeway on-ramps and off-ramps. As noted above, the limited number and the indirect routing of some roads and streets in the community can create heavy, slow traffic conditions and excessively long travel routes from point-to-point within the community. Thus, in the event of an emergency at a key intersection, overpass, underpass, bridge, or other circulation corridor, sections of the City may become temporarily isolated and response times for emergency crews increased beyond ideal times.

Hillsides and slopes, caused by the mountains and hills surrounding the northeastern boundaries of the City of Fremont, have roadways with designated surfaces (grades) of 15% maximum; however, there are some private roadways and driveways to building sites with roadway surfaces in excess of 20%. These conditions can further slow emergency vehicle response times.

Intersections are rated on a level of service scale (LOS). This scale is "A" for excellent operational conditions to "F", which represents a poor ratio. In the General Plan, dated December 2011, Chapter 3 of the Mobility Study evaluated 68 intersections. Of the intersections evaluated, ten (10) received a LOS of "D" or less for both a.m. and p.m. peak hours. These less than satisfactory or failing marks reflect "barriers" which reduce the response time of emergency equipment.

g. *Population.* The current and rapidly growing population in the community creates both fire and police protection problems:

(i) With more people, more emergency incidents requiring a public safety response occur. The greater the frequency of alarms, the greater the likelihood that there will be simultaneous emergency incidents requiring public safety response. This results in longer response times and fewer fire companies or police units to respond to any emergency within the community; and

(ii) With more people, there is more traffic congestion during a greater part of the day. Such traffic congestion not only slows emergency vehicle response but often restricts access to crime and fire scenes.

h. *Buildings, Landscaping and Clearances.* Many of the newer large buildings and building complexes are of designs which greatly limit visibility, approach and accessibility by public safety resources. Many houses and other buildings with wood roofs or sidings are so close together that fire will readily spread from one to another by both radiation and convection.

i. *Water Supply.* The water supply (domestic, industrial and fire-flow demands) system within the City of Fremont is directly affected by the topographical layout of the City. The water distribution system operates from eleven (11) reservoirs that are supported by twelve (12) booster pump stations strategically located throughout the City of Fremont. This water distribution system provides adequate water (fire-flow of 2,000 GPM) in most parts of the City; while some hydrants still provide less than 500 GPM.

j. *Business and Industry Centers.* The current clusters of high-tech, bio-tech, green-tech and manufacturing businesses create additional demands on water, sewer and electrical facilities and also offer opportunities and access to innovative products and technology:

(i) The more businesses, the greater the demands on water, sewer and power facilities during peak mid-day periods and could lead to shortages and service interruptions that can effect health and safety; and

(ii).The availability of high-tech, bio-tech and green-tech businesses creates unique access to innovative products and technology to reduce energy and water use and reduce waste discharge to mitigate business demands.

Analysis. The above local geologic and topographic conditions increase fire frequency, magnitude, exposure and accessibility problems and have a negative impact upon the response capability of public safety resources. Seismic hazards in combination with soils conditions have the potential to produce substantial structure damage or structural failure, multiple major fires and additional fire dangers, as well as place great strain on police, firefighting and rescue resources. A seismic event could also trigger widespread damage to hazardous material storage vessels and cause substantial hazardous material releases into the environment. In addition, the quantity of Police and Fire Department resources that can arrive within an effective time is limited. A major seismic event would disrupt transportation systems that already limit emergency response due to congestion, steep terrain, landslide vulnerability, firestorm vulnerability, reduced visibility and indirect routing.

3. Conclusion

Local climatic, geologic, and topographic conditions impact crime prevention efforts and the frequency, spread acceleration, intensity, and size of fires involving buildings, strength of building structural systems to resist local hazards, and ability to deliver uninterrupted water, sewer and power utility services in this community. Further, the potential for significant damage arising from these conditions is found to make it reasonably necessary that the 2016 California Building Code, 2016 California Mechanical Code, 2016 Electrical Code, 2016 Plumbing Code, 2016 California Residential Building Code, 2016 California Existing Building, 2016 California Energy Code, 2016 California Green Building Standards Code and 2016 California Fire Code be changed or modified to mitigate the effects of the above conditions.

PART II:

SPECIFIC MODIFICATIONS

A. Amendments to the 2016 California Fire Code

Time is the eternal enemy to the firefighter. The elapsed time from ignition to extinguishment is directly proportional to the amount of heat, smoke and toxic gases created from a fire. This information demonstrates the rapid growth of heat, flame and toxic properties of fire over time. Professional sources indicate that as temperature increases over time, survivability of occupants and conservation of property decreases. (Fire Protection Handbook 19th ed., the National Fire Protection Association).

Local environmental factors including topographical, geological and climatic conditions contribute to the likelihood of major fire, rescue and toxic containment operations as well as contribute to emergency response delays. Mitigation systems aid in the confinement, extinguishment and notification of occupants to allow for evacuation and will assist in the further reduction of injury and fatalities to life and the loss of property. The modifications proposed to the California Fire Code are designed to mitigate the response time delays, increase survivability, and mitigate the impact of hazardous materials incidents caused by the climatic, geologic and topographic conditions present in the City of Fremont. For all of the reasons listed below, these regulations are needed to reduce human and property losses due to fire or hazardous materials releases in the City of Fremont.

1. Modification to 2016 California Fire Code Sections 508

Local Conditions Part I B.1.c, B.2.a, B.2.d, and B.2.h.

This modification to the Fire Code may require the dedication of a fire command center. Because of the nature of mid-rise buildings, more people are required to coordinate and execute a response to more remote areas of these structures. It is typical for a confirmed mid-rise fire to require six engines, two trucks, and two Battalion Chiefs to deal with the initial emergency and logistical needs at the scene. This code modification allows the fire department to strategically place a fire command center within these structures.

The fire command center will improve fire ground assessment, coordination and rescue efforts during an emergency, thereby increasing firefighting efficiency. The increased efficiency

will correspondingly reduce injury to persons and property in mid-rise fires. By improving the delivery of services and reducing the demand on fire department resources in mid-rise structures, more emergency personnel are available for other emergencies, either during dry seasons to combat wild fires in the hill areas or after a seismic event.

2. Modifications to 2016 California Fire Code Sections 903, 904, and 905 (Fire Extinguishing Systems)

Local Conditions Part I B.1.a through B.1.e and B.2.a through B.2.j

This series of modifications generally requires the installation of an automatic fire extinguishing system (AFES) in all new buildings excluding Group U, Division 1 (private garages, carports, sheds and agricultural buildings). AFES', the alternatives presented and standpipe systems are effective in confining, extinguishing, or aiding in the extinguishment of a fire, as well as reducing the amount of toxic gases and smoke generated by a fire. They also allow people to safely evacuate the building and can confine the fire until emergency resources arrive at the scene. An AFES throughout a structure serves to limit the loss of life and property.

AFES' will help mitigate dry, hot seasonal local conditions that contribute to fire ignition and fire loss. They will also help mitigate emergency response delays that impair the survival of people and structures, whether those delays are caused by the nature of the City's transportation system, impairment of the transportation system by fog, earthquakes, firestorms, congestion and other local conditions, or deployment of firefighting resources to other emergency situations during major disasters such as firestorms or earthquakes. AFES' will also help mitigate fire and structural vulnerability in other structures and locations by helping to extinguish fires sooner, thereby freeing up firefighting and rescue resources.

3. Modifications to 2016 California Fire Code Sections 907, 914, and 1103 (Fire Alarm and Detection Systems)

Local Conditions Part I B.1.a through B.1.e and B.2.a through B.2.j

This series of modifications requires that fire alarm and detection systems be installed to nationally recognized standards and that they "alarm" or signal with a more specific location within a building. The installation of more specific fire alarm and detection devices helps to minimize the amount of time firefighters need to determine the nature and extent of a fire and provides occupants additional time to escape.

The installation of emergency voice/alarm communication systems improves the fire department incident commander's ability to control or give instruction to the large number of people that would be expected to be present throughout a covered mall or Buildings four or more stories in height.

Hotels and motels in excess of three stories or eight sleeping units are required to install a manual fire alarm system. The installation of a manual fire alarm system can initiate an early response by firefighters and provide occupants additional time to escape.

4. **Modifications to Fremont Municipal Code Title 15, Division 2, Chapter 15.60 (Automatic Fire Extinguishing Systems Retrofit Requirements For Certain Types of Apartment Buildings)**

Local Conditions Part I B.1.a through B.1.e and B.2.a through B.2.j

Fremont Municipal Code Title 15, Division 2, Chapter 15.60, requires that all existing central corridor hotel and apartment buildings (R-1 occupancies) that are two stories or more in height containing 10 or more dwellings be retrofitted with AFES. These structures are especially dangerous during a fire for the following reasons: (1) The center corridor design creates longer escape paths that the occupants must travel in the interior of a building while subjected to the effects of the fire; (2) The center corridor design also creates a natural chimney effect causing an exceedingly dangerous condition known as "fire flash-over." Flash-over results from the accumulation of gases from the fire seeping through the hallway. The gases accumulate in the hallway ceiling area and ignite when the ignition temperature is reached. In the dry, hot conditions typical of Fremont summer months; the flash point is achieved sooner. Ignition of these gases can be fatal to those people in the hallway and block the escape route of occupants in their units.

The installation of AFES, smoke detectors and self-closing devices will contain the rapid spreading flame and smoke and help to prevent flash-over ignition by lowering the hallway temperature and increasing moisture. This will provide additional time for the Fire Department to respond and occupants to escape. The retrofit of AFES in center corridor residential structures also has the same benefits as AFES installations in new structures, as discussed above regarding modifications to California Fire Code Section 1003.

5. **Modifications to 2016 California Fire Code Sections 4903, 4905, and 4907 (Wildland-Urban Interface Fire Areas)**

Local Conditions Part I B.1.a through B.1.e and B.2.c through B.2i

This series of modifications generally allows the fire department to require Community Protection Plans, new or remodeled structures to comply with enhanced Building Standards, and establishes the need for Defensible Spaces around structures in the Wildland-Urban Interface Areas. These requirements help mitigate dry, hot seasonal local conditions that contribute to fire ignition, its spread and ultimately fire loss.

Pre-established Community Protection Plans can help mitigate emergency response delays that impair the survival of people and structures, whether those delays are caused by the nature of the City's transportation system, impairment of the transportation system by fog, earthquakes, firestorms, congestion and other local conditions, or deployment of firefighting resources to other emergency situations during a major disaster. The enhanced construction and defensible space requirements also improve the ignition resistance of and the fire spread toward these structures in the event of a fire in the Wildland-Urban Interface Area,

6. **Modifications 2016 California Fire Code Sections 202, 5001, 5003-5005, 5701, 5703, 5705 and 6004 (Hazardous Materials Related Requirements)**

Local Conditions Part I B.1.c, B.1.e, B.2.a, B.2.d, and B.2.f through B.2.j

These modifications to the California Fire Code provide extra protection systems for management and use of hazardous materials, including flammable and toxic gases, liquids and solids. These provisions require increased spill containment, improved secondary containment mechanisms for a wider range of hazardous materials, lower quantity thresholds and construction and monitoring for hazardous materials systems.

These changes are necessitated by the likelihood of substantial earthquake events in Fremont. Intense shaking during earthquakes increases the risk of hazardous material being released, whether directly caused by the earthquake shaking, or indirectly as the result of structural failure or earthquake-caused fires. The improved management and containment measures will mitigate the possibility of containment failure during an earthquake, and correspondingly reduce the likelihood of injury to persons and loss of property caused by the release of hazardous material to the environment.

7. Modifications to 2016 California Fire Code Chapter 56

Local Conditions Part I B.1.a through B.1.e and B.2.a through B.2.j

These modifications to the California Fire Code maintain the prohibition on fireworks and periodic management of explosives within the City of Fremont as established in Fremont Municipal Code Title 9, Chapter 9.20, and California Code of Regulations, Title 19, Division 1, Chapter 10 respectively.

8. Modifications to 2016 California Fire Code Chapter 80

Local Conditions Part I B.1.a through B.1.e and B.2.a through B.2.j

The Standard referenced in Chapter 80 (Highly Toxic and Toxic Materials) is NFPA 13 and is being changed to align with the provisions of Section 903 of the California Fire Code.

B. Amendments to the 2016 California Building Code

1. Modifications to 2016 California Building Code Section 112 (Flexible Utility Connection)

Local Conditions Part I B.2.a, B.2.b, B.2.g, B.2.h and B.2.i

This modification to the California Building Code requires flexible utility connections in areas prone to liquefaction. Earthquake hazards in the City of Fremont including the southern part of the Hayward Fault, the Calaveras Fault, the San Andreas Fault and the northern portion of the Hayward Fault could cause severe earth shaking as great as Scale X on the Modified Mercalli Intensity Scale in a large part of the City. The soft soil conditions described in Item 2b of these findings intensify this shaking.

These changes are necessitated by the likelihood of substantial earthquake events in Fremont. Flexible utility connections will decrease the likelihood of utility failures during an

earthquake and during the life of a building through its natural settlement process. This change will significantly reduce the fuel and ignition sources for fires during seismic events.

2. Modifications to 2016 California Building Code Sections 402.5, 403.3, 404.3, 903 and 1507 (Automatic Fire Extinguishing Systems and Roofing Requirements)

Local Conditions Part I B.1.a through B.1.e, B.2.a, B.2.d, B.2.e, B.2.f and B.2.h

Earthquake hazards in the City of Fremont, including the Hayward Fault and the Calaveras Fault, could cause severe earth shaking as great as Scale X on the Modified Mercalli Intensity Scale in a large part of the City. The soft soil conditions described in Part I Item 2b of these findings intensify this shaking.

The issue of fire inception and spread is specifically discussed in detail in a study by EQE International. An analysis of fire ignition per equivalent dwelling clearly indicates that the possibility of fire ignition increases as earthquake shaking increases.[4] This information was developed from a large data base and should be adjusted upward when considering the extremely dry conditions existing in the City of Fremont.

One of the major hazards associated with earthquakes is fire due to broken gas lines and short circuits of electrical systems. Most buildings in Fremont are entirely or partially combustible, which increases vulnerability to fire in the City.

The Hayward Fault intersects Freeway 680 and many major thoroughfares in the City. In addition, large developments on the hillside pose additional difficulties for emergency response teams. Greatly reduced accessibility due to the obstruction of the path of travel, combined with a high demand for rescue and emergency medical treatment, will greatly limit the ability of the post-disaster fire response teams. Mutual Aid will also be rather limited, if at all possible, immediately following a major earthquake along the Hayward Fault due to the expected regional scope of such a disaster. With the inability of emergency services to guarantee rapid response to various sections of the City, it is necessary to mitigate this problem by requiring additional built-in automatic fire protection systems, which will provide for early detection and initial fire control until the arrival of the firefighting equipment and other emergency services.

Further, Fremont has a large population of businesses handling, using and storing hazardous materials. Fire in a facility storing or using hazardous materials can spread rapidly and will be more intense and difficult to control due to the nature of the stored materials. Delay in extinguishing the fire can increase the volume and extent of the leakage or spillage of these materials, and as a result of an earthquake and an ensuing fire, can create major environmental and health crises at a local and regional level.

The proposed requirements for Roofing and Automated Fire Extinguishing Systems are reasonably necessary due to the geological, topographical and climatic conditions outlined in these findings as they would limit the spread of fires by flying ash and embers from one building to the next.

For additional findings, see Part II, Section A.2

3. **Modifications to 2016 California Building Code Sections 406, Table 602c, 708, 711, and 1020 (Fire Resistivity, Occupancy Separation, and Exiting)**

Local Condition Part I B.2.a, B.2.h, and B.2.i

The proposed code changes are necessary due to the proximity of most sites to the Hayward Fault and the high probability of an earthquake along the fault. The resulting intense earthquake shaking will result in a much higher demand on structures that can cause damages to building and fire suppression systems. The required fire separation between residential unit (Sections 420 and 1708) and between residential occupancies and other occupancies (Sections 406.1.4 and 508.3.2.3) provides a passive protection system and gives occupants slightly more time to exit. Disallowing elimination of rated corridor (Section 1020) for group A provides a safe exit in the event of post-earthquake fire. Disallowing combustible decking in roofs of high-rise buildings provide for safer fire suppression from roofs of high-rise buildings in the event of post-earthquake fire.

4. **Modifications to 2016 California Building Code Sections 701A, 702A, 707A, and 705A (Wildland-Urban Interface Fire Area)**

Local Conditions Part I B.1.a through B.1.e, B.2.a, B.2.c, B.2.d, B.2.e, B.2.f and B.2.h

Fires in Santa Barbara, the Oakland Hills and Malibu have shown that fires in hill areas spread rapidly and, in all three of these fires, burned out of control for a long time resulting in many deaths and major devastation. Post-fire analyses revealed that noncombustible buildings and those with certain fire-resistant construction had a much higher level of survivability.[5]

The Fire Hazard Zone in Fremont is extremely similar to the fire zones in Oakland, Santa Barbara, and Malibu. The climate is very similar to Oakland except that Fremont is dryer and hotter during the summer. The winds pass through Fremont with the same speed and intensity as the Santa Ana winds. The potential of a major fire occurring in the Fremont Fire Hazard Zone is substantially the same as the regions named above.

The proposed construction measures are targeted to enhance the fire resistively of structures located in the Wildland-Urban Interface Fire Area and thereby provide a reasonable level of safety for the occupants of those structures.[6]

5. **Modifications to 2016 California Building Code Sections 1612 and 1613 (Structural design and loading)**

Local Conditions Part I B.2.a and B.2.b

(a) *Flood Load, 2016 CBC Section 1612* amending definition of flood hazard area to be more specific to local conditions as identified by FEMA.

(b) *Minimum distance for structural separation, 2016 CBC 1613.5.2 amending ASCE 7, Section 12.12.3.* The inclusion of the importance factor in this equation has the unintended consequence of reducing the minimum seismic separation distance for important facilities such

as hospitals, schools, police and fire stations from adjoining structures. The amendment to omit the importance factor from Equation 12.12-1 will ensure that a safe seismic separation distance is provided. This proposed amendment is a continuation of an amendment adopted during previous code adoption cycles.

(c) *Suspended Ceilings, 2016 CBC Section 1613.7.* The California Building Code has no information regarding the design requirements for ceiling suspension systems for seismic loads. It is through the experience of prior earthquakes, such as the Northridge Earthquake, that this amendment is proposed so as to minimize the amount of bodily and building damage within the spaces in which this type of ceiling will be installed. This proposed amendment is a continuation of an amendment adopted during previous code adoption cycles.

(d) *Wood Diaphragm, 2016 CBC Section 1613.5.4.* A joint Structural Engineers Association of Southern California (SEAOSC), Los Angeles County and Los Angeles City Task Force investigated the performance of concrete and masonry construction with flexible wood diaphragm failures after the Northridge earthquake. It was concluded at that time that continuous ties are needed at specified spacing to control cross grain tension in the interior of the diaphragm. Additionally, there was a need to limit subdiaphragm allowable shear loads to control combined orthogonal stresses within the diaphragm. Recognizing the importance and need to continue the recommendation made by the task force while taking into consideration the improve performances and standards for diaphragm construction today, this proposal increases the continuous tie spacing limit to 40 ft in lieu of 25 ft and to use 75% of the allowable code diaphragm shear to determine the depth of the sub-diaphragm in lieu of the 300 plf and is deemed appropriate and acceptable. Due to the frequency of this type of failure during the past significant earthquakes, various jurisdictions within the Los Angeles region have taken this additional step to prevent roof or floor diaphragms from pulling away from concrete or masonry walls. Local geological and topographical conditions described in Part I B2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

(e) *Maximum S_{DS}, 2016 CBC Section 1613.5.5.* Amendment in the California Building Code is made to be consistent with ASCE 7-16, and is further amended herein to be consistent with ASCE 7-16 Supplement 1. The modification is necessary to avoid misinterpretation on the intent of the five story limit for which the SDS cap is applicable where there is flexible structure above a rigid podium base. The addition of "grade plane" clarifies the intent that the base is measured from the lowest structure in those instances where there is a vertical combination of two systems. Many of such combinations of systems will not satisfy exclusion 1, in which the structure must meet the definition of "regular" based on ASCE 7, Section 12.3.2. This modification provides safe design requirements in the selection of building period to calculate seismic base shear in building design accounting for dynamic story mass distribution throughout the inelastic range of ground motion. This amendment does not prevent designing of five levels of light frame wood construction on top of a concrete podium by using the calculated SDS without the 70% cap. Local geological and topographical conditions described in Part I B2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

6. **Modifications to 2016 California Building Code Sections 1704.6, 1705, and 1707 (Special Inspection, Structural Observation, and Quality Control)**

Local Conditions Part I B.2.a and B.2.b

The proposed code changes are necessary due to the proximity of most sites to the Hayward Fault and the high probability of an earthquake along the fault. The additional special inspection, structural observation and quality control are administrative amendments are necessary to obtain quality construction necessary to resist strong earthquake shaking in buildings.

7. **Modifications to 2016 California Building Code Sections 1803, 1804, and 1807 (Soil Investigation and Excavation)**

Local Condition Part I B.2.a and B.2.b

The proposed modifications require additional geotechnical reports and requirements for excavation and fills. These changes are necessary due to the proximity of most sites to the Hayward Fault and the high probability of an earthquake along the fault. Concrete and masonry retaining walls can also be greatly affected by expansive soils and earthquakes. Failure of these elements can have significant and accumulative results. In addition, local soil conditions, including soils prone to liquefaction and expansive soils necessitate stricter excavation, grading and fill requirements. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

8. **Modifications to 2016 California Building Code Section 1809 (Shallow Foundation and Stepped Footings)**

Local Condition Part I B.2.a and B.2.b

(a) Stepped footings, amending 2016 CBC Section 1809.3. With the higher seismic demand placed on buildings and structures in this region, precautionary steps are proposed to reduce or eliminate potential problems that may result for under reinforced footings located on sloped surfaces. Requiring minimum reinforcement for stepped footings is intended to address the problem of poor performance of plain or under-reinforced footings during a seismic event.

(b) Prescriptive footings for light-frame construction, amending 2016 CBC Section 1809.7. No substantiating data has been provided to show that under-reinforced footings are effective in resisting seismic loads and may potentially lead to a higher risk of failure. Therefore, this proposed amendment requires minimum reinforcement in continuous footings to address the problem of poor performance of plain or under-reinforced footings during a seismic event. With the higher seismic demand placed on buildings and structures in this region, precautionary steps are proposed to reduce or eliminate potential problems that may result by following prescriptive design provisions for footing that does not take into consideration the surrounding environment. It was important that the benefit and expertise of a registered design professional be obtained to properly analyze the structure and take these issues into

consideration. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force that investigated the poor performance observed in the 1994 Northridge Earthquake. Local geological and topographical conditions described in Part I B2 are similar to Southern California. This proposed amendment is a continuation of an amendment adopted during previous code adoption cycles.

9. Modifications to 2016 California Building Code Sections 1905, 1906, and 1907 (Concrete Construction)

Local Condition Part I B.2.a

(a) *ACI 318, Section 18.5 amending 2016 CBC Section 1905.* The proposed amendment requires minimum reinforcement in continuous footings to address the problem of poor performance of plain or under-reinforced footings during a seismic event.

(b) *ACI 318, Section 18.7.5 amending 2016 CBC Section 1905.* These amendments are intended to provide increased confinement to concrete columns if certain thresholds are exceeded.

In addition, this amendment also limits the use of very high gravity-loaded walls being used to resist earthquake loads.

Furthermore, this modification ensures that reinforcing bars are placed in sufficiently thick concrete to prevent buckling of such reinforcement. Rebar placed in very thin concrete topping slabs have been observed in some instances to have popped out of the slab due to insufficient concrete coverage.

10. Modifications to 2016 California Building Code Sections 2304, 2305.4, 2305.5, 2306, 2307, 2308, 2505 and 2508 (Wood Construction)

Local Condition Part I B.2.a

(a) Fastener requirements, 2016 CBC Section 2304.10.1. Due to the high geologic activities in the Southern California area and the expected higher level of performance on buildings and structures, this proposed local amendment limit the use of staple fasteners in resisting or transferring seismic forces. In September 2007, limited cyclic testing data was provided to the ICC Los Angeles Chapter Structural Code Committee showing that stapled wood structural shear panels do not exhibit the same behavior as the nailed wood structural shear panels. The test results of the stapled wood structural shear panels appeared much lower in strength and drift than the nailed wood structural shear panel test results. Therefore, the use of staples as fasteners to resist or transfer seismic forces shall not be permitted without being substantiated by cyclic testing. This proposed amendment is a continuation of a similar amendment adopted during previous code adoption cycles.

(b) Quality of Nails, 2016 CBC Section 2305.4. The overdriving of nails into the structural wood panel still remains a concern when pneumatic nail guns are used for wood

structural panel shear wall nailing. Box nails were observed to cause massive and multiple failures of the typical 3/8-inch thick plywood during the 1994 Northridge Earthquake. The use of clipped head nails as allowed in Table A1 of AFPA SDPWS footnote referencing to ASTM F1667, continues to be restricted from being used in wood structural panel shear walls where the minimum nail head size must be maintained in order to minimize nails from pulling through sheathing materials. Clipped or mechanically driven nails used in wood structural panel shear wall construction were found to perform much less in previous wood structural panel shear wall testing done at the University of California Irvine. The existing test results indicated that, under cyclic loading, the wood structural panel shear walls were less energy absorbent and less ductile. The panels reached ultimate load capacity and failed at substantially less lateral deflection than those using same size hand-driven nails. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the poor performance observed in 1994 Northridge Earthquake. Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response. This proposed amendment is a continuation of an amendment adopted during previous code adoption cycles.

(c) Hold-down connectors, 2016 CBC Section 2305.5. ICC-ES AC 155 Acceptance Criteria for Hold-downs (Tie-Downs) Attached to Wood Members is widely used to establish allowable values for hold-down connectors in evaluation reports. AC 155 uses monotonic loading to establish allowable values. Yet, cyclic and dynamic forces imparted on buildings and structures by seismic activity cause more damage than equivalent forces that are applied in a monotonic manner. However, the engineering, regulatory and manufacturing industries have not reached consensus on the appropriate cyclic or dynamic testing protocols. This condition is expected to continue for some time. In the interim, this proposed amendment continues to limit the allowable capacity to 75% of the evaluation report value to provide an additional factor of safety for statically tested anchorage devices. Steel plate washers will reduce the additional damage that can result when hold-down connectors are fastened to wood framing members. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the poor performance observed in 1994 Northridge Earthquake. Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response. This proposed amendment is a continuation of an amendment adopted during previous code adoption cycles with additional editorial revisions for clarification.

(d) Wood-frame diaphragms, 2016 CBC Section 2306.2; Wood-frame shear walls, 2016 CBC Section 2306.3 and 2307.2. The Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the damages to buildings and structures during the 1994 Northridge Earthquake recommended reducing allowable shear values in wood structural panel shear walls or diaphragms that were not substantiated by cyclic testing. That recommendation was consistent with a report to the Governor from the Seismic Safety Commission of the State of California recommending that code requirements be "more thoroughly substantiated with testing." The allowable shear values for wood structural panel

shear walls or diaphragms fastened with staples are based on monotonic testing and does not take into consideration that earthquake forces load shear wall or diaphragm in a repeating and fully reversible manner.

In September 2007, limited cyclic testing was conducted by a private engineering firm to determine if wood structural panels fastened with staples would exhibit the same behavior as the wood structural panels fastened with common nails. The test result revealed that wood structural panel fastened with staples appeared to be much lower in strength and stiffness than wood structural panels fastened with common nails. It was recommended that the use of staples as fasteners for wood structural panel shear walls or diaphragms not be permitted to resist seismic forces in structures assigned to Seismic Design Category D, E and F unless it can be substantiated by cyclic testing.

Furthermore, the cities and county within the Los Angeles region has taken extra measures to maintain the structural integrity of the framing of shear walls and diaphragms designed for high levels of seismic forces by requiring wood sheathing be applied directly over the framing members and prohibiting the use of panels placed over gypsum sheathing. This proposed amendment is intended to prevent the undesirable performance of nails when gypsum board softens due to cyclic earthquake displacements and the nail ultimately does not have any engagement in a solid material within the thickness of the gypsum board.

Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

(e) The intense earthquake shaking will result in a much higher demand on structural system and hardware. Materials with low ductility will fail in the brittle mode under this high demand. Drywall and stucco shear walls have proven to be brittle in past earthquakes; therefore, modifications are required to disallow these materials as shear earthquake load resisting elements. (Sections 2308, 2505.1, 2505.2 and 2508.5).

C. Amendments to the 2016 California Mechanical Code

1. Modifications to 2016 California Mechanical Code Sections 507 and 510 (Commercial Hoods and Kitchen Ventilation)

Local Conditions Part I B.1.a, B.1.b, B.1.d, B.1.e and B.2.a, B.2.d, B.2.f, B.2.h and B.2.i

There have been a number of grease duct fires in the City of Fremont in single story buildings. These fires were contained by shafts isolating the fire to the shafts only. In cases where there was no shaft, the fire spread to the roof.

The protection of hoods and ducts in an enclosure constructed of fire rated materials is in the local amendments to restrict grease duct fires to the hood and duct and prevent the spread of fire from the hood or duct to the rest of the building. Portions of the hood and duct are protected so that in the case of a grease duct fire, all portions of the hood and grease duct that are in concealed spaces such as ceilings and walls, are protected in a fire rated duct enclosure.

D. Amendments to the 2016 California Plumbing Code

1. Modifications to 2016 California Plumbing Code Section 1211 (Earthquake Shut-off valve)

Local Conditions Part I B.2.a, B.2.b, B.2.g, B.2.h and B.2.i

This modification to the Plumbing Code requires the installation of a seismic actuated gas shutoff valve. Earthquake hazards in the City of Fremont including the Hayward Fault and the Calaveras Fault could cause severe earth shaking as great as Scale X on the Modified Mercalli Intensity Scale in a large part of the City. The soft soil conditions described in Part I Item 2b of these findings intensify this shaking. An earthquake-actuated shutoff valve can significantly reduce the fuel and ignition sources for fires during seismic events. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

E. Amendments to the 2016 California Electrical Code

1. Modifications to 2016 California Electric Code Article 110 (Requirements for Electrical Installations)

Local Condition Part I B.2.b

The proposed changes require non-ferrous materials for electrical installations in corrosive environments. These changes are based on the corrosive soils prevalent in Fremont and will reduce the likelihood of electrical system failures caused by corrosion.

2. Modifications to 2016 California Electrical Code Article 230 (Services)

Local Conditions Part I B.2.a, B.2.b, B.2.g, B.2.h and B.2.i

This modification to the Electrical Code requires flexible utility connections in areas prone to liquefaction. Earthquake hazards in the City of Fremont including the Hayward Fault and the Calaveras Fault could cause severe earth shaking as great as Scale X on the Modified Mercalli Intensity Scale in a large part of the City. The soft soil conditions described in Item 2b of these findings intensify this shaking.

These changes are necessitated by the likelihood of substantial earthquake events in Fremont. Flexible utility connections will decrease the likelihood of utility failures during an earthquake and during the life of a building through its natural settlement process. This change will significantly reduce the fuel and ignition sources for fires during seismic events.

F. Amendments to the 2016 California Residential Code

1. Modifications to 2016 California Residential Code Sections R301, R302, R313, R322 and R337 (Fire Resistant and Flood Construction, Fire Sprinkler, & Wildland-Urban Interface)

Local Conditions Part I B.1.a through B.1.e, B.2.a, B.2.c, B.2.d, B.2.e, B.2.f and B.2.h

These sections are amended to add requirements for structures located in the WUI Fire Area. Refer to Part II B.3 and Part II A.5 for findings for WUI area.

These modifications are required to make the Residential Code consistent with modifications made to similar California Building Code sections. The proposed code changes are necessary due to the proximity of most sites to the Hayward Fault and the high probability of an earthquake along the fault. The resulting intense earthquake shaking will result in a much higher demand on structures that can cause damages to building and fire suppression systems. The required fire separation between residential units and between residential occupancies and other occupancies provides a passive protection system and gives occupant slightly more time to exit.

One of the major hazards associated with earthquakes is fire due to broken gas lines and short circuits of electrical systems. The Hayward Fault intersects Interstate 680 and many major thoroughfares in this City. In addition, large developments on the hillside pose additional difficulties for emergency response teams. Greatly reduced accessibility due to the obstruction of the path of travel, combined with a high demand for rescue and emergency medical treatment, will greatly limit the ability of the post-disaster fire response teams. Mutual Aid will also be rather limited, if possible at all, immediately following a major earthquake along the Hayward Fault due to the expected regional scope of such a disaster. With the inability of emergency services to guarantee rapid response to various sections of the City, it is necessary to mitigate this problem by requiring additional built-in automatic fire protection systems, which will provide for early detection and initial fire control until the arrival of the firefighting equipment and other emergency services.

2. Modifications to 2016 California Residential Code Section R322 (Flood Design)

Local Conditions Part I B.2.a and B.2.b

(a) Determination of design flood elevation, amending 2016 CRC Section R322.1.4. This section is amended to cross reference and be consistent with the changes to CBC Section 1612 which clarifies that the Flood Insurance Study for Alameda County should be used to specify the local conditions as identified by FEMA. CBC Section 1612 provides additional information and more references pertaining to flood construction.

3. Modifications to 2016 California Residential Code Sections R401, R403 and R404 (Foundations, Footings, and Soil Reports)

Local Condition Part I B.2.a

(a) Soil tests, amending 2016 CRC Section 401.4 and Geotechnical evaluation, amending 2016 CRC Section 401.4.1. This amendment tracks the amendment to soil testing requirements in the CBC, section 1803, which is amended by FMC 15.10.360. Also, this amendment allows the building official flexibility to accept the allowable

bearing pressure shown in Table R401.4.1 for type R3 and U occupancies.

(b) Continuous footing in Seismic Design Categories D_0, D_1 and D_2, amending 2016 CRC Section R403.1.2 and Isolated Concrete footings, amending 2016 CRC Section R403.1.3.6. With the higher seismic demand placed on buildings and structures in the City of Fremont, precautionary steps are proposed to reduce or eliminate potential problems that may result for under-reinforced footings located on sloped surfaces. Requiring minimum reinforcement for stepped footings is intended to address the problem of poor performance of plain or under-reinforced footings during a seismic event. Furthermore, interior walls can easily be called upon to resist over half of the seismic loading imposed on simple buildings or structures. Without a continuous foundation to support the braced wall line, seismic loads would be transferred through other elements such as non-structural concrete slab floors, wood floors, etc.

The proposed change is to limit the use of the exception to structures assigned to Seismic Design Category A, B or C where lower seismic demands are expected. Requiring interior braced walls be supported by continuous foundations is intended to reduce or eliminate the poor performance of buildings or structures. This proposed amendment is consistent with an amendment adopted during previous code adoption cycles for the California Residential Code.

(c) Wood foundation walls, amending 2016 CRC Section 404.2. No substantiating data has been provided to show that a wood foundation wall is effective in supporting buildings and structures during a seismic event while being subject to deterioration caused by the combined detrimental effect of constant moisture in the soil and wood-destroying organisms. Wood foundation walls, when they are not properly treated and protected against deterioration, have performed very poorly and have led to slope failures. The proposed amendment takes the precautionary steps to reduce or eliminate potential problems that may result in using wood foundation walls that experience relatively rapid decay due to the fact that the region does not experience temperatures cold enough to destroy or retard the growth and proliferation of wood-destroying organisms. This proposed amendment is consistent with an amendment adopted during previous code adoption cycles for the California Residential Code.

4. Modifications to 2016 California Residential Code Sections R602 and R606 (Wood Wall and Masonry Wall Construction)

Local Condition Part I B.2.a

(a) Fastening Schedule, amending 2016 CRC Table R602.3(1); Alternate Attachments to Table R602.3(1) amending 2016 CRC Table R602.3(2). The Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the damages to buildings and structures during the 1994 Northridge Earthquake recommended reducing allowable shear values in wood structural panel shear walls or diaphragms that were not substantiated by cyclic testing. That

recommendation was consistent with a report to the Governor from the Seismic Safety Commission of the State of California recommending that code requirements be "more thoroughly substantiated with testing." The allowable shear values for wood structural panel shear walls or diaphragms fastened with staples are based on monotonic testing and does not take into consideration that earthquake forces load shear wall or diaphragm in a repeating and fully reversible manner.

In September 2007, limited cyclic testing was conducted by a private engineering firm to determine if wood structural panels fastened with staples would exhibit the same behavior as the wood structural panels fastened with common nails. The test result revealed that wood structural panel fastened with staples appeared to be much lower in strength and stiffness than wood structural panels fastened with common nails. It was recommended that the use of staples as fasteners for wood structural panel shear walls or diaphragms not be permitted to resist seismic forces in structures assigned to Seismic Design Category D_0, $D_1$and D_2 unless it can be substantiated by cyclic testing.

Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

(b) Top Plate, amending 2016 CRC Section R602.3.2. Due to the high seismic risk in Fremont, extra measures are taken to maintain the structural integrity of the framing of the shear wall system for buildings and structures by not allowing single top plate construction. The performance of modern day braced wall panel construction is directly related to an adequate load path extending from the roof diaphragm to the foundation system. A single top plate is likely to be over-nailed due to the nailing requirements at a rafter, stud, top plate splice, and braced wall panel edge in a single location. In addition, notching on a single top plate for plumbing, ventilation and electrical wiring can reduce the load transfer capacity of the single plate without proper detailing. Majority of buildings and structures designed and built per the California Residential Code with a single top plate may not need structural observation and special inspections. The potential construction mistakes mentioned above could not be caught and corrected by knowledgeable engineers and inspectors, and could jeopardize structural performance of buildings and structures located in high seismic areas.

Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

(c) Bracing Requirements Based on Seismic Design Category and Wind Speed, amending Table 2016 CRC Tables R602.10.3(1), R602.10.3(2), R602.10.3(3), R602.10.4, Figure R602.10.6.1, Figure R602.10.6.2, Figure R602.10.6.4, R602.10.6.4. Due to the high wind and seismic activities and the expected higher level of performance on buildings and structures in Fremont, this proposed amendment disallows the use of shear

walls sheathed with lath, plaster or gypsum board and other materials that are poor performance from previous earthquakes.

3/8" thick 3 ply-plywood shear walls experienced many failures during the Northridge Earthquake. Box nails were observed to cause massive and multiple failures of the typical 3/8" thick 3-ply plywood during the Northridge earthquake. This proposed amendment specifies minimum sheathing thickness, nail size and spacing so as to provide a uniform standard of construction for designers and buildings to follow. This is intended to improve the performance level of buildings and structures that are subject to the higher seismic demands and reduce and limit potential damages to property. This proposed amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the poor performance observed in 1994 Northridge Earthquake.

In September 2007, limited cyclic testing was conducted by a private engineering firm to determine if wood structural panels fastened with staples would exhibit the same behavior as the wood structural panels fastened with common nails. The test result revealed that wood structural panel fastened with staples appeared to be much lower in strength and stiffness than wood structural panels fastened with common nails. It was recommended that the use of staples as fasteners for wood structural panel shear walls or diaphragms not be permitted to resist seismic forces in structures assigned to Seismic Design Category D_0, D_1 and D_2 unless it can be substantiated by cyclic testing.

Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

(d) Minimum number of braced wall panels, amending 2016 CRC Section R602.10.2.3. Plywood shear walls with high aspect ratio experienced many failures during the Northridge Earthquake. This proposed amendment specifies a minimum braced wall length to meet an aspect ratio consistent with other sections of the Residential Code as to provide a uniform standard of construction for designers and buildings to follow. This is intended to improve the performance level of buildings and structures that are subject to the higher seismic demands and reduce and limit potential damages to property. This proposed amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the poor performance observed in 1994 Northridge Earthquake.

Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

(e) Reinforcement requirements for masonry elements, amending 2016 CRC Section R606.12.2.2.3. Reinforcement using longitudinal wires for buildings and

structures located in high seismic areas are deficient and not as ductile as deformed rebar. Having vertical reinforcement closer to the ends of masonry walls help to improve the seismic performance of masonry buildings and structures.

Local geological and topographical conditions described in Part I B.2 are similar to Southern California. The proposed modification would help mitigate damages to buildings caused by earthquakes and thus likely reducing the required emergency response.

G. Amendments to the 2016 California Green Building Standards Code

1. Modifications to 2016 California Green Building Code Sections 301, 4.106 and 5.106 (Electrical Vehicle)

Local Condition: Part I B.1

The proposed amendment, recommended to Council by the Environmental Sustainability Commission, is to enhance the use of electric vehicles (EV) in the community, thereby reducing community-wide greenhouse emissions attributed to the transportation sector.

H. Amendments to the 2016 California Energy Code

1. Modifications to 2016 California Energy Code Table 140.7-B (Outdoor Lighting)

Local Condition: Part I B.1

The proposed amendment, recommended to Council by the Environmental Sustainability Commission, reduces the maximum allowable wattages for lighting in various non-residential outdoor applications for new construction projects and retrofits of over 50 percent of total lighting. This requirement will promote the use of new, high-efficiency LED lighting, offering long-term energy savings and the related reduction in greenhouse gas emissions while still maintaining high levels of lighting quality.

I. Amendments to the 2016 California Existing Building Code

1. Modifications to 2016 California Existing Building Code Sections 301 and 401 (Wildland-Urban Interface (WUI))

Local Conditions Part I B.1.a through B.1.e, B.2.a, B.2.c, B.2.d, B.2.e, B.2.f and B.2.h

These sections are amended to add requirements for structures located in the WUI Fire Area. Refer to Part II B.3 and Part II A.5 for findings for WUI area. This amendment is carry over from the last code adoption.

2. Modifications to 2016 California Existing Building Code Section 407 (Occupancy)

Local Conditions Part I B.1.a through B.1.e, B.2.a, B.2.c, B.2.d, B.2.e, B.2.f and B.2.h

This section is amended to add Table 1012.4 of the 2015 International Existing Building Code. This table provides clarification on relative hazard between the different occupancy groups based on life safety and means of egress. This amendment is carry over from the last code adoption.

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References:

[1] Jeanne Perkins, On Shaky Ground Supplement, Association of Bay Area Governments. September 1998. pg. 17

[2] John Boatwright and Jeanne Perkins, On Shaky Ground. Association of Bay Area Governments, April 1995. pp. 6,7.

[3] Wilfred D. Quan, Near Fault Seismic Issues. EERI Annual Meeting, 1997.

[4] Drs. Charles Scawthorn and Mahmoud Khater, Fire Following Earthquake, Conflagration Potential in the Greater Los Angeles, San Francisco, Seattle and Memphis Areas. National Committee on Property Insurance. 1992. Figure 3-7, Section 3-23.

[5] Scawthorn and Khater, Fire Following Earthquake.

[6] Scawthorn and Khater, Fire Following Earthquake. Section 3-15.

Other Supporting Documents:

1994 Northridge Earthquake. Seismic Safety Commission, 1994

Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area. California Department of Conservation, Division of Mines and Geology 1987

Proceedings, Conference on Earthquake Hazards in the Eastern San Francisco Bay Area. California Department of Conservation, Division of Mines and Geology 1982.

Fremont Meadows Active Fault Investigation and Evaluation. Woodward-Clyde & Associates. 1970