

7 DRAFT ZONING ORDINANCE DEVELOPMENT

This section addresses the development of the Draft Zoning Ordinance. The proposed Draft Zoning Ordinance is located in Appendix A. Assuming shaking and PGD from the design earthquake, HAZUS provides models to estimate life threatening injuries and deaths during the day or night as a function of building damage state for new buildings built in accordance with the current International Building Code. These HAZUS results can be analyzed by “sorting” according to different variables, e.g. number of deaths, number of occupants, loss ratio. Using sorting, it became clear that the structures susceptible to highest numbers of potential life threatening injuries and deaths were the same that experienced the highest economic losses. These losses were a function of building fragility (foundation and superstructure characteristics) in conjunction with size of building and occupancy levels.

The HAZUS analysis resulted in four classifications of vulnerability with a fairly definite split between the Very High Vulnerability, and High Vulnerability categories. Vulnerability refers to a) potentially life threatening injuries and deaths and b) high loss ratio/economic losses.

7.1 Very High Vulnerability

Highest vulnerability to the two key variables (deaths and economic losses) occurred primarily in large buildings with shallow foundations. For example, the highest total number of deaths occurs in the Large Hotel, C1H structural system on a shallow foundation with night-time occupancies exceeding 1,000 people. The “best” Very High Vulnerability structures have approximately ten times as many fatalities (0.65/building) as the “worst” Low Vulnerability buildings (0.06/building). The economic Loss Ratio (which includes contents and lost revenue) can approach 50 percent, while the low vulnerabilities can be as low as 4 percent to 6 percent. Eight buildings have been designated as “Very High Vulnerability”. There are no Very High Vulnerability buildings in Hazard Zones 4, 3, or 2.

7.2 High Vulnerability

The difference between the buildings rated High Vulnerability as opposed to Very High Vulnerability are primarily those that are built with mat foundations and/or with steel frame. Examples of High Vulnerability buildings are large hotels and offices. The loss ratio of High Vulnerability buildings typically is in the low to mid 20 percent range; although one mid-rise multi use building is an estimated 42 percent. There are High Vulnerability buildings in Hazard Zones 5 and 4, but none in Zones 3 and 2.

7.3 Moderate Vulnerability and Low Vulnerability

Buildings in Zone 5 that have estimated fatalities of less than 23 percent with estimated Loss Ratios ranging from 14 to 45 percent are in the Moderate Vulnerability and Low Vulnerability categories. All small buildings fall into these categories. Many medium size structures also fall into these categories, albeit with a variety of mitigating characteristics. Because of the comparatively few fatalities for such structures located in the area with highest risk from seismically-induced ground failure, no specific development standards are being proposed for the Moderate and Low Vulnerability structures.

Regulations proposed for the overlay are intended to minimize development with characteristics of Very High Vulnerability and High Vulnerability. Since the Very High and High Vulnerability structure and

occupancy types do not occur in Zones 3 and 2, it was determined that the Overlay provisions would not apply to those zones; they will only apply to Zones 4 and 5.

The Overlay provisions were taken directly from the recommendations presented in Section 6.4. The Very and High Vulnerability building categories are shown in Tables 6.1 and 6.2 for Hazard Zone 5 and 4 respectively.