Comparing the Scales

Intensity (Mercalli)	Observations (Mercalli)	Richter Scale Magnitude (approx. comparison)
I	No effect	1 to 2
II	Noticed only by sensitive people	2 to 3
III	Resembles vibrations caused by heavy traffic	3 to 4
IV	Felt by people walking; rocking of free standing objects	4
V	Sleepers awakened; bells ring	4 to 5
VI	Trees sway, some damage from falling objects	5 to 6
VII	General alarm, cracking of walls	6
VIII	Chimneys fall and some damage to building	6 to 7
IX	Ground crack, houses begin to collapse, pipes break	7
X	Ground badly cracked, many buildings destroyed. Some landslides	7 to 8
XI	Few buildings remain standing, bridges destroyed.	8
XII	Total destruction; objects thrown in air, shaking and distortion of ground	8 or greater

In the following two pages you will see anticipated damage statistics based on research done by the National Science Foundation in 1996 which is quite different from what you see in this table.

According to National Science Foundation, which based its findings on research done after the 1989 Loma Prieta and the 1994 Northridge earthquakes, the actual damage is going to be much less. For example, according to the table above “many buildings destroyed” can be expected in shaking zone X, while the National Science Foundation puts the number of houses significantly damaged (cripple wall collapsed, hillside homes slid on foundations, or soft stories damaged) at only 12%. A large percentage of these will be the more vulnerable hillside homes, soft story homes, homes with differed maintenance problems, and cripple wall homes with wood siding.

In shaking zone IX this kind of damage will only be 8% and will primarily effect the those houses that have inherent structural weaknesses. This is how I understand this table but strongly encourage you to do your own research.

MATRICES FOR PREDICTING PERCENT OF UNITS MADE UNINHABITABLE

The final matrices used in this project for relating intensity and building construction to percent of dwelling units made uninhabitable are shown in the tables below, the first for red-tagged units and the second for yellow-tagged multi-family units. Prior to ABAG's work on housing habitability, the only published matrix for relating these variables was developed by Dunne and Sonnenfeld (1991). The matrices developed for ***red-tagged*** and ***yellow-tagged*** units in this project has been modified from this earlier matrix based on actual data from the Loma Prieta and Northridge earthquakes. The percentages are provided using two significant figures, with a the smallest unit equal to 0.01%.

TABLE: PERCENT OF DWELLING UNITS RED TAGGED

TYPE	INTENSITY					
	V	VI	VII	VIII	IX	X+
Mobile Homes	0	0	0.87	40	90	100
Unreinforced Masonry	0	0.05	2.9	45	70	80
Non-Wood , 4-7 Stories, <1940	0	0.30	8.0	45	70	80
Non-Wood, 4-7 Stories, >1939	0	0	0	16	54	70
Non-Wood, 7+ Stories, <1940	0	0.30	8.0	45	70	80
Non-Wood, 7+ Stories, >1939	0	0	0	16	54	70
Wood-Frame, 4-7 Stories, <1940, Multi-Family	0	1.4	2.5	45	70	80
Wood-Frame, 4-7 Stories, >1939, Multi-Family	0	0	0.09	10	15	25
Wood-Frame, 1-3 Stories, <1940, Multi-Family	0	0.05	0.53	11	44	64
Wood-Frame, 1-3 Stories, >1939, Multi-Family	0	0.01	0.04	6.5	15	25
Wood-Frame, 1-3 Stories, <1940, Single Family	0.01	0.04	0.12	1.8	8.4	12
Wood-Frame, 1-3 Stories, >1939, Single Family	0	0	0.02	0.18	0.69	1.8
"Other" (tents, caves, boats, etc.)	0	0	0	0	0	0

TABLE: PERCENT OF DWELLING UNITS YELLOW TAGGED (SINGLE FAMILY UNITS NOT RENDERED UNINHABITABLE)

TYPE Modified Mercalli Scale	INTENSITY					
	V	VI	VII	VIII	IX	X+
Mobile Homes	0	0	0	0	0	0
Unreinforced Masoruy	0	3.3	6.2	8.5	30	20
Non-Wood, 4-7 Stories, <1940	0.30	7.7	37	25	30	20
Non-Wood, 4-7 Stories, >1939	0	0	0	38	16	16
Non-Wood, 7+ Stories, <1940	0.30	7.7	37	25	30	20
Non-Wood, 7+ Stories, >1939	0	0	4	38	16	16
Wood-Frame, 4-7 Stories, <1940, Multi-Family	0	1.7	9.7	25	10	10
Wood-F rame, 4-7 Stories, >1939, Multi-Fami ly	0	0.05	2.6	**17**	25	25
Wood-Frame, 1-3 Stories, < I 940, Multi- Family	0	0. 15	0.94	6.6	20	20
Wood-F rame, 1-3 Stories, > I 939, Multi- Family	0. 01	0.02	0.10	**12**	13	22
Wood-Frame. 1-3 Stories, <1940, Sing le Family	0	0	0	0	0	0
Wood-Frame, 1-3 Stories, >1939. Sin g le Family	0	0	0	0	0	0
"Other" (te nts, caves, boats, etc.)	0	0	0	0	0	0

Small changes to the values in these matrices have a significant impact on estimates of uninhabitable units. In particular, damage to wood-frame dwellings is an extremely significant component of the dwelling losses. For example, the over 32,000 wood-frame dwelling units built after 1939 predicted to be uninhabitable in a southern Hayward scenario is 42% of the total uninhabitable units.

Note that the "0" values provided in these tables are actually greater than zero, but still quite small. Although occasional dwellings are "tagged" in these categories (as can be seen in Appendix B and C), there are also large numbers of dwellings exposed to these relatively low levels of shaking.

[2] Single family homes remain habitable if yellow-tagged. Yellow-tagging does not occur with mobile homes.