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Intensity Distribution and Isoseismal Maps for the Nisqually, Washington, Earthquake of 28 February 2001

by

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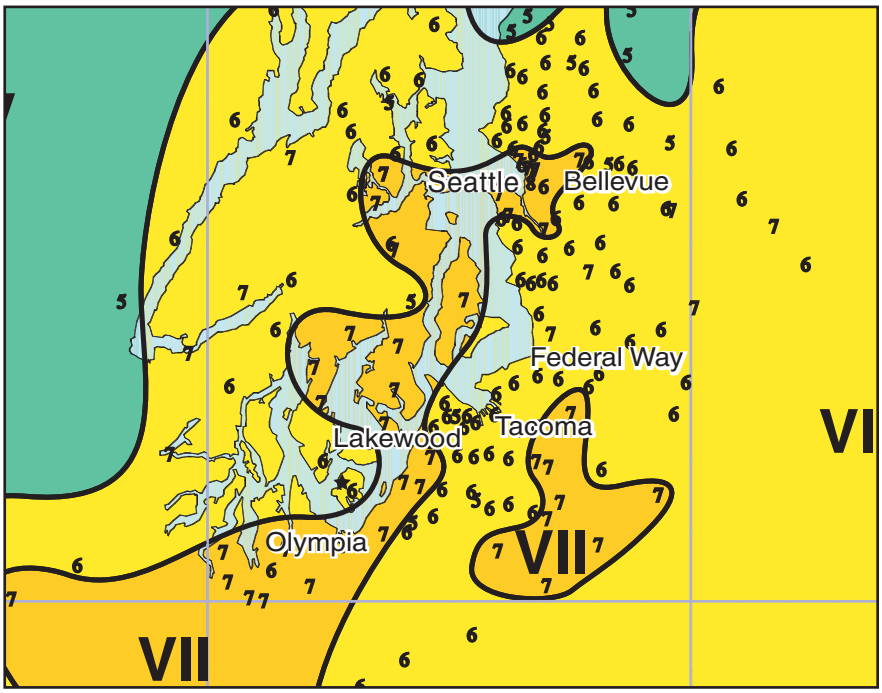

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Abstract

We present isoseismal maps, macroseismic intensities, and community summaries of damage for the MW=6.8 Nisqually, Washington, earthquake of 28 February, 2001. For many communities, two types of macroseismic intensity are assigned, the traditional U.S. Geological Survey Modified Mercalli Intensities (USGS MMI) and a type of intensity newly introduced with this paper, the USGS Reviewed Community Internet Intensity (RCII). For most communities, the RCII is a reviewed version of the Community Internet Intensity (CII) of Wald and others (1999). For some communities, RCII is assigned from such non-CII sources as press reports, engineering reports, and field reconnaissance observations. We summarize differences between procedures used to assign RCII and USGS MMI, and we show that the two types of intensity are nonetheless very similar for the Nisqually earthquake. We do not see evidence for systematic differences between RCII and USGS MMI that would approach one intensity unit, at any level of shaking, but we document a tendency for the RCII to be slightly lower than MMI in regions of low intensity and slightly higher than MMI in regions of high intensity. The highest RCII calculated for the Nisqually earthquake is 7.6, calculated for zip code 98134, which includes the "south of downtown" (Sodo) area of Seattle and Harbor Island. By comparison, we assigned a traditional USGS MMI 8 to the Sodo area of Seattle. In all, RCII of 6.5 and higher were assigned to 58 zip-code regions. At the lowest intensities, the Nisqually earthquake was felt over an area of approximately 350,000 square km (approximately 135,000 square miles) in Washington, Oregon, Idaho, Montana, and southern British Columbia, Canada. On the basis of macroseismic effects, we infer that shaking in the southern Puget Sound region was somewhat less for the 2001 Nisqually earthquake than for the Puget Sound earthquake of April 13, 1949, which had nearly the same hypocenter and magnitude. Allowing for differences in hypocenter, shaking in the 2001 earthquake was very similar to that produced by the Puget Sound earthquake of April 25, 1965. First-person accounts of the effects of the 2001 earthquake on individual households are given for some communities.

Introduction

On February 28, 2001, 10:54 a.m. Pacific Standard Time, the U.S. Pacific Northwest and adjacent Canada were shaken by an earthquake centered beneath the southern Puget Sound lowlands of Washington. The shock is referred to as the "Nisqually" earthquake, after the Nisqually River delta, which is located near the shock's epicenter. One death, due to heart attack, is attributed to the Nisqually earthquake, and approximately four hundred people sustained injuries due to the shock. Nearly three hundred buildings were declared uninhabitable (red-tagged or yellow-tagged; table 4.1 in Nisqually Earthquake Clearinghouse Group, 2001). Air transportation into the Puget Sound region was restricted as a result of earthquake damage to SeaTac Airport and Boeing Field. Economic losses were initially estimated to be over one billion dollars (Nisqually Earthquake Clearinghouse Group, 2001), but as of this writing final estimates of economic losses have not been prepared. As of July 30, 2001, Federal disaster assistance in the form of disaster housing assistance, individual and family grants, and low interest loans from the Small Business Administration totaled $129.7 million (information extracted from Web-site at *http://www.fema.gov/diz01/d1361n89.shtm*, dated July 30, 2001): such Federal disaster assistance would address only a small fraction of the total economic losses.

The hypocenter and magnitudes of the Nisqually earthquake are as follows (U.S. Geological Survey, 2001).

Origin time: 28 February 2001, 18:54:32.8 UTC (10:54:32.8PST)

Epicenter: 47.149N., 122.727W.

Depth: 52 km

Magnitude: 6.5m_b(GS), 6.6M_S(GS), 6.7M_W(GS), 6.8M_W(HRV), 6.5$M_{e(}$GS)

The purpose of this report is to describe the overall distribution of damage and felt effects in the earthquake. The spatial distribution of damage associated with the Nisqually earthquake, as with most damaging earthquakes, was complex. We represent the damage at several levels of generality. At the most general levels, we represent the severity of ground motion within communities by means of macroseismic intensities, and we use isoseismal contours to represent the distribution of average intensities (fig. 1-2). In this study, "community" is synonymous with

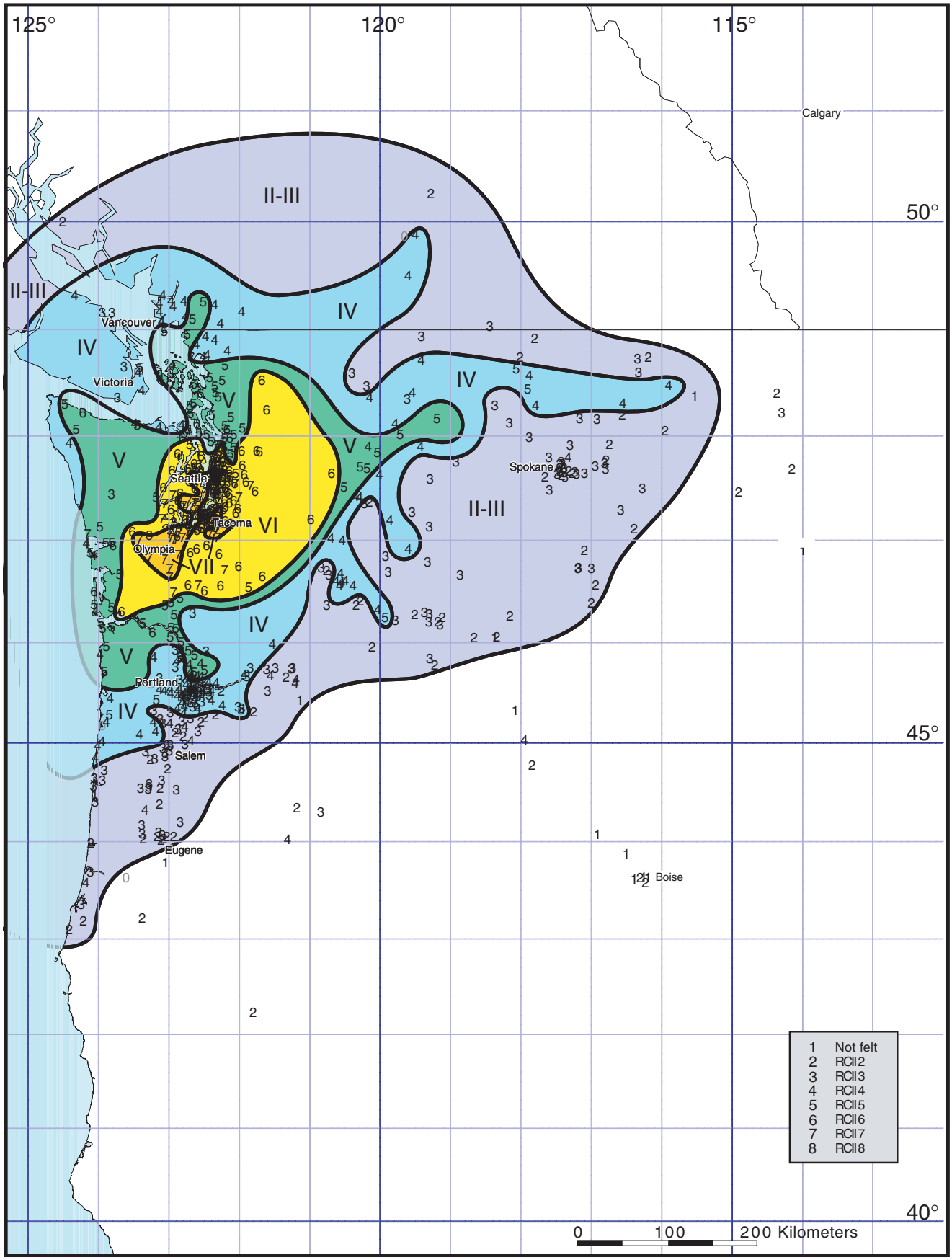


Figure 1. Far-field isoseismal map and Reviewed Community Internet Intensities (RCII) for the Nisqually earthquake.

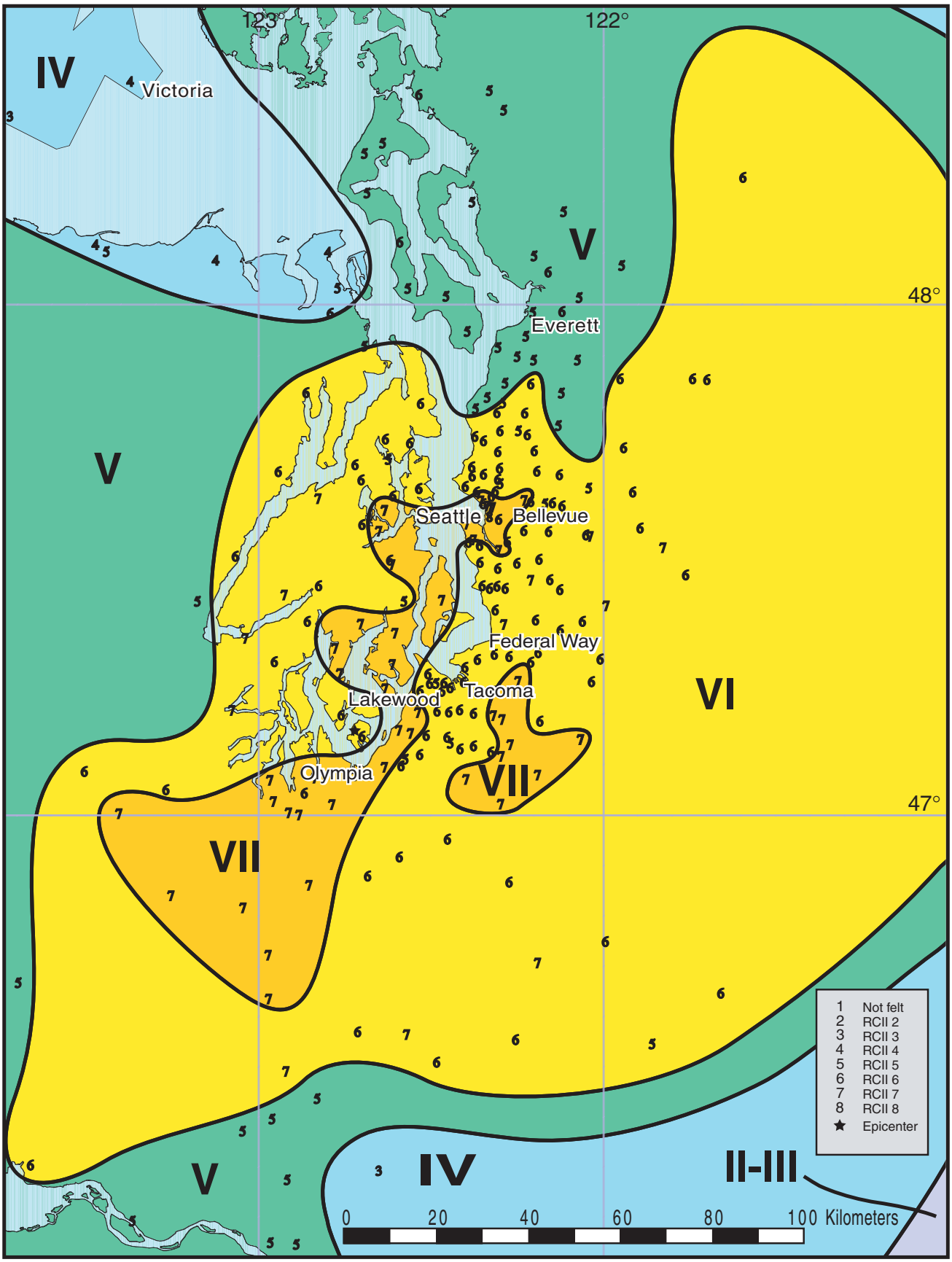


Figure 2. Isoseismals and distribution of Reviewed Community Internet Intensities (RCII) in the Puget Sound region for the Nisqually earthquake.

"postal zip-code region" unless specifically stated otherwise. At a more specific level, in the section entitled **Description of Earthquake Effects**, we summarize the damage or effects that we used to assign intensities to individual locations. Finally, at the most specific level, we report individual instances of damage and effects that, although not necessarily decisive in the assigning of intensities, are nevertheless illustrative of phenomena that were associated with the Nisqually earthquake.

The maps of figures 1 and 2 show the distribution of macroseismic intensities associated with the Nisqually earthquake. The type of intensity plotted is what we call the **Reviewed Community Internet Intensity**, or **RCII**. The use of the RCII is new with this paper, but we anticipate that it will become the standard intensity for official USGS intensity maps of the most damaging future earthquakes, replacing the Modified Mercalli Intensity (MMI) that has been assigned to U.S. earthquakes by an agency of the Federal government since 1931. For many purposes, the RCII can be used interchangeably with the MMI. For most communities, however, the data and procedures used to assign RCII are different than the data and procedures used to assign MMI, and these differences may in principle lead to differences in the intensity values themselves that are significant for some studies. An important purpose of this paper is to document similarities and differences of RCII and MMI for the Nisqually earthquake.

A preliminary USGS MMI map for the Nisqually earthquake was presented by Hopper and others (2001) and has been published in the weekly edition of the USGS/National Earthquake Information Center's Preliminary Determination of Epicenters bulletin. The maps presented in this paper supercede the preliminary USGS MMI map.

CII and the Derivation of RCII from CII

A macroseismic intensity is a number that characterizes the severity of earthquake ground shaking at a specific location by considering non-instrumental ("macroseismic") observations of the effects of the shaking on people, manmade structures, and natural surroundings at the location.

The Community Internet Intensity (CII) is a macroseismic intensity prepared automatically from observations submitted by volunteers through the Internet to the USGS CII Web-site (*http://pasadena.wr.usgs.gov/shake*; Wald and others, 1999). Users volunteer observations by means of Web questionnaires, specific effects noted on the Web-questionnaires are coded as numbers, the numbers are averaged, weighted and summed, and the weighted sum of averages is converted by a formula to an intensity value (Dengler and Moley, 1994; Wald and others, 1999). The CII are recalculated in the hours and days following an earthquake as new data are received; the current values of CII are presented in maps and tables on the USGS CII Web-site. For the Nisqually earthquake, the CII were based on over 12,000 questionnaires volunteered by residents of the northwestern U.S. and adjacent Canada. Archives of CII data are maintained on the USGS CII Web-site.

The CII procedure was designed with the intention that CII would agree on average with the traditional USGS Modified Mercalli Intensity (MMI). The formula for converting the weighted sum of Web-questionnaire responses to a CII intensity was derived by regression from a learning set of weighted sums and traditional USGS MMI (Wald and others, 1999). Unlike the MMI, which is only assigned as integer values, the CII is calculated as a decimal number. In many presentations, the CII are rounded off to integer values and we will do so for some comparisons made in the present paper. In rounding off, CII having values from 7.5 through 8.4 are rounded off to 8, CII having values from 6.5 through 7.4 are rounded off to 7, etc. In this paper, however, we will also present a reviewed version of CII in decimal form, to the nearest tenth of an intensity unit. We do this not because we believe that individual CII are accurate to the nearest tenth of an intensity unit, but because there is evidence that decimal intensities are capable in certain situations of resolving systematic variations of intensity that are smaller than one intensity unit (Dengler and Dewey, 1998).

The CII procedure has major advantages over the procedure that has traditionally been used at the USGS to assign MMI: the CII procedure produces intensities and intensity maps much more rapidly than the traditional MMI procedure; the CII procedure, once established for a region, requires much less personnel time than the MMI procedure; for many communities, the CII is based on many more observations than the traditional MMI. Experience to date suggests that, overall, rounded-off CII agree well with the MMI from the same communities.

We here introduce the Reviewed Community Internet Intensity (RCII) as a minor modification to the CII. The additional, RCII-specific, procedures are intended to define a unique set of mostly Internet-based intensities from the many possible sets of CII, to minimize the influence of errors in Web-questionnaire responses, and to account for reliable macroseismic observations that come from other sources than the CII Web-site. RCII will be assigned to a relatively few U.S. earthquakes, principally damaging earthquakes for which there are many macroseismic observations from other sources than the CII Web-site and non-damaging earthquakes in regions of low seismicity. Reports describing the assignment of RCII will be available through the USGS CII Web-site.

The characteristics of RCII and its differences from CII are as follows:

(1) The default RCII for a community will be the CII for that community computed with data that have been contributed to the CII Web-site before a specified cut-off time. There will thus be only one set of RCII for each earthquake. In contrast, the CII posted on the CII Web-site are updated continuously as new observations are contributed, and the CII assigned to a community may change as new observations are received for the community. Provisionally, on the basis of experience with CII to date, we are basing the RCII on data received within 14 days of the earthquake's occurrence.

In the case of the Nisqually earthquake, the imposition of a 14 day cut-off period (deleting observations submitted after March 14, 2001, 10:54:32 PST) had little effect on the overall intensity distribution that would have been derived by considering all reports contributed through September 13, 2001, the latest date on our overall working file of observations submitted to the CII Web-site. CII could be computed for 606 zip codes with the data contributed through 14 days, compared with the 614 zip codes for which CII could be computed with data contributed through September 13. For 109 of the 606 zip codes, the values of CII computed with the data contributed through 14 days differed from the CII computed with the data contributed through September 13, but for only three of the zip codes was the change as large as one intensity unit.

(2) Data used in the calculation of RCII will be more thoroughly reviewed than data used in the calculation of CII. We look for evidence that observers have used wrong zip codes for entering data, that they did not understand a critical element of the CII Web-questionnaire, or that the CII Web-questionnaire was not suitable for their situations at the time of the earthquake. We examine individual observations from zip codes whose CII are conspicuous outliers from the trends suggested by other CII.

In about 10 percent of zip codes for the Nisqually earthquake, we identified cases of people entering data from locations that were actually situated well outside of the zip code. Many of these incorrectly entered data were submitted by Canadians who deliberately entered Canadian observations in U.S. zip codes because the CII Web-questionnaire had no provision for Canadian postal-codes. We were able to obtain RCII for 27 Canadian towns with these data.

Not counting changes of RCII due to correction for incorrectly entered zip codes, 37 of the 606 RCII were changed from the corresponding CII as a result of our identifying cases where the observer seems to have misunderstood the intent of a query on the Web-questionnaire, or where our formulation of a query incorporated an incorrect assumption about the situation of the observer at the time of the earthquake. Only one of these changes was as large as one intensity unit.

Cases of observers misunderstanding the CII Web-questionnaire most commonly arose with the questionnaire's attempt to elicit information about damage to the observer's building. The questionnaire, for example, allowed the observer to cite "building shifted over foundation" as one type of damage. This effect was listed among possible types of damage in order to provide observers a chance to report buildings that were permanently shifted over their foundations by the earthquake, and the effect has been treated in CII calculations as indicating serious damage. For the Nisqually earthquake, about 0.5 percent of observers reported that their "building shifted over foundation". On the basis of other information they provided, however, it is clear that many of these observers were intending to state only that they perceived the building superstructure to have moved with respect to the foundation during the earthquake. We edited out the "building shifted over foundation" response except for cases where a "building permanently shifted over foundation" might have consistent with other effects reported by the observer. (We have also, subsequent to this study, changed the corresponding questionnaire item to read "building permanently shifted over foundation".)

As examples from the Nisqually earthquake of observers' situations that were different than we had assumed when we formulated a query, we cite cases in which "building shifted over foundation" or "separation of porch, balcony, or other addition from building" were described for mobile homes that were not explicitly stated to be strapped to

their foundations. These effects to mobile homes may have been real, but the CII effects as described on the Web-questionnaire were intended to refer to fixed structures.

(3) RCII may be adjusted from the CII, or assigned to communities for which there are no CII, on the basis of macroseismic observations other than those volunteered over the Internet to the CII Web-site. Sources of such observations include press reports, engineering reports, and field reconnaissance, and we will here refer to the observations as "traditional" macroseismic observations, because they were the type of observations used to assign traditional USGS MMI. In contrast, the CII are based entirely on observations volunteered over the Internet. Zip codes for which RCII are adjusted from CII will be those in which the traditional macroseismic data are judged to provide significantly better insight into the level of shaking than provided by the CII data and to imply an MMI value that differs from the CII value as rounded off to the nearest integer. RCII will be assigned to these zip codes by the traditional USGS MMI classification procedure, as discussed by Stover and Coffman (1993). RCII assigned from traditional macroseismic observations will be assigned integer values, consistent with the assigning of USGS MMI. Zip codes for which intensities are adjusted will generally be among those for which either the MMI value or the rounded-off CII value are 6 or greater. On the basis of traditional macroseismic data, RCII may also be assigned to locations to which CII are not assigned.

In the case of the Nisqually earthquake, we changed one RCII (that for SeaTac, Washington, now listed under intensity 7) from the corresponding CII on the basis of traditional macroseismic data. We also assigned RCII on the basis of a press report to a community (Adna, Washington, intensity 6) from which had received no CII data. We did not assign RCII on the basis of responses to the traditional USGS postal questionnaires (see next section), because a major purpose of this paper is to determine how future RCII assigned without postal questionnaire data might be biased with respect to traditional USGS MMI assigned with postal questionnaire data.

Traditional USGS MMI for the Nisqually Earthquake

Modified Mercalli Intensities (MMI) have been assigned by U.S. government agencies since 1931. The assigning of an MMI is a classification scheme similar to that used for most macroseismic intensities (e.g., Gruenthal and others, 1998), though not for the CII. The various macroseismic effects reported for a community are considered collectively in light of the effects that are defined in the Modified Mercalli Intensity Scale of 1931 (Wood and Neumann, 1931) as characteristic of different intensity levels. The selected intensity is that for which the match is best in the judgement of the seismologist. Experience with the MMI scale in the decades since 1931 has shown that some criteria of the MMI scale are more reliable than others as indicators of the level of ground shaking. Moreover, construction methods have changed appreciably since the scale was introduced. Assigning of USGS MMI values has therefore involved use of the original criteria of Wood and Neumann (1931) with amendments and modifications that were developed after 1931. In assigning intensities to the Nisqually earthquake, we follow amendments and modifications that are summarized by Stover and Coffman (1993) and that have been used by the USGS to assign MMI in recent years (e.g., Dewey and others, 1995).

Except in regions of strong damage, traditional USGS MMI have been heavily dependent on macroseismic observations collected by means of USGS postal questionnaires. Following the Nisqually earthquake, the USGS sent out 1,163 mail questionnaires to post offices situated within 800 km of the earthquake epicenter and to post offices, police stations, and fire stations within 140 km of the epicenter. Over 75 percent of these postal questionnaires were returned. Those receiving the questionnaires were asked to describe damage and other earthquake effects that were characteristic of their entire communities or zip-code areas.

Two of the authors (J.W. Dewey and M.G. Hopper) conducted a reconnaissance field trip in the region of strongest shaking during March 1–March 9. They visited neighborhoods in Seattle and Olympia, smaller towns in a polygon bounded by Seattle, Steilacoom, Olympia, Shelton, Elma, Chehalis, Ashford, Enumclaw, and Auburn, and towns in the Longview area. They focussed on sites of significant damage that had been identified in the press, neighborhoods in Seattle within which strong-motion seismographs were located at the time of the earthquake, and towns that had experienced intensity 8 effects in the Puget Sound earthquake of April 13, 1949.

In addition to using data and observations that we collected ourselves, we made significant use of press reports and

preliminary reconnaissance reports by Bray and others (2001), EQE International (2001), Filiatrault and others (2001), and the Nisqually Earthquake Clearinghouse Group (2001).

Most of the MMI listed for Canadian cities were provided by the Geological Survey of Canada (GSC). These MMI are "traditional" only in the sense that the USGS has traditionally relied on the GSC and earlier Canadian government seismological services for MMI in Canada. In recent years, the GSC has been collecting macroseismic data via the Internet (e.g., Cajka and Halchuk, 1998), and the present MMI are based on such data. We received the GSC MMI as one for each Internet observer. For cities with more than two Internet observers, we have sorted intensities in order of increasing size and taken for the city MMI the highest intensity in the 50th percentile—75th percentile range. For cities with two observations, the city MMI corresponds to the higher of the two. In this paper, we use the GSC MMI for MMI isoseismal maps, and the GSC MMI are listed in the **Description of Earthquake Effects** section, but, because the GSC MMI are now based on a different instrument for collecting macroseismic data than the traditional USGS MMI, we do not use GSC MMI in our comparison of RCII and MMI (next section).

Comparison of RCII and MMI for the Nisqually Earthquake

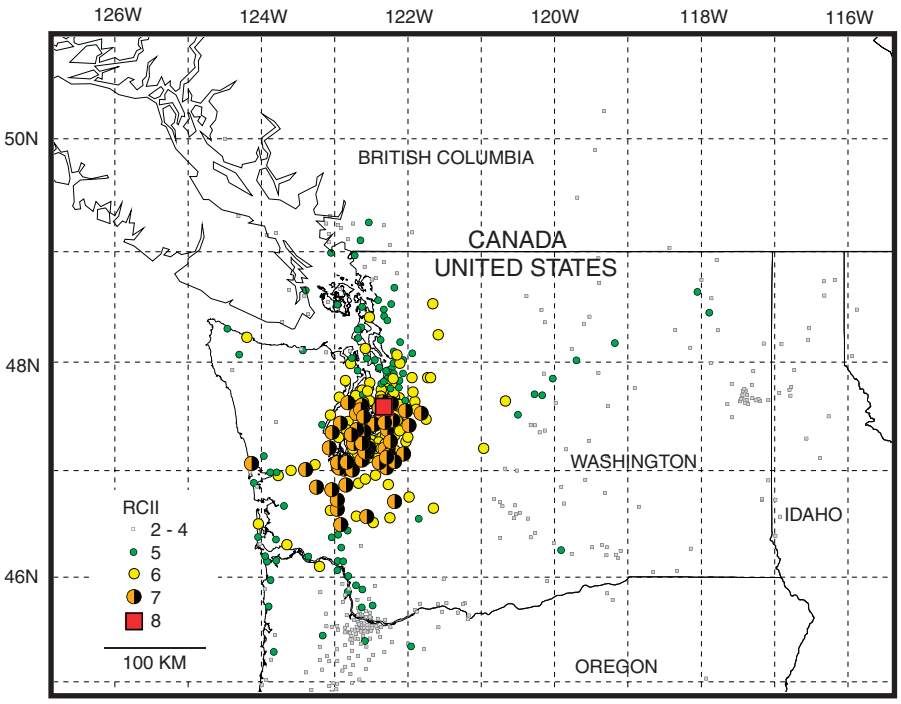
In this section, we summarize several studies conducted to evaluate the possibility that RCII might be biased with respect to traditional MMI for the Nisqually earthquake. In principle, because of the different data and procedures used to assign RCII and MMI, it would not be surprising if there were biases in RCII with respect to MMI at some levels of shaking, notwithstanding that the RCII (CII) procedure was formulated so that RCII (CII) would on average agree with MMI. Therefore, at the same time that we present evidence for the overall similarity of MMI and RCII for the Nisqually earthquake, we also note discrepancies that might point to a systematic bias.

For the Nisqually earthquake, there were 676 zip codes to which traditional MMI were assigned and 606 to which RCII were assigned. For 333 of these zip codes, both MMI and RCII were assigned (table 1). We defer, to a later paragraph, discussion of zip codes in which one or both of the MMI and RCII correspond to "not felt," and we consider here the 297 zip codes for which both MMI and RCII were 2 or greater. For 89 percent of these zip codes, the MMI and rounded-off RCII agree to within one intensity unit. We regard the scatter shown in table 1 as broadly similar to what one might expect from random errors in both RCII and MMI. The Nisqually data nonetheless suggest that RCII may be somewhat smaller than MMI in regions of lowest intensity and somewhat higher than MMI in regions of highest intensity. Thus, as an illustration of possible bias in regions of lower intensity, we consider the 203 zip codes for which either an MMI of 5 or less was assigned or a rounded-off RCII of 5 or less was assigned. Among these zip codes, there were 52 cases of RCII > MMI, 69 cases of RCII = MMI, and 82 cases of RCII < MMI. The possibility of RCII being systematically less than MMI in regions of low intensity has been noted previously (Dewey and others, 2000; 2001). As an illustration of possible bias in regions of higher intensity, we consider the 68 zip codes for which either an MMI of 7 or more was assigned or a rounded-off RCII of 7 or more was assigned: there were 30 cases of RCII > MMI, 18 cases of RCII = MMI, and 20 cases of RCII < MMI.

Maps of MMI and RCII for the Nisqually earthquake (fig. 3A and 3B) show the similarities and differences noted in the previous paragraph. The maps are very similar overall. However, the RCII map (fig. 3A) shows relatively more intensity 7 observations near the epicenter and relatively fewer intensity 5 observations in northern Oregon and eastern Washington.

For zip codes in which one or both of the MMI and RCII correspond to "not felt," there is a clear tendency (table 1) for the RCII to correspond to "felt" while the MMI corresponds to "not felt." This is an expected consequence of sampling bias. The procedure for obtaining macroseismic data to calculate RCII is strongly biased towards obtaining data from people who have felt the earthquake (see section entitled **Defining the Outermost RCII Isoseismal**).

A plot of rounded-off RCII and MMI versus distance (fig. 4) shows the general similarity between the two types of intensity. The distance ranges in which a given value of intensity is observed are similar for RCII and MMI, as are the median distances. In figure 4 all RCII and MMI from the United States are plotted, including those for zip codes from which only one type of the two types of intensity is available.



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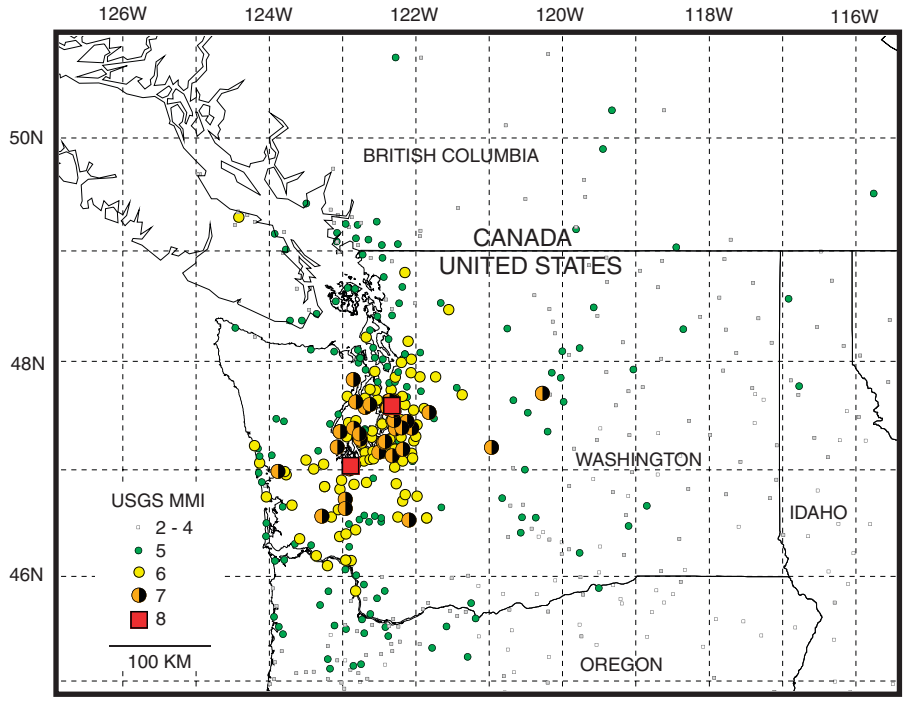


B

Figure 3. Comparison of: (A) Reviewed Community Internet Intensities (RCII) and, (B) traditional USGS Modified Mercalli Intensities (MMI) for the Nisqually earthquake.

USGS MMI \ RCII	NF	2	3	4	5	6	7	8
8							2	**1**
7					2	16	**17**	
6				1	19	**33**	25	
5		2	10	26	**31**	18	5	
4		3	12	**20**	6	1		
3	1	7	**12**	4	2			
2	1	6	11	5				
NF	**5**	18	5	5	1			

Table 1. Comparison of USGS MMI and RCII for zip codes to which both types of intensity were applied.

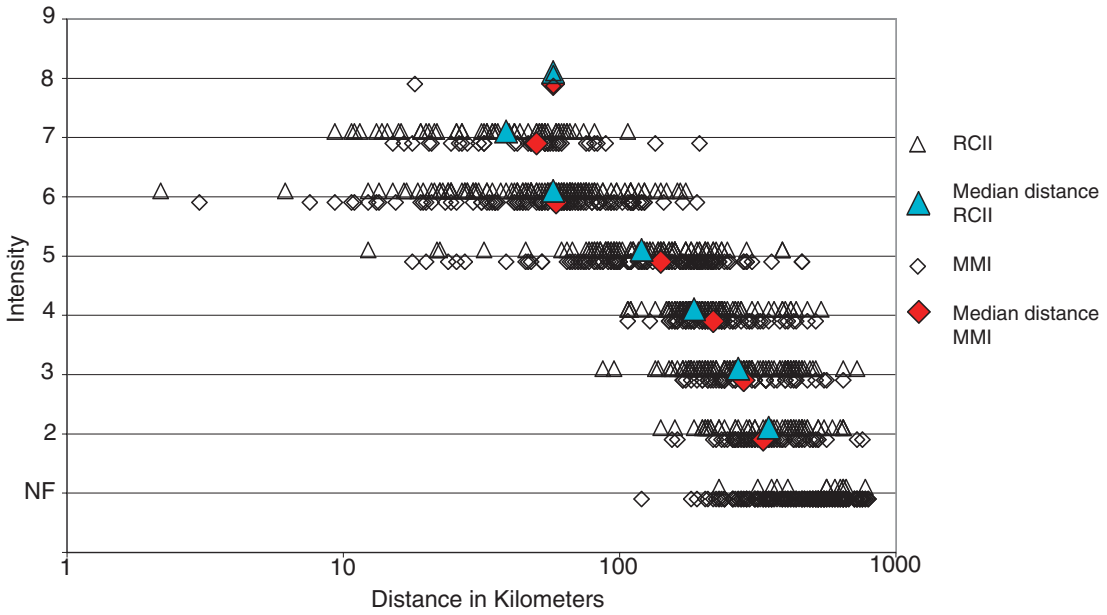


Figure 4. USGS MMI and rounded-off RCII as a function of Log(epicentral distance).

Reports of Specific Types of Damage are not a Necessary or Sufficient Condition for Assigning High RCII

Traditional USGS MMI values of 6 and higher generally require reports of specific types of damage to buildings or other human structures in the community; the only exception is that intensity 6 may be assigned solely on the basis of many objects fallen from shelves (Stover and Coffman, 1993). Thus, in the absence of reports of many objects fallen from shelves, assignment of a USGS MMI of 6 would require reports of minor damage such as a few broken windows, fallen plaster, or large cracks in interior walls. Assignments of progressively higher intensities require reports of specific types of damage that are associated with progressively higher levels of shaking. However, assignment of USGS MMI of 6 or larger on the basis of building damage does not necessarily require that the damage be observed in many buildings of the community. An assignment of USGS MMI 7 to a community, for example, might be made on the basis of 10 percent of the houses having experienced large cracks or bricks fallen from unreinforced chimneys. To obtain information on the presence of building damage, the traditional USGS postal questionnaire asks respondents to note the occurrence of various types of building damage in their community. Traditional MMI of 8 and above are typically based on additional observations besides the postal questionnaires.

The situation with CII and RCII is different than that described above for USGS MMI. Observations of particular types of damage are neither necessary nor sufficient for assigning the higher values of RCII. The CII data collection procedure differs from the USGS MMI data collection procedure in that the CII Web-questionnaire only asks for damage information about the building in which the observer was located at the time of the earthquake. If 10 percent of the houses in a community experience major chimney damage, there is a good chance that no one of a small number of Web questionnaires from the community will report "major chimney damage." To obtain from the CII Web-questionnaires CII and RCII that are consistent on average with USGS MMI, the CII procedure therefore does not insist that specific types of damage be necessary or sufficient for assigning a particular level of intensity. This is implicit in the equations used to calculate CII (Wald and others, 1999). A rounded-off CII or RCII of 7 may in principle be assigned to a community without any building damage having been reported on questionnaires submitted from the community, provided that non-damage effects are sufficiently strong. Similarly, RCII of 8 or higher may in principal be assigned to a community without reports of specific types of building damage that are necessary for assigning USGS MMI of 8 or higher having been received from that community.

The ability to incorporate traditional macroseismic data into the assigning of RCII (see section entitled ***CII and the Derivation of RCII from CII***) does mean that an RCII could be changed from the corresponding CII on the basis of observations of damage or non-damage in buildings that come from other sources than the CII Web-questionnaire. Our convention is that we will not make such changes unless we find the evidence from traditional macroseismic data to be compelling that the RCII derived from Web-questionnaires significantly misrepresents the level of shaking compared to the USGS MMI implied by the traditional data. In addition, although postal questionnaire data are available for the Nisqually earthquake, such data will not be available for future damaging earthquakes, and we therefore do not adjust Nisqually RCII's on the basis of postal questionnaire observations. As noted earlier, in the case of the Nisqually earthquake we made two changes/additions to RCII solely on the basis of traditional macroseismic data.

In the Nisqually earthquake, there were 58 communities to which rounded-off RCII 7 was assigned. Figure 5 shows that, in a half dozen of these communities with the largest numbers of observations, 10 percent or more of observers did report damage that, if characteristic of the area, would be used to justify assigning USGS MMI 7 to the community. Such damage would be "many windows cracked or broken out," "masonry fell from block or brick walls," or "old chimney, major damage or fell down." There are, however, clearly communities assigned rounded-off RCII of 7, from which rather large numbers of observations were submitted, that had few or no observations of types of damage that would be considered necessary to assign USGS MMI of 7. For example, there were 39 observations submitted from zip code 98335 (Gig Harbor, Washington, RCII=6.5) and none reported effects that are necessary or sufficient to assign USGS MMI 7.

There were 125 communities to which rounded-off RCII 6 was assigned. The percentages of observers reporting effects that are necessary or sufficient to assign USGS MMI 6, in the absence of many items fallen from shelves, are typically in the 10-30 percent range (fig. 6). It is noteworthy that damages that are normally considered characteristic of USGS MMI 7 were also reported by some

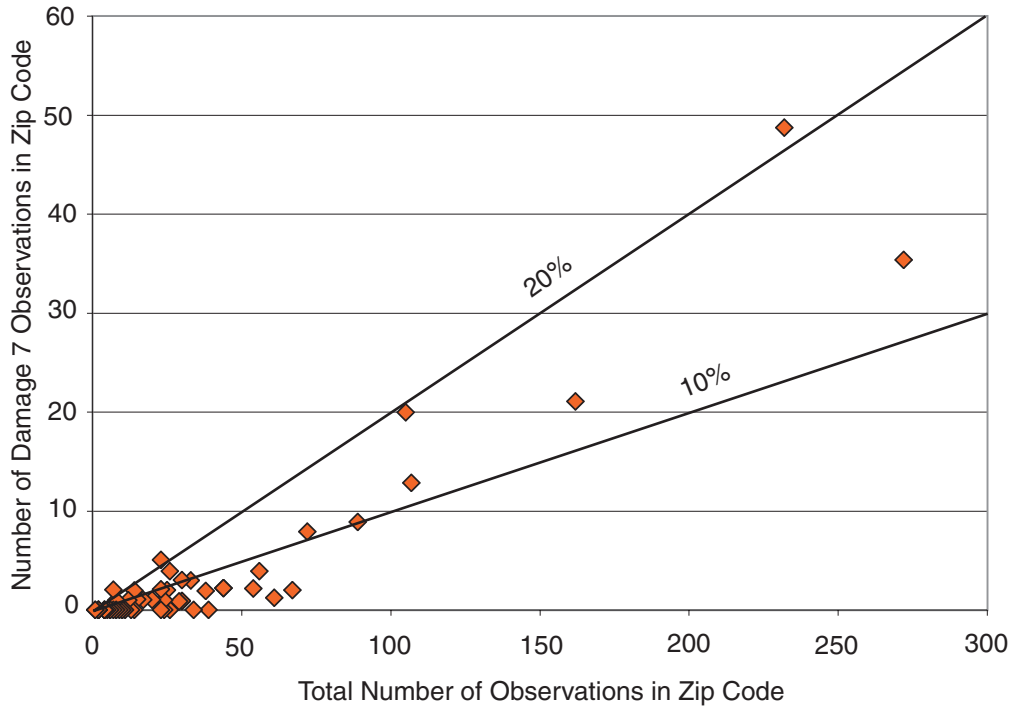


Figure 5. For zip codes to which RCII 7 is assigned, the number of observers reporting damage that is characteristic of USGS MMI 7 as a function of the total number of observations in the zip code.

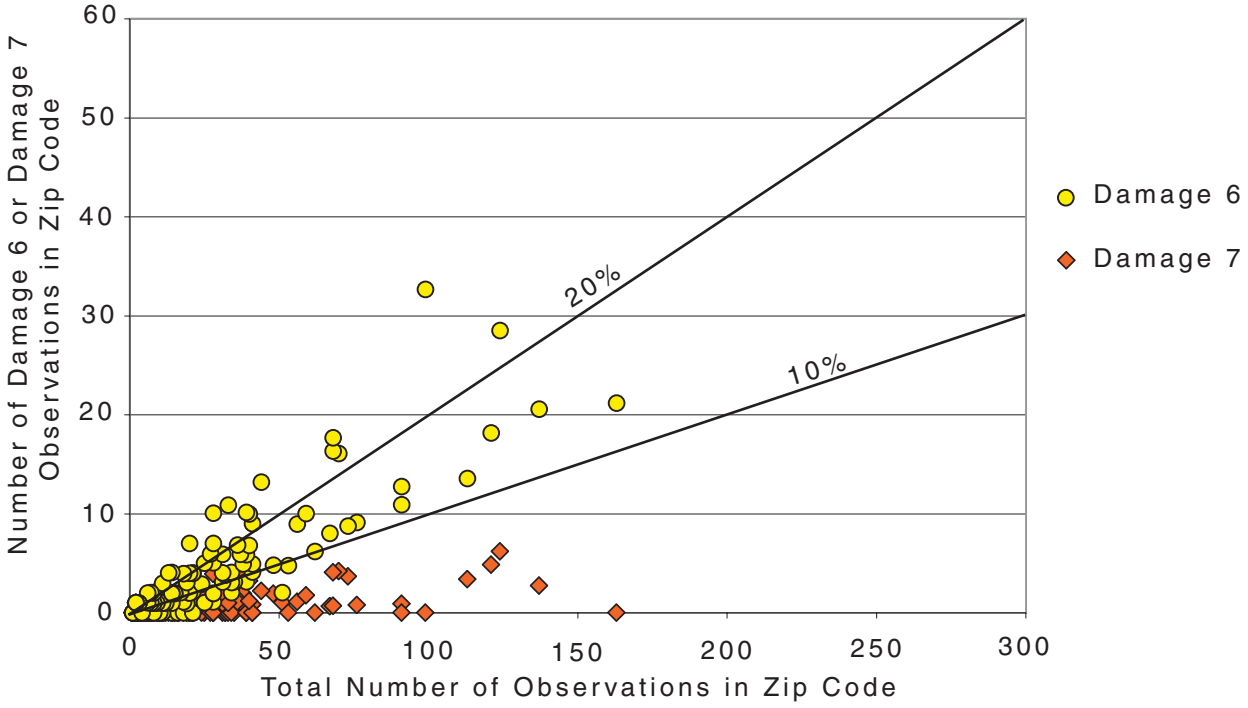


Figure 6. For zip codes to which RCII 6 is assigned, numbers of observers reporting damage that is characteristic of USGS MMI 6 and USGS MMI 7 as functions of the total number of observations in the zip code. Redmond, Washington, outside of the bounds of this figure with 595 observations; had 13 percent reporting damage 6 effects and 1 percent reporting damage 7 effects.

observers in zip codes having RCII 6. However, even with these damages such as are typically associated with USGS MMI 7, the non-damage effects from these communities were not sufficiently strong to lead to a rounded-off CII or RCII of 7.

Defining the Outermost RCII Isoseismal

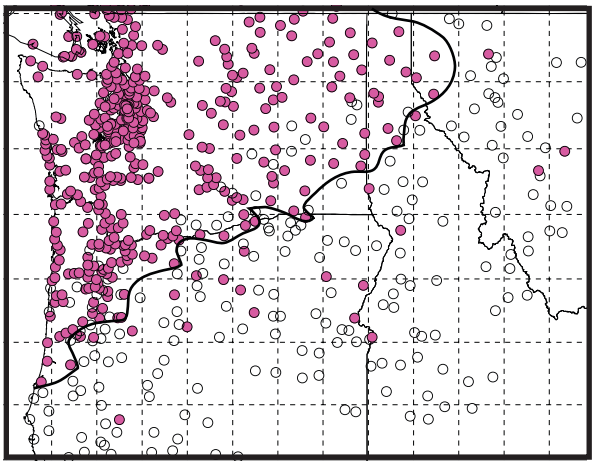
With RCII, there is a potential problem in defining the outermost isoseismal, beyond which the earthquake is generally not felt. With the traditional USGS MMI procedure, the limits of shaking are defined largely by "not felt" responses on postal questionnaires returned from the most distant communities (fig. 7A). The traditional procedure obtains "not felt" observations by intentionally canvassing communities beyond the limits within which an earthquake is likely to have been felt. "Not felt" reports obtained by the RCII procedure, however, must come from people who have learned about the earthquake by some means other than being canvassed, who overcome the natural lack of enthusiasm for contributing a null observation, and who log into the CII Web-site to volunteer that they did not feel the earthquake.

Consideration of the total population exposed to shaking helps correct for the bias towards felt reports in the Web-questionnaire data—one may count a community from which no Web-questionnaires were received as a being, in effect, a "not felt" observation (Dewey and others, 2001). This procedure presupposes that the community has a large enough population that a report would have been received if the earthquake had been felt in the community. For the Nisqually earthquake, we considered non-reporting zip codes with populations exceeding 1,000 and 10,000, respectively, as possible surrogates for "not felt" observations. Within the land areas of the United States, the felt area implied by traditional USGS MMI data is about 240,000 square kilometers (fig. 7A). Counting as "not felts" those non-responding zip codes with populations exceeding 10,000, the felt area implied by RCII data is about 300,000 square kilometers (fig. 7B). Counting as "not felts" all non-responding zip codes having populations exceeding 1,000, the RCII data imply an outermost isoseismal that encompasses approximately 210,000 square kilometers (fig. 7C) within the U.S. We consider the non-responding zip codes having populations exceeding 1,000 to be a better surrogate for traditional "not felts" than non-responding zip codes with populations exceeding 10,000. For our final map (fig. 1), however, we defined the outermost isoseismal in part by consideration of the "not felt" observations obtained with the traditional USGS MMI procedure.

Number of Observations as a Guide to the Reliability of RCII

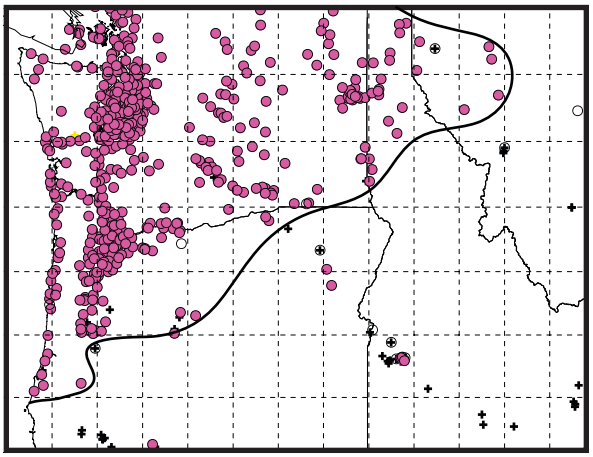
Dewey and others (2000, 2001) found in study of other earthquakes that requiring a minimum of three observations per zip code greatly reduces the number of inappropriate intensities assigned from data volunteered over the Internet. Such a requirement, however, also results in discarding valid intensities based on one or two observations. In the present study, we did not apply the requirement of at least three observations per zip code. The extra stage of review involved in producing RCII from CII (described in the section entitled ***CII and the Derivation of RCII from CII***) removed many spurious observations. We checked individual observations for zip codes to which rounded-off RCII of 6 or 7 had been assigned on the basis of only one or two observations. We sought redundancy of observation by considering intensities based on one or two observations in the context of intensities assigned to neighboring zip codes and in the context of overall trends of attenuation with distance.

Figure 8 shows that allowing RCII based on one and two observations per zip code does not greatly increase the dispersion of intensity observations plotted as a function of distance, compared with RCII based on three or more observations and RCII based on 10 or more observations. Some of the dispersion of RCII in figure 8 is probably due to azimuthal variations of attenuation from the source, rather than to noise in the RCII measurements. For example, distant communities to the SE of the epicenter show systematically lower RCII than communities at the same distance to the NE of the epicenter (fig. 9).



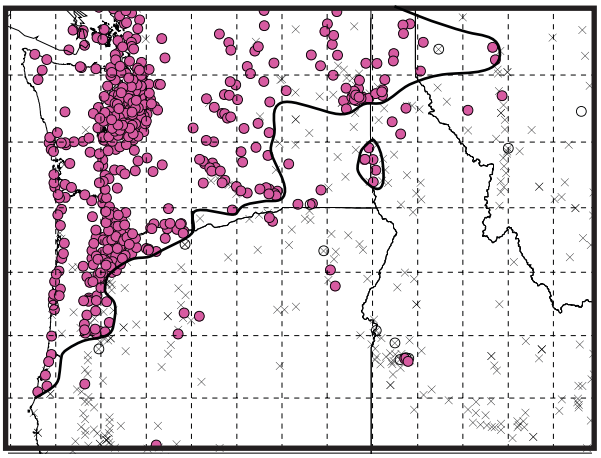
A

- Felt from postal questionnaire
- Reported not felt on postal questionnaire



B

- Felt from CII Web questionnaire
- Reported not felt on CII Web questionnaire
- Zip-code with no CII felt reports, population > 10,000



C

- Felt from CII Web questionnaire
- Reported not felt on CII Web questionnaire
- Zip-code with no CII felt reports, population > 1,000

Figure 7. Defining the outermost isoseismal of the Nisqually earthquake within the U.S. (A) outermost isoseismal contoured on USGS MMI. (B) Outermost isoseismal contoured on RCII, assigning "not felt" to zip codes that have more than 10,000 people and from which no CII observations were received. (C) Outermost isoseismal contoured on RCII, assigning "not felt" to zip codes that have more than 1,000 people and from which no CII observations were received.

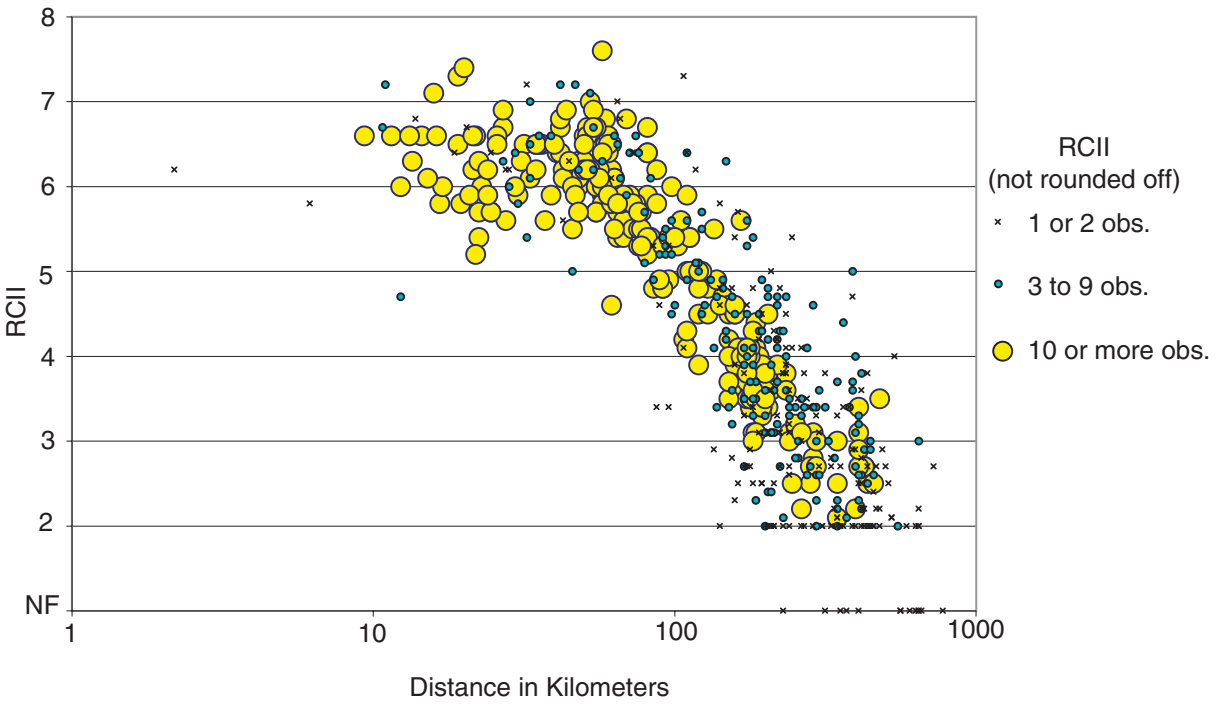


Figure 8. RCII, not rounded off, plotted as a function of Log(epicentral distance), with symbols indicating the numbers of observations used to calculate each RCII.

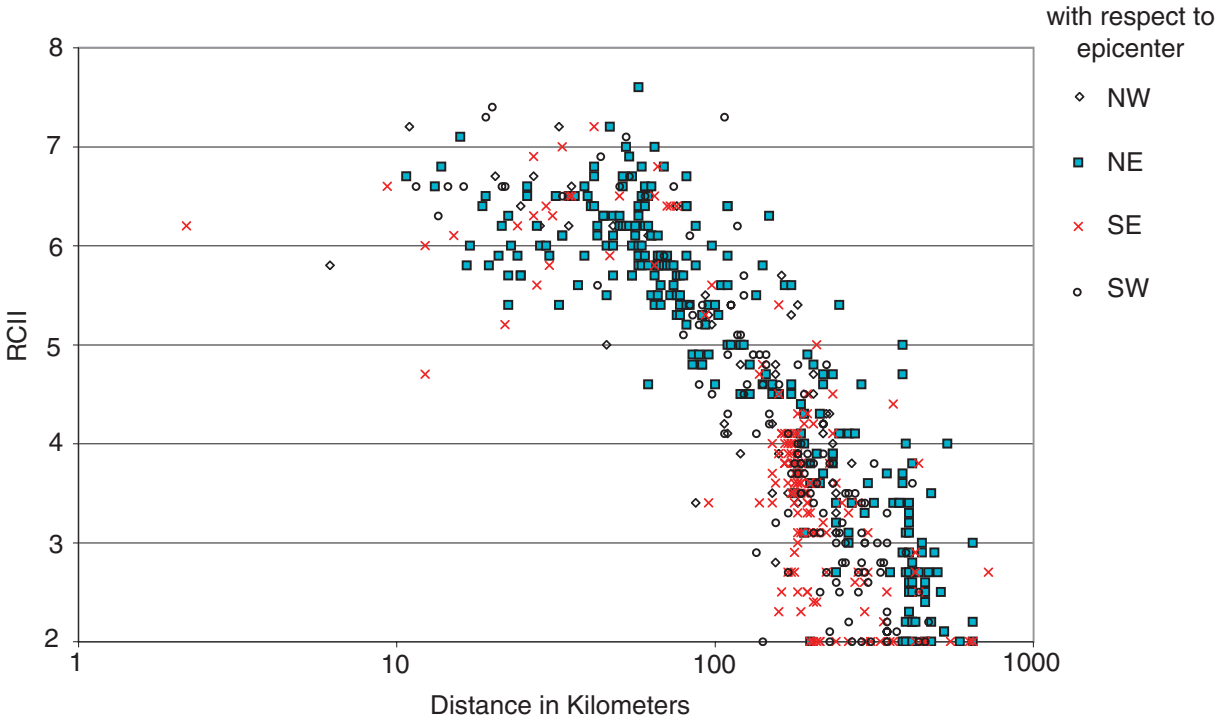


Figure 9. RCII, not rounded off, plotted as a function of Log(epicentral distance), with symbols differentiating the azimuthal quadrant in which the community is located.

Comparison of the 2001 Nisqually Earthquake with the Puget Sound Earthquakes of 1949 and 1965

The Washington earthquakes of April 13, 1949, and April 29, 1965, had sizes and hypocenters that were similar to those of the Nisqually earthquake. The epicenter for the 1949 earthquake, computed in a special study by Villasenor and others (2001), is within 10 km of their hypocenter of the 2001 earthquake: the difference between the two epicenters is not resolvable to a high level of confidence. The epicenter for the 1965 earthquake calculated by Villasenor and others (2001) is about 35 km northeast of that of the 2001 earthquake. The focal depths are within 15 km of each other (U.S. Geological Survey, 2001; Baker and Langston, 1987; Langston and Blum, 1977). The seismic moments are nearly identical (U.S. Geological Survey, 2001; Baker and Langston, 1987; Langston and Blum, 1977) and imply moment magnitudes of 6.8 (1949), 6.7 (1965), and 6.8 (2001).

Intensities assigned to the 1949 and 1965 earthquakes were Modified Mercalli Intensities. For the purposes of comparing intensities for the three earthquakes, we focus for the 2001 earthquake on the traditional USGS MMI, although most conclusions also hold from comparing the isoseismals of the 1949 and 1965 earthquakes with the isoseismals on the RCII for 2001.

In much of western Washington and northwestern Oregon, intensities for the 1949 earthquake were systematically higher than for the 2001 earthquake (fig. 10). We think that these differences result in part from shaking in the epicentral region having been stronger in 1949 than in 2001, due to differences in some source property such as the source-time function or the direction of rupture propagation. For most of the towns assigned MMI 8 in 1949, the effects reported on unreinforced masonry chimneys and buildings (Murphy and Ulrich, 1951) were substantially more dramatic than we observed or were reported in the same types of structures in the same towns in 2001.

For the comparison shown in figure 10, we have attempted to minimize the effects of changing conventions in the assignment of MMI. Most intensities that are plotted for 1949 in figure 10 were assigned by Stover and Coffman (1993) for the preparation of their intensity map of the 1949 earthquake. These intensities reflect recent USGS conventions for the assigning of MMI from macroseismic data, and they are slightly but systematically lower than the intensities assigned by Murphy and Ulrich (1951) on the basis of the same macroseismic data. The intensities plotted in figure 10 also includes 39 interpretations of the present authors, again applying recent USGS conventions to the macroseismic data reported by Murphy and Ulrich (1951). The reinterpretations that we made were for observations to which Murphy and Ulrich (1951) assigned MMI 8, and to which we do not know if Stover and Coffman (1993) would have assigned MMI 7 or 8 (their map does not distinguish intensity 8 regions within the intensity 7 isoseismal.) In all, for almost half of the communities to which Murphy and Ulrich (1951) assigned MMI 8, 7, 6, or 5, we and Stover and Coffmann assign lower intensities. Nonetheless, after these adjustments have been made, the 1949 intensities are still higher than the 2001 intensities in western Washington and northwestern Oregon.

The intensities of the 1965 earthquake were generally similar to those of the 2001 earthquake (fig. 11). A summary statement by Algermissen and Harding (1965) on the 1965 earthquake could equally well be made for the 2001 earthquake: “Although intensity VIII damage was observed in a few areas, this earthquake is best described, in terms of intensity, as an earthquake with maximum intensity near the upper limit of intensity VII.” Macroseismic effects for communities assigned intensity 7 and 8 in 1965 are summarized by von Hake and Cloud (1967) and U.S. Department of Commerce (1967): we judge that assigning of intensity 7 and 8 for the 1965 earthquake was completely consistent with our assigning of USGS MMI 7 and 8 to the 2001 earthquake. Macroseismic effects of communities assigned intensity 5 and 6 are summarized in U.S. Department of Commerce (1967). It appears to us that criteria of recent decades for assigning intensity 5 and 6 are somewhat more conservative than was the case in 1965. Thus, in recent years a report that an earthquake was “felt by all” in the community has not been considered diagnostic of intensity 5 in that community (Stover and Coffman, 1993), whereas in 1965 “felt by all” was considered diagnostic of intensity 5. Similarly, reports of “trees and bushes shaken moderately” would not today be considered diagnostic of intensity 6 (Stover and Coffman, 1993), whereas they seem to have been so considered in 1965. Because of the slightly more conservative criteria for assigning intensities of 5 and 6 in 2001 than in 1965, we do not regard as significant the slight differences in the distribution of intensity 5 and 6 values for the 1965 and 2001 earthquakes.

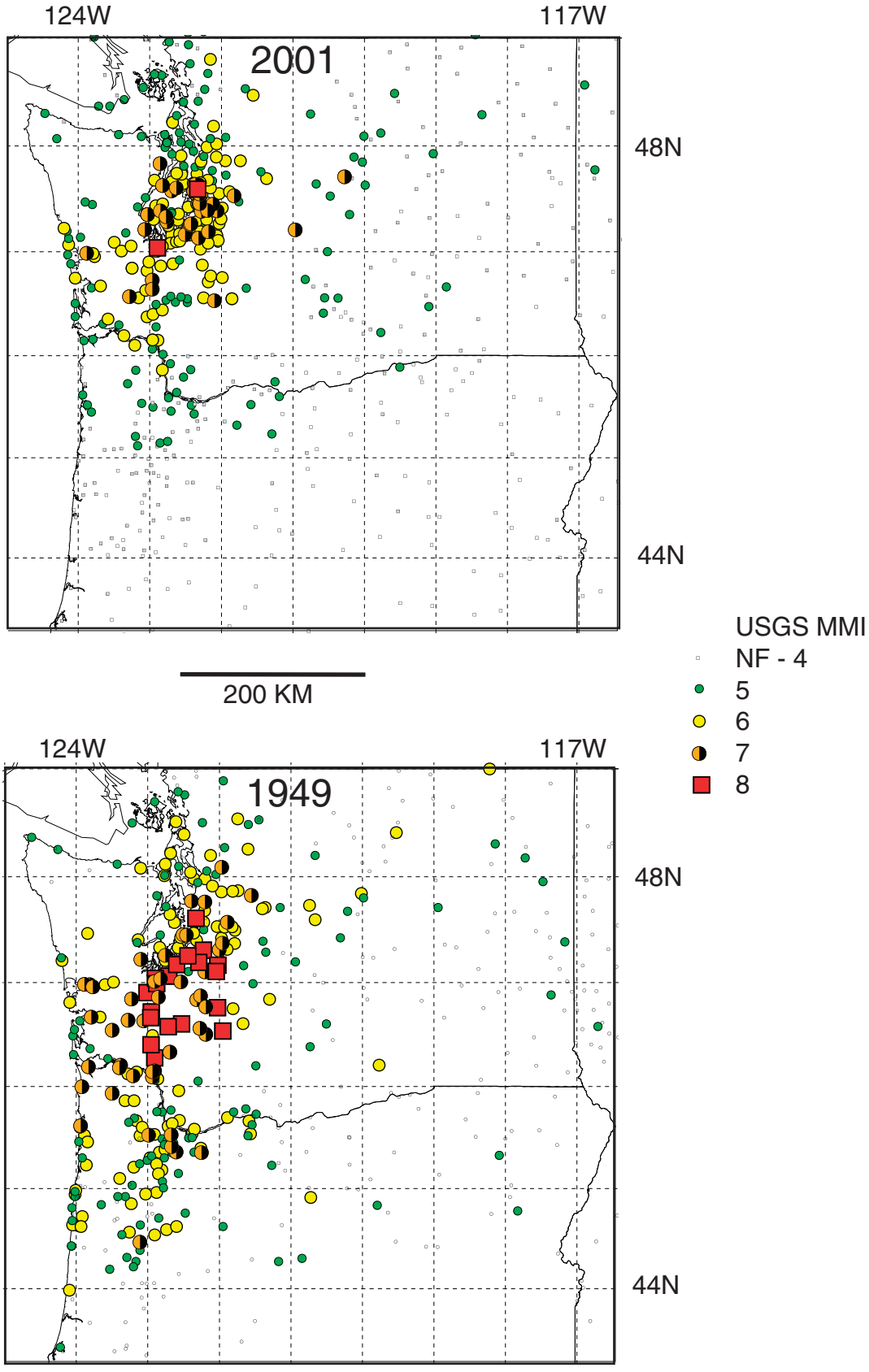


Figure 10. USGS MMI from the Nisqually earthquake and the Puget Sound earthquake of April 13, 1949, for the United States and Vancouver Island, BC, Canada.

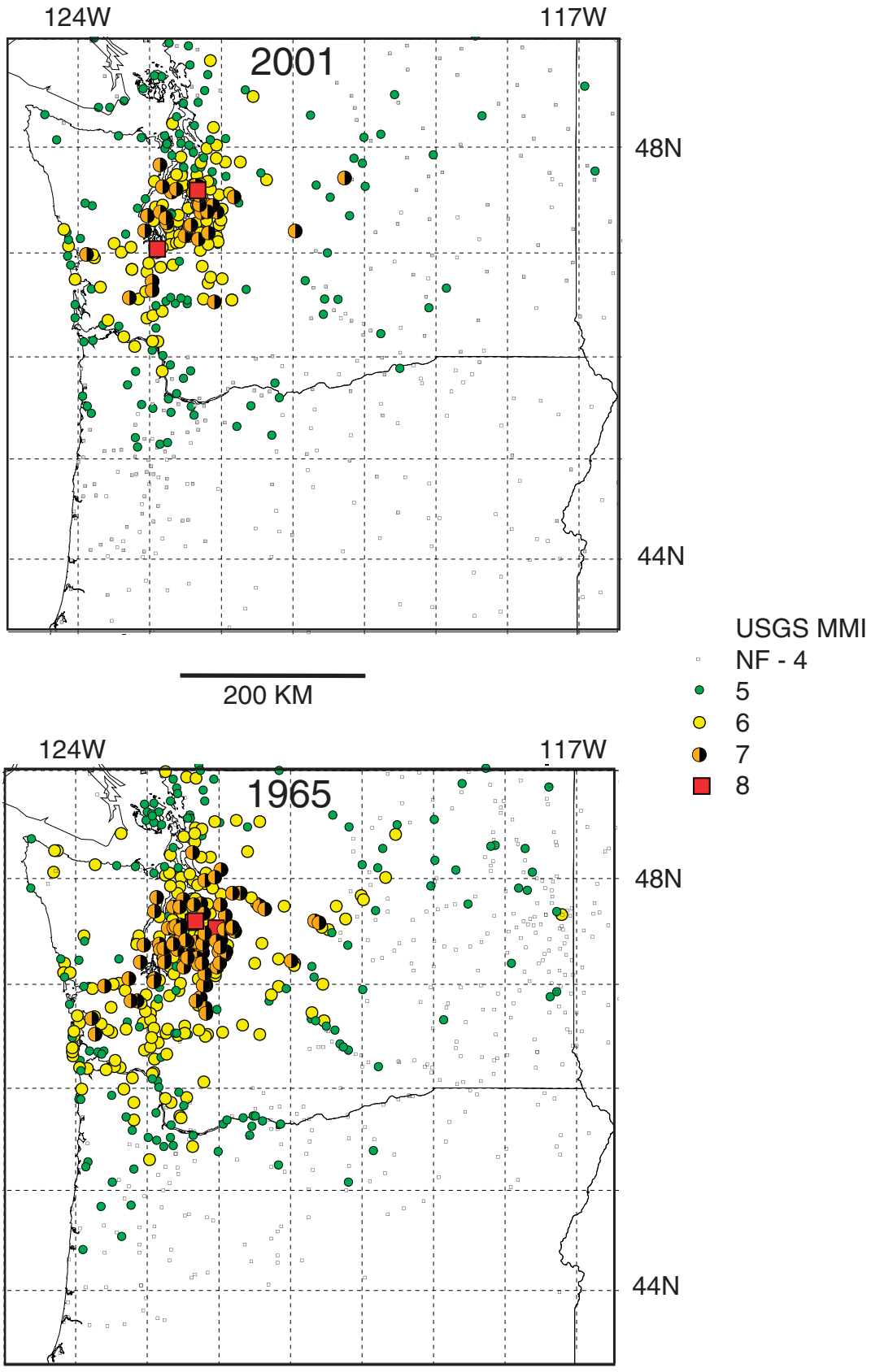


Figure 11. USGS MMI from the Nisqually earthquake and the Puget Sound earthquake of April 29, 1965, for the United States and Vancouver Island, BC, Canada.

Description of Earthquake Effects

The earthquake was felt over approximately 350,000 square kilometers (approximately 135,000 square miles) of the land area of the United States and adjacent Canada.

The effects of the earthquake varied significantly within individual areas between isoseismal contours. Some of this variation is revealed by the values of intensity assigned to individual communities between isoseismal contours (figs. 1 and 2), but within individual communities there were finer scale variations of earthquake effects that for the most part are not represented on the maps. Similar variations of effects have been noted for centuries in earthquake studies. Factors involved in variations of damage within a relatively small area include differences in the seismic resistance of human structures, differences in focussing of seismic energy by variations in the properties of the earth material through which the earthquake waves travel, differences in focussing of seismic energy by the topography of the ground surface, and differences in the failure susceptibilities of the geologic foundations of human structures.

For individual communities, below, both RCII and MMI are given, if available. We give the postal zip code, as of 2001, for U.S. communities, and geographic coordinates for a point in the zip code that will usually correspond approximately to the centroid of the population distribution in the zip code.

Effects summarized from postal questionnaires are those that are important in assigning MMI of 6 and higher and that provide additional or different perspectives on shaking than provided by other traditional macroseismic data or by Web-questionnaire data. With the exception of "difficulty standing or walking during the earthquake," effects summarized from Web-questionnaires correspond to those questions that pertain to movement of inanimate objects or building damage.

As we state elsewhere in the text, the RCII are not influenced by observations reported on the postal questionnaires.

First-person accounts given in the community reports were taken from "Additional Comments" that accompanied the macroseismic observations submitted to the CII Web-site. The additional comments provided by respondents to the Web-site were commonly very helpful to us in providing context for interpreting other responses. We intend the examples given in this section to be illustrative of how people described their experiences and observations in their own words.

RCII 7.5-8.4 (or MMI 8 for communities with no RCII) in Washington

Seattle (Sodo and Harbor Island) (RCII=7.6, MMI=8) (Zip Code 98134; 47.590N, 122.326W)—Many buildings were damaged in Sodo along 1st Ave. South from South Jackson St. to South Hanford St. Along this stretch cracked or collapsed walls, fallen parapets and broken windows were common in old buildings (fig. 12; fig. 13). Notable damage included collapsed unreinforced masonry walls at the Seattle Chocolates building and at the Acme Tool and Specialty building and a collapsed front facade at the Starbucks Headquarters building.

Figure 12. Partial collapse of URM building wall, Sodo neighborhood of Seattle.

Figure 13. Damage to upper wall of URM building, Sodo neighborhood of Seattle.

(Pacific Earthquake Engineering Research Center (PEER) and USGS field observations).

The Holgate Street Overpass over I-5 sustained shear failure of its columns (Nisqually Earthquake Clearinghouse Group, 2001). The Spokane Street overcross of SR-99 sustained damage to the superstructure (Pacific Earthquake Engineering Research Center (PEER), p. 42 ff). Concrete spalled from the bearing seat of an expansion joint, damaging the Fourth Avenue on-ramp to I-90 (Nisqually Earthquake Clearinghouse Group, 2001, p. 19).

"A number of structures in the Sodo area were extensively damaged by liquefaction-induced foundation failure" (Nisqually Earthquake Clearinghouse Group, 2001). Soil liquefaction, as evidenced by ejection of sand, was observed at many locations of the south of downtown Seattle area (Bray and others, 2001).

Thirteen hundred gallons of gasoline and diesel fuel spilled on Harbor Island (Nisqually Earthquake Clearinghouse Group, 2001). Soil liquefaction and fill compaction occurred on Harbor Island, producing cracks in pavement of Terminals 5, 18 and 30 (Bray and others, 2001).

An internet respondent on the waterfront reported, "Many ceiling tiles were down and a file cabinet and book shelf had fallen over."

Percentages of effects noted by 52 internet respondents: difficulty standing or walking during the earthquake—52%; objects toppled over or fell off shelves—85%; pictures on walls moved or were knocked askew—65%; furniture or appliances slid, toppled over, or became displaced—65%; hairline cracks in walls—40%; a few large cracks in walls—40%; many large cracks in walls—12%; one or several windows cracked—15%; many windows cracked or broken out—8%; ceiling tiles or lighting fixtures fell—40%; cracks in chimney—4%; masonry fell from block or brick walls—33%; outside walls tilted over or collapsed—6%; separation of porch, balcony or other addition from building—8%.

Olympia (RCII=7.3, MMI=7, except MMI=8 in Capitol Hill)— See under RCII 6.5-7.4.

RCII 6.5-7.4 (or MMI 7 for communities with no RCII) in Washington

Boeing Field and Seattle (Georgetown) (RCII=6.7, MMI=7) (Zip Code 98108; 47.523N, 122.300W)—The control tower was damaged at Boeing Field (Nisqually Earthquake Clearinghouse Group, 2001). Extensive liquefaction occurred at Boeing Field (King County Airport) and in the industrial area along the Duwamish River north of the airport (Nisqually Earthquake Clearinghouse Group, 2001; Bray and others, 2001).

An observer via Internet reported, "Nearly all bookcases and some file cabinets fell and the computer on my desk fell to the floor. Large cracks appeared in the stairwells, and lots of fine concrete dust filled the air. Linoleum on the first floor near stanchions was buckled and raised in about a one-foot radius around each stanchion that I saw." A nearby observer in an office on East Marginal Way noted, "When I first came out of the building there was water pouring out from the sidewalk."

Percentages of effects noted by 72 internet respondents: difficulty standing or walking during the earthquake—46%; objects toppled over or fell off shelves—72%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—46%; hairline cracks in walls—19%; a few large cracks in walls—21%; many large cracks in walls—7%; one or several windows cracked—10%; many windows cracked or broken out—4%; ceiling tiles or lighting fixtures fell—38%; cracks in chimney—1%; major damage to old chimney—1%; masonry fell from block or brick walls—6%; outside walls tilted over or collapsed—1%; separation of porch, balcony or other addition from building—4%.

Bremerton (RCII=6.8, MMI=7) (98337; 47.602N, 122.630W)—Many Kitsap County schools experienced minor damage, including cracked walls and fallen ceiling tiles. Elevators were damaged at Harrison Hospital and plumbing of the heating system was damaged. A grandstand at the west end of Thunderbird Stadium was damaged (press reports).

A number of homes were damaged in the area between 11th and Burwell Streets, and between Warren and Naval Avenues. The damage typically involved cracked or fallen chimneys. Many chimneys were damaged in West Bremerton (press reports). "Probably 30 to 50 [Bremerton homes] took major hits, with roofs buckling and walls collapsing" (Seattle Post-Intelligencer, March 3, 2001, p. A6, col. 4).

The exterior walls of some commercial buildings were cracked and some windows were broken. Many items fell from shelves in food stores, and ceilings were damaged (press reports).

The Naval Hospital at Bremerton sustained water damage from broken sprinklers. Some cranes on piers at the Naval

Submarine Base at Bangor suffered minor damage and a light pole fell (press reports).

Percentages of effects noted by 33 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—36%; a few large cracks in walls—21%; ceiling tiles or lighting fixtures fell—18%; cracks in chimney—6%; major damage to old chimney—9%; separation of porch, balcony or other addition from building—6%.

Bremerton (NE) (RCII=6.7, MMI=--) (98310; 47.602N, 122.630W)—Percentages of effects noted by 30 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—77%; pictures on walls moved or were knocked askew—73%; furniture or appliances slid, toppled over, or became displaced—43%; hairline cracks in walls—27%; a few large cracks in walls—13%; many large cracks in walls—3%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—27%; masonry fell from block or brick walls—3%.

Buckley/Wilkeson (RCII=6.5, MMI=6) (98321; 47.152N, 122.062W)—At the entrance to Wilkeson a 76-year-old arch consisting of two 20-foot-high columns of Wilkeson sandstone connected at the top by a large fir log was damaged by the earthquake and had to be removed (Tacoma News Tribune, March 1, 2001). The USGS field team found that bricks fell from a few old chimneys, but many old chimneys and the downtown's old unreinforced masonry buildings were undamaged. A few items fell from grocery shelves. Percentages of effects noted by 12 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—58%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—25%; a few large cracks in walls—17%; one or several windows cracked—17%; masonry fell from block or brick walls—8%.

Centralia (RCII=6.6, MMI=7) (98531 46.725N, 122.967W)—A cornice was damaged on a downtown hardware store and bricks fell from the tops of several old unreinforced masonry buildings. An abandoned one-story unreinforced brick building that had once housed a garage and auto-glass shop was damaged by the earthquake and collapsed seven days after the earthquake (fig. 14). A large plate-glass window was broken in an automobile dealership. At Centralia College about 35 ceiling tiles and 1 lighting fixture fell. In residential areas near Centralia College the USGS field team found approximately 10% of old chimneys were damaged. (The Chronicle, March 1, 2001, p. A10 and engineering reports and USGS field team). Percentages of effects noted by 38 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—74%; furniture or appliances slid, toppled over, or became displaced—37%; hairline cracks in walls—29%; a few large cracks in walls—21%; many large cracks in walls—3%; one or several windows cracked—11%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—13%; cracks in chimney—3%; masonry fell from block or brick walls—5%; separation of porch, balcony or other addition from building—8%.

Figure 14. Unreinforced building in Centralia, damaged in the earthquake, and partially collapsed seven days after the earthquake.

Chehalis (RCII=6.5, MMI=7) (98532; 46.638N, 122.966W)—At the Bennett Elementary School about a quarter of the decorative plasterwork in the auditorium fell and the rest separated from the wall; two third-floor windows fell out (The Chronicle, Centralia/Chehalis, March 2, 2001). At the Chehalis Timberland Library 1,500 to 2,000 books were shaken from shelves and some books sustained water damage from a broken pipe; the building sustained some structural damage (The Chronicle, March 2, 2001, p. A2). The basement floor of the Chehalis Post Office buckled and stonework in the postmaster's office separated (The Chronicle, March 2, 2001, p. A2). Many items fell from store shelves (press reports).

Figure 15. Brick veneer was peeled from the upper wall (near street) of this apartment building in Chehalis.

In a residential district along a hillside just south of the center of town, the USGS field team found that approximately 25% of the chimneys were damaged and a few had completely collapsed. Brick veneer peeled off part of a wall of a three-story apartment building in this district (fig. 15). In other parts of Chehalis, a few chimneys were damaged.

Percentages of effects noted by 25 internet respondents: difficulty standing or walking during the earthquake—60%; objects toppled over or fell off shelves—84%; pictures on walls moved or were knocked askew—68%; furniture or appliances slid, toppled over, or became displaced—36%; hairline cracks in walls—28%; a few large cracks in walls—16%; many large cracks in walls—4%; one or several windows cracked—8%; many windows cracked or broken out—4%; ceiling tiles or lighting fixtures fell—16%; cracks in chimney—8%; masonry fell from block or brick walls—4%.

Cinebar (RCII=6.8, MMI=5) (98533; 46.567N, 122.566W)—Postal questionnaires reported: a few old chimneys cracked; a few windows cracked. Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—100%; hairline cracks in walls—100%; a few large cracks in walls—50%; ceiling tiles or lighting fixtures fell—50%.

Copalis Beach (RCII=7.3, MMI=6) (98535; 47.065N, 124.136W)—Postal questionnaires reported: a few old chimneys cracked or lost bricks; a few windows cracked.

Effects noted by one internet respondent: pictures on walls moved or were knocked askew; hairline cracks in walls; many large cracks in walls; ceiling tiles or lighting fixtures fell; separation of porch, balcony or other addition from building.

DuPont (RCII=6.6, MMI=6) (98327; 47.097N, 122.630W)—Books fell off shelves and artwork fell (Tacoma News Tribune, March 1, 2001). The USGS field team observed isolated chimney damage including a couple of old chimneys that lost a few bricks. Percentages of effects noted by 29 internet respondents: difficulty standing or walking during the earthquake—34%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—59%; furniture or appliances slid, toppled over, or became displaced—34%; hairline cracks in walls—45%; a few large cracks in walls—7%; many large cracks in walls—3%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—21%; major damage to modern chimney—3%; masonry fell from block or brick walls—3%; separation of porch, balcony or other addition from building—7%.

Elma (RCII=6.7, MMI=6) (98541; 47.006N, 123.400W)—The USGS field team noted isolated chimney damage and visited a grocery store where only a few things fell. Percentages of effects noted by 11 internet respondents: difficulty standing or walking during the earthquake—45%; objects toppled over or fell off shelves—73%; pictures on walls moved or were knocked askew—64%; furniture or appliances slid, toppled over, or became displaced—45%; hairline cracks in walls—36%; a few large cracks in walls—18%; one or several windows cracked—9%; ceiling tiles or lighting fixtures fell—18%.

Fox Island (RCII=6.8, MMI=--) (98333; 47.252N, 122.629W)—Percentages of effects noted by two internet respondents: objects toppled over or fell off shelves—

50%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—50%; ceiling tiles or lighting fixtures fell—50%.

Gig Harbor (RCII=6.5, MMI=5) (98329; 47.379N, 122.700W)—In some stores many items fell from shelves, and furniture overturned (Tacoma News Tribune, March 1, 2001).

Percentages of effects noted by 10 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—80%; pictures on walls moved or were knocked askew—70%; furniture or appliances slid, toppled over, or became displaced—30%; hairline cracks in walls—20%; cracks in chimney—10%.

Gig Harbor (N) (RCII=6.6, MMI=6) (98332; 47.361N, 122.600W)—Percentages of effects noted by 13 internet respondents: difficulty standing or walking during the earthquake—46%; objects toppled over or fell off shelves—62%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—38%; hairline cracks in walls—38%; a few large cracks in walls—8%; ceiling tiles or lighting fixtures fell—8%.

Gig Harbor (S) (RCII=6.5, MMI=6) (98335; 47.300N, 122.608W)—Percentages of effects noted by 39 internet respondents: difficulty standing or walking during the earthquake—69%; objects toppled over or fell off shelves—74%; pictures on walls moved or were knocked askew—79%; furniture or appliances slid, toppled over, or became displaced—28%; hairline cracks in walls—21%; ceiling tiles or lighting fixtures fell—5%; cracks in chimney—3%; separation of porch, balcony or other addition from building—5%.

Glenoma (RCII=—, MMI=7) (98336; 46.528N, 122.099W)—Postal questionnaires reported: several old chimneys lost bricks and a few twisted, leaned or fell; many small objects overturned and fell and knickknacks broke; large furniture and heavy appliances were displaced; many items were shaken off store shelves.

Graham (RCII=6.5, MMI=6) (98338; 47.025N, 122.294W)—Percentages of effects noted by 24 internet respondents: difficulty standing or walking during the earthquake—46%; objects toppled over or fell off shelves—88%; pictures on walls moved or were knocked askew—79%; furniture or appliances slid, toppled over, or became displaced—42%; hairline cracks in walls—4%.

Issaquah (RCII=6.8, MMI=6) (98027; 47.551N, 122.034W)—An internet respondent said, “I experienced violent shaking and jerking. Computer monitors and large heavy bookshelves fell over. Water pipes burst. Glass in the entry shattered.”

Percentages of effects noted by 61 internet respondents: difficulty standing or walking during the earthquake—54%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—49%; hairline cracks in walls—28%; a few large cracks in walls—13%; many large cracks in walls—3%; one or several windows cracked—7%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—26%.

Kent (Midway) (RCII=6.7, MMI=7) (98032; 47.378N, 122.285W)—Percentages of effects noted by 54 internet respondents: difficulty standing or walking during the earthquake—63%; objects toppled over or fell off shelves—81%; pictures on walls moved or were knocked askew—61%; furniture or appliances slid, toppled over, or became displaced—39%; hairline cracks in walls—30%; a few large cracks in walls—13%; many large cracks in walls—4%; one or several windows cracked—6%; ceiling tiles or lighting fixtures fell—28%; cracks in chimney—2%; masonry fell from block or brick walls—4%; separation of porch, balcony or other addition from building—4%.

Lacey (RCII=6.6, MMI=6) (98503; 47.024N, 122.783W)—A woman had just brought her 2-year-old son into her mother’s kitchen in Lacey when the shaking started. “Stuff all around us was crashing. Dishes were falling off the open shelves, water was splashing out of the pot of potatoes on the stove and one potato piece actually flew out of the pot. A flying cup hit me on the wrist. Three 19-inch TVs fell in three different rooms, ceramic figurines were broken in the cabinets, cupboards and drawers were opened and some dishes were broken throughout the house. The dog’s water dish (on the basement floor) completely emptied. A concrete 2-foot statue outside tipped over. My 3 1/2-year-old was still in the car in his car seat. He later told me that he thought ‘Grandma’s dog shake car.’ He was not scared.”

Percentages of effects noted by 67 internet respondents: difficulty standing or walking during the earthquake—45%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—75%; furniture or appliances slid, toppled over, or became displaced—36%; hairline cracks in walls—28%; a few large

cracks in walls—9%; many large cracks in walls—3%; one or several windows cracked—6%; many windows cracked or broken out—1%; ceiling tiles or lighting fixtures fell—25%; cracks in chimney—6%; masonry fell from block or brick walls—1%; separation of porch, balcony or other addition from building—3%.

Lacey (SE)/Nisqually (RCII=6.6, MMI=6) (98513; 47.081N, 122.713W)—Many items fell in the garage of a house in Nisqually, and the house's chimney was cracked (Tacoma News Tribune, March 2, 2001). The USGS field team visited a store in Nisqually where several bottles fell from shelves and items also fell from shelves in a nearby home. Seiching occurred in the long, narrow tanks of a fish hatchery near Nisqually and water sloshed over its edges. Engineering investigations found "surprisingly limited evidence of liquefaction or lateral spreading" in areas of the Nisqually delta where susceptible soils exist (Nisqually Earthquake Clearinghouse Group, 2001, p. 8).

Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—75%; objects toppled over or fell off shelves—85%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—30%; hairline cracks in walls—20%; a few large cracks in walls—10%; one or several windows cracked—10%; many windows cracked or broken out—5%; ceiling tiles or lighting fixtures fell—5%.

Lakebay (RCII=7.2, MMI=6) (98349; 47.282N, 122.760W)—Near Lakebay a chimney and fireplace fell off a single-family 1930s-era home (Tacoma News Tribune, March 4, 2001). Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—62%; hairline cracks in walls—75%; a few large cracks in walls—12%.

Lakewood Center (W) (RCII=6.6, MMI=6) (98498; 47.164N, 122.555W—Percentages of effects noted by 44 internet respondents: difficulty standing or walking during the earthquake—57%; objects toppled over or fell off shelves—75%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—41%; hairline cracks in walls—39%; a few large cracks in walls—20%; many large cracks in walls—2%; one or several windows cracked—7%; ceiling tiles or lighting fixtures fell—9%; cracks in chimney—5%; major damage to old chimney—2%; masonry fell from block or brick walls—2%; outside walls tilted over or collapsed—2%.

Medina (RCII=7.0, MMI=--) (98039; 47.621N, 122.226W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—50%; cracks in chimney—50%.

Mineral (RCII=6.5, MMI=6) (98355; 46.710N, 122.186W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—25%; furniture or appliances slid, toppled over, or became displaced—50%; one or several windows cracked—25%; ceiling tiles or lighting fixtures fell—25%; cracks in chimney—25%.

Nisqually (RCII=6.6, MMI=6) (98513; 47.081N, 122.713W)—See Lacey (SE)/Nisqually.

Oakville (RCII=7.1, MMI=6) (98568; 46.843N, 123.249W)—A manufactured home was shaken off its foundations (Lewis County Chronicle, March 6, 2001) and many things fell off grocery shelves.

Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—60%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—60%; hairline cracks in walls—60%; a few large cracks in walls—20%; one or several windows cracked—20%; ceiling tiles or lighting fixtures fell—20%; separation of porch, balcony or other addition from building—20%.

Olympia (RCII=7.3, MMI=7, except MMI=8 in Capitol Hill) (98501; 47.003N, 122.878W)—The Capitol Legislative Building was damaged and the legislators forced to move out. There was cracking in some of the ribs of the dome, and "severe cracking of the nonstructural sandstone pilaster from one of the exterior masonry buttresses supporting the dome.…Significant differential movement occurred between the drum [cylindrical wall below the dome] and the lower masonry portion of the building…As a result of the movement of the drum and the dome, horizontal cracking of the architectural plaster occurred at the base of each [of the] interior masonry buttresses" (Pacific Earthquake Engineering Research Center

Figure 16. Damaged pilaster on State Capitol building, Olympia.

(PEER), p. 8-11; see our fig. 16). Inside the building one chandelier outside the Senate was found hanging from its safety chain and both House and Senate chambers were littered with plaster from the ceilings (Seattle Times (Web), March 5, 2001). A photograph shows a fourth-floor office knee-deep in folders and papers (Seattle Post-Intelligencer (Web), March 1, 2001).

At the Temple of Justice, plaster fell in the Supreme Court Chambers (press reports) and vertical cracks in plaster appeared in room corners (PEER, p. 53). In the Main Library in the Temple of Justice freestanding bookshelves leaned sideways and broke, but only a few books fell; in the Law Library in the same building massive wooden bookshelves along the walls were undamaged, but many books were thrown to the floor (PEER, p. 57-59). At the reinforced concrete General Administration Building "diagonal shear cracking occurred in the central walls between the first and second floor. This cracking could also be observed on the inside faces of these walls. Similar diagonal cracking was also observed in the corner walls of the building" (PEER, p. 34). At the state headquarters building of the Washington Department of Fish and Wildlife a glass panel cracked in the building rotunda. Contents on the fifth and sixth floors were tossed around. A couple of water pipes were broken (press reports). The two-story, brick Employment Security Annex on Capitol Way was damaged beyond repair (AP, March 8, 2001).

Contents of some buildings were strongly disturbed with computers and monitors off desks; in other buildings, contents were not much affected. The Department of Transportation building had cracked windows.

An internet respondent from the Natural Resources Building on the Capitol campus said, "Filing cabinets flew open; items on shelves shuddered off and plummeted, littering the ground with broken glass and debris. The large plate windows bowed and were very noisy but did not shatter."

In the residential neighborhood adjacent to the Capitol, the USGS field team found many damaged chimneys and some that had fallen (fig. 17). In some blocks approximately 25% of houses experienced chimney damage. Lincoln Elementary School sustained in-plane cracking of masonry walls (PEER, p. 20-21); its damaged east facade caused the closure of the school for repairs; inside the

Figure 17. Toppled chimney, Capitol Hill neighborhood of Olympia.

school books flew off shelves and drawers flew open; children on the playground watched a water tower swinging back and forth (The Olympian, March 4, 2001, p. C1).

In downtown Olympia, an eight-story hotel on Capitol Way was damaged by differential settling of the west side of the building with respect to the east side; the structure also experienced minor spalling and cracking of reinforced concrete columns in the underlying parking structure, a broken water pipe on the roof that flooded several floors of the building and much overturned furniture in the upper three stories (PEER, p. 11-14, 59-60). In other downtown buildings masonry walls cracked or partially collapsed, plaster fell, lighting fixtures jarred loose and many books and other items fell from shelves (fig. 18).

The heavily damaged Fourth Avenue Bridge, which spans a small inlet, was already decaying and scheduled for replacement; its arched main spans were undamaged except for the collapse of the unreinforced, decayed pedestrian handrails, but there was severe damage at the bases of the flares at the tops of the columns supporting the approach on the western side (PEER, p. 46-49; Nisqually Earthquake Clearinghouse Group, 2001, p. 17). Lateral spreading and a 400-foot-long slide occurred along the banks of Capitol Lake (PEER, p. 49; Nisqually Earthquake Clearinghouse Group, 2001, p. 8-9; Bray and others, 2001), and liquefaction (sand boils) occurred along rail tracks north of Deschutes Parkway (Bray, and others, 2001).

Figure 18. Bricks fallen from an unreinforced masonry parapet litter a sidewalk in downtown Olympia. In the Puget Sound earthquakes of 1949 and 1965, debris falling from buildings killed people on sidewalks below. Fortunately, this did not happen with the Nisqually earthquake.

At the Port of Olympia, liquefaction caused minor cracking of roads and of the banks of a marina (Bray and others, 2001). There was little evidence of liquefaction or lateral spreading in areas where liquefiable soils are known to exist in the Port of Olympia (Nisqually Earthquake Clearinghouse Group, 2001, p. 8).

Percentages of effects noted by 162 internet respondents: difficulty standing or walking during the earthquake—56%; objects toppled over or fell off shelves—91%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—65%; hairline cracks in walls—43%; a few large cracks in walls—22%; many large cracks in walls—15%; one or several windows cracked—10%; many windows cracked or broken out—6%; ceiling tiles or lighting fixtures fell—35%; cracks in chimney—3%; major damage to old chimney—4%; masonry fell from block or brick walls—7%; outside walls tilted over or collapsed—1%; separation of porch, balcony or other addition from building—1%.

Olympia (Evergreen St Col) (RCII=7.4, MMI=--) (98505; 47.072N, 122.962W)—Percentages of effects noted by 15 internet respondents: difficulty standing or walking during the earthquake—60%; objects toppled over or fell off shelves—73%; pictures on walls moved or were knocked askew—47%; furniture or appliances slid, toppled over, or became displaced—53%; hairline cracks in walls—27%; a few large cracks in walls—33%; one or several windows cracked—20%; many windows cracked or broken out—7%; ceiling tiles or lighting fixtures fell—33%.

Olympia (N) (RCII=6.6, MMI=--) (98506; 47.076N, 122.833W)—Percentages of effects noted by 44 internet respondents: difficulty standing or walking during the earthquake—39%; objects toppled over or fell off shelves—82%; pictures on walls moved or were knocked askew—77%; furniture or appliances slid, toppled over, or became displaced—32%; hairline cracks in walls—41%; a few large cracks in walls—11%; many large cracks in

walls—2%; one or several windows cracked—2%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—16%; cracks in chimney—2%; outside walls tilted over or collapsed—5%.

Olympia (W) (RCII=6.6, MMI=6) (98502; 47.030N, 122.952W)—A flow slide removed part of Highway 101, closing both northbound lanes (Nisqually Earthquake Clearinghouse Group, 2001, p. 9).

The USGS field team visited a supermarket that experienced moderate disturbance of stock. Items fell particularly from the west side of aisles; wine bottles were stored on the east side of an aisle, and hardly any fell. A few light fixtures were displaced, but were prevented from falling by restraints. Some ceiling tiles fell.

Percentages of effects noted by 56 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—82%; pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—36%; hairline cracks in walls—32%; a few large cracks in walls—9%; many large cracks in walls—2%; one or several windows cracked—5%; ceiling tiles or lighting fixtures fell—5%; masonry fell from block or brick walls—5%; outside walls tilted over or collapsed—4%.

Orting (RCII=7.2, MMI=6) (98360; 47.082N, 122.186W)—A homeowner reported cracks in foundation and walls, and many fallen and damaged knickknacks and china (Tacoma News Tribune, March 3, 2001).

Percentages of effects noted by nine internet respondents: difficulty standing or walking during the earthquake—56%; objects toppled over or fell off shelves—89%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—56%; hairline cracks in walls—56%; a few large cracks in walls—11%; one or several windows cracked—22%; ceiling tiles or lighting fixtures fell—33%.

Pacific (RCII=6.6, MMI=5) (98047; 47.267N, 122.243W)—Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—67%; objects toppled over or fell off shelves—83%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—33%.

Pe Ell (RCII=--, MMI=7) (98572; 46.566N, 123.285W)—Postal questionnaires reported: interior walls sustained many large cracks and split at seams; exterior walls sustained large cracks, bulged and partially collapsed; a few old chimneys twisted or leaned and a few modern chimneys lost bricks; a few windows cracked; large furniture and heavy appliances were displaced.

Port Orchard (S) (RCII=6.5, MMI=--) (98367; 47.496N, 122.609W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—64%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—86%; furniture or appliances slid, toppled over, or became displaced—21%; hairline cracks in walls—36%; ceiling tiles or lighting fixtures fell—7%.

Puget Sound Naval Shipyard (RCII=7.2, MMI=--) (98314; 47.561N, 122.647W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—57%; objects toppled over or fell off shelves—86%; pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—43%; hairline cracks in walls—43%; a few large cracks in walls—43%; one or several windows cracked—14%; ceiling tiles or lighting fixtures fell—29%; masonry fell from block or brick walls—29%.

Puyallup (NE) (RCII=6.5, MMI=6) (98372; 47.191N, 122.289W)—The USGS field team found slight damage to walls of some unreinforced masonry buildings and a few fallen chimneys. A large supermarket experienced mild disturbance of stock, with some items off shelves in nearly every aisle; typical shelves in the store had raised edges that probably kept some items from sliding off.

Percentages of effects noted by 23 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—78%; pictures on walls moved or were knocked askew—74%; furniture or appliances slid, toppled over, or became displaced—26%; hairline cracks in walls—30%; a few large cracks in walls—9%; ceiling tiles or lighting fixtures fell—4%; cracks in chimney—9%; separation of porch, balcony or other addition from building—9%.

Puyallup (NW) (RCII=6.5, MMI=6) (98371; 47.199N, 122.315W)—An observer commented, “It wasn’t the shaking or noise that woke me up but rather the pictures that were falling on my head from the wall.”

Percentages of effects noted by 26 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—58%; pictures on walls moved or were knocked askew—69%; furniture or appliances slid, toppled over, or became dis-

placed—50%; hairline cracks in walls—38%; a few large cracks in walls—23%; one or several windows cracked—8%; ceiling tiles or lighting fixtures fell—31%; cracks in chimney—12%; major damage to old chimney—4%; masonry fell from block or brick walls—15%.

Puyallup (S) (RCII=7.0, MMI=--) (98375; 47.119N, 122.292W)—Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—75%; a few large cracks in walls—25%; ceiling tiles or lighting fixtures fell—38%; cracks in chimney—12%; masonry fell from block or brick walls—12%.

Puyallup (SE) (RCII=6.5, MMI=--) (98374; 47.142N, 122.265W)—Percentages of effects noted by 24 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—88%; pictures on walls moved or were knocked askew—83%; furniture or appliances slid, toppled over, or became displaced—25%; hairline cracks in walls—29%; a few large cracks in walls—4%; one or several windows cracked—4%; ceiling tiles or lighting fixtures fell—12%; cracks in chimney—4%; masonry fell from block or brick walls—4%; separation of porch, balcony or other addition from building—4%.

Ravensdale (RCII=6.6, MMI=6) (98051; 47.415N, 121.988W)—Postal questionnaires reported: a few mobile homes fell off their foundations; interior walls sustained a few large cracks; a few windows cracked; many small objects overturned and fell; heavy appliances were displaced by inches; paved sidewalks and streets sustained large cracks and large displacements; an old highway bridge sustained structural damage; ground slumps appeared on hillsides.

Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—75%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—25%; one or several windows cracked—25%.

Renton (SW) (RCII=7.0, MMI=7) (98055; 47.465N, 122.207W)—Buildings on the Boeing campus sustained water damage and damage to ceilings and windows (Nisqually Earthquake Clearinghouse Group, 2001). Several Boeing buildings were red-tagged. Nonstructural damage included filing cabinets that fell over, computers and monitors that were shaken from desks, a fallen ceiling light and some broken water pipes.

An internet respondent reported, “People were diving under desks, the lights went out, plaster and tiles were falling from the walls and ceiling and windows were breaking. I decided to head down the stairs. About a third way down another large wave hit and people fell and were thrown aside. I could see big cracks going up the walls of the stairwell and what looked like the top of the stairs starting to separate from the second floor. A quick visual of the outside of the building showed many broken windows.”

Percentages of effects noted by 105 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—74%; pictures on walls moved or were knocked askew—65%; furniture or appliances slid, toppled over, or became displaced—46%; hairline cracks in walls—40%; a few large cracks in walls—37%; many large cracks in walls—10%; one or several windows cracked—13%; many windows cracked or broken out—11%; ceiling tiles or lighting fixtures fell—46%; major damage to old chimney—1%; masonry fell from block or brick walls—10%; separation of porch, balcony or other addition from building—5%.

Rochester (RCII=6.9, MMI=6) (98579; 46.819N, 123.041W)—Percentages of effects noted by 10 internet respondents: difficulty standing or walking during the earthquake—70%; objects toppled over or fell off shelves—90%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—70%; hairline cracks in walls—50%; a few large cracks in walls—10%; one or several windows cracked—10%; ceiling tiles or lighting fixtures fell—20%; cracks in chimney—10%; separation of porch, balcony or other addition from building—10%.

Seabeck (RCII=6.7, MMI=7) (98380; 47.625N, 122.823W)—Press reports indicated some chimney damage and six damaged homes.

Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—62%; objects toppled over or fell off shelves—62%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—38%; separation of porch, balcony or other addition from building—12%.

SeaTac (RCII=7.0, MMI=7) (98158; 47.454N, 122.304W)—The airport suffered extensive nonstructural damage. The North Satellite Terminal was closed for a

day as a result of water damage. Terminal C had damage to ceiling tiles and light fixtures. Pounding between the wings and the main terminal building also caused internal damage (Nisqually Earthquake Clearinghouse Group, 2001, p. 14). The steel framework supporting the windows and roof of the SeaTac control tower failed resulting in an estimated $2 million damage (Nisqually Earthquake Clearinghouse Group, 2001, p. 13).

A worker on the ramp at Seattle-Tacoma International Airport said, "I was stationary in a minivan when I noticed a rolling motion. I initially thought someone was jumping on the tow hitch. I realized it was a quake when I saw the twin turboprop aircraft directly in front of me bouncing from side to side. I could feel and see the ground welling up and down underneath my feet. The poles for the flood lights above the passenger terminal were swaying back and forth rapidly. The air traffic control tower 200 feet to my right was swaying back and forth, as well. Just then, the windows of the control tower blew out and shattered. I saw the aircraft in the air abort their approach and enter into a holding pattern."

Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—50%.

Seattle (Downtown) (RCII=6.5, MMI=7) (98101; 47.610N, 122.334W)—Interior walls of the third floor of the King County Court House in downtown Seattle sustained large cracks and sections of masonry interior walls collapsed; windows were shattered and ceiling tiles fell (press reports). An estimated several hundred thousand dollars worth of glass sculptures were destroyed at the Washington State Convention and Trade Center. Many books fell from the shelves of the Seattle Central Public Library (Seattle Post Intelligencer, March 3, 2001). In a large mall near 5th and Union the USGS field team found that up to 10% of merchandise fell in some stores, but nothing fell in other stores; soup sloshed out of a tureen; false ceilings and decorations hung from the ceiling by pipes swung, in one instance breaking sprinkler heads; and a few hairline cracks appeared. Settlement was observed at the Washington State Ferry Terminal (Nisqually Earthquake Clearinghouse Group, 2001).

An internet respondent on the 17th floor of a Pike Street office building said, "Shelves fell along with all their contents. Decorative parts of the ceiling came down in the lobby. There were cracks in the stairwells as we evacuated the building." Another internet respondent on the third floor of a five-story office building reported, "Equipment racks fell over. A fire extinguisher and its bracket popped completely off the wall. A monitor fell off a top rack. Ceiling tiles fell. Small chunks of concrete were visible all around the inside perimeter of the building."

Percentages of effects noted by 272 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—69%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—34%; hairline cracks in walls—28%; a few large cracks in walls—18%; many large cracks in walls—6%; one or several windows cracked—5%; many windows cracked or broken out—7%; ceiling tiles or lighting fixtures fell—26%; cracks in chimney—1%; major damage to old chimney—1%; masonry fell from block or brick walls—8%; outside walls tilted over or collapsed—1%; separation of porch, balcony or other addition from building—1%.

Seattle (Madrona) (RCII=6.6, MMI=7) (98122; 47.608N, 122.318W)—At Swedish Providence Medical Center's modern building at E Jefferson St. and 16th Ave. the USGS field team found that small cracks appeared in a concrete wall and very little fell; next door in the center's old building (about 1910) plaster fell, an elevator was damaged and the building was at least partially closed. A doctor reported, "I was in the original (1910) part of Providence Hospital on the 6th floor. We experienced a violent initial P wave that caused my head to snap up and hit the occulus of my microscope. Plaster and the underlying concrete began to form large cracks and exploded into the room causing a dust cloud. I decided to run to the newer (about 1990) part of the hospital. At the juncture between the buildings (a hallway), the buildings were separating in a north-to-south direction by up to 18 inches, opening and closing like a mouth. I jumped across the space and waited while the motion stopped. I later checked moved objects in our area. The greatest damage was caused by a fallen bookcase that pulled the metal earthquake-restraining straps out of the wall."

Many houses experienced chimney damage in the blocks near Lake Washington.

Percentages of effects noted by 107 internet respondents: difficulty standing or walking during the earthquake—37%; objects toppled over or fell off shelves—77%; pictures on walls moved or were knocked askew—58%; furniture or appliances slid, toppled over, or became displaced—28%; hairline cracks in walls—34%; a few large

cracks in walls—16%; many large cracks in walls—3%; one or several windows cracked—9%; many windows cracked or broken out—1%; ceiling tiles or lighting fixtures fell—14%; cracks in chimney—2%; major damage to old chimney—2%; masonry fell from block or brick walls—10%; separation of porch, balcony or other addition from building—1%.

Seattle (Pioneer Square) (RCII=6.8, MMI=8) (98104; 47.604N, 122.326W)—Many of the red-tagged buildings in Seattle were in the Pioneer Square area. On the corner of Second Ave. and Jackson St., part of the unreinforced masonry upper wall of an old hotel collapsed into the street, shredding the awning of a nightclub and cafe and smashing cars parked on the street beside the building. At a century-old building next to the Alaskan Way viaduct, a wall separated from the building and large cracks appeared; a staircase sank and plaster fell onto the floors. Many other buildings in the area had dislodged cornices and fallen bricks. Groceries fell into the aisles. Several art galleries experienced extensive losses to collections of art glass. Interviews by the USGS field team with store owners in Pioneer Square revealed that some stores with much easily tipped merchandise had only a few fallen items and some fallen plaster, while other buildings reported broken merchandise losses of thousands of dollars, broken windows and other damage.

An internet respondent in a hospital on 9th Ave. reported, "Two different buildings are connected and were swaying at different speeds, swinging about 1 foot apart." Another observer on the 16th floor of a highrise on Madison reported, "No structural damage in building but lots of cosmetic damage. Bookshelves down, huge file cabinets tipped over with fronts ripped off. Two people slightly hurt."

Percentages of effects noted by 232 internet respondents: difficulty standing or walking during the earthquake—45%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—57%; furniture or appliances slid, toppled over, or became displaced—41%; hairline cracks in walls—34%; a few large cracks in walls—21%; many large cracks in walls—9%; one or several windows cracked—9%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—29%; cracks in chimney—1%; major damage to old chimney—1%; masonry fell from block or brick walls—19%; separation of porch, balcony or other addition from building—3%.

Seattle (Queen Anne E) (RCII=6.5, MMI=7) (98109; 47.621N, 122.351W)—Engineers reported that a pier adjacent to the Navy Reserve Center on Lake Union moved several inches (Nisqually Earthquake Clearinghouse Group, 2001; Bray and others, 2001). The USGS field team saw many damaged chimneys in this neighborhood. Residents reported that pictures and small objects fell, a washing machine was displaced and a bookcase tipped over. One grocery reported many things fell, requiring the store to be closed for an hour to clean up; another reported about $1,000 loss including 100-150 liquor bottles.

An internet respondent on Westlake Ave N reported, "Books were tossed from bookshelves, filing cabinets toppled, computer monitors fell from desks and large cracks appeared in the stairwell."

Percentages of effects noted by 89 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—81%; pictures on walls moved or were knocked askew—55%; furniture or appliances slid, toppled over, or became displaced—34%; hairline cracks in walls—29%; a few large cracks in walls—19%; many large cracks in walls—7%; one or several windows cracked—1%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—26%; major damage to old chimney—1%; masonry fell from block or brick walls—7%; separation of porch, balcony or other addition from building—2%.

Seattle (West Seattle) (RCII=6.9, MMI=7) (98116; 47.575N, 122.393W)—The USGS field team observed many damaged and fallen chimneys in West Seattle; in some blocks nearly all chimneys were damaged. In one grocery store fallen items piled up about a foot deep in some aisles; all the liquor bottles shifted toward the back of the shelves; a refrigerator for flowers fell over and smashed a computer printer; losses were about $1,500; a 1965-earthquake crack that ran all the way across the concrete slab floor reopened; molding covering a 1965 wall-ceiling separation fell when the space opened wider.

Percentages of effects noted by 30 internet respondents: difficulty standing or walking during the earthquake—47%; objects toppled over or fell off shelves—87%; pictures on walls moved or were knocked askew—83%; furniture or appliances slid, toppled over, or became displaced—53%; hairline cracks in walls—47%; a few large cracks in walls—20%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—10%; cracks in chimney—20%; major damage to old chimney—7%; major damage to modern chimney—3%; masonry fell from block or brick walls—10%; separation of porch, balcony or other addition from building—3%.

Seattle (Youngstown) (RCII=6.6, MMI=6) (98126; 47.544N, 122.373W)—Percentages of effects noted by 17 internet respondents: difficulty standing or walking during the earthquake—59%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—65%; furniture or appliances slid, toppled over, or became displaced—35%; hairline cracks in walls—29%; a few large cracks in walls—12%; many windows cracked or broken out—6%; ceiling tiles or lighting fixtures fell—12%.

Shelton (RCII=6.7, MMI=7 (98584; 47.209N, 123.073W)—The USGS field team found sporadic chimney damage throughout the city, with some blocks at the north end of town having many damaged chimneys. Parapets fell on both sides of the old unreinforced masonry Parkview Manor. Objects fell from grocery shelves (several dozen in one aisle).

Percentages of effects noted by 30 internet respondents: difficulty standing or walking during the earthquake—77%; objects toppled over or fell off shelves—77%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—30%; a few large cracks in walls—17%; many large cracks in walls—3%; one or several windows cracked—7%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—10%; cracks in chimney—10%; major damage to old chimney—3%; separation of porch, balcony or other addition from building—3%.

Snoqualmie (RCII=6.7, MMI=7) (98065; 47.529N, 121.823W)—The Snoqualmie–Fall City road was closed due to downslope movement of part of the roadbed (press reports).

Percentages of effects noted by 23 internet respondents: difficulty standing or walking during the earthquake—57%; objects toppled over or fell off shelves—74%; pictures on walls moved or were knocked askew—78%; furniture or appliances slid, toppled over, or became displaced—48%; hairline cracks in walls—52%; a few large cracks in walls—57%; many large cracks in walls—4%; one or several windows cracked—13%; many windows cracked or broken out—9%; ceiling tiles or lighting fixtures fell—57%; cracks in chimney—13%; major damage to old chimney—9%; masonry fell from block or brick walls—9%.

Spanaway (RCII=6.9, MMI=5) (98387; 47.073N, 122.394W)—Percentages of effects noted by 23 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—78%; pictures on walls moved or were knocked askew—74%; furniture or appliances slid, toppled over, or became displaced—43%; hairline cracks in walls—48%; a few large cracks in walls—4%; many large cracks in walls—4%; ceiling tiles or lighting fixtures fell—9%; cracks in chimney—4%; masonry fell from block or brick walls—9%; separation of porch, balcony or other addition from building—4%.

Steilacoom (RCII=6.7, MMI=6) (98388; 47.170N, 122.589W)—"Damage to a ward of the Western States State Hospital forced relocation of 239 patients to another location" (Nisqually Earthquake Clearinghouse Group, 2001). The USGS field team found that a few things fell off shelves in one store and goods valued at $200 - $300 were broken in another store.

Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—33%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—67%; a few large cracks in walls—17%; one or several windows cracked—17%; ceiling tiles or lighting fixtures fell—17%.

Tacoma (University Place) (RCII=7.1, MMI=—) (98467; 47.205N, 122.534W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—71%; pictures on walls moved or were knocked askew—43%; furniture or appliances slid, toppled over, or became displaced—57%; hairline cracks in walls—14%; a few large cracks in walls—21%; one or several windows cracked—7%; many windows cracked or broken out—7%; ceiling tiles or lighting fixtures fell—29%; cracks in chimney—7%; major damage to modern chimney—7%; masonry fell from block or brick walls—7%.

Tahuya (RCII=6.6, MMI=6) (98588; 47.436N, 122.921W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—75%; furniture or appliances slid, toppled over, or became displaced—25%; one or several windows cracked—25%.

Tenino (RCII=6.5, MMI=6) (98589; 46.864N, 122.849W)—Postal questionnaires reported: a few old chimneys twisted, leaned or lost bricks; a few windows cracked.

Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—25%; many large cracks in walls—25%.

Tumwater (W) (RCII=6.6, MMI=7) (98512; 47.008N, 122.908W)—"Lateral spreading at the Sunset Lake mobile home park removed a portion of roadway and damaged utilities and trailer foundation slabs" (Nisqually Earthquake Clearinghouse Group, 2001, p. 8).

The USGS field team observed about 5% of chimneys damaged and saw one overturned tombstone. The old, abandoned Brew House sustained shear cracks by a tower window.

Percentages of effects noted by 34 internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—65%; pictures on walls moved or were knocked askew—65%; furniture or appliances slid, toppled over, or became displaced—38%; hairline cracks in walls—15%; a few large cracks in walls—9%; ceiling tiles or lighting fixtures fell—21%; cracks in chimney—3%; separation of porch, balcony or other addition from building—6%.

Union (RCII=7.2, MMI=7) (98592; 47.351N, 123.034W)—Postal questionnaires reported: a few mobile homes fell off their foundations; exterior and interior walls sustained a few large cracks; several old chimneys twisted, leaned or lost bricks and a few fell; a few windows cracked.

Effects noted by one internet respondent: difficulty standing or walking during the earthquake; objects toppled over or fell off shelves; pictures on walls moved or were knocked askew; furniture or appliances slid, toppled over, or became displaced.

Vashon (RCII=6.5, MMI=6) (98070; 47.426N, 122.464W)—Percentages of effects noted by 26 internet respondents: difficulty standing or walking during the earthquake—65%; objects toppled over or fell off shelves—73%; pictures on walls moved or were knocked askew—77%; furniture or appliances slid, toppled over, or became displaced—31%; hairline cracks in walls—31%; a few large cracks in walls—4%; one or several windows cracked—8%; cracks in chimney—4%; separation of porch, balcony or other addition from building—4%.

Vaughn (RCII=6.7, MMI=7) (98394; 47.331N, 122.774W)—A fireplace collapsed in a home (Tacoma News Tribune, March 1, 2001).

Percentages of effects noted by two internet respondents: objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—50%.

Wilkeson (RCII=6.5, MMI=6) (98321; 47.152N, 122.062W)—See Buckley/Wilkeson.

Winlock (RCII=6.6, MMI=5) (98596; 46.494N, 122.916W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—86%; objects toppled over or fell off shelves—86%; pictures on walls moved or were knocked askew—86%; furniture or appliances slid, toppled over, or became displaced—43%; hairline cracks in walls—43%; a few large cracks in walls—29%.

RCII 5.5-6.4 (or MMI 6 for communities with no RCII) in British Columbia

Coombs (RCII=—, MMI=6) (49.300N, 124.420W)—Cracks were reported in interior walls.

RCII 5.5-6.4 (or MMI 6 for communities with no RCII) in Oregon

Clatskanie (RCII=5.7, MMI=6) (Zip Code 97016; 46.100N, 123.212W)—Roof beams shifted in the old gymnasium of Clatskanie Elementary School (press reports). The USGS field team observed isolated chimney damage. Light disturbance to stock was reported in a convenience store.

Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—67%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—33%; a few large cracks in walls—33%.

RCII 5.5-6.4 (or MMI 6 for communities with no RCII) in Washington

Adna (RCII=—, MMI=6) (Zip Code 98522; 46.629N, 123.060W)—The metal support systems for ceiling tiles at the Adna Middle-High School were damaged and some tiles fell in several rooms (The Chronicle, Lewis County, March 2, 2001).

Algona (RCII=5.9, MMI--) (98001; 47.316N, 122.270W)—Percentages of effects noted by 28 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—64%; pictures on walls moved or were knocked askew—61%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—21%; a few large cracks in walls—4%; ceiling tiles or lighting fixtures fell—4%.

Allyn (RCII=6.2, MMI=7) (98524; 47.385N, 122.854W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%.

Anderson Island (RCII=6.2, MMI=6) (98303; 47.159N, 122.696W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—50%; hairline cracks in walls—50%.

Ashford (RCII=6.4, MMI=6) (98304; 46.753N, 121.990W)—The USGS field team visited a fire station whose unreinforced concrete-block walls sustained cracks through the blocks. Most of the cracks were only a few millimeters in width and occurred around wall openings for windows and heat vents. The largest crack, between the tall garage-bay doors, was wide enough to admit daylight. Splinters of wood from the ceiling littered the floor. The station was yellow-tagged and in use. The foundation was cracked at an adjacent house, and a nearby convenience store had many items fall off shelves requiring several hours to clean up. There was isolated chimney damage in the area.

Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—83%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—17%; separation of porch, balcony or other addition from building—17%.

Auburn (RCII=6.2, MMI=6) (98002; 47.305N, 122.207W)—The USGS field team observed slight damage to several old unreinforced masonry buildings. Bricks fell off the front facade of an old building beside the railroad tracks. There was mild disturbance to stock of a supermarket in the area.

Percentages of effects noted by 27 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—48%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—37%; a few large cracks in walls—15%; one or several windows cracked—4%; ceiling tiles or lighting fixtures fell—7%; cracks in chimney—4%.

Auburn (NE) (RCII=5.5, MMI=--) (98092; 47.324N, 122.185W)—Percentages of effects noted by 31 internet respondents: difficulty standing or walking during the earthquake—35%; objects toppled over or fell off shelves—58%; pictures on walls moved or were knocked askew—65%; furniture or appliances slid, toppled over, or became displaced—13%; hairline cracks in walls—6%; a few large cracks in walls—3%; ceiling tiles or lighting fixtures fell—6%.

Bainbridge Island/Winslow (RCII=5.9, MMI=6) (98110; 47.645N, 122.531W)—Some chimneys were damaged and five homes had some type of damage (press reports).

Percentages of effects noted by 35 internet respondents: difficulty standing or walking during the earthquake—26%; objects toppled over or fell off shelves—71%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—23%; hairline cracks in walls—20%; a few large cracks in walls—3%; ceiling tiles or lighting fixtures fell—6%; separation of porch, balcony or other addition from building—3%.

Belfair (RCII=6.2, MMI=6) (98528; 47.455N, 122.822W)—Percentages of effects noted by 11 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—73%; pictures on walls moved or were knocked askew—82%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—45%; separation of porch, balcony or other addition from building—9%.

Bellevue (Bellevue Sq) (RCII=5.5, MMI=--) (98004; 47.620N, 122.207W)—Percentages of effects noted by 163 internet respondents: difficulty standing or walking during the earthquake—28%; objects toppled over or fell off shelves—44%; pictures on walls moved or were knocked askew—55%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—15%; a few large cracks in walls—6%; one or several windows cracked—4%; ceiling tiles or lighting fix-

tures fell—8%; cracks in chimney—1%; separation of porch, balcony or other addition from building—1%.

Bellevue (Clyde Hill) (RCII=--, MMI=6) (98009; 47.603N, 122.155W)—Postal questionnaires reported: interior walls split at seams; a few windows cracked; large furniture was displaced.

Bellevue (Evergreen Vill.) (RCII=5.6, MMI=--) (98007; 47.617N, 122.143W)—Percentages of effects noted by 67 internet respondents: difficulty standing or walking during the earthquake—39%; objects toppled over or fell off shelves—55%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—16%; a few large cracks in walls—6%; ceiling tiles or lighting fixtures fell—1%; cracks in chimney—3%; major damage to modern chimney—1%.

Bellevue (Lake Hills) (RCII=5.8, MMI=--) (98008; 47.611N, 122.116W)—Percentages of effects noted by 121 internet respondents: difficulty standing or walking during the earthquake—32%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—59%; furniture or appliances slid, toppled over, or became displaced—30%; hairline cracks in walls—31%; a few large cracks in walls—5%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—7%; cracks in chimney—2%; masonry fell from block or brick walls—3%; outside walls tilted over or collapsed—1%.

Black Diamond (RCII=6.3, MMI=6) (98010; 47.311N, 122.005W)—Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—60%; objects toppled over or fell off shelves—80%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—40%; hairline cracks in walls—20%.

Bothell (RCII=5.7, MMI=--) (98011; 47.750N, 122.216W)—Percentages of effects noted by 76 internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—58%; pictures on walls moved or were knocked askew—58%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—20%; a few large cracks in walls—4%; many large cracks in walls—1%; ceiling tiles or lighting fixtures fell—5%; cracks in chimney—1%; masonry fell from block or brick walls—1%.

Bothell (N) (RCII=5.9, MMI=--) (98021; 47.792N, 122.224W)—Percentages of effects noted by 99 internet respondents: difficulty standing or walking during the earthquake—32%; objects toppled over or fell off shelves—62%; pictures on walls moved or were knocked askew—55%; furniture or appliances slid, toppled over, or became displaced—15%; hairline cracks in walls—21%; a few large cracks in walls—5%; one or several windows cracked—1%; ceiling tiles or lighting fixtures fell—29%; separation of porch, balcony or other addition from building—1%.

Bremerton (W) (RCII=6.3, MMI=7) (98312; 47.575N, 122.696W)—Percentages of effects noted by 44 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—66%; pictures on walls moved or were knocked askew—66%; furniture or appliances slid, toppled over, or became displaced—34%; hairline cracks in walls—30%; a few large cracks in walls—11%; many large cracks in walls—9%; one or several windows cracked—2%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—16%; cracks in chimney—7%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—5%.

Brinnon (RCII=6.1, MMI=6) (98320; 47.678N, 122.938W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—50%; hairline cracks in walls—50%.

Burien (RCII=6.0, MMI=6) (98148; 47.450N, 122.326W)—Fourteen houses were evacuated as a result of landslide damage (Nisqually Earthquake Clearinghouse Group, 2001).

Percentages of effects noted by 18 internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—56%; pictures on walls moved or were knocked askew—39%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—22%; ceiling tiles or lighting fixtures fell—6%; masonry fell from block or brick walls—6%.

Carnation (RCII=6.4, MMI=--) (98014; 47.638N, 121.911W)—Percentages of effects noted by 11 internet respondents: difficulty standing or walking during the earthquake—55%; objects toppled over or fell off shelves—82%; pictures on walls moved or were knocked askew—82%; furniture or appliances slid, toppled over, or became displaced—9%; hairline cracks in walls—27%; one or several windows cracked—18%; separation of porch, balcony or other addition from building—9%.

Chimacum (RCII=5.5, MMI=5 (98325; 47.986N, 122.788W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—25%; hairline cracks in walls—25%.

Clallam Bay (RCII=5.7, MMI=4) (98326; 48.225N, 124.202W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—50%.

Cle Elum (RCII=5.5, MMI=7) (98922; 47.206N, 120.969W)—Percentages of effects noted by 15 internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—60%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—13%; hairline cracks in walls—27%; a few large cracks in walls—7%; one or several windows cracked—7%; cracks in chimney—7%.

Concrete (RCII=5.6, MMI=5) (98237; 48.531N, 121.664W)—Postal questionnaires reported: exterior and interior walls sustained hairline cracks; a few old chimneys cracked; a few windows cracked.

Percentages of effects noted by nine internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—56%; furniture or appliances slid, toppled over, or became displaced—11%; hairline cracks in walls—22%.

Cosmopolis (RCII=6.1, MMI=6) (98537; 46.954N, 123.774W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—33%; ceiling tiles or lighting fixtures fell—33%.

Curtis (RCII=--, MMI=6) (98538; 46.558N, 123.157W)—Postal questionnaires reported: concrete water tower at the top of Curtis Hill was damaged; interior walls sustained a few large cracks and split at seams; a few windows cracked; several small objects overturned and fell; several knickknacks broke; small appliances fell to the floor.

Darrington (RCII=6.3, MMI=--) (98241; 48.249N, 121.592W)—Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—17%; objects toppled over or fell off shelves—83%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—33%.

Des Moines (RCII=6.1, MMI=6) (98198; 47.407N, 122.310W)—Percentages of effects noted by 24 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—75%; pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—25%; a few large cracks in walls—4%; ceiling tiles or lighting fixtures fell—8%.

Des Moines (RCII=6.0, MMI=--) (98188; 47.450N, 122.281W)—Percentages of effects noted by 41 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off shelves—66%; pictures on walls moved or were knocked askew—59%; furniture or appliances slid, toppled over, or became displaced—29%; hairline cracks in walls—22%; a few large cracks in walls—12%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—10%.

Duvall (RCII=6.2, MMI=5) (98019; 47.725N, 121.937W)—Percentages of effects noted by 11 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—82%; pictures on walls moved or were knocked askew—73%; furniture or appliances slid, toppled over, or became displaced—27%; hairline cracks in walls—45%; cracks in chimney—9%; separation of porch, balcony or other addition from building—9%.

East Bremerton (RCII=5.7, MMI=--) (98311; 47.631N, 122.606W)—Percentages of effects noted by 28 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—54%; pictures on walls moved or were knocked askew—68%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—25%; a few large cracks in walls—14%; ceiling tiles or lighting fixtures fell—4%; cracks in chimney—4%; major damage to old chimney—4%; separation of porch, balcony or other addition from building—4%.

Eatonville (RCII=5.9, MMI=6) (98328; 46.871N, 122.270W)—Percentages of effects noted by 16 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off

shelves—81%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—19%.

Elbe (RCII=--, MMI=6) (98330; 46.767N, 122.150W)— Postal questionnaires reported: several old chimneys cracked or lost bricks; a few windows cracked.

Enumclaw (RCII=6.0, MMI=6) (98022; 47.267N, 122.031W)—Percentages of effects noted by 28 internet respondents: difficulty standing or walking during the earthquake—57%; objects toppled over or fell off shelves—68%; pictures on walls moved or were knocked askew—79%; furniture or appliances slid, toppled over, or became displaced—25%; hairline cracks in walls—25%; a few large cracks in walls—4%.

Everett (E) (RCII=5.6, MMI=--) (98205; 47.990N, 122.116W)—Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—35%; furniture or appliances slid, toppled over, or became displaced—25%; hairline cracks in walls—20%; a few large cracks in walls—15%; ceiling tiles or lighting fixtures fell—20%; separation of porch, balcony or other addition from building—5%.

Fall City (RCII=5.7, MMI=6) (98024; 47.568N, 121.890W)—Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—83%; pictures on walls moved or were knocked askew—83%; hairline cracks in walls—17%; cracks in chimney—17%.

Federal Way (RCII=5.6, MMI=--) (98003; 47.320N, 122.312W)—Percentages of effects noted by 53 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—55%; pictures on walls moved or were knocked askew—49%; furniture or appliances slid, toppled over, or became displaced—4%; hairline cracks in walls—21%; a few large cracks in walls—2%; ceiling tiles or lighting fixtures fell—4%; cracks in chimney—4%.

Federal Way (W) (RCII=6.1, MMI=--) (98023; 47.310N, 122.361W)—Percentages of effects noted by 39 internet respondents: difficulty standing or walking during the earthquake—49%; objects toppled over or fell off shelves—69%; pictures on walls moved or were knocked askew—77%; furniture or appliances slid, toppled over, or became displaced—13%; hairline cracks in walls—21%; many large cracks in walls—3%; ceiling tiles or lighting fixtures fell—5%; cracks in chimney—3%; separation of porch, balcony or other addition from building—3%.

Fife (RCII=5.9, MMI=--) (98424; 47.244N, 122.351W)— Along the Puyallup River Valley there was little evidence of liquefaction or lateral spreading in areas where susceptible soils exist (Nisqually Earthquake Clearinghouse Group, 2001).

Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—52%; objects toppled over or fell off shelves—62%; pictures on walls moved or were knocked askew—52%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—14%.

Fircrest (RCII=6.0, MMI=--) (98466; 47.228N, 122.535W)—Percentages of effects noted by 31 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—55%; pictures on walls moved or were knocked askew—74%; furniture or appliances slid, toppled over, or became displaced—39%; hairline cracks in walls—26%; a few large cracks in walls—3%; one or several windows cracked—6%; ceiling tiles or lighting fixtures fell—10%; cracks in chimney—6%; masonry fell from block or brick walls—3%.

Fort Lewis (RCII=6.0, MMI=6) (98433; 47.101N, 122.583W)—A parapet failed in a military dormitory (PEER, p. 21).

An internet respondent in an office within a maintenance facility at Fort Lewis said, “The floor started to pitch up and down. The 12 ft X 12 ft room began to twist from left to right. We ran out the open bay door. In the parking lot, 2.5-ton trucks and five Hummers pitched back and forth. The parking lot looked as if there were waves rolling through the ground. While walking I felt as though I suddenly became heavier and then lighter.”

Percentages of effects noted by 31 internet respondents: difficulty standing or walking during the earthquake—61%; objects toppled over or fell off shelves—55%; pictures on walls moved or were knocked askew—52%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—26%; a few large cracks in walls—16%; one or several windows cracked—3%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—3%; cracks in chimney—6%; major damage to old chimney—6%; masonry fell from block or brick walls—3%.

Gold Bar (RCII=6.4, MMI=--) (98251; 47.857N, 121.696W)—Effects noted by one internet respondent:

objects toppled over or fell off shelves; pictures on walls moved or were knocked askew.

Grapeview (RCII=6.4, MMI=6) (98546; 47.306N, 122.950W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; cracks in chimney—50%.

Grays River (RCII=--, MMI=6) (98621; 46.353N, 123.589W)—Postal questionnaires reported: interior walls sustained hairline cracks; a few old chimneys cracked; a few windows cracked; many small objects overturned and fell; heavy appliances were displaced by inches.

Greenbank (RCII=5.6, MMI=5) (98253; 48.124N, 122.587W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—14%; objects toppled over or fell off shelves—43%; pictures on walls moved or were knocked askew—57%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—29%; one or several windows cracked—14%; cracks in chimney—14%; outside walls tilted over or collapsed—14%.

Hansville (RCII=--, MMI=6) (98340; 47.906N, 122.566W)—Postal questionnaires reported: a few old chimneys lost bricks; many small objects overturned and fell, many knickknacks broke and many items were shaken off store shelves; heavy appliances were displaced by inches; small appliances fell to the floor.

Issaquah(N) (RCII=5.9, MMI=--) (98029; 47.554N, 122.047W)—Percentages of effects noted by 32 internet respondents: difficulty standing or walking during the earthquake—28%; objects toppled over or fell off shelves—72%; pictures on walls moved or were knocked askew—59%; furniture or appliances slid, toppled over, or became displaced—31%; hairline cracks in walls—19%; a few large cracks in walls—3%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—12%.

Kent (RCII=6.1, MMI=7) (98031; 47.388N, 122.193W)—Near Second Ave. and Harrison St. an unreinforced-masonry wall of a single-story warehouse partially collapsed. Masonry fell from the front of a building on Second Ave. South (Tacoma News Tribune, March 1, 2001, p. A10. col. 6). Windows shattered in a department store on Meeker St. (Tacoma News Tribune, March 1, 2001, p. A10. col. 6).

Percentages of effects noted by 38 internet respondents: difficulty standing or walking during the earthquake—39%; objects toppled over or fell off shelves—66%; pictures on walls moved or were knocked askew—63%; furniture or appliances slid, toppled over, or became displaced—21%; hairline cracks in walls—29%; a few large cracks in walls—5%; one or several windows cracked—5%; ceiling tiles or lighting fixtures fell—3%; cracks in chimney—5%; masonry fell from block or brick walls—5%.

Kent (Covington) (RCII=6.2, MMI=5) (98042; 47.368N, 122.121W)—Percentages of effects noted by 32 internet respondents: difficulty standing or walking during the earthquake—53%; objects toppled over or fell off shelves—84%; pictures on walls moved or were knocked askew—69%; furniture or appliances slid, toppled over, or became displaced—28%; hairline cracks in walls—31%; a few large cracks in walls—6%; many large cracks in walls—3%; cracks in chimney—3%.

Kingston (RCII=5.7, MMI=5) (98346; 47.811N, 122.526W)—Percentages of effects noted by 11 internet respondents: difficulty standing or walking during the earthquake—55%; objects toppled over or fell off shelves—45%; pictures on walls moved or were knocked askew—73%; furniture or appliances slid, toppled over, or became displaced—9%; hairline cracks in walls—45%; a few large cracks in walls—9%.

Kirkland (RCII=5.8, MMI=6) (98033; 47.679N, 122.189W)—Percentages of effects noted by 91 internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—71%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—20%; a few large cracks in walls—7%; many large cracks in walls—1%; ceiling tiles or lighting fixtures fell—10%.

Kirkland (N) (RCII=5.8, MMI=--) (98034; 47.719N, 122.197W)—Percentages of effects noted by 59 internet respondents: difficulty standing or walking during the earthquake—37%; objects toppled over or fell off shelves—58%; pictures on walls moved or were knocked askew—59%; furniture or appliances slid, toppled over, or became displaced—24%; hairline cracks in walls—17%; a few large cracks in walls—5%; one or several windows cracked—2%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—8%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—2%.

La Conner (RCII=5.8, MMI=5) (98257; 48.409N, 122.531W)—Postal questionnaires reported: interior walls split at seams; a few windows cracked; a few items were shaken off store shelves.

Effects noted by one internet respondent: objects toppled over or fell off shelves; pictures on walls moved or were knocked askew.

Lacey (N) (RCII=6.3, MMI=6) (98516; 47.047N, 122.863W)—The USGS field team observed a few damaged chimneys along Martin Way east of Olympia. At a store near Martin Way and College St. NE, items fell from shelves.

Percentages of effects noted by 28 internet respondents: difficulty standing or walking during the earthquake—61%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—64%; furniture or appliances slid, toppled over, or became displaced—32%; hairline cracks in walls—25%; a few large cracks in walls—4%; ceiling tiles or lighting fixtures fell—4%; cracks in chimney—4%.

Lake Forest Park (RCII=5.5, MMI=--) (98155; 47.758N, 122.296W)—Percentages of effects noted by 34 internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—68%; furniture or appliances slid, toppled over, or became displaced—24%; hairline cracks in walls—18%; a few large cracks in walls—3%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—6%; cracks in chimney—3%; masonry fell from block or brick walls—3%.

Lakewood Center (E) (RCII=5.8, MMI=7) (98499; 47.161N, 122.509W)—Percentages of effects noted by 37 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—46%; pictures on walls moved or were knocked askew—70%; furniture or appliances slid, toppled over, or became displaced—24%; hairline cracks in walls—24%; a few large cracks in walls—5%; one or several windows cracked—3%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—8%; cracks in chimney—5%; masonry fell from block or brick walls—3%.

Lakewood Center (S) (RCII=6.1, MMI=--) (98439; 47.123N, 122.529W)—An observer at McChord AFB said, “I was strapped in a military transport aircraft and waiting to start engines when the quake hit. We were rolling around like a fish out of water, and fortunately were not moving at the time. No damage was noted, but it was quite a ride!”

Percentages of effects noted by 19 internet respondents: difficulty standing or walking during the earthquake—47%; objects toppled over or fell off shelves—47%; pictures on walls moved or were knocked askew—53%; furniture or appliances slid, toppled over, or became displaced—16%; hairline cracks in walls—16%; a few large cracks in walls—11%; one or several windows cracked—5%; cracks in chimney—5%; separation of porch, balcony or other addition from building—5%.

Leavenworth (RCII=5.6, MMI=5) (98826; 47.644N, 120.675W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—43%; pictures on walls moved or were knocked askew—86%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—29%; masonry fell from block or brick walls—14%.

Lilliwaup (RCII=6.2, MMI=5) (98555; 47.513N, 123.063W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—33%.

Littlerock (RCII=--, MMI=6) (98556; 46.902N, 123.017W)—The USGS field team visited a grocery where stock shifted toward the back of shelves, so few items fell; objects fell off shelves at a home and two televisions fell on the third floor. There was mild disturbance of a convenience store’s stock.

Longbranch (RCII=5.8, MMI=--) (98351; 47.201N, 122.756W)—Effects noted by one internet respondent: difficulty standing or walking during the earthquake; objects toppled over or fell off shelves; pictures on walls moved or were knocked askew.

Maple Valley (RCII=6.0, MMI=7) (98038; 47.385N, 122.057W)—Percentages of effects noted by 25 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—72%; furniture or appliances slid, toppled over, or became displaced—32%; hairline cracks in walls—20%; one or several windows cracked—4%; ceiling tiles or lighting fixtures fell—4%.

Marysville (RCII=5.9, MMI=5) (98270; 48.066N, 122.156W)—Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—65%; objects toppled over or fell off shelves—55%; pictures on walls moved or were knocked

askew—80%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—35%; a few large cracks in walls—15%; cracks in chimney—5%.

McCleary (RCII=5.6, MMI=6) (98557; 47.053N, 123.264W)—The USGS field team observed a few cracked chimneys and many undamaged old chimneys.

Percentages of effects noted by two internet respondents: objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—50%.

Mercer Island (RCII=6.4, MMI=--) (98040; 47.563N, 122.227W)—An internet respondent driving over Lake Washington on I-90 just east of Mercer Island said, "I struggled to control the skidding vehicle and noticed other drivers with similar problems. I saw light posts wiggling like worms."

Percentages of effects noted by 40 internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—73%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—28%; hairline cracks in walls—28%; a few large cracks in walls—10%; ceiling tiles or lighting fixtures fell—10%; major damage to modern chimney—3%; masonry fell from block or brick walls—3%; outside walls tilted over or collapsed—3%; separation of porch, balcony or other addition from building—3%.

Mill Creek (RCII=5.8, MMI=--) (98012; 47.849N, 122.207W)—Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—40%; objects toppled over or fell off shelves—65%; pictures on walls moved or were knocked askew—65%; furniture or appliances slid, toppled over, or became displaced—10%; hairline cracks in walls—35%; a few large cracks in walls—5%; ceiling tiles or lighting fixtures fell—5%.

Milton (RCII=6.1, MMI=--) (98354; 47.248N, 122.316W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—75%; pictures on walls moved or were knocked askew—50%.

Moclips (RCII=--, MMI=6) (98562; 47.223N, 124.204W)—Postal questionnaires reported: a few old chimneys lost bricks or fell.

Monroe (RCII=6.0, MMI=6) (98272; 47.859N, 121.947W)—Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—29%; hairline cracks in walls—43%; a few large cracks in walls—14%; masonry fell from block or brick walls—5%.

Montesano (RCII=5.9, MMI=6) (98563; 47.090N, 123.501W)—Percentages of effects noted by nine internet respondents: difficulty standing or walking during the earthquake—22%; objects toppled over or fell off shelves—56%; pictures on walls moved or were knocked askew—56%; hairline cracks in walls—33%; a few large cracks in walls—11%.

Morton (RCII=6.4, MMI=6) (98356; 46.558N, 22.250W)—Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—67%; a few large cracks in walls—17%; one or several windows cracked—17%; ceiling tiles or lighting fixtures fell—33%.

Mossyrock (RCII=6.4, MMI=5) (98564; 46.513N, 122.479W)—Effects noted by one internet respondent: objects toppled over or fell off shelves; pictures on walls moved or were knocked askew.

Mountlake Terrace (RCII=5.5, MMI=--) (98043; 47.793N, 122.304W)—Percentages of effects noted by 28 internet respondents: difficulty standing or walking during the earthquake—11%; objects toppled over or fell off shelves—46%; pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—11%; hairline cracks in walls—25%; a few large cracks in walls—4%; ceiling tiles or lighting fixtures fell—25%.

Newport Hills (RCII=6.1, MMI=--) (98006; 47.561N, 122.155W)—Percentages of effects noted by 68 internet respondents: difficulty standing or walking during the earthquake—40%; objects toppled over or fell off shelves—68%; pictures on walls moved or were knocked askew—49%; furniture or appliances slid, toppled over, or became displaced—28%; hairline cracks in walls—34%; a few large cracks in walls—16%; many large cracks in walls—1%; one or several windows cracked—1%; ceiling tiles or lighting fixtures fell—10%; cracks in chimney—1%; masonry fell from block or brick walls—1%.

Normandy Park (RCII=6.3, MMI=6) (98166; 47.455N, 122.347W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—79%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—36%; a few large cracks in walls—21%; ceiling tiles or lighting fixtures fell—29%; cracks in chimney—7%.

North Bend (RCII=6.4, MMI=5) (98045; 47.476N, 121.757W)—Percentages of effects noted by 28 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—86%; pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—32%; hairline cracks in walls—29%; a few large cracks in walls—18%; many large cracks in walls—7%; one or several windows cracked—4%; many windows cracked or broken out—4%; ceiling tiles or lighting fixtures fell—18%; cracks in chimney—11%; masonry fell from block or brick walls—14%; separation of porch, balcony or other addition from building—4%.

Ocean Park (RCII=5.5, MMI=5) (98640; 46.503N, 124.044W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—100%; objects toppled over or fell off shelves—25%; pictures on walls moved or were knocked askew—100%; hairline cracks in walls—25%.

Onalaska (RCII=5.8, MMI=5 (98570; 46.573N, 122.708W)—Percentages of effects noted by 10 internet respondents: difficulty standing or walking during the earthquake—40%; objects toppled over or fell off shelves—70%; pictures on walls moved or were knocked askew—80%; furniture or appliances slid, toppled over, or became displaced—30%; hairline cracks in walls—20%; separation of porch, balcony or other addition from building—10%.

Packwood (RCII=5.6, MMI=5) (98361; 46.650N, 121.655W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—29%; objects toppled over or fell off shelves—57%; pictures on walls moved or were knocked askew—86%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—14%; one or several windows cracked—14%; cracks in chimney—14%.

Parkland (RCII=5.9, MMI=6) (98444; 47.157N, 122.449W)—Percentages of effects noted by 18 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—72%; pictures on walls moved or were knocked askew—72%; furniture or appliances slid, toppled over, or became displaced—22%; hairline cracks in walls—39%; one or several windows cracked—17%.

Parkland (Brookdale) (RCII=6.2, MMI=--) (98445; 47.134N, 122.412W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—36%; objects toppled over or fell off shelves—79%; pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—21%; hairline cracks in walls—21%; ceiling tiles or lighting fixtures fell—7%; cracks in chimney—7%.

Parkland (Summit) (RCII=6.3, MMI=--) (98446; 47.140N, 122.372W)—Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—75%; pictures on walls moved or were knocked askew—88%; furniture or appliances slid, toppled over, or became displaced—25%; separation of porch, balcony or other addition from building—12%.

Port Orchard (RCII=6.4, MMI=--) (98366; 47.505N, 122.615W)—Some homes experienced cracked or broken chimneys. A commercial building sustained major cracks in a concrete block wall (press accounts).

An internet respondent fishing in a boat south of Blake Island and north of Vashon Island said, “The boat felt like someone was pushing it up from below and letting it drop back down fairly quickly, like hitting something. There was a massive green cloud of pollen rising above the trees.”

Percentages of effects noted by 41 internet respondents: difficulty standing or walking during the earthquake—54%; objects toppled over or fell off shelves—85%; pictures on walls moved or were knocked askew—78%; furniture or appliances slid, toppled over, or became displaced—37%; hairline cracks in walls—32%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—7%; cracks in chimney—2%.

Poulsbo (RCII=5.9, MMI=6) (98370; 47.742N, 122.628W)—Chimneys were damaged on seven homes. Saint Charles Episcopal Church was damaged (press reports).

Percentages of effects noted by 34 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—68%; pictures on walls moved or were knocked askew—71%;

furniture or appliances slid, toppled over, or became displaced—15%; hairline cracks in walls—18%; a few large cracks in walls—3%; many large cracks in walls—3%; ceiling tiles or lighting fixtures fell—3%; cracks in chimney—3%; outside walls tilted over or collapsed—3%; separation of porch, balcony or other addition from building—3%.

Puyallup (South Hill) (RCII=6.3, MMI=7) (98373; 47.128N, 122.322W)—Percentages of effects noted by 13 internet respondents: difficulty standing or walking during the earthquake—46%; objects toppled over or fell off shelves—92%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—31%; hairline cracks in walls—23%; a few large cracks in walls—8%; one or several windows cracked—15%; ceiling tiles or lighting fixtures fell—23%.

Quilcene (RCII=6.4, MMI=7) (98376; 47.832N, 122.858W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—75%; hairline cracks in walls—25%.

Rainier (RCII=6.4, MMI=6) (98576; 46.883N, 122.679W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—57%; objects toppled over or fell off shelves—86%; pictures on walls moved or were knocked askew—86%; furniture or appliances slid, toppled over, or became displaced—57%; hairline cracks in walls—14%.

Redmond (RCII=5.6, MMI=5) (98052; 47.672N, 122.123W)—Percentages of effects noted by 595 internet respondents: difficulty standing or walking during the earthquake—30%; objects toppled over or fell off shelves—57%; pictures on walls moved or were knocked askew—45%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—18%; a few large cracks in walls—8%; many large cracks in walls—1%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—4%; masonry fell from block or brick walls—1%.

Renton (Cascade) (RCII=6.2, MMI=7) (98058; 47.447N, 122.122W)—A Maplewood home was destroyed by an earth flow triggered by the shock.

Percentages of effects noted by 36 internet respondents: difficulty standing or walking during the earthquake—39%; objects toppled over or fell off shelves—69%; pictures on walls moved or were knocked askew—61%; furniture or appliances slid, toppled over, or became displaced—28%; hairline cracks in walls—17%; a few large cracks in walls—11%; many large cracks in walls—3%; one or several windows cracked—3%; many windows cracked or broken out—3%; ceiling tiles or lighting fixtures fell—8%; separation of porch, balcony or other addition from building—3%.

Renton (Highlands) (RCII=6.1, MMI=--) (98059; 47.467N, 122.151W)—Percentages of effects noted by 19 internet respondents: difficulty standing or walking during the earthquake—47%; objects toppled over or fell off shelves—74%; pictures on walls moved or were knocked askew—68%; furniture or appliances slid, toppled over, or became displaced—16%; hairline cracks in walls—16%; a few large cracks in walls—5%; separation of porch, balcony or other addition from building—5%.

Renton (N) (RCII=6.4, MMI=--) (98056; 47.507N, 122.182W)—A landslide dammed the Cedar River; engineers breached the landslide to avoid flooding nearby homes (Nisqually Earthquake Clearinghouse Group, 2001).

Percentages of effects noted by 18 internet respondents: difficulty standing or walking during the earthquake—56%; objects toppled over or fell off shelves—89%; pictures on walls moved or were knocked askew—44%; furniture or appliances slid, toppled over, or became displaced—39%; hairline cracks in walls—22%; a few large cracks in walls—6%; many large cracks in walls—11%; one or several windows cracked—11%; many windows cracked or broken out—11%; ceiling tiles or lighting fixtures fell—17%; masonry fell from block or brick walls—11%.

Riverton Heights (RCII=6.3, MMI=--) (98168; 47.489N, 122.302W)—Percentages of effects noted by 33 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—70%; pictures on walls moved or were knocked askew—58%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—24%; a few large cracks in walls—15%; many large cracks in walls—3%; one or several windows cracked—6%; ceiling tiles or lighting fixtures fell—24%; cracks in chimney—3%; masonry fell from block or brick walls—3%; outside walls tilted over or collapsed—3%.

Rockport (RCII=--, MMI=6) (98283; 48.470N, 121.555W)—Postal questionnaires reported: a few modern chimneys cracked; many small objects overturned and fell.

Rosburg (RCII=6.2, MMI=5) (98643; 46.307N, 123.657W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the

earthquake—100%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; cracks in chimney—50%.

Roy (RCII=5.8, MMI=--) (98580; 46.956N, 122.448W)— Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—12%; hairline cracks in walls—25%.

Seattle (Ballard) (RCII=5.5, MMI=--) (98107; 47.670N, 122.376W)—Percentages of effects noted by 51 internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—63%; pictures on walls moved or were knocked askew—73%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—20%; a few large cracks in walls—2%; major damage to old chimney—2%.

Seattle (Beacon Hill) (RCII=5.8, MMI=--) (98144; 47.585N, 122.300W)—Many bottles and cans fell and broke inside coolers and a few things fell off shelves at two stores.

Percentages of effects noted by 73 internet respondents: difficulty standing or walking during the earthquake—37%; objects toppled over or fell off shelves—48%; pictures on walls moved or were knocked askew—48%; furniture or appliances slid, toppled over, or became displaced—23%; hairline cracks in walls—19%; a few large cracks in walls—4%; many large cracks in walls—5%; one or several windows cracked—3%; many windows cracked or broken out—1%; ceiling tiles or lighting fixtures fell—8%; masonry fell from block or brick walls—5%.

Seattle (Capitol Hill) (RCII=6.2, MMI=7) (98102; 47.630N, 122.321W)—The Flentrop Organ in Saint Marks Episcopal Cathedral was heavily damaged (Seattle Post Intelligencer, March 3, 2001, p. A6, col. 1). The USGS field team observed a few bricks off parapets and chimneys; stores reported several dozen to a hundred items off shelves.

Percentages of effects noted by 68 internet respondents: difficulty standing or walking during the earthquake—53%; objects toppled over or fell off shelves—81%; pictures on walls moved or were knocked askew—63%; furniture or appliances slid, toppled over, or became displaced—26%; hairline cracks in walls—31%; a few large cracks in walls—7%; many large cracks in walls—4%; one or several windows cracked—13%; many windows cracked or broken out—1%; ceiling tiles or lighting fixtures fell—7%; cracks in chimney—4%; major damage to old chimney—3%; masonry fell from block or brick walls—3%.

Seattle (Columbia) (RCII=5.7, MMI=6) (98118; 47.541N, 122.275W)—A glass shop reported that two pieces of glass tipped over and an empty file cabinet stacked on top of another empty file cabinet slid several inches; customers from the neighborhood said drawers facing north or south opened but those facing east or west did not. A grocery worker watched cola bottles fall; the store was closed several hours for clean up. At Seward Park nothing fell in the park office, but old cracks were enlarged on the patio between the office and a playground; a picnic shed on the hill above the office leaned but did not collapse; at the ranger's home in the park, pictures propped on a shelf fell down and several knickknacks fell off the window sills.

Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—57%; pictures on walls moved or were knocked askew—57%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—19%; a few large cracks in walls—5%; ceiling tiles or lighting fixtures fell—5%; separation of porch, balcony or other addition from building—5%.

Seattle (Crown Hill) (RCII=5.8, MMI=--) (98117; 47.687N, 122.377W)—Percentages of effects noted by 48 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—73%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—31%; a few large cracks in walls—4%; many large cracks in walls—2%; one or several windows cracked—4%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—2%; cracks in chimney—2%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—2%.

Seattle (Delridge) (RCII=6.2, MMI=7) (98106; 47.534N, 122.355W)—The USGS field team observed several damaged chimneys. A waterfront restaurant sustained many broken windows, minor cracks in columns and lost $3,000 in wine.

Percentages of effects noted by 17 internet respondents: difficulty standing or walking during the earthquake—35%; objects toppled over or fell off shelves—71%;

pictures on walls moved or were knocked askew—71%; furniture or appliances slid, toppled over, or became displaced—35%; hairline cracks in walls—12%; a few large cracks in walls—12%; many windows cracked or broken out—6%; separation of porch, balcony or other addition from building—6%.

Seattle (Haller Lake) (RCII=5.5, MMI=6) (98133; 47.738N, 122.343W)—Percentages of effects noted by 62 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off shelves—44%; pictures on walls moved or were knocked askew—56%; furniture or appliances slid, toppled over, or became displaced—15%; hairline cracks in walls—26%; a few large cracks in walls—5%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—6%; cracks in chimney—2%; separation of porch, balcony or other addition from building—2%.

Seattle (Lake City) (RCII=5.9, MMI=—) (98125; 47.717N, 122.302W)—Percentages of effects noted by 56 internet respondents: difficulty standing or walking during the earthquake—30%; objects toppled over or fell off shelves—68%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—11%; hairline cracks in walls—25%; a few large cracks in walls—7%; ceiling tiles or lighting fixtures fell—9%; cracks in chimney—2%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—4%.

Seattle (Laurelhurst) (RCII=5.8, MMI=--) (98105; 47.663N, 122.302W)—Books spilled from shelves and bookracks were distorted (Nisqually Earthquake Clearinghouse Group, 2001).

Percentages of effects noted by 137 internet respondents: difficulty standing or walking during the earthquake—29%; objects toppled over or fell off shelves—54%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—23%; a few large cracks in walls—9%; ceiling tiles or lighting fixtures fell—7%; major damage to old chimney—1%; masonry fell from block or brick walls—1%.

Seattle (Lincoln Park) (RCII=6.2, MMI=--) (98136; 47.540N, 122.388W)—Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—62%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—57%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—5%; a few large cracks in walls—10%; ceiling tiles or lighting fixtures fell—5%; cracks in chimney—5%.

Seattle (Magnolia Bluffs) (RCII=5.8, MMI=6) (98199; 47.649N, 122.396W)—The reinforced concrete framework of the Magnolia Viaduct was damaged and the bridge was closed (Nisqually Earthquake Clearinghouse Group, 2001). The USGS field team observed isolated chimney damage in this area and talked to a guard at Pier 90 who saw ground rolling in the paved lot and a large piece of concrete falling from the nearby Magnolia Viaduct.

Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—45%; objects toppled over or fell off shelves—70%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—15%; hairline cracks in walls—15%; ceiling tiles or lighting fixtures fell—5%; cracks in chimney—5%.

Seattle (Montlake) (RCII=6.1, MMI=7) (98112; 47.640N, 122.310W)—In the Montlake district dozens of homes had severe chimney damage (press reports).

Percentages of effects noted by 39 internet respondents: difficulty standing or walking during the earthquake—26%; objects toppled over or fell off shelves—77%; pictures on walls moved or were knocked askew—64%; furniture or appliances slid, toppled over, or became displaced—13%; hairline cracks in walls—33%; a few large cracks in walls—10%; one or several windows cracked—8%; ceiling tiles or lighting fixtures fell—3%; cracks in chimney—18%; major damage to old chimney—8%; masonry fell from block or brick walls—5%.

Seattle (Queen Anne W) (RCII=6.2, MMI=7) (98119; 47.638N, 122.364W)—The USGS field teams observed chimneys that lost bricks, cracked at the roof line or fell above the roof line. Two tombstones overturned in a cemetery.

Percentages of effects noted by 70 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—66%; pictures on walls moved or were knocked askew—63%; furniture or appliances slid, toppled over, or became displaced—27%; hairline cracks in walls—21%; a few large cracks in walls—11%; many large cracks in walls—1%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—6%; cracks in chimney—3%; major damage to old chimney—1%; masonry fell from block or brick walls—4%.

Seattle (Shoreline) (RCII=5.8, MMI=--) (98177; 47.747N, 122.369W)—Percentages of effects noted by 14

internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—71%; pictures on walls moved or were knocked askew—79%; furniture or appliances slid, toppled over, or became displaced—21%; hairline cracks in walls—29%.

Seattle (Shorewood) (RCII=5.7, MMI=--) (98146; 47.501N, 122.354W)—Percentages of effects noted by 16 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—69%; pictures on walls moved or were knocked askew—56%; furniture or appliances slid, toppled over, or became displaced—19%; hairline cracks in walls—25%.

Seattle (Skyway) (RCII=6.2, MMI=--) (98178; 47.499N, 122.247W)—Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—62%; objects toppled over or fell off shelves—62%; pictures on walls moved or were knocked askew—75%; furniture or appliances slid, toppled over, or became displaced—38%; hairline cracks in walls—12%; a few large cracks in walls—12%; one or several windows cracked—12%; ceiling tiles or lighting fixtures fell—12%; cracks in chimney—12%; major damage to old chimney—12%; masonry fell from block or brick walls—12%.

Seattle (Wallingford) (RCII=5.7, MMI=--) (98103; 47.673N, 122.343W)—Residents reported pictures were askew and small objects fell.

Percentages of effects noted by 113 internet respondents: difficulty standing or walking during the earthquake—23%; objects toppled over or fell off shelves—63%; pictures on walls moved or were knocked askew—53%; furniture or appliances slid, toppled over, or became displaced—15%; hairline cracks in walls—20%; a few large cracks in walls—4%; many large cracks in walls—1%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—3%; cracks in chimney—3%; major damage to old chimney—2%; masonry fell from block or brick walls—1%.

Seattle (Wedgwood) (RCII=5.8, MMI=--) (98115; 47.685N, 122.297W)—Percentages of effects noted by 91 internet respondents: difficulty standing or walking during the earthquake—32%; objects toppled over or fell off shelves—69%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—16%; a few large cracks in walls—5%; many large cracks in walls—1%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—4%; cracks in chimney—3%; outside walls tilted over or collapsed—1%; separation of porch, balcony or other addition from building—1%.

Seattle (World Trade Center) (RCII=6.0, MMI=--) (98121; 47.615N, 122.345W)—Percentages of effects noted by 124 internet respondents: difficulty standing or walking during the earthquake—31%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—56%; furniture or appliances slid, toppled over, or became displaced—24%; hairline cracks in walls—29%; a few large cracks in walls—12%; many large cracks in walls—1%; many windows cracked or broken out—1%; ceiling tiles or lighting fixtures fell—10%; major damage to old chimney—1%; masonry fell from block or brick walls—3%; separation of porch, balcony or other addition from building—1%.

Silverdale (RCII=5.8, MMI=6) (98383; 47.662N, 122.698W)—Press reported some chimney damage and nine homes damaged in all.

Percentages of effects noted by 33 internet respondents: difficulty standing or walking during the earthquake—61%; objects toppled over or fell off shelves—70%; pictures on walls moved or were knocked askew—52%; furniture or appliances slid, toppled over, or became displaced—12%; hairline cracks in walls—27%; ceiling tiles or lighting fixtures fell—9%; cracks in chimney—3%.

Silverdale (NW) (RCII=5.9, MMI=--) (98315; 47.692N, 122.716W)—Percentages of effects noted by 11 internet respondents: difficulty standing or walking during the earthquake—55%; objects toppled over or fell off shelves—45%; pictures on walls moved or were knocked askew—82%; furniture or appliances slid, toppled over, or became displaced—27%; hairline cracks in walls—27%; many large cracks in walls—9%; ceiling tiles or lighting fixtures fell—18%; cracks in chimney—9%.

Skykomish (RCII=--, MMI=6) (98288; 47.692N, 121.371W)—Postal questionnaires reported: exterior walls sustained large cracks; interior walls split at seams; several old chimneys lost bricks; a few windows cracked; in some buildings almost all small objects overturned and fell; many knickknacks broke and many items were shaken off store shelves; large furniture and heavy appliances were displaced; small appliances overturned.

Sultan (RCII=6.4, MMI=6) (98294; 47.859N, 121.737W)—Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—88%; pictures on walls moved or were knocked askew—75%; furniture or appliances slid, toppled over, or became displaced—50%; ceiling tiles or lighting fixtures fell—12%.

Sumner (RCII=6.4, MMI=7) (98390; 47.189N, 122.180W)—Bricks fell from the old (about 1920s) bell tower of the United Methodist Church (press reports). The USGS field team observed isolated chimney damage.

Percentages of effects noted by 40 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—70%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—35%; hairline cracks in walls—25%; a few large cracks in walls—12%; many large cracks in walls—3%; ceiling tiles or lighting fixtures fell—8%; cracks in chimney—5%; major damage to old chimney—3%; separation of porch, balcony or other addition from building—3%.

Suquamish (RCII=6.1, MMI=6) (98392; 47.734N, 22.557W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—33%; a few large cracks in walls—33%.

Tacoma (RCII=--, MMI=6) (98418; 47.252N, 122.460W)—Postal questionnaires reported: a few old chimneys twisted, leaned, lost bricks or fell; a few windows cracked; small appliances overturned and fell to the floor; a few tombstones twisted or fell.

Tacoma (RCII=6.2, MMI=--) (98443; 47.204N, 122.373W)—Percentages of effects noted by two internet respondents: objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—50%; a few large cracks in walls—50%; ceiling tiles or lighting fixtures fell—50%; masonry fell from block or brick walls—50%.

Tacoma (Downtown) (RCII=5.7, MMI=7) (98402; 47.255N, 22.441W)—Half a dozen bricks and three coping stones fell from the rear facade of a century-old high school (press reports).

Percentages of effects noted by 39 internet respondents: difficulty standing or walking during the earthquake—26%; objects toppled over or fell off shelves—49%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—33%; a few large cracks in walls—13%; many large cracks in walls—3%; ceiling tiles or lighting fixtures fell—5%.

Tacoma (Franklin Park) (RCII=6.0, MMI=--) (98405; 47.248N, 122.464W)—Percentages of effects noted by 41 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off shelves—59%; pictures on walls moved or were knocked askew—46%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—24%; a few large cracks in walls—7%; one or several windows cracked—2%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—2%; cracks in chimney—2%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—5%.

Tacoma (Garfield Park) (RCII=5.9, MMI=--) (98403; 47.264N, 122.458W)—Percentages of effects noted by 12 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—75%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—33%; a few large cracks in walls—8%; one or several windows cracked—8%.

Tacoma (Hillsdale) (RCII=5.7, MMI=--) (98404; 47.211N, 122.413W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—43%; objects toppled over or fell off shelves—43%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—29%; hairline cracks in walls—14%; a few large cracks in walls—7%.

Tacoma (Jefferson Park) (RCII=6.2, MMI=--) (98406; 47.263N, 122.499W)—Percentages of effects noted by 25 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off shelves—76%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—40%; a few large cracks in walls—12%; one or several windows cracked—8%; many windows cracked or broken out—4%; ceiling tiles or lighting fixtures fell—12%; cracks in chimney—8%; major damage to old chimney—4%; masonry fell from block or brick walls—8%.

Tacoma (Lincoln Park) (RCII=5.7, MMI=--) (98408; 47.207N, 122.444W)—Percentages of effects noted by 15 internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—47%; hairline cracks in walls—27%; a few large

cracks in walls—7%; separation of porch, balcony or other addition from building—7%.

Tacoma (Point Defiance Park) (RCII=6.3, MMI=--) (98407; 47.282N, 122.504W)—A landslide at Salmon Beach damaged nine homes and forced evacuation of others (Nisqually Earthquake Clearinghouse Group, 2001).

Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—86%; pictures on walls moved or were knocked askew—76%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—52%; a few large cracks in walls—5%; one or several windows cracked—5%; many windows cracked or broken out—5%; cracks in chimney—14%; masonry fell from block or brick walls—5%.

Tacoma (Port of Tacoma) (RCII=6.0, MMI=--) (98422; 47.295N, 122.398W)—The Port of Tacoma reported buckled pavement and structural damage to three buildings (Nisqually Earthquake Clearinghouse Group, 2001, March 2001).

Percentages of effects noted by 10 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—40%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—30%.

Tacoma (Port of Tacoma) (RCII=6.0, MMI=7) (98421; 7.266N, 122.401W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—71%; objects toppled over or fell off shelves—57%; pictures on walls moved or were knocked askew—86%; furniture or appliances slid, toppled over, or became displaced—43%; hairline cracks in walls—14%.

Tacoma (South) (RCII=5.8, MMI=6) (98409; 47.208N, 122.478W)—Merchants in the Tacoma Mall reported "minor damage from toppled shelves, broken glassware and oozing bottles." Fallen items cluttered each of Rite-Aid's aisles (Tacoma News Tribune, March 1, 3001).

Percentages of effects noted by 34 internet respondents: difficulty standing or walking during the earthquake—44%; objects toppled over or fell off shelves—56%; pictures on walls moved or were knocked askew—47%; furniture or appliances slid, toppled over, or became displaced—3%; hairline cracks in walls—15%; a few large cracks in walls—9%; one or several windows cracked—3%; ceiling tiles or lighting fixtures fell—9%.

Tacoma (Tacoma Community College) (RCII=6.4, MMI=--) (98465; 47.249N, 122.527W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—100%; pictures on walls moved or were knocked askew—100%; furniture or appliances slid, toppled over, or became displaced—50%; hairline cracks in walls—50%.

Tokeland (RCII=--, MMI=6) (98590; 46.747N, 124.046W)—Postal questionnaires reported: a few old chimneys cracked; a few windows cracked; a few small objects overturned and fell; several knickknacks broke; many items were shaken off store shelves.

Winslow (RCII=5.9, MMI=6) (98110; 47.645N, 122.531W)—See Bainbridge Island/Winslow.

Yelm (RCII=5.6, MMI=5) (98597; 46.921N, 122.588W)—An observer at home said, "Nearly all items not secured ended up on the floor. Lighter items (picture frames, models) were thrown across rooms up to 10 feet."

Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—57%; objects toppled over or fell off shelves—48%; pictures on walls moved or were knocked askew—52%; furniture or appliances slid, toppled over, or became displaced—24%; hairline cracks in walls—19%.

RCII 4.5-5.4 (or MMI 5 for communities with no RCII) in British Columbia

Aldergrove (RCII=--, MMI=5) (49.050N, 122.470W)

Chemainus (RCII=--, MMI=5) (49.010N, 123.780W)

Coquitlam (RCII=--, MMI=5) (49.230N, 122.800W)

Cranbrook (RCII=--, MMI=5) (49.510N, 115.760W)

Grantham's Landing (RCII=--, MMI=5) (49.420N, 123.500W)

Oliver (RCII=--, MMI=5) (49.190N, 119.820W)

Sasseenos (Sooke) (RCII=--, MMI=5) (48.370N, 123.720W)

Sidney (RCII=5.3, MMI=--) (48.650N, 123.400W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—33%; hairline cracks in walls—33%; ceiling tiles or lighting fixtures fell—33%.

RCII 4.5-5.4 (or MMI 5 for communities with no RCII) in Idaho

Nordman (RCII=--, MMI=5) (Zip Code 83848; 48.567N, 116.921W)—Postal questionnaires reported: a few small objects overturned and fell; a few knickknacks broke; hanging pictures swung out of place.

RCII 4.5-5.4 (or MMI 5 for communities with no RCII) in Oregon

Astoria (RCII=4.9, MMI=5) (Zip Code 97103; 46.156N, 123.798W)—Percentages of effects noted by 24 internet respondents: difficulty standing or walking during the earthquake—21%; objects toppled over or fell off shelves—38%; pictures on walls moved or were knocked askew—38%; furniture or appliances slid, toppled over, or became displaced—8%; hairline cracks in walls—17%.

Bay City (RCII=—, MMI=5) (97107; 45.520N, 123.876W)—Postal questionnaires reported: a few windows cracked; a few small objects overturned and fell; many items were shaken off store shelves.

Cloverdale (RCII=4.8, MMI=3) (97112; 45.286N, 123.836W)—Effects noted by one internet respondent: pictures on walls moved or were knocked askew.

Gaston (RCII=4.5, MMI=0) (97119; 45.443N, 123.167W)—Percentages of effects noted by three internet respondents: objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—67%.

Gladstone (RCII=4.5, MMI=--) (97027; 45.390N, 122.590W)—Effects noted by one internet respondent: hairline cracks in walls.

Hammond (RCII=4.6, MMI=--) (97121; 46.198N, 123.953W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—100%.

Irrigon (RCII=--, MMI=5) (97844; 45.888N, 119.507W)—Postal questionnaires reported: a few knickknacks broke; hanging pictures fell.

Nehalem (RCII=4.8, MMI=4) (97131; 45.722N, 123.905W)—Percentages of effects noted by two internet respondents: pictures on walls moved or were knocked askew—100%; a few large cracks in walls—50%.

Rainier (RCII=4.5, MMI=5) (97048; 46.065N, 122.967W)—There was little or no damage to buildings (Clatskanie Chief, March 8, 2001).

Percentages of effects noted by six internet respondents: objects toppled over or fell off shelves—17%; pictures on walls moved or were knocked askew—33%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—17%.

Rockaway Beach (RCII=--, MMI=5) (97136; 45.615N, 123.940W)—Postal questionnaires reported: a few windows cracked; a few small objects overturned and fell; heavy appliances were displaced by inches; a few items were shaken off store shelves.

Saint Helens (RCII=4.9, MMI=6) (97051; 45.861N, 122.828W)—Postal questionnaires reported: a few old chimneys cracked, twisted, leaned, lost bricks or fell; a few windows cracked.

Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—20%; pictures on walls moved or were knocked askew—40%; furniture or appliances slid, toppled over, or became displaced—20%; hairline cracks in walls—40%.

Seaside (RCII=4.6, MMI=--) (97138; 45.970N, 123.879W)—Percentages of effects noted by 10 internet respondents: difficulty standing or walking during the earthquake—10%; objects toppled over or fell off shelves—20%; pictures on walls moved or were knocked askew—60%; hairline cracks in walls—20%; cracks in chimney—10%.

Timber (RCII=--, MMI=5) (97144; 45.727N, 123.312W)—Postal questionnaires reported: a few small objects overturned and fell; a few dinnerware items and knickknacks broke; a few people ran out of buildings; people had difficulty maintaining balance and walking; felt by many.

Tygh Valley (RCII=—, MMI=5) (97063; 45.232N, 121.297W)—Postal questionnaires reported: a few small objects overturned and fell; hanging pictures swung out of place; a few people ran out of buildings; people had difficulty maintaining balance; felt by many.

Warrenton (RCII=4.8, MMI=5) (97146; 46.145N, 123.925W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—50%; pictures on walls moved or were knocked askew—25%; furniture or appliances slid, toppled over, or became displaced—25%; hairline cracks in walls—25%; a few large cracks in walls—25%.

Wemme (RCII=5.0, MMI=--) (97067; 45.340N, 121.960W)—Effects noted by one internet respondent: objects toppled over or fell off shelves.

RCII 4.5-5.4 (or MMI 5 for communities with no RCII) in Washington

Aberdeen (RCII=5.4, MMI=6) (Zip Code 98520; 46.984N, 123.796W)—Percentages of effects noted by 31 internet respondents: difficulty standing or walking during the earthquake—35%; objects toppled over or fell off shelves—39%; pictures on walls moved or were knocked askew—45%; furniture or appliances slid, toppled over, or became displaced—16%; hairline cracks in walls—16%; a few large cracks in walls—6%; many large cracks in walls—3%.

Acme (RCII=4.6, MMI=5) (98220; 48.675N, 122.191W)—Effects noted by one internet respondent: difficulty standing or walking during the earthquake; pictures on walls moved or were knocked askew.

Addy (RCII=5.0, MMI=--) (99101; 48.448N, 117.892W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—67%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—33%; hairline cracks in walls—33%; ceiling tiles or lighting fixtures fell—33%.

Amanda Park (RCII=--, MMI=5) (98526; 47.471N, 123.907W)—Postal questionnaires reported: a few small objects overturned and fell; a few knickknacks broke; a few items were shaken off store shelves.

Anacortes (RCII=4.5, MMI=--) (98221; 48.500N, 122.631W)—The 145-foot tall Morrison Mill smokestack, built in 1926, was cracked and subsequently taken down (Seattle Post-Intelligencer, March 5, 2001).

Percentages of effects noted by 29 internet respondents: difficulty standing or walking during the earthquake—21%; objects toppled over or fell off shelves—17%; pictures on walls moved or were knocked askew—34%; furniture or appliances slid, toppled over, or became displaced—10%; hairline cracks in walls—7%; a few large cracks in walls—3%; ceiling tiles or lighting fixtures fell—3%.

Arlington (RCII=5.0, MMI=6) (98223; 48.183N, 122.112W)—Percentages of effects noted by 21 internet respondents: difficulty standing or walking during the earthquake—24%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—48%; furniture or appliances slid, toppled over, or became displaced—10%; hairline cracks in walls—29%; cracks in chimney—5%.

Baring (RCII=--, MMI=5) (98224; 47.758N, 121.448W)—Postal questionnaires reported: several small objects overturned and a few fell; contents fell out of heavy appliances; several items were shaken off store shelves.

Beaver (RCII=4.8, MMI=5) (98305; 8.067N, 124.305W)—Effects noted by one internet respondent: objects toppled over or fell off shelves; pictures on walls moved or were knocked askew.

Bellevue (Midlakes) (RCII=5.4, MMI=6) (98005; 47.615N, 122.166W)—Postal questionnaires reported: exterior walls of solid brick and concrete blocks sustained large cracks; interior walls sustained a few large cracks and split at seams; a few windows cracked; many dinnerware items and knickknacks broke; large furniture and heavy appliances were displaced; approaches to highway bridges settled; moderate landslides occurred; ground slumps appeared in road fill.

Percentages of effects noted by 84 internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—40%; pictures on walls moved or were knocked askew—51%; furniture or appliances slid, toppled over, or became displaced—12%; hairline cracks in walls—12%; a few large cracks in walls—4%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—6%; separation of porch, balcony or other addition from building—1%.

Blaine (RCII=4.5, MMI=5) (98230; 48.964N, 122.732W)—Percentages of effects noted by 15 internet respondents: difficulty standing or walking during the earthquake—7%; objects toppled over or fell off shelves—27%; pictures on walls moved or were knocked askew—20%; hairline cracks in walls—13%.

Bow (RCII=4.5, MMI=4) (98232; 48.562N, 122.413W)—Percentages of effects noted by five internet respondents: objects toppled over or fell off shelves—20%; pictures on walls moved or were knocked askew—40%.

Bridgeport (RCII=5.4, MMI=--) (98813; 48.016N, 119.703W)—Effects noted by one internet respondent: difficulty standing or walking during the earthquake; objects toppled over or fell off shelves; pictures on walls moved or were knocked askew.

Brush Prairie (RCII=5.4, MMI=--) (98606; 45.730N, 122.484W)—Percentages of effects noted by two internet

respondents: objects toppled over or fell off shelves—50%; hairline cracks in walls—50%.

Burlington (RCII=4.6, MMI=4) (98233; 48.479N, 122.334W)—Percentages of effects noted by 16 internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—25%; pictures on walls moved or were knocked askew—25%; furniture or appliances slid, toppled over, or became displaced—6%; hairline cracks in walls—12%; cracks in chimney—6%.

Carbonado (RCII=--, MMI=5) (98323; 47.080N, 122.051W)—Postal questionnaires reported: exterior walls sustained large cracks; several small objects overturned and fell and knickknacks broke.

Cashmere (RCII=4.5, MMI=5) (98815; 47.517N, 120.503W)—Percentages of effects noted by four internet respondents: objects toppled over or fell off shelves—25%; pictures on walls moved or were knocked askew—50%.

Castle Rock (RCII=4.5, MMI=5) (98611; 46.278N, 122.914W)—Percentages of effects noted by 11 internet respondents: pictures on walls moved or were knocked askew—18%; furniture or appliances slid, toppled over, or became displaced—9%; hairline cracks in walls—9%.

Cathlamet (RCII=5.1, MMI=6) (98612; 46.195N, 123.363W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—33%.

Chelan (RCII=4.7, MMI=5) (98816; 47.848N, 120.027W)—Percentages of effects noted by nine internet respondents: difficulty standing or walking during the earthquake—11%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—11%.

Clinton (RCII=5.2, MMI=5) (98236; 47.951N, 122.392W)—Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—80%; pictures on walls moved or were knocked askew—80%.

Copalis Crossing (RCII=--, MMI=5) (98536; 47.125N, 124.135W)—Postal questionnaires reported: interior walls sustained hairline cracks; a few small objects overturned and fell and knickknacks broke; hanging pictures fell.

Coulee Dam (RCII=4.6, MMI=4) (99116; 48.174N, 119.181W)—Percentages of effects noted by 6 internet respondents: difficulty standing or walking during the earthquake—17%; pictures on walls moved or were knocked askew—83%; furniture or appliances slid, toppled over, or became displaced—33%; hairline cracks in walls—17%.

Coupeville (RCII=5.0, MMI=6) (98239; 48.219N, 122.682W)—Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—7%; objects toppled over or fell off shelves—29%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—7%; hairline cracks in walls—7%; ceiling tiles or lighting fixtures fell—7%; separation of porch, balcony or other addition from building—7%.

Edmonds (RCII=5.3, MMI=5) (98020; 47.801N, 122.367W)—Percentages of effects noted by 19 internet respondents: difficulty standing or walking during the earthquake—32%; objects toppled over or fell off shelves—42%; pictures on walls moved or were knocked askew—63%; hairline cracks in walls—16%; ceiling tiles or lighting fixtures fell—5%.

Edmonds (NE) (RCII=5.4, MMI=--) (98026; 47.823N, 122.334W)—Percentages of effects noted by 25 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—32%; pictures on walls moved or were knocked askew—64%; furniture or appliances slid, toppled over, or became displaced—24%; hairline cracks in walls—32%; separation of porch, balcony or other addition from building—4%.

Electric City (RCII=--, MMI=5) (99123; 47.926N, 119.037W)—Postal questionnaires reported: interior walls sustained hairline cracks.

Eltopia (RCII=--, MMI=5) (99330; 46.475N, 119.101W)—Postal questionnaires reported: a few small objects overturned and fell; hanging pictures swung out of place; felt by many.

Entiat (RCII=4.9, MMI=7) (98822; 47.706N, 120.276W)—Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—33%; hairline cracks in walls—33%.

Ethel (RCII=--, MMI=5) (98542; 46.536N, 122.776W)—Postal questionnaires reported: a few small objects over-

turned and fell; small appliances were displaced; a few items were shaken off store shelves.

Everett (Beverly Park) (RCII=4.9, MMI=--) (98203; 47.942N, 122.222W)—Percentages of effects noted by 49 internet respondents: difficulty standing or walking during the earthquake—22%; objects toppled over or fell off shelves—22%; pictures on walls moved or were knocked askew—39%; furniture or appliances slid, toppled over, or became displaced—4%; hairline cracks in walls—16%; a few large cracks in walls—16%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—8%.

Everett (downtown) (RCII=5.3, MMI=6) (98201; 47.988N, 122.201W)—Postal questionnaires reported: a few mobile homes fell off their foundations; exterior walls sustained large cracks; interior walls sustained a few large cracks and split at seams; a few old chimneys twisted, leaned, lost bricks or fell; some windows were broken out; in some buildings almost all small objects overturned and fell and almost all knickknacks broke; almost all items were shaken off store shelves; large furniture and heavy appliances were displaced; retaining walls partially fell; a few tombstones twisted or fell.

Percentages of effects noted by 46 internet respondents: difficulty standing or walking during the earthquake—35%; objects toppled over or fell off shelves—35%; pictures on walls moved or were knocked askew—46%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—17%; a few large cracks in walls—7%; ceiling tiles or lighting fixtures fell—2%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—2%.

Everett (S) (RCII=4.8, MMI=5) (98204; 47.902N, 122.247W)—Percentages of effects noted by 32 internet respondents: difficulty standing or walking during the earthquake—28%; objects toppled over or fell off shelves—16%; pictures on walls moved or were knocked askew—41%; furniture or appliances slid, toppled over, or became displaced—6%; hairline cracks in walls—16%; ceiling tiles or lighting fixtures fell—12%.

Everett (SE) (RCII=5.3, MMI=--) (98208; 47.895N, 122.199W)—Percentages of effects noted by 23 internet respondents: difficulty standing or walking during the earthquake—48%; objects toppled over or fell off shelves—26%; pictures on walls moved or were knocked askew—52%; furniture or appliances slid, toppled over, or became displaced—4%; hairline cracks in walls—22%; a few large cracks in walls—4%; separation of porch, balcony or other addition from building—4%.

Freeland (RCII=4.6, MMI=5) (98249; 48.034N, 122.564W)—Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—12%; objects toppled over or fell off shelves—38%; pictures on walls moved or were knocked askew—25%.

Grandview (RCII=4.5, MMI=3) (98930; 46.254N, 119.916W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; pictures on walls moved or were knocked askew—50%.

Granite Falls (RCII=5.0, MMI=5) (98252; 48.079N, 121.943W)—Percentages of effects noted by nine internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—44%; hairline cracks in walls—22%.

Harrah (RCII=--, MMI=5) (98933; 46.410N, 20.574W)—Postal questionnaires reported: a few small objects overturned and fell and knickknacks broke; a few items were shaken off store shelves.

Hoodsport (RCII=5.0, MMI=5) (98548; 47.424N, 123.174W)—Percentages of effects noted by four internet respondents: difficulty standing or walking during the earthquake—25%; pictures on walls moved or were knocked askew—25%.

Hoquiam (RCII=5.2, MMI=7) (98550; 46.982N, 123.884W)—Percentages of effects noted by eight internet respondents: difficulty standing or walking during the earthquake—75%; objects toppled over or fell off shelves—25%; pictures on walls moved or were knocked askew—62%; hairline cracks in walls—38%; a few large cracks in walls—25%; cracks in chimney—12%.

Humptulips (RCII=5.3, MMI=5) (98552; 47.136N, 123.972W)—Percentages of effects noted by two internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—100%.

Kalama (RCII=4.6, MMI=5) (98625; 46.011N, 122.817W)—Percentages of effects noted by three internet respondents: pictures on walls moved or were knocked askew—33%; a few large cracks in walls—67%; one or several windows cracked—33%.

Kelso (RCII=5.4, MMI=6) (98626; 46.148N, 122.887W)—Postal questionnaires reported: drywall split at seams; in some buildings almost all small objects overturned and

fell; heavy appliances were displaced by inches; many items were shaken off store shelves.

Percentages of effects noted by 24 internet respondents: difficulty standing or walking during the earthquake—42%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—33%.

Kenmore (RCII=5.4, MMI=6) (98028; 47.758N, 122.243W)—Percentages of effects noted by 45 internet respondents: difficulty standing or walking during the earthquake—38%; objects toppled over or fell off shelves—53%; pictures on walls moved or were knocked askew—62%; furniture or appliances slid, toppled over, or became displaced—11%; hairline cracks in walls—7%; a few large cracks in walls—2%; many large cracks in walls—2%; one or several windows cracked—4%; masonry fell from block or brick walls—2%.

Kettle Falls (RCII=4.7, MMI=--) (99141; 48.636N, 118.055W)—Effects noted by one internet respondent: objects toppled over or fell off shelves.

Keyport (RCII=4.6, MMI=--) (98345; 47.702N, 122.620W)—Percentages of effects noted by 16 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—12%; pictures on walls moved or were knocked askew—19%; hairline cracks in walls—6%.

La Center (RCII=4.8, MMI=--) (98629; 45.881N, 122.624W)—Effects noted by one internet respondent: difficulty standing or walking during the earthquake; pictures on walls moved or were knocked askew.

Lake Stevens (RCII=5.0, MMI=6) (98258; 48.017N, 122.067W)—Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—25%; objects toppled over or fell off shelves—35%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—10%; hairline cracks in walls—5%; a few large cracks in walls—5%; ceiling tiles or lighting fixtures fell—5%; cracks in chimney—5%; masonry fell from block or brick walls—5%.

Langley (RCII=5.4, MMI=5) (98260; 48.019N, 122.453W)—Percentages of effects noted by 10 internet respondents: difficulty standing or walking during the earthquake—40%; objects toppled over or fell off shelves—70%; pictures on walls moved or were knocked askew—50%; hairline cracks in walls—20%; many windows cracked or broken out—10%.

Long Beach (RCII=4.9, MMI=5) (98631; 46.377N, 124.047W)—Percentages of effects noted by seven internet respondents: difficulty standing or walking during the earthquake—29%; objects toppled over or fell off shelves—29%; pictures on walls moved or were knocked askew—43%; hairline cracks in walls—29%.

Longview (RCII=5.4, MMI=6) (98632; 46.151N, 122.963W)—Ceiling tiles fell at the Fred Meyer store (Daily News, March 1, 2001). The USGS field team visited a WalMart where enough items fell to fill a dozen shopping carts.

Percentages of effects noted by 68 internet respondents: difficulty standing or walking during the earthquake—40%; objects toppled over or fell off shelves—47%; pictures on walls moved or were knocked askew—54%; furniture or appliances slid, toppled over, or became displaced—10%; hairline cracks in walls—22%; one or several windows cracked—1%; ceiling tiles or lighting fixtures fell—3%; masonry fell from block or brick walls—1%.

Lopez (RCII=4.7, MMI=--) (98261; 48.521N, 122.967W)—Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—40%; pictures on walls moved or were knocked askew—40%; hairline cracks in walls—20%.

Lynnwood (RCII=5.2, MMI=5) (98036; 47.812N, 122.288W)—Percentages of effects noted by 29 internet respondents: difficulty standing or walking during the earthquake—28%; objects toppled over or fell off shelves—38%; pictures on walls moved or were knocked askew—41%; furniture or appliances slid, toppled over, or became displaced—14%; hairline cracks in walls—17%; a few large cracks in walls—7%; one or several windows cracked—3%; masonry fell from block or brick walls—3%.

Lynnwood (N) (RCII=4.8, MMI=6) (98037; 47.851N, 122.282W)—Percentages of effects noted by 46 internet respondents: difficulty standing or walking during the earthquake—24%; objects toppled over or fell off shelves—41%; pictures on walls moved or were knocked askew—30%; furniture or appliances slid, toppled over, or became displaced—4%; hairline cracks in walls—7%.

Marysville (NW) (RCII=5.0, MMI=--) (98271; 48.097N, 122.198W)—Percentages of effects noted by 18 internet respondents: difficulty standing or walking during the earthquake—50%; objects toppled over or fell off shelves—22%; pictures on walls moved or were knocked

askew—39%; furniture or appliances slid, toppled over, or became displaced—6%; hairline cracks in walls—17%.

***Matlock (RCII=--, MMI=5) (98560; 47.178N, 123.338W)*—**Postal questionnaires reported: interior walls sustained hairline cracks; a few small objects overturned and fell and knickknacks broke; a few items were shaken off store shelves.

***McChord AFB (RCII=--, MMI=5) (98438; 47.134N, 122.496W)—**Postal questionnaires reported: a few windows cracked; several small objects overturned and fell and a few knickknacks broke; a few items were shaken off store shelves.

***Methow (RCII=--, MMI=5) (98834; 48.090N, 120.006W)*—**Postal questionnaires reported: a few small objects overturned and fell and knickknacks broke; a few items were shaken off store shelves.

***Mount Vernon (RCII=4.7, MMI=5) (98273; 48.416N, 122.327W)—**Percentages of effects noted by 33 internet respondents: difficulty standing or walking during the earthquake—27%; objects toppled over or fell off shelves—21%; pictures on walls moved or were knocked askew—33%; hairline cracks in walls—18%; a few large cracks in walls—3%; masonry fell from block or brick walls—3%.

***Mount Vernon (S) (RCII=4.6, MMI=--) (98274; 48.379N, 122.286W)—**Percentages of effects noted by 14 internet respondents: difficulty standing or walking during the earthquake—21%; objects toppled over or fell off shelves—14%; pictures on walls moved or were knocked askew—43%; hairline cracks in walls—29%; one or several windows cracked—7%.

***Mukilteo (RCII=4.8, MMI=--) (98275; 47.920N, 122.302W)—**Percentages of effects noted by 20 internet respondents: difficulty standing or walking during the earthquake—15%; objects toppled over or fell off shelves—35%; pictures on walls moved or were knocked askew—45%; furniture or appliances slid, toppled over, or became displaced—5%; hairline cracks in walls—10%.

***Naselle (RCII=5.1, MMI=--) (98638; 46.353N, 123.804W)—**Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—80%; objects toppled over or fell off shelves—40%; pictures on walls moved or were knocked askew—80%.

***Oak Harbor (RCII=4.8, MMI=5) (98277; 48.315N, 122.637W)—**Percentages of effects noted by 63 internet respondents: difficulty standing or walking during the earthquake—29%; objects toppled over or fell off shelves—29%; pictures on walls moved or were knocked askew—48%; furniture or appliances slid, toppled over, or became displaced—6%; hairline cracks in walls—11%; a few large cracks in walls—2%; one or several windows cracked—2%; ceiling tiles or lighting fixtures fell—2%; separation of porch, balcony or other addition from building—2%.

***Olalla (RCII=5.4, MMI=--) (98359; 47.424N, 122.575W)—**Percentages of effects noted by three internet respondents: objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—100%.

***Olga (RCII=--, MMI=5) (98279; 48.656N, 122.836W)—**Postal questionnaires reported: interior walls sustained hairline cracks; people had difficulty maintaining balance; vibration was described as strong; earth noise was described as strong.

***Orondo (RCII=4.8, MMI=4) (98843; 47.697N, 120.172W)—**Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—33%.

***Pacific Beach (RCII=--, MMI=5) (98571; 47.198N, 124.159W)—**Postal questionnaires reported: a few small objects overturned and fell; a few items were shaken off store shelves.

***Parkland (Pac. Luth. U.) (RCII=5.2, MMI=--) (98447; 47.145N, 122.441W)—**Percentages of effects noted by 12 internet respondents: difficulty standing or walking during the earthquake—17%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—33%; furniture or appliances slid, toppled over, or became displaced—25%; hairline cracks in walls—33%; many windows cracked or broken out—8%; ceiling tiles or lighting fixtures fell—8%.

***Point Roberts (RCII=4.7, MMI=4) (98281; 48.988N, 123.055W)—**Percentages of effects noted by six internet respondents: pictures on walls moved or were knocked askew—83%; hairline cracks in walls—17%; cracks in chimney—17%.

***Port Angeles (RCII=4.8, MMI=5) (98362; 48.106N, 123.438W)—**Percentages of effects noted by 50 internet respondents: difficulty standing or walking during the earthquake—26%; objects toppled over or fell off shelves—10%; pictures on walls moved or were knocked askew—38%; furniture or appliances slid, toppled over, or

became displaced—16%; hairline cracks in walls—14%; a few large cracks in walls—6%; many large cracks in walls—2%; one or several windows cracked—2%; many windows cracked or broken out—2%; ceiling tiles or lighting fixtures fell—4%; major damage to old chimney—2%; major damage to modern chimney—2%; masonry fell from block or brick walls—2%; outside walls tilted over or collapsed—2%; separation of porch, balcony or other addition from building—2%.

Port Hadlock (RCII=5.2, MMI=5) (98339; 48.035N, 122.768W)—Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—40%; objects toppled over or fell off shelves—60%; pictures on walls moved or were knocked askew—40%.

Port Ludlow (RCII=4.9, MMI=5) (98365; 47.922N, 122.690W)—Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—17%; objects toppled over or fell off shelves—50%; pictures on walls moved or were knocked askew—67%; furniture or appliances slid, toppled over, or became displaced—17%.

Randle (RCII=5.3, MMI=6) (98377; 46.549N, 121.856W)—The Silver Creek Bridge sustained cracks in columns and was given a 5-ton weight limitation (The Chronicle, Centralia/Chehalis, Washington, March 6, 2001, p. A9).

Percentages of effects noted by six internet respondents: difficulty standing or walking during the earthquake—33%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—50%; furniture or appliances slid, toppled over, or became displaced—17%; hairline cracks in walls—33%; a few large cracks in walls—17%.

Raymond (RCII=5.4, MMI=6) (98577; 46.671N, 123.693W)—Postal questionnaires reported: one entire block of buildings was condemned; exterior walls sustained large cracks and partially collapsed; clay tile sustained large cracks; interior walls sustained a few large cracks and split at seams; a few old chimneys twisted or leaned; a few windows cracked; many small objects overturned and fell.

Percentages of effects noted by three internet respondents: difficulty standing or walking during the earthquake—67%; objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—100%.

Redmond (E) (RCII=5.3, MMI=--) (98053; 47.646N, 122.039W)—Percentages of effects noted by 49 internet respondents: difficulty standing or walking during the earthquake—18%; objects toppled over or fell off shelves—59%; pictures on walls moved or were knocked askew—53%; furniture or appliances slid, toppled over, or became displaced—12%; hairline cracks in walls—18%; ceiling tiles or lighting fixtures fell—2%.

Riverside (RCII=--, MMI=5) (98849; 48.488N, 119.580W)—Postal questionnaires reported: a few items were shaken off store shelves.

Ryderwood (RCII=4.6, MMI=6) (98581; 46.375N, 123.043W)—Postal questionnaires reported: interior walls sustained hairline cracks; a few old chimneys cracked; many small objects overturned and fell; many knickknacks broke; large furniture and heavy appliances were displaced.

Percentages of effects noted by two internet respondents: pictures on walls moved or were knocked askew—100%.

Salkum (RCII=--, MMI=5) (98582; 46.515N, 122.645W)—Postal questionnaires reported: a few small objects overturned and fell; a few knickknacks broke; a few items were shaken off store shelves.

Seattle (University of Washington) (RCII=5.4, MMI=6) (98195; 47.654N, 122.296W)—Percentages of effects noted by 126 internet respondents: difficulty standing or walking during the earthquake—27%; objects toppled over or fell off shelves—40%; pictures on walls moved or were knocked askew—25%; furniture or appliances slid, toppled over, or became displaced—18%; hairline cracks in walls—18%; a few large cracks in walls—13%; many large cracks in walls—2%; one or several windows cracked—4%; ceiling tiles or lighting fixtures fell—10%; masonry fell from block or brick walls—2%; separation of porch, balcony or other addition from building—1%.

Sedro Woolley (RCII=4.5, MMI=5) (98284; 48.527N, 122.233W)—Percentages of effects noted by 16 internet respondents: difficulty standing or walking during the earthquake—12%; objects toppled over or fell off shelves—25%; pictures on walls moved or were knocked askew—38%; hairline cracks in walls—25%.

Sekiu (RCII=5.4, MMI=5) (98381; 48.303N, 124.468W)—Percentages of effects noted by four internet respondents: objects toppled over or fell off shelves—25%; pictures on walls moved or were knocked askew—25%; hairline cracks in walls—75%.

Silver Creek (RCII=--, MMI=5) (98585; 46.549N, 122.476W)—Postal questionnaires reported: several small objects overturned and fell; a few knickknacks broke; small appliances were displaced; a few items were shaken off store shelves; hanging pictures fell.

Skamokawa (RCII=--, MMI=5) (98647; 46.295N, 123.433W)—Postal questionnaires reported: a few small objects fell; a few knickknacks broke.

Snohomish (RCII=5.4, MMI=6) (98290; 47.895N, 122.072W)—Percentages of effects noted by 23 internet respondents: difficulty standing or walking during the earthquake—35%; objects toppled over or fell off shelves—43%; pictures on walls moved or were knocked askew—57%; hairline cracks in walls—26%; cracks in chimney—4%; separation of porch, balcony or other addition from building—4%.

Snohomish (S) (RCII=4.9, MMI=--) (98296; 47.831N, 122.118W)—Percentages of effects noted by 13 internet respondents: difficulty standing or walking during the earthquake—31%; objects toppled over or fell off shelves—46%; pictures on walls moved or were knocked askew—38%; hairline cracks in walls—23%.

South Bend (RCII=--, MMI=5) (98586; 46.654N, 23.820W)—Postal questionnaires reported: a few small objects overturned and fell; a few knickknacks broke; a few items were shaken off store shelves.

Stanwood (RCII=4.5, MMI=5) (98292; 48.201N, 122.378W)—Percentages of effects noted by 35 internet respondents: difficulty standing or walking during the earthquake—9%; objects toppled over or fell off shelves—11%; pictures on walls moved or were knocked askew—51%; furniture or appliances slid, toppled over, or became displaced—9%; hairline cracks in walls—23%; a few large cracks in walls—3%; outside walls tilted over or collapsed—3%; separation of porch, balcony or other addition from building—3%.

Stehekin (RCII=--, MMI=5) (98852; 48.298N, 120.755W)—Postal questionnaires reported: a few small objects overturned and fell; a few broke; a few items were shaken off store shelves.

Tacoma (RCII=--, MMI=5) (98413; 47.208N, 122.481W)—Postal questionnaires reported: people had difficulty maintaining balance.

Tacoma (Camp Murray) (RCII=4.7, MMI=--) (98430; 47.114N, 122.571W)—Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—60%; objects toppled over or fell off shelves—20%; pictures on walls moved or were knocked askew—40%.

Tacoma (Univ. Puget Sound) (RCII=5.4, MMI=--) (98416; 47.263N, 122.482W)—Percentages of effects noted by 15 internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—33%; pictures on walls moved or were knocked askew—40%; furniture or appliances slid, toppled over, or became displaced—7%; hairline cracks in walls—27%; a few large cracks in walls—33%; one or several windows cracked—7%.

Toledo (RCII=5.1, MMI=6) (98591; 46.440N, 122.827W)—Percentages of effects noted by five internet respondents: difficulty standing or walking during the earthquake—20%; objects toppled over or fell off shelves—60%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—20%.

Vader (RCII=5.3, MMI=6) (98593; 46.399N, 122.958W)—The USGS field team observed isolated chimney damage.

Effects noted by one internet respondent: objects toppled over or fell off shelves.

Vancouver (Salmon Crest) (RCII=4.5, MMI=--) (98686; 45.712N, 122.632W)—Percentages of effects noted by 13 internet respondents: difficulty standing or walking during the earthquake—23%; objects toppled over or fell off shelves—8%; pictures on walls moved or were knocked askew—46%; furniture or appliances slid, toppled over, or became displaced—8%; hairline cracks in walls—15%; a few large cracks in walls—15%.

Wauna (RCII=--, MMI=5) (98395; 47.365N, 122.698W)—Postal questionnaires reported: a few windows cracked; a few small objects overturned and fell; several items were shaken off store shelves.

Westport (RCII=4.9, MMI=5) (98595; 46.884N, 124.106W)—Percentages of effects noted by three internet respondents: objects toppled over or fell off shelves—67%; pictures on walls moved or were knocked askew—33%; hairline cracks in walls—67%.

Whidbey Island Naval Air Station (RCII=4.5, MMI=--) (98278; 48.295N, 122.690W)—Percentages of effects noted by 16 internet respondents: difficulty standing or walking during the earthquake—6%; objects toppled over or fell off shelves—31%; pictures on walls moved or were knocked askew—38%; hairline cracks in walls—19%.

Woodinville (RCII=5.4, MMI=5) (98072; 47.768N, 122.127W)—Percentages of effects noted by 53 internet respondents: difficulty standing or walking during the earthquake—34%; objects toppled over or fell off shelves—43%; pictures on walls moved or were knocked askew—60%; furniture or appliances slid, toppled over, or became displaced—11%; hairline cracks in walls—21%; a few large cracks in walls—6%; ceiling tiles or lighting fixtures fell—4%; masonry fell from block or brick walls—2%.

Woodland (RCII=4.7, MMI=5) (98674; 45.922N, 122.713W)—Percentages of effects noted by nine internet respondents: difficulty standing or walking during the earthquake—11%; objects toppled over or fell off shelves—22%; pictures on walls moved or were knocked askew—33%; hairline cracks in walls—44%.

Yacolt (RCII=--, MMI=5) (98675; 45.862N, 122.428W)—Postal questionnaires reported: a few small objects overturned and fell; a few items were shaken off store shelves.

RCII 3.5-4.4 (or MMI 4 for communities with no RCII) in British Columbia

Burnaby, Cherryville, Chilliwack, Delta, Duncan, Gibsons, Kelowna, Keremeos, Ladner, Ladysmith, Lillooet, Merritt, Mission, New Westminster, North Vancouver, Parksville, Penticton, Port Alberni, Port Coquitlam, Port Moody, Port Renfrew, Princeton, Qualicum Beach, Richmond, Saanichton, Sardis, Squamish, Summerland, Surrey, Vancouver, Victoria, View Royal, West Vancouver

RCII 3.5-4.4 (or MMI 4 for communities with no RCII) in Idaho

Hayden Lake (83835), Sandpoint (83864)

RCII 3.5-4.4 (or MMI 4 for communities with no RCII) in Montana

Troy (59935)

RCII 3.5-4.4 (or MMI 4 for communities with no RCII) in Oregon

Aloha (N) (97006), Aloha (S) (97007), Amity (97101), Beaverton (97005), Beaverton (S) (97008), Bend (S) (97702), Blachly (97412), Boring (97009), Cornelius (97113), Depoe Bay (97341), Eagle Creek (97022), East Portland (97214), Forest Grove (97116), Government Camp (97028), Grand Ronde (97347), Hebo (97122), Hillsboro (N) (97124), Hillsboro (S) (97123), Hood River (97031), Hubbard (97032), Kenton (97217), Lake Oswego (W) (97035), Lakeside (97449), Lents (97266), Lincoln City (97367), Mcminnville (97128), Midway (97216), Milwaukie (97222), Monroe (97456), Multnomah (97219), North Powder (97867), Odell (97044), Oregon City (97045), Otis (97368), Parkrose (97220), Portland (Bridlemile) (97221), Portland (Cedar Mill) (97229), Portland (Downtown) (97204), Portland (Holladay Park) (97232), Portland (Hollywood) (97213), Portland (Homestead) (97201), Portland (Int. Airport) (97218), Portland (Irvington) (97212), Portland (Mt. Tabor Park) (97215), Portland (N. Downtown) (97209), Portland (NW Downtown) (97210), Portland (NW Hillside) (97205), Portland (Overlook Park) (97227), Portland (Powell Butte Park) (97236), Portland (Reed Coll.) (97202), Portland (Rockwood) (97233), Portland (St. Johns) (97203), Portland (Woodstock) (97206), Rickreall (97371), Rockwood Corners (97230), Saint Paul (97137), Sandy (97055), Scotts Mills (97375), Sheridan (97378), Sherwood (97140), The Dalles (97058), Tigard (97223), Tigard (97224), Tillamook (97141), Tolovana Park (97145), Troutdale (97060), Tualatin (97062), Vernonia (97064), Warren (97053), West Slope (97225), Wilsonville (97070)

RCII 3.5-4.4 (or MMI 4 for communities with no RCII) in Washington

Ariel (98603), Bellingham (downtown) (98225), Bellingham (NE) (98226), Bingen (98605), Camas (98607), Carlton (98814), Chewelah (99109), Colville (99114), Connell (99326), Cusick (99119), Deming (98244), East Wenatchee (98802), Eastsound (98245), Ellensburg (98926), Everson (98247), Felida (98685), Ferndale (98248), Ford (99013), Forks (98331), Friday Harbor (98250), Grandview (98930), Grayland (98547), Hazel Dell (98665), Ilwaco (98624), Inchelium (99138), Keller (99140), Lyman (98263), Lynden (98264), Malaga (98828), Manson (98831), Mead (99021), Moxee City (98936), Naches (98937), Omak (98841), Orchards (98662), Pateros (98846), Port Angeles (W) (98363), Prosser (99350), Quincy (98848), Republic (99166), Ridgefield (98642), Royal City (99357), Selah (98942), Stevenson (98648), Sunnyside (98944), Terrace Heights (98901), Thorp (98946), Tonasket (98855), Trout Lake (98650), Twisp (98856), Vancouver (Carter Park) (98660), Vancouver (Cascade Park) (98684), Vancouver (Evergreen Park) (98661), Vancouver (Leverich Park) (98663),

Vancouver (McLaughlin) (98664), Vancouver (Proebstel) (98682), Washougal (98671), Wenatchee (98801), Wide Hollow (98908), Yakima (98902), Yakima (SW) (98903)

RCII 2.5-3.4 (or MMI 3 for communities with no RCII)in British Columbia

CFB Esquimalt Victor, Comox, Courtenay, Gabriola Island, Grand Forks, Hope, Kamloops, Nanaimo, Nanoose Bay, Shawnigan Lake, Sooke, South Surrey, Trail, Union Bay

RCII 2.5-3.4 (or MMI 3 for communities with no RCII) in Idaho

Bonners Ferry (83805), Coeur D' Alene (83814), Coeur D'Alene (N) (83815), Fernwood (83830), Moscow (83843), Naples (83847), Pinehurst (83850), Post Falls (83854), Priest River (83856), Saint Maries (83861), White Bird (83554)

RCII 2.5-3.4 (or MMI 3 for communities with no RCII) in Montana

Kalispell (59901), Trout Creek (59874)

RCII 2.5-3.4 (or MMI 3 for communities with no RCII) in Oregon

Albany (97321), Arlington (97812), Aurora (97002), Banks (97106), Boardman (97818), Brightwood (97011), Brooks (97305), Canby (97013), Cascade Locks (97014), Cheshire (97419), Clackamas (97015), Coos Bay (97420), Corvallis (97331), Corvallis (N) (97330), Corvallis (S) (97333), Dallas (97338), Dayton (97114), Deadwood (97430), Deer Island (97054), Eddyville (97343), Elmira (97437), Eugene (97401), Eugene (N) (97404), Fairview (97024), Fossil (97830), Foster (97345), Gresham (N) (97030), Gresham (S) (97080), Hermiston (97838), Independence (97351), Lafayette (97127), Lake Oswego (E) (97034), Lebanon (97355), Logsden (97357), Marcola (97454), Molalla (97038), Mount Hood (97041), Newberg (97132), Newport (97365), Oak Grove (97267), Philomath (97370), Portland (97231), Portland (Concordia) (97211), Prineville (97754), Reedsport (97467), Rhododendron (97049), Salem (NE) (97303), Salem (NW) (97304), Salem (Rosedale) (97306), Salem (S) (97302), Salem (SE) (97301), Scappoose (97056), Siletz (97380), Silverton (97381), Southbeach (97366), Toledo (97391), Waldport (97394), West Linn (97068), Willamina (97396), Woodburn (97071), Yamhill (97148)

RCII 2.5-3.4 (or MMI 3 for communities with no RCII) in Washington

Almira (99103), Amboy (98601), Beverly (99321), Carson (98610), Cedonia (99137), Chattaroy (99003), Cheney (99004), Coulee City (99115), Cowiche (98923), Curlew (99118), Custer (98240), Ephrata (98823), Glenwood (98619), Granger (98932), Ione (99139), Kennewick (S) (99337), Kennewick (W) (99338), Klickitat (98628), Liberty Lake (99019), Loomis (98827), Loon Lake (99148), Mabton (98935), Mansfield (98830), Marlin (98832), Mattawa (99349), Mazama (98833), Moses Lake (98837), Newport (99156), Nine Mile Falls (99026), Okanogan (98840), Oroville (98844), Othello (99344), Prescott (99348), Pullman (99163), Quinault (98575), Rice (99167), Richland (99352), Rosewood (99208), Spokane (99299), Spokane (99223), Spokane (Audubon Park) (99205), Spokane (E. Downtown) (99202), Spokane (Fox Hills) (99207), Spokane (Highland) (99204), Spokane (Holmberg Park) (99218), Spokane(NE) (99217), Spokane (Spokane Falls) (99201), Spokane (Trentwood) (99216), Springdale (99173), Toutle (98649), Underwood (98651), Vancouver (Fisher) (98683), Veradale (99037), Wapato (98951), Washington State University (99164), Washtucna (99371), Wauconda (98859), West Richland (99353), White Salmon (98672), White Swan (98952), Winthrop (98862)

RCII 2.0-2.4 (or MMI 2 for communities with no RCII) in British Columbia

Powell River, Vernon

RCII 2.0-2.4 (or MMI 2 for communities with no RCII) in Idaho

Athol (83801), Boise (83704), Boise (83705), Clark Fork (83811), Genesee (83832), Lewiston (83501), Moyie Springs (83845), Rathdrum (83858), Sagle (83860), Wallace (83873)

RCII 2.0-2.4 (or MMI 2 for communities with no RCII) in Montana

Drummond (59832), Heron (59844), Lincoln (59639), Plains (59859), Polson (59860), Whitefish (59937)

RCII 2.0-2.4 (or MMI 2 for communities with no RCII) in Oregon

Baker (97814), Bandon (97411), Beaver Creek (97004), Blue River (97413), Brownsville (97327), Cascadia (97329), Columbia City (97018), Coquille (97423), Corbett (97019), Dayville (97825), Estacada (97023), Eugene (S) (97405), Eugene (SE) (97403), Eugene (W) (97402), Florence (97439), Gates (97346), Gervais (97026), Halfway (97834), Halsey (97348), Huntington (97907), Jefferson (97352), Klamath Falls (97601), Lexington (97839), Milton-Freewater (97862), Monmouth (97361), Mosier (97040), Mount Angel (97362), Mulino (97042), Powell Butte (97753), Prospect (97536), Roseburg (97470), Rufus (97050), Scio (97374), Shaniko (97057), Shedd (97377), Spray (97874), Springfield (E) (97478), Springfield (W) (97477), Stanfield (97875), Stayton (97383), Swisshome (97480), Tangent (97389), Terrebonne (97760), Turner (97392), Veneta (97487), Warm Springs (97761)

RCII 2.0-2.4 (or MMI 2 for communities with no RCII) in Washington

Benton City (99320), Bickleton (99322), Evans (99126), Fairchild Air Force Base (99011), Harrington (99134), Hartline (99135), Kennewick (99336), La Crosse (99143), Lowden (99360), Manito (99203), Mesa (99343), Northport (99157), Palouse (99161), Pasco (99301), Paterson (99345), Rock Island (98850), Saint John (99171), Spokane (99212), Spokane (Chester) (99206), Spokane (Spokane Falls CC) (99224), Sprague (99032), Tekoa (99033), Tieton (98947), Toppenish (98948), Waitsburg (99361), Walla Walla (99362), Warden (98857), Zillah (98953)

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