DAMAGE IN SAN MATEO COUNTY, CALIFORNIA IN THE EARTHQUAKE OF 18 APRIL 1906

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INTRODUCTION

The San Mateo county area was greatly affected by the earthquake of 18 April 1906. But because the earthquake and fire damages in San Francisco were much more spectacular, the 1906 damages in San Mateo county have been relatively neglected in the past. The compilation in this report is focussed on the 1906 earthquake damages in San Mateo county itself.

In the listing here, the damages at each locality have been organized and listed by locality. This listing is part of a general study to improve the seismic intensity maps of the 1906 earthquake. Much of the data comes from the detailed report by Lawson and others (1908). Much additional data has been obtained from a search of local and regional newspapers of April and May 1906.

The geologic setting and fault distance have been determined at each of the localities in the compilation. Thus it is possible to analyze the importance of geology and distance from the fault on earthquake damages. The seismic intensity rating at each locality has been determined using both the Rossi-Forel scale, which was used in 1906, and the later Modified Mercalli scale, as discussed in the section on seismic intensities.

The listing of damages shows what happened in the great 1906 earthquake, and thus shows what could happen in any major future earthquake in the same region. The listing is thus useful for improved disaster planning both by communities and by individuals.

LOCATION AND GEOLOGIC SETTING

The location of San Mateo county in California is shown on the inset map of Figure 1. San Francisco county is on the north, Santa Clara and Santa Cruz counties are on the south, San Francisco Bay is on the east, and the Pacific Ocean is on the west.

The western part of San Mateo county is mostly mountainous. The hills and mountains rise sharply from the ocean in coastal cliffs, and there are only a few flat coastal terraces and stream bottoms along the coast. The mountainous region is mostly underlain by sedimentary rocks of Mesozoic and Tertiary age.

The eastern part of San Mateo county, which has most of the population, is a gently-sloping alluvial surface alongside San Francisco Bay. In many places near the bay the alluvium is several hundred feet thick (Goldman, 1969). The thickness of the alluvium decreases to zero at the edge of the hills. The towns are mostly along El Camino Real, which was the path of the main highway and the railroad in 1906. The boundary between the hills on the west and the alluvial surface on the east is shown by a dotted line in figure 1.

The San Andreas fault, on which the 1906 earthquake rupture occurred, goes through the mountains on a northwest-southeast path approximately in the middle of the county.

Local geology types. In the compilation, the local geology is determined according to the following categories, based on the age and type of rock:

A. Alluvium;

B. Older sediments of Quaternary age;

C. Sedimentary rocks of Middle and Late Tertiary age (Oligocene, Miocene and Pliocene);

D. Sedimentary rocks of Cretaceous and Early Tertiary age (Cretaceous, Paleocene and Eocene);

E. Detrital sedimentary rocks of pre-Cretaceous age;

F. Carbonate sedimentary rocks of pre-Cretaceous age;

G. Igneous and metamorphic rocks.

The alluvium has been further subdivided into several sub-types, according to the local geometric situation of the alluvium. For instance, the seismic properties of the thin alluvium that occurs on a coastal terrace or on a river terrace may be very different from the properties of the thick alluvium in a large valley. Where the alluvium is thin, the type of underlying bedrock may also be important, and is therefore noted in the geologic determinations.

Therefore, the local geometry of the alluvium and the type of underying bedrock is indicated in the sub-types of alluvium such as At/D (alluvial terrace with thin deposits above Type D bedrock) or An/C (narrow alluvial valley in Type C bedrock). Categories of alluvium are:

Av. In a large alluvial valley, with thick sedimentary deposits, as in the Sacramento Valley of California;

Am. Bay mud alluvium along the edge of San Francisco Bay;

An. In a narrow alluvial valley that is less than 3 km wide;

Ae. Near the edge of an alluvial valley, within 0.5 km of surface bedrock;

At. In thin terrace deposits over bedrock;

Ac. Colluvium and slope wash deposits that have been distinguished on a geologic map.

The local geology of the alluvium and bedrock have been determined from the geologic map of Brabb and Pampeyan (1972).

Distance from the fault rupture. The distances given for each locality are the perpendicular distances to the locality from the 1906 earthquake rupture on the San Andreas fault, as shown on the maps of Lawson and others (1908).

DAMAGE LISTING

The damage is compiled by locality, and is listed alphabatically by locality in the county list (Table 3). For convenience, a two-letter code has been assigned to each locality for showing the locations on the locality map (figure 1). The first letter of the locality name is also the first letter of the code.

Within the locality listing, the types of damage are listed in sequence from buildings to ground failures. As much as possible, the damages are indicated by direct quotations of the source, so that the damage listing is free of major interpretations by the compiler. The quotations have been simplified by leaving out some words, as indicated by the dots. In general, all available information on the significant damages has been included. However, in some places, for intance in the city of San Mateo, the newspapers give a more complete listing of the damages, and only the major damages are included in the compilation here. The place where the newspaper microfilms are available is noted in the References.

SEISMIC INTENSITY SCALES

For mapping and comparison, the earthquake damage has been rated for apparent seismic intensity. As used here, the seismic intensity is a system that assigns a progressively increasing numerical rating to the increasing severity of the damage that is caused directly by the earthquake shaking, such that a higher intensity rating indicates a greater severity of seismic shaking. Severe damages due to ground failure effects are rated separately in this compilation, as noted below.

Rossi-Forel Intensity Scale

The Rossi-Forel (RF) intensity scale, listed in table 1 from Lawson and others (1908, p. 161), was used in the maps of the report by Lawson and others (1908), and is included in this compilation for consistency with the Lawson report. The 1906 RF scale is basically simple in content. At the level of significant damage (as in San Mateo county) the RF scale is based primarily on the damage to buildings and to chimneys. As shown in the listing of Table 1, intensity RF VII is indicated by the fall of some (but not many) chimneys; intensity RF VIII is indicated by the fall of many chimneys; and intensity RF IX is indicated by the partial or complete collapse of some buildings (usually large brick buildings).

The shifting of house foundations is another type of damage that can be used when reported, although it is not specifically listed in the RF scale. Correlation of foundation damages with other damages at several places in 1906 indicates that the shifting of a few foundations correlates with intensity RF VIII, and shifting of many foundations (25% or more, if small shifts are included as well as large shifts) approximately correlates with intensity RF IX.

The intensity ratings of this compilation do not use the occurrence of landslides or ground failures, as the proper intensity rating of landslides is not certain. In the written version of the 1906 RF scale (Table 1), the occurrence of landslides and cracked ground is listed at intensity RF X. However, this high rating for landslides and ground cracking is inconsistent with the building damages in areas of landslides. For instance, landslides occurred at many places in the hills of western San Mateo county at the time of the 1906 earthquake, but the building damages indicate only seismic intensity RF VIII in most of the area.

The intensity maps by Lawson and others (1908) did not give intensity RF X ratings to the places in the mountains where the landslides occurred, and thus the occurrence of landslides was not used in the intensity rating on the Lawson maps. The same policy is followed here, and landslides and cracked ground are not used for definite intensity ratings. The other types of ground failure are similarly not used for seismic intensity in this report.

Another major problem in the usage of the RF scale is that the only criteria for intensity IX in the RF scale is the partial or complete collapse of some buildings. This applies mainly to brick or masonry buildings, because simple wood buildings are resistant to earthquake damage. Thus the RF scale cannot give intensity RF IX ratings in areas where large brick buildings are uncommon or absent, as in hill localities. Therefore there can be few or no intensity RF IX ratings in the hills, although the shaking may actually be intensity RF IX.

Modified Mercalli Intensity Scale

Beginning in 1931, most seismic intensity studies in the United States have used the Modified Mercalli (MM) intensity scale of Wood and Neumann (1931). The MM scale is basically similar to the Rossi-Forel scale in most criteria, but makes some additions and changes. An important improvement was giving a rating to the movement and fall of loose objects, as mostly intensity MM VI. This criterion was not clearly defined in the Rossi-Forel scale. The MM scale also notes specifically that buildings of weaker strengths will be damaged more than stronger buildings for the same severity of seismic shaking. This shows that the MM scale was intended as a scale of the seismic shaking. A difficulty is that the MM scale attempts to categorize building strengths according to the type of materials used in the construction, although the building design and the techniques of construction may be much more important for damage than the type of material used.

The investigation of the 1906 earthquake damages has shown that there are significant problems in the use of the MM scale. A major problem is the inclusion of ground failures and the effects of ground failure at a rating level that is inconsistent with the building damages due to shaking, as discussed below. This is similar to the problem of landslides on the RF scale. An additional problem is that the inherent strength of a building depends more on the design and construction of a building than on the type of materials that were used, and thus the rating of intensities based only on the materials of construction can cause significant errors. Also, the MM scale has some of the same

problems as in the use of the RF scale, such as the inability to get intensity IX ratings in the hills because of an absence of suitable buildings.

Ground Failures

In both the RF and MM scales, the occurrence of ground failures such as landslides and ground deformation are given very high ratings. This is probably because of the severe damages that ground failures can cause (landslides can bury buildings, and did bury some buildings in 1906). But recent evaluation has shown that the ratings of ground failures are inconsistent with the building damages that are directly due to shaking (Nason and Espinosa, 1977). Because of this, the seismic intensity ratings of this compilation are made only on the building damages caused by shaking and not on the damages that are due to ground failures such as landslides, liquefaction or compaction. In this way the uncertainties of the rating of ground failures do not cause additional problems in the intensity ratings. Instead, the occurrences of ground failures are noted separately in Table 3 and in figure 3.

Fault Rupture

Another type of ground failure is the rupture along the earthquake fault, which was used as intensity X on the maps of the Lawson report. Actually, the RF scale does not list fault zones in the intensity criteria; but the modified scale used by H.O. Wood in San Francisco does list fault rupture at its highest rating (Wood intensity A). It has been suggested that the high intensity rating

along the fault zone was simply because of the occurrence of ground failure there, but the fact that landslides are ignored on the other parts of the Lawson maps indicates that the intensity RF X rating of fault zones is not just because of the occurrence of ground rupture. A careful examination of the damage data along the 1906 fault rupture shows that the damages at the fault were not significantly different from other places (Nason, 1978). Within San Mateo county, the places on the fault were Portola Valley (PT) and San Andreas lake (SA); the damages at these places were not unusual. Therefore, the occurrence of the earthquake fault rupture is not used for intensity rating in this study.

The only remaining criteria for intensity RF X is "great disaster", which would be much worse than RF IX. According to this criteria, there were not any places in San Mateo county that rate as RF X.

SEISMIC INTENSITY ASSIGNMENTS OF THIS STUDY

As noted in the previous section, there are difficulties with some parts of the existing Rossi-Forel and Modified Mercalli intensity scales. Therefore, several operating procedures have been introduced for use with the seismic intensity ratings in this report. These operating procedures are:

1). The occurrences of ground failures such as landslides or liquefaction have not had any intensity value assigned to them and have not been used in the intensity ratings of table 3 or figure 2. Instead, the occurrences of ground failures are shown on a separate map (figure 3).

2). The occurrence of ground rupture along the earthquake fault has not been used for intensity rating. In any case, the earthquake rupture zone is only 10 meters wide in most places (Lawson and others, 1908), which is too narrow to show on the maps.

3). Where the reported damages only indicate a minimum value for the intensity rating, because there is an absence of suitable buildings for indicating possible higher intensities, or an absence of descriptions that would indicate the maximum intensity, the intensity value is underlined to indicate that this is a minimum value.

4). At localities where the intensity rating was either intensity VII or intensity VIII, but was definitely not any intensity greater than VIII, the intensity rating is given as VII/VIII. This is different than VII because the underlined value VII does not exclude intensity IX, while the VII/VIII value does exclude intensity IX.

5). Where there is information that indicates that unusual damage was possibly due to poor quality of construction rather than severe shaking, or if there is a conflict in the intensity rating of different types of damages, or if there are other uncertainties, the intensity rating is given with a question mark (?), and the difficulties are discussed.

6). At localities where all or nearly all chimneys have fallen, which is more than the usual damage for intensity VIII but is not definite for intensity IX in the Rossi-Forel or Modified Mercalli scale, an intensity rating of VIII/IX is used. A rating of MM VIII/IX is also used where there has been the collapse of a building that might be weak in design or construction.

SEISMIC INTENSITY MAPS

One purpose of this compilation is to independently evaluate the apparent intensity ratings shown on the intensity maps of Lawson and others (1908). This is necessary because questions have arisen about some of the fundamental features of the seismic intensity scale used in the 1906 earthquake investigation, as discussed in an earlier section. Therefore a thorough examination of the earthquake damage and intensity data is made in this report to determine how and if the intensity maps of the Lawson report should be updated.

The seismic intensity ratings shown on the map of this study (figure 2) are compiled directly from the listings of table 3. It is noteworthy that the resulting map is different in many important ways from the map pattern shown by Lawson and others (1908), particularly in the hills. The Lawson report does not indicate what the rating at any site was based on. But it is clear that the listed earthquake damage is significantly greater at some places than is indicated on the Lawson maps.

For instance, on the coast south of Half Moon Bay at Pescadero (PE), the Lawson maps show intensity VII-VIII. But the damage (all but three chimneys fell in a sizeable town) indicates a much higher intensity of intensity VIII/IX. At Greenoaks Creek (GC) and Whitehouse Creek (WC) the described damages are that the chimneys fell and some houses shifted on foundations. The maps of the Lawson report show only intensity VI for these localities (at the boundary between V-VI and VI-VII), but these damages clearly indicate intensity VIII or possibly more. The damage data show that most locations in the hills of western San Mateo County were seismic intensity VIII or more.

SEISMIC GROUND FAILURES

Several types of ground failures were triggered by the 1906 earthquake. The known instances of ground failure are listed in Table 3 and shown on Figure 3. The seismic ground failures are also discussed in the report by Youd and Hoose (1978).

The most common type of ground failure was landslides. The largest landslide was at Mussel Rock, on the coast near the northern county line, and landslides occurred at many places in the hills. A special type of landslide that was called an "earth-flow" occurred near Colma and near Half Moon Bay.

In many places deformation of the ground was described without indicating the cause of the deformation. In mountain areas the cause was probably an adjacent landslide in most instances. In alluvial areas there might be several causes, with compaction and settlement or liquefaction of weak alluvial fills being common.

A major cause of ground failure in earthquakes is the process of "liquefaction", which is a loss of strength (and thus "liquefaction") in a sandy material because of earthquake-caused movement of the water in the sand. The processes and mechanisms of liquefaction were not recognized or understood in 1906, so there were not any direct descriptions of the occurrence of liquefaction. However, some of the instances of ground deformation may have been due to liquefaction processes. In a few instances there is a description of a flow of sand and water out of a crack; these are considered to be reliable indicators of the occurrence of liquefaction.

REFERENCES

Aitkin, F.R., and Hilton, Edward, 1906, A history of the earthquake and fire in San Francisco: Edward Hilton Co., San Francisco, 285 p.

Brabb, E.E., and Pampeyan, E.H., 1972, Preliminary geologic map of San Mateo county, California: U.S. Geol. Survey, map MF-328.

Derleth, Charles Jr., 1907, The destructive extent of the California earthquake, in Jordan, D.S., The California earthquake of 1906: San Francisco, A.M. Robertson Co., p. 81-212.

Gilbert, G.K., Humphrey, R.L., Sewell, J.S. and Soule, F., 1907, The San Francisco earthquake and fire of April 18, 1906 and their effects on structures and structural materials: U.S. Geological Survey Bull. 324, 170 p.

Goldman, H.B., 1969, Geology of San Francisco Bay: Calif. Div. Mines Geology, Spec. Rep. 97, p. 9-29.

Lawson, A.C., and others, 1908, The California earthquake of April 18, 1906; report of the California State Earthquake Investigation Commission: Carnegie Inst., Washington, pub. 87, 451 p.

Nason, Robert, 1978, Seismic intensities in the 1906 earthquake fault zone: Seism. Soc. Am. East. Sect., Earthquake Notes, v. 49, n. 1, p. 1.

Nason, Robert, and Espinosa, A.F., 1977, Proposed revision of the Modified Mercalli intensity scale: Geol. Soc. Am. Abs. with Prog., v. 9, n. 4, p. 473.

Redwood City Times-Gazette, 1906a, Wednesday's earthquake - Redwood City, Menlo Park, Pescadero, Halfmoon Bay, Killed by a falling chimney: Redwood City, Calif., 21 April 1906, p. 3. (Available at Redwood City Public Library).

_____, 1906b, Have stood the test: Redwood City, Calif., 12 May 1906, p. 4.

Redwood City Tribune, 1970, Eyewitness describes the 1906 earthquake which spread havoc throughout the peninsula: Redwood City, Calif., 15 April 1970, p. 6W.

Sacramento Bee, 1906, Quake center in San Mateo: Sacramento, Calif., 26 April 1906, p. 9. (Available at the Library of the University of California, Berkeley).

San Francisco Call, 1906a, Great drydocks at Hunters Point are not damaged: San Francisco, Calif., 3 May 1906, p. 7. (Available at the San Francisco Public Library).

_____, 1906b, Spring Valley water supply is reported to have always been insufficient: San Francisco, Calif., 29 May 1906, p. 3.

San Francisco Chronicle, 1906, Damage in San Mateo county: San Francisco, Calif., 3 May 1906, p. 19. (Available at the San Francisco Public Library).

San Francisco Examiner, 1906, Temblor hurls water mains from huge trestle: San Francisco, Calif., 14 May 1906, p. 1,2. (Available at the San Francisco Public Library).

San Jose Herald, 1906, Half million dollars damage at Redwood: San Jose, Calif., 24 April 1906, p. 4. (Available at the San Jose Public Library).

San Jose Mercury, 1906a, Many buildings are in ruins at the surf city: San Jose, Calif., 20 April 1906, p. 8. (Available at the San Jose Public Library).

_____, 1906b, Where scores met death, News from the coast towns: San Jose, Calif., 21 April 1906, p. 1,3.

San Mateo Leader, 1906a, Things done at Menlo Park: San Mateo, Calif., 2 May 1906, p. 2. (Available at the San Mateo Public Library).

_____, 1906b, Some features of the great earthquake: San Mateo, Calif., 23 May 1906, p. 3.

San Mateo Times, 1906, San Francisco destroyed by a terrible fire: San Mateo, Calif., 21 April 1906, p. 1. (Available at the San Mateo Public Library).

The Enterprise, 1906a, Recovering from the shock, Sustain heavy loss: South San Francisco, Calif., 28 April 1906, p. 1. (Available at the South San Francisco Public Library).

_____, 1906b, Wilmarth-Fromer, News from the Halfmoon Bay section: South San Francisco, Calif., 5 May 1906, p. 1, 2.

_____, 1906c, Woodside, Menlo Park: South San Francisco, Calif., 26 May 1906, p. 2.

Youd, T.L., and Hoose, S.N., 1978, Historic ground failures in northern California triggered by earthquakes: U.S. Geol. Survey, Prof. Paper 993, 177 p.

Wood, H.O., and Neumann, Frank, 1931, Modified Mercalli intensity scale of 1931: Seism. Soc. Am. Bull., v. 21, p. 277-283.

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TABLE 1: ROSSI-FOREL INTENSITY SCALE (1906)

INTENSITY VI. Severe shock; general awakening of sleepers, stopping of clocks, some window glass broken.

INTENSITY VII. Violent shock; overturning of loose objects; falling of plaster; some chimneys fall.

INTENSITY VIII. Fall of chimneys; cracks in the walls of buildings.

INTENSITY IX. Partial or total collapse of some buildings.

INTENSITY X. Great disasters; overturning of rocks; fissures in surface of earth; mountain slides.

ADDITIONAL RATING IN THIS REPORT (1979):

INTENSITY VIII/IX. All or nearly all chimneys fall (more than 90%).

TABLE 2: MODIFIED MERCALLI INTENSITY SCALE (1931)

INTENSITY VI. Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys.

INTENSITY VII. Damage neglible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly-built or badly designed structures; some chimneys broken.

INTENSITY VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water.

INTENSITY IX. Damage considerable in specially designed structures; well designed frame structures thrown out of plumb; (damage) great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.

INTENSITY X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed over banks.

ADDITIONAL INTENSITY RATING USED IN THIS REPORT(1979):

INTENSITY VIII/IX. All or nearly all chimneys fall (more than 90%), or some buildings of unknown weakness collapse.

TABLE 3

1906 EARTHQUAKE DAMAGES IN SAN MATEO COUNTY

ANO NUEVO LIGHTHOUSE

Location. AN, on the coast 40 km south of Half Moon Bay.
Distance. 27 km west of the earthquake fault.
Geology. Type C.

Chimneys. "A brick chimney in the house ((near the lighthouse)) was cracked and twisted 0.75 inch out of place." (Lawson and others, 1908, p. 274).

Intensity discussion. The lighthouse locality had only a few buildings, so the damages indicate only a minimum value of intensity.
Intensity. Modified Mercalli VII; Rossi-Forel VII.

BADEN

Location. BD, 2 km west of South San Francisco.
Distance. 3 km east of the earthquake fault.
Geology. Type A.

Ground deformation. "The electric-car line...turns a right-angle at Baden, from northwest to northeast. The rails northwest and those northeast of the turn were both badly bent." (Lawson and others, 1908, p. 248).

"The track of the electric tramway line, just south of Baden, shows evidence of intense disturbance. ...((For)) about 1000 feet along the filled-in roadbed...the double tracks were twisted back and forth in a zig-zag fashion, and up and down to some extent. ...Most of the poles supporting the electric wires were thrown out of line. ...The tracks of the ((nearby, better-ballasted)) Southern Pacific Railway line...were slightly disturbed." (Lawson and others, 1908, p. 247).

"Near Baden the ((main water line)) had been telescoped 42 inches." (Gilbert, 1907, p. 18).

Ground failure. Deformation.

BELLVILLE

Location. BV, on San Gregorio Creek 7 km east of San Gregorio.
Distance. 10 km west of the earthquake fault.
Geology. Type C.

Ground deformation, Landslide. "Near Bellville a small alkali flat was raised about 3 feet. There was a landslide into the road for a distance of 300 feet." (Lawson and others, 1908, p. 266).

Discussion of damage. The uplift of the alkali flat may have been at the toe of a landslide.
Ground failure. Deformation and landslide.

BELMONT

Location. BM, 7 km southeast of San Mateo, population 562.
Distance. 6 km east of the earthquake fault.
Geology. Type Ae/E.

Foundations. Of 67 house foundations examined in a special survey, 2 houses had shifted and 5 foundations had cracked. (Lawson and others, 1908, p. 355-356).

Chimneys. "A majority of chimneys fell" (Lawson and others, 1908, p. 246). Of 81 brick chimneys that were examined in a special survey, 71 chimneys (88 percent) had fallen. (Lawson and others, 1908, p. 355-356).

Intensity discussion. The chimney damage indicates a high VIII rating for intensity, but the lack of much foundation damage indicates a middle VIII intensity rating.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

BELMONT WEST

Location. BW, west of Belmont.
Distance. 0-6 km east of the earthquake fault.
Geology. Types C and E.

Landslides. "Thru the hills west of Belmont no cracks or big landslides were found, but there were small landslides along the road leading from Belmont to Crystal Springs Lake." (Lawson and others, 1908, p. 246).

Ground failure. Landslides.

BURLINGAME

Location. BU, 2 km north of San Mateo.
Distance. 5 km east of the earthquake fault.
Geology. Type A.

Buildings. "Brick walls generally fell." (Lawson and others, 1908, p. 247). "The rear walls of the new public school building, just completed, fell." (San Jose Herald, 1906).

Chimneys. "Many of the houses...were badly wrecked, due to the falling of extra heavy chimneys thru the roofs." (Lawson and others, 1908, p. 247).

Intensity discussion. The report that many brick walls fell indicates an upper intensity VIII.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

CAHILL RIDGE

Location. CH, 6 km southwest of San Mateo.
Distance. 2 km west of the earthquake fault.
Geology. Type E.

Chimneys. "A small house lost one of two chimneys." (Lawson and others, 1908, p. 253).

Articles. "Things inside were shaken around." (Lawson and others, 1908, p. 253).

Shattered soil. "In an area of limestone, a small patch some 30 feet in diameter was torn up as tho it had been plowed and harrowed, and no large pieces of sod were left intact." (Lawson and others, 1908, p. 253).

Intensity discussion. Because there was only one house at this locality, the actual intensity is not well determined. One of two chimneys fell on the house, which suggests intensity VIII at this location.
Ground failure. Shattered soil.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

COLMA

Location. CM, 20 km northwest of San Mateo.
Distance. 3 km east of the earthquake fault.
Geology. Type B.

Buildings. "The stone chapels at several cemeteries were badly shaken and partially wrecked. ((Photogaphs show the buildings at two cemeteries in which the upper part of the building walls had fallen out)). ...The stone railroad station was badly wrecked, fully one-third of it being shaken down." (Lawson and others, 1908, p. 248-249).

Cemeteries. "It is estimated that in Holy Cross Cemetery over 75 per cent of all the monuments were either thrown down or twisted on their bases. ...In a few cases monuments were snapt off. ...The other cemeteries all suffered about the same, but the percentage of fallen monuments was not nearly so high in the others as it was in Holy Cross Cemetery." (Lawson and others, 1908, p. 248-249).

Ground deformation. "This location...was marsh land, beginning at a point about 100 yards north of Holy Cross Cemetery, where the rails ((of United Railroads)) parted, and ending about 1,000 yards north of Holy Cross, where the rails buckled up in the air. We had to cut out about 3 feet at this point, and add 3 feet where it parted at the other end. Of course there was a decided movement of the rails all along, in a lateral direction, which left the tracks out of alignment, but was not enough to prevent operation of cars." (Lawson and others, 1908, p. 243).

"In front of the Holy Cross railway station the tracks of the main line of the Southern Pacific were slightly bent. ...Around the station the ground had settled." (Lawson and others, 1908, p. 249).

Landslide. "North of Holy Cross Station, by a little lake west of the cemetery, there was a large landslide along the roadbed of the Southern Pacific Railway. For about 300 feet the bed caved and in one place the west track was left suspended in the air." (Lawson and others, 1908, p. 249).

Earth-flow. "Perhaps the best illustration of an earth-flow ...occurred in the upper part of Mount Olivet Cemetery. ...This stream of sand and water, admixed with the loam of the slope, flowed rapidly down the course of a shallow arroyo ((shallow canyon)). ...The flow was so rapid that it carried away many small trees; a windmill was wrecked. ...One of the pumping stations of the cemetery was demolished by it, and 2 houses were carried off their feet, and were extricated afterwards with difficulty. ...It was found that ((the flow)) had left a streak of muddy sand on the bottom of the arroyo averaging 100 feet wide and about 3 feet thick." (Lawson and others. 1908, p. 392-394).

Intensity discussion. The partial collapse of a building indicates RF IX, but only requires VIII on the Modified Mercalli scale since the building may have been weakly built.

Ground failure. Deformation, earth-flow, landslide and settlement.

Intensity. Modified Mercalli VIII; Rossi-Forel IX.

COOLEY LANDING

Location. CL, at edge of San Francisco Bay east of Menlo Park.

Distance. 13 km east of the earthquake fault.

Geology. Type Am?.

General. "No damage except broken chimneys was noticeable ...and solidly built houses seemed to be intact. One house on a poor foundation was knocked down; while the barns, tanks, etc., belonging to it were uninjured." (Lawson and others, 1908, p. 259).

Ground deformation. "People reported new holes formed in the slough near Cooley's Landing." (Lawson and others, 1908, p. 259).

Intensity discussion. Apparently there were a number of houses at this locality. It is not clear if 'broken chimneys' means fallen or cracked, but perhaps it only means cracked, as fallen chimneys are clearly described as fallen in other descriptions. One weak house foundation collapsed. The damages indicate RF intensity VII or VIII, and do not indicate more than intensity VIII.

Ground failure. Deformation.

Intensity. Modified Mercalli VII/VIII; Rossi-Forel VII/VIII.

CRYSTAL SPRINGS LAKE

Location. CS, 7 km south of San Mateo.

Distance. 0.6 km west of the earthquake fault.

Geology. Type E.

General. "A house...2000 feet southwest of the dam ((on the Half Moon Bay road)) was thrown from its foundations, while some 200 feet northwest of this house there was a slide in the canyon." (Lawson and others, 1908, p. 253).

Intensity discussion. This is a single house locality, and the damage might indicate either intensity VIII or intensity IX.

Ground failure. Landslide.

Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

DEVIL'S SLIDE NORTH

Location. DN, on coast 14 km north of Half Moon Bay.
Distance. 7 km west of the earthquake fault.
Geology. Type D.

Landslides. "Just north of the point known as Devil's Slide, there was a landslide of the whole face of the west end of Montara Mountain. It started about 800 feet above the sea, and swept down carrying away many hundred feet of ((railroad)) roadbed." (Lawson and others, 1908, p. 252).

Discussion of damage. This location has a continuing problem with landslides.
Ground failure. Landslides.

DEVIL'S SLIDE SOUTH

Location. DS, on coast 14 km north of Half Moon Bay.
Distance. 7 km west of the earthquake fault.
Geology. Type G.

Landslides. "South from Devil's Slide to the first small coast valley, there were landslides along the cliffs. ...Wherever the railway bed was filled or built out with this material, there was more or less sliding and settling." (Lawson and others, 1908, p. 252).

Discussion of damages. This area has steep coastal cliffs.
Ground failure. Landslides.

FAIROAKS

Location. FO, 16 km southeast of San Mateo.
Distance. 8 km east of the earthquake fault.
Geology. Type A.

House. "A newly completed 1-story bungalow had entirely collapsed." (Lawson and others, 1908, p. 259).

Intensity discussion. The collapse of the bungalow suggests intensity IX, but possibly the building was weak; thus the intensity rating is uncertain.
Intensity. Modified Mercalli IX?; Rossi-Forel IX?

GAZOS CREEK

Location. GZ, near the coast 32 km south of Half Moon Bay.
Distance. 21 km west of the earthquake fault.
Geology. Type C.

Landslide. "A small landslip...showed a 2-foot vertical displacement at the top, and the land had shoved into the road below. This slide measured 150 feet from its top to the road, and its width at the road was 100 feet." (Lawson and others, 1908, p. 273).

Ground failure. Landslide.

GREENOAKS CREEK

Location. GO, near the coast 38 km south of Half Moon Bay.
Distance. 24 km west of the earthquake fault.
Geology. Type At/C.

General. "At the Cascade ranch...cows were thrown off their feet, chimneys were down, the house cracked, and nearly all plastering fell off." (Lawson and others, 1908, p. 273).

Intensity discussion. This locality involves only a single ranch, so the damages indicate only a minimum intensity of VIII, although the actual intensity may have been greater.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

HALF MOON BAY

Location. HM, on coast 16 km southwest of San Mateo.
Distance. 9 km west of the earthquake fault.
Geology. Type At/C.

Building damage. "Many buildings were badly damaged, some old frame houses and the brick bank building being flat, while the upper half of a 2-story brick structure was demolished." (Lawson and others, 1908, p. 266).

"The large two-story brick building containing two stores and occupied by Levy Bros. as a general merchandise store was leveled to the ground, as was the large brick building occupied by the Bank of Halfmoon Bay. Both buildings are a total loss. The two-story brick building owned by Supervisor Debendetti and occupied by him as a general merchandise store was so badly damaged that what is left of it will have to be torn down." (The Enterprise, 1906b).

Foundation. "The Methodist church was thrown from its foundation and badly wrecked." (The Enterprise, 1906b).

Adobe, injuries. "An adobe house...was thrown down by the earthquake, killing three people." (Lawson and others, 1908, p. 266).

"The old Vasquez adobe, one of the oldest landmarks, is a total wreck. In this three lives were lost. ...There were many others in the old building and that many others were not lost is certainly wonderful." (The Enterprise, 1906b).

Plaster, other. "All the plaster in the Occidental hotel was knocked from the walls, windows broken, and otherwise damaged. Hotel Mosconi was badly injured, the plaster is all down, the fixtures of the barroom badly wrecked and much other damage done." (The Enterprise, 1906b).

Liquefaction. "The bridge over Pilarcitos Creek. north of the town...was badly cracked. ...Just south of the bridge, several small cracks in the low ground west of the road permitted water to spurt up, bringing sand with it." (Lawson and others, 1908, p. 266).

Landslides. "From Half Moon Bay to San Mateo, there were several large slides...((which)) resulted from the slipping of large masses of rock. ...Following the road along Pilarcitos Creek...many cracks and slides were found on the ocean side of the ridge, but few on the east side. All of these seemed to be due to slipping of the earth. At one place there had been such a large slide that big blocks of sandstone had fallen down into the road." (Lawson and others, 1908, p. 252, 265).

"Near Half Moon Bay considerable masses of granite were dislodged on a steep slope." (Lawson and others, 1908, p. 389).

Earth-flows. "One ((flow landslide))...was formed in the hills...immediately south of Frenchman Creek, 1.5 miles north of the town, and a mile from the sea, at an elevation of 100 feet. ...The whole length of the slide was 500 feet. The width of the main hole was on the average about 100 feet. ...Another flow of similar character took place 3 miles north-northwest of the town of Half Moon Bay, on the creek next west of Frenchman Creek. ...An acre of the gently sloping alluvial floor of a broad, short valley...caved and flowed out. ...A flood of earth covers about 2 acres of the meadow. ...The largest of the earth-flows seen occurred in the canyon...2.5 miles east-northeast of the town of Half Moon Bay, at an elevation of about 500 feet. ...Two other smaller earth-flows occurred just over the hill westward from the last one described." (Lawson and others, 1908, p. 395-397).

Intensity discussion. The buildings that collapsed may have been weak, and thus the MM intensity is uncertain.

Ground failures. Earth-flows, landslides, and liquefaction.

Intensity. Modified Mercalli VIII/IX; Rossi-Forel IX.

HOMESTEAD

Location. HS, 2 km southeast of San Mateo.
Distance. 5 km east of the earthquake fault.
Geology. Type E.

Building. "In the foothills...the brick building of the Crocker Orphanage was completely ruined." (Lawson and others, 1908, p. 246).

Intensity discussion. It is not known if the description 'completely ruined' means badly cracked or collapsed. Thus the intensity rating is uncertain.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

KING'S MOUNTAIN HOUSE

Location. KM, on ridge 4 km west of Woodside.
Distance. 3 km west of the earthquake fault.
Geology. Type D.

General. "Brick chimneys were knocked down and some dishes were broken, but no damage was done to the house." (Lawson and others, 1908, p. 265).

Intensity discussion. This is a single site; the fall of chimneys indicates intensity VIII.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

LA HONDA

Location. LH, 10 km east of San Gregorio, population 105.
Distance. 7 km west of the earthquake fault.
Geology. Type C.

General. "At the hotel, plaster fell from first floor walls; the rest were little damaged. ...Lamps were all shaken off the tables, and all the chimneys were down." (Lawson and others, 1908, p. 266).

Intensity. Modified Mercalli VIII/IX; Rossi-Forel VIII/IX.

LA HONDA NORTH

Location. LN, north of La Honda, exact location unknown.
Distance. Approximately 3 km west of the earthquake fault.
Geology. Type C or D.

General. "The Weeks house, a strongly-built frame structure...was badly damaged. A large...chimney fell thru the roof...the front door was cracked, and many of the door jambs were broken. The heavily built barn...was badly strained." (Lawson and others, 1908, p. 266-267).

Intensity discussion. This is a single site; the strong damages to the building suggest that the seismic intensity may have been greater than VIII.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

MENLO PARK

Location. MP, 18 km southeast of San Mateo.
Distance. 8 km east of the earthquake fault.
Geology. Type A.

Buildings. "At the Catholic Seminary...a 4-story brick building, the upper part of many of the walls fell; towers and chimneys also came down; arches sprung apart, allowing their keystones to drop, catch, and hang. There were many cracks in all the walls which remained standing. ...The chapel...was thrown in a heap. The 1-story brick buildings...were little damaged." (Lawson and others, 1908, p. 259).

"St. Patrick's seminary...is an example of most excellent brick work, yet it was decidedly shattered in the main towers." (Derleth, 1907, p. 134).

"The roof of a large 3-story brick house...had collapsed, the bricks having been shaken from the walls down to the second floor. The Arcade of the Sacred Heart Convent was thrown down." (Lawson and others, 1908, p. 259).

"Duff & Doyle's two story brick building...was partially destroyed, but other business buildings were not severely damaged." (San Mateo Leader, 1906a).

"The Coleman building...was unharmed. ...Architects and contractors have examined it and say that it is in the same condition as before the quake. They account for this from the peculiar construction of the roof and walls. The latter were thick and firmly built and the former lightly constructed. The chimneys were boxed with cement in between." (The Enterprise, 1906c).

"The main school building of Hoitt's school for boys...collapsed, the first floor being telescoped into the basement. A number of the older students were sleeping in this building, but all escaped uninjured." (San Jose Herald, 1906).

Foundations. "Houses...in some instances were shaken from their foundations." (San Mateo Leader, 1906a). "The public school building was shifted on its foundations." (San Jose Mercury, 1906).

Smokestack. "The round power-house chimney (35 feet high) ((of St. Patrick's seminary)) was cracked in the middle and the top broken off." (Lawson and others, 1908, p. 259).

Water-tanks. "A wooden tank was uninjured, altho it was on an 80-foot tower. A mile nearer Fairoaks station, a watertank only 12 feet high was thrown down. With this one exception all the tanks on this side of the county road appeared to be standing." (Lawson and others, 1908, p. 259).

Chimneys. "Houses lost chimneys." (San Mateo Leader, 1906a).

Injuries. "No lives lost or injuries." (Redwood City Times-Gazette, 1906a).

Intensity discussion. The strength of the buildings with partial collapse is not known.
Intensity. Modified Mercalli VIII; Rossi-Forel IX.

MILLBRAE

Location. MB, 6 km northwest of San Mateo, population 261.
Distance. 3 km east of the earthquake fault.
Geology. Type B.

Building. "((At a brick powerhouse)) the north and south walls fell." (Lawson and others, 1908, p. 247).

Intensity discussion. The damage of only one building is described, so the intensity rating is uncertain.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

MINDEGO HILL

Location. MH, in mountains 5 km east of La Honda.
Distance. 5 km west of the earthquake fault.
Geology. Type D.

Landslide and ground settlement. "On the north side of Alpine Creek, a tract of some 50 acres sank. ...The land, which before the earthquake was steeply inclined, is now comparatively level, the eastern and northern part having sunk perhaps 100 feet, while that on the west has sunk but 10 or 15 feet. The surface of the sunken tract was greatly seamed and cracked." (Lawson and others, 1908, p. 389).

Ground failure. Landslide, settlement.

MONTARA POINT

Location. MT, 10 km northwest of Half Moon Bay.
Distance. 11 km west of the earthquake fault.
Geology. Type At/G.

General. "The old, low brick structure...did not show any effects of the shock, but there was some damage to a wooden tank-house." (Lawson and others, 1908, p. 252).

Intensity discussion. This is a single site, so the damages indicate only a minimum intensity value. The damage to the wooden tank house is difficult to rate.
Intensity. Modified Mercalli VII; Rossi-Forel VII.

MUSSEL ROCK

Location. MR, on coast near the north county line.
Distance. 0.0 km to 1 km east of the earthquake fault.
Geology. Type C.

Landslide. "At the time of the earthquake there was an extensive movement of the landslide, and a tongue of landslide material, about 50 feet high and about 200 feet wide, was projected into the ocean. ...All about the crest to the east of the landslide, and on its south side, the ground was greatly disturbed by fresh landslide cracks, scarps, and fissures, extending well back from the edge of its encircling cliffs." (Lawson and others, 1908, p. 92).

"The whole side of the cliff for half a mile broke away with a crash, and slid down the slope and toward the sea. When it had stopped, the far-flying outer portions from the base of the cliff had formed a new promontory reaching well out in the ocean, and the upper part was some two hundred feet lower than before. Cracked and contorted it was, to be sure, but in the main the surface had ridden along undisturbed on the sliding sands below, and bore the same covering of underbrush as before. A cabbage patch at the top of the hill was cut in two by the slide; while part of it remained on the hilltop, another portion reposed unharmed some three hundred feet below and the remainder either hung on terraces near the top or was stretched out on the steep slope between." (Aitkin and Hilton, 1906, p. 50-52).

Cracks. "Along the top of the cliffs large cracks were formed to a distance of several hundred feet from the edge. Many of these cracks were a foot or even as much as 3 feet in width, and small scarps were often present, 4 or 5 feet high and 20 or 30 yards long." (Lawson and others, 1908, p. 250).

Ground failure. Landslides.

MUSSEL ROCK NORTH

Location. MN, on coast at northern county line.
Distance. 0.0 km to 1 km east of the earthquake fault.
Geology. Type C.

Landslides. "The most notable earth-avalanches were along the sea-cliffs between the city ((San Francisco)) and Mussel Rock. ...The rocks are for the most part rather soft and incoherent. ...Great quantities of earth and rock were caused to fall or slip down. The great earth slump at Mussel Rock was also notably accelerated." (Lawson and others, 1908, p. 387).

"About a mile to the north of the real line of the fault the double-tracked roadbed of the Ocean Shore Railroad was being graded along the side of this bluff; the sand thrown down by the earthquake completely obliterated all that had been done, and left a monster steam shovel buried, upside down, a hundred feet down the slope." (Aitkin and Hilton, 1906, p. 50).

Ground failure. Landslides.

PACÍFICA

Location. PA, on coast near northern county line.
Distance. 5-7 km west of the earthquake fault.
Geology. Type E.

Landslides. "There were examples of such ((landslide)) slips along the coast hills north of San Pedro Point" (Lawson and others, 1908, p. 398). "Along the base of the cliffs south of Laguna Salada, there were several small slides. ...One big rock pinnacle...was shaken down." (Lawson and others, 1908, p. 251).

Ground failure. Landslides.

PESCADERO

Location. PE, 24 km south of Half Moon Bay, population 381.
Distance. 18 km west of the earthquake fault.
Geology. Type An/C.

Buildings. "None of the churches had lost their steeples, tho one church was cracked open." (Lawson and others, 1908, p. 272).

"The Catholic Church is off its foundations. ...The schoolhouse will need extensive repairs. ...The feedmill was wrecked in the rear by a large water tank and windmill falling on the roof. ...Several residences needed underpinning repaired." (Redwood City Times-Gazette, 1906b).

Chimneys. "All but 3 brick chimneys fell." (Lawson and others, 1908, p. 272).

Plaster. "Plastering was knocked from walls in most of the houses." (Lawson and others, 1908, p. 272).

Water-tanks. "All the water-tanks observed were still standing." (Lawson and others, 1908, p. 272).

Liquefaction. "In several places the ground opened and water issued in large amounts." (Redwood City Times-Gazette, 1906a).

Ground cracks. "Cracks were visible in the streets. ...Cracks in the road also appeared, and dust spurted up." (Lawson and others, 1908, p. 272).

Landslides. "Slides of earth and rock are noticed on places along the road, the most serious being on the Tho. Enos place. The first one occurred about 24 hours after the quake, when the road sank...for a distance of about 75 yards, to a depth of fifteen feet. Another slide a week later occurred before daylight. ...A large stream of water gushed out at both sides of the slide." (Redwood City Times-Gazette, 1906b).

Escaping gas. "One of the strangest and most interesting phenomenon in consequence of the earthquake was the gas wells in D.S. Jackson's field. ...Soon after the earthquake a bubbling was heard and on investigation, water was seen coming up in several places. It was of cool temperature, but appeared to be boiling. Willis Jackson applied a lighted match to several places and flames immediately shot up to a height of...four or five feet, producing an intense heat. At present writing the gas seems to have zbout all disappeared. What is the more remarkable about the case is that no trace of either oil or gas or anything like it had ever been seen here before." (Redwood City Times-Gazette, 1906b).

Ground failures. Cracks, escaping gas, landslides, and liquefaction.

Intensity. Modified Mercalli VIII/IX; Rossi-Forel VIII/IX.

PESCADERO CREEK

Location. PC, 24 km south of Half Moon Bay.
Distance. 11-17 km km west of the earthquake fault.
Geology. Type An/C.

Foundations. "A mile from the town of Pescadero...a farm house...was nearly shaken off its foundations." (Lawson and others, 1908, p. 273).

Chimneys. "Wherever there are buildings in this region, no damage had been done except to chimneys, which had fallen." (Lawson and others, 1908, p. 273).

Landslide. "About 2 miles east of the town, on the north bank of Pescadero Creek, a landslide had slipped down toward the bed of the stream. The greatest vertical displacement at the top of the slide was 15 feet...and the span...along the road ((was)) about 220 feet. ...The road had dropt 6 feet at the south end and 8 feet at the north. ...Four miles from the town of Pescadero, on the east side of a bridge over Pescadero Creek, the ground had sunk 2 inches and the aperature filled by the landsliding. A mile nearer the town, the road had dropt 5 feet but had been filled by a big slide. ...The chicken house...was carried down and partly buried by the landslide." (Lawson and others, 1908, p. 272-273).

Liquefaction. "A mile from the town of Pescadero...water oozed out of level ground." (Lawson and others, 1908, p. 273).

Intensity discussion. Apparently most chimneys had fallen, but this is not certain, nor is it known how many buildings there were.
Ground failure. Landslides and liquefaction.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

PIGEON POINT LIGHTHOUSE

Location. PP, 31 km south of Half Moon Bay.
Distance. 25 km west of the earthquake fault.
Geology. Type D.

General. "The brick lighthouse, 125 feet high, showed a slight crack all the way around inside, about 40 feet from the ground. ...In the houses near the lighthouse the damage was slight; brick chimneys had not fallen, tho slightly cracked, and the same was true of plastering." (Lawson and others, 1908, p. 273).

Intensity discussion. This is a single site, so the intensity rating is uncertain. The crack of the lighthouse may indicate intensity VIII.
Intensity. Modified Mercalli VII/VIII; Rossi-Forel VII/VIII.

PILARCITOS DAM

Location. PD, 9 km north of Half Moon Bay.
Distance. 3 km west of the earthquake fault.
Geology. Type E.

Chimneys. "((The house)) lost two out of three chimneys by the shock." (Lawson and others, 1908, p. 253).

Intensity discussion. This is a single site, so the intensity is a minimum value.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

POMPONIO CREEK

Location. PM, 2 to 8 km southeast of San Gregorio.
Distance. 13-16 km west of the earthquake fault.
Geology. Type An/C.

Chimneys. "On the Pomponio Creek road, chimneys were shaken but not destroyed." (Lawson and others, 1908, p. 273).

Landslide. "On the Pomponio Creek road...a big slide above the last house forced the observer to leave the road and take the trail." (Lawson and others, 1908, p. 273).

Intensity discussion. The description suggests that there were several houses and that chimneys were damaged, but the amount of damage is uncertain; thus the intensity rating is uncertain.
Ground failure. Landslide.
Intensity. Modified Mercalli VII?; Rossi-Forel VII?.

PORTOLA

Location. PV, at the fault rupture near the south county line.
Distance. 0.0 to 0.4 km from the earthquake fault.
Geology. Type mixed At, C, and D.

Foundations. "The Portola store was thrown off its foundation. The Catholic Church...was thrown bodily about two feet toward the north, apparently thrust over by the underpinning when it gave way. The Portola schoolhouse was also thrown from its foundations. ...Two small dwelling-houses...were thrown from their foundations." (Lawson and others, 1908, p. 263).

Chimneys. "Brick chimneys were all down." (Lawson and others, 1908, p. 263).

Intensity discussion. That some building foundations collapsed indicates either intensity MM VIII or MM IX, depending on what percentage of buidings were damaged. The presence of a store, a church, and a school suggests that there were probably many buildings, of which only a few foundations were damaged, but this evaluation is uncertain. The fall of all the chimneys indicates a rating of intensity VIII/IX.

Intensity. Modified Mercalli VIII/IX; Rossi-Forel VIII/IX.

PORTOLA ROAD

Location. PR, northwest of Portola.
Distance. 0 to 2 km east of the earthquake fault.
Geology. Type A, B, C, and D.

General. "From Portola to Woodside, the houses showed considerable damage, with chimneys down. ...The white oaks in the field...had many large branches broken off. A shanty...was down flat; and in a few cases the underpinning of houses had given way. ...A large live oak had its top broken off about 20 feet from the ground; at the place of fracture the tree is about three feet in diameter." (Lawson and others, 1908, p. 263).

Intensity discussion. That some building foundations collapsed indicates either intensity MM VIII or MM IX, depending on what percentage of buildings were so damaged.

Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

PURISIMA

Location. PU, 7 km south of Half Moon Bay.
Distance. 12 km west of the earthquake fault.
Geology. Type At/C.

Chimneys. "The chimneys were all down." (Lawson and others, 1908, p. 266).

Intensity: Modified Mercalli VIII/IX; Rossi-Forel VIII/IX.

PURISIMA CREEK

Location. PK, 7 km south of Half Moon Bay.
Distance. 5 km west of the earthquake fault.
Geology. Type C.

Landslide. "Following the trail from King's Mountain House down Purisima Creek, a large slide on the northeast side of the creek had filled the road to a width of about 100 feet. ...On the northeast side of the creek, just below Borden's Mill, a big slide had dammed the creek to a depth of 25 of 30 feet. The slide was between 0.25 and 0.5 mile long. ...A bridge just above the mill was crusht by a slide from the south side of the creek." (Lawson and others, 1908, p. 265).

Ground failure. Landslide.

REDWOOD CITY

Location. RC, 13 km southeast of San Mateo, population 1653.
Distance. 7 km east of the earthquake fault.
Geology. Type A.

Buildings. "Many buildings were partially wrecked and the new courthouse was completely ruined." (Lawson and others, 1908, p. 259).

"New courthouse ((is)) in ruins, except dome. Sequoia High School, ruined to basement. Carnegie library, walls ruined. First National Bank, front gone, side wall damaged. Redwood City Commercial Bank, in ruins. Alhambra, badly wrenched. ...((Several buildings have)) front gone. ...((Several brick stores are)) badly wrecked. ...Residence districts: west of county road, several houses down; east of county road, damage not so great; north end of town, damage some." (Redwood City Times-Gazette, 1906a).

"The new Court House, a handsome building of stone, recently finished and accepted, ((is)) a mass of ruins. The old Court House was also down, but not so complete a wreck. The brick jail was likewise destroyed. ...The beautiful new High School, a two story building, was a heap of debris. So also was the new Carnegie library. The whole front of the Bank of Redwood, a two story brick building, had been thrown down, and its cupola was also in the street. Another bank, a two-story brick building, had been laid flat. ...The Capitol Hotel, a three-story brick...was a complete ruin." (Sacramento Bee, 1906).

Foundations. "Over 40 houses in the town were moved upon their foundations." (Lawson and others, 1908, p. 259). Of 78 house foundations examined in a special survey, 33 houses had shifted and one foundation was cracked. (Lawson and others, 1908, p. 355-356).

"No dwellings escaped damage, and many houses were totally wrecked. Some of them appeared twisted from their foundations, and had been thrown down." (Sacramento Bee, 1906).

Chimneys. "Ninety-four per cent of the chimneys fell." (Lawson and others, 1908, p. 259).

Plaster. "A majority of houses had the plaster badly cracked." (Lawson and others, 1908, p. 259).

Water-tanks. "Along the two roads leading from Redwood to Portola, out of 23 big public water tanks 20 were thrown down." (Lawson and others, 1908, p. 259).

Articles. "Dishes and similar objects were universally thrown down." (Lawson and others, 1908, p. 259).

Injury. "'A guest of the Capitol Hotel had a leg broken." (San Francisco Chronicle, 1906).

Aftershock damage. "((After the main earthquake)) our father...check((ed)) his law office in rooms above the First National Bank. ...Suddenly there was a sharp jolt and the dome of the building with its jaunty weather vane toppled to the street." (Redwood City Tribune, 1970).

Intensity. Modified Mercalli IX; Rossi-Forel IX.

SAN ANDREAS DAM

Location. SA, adjacent to the fault rupture 3 km west of Millbrae.
Distance. 0.0km from the earthquake fault.
Geology. Type E.

Building. "A brick house...stood a few feet from the ((earthquake)) fissure and is as solid today as when it was built. There is not a scratch or crack on it. But it was scientifically built, with plenty of cement mortar." (San Francisco Examiner, 1906).

Intensity discussion. The absence of any significant damage to the well-built house means that the intensity can not be accurately determined, but the intensity may be much less than MM IX.
Intensity. Modified Mercalli VII?; Rossi-Forel VII?.

SAN BRUNO

Location. SB, 10 km northwest of San Mateo.
Distance. 3 km east of the earthquake fault.
Geology. Type B.

Chimneys. "In the few houses...the chimneys had all fallen" (Lawson and others, 1908, p. 247).

Ground settlement. "The approaches to the bridges between San Bruno and South City ((South San Francisco)) were sunken, making the bridges difficult of passage." (San Jose Mercury, 1906b).

Ground deformation. "At San Bruno the ((6:10 train from San Jose)) was halted on account of damaged track, and a great majority of the passengers started on afoot ((toward San Francisco)). ...((Later)) the train had finally managed to creep across the shaken track and proceed on its way. ...The railroad ((from San Jose north)) was in fairly good condition. ...But north of San Bruno there are several arms of the bay marsh lands reaching up into the peninsula and across these the railroad company was compelled to construct grades ((fills)) that vary from four to ten feet in height above the marsh land. ...The earth embankments were sunk and cracked and the track twisted into serpentine shapes for long distances." (San Mateo Leader, 1906b).

Landslides. "There were examples of such slips ((landslides)) ...near the road halfway between San Bruno and San Andreas Lake" (Lawson and others, 1908, p. 398).

Ground failures. Landslides, deformation, and settlement.
Intensity. Modified Mercalli VIII/IX; Rossi-Forel VIII/IX.

SAN CARLOS

Location. SC, 9 km southeast of San Mateo.
Distance. 7 km east of the earthquake fault.
Geology. Type Ae/E.

Buildings. "The railway station...a low 1-story stone building, was badly damaged, some of the walls being partly thrown down, and the rest of the building cracked." (Lawson and others, 1908, p. 246).

Foundations. "A large frame house near the station was shaken from its cement foundations and the foundation itself was badly cracked." (Lawson and others, 1908, p. 246).

Intensity discussion. The report of damage is insufficient for an accurate intensity rating, but indicates at least intensity VIII.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

SAN GREGORIO REGION

Location. SG, 16 km south of Half Moon Bay, population 89.
Distance. 15 km west of the earthquake fault.
Geology. Type An/C.

General. "The hotel lost only a little plaster and a few dishes. Chimneys and tanks all thru the valley were thrown down. Of the two stores...the one in the bottom-land suffered most, nearly all the shelf goods being thrown down." (Lawson and others, 1908, p. 266).

Ground cracks. "Cracks from 12 to 18 inches wide appeared in the cultivated bottom-land." (Lawson and others, 1908, p. 266).

Liquefaction. "He saw fissures in the earth from a few inches to fifteen feet in width, from which a little sand and water was being forced out." (San Jose Herald, 1906).

Landslide. "A couple of miles farther east ((of San Gregorio)), the creek was dammed to a depth of 6 feet by a slide from its southeast bank." (Lawson and others, 1908, p. 266).

Intensity discussion. The description does not indicate what percentage of chimneys fell.
Ground failure. Liquefaction, landslide.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

SAN MATEO

Location. SM, near the bay about halfway between the northern and southern county lines, population 1832.
Distance. 6 km east of the earthquake fault.
Geology. Type A.

Buildings. "Almost all brick and cement buildings were damaged and several were completely ruined ((the photographs show several collapses))." (Lawson and others, 1908, p. 246).

"The three-story structure occupied by the carriage factory...is a total loss. The City Hall and library building...fell in, but the first floor can still be used. ...The Southern Pacific warehouse is flat with the earth. Practically all brick structures must be partially rebuilt." (San Francisco Chronicle, 1906).

"The most complete wrecks are: the freight depot of the Southern Pacific, level with the ground; The Armitage Orphanage, the third story of which was nearly completed, a heap of ruins. The same is true of Wisnom's building. ...C.W. Clark's house, the old Hobart mansion, collapsed. Jennings stable is almost ruined;

the west end of Coleman block, second story ((wall)) is down exposing the bedrooms. ...Early's store is wrecked, Levy Bros. badly broken, Thorsen's saloon smashed in from the top, the City Hall and library roof resting on the first floor, the Union Hotel broken in the middle. Corbett's saloon crushed by brick from Odd Fellows' building, the latter fallen in the rear, the Palm House badly shattered, the Jensen building...cracked and torn but still habitable, Wisnom's new hotel seriously hurt...his three brick buildings...stood the strain well and show but slight damage. ...Morse's pharmacy shattered and side walls of offices above out. ...A few frame structures are total losses and plastering and chimneys are down in practically all of them. Many brick structures not destroyed must be rebuilt from the ground up." (San Mateo Times, 1906).

Foundations. "Many structures suffered by being thrown from their foundations, while others were shifted without material damage." (Lawson and others, 1908, p. 246). Of 602 house foundations examined in a special survey, 149 houses had shifted and 106 foundations were cracked. (Lawson and others, 1908, p. 355-356).

Chimneys. "Nearly every brick chimney in town was shaken down." (Lawson and others, 1908, p. 246). Of 723 brick chimneys examined in a special survey, 664 chimneys ((92 per cent)) had fallen. Of terra cotta chimneys, 10 per cent or less were damaged. (Lawson and others, 1908, p. 355-356).

Ground deformation. "The electric railroad track a few miles north of San Mateo...was built over the low land on a heavy, but loose, embankment of earth and stone. At one place this roadbed was shaken apart between the rails, and a crack from 1 to 2 feet wide and extending down many feet...was formed in it ((the embankment)) for a distance of over 1000 feet. ...Thruout that stretch not one of the heavy steel rails was left unbent. ...Such wrecking of railroad tracks occurred wherever the underlying foundation was loose, but the stretches of track on solid ground were not affected." (Lawson and others, 1908, p. 366).

San Francisco water aqueduct (location unknown): "The Alameda conduit and submarine pipes crossing the bay suffered no injury except to attachments at the San Mateo end, and to a slip joint at the Alameda end." (San Francisco Call, 1906b).

Water system. "The water was shut off for a time on account of a broken hydrant but Supervisor Losh restored it to half pressure as soon as possible. ...The pumps are working." (San Mateo Times, 1906).

Injuries. "No life was lost nor any serious injury sustained by any one." (San Mateo Times, 1906).

Ground failure. Deformation.

Intensity. Modified Mercalli IX; Rossi-Forel IX.

SAN MATEO EAST

Location. SE, at edge of bay east of San Mateo.
Distance. 7 km east of the earthquake fault.
Geology. Type Am.

Ground cracks. "The low, muddy land along San Francisco Bay, east of San Mateo, was seamed with cracks by the earthquake." (Lawson and others, 1908, p. 366).

Ground settlement. "The alluvial flats ((around San Mateo Point)) showed some slight cracks, and there was a slight sinking of the ground near the bay." (Lawson and others, 1908, p. 246).

Ground failure. Cracks.

SAN MATEO HILLS

Location. SH, on the west side of San Mateo.
Distance. 3 km east of the earthquake fault.
Geology. Type E.

Foundations. Of the 95 house foundations examined in a special survey, 6 houses had shifted and 33 foundations had cracked. (Lawson and others, 1908, p. 355-356).

Chimneys. Of 210 brick chimneys examined in a special survey, 154 chimneys ((73 per cent)) had fallen. (Lawson and others, 1908, p. 355-356).

Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

SAN MATEO POINT

Location. ST, bedrock hill at edge of bay north of San Mateo.
Distance. 7 km east of earthquake fault.
Geology. Type E.

General. "Low frame buildings were uninjured. Tanks...which were half full of water, were almost emptied by the shock." (Lawson and others, 1908, p. 246).

Intensity discussion. The emptying of the water tanks indicates strong shaking, but the damages do not accurately indicate the seismic intensity.

SAN MATEO POINT WEST

Location. SW, north of San Mateo.
Distance. 7 km east of the earthquake fault.
Geology. Type Am?.

General. "At a lumber yard about half a mile west of the point, part of the wharf was broken, lumber piles were overturned, and a chimney fell." (Lawson and others, 1908, p. 246).

Cracks and settlement. "The alluvial flats around ((San Mateo)) point showed some small cracks, and there was a slight sinking of the ground near the bay." (Lawson and others, 1908, p. 246).

Intensity discussion. The damage does not indicate a definite intensity, but the fall of the chimney suggests intensity VIII or more.
Ground failure. Cracks and settlement.
Intensity. Modified Mercalli VIII?; Rossi-Forel VIII?

SAN PEDRO VALLEY (now the southern part of Pacifica)

Location. SP, 15 km north of Half Moon Bay, now part of Pacifica.
Distance. 6 km west of the earthquake fault.
Geology. Type An/E.

General. "Two old wooden houses showed no structural damage, and only one of two brick chimneys was thrown down." (Lawson and others, 1908, p. 252).

Intensity discussion. Because there are only two buildings, the intensity rating is uncertain.
Intensity. Modified Mercalli VII/VIII; Rossi-Forel VII/VIII.

SCARPER PEAK

Location. SR, 8 km north of Half Moon Bay.
Distance. 4 km west of the earthquake fault.
Geology. Type G.

Landslides. "On the south face of Scarper Peak, and on the southwest face of Ox Hill, there were several landslides both large and small." (Lawson and others, 1908, p. 252).

Ground failure. Landslides.

SEARSVILLE LAKE

Location. SV, 3 km southeast of Woodside.
Distance. 1 km east of the earthquake fault.
Geology. Type uncertain, because of uncertain location, may be An/B.

General. "The Preston residence...lost its chimneys. Along the road...the water-tanks were all thrown down ((except one))." (Lawson and others, 1908, p. 263).

Intensity discussion. The fall of water-tanks is not part of the intensity scale, but may indicate a high intensity.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

SOUTH SAN FRANCISCO

Location. SS, near to bay near the northern county line.
Distance. 5 km east of the earthquake fault.
Geology. Type Ac.

Buildings. "The corner fell from a new brick building...and some of the other large brick buildings were slightly cracked." (Lawson and others, 1908, p. 248).

"The South S. F. Power & Lighting Co. is repairing its building, which was badly wrecked. ...Carpenters are today bracing the Arrival saloon which was badly twisted by the earthquake. ...Mr. H. Gaerdes has men at work remodeling his store building which was wrecked. ...Mr. Butler has a large force of men at work repairing the Martin block. The south side will be rebuilt from the first story up. The walls of the other sides are slightly damaged and will soon be in good shape." (The Enterprise, 1906a).

Foundation. "Laurel Hall on Railroad Avenue...was set off its feet." (San Francisco Call, 1906a).

Smokestacks. "((At San Bruno point)) there are several tall brick stacks, none of which fell. Some were entirely uninjured and others slightly cracked, but only one, so far as is known, was badly enough damaged to require rebuilding." (Lawson and others, 1908, p. 248).

Chimneys. "Many chimneys fell, but no badly wrecked houses were seen." (Lawson and others, 1908, p. 248).

Water. "Owing to the demoralized condition of the water pipes during the past week no attempt will be made to collect water rents this month. Chas. Young, the plumber, is in charge of the reconstruction work of the Company's water system. Everything will be in good shape within a few days. This place has been quite fortunate in this respect, being out of water only two days." (The Enterprise, 1906b).

Injury. "John B Holmes...was crushed in one of the houses that slid into the bay from First Avenue ((and is the only fatality))." (San Francisco Call, 1906a).

Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

SOUTH SAN FRANCISCO EAST

Location. SF, flat marsh land on east side of South San Francisco.
Distance. 5 km east of the earthquake fault.
Geology. Type Am?.

Ground Deformation. ""Between the town ((South San Francisco)) and San Bruno point...the rails are bent and broken in a number of places, where the track crosses the marsh." (Lawson and others, 1908, p. 248).
"The Santa Fe track was badly twisted at First Avenue but was soon repaired." (San Francisco Call, 1906a).

Ground failure. Deformation.

WHITEHOUSE CREEK

Location. WC, 35 km south of Half Moon Bay.
Distance. 23 km west of the earthquake fault.
Geology. Type C.

General. "At several farm houses brick chimneys were down, houses slightly moved on their foundations, dishes broken, and plastering cracked." (Lawson and others, 1908, p. 273).

Intensity discussion. The damage includes movement of houses on foundations, which suggests that the seismic intensity might be greater than VIII.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.

WOODSIDE

Location. WS, 16 km south of San Mateo.
Distance. 1 km east of the earthquake fault.
Geology. Type B and D.

Building. "The upper part of a brick winery 1 1/2 stories high was demolished, the roof being split down the middle and smashed to pieces." (Lawson and others, 1908, p. 264).

Houses. "A house 1 1/2 stories high was thrown toward the southeast. .....A large frame house...was demolished; while another on the opposite side of the road...was not badly damaged." (Lawson and others, 1908, p. 264).

Adobe. "The old adobe house...was thrown down." (Lawson and others, 1908, p. 264).

General. "Near Woodside, a 1-story sandstone house had its south wall thrown down, and was otherwise badly damaged. About 50 feet of stone wall laid with mortar...3 feet high and 1.5 feet wide, was thrown down." (Lawson and others, 1908, p. 264).

"Most of the buildings that were damaged have been repaired and those too far gone are being torn down. The residences of Chas. Josselyn and A.W. Jackson suffered most, each of which will be torn down. ...The schoolhouse is being repaired and will be ready for use next week." (The Enterprise, 1906c).

Water-tank. "A tank at the cross-roads...was left standing" (Lawson and others, 1908, p. 264). "The roads are becoming quite dusty owing to the tanks along the road being down." (The Enterprise, 1906c).

Fire. "One dwelling was destroyed...by fire from an overturned stove." (San Jose Herald, 1906).

Injury. "The gardener of Mr. Josselyn was killed by the chimney coming through the roof upon his bed." (San Jose Herald, 1906).

Ground cracks. "On the Bear Creek road, southwest of Woodside, there were many cracks caused by landslips down steep banks." (Lawson and others, 1908, p. 265).

Intensity discussion. The partial building collapses indicate RF IX, but the possible weakness of the buildings means that the Modified Mercalli intensity is not necessarily more than MM VIII.
Ground failure. Landslides.
Intensity. Modified Mercalli VIII/IX; Rossi-Forel IX.

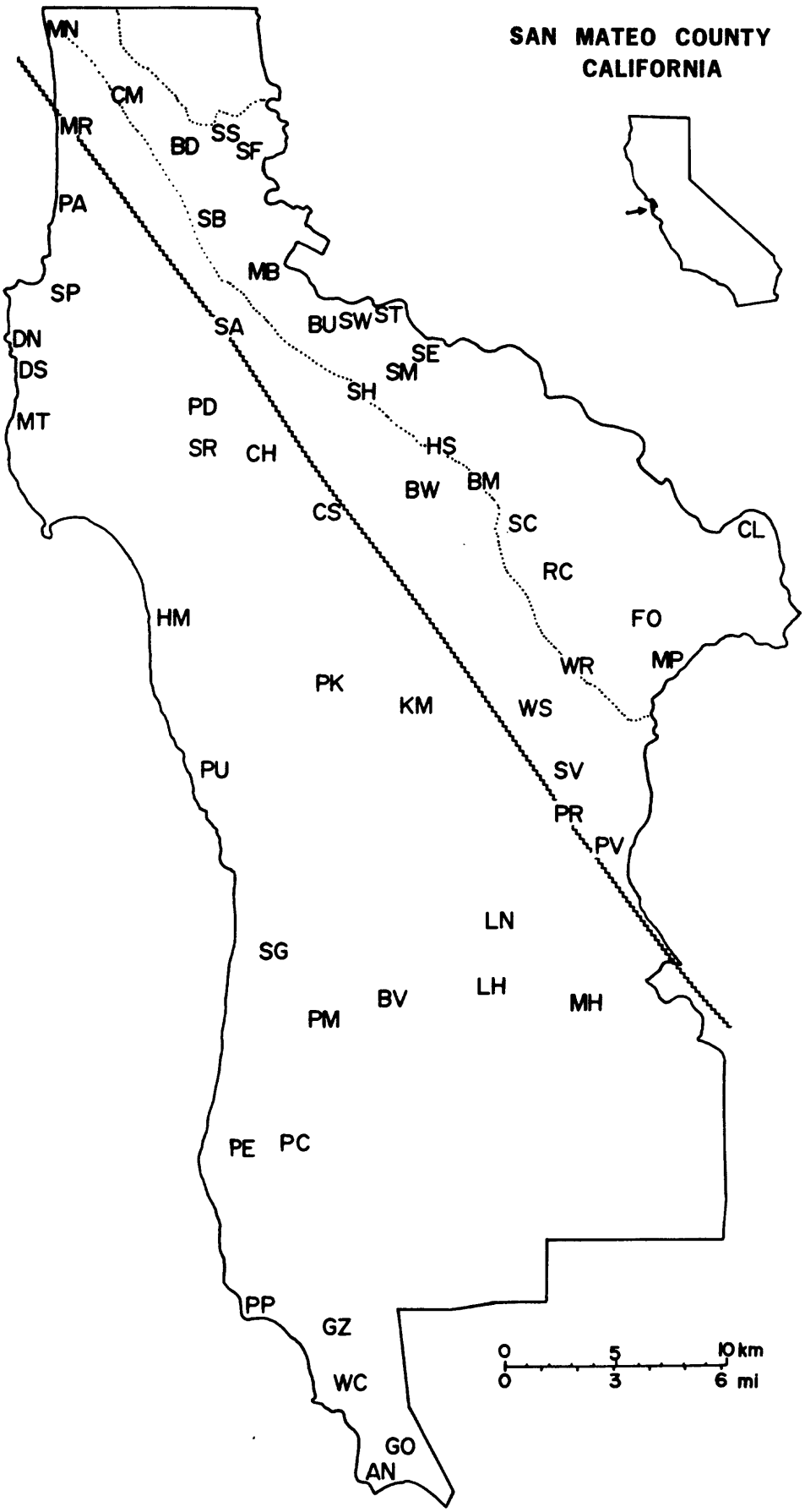
WOODSIDE ROAD

Location. WR, east of Woodside.
Distance. 1 to 7 km east of the earthquake fault.
Geology. Type D.

General. "Between Redwood City and Woodside, all of the public water-tanks were thrown down or had to be rebuilt. ...There were many cracks caused by landslips down steep banks. ...A house and dairy...were moved on their foundations. ...Tops of spruce trees were broken by the shock." (Lawson and others, 1908, p. 265).

Intensity discussion. The damages are incompletely described, but the foundation movement indicates at least intensity RF VIII.

Ground failure. Landslides.
Intensity. Modified Mercalli VIII; Rossi-Forel VIII.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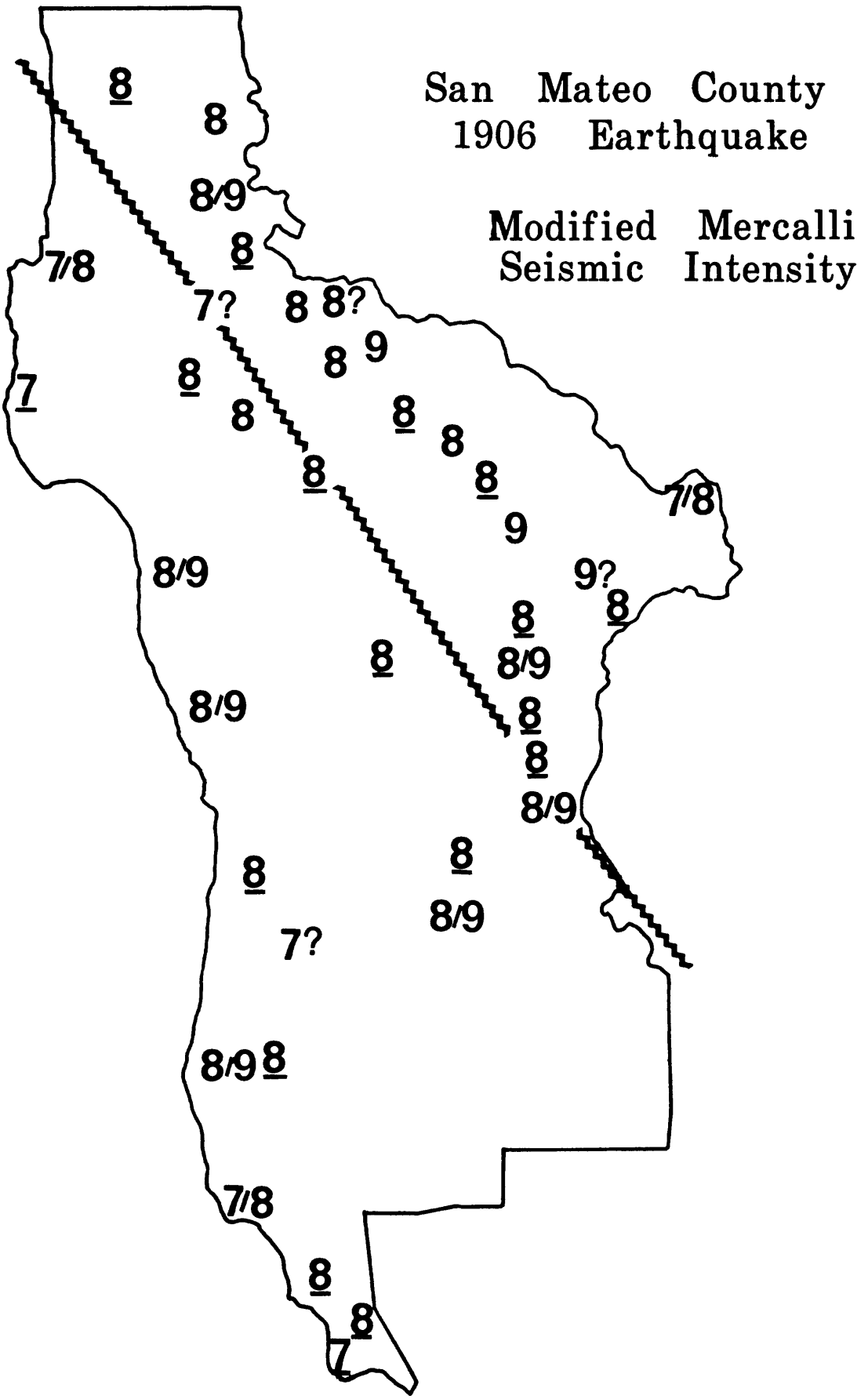
San Mateo County
1906 Earthquake
Modified Mercalli
Seismic Intensity
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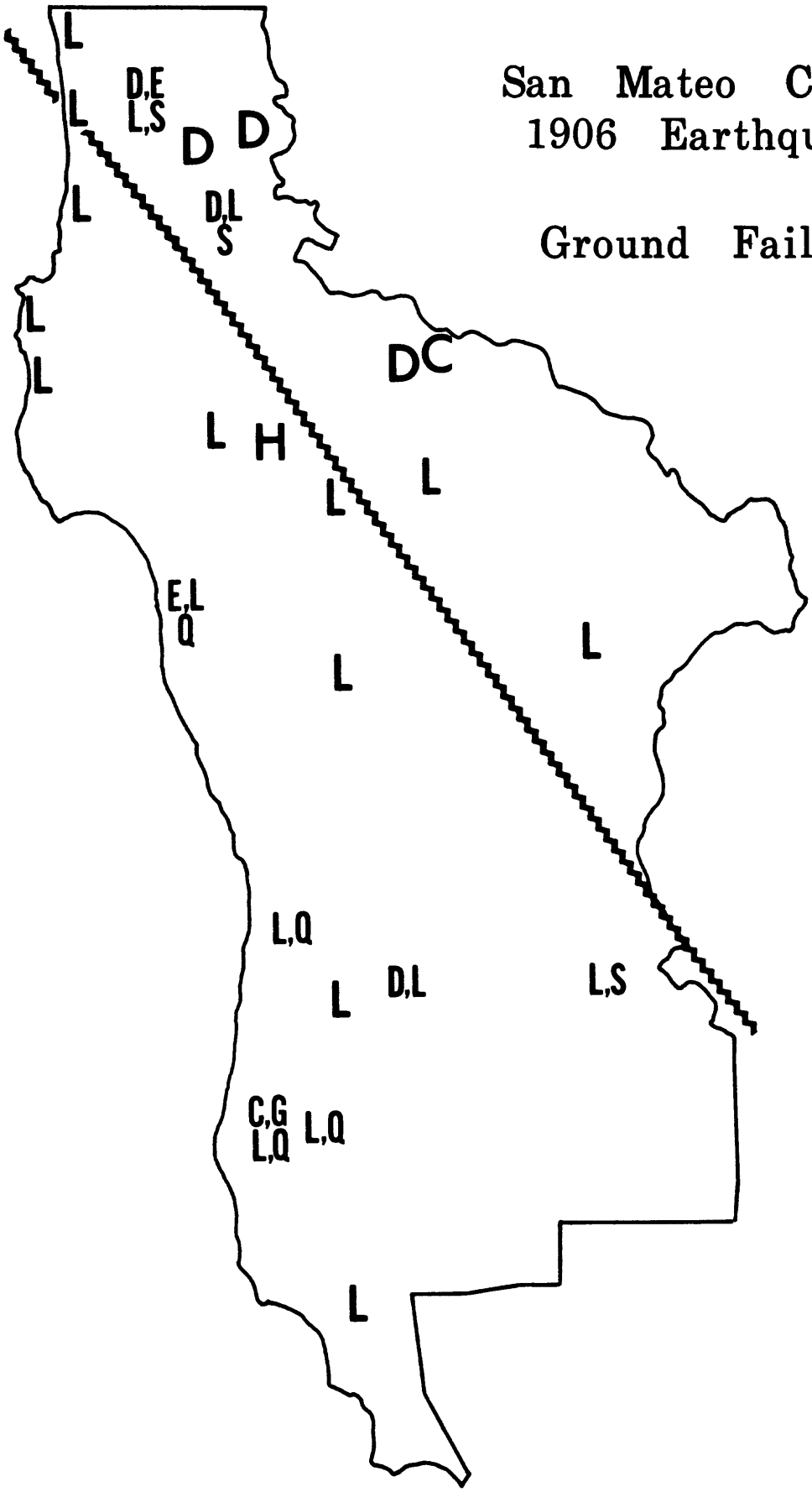

San Mateo County
1906 Earthquake

Ground Failures