Texas Panhandle Earthquakes

The Texas Panhandle sees a wide variety of weather throughout the year, but our area is also occasionally shaken by earthquakes. With respect to earthquake hazards nationally, the Panhandles are in a relatively low threat level compared with locations along the U.S. west coast and the Intermountain West (Figure 1). Within the state of Texas, the Panhandle is a geographic region with the second highest earthquake risk level (Frohlich et al. 2000). Although the exact number of earthquakes that have affected the Texas Panhandle is unknown, nearly 91 percent of known Texas Panhandle earthquakes since 1907 have had Richter Scale magnitudes less than 5.0. Only three known earthquakes have had magnitudes at or above 5.0. The largest known earthquake in the Texas Panhandle had a Richter Scale magnitude of 5.4 and occurred on 30 July 1925. No known earthquakes in our area have had a magnitude of 6.0 or greater, but there is no guarantee that has never happened since the seismic record is extremely small. Frohlich and Davis (2002) estimated that an earthquake with a magnitude greater than 6.0 might occur every 300 years in the Texas Panhandle, which could result in serious damage if it occurred near an inhabited location. An earthquake with a magnitude between 5.5 and 6.0 is estimated to occur every 50 to 100 years in the Texas Panhandle.

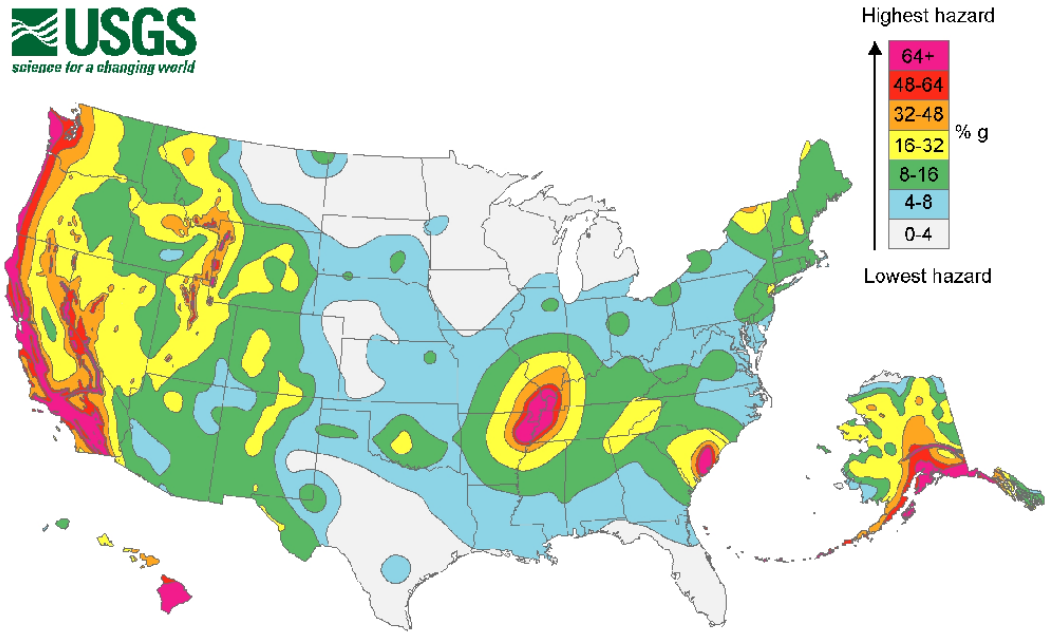

Figure 1. United States Geological Survey (USGS) National Seismic Hazard Map. Courtesy of the USGS.

Most of the earthquakes in the Texas Panhandle occur along the boundary between the Amarillo-Wichita Uplift and the Anadarko Basin system (Figure 2). This area contains subterranean faults extending from just north of Amarillo into southwestern Oklahoma. Seismologists and

geologists suggest that the earthquakes associated with the Amarillo-Wichita Uplift is of concern because it is geologically similar to the Reelfoot Rift (located in northeastern Arkansas), which has produced historic, powerful earthquakes near New Madrid, Missouri. However, this is merely speculation since the largest known earthquake in the Texas Panhandle had a magnitude of 5.4.

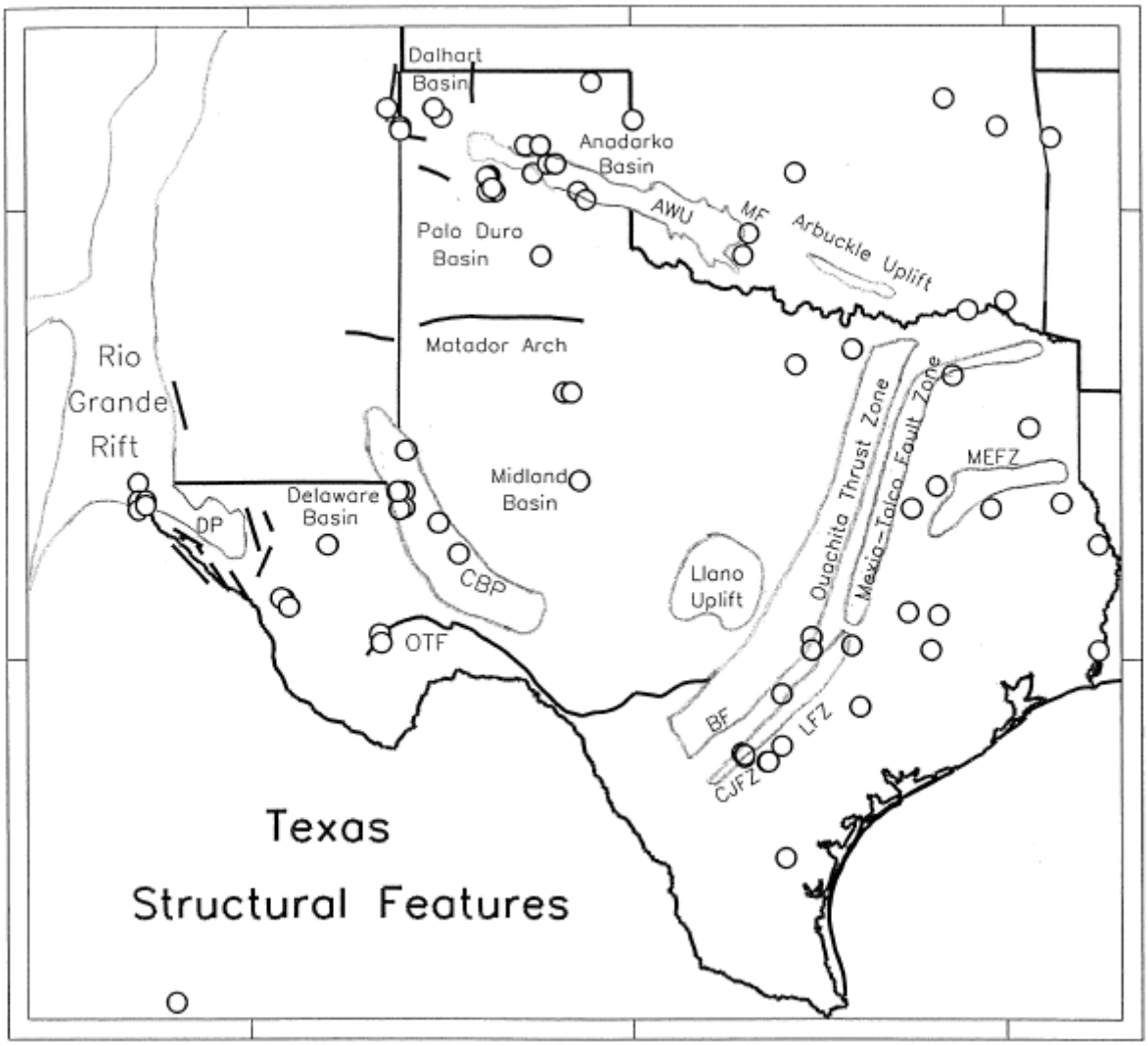

Figure 2. Structural features of Texas. Lines indicate faults and circles are where earthquakes were felt through 2001. The abbreviation AWU denotes the Amarillo-Wichita Uplift. From Frohlich and Davis (2002).

It is also possible that many earthquakes in the Panhandle may not be naturally caused, but rather, they may be the result of petroleum production. In fact, some of the strongest earthquakes in the Panhandle have occurred very close to a large oil and gas field near Panhandle, TX. Controversy does exist with this theory since earthquakes induced by oil field

activity usually do not exceed magnitudes of 5.0. Almost no seismic record exists prior to 1920, around the time when oil and gas production began in the Panhandle. As a result, it is difficult to prove or disprove this theory. Other earthquakes that have occurred near Dalhart may be associated with a northwestward extension of Amarillo-Wichita Uplift. These earthquakes likely occur naturally since there are no oil or gas fields in this area (Figure 3).

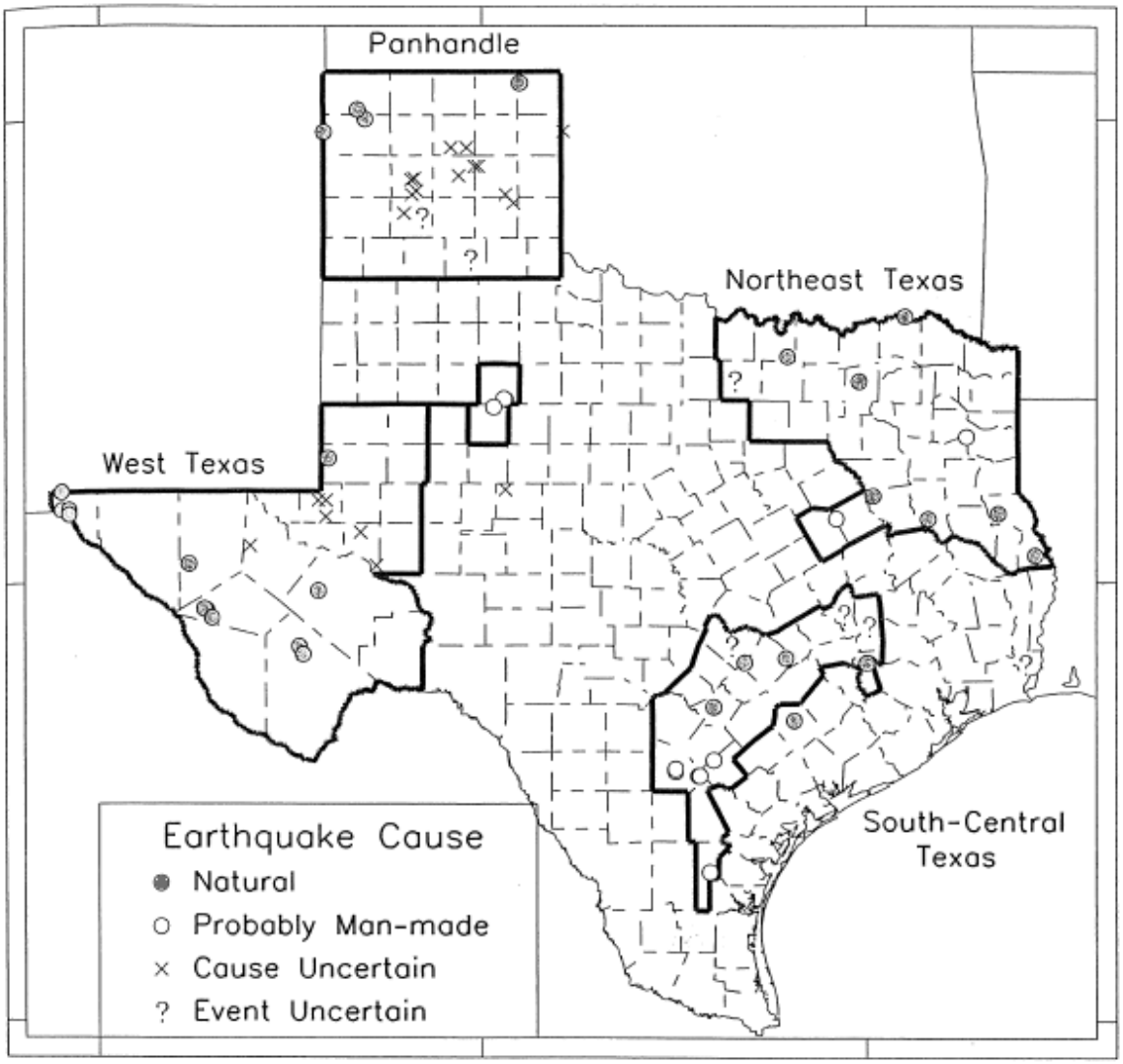

Figure 3. Four geographic regions in Texas where earthquakes have been felt through 2001. Symbols indicate whether earthquakes are of natural, man-made, or uncertain origin. Question marks indicate locations of questionable earthquakes. From Frohlich and Davis (2002).

Texas Panhandle Earthquakes of Richter Scale Magnitude 3 or Higher, 1907-2011

Date	Location	Richter Scale Magnitude	Modified Mercalli Intensity (Appendix A)	Comments
April 1907	Amarillo	3.6	V	Possibly spurious
28 March 1917	Panhandle	3.9	VI	
30 July 1925	All over the Panhandle	Strongest 4.2	IV	Several foreshocks
30 July 1925	**Panhandle**	**5.4**	**VI**	**Strongest known earthquake in TX Panhandle**
31 July 1925	White Deer	3.0	III	
19 June 1936	Clarendon	3.0	III	
20 June 1936	Borger	5.0	VI	
20 June 1936	Borger	3.9	III-IV	
20 June 1936	Borger	3.9	III	
12 March 1948	Dalhart	5.2	VI	
20 June 1951	Amarillo	4.2	V	
20 July 1966	Borger	4.1	V	
15 Feb. 1974	Perryton	4.5	V	
9 June 1980	Pampa	4.3	V	
14 October 1982	Dalhart	3.9	III	
7 Nov. 1982	Wheeler County	3.1		
3 April 1984	Oldham County	3.4		
21 May 1984	Oldham County	3.1		

3 March 1986	Oldham County	3.1		
25 March 1996	Channing	3.5		
23 Nov. 1996	McLean	3.0		
12 Feb. 1997	McLean	3.0	IV	
15 Feb. 1997	McLean	3.2	V	
7 August 2000	Amarillo	3.3	III	
7 August 2000	Amarillo	3.0	III	
7 August 2000	Amarillo	3.0	III	
10 August 2000	Amarillo	3.0	III	
17 August 2000	Amarillo	3.9	V	
16 Dec. 2000	Amarillo	3.9	IV	
24 Sept. 2003	Amarillo	3.3	IV	
17 Feb. 2006	Near Fritch	3.5	III	
12 Oct. 2008	Wheeler County	3.0	III	
13 Oct. 2008	Near Miami	3.7	IV	

Appendix A – Modified Mercalli Intensity Scale

I. Not felt but still detected by seismographs.

II. Felt only by a few persons at rest, especially on upper floors of buildings.

III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations are similar to the passing of a truck.

IV. Felt indoors by many, outdoors by few during the day. At night, some people may be awakened. Dishes, windows, and doors disturbed. Walls may make cracking sound. Sensation is like a heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone and people will likely be awakened. Some dishes and windows are broken and unstable objects are overturned. Pendulum clocks may stop.

VI. Felt by all, many people are frightened. Pictures are knocked off walls. Some heavy furniture is moved. Fallen plaster may occur. Overall damage is slight.

VII. It becomes difficult to stand. Damage is negligible in buildings of good design and construction and slight to moderate in well-built ordinary structures. There is considerable damage in poorly built or badly designed structures. Some chimneys are broken.

VIII. There is slight damage in specially designed structures and considerable damage in ordinary substantial buildings with partial collapse. Damage is great in poorly built structures. Chimneys, factory stacks, columns, monuments, and walls topple. Heavy furniture is overturned. Steering of automobiles is affected.

IX. There is considerable damage in specially designed structures. Well-designed frame structures are thrown out of plumb. Damage is great in substantial buildings with partial collapse. Buildings are shifted off foundations.

X. Some well-built wooden structures are destroyed. Most masonry and frame structures are destroyed along with foundations. Rails are bent.

XI. Few, if any (masonry), structures remain standing. Bridges are destroyed and rails are bent greatly.

XII. There is nearly total damage. Lines of sight and level are distorted. Objects are thrown into the air.

Adapted from the United States Geological Survey.

References

Frohlich, Cliff, and Scott D. Davis. Texas Earthquakes. Austin: University of Texas Press, 2002.

Frohlich, C., S. D. Davis, and J. Pulliam. 2000. Earthquake hazard identification and risk assessment for Texas: A preliminary analysis of counties at risk. Chapter 12 in Hazard Analysis, Governor's Division of Emergency Management, Texas Department of Public Safety. Austin.

"The Modified Mercalli Intensity Scale". United States Geological Survey, 27 Oct. 2009. Web. 13 Nov. 2011. < http://earthquake.usgs.gov/learn/topics/mercalli.php>.