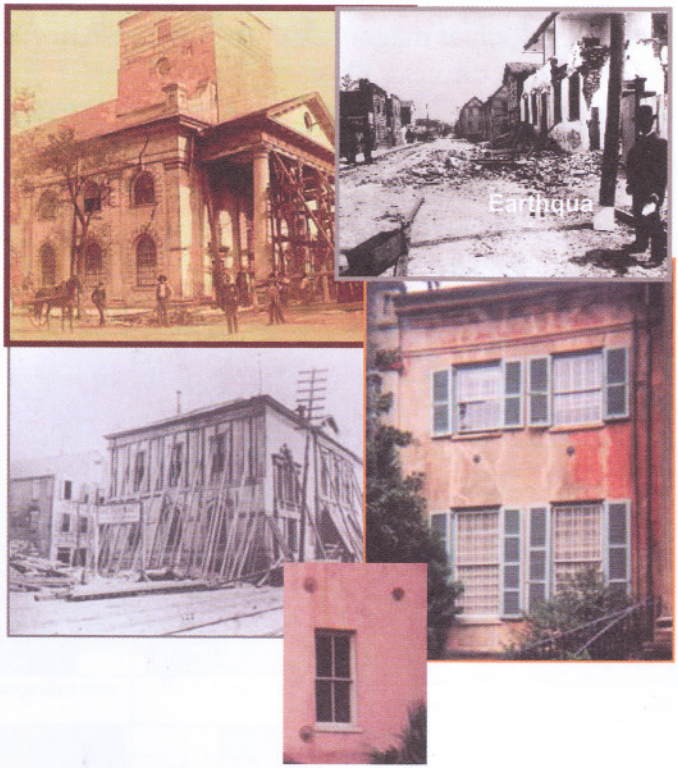
The Charleston Earthquake Tour



A Walk, Through History

August 31, 1886 and Today

This brochure was created by the Advanced GIS students at the College of Charleston.
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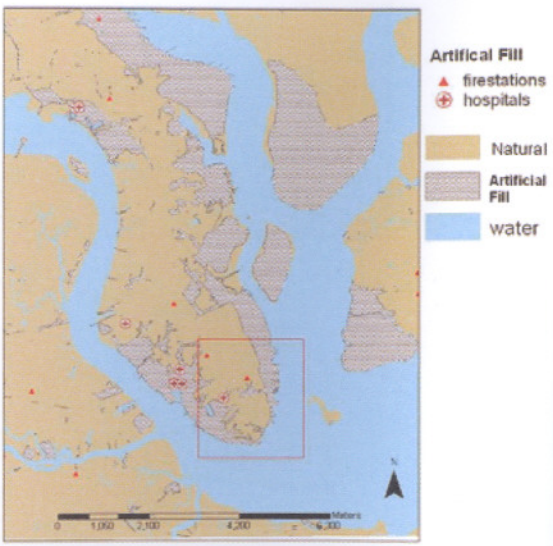
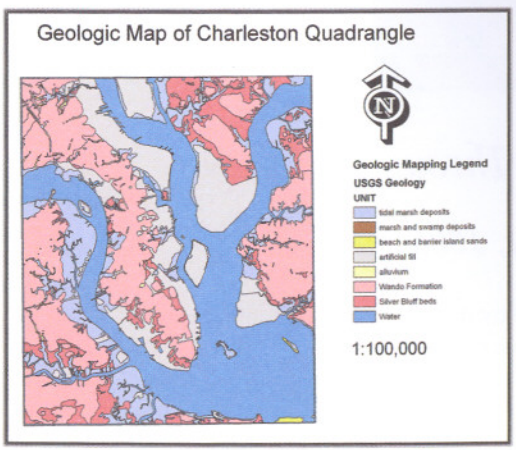
Why Charleston?

What if it happened today?

Geologically, Charleston lies on one of the most seismically active areas in the Eastern United States. Although usually not felt, 10 to 30 earthquakes are recorded annually in the Middleton Place – Summerville Seismic Zone near Charleston. Forecasts indicate a 40-60% chance of a Richter magnitude 6 earthquake somewhere in the Eastern U.S. within the next 30 years.

If an earthquake similar to the 1886 event happened today, many problems would result in Charleston due to the large percentage of land with artificial fill and large number of historic homes. These areas, shown in this map, could experience liquefaction during an earthquake. A great deal of damage would occur in these areas. Notice where the Hospitals are located!





Some features to look for on the tour

		
X-Shaped cracks present between windows	Earthquake Bolt Plates	Repairs to the corners of masonry buildings.
		
Cracks cross cutting through building that have been over mortared.	Note the difference in mortar thickness between original mortar and repaired sections – Repairs are thicker	Breaks between steps and the building front
		
Wood-frame buildings tilted from perpendicular	Rebuilt upper stories	Window Sills no longer in line with one another (tilted)
		
Tilted and cracked headstones and mausoleums.	Broken or fractured building materials.	Evidence of the movement of the upper stories.

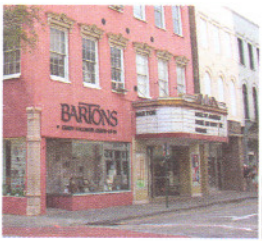
EARTHQUAKE TOUR

This walk will take you through some of the worst hit areas in Downtown Charleston.

Stop 1. Start off in front of **Randolph Hall** on the College of Charleston campus. Construction was completed in 1829. There are many things to notice on this building: a) the large vertical cracks between windows that are structurally weaker than the rest of the building; b) the color and change of the roofline; c) the steps had collapsed and have been rebuilt; d) the windows are also not in line with one another due to settling after the earthquake; e) earthquake bolts that were used to tie the walls together; f) the new front façade.

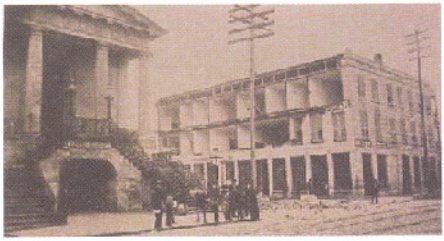
Stop 2. Turn right down St. Phillips Street after leaving the Cistern. Look back at Calhoun Street. Notice the changes in elevation of the street.

Stop 3. At the light, turn left on George Street. On the corner, look at the **John Rivers Communication Museum**. This house was built in 1803, yet did not sustain much damage. This is because it is a wood-framed structure which is flexible and can move more during an earthquake. In contrast, brick structures tend to be more seriously damaged because the rigidity of the material causes it to crumble.

Stops 4-5. Continue down George Street and stop at the intersection with King Street. Look at the building on the southeast corner of the intersection. King Street exhibits a lot of evidence of the 1886 earthquake on most of the buildings. Earthquake bolts (in circles above and below) were installed after the 1886 earthquake to hold damaged buildings together. After their installation, they were literally screwed in little by little to bring walls back together. Turn right on King Street and continue to Wentworth Street. You will pass **327 King Street** at George Street and **273 King Street** at the corner of King and Wentworth Streets. Like most brick buildings, they exhibit the earthquake bolts (in circled areas). The bolts on 327 King Street have stylish decorative "heads" covering the bolts.

Stop 6. One block further on King Street on the left, you will see the **Charleston Place Hotel complex.** This hotel was built nearly 100 years after the earthquake and was built to code to resist earthquake damages. In fact, a seismograph (which records earthquake seismic waves) is located behind the Bell station! The seismograph is there to detect vibrations and to measure settling of the building. The Earthquake bolts seen are *decorative* bolt plates (circled) installed in order to blend the structure into its surroundings.



Stop 7. Next, turn left onto Market Street. Ahead, you will see **Market Hall** at the head of the Market, which is a great spot for tourists to visit because of the shops along the streets as well as the market itself. It was constructed 1840-4. This area sustained the greatest amount of damage from the earthquake. The Market is built on artificial fill, which is very unstable during earthquakes. This area used to be the tip of a tiny finger of a creek running through a marsh that extended from here to the Cooper River.

Stop 8. Cross Meeting Street near Market Street. Head SE down Meeting Street (toward the Battery). At the corner of Cumberland Street, turn left onto Cumberland Street and walk a half-block to **The Powder Magazine**, located at 21 Cumberland Street. This is one of the oldest structures still standing in Charleston, constructed in 1713. Note the large cross-shaped bolt (circled area) on the left side. There is also added support to the roof. This was located on the periphery of the wall that encircled the city. Read the history and look at the 1704 map on the wrought iron fence. Notice the mud flats and marsh on the maps and how much area had to be filled in to create land to build upon in the 1800s. This "made ground" is highly unstable. A major earthquake will cause made ground to act as a liquid (liquefaction).

Stop 9. Walk to the Corner of Cumberland Street and Church Street. Survey to the left: notice how few old buildings are present. This area sustained the worst damage from the earthquake and has been completely rebuilt. Turn right onto Church Street. Notice the tilting of the ground up towards the St. Philips Church. This is due to the natural contours of the area, and NOT as a result of the earthquake.

Stop 10. **St. Philips Church** is located at 146 Church Street. The original church was constructed 1722-23, while the present day church was constructed 1835-38. Note the large brace supporting the steeple (in circled area).

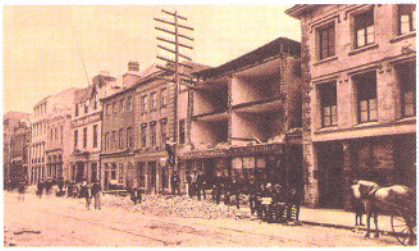
Stop 11. Across the street is the **St. Philips Church Graveyard.** Note how the tombstones lean because of liquefaction from the 1886 earthquake. Liquefaction is the condition where the ground becomes soft due to ground shaking, and sand behaves as a liquid. During the earthquake, the tombstones began to lean because they lost the support of firm ground.

Stop 12. Walk to Chalmers Street and turn left. **10 Chalmers Street** has a massive brace supporting its chimney (in circled area). The earthquake destroyed many chimneys in Charleston.

Stop 13. Continue walking across State Street and cut through the parking lot to East Bay Street. Turn left on East Bay Street and walk up to Queen Street. At this point, cross to the other side of East Bay Street. Look back at the **Wagener Building** (1880) on the corner of Queen and East Bay. Notice all the cracks in the building.

Stop 14. Go down Venue Range to Waterfront Park and check out the maps of how the city has grown. Note where changes have occurred, especially with regard to tidal creeks and marsh.

Stop 15. Walk down East Bay Street towards the Battery. From in front of the old Custom House (Old Exchange Building) on the corner of East Bay Street and Broad Street, take a look down **Broad Street**. This street had near total destruction. Note today's current street has been restored to the old look.



Stop 16. Continue to **Rainbow Row** and note the variations in earthquake bolts.

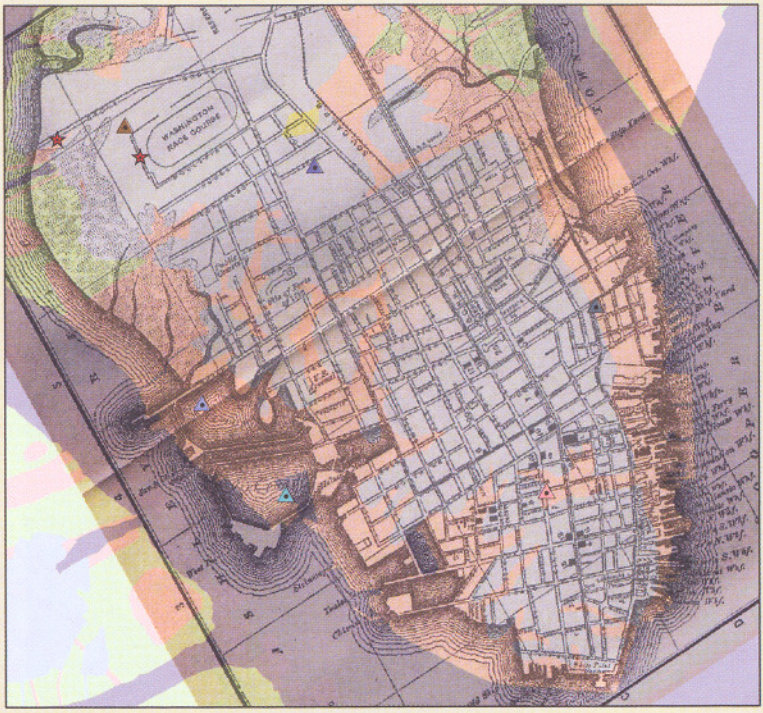
Stop 17. Cross Tradd Street and look back at the tan house, **#83 East Bay Street.** Notice the windows!

Stop 18. Turn back down East Bay Street towards the Battery. As you walk this way, take a look at the last building on the left. This building split apart during the earthquake. Walk up to this edifice and take a look at the brass plaque on the side. Locate the **Granville Bastian**.

On your way back to the College of Charleston campus, remember what you have learned about and look at the different earthquake bolts, cracks, and tilting of buildings.

Stop 19. Glebe Street between Wentworth and George. Look at the buildings along this street. Almost all show evidence of earthquake damage.

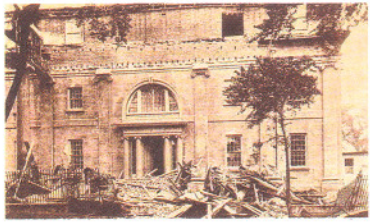
Aerial photograph of downtown Charleston overlain on the present day geologic map. Note that much of the present day city is built on formations labeled as "Artificial Fill" and "Marsh or Swamp Deposits". These materials are extremely unstable under conditions of severe shaking present during a large earthquake.



This map of Charleston in 1885 has been rectified to overlay with the present day geologic map of Charleston. Notice that much of the present day peninsula was open water and swamp back in 1885. Much of the land that was created used rubble from the 1886 earthquake.

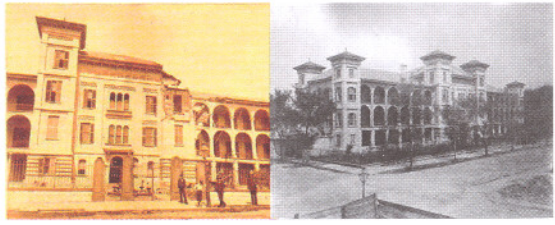
Other sites not included in tour:

The Old Citadel at Marion Square: The Embassy Suites Hotel at Marion Square Park (on King and Calhoun) is the old site of The Citadel.



The Medical University of South Carolina is located on Calhoun Street.
Shown is the College of Pharmacy.

Roper Hospital is located on Calhoun Street.



25 Bull Street shows evidence of repairs. Clearly visible is the difference between the pre-earthquake building and the repaired structure.

How should we prepare for an earthquake?

Survey your home or workplace to determine what hazards exist.

Secure fixtures such as lights, ceiling tiles, cabinets, and top heavy objects to resist moving or falling during the shaking. Place heavy or large objects on lower shelves. Remove hazardous objects above sleeping areas. Fasten your water heater to the wall by strapping it. Check the electrical wiring and connections to gas appliances. Defective electrical wiring, leaking gas, or inflexible connections are extremely hazardous.

Store breakables in low, closed cabinets. Have on hand:

1. A flashlight and battery-powered radio in case you lose power. The official source of information during a disaster is obtained through the Emergency Warning System.
2. A supply of drinking water and nonperishable foods that can be prepared without cooking. Plan a "goodie closet" and rotate the food.
3. A fire extinguisher and first aid kit.

Think in terms of your family or workplace as being self-sufficient for at least 72 hours following a disaster.

Develop a family work plan which addresses what to do if the earthquake occurs while family members are at home, school or work. Discuss where and how contact should be made and where to meet. Coordinate your plan with the school's plan.

Practice your plan. Hold drills so each member of your family knows what to do in an earthquake. Teach responsible family members how to turn off electricity, gas, and water at main switches and valves.

What to do during an earthquake

Stay calm. Think through the consequences of any action you take.

Stay put. If you are inside, stay inside. If you are outdoors, stay there. Most earthquake injuries occur when entering or leaving buildings.

Take cover. If indoors, take cover under a heavy desk, table, bench, a supported doorway, or along an inside wall. Stay away from glass. Don't use candles, matches, or other open flame during or after the tremor because of possible gas leaks. Douse all fires.

If outdoors, **move away from buildings and utility wires** . The greatest danger from falling debris is just outside doorways and close to outer walls. Once in the open, stay there until the shaking stops. If in a moving car, stop as quickly as safety permits, but stay in the vehicle. A car may jiggle violently on its springs, but it is a good place to stay until the shaking stops. When you drive on, watch for hazards created by the earthquake, such as fallen or falling objects, downed electric wires, or broken or undermined roadways.

After the earthquake

After the earthquake essential services may be out for a several days. The use of telephones will probably be impaired for some time. If your phone is working, it would be best not to burden the lines with unnecessary calls. Listen to the Emergency Warning System for official information concerning what to do and the extent of damage in your area.

Initially, emergency response activities will probably be focused on those locations hardest hit and the restoration of service to critical facilities. People in areas with moderate damage will likely be on their own until the situation has settled somewhat.

Be prepared for additional earthquake shocks called **aftershocks**. Although most of these are smaller than the main shock, some may be large enough to cause additional damage or topple weakened structures.

Check for injuries. Do not attempt to move seriously injured persons unless they are in immediate danger of further injury or in a location subject to imminent collapse.

Turn on your radio or television to get the latest emergency information from local authorities.

Check your utilities. The earthquake may have broken gas, electrical, and water lines. Open windows and go outside and shut off the main gas valve. Report any leakage to authorities. Do not reenter the building until a utility official says it is safe. If electrical wiring is damaged, shut off power at the main meter box. If water pipes are damaged, shut off the water supply at the main valve. Emergency water may be obtained from hot water tanks, toilet tanks (not bowls), and melted ice cubes.

Check sewage lines to see that they are intact before using sanitary facilities.

If you cannot reenter your home, emergency shelters will be available for your use. These may be schools or churches and will be surveyed to ensure their stability in case of aftershocks. Tent cities may also be established to house those displaced by an earthquake.

Important Numbers:

Charleston County Emergency Preparedness: 843-202-7400

Charleston Co. Sheriff: Call 9-1-1 for emergency assistance only.

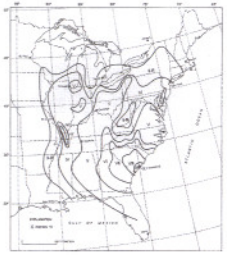
Project Impact: 843-202-6940

Facts about the 1886 Earthquake

- On Tuesday evening, around 9:50 p.m. on August 31, 1886, an earthquake centered near Charleston devastated the peninsula and surrounding area.

- The quake was estimated at between 6.9 and 7.3 on the Richter scale, the largest on the East Coast, with the initial shock lasting less than one minute.

It was felt over 2.5 million square miles, from Cuba to New York, and Bermuda to the Mississippi River, with structural damage extending several hundred miles to the cities in Alabama, Ohio, and Kentucky.



- The earthquake caused approximately $8,000,000 in damages in 1886 dollars with 90% of all structures incurring some damage.

- Almost 14,000 chimneys were broken off from houses at the roofline.

- To repair many buildings, earthquake bolts were inserted into buildings to "pull" the structures back together.

- Nearly 110 lives were lost.

Photographs and provided by the following sources:
Santee Cooper GIS Laboratory - College of Charleston,
The United States Geologic Survey, and
The Charleston Historical Society.

For more information:
http://www.scequakes.cofc.edu or www.charlestoncounty.org

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