Laser scanning shows rates and patterns of surface deformation from the South Napa earthquake

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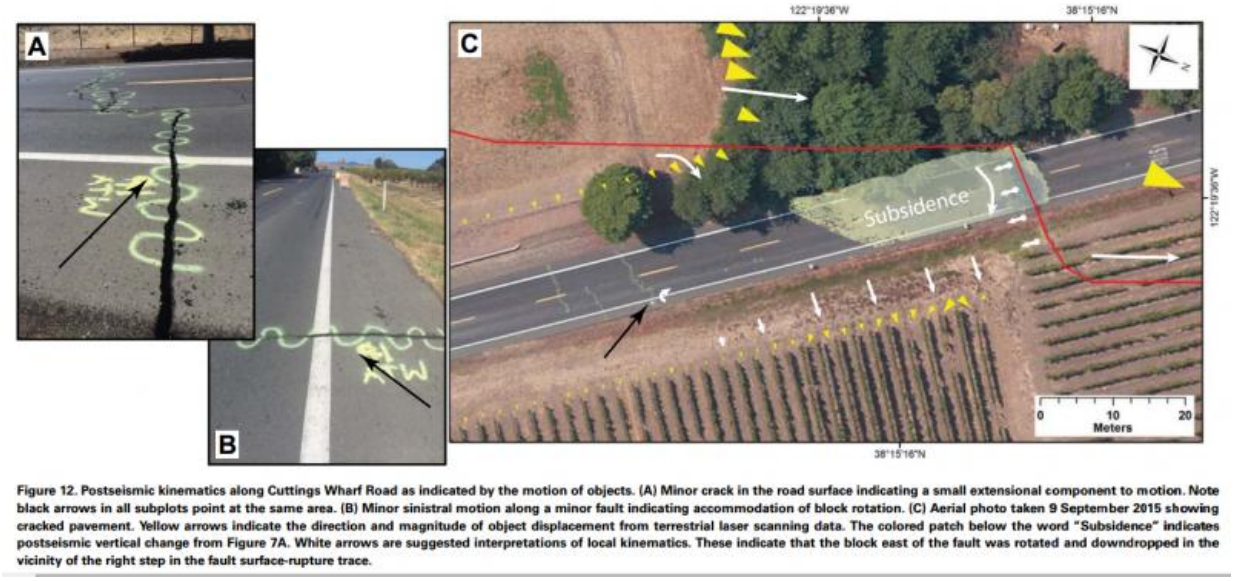

Figure 12. Postseismic kinematics along Cuttings Wharf Road as indicated by the motion of objects. (A) Minor crack in the road surface indicating a small extensional component to motion. Note black arrows in all subplots point at the same area. (B) Minor sinistral motion along a minor fault indicating accommodation of block rotation. (C) Aerial photo taken 9 September 2015 showing cracked pavement. Yellow arrows indicate the direction and magnitude of object displacement from terrestrial laser scanning data. The colored patch below the word "Subsidence" indicates postseismic vertical change from Figure 7A. White arrows are suggested interpretations of local kinematics. These indicate that the block east of the fault was rotated and downdropped in the vicinity of the right step in the fault surface-rupture trace.

Figure 12 from DeLong et al.: Postseismic kinematics along Cuttings Wharf Road as indicated by the motion of objects. Click on the image for a larger version. Credit: Geosphere, USGS, and DeLong et al.

U.S. Geological Survey scientists used 3D laser scanning to make repeat measurements of an area affected by the 2014 magnitude 6.0 South Napa earthquake in order to define in great detail the surface deformation that occurred both during and after the earthquake. The

recent revolution in 3D laser measurement technology (LiDAR) allows scientists to collect detailed information about the shape of the land surface and the objects that sit upon it with unprecedented accuracy.

These spatially extensive measurement techniques provide new understanding of how earthquakes and other phenomena deform the shape of Earth's surface, reinforce the notion that not all surface deformation occurs during an earthquake itself, and provide insight into what can be expected following future earthquakes. When earthquakes strike, damage is expected to occur along the fault trace over a few seconds or perhaps minutes as Earth's tectonic plates shift, shake, and tear the ground.

However, in some cases, the damage to Earth's crust and what sits on top of it can unfold slowly over hours, days, weeks, and even years following an earthquake. This is often termed 'afterslip.' and it has been observed following many moderate earthquakes. Surface deformation following the South Napa quake occurred variously as discrete fault slip, rotation of a block of earth adjacent to the fault, and by vertical elevation changes. Comparison of the new 2014 terrestrial laser scanner data with 2003 airborne laser scanner data also indicate that the earthquake caused vertical warping across the fault zone rather than forming a distinct vertical scarp, challenging notions of how topography is created in moderate earthquakes.

More information: Rates and patterns of surface deformation from laser scanning following the South Napa earthquake, California, Stephen B. DeLong et al., dx.doi.org/10.1130/GES01189.1

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