An $M=7.6$ earthquake ruptured the Luhuo segment of the Xianshuihe fault zone, Sichuan, in Feb., 1973. Since then, several across-fault (across the 1973 rupture) deformation observation systems have been set up at Xialatuo site in Luhuo County. By using the observation data, this paper studies the characteristic of the post-seismic slip/deformation and their temporal-spatial variations for the Luhuo segment. Our study mainly shows that (1) in the first five years following the 1973 earthquake, the earthquake fault at Xialatuo site behaved as an open one that the post-seismic slip showed mainly as aseismic left-lateral slip (creeping) at an average rate of 10.27mm/a along with slight tensional creeping. From 1979, however, the rate of the post-seismic left-lateral creep has been slowing down gradually from 5.3mm/a to 2.27mm/a, and the process of the rate slowing down obeys a logarithmic function, suggesting that during this period the fault plane has been tending to re-couple and re-lock gradually with some strain having built-up. (2) Since 1999 the rate of relative left-lateral displacement/deformation at far-fields on both sides of the fault segment is estimated to be 10mm/a, much greater than the near-fault (40m to 144m across the fault) left-lateral creep rates of 0.66 mm/a to 2.52mm/a in the same stage. Also, such significant differences of the near- to far-fault displacement/deformation rates occur along an about 2×30-km-wide zone centered along the fault segment, indicating the width of the seismogenic fault zone associated with the stress/strain build-up and release during major earthquake cycles here.