On a daily basis, humans walk over a variety of terrains. Studies have shown that spatiotemporal gait parameters, such as stride length, stride frequency, stride variability, etc., change when humans walk down a decline and up an incline compared to level ground. However, these studies have been limited to using fixed speed treadmills or analyzing a small number of strides when conducted over ground. Thus, there is a need to investigate the fluctuations in spatiotemporal gait parameters of humans walking at their self-selected speed, which requires recording hundreds of strides. Here we hypothesized that subjects will walk with a slower speed and have greater stride variability on an incline or decline compared to level ground. We used a self-paced treadmill and had 7 young adults walk on three slopes (+9 degrees, incline; 0 degrees, level; -9 degrees, decline). A motion capture system was used to calculate spatiotemporal gait parameters. The results showed that subjects walked the fastest on level ground (1.15 +/- 0.17 m/s). Subjects walked more slowly during decline walking (1.06 +/- 0.14 m/s) and walked the slowest during incline walking (0.92 +/- 0.18 m/s). There was not a single steady-state speed that subjects used for all slopes. Instead, there were multiple periods when the subject was not at a steady state. Only ~60% of the strides could be classified as being at steady-state. When walking down a decline, subjects needed ~10 +/- 1 more strides to reach the first steady-state period. When walking on an incline and decline, stride length variability increased by 69% and 62% compared to level ground. These results provide greater insight on the fluctuations during self-selected walking speeds subjects use on different slopes. This could have implications on balance control and fall risk during walking.