This article provides a combined computational and analytical study to investigate the lateral impact behavior of pressurized pipelines and inspect all the parameters such as the outside diameter and internal pressure and evaluate how they affect such behavior. In this study, quartic polynomial functions are applied to formulate the maximum crushing force (Fmax), maximum permanent displacement (W), and absorbed energy (E) of the pressurized pipelines during the impact problem. The effects of the diameter and pressure on Fmax, W, and E are therefore illustrated through analyzing these functions. Response surfaces are also plotted based on the generated quartic polynomial functions and the quality (accuracy) of these functions are verified through several techniques.