Managed lanes (MLs) have been implemented as a vital strategy for traffic management and traffic safety improvement. The majority of previous studies involving MLs have explored a limited scope of examining the impact of the MLs segments as a whole, without considering the safety and operation effects of the access design. Also, there are limited studies investigated the effect of connected vehicles on managed lanes. Hence, this study has two main objectives. The first objective will be achieved by determining the optimal managed lanes access design including accessibility level and weaving distance for an at-grade access design. The second objective is studying the effect of applying connected vehicles (CVs) on the safety and the operation of the network. Several scenarios were tested using microscopic traffic simulation to determine the optimal access design while taking into consideration accessibility levels and weaving lengths. Both safety (e.g., standard deviation of speed, time-to-collision, and conflict rate) and operation (e.g., level of service, average speed, average delay) performance measures were included in the analysis. For the first objective, the results of the safety and operational analysis suggested that one accessibility level is the optimal option in the 9-mile network. A weaving length between 1,000 feet and 1,400 feet per lane change was suggested based on the safety analysis. In addition, from the operation perspective, a weaving length between 1,000 feet and 2,000 feet per lane change was recommended. For the second goal, the results revealed that the optimal market penetration rate of connected vehicles was found to be between 20% and 25% in the managed lanes network. This study has major implications for improving MLs considering access zone design and including connected vehicles and connected vehicles lanes.