Traffic crashes are a major cause of concern globally. Extensive efforts from transportation professionals have been made to investigate new methods to identify the contributing factors to crashes at various locations on the road network. Corridors, among other road network's components, play a vital role in moving people and goods between primary zones in different areas, and the safety and operational improvements of them have been the focus of many studies since they carry the most traffic on the road network. Corridors contain mainly intersections and segments, and previous corridor studies have focused on a sole type of road entity. Having both components while analyzing corridors in addition to corridor-level variables in a hierarchical joint model framework would provide a comprehensive understanding of the existing safety problems along corridors. Therefore, this research aims to provide a complete understanding of the contributing factors to crashes at intersections and segments along corridors. In addition, it explores the associated crash risk factors with crash counts of different types and severity levels. The results reveal that accounting for the variations in traffic volumes and roadway characteristics, by estimating the model with random parameters, across corridors improved the model's performance. Also, the results confirm the importance of accounting for the spatial autocorrelation between road entities along the same corridor, and the adjacency-based first-order neighboring structure provides the best fit for the data among the other neighboring structures. Furthermore, it was found that the significant variables and their magnitudes are different across crash types and severity levels. Also, road designers and engineers should carefully identify the optimal number and location of driveways, median openings, and access points within the influence area of intersections since they significantly affect crashes along corridors. Lastly, this research suggests and justifies considering the proposed hierarchical joint model for future corridor studies.