Despite subsequent strengthening measures, pavements constructed in Algeria suffer rapid deterioration soon after completion, with continued decline in some cases. Various factors contribute to this problem, including cost and availability of materials, build quality, and environmental conditions. The entire Algerian road network is based on flexible and semi-rigid pavements. This study explores pavement structures using numerical predictive models to advance our understanding of road construction and maintenance. Using Abaqus 2022 finite element analysis software, we consider three scenarios: a simple pavement, a pavement reinforced with geosynthetics, and a rigid pavement. We compare the results concerning the vertical stresses, interface stresses, and vertical displacements at the level of the critical pavement sections. The aim of this research was to achieve behavior in flexible pavement similar to that of rigid pavement through the study of the reinforcement effect of flexible pavements with geogrids. The layers were treated as elastic, and a finite element analysis was conducted for various geogrid stiffness values (geogrid/soil stiffness ratios ranging from 1 to 50). The model enabled us to select the geogrid with the appropriate stiffness for each soil stiffness. The main conclusions are presented and discussed in depth, with the results confirming that rigid pavements offer greater strength and better durability. We then provide convincing evidence that the performance characteristics of rigid pavements can be obtained for flexible pavements by integrating a geogrid reinforcement system. This system is based on the choice of the stiffness ratio of the supporting soil and the rigidity of the geogrid. This option allows the state of the supporting soil to be accepted as it is and for intervention to target in the composite soil–geogrid rigidity.