As the connector industry moves towards the use of smaller and smaller contact designs, achievable contact normal forces have been reduced to levels below what has been typically used previously in connector applications. Therefore, improving the ability to predict and analyze the mechanical and electrical performance of these lower force contact interfaces is becoming increasingly important. This paper will illustrate further development and experimental verification of a new method to simulate elastic/plastic contact between two multi-layered non-conforming rough surfaces. This new approach involves using five scale independent parameters to statistically model two 3-dimensional multilayered surfaces coming into contact. The mechanical and electrical response characteristics of all the layer materials, as well as frictional behavior at the contacting asperity surfaces; are taken into account as pressure is applied between the surfaces and the a-spot distribution is formed. The mechanical and electrical contact performance of the resulting interface are calculated and visualized in 3 dimensions. The model has been extended and applied to contacts with varying surface finish materials and surface topology characteristics. These results are then compared to experimental data generated from samples with comparable finishes.