abstract We investigate the global pulsation properties of DBV white dwarf models that include both the double-layered envelope structure expected from time-dependent diffusion calculations, as well as a non-uniform C/O core expected from prior nuclear burning. We compare these models to otherwise identical models containing a pure C core to determine whether the addition of core structure leads to any significant improvement. Our double-layered envelope model fit to GD 358 that includes an adjustable C/O core is significantly better than our pure C core fit ($7\sigma$ improvement). We find a comparable improvement from fits to a second DBV star, CBS 114, though the values of the derived parameters may be more difficult to reconcile with stellar evolution theory. We find that our models are systematically cooler by 1,900 K relative to the similar models of fb02. Although a fit to their model reproduces the mass and envelope structure almost exactly, we are unable to reproduce the absolute quality of their fit to GD 358. Differences between the constitutive physics employed by the two models may account for both the temperature offset and the period residuals.