Here we illustrate the usefulness of using the chemical potential as the primary unknown by modeling isothermal vapor transport through a partially saturated cylindrically symmetric capillary tube of variable cross-sectional area using a single equation. There are no fitting parameters and the numerical solutions to the equation are compared with experimental results with excellent agreement. We demonstrate that isothermal vapor transport can be accurately modeled without modeling the details of the contact angle, microscale temperature fluctuations, or pressure fluctuations using a modification of the Fick-Jacobs equation. We thus conclude that for a single, axisymmetric pore, the enhancement factor depends upon relative humidity boundary conditions at the liquid bridge interfaces, distance between liquid bridges, and bridge lengths.