Monodeuterated methyl radical is a simple organic radical with applications in investigations of combustion chemistry. CH$_2$D is readily synthesized via DC discharge of CH$_3$DI coupled to a slit-jet supersonic expansion, enabling the first high-resolution spectroscopic study of this molecule. In the present work, multiple transitions of both the symmetric and asymmetric CH stretches of CH$_2$D were measured. Fine and hyperfine structure, arising from interactions between the unpaired electron, both hydrogens (I = 1/2), and the deuteron (I = 1), were resolved in several transitions. These complex line profiles were fit using a least-squares analysis to a Watson A-reduced asymmetric top Hamiltonian to obtain rotational, fine, and hyperfine constants.