Within the broad area of probabilistic modelling of individual discrete choice, we develop three strands of discussion. First, we outline a theoretical framework for the modelling of individual discrete choice under risk, distinguishing between three specific sources of randomness; in preference orderings, in outcomes, and in attribute tastes. Second, we apply this theoretical modelling framework to the domain of journey time risk (or ‘reliability’), a subject which has acquired prominence in the transportation policies of many countries. Third, we apply the modelling framework empirically, based upon a Stated Preference experiment of 2395 rail travellers choosing between alternative journeys embodying different levels of journey time risk. Across the sample of travellers, we estimate a mean value of scheduled journey time of 25.62pence/min, against a median of 18.55pence/min. We further estimate a mean ‘reliability ratio’ (ratio of the value of standard deviation of journey time to the value of scheduled journey time) of 2.07, against a median of 0.85. The properties of the distribution of the reliability ratio suggest a predominant behaviour of aversion to journey time risk.