This research effort develops a national freight mode choice model employing data from the 2012 Commodity Flow Survey (CFS). While several research efforts have developed mode choice model with multiple modes in the passenger travel context, the literature is sparse in the freight context. The primary reasons being unavailability and/or the high cost associated with the acquisition of mode choice and level of service (LOS) measures - such as travel time and travel cost. The first contribution of the research effort is to develop travel time and cost measures for various modes reported in the CFS. The study considers five modes: hire truck, private truck, air, parcel service and other modes (rail, ship, pipeline, and other miscellaneous single and multiple modes). The LOS estimation is undertaken for a sample of CFS 2012 data that is partitioned into estimation sample and holdout sample. Subsequently, a mixed multinomial logit model is developed using the estimation sample. The exogenous variables considered in the model include LOS measures, freight characteristics, and transportation network and Origin-Destination variables. The model also accounts for unobserved factors that influence the mode choice process. The estimated mode choice model is validated using the holdout sample. Finally, a policy sensitivity analysis is conducted to illustrate the applicability of the proposed model.