The study contributes to safety literature on transportation safety by employing copula based models for count frequency analysis at a macro-level. Most studies in the transportation safety area identify a single count variable (such as vehicular, pedestrian or bicycle crash counts) for a spatial unit and study the impact of exogenous variables. While the traditional count models perform adequately in the presence of a single count variable, it is necessary to modify these approaches to examine multiple dependent variables for each study unit. To that extent, the current research effort contributes to literature by developing two multivariate models based on copula methodology. First, a copula based bivariate negative binomial model for pedestrian and bicyclist crash frequency analysis is developed. Second, a multivariate negative binomial model for crashes involving non-motorized road users, passenger cars, vans, light trucks and heavy trucks is proposed. The proposed approaches also accommodate for potential heterogeneity (across zones) in the dependency structure. The formulated models are estimated using traffic crash count data at the Statewide Traffic Analysis Zone (STAZ) level for the state of Florida for the years 2010 through 2012. The STAZ level variables considered in our analysis include exposure measures, socio-economic characteristics, road network characteristics and land use attributes. A policy analysis is also conducted along with a representation of hotspot identification to illustrate the applicability of the proposed model for planning purposes. The development of such spatial profiles will allow planners to identify high risk zones for screening and treatment purposes.