4.4.2 Evaluating Bicycle Networks Based on Traffic Stress and Connectivity

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For most people bicycling is a discretional mode of travel that they will consider only if their route does not subject them to an unacceptable level of traffic stress (perceived danger) or require an unacceptable level of detour (circuity). We develop and demonstrate a bicycle network evaluation model based on these fundamental principles of connectivity, safety, and directly. First, we propose a scheme for classifying network links at different levels of traffic stress based on such characteristics as road width, presence of bike lanes, and intersection approach and crossing features. The different levels of traffic stress aim to represent cumulative fractions of the population; that is, while only a small fraction of the population will ride on links with high stress, more and more people are willing to ride as the level of traffic stress declines. We model the stress level of a route as equal to the maximum stress level of its constituent links (weakest link). Networks can thus be identified for different stress levels “a sparse network for the lowest stress level consisting mostly of off-street paths and local streets, and an increasingly dense network for increasing levels of stress. For a given level of stress, two points are connected if there is a route between them that does not exceed the specified stress level and does not exceed the acceptable level of detour. This way the bicycle network can be evaluated by determining its level connectivity for different maximum levels of stress. Example measures of connectivity include the fraction of the region's resident-job pairs that are connected, and the fraction of residents connected to a shopping area within 1.5 miles. The models and methods are implemented for San Jose, CA using GIS models of the unabridged street network, GIS files describing network links and socioeconomic data, and custom programs developed for network analysis.