

# **Population density, LDV miles, speed, travel time and fuel use – Net effects on location choice in the U.S.**

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## **ABSTRACT**

This paper raises research issues related to the joint effects of a time and fuel cost budget on U.S. vehicle owning households' spatial location choices over multiple decades (past vs. future). The long-run competition between electricity using passenger rail and elevators, vs. oil using highway transport networks is considered. It is noted that the future should be unlike the past, since electrification of passenger vehicle drivetrains will considerably alter the pattern of changes of fuel use as a function of the nature of the built environment.

It is shown that the time budget effect of increasing density on LDV owner satisfaction is presently non-linear, having a "U" shape, with greatest time spent in the vehicle at the highest and lowest densities. We treat "effective" accessibility in this paper as the ability to make all desired trips with the least time and fuel cost. At the lowest levels of density, in rural areas, transit services simply cannot be provided and distance to desired trip destinations is so great that it offsets higher speed, reducing effective accessibility. Higher speed, on the other hand, drives up fuel use per unit time, making rural areas the most expensive in terms of fuel needed. At the highest levels of density, rail transit is argued to be necessary to support neighborhoods reliant on a large share of mid- to high-rise dwelling units. We argue that in the long-run such development increases street level vehicle congestion and makes vehicle ownership relatively undesirable, thereby pushing those who prefer vehicles rather than transit into less dense locations. We argue that an important oversight in past research is the lack of a study on the effect of speed and aggressiveness of driving, time in the vehicle, and resulting fuel consumption per vehicle per day at different densities. Looking toward the future, adoption of oil saving benefits of electric drive in more dense and more compact urban residential development without emphasis on elevators and high rise buildings should be a top priority. Adaptation of the built environment to enable electric rail transit and elevator transport is worth pursuing judiciously, but requires such a jump in density to succeed that it is unlikely to be a major contributor to future U.S. national oil savings.

Our deductions are based on a review of recent summary literature on the effects of the built environment on vehicle miles of travel (VMT) and/or fuel use, combined with a nascent step toward a proposed improved method of imputing per vehicle fuel consumption. We close by considering whether or not demographic shifts will favor relatively high density development in the future, or tend to maintain the status quo.

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