**Executive Summary**

Urban and transportation planners often find it difficult to predict the demand for proposed new initiatives on upgraded transportation services and infrastructure. Examples of such initiatives include new roads, expanded highway lanes, a rapid transit system, congestion pricing, etc. Added to the uncertainty about demand is whether these initiatives can satisfactorily meet likely forthcoming regulations concerning fossil fuel consumption and fossil carbon emissions. Given the generally high cost of transportation projects or their impacts, it is desirable to have methods for estimating demand and use of new services or infrastructures. What is needed is a more reliable and deterministic approach for estimating market demand, use, and associated impacts (e.g. carbon emissions), especially for new services and infrastructures as we move toward a more sustainable and carbon constrained world. This is especially so for mobility projects as they tend to be very expensive. Toward that end, we advance herein an advanced modeling and analysis method that permits the assessment of transportation policy and project initiatives on meeting specific objectives.

The objective of topic 6 of this BAA is to identify ways which could bring about a dramatic change in resident transit behavior from current practice to a state where communities are more walkable and bicycling friendly. This notion is quite consistent with concepts of sustainable communities. More specifically, what policy and infrastructure changes could be implemented to make communities more walkable and bicycling friendly? Clearly, there is more to this than just blocking off streets or implementing traffic calming methods. To move forward on this, one must first understand the level of accessibility offered to residents of a community of interest? Would they use these new services or infrastructure? How much would it cost? What are the "low hanging" fruit that could get such a transition started? What policies might be needed to keep the transition going if it should falter or there is a need to accelerate progress? Would these communities actual use less energy and emit less fossil carbon? If yes, how much so?  We believe that our advanced modeling method provides the needed deterministic approach for identify opportunities to achieve more walkable and bicycling friendly communities.

A general approach is as follows:
1. Identify "ideal" communities (urban, suburban, exurban) elsewhere in the world that have the desired attributes
2. Gather data on the socio economic and infrastructural circumstances present in those areas.
3. Identify communities in the United States reminiscent of those ideal areas, at least at first
4. Gather data on those communities
5. Conduct a sketch analysis

6.  Apply these data to models representing resident demand for transportation and mobility services.

7.  Explore impacts of projects and policies within those models to estimate community demand for such services.

8.  Make recommendations

Unfortunately, the data required to fully develop the analysis entailed in the general approach are often not available in a timely fashion and are very costly to generate. In the absence of such information, the next best approach employs virtual communities. Such communities can in principle be composed to represent almost any place on earth. The challenge is determining what level of detail is necessary. Stated otherwise, identify only those factors that really matter; forget the rest.

Our approach to this challenge is to employ agent based modeling and activity based transit demand modeling. After identifying ideal and target communities, conducting a preliminary sketch analysis to serve as a basis of comparison, we proceed with the modeling effort. To one degree or another, these models represent virtual communities comprised of virtual decision makers who act in a way to achieve either personal or organization objectives. These virtual decision makers in software, often called agents, include residents, consumers, government, transport providers, vehicle manufactures, energy providers, and others. By developing these models with population, land use, and transit patterns consistent with actual locations and using reasonable and accepted decision rules consistent with the different classes of agents, one can expect the sought after collective responses revealed in the temporal demand and use function to be quite consistent with those in actual locations.

This work integrates activity based transit demand modeling with an agent based modeling method that has been used to estimate the penetration of Plug-In Hybrid Electric Vehicles into the U. S. auto marketplace. This latter model, the Virtual AutoMotive MarketPlace model (VAMMP), was develop to characterize automobile purchasing behavior under varying vehicle and fuel pricing regimes, especially in the context of government policy initiatives. The integrated model developed for this work is intended to explore the effect of a variety of cost and policy options on a successful dramatic transition to a more sustainable community that is more walkable and bicycling friendly.

After completing model integration, sketch analysis, and interrogating the models for outcomes to a series of cost and policy scenarios, we consolidate these results and make recommendations. Further, we also provided a validated modeling methodology for use in the community at large.