Regional Evaluation Decision tool for Smart Growth

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Objectives

This project is one of the SHRP 2 Capacity projects (C16) to provide transportation planning agencies with improved tools and methods for more accurately and comprehensively integrating transportation investment decision-making with land development and growth management (smart growth strategies). To achieve this goal, there are several objectives:

- Understanding the critical decision points in the transportation planning process for highway capacity and assessing whether, how and to what extent smart growth approaches to land use policies and planning may affect demand for such capacity.
- Reporting on existing research to understand the dynamics and inter-relationships of smart growth strategies with the performance of a transportation investment.
- Building on existing applications to identify the range of features and capabilities these tools and methods need to represent, including the performance metrics needed to assess smart growth alternatives.
- Facilitating improved communication, interaction and partnerships between decision-makers and planners in both the transportation and land use arenas.

The motivation is to synthesize existing research and package it into an easy to use software tool that can be used by transportation and land use planners. The innovation in the project is that by combining multiple research sources, we are able to provide more comprehensive software that bridges the gap between regional agencies visioning processes and their transportation plans, which evaluate projects. This tool evaluates scenarios at a regional level with available data sources.

Methodology

There are 3 major phases to the project: the research phase, the software development phase, and testing the product at 3 case study sites.

Research Phase

The research phase included a review of planning processes with a focus on smart growth and a series of interviews with regional, state and federal agencies that are engaged in the evaluation of smart growth strategies and were able to provide insights on information needs for practitioners. These interviews focused on legislative actions, goals and objectives, strategies, and performance metrics and tools that are in place or being considered for evaluation of smart growth. The key findings from this were that most agencies are either engaged in or interested in scenario planning as a strategy for evaluating smart growth and that there is a strong need for coordination, cooperation, and communication with local governments on land use policy, since land use regulations are primarily governed by local governments. This led to the development of a software tool that evaluates scenarios rather than projects and that is accessible to land use planners and local governments in addition to regional planning agencies.

The remainder of the research phase included a literature review on specific aspects of smart growth evaluations and produced several key findings:

- The underlying relationships that define the effects of smart growth on **peak travel** and transportation capacity needs are not well understood. While there has been considerable research and well established relationships between smart growth and daily travel demand, research on travel effects by trip purpose or by time of day is much more limited. This creates a challenge for the prospect of estimating the effects of smart growth development patterns and transportation management on peak period traffic conditions and congestion.
- There is a need for further study of **induced travel** when measured as a function of travel-time benefits afforded by a transportation expansion in a manner that captures the facility's role in the network, the effects of non-capacity operational improvements, and the degree to which land use plans represent a priori conditions rather than effects of the added transportation access.
- There is a critical need for data and statistical analysis to ascertain the transferable relationships between smart growth characteristics such as the development density and diversity and transportation network connectivity, and the resulting traffic **congestion** on local streets, arterials and highways.
- There are a number of smart growth and logistical strategies that can reduce the exposure of **goods movement** to congestion and delay, but currently no means to quantify the effects of these strategies.
- Highly sophisticated land use and transportation **models** do not have the capability to perform quick response visioning and scenario analysis or the ability to scale effectively between the local, corridor and regional levels of analysis for effective communication with local governments and sub-regional agencies and the public. In addition, most regions lack the resources to develop these highly sophisticated models in the first place.

While there are at least a dozen application tools that have been successfully used as stand-alone models or to supplement regional travel models for scenario planning and production of travel, socio-economic and environmental indicators, few of the available tools address the effects of: the relationship between peak travel demand and network supply (capacity) on congestion and congestion and accessibility on induced growth or induced travel. The research on freight demand was not quantifiable at this stage so sensitivity of freight to smart growth strategies could not be included in the software tool, but the research will be available as part of the on-line resources as a supplement to the software.

Software Development Phase

The software tool is a regional evaluation decision tool for analyzing the impact of various smart growth policies (REDSmart). The tool is designed to be a high level evaluation at a regional scale that can bridge the distance between evaluating smart growth policies during a regional visioning process and evaluating smart growth policies at a project or alternative level in a regional transportation plan. The REDSmart tool evaluates policy scenarios to identify the most promising policies that could be further tested using a more detailed project-level tool. Currently, REDSmart can provide information on the following changes in the regional system:

- **Built Environment** – changes to urban form (proportion of population and employment living in mixed use areas, transit oriented developments, or rural/greenfield areas)
- **Travel Demand -** changes in population demographics (age structure), changes in personal income, changes in firms by size or industry, relative amounts of development occurring in urban core, close in communities, suburban or rural areas, urban core, close in communities, suburban or rural area population and employment densities, auto and light truck proportions by year, induced demand – short term impacts

- **Transportation Supply -** amounts of regional transit service, amounts of freeway and arterial capacity
- **Policies -** pricing (vehicle miles traveled charges or parking pricing programs), ITS strategies (incident management), and demand management (vanpool, telecommuting, ridesharing, and transit pass programs)

The software tool is designed to evaluate region, which can be a multi-county metropolitan region. It distinguishes between population and employment living/working in the urban core, close in communities, suburban and rural/greenfield areas based on densities, diversity in land uses, street design or intersection densities, job accessibility by auto, distances to transit stops, and connectivity of the street system. The model can be developed using base data for these factors to identify the base and future demand (as well as the change) or simply providing changes in these factors to identify the change in travel demand.

The regional evaluation decision tool for smart growth is a disaggregate policy model that predicts travel demand impacts at an individual household level. Figure 1 presents the modeling system with inputs, model components, and feedback loops.

The tool does not provide specific spatial results beyond the built environment categories (called place types) at the regional level, but does capture individual household and firm characteristics and the interactions between policies. The disaggregate nature of the model captures impacts that may be occurring for small portions of the population (say 0-vehicle households) where aggregate models have a more difficult time capturing these impacts. The model also has the capability to capture interactions between policies. For example, a policy that increases urban area density will decrease household vehicle miles traveled by increasing shorter trips and increasing non-auto travel. Higher densities also increase the market for car sharing. Increased car sharing in turn reduces household vehicle ownership, which also reduces household vehicle miles traveled.

The software tool is implemented in R, which is a freely available language for statistical computing and graphics which provides a wide variety of functions. R can be used for routine data manipulation and analysis, and the analysis and visualization of model results. The software code has been developed with a Graphical User Interface (GUI) to allow for non-technical users to be able to use the tool for planning activities more easily. Figure 2 shows the GUI for REDSmart.

Testing Phase

We propose to conduct three pilot tests to demonstrate the appropriate use of the software, the development of input data, the evaluation of results, and any lessons learned from the application. These pilot tests will be conducted through partnerships with potential users of the system (one state Department of Transportation (DOT), one large Metropolitan Planning Organization (MPO) and one small MPO) to provide a useful range of applications to test the software:

- Maryland Department of Transportation (MDOT)
- Atlanta Regional Commission (ARC)
- Thurston Regional Planning Commission (TRPC) in Olympia Washington

The approach to developing smart growth planning tools has defined the tool for regional analysis, so the state DOT example be used to demonstrate how state DOTs are engaged in regional planning. The testing phase will be conducted from December 2011 to February 2012.

Figure 1. Overview of Modeling Process

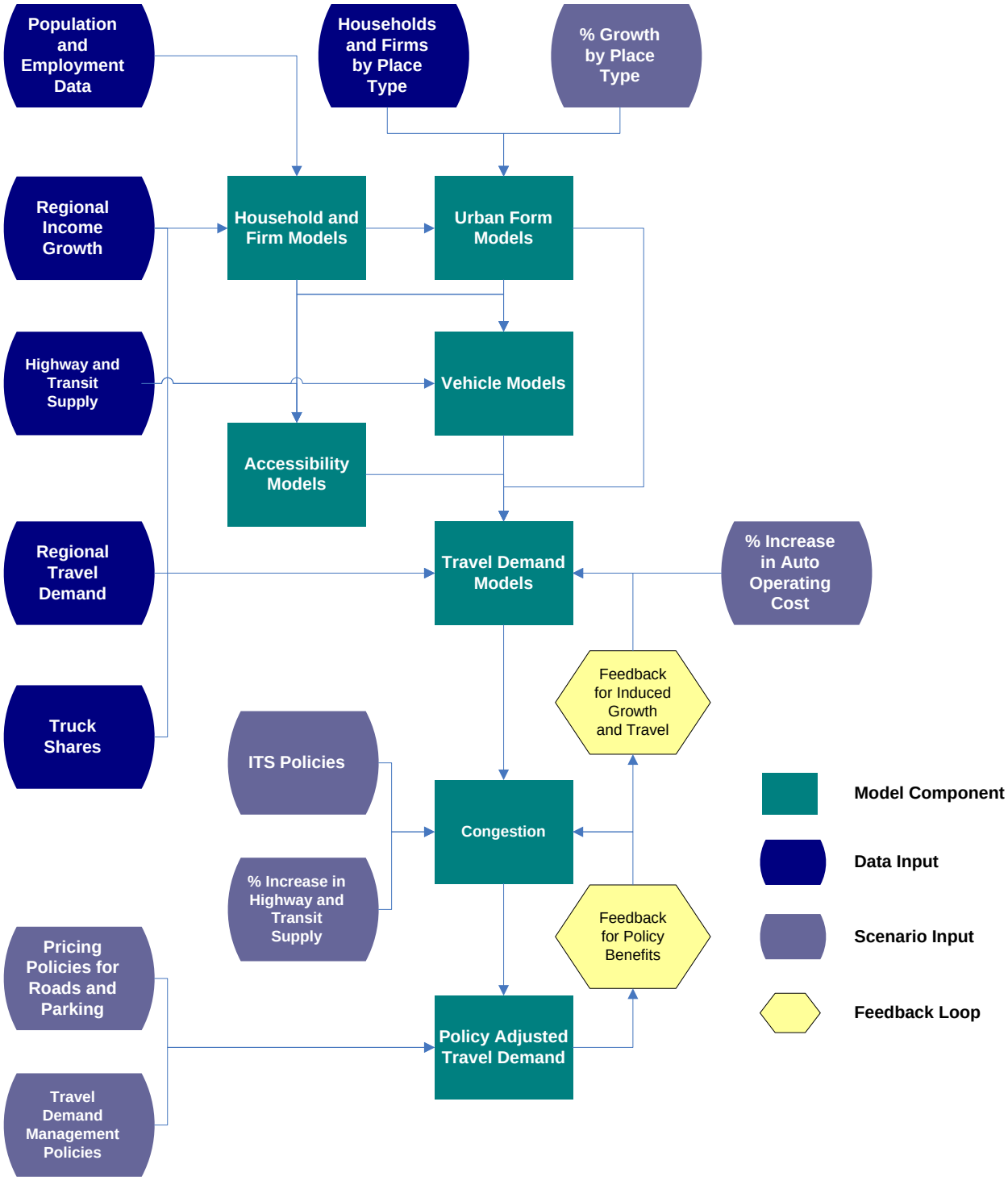
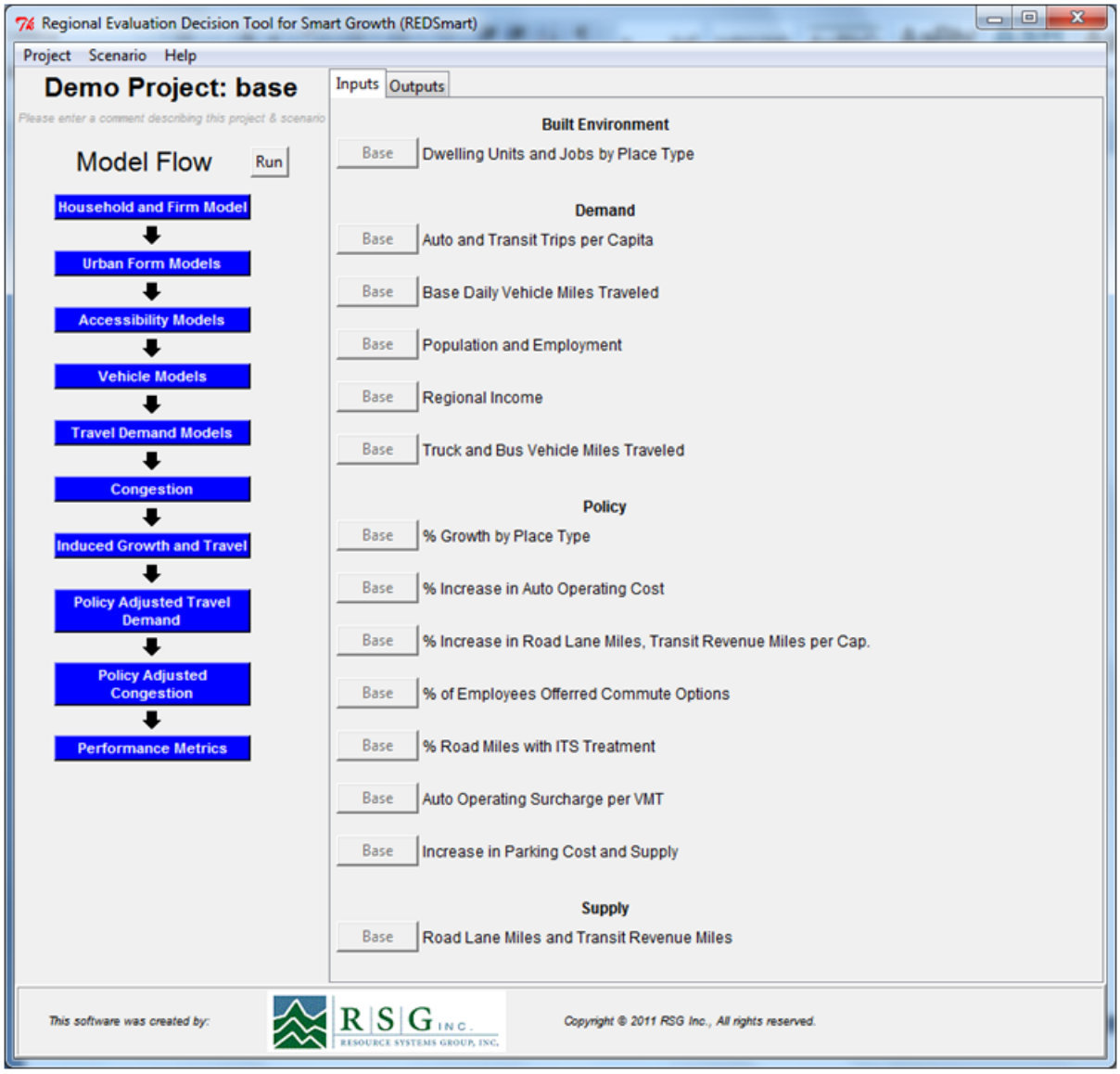


Figure 2. Regional Evaluation Decision tool for Smart Growth (REDSmart)



Expected Major Results

We expect (and hope) that the major results of the project offer the following to stakeholders involved in regional land use and transportation planning activities:

- A decision support software tool for regional and local planners to test smart growth scenarios and evaluate their impact on travel demand
- On-line resources to understand the dynamics and inter-relationships of smart growth strategies with the performance of a transportation investment as background and a supplement to the software tool

We believe that these two products will facilitate improved communication, interaction and partnerships between decision-makers and planners in both the transportation and land use arenas.

Implications for Travel Modeling Practice

We believe that the software tool (REDSmart) and the supplementary on-line resources can bridge the gap between regional planning visioning exercises and transportation plans in relation to the evaluation of smart growth strategies. This will allow state, regional and local agencies to engage in the evaluation of smart growth strategies quickly and easily so that promising smart growth strategies can be identified and pursued in the land use and transportation planning processes. This should supplement more sophisticated modeling efforts, which can be used to evaluate specific smart growth projects. It is designed to be accessible to land use and transportation planners with no modeling experience.